ARMY TM11-5805-628-12
NAVY NAVELEX 0967-462-8070

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

AUTOMATIC TELEPHONE CENTRAL OFFICES
AN/TTC-38(V)1
AND
AN/TTC-38(V)2

This copy is a reprint which includes current pages from Changes 1 through 4.

DEPARTMENTS OF THE ARMY AND THE NAVY

JANUARY 1974

WARNING

HIGH VOLTAGE

High voltage is used in this equipment. Be careful when working near the interior of the equipment, or near the ac power distribution. Observe warning notes in this technical manual and warning decals on equipment. Death on contact may result if safety precautions are not observed.

VENTILATION IS ESSENTIAL

To prevent asphyxiation, ventilate the AN/TTC -38(V)(*) at all times when occupied.

EXPLOSIVE GAS

Batteries BT1 through BT4 give off explosive gas (hydrogen and oxygen) when charging. Batteries are charged continuously during normal operation.

a. Make sure battery exhaust vent is open and battery blower is operating.
b. Keep open flames away from battery exhaust vent.

DO NOT TAKE CHANCES

Change

No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 15 July-1989

Operator's and Organizational
Maintenance Manual
for

AUTOMATIC TELEPHONE CENTRAL OFFICES
AN/TTC-38(V) 1 (NSN 5805-00-186-0681)
and
AN/TTC-38(V) 2 (NSN 5805-00-186-0640)

TM 11-5805-628-12/NAVELEX 0967-LP-462-8070/TO 31W2-2TTC38-1, 18 January 1974, is changed as follows:

1. Remove old pages and insert new pages as indicated below. : New or changed material is indicated by a vertical bar in the margin of the page.

Remove pages	Insert pages
v and vi	v and vi
5-1 through 5-4	5-1 through 5-4
None	5-4.1 through 5-4.5/(5-4.6 blank)

2. File this change sheet in the front of the publication for reference purposes.

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To be distributed in accordance with DA Form 12.-51 operator and unit requirements for AN/TTC-38(V)1-2.

TM 11-5805-628-12
NAVELEX 0967-LP-462-8074
TO 31W2-2TTC38-1
C4

Change
No. 4

DEPARTMENTS OF THE ARMY
THE NAVY, AND THE AIR FORCE
WASHINGTON, DC, 16 November 1983

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

FOR

AUTOMATIC TELEPHONE CENTRAL OFFICES
AN/TTC-38(V) 1 (NSN 5805-00-186-0681)
AND
AN/TTC-38(V)2 (NSN 5805-00-186-0640)

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1. NAVELEX number has been changed as follows: NAVELEX 0967-LP462-8070.

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3. Remove old pages and insert new pages as indicated below:

Remove	*Insert*
i through vii.1	i through x
ix and 1-0	ix and 1-0
1-5 and 1-6	1-5 and 16
1-13 through 1-21	1-13 through 1-22
2-7 through 2-10	2-7 through 2-10
2-19 through 2-28	2-19 through 2-28
2-39 and 2-40	2-39 and 2-40
2-47 through 2-50	2-47 through 2-50
4-15 and 4-16	4-15 and 4-16
4-21 through 4-30	4-21 through 4-30
4-33 and 4-34	4-33 and 4-34
4-41 and 4-42	4-41 and 4-42
4-75 and 4-76	4-75 and 4-76
5-1 through 5-12	5-1 through 5-12
5-59 and 5-60	5-59 and 5-60
5-83 and 5-84	5-83 and 5-84
5-149 and 5-150	5-149 and 5-150
A-1 and A-2	A-1, A-2 and A-3
B-1 through B-6	B-1 through B-6
B-11 through B-16	B-11 through B-16
B-19 through B-26	B-19 through B-26
B-29 through B-32	B-29 through B-32
FO-36 Sheet 2 of 2	FO-36 Sheet 2 of 2
FO-43	FO-43 and FO-44

4. File this change sheet in front of the publication.

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  - SAAD (30)
  - TOAD (14)
  - SHAD (3)
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  - 29-136
  - (2 copies each unit)
  - 29-207
  - 29-610

ARNG: None

USAR: None

For explanation of abbreviations used, see AR 310-50.

WARNING

DANGEROUS CHEMICALS ARE USED IN NICKEL-CADMIUM BATTERIES

The electrolyte used in nickel-cadmium batteries contains potassium hydroxide (KOH), which is a caustic chemical agent. Serious and deep burns of body tissue will result if the electrolyte comes in contact with the eyes or any part of the body. Use rubber gloves, rubber apron, and protective goggles when handling the electrolyte. If accidental contact with the electrolyte is made, use ONLY clean clear water and immediately (seconds count) flush contaminated areas. Continue flushing with large quantities of clean clear water for at-least 15 minutes. Seek medical attention without delay.

EXPLOSIVE GASES ARE GENERATED BY NICKEL-CADMIUM BATTERIES

Hydrogen and oxygen gases are generated in explosive proportions while the nickel-cadmium battery is being charged. Charge the nickel-cadmium battery in a well-ventilated area to reduce concentrations of explosive gases. Turn off the battery charger before connecting or disconnecting the nickel-cadmium battery to prevent arcing. Do not use matches or an open flame in the charging area. Arcs, flames, or sparks in the charging area will ignite the gases and cause an explosion. The battery box cover must be removed and the battery case vent plug (if any) must be open when charging.

DO NOT MIX SULPHURIC ACID AND KOH

The electrolyte used in nickel-cadmium batteries reacts violently to the sulphuric acid in the more common lead-acid types of batteries. DO NOT add sulphuric acid electrolyte to the battery; the mixing of the acid and KOH electrolytes will cause a violent reaction which could result in the splattering of the mixture into the eyes and onto the' skin.

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TO 31W2-2TTC38-1

TECHNICAL MANIAL
No. 11-5805-628-12
NAVELEX 0967-462-8070

TO 31W2-2TTC38-1

DEPARTMENTS OF THE ARMY

THE NAVY, AND THE AIR FORCE

WASHINGTON. DC, 18 January 1974

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

FOR

AUTOMATIC TELEPHONE CENTRAL OFFICES
AN/TTC-38(V)1 (NSN 5805-00-186-0681)
AND
AN/TTC-38(V)2 (NSN 5805-00-186-0640)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703.

For Air Force, submit AFTO Form 22 (Technical Order System Publication Improvement Report and Reply) in accordance with paragraph 6-5, Section VI, T.O. 00-5-1. Forward direct to prime ALC/MST.

For Navy, mail comments to the Commander, Naval Electronics Systems Command, ATTN: ELEX 8122, Washington, DC 20360.

In either case, a reply will be furnished direct to you.

LIST OF ILLUSTRATIONS

LIST OF TABLES

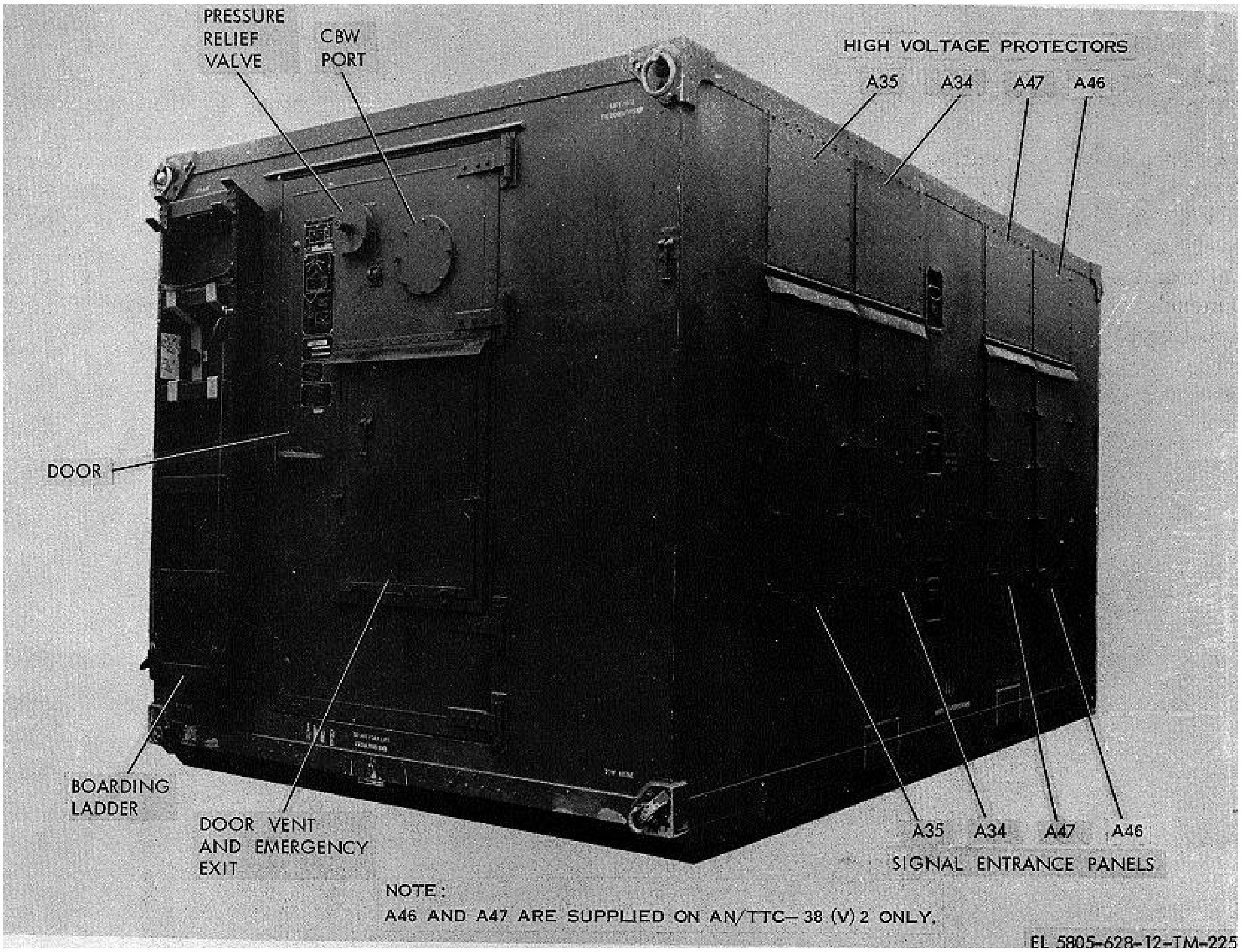


Figure 1-1. Automatic Telephone Central Office AN/TTC-38(V)1 or AN/TTC-38(V)2 exterior rear curbside view.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes Automatic Telephone Central Offices AN/TTC-38(V)1 and AN/TTC38(V)2 (figs. 1-1 through 1-7 and FO-1) and covers their installation, operation, and operator's and organizational maintenance. In this manual the nomenclature AN/TTC-38(V)(*) is used to refer to both the AN/TTC-38(V)1 and AN/TTC-38(V)2.

b. Throughout this manual, where appropriate, references are made to other publications which cover installation, operation, and maintenance of equipments installed in, or used in conjunction with AN/TTC-38(V)(*). A complete listing of applicable reference publications is provided in appendix A.

c. The maintenance allocation chart appears in appendix B.

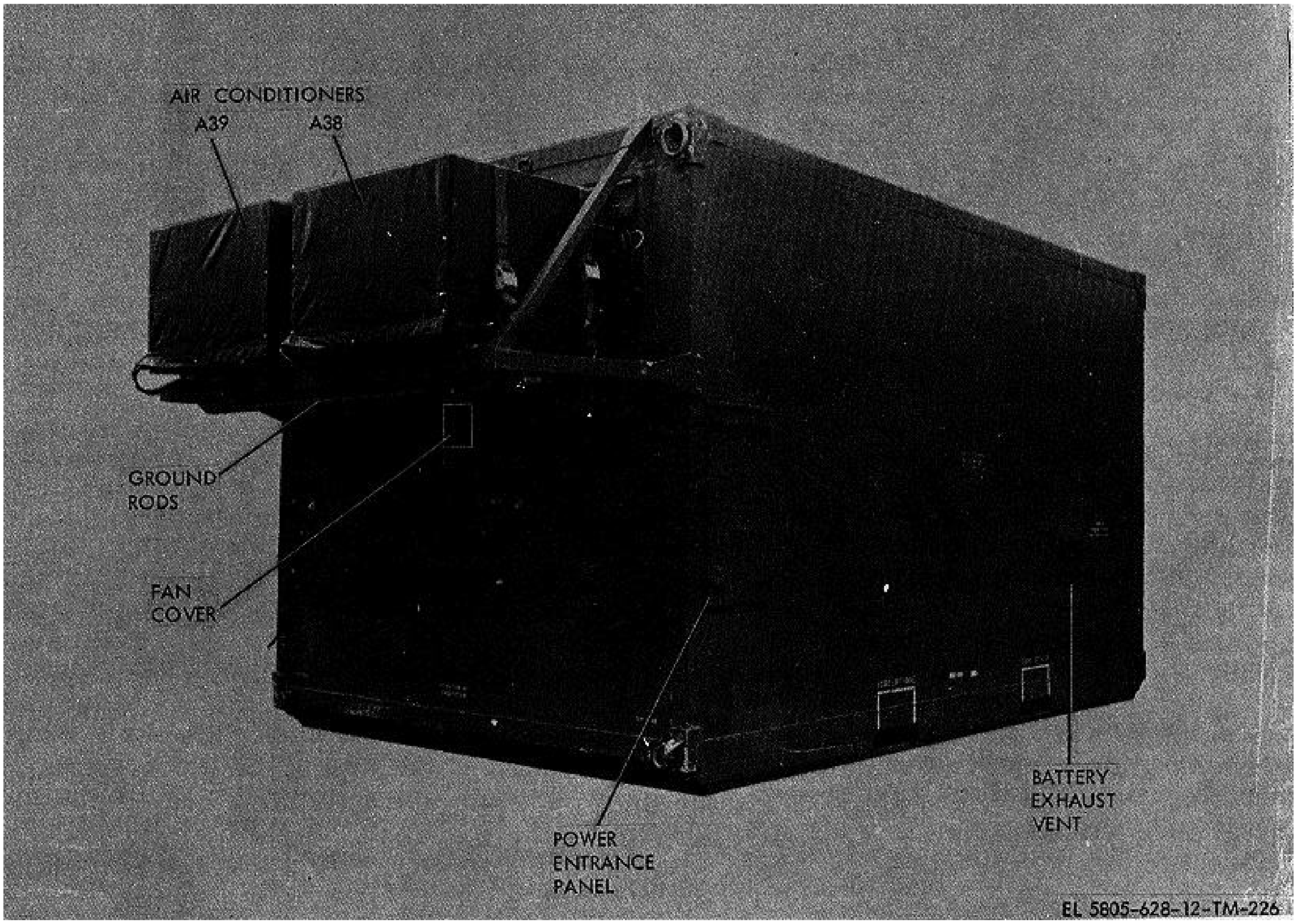


Figure 1-2. Automatic Telephone Central Office AN/TTC-38(V)(*) exterior front roadside view.

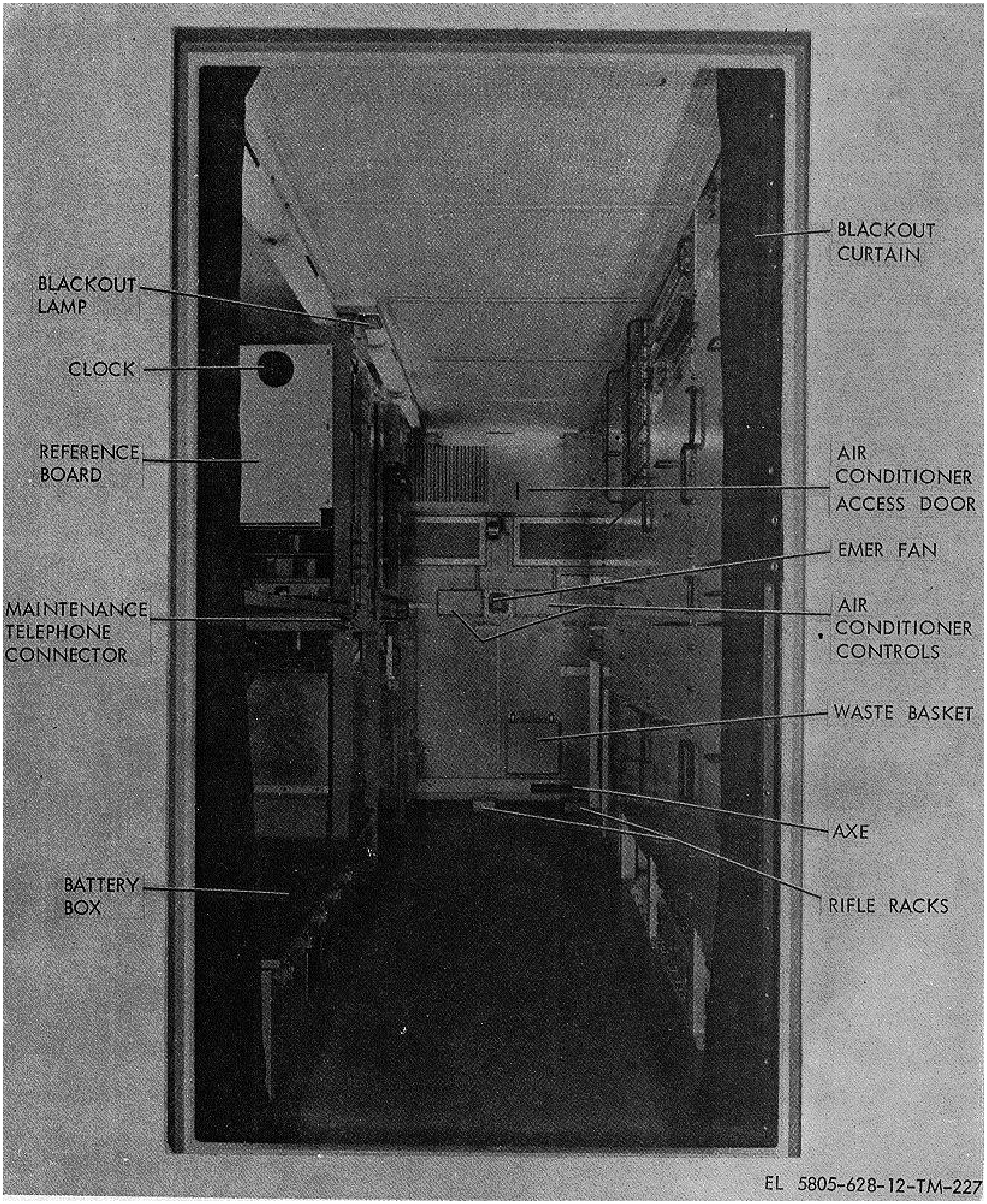


Figure 1-3. Automatic Telephone Central Office AN/TTC-38(V)(*) exterior rear view.

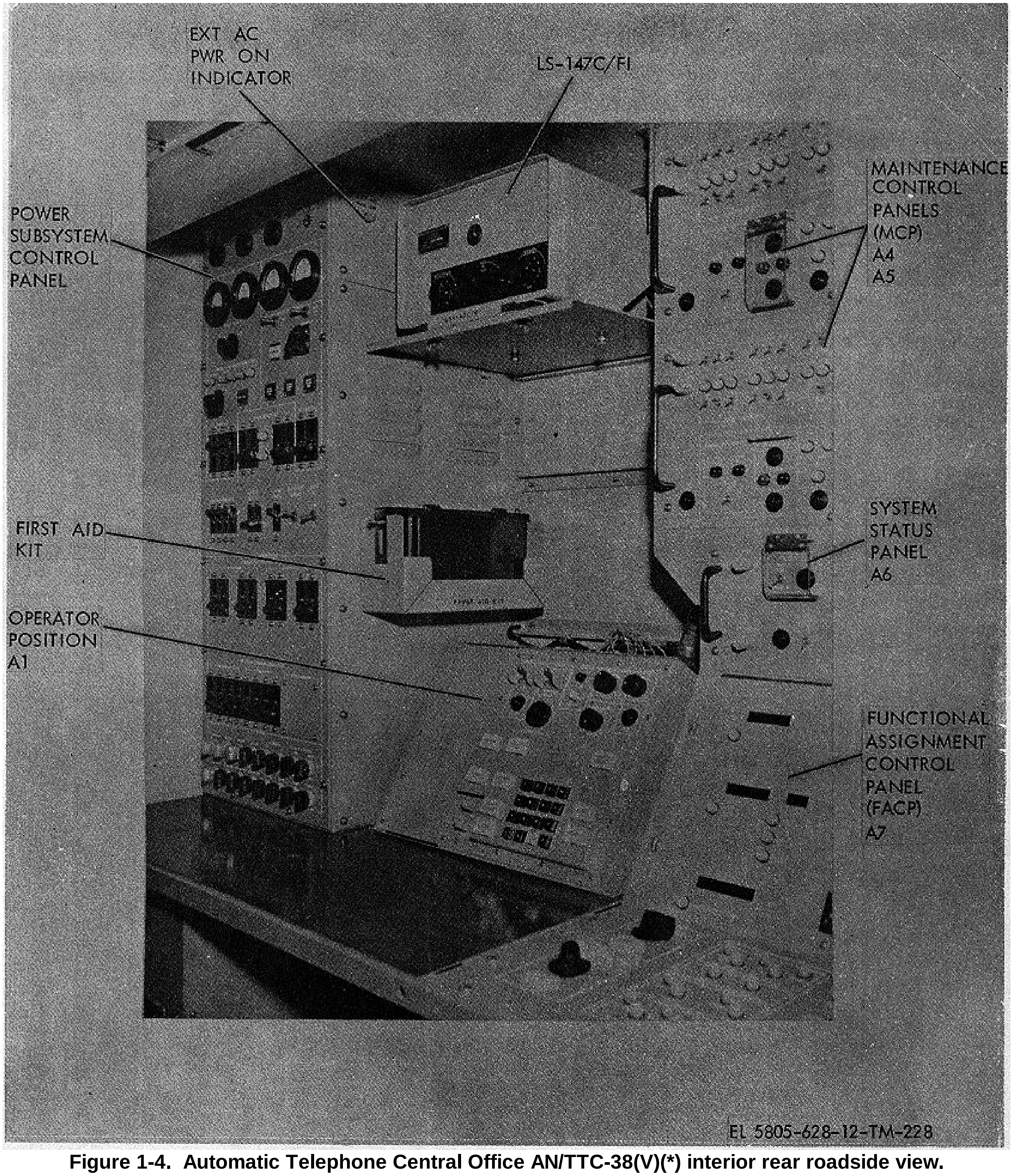


Figure 1-4. Automatic Telephone Central Office AN/TTC-38(V)(*) interior rear roadside view.

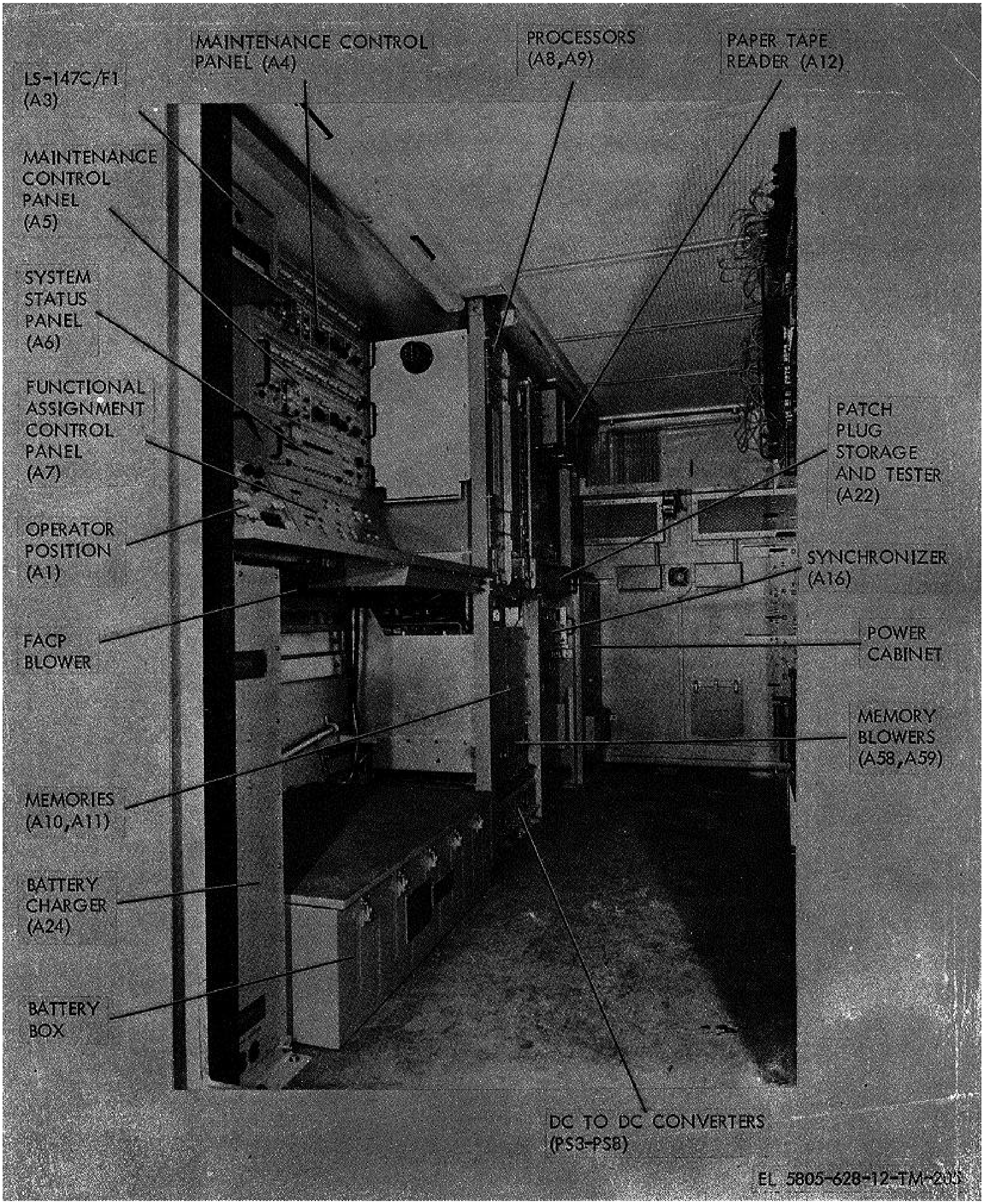


Figure 1-5. Automatic Telephone Central Office AN/TTC-38(V)(*) interior front roadside view.

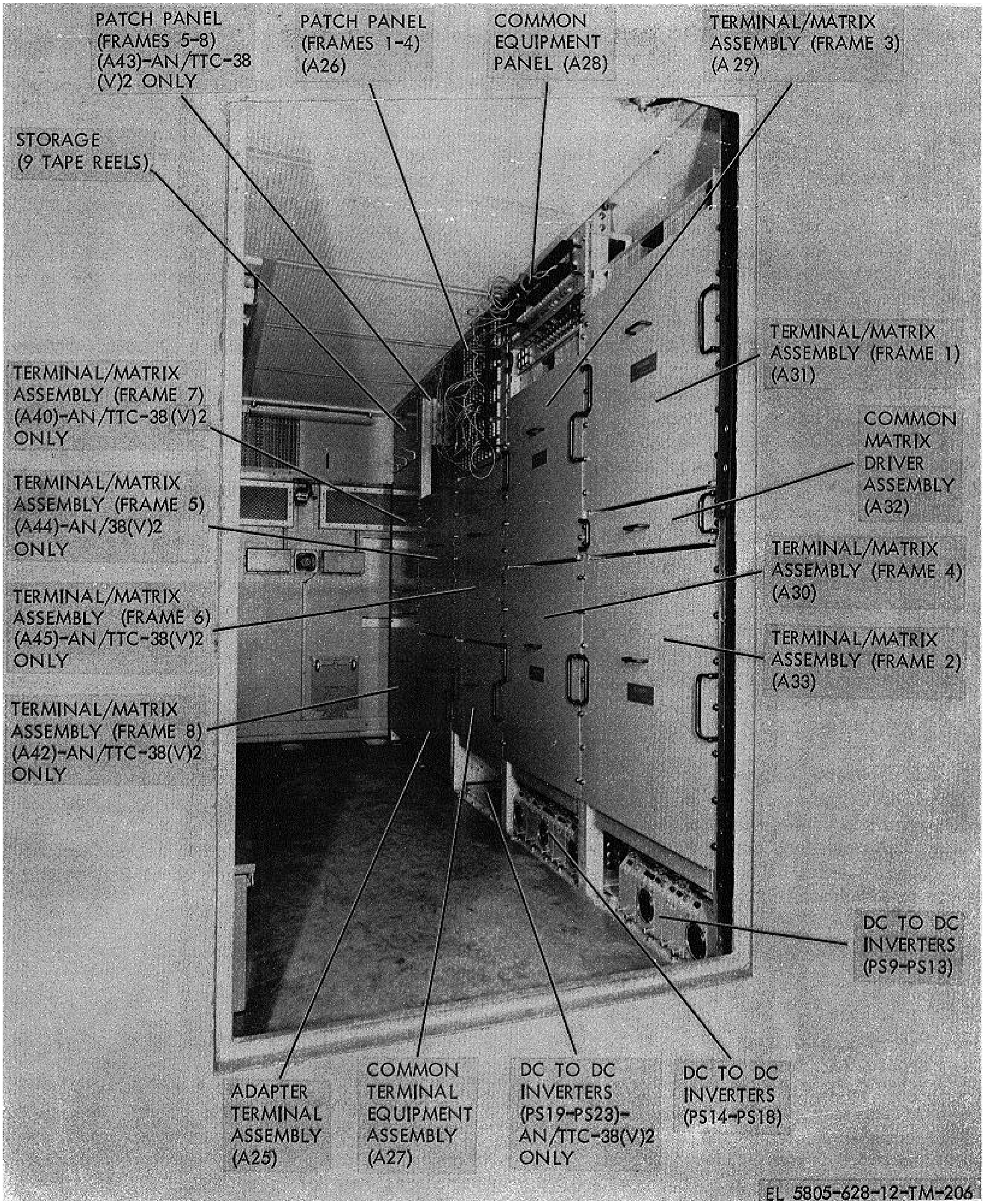


Figure 1-6. Automatic Telephone Central Office AN/TTC-38 (V)(*) interior front curbside view.

1-2. Consolidated Index of Army Publications and Blank Forms.

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

1-3. Reports of Maintenance Forms, Records and Reports.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (Army). Air Force personnel will use AFR 66-1 for maintenance reporting and TO-00-35D54 for unsatisfactory equipment reporting. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem (MDCS) IAW OPNAVINST 4790.2, Vol. 3 and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2, Vol. 2, chapter 17.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/ DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 7518/MCO P4610.19C/DLAR 4500.15.

1-4. Administrative Storage.

Administrative Storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage is covered in paragraph 1-5.

1-5. Repackaging for Shipment or Limited Storage.

Repackaging the assemblage for shipment or limited storage normally will be performed at a packaging facility or by a packaging team. If emergency packaging is required, select materials from those listed in SB 38-100. Package the assemblage in accordance with the original packaging so far as possible by reversing the unpacking procedures outlined in Chapter 2.

1-5.1. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-5.2. Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your AN/TTC-38(V)(*) Automatic Telephone Central Office needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. Well send you a reply.

b. Air Force. Air Force personnel are encouraged to submit EIR's in accordance with AFR 900-4.

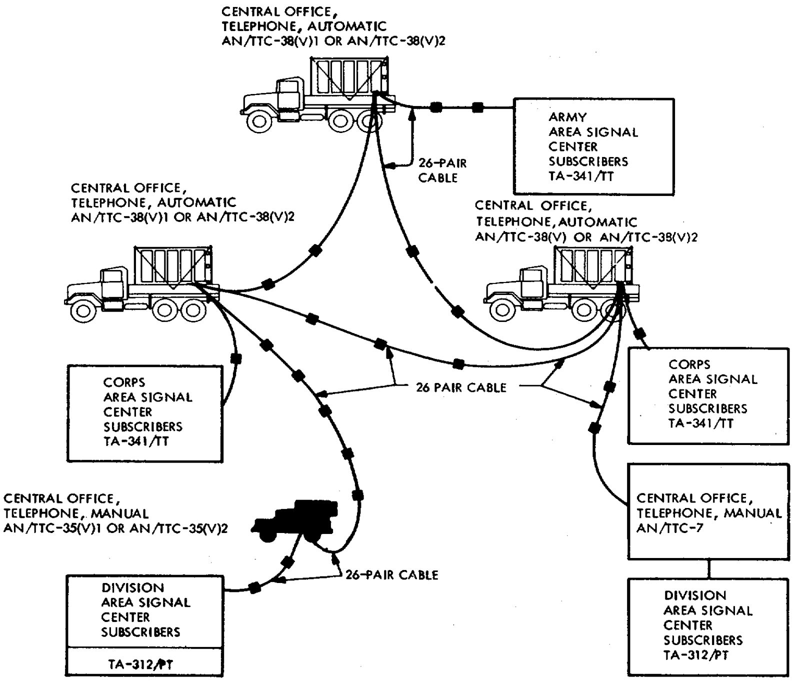
c. Navy. Navy personnel are encouraged to submit EIR's through their local Beneficial Suggestion Program.

Section II. DESCRIPTION AND DATA

1-6. Purpose and Use.

a. Purpose. Automatic Telephone Central Offices AN/TTC-38(V)1 and AN/TTC-38(V)2 are air or vehicular transportable assemblages used to provide switching facilities in an area-type communications system. The AN/TTC-38(V)1 provides facilities to interconnect or terminate 300 voice-frequency (vf) or wideband telephone circuits. The AN/TTC-38(V)2 provides facilities to interconnect or terminate 600 vf or wideband telephone circuits.

b. Use. The use of the AN/TTC-38(V)1 and AN/TTC-38(V)2 is governed by the tactical situation and the requirements set down by the system planner. Refer to figure 1-7 for typical applications of the AN/TTC-38(V)1 and AN/TTC-38(V)2.



EL 5805-628-12-TM-68

Figure 1-7. Typical Applications of AN/TTC-38(V)(*).

1-7. Technical Characteristics

a. Power Requirements.

Input voltage	115/208 volts ac, 50, 60, or 400 Hertz, three phase*
Alternate input voltage	28 volts dc

Consumption in kilowatts (kw)(Table 3-1).

AN/TTC-38(V)1:

Air conditioners (2)	13.0
Battery charger	9.75
Ac indicator lamps and relays	0.048
Ac convenience outlets	0.6
Fluorescent lamps	0.192
Total	23.59

AN/TTC-38(V)2:

Air conditioners(2)	13.0
Battery charger	12.4
Ac indicator lamps and relays	0.048
Ac convenience outlets	0.6
Fluorescent lamps	0.192
Total	26.24

*The AN/TTC-38(V)(*) is normally operated with 50/60 Hz power. If the 400 Hz option is utilized, observe the special precautions throughout this manual.

b. Telephone Signal Characteristics.

No. switchboard terminals:

AN/TTC-38(V)1	300
AN/TTC-38 (V) 2	600

No. adaptable terminals:	48

No. SF/DC terminals:

AN/TTC-38 (V) 1	300
AN/TTC-38 (V) 2	600

No. DTMF common battery terminals:

AN/TTC-38 (V) 1	224 maximum
AN/TTC-38 (V) 2	448 maximum

No. 26-pair connectors:	
AN/TTC-38 (V) 1	28
AN/TTC-38 (V) 2	56
No. field side telephone pairs:	
AN/TTC-38 (V)1	600
AN/TTC-38 (V-) 2	1200
No. field side spare pairs:	
AN/TTC-38 (V) 1	128
AN/TTC-38 (V) 2	256
No. spare network terminals:	
AN/TTC-38 (V) 1	7 (as issued)
AN/TTC-38 (V) 2	4 (as issued)
Terminal impedance	600 ohms
Terminal bandwidth	300 Hz to 80 kHz
No. line groups	30 maximum
No. lines per group	5 maximum
No. trunk groups	120 maximum
No. trunks per group:	
AN/TTC-38 (V) 1	300 maximum
AN/TTC-38 (V) 2	600 maximum
No. 5-party conference bridges	4
No. 9-party conference bridges	1
No. preprogrammed conferences	10 maximum
No. preprogrammed conferees	9 maximum
No. direct access capability terminations	36 maximum

c. Compatible Terminal Equipment.

Standard automatic lines (subsets):	
Telephone Set TA-341 ( )/TT	
WECO Type 2500	See note
Switchboard AN/TTC-32	See note
Adaptable automatic lines:	
Commercial Exchange DC Closure Lines	See note
Telephone Set TA-236/FT	See note
Adaptable non-automatic lines (operator needed to connect call):	
Telephone Set TA-312/PT	
Standard automatic trunks (switchboards):	
Automatic Telephone Central Office AN/TTC-38 (V) (*)	
Automatic Telephone Central Office AN/TTC-31	See note
Automatic Telephone Central Office AN/TTC-25	See note
Automatic Telephone Central Office AN/TTC-30	
Standard converter trunks:	
Telephone Signal Converter CV-1919/G	
Telephone Signal Converter CV-1918( )/G(V)1	
Telephone Signal Converter CV-2875/G	
Adaptable automatic trunks:	
Automatic Telephone Central Office AN/TTC-28	See note
AUTOVON PBX Access Lines	See note
Commercial SF-supervised Exchanges	See note
Adaptable non-automatic trunks:	
Manual Telephone Switchboard SB-22/PT	
Manual Telephone Switchboard SB-86/P	
Telephone Signal Converter CV-1548/G	
Telegraph-Telephone Signal Converter TA-182/U	
Manual Telephone Central Office AN/TTC-7	
Adaptable semi-automatic trunks:	
Manual Telephone Switchboard SB-3082(V)1/GT and SB-3082(V)2/GT	
Manual Telephone Central Office AN/TTC-35(V)1 and AN/TTC-35(V)2	
Wideband equipment:	
Voice Security Devices	See note

NOTE

These are advanced development, commercial or special equipments. No TM references are available through AG Publications.

d. Ancillary Equipment:

Power generator.

Remote page printer.

Remote teletypewriters.

Remote punching devices.

Service telephone.

Telephone-Telegraph Signal Converter TH-22/T or TH-81/GCC.

e. Central Office Generated Signals.

Function	Freq in Hz (see note 1)	Single tone level in dbm	Duration (see note 2)	Remarks
Digits: 1	697/1209	-7± 2		
2	697/1336			
3	697/1477			
4	770/1209			
5	770/1336		See note 3.	
6	770/1477			
7	852/1209			
8	852/1336			
9	852/1477			
0	941/1336			
Seize, also ring trip.	2250	-7 ± 2	Continuous.	Shut off by seize acknowledge.
Ring trip trip, also seize acknowledge and release acknowledge to lines, converters, manual switchboards and PABX's.	570 250 ms.	-7 ± 2	Continuous.	Until seize or release stops plus
Seize acknowledge and restart signal on trunks, also queue advance trip	852/1209	-7 ± 2	Continuous.	Until seize stops plus 250 ms or until queue advance stops.
Dial tone 425		-14 ± 2	Continuous, max 10 seconds	Shut off by first digit.
Ring (routine)	570	-4 ± 2	3 min or shut off by ring trip or queue advance.	50 ms on, 50 ms off. 2 seconds on, 4 seconds off.
Ring (priority)	570/425	-4 ± 2	3 min or shut off by ring trip or queue advance.	50 ms 425, 50 ms 570. 1 second on, 1 second off.
Conference	941/1477	-7 ± 2	Operator controlled.	
Recall, also special trunk precedence indicator, also rering.	941/1209	-7 ± 2	Operator controlled. (See note 3).	
Answer tone.	2600	-7 ± 2	275 ± 50 msec.	Sent to calling party when called party answers, also sent to released party during preemption.
Busy tone	425	-14 ± 2	10 seconds or shut off by release.	1/4 second on, 1/4 second off.
Ringback tone	425	-14 ± 2	3 min or until ring stops.	2 seconds on, 4 seconds off. 50 ms on, 50 ms off.
Error signal.	425/1050 freq shift	-14 ± 12	continuous.	1/8 second 425, 1/8 second 1050.
Preempt tone.	570/425	-14 ± 2	2 ± 1/4 seconds.	Continuous.
Precedence signals	FO- 697/1633 F - 770/1633 I - 852/1633 P- 941/1633	-7 ± 2	Operator controlled	
Release.	2600	-7 ± 2	Continuous up to 3 to 10 seconds max time out.	Shut off after receipt of 425 ms of release acknowledge.
Release acknowledge (trunks)	2600	-7 ± 2		Cutoff 250 ms after end of release.
Test tone	1050 ± 25	-4 ± 1/2	Continuous.	

Function	Freq in Hz (see note 1)	Single tone level in dbm	Duration (see note 2)	Remarks
Recall response	570	-14 ± 2	Until recall stops.	
Proceed signal	941/1209	-7 ± 2	Same as digits. (See note 3).	Cutoff by digit signal.
Interdigit signal	941/1633	-7 ± 2	Same as digits. (See note 3).	Cutoff by proceed signal or restart signal.
Routine lamp turn on.	697/1209	-7 ± 2	50 ms	
Priority lamp turn on.	770/1209	-7 ± 2	50 ms	
Alarm lamp turn on.	697/1633	-7 ± 2	50 ms	
Alarm lamp turn off.	770/1633	-7 ± 2	50 ms	
Queue lamp turn off.	852/1477	-7 ± 2	50 ms	
Hold lamp turn on.	770/1336	-7 ± 2	50 ms	
Hold lamp turn off.	69771477	-7 ± 2	50 ms	
Selective release trip.	697/1336	-7 ± 2	Until signal' stops.	
Common release trip.	852/1336	-7 ± 2	Until signal stops.	
Master clear.	770/1477	-7 ± 2	50 ms	
Unstaffed.	2250	-7 ± 2	Continuous	Shut off by STAFFED switch.
Queue advance.	2250	-7 ± 2	Continuous	Shut off by queue advance trip.
Hold.	941/1209	-7 ± 2	Operator controlled.	
Rering.	941/1209	-7 ± 2	Operator controlled.	
Clear/wipeout.	941/1209	-7 ± 2	Operator controlled.	
Intercom seize.	2600	-14 ± 2	Intercom ports only.	
Trunk Precedence signals.	FO-770/1209 F-697/1477 I- 697/1336 P- 697/1209 R-941/1336	-7 ± 2	See note 3.	Sent between registers on trunk calls.
Commercial DTMF line ring signal.	20	100 volts rms max, open circuit.	Shut off upon detection of closure or 3 min time out.	2 seconds on, 4 seconds off.

THE FOLLOWING SIGNALS PERTAIN TO SPECIAL LINES AND TRUNKS ONLY

Idle tone.	1050 ± 25	-14 ± 2	Continuous	Sent to ringdown trunks when idle.
1600 Hz ringdown signal.	1600	-7 ± 2	2 seconds.	
20 Hz ringdown signal.	20	100 volts rms max, open circuit.	2 seconds.	
CB line ring.	20	100 volts rms max, open circuit.	Shut off upon detection of closure or 3 min. time out.	2 seconds on, 4 seconds off.

NOTES

1. Unless otherwise noted, the tolerance of all frequencies is ± 1. 3%.
2. Unless otherwise noted, the tolerance of all durations and interrupt rates is ± 20%.
3. For confirmation signaling the total time from the beginning of transmission of one digit until the beginning of transmission of the next, including confirmation signaling and inter-digit plus proceed or restart, does not exceed 200 ms under normal conditions. No digit tone is transmitted for over one second. For tone burst signaling, signal duration is 70 ± 15 seconds. Break duration equals signal duration.

f. Manual Cordless Switchboard Generated Signals.

Function	(see note 1)	Freq in Hz level in dbm	Single tone Duration (see note 2)	Remarks
Digits: 1	697/1209	-14 ± 2	Operator controlled.	Operator originated (keysender).
2	697/1336			
3	697/1477			
4	770/1209			
5	770/1336			
6	770/1477			
7	852/1209			
8	852/1336			
9	852/1477			
0	941/1336			
Precedence levels (16-button keyset)	FO- 697/1633 F-770/1633 I - 852/1633 P - 941/1633	-14 ± 2	Operator controlled.	Operator originated (keysender).
Conference.	941/1477	-14 ± 2	Operator controlled.	Operator originated (keysender).
Recall.	941/1209	-14 ± 2	Operator controlled.	Operator originated (keysender).
Seize.	2250	-14 ± 2	Continuous.	Cut off by seize acknowledge.
Seize acknowledge.	570	-14 ± 2	Continuous. until seize stops plus 250 ms.	
Release.	2600	-14 ± 2	Continuous up to 3 to 5 seconds max timeout.	Cutoff by release acknowledge.
Release acknowledge.	570	-14 ± 2	Continuous up to 3 to 5 seconds max timeout.	Cutoff 250 ms after release ends.
1600-Hz trunk signal.	1600	-14 ± 2	1.25 ± 0.25 seconds.	
20-Hz trunk signal.	20 ± 5	MIL-STD-188	1.25 ± 0.25 seconds.	
Ring (2-wire ringdown).	20 ± 5	MIL-STD-188	1.25 ± 0.25 seconds.	
Ringback (while ringing 2-wire ringdown).	20-Hz harmonics		1.25 ± 0.25 seconds.	
Ring (CBS lines).	20 ± 5	MIL-STD-188	Continuous until called party comes off hook.	1 second on, 2 seconds off.
Ringback (while ringing CBS lines).	20-Hz harmonics		Continuous until called party comes off hook.	1 second on, 2 seconds off.
Preempt tone.	1000	-14 ± 2	Timed or operator controlled.	1/4 second on, 1/4 second off.
Test tone.	1000	-4 ± 2	Continuous.	Available at test tone terminals.
Idle tone.	1000	-14 ± 2	Continuous.	Sent to ringdown trunks when idle.
All links busy.	1000	-14 ± 2	Subscriber controlled.	1/4 second on, 1/4 second off.
Ringback tone (while in queue).	570	-14 ± 2	Continuous until operator answers.	2 seconds on, 4 seconds off, 50 ms on, 50 ms off.

NOTES

1. Unless otherwise noted, the tolerance of all frequencies is ± 1.5%.
2. Unless otherwise noted, the tolerance of all durations and interrupt rates is ± 20%.

g. Converter Generated Signals.

Function	Freq in Hz (see note 1)	Single tone level in dbm	Duration (see note 2)	Remarks
Digits: 1	697/1209	-14 ± 2	Operator controlled.	Operator originated.
2	697/1336			
3	697/1477			
4	770/1209			
5	770/1336			
6	770/1477			
7	852/1209			
8	852/1336			
9	852/1477			
0	941/1336			
Seize	2250	-14 ± 2	Operator controlled.	Held until seize acknowledge is heard.
Seize acknowledge.	570	-14 ± 2	Continuous until 250 ms after seize stops.	
Ringback tone.	425	-14 ± 2	Until operator answers.	2 seconds on, 4 seconds off. 50 ms on, 50 ms off.
Conference.	941/1477	-14 ± 2	Operator controlled.	Operator originated.
Recall.	941/1209	-14 ± 2	Operator controlled.	Operator originated.
Release.	2600	-14 ± 2	Continuous up to 3 to 10 seconds.	Operator originated, shut off by release acknowledge.
Release acknowledge.	570	-14 ± 2		Cutoff 250 ms after release ends.

NOTES

1. Unless otherwise noted, the tolerance of all frequencies is ± 1.3%.
2. Unless otherwise noted, the tolerance of all durations and interrupt rates is ± 20%.

h. Telephone Generated Signals.

Function	Freq in Hz (see note 1)	Single tone level in dbm	Duration (see note 2)	Remarks
Digits: 1	697/1209	-7 ± 2	Subscriber controlled.	
2	697/1336			
3	697/1477			
4	770/1209			
5	770/1336			
6	770/1477			
7	852/1209			
8	852/1336			
9	852/1477			
0	941/1336			
Seize or ring trip.	2250	-4 ± 2	Continuous.	Min. of 250 ms, cut off by seize acknowledge or ring trip trip.
Recall	941/1209	-7 ± 2	Subscriber controlled.	
Release	2600	-4 ± 2	Continuous up to 3 to 10 seconds.	Cut off 425 ms after receipt of release acknowledge.
Conference	941/1477	-7 ± 2		Subscriber controlled.
Conference release	941/1209	-7 ± 2	Subscriber controlled.	
Ring (point to point)	570 ± 2%	-4 ± 2	1.5 ± 0.5 seconds.	

Function	Freq in Hz (see note 1)	Single tone level in dbm	Duration (see note 2)	Remarks
Precedence signals (16-button keyset)	FO- 697/1633 F-770/1633 I- 852/1633 P-941/1633	-7 ± 2	Subscriber controlled.	

NOTES

1. Unless otherwise noted, the tolerance of all frequencies is ± 1.3%.
2. Unless otherwise noted, the tolerance of all duration anl(' interrupt rates is ± 20%.

1-8. Items Comprising an Operable Equipment

NSN	Item	Quantity (ea)		Height (in.)	Depth (in.)	Width (in.)	Weight (lb.)
		AN/TTC-38(V)1	AN/TTC-38(V)2				
	Automatic Telephone Central Office AN/TTC- 38(V)1	1		83	177	87	5875
	Automatic Telephone Central Office AN/TTC- 38(V)2		1	83	177	87	6940
	Operator position assembly	1	1	12	7	16	16
	Headset-microphone it- 325/TTC (for Al)	1	1	11	3	7	
	Remote operator module assembly C- 9434/TTC- 38(V) (includes Headset-microphone H- 325/TTC)(.2,A49)	0	1	9	16	23	42
5830-00-752-5357	Intercommunication Station LS- 147C/FI	1	1	7-1/4	7	11-1/2	10
	Maintenance control panel (A4,A5)	2	2	9-1/4	6-1/2	27	11 ea.
	System status panel (A6)	1	1	6-1/2		24	4
	Functional assignment control panel (A7)	1	1	9-1/2	15	24	15
	Central processor (A8,A9)	2	2	33	22	10	80 ea.
	Memory (A10,All)	2	2	18-3/4	19	12	65 ea.
	Paper tape reader (A12)	1	1	10	12	24	30
	Modem (A13)	1	1	3-1/2	11-1/4	15	8
	Motor controller (A14,A15)	2	2	4-1/4	3-1/2	8	3 ea.
	Synchronizer assembly (A16)	1	1	7	5-3/1	24	30
	Control transfer assembly (A19)	1	1	12	5-1/2	23	29
	Paper tape punch (A20)	1	1	8-1/2	18-1/2	22	40
	Page printer (A21)	1	1	8-1/2	18-1/2	18-1/2	40
	Patch plug and cable tester (A22)	1	1	3	6	6-3/4	6
	NTS power control panel (A23)	1	1	3-1/2	6-1/2	25	5
	Battery charger (A24)	1	1	36	18	10	274
	Adapter assembly (including adapters)(A25)	1	1	22-1/2		25-1/2	65
5805-00-190-5712	DTMF terminal circuit card	50	50				
	20-Hz ring-down	12	12				
	1600-Hz ring-down	12	12				
	Dc closure	4	4				
	Common battery dial pulse	12	12				
	AUOTOVON/SF dial (3 cards)	4	4				

NSN	Item	Quantity (ea)		Height (in.)	Depth (in.)	Width (in.)	Weight (lb.)
		AN/TTC-38(V)1	AN/TTC-38(V)2				
	Patch panel (A26,A43)	1	2	21-1/4	8-1/2	25	25 ea.
	Common terminal equipment assembly (A27)	1	1	15-1/4	13-1/2	25-1/2	75
	Common equipment panel (A28)	1	1	7-1/2	1	25	7
	Terminal/matrix frame assembly (A29,A30,A31,A33, A40,A42,A44,A45)	4	8	26	14	25-1/2	105 ea.
	Common matrix driver assembly (A32)	1	1	4-1/2	16-1/2	25-1/4	18
	High voltage protector (A34,A35, A46,A47)	2	4	55	5	18-1/4	
	Connector assembly (A36,A48)	1	2	28	4	13-1/2	5
	Distribution panel assembly (A37)	I	1	19	6	23	5
4120-00-411-3730	Air conditioner, horizontal compact, 18,000 BTU, 208V, 2 phase 50/60 Hertz, model MAC6H18- 208-1201-02 (A38,A39)	2	2	20	28	30	250 ea.
	20-Hz ring generator (A50)	1	1	17	6	13-1/2	
	Power relay assembly (A51)	1	1	28	4	24	
	Blower assembly, NTS (A52,A53,A54,A55,A56)	5	5	6	7	23	6 ea.
	Blower assembly, power panel (A57)	1	1	9	2	18-3/4	
	Blower assembly, memory (A58, A59)	2	2	5	16	10	
	Storage battery 6TNC (BT1-4)	4	4	9	11	10	71 ea.
	Inverter, dc to ac (PS1, PS2)	2	2	18	13	9	40 ea.
	Converter, dc to dc, type 1 (± 24V, ± 12V, -6V) (PS4, PS7)	2	2	7	18	5	18 ea.
	Converter dc to dc, type 2 (± 5) (PS3, PS8)	2	2	7	18	3-1/2	16 ea.
	Converter, dc to dc, type 3 (± 5V, -10V, -18V) (PS5, PS6)	2	2	7	18	3-1/2	17 ea.
	Converter, dc to dc, Type 4 (± 5V) (PS13, PS18, PS23)	2	2	7	18	5	16 ea.
	Converter, dc to dc, type 5 (± 12V) (PS12, PS17, PS22)	2	3	7	18	3-1/2	13 ea.
	Converter, dc to dc, type 6 (-6V, ± 15V, -15V) (PS11, PS16, PS21)	2	2	7	18	5	25 ea.
	Converter, dc to dc, type 7 (± 9V, -12V) (PS10, PS15, PS20)	2	3	7	18	3-1/2	13 ea.
	Converter, dc to dc, type 8 (± 48V) (PS9, PS14, PS19)	2	3	7	18	5	22 ea.
	Power supply, ac to dc (12V) (PS24)	1	1	5	5	7	22
	Convenience fan (B1)	1	1	4-3/4	1-3/4	4-3/4	
	Accessory shelf	1	1	54	4-1/4	17-1/4	1
	Power distribution panel	1	1	24	6	13	
	Power control: panel	1	1	32-1/2	4	13-1/2	
	Electrical grounding cable W307	1	1		1500		

NSN	Item	Quantity (ea)		Height (in.)	Depth (in.)	Width (in.)	Weight (lb.)
		AN/TTC-38(V)1	AN/TTC-38(V)2				
5995-00-196-1293	External power electrical cable assembly (W299) SM-D-744663	2	2		600		
5995-00-198-3458	External power electrical cable assembly (W300) SM-D-744664	1	1		300		
	Reel, cable RC-435/U (for W300, W307)	2	2				
	Patch cord, 4-wire, 6-in.	28	54		6		
5995-00-149-0670	Patch cord, 4-wire, 12-in.	32	60		12		
5995-00-307-9468	Patch cord, 4-wire, 24-in.	32	60		24		
5995-00-307-9469	Patch cord, 4-wire, 36-in.	22	40		36		
5995-00-307-9470	Patch cord, 2-wire, 6-in.	18	40		6		
5995-00-307-9480	Patch cord, 2-wire, 12-in.	18	40		12		
5995-00-307-9485	Patch cord, 2-wire, 24-in.	18	40		24		
5995-00-307-9486	Patch cord, 2-wire, 36-in.	16	30		36		
5995-00-307-9488	Patch plug, 4-wire	275	550				
5110-00-293-2339	Axe, single bit	1	1				
7210-00-753-3043	Chair	2	2				18 ea.
7520-00-926-4726	Wastepaper basket	1	1	10-1/4	7-1/2	10-1/4	2
7920-00-178-8315	Dust brush	1	1				
6645-00-410-2395	Clock	1	1	4-1/2	2-1/2	4-1/2	
4210-00-270-4512	Fire extinguisher	1	1				17
4210-00-288-6849	Bracket, fire extinguisher	1	1				
6545-00-922-1200	First aid kit	1	1	5-3/4	3-1/4	8-1/2	3
6230-00-729-9614	Lantern	1	1				
	Ladder, vehicle boarding	1	1				
7520-00-162-6179	Pencil sharpener MX-3391/G	1	1				1
5120-00-251-4489	Hammer	1	1				12
	Rotary card file	1	1				2
	Vacuum cleaner	1	1				
	Ground strap	1	1		120		1
5975-00-224-5260	Ground Rod MX- 148/G	2	2		72		6
	Paper tape winder	1	1	8	10-1/4	5-1/2	7
	Lift and tie down assembly	1	1				
	Accessory shelf	1	1	54	4-1/4	17-1/4	1
6210-00-921-6682	Shield, light f/fluorescent	1	1				
6240-00-152-2996	Lamp, fluorescent (F20T12/CW) (24455)	5	5				
	Lamp incandescent 30V, 50 watt	2	2				
	Lamp, blackout	1	1				
	Card extractor	1	1				
	Tool ± 57269	2	2				
	Tape, Blank Data Base (V)1 SM-D-751710 (on reel)	1	0				

NSN	Item	Quantity (ea)		Height (in.)	Depth (in.)	Width (in.)	Weight (lb.)
		AN/TTC-38(V)1	AN/TTC-38(V)2				
	Tape, Blank Data Base (V)2 SM-D-751711 (in reel)	0	1				
	Tape, bootstrap diagnostic SM-D-751714 and tape, maintenance control panel diagnostic SM-D-751718 (combined on one reel)	1	1				
	Tape, memory-to-memory and control transfer diagnostic SM-D-751717 and tape, memory diagnostic SM-D-751716 (combined on one reel)	1	1				
	Tape, paper tape reader/punch diagnostic SM-D-751722 and tape, FACP diagnostic SM-D-751719 (combined on one reel)	1	1				
	Tape, common control synchronizer diagnostic SM-D-751720 and tape, remote devices synchronizer diagnostic SM-D-751721 (combined on one reel)	1	1				
	Tape, central processor diagnostic SM-D-751715 (on reel)	i	1				
	Tape, Operational program SM-D-751723 (on reel)	1	1				
	Tape, Diagnostic Loader SM-D-752126 (not on reel)	1	1				
7530-00-223-7966	Paper, teletype; single copy w/o carbon, friction feed.					5 dia.	8½
7530-00-965-2411	Tape, teletypewriter, paper 1 in. wide.						
7510-00-705-8798	Ribbon, RO-33 teletype						

1-9. Equipment Description

(figs. 1-1 through 1-7 and FO-1)

All components of the AN/TCC-38(V)(*) are housed in Shelter, Electrical Equipment S-280/G (modified). The shelter facility is fully insulated and weather-proofed, and can be transported by air or ground vehicle. Equipment is housed in racks which are secured to the floor, ceiling, and walls of the shelter facility. Mounting and storage compartments are provided for storing spare parts and accessories. Remote operator positions are housed in transit cases. These operator positions are stored separately for movement of the AN/TTC-38(V)(*) and are installed at remote locations for operation.

a. Lighting. Five fluorescent light fixtures are mounted on the ceiling of the assemblage (fig. FO-1) to provide primary lighting. Two incandescent lights provide lighting when the temperature is too low for the fluorescent lights to operate. The lighting may be controlled by a door interlock for blackout operations, or bypassed if blackout conditions are not required. A blue low-level lighting' system provides light if the door is opened during blackout conditions. A blackout curtain provides supplemental blackout protection for the door during blackout conditions.

b. Power Connections. Watertight ac power receptacle is provided in the power entry panel on the roadside wall of the assemblage (fig. 1-2) for connection to an external power source. The ac power is routed through the power entry panel to the power control panel for distribution to power subsystem equipment. AC power may be provided by an engine generator set or from a commercial power source. External dc power may also be connected through the dc terminals in the power entry panel.

c. Signal Connections. Twenty-six pair cable connections are made to the AN/TCC-38(V)(*) through signal entry panels on the curbside wall (fig. 1-1). Signal patching facilities are provided at the patch panel on the interior curbside wall.

d. Environment. Personnel environmental conditions are supplied by the two air conditioners (fig. 1-2) which provide both heating and cooling. These may be supplemented by direct ventilation through the door filter and exhaust blower.

e. *Network Terminal Subsystem*. The network terminal subsystem equipment located on the curb-side wall (figs. 1-6, 1.7 and: FO-1) performs all telephone signaling and connection functions.

(1) *Matrix/terminal frame assemblies*. Four matrix/terminal frame assemblies (A29, A30, A31, and A33) are provided in the AN/TTC38(V)1; eight (A29, A30, A31, A33, A40, A42, A44, and A45) are provided in the AN/TTC38(V)2. Each frame assembly contains printed circuit cards which interface with standard fourwire terminals and scan terminals for supervisory signals (seize and release). The frame assemblies also contain crosspoint circuit cards which connect both voice (narrowband) and wideband signal paths. Each frame assembly is dedicated to service up to 80 telephone terminals. Terminals in a frame are organized into eight 10-terminal groups. In addition, two unscanned service terminals used with common equipment such as conference bridges and sender/receivers are provided in each group. The quantity of terminals varies in each frame assembly and therefore, the quantity of various circuit card types also varies.

(2) *Common equipment assembly*. Common equipment assembly A27 contains circuits cards with functions which are shared by all terminals. These functions include the following. Sender/ receivers detect incoming signaling tones and select signaling tones to be sent out of the central office. Tone sources generate signaling tones. Auxiliary sender/receivers test various devices in the network/terminal subsystem. Bus ringers develop the timing of ringback, normal ring, priority ring, and seize trip signals, and amplify these signals. Conference bridges interconnect parties making conference calls.

(3) *Adapter assembly*. Adapter assembly A25 allows 48 printed circuit card type adapters to be plugged into the system. There are five types of adapters. A complement of adapters, including each type, is issued with the AN/TTC38 (V) (*). However, any combination of adapters may be plugged into A25 to meet the operational situation.

(4) *Common matrix driver assembly*. Driver circuit cards in assembly A32 provide connection control signals to the matrix/terminal assemblies. Also, error summary cards collect driver test results for reporting to the common control. The common drive assembly contains different quantities of cards in the AN/TTC-38(V)1 and AN/TTC-38(V)2 because of the different quantities of frames and links:

(5) *20-Hz ringer*. The 20-Hz ringer (A50) develops high level 20-Hz ring signals.

(6) *Patch panels*. On AN/TTC-38(V)l patch panel A26 breaks out network and field side 4wire appearances of four frames. The additional, four frames in AN/TTC-38(V)2 are patched on A43. The panels are organized and color coded for easy identification of network frame, group, and terminal numbers, signal entry connections, and adapter connections. The arrangement is such that a 4-wire field-side quad connector can be patched to an adjacent network quad with a single patch plug. Longer patch cords are provided so that this arrangement can be varied.

(7) *Common equipment panel*. Panel A28 provides. for connection of sender/receivers and conference bridges to network service terminals. Also remote I/O (input/output) devices such as the remote printer and teletypewriters are patched from A28.

f. *Common Control Subsystem*. The common control subsystem, which is located on the roadside wall (figs. 1-4, 1-5, and FO-1), controls every step of telephone call processing performed by the network terminal subsystem. In addition it performs numerous monitoring, maintenance, and reporting functions. It is basically a dual stored program computer with special interface circuits for telephone control and a special peripheral device, functional assignment control panel, which is used for making data base entries. Several normal computer-type peripheral devices are also provided.

(1) *Processors*. The processors (A8 and A9) execute instructions in the stored program. One of the processors operates on-line continuously when the AN/TTC-38(V)(*) is in operation. The second processor is either in a standby or off-line condition. Standby means that the processor is fully operating and ready to be automatically switched on line in the event the on-line processor fails. Off-line means that the processor is either inoperative or performing some other program and can not be switched on-line to control call processing. There are 52 types of instructions which are executed by the processor. Five of these are special purpose control instructions; the remainder are normal computer machine language instructions.

(2) *Memories*. There are two 64,000-word (64K) memories. Each memory consists of a control circuit card and four 16K ferrite core memory modules. Memory A10 is used by processor A8; memory All is used by processor A9. Each memory word consists of the 24-bit instruction word plus a parity bit which is used to detect read errors. The on-line operational program is stored in the memory of on-line and standby processors. Portions of the memory are used

to store the data base and used as operational registers by the processor.

(3) *Maintenance control panels (MCP)*. Each processor has a separate panel (A4 and A5) used for control and maintenance purposes. Maintenance functions include both maintenance of the processor and manually initiated maintenance testing of the AN/TTC-38(V)(*).

(4) *System status panel*. System status panel A6 provides visual and audible alarms of system malfunctions. In addition, controls for the common control subsystem switchover, tape reader, and synchronizers are provided.

(5) *Functional assignment control panel*. The FACP (A7) permits access to the data base of the AN/TTC-38(V)(*) program. It allows operational personnel to assign, change, and delete terminal numbers, directory numbers, classmarks, and numerous other variable factors associated with telephone terminals. The FACP is used to display information which has been entered into the data base and to initiate printouts of this data on the page printer. Traffic meters are also displayed on the FACP. Operational control of peripheral devices is another function controlled by the FACP. Intercom station LS-147C/FI is located near the FACP to provide local communication.

(6) *Modem*. Modem A13 contains a keyer which sends teletype signals to the remote page printer and a keyer-converter which converts fsk signals to and from the remote teletypewriter. A second keyer-converter can be installed in A13 to convert signals for the spare remote teletypewriter channel.

(7) *Synchronizer assembly*. The synchronizer assembly (A16) contains printed circuit cards which synchronize the timing of peripheral devices to the timing of the processors. They also permit sharing of peripheral devices by the two processors.

(8) *Paper tape reader*. Paper tape reader A12 provides for the loading of program tapes into the common control subsystem memories. Tapes of the data base can also be read in from A12. In addition punched tapes of various types of tables can be sent to local or remote printers or punch.

(9) *Page printer*. Page printer A21 is used to report operational and maintenance messages and data. Motor control A14 turns on the page printer motor only while messages are being received.

(10) *Tape punch*. Tape punch A20 permits punching of program, data base, or teletype message tapes either from data stored in one of the memories or from the paper tape reader. Motor control A15 controls the punch motor. Paper tape winder A60 is provided to take-up and spool punched tape.

g. *Operator Positions*. The operator subsystem consists of up to three operator positions. One (Al) is permanently mounted in the assemblage, the other two (Switchboard Remote Control C-9434/ TTC-38(V)) are remotely located and connected to the central office circuits through the signal entry panels. Any combination of the three positions can be staffed to meet different traffic and system configuration requirements. Operators assigned to the position can extend calls, grant precedence on a onetime -basis, connect progressive conferences, received intercepted calls, act as information attendants, and offer other assigned services. An intercom feature allows operators to converse with each other through their Headset-Microphones H-325/TTC.

h. *Power Subsystem*. The power subsystem receives primary ac or alternate dc power from external sources and converts it to ac and dc levels required by equipment in the assemblage. Floating batteries permit continuous operation of the central office through power source interruptions of up to one hour for the AN/TTC-38(V)1 and one-half hour for the AN/TTC-38(V)2. Components of the power subsystem on the roadside wall include the power control panel, batteries, battery charger, dc-to-ac inverters, and dc-to-dc converters for the common control subsystem. Additionally there are several dc-to-dc converters and a control panel on the curbside wall which provide power to the network terminal subsystem. Operator positions contain internal power supplies and are powered from available ac sources at their remote locations or from assemblage power.

1-10. Terminal Features

a. *General*. The AN/TTC-38(V)(*) is capable of connection to a variety of terminal devices. Ancillary operating equipment permits flexible control and monitoring of the system from remote locations. The . stored program of the common control permits installation personnel to assign special capabilities to selected lines and trunks.

b. *Terminals*. All telephone and wideband circuits are connected through the signal entry panel to the patch panels. At the patch panels the circuit is either connected to a standard terminal or through an adapter which makes the telephone circuit compatible with the operating equipment of the AN/TTC38(V)(*). A maximum of 48 terminals may be adapted. In addition, each circuit must be classmarked when it is installed. Classmarking, which is entered through the FACP, identifies the type of circuit at each terminal so that the common control subsystem will respond to and supply the proper types of signals for each terminal.

(1) *SF/DC terminals*. Standard AN/TTC38(V)(*) terminals connect to four-wire circuits which use single frequency (SF) or direct current (dc) supervision and dual-tone multiple-frequency (DTMF) signaling. Automatic switching is provided to telephones such as the TA-341( )/TT and trunks to other central offices such as the AN/TTC-38(V)(*).

(2) *Common battery, DTMF*. Terminals 4 through 10 of each group can be converted for connection to two-wire, common battery DTMF telephone sets such as the Western Electric Company (WECO) type 2500. A maximum of 224 terminals in the AN/TTC-38(V)1 and 448 terminals in the AN/ TTC-38(V)2 can be converted to this type of service. Conversion is accomplished by replacing the SF/DC terminal circuit card for the terminal with a DTMF terminal circuit card. Normal automatic service is provided to common battery DTMF telephones. Also, privileges consistent with the keys present on the commercial telephone may be granted to these terminals. The * key on commercial telephones is equivalent to the R key on military telephones. Also the commercial #key is the same as the military C key. Wideband privilege may be granted to DTMF circuits by assigning appropriate terminal type codes.

(3) *20-Hz ring-down*. Terminals adapted for 20Hz ring-down are compatible with two-wire manual devices such as TA-312/PT, SB-86/P, SB-22/PT, AN/TTC-7, or SB-3082(V)(*)/GT. All incoming calls from these terminals are routed to the operator for connection. Outgoing calls from automatic subscribers may be automatically connected to the ringdown circuit or operator connected. The classmark assigned to the 20-Hz ring-down during installation determines which type of outgoing service is provided.

(4) *1600-Hz ring-down*. Terminals adapted for 1600-Hz, ring-down are compatible with several types of manual or automatic lines and trunks which appear as four-wire 1600-Hz circuits at the AN/TTC38(V)(*). These include manual telephones and switchboards TA-312/PT, SB-86/P, and SB-22/PT which are converted by TA-182/U or CV-1548/G for use over carrier circuits. Calls from four-wire 1600-Hz trunks from SB-3082(V)1 or SB-3082(V)2 which use DTMF signaling are automatically connected by the AN/TTC-38(V)(*). Incoming calls from manual circuits are routed to the operator for servicing. The manual circuits may be classmarked for either automatic or operator-assisted outgoing service.

(5) *Dc closure*. Terminals adapted for dc closure look like a standard two-wire, common battery, commercial subset to a commercial central office or private branch exchanges (PBX). All incoming calls are signaled by a 20-Hz ring and routed to the operator for connection. However, if the dc closure line is classmarked for DAC (direct access), the incoming call is routed directly to the proper tactical subscriber. Outgoing calls dialed by AN/TTC38(V)(*) subscribers are automatically routed to the operator for dialing. Also, the classmark determines whether dial pulse or DTMF signaling is sent on outgoing calls.

(6) *Common battery dial pulse*. Terminals adapted for common battery dial pulse are compatible with two-wire rotary dial telephone sets such as TA-236/FT. Automatic incoming and outgoing service is provided to these terminals.

(7) *AUTOVON/SF dial*. Terminals adapted for this type of service are compatible with several types of automatic trunks. These include AUTOVON PBX access lines, commercial exchanges and AN/TTC-38 trunks. Each trunk is classmarked so that it will respond to the proper type of signaling and numbering plan. This terminal adapter is also used to interface with converter CV-3478 NATO Interface Unit (NIU).

c. Ancillary Equipment.

(1) *Remote page printer*. A page printer at a remote location may be connected through the signal entry panel. This printer provides identical printouts to the page printer in the assemblage. The remote printer may be either a 150 words-per-minute ASCII or a 100 words-per-minute Baudot type operating through a telegraph-telephone signal converter such as TH-22/TG. A MIL-STD-188C low level dc interface may also be used with the remote printer and teletypes. The remote page printer is simplex connected.

(2) *Remote teletypewriter*. A full duplex channel is available through the signal entry panel for connection of a remote teletypewriter. This teletypewriter can perform many of the assignment, change, deletion, display, printout, and punching functions which are performed by the FACP in the assemblage. Either 150-wpm ASCII or 100-wpm Baudot teletypewriters may be connected through a converter such as TH-22/TG.

(3) *Spare remote teletypewriter*. Partial provisions are made in the AN/TTC-38(V)(*) for a second remote teletypewriter channel. This channel is similar to the basic remote teletypewriter channel except that a few less operations can be performed. Another modem must be installed in the AN/TTC38(V)(*) to activate this channel; all other wiring and programming are included.

(4) *Service telephone*. A telephone such as TA341 ( )/TT should be located in the AN/TTC38(V)(*). A mounting bracket for this telephone is provided in the assemblage. This phone is used both for communication with personnel in the assemblage and as a maintenance tool for checking circuits.

1-11. Programmed Features

a. *Line Groups*. Up to five subsets connected to different AN/TTC-38(V)(*) terminals can be combined to form a line group. Any member of the group may be called by dialing that member's directory number. When the particular member called is busy the program searches for and rings a lower ranked member in the group. If all lower ranked members of the group are busy then the calling party will receive busy tone, even if there are idle higher ranking members of the group. If a precedence call is directed to a member of the line group and that member and all lower ranked members - are busy, the call with the lowest precedence and rank in the group will be preempted. Under no circumstances will a higher ranked member be connected to a call directed at a lower ranked member. Ranking within the line group is programmed at the FACP.

b. *Trunk Groups*. Trunks may be combined into trunk groups. The program searches for a non-busy trunk over the route a call must travel. Busy tone can be returned only if all trunks in a selected group are busy.

c. *Trunk Routing*. One primary and one alternate route for each central office destination can be stored in the operational program. If trunks, in the primary route are busy, connection of the call over the alternate route is attempted before busy tone is returned.

d. *Numbering Plan*. The AN/TTC-38(V)(*) uses a seven-digit numbering plan of the form PRSLXXX. The two-digit primary area code (PR) is restricted to numbers 70 through 98. Numbers 70, 71, 80, 81, 90, and 91 are not assigned when the telephone system permits automatic connection between AUTOVON and tactical subscribers. The two-digit switchboard locator (SL) numbers may. be any value from 00 through 99. Three-digit subscriber numbers (XXX) 1-20 are divided into four number blocks. Numbers 0 and 000 are restricted for use as operator directory numbers; only the initial 0 needs to be dialed to call the local operator. PR-SL-000 must be dialed to call the operator of a distant office. Numbers 001-099 are restricted to DC closure lines. Numbers 100 through 699 are allocated to local subscribers. These are identified as IXX numbers throughout this manual. Numbers 700 through 999 (identified as JXX numbers) may be allocated to automatic switchboards, manual switchboards, or local subscribers.

e. *Abbreviated Dialing*. Normal subscribers of the same central office need only dial the three-digit IXX portion of the directory number to call each other.

f. *Fixed Directory Subscriber List*. Fixed directory numbers may be assigned to subscribers who rove throughout the telephone system. Up to 3600 such numbers may be entered into the program's fixed directory subscriber list (FDSL). These are seven digit numbers of the general form 99PXJXX. Each home central office must store the local subscriber number (IXX) of roving subscribers in the FDSL. All other offices must store the PR and SL numbers of roving subscribers current central office in their FDSL.

g. *Fixed Directory Unit List*. Roving central offices (roving units) can be assigned fixed directory numbers. Up to 100 such numbers can be assigned in the program's fixed directory unit list (FDUL). These numbers are of the form 99XXIXX. The final IXX portion of the number represents normal local directory numbers of subscribers in the roving unit. The initial four digits (99XX) are the fixed portion of the number. Each central office in the telephone system must store the current PR and SL numbers for all roving units in the FDUL.

h. *Precedence.* Telephones' equipped with precedence keys or a recall (R) key can be assigned precedence calling privileges. All calls are normally processed on a routine precedence basis. However, calling parties assigned and exercising priority, immediate, flash, and flash override precedence levels receive preferential treatment. The type of preferential treatment offered depends on the type of call being placed. Basically, precedence permits preemption of central office network and terminal circuits such as links and conference bridges; preemption of busy trunks; preemption of busy called subscriber lines; and placement of calls ahead of lower precedence calls in operator's and information attendant's queues. 20Hz or 1600-Hz ring-down lines may be classmarked for precedence; this places incoming calls from these lines ahead of routine calls in the operator's queue.

i. Operator Queue. All calls to the operator are placed in a queue (waiting line) which is controlled by the program. Up to 18 calls may be placed in the queue. Calling subscribers in the queue receive ringback. When the queue is full, calls to the operator receive busy. Precedence calls to the operator are placed at the head of the queue in order of precedence and order of arrival. The single queue may be serviced by up to three operators at the central office; as each operator answers a call, the call presently at the head of the queue is connected to him. It is possible to route operator calls to the operator at a remote central office. In this case the operator queue at the remote office stores all calls.

j. Preprogrammed Conferences. The central office is capable of automatically establishing a conference call from a list of predesignated subscribers. Any member of a conference list may initiate the conference from his subset.

k. Progressive Conference. Subscribers with this privilege may establish a conference call to any group of subscribers. The calling subscriber progressively connects each conferee using his subset. Also, an operator can establish a progressive conference for subscribers who are not assigned the conference privilege.

l. Direct Access Capability. Telephones classmarked for direct access capability (DAC) directly ring and connect to a predesignated terminal when lifted off hook. No dialing is required. DAC lines are further classed into one of three types: Type A is capable of receiving incoming calls. 11 calls to a type B DAC line are automatically intercepted by the operator. Type C DAC terminals initiate a preprogrammed conference when lifted off hook. Any precedence level may be assigned, to DAC terminals. Any line (standard or adapted) may be classmarked for DAC.

m. Recall. After a call is connected, any normal subscriber can recall the operator at his local central office by depressing the subset R key until he hears the recall response tone. When the operator answers the recall he can converse with both parties connected in the call. Recalls are placed in the operator queue at the precedence of the existing call. While in the operator queue, recalls do not receive ringback; this allows normal conversation to take place.

n. Intercept. The program intercepts calls in which certain types of errors or abnormalities occur. These situations include keying a nonexistent or unassigned terminal or switchboard, and calls to an out-of-service terminal. On interoffice calls the first switchboard detecting the error condition intercepts the call. Each office selects the routing of intercepted calls; they may be routed to the operator, the information attendant, or sent error tone.

o. Information Attendant. Any DTMF line (TA341( )/TT or WECO 2500 with * key) may be assigned the function of information attendant. Any number of information attendants can be assigned to each central office. One directory number is assigned to the information attendant. A six-call queue is provided for this directory number to expedite information service. Calls to the information attendant directory number may be directed to the operator if desired.

p. Traffic Metering. The program monitors and counts several types of traffic events. These are described in chapter 3.

q. Line Load. When line load control is applied at a central office all normal routine telephones which are appropriately classmarked are restricted from initiating interoffice trunk calls.

r. On-line Maintenance Routines. Several operational capabilities of the AN/TTC-38(V)(*) are checked by the operational program. Some of these tests are automatically performed periodically; other tests are performed as circuits are used during call processing. In all cases, failures are signaled to central office maintenance personnel by means of audible and visual alarms and maintenance message printouts on the page printer.

s. Off-line Maintenance Routines. Special off-line maintenance programs are provided with the AN/TTC-38(V)(*). They are used to checkout circuits and diagnose problems in the common control subsystem and network terminal subsystem. These programs are run by placing the standby processor in the off-line state and substituting the selected off-line program for the on-line operational program.

1-11.1. Computer Program Tapes.

The AN/TTC-38 (VO1 and AN/TTC-38(V)2 are supplied with periodic issues of revised computer program tapes for pre-loading, loading, operation and maintenance. In case of damage or destruction, new tapes may be requested by writing directly to: Commanding General, USA Communications-Electronics Command, ATTN: DRSEL-ME-SC, Fort Monmouth, NJ 07703.

1-12. Differences in Models

The AN/TTC-38(V)1 and AN/TTC-38(V)2 are operated in an identical manner; however, different quantities and types of equipment are supplied to accommodate the different quantity of telephone terminals serviced by each. These differences are clearly identified in paragraph 1-8, table of components. Different air conditioner types are required for 50/60Hz and 400-Hz power installation. The AN/TTC38(V)1 and AN/TTC-38(V)2 are supplied with 50/60Hz air conditioners. If the assemblage is to be used with 400-Hz power, install the proper air conditioners.

CHAPTER 2

SERVICE UPON RECEIPT AND INSTALLATION

Section I. SYSTEM PLANNING

2-1. General

Telephone system planners determine the central office location and types of terminal connections. Follow the instructions provided in this chapter to implement system plans.

2-2. System Layout Factors

Select a location for the switchboard which satisfies the following distances from the switchboard.

3 phase power source	75 feet (max.)
Remote operator's position	1200 feet (max.)[a]
Remote TTY position (direct connection)	1200 feet (max.)
Telephones TA-341(*)/PT	4.5 miles (max.) ac mode 2.8 miles (max.) dc mode

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[a] 1200 feet maximum if powered from AN/TTC-38 (V) (*). 4.5 miles maximum if using local power.

Section II. SERVICE UPON RECEIPT OF MATERIEL

2-3. Unpackaging and Checking

a. *Packaging Data*. The AN/TTC-38(V)(*) is packed in a reusable wooden crate. The assemblage is anchored to eyebolts in the skid base of the crate and is blocked at the sides and ends with lumber. The skid base has entries for handling with a forklift. The dimensions of the crate are 107 by 201 by 111 inches. The volume is 1381 cubic feet, and the weight of the crated AN/TTC-38(V)1 is approximately 7,375 pounds. The crated AN/TTC-38(V)2 weighs 8,440 pounds.

b. *Removal of Contents* (fig. 2-1).

CAUTION

Do not thrust any tools into the interior of any pack or package.

(1) Unfasten the lag bolts with wrenches, and remove the top, front, rear, and side panels from the crate base.

(2) Detach the tiedowns from the eyebolts in the base of the crate. When cable or tiedown rods are used for anchoring, loosen the turnbuckles.

(3) Remove the wood blocking from the sides and ends of the assemblage.

CAUTION

Be careful when handling tools, because the aluminum skin of the assemblage can be easily damaged.

(4) Remove the assemblage from the crate base. Use overhead lifting equipment whenever available; if it is not available, remove the headers from the crate base, lift the shelter from either side with a forklift, using the two holes in each skid labeled "fork lift here." If a fork lift is not available, drag the assemblage from the crate base by the towing eyes.

(5) Send the crate to a local storage area, if practical, for reuse.

2-4. Checking Unpacked Equipment I

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6 (para 1-3b).

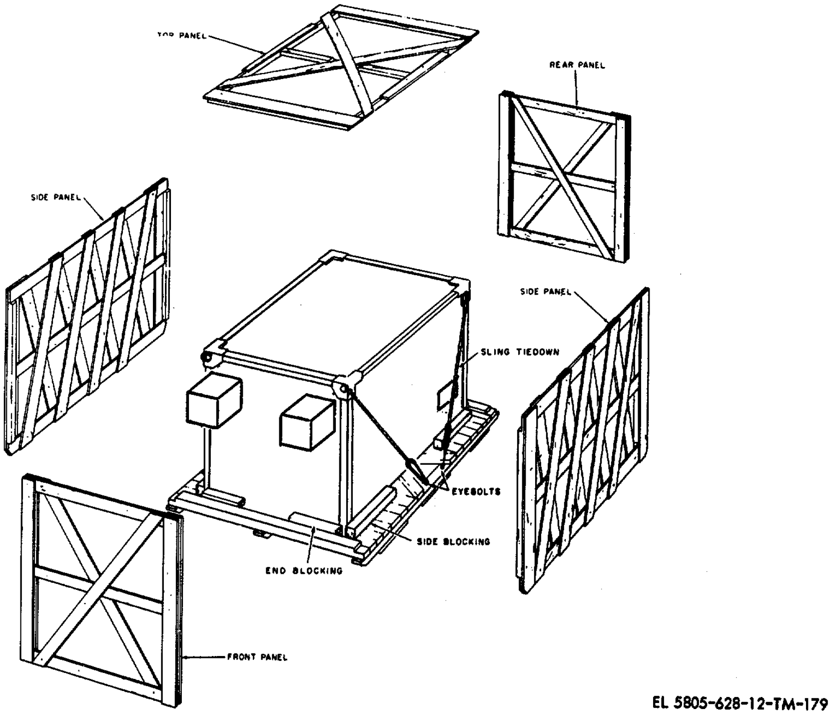


Figure 2-1. Typical packaging diagram.

b. Check the equipment against the component listing in paragraph 1-8 and the packing slip to see if the shipment is complete. Report all discrepancies in accordance with paragraph 1-3. The equipment should be placed in service even though a minor assembly or part that does not affect proper functioning is missing.

c. Check to see whether the equipment has been modified. (Equipment which has been modified will have the MWO number on the front panel, near the nomenclature plate.) Check also to see whether all currently applicable MWO's have been applied. (Current MWO's applicable to the equipment are listed in DA Pam 310-7 as applicable.) d. For dimensions, weights, and volume of packaged items, see SB 700-20.

2-5. Loading and Unloading

a. Truck Installation of Assemblage.

(1) Use the sling hooks (nearest turnbuckles) to connect the sling assemblies to the lift and tie down points of the assemblage (fig. 2-2).

(2) Connect the sling hooks, at the opposite ends of the cables, to the lifting ring, and place the lifting ring over the lifting hook of the lifting device.

(3) Tie a 1/2-inch rope (at least 15 feet long) to each rear towing eye.

WARNING

To avoid injury to personnel, or damage to equipment, only personnel engaged in the actual loading operation should be permitted near the truck, lifting device, and assemblage. To eliminate confusion, all instruction must come from the loading crew supervisor.

(4) Lower the tailgate of the truck and make sure that all tools and equipment have been removed from the body of the truck.

(5) Slowly lift the assemblage high enough to clear the body of the truck.

NOTE

The entrance door of the assemblage must be at the rear of the truck, and the front end of the assemblage must be flush against the front of the truck body.

WARNING

All personnel must remain clear of the truck while the assemblage is being lowered onto the truck

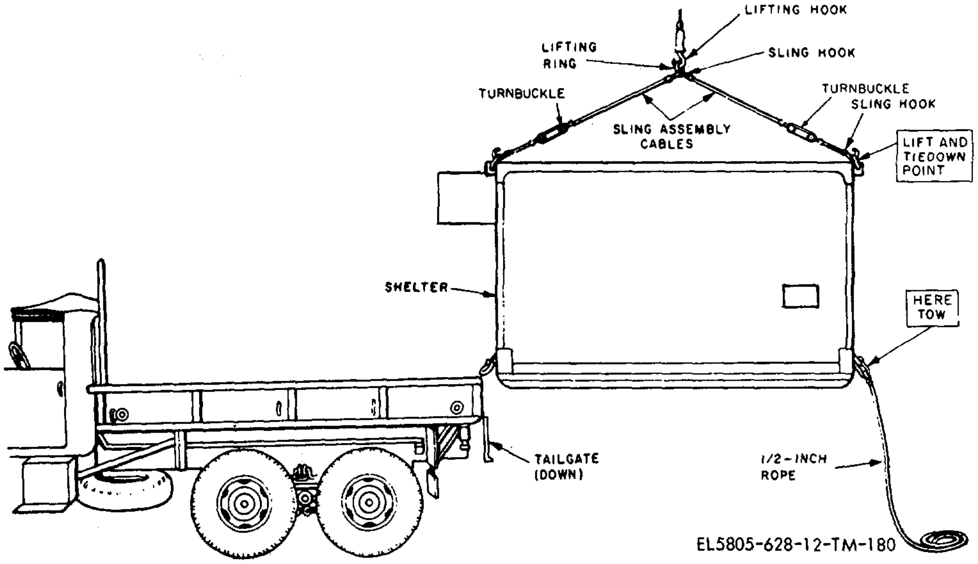


Figure 2-2. Lifting and loading assemblage on truck.

(6) Position a man at the free end of each of the 1/2-inch ropes to guide the assemblage.

(7) Back the truck slowly into position under the assemblage and slowly lower the assemblage into the truck.

(8) Remove the lifting ring from the lifting hook and disassemble the lifting ring and the sling hooks.

(9) Remove the sling hooks from the lift and tiedown points.

(10) Disconnect the 1/2-inch ropes from the rear towing eyes.

(11) Raise and secure the truck tailgate.

(12) Install a tiedown ring assembly (part of the sling assembly) above the center support of each cargo bed side rail of the truck (A, fig. 2-3).

(13) At each side of the assemblage, use the hook at the end farthest from the turnbuckle to hook each sling assembly to a lift and tiedown point of the assemblage.

(14) Secure the sling hooks at the opposite end of the cables to the tiedown ring (B, fig. 2-3).

CAUTION

Do not overtighten the turnbuckles. Overtightening turnbuckles will damage the assemblage.

(15) Tighten all turnbuckles evenly by hand, and then turn each turnbuckle an additional one half turn with a bar or rod inserted into the slot of the turnbuckle.

(16) After the truck is driven to the operating site, lower the tailgate to the horizontal position; then remove the ladder from the assemblage and secure it to the left side of the tailgate.

b. Unloading Assemblage. To unload the assemblage from the truck, reverse the procedures given in a above.

2-6. Ground Installation of Assemblage

When installed on the ground, the assemblage should be placed on a firm, dry surface with good drainage; the site should be prepared and leveled. The assemblage should be placed on concrete blocks or wooden beams, if possible, and positioned to facilitate connections of power, and signal cables. If a generator set is used to provide power, it should be located approximately 75 feet away from the assemblage to minimize fire hazard and generator noise interference.

2-7. Preparation for Use

(figs. FO-2 and FO-3)

To prepare the switchboard for use, perform the procedures listed below before applying power.

NOTE

Special set screws are clamped to the bottom of each chair for transit (GG, 2-3

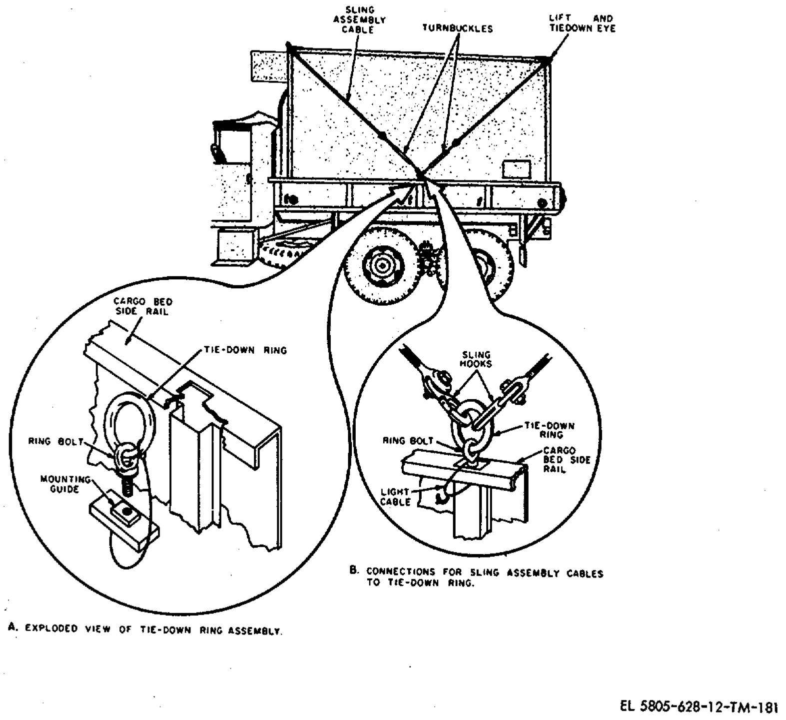


Figure 2-3. Securing assemblage on truck.

Figs. FO-2 and FO-3). Insert these screws in the chair mounting floor holes to keep dirt out of holes. Secure chair holddown screws with chair in use.

a. Loosen the operator's chairs from their transit position.

b. Remove. printer and punch transit bolts marked "T" in view FF of figures FO-2 and FO-3 and install paper in each of the teleprinters following the procedure described in the teleprinter technical manuals. Remove the tape or wire which secures the print mechanism.

c. Remove the tape winder from the stowed position and install it on the vertical post to left of punch A20.

d. Install the chad box on the chad chute using the clamp.

e. Open the vents in the shelter as required for operation.

f Open battery box external vent cover.

g. Unsnap the dust cover from the air conditioner condenser coils: Roll up and secure in place on the top of the air conditioner.

NOTE

Check out batteries (TM 11-6140-20315-3) and see that batteries are installed in proper position (fig. 5-10).

2-8. Grounding

The AN/TTC-38(V)(*) must be properly grounded before input power is connected. Select a grounding site (within 6 feet of the power entry panel) that is low and damp, and that will not interfere with the entrance door, power or signal cables.

a. Loosen and lift the cover of the power entry panel (fig. 1-2).

b. Use the cover support to secure the cover in the open position.

c. Remove a ground rod and the sledge hammer from their mountings under the air conditioners (fig. FO-1).

d. Remove any dirt or grease from the ground rod.

e. Scoop out a small hole, about 6 inches deep, at the selected grounding site.

f. Drive the ground rod into the hole until the top of the ground rod is approximately 3 inches above the bottom of the hole.

g. Remove a 10-foot ground strap from the storage cabinet in the assemblage.

h. Connect one end of the ground strap to the ground rod, and the other end to the GND terminal in the power entry panel.

i. Saturate the ground around the rod with water to keep it moist.

j. If a generator set is used to supply ac power connect ground cable W307 between GND (E2) terminal on power entry panel and GND post on generator set.

Section III. INSTALLATION INSTRUCTIONS

2-9. Power

CAUTION

1. AN/TTC-38(V)(*) is normally' supplied for use with 50/60 Hz ac power. If only 400 Hz power is available, assemblage must be strapped internally by higher echelon maintenance personnel. Do not connect 400 Hz unless strapping has been done because equipment will be damaged.

2. If the AN/TTC-38(V)(*) is strapped for 400 Hz input power, the air conditioners cannot be used. Application of 400 Hz will damage air conditioners if operated.

a. *AC Power Entry Connections*. Remove the power cable reel containing cable W300 from inside the shelter. Unpack cable 299 which is shipped in separate packing crate. Connect external ac power as follows:

WARNING

Make certain external ac power source is off.

NOTE

As required, procure Reel, Cable; RC-405 (FSN 8130-711-0537) to store the 50-foot (W 299) cable. Reels, Cable RC-405 are stored separately from assemblage; they may be mounted on power generator (refer to generator technical manual).

(1) Connect stub ends of power cable W300 to ac power source: L1 BLK to phase A; L2 RED to phase B; L3 BLU to phase C; and LO WHAT to neutral.

(2) Open watertight covers on power entry connector J1.

(3) If ac power source is located more than 25 feet from the central office, connect P2 (stub) of cable W299 (50 feet) to P1 of cable W300. Connect P1 of cable W299 to connector J1 on power entry panel. If ac power source is located less than 25 feet from the .central office, connect P1 of cable W300 to connector J1 on power entry panel.

b. External DC Power Entry Connections.

WARNING

Make certain external dc power source is off.

CAUTION

Observe polarity when connecting dc input power.

(1) Connect negative lead from dc power source to E13 NEG on power entry panel.

(2) Connect positive lead from dc power source to E14 POS on power entry panel.

c. Power Turn-On. See paragraph 3-4 for startup procedure from ac power source. If external dc power source is used, see paragraph 328.

2-10. Remote Operator Position Installation
(fig. FO-4)

Remove the remote operator's position from the separate package and move it to its assigned location. Connect the remote operator position cables to the signal entry panels before any other remote equipment. This is because the signal entry panel connectors J15 are at the bottom of the panel, and are easier to position when no other connectors are in place.

a. Install ground rod (para 2-8) .

b. Connect ground strap from GND to ground rod.

c. Connect power cable between operator position POWER connector J2 and assemblage connector J7 or J8 on power entry panel. Operator position may be connected to local power by connecting POWER J2 to source of 115 vac, 60 Hz power.

d. Connect signal wires from INTERCOM, SIG PORT, PORT 2, and PORT 1 binding posts on operator position to binding posts on Distribution Box J-1077A/U.

e. Connect WM-130( )/G cable between J1077A/U and J15 on assigned signal entry panel.

NOTE

Patch plugs are stored in drawer A22. You must raise slide retaining catches to close drawer.

f. Patch orange operator position quads on patch panel to yellow network quads, using patch plugs on four-wire patch plugs or cords,(C, fig. 2-4).

g. After processors are activated (para 2-18), assign terminal number to operator positions and mark in service as applicable (para 2-23).

2-11. Line and Trunk Connections

(fig. 2-4)

Lines and trunks are connected to the assemblage at the signal entry panels. Connect the cables sequentially starting at the bottom of the signal entry panel. All cable pairs appear at the black field side quads on the patch panels. Patch lines and trunks to network quads, either directly, or through blue adapter quads. Use patch plugs when field quads are adjacent to the assigned quads. Otherwise use four-wire or two-wire patch cords, making sure the white strip on each plug end is oriented according to the situation (B). Orientation of stripes on two wire patch cords may vary depending on the side of network quad used. The patch plugs and patch cords are stored in drawer A22.

a. Standard Lines and Trunks. Patch standard field quads directly to network quads using patch plugs, wherever possible, or a four-wire patch cord may be used. If field receive and transmit pairs are not on the same quad, use two two-wire patch cords as shown (C). Use two-wire patch cords for common 'battery DTMF connections (F) and replace SF/DC terminal card with DTMF terminal card (fig. FO-36). When using Telephone Set TA-341A/TT, refer to the following installation instructions.

Installation Instructions for TA-341A/TT

Mode of Operation	ACI/CI	DCICB	AC/LB	DC/LB
TA-341A/TT AC/CB DC/CB. LB Switch	AC/CB	DC/CB	LB	LB
TA-341A/TT MODE SELECTOR SWITCH	AC	DC	AC	DC
*SF/DC Card AC-Adapter/DC toggle switch	DC	DC	AC	DC
Terminal Programming	01-03	04-06	01-03	04-05

*When telephone is used as a common battery set, toggle switch on SF/DC card must be set to DC for proper operation.

b. Adapters. Each adapter has two blue quads on the patch penal, the left (field) side and the right (network) side. Adapters are identified on the patch panel by designators Al through A12 for each frame, according to the table below. Note that in AN/TTC-38(V)2, each special circuit has a dual, parallel appearance, ore on each patch panel. Only one set of quads for each special circuit can be patched. For four-wire adapters, use a four-wire patch cord, or two two-wire patch cords if field transmit and receive pairs are not adjacent (d). For two-wire adapters, use a two-wire patch cord between the field side pair which is used and the adapter quad, as shown. Patch the right adapter quad to the network with a four-wire patch cord (E). For all adapted circuits toggle switch on SF/DC terminal card (fig. FO-36) must be set to AC ADAPTER.

Special circuit No.	Patch panel A26	Patch panel A43*
1-12	Frame 2, A1-A12	Frame 5, A1-A12
13-24	Frame 2, A1-A12	Frame 6, A1-A12
25-36	Frame 3, A1-A12	Frame 7, A1-A12
37-48	Frame 4, A1-A12	Frame 8, A1-A12

*On AN/TTC38(V)2 only.

c. Line/Trunk Assignments. After processors are activated (para 2-18), assign directory number, precedence level, and special privileges to lines and mark in-service, as applicable (para 2-21). Assign trunk group and special requirements to trunks and mark in-service as applicable (fig. 2-22).

2-12. Remote Teletype Connections

(fig. 2-5)

The remote teletype is connected to the assemblage at a signal entry panel, and appears on a black field side quad on a patch panel. Any two of 26 pairs on any connector (except J15) on any signal entry panel may be selected, with the corresponding patch panel appearance. The field side quad is patched to the I/O section of common equipment panel A28.

NOTE

Modem keyer and converter modules may be strapped for either normal keying (1232. 5Hz mark, 1317. 5Hz space) or reverse keying (1317. 5Hz mark, 1232 5Hz space). Strapping is performed by higher category maintenance. Check technical manual on remote modem if in doubt about keying sense. Both local and remote modem must use the same keying sense.

a. If a remote modem is used, patch field side quad to MODEN TTY quad on common equipment panel A28 (A). If the remote teletype is wired directly, patch field side quad to DIRECT TTY quad on A28 (B).

b. Set TTY switches at rear of system status panel A6 to selected MODEM or DIRECT interface, and to select 75 BAUD or ASCII code.

c. Energize and perform preliminary adjustments on remote teletype according to applicable technical manual.

d. After processors are activated classmark remote teletype I/O channel as applicable (para 5-17).

e. Set modem mode switch S1 to NOR position.

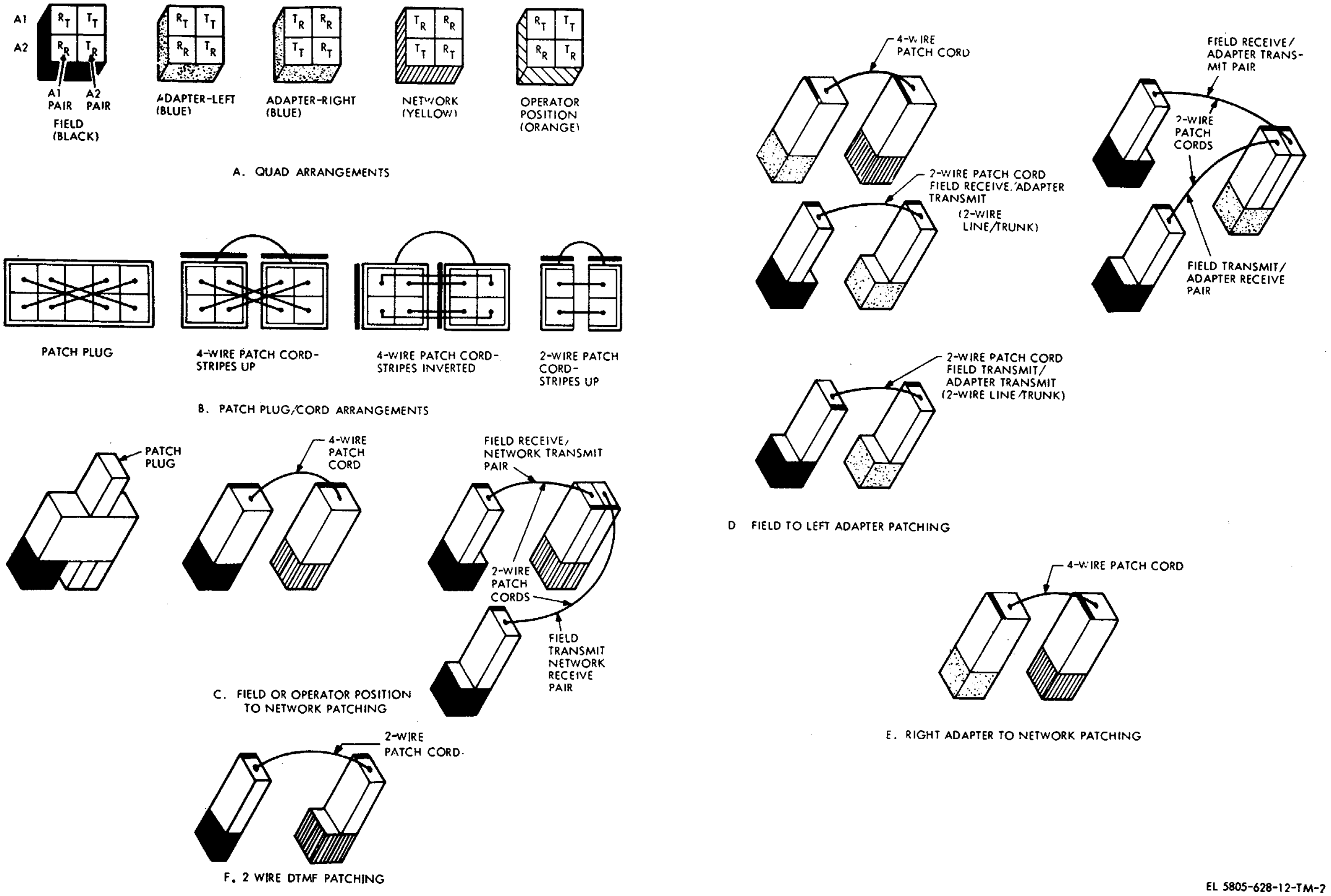
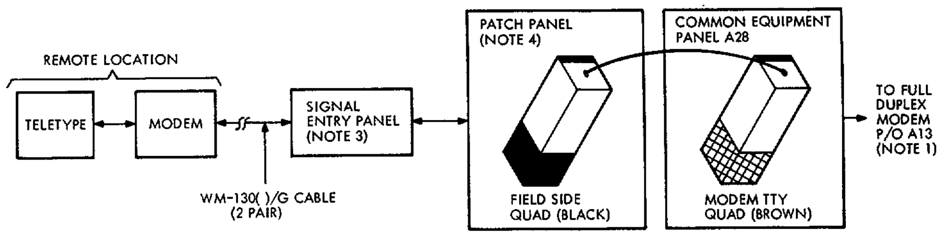
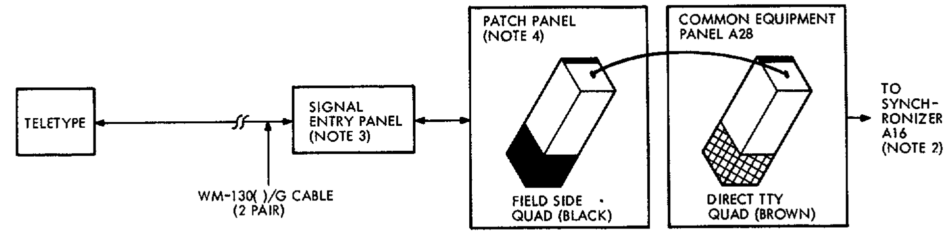


Figure 2-4. Patching details.



A. REMOTE TELETYPE WITH MODEM



B. REMOTE TELETYPE – DIRECT (NOTE 5)

NOTES:
1. ON SYSTEM STATUS PANEL A6, SET TTY INTERFACE SELECT SWITCH TO MODEM POSITION. SET TTY CODE SELECT SWITCH TO 75 BAUD OR ASCII POSITION.
2. ON SYSTEM STATUS PANEL A6, SET TTY INTERFACE SELECT SWITCH TO DIRECT POSITION. SET TTY CODE SELECT SWITCH TO 75 BAUD OR ASCII POSITION.
3. TELETYPE MAY BE CONNECTED TO ANY TWO OF 26 PAIRS ON ANY CONNECTOR, EXCEPT J15, ON ANY SIGNAL ENTRY PANEL.
4. TELETYPE IS CONNECTED TO ANY FIELD SIDE QUAD ON EITHER PATCH PANEL, DEPENDING ON SIGNAL ENTRY PAIRS SELECTED.
5. LINE SELECTOR SWITCH ON TT-98, OR SIMILAR SWITCHES ON OTHER TELETYPE EQUIPMENT, MUST BE SET FOR POLAR OPERATION.

EL 5805-628-12-TM-4

Figure 2-5. Remote teletype connections.

f. Enter remote channel access code in both processors (para 5-16).

g. Perform daily readiness check on teletype channel (para 5-4, sequence 48).

2-13. Spare Remote Teletype Connections
(fig. 2-6)

The spare remote teletype is connected to the assemblage at a signal entry panel, and appears on a black field side quad on a patch panel. Any two of 26 pairs on any connector (except J15) on any signal entry panel may be selected, with the corresponding patch panel appearance. The field side quad is patched to the I/O section of common equipment panel A28.

NOTE

As necessary, have higher category maintenance strap modem keyer and converter for normal or reverse keying.

a. If a remote modem is used, install spare full duplex modem in A13 as follows (fig. 3-8): (1) Remove blank panels on both sides of mode switch.

(2) Install spare power supply module in space next to power supply module. Tighten mounting screws.

(3) Install spare converter module in space next to mode switch. Tighten mounting screws.

(4) Install spare keyer module in space next to spare connector module. Tighten mounting screws.

b. If a remote modem is used, patch field side quad to MODEM SP TTY quad on common equipment panel A28 (A, fig. 2-6). If the spare teletype is wired directly, patch field side quad to DIRECT SP TTY quad on A28 (B).

c. Set SPARE TTY switches at rear of system status panel A6 to select MODEM or DIRECT interface, and to select 75 BAUD or ASCII code.

d. Energize and perform preliminary adjustments on spare remote teletype according to applicable technical manual.

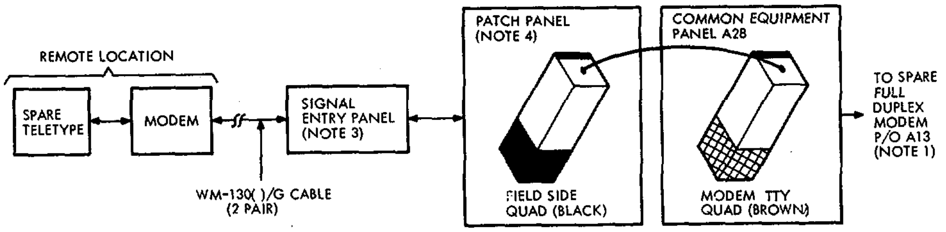
e. After processors are activated (para 2-18), classmark spare remote TTY I/O channel if necessary (para 5-17).

f. Set modem mode switch S2 to NOR.

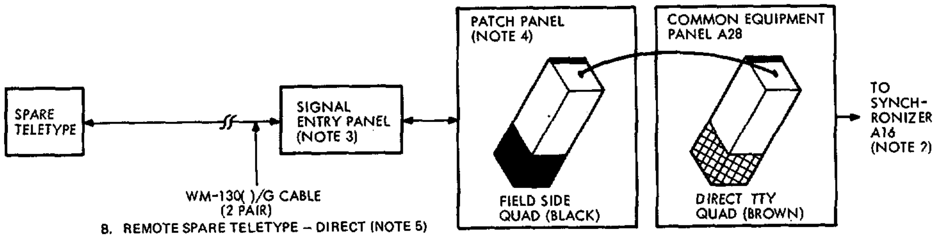
g. Perform daily readiness check on spare teletype channel (para 5-4, sequence 48).

2-14. Remote Page Printer Connections
(fig. 2-7)

The remote page printer is connected to the assemblage at a signal entry panel, and appears as a pair



A. REMOTE SPARE TELETYPE WITH MODEM



B. REMOTE SPARE TELETYPE – DIRECT (NOTE 5)

NOTES:
1. INSTALL SPARE MODULES IN MODEMS A13; INSTALL SPARE PRINTED CIRCUIT CARDS IN SYNCHRONIZER A16. ON SYSTEM STATUS PANEL A6, SET SPARE TTY INTERFACE SELECT SWITCH TO MODEM POSITION; SET SPARE TTY CODE SELECT SWITCH TO 75 BAUD OR ASCII POSITION.
2. INSTALL SPARE PRINTED CIRCUIT CARDS IN SYNCHRONIZER A16. ON SYSTEM STATUS PANEL A6, SET SPARE TTY INTERFACE SELECT SWITCH TO DIRECT POSITION; SET SPARE TTY CODE SELECT SWITCH TO 75 BAUD OR ASCII POSITION.
3. SPARE TELETYPE MAY BE CONNECTED TO ANY TWO OF 26 PAIRS ON ANY CONNECTOR, EXCEPT J15, ON ANY SIGNAL ENTRY PANEL.
4. SPARE TELETYPE IS CONNECTED TO ANY FIELD SIDE QUAD ON EITHER PATCH PANEL, DEPENDING ON SIGNAL ENTRY PAIRS SELECTED.
5. LINE SELECTOR SWITCH ON TT-98, OR SIMILAR SWITCHES ON OTHER TELETYPE EQUIPMENT, MUST BE SET FOR POLAR OPERATION.

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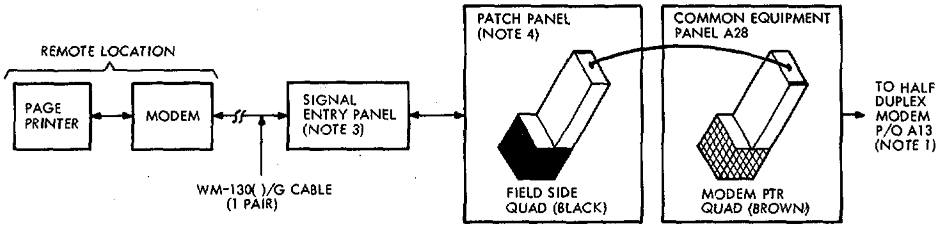
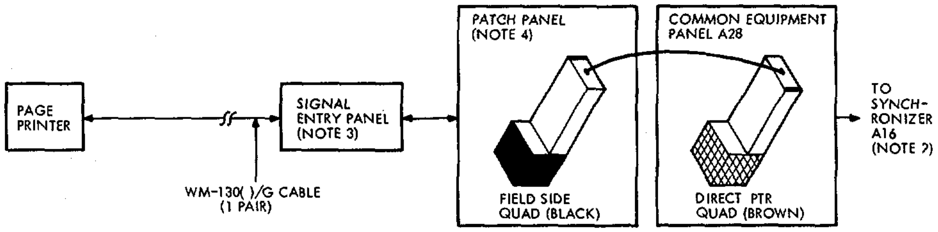
Figure 2-6. Spare remote teletype connections.



A. REMOTE PAGE PRINTER WITH MODEM



B. REMOTE PAGE PRINTER – DIRECT (NOTE 5)

NOTES:
1. ON SYSTEM STATUS PANEL A6, SET REMOTE PRINTER INTERFACE SELECT SWITCH TO MODEM POSITION. SET REMOTE PRINTER CODE SELECT SWITCH TO 75 BAUD OR ASCII POSITION.
2. ON SYSTEM STATUS PANEL A6, SET REMOTE PRINTER INTERFACE SELECT SWITCH TO DIRECT POSITION. SET REMOTE PRINTER CODE SELECT SWITCH TO 75 BAUD OR ASCII POSITION.
3. PAGE PRINTER MAY BE CONNECTED TO ANY OF 26 PAIRS ON ANY CONNECTOR, EXCEPT J15, ON ANY SIGNAL ENTRY PANEL.
4. PAGE PRINTER IS CONNECTED TO ANY FIELD SIDE QUAD ON EITHER PATCH PANEL, DEPENDING ON SIGNAL ENTRY PAIR SELECTED.
5. LINE SELECTOR SWITCH ON TT-98, OR SIMILAR SWITCHES ON OTHER TELETYPE EQUIPMENT, MUST BE SET FOR POLAR OPERATION.

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Figure 2-7. Remote page printer connections.

on a black field side quad on a patch panel. Any one of 26 pairs on any connector (except J15) on any signal entry panel may be selected, with the corresponding patch panel appearance. The field side pair is patched to the I/O section of common equipment panel A28.

NOTE

As necessary, have higher category maintenance strap modem keyer and converter for normal or reverse keying.

a. If a remote modem is used, patch field side pair to MODEM PTR quad on common equipment panel A28 (A). If the remote page printer is wired directly, patch field side pair to the DIRECT PTR quad on A28 (B).

b. Set REMOTE PRINTER switches at rear of system status panel A6 to select MODEM or DIRECT interface, and to select the 75 BAUD or ASCII code.

c. Energize and perform preliminary adjustments on remote page printer according to technical manual for page printer.

d. After processors are activated (para 2-18), classmark remote printer I/O channel if applicable (para 5-17).

e. Perform daily readiness check on printer channels (para 5-4, sequence 36).

2-15. Intercommunication Station LS-147C/FI Connections

The intercom is wired directly to common equipment panel A28, and appears at the white INTERCOM quad in the TEST section. The only connection required is patching to a field side quad on a patch panel.

a. Connect two-wire patch cord from left or right side of white INTERCOM quad on common equipment panel A28 to designated field side quad on patch panel.

b. Set OFF-SEND switch on LS-147C/FI to 5 (about midpoint). The glow lamp goes on.

c. Depress PRESS-TO-TALK switch and speak into speaker-microphone on LS-147C/FI front panel. Release switch to listen.

NOTE

Calls may be received with OFF-SEND switch in OFF position.

d. Adjust RECEIVE control to regulate volume of incoming call or answer.

2-16. Maintenance Phone Connections

Install the maintenance phone in the assemblage and assign a network terminal as. follows:

a. Place phone on shelf (fig. FO-1).

b. Connect phone plug to assemblage connector block (fig. FO-1) as described in telephone technical manual.

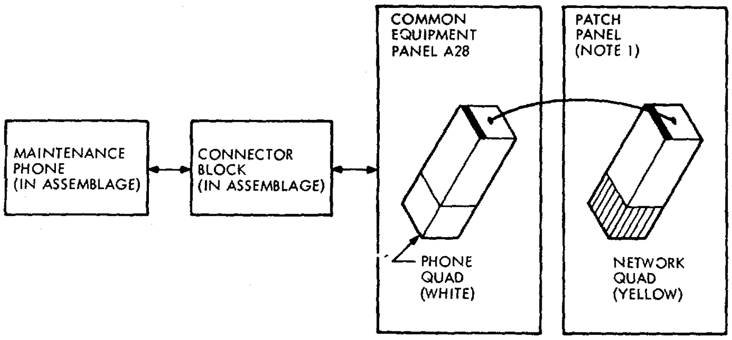
c. Connect four-wire patch cord from white PHONE quad on common equipment panel A28 to designated network quad on patch panel (fig. 2-8).

d. After processors are activated (para 2-18), assign directory number precedence levels and special privileges, and mark line in service, as applicable (para 2-21).

e. Perform self ring test on maintenance phone (TM 11-5805-384-12).

NOTE

Some service terminals are not equipped. The notes in figure FO-36 identify which frames and groups are equipped with service terminals.



NOTE: 1. MAINTENANCE PHONE IS CONNECTED TO ANY NETWORK QUAD ON EITHER PATCH PANEL, AS ASSIGNED.

Figure 2-8. Maintenance phone installation.

2-17. Common Equipment Patching
(fig. 2-9)

Conference bridges, sender/receivers, and auxiliary sender/receivers appear on common equipment panel A28. Patch common equipment to yellow network terminals 11 or 12 (service terminals) on A28. Use patch plugs when the common equipment quads are adjacent to the assigned network terminal quads (B). Otherwise, use four-wire patch cords (C). The processors must be activated before assignments can be made from the FACP.

a. Conference Bridges. There are five conference bridges (four five-party and one nine party bridge). The bridge ports appear on green quads on A28, labeled 1 through 5 and 1 through 10. (Port 10 of the nine-party bridge provides ring back, and is also patched to the network.) After patching, perform conference bridge terminal TM 11-5805-628-12/ NAVELEX 0967-LP462-8071 assignment and mark in service as applicable (para 2-25).

b. Sender/Receivers. There are provisions for 20,sender/receivers on A28, at red quads labeled I through 20. However, 11 are supplied with AN/TTC-38(V)I and 15 with AN/TTC-38(V)2, and are patched according to assignments. After patching, perform sender/receiver terminal assignment and mark in service as applicable (para 2-24).

c. Auxiliary Sender/Receivers. There are provisions for two auxiliary sender/receivers with redundant appearances for each on A28, at violet quads labeled AUX (para 3-2 e). However, two auxiliary sender/receivers are supplied and are patched according to assignments. After patching, perform sender/receiver terminal assignment and mark in service as applicable (para 2-24).

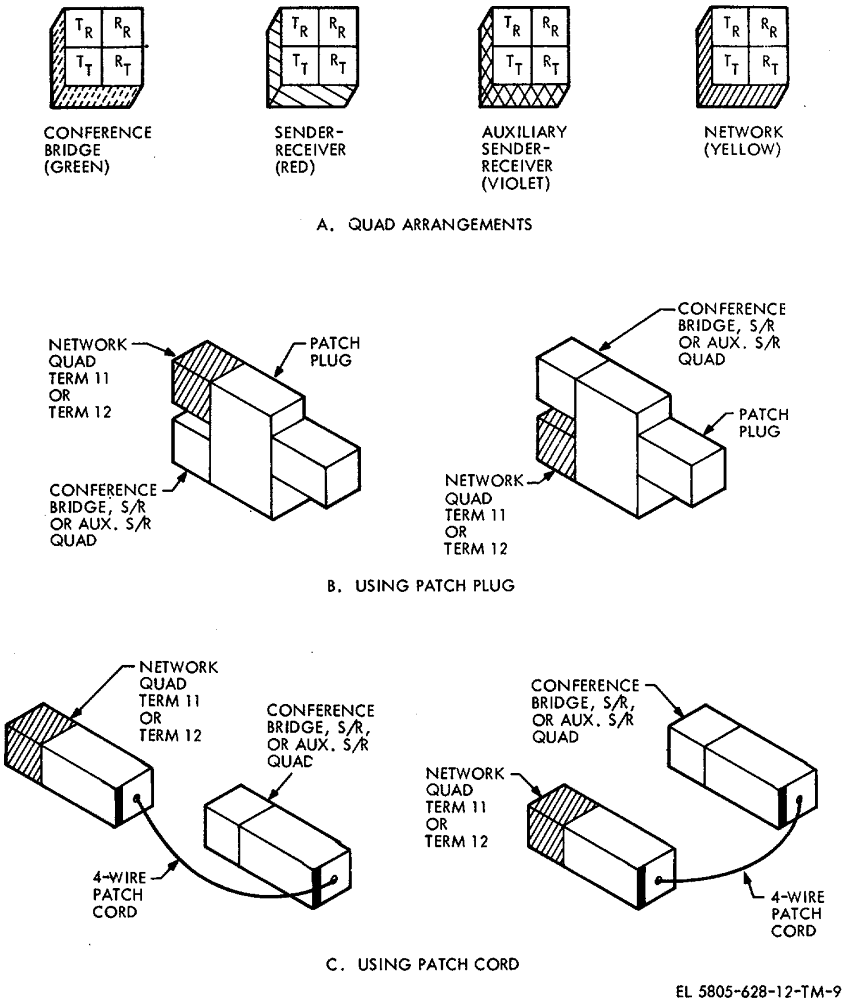


Figure 2-9. Common equipment patching.

2-18. Common Control Subsystem Activation

a. General. Use the following procedures to bring processors A8 and A9 to the one-line or standby state. With at least one of the processors activated, data base entries can be made and the central office can start to process calls. Unless otherwise specified, all procedures are carried out using controls and indicators of the maintenance control panel (MCP) of the processor being loaded. The basic sequence to be followed in bringing processors A8 and A9 to the online status is:

(1) Processor checkout.
(2) Clearing memory.
(3) Preloader read-in and checkout.
(4) Loader read-in.
(5) Data base and fixed program read-in.
(6) Preliminary network connection.
(7) Program starting.
(8) Data Base entries.
(9) Loading of current directory.
(10) Call processing.

b. Checking Processor. Checkout processor using off-line diagnostics (para 5-46 through 556). If other processor is on-line and central office is operative, do not perform off-line network diagnostic and off-line memory-to-memory diagnostic. Perform remote devices diagnostic only if remote channel is installed (i.e., remote printer, remote teletype, spare remote teletype).

c. Clearing Memory. Use the following procedure to clear the memory of one of the processors. The procedure is performed from the maintenance control panel of the processor having its memory cleared.

(1) Set WORD SWITCH REGISTER to 00000000 and press NORMAL HALT.

(2) Set CLOCK OPERATE CONTROL to CONT.

(3) Set MEMORY guarded switch to UNPROTECTED.

(4) Set REGISTER SELECT to MEM.

(5) Set RUN/ONE INSTR to RUN.

(6) Set OPERATIONAL CONTROL to STORE SEQLY.

(7) Simultaneously press COORDINATE and INITIATE. Release both.

(8) See that ACTIVE lights.

(9) Press NORMAL HALT.

(10) See that PRCS HALT lights.

(11) Memory is now cleared.

d. Entering Preloader. Read preloader into memory as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set OPERATIONAL CONTROL to STORE.

(4) Set RUN/ONE INSTR to ONE INSTR.

(5) Set REGISTER SELECT to PEX.

(6) Set CLOCK OPERATE CONTROL to CONT.

(7) Press and release CLEAR.

(8) Set WORD SWITCH REGISTER to first address entry in; table 2-1 for operational program and table 5-8 for diagnostic program.

(9) Press INITIATE.

(10) See that BUS INDICATOR displays first address entry in table.

(11) Set REGISTER SELECT to MEM.

(12) Set OPERATIONAL CONTROL to STORE SEQLY.

(13) Read preloader into memory by performing steps (a) through (c) below for each of instruction entries in table.

(a) Set WORD SWITCH REGISTER to proper instruction value (e.g., in table 2-1 WORD SWITCH REGISTER set to 01077751 for first instruction entry in table).

(b) Press INITIATE.

(c) See that BUS INDICATOR displays entered instructions value (e.g. BUS INDICATOR displays 01077751 for first entry in table.

Table 2-1. On-Line Program Preloader Instruction Entries

Address	WORD SWITCH REGISTER setting(instruction)
00277750	01077751
00277751	00002434
00277752	05200377
00277753	24077755
00277754	22077750
00277755	70100000
00277756	70000001
00277757	01077760
00277760	00002400
00277761	02200040
00277762	24077757
00277763	01077764
00277764	00002404
00277765	34000020
00277766	35000010
00277767	72000001
00277770	74000003
00277771	22077757
00277772	62501776
00277773	72100001
00277774	74100107
00277775	22077756
00277776	00000000

e. Checking Preloader. See that preloader instructions have been read correctly into memory as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set OPERATIONAL CONTROL to STORE.

(4) Set REGISTER SELECT to PEX.

(5) Set WORD SWITCH REGISTER to first address shown in table 2-1 or 5-8.

(6) Press INITIATE.

(7) See that BUS INDICATOR displays 'irst address given in table.

(8) Set OPERATIONAL CONTROL to CONT PNL INSTR.

(9) Set REGISTER SELECT to A.

(10) Set WORD SWITCH REGISTER to 55137754.

(11) Press INITIATE.

(12) See that value displayed on BUS INDICATOR (instruction) agrees with related address in table.

(13) Continue by repeating steps (11) and (12) above for each instruction entry in Table 2-1.

(14) If incorrect instruction is found, record error address and check other address, then enter correct instruction into that memory address (para 5-61 or 5-63).

f. Loading Punched Tape Reader. Place operational program loader tape or other required tape (SM-D-751709) on punched tape reader as follows:

CAUTION

Never use adhesive or mechanical catches to secure tape to reel. Tape must be secured to reel so that it will pull loose when run to end. Damage to tape or reader may result if tape sticks to reel.

(1) Set MODE SELECT on paper tape reader to REEL (or STRIP if tape is not on reel).

(2) Set POWER ON/OFF on paper tape reader to OFF.

(3) Place paper tape reel on feed hub of paper tape reader and thread tape to empty reel on take up hub (fig. 3-10). If a strip is being loaded feed strip through head only. Sprocket holes are close to wall.

(4) Set POWER ON/OFF on paper tape reader to ON.

(5) Set TAPE READER switch of system status panel RESET SELECT to ON.

(6) Press RESET on system status panel several times. This clears paper tape reader synchronizer, observe tape stepping both when depressing and releasing.

g. Reading Loader Tape. Read in the loader tape as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT lights.

(3) Press CLEAR.

(4) Set OPERATIONAL CONTROL to STORE.

(5) Set RUN/ONE INSTR to ONE INSTR.

(6) Set REGISTER SELECT to PEX.

(7) Set WORD SWITCH REGISTER to 00277750.

(8) Press INITIATE.

(9) See that BUS INDICATOR displays 00277750.

(10) Set OPERATIONAL CONTROL to CMPT, then set RUN/ONE INSTR to RUN.

(11) Press INITIATE. This starts the tape loading process. When tape loading stops, proceed to step (12) below.

(12) See that PRGM HALT is Lighted.

(13) Set REGISTER SELECT to PEX.

(14) See that BUS INDICATOR displays 00277777. Reload tape if different number is displayed.

(15) Remove tape from punched tape reader.

h. Entering Data Base. Read in the data base tape (SM-D-75170) (Pate 0) as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT lights.

(3) Set OPERATIONAL CONTROL to STORE.

(4) Set REGISTER SELECT to PEX.

(5) Set WORD SWITCH REGISTER to 00002000.

(6) Press CLEAR.

(7) Press INITIATE.

(8) Place data base tape on paper tape reader (f above).

(9) Set OPERATIONAL CONTROL to CMPT.

(10) Set RUN/ONE INSTR to RUN.

(11) Press INITIATE. This begins loading of the data base tape.

(12) When read-in of the tape is complete, see that PRGM HALT lights and BUS INDICATOR displays 00002056. If different number is displayed reload tape.

(13) Set TAPE READER REWIND on system status panel to ON. This rewinds loader paper tape. When it is fully rewound proceed to step (14).

(14) Set TAPE READER REWIND on system status panel to OFF.

(15) Remove tape from paper tape reader.

i. Entering Fixed Program. Read in the fixed program by following steps h(l) through (15) above using first page one of tape deck SM-D-751723, then again using page two of SM-D-751723. The processor is now ready for a program start-up.

j. Start-up Options. At this point you have several options based on the following factors: status of the second processor, availability of a current directory tape, and speed of installation required.

(1) Dual processor start-up. If second processor is not started, a current directory tape is not available, and time allows, proceed as follows:

(a) Bring second processor to program startup point (a through i above).

(b) Select on-line processor and place it on line (k below).

(c) Perform program start-up at both processors (i below). This places both processors in the short loop mode.

(d) Perform data base entries (m below).

(e) Manually load current directory (n below).

(f) Punch current directory tape ror future use (o below).

(g) Place the on-line processor in the long loop (call processing) mode (p below).

(2) *Single processor start-up*. You may want to complete start-up of the central office using only one processor, and. then start up the second processor later. This permits quicker activation of the central office. The other processor may be operating on-line, and you may be operating on-line, and you may wish to bring the processor up to standby. Either procedure is accomplished as follows:

(a) After performing a through i above, place processor on-line c(k below) unless other processor is already on-line.

(b) Perform program start-up (l below) to place the processor in the short loop mode.

(c) Perform data base entries (m below).

(d) Load current directory (n below).

(e) If no current directory tape was available, punch one now for future use (o below).

(f) If the processor is on-line, place it in the long loop (call processing) mode (p below).

(g) If the processor is not on-line and you wish to place it on-line, perform a manual control transfer (q below).

k. Preliminary Network Connection. Connect a processor to the network prior to program, startup as follows: (1) Set REGISTER SELECT to CPS.

(2) Press NORMAL HALT. See that PRCS HALT lights.

(3) Set system status panel AUTO ENABLE/DISABLE to DISABLE.

(4) Press system status panel CONTROL TRANSFER MANUAL as required to illuminate BUS INDICATOR 23 (CPS23) of the selected online processor. The processor is now connected to the network.

(5) If you wish to permit automatic switchover of processors, set system status panel AUTO ENABLE/DISABLE to ENABLE.

NOTE

If on-line control is transferred to an active processor, the program will run in the long loops (call processing) mode.

l. Program Start-up and Restart. Start up or restart the program as follows:

(1) Press NORMAL HALT. Set MEMORY UNPROTECTED/PROTECTED to PROTECTED. Set REAL TIME CLOCK to ENABLE. Press CLEAR.

(2) See that PRCS HALT is illuminated .

(3) Set OPERATIONAL CONTROL to STORE.

(4) Set REGISTER SELECT to PEX.

NOTE

Use start address. only during initial activation of processor, when no data base is loaded. Always use restart address after current directory is loaded.

(5) Set the WORD SWITCH REGISTER to starting address as follows:

EQUIPMENT	WORD SWITCH REGISTER
AN/TTC-38(V)1 Start	00240000
AN/TTC-38(V)1 Restart	00240001
AN/TTC-38(V)2 Start	60240000
AN/TTC-38(V)2 Restart	60240001

(6) Press INITIATE.

(7) Set OPERATIONAL CONTROL to CMPT.

(8) Press INITIATE. The operational program is now running in the short loop mode. If no faults are printed out within 15 seconds go to m below. If the processor is connected to the network, the ON-LINE indicator is illuminated.

If not, the STANDBY indicator is illuminated.

m. Data Base Entries. There are four basic priority groups of data base entries ((1) through (4)-below). The entries in group one all involve fundamental functioning of the central office and therefore should be made immediately after starting up the program. Other entries may be made later as required by system plans. The groups are listed in the order that data must be entered. For example, trunk assignments (priority group 2) must be made before trunk routing is assigned. The order of assignment within a priority group is usually not critical; however, any special restrictions noted in the assignment procedure must be followed. The program will light ERROR on the FACP and printout an error message if you assign functions in incorrect priority order. Changes and deletions must also follow these priorities. For example, if you are changing DAC routing to a newly assigned route, the priority group 3 routing assignments or changes must be changed first.

(1) *Priority group 1 I/O and common equipment assignments*.

(a) Classmark I/O devices (para 5-17).

(b) Assign sender/receivers and auxiliary sender/receivers (para 2-24).

(c) Assign conference bridges (para 2-25).

(2) *Priority group 2 central office service, line, and trunk assignments*.

(a) Assign operator positions (para 2-23).

(b) Assign information attendant (para 2-50).

(c) Assign Lines (para 2-21).

(d) Assign Trunks (para 2-22).

(e) Routing Information calls to Operator (para 2-38).

(f) DAC (para 2-49).

(3) *Priority group 3 routing assignments.*

(a) PR routing (para 2-27, 2-29).

(b) SL routing (para 2-32).

(c) Alternate SL routing (para 2-34).

(d) JXX Routing (para 2-36).

(e) Other special routing (para 2-29, 2-30).

(4) *Priority group 4 special feature assignments.*

(a) Fixed directory (para 2-40).

(b) Line Groups (para 2-43).

(c) Preprogrammed conferences (para 2-44).

(d) Call forwarding (para 2-48).

(e) Unstaffed operator routing (para 2-37).

n. Loading Current Directory. The current directory consists of all assignments which are currently stored in a processor's memory. Assignments must be initially entered manually from the functional assignment control panel (para 2-21) or remote teletype (para 2-85). These devices may also be used to change or delete entries. If both processors are in the short loop and/or long loop modes and active, directory assignments, changes, and deletions made from the FACP and remote teletype are entered into the memories of both simultaneously. Manual assignment procedures are time consuming and subject to human errors. Therefore, once you have correctly entered the current directory manually, punch a current directory tape o below. This tape can be used to quickly reload the current directory later (para 5-19).

o. Punching Current Directory Tape. Use this procedure whenever you want to punch a tape of the current directory which is loaded into memory. Punch the tape from the standby processor. Mark the punch and memory to memory channel out of service from the on-line processor (para 5-17). The tape contains the complete current directory; it is not possible to selectively punch portions of the current directory. The procedure is performed from the standby maintenance control panel. Do not assign, change, or delete from the FACP while a current directory tape is being punched.

(1) See that punch is loaded with tape.

(2) Set FUNCTION CODE to 14 (fig. 2-10).

(3) Press READ.

(4) See that punch starts.

(5) After punch stops, verify tape (para 5-19.1).

(6) Mark punch and memory-to-memory channel back in service from on-line processor (para 5-17).

p. Entering Call Processing Mode. Change the operational program mode of the on-line processor from the short loop to the long loop (call processing) by performing the following procedure. In the long loop mode, the processor is able to control telephone traffic switching in the central office. If a processor goes from standby to on-line as a result of a control transfer, it enters the long loop mode automatically.

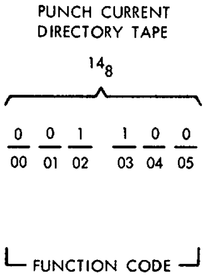


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Figure 2-10. MCP switch setting for punching current directory tape.

Use the maintenance control panel of the online processor to perform the following steps.

(1) Observe that ACTIVE and ON-LINE are illuminated.

(2) Set FUNCTION CODE to 03 (fig. 5-13).

(3) Press READ.

q. Transferring Control. Use this procedure to transfer control to a standby processor.

(1) See that STANDBY on maintenance control of selected processor is illuminated.

(2) Set system panel AUTO ENABLE/DISABLE switch to DISABLE.

(3) Press system status panel CONTROL TRANSFER MANUAL.

(4) See that ON-LINE on maintenance control panel of selected processor is illuminated. This processor is now running in the long loop (call processing) mode.

(5) See that OFF-LINE on maintenance control panel of other processor is illuminated.

(6) Perform program start-up (1 above) at off-line processor if you wish to place it in standby. Observe that STANDBY is illuminated.

(7) Set system status panel AUTO ENABLE/ DISABLE to ENABLE if you wish to permit automatic switchover.

r. Manual Fixed Data Base Entries. Make the following data base enties, if applicable, in each processor every time the program is loaded.

(1) If remote teletypes are installed, enter I/O access code (para 5-16).

(2) Set 24-hour clock (para 5-15). The clock must also be set after processor is halted or incorrect time will be printed on maintenance messages.

(3) Change classmarks of I/O channels (para 5-17). These need only be changed if I/O devices are different from the initial classmarking established by the program. Also remember to classmark I/O devices back in service in the on-line processor after they have been marked out-of-service for maintenance purposes.

Section IV. FACP PROCEDURES

2-19. General

Use the FACP procedures to program the semipermanent data required to set up the switching system. Table 2-2 identifies allowable FACP operations. The procedures are also used to display or print out any of the programmed data related to any terminal or group of terminals. This chapter includes assignment, change, and deletion procedures; chapter 3 includes the display and printout procedures.

Table 2-2. Allowable FACP Command/Function Combinations

	COMMAND Switches					
FUNCTION Switches	**ASSIGN**	**CHANGE**	**DELETE/RESET**	**DISPLAY**	**PRINT**	**PUNCH**
TERMINAL SERVICE	Yes	Yes	Yes	Yes	Yes	Yes**
TERMINAL NO ASGMT	Error	Yes	Error	Yes	Option*	Option*
DIRECTORY NO ASGMT	Error	Yes	Error	Yes	Yes	Option*
TRUNK GR NO	Error	Error	Yes	Yes	Yes	Option*
PR ROUTING	Yes	Error	Yes	Yes	Yes	Option*
SL ROUTING	Yes	Error	Yes	Yes	Yes	Option*
ALTN SL ROUTING	Yes	Error	Yes	Yes	Yes	Option*
OP/JXX ROUTING	Yes	Error	Yes	Yes	Yes	Option*
FIXED DIR ROUTING	Yes	Yes	Yes	Yes	Yes	Option*
PRST CONF ENTRY	Yes	Error	Yes	Yes	Yes	Option*
LINE GR ENTRY	Yes	Error	Yes	Yes	Yes	Option*
DAC ROUTING	Error	Yes	Error	Yes	Yes	Option*
TRUNK TEST	Yes	Error	Error	Error	Error	Error
STATUS	Error	Yes	Error	Yes	Option	Error
TRAFFIC METERS	Error	Error	Yes	Yes	Yes	Yes***
TR GR METERS	Error	Yes	Yes	Yes	Yes	Yes***

*Available only as an option.

**This command and function will cause the entire program data base to be punched.

***Punched in a print format; suitable for retransmission purposes only.

a. Field Codes. Tables 2-3 through 2-6 describe the terminal type, class, status, and function codes called out in the FACP procedures.

b. Program Time Out. A 60-second time out period begins each time a character (command or data) is received from the FACP. This period is ended and started again when the next character is received. When the time out period is exceeded, the program terminates the FACP entry currently in progress and clears the FACP. You may regain access by re-initiating the appropriate procedure.

c. Program Checks. The I/O programs check the input data for each of the procedures. The principal checks are described in paragraphs which follow the related procedures. If an entry fails to meet one or more of the program checks, the program will turn on the ERROR lamp. Also logical analysis should indicate the cause of other types of errors not listed in the checks paragraphs.

d. Errors. Errors detected by the operator before the CONTINUE switch is depressed can be corrected by depressing the COMMAND-FIELD CLEAR switch and entering corrected data in the appropriate field. Errors detected by the operator after the CONTINUE switch is depressed can only be corrected by depressing the COMMAND-FACP CLEAR switch and re-initiating the entire procedure. Errors detected by the program after CONTINUE is depressed can be corrected by depressing the COMMAND-FIELD CLEAR switch and entering corrected data in the appropriate field. Always check the ERROR lamp after depressing the CONTINUE switch. If the ERROR lamp goes on, depress the COMMAND-FIELD CLEAR switch and observe that the field just entered is cleared. Key in corrected data and depress CONTINUE switch again. Check the ERROR lamp.

e. Standby Processor Data Base. FACP assignments, changes, and deletions are made in both the data bases of the on-line and standby processors. If one processor is off line, the message UPDATE ERR NO 8 is printed following the printout of data modified. This message points out that the date base of the off-line processor was not updated. Punch a tape of the change from the FACP. Load this data base update tape when the processor is brought back to the standby status (para 5-19).

2-20. FACP Assignment Procedures

All assignments are documented automatically on the local and remote page printers. When the LINE LOAD is set from the FACP, messages will also be printed out at both the remote and remote spare teletypewriters. Messages follow the format described in paragraph 3-13 unless otherwise specified in a specific procedure.

2-21. FACP Line Assignment

Use this procedure to assign a line to a subscriber. The subscriber's terminal number is entered into

Table 2-3. Terminal Type Codes

Terminal type code	*Description*
00	UNASSIGNED
01	4-Wire, AC Supervised Line
02	4-Wire, AC Supervised Line, Wideband Access
03	4-Wire, AC Supervised Line, Information Attendant
04	4-Wire, DC Supervised Line
05	4-Wire, DC Supervised Line, Information Attendant
06	2-Wire, CB DTMF Line
07	2-Wire, CB DTMF Line, Information Attendant
08	AN/TTC- 38 Trunk, Originating Office Control
09	AN/TTC- 38 Trunk, Originating Office Control Narrowband MODE II paired
10	AN/TTC- 38 Trunk, Originating Office Control, Wideband MODE I
11	AN/TTC-38 Trunk, Spill Forward Control
12	AN/TTC-38 Trunk, Spill Forward Control, Narrowband MODE 11 paired
13	AN/TTC- 38 Trunk, Spill Forward Control, Wideband MODE I
14	AN/TTC- 38 Trunk, 7-digit tone burst (Satellite)
15	AN/TTC- 38 Trunk, 7-digit tone burst (Satellite) Narrowband, MODE II paired
16	AN/TTC- 38 Trunk, 7-digit tone burst (Satellite), Wideband MODE I
17	3-Digit PABX Trunk (tone burst)
18	Not Used
19	3-Digit PABX Trunk (tone burst), Wideband MODE I
20	3-Digit Satellite PABX Trunk (tone burst)
21	Not Used
22	3-Digit Satellite PABX Trunk (tone burst), Wideband MODE I
23	Wideband MODE II Trunk
24	AN/TTC- 25 Trunk, Spill Forward Control
25	AN/TTC- 25 Trunk, Originating Office Control
26	AN/TTC- 30 Trunk
27	AN/TTC- 31 Trunk
28	2 wire CB DTMF line, Wideband Access
29	Converter Trunk (CV- 1918, CV- 1919, CV- 2875)
30	2-Wire CB Dial Pulse Line
31	DC Closure line- Dial Pulse Outward
32	DC Closure line- DTMF Outward
33	20-Hz Ringdown line- Opr. Intercept Incoming and Outgoing
34	20-Hz Ringdown line- Opr. Intercept Incoming, Automatic Outgoing
35	20-Hz Ringdown Trunk
36	1600-Hz Ringdown line, Opr. Intercept Incoming and Outgoing
37	1600-Hz Ringdown line, Opr. Intercept Incoming, Automatic Outgoing
38	1600-Hz Ringdown Trunk, Automatic Outward, Opr. Intercept Incoming
39	1600-Hz Ringdown Trunk, Automatic/Outgoing, Dial Tone Incoming (SB-3082)
40	AUTOVON Trunk: Non-precedence Automatic Access
41	AUTOVON Trunk: Priority Automatic Access
42	AUTOVON Trunk: Immediate Automatic Access
43	AUTOVON Trunk: Flash Automatic Access
44	AUTOVON Trunk: Flash Override Automatic Access
45	AUTOVON Trunk: Operator Attended
46	AN/TTC- 28 Trunk (3-digit SF dial pulse trunk)
47	5-Digit SF Dial Pulse Trunk
48	7-Digit Commercial SF Dial Pulse Trunk, Automatic Incoming, Delay Dial
49	7-Digit Commercial SF Dial Pulse Trunk, Automatic Incoming, Non-stop Dial
50	7-Digit Commercial SF Dial Pulse Trunk, Opr. Intercept Incoming, Delay Dial
51	7-Digit Commercial SF Dial Pulse Trunk, Opr. Intercept Incoming, Non-stop Dial
52	Operator Signal Port
53	Operator Port 1 (Not for entry- Display purposes only)
54	Operator Port 2 (Not for entry- Display purposes only)
55	DTMF SENDER/RECEIVER
56	AUXILIARY SENDER/RECEIVER
57	5-Party Conference Circuit- MASTER PORT
58	5-Party Conference Circuit- PARTY PORT (not for entry- Display only)
59	9-Party Conference Circuit- MASTER PORT
60	9-Party Conference Circuit-PARTY PORT (not for entry-Display only)
61	1 0- or 13-Digit NATO SF Dial Pulse Trunk

Table 2-4. Class Codes

			AUTOVON access			DAC type	
Class	**Maximum**	**Progressive**	**Intra-**	**Inter-**		**B**	**C**
01***	ROUTINE	-	-	-	-	-	-
02	ROUTINE	-	-	-	-	-	-
03	PRIORITY	-	-	-	-	-	-
04	IMMEDIATE	-	-	-	-	-	-
'05	FLASH	-	-	-	-	-	-
06	FLASH OVERRIDE	-	-	-	-	-	-
07	ROUTINE	-	-	-	-	X	-
08	PRIORITY	-	-	-	-	X	-
09	IMMEDIATE	-	-	-	-	X	-
10	FLASH	-	-	-	-	X	-
11	FLASH OVERRIDE	-	-	-	-	X	-
12	ROUTINE	-	X	-	-	X	-
13	PRIORITY	-	X	-	-	X	-
14	IMMEDIATE	-	X	-	-	X	-
15	FLASH	-	X	-	-	X	-
16	FLASH OVERRIDE	-	X	-	-	X	-
17	ROUTINE	-	-	-	X	-	-
18	PRIORITY	-	-	-	X	-	-
19	IMMEDIATE	-	-	-	X	-	-
20	FLASH	-	-	-	X	-	-
21	FLASH OVERRIDE	-	-	-	X	-	-
22	ROUTINE	-	X	-	X	-	-
23	PRIORITY	-	X	-	X	-	-
24	IMMEDIATE	-	X	-	X	-	-
25	FLASH	-	X	-	X	-	-
26	FLASH OVERRIDE	-	X	-	X	-	-
27	ROUTINE	-	-	-	-	-	X
28	PRIORITY	-	-	-	-	-	X
29	IMMEDIATE	-	-	-	-	-	X
30	FLASH	-	-	-	-	-	X
31	FLASH OVERRIDE	-	-	-	-	-	X
32	ROUTINE	-	X	-	-	-	-
33	PRIORITY	-	X	-	-	-	-
34	IMMEDIATE	-	X	-	-	-	-
35	FLASH	-	X	-	-	-	-
36	FLASH OVERRIDE	-	X	-	-	-	-
37	ROUTINE	X	-	-	-	-	-
38	PRIORITY	X	-	-	-	-	-
39	IMMEDIATE	X	-	-	-	-	-
40	FLASH	X	-	-	-	-	-
41	FLASH OVERRIDE	X	-	-	-	-	-
42	ROUTINE	X	X	-	-	-	-
43	PRIORITY	X	X	-	-	-	-
44	IMMEDIATE	X	X	-	-	-	-
45	FLASH	X	X	-	-	-	-
46	FLASH OVERRIDE	X	X	-	-	-	-
47	ROUTINE	X	X	X	-	-	-
48	PRIORITY	X	X	X	-	-	-
49	IMMEDIATE	X	X	X	-	-	-
50	FLASH	X	X	X	-	-	-
51	FLASH OVERRIDE	X	X	X	-	-	-

***Restricted Trunk Access When Line Load Control is in Effect.
DAC Type A: Normal DAC, Capable of Placing and Receiving Calls.
DAC Type B: Normal DAC, Outgoing, incoming calls intercepted to operator.
DAC Type C: Normal DAC, off-hook indicates preset conference request.

Table 2-5. Status Codes

Code	Status
00	UNASSIGNED
01	IN-SERVICE (ON-HOOK/IDLE)
02	OUT-OF-SERVICE
03	LINE/TRUNK ON LOCKOUT
04	LINE/TRUNK ON LOCKOUT - S/R CONNECTED
05	TRUNK ON LOCKOUT - MARKED FOR MAINTENANCE ROUTINING
06	TRUNK ON LOCKOUT - MARKED FOR ROUTINING - S/R CONNECTED
07	SENDER/RECEIVER CONNECTED
08	NARROWBAND CALL ESTABLISHED
09	NARROWBAND BUSY OP RECALL
10	NARROWBAND BUSY IN OPERATOR HOLD STATE
11	WIDEBAND CALL ESTABLISHED
12	WIDEBAND BUSY IN OPERATOR HOLD STATE
13	CONNECTED TO RINGBACK BUS
14	CONNECTED TO RING BUS
15	IN OPERATOR HOLD STATE - NO CONNECTION ESTABLISHED
16	IN OPERATOR HOLD STATE - CONNECTED TO RINGBACK BUS
17	IN OPERATOR HOLD STATE - CONNECTED TO RING BUS
18	IN OPERATOR/INFO ATTNDT QUEUE (CONNECTED TO RINGBACK BUS)
19	TRANSIENT STATE

Table 2-6. Function Codes

Function code for	Code
PR = 65	0 - unassigned 1 - home 2 - foreign 3 - undefined/error
PR = 68 and 69	0 - unassigned 1 - home - includes "T" digit 2 - foreign 3-home-delete 'T" digit
PR = 70 to 98	0 - unassigned 1 - home 2 - foreign 3 - alternate home 4 - home - add this PR to incoming AN/TTC-30 calls 5 - foreign - add this PR to incoming AN/TTC -30 calls 6 - alternate home - add this PR to incoming AN/TIC-30 calls
SL	0 - unassigned 1 - home 2 - foreign (not directly connected) 3 - foreign (directly connected)
Alternate SL	0 - undefined/error 1 - undefined/error 2 - foreign (not directly connected) 3 - foreign (directly connected)
Preset Conference	0 - tactical subscriber 1 - autovon subscriber 2 - SF commercial subscriber
NATO IAP NAC	1 - home 2 - foreign 3 - foreign - 10 digit directly connected 4 - autovon gateway 5 - survivability gateway

the data base; he is assigned a directory number and precedence level; special privileges and/or requirements are specified; and the terminal is placed in service or out of service. If ERROR lamp goes on, see paragraph 2-26.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION TERMINAL SERVICE switch.

c. When TERMINAL NO lamp goes on, key in 4-digit terminal number (frame-group-terminal number). Verify that displayed digits are correct, and depress CONTINUE switch.

d. When TERMINAL TYPE lamp goes on, key in a 2-digit code specifying line type. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When CLASSCODE lamp goes on, key in 2-digit class-of-service code specifying privileges for line. Verify that displayed digits are correct, and depress CONTINUE switch. (The information attendant should have a class code of 02.) f. When DIR NO lamp goes on, key in 3-digit directory number assignment. Verify that displayed digits are correct, and depress CONTINUE switch.

g. If line was assigned class code specifying DAC with the preset conference privilege, the CONF lamp will go on. When this occurs, key in 2-digit number of preset conference group to which line is assigned. Verify that displayed digits are correct, and depress CONTINUE switch.

h. If line was assigned terminal type code corresponding to an adapted terminal, the SPCL CKT NO lamp will go on. When this occurs, key in 2digit special circuit number for adapter location (fig. FO-39). Verify that displayed digits are correct, and depress CONTINUE switch.

i. When STATUS lamp goes on, key in 2-digit in-service code (01) or 2-digit out-of-service code (02). Verify that displayed digits are correct, and depress CONTINUE switch.

j. If line was assigned class code corresponding to a type A or type B DAC, the PR-SL-XXX/ NNX-XXXX lamp will go on. When this occurs, key in 7-digit directory number of the DAC called party. Seven digits are required even if called party is a local subscriber (local PR-SL code). Verify that displayed digits are correct, and depress CONTINUE switch.

k. When STORE lamp goes on, you may exercise any of the following options. Automatic printout *of data entered will occur whenever data is stored.

(1) If you want a record of the line assignment on tape, depress I/O COMMANDS-PUNCH switch. After entry has been punched, any of the following options can be performed.

NOTE

Always verify tapes punched by this option (para 5-19.1).

(2) If you do not wish to store the entry in memory because a tape is being prepared for later read-in or an error exists, depress the COMMAND FACP CLEAR switch. This will turn off the field lamps and clear the digital readouts.

(3) If you wish to store this entry and repeat the line assignment procedure for a new terminal, depress COMMAND-STORE AND REPEAT switch and return to step c above.

(4) If you want to store this entry but do not want to repeat the terminal assignment procedure, depress COMMAND-STORE switch.

2-22. FACP Trunk Assignment

Use this procedure to assign a terminal to a trunk. The trunk terminal number and trunk type are entered in the data base; the trunk is assigned to a' trunk group; special requirements are specified; and the terminal is placed in-service or out-of-service. The wideband trunk of a wideband trunk pairing must be assigned a terminal before the narrowband trunk. If ERROR lamp goes on, see paragraph 2-26.

a. Depress COMMAND ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION TERMINAL SERVICE 'switch.

c. When TERMINAL NO lamp goes on, key in 4-digit terminal number (frame-group-terminal number). Verify that displayed digits are correct, and depress CONTINUE switch.

d. When TERMINAL TYPE lamp goes on, key in 2-digit code from table 2-3, specifying trunk type. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When TRK GR NO lamp goes on, key in 3digit code specifying trunk group to which trunk is being assigned. Verify that displayed digits are correct, and depress CONTINUE switch.

NOTE

The wideband trunk of a wideband trunk pairing must be assigned a terminal before the narrowband trunk is assigned. Wideband MODE II trunks (type codes 09, 12, 15) may only be assigned in AN/ TTC-38(V)2.

J. If trunk was assigned termination type code indicating narrowband trunk of wideband trunk pair, the MODE II TERM NO lamp will go on. When this occurs, key in 4-digit terminal number (frame group-terminal number) of wideband trunk member of pair. Verify that displayed digits are correct, and depress CONTINUE switch.

g. If trunk was assigned termination type corresponding to an adapted terminal, the SPCL CKT NO lamp will go on. When this occurs, key in 2-digit special circuit number corresponding to adapter slot location. Verify that displayed digits are correct, and depress CONTINUE switch.

h. When STATUS lamp goes on, key in 2-digit in-service code (01) or 2-digit out-of-service code (02). Verify that displayed digits are correct, and depress CONTINUE switch.

i. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

j. The first time a trunk is assigned to a trunk group you must assign a trunk group lost call minimum count. Use the procedure described in paragraph 2-67 to assign a minimum number of lost calls to a trunk group. When the number is exceeded, the lost call alarm is activated. Since both the assignment and change procedures are, identical and the COMMAND-CHANGE switch is used, the procedure is included as a change procedure. If no assignment or change has been made to the number, the minimum count is assumed to be zero.

2-23. FACP Operator Assignment

Use this procedure to assign a terminal number to the operator signal port. The terminal number is entered into the data base, and the terminal is placed in service or out of service. 'It is not necessary to assign either of the two operator talking ports. This assignment is performed automatically by the program. If ERROR lamp goes on, see paragraph 2-26.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION TERMINAL SERVICE switch.

c. When TERMINAL NO lamp goes on, key in 4-digit terminal number (frame-group-terminal number) of operator signal port., Terminal number must be between 01 and 10. Verify that displayed digits are correct, and depress CONTINUE switch., d. When TERMINAL TYPE lamp goes on, key in termination type code 52. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STATUS lamp goes on, key in 2-digit in-service code (01) or 2-digit out-of-service code (02). Verify that displayed digits are correct, and depress CONTINUE switch.

f. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-24. FACP Sender/Receiver Assignment

Use this procedure to assign a terminal to a sender/ receiver or an auxiliary sender/receiver (para. 3-2e). The terminal number and type and slot location are entered in the data base; and the terminal, is placed in-service or out-of-service. If ERROR lamp goes on, see paragraph 2-26.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION TERMINAL SERVICE switch.

c. When TERMINAL NO lamp goes on, key in 4-digit terminal number (frame-group-terminal number). Terminal number must be 11 or 12. For proper system operation, auxiliary sender/receiver 21 must be assigned frame number 1, 3, 5, or 7. Auxiliary sender/receiver 22 must be assigned frame number 2, 4, 6, or 8. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When TERMINAL TYPE lamp goes on, key in 2-digit code specifying sender/receiver. This code is 55 for sender/receiver and 56 for auxiliary sender/ receiver. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When SPCL CKT NO lamp goes on, key in 2-digit special circuit number corresponding to sender/receiver slot location. This number is 21 for frames 1, 3, 5, or 7 (bus A), and 22for frames 2,4, 6, or 8 (bus B). Verify that displayed digits are correct, and depress CONTINUE switch.

f: When STATUS lamp goes on, key in 2-digit in-service code (01) or 2-digit out-of-service code (02). Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-25. FACP Conference Bridge Assignment

Use this procedure to assign a terminal, number to the conference bridge master port. The terminal number is entered into the data base, and the terminal is placed in-service or out-of-service. The terminal assignments for the remaining conference bridge ports are performed automatically by the program. If ERROR lamp goes on, see paragraph 2-26.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION TERMINAL SERVICE switch.

c. When TERMINAL NO lamp goes on, key in 4digit terminal number (frame-group-terminal number) of conference bridge master port. Terminal number must be 11 or 12. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When TERMINAL TYPE lamp goes on, key in 2-digit code for a 5-party conference circuit (57) or a 9-party conference circuit (59). Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STATUS lamp goes on, key in 2-digit in-service code (01) or 2-digit out-of-service code (02). The status of the master port determines the status of the entire bridge. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. The printout of the conference bridge assignment will only include the entry for conference master port.

2-26. Terminal Service Assignment Checks

Field	Checks
TERMINAL NO	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number - between 1 and 12. 2. Number not already assigned.
TERMINAL TYPE	1. Digits between 01 and 60. 2. Not code 52 unless same terminal number in next 2 groups are unassigned. 3. Not code 57 unless same terminal numbers in next 4 groups are unassigned. 4. Not code 59 unless same terminal numbers in next 9 groups are unassigned. 5. If terminal number is 11 or 12, only codes 55-60are legal. 6. Not codes 9, 12 or 15 for AN/TTC-38(V)1. 7. Not non-control port of operator (53, 54) 5-party (58), or 9party (60) conference bridge.
CLASSCODE	1. Digits between 01 and 51. 2. Terminal types 31, 32, 33, and 36 may only be assigned class codes 1-16. 3. Terminal types 30, 34, and 37 may only be assigned class codes 01-31. 4. No more than 36 DAC's. 5. Terminal types 3, 5, and 7 may only be assigned class codes 01 or 02.
DIR NO	1. Digits between 001 and 999. 2. If first digit is 0, termination type must be 31 or 32.
TRK GR NO	1. Digits between 001 and 120. 2. If group is already assigned, check termination types for legal mixing. a. Type codes 08-16 and 23. b. Type codes 17-23. c. Type codes 24 and 25. d. Type codes 29, 35, 38 and 39. e. Type codes 14, 15, 16, and 23.
CONF	Digits fall between 10 and 19.
MODE II TERM NO	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)l, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number - between 1 and 12. 2. Frame, group, and terminal number must already be assigned as Mode II trunk (terminal type 23) with same trunk group number. 3. Frame, group, and terminal number must not be already paired. 4. No more than 50 Mode 11 entries may be paired.

Field	**Checks**
SPCL CKT NO	1. Digits fall into allowable ranges. a. 01-48 for termination types 30-51. b. 01-20 for termination type 55. c. 21 and odd frame number for termination type 56. d. 22 and even frame number for terminal type 56. 2. Number not already assigned.
STATUS	01 for in-service or 02 for out-of-service.
PR-SL-XXX/NNX-XXXX	Digits fall into allowable range: 1. PR-SL-XXX a. PR - 70 to 99 b. SL - 00 to 99 c. XXX - 100 to g99 2. NNX-XXXX a. N-2to9 b. X-Oto9

2-27. FACP PR Routing Assignment

Use this procedure to assign a-PR number to the local office or to assign routing for a foreign PR. The PR number is entered with a function code identifying it as home or foreign. If the PR number is foreign, primary and alternate trunk group numbers are entered for primary and alternate routes. If ERROR lamp goes on, see paragraph 2-31.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-PR ROUTING switch.

b.1. When MODE II TERM NO lamp goes on, depress CONTINUE switch.

c. When PR NO lamp goes on,. key in 2-digit PR number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When FUNCTION CODE lamp goes on, key in 1-digit function code (1 for a home PR, 2 for a foreign PR without an alternate SL table,. and 3 for a foreign PR with an alternate SL table). Verify that displayed digit is correct, and depress CONTINUE switch. If 1 was entered, proceed to step *g*. If 2 or 3 was entered, proceed to step e below.

e. When PRI TRK GR NO lamp goes on, key: in 3-digit trunk group number of primary route. Verify that displayed digits are correct, and depress. CONTINUE switch.

f. When ALTN TRK GR NO lamp goes on, key in 3-digit trunk group number of the alternate route. If no alternate route is to be specified, key in 000. If the alternate route is home, key in 999. Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, store and repeat) described in paragraph 2-21k.

2-27.1 FACP NATO Routing Assignment.

Use this procedure to assign a 6-digit NATO routing number. The NATO number is entered with a function code identifying the gateway. If the gateway is foreign, primary and alternate trunk group numbers are entered for primary and alternate routes. If the gateway is survivability, only primary trunk group number is entered. If the gateway is AUTOVON, the AUTOVON routing must already be assigned. If ERROR lamp goes on, see paragraph 2-31.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION PR ROUTING switch.

c. When MODE II TERM NO lamp goes on, key in the first four digits of the 6-digit NATO number and depress CONTINUE switch.

d. When PR NO lamp goes on, key in last 2 digits of the 6-digit NATO number. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When FUNCTION CODE lamp goes on, key in digit function code (1 for home, 2 for foreign, 3 for foreign 10 digit directly connected, 4 for AUTOVON Gateway and 5 for survivability Gateway). Verify that displayed digit is correct, and depress CONTINUE switch. If 1 or 4 was entered, proceed to step *h*. If 2, 3, or 5 was entered, proceed to step *f* below.

f. When PRI TRK GR NO lamp goes on, key in 3-digit trunk group number of primary route. Verify that displayed digits are correct and depress CONTINUE switch. If function code 5 was entered in e above, proceed to h below. If 2 or 3 was entered, proceed to g below.

g. When ALTN TRK GR NO lamp goes on, key in 3-digit trunk group number of the alternate route. If no alternate route is to be specified, key in 000. If the alternate route is home, key in 999. Verify that display digits are correct, and depress CONTINUE switch.

h. When STORE lamp goes on, you may exercise any option (punch, clear, store, store and repeat) described in paragraph 2-21k.

2-28. FACP AN/TTC-30 PR Assignment

Use this procedure to assign the PR number to be added to all incoming-calls from AN/TTC-30 trunks. The PR number is entered into the data base. If it is a foreign PR number, primary and alternate trunk group numbers are assigned for the primary and alternate routes to the PR. If ERROR lamp goes on, see paragraph 2-31.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-PR ROUTING switch.

b.1. When MODE II TERM NO lamp goes on, depress CONTINUE switch.

c. When PR NO lamp goes on, key in 2-digit PR number to be added to AN/TTC-30 calls.

d. When FUNCTION CODE lamp goes on, key in 1-digit function code (4 for the home PR of local office, 5 for a foreign PR without an alternate SL table, and 6 for a foreign PR with an alternate SL table). Verify -that displayed digit is correct, and depress CONTINUE switch. If 4 was entered, proceed to step g. If 5 or 6 was entered, proceed to step e.

e. When PRI TRK GR NO lamp goes on, key in 3-digit trunk group number of primary route. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When ALTN TRK GR NO lamp goes on, key in 3-digit trunk number of alternate route. If no alternate route is to be specified, key in 000. If the alternate route is home, key in 999. Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-29. FACP AUTOVON Routing Assignment

Use this procedure to assign routing for all calls to AUTOVON. PR numbers 68 (routine calls) and 69 precedence calls) are. assigned to AUTOVON trunk groups. When the routing for PR = 69 is entered, the program automatically establishes the routing for PR = 68. If the local office does not have trunks connected directly to AUTOVON, primary and alternate routes to an office connected to AUTOVON are entered, and the routing established by the program for PR = 68 is identical to that entered for PR = 69. If the local office is connected directly to AUTOVON, the numbers of the AUTOVON trunk groups are entered, and the alternate for PR = 69 becomes the primary for PR = 68 and vice versa. If the ERROR lamp goes on during the procedure, see paragraph 2-31.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-PR ROUTING switch.

b.1. When MODE II TERM NO lamp goes on, depress I CONTINUE switch.

c. When PR NO lamp goes on, key in 69. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When FUNCTION CODE lamp goes on, key in function code 1 if local office interfaces with AUTOVON directly and function code 2 if local office does not interface directly with AUTOVON. Verify that displayed digit is correct, and depress CONTINUE switch.

e. When PRI TRK GR NO lamp goes on, key in AUTOVON trunk group number for precedence calls if function code 1 was entered. Key in trunk group number of the primary route to the interface office if function code 2 was entered. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When ALTN TRK GR NO lamp goes on, key in AUTOVON trunk group number for precedence calls if function code 1 was entered. Key in trunk group number of the alternate route to the interface office if function code 2 was entered. Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21*k*. The printouts recording the assignment will include entries for both PR = 68 and PR = 69.

NOTE

When only one trunk group exists between an AN/TTC-38(V)(*) and AUTOVON, regardless whether or not the group is a precedence or routine trunk group, enter the group as the PRI TRK GR NO and 000 for ALTN TRK GR NO. The routing for PR = 68 and 69 will then be identical as with the case of a function code = 2.

h. Display PR routing (para 3-11) for both PR 68 and PR 69.

(1) For direct AUTOVON trunk groups (function code 1), verify that the assigned alternate trunk group is displayed as the primary trunk group for PR 68. Also verify that the PR 68 alternate trunk group is displayed as 000. Verify that for PR 69 the assigned primary trunk group is correct and that 000 is displayed as an alternate trunk group.

(2) If no alternate trunk group is assigned verify that the assigned primary trunk group number is displayed for both PR 68 and 69.

(3) For indirect interface trunk groups (function code 2) verify that the primary and alternate trunk group numbers for PR 68 and PR 69 are identical.

2-29.1 Autovon Adapter Level Adjustment and Conditioning Procedures

a. The following level adjustment procedures will be utilized to set the transmit and receive levels for all AUTOVON adapter cards. Toggle switch must be in VON position.

(1) Connect a patch cord from the test tone quad located on the common equipment panel to the field side of the adapter (to adjust receive line) and then to the network side of the adapter (to adjust transmit line). The test tone provides a 1050 Hz signal at -4 dbm ±2 db (-dbmo).

(2) Connect TTS-37B noise measuring set (db meter) to network side of adapter, transmit portion, to adjust receive line and then to the field side of adapter, transmit portion, to adjust transmit line. See figure 2-10.1.

(3) Necessary adjustments are made to the adapter at the adapter terminal assembly. When measuring the transmit line, adjust the transmit pad until the TTS-37B indicates -16 db. Transmit pad is now set at -14 db. When measuring the receive line, adjust the receive pad until the TTS-37B indicates -11 db. Receive pad is now set at -9 db.

(4) Return system to prior status.

b. For the AUTOVON conditioning procedure, set up patching arrangement as shown in figure 2-10.2. Coordination with the AUTOVON tech controller may be required to condition the circuits for proper operation. It should be noted that the transmit and receive levels given for conditioning AUTOVON circuits are not fixed. These levels can vary depending upon the number of patching facilities involved, cabling, and radio shots. When it has been established that the AUTOVON circuit is operating, the patching arrangement shown in figure 2-10.3 may be utilized but is not required.

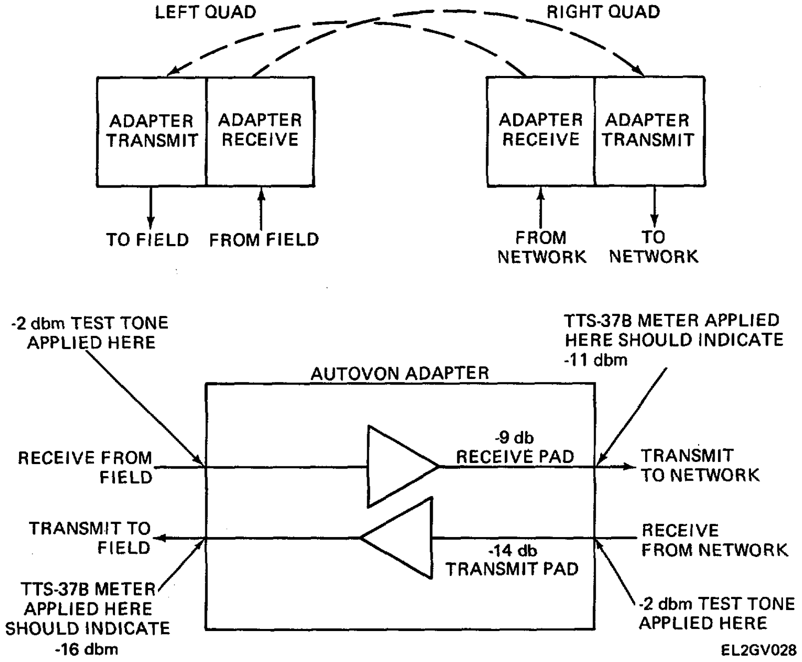


Figure 2-10.1. AUTOVON level adjustments.

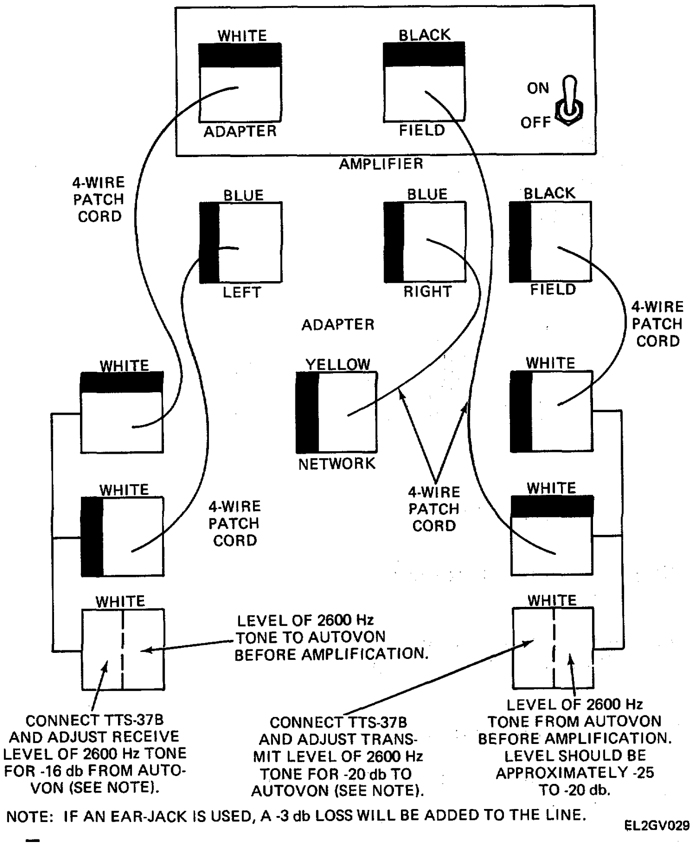


Figure 2-10.2. AUTOVON patching with use of amplifiers and monitoring equipment.

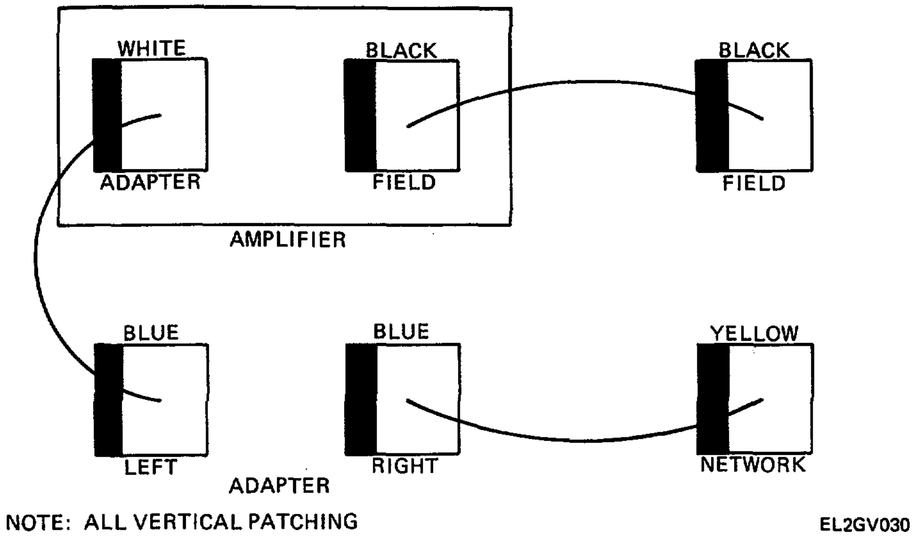


Figure 2-10.3. AUTOVON patching with use of amplifiers.

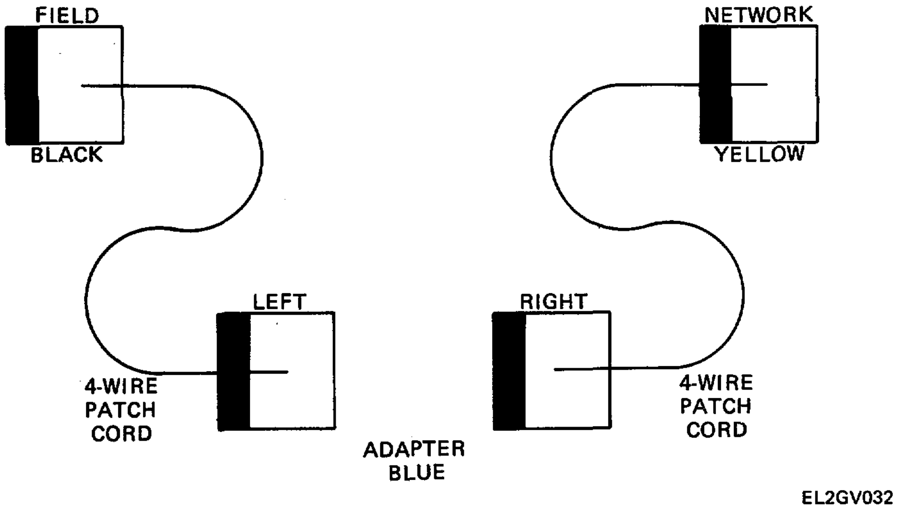


Figure 2-10.4. AUTOVON patching without amplifiers.

2-30. FACP SF Commercial Routing Assignment

Use this procedure to route calls initiated with the R5 access code. If ERROR lamp goes on, see paragraph 2-31.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-PR ROUTING switch.

b.1. When MODE II TERM NO lamp goes on, depress CONTINUE switch.

c. When PR NO lamp goes on, key in 65. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When FUNCTION CODE lamp goes on, key in function code 1 if local office interfaces with SF Commercial office directly, or function code 2 if local office does not interface with SF commercial office directly. Verify that displayed digit is correct, and depress CONTINUE switch.

e. When PRI TRK GR NO lamp goes on, key in 3digit trunk group number of SF commercial trunk if function code 1 was entered. Key in 3-digit trunk group number of primary route to interface office if function code 2 was entered. Verify that displayed digits are correct, and depress CONTINUE switch.

f: When ALTN TRK GR NO lamp goes on, key in 000 if function code 1 was entered. Key in 3-digit trunk group number of alternate route to interface office if function code 2 was entered. Verify that displayed digits are correct and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store, and repeat) described in paragraph 2-21k.

2-31. PR Routing Assignment Checks

Field	Checks
MODE II TERM NO	NATO digits must fall into allowable range 90XX to 91XX where X = 0-9.
PR NO	1. PR digits must fall into allowable range (65,69 thru 98). 2. Number not already assigned.
FUNCTION CODE	1. Digits must fall into allowable range for specific PR. a. If PR is 65, code is 1 or 2. b. If PR is 69, code is 1, 2 or 3. c. If PR is between 70 and 98, code is between 1 and 2. 2. Only one PR may be assigned a function code of 4, 5 or 6. 3. Digits must fall into the range 1 thru 5 for 6 digit NATO number. a. If digit 4 is entered, PR 69 must be assigned. b. If digit 5 is entered, another 6 digit NATO number must already have been entered that has the same first three digits (IAP) and has a function code of 1 (home).
PRI TRK GR NO	1. Digits must fall into allowable range (between 001 and 120). 2. Trunk group must already be assigned. 3. If PR number is 65 and function code is 1, trunks in group must have termination type 48-51, and only one type is allowed. All other PR's may not have trunk groups with these terminal types. 4. If PR number is 65 and function code is 2, all trunks in group must have termination types 08-16. 5. If PR number is 69 and function code is 1, trunks in group must have termination type 40-45, and these types are not allowed for any other PR. 6. If PR number is 69 and function code is 2, all trunks in group must have termination types 08-16. 7. For 6 digit NATO number, the trunks in the group must have terminal type 8 thru 16 or 61 except for function code 3, which is restricted to terminal type 61 only.
ALTN TRK GR NO	1. Digits must fall into allowable range (000,001-120, 999). 2. Trunk group must already be assigned for 001-120. 3. If PR number is 65 and function code is 1, enter 000. 4. If PR number is 69 and function code is 1, trunks in group must have termination types 40-45, and only one type is allowed. These types are not allowed for any other PR. 5. If PR number is 65 or 69, 999 entry is illegal. 6. If PR number is 65 and function code is 2, all trunks in group must have termination types 08-16. 7. If PR number is 69 and function code is 2, all trunks in group must have termination types 08-16. 8. For a 6 digit NATO number the trunks in the group must have terminal type 8 thru 16 or 61.

2-32. FACP SL Routing Assignment

Use this procedure to assign an SL number to the local office or to assign routing for a foreign SL. The SL number is entered with a function code identifying it as home or foreign. If the SL number is foreign, primary and alternate trunk group numbers are entered for primary and alternate routes. If ERROR lamp goes on, see paragraph 2-33.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-SL ROUTING switch.

c. When SL NO lamp goes on, key in 2-digit SL number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When FUNCTION CODE lamp goes on, key in 1-digit function code (1 for home, 2 for foreign not played digit is correct, and depress CONTINUE switch if 1 was entered, proceed to step *g*. 1f 2 or 3 was entered, proceed to step *e.*

e. When PRI TRK GR NO lamp goes on, key in 3-digit trunk group number of primary route. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When ALTN TRK GR NO lamp goes on, key in 3-digit trunk group number of alternate route. If no alternate route is designated, key in 000. If the alternate route is to be home, key in 999. Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-33. SL Routing Assignment Checks

Field	**Checks**
SL NO	1. Digits between 00 and 99. 2. SL unassigned.
FUNCTION CODE	Digit between 1 and 3.
PRI TRK GR NO	1. Digits between 001 and 120 (except trunk groups With types 40-45 and 48-51 which can never be a route for an SL). 2. Trunk group assigned.
ALTN TRK GR NO	1. Digits 999 or between 000 and 120 (except trunk groups with types 40-45 and 48-51 which can never be assigned a route for an SL). 2. Trunk group (001-120) assigned.

2-34. FACP Alternate SL Routing Assignment

Use this procedure to add an alternate SL entry to a PR table. If ERROR lamp goes on, see paragraph 2-35.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-ALTN SL ROUTING switch.

c. When PR NO lamp goes on, key in 2-digit PR number to whose table the alternate SL is being assigned. PR number must have been previously assigned with function code of 3 or 6 (para 2-27). Verify that displayed digits are correct, and depress CONTINUE switch.

d. When ALTN SL NO lamp goes on, key in 2-digit alternate SL number. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When FUNCTION CODE lamp goes on, key in 1-digit function code (2 for foreign not. directly connected, or 3 for foreign directly connected). Verify that displayed digit is correct, and depress CONTINUE switch.

f. When PRI TRK GR NO lamp goes on, key in 3-digit trunk group number of primary route. Verify that displayed digits are correct, and depress CONTINUE switch.

q. When ALTN TRK GR NO lamp goes on, key in 3-digit trunk group number of alternate route. If no alternate route i§ desired, key in 000. If desired alternate route is home, key in 999. Verify that displayed digits are correct, and depress CONTINUE switch.

h. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-35. Alternate SL Routing Assignment Checks

Field	**Checks**
PR NO	1. Digits must fall into allowable range (between 70 and 98). 2. PR number must have already been assigned function code 3 or 6.
ALTN SL NO	1. Digits must fall into allowable range (between 00 and 99). 2. SL must not be in this alternate SL table.
FUNCTION CODE	Digit must be 2 or 3.
PRI TRK GR NO	1. Digits must fall into allowable range (between 001 and 120). 2. Trunk group must already be assigned. 3. Trunk groups with types 40-45 or 48-51 can not be used as a route for an alternate SL.
ALTN TRK GR NO	1. Digits must fall into allowable range (000, 001-120, 999). 2. Trunk group must already be assigned for digits 001-120. 3. Trunk groups with types 40-45 or 48-51 can not be used as a route for an alternate SL.

2-36. FACP JXX Routing Assignment

Use this procedure to assign a JXX number (700999) to a trunk group. This routes calls to that number to another switchboard via the designated trunk group. If the ERROR lamp goes on, see paragraph 2-39. Use the line assignment procedure (para 2-21) to assign a JXX number to a line terminal.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-OP/JXX ROUTING switch.

c. When DIR NO lamp goes on, key in 3-digit JXX number (700-999). Verify that displayed digits are correct, and depress CONTINUE switch.

d. When PRI TRK GR NO lamp goes on, key in 3-digit trunk group number for the routing assignment. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-37. FACP Unstaffed Operator Routing Assignment

Use this procedure to route local operator calls to another central office when all local office operator positions are unstaffed. If ERROR lamp goes on, see paragraph 2-39.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-OP/JXX ROUTING switch.

c. When DIR NO lamp goes on, key in 000. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When PR-SL-XXX/NNX-XXXX lamp goes on, key in full 7-digit directory number of location where TM 11-5805-628-12/NAVELEX 0967-462-8070 unstaffed operator calls are to be routed. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. The printout confirming the assignment will be in the following format:

OPR..PR-SL-XXX
000.. 76-22-000

2-38. FACP Routing Information

Calls to the Operator Use these procedures to route information calls to the operator when there is no information attendant at the switchboard. Information calls can be routed to the operator only if there is just one line assigned an information attendant terminal code and it is marked out-of-service. If more than one line is assigned an information attendant terminal type code, delete all but one and mark the remaining one out-of-service. Use the terminal service deletion (para 2-73) and the status change (para 2-65) procedures. If no information attendant line is assigned, proceed as follows:

a. Perform steps in paragraph 2-21 a through d of the line assignment procedure.

b. When TERMINAL TYPE lamp goes on, key in 2-digit code specifying an information attendant terminal type.

c. Complete the line assignment procedure (para 2-21) but mark the line out-of-service by entering status code 02 in step *i*.

2-39. OP/JXX Routing Assignment Checks

Field	Checks
DIR NO	1. Digits must fall into allowable range (000, 700-999). 2. Directory Number (700-999) must not already be assigned. 3. Unstaffed operator routing must not already be assigned.
PRI TRK GR NO (JXX numbers only)	1. Digits must fall into allowable range (001-120). 2. Trunk group must already be assigned. 3. Trunk group may not contain types 40-45 or 48-51.
PR-SL-XXX/NNX-XXXX	1. Digits must fall into allowable range (PR: 70-98; SL: 00-99; XXX:000-999). NNX-XXXX does not apply. 2. Full routing for PR-SL-XXX must already be programmed. 3. Routing for PR-SL-XXX must not be over SF or AUTOVON trunks (terminal types 40-45 and 46-51) or dc closure, 20 Hz, or 1600 Hz operator intercept lines (terminal types 31-32, 33, and 36).

2-40. FACP Fixed Directory Routing Assignment

Use this procedure to assign a 7-digit PR-SL-XXX directory number to a fixed directory subscriber. Both the mobile subscriber's 5-digit fixed directory number and the 7-digit directory number identifying his current location in the system are entered. This allows the program to route calls using the fixed directory number to the subscriber. If the ERROR lamp goes on, see paragraph 2-41.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-FIXED DIR ROUTING switch.

c. When FIXED DIR NO/TRFC CNT lamp goes on, key in either a 5-digit fixed directory subscriber list (FDSL) number (PXJXX) or a 5-digit fixed directory unit list (FDUL) number (XXIXX).

Verify that displayed digits are correct, and depress CONTINUE switch.

d. When PR-SL-XXX/NNX-XXXX lamp goes on, key in full 7-digit PR-SL-XXX number. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-41. Fixed Directory Routing Assignment Checks

Field	Checks
FIXED DIR NO	1. Digits must fall into allowable range a. PXJXM P - between 7 and 9 J - between 7 and 9 X - between 0 and 9 M - between 0 and 3 b. XXIXX X - between 0 and 9 I - between 0 and 6 2. Routing not already assigned.
PR-SL-XXX	1. Digits fall into allowable range. a. PR between 70 and 98. b. SL between 00 and 99. c. XXX between 000 and 999. 2. Routing already assigned for PR-SL-XXX.

2-42. FACP Line Group Entry Assignment

Use this procedure to assign a subscriber to a line group. The subscriber's directory number, the terminal number, the line group number, and the subscriber's group ranking are entered. When initially programming a line group, members must be assigned in order of rank (rank one first); continue in descending order of rank. All higher ranks must be assigned. If another subscriber is programmed for the same rank as entered in this procedure, the new entry will cause the old entry and any entries below to be moved down by one rank. If the table is full the ERROR lamp will go on (para 2-43).

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-LINE GR ENTRY switch.

c. When LINE GR NO lamp goes on, key in 2-digit line group number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When RANK lamp goes on, key in 1-digit line group ranking number for the subscriber. Verify that displayed digit is correct, and depress CONTINUE switch.

e. When TERMINAL NO lamp goes on, key in 4digit terminal number (frame, group, and terminal). Verify that displayed digits are correct, and. depress CONTINUE switch.

f. When DIR NO lamp goes on, key in subscriber's 3-digit directory number. Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. Always print out the line group after assigning, to verify that it was correctly entered in the program (para 3-12 and 3-13).

2-43. Line Group Entry Assignment Checks

Field	**Checks**
LINE GR NO	1. Digits between 01 and 30. 2. Specified line group has space for entry.
RANK	1. Digit between 1 and 5. 2. Rank 2 cannot be assigned before rank 1, etc.
TERMINAL NO	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)l, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number - between 1 and 10. 2. Terminal already assigned. 3. Terminal types 31, 32, 33, and 36 are illegal.
DIR NO	1. Digits between 100 and 999. 2. Directory number already assigned to specified terminal number. 3. Combination of terminal number and directory number not already in line group table.

2-44. FACP Preset Conference Entry Assignment

Use this procedure to assign a subscriber to a preset conference. The conference number, the subscriber type (function code), and the subscriber's directory number are entered. If ERROR lamp goes on, see paragraph 2-45.

a. Depress COMMAND ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-PRST CONF ENTRY switch.

c. When CONF lamp goes on, key in 2-digit conference number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When FUNCTION CODE lamp goes on, key in 1-digit function code for subscriber type. Verify that displayed digit is correct, and depress CONTINUE switch.

e. When PR-SL-XXX/NNX-XXXX lamp goes on, key in 7-digit directory number. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-45. Preset Conference Entry Assignment Checks

Field	**Checks**
CONF	1. Digits between 10 and 19. 2. Specified conference has space for entry (9 maximum).
FUNCTION CODE	Digit between 0 and 2.
PR-SL-XXX/NNX-XXXX	1. Digits in PR-SL-XXX range if function code is 0. a. PR - between 70 and 99. b. SL - between 00 and 99. c. XXX - between 000 and 999. 2. Digits in NNX-XXXX range if function code is 1 or 2. a. N - between 2 and 9. b. X - between 0 and 9. 3. If function code is 0, routing must be programmed for PR-SL-XXX. 4. If function code is 0 and PR and SL are home, XXX terminal types 31, 32, 33, and 36 are illegal. 5. If function code is 1 or 2, PR's 65, 68, and 69 must be programmed for routing. 6. PR 99 is only valid when SL-IXX corresponds to assigned fixed directory number. 7. If function code is 2, PR 65 must be programmed for routing.

2-46. FACP Standard Trunk Test Assignment

Use this procedure to test an individual trunk, an entire trunk group, or all trunks. The test consists sending release tone over all designated trunks which are not idle. Busy trunks are not tested. If ERROR lamp goes on, see paragraph 2-47.

a. Depress COMMAND-ASSIGN switch.

b. When READY lamp goes on, depress FUNCTION-TRUNK TEST switch.

c. When TERMINAL NO lamp goes on, if an individual trunk is to be tested, key in 4-digit terminal number (frame-group-terminal number). If a trunk group is to be tested, depress CONTINUE switch, and when TRK GR NO lamp goes on, key in 3-digit trunk group number. If all trunks are to be tested, depress CONTINUE switch, and when TRK GR NO lamp goes on, key in 777. Verify that displayed digits are correct, then depress CONTINUE switch.

d. When STORE lamp goes on, depress COMMAND-STORE switch. The punch and store and repeat options cannot be used. The printout confirming receipt of trunk test request and test completion (para 5-7f) are:

FGT/TGN TRK TS

X-X-XX (frame group terminal) or YYY (trunk
group number) followed by

TRK TST CMPT

2-47. Trunk Test Assignment Checks

Field	Checks
TERMINAL NO	1. Digits must fall into allowable range: a. Frame - between 1 and 4 for AN/TrC38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number- between 1 and 10. 2. Must be assigned as trunk. 3. Trunk must be testable (terminal types 08-22, 24, 25, 26, 27, and 29).
TRK GR NO	1. Digits must fall into allowable range (001-120, 777). 2. Trunks in group must be testable (terminal types 8-22, 24, 25, 26, 27, and 29). 3. Trunk group must be assigned.

2-48. FACP Call Forwarding Assignment

Use this procedure to have calls to a designated directory number automatically forwarded to another directory number. The terminal numbers corresponding to the directory number to which calls are to be forwarded and the directory number to which calls are to be forwarded are displayed and printed. Then the directory number assignment change procedure is performed which assigns the letter directory number to the former terminal number.

a. Display terminal number (frame-group-terminal number) for directory number to which calls are to be forwarded (para 2-55). Record data using the print option.

b. Repeat step a for directory number whose calls are to be forwarded.

c. Perform directory number assignment change (para 2-55), keying in the 3-digit directory number displayed and printed in step b above.

d. Save printout data from a, b, and c above for use in removing call forwarding at a later time.

e. Remove call forwarding using directory number assignment change procedure.

2-49. FACP DAC Assignment

Use the line assignment procedure described in paragraph 2-21 to assign direct access capability (DAC) to a subscriber. There are three types of. DAC assignments: a type A (class codes 17-26) subscriber going off-hook causes a designated terminal to ring automatically, and my receive incoming calls; a type B (class codes 07-16) subscriber going off-hook also causes a designated terminal to ring automatically, but incoming calls are intercepted by the operator; a type C (class codes 27-31) subscriber going off-hook causes preset conference terminals to ring automatically.

2-50. FACP Information Attendant Assignment

Use the line assignment procedure described in paragraph 2-21 to assign a directory number to an information attendant.

Use the appropriate termination type code (03, 05, or 07). If termination code is 07, the common battery DTMF subset must have a 12 button keyset. Mark the line in-service in step 2-21i.

The information attendant may be assigned any directory number between 100 and 699.

All information attendants at the same office will have the same directory number,

2-51. FACP Change Procedures

Use the FACP change procedures to change parameters entered during assignment procedures. A change is allowed only when the primary entry parameter (such as terminal or PR number) is already assigned. Any attempt to change a non-existent entry turns on the ERROR lamp. A change procedure can be used to change any data parameter as long as it does not violate either of the following restrictions.

a. Only fields displayed during the procedure sequence can be changed.

b. No parameter can be changed which would require a new field indication to be turned on, or a field indicator to go off and the data associated with it to be discarded. If such changes are attempted, the program will reject. the input and turn on the ERROR lamp when the STORE switch is depressed. Changes are recorded by the local and remote page printers using the standard message formats described in paragraph 3-13.

2-52. FACP Terminal Service Change

Use this procedure to change any of the data parameters for a particular terminal which were entered during the line assignment procedure. The terminal number is keyed in, and the program causes all parameters that were entered during the line assignment procedure to be displayed. Then each parameter is called up individually by the program, and the data is either changed or passed by. If you have any doubt as to whether a particular change is legal, delete the current line assignment (para 2-55), then reassign new data parameters (para 2-53). If error lamp goes on, refer to paragraph 2-26, except that TERMINAL NO must already be assigned.

a. Depress COMMAND-CHANGE switch.

b. When READY lamp goes on, depress FUNCTION-TERMINAL SERVICE switch.

c. When TERMINAL NO lamp goes on, key in 4-digit terminal number (frame-group-terminal number) whose parameters are to be modified. Verify that displayed digits are correct, and depress CONTINUE switch.

d. All parameters that were entered during the line assignment procedure are now displayed automatically. The appropriate lamps are on steady to indicate the nature of the displayed parameters.

e. When TERMINAL TYPE lamp flashes, if a change is required, key in new 2-digit terminal type code. The first digit keyed clears the field. It is only possible to change type codes which fall into the same group (table 2-3). Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

f. When CLASS CODE lamp flashes, if a change is required, key in new 2-digit class code. The first digit keyed clears the field. It is only possible to change class codes which fall into the same group (table 2-4). Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

g. When DIR NO or TRK GR NO lamp flashes, if a change is required, key in new 3-digit directory or trunk group number. Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

h. If CONF lamp flashes, and a change is required, key in new 2-digit preset conference number. Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

i. If MODE II TERM NO lamp flashes and a change is required, key in 4-digit terminal number of the MODE II wide band circuit which is to be paired with this narrow band terminal. Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

j. If SPCL CKT NO lamp flashes and a change is required, key in new 2-digit special circuit number. Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

k. When STATUS lamp flashes, and a change is required, key in new 2-digit status code. Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

l. If PR-SL-XXX/NNX-XXXX lamp flashes and a change is required, key in new PR-SL-XXX or NNX-XXXX number for the DAC called party. Verify that displayed digits are correct, and depress CONTINUE switch. If no change is required, depress CONTINUE switch.

m. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-53. FACP Terminal Number Assignment Change

Use this procedure to change the terminal assignment of a line, trunk, conference bridge, operator, or sender/receiver. When the current terminal number is entered, the program displays all information entered during the terminal service assignment procedure. The new terminal is then entered. The message format used to record the change is the same as that used for a terminal service change. If the change is made for an operator position or conference bridge, only the change for the signal port or master port will be printed. If the ERROR lamp goes on, see paragraph 2-55.

a. Depress COMMAND-CHANGE switch.

b. When READY lamp goes on, depress FUNCTION-TERMINAL NO ASGMT switch.

c. When TERMINAL NO lamp goes on, key in old 4-digit terminal number (frame, group, and terminal number). Verify that displayed digits are correct, and depress CONTINUE switch.

d. Observe that digital readouts display the information entered during the initial terminal assignment procedure.

e. When TERMINAL NO lamp goes on again, key in new 4-digit terminal number (frame, group, and terminal number) to which line is being transferred. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-54. Terminal Assignment Number Change Checks

Field	**Checks**
TERMINAL NO (first entry)	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number - between 1 and 12. 2. Terminal assigned.
TERMINAL NO (second entry)	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number - between 1 and 12. 2. Terminal not assigned. 3. Terminal number differs from first entry.

2-55. FACP Directory Number Assignment Change

Use this procedure to change the terminal number to which a particular directory number is assigned, such as is required for call forwarding. If ERROR lamp goes on, refer to paragraph 2-56.

a. Depress COMMAND-CHANGE switch.

b. When READY lamp goes on, depress FUNCTION-DIRECTORY NO ASGMT switch.

c. When DIR NO lamp goes on, key in 3-digit directory number. Verify that displayed digits are 2-34 correct, and depress CONTINUE switch.

d. The current terminal number corresponding to the directory number is now displayed.

e. When TERMINAL NO lamp goes on, key in new 4-digit terminal number (frame-group-terminal number) to which directory number is being assigned. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-56. Directory Number Assignment Change Checks

Field	Checks
DIR NO	1. Digits fall into allowable range (001-999). 2. Local subscriber table entry must be a frame-group-terminal number, not a trunk group number.
TERMINAL NO	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number - between 1 and 10. 2. Terminal must be already assigned.

2-57. FACP PR Routing Change

It is not possible to change any PR routing field parameter with the COMMAND-CHANGE switch. A deletion of PR routing followed by an assignment must be performed to change any of the field parameters.

a. Delete PR routing entry using procedure of paragraph 2-75.

b. Assign new PR routing entry using procedure of paragraph 2-27.

2-58. FACP SL Routing Change

It is not possible to change any SL routing field parameter using the COMMAND-CHANGE switch. A deletion of SL routing followed by an assignment must be performed in order to change any of the field parameters.

a. Delete SL routing entry using procedure of paragraph 2-76.

b. Assign new SL routing entry using procedure of paragraph 2-32.

2-59. FACP Alternate SL Routing Change

It is not possible to change any alternate SL routing field parameter using the COMMAND-CHANGE switch. A deletion of alternate SL routing followed by an assignment must be performed to change any of the field parameters.

a. Delete alternate SL routing entry using procedure of paragraph 2-77.

b. Assign new alternate SL routing entry using procedure of paragraph 2-34.

2-60. FACP Unstaffed Operator Routing Change

It is not possible to change any unstaffed operating routing entry using the COMMAND-CHANGE switch. A deletion of unstaffed operator routing followed by an assignment must be performed to change the routing entry.

a. Delete unstaffed operator routing entry using procedure of paragraph 2-78.

b. Assign new unstaffed operator routing entry using procedure of paragraph 2-37.

2-61. FACP JXX Routing Change

It is not possible to change any JXX routing entry using the COMMAND-CHANGE switch. A deletion of JXX routing followed by an assignment must be performed to change the routing entry.

a. Delete JXX routing entry using procedure of paragraph 2-79.

b. Assign new JXX routing entry using procedure of paragraph 2-36.

2-62. FACP Fixed Directory Routing Change

Use this procedure to modify the fixed directory routing table to reflect a roving subscriber's or unit's present location. If ERROR lamp goes on, refer to paragraph 2-41, except that FIXED DIR NO must already be assigned.

a. Depress COMMAND-CHANGE switch.

b. When READY lamp goes on, depress FUNCTION-FIXED DIR ROUTING switch.

c. When FIXED DIR NO/TRFC CNT lamp goes on, key in either the 5-digit fixed directory subscriber list (FDSL) number (PXJXX) or the 5-digit fixed directory unit list (FDUL) number (XXIXX). Verify that displayed digits are correct, and depress CONTINUE switch.

d. The current PR-SL-XXX number corresponding to the fixed directory number is now displayed.

e. When PR-SL-XXX/NNX-XXXX lamp goes on, key in new 7-digit PR-SL-XXX number. Verify that displayed digits are correct, and depress CONTINUE switch.

f: When STORE lamp goes on, you may exercise any of the options (punch,. clear, store, and store and repeat) described in paragraph 2-21k.

2-63. FACP DAC Routing Change

Use this procedure to change the routing for a DAC subscriber. When the terminal number of the DAC subscriber is entered, the program displays the existing DAC routing by displaying either a preset conference number or a subscriber directory number. A new conference number or 7-digit directing number is then entered to change the routing. If the ERROR lamp goes on, see paragraph 2-64.

a. Depress COMMAND-CHANGE switch.

b. When READY lamp goes on, depress FUNCTION-DAC ROUTING switch.

c. When TERMINAL lamp goes on, key in 4-digit terminal number (frame, group, and terminal number) of DAC. Verify that displayed digits are correct, and depress CONTINUE switch.

d. Observe that either the conference number (CONF) or subscriber directory number (PR-SLXXX/NNX-XXXX) is displayed to indicate the existing routing. Proceed to step e for type A and B DAC. Proceed to step f for type C DAC. See table 2-4 for an explanation of DAC types.

e. When PR-SL-XXX/NNX-XXXX lamp goes on, key in new 7-digit directory number. Verify that displayed digits are correct, and depress CONTINUE switch. Proceed to step g.

f. When CONF lamp goes on, key in new 2-digit conference number. Verify that displayed digits are correct, and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-64. DAC Routing Change Checks

Field	**Checks**
TERMINAL NO	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal number- between 1 and 10. 2. Terminal in DAC table.
PR-SL-XXX/NNX-XXXX	Digits fall into allowable range. 1. PR-SL-XXX a. PR - 70 to 99. b. SL - 00 to 99. c. XXX - 100 to 999. 2. NNX-XXXX a. N-2to9 b. X-Oto9
CONF	Digits between 10 and 19.

2-65. FACP Status Changes

Use this procedure to mark any terminal in-service or out-of-service, or to mark an entire trunk group out of service. If ERROR lamp goes on, refer to paragraph 2-66.

a. Depress COMMAND CHANGE switch.

b. When READY lamp goes on, depress-FUNCTION STATUS switch.

c. When TERMINAL NO lamp goes on:

(1) If a terminal status is to be changed, key in 4-digit terminal number (frame-group-terminal number). Verify that displayed digits are correct, and depress CONTINUE switch. The current status of the terminal is now displayed.

(2) If a trunk group status is to be changed, depress CONTINUE switch. When TRK GR NO lamp goes on, key in 3-digit trunk group number. Verify that displayed digits are correct, and depress CONTINUE switch. The current status of the trunk group is now displayed. A trunk group is considered in service if at least one trunk is in service.

d. When STATUS lamp goes on, key in 2-digit status code (01 for in-service, 02 for out-of-service). Verify that displayed digits are correct, and depress CONTINUE switch.

NOTE

The gross status is displayed here, not the current dynamic status. Therefore, both locked out and operating terminals are reported as status 01. You may remove a lockout by keying in 01 into the STATUS field and pressing CONTINUE. After the remaining portions of the status change procedure are completed, display status (para 3-11) to verify that the lockout has been removed.

e. When STORE lamp goes on, you may exercise any of three options (clear, store, and store and repeat) described in paragraph 2-21k. The change in status will be recorded in the following format:

F-G-TN/TGN	STAT
X-X-XX	XX
or	
XXX	XX

2-66. Status Change Checks

Field	**Checks**
TERMINAL NO..	1. Digits fall into allowable range. a. Frame - between 1 and 4 for AN/TTC-38(V)1, between 1 and 8 for AN/TTC-38(V)2. b. Group - between 1 and 8. c. Terminal - between 1 and 12. 2. Terminal must already be assigned.
TRK GR NO	1. Digits must fall into allowable range (001-120). 2. Group number must already be assigned.
STATUS..	Digits must be 01 (in-service) or 02 (out-of-service).

2-67. FACP Trunk Group Minimum Count Change

Use this procedure to assign or change the trunk group minimum count. This count establishes the threshold for the lost call alarm for a trunk group. If the number of lost calls in a trunk group exceeds the threshold in a 5-minute period, a lost call alarm is generated. If no threshold is assigned using this procedure, the minimum count is assumed to be zero. When a change is made, the following message format is used to document the change:

TGN	MIN
XXX	X

NOTE If ERROR lamp goes on, see paragraph 2-68.

a. Depress COMMAND-CHANGE switch.

b. When READY lamp goes on, depress FUNCTION-TRK GR METERS switch.

c. When TRK GR NO lamp goes on, key in 3-digit trunk group number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When GR MIN COUNT lamp goes on, key in 2digit minimum count for the trunk group. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k.

2-68. Trunk Group Minimum Count Change Checks

Field	**Checks**
TRK GR NO	1. Digits between 001 and 120. 2. Trunk group must be assigned.
GR MIN COUNT	Digits between 00 and 30.

2-69. FACP AN/TTC-30 PR Change

Use this procedure to change the PR which is assigned to incoming calls from an AN/TTC-30. The PR routing for the PR currently assigned to the AN/ TTC-30 is deleted and then reassigned with a new function code. Then the PR routing for the PR to be assigned to the AN/TTC-30 is deleted and reassigned with a new function code.

a. Delete the PR entry for the PR currently assigned for addition to incoming AN/TTC-30 calls. See paragraphs 2-75.

b. Assign the PR routing deleted in step a, changing the function code from 4, 5, or 6 to 1, 2, or 3. See paragraph 2-27.

c. Delete the PR entry for the PR to be assigned for addition to incoming AN/TTC-30 calls. See paragraph 2-75.

d. Assign the PR routing deleted in step c above, changing the function code from 1, 2, or 3 to 4, 5, or 6. See paragraph 2-28.

2-70. FACP AUTOVON and SF Commercial Routing Changes

These changes are performed as for any PR routing change except that the proper PR codes are used (69 for AUTOVON, 65 for SF commercial). The PR entry is deleted, thus deleting all entries in the PR table associated with the given PR. Then the new entry is assigned to assign new routing to AUTOVON or SF commercial offices.

a. Delete PR routing entry using procedure of paragraph 2-75.

b. Assign new entry, using procedure of paragraph 2-29 for AUTOVON routing, or procedure of paragraph 2-30 for SF commercial routing.

2-71. FACP Line Group and Preset Conference Entry Changes

It is not possible to change an entry for either one of these functions. If a table is full, delete an existing entry (see paragraph 2-82 for deletion of a line group entry, and paragraph 2-81 for deletion of a preset conference entry). Then add the new entry (see paragraph 2-42 for line group entry assignment, and paragraph 2-44 for preset conference entry assignment). Until a table is full, the new entry is added to the table.

2-72. FACP Deletion Procedures

Use the FACP deletion procedures to delete assignments from the data base. Program checks performed during a delete/reset procedure insure that digits entered during the sequence fall within the allowable range for the parameter.

2-73. FACP Terminal Service Deletion

Use this procedure to delete any and all table entries for a terminal with the exception of an entry in a preprogrammed conference. If the terminal is a trunk and the only trunk in its trunk group, the trunk group table entries are also deleted. When an operator signal port or conference bridge master port is deleted, the message printout documenting the deletions indicates only the master port. However, all other port assignments are deleted.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-TERMINAL SERVICE switch.

c. When TERMINAL NO lamp goes on, key in 4digit terminal number (frame, group, and terminal number) of terminal to be deleted. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k, and the following message will be printed:

```
DLTD
F-G-TN TYPE CLASS DIR TGN CONF MODE
II SPCKT STAT DACNO X-X-XX 0
```

2-74. FACP Trunk Group Deletion

Use this procedure to delete a trunk group from all routing tables. If the group was a primary trunk route before deletion, then the previous alternate route trunk group will be shifted into the primary route assignment, and there will no longer be an alternate route. If the group was a secondary trunk route before deletion, there will no longer be an alternate route.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-TRK GR NO switch.

c. When TRK GR NO lamp goes on, key in 3-digit number of trunk group to be deleted, or key in 777 to delete all trunk groups. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, you may exercise any of the options (punch, clear, and store, and store and repeat) described ii paragraph 2-21k. The message recording the deletion of a trunk group will be in the following format:

```
TGN.................................DLTD
XXX
```

e. When routing for a PR, SL, ALTN SL, or JXX number is deleted by deleting the entire trunk group or by deleting the last trunk in a group (para 2-73), the following message will be printed:

```
RTG          DLTD
PR           71
PR           83
SL           22
PR           84          SLA21
PR           84          SLA22
JXX          842
```

2-75. FACP PR or 6-digit NATO Deletion

Use this procedure to delete all entries in the PR table associated with a PR or a 6-digit NATO number. If there is an associated alternate SL table, it is also deleted. If the deleted PR was used for unstaffed operator routing, fixed directory routing, DAC routing, or preset conference routing, delete these entries separately, using the appropriate deletion procedures.

a Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION PR ROUTING switch.

b.1. When MODE II TERM NO lamp goes on for 2-digit PR number, depress CONTINUE switch or for 6digit NATO number enter first 4 digits of the number to be deleted. Verify that displayed digits are correct, and depress CONTINUE switch.

c. When PR NO lamp goes on, key in 2-digit number of PR to be deleted or the last two digits of the 6-digit NATO number to be deleted. Verify that displayed digits are correct, and depress CONTINUE switch.

d When STORE-lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k, and the following message will be printed.

```
DLTD
NATO/PR FC PTG ATG
XX
```

2-75.1 FACP NATO Deletion

Use this procedure to delete all entries in 6-digit NATO routing tables.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-PR. ROUTING switch.

c. When MODE II TERM NO lamp goes on, key in the first four digits of the 6-digit NATO number and depress CONTINUE switch.

d When PR NO lamp goes on, key in last 2 digits of the 6-digit NATO number. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STORE lamp goes on, you may exercise any of the options (punch, clear, store and store and repeat) described in paragraph 2-21k and the following message will be printed:

```
DLTD
NATO 1 PR FC PTG ATG
XXXX XX
```

2-76. FACP SL Deletion

Use this procedure to delete all entries in the SL table associated with a given SL number. If the deleted SL was used for unstaffed operator routing, fixed directory routing, DAC routing, or preset conference routing, delete these entries separately using the appropriate deletion procedures.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-SL ROUTING switch.

c. When SL NO lamp goes on, key in 2-digit number of SL which is to be deleted. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and clear) described in paragraph 2-21k, and the following message will be printed:

```
DLTD
SL FC PTG ATG
XX
```

2-77. FACP Alternate SL Deletion

Use this. procedure to delete the entry associated with a given SL number in the alternate SL table.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-ALTN SL ROUTING switch.

c. When PR NO lamp goes on, key in 2-digit number of PR identifying alternate SL table. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When ALTN SL NO. lamp goes on, key in 2digit number of SL to be detected. Verify that displayed digits are correct, and depress CONTINUE switch.

e. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. When the deletion is made, the following message is printed:

DLTD
PR SLA FC PTG ATG
<u>XX</u> <u>XX</u>

2-78. FACP Unstaffed Operator Routing Deletion

Use this procedure to delete the routing assigned for unstaffed operator calls.

b. When READY lamp goes on, depress FUNCTION-OP/JXX ROUTING switch.

c. When DIR NO lamp goes on, key in 000. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. When the routing is deleted, the following message is printed.

DLTD
OPR PR-SL-XXX
000 00-00-000

2-79. FACP JXX Routing Deletion

Use this procedure to delete routing for a JXX number (700-999) which is programmed to route to a trunk group. If routing is programmed to a terminal for the requested JXX number, the ERROR lamp is turned on.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-OP/JXX ROUTING switch.

c. When DIR NO lamp goes on, key in JXX number whose routing is to be deleted. Verify that displayed digits are correct, and depress CONTINUED switch.

d. When store lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. When the routing is deleted, the following message is printed:

DLTD
JXX TGN
XXX

2-80. FACP Fixed Directory Routing Deletion

Use this procedure to delete the routing for a given fixed directory number.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-FIXED DIR ROUTING switch.

c. When FIXED DIR NO/TRFC CNT lamp goes on, key in 5-digit fixed directory number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, you may exercise any of the options (punch, clear, store and store and repeat) described in paragraph 2-21k. The following message will be printed to record the deletion:

DLTD
DIR NO PR-SL-XXX
<u>XXXXX</u>

2-81. FACP Preset Conference Entry Deletion

Use this procedure to delete a specific entry from a preset conference table. If the party deleted is a DAC, then the DAC routing entry must be changed (para 2-63). Otherwise the party will receive error tone when he goes off-hook.

a. Depress COMMAND DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION PRST CONF ENTRY switch.

c. When CONF lamp goes on, key in 2-digit conference number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When FUNCTION CODE lamp goes on, key in 1-digit function code. Verify that displayed digit is correct, and depress CONTINUE switch.

e. When PR-SL-XXX/NNX-XXXX lamp goes on, key in-7-digit directory number which is to be deleted. Verify that displayed digits are correct, and depress CONTINUE switch.

f. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-21k. When the store and repeat option is used, start procedure to delete each succeeding entry from the same conference number at step *d* above.

g. The following message will be printed to record the deletion:

DLTD CONF	FUNC	PR-SL-XXX/NNX-XXXX
XX	X	XX-XX-XXX or;
XX	X	XXX-XXXX

h. If the party deleted is a DAC, change the DAC routing entry (para 2-63) to the conference or the DAC will receive error tone when it goes off-hook.

2-82. FACP Line Group Entry Deletion

Use this procedure to delete a subscriber from a line group.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-LINE GR ENTRY switch.

c. When LINE GR NO lamp goes on, key in 2digit line group number. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When RANK lamp goes on, key in 1-digit line group ranking of subscriber. Verify that displayed digit is correct, and depress CONTINUE switch.

e. When TERMINAL NO lamp goes on, key in 4-digit terminal number (frame-group-terminal number) of subscriber to be deleted from line group. Verify that displayed digits are correct.

f. When DIR NO lamp goes on, key in 3-digit directory number of subscriber to be deleted from line group. Verify that displayed digits are correct and depress CONTINUE switch.

g. When STORE lamp goes on, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 221 b. The deletion is recorded as follows:

DLTD LGN	RK	F-G-TN	DIR
XX	X	X-X-XX	XXX

2-83. FACP Traffic Meters Reset

Use this procedure to reset the switchboard traffic counters associated with narrowband, wideband, and operator traffic meters.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-TRAFFIC METERS switch.

c. When STORE lamp goes on, depress COMMAND-STORE switch. The punch and store and repeat options may not be exercised here.

d. No printout will occur to confirm the meters reset. If you wish to confirm the results, obtain a printout or display of the traffic meters, using the appropriate procedure.

2-84. FACP Trunk Group Meters Reset

Use this procedure to reset the traffic meters for any selected trunk group or for all trunk groups.

a. Depress COMMAND-DELETE/RESET switch.

b. When READY lamp goes on, depress FUNCTION-TRK GR METERS switch.

c. When TRK GR NO lamp goes on, key in 3digit trunk group number of the group with counters to be reset, or key in 777 to reset counters for all trunk groups. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, depress COMMAND-STORE switch. The punch and store and repeat options may not be exercised here.

e. No printout will occur to confirm the meters reset. If you wish to confirm the results, obtain a printout or display of the traffic meters, using the appropriate procedure.

Section V. REMOTE TELETYPE PROCEDURES

2-85. TTY Procedures

Use the TTY procedures to perform modifications to the program data base from the remote teletype. Additional procedures in chapter 3 are used to obtain printouts of selected tables or punched paper tapes of the same tables for later printout. The TTY procedures are similar to the FACP procedures both in what they accomplish and in the basic sequence of steps. Mnemonic codes and the teletype keyboard replace FACP controls and indicators; printouts replace FACP digital readouts.

a. TTY I/O Operation. The remote TTY and remote spare TTY I/O channels can perform the operations indicated in (1) and (2) below. The remote TTY I/O channel has precedence over FACP inputs; the remote spare TTY I/O channel has precedence over both remote TTY and FACP inputs. However, the FACP operator can preempt either TTY by depressing his REMOTE I/O INHIBIT switch. The message $ EOA PRMT is sent to the remote TTY when it is preempted by the remote spare TTY. The message $ EOA RMT I/O INHIB is sent to whichever TTY is active when the FACP preempts by activating the remote I/O inhibit. If neither TTY is active the message RMT I/O INHIB is sent to both. When the preempt condition is removed at the FACP, the messages RMT I/O INHIB OFF is sent to both remote telephones.

(1) Allowable remote TTY operations.

Function			*Command*		
	Assign	*Change*	*Delete/reset*	*Print*	*Punch*
Terminal service	Yes	Yes	Yes	Yes	Yes
Terminal number assignment	Error	Yes	Error	Error	Option (see note)
Directory number assignment	Error	Error	Error	Yes	Yes
Trunk group number	Error	Error	Yes	Yes	Yes
PR routing	Yes	Error	Yes	Yes	Yes
SL routing	Yes	Error	Yes	Yes	Yes
Alternate SL routing	Yes	Error	Yes	Yes	Yes
OP/JXX routing	Yes	Error	Yes	Yes	Yes
Fixed directory routing	Yes	Yes	Yes	Yes	Yes
Preset conference entry	Error	Error	Error	Yes	Yes
Line group entry	Error	Error	Error	Yes	Yes
DAC routing	Error	Error	Error	Yes	Yes
Traffic meters	Error	Error	Yes	Yes	Yes
Trunk group meters	Error	Yes	Yes	Yes	Yes
Line load	Yes	Error	Yes	Error	Error

NOTE. Available only as option during change procedure.

(2) Allowable remote spare TTY operations.

Function			*Command*		
	Assign	*Change*	*Delete/reset*	*Print*	*Punch*
Terminal service	Error	Error	Error	Yes	Yes
Terminal number assignment	Error	Error	Error	Error	Error
Directory number assignment	Error	Error	Error	Yes	Yes
Trunk group number	Error	Error	Error	Yes	Yes
PR routing	Yes	Error	Yes	Yes	Yes
SL routing	Yes	Error	Yes	Yes	Yes
Alternate SL routing	Yes	Error	Yes	Yes	Yes

Function			*Command*		
	Assign	*Change*	*Delete/reset*	*Print*	*Punch*
OP/JXX routing	Error	Error	Error	Yes	:Yes
Fixed directory routing	Yes	Yes	Yes	Yes	Yes
Preset conference entry	Error	Error	Error	Yes	Yes
Line group entry	Error	Error	Error	Yes	Yes
DAC routing	Error	Error	Error	Yes	Yes
Traffic meters	Error	Error	Yes	Yes	Yes
Trunk group meters	Error	Yes	Yes	Yes	Yes
Line load	Yes	Error	Yes	Error	Error

b. TTY Codes. The TTY channels can use either the ASCII or the Baudot character set. All examples in this manual employ the ASCII character set. Use a colon (:) in place of an equal (=) sign if using a TTY with a baudot character set. When using the baudot character set, you do not have to select figures or letters. This is handled automatically by the program. An exception is the TTY access code which requires the use of the figures and letters shift keys. Character set selection is accomplished by operations at the system status panel (para 212, 2-13, and 2-14) and the maintenance control panel (para 5-17) in the assemblage.

(1) *Access code*. An 8-character alphanumeric access code is used by the two remote teletypes to gain access to the central office. The access code, programmable at the maintenance control panel (para 5-16), is in the form PRSLXXXX. PRSL is generally the home PR and SL for the switchboard, and XXXX is a combination of alphanumeric characters.

(2) *Command codes*. Use the command codes listed below to enter commands. These codes correspond to the FACP COMMAND pushbutton switches. Not all FACP commands are available for TTY use. The CLR code is similar to the FACP CLEAR switch but can only be used after the punch option or at the end of an input sequence to cancel the input request.

Command	*Code.*
Assign	ASN
Change	CHG
Delete/reset	DEL
Store	STR
Store and repeat............................	RPT
Clear...	CLR
Print	PRT
Punch	PCH

(3) *Function codes*. Use the function codes listed below to enter functions. These codes correspond to the FACP FUNCTION pushbutton switches. Not all FACP functions are available for TTY use. The line load function code corresponds to the LINE LOAD switch on the FACP, but must be used with either the ASN or DEL command code.

Function	*Code*
Terminal service	TMS
Terminal number assignment	TMA
Directory number assignment	DIR
Trunk group number	TGN
PR routing	PRR
SL routing	SLR
Alternate SL routing	SLA
Operator/JXX routing	OPJ
Fixed directory routing	FXD
Preset conference entry	PRC
Line group entry	LGR
DAC routing	DAC
Traffic meters	TFM
Trunk group meters	TGM
Line load	LLD

(4) Field identifier codes. The field identifier codes correspond to the FACP field indicator lamps. they are transmitted by the switchboard to indicate the next data to be entered by the operator.

Field	*Code*
Terminal number	F-G-TN=
Terminal type	TYPE=
Class code	CLASS=
Directory number	DIR=
Trunk group number	TGN=
Conference number	CONF=
Group minimum count	MIN=
Mode II terminal number	MODE II=
Special circuit number	SPCKT-
PR number	PR=
SL number	SL=
Alternate SL number	SLA=

Field	*Code*
Status	STAT=
Line group number	LGN=
Function code	FUNC=
Rank	RANK=
Primary trunk group number	PTG=
Alternate trunk group number	ATG=
Fixed directory number	FDN=
PR-SL-XXX	PR-SL-XXX=
NNX-XXXX	NNX-XXXX=
Direct access number	DAC NO=
Error	ERR

(5) *Control codes*. Use the control codes to transmit control information from the TTY to the switchboard. The start-of-message code (ZCCC) initiates any input message to the switchboard. The end-of-access code (EOA) relinquishes control of the I/O. Use control character Z to stop any requested printout in progress at the TTY, including those printouts derived by transmitting prerecorded data from the tape reader. This control character will also stop any TTY-requested punch at the shelter. The printout or punching is stopped after the line of data currently being printed or punched is completed.

Control	*Code*
start-of-message	ZCCC
End-of-access	EOA
Print/punch stop	Z

c. *Access Procedure*. Use the following procedure to obtain I/O access from the TTY before performing any of the TTY procedures.

(1) Type Z.

(2) Observe that switch responds by performing a carriage return and line feed and by printing Z.

(3) Type CCC.

(4) Observe that switch responds by printing CCC and skipping space. The space indicates receipt of a valid character block.

(5) Type 8-character access code (para 2-85b(1)).

(6) Observe that switch responds by printing access code. Observe that switch verifies access code by performing carriage return and line feed and printing Z.

(7) Perform TTY procedure. TTY loses access if 60 seconds elapse without a character entry following an input character or at end of a switch reply or printout. When time-out occurs, switch prints $ EOA, and you must repeat the access procedure to regain access.

d. *Procedures*. Figure 2-11 illustrates a series of typical assignments, changes, and deletions made from the TTY. The underlined (for illustration only) characters are those typed by the TTY operator. Significant elements in these sequences are described below.

(1) Operator gains TTY access to I/O (para 2-85b(1)).

(2) Operator types CCC, and switch prints CCC and skips space.

(3) Operator types command such as ASN, and switch prints command and skips space.

(4) Operator types function such as TMS, and switch prints function and skips space.

(5) If legal command and function were entered, switch prints first field identifier such as F-G-TN(6) Operator types requested data. Switch prints each data character. If data meets error check criteria, switch prints next field identifier.

(7) When data has been entered for last field in sequence, switch performs carriage return and line feed and prints Z.

(8) checks data for correctness and exercises punch, clear, store, and store and repeat options as desired.

(9) The switch acknowledges all commands by skipping a space, printing $, skipping a space, and printing three characters of command.

(10) If store and repeat option is exercised in step (8), switch starts next' procedure sequence by printing first field identifier.

(11) After clear, punch, or store command, switch performs carriage return and line feed and prints Z when it is ready to continue.

(12) When switch detects typographical error during an input sequence, it skips a space, prints $, skips a space, and prints ERR. This is followed by a carriage return, line feed, and Z. If the operator types a valid but incorrect data parameter, he may cancel the message by typing Z. In either case, the

```
ZCCC 7224A5X7
ZCCC ASN TMS
F-G-TN-1-1-01 TYPE 01 CLASS 33 DIR=256 STAT 01
ZRPT $ RPT
F-G-TN 2-6-07 TYPE 34 CLASS 18 DIR-416 SPCKT-17 STAT-01 DAC NO =77-22-163
ZRPT $ RPT
F-G-TN-4-1-02 TYPE 01 CLASS 23 DIR-345 STAT 01 DAC NO =543-2786
ZRPT $ RPT
F-G-TN=5-6-10 TYPE 01 CLASS-19 DIR-621 STAT 01 DAC NO =74-63-231
ZROT
ZRPT $ RPT
F-G-TN-4-1-05 TYPE 09 TGN 016 MODEII-3-7-08
ZPCH $ PCH
ZCLR $ CLR
ZCCC ASM $ ERR
ZCCC ASN PRR
PR-69 FUNC 2 PTG 056 ATG-057
ZPCH $ PCH
ZRPT $ RPT
PR-77 FUNC 2 PTG 205 $ ERR
ZCCC ASN PRR
PR-77 FUNC 2 PTG 105 ATG=106
ZPCH $ PCH
ZSTR $ STR
ZEOA $ EOA
```

a. Assignment Sequence

```
ZCCC 7224A5X7
ZCCC CHG FXD
FDN-73402
DIR NO  PR-SL-XXX
73402    94-13-402
FDN-73402  PR-SL-XXX 94-26-402
ZPCH $ PCH
ZSTR $ STR
ZEOA $ EOA
```

b. Change Sequence

```
ZCCC 7224A5X7
ZCCC DEL FXD
FDN-78813
ZSTR $ STR
ZCCC DEL PRC
CONF-15 FUNC 2 NNX-XXXX-364-7563
ZRPT $ RPT
CONF-15 FUNC-1 PR-SL-XXX-84-53-841
ZSTR $ STR
ZEOA $ EOA
```

c. Delete Sequence

```
ZCCC 7224A5X7
ZCCC PRT TFM
ZSTR $ STR

TRFC MTR TBL
METER        COUNT
TOT NB        00631
FO   NB       00007
FLA NB        00013
IMM NB        00062
PRI  NB       00178
TOT WB        00054
PRI  WB       00047
OP            00138
RECALL        00021
INTCP         00034
INFO          00000
$ END TBL
ZCCC PRT LGR
LGN 21
ZSTR $ STR

LINE GR TBL

LGN     RK     F-G-TN     DIR

 21      1     3-6-02     621
 21      2     4-5-05     621
 21      3     1-6-07     622
 21      4     7-8-10     122
 21      5     6-3-09     343

$ END TBL
ZEOA $ EOA
```

d. Print Sequence

EL 5805-628-12-TM-30

Figure 2-11. Typical remote TTY sequences.

operator must then repeat the entry sequence. If the error is made on the final command at the end of the sequence, the switch performs a carriage return and line feed and prints Z. The operator is then allowed to repeat the command.

(13) Access is terminated when the TTY operator types EOA or 60 seconds elapse without a character entry (para 2-85c(7)).

e. Errors. Errors reported by the switch (para 2-85d(12)) or detected by the operator are canceled by typing Z. However the entire entry sequence must be repeated. The only exception is an error on the final command at the end of the sequence. The switch will print Z and allow the command to be typed again. Error checks performed by the program are the same as those performed during FACP procedures.

2-86. TTY Assignment Procedures

The TTY assignment procedures parallel the FACP assignment procedures (para 2-19 thru 2-50). Refer to the corresponding FACP procedure for an explanation of the purpose of the procedure and for error check data. Use the access procedure (para 2-85c) to gain I/O access from the TTY. Procedures are the same for both the remote TTY and the remote spare TTY except that procedures allowable for one may not be allowable for the other (para 2-85a).

2-87. TTY Line Assignment

Use this procedure to assign a line to a subscriber.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type TMS. Observe that switch responds by skipping space and printing TMS.

c. When switch prints F-G-TN= , type 4-digit terminal number (frame-group-terminal number). Observe that terminal number is printed.

d. When switch prints TYPE=, type 2-digit code specifying line type. Observe that type code is printed.

e. When switch prints CLASS =, type 2-digit class-of-service code specifying privileges for line. Observe that class code is printed.

f. When switch prints DIR=, type 3-digit directory number assignment.

g. If line was assigned class code specifying DAC with preset conference privilege, switch will print CONF=. When this occurs, type 2-digit number of preset conference group to which line is assigned. Observe that conference group number is printed.

h. If line was assigned terminal type code corresponding to an adapted terminal, switch will print SPCKT =. When this occurs, type 2-digit special circuit number for adapter location. Observe that special circuit number is printed.

i. When switch prints STAT =, type 2-digit in-service code (01) or 2-digit out-of-service code (02). Observe that code is printed.

j. If line was assigned class code corresponding to a type A or type B DAC, switch will print DAC NO -. When this occurs, type 7-digit directory number of DAC called party. Observe that directory number is printed.

k. Verify that all printed message data is correct.

l. When switch types Z, you may exercise any of the following options.

(1) If you want a record of the line assignment on tape, type PCH. Observe that switch prints PCH. After tape is punched by punch in shelter, observe that switch prints $ PCH, performs carriage return and line feed, and prints Z. Any of the following options can now be performed.

(2) If you do not want to store the entry in memory because an error exists or a tape is being prepared for later read-in, type CLR. Observe that CLR is printed. After switch performs clear command, observe that switch prints $ CLR, performs carriage return and line feed, and prints Z, allowing a new command to be initiated.

(3) If you want to store entry and repeat line assignment procedure for a new terminal, type RPT. Observe that RPT is printed. After performing store and repeat command, switch will type $ RPT, perform a carriage return and line feed, and type F-G-TN = as a request for the next terminal number.

(4) If you want to store entry but do not want to repeat line assignment procedure, type STR. Observe that STR is printed. After performing store command, switch will print $ STR, perform carriage return and line feed, and print Z, allowing a new command to be initiated.

2-88. TTY Trunk Assignment

Use this procedure to assign a terminal to a trunk.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type TMS. Observe that switch responds by skipping space and printing TMS.

c. When switch prints F-G-TN =, type 4-digit terminal number (frame-group-terminal number). Observe that terminal number is printed.

d. When switch prints TYPE=, type 2-digit code specifying trunk type. Observe that type code is printed.

e. When switch prints TGN=, type 3-digit number specifying trunk group to which trunk is being assigned. Observe that trunk group number is printed.

NOTE

The wideband trunk of a Mode II wide-band trunk pair (AN/TTC-38(V)2 only) must be assigned a terminal before the narrowband trunk is assigned.

f. If trunk was assigned, termination type code indicating narrowband trunk of wideband trunk pair (AN/TTC-38(V)2) switch will print MODE II=. Type 4-digit (frame-group-terminal) terminal number. Observe that terminal number is printed.

g. If trunk was assigned termination type code indicating an adapted terminal, switch will print SPCKT=. Type 2-digit special circuit number indicating adapter slot location. Observe that special circuit number is printed.

h. When switch prints STAT=, type 2-digit in-service code (01) 2-digit in-service code (01) or 2-digit out-of-service code 02). Observe that code number is printed.

i. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-89. TTY Operator Assignment

Use this procedure to assign a terminal number to the operator signal port. Operator talking port 1 (type 53) and talking port 2 (type 54) are automatically assigned by the program to the same terminal number in the next two higher numbered groups in the same frame. Do not attempt to assign them manually.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type TMS. Observe that switch responds by skipping space and printing TMS.

c. When switch prints F-G-TN =, type 4-digit terminal number (frame-group-terminal number) of operator signal port. Terminal number (TN) must be between 01 and 10. Observe that terminal number is printed.

d. When switch prints TYPE=, type termination type code 52. Observe that 52 is printed.

e. When switch prints STAT=, type 2-digit in-service code (01) or 2-digit out-of-service code (02). Observe that code is printed.

f: When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-90. TTY Sender/Receiver Assignment

Use this procedure to assign a terminal to a sender/ receiver or an auxiliary sender/receiver.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type TMS. Observe that switch responds by skipping space and typing TMS.

c. When switch types F-G-TN =, type 4-digit terminal number (frame-group-terminal number). Assign terminal number (TN) of 11 or 12. Assign frame number (F) of 1, 3, 5, or 7 to auxiliary sender/ receiver A. Assign frame number (F) of 2, 4, 6, or 8 to auxiliary sender/receiver B. Observe that terminal number is printed.

d. When switch prints TYPE=, type 2-digit code specifying sender/receiver (55 for sender/receiver, 56 for auxiliary sender/receiver). Observe that code is printed.

e. When switch prints SPCKT =, type 2-digit number indicating sender/receiver slot location (21 for auxiliary sender/receiver A, 22 for auxiliary sender/receiver B). Observe that number is printed.

f: When switch prints STAT=, type 2-digit in-service code (01) or 2-digit out-of-service code (02). Observe that code is printed.

g. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-91. TTY Conference Bridge Assignment

Use this procedure to assign a terminal number to a conference bridge master port. The program automatically assigns the remaining conference ports to the same terminal number in the next four (5party bridge) or nine (9-party bridge) group numbers.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type TMS. Observe that switch responds by skipping space and typing TMS.

c. When switch types F-G-TN =, type 4-digit terminal number (frame-group-terminal number) of conference bridge master port. Terminal number (TN) must be 11 or 12. Observe that terminal number is printed.

d. When switch prints TYPE=, type 2-digit code for 5-party conference circuit (57) or 9-party conference circuit (59). Observe that code is printed.

e. When switch prints STAT=, type 2-digit in-service code (01) or 2-digit out-of-service code (02). Observe that code is printed.

f: When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-92. TTY PR Routing Assignment

Use this procedure to assign a PR number to the local office or to assign routing for a foreign PR.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type PRR. Observe that switch responds by skipping space and printing PRR.

b.1. When switch prints MODE II =, type 000. Observe that number is printed.

c. When switch prints PR=, type 2-digit PR number. Observe that number is printed.

d. When switch prints FUNC=, type 1-digit function code (1 for home PR, 2 for foreign PR without alternate SL table, and 3 for foreign PR with alternate SL table). Observe that code is printed. If 1 was entered, proceed to step g. If 2 or 3 was entered, proceed to step e.

e. When switch prints PTG =, type 3-digit trunk group number of primary route. Observe that number is printed.

f. When switch prints ATG =, type 3-digit trunk group number of alternate route. If no alternate route is to be specified, type 000. Observe that number is printed.

g. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-92.1 TTY NATO Routing Assignment.

Use this procedure to assign a 6-digit NATO routing number. The NATO number is entered with a function code identifying the gateway. If the gateway is foreign, primary and alternate trunk group numbers are entered for primary and alternate routes. If the gateway is survivability, only primary trunk group number is entered. If the gateway is Autovon, the Autovon routing must already be assigned.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type PRR. Observe that switch responds by skipping space and printing PRR.

c. When switch prints MODE II = , type first 4 digits of 6-digit NATO number. Observe that number is printed.

d. When switch prints PR =, type last 2 digits of NATO number. Observe that number is printed.

e. When switch prints FUNC = , type 1 -digit function code (1 for home, 2 for foreign, 3 for foreign 10-digit directly connected, 4 for Autovon gateway and 5 for survivability gateway). Observe that code is printed. If 1 or 4 was entered, proceed to step h. If 2, 3 or 5 was entered, proceed to step f below.

f. When switch prints PTG =, type 3-digit trunk group number of primary route. Observe that number is printed. If function code 5 was entered in e above, proceed to h. If 2 or 3 was entered, proceed to g below.

g. When switch prints ATG = , type 3-digit trunk group number of alternate route. If no alternate route is being specified, type 000. Observe the number is printed.

h. When switch prints Z, you may exercise any of the 4 options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-93. TTY AN/TTC-30 PR Assignment

Use this procedure to assign the PR number to be added to all incoming calls from AN/TTC-30 trunks.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type PRR. Observe that switch responds by skipping space and printing PRR.

b. . When switch prints MODE II =, type 000. Observe that number is printed.

c. When switch prints PR=, type 2-digit PR number to be added to AN/TTC-30 calls.

d. When switch prints FUNC =, type 1-digit function code (4 for home PR of local office, 5 for foreign PR without alternate SL table, and 6 for foreign PR with alternate SL table). Observe that code is printed. If 4 was entered, proceed to step g. If 5 or 6 was entered, proceed to step e.

e. When switch prints PTG =, type 3-digit trunk group number of primary route.

f. When switch prints ATG =, type 3-digit trunk group number of alternate route. If no alternate route is to be specified, type 000. Observe that number is printed.

g. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-94. TTY SL Routing Assignment

Use this procedure to assign an SL number to the local office or to assign routing for a foreign SL.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type SLR. Observe that switch responds by skipping space and printing SLR.

c. When switch prints SL =, type 2-digit SL number. Observe that number is printed.

d. When switch prints FUNC =, type 1-digit function code (1 for home, 2 for a foreign office not directly connected to home office, and 3 for a foreign office directly connected to home office). Observe that number is printed. If 1 was entered, proceed to step g. If 2 or 3 was entered, proceed to step e.

e. When switch prints PTG =, type 3-digit trunk group number of primary route. Observe that number is printed.

f: When switch prints ATG =, type 3-digit trunk group number of alternate route. If no alternate route is to be specified, type 000. Observe that number is printed.

g. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-95. TTY Alternate SL Routing Assignment

Use this procedure to add in alternate SL entry to a PR table.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type SLA. Observe that switch responds by skipping space and printing SLA.

c. When switch prints PR=, type 2-digit PR number to whose table the alternate SL is being assigned. PR number must have been previously assigned with function code of 3 or 6. Observe that number is printed.

d. When switch prints SLA =, type 2-digit alternate SL number. Observe that number is printed.

e. When switch prints FUNC =, type 1-digit function code (2 for foreign not directly connected or 3 for foreign directly connected). Observe that number is printed.

f. When switch prints PTG =, type 3-digit trunk group number of primary route. Observe that number is printed.

g. When switch prints ATG=, type 3-digit trunk group number of alternate route. If no alternate route is to be specified, type 000. Observe that number is printed.

h. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-96. TTY AUTOVON Routing Assignment

Use this procedure to assign, routing for all calls to AUTOVON.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type PRR. Observe that switch responds by skipping space and printing PRR.

b.1. When switch prints MODE II =, type 000. Observe that number is printed.

c. When switch prints PR =, type 69. Observe that number is printed.

d. When switch prints FUNC=, type 1-digit function code (1 if local office interfaces directly with AUTOVON or 2 if local office does not interface directly with AUTOVON). Observe that number is printed.

e. When switch prints PTG=, type 3-digit AUTOVON trunk group number for precedence calls if function code 1 was entered in step d. If only one routine trunk group to AUTOVON exists, type 3digit number of the group. Type 3-digit trunk group number of primary route to interface office if function code 2 was entered. Observe that number is printed.

f. The trunk group (routine or precedence) to AUTOVON exists, type 000. Type 3-digit trunk group number of alternate route to interface office if function code 2 was entered.

g. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-97. TTY SF Commercial Routing Assignment

Use this procedure to route calls initiated with the R5 access code.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type PRR. Observe that switch responds by skipping space and printing PRR.

c. When switch prints PR=, type 65. Observe that' number is printed.

d. When switch prints FUNC =, type 1 if local office interfaces directly with SF commercial office. Type 2 if local office does not interface directly with SF commercial office. Observe that function code is printed.

e. When switch prints PTG =, type 3-digit trunk group number of SF commercial trunk if function code 1 was entered in step d. Type 3-digit trunk group number of primary route to interface office if function code 2 was entered. Observe that number is printed.

f: When switch prints ATG=, type 000 if function code 1 was entered in step d. Type 3-digit trunk group number of alternate to interface office if function code 2 was entered. Observe that number is printed.

g. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-87l.

2-98. TTY JXX Routing Assignment

Use this procedure to assign a JXX number (700999) to a trunk group.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type OPJ. Observe that switch responds by skipping space and printing OPJ.

c. When switch prints DIR =, type 3-digit JXX number (700-999). Observe that number is printed.

d. When switch prints PTG=, type 3-digit trunk group number for routing assignment. Observe that number is printed.

e. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-87l.

2-99. TTY Unstaffed Operator Routing Assignment

Use this procedure to route local operator calls to another central office when all local operator' positions are unstaffed.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type OPJ. Observe that switch responds by skipping space and typing OPJ.

c. When switch prints DIR =, type 000. Observe that 000 is printed.

d. When switch prints PR-SL-XXX =, type full 7-digit directory number to, which unstaffed operator calls are to be directed.

e. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-100. TTY Fixed Directory Routing Assignment

Use this procedure to assign a 7-digit PR-SL-XXX directory number to a fixed directory subscriber.

a. Type CCC followed by ASN. Observe that CCC ASN is printed.

b. Type FXD. Observe that switch responds by skipping space and typing FXD.

c. When switch prints FDN =, type either 5-digit fixed directory subscriber list (FDSL) number (PSJXX) or 5-digit fixed directory unit list (FDUL) number (XXIXX). Observe that number is printed.

d. When switch prints PR-SL-XXX =, type full 7-digit PR-SL-XXX number. Observe that number is printed.

e. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-101. TTY Line Load Control Set

Use this procedure to set the line load control. This restricts subscriber access to trunks.

a. Type CCC followed by: ASN. Observe that CCC ASN is printed.

b. Type LLD. Observe that switch responds by skipping space and printing LLD and then LINE LOAD ON.

2-102. TTY Change Procedures

The TTY change procedures parallel the FACP change procedures (para 2-51 through 2-71). However, you must always type the data for each field identifier even if it is not to be changed. Refer to the corresponding FACP procedure for additional information and error check data. Procedures are the same for both the remote TTY and the remote spare TTY except that procedures allowable for one may not be allowable for the other (para 2-85a). Use the access procedure (para 2-85c) to gain I/O access from the TTY.

2-103. TTY Terminal Service Change

Use this procedure to change any of the data parameters entered for a particular terminal during a line, assignment procedure. If you believe that a particular change may not be legal, delete the current line assignment and reassign new data parameters.

a. Type CCC followed by CHG. Observe that CCC CHG if printed.

b. Type TMS. Observe that switch responds by skipping space and printing TMS.

c. When switch prints F-G-TN =, type 4-digit terminal number (frame-group-terminal number) whose parameters are to be modified. Observe that parameters associated with this terminal are printed in tabular form with headings. This table defines the current terminal assignment. A typical printout is as follows:

```
F-G-TN TYPE CLASS DIR TGN CONF MODE II
SPCKT STAT DAC NO
1-6-07  34  13  278  -  ----  17  01  74-22-163
```

d. Observe that switch now requests an entry for each parameter for which data was previously entered. Type the same data if no change is required. Type new data where-a change: is required. Observe that each entry is printed.

e. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-87l.

2-104. TTY Terminal Number Assignment Change

Use this procedure to change the terminal assignment of a line, trunk, conference bridge, operator, or sender/receiver.

a. Type CCC followed by CHG. Observe that CCC / CHG is printed.

b. Type TMA. Observe that switch responds by skipping space and typing TMA.

c. When switch prints F-G-TN=, type old 4-digit terminal number (frame-group-terminal number). Observe that parameters associated with this terminal are printed in tabular form as described in paragraph 2-c.

d. When switch again prints F-G-TN=, type new 4-digit terminal number (frame-group-terminal number) to which line is being transformed. Observe that number is printed.

e. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-105. TTY Fixed Directory Routing Change

Use this procedure to modify the fixed directory routing table to reflect the present location of a mobile subscriber or unit.

a. Type CCC followed by CHG. Observe that CCC CHG is printed.

b. Type FXD. Observe that switch responds by skipping space and printing FXD.

c. When switch prints FDN =, type either 5-digit fixed directory subscriber list (FDSL) number (PXJXX) or 5-digit fixed directory unit list (FDUL) number (XXIXX). Observe that fixed directory number and current PR-SL-XXX number are printed in tabular form with headings. An example is:

DIR NO	*PR-SL-XXX*
73402	94-26-402

d. When switch prints FDN =, type fixed director number. Observe that number is printed.

e. When switch prints PR-SL-XXX=, type new 7-digit PR-SL-XXX number. Observe that number is printed.

f. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-106. TTY Trunk Group Minimum Count Change

Use this procedure to assign or change the trunk group minimum count.

a. Type CCC followed by CHG. Observe that CCC CHG is printed.

b. Type TGM. Observe that switch responds by skipping space and printing TGM.

c. When switch prints TGN =, type 3-digit trunk group number. Observe that trunk group number and current minimum count are printed in tabular form with headings. An example is:

TGN	*MIN*
342	21

d. When switch prints TGN =, type 3-digit trunk group number. Observe that number is printed.

e. When switch prints MIN =, type new 2-digit minimum count for trunk group. Observe that number is printed.

f. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-107. TTY AN/TTC-30 PR Change

Use this procedure to change the PR which is assigned to incoming calls from an AN/TTC-30.

a. Delete the PR entry for the PR currently assigned for addition to incoming AN/TTC-30 calls (para 2-112).

b. Assign the PR routing deleted in step a changing the function code from 4, 5, or 6 to 1, 2, or 3 (para 2-92).

c. Delete the PR entry for the PR to be assigned for addition to incoming AN/TTC-30 calls. See paragraph 2-112.

d. Assign the PR routing deleted in step c, changing the function code from 1, 2, or 3 to 4, 5, or 6. See paragraph 2-92.

2-108. TTY AUTOVON and SF Commercial Routing Changes

AUTOVON and SF commercial routing changes are accomplished in the same way as any other PR routing change except that the proper PR codes (69 for AUTOVON, 65 for SF commercial) are used. Delete the current PR routing entry as described in paragraph 2-112. Then assign the new PR routing, using the procedure in paragraph 2-96 for AUTOVON routing or the procedure in paragraph 2-97 for SF commercial routing.

2-109. TTY Deletion Procedures

The TTY deletion procedures parallel the FACP deletion procedures (para 2-72 through 2-84). Procedures are the same for both the remote TTY and the remote spare TTY except that procedures allowable for one may not be allowable for the other (para 2-85a). Use the access procedure (para 2-85c to gain I/O access from the TTY.

2-110. TTY Terminal Service Deletion

Use this procedure to delete table entries for a terminal.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type TMS. Observe that switch responds by skipping space and printing TMS.

c. When switch prints F-G-TN=, type 4-digit terminal number (frame-group-terminal number) of terminal to be deleted. Observe that terminal number is printed.

d. When switch types Z, you may exercise any of the options (punch, clear, store, and store and repeat) described: in paragraph 2-871.

2-111. TTY Trunk Group Deletion

Use his procedure to delete a trunk group from all routing tables. If the group was a primary trunk group before deletion, the previous alternate trunk group will become the primary trunk group.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type TGN. Observe that switch responds by skipping space and printing TGN.

c. When switch prints TGN=, type 3-digit number of trunk group to be deleted, or type 777 to delete all trunk groups. Observe that number is printed.

d. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-112. TTY PR Deletion

Use this procedure to delete all entries in the PR table associated with a PR. Any associated alternate SL table is also deleted. If the deleted PR was used for unstaffed operator routing, fixed directory routing, DAC routing, or preset conference routing, delete these entries separately, using the appropriate deletion procedures.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type PRR. Observe that switch responds by skipping space and printing PRR.

c. When switch prints PR=, type 2-digit number of PR to be deleted. Observe that number is printed.

d. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-113. TTY SL Deletion

Use this procedure to delete all SL table entries associated with a given SL number. If the SL was used for unstaffed operator routing, fixed directory routing, DAC routing, or preset conference routing, delete these entries separately, using the appropriate deletion procedures.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type SLR. Observe that switch responds by skipping space and printing SLR.

c. When switch prints SL =, type 2-digit number of SL to be deleted. Observe that number is printed.

d. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-114. TTY Alternate SL Deletion

Use this procedure to delete the entry associated with a given SL number in the alternate SL table.

a. Type CCC followed by DEL. Observe that CC DEL is printed.

b. Type SLA. Observe that switch responds by skipping space and printing SLA.

c. When switch prints PR=, type 2-digit umber of PR identifying alternate SL table. Observe that number is printed.

d. When switch prints SLA=, type 2-digit number of SL to be deleted. Observe that number is printed.

e. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-115. TTY Unstaffed Operator Routing Deletion

Use this procedure to delete the routing assigned for unstaffed operator calls.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type OPJ. Observe that switch responds by skipping space and typing OPJ.

c. When switch printed DIR-, type 000. Observe that number is printed.

d. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-116. TTY JXX Routing Deletion

Use this procedure to delete routing for a JXX number (700-999) which is programmed to route to a trunk group.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type OPJ. Observe that switch. responds by skipping space and printing OPJ.

c. When switch prints. DIR=, type 3-digit JXX number whose routing is to be deleted.

d. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in paragraph 2-871.

2-117. TTY Fixed Directory Routing Deletion

Use this procedure to delete the routing for a fixed directory number.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type FXD. Observe that switch responds by skipping space and printing FXD.

c. When switch prints FDN=, type 5-digit fixed directory number whose routing is to be deleted. Observe that number is printed.

d. When switch prints Z, you may exercise any of the options (punch, clear, store, and store and repeat) described in 2-871.

2-118. TTY Traffic Meters Reset

Use this procedure to reset the switchboard traffic counters associated with narrowband, wideband, and operator traffic meters.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type TFM. Observe that switch responds by skipping space and printing TFM.

c. When switch prints Z, type STR. Observe that STR $ STR is printed, indicating receipt and execution of store command. The punch and store and repeat options' cannot be exercised.

2-119. TTY Trunk Group Meters Reset

Use this procedure to reset the traffic meters for any selected trunk group or for all trunk groups.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type TGM. Observe that switch responds by skipping space and printing TGM.

c. When switch prints TGN=, type 3-digit number of trunk group whose counters are to be reset. Type 777 to reset counters of all trunk groups. Observe that number is printed.

d. When switch prints Z, type STR. Observe that STR $-STR is printed, indicating receipt and execution of store command. The punch and store and repeat options cannot be exercised.

2-120. TTY Line Load Control Reset

Use this procedure to reset line load control, removing program restriction of subscriber access to trunks.

a. Type CCC followed by DEL. Observe that CCC DEL is printed.

b. Type LLD. Observe that switch responds by skipping space and printing LLD and then LINE LOAD OFF.

Section VI. PRELIMINARY CHECKS

2-121. General

The following is a checklist of operations which are accomplished during installation. The procedures are not necessarily listed in the order in which they should be performed. Many steps may be simultaneously performed. Also, certain functions may not be applicable to all sites.

2-122. Before Applying Power

a. Check to insure the shelter is placed firmly on its supports.

b. Check that the grounding system is complete and that all connections are tight.

c. Check all power connections to insure they are tight.

d. Check to insure operating power and frequency of air conditioners match the supply.

e. Check to insure battery box vents are open.

f. Check to insure that fan cover on front of shelter (fig. 1-2) is open.

2-123. Preoperational Checks

a. Check all signal cable connections to insure that they are tight.

b. Check that the chad tube is in place.

c. Check that all patch cords and plugs in use are seated firmly.

d. Check that paper has been installed in the teleprinters and the print mechanism securing material has been removed.

e. Check that the tape winder has been removed from its transit position and is mounted securely to vertical post 2.

2-124. Processor Checks (On-Line and Standby)

a. Before data is loaded, check that memory is cleared.

b. Was the data base loaded?

c. Was the fixed program loaded?

d. Was the program started without obtaining printouts?

e. Was the up-to-date current directory loaded?

f. Is memory protected?

g. Are both processors ready for on-line operation?

h. Are applicable manual data base entries made in both processors: 24-hour time, I/O access code, I/O classmarks.

i. Has an up-to-date current directory tape been punched?

2-125. Network Status Checks

a. Do printouts of FACP assignments agree with orders from system planners?

b. Are all conference bridges marked in service?

c. Are auxiliary sender/receivers assigned to the proper frames? Are they both marked in-service?

d. Check that telephone or trunk assignments do not overlap conference port automatic assignment numbers.

e. Are PR routing numbers assigned and alternate paths defined?

f. Are SL routing numbers assigned and alternate paths defined?

g. Has the fixed directory routing assignment been accomplished?

h. Have line and trunk group assignments been accomplished?

i. Have subscriber conference assignments been accomplished?

j. Have the DAC lines been assigned?

k. Has a number been assigned for the information attendant?

l. Have traffic meters been reset?, Has the minimum lost call value been assigned?

m. Are all sender/receivers patched in and marked in-service?

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

3-1. Damage from Improper Settings

There are no operator control settings which will result in damage to the AN/TrC-38(V)(*). However, there are several installation and maintenance precautions to be observed. The warning page summarizes hazards. Specific precautions are located with procedures to which they apply. Also several warning labels are located within the assemblage. Observe all cautions and warnings when working in the ANfITC-38(V)(*).

3-2. Operator Controls

a. Maintenance Control Panel (fig. 3-1).

Control, indicator. connector	**Function**
SPARE fuse	Stores spare 2.5 ampere fuse.
5 VDC 2.5 AMP fuse	Protects 5-volt power to panel lamps and switches.
WORD SWITCH REGISTER 00-23 switches	Permit manual insertion of data or instructions into processor or memory. Numbers 00-23 indicate the bit number. Switches insert logic 1 when up and logic 0 when down. Each group of three switches corresponds to one octal digit.
BUS INDICATOR 00-23 and P lamps.	Display contents of selected processor register or memory location. Numbers 00-23 indicate bit number. P displays memory even-parity bit. Lamp on indicates logic 1; off indicates logic 0.
FUNCTION CODE 00-05 switches	Permit manual insertion of function code number into processor. Two groups of three switches correspond to two octal digits. Switches insert logic 1 when up and logic 0 when down.
ADDRESS SWITCH REGISTER 07-23 switches	Permit manual insertion of memory address or other data numbers. Switch numbers correspond to instruction word bit numbers. PAGE bits 07 and 08 identify 16,000 word memory blocks. Bits 10-23 identify memory word addresses on each page. When set, PAGE bit 09 tells computer to read PAGE bits 07 and 08.
MEMORY guarded switch	PROTECTED position prevents accidental alteration of fixed portion of stored program. Data base may be altered. UNPROTECTED position permits loading or changing of the operational program.
READ pushbutton switch	Flags program to read contents of WORD SWITCH REGISTER, FUNCTION CODE switches, and ADDRESS SWITCH REGISTER.
LAMP TEST pushbutton switch	Lights all lamps on maintenance control panel.
HALT MONITOR AND CONTROL panel section	Controls manner of halting the processor.
PARITY ERROR - DATA WORD lamp	Lights if processor detects parity error in data word.
PARITY ERROR - INSTR WORD lamp	Lights if processor detects parity error in instruction word.
PARITY ERROR HALT	ON position halts processor if switch parity error is detected. OFF position allows processor to continue running if parity error is detected.
IMMED HALT guarded pushbutton switch	Stops processor at current instruction.
PRGM HALT lamp	Lights when a program halt occurs.
PRCS HALT lamp	Lights when a processor halt occurs.

Control, indicator. connector	Function
NORMAL HALT guarded pushbutton switch	Stops processor at next normal program halt instruction.
PRCS IDENT LEFT and RIGHT lamps	LEFT lamp indicates maintenance control panel controls left-hand processor A8. RIGHT lamp indicates maintenance control panel controls right-hand processor A9.
ACTIVE lamp	Lights when processor is not processor halt condition.
CLEAR pushbutton switch	Clears processor registers during halt condition.
PROCESSOR STATUS	ON-LINE lamp indicates processor is performing on-line control of the central office. STANDBY lamp indicates processor is loaded with operational program and is available to take over on-line control. OFF-LINE lamp indicates that processor is either inoperative or being used to run off-line programs. It is unavailable to take over control of the central office.
CLOCK OPERATE CONTROL 3-position rotary Switch	CONT position allows processor clock to run continuously. SINGLE TRAIN position allows only one series of pulses P1, P2, and P3 to be generated each time INITIATE is depressed. SINGLE PULSE position allows only one pulse to be generated each time INITIATE is depressed.
CLOCK OPERATE CONTROL	Used in conjunction with ADV-RPT switch SINGLE PULSE position of CLOCK OPERATE CONTROL rotary switch, determines whether single pulse advances from P1 to P2, to P3 or whether same pulse repeats when INITIATE is pressed.
CLOCK OPERATE CONTROL P1, P2, P3 lamps	Used in conjunction with SINGLE PULSE position of CLOCK OPERATE CONTROL rotary switch, identify next single pulse to be generated.
REAL TIME CLOCK guarded switch	DISABLE position stops the central processor real time clock. ENABLE position allows the central processor real time clock to run.

NOTE

The switch is guarded because stopping the real time clock will halt the operational program.

Control, indicator. connector	Function
REGISTER SELECT 20-position rotary switch	Selects the following registers to be displayed on the BUS INDICATOR when the processor is halted. SBR -Signalling buffer register LSR - Link select register OAR -Outlet address register IAR -Inlet address register MO - Memory output register MEM - Current memory word PEX. - Memory address: page (bits 07, 08) program counter (bits 09-23) PC - Program counter EOA -Effective operand address register A - A-register B - B-register Q - Q-register IR - Instruction register CPS - Central processor status register CPD -Central processor decision register BR - Bank register SHC - Shift counter RTC -Real time clock SC1 - Select control 1 SC2 - Select control 2
OPERATIONAL CONTROL 5-position rotary switch	CMPT (compute) position is used for normal processing.

NOTE

MEMORY DISPLAY, STORE, and STORE SEQLY positions are used only when REGISTER SELECT is set to MEM.

MEMORY DISPLAY position permits displaying specific memory locations when processor is halted.

STORE position permits storing of data in a word displayed using MEMORY DISPLAY position.

STORE SEQLY (sequentially) position permits clearing of memory or storing of repetitive pattern in memory during halt.

CONT PNL INST (control panel instruction) position permits execution of an instruction from the maintenance control panel.

Control, indicator. connector	Function
COORD INITIATE pushbutton switch	Determines storage method when OPERATIONAL CONTROL

Control, indicator. connector	Function
	switch is set to STORE SEQLY. Released position allows storage into single sequential memory addresses each time INITIATE is depressed. (RUN-ONE INSTR must be set to ONE INSTR). Depressed position allows writing into all memory locations when initiate is simultaneously depressed. (RUN-ONE INSTR must be set to RUN).
RUN-ONE INST switch	RUN position permits normal continuous processing. ONE INST position allows only one instruction to be executed each time INITIATE is pressed.
INITIATE pushbutton switch	Starts processor.

b. System Status Panel, Front View (fig. 3-2).

Control, indicator. connector	Function
SPARE FUSE	Stores spare one ampere fuse.
5V 2.0 amp fuse	Protects 5-volt power to panel lamps and switches.
CONTROLTRANSFER guarded toggle switch	AUTO ENABLE position allows processors to automatically transfer on-line control of the control of the control office. DISABLE position prohibits automatic transfer of control between processors and allows manual transfer.
CONTROLTRANSFER MANUAL guarded push-button switch	Manually switches on-line con-trol between processors.
LAMP TEST pushbutton switch	Lights all lamps on system status panel.
TAPE READER REWIND switch	ON position rewinds tape on paper tape reader A12. OFF position used when paper tape reader is reading or inactive.
ALARM MONITOR section	Alerts central office operator when faults occur.
MAJOR FAULT section	Indicates faults which degrade central office operation.
AC PWR lamp	Indicates loss of prime ac power, or battery charger failure.
DC PWR lamp	Indicates loss or drop in voltage on any of the central office dc to dc converter outputs.
SDR/RCVR lamp	Indicates that three or more sender/receivers have failed.
BUS lamp	Indicates signaling register bus faults.
CONTROL TRANSFER lamp	Indicates that either manual or automatic control transfer has occurred. It also indicates failure of standby processor.
RING lamp	Indicates that a switchover has occurred in either 20-Hz ringer or system ring bus.
TRUNK GROUP lamp	Indicates that all trunks in single trunk group have failed.
MINOR FAULT lamp	Indicates fault has occurred which does not seriously degrade control office operation. Fault is identified by maintenance message on page printer. Minor faults include: Trunk failure Sender/receiver failure Auxiliary sender/receiver failure Connect failure Disconnect failure Driver failure FACP failure Excess of lost calls within any trunk group Line or trunk lockout
LOCAL PRINTER FAULT lamp	Indicates failure of local page printer channel.
Audio alarm	Sounds when any indicator in ALARM MONITOR section lights.
AUDIO ALARM RESET pushbutton switch	Silences audio alarm.
SUPERVISORY ALARM lamp	Indicates occurrence of certain traffic conditions or erroneous control situations. Message on page printer identifies condition. Supervisory conditions signaled include: Addressing non-existent input/output device Trunk shuttle attempt All sender/receivers busy Illegal I/O order
SUPERVISORY RESET pushbutton switch	Turns off SUPERVISORY ALARM lamp.
RESET SELECT toggle switches	ON position selects input/out-put channel synchronizer to be reset. OFF position prevents manual resetting of synchronizer

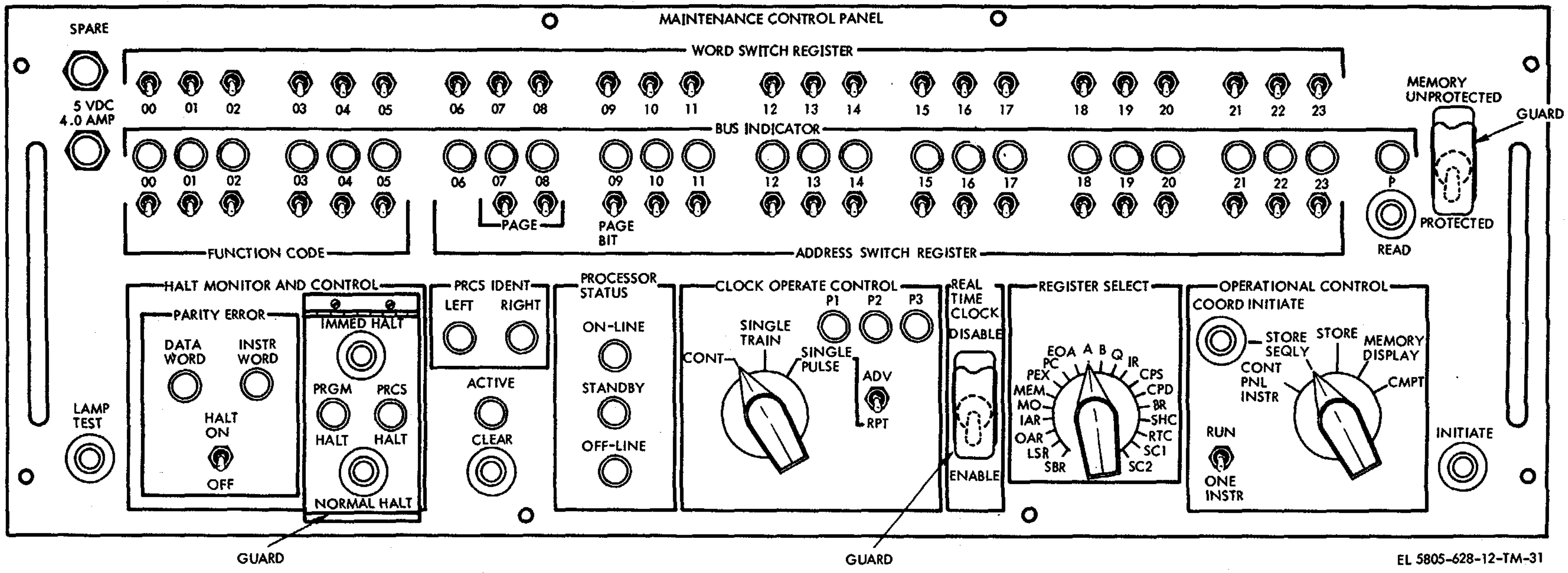


Figure 3-1. Maintenance control panel.

Control, indicator. connector	**Function**
	Synchronizer channels selected include:

MEM/MEM	Memory-to-memory transfer channel.
TAPE READER	Paper tape reader channel.
REMOTE PRINTER	Remote page printer channel.
LOCAL PRINTER	Local page printer channel.
TAPE PUNCH	Paper tape punch channel.
TTY	Remote teletype channel.
SPARE TTY	Spare remote teletype channel.
ALARM REGISTER	System status panel alarm synchronizer.

Control, indicator. connector	**Function**
RESET pushbutton switch	Resets synchronizer selected by RESET SELECT switches.
REMOTE I/O INHIBIT lamp	Indicates when remote teletype channels are inhibited.
LINE LOAD SET lamp	Indicates when line load restrictions are applied.

c. System Status Panel (fig. 3-3).

Control, indicator. connector	**Function**
CODE SELECT toggle switches	Select type of teletype code used by remote devices. 75 BAUD position selects 100 word-per-minute, 6-1evel, Baudot code. ASCII position selects 150 word-per-minute, 8-level, ASCII code.
TTY switches	Select remote teletype channel.
SPARE TTY switches	Select spare remote teletype channel.
REMOTE PRINTER switches	Select remote page printer channel.
INTERFACE SELECT toggle switches	Select type of signal used by remote devices. MODEM position selects fsk conversion by modem A13. DIRECT position selects direct synchronizer output: +6-volt, 1-ma max, mark-6-volt space MIL-STD-188C standard low level dc interface.

d. Patch Panel (fig. 3-4).

Control, indicator. connector	**Function**
BLK (black) socket	Connects to 2 field side pairs on signal entry panel. Letters A through G identify 26-pair connectors. Numbers 1 through 26 identify pairs on each connector.
YEL (yellow) socket	Connects to 4-wire network scanned terminal. Terminals are organized into 4 frames of 8 groups (GR) of 10 terminals. Refer to figure FO-36 for identification of usable network terminals.
BLU (blue) socket pairs	Connect to adapters. Left-hand socket connects to adapter field side input/output; right-hand socket to network input/output. Patch panel adapter numbers correspond to special circuit (adapter) number as follows:

Patchpanel		*Special circuit number*
Frames 1 and 5	A1-A12	01-12
Frames 2 and 6	A1-A12	13-24
Frames 3 and 7	A1-A12	25-36
Frames 4 and 8	A1-A12	37-48

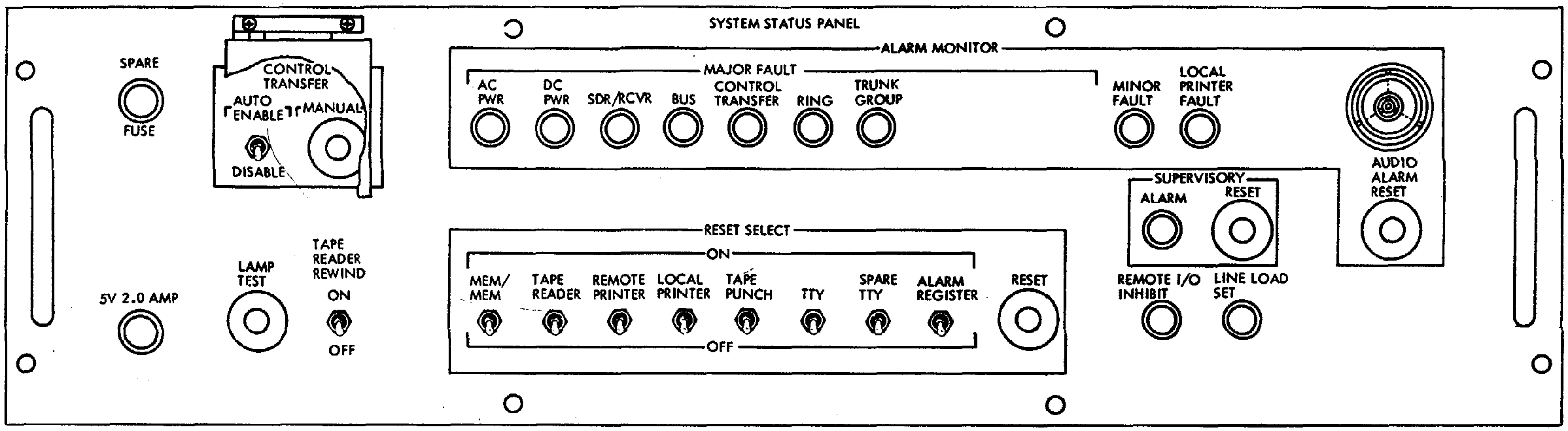
Control, indicator. connector	**Function**
ORN (orange) sockets	Connect to operator position field side 4-wide ports:

SP	Signalling Port
TP1	Talking Port 1
TP2	Talking Port 2
Frames 1 and 5	Assemblage operator
Frames 2 and 6	A365J15,A47J15
Frames 3 and 7	A34J15,A46J16
Frames 4 and 8	No connection

Control, indicator. connector	**Function**
WHT (white sockets	Connect to each other in three groups for each frame as marked on panel. These are used as mon buses to connect test equipment, multiple field terminals, or other bused signals.

e. Common Equipment Panel (fig. FO-5).

Control, indicator. connector	**Function**
YEL (yellow) TERM 11-and TERM 12 sockets	Connect to network service Terminals 11 and 12 in the eight groups of frames 1 through 4 of ANITCC 38(V)1 and frames 1 through 8 of AN/TCC 38(V)2.



TM 5805-628-12-TM-32

Figure 3-2. System status panel, front view.

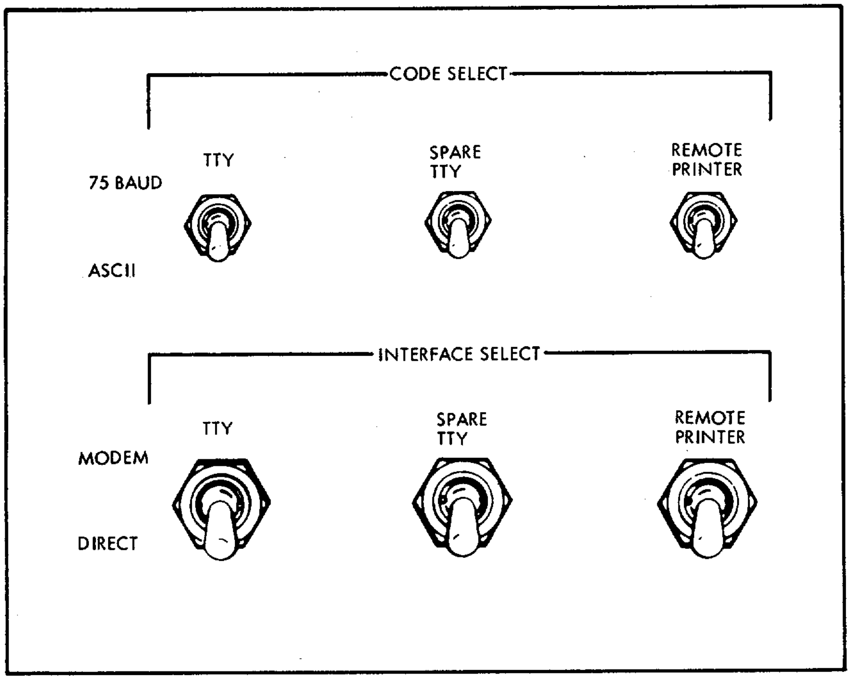


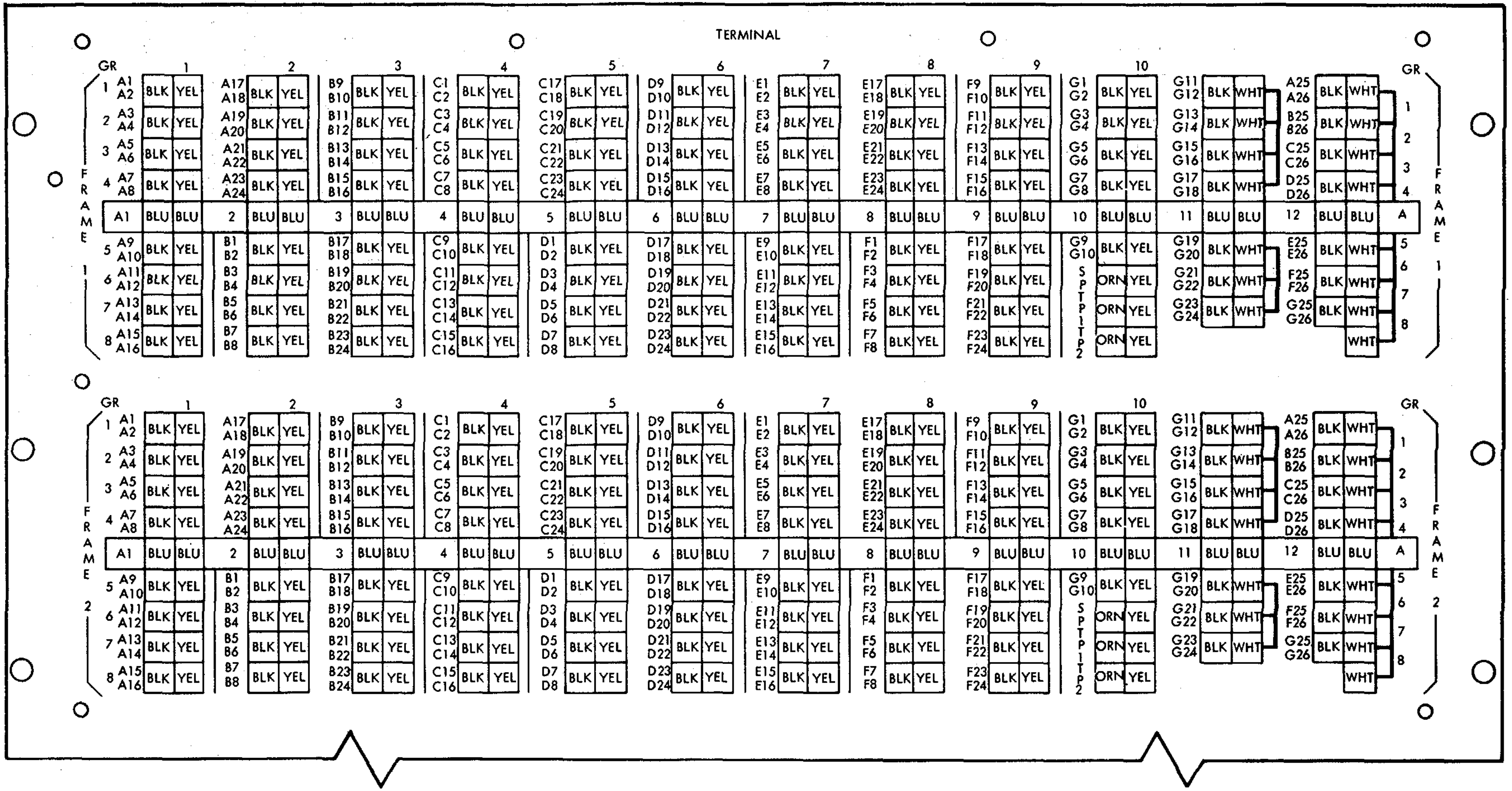
Figure 3-3. System status panel, rear controls.

Control, indicator. connector	Function
V10 (violet) AUX sockets	Connect to auxiliary sender/receivers. AUX sockets in the FRAME 1, 5 and FRAME 3, 7 portion connect to auxiliary sender/receiver 21. AUX sockets in the FRAME 2, 6 and FRAME 4, 8 portion connect to auxiliary sender/receiver 22.
GRN (green) sockets	Connect to conference bridge ports organized as follows:

Socket location	*Type and identification*	
FRAME 1, 5 TERM 11	5 party	A
FRAME 2,6 TERM 11	5 party	B
FRAME 3, 4 7,8 TERM 11	9 party	A27A149, A27A150
FRAME3,7 TERM 12	5 party	C
FRAME 4,8 TERM 12	5 party	D

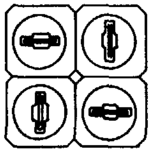
Numbers 1 through 5 or 1 through identify port numbers.

Control, indicator. connector	Function
RED sockets	Connect to sender/receivers identified by numbers 1 through 20.
WHT (white) COM sockets	Connect to each other in two groups as marked on the panel. These are used as common buses.
TONE white socket	Connects to 1050-Hz test tone source. Tone may be patched to different circuits for testing.
PHONE white socket	Connects to telephone terminals near FACP. Telephone may be patched to network scanned terminal or directly to field side connections on patch panel.
INTERCOM white socket	Connects to LS-147C/FI in assemblage for patching to field side cables on patch panel.
MODEM-TTY brown socket	Connects to remote teletype modem output for patching through field side patch panel pairs.
MODEM SP TTY brown socket	Connects to spare remote teletype modem output for patching through field side patch panel pairs.
MODEM-PTR brown socket	Connects to remote printer modem output for patching through field side patch panel pairs.
DIRECT-TTY brown socket	Connects directly to remote teletype channel synchronizer for patching through patch panel field side pairs.
DIRECT-SP TTY brown socket	Connects directly to spare remote teletype channel synchronizer for patching through patch panel field side pairs.



NOTES:

1. ONE HALF OF PANEL A26 IS SHOWN. LOWER HALF IS IDENTICAL FOR FRAMES 3 AND 4. PANEL A46 IS IDENTICAL FOR FRAMES 5 THROUGH 8 ON AN/TTC-38(V)2.
2. BLK (BLACK) - FIELD
   YEL (YELLOW) - NETWORK
   BLU (BLUE) - ADAPTER
   ORN (ORANGE) - OPERATOR
   WHT (WHITE) - TEST
3. TWO-PAIR SOCKET PIN ARRANGEMENT.



EL 5805-628-12-TM-34

Figure 3-4. Patch panel.

Control, indicator. connector	Function
DIRECT-PTR brown socket	Connects directly to remote page printer channel synchronizer for patching through patch panel field side pairs.
LEGEND section	Explains socket color codes and receive pair and transmit pair tip and ring pin orientation.

f. Operator Position (fig. 3-5).

Control, indicator. connector	Function
PWR/LOGIC ON/OFF guarded toggle switch	Turns on prime ac power to operator position.
PWR/LOGIC RESET pushbutton switch	Resets all operator position logic.
MODE STAFFED/UNSTAFFED guarded toggle switch.	Places operator position in staffed or unstaffed mode.
NIGHT RINGER	Provides ringing for incoming service request.
STATUS ALARM lamp	Lights to indicate major or minor alarm in assemblage; goes off when alarm condition is removed.
STATUS QUEUE lamp	Flashes to indicate incoming precedence call; goes on steady to indicate incoming routine call. Goes off if no calls are in queue.
HEADSET VOLUME control	Varies headset volume from full on to full off.
NIGHT RINGER VOLUME control	Varies audible ringer volume from full on to full off.
LAMP INTENSITY control	Varies intensity to all operator position lamps.
LAMP TEST pushbutton switch	Causes all lamps on operator position to light when depressed, with no interference to operation.
INTERCOM indicator switch	Flashes to indicate incoming call over operator's intercom. Goes on steady when depressed to answer call or initiate call over intercom. Goes off when depressed to release call before called operator answers. Called operator indicator will continue to flash to indicate that he was called.
HOLD indicator switch	Goes on when depressed to place call on hold. Goes off when depressed again to retrieve call on hold, or when held party goes on hook.
RERING pushbutton switch	Used to re-ring manual ring-down lines and trunks. The first ring is sent automatically by AN/TTC-38(V)(*).
CLEAR/WIPE OUT pushbutton switch	Stops ringback when called party/ does not answer; stops error tone when operator performs illegal operation; stops busy tone when called party is busy; stops dial tone; and clears digits keyed in error.
QUEUE ADVANCE indicator switch	Used to answer incoming calls. Goes on one second after depressed; goes off when depressed again to answer next call in queue or when call is released. Also goes on when initiating a call or retrieving a call on hold.
CALL/SEIZE indicator. switch	Used to initiate or extend a call. Goes on and off when QUEUE ADVANCE lamp goes on and off.
COMMON RELEASE indicator switch	Used to release call and bypass calls in queue. Goes on when depressed; goes off when call is initiated. Also goes on when releasing with QUEUE ADVANCE switch, and when call is placed on hold.
RELEASE 1 indicator switch	Releases recalling party on port 1. Also releases dc closure line when monitored. Goes on when depressed; goes off one second later.
RELEASE 2 indicator switch	Releases party on port 2 when recalling party desires call extension. Also releases called party when operator initiates or extends call. Goes on when depressed; goes off one second later.
0-9 keyset pushbutton switches	Used to key called party director number.
FO, F, I, P keyset pushbutton switches	Used to initiate precedence call or call extension.
C keyset pushbutton switch	Used to initiate conference call, to signify end of digits to commercial PBX, or to monitor dc closure line.
R keyset pushbutton switch	Used to key called party digits to commercial PBX, or to gain access to AUTOVON or for precedence.
1/4A fuse	Provides protection for operator position circuits.
SPARE fuse	Stores spare 1/4 ampere fuse.
HEADSET connector J3	Connects headset and microphone assembly to operator position.

Control, indicator. connector	Function
INTERCOM, SIG PORT, PORT 1, PORT 2 binding posts (fig. FO-4)	Connect field cable from assemblage to remote operator position ports.
GND binding post (fig. FO-4)	Connects ground rod to remote operator position.
POWER connector J2 (fig. FO-4)	Connects ac power to operator position.

g. Power Subsystem Control Panel (fig. FO-6).

Control, indicator. connector	Function
Phase fault audible alarm	Sounds if phase fault exists in primary ac power.
Circuit breaker/battery charger audible alarm	Sounds if any of DC/AC INVERTERS or DC-DC CONVERTERS or BATTERY CHARGER circuit breakers trip, or if battery charger fault exists.
Battery storage audible alarm	Sounds if external battery vent cover is closed.
ELAPSED TIME meter	Indicates time that dc power is applied.
AC ammeter	Indicates current drawn from primary ac power source in each phase in conjunction with PHASE SELECT switch.
AC voltmeter	Indicates voltage of prime ac power source for each phase in conjunction with PHASE SELECT switch.
PHASE SELECT rotary switch	Switches ac ammeter and voltmeter into each phase of ac primary power for monitoring current and voltage.
MODE rotary switch	Set to 50/60-Hz or 400-Hz position in accordance with primary ac power source frequency.
50/60-Hz lamp	Illuminates if primary ac power source is 50- or 60-Hz and phasing is correct (MODE switch set to 50/60-Hz).
400-Hz lamp	Illuminates if primary ac power source is 400-Hz and phasing is

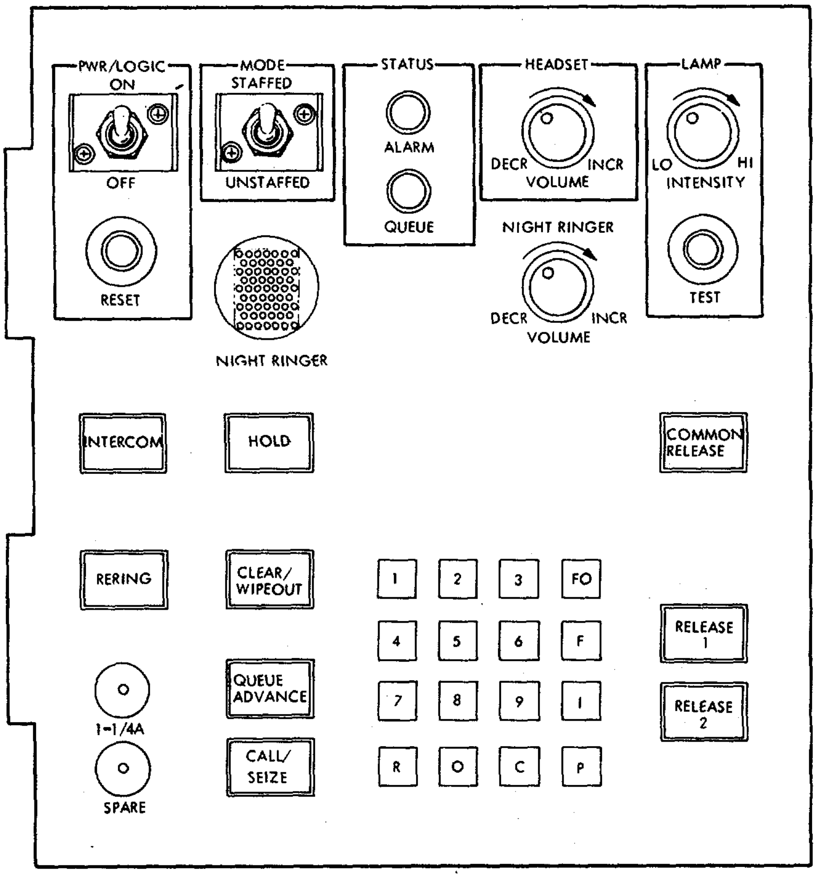


Figure3-5. Operator position panel.

Control, indicator. connector	Function
	correct (MODE switch set to 400-Hz).
PHASE DETECTING A, B, C lamps	Indicate presence of primary ac power on all three phases when MAIN AC circuit breaker is set to ON.
PHASE FAULT indicator switch	During startup, goes on when MAIN AC circuit breaker is set to ON, goes off when depressed. Goes on again when MODE switch is set and goes off when depressed again if input ac frequency and phasing are correct.
MAIN AC circuit breaker	Applies primary ac power to ac control, metering, and alarm circuits, and to circuit breakers for utility outlets, fluorescent lights, and battery charger.
DC ammeter	Indicates battery charger current when CHGR CUR/LOAD CUR switch is in CHGR CUR position; indicates dc load current when CHGR CUR/LOAD CUR switch is in LOAD CUR position.
DC voltmeter	Indicates dc load voltage.
FLOAT/EQL toggle switch	Set to EQL position after battery operation. Normally set to FLOAT position.
CHGR CUR/LOAD CUR toggle switch	Causes DC ammeter to indicate battery charger output current or dc load current.
DC POWER ON indicator switch	Energizes ELAPSED TIME meter and low voltage detector circuit. Enables audio alarm if circuit breaker fault or battery charger fault exists.
EXTERNAL DC guarded toggle switch	Set to ON if external dc power source is to be used.
CIRCUIT BREAKERFAULT indicator switch	Goes on if any of DC/AC INVERTERS or DC-DC CONVERTERS or BATTERY CHARGER circuit breakers are tripped. When depressed, turns off audible alarm. Goes off when depressed again if above circuit breakers are reset.
BATTERY CHARGER FAULT indicator switch	Goes on if battery charger fault exists. When depressed, turns off audible alarm. Goes off when depressed again if battery charger fault is cleared.
BATTERY STORAGE. FAULT indicator switch	Goes on if external battery vent cover is closed and system is operating on battery power.
DC CONTROL circuit breaker	Applies dc power to dc control circuits. Trips if low dc voltage is detected, in turn tripping all other dc circuit breakers.
DC/AC INVERTERS 1 circuit breaker	Applies dc power to dc/ac inverter No. 1.
DC/AC INVERTERS 2 circuit breaker	Applies dc power to dc/ac inverter No. 2.
DC/AC INVERTERS 1 lamp	Indicates presence of dc/ac inverter 1 output.
DC/AC INVERTERS 2 lamp	Indicates presence of dc/ac inverter 2 output.
BATTERY CHARGER circuit breaker	Applies ac power to battery charger. Trips if phase fault exists in primary ac power.
UTILITY OUTLETS circuit breaker	Applies ac power to utility outlets Trips if phase fault exists in primary ac power.
FLUOR LIGHTS circuit breaker	Energizes fluorescent lamps dc power supply.
BLACK-OUT BYPASS toggle switch.	Bypasses door blackout switch.
EMER FAN toggle switch	Turns on emergency exhaust fan.
DC/DC CONVERTERS circuit breakers:	
COMMON CONTROL SUBSYSTEM:	
PROCESSOR/MEMORY 1	Energizes power supplies for memory No. 1, processor No. 1, and maintenance control panel No. 1.
PROCESSOR/MEMORY 2	Energizes power supplies for memory No. 2, processor No. 2, and maintenance control panel No. 2.
I/O SYNCHRONIZERS A, I/O SYNCHRONIZERSB	Energizes redundant power supplies for common synchronizer, system status panel, functional assignment control and control transfer.
NETWORK TERMINAL SUBSYSTEM:	
PRIMARY 300 LINE	Energizes power supplies for AN/TTC-38(V)l and (V)2 network/terminal assemblies.
BACK UP	Energizes redundant power supplies for network/terminal assemblies.
ADDITIONAL 300 LINE (Blank panel on AN/TTC-38(V)1	Energizes power supplies for AN/TTC-38(V)2 network/terminal assemblies.

Control, indicator. connector	Function
OA, OB, OC CONT 1 AMP fuses	Provide protection for ac control, alarm, and meter circuits.
LTG CONT 15 AMP fuse	Provides protection for all lighting circuits.
DC CONTROL 1-5 AMP, DC CONTROL 2-15 AMP fuses	Provide protection for dc control, alarm, and meter circuits.
BATTERY STORAGE FAN 1.5 AMP fuse	Provides protection for battery fan.
BATIERY STORAGE ALARM 1 AMP fuse	Provides protection for battery storage alarm circuit.
RMT OPER 5 AMP fuse	Provides protection for two remote operator positions.
EMER FAN 1.5 AMP fuse	Provides protection for emergency fan.
NTS PWR CONT 15 AMP fuse	Provides protection for NTS power relays.
BAT CHG FAN 1.5 AMP fuse	Provides protection for battery charger fan.
EXT DC 1 AMP fuse	Provides protection for external dc control circuits.
SPARE 1 AMP, 5 AMP, 15 AMP fuses	Store spare fuses.

h. NTS Power Control Panel (fig. 3-6).

NEST FAN FUSES (24 VDC, 1.5 AMP) A52, A53 A54, A55, A56, and SPARE fuses.	Provide protection for five designated NTS blower assemblies and store spare fuse.
NTS POWER CONTROL toggle switches and lamps	Energizes NTS assemblies as follows:
A25	Adapter terminal assembly
A27A	Common terminal equipment assembly bus A
A27B	Common terminal equipment assembly bus B

Note

Switches A27A and A27B also shut off output from 20 Hz ringers A and B respectively. They do not, however, shut off power to 20 Hz ringer A50.

Control, indicator. connector	Function
A29	Terminal/matrix frame assembly No. 3
A30	Terminal/matrix frame assembly No. 4
A31	Terminal/matrix frame assembly No. 1
A32	Common matrix driver assembly No. 1
A33	Terminal/matrix frame assembly No. 2
A40	Terminal/matrix frame assembly No. 7
A41	Not used
A42	Terminal/matrix frame assembly No. 8
A44	Terminal/matrix frame assembly No. 5
A45	Terminal/matrix frame assembly No. 6

i. Power Entry Panel (fig. 1-2).

CB5/A38 circuit breaker	Energizes air conditioner A38.
CB6/A39 circuit breaker	Energizes air conditioner A39.
J1 connector	Connects external ac power to central office.
E2 GND stud	Connects to ground rod.
E13 NEG, E14 POS studs	Connects external dc power to central office.
J7, J8 connectors	Connect power to two remote operator positions.

j. Dc to Dc Converters (fig. FO-7). The eight types of dc-to-dc converters contain different combinations of power supplies described below.

+5V Converters	
+5V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates +5V converter fault.
ON/OFF toggle switch	Energizes +5V converter
+5V, +5V RTN tip jacks	Monitor points for output voltage.
+9V Converters	
+9V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates +9V converter fault.
ON/OFF toggle switch	Energizes +9V converter.
+9V, +9V RTN tipjacks	Monitor points for output voltage.

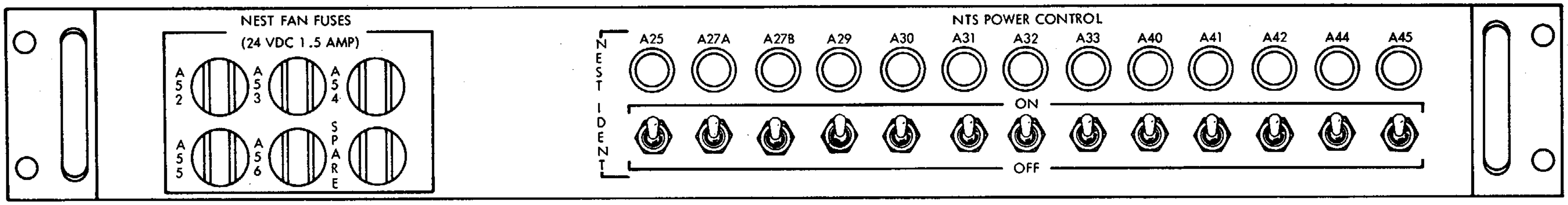


Figure 3-6. NTS power control, front panel.

Control, indicator. connector	Function
+12V Converters	
+12V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates +12V converter fault.
ON/OFF toggle switch	Energizes + 12V converter.
+15V, +12V RTN tip jacks	Monitor points for output voltage.
+15V Converters	
+15V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates +15V converter fault.
ON/OFF toggle switch	Energizes +15V converter.
+12V, +12V RTN tip jacks	Monitor points for output voltage.
+24V Converters	
+24V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates +24V converter fault.
ON/OFF toggle switch	Energizes +24V converter.
+24V, +24V RTN tip jacks	Monitor points for output voltage.
+50 V Converters	
+50V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates +50V converter fault.
ON/OFF toggle switch	Energizes +50V converter.
+50V, +50V RTN tip jacks	Monitor points for output voltage.
-6V Converters	
-6V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates -6V converter fault.
ON/OFF toggle switch	Energizes -6V converter.
-6V, -6V RTN tip jacks	Monitor points for output voltage.
-10V Converter	
-10V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates -10V converter fault.
ON/OFF toggle switch	Energizes -10V converter.
-10V, -10V RTN tip jacks	Monitor points for output voltage.
-12V Converters	
-12V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates -12V converter fault.
ON/OFF toggle switch	Energizes -12V converter.
-12V, -12V RTN tip jacks	Monitor points for output voltage.
-13V Converter	
-13V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates -13V converter fault.
ON/OFF toggle switch	Energizes -13V converter.
-13V, -13V RTN tip jacks	Monitor points for output voltage.
-15V Converter	
-15V VOLT ADJ screwdriver adjustment	Adjusts converter output voltage.
FAULT lamp (red)	Indicates 15V converter fault.
ON/OFF toggle switch	Energizes - 15V converter.
-15V, -15V RTN tip jacks	Monitor points for output voltage.

k. Punched Tape Reader (fig. 3-7).

POWER switch	Energizes paper tape reader.
MODE SELECT switch	Set to REEL or STRIP position according to type of tape.
Supply and take-up reels	M6unt supply and take-up tape.
Read head	Senses light through punched tape holes.
Supply tape and take-up tape sensing arms	Angular positions provide independent servo feedback signals for smooth motor control.

l. Modem (fig. 3-8).

Converter module A13A1	Converts fsk teletype signals from remote teletype to dc levels to drive synchronizer.
LEVEL adjustment screw	Maintenance adjustment for mark hold threshold.
BIAS adjustment screw	Maintenance adjustment to control dc output distortion.
INPUT test point	Maintenance test point to monitor fsk input during adjustment.
DSCRM test point	Maintenance test point to monitor

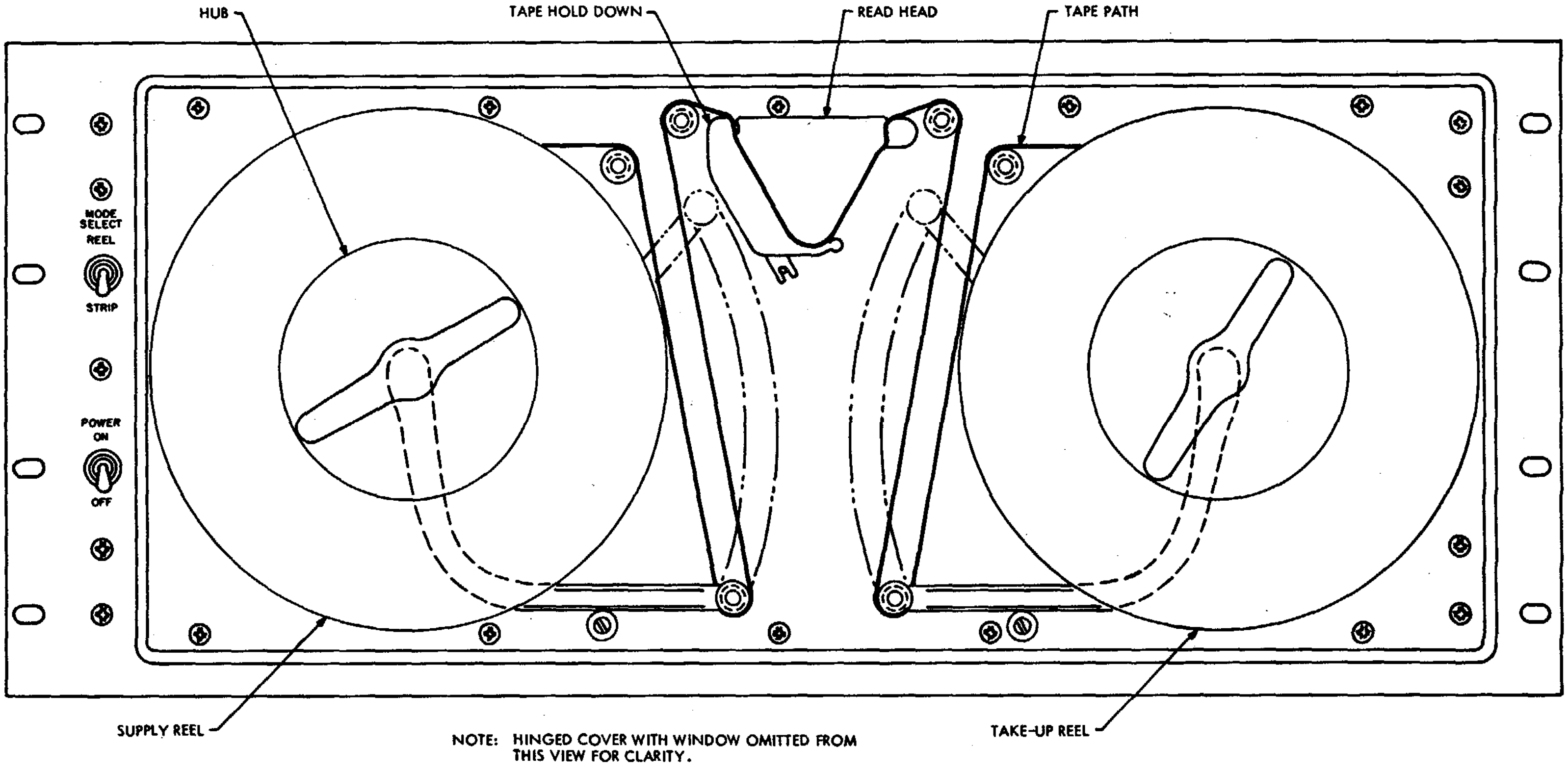


Figure 3-7. Punched tape reader, front view.

discriminator during adjustment.

Control, indicator. connector	Function
OUTPUT test point	Maintenance test point to monitor d output during adjustment.
GND test point	Provides signal ground to test equipment.
Keyer A13A2	Converts dc teletype signals from synchronizer A16 to fsk sent to remote teletype.
Mark +6V: 1232-Hz Space -6V: 1317-Hz	
LEVEL adjustment screw	Maintenance adjustment for output signal level.
INPUT test point	Maintenance test point to monitor internal dc input signal during adjustment.
GRD test point	Provides signal ground for INPUT test point.
OUTPUT test points	Maintenance test points to monitor balanced fsk output during adjustment.
KEYER A13A3	Provides fsk signals to remote printer.
Blank Panel A13A4	Provides space to install converter for spare remote teletype.
Blank Panel A13A5	Provides space to install keyer for spare remote teletype.
Remote teletype selector switch A13S1	Selects connection mode for remote teletype modem A13A1 and A13A2. L-B position permits testing from remote location by looping back converter dc output through keyer to remote teletype. NOR position permits normal full duplex communication with remote teletype. LOC position permits testing through a local loop by looping back keyer fsk output through converter to synchronizer A16.
Spare remote teletype selector switch A13S2	Provides some function as S1 for spare remote teletype keyer and converter if installed.
Blank panel A13A6	Provides space to install power supply for spare remote teletype channel keyer and converter.

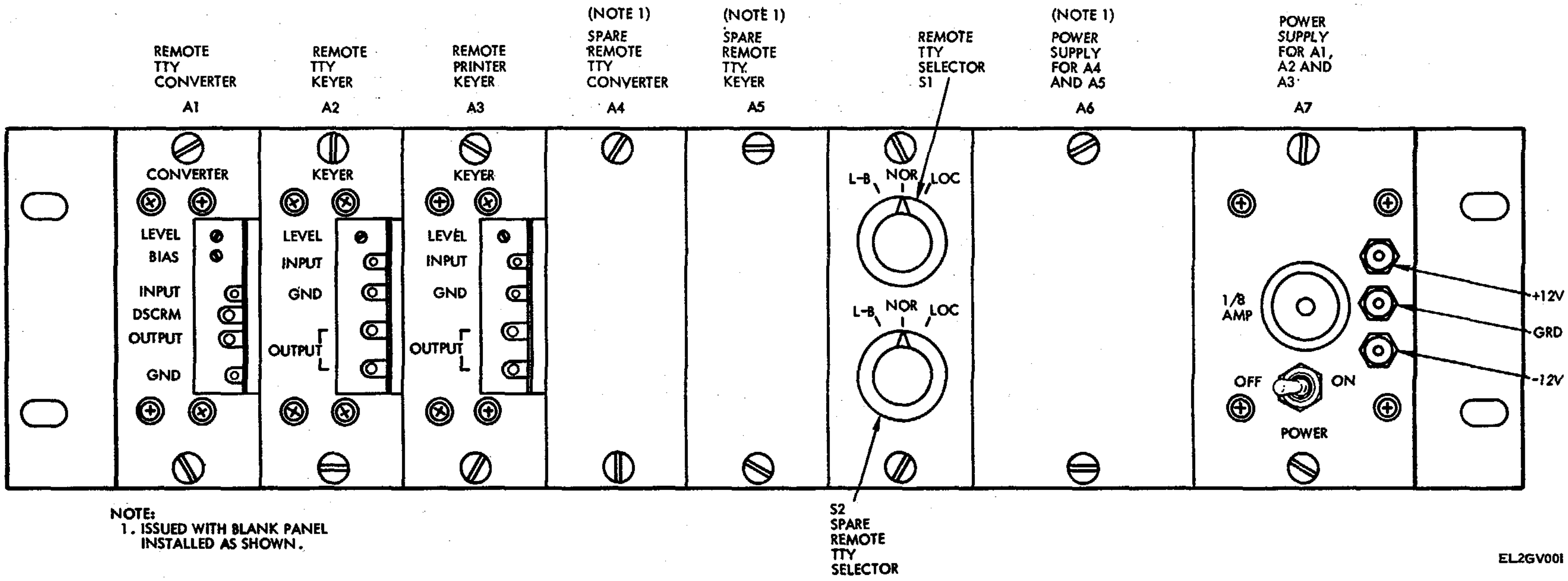
Control, indicator. connector	Function
Power supply A13A7	Supplies power to A13A1, A13A2, and A13A3.
Red indicator lamp	Indicates power supply turned on.
1/8 AMP fuse	Protects power supply.
POWER ON/OFF switch	Turns on power supply and A13A1, A13A2, and A13A3.
Red test point	Maintenance test point to check +12-volt power.
Black test point	Ground for red and white test points.
White test point	Maintenance test point to check -12-volt power.

m. Shelter Controls (fig. FO-1).

LIGHTS-ON/OFF switch S4 (near door)	Turns on shelter lighting.
Door interlock switch S5	With door open, turns off fluorescent or incandescent lamps and turns on blackout lamp (unless) bypassed).
LIGHTS-FLUOR/EMER switch S7 (near door)	Turns on incandescent lamps when fluorescent lamps do not function because of cold.
Fluorescent lamps DS8-DS13	Provide normal shelter lighting.
Incandescent lamps DS14, DS15	Provide shelter lighting under dc - operation or in cold conditions.
Blackout lamp DS16 (blue) opened	Provide lighting when door is under blackout conditions.
MAINT TEL connector	RCV T and R connect to maintenance telephone receiver pair tip and ring; XMT T and R connect to maintenance telephone transmit pair. Wires from this connector connects to PHONE connector on A28.
50/60 Hz utility outlets J2	Provide outlets for connecting and J3 test equipment to 115 VAC 50/60 Hz power.

CAUTION
If AN/TITC-38(V)(*) is operated on 400 Hz power, connect only 400 Hz equipment to these outlets.

EXT AC PWR ON indicator DS25 on power cabinet panel	Indicates external power is on.
EXT AC CONT 1 AMP fuse F17 on power cabinet panel	Protects EXT AC CONT indicators and phase relays.



NOTE:
1. ISSUED WITH BLANK PANEL INSTALLED AS SHOWN.

Figure 3-8. Modem front panel.

Control, indicator. connector	Function
INV FAN 1.6 AMP fuse F16 on power cabinet panel	Protects power panel blower assembly A67.
Processor fuses A8F9 and A9F9, 1.5 AMP	Protect processor blowers.
BATTERY POWER circuit breaker	Connects batteries to system in depressed position.

n. Functional Assignment Control Panel (fig. 3-9).

Control, indicator. connector	Function
Field indicators aid displays	Includes indicator lamps which indicate the nature of data to be displayed and digital readouts which display the data in fields. Lamp flashes while the digital readouts for a field are being filled with digits. A flashing indicator during an assign or change sequence designates the field being entered or changed. Normally an indicator goes from flashing to steady when a new field is addressed by the program.
TERMINAL NO lamp and display	Displays 4-digit terminal number which specifies frame (1st digit), group (2nd digit), and terminal (3rd and 4th digits). If the digital readouts are not filled when a new field indicator is addressed, the lamp goes from flashing to off.
TERMINAL TYPE lamp and display	Displays 2-digit code which specifies the terminal type (table 2-3).
CLASSCODE lamp and display	Displays a 2-digit code which delineates subscriber privileges (table 2-4).
DIR NO lamp and display	Displays subscribers 3-digit local directory number. Uses same digital readouts as TRK GR NO.
TRK GR NO lamp and display	Displays 3.digit trunk group number. Uses same digital readouts as DIR NO.
CONF lamp and display	Displays 2-digit conference number. Uses same digital readouts as GR MIN COUNT.
GR MIN COUNT lamp and display	Displays 2-digit group minimum count numbers which set the threshold for lost call alarm for each trunk group. Use same digital readouts as CONF.
MODE II TERM NO lamp and display	Displays 4-digit terminal number of wideband mode II trunk paired with a narrowband trunk. Used only in 600-line system.
SPCL CKT NO lamp and display	Displays 2-digit special circuit number which specifies adapter card or sender/receiver location. Uses same digit readouts as PR NO and 8L NO.
PR NO lamp and display	Displays 2-digit primary area number. Use same digital readouts as SPCL CKT NO and SL NO.
SL NO lamp and display	Displays 2-digit SL (switch locator) number. Uses same digital readouts as SPCL CKT NO and PR NO.
STATUS lamp and display	Displays 2-digit status code which indicates the status of a line or trunk (table 2-5). Uses same digital readouts as LINE GR NO and ALTN SL NO.
LINE GR NO lamp and display	Displays 2-digit line group number which specifies -to which of 30-line groups a subscriber is assigned. Uses same digital readouts as STATUS and ALTN SL NO.
ALTN SL NO lamp and display	Displays 2-digit alternate SL number. Uses same digital readouts as STATUS and LINE GR NO.
FUNCTION CODE lamp and display	Displays 1-digit function code (table 2-6). Uses same digital readout as RANK.
RANK lamp and display	Displays 2-digit number giving relative position of subscriber in a line group. Uses same digital readout as FUNCTION CODE.
PRI TRK GR NO lamp and display	Displays 3-digit primary trunk group number for PR, SL, or alternate SL routing.
ALTN TRK OR NO lamp and display	Displays 3-digit alternate trunk group number for PR, SL, alternate SL, or JXX routing.
FIXED DIR NO/TRFC CNT lamp and display	Displays 5digit fixed directory number or traffic count specified by TRAFFIC METERS instruction plate.
PR.SL.XXX/NNX-XXXX lamp and display	Displays full 7-digit directory number in either tactical or AUTOVON or commercial format.
Circuit breaker	Applies power to FACP.
POWER lamp	Lights when the circuit breaker is on.
READY lamp	Turned on by the program in response to operator depressing COMMAND or I/O COMMANDS switch. Indicates FACP operator has access to I/0.

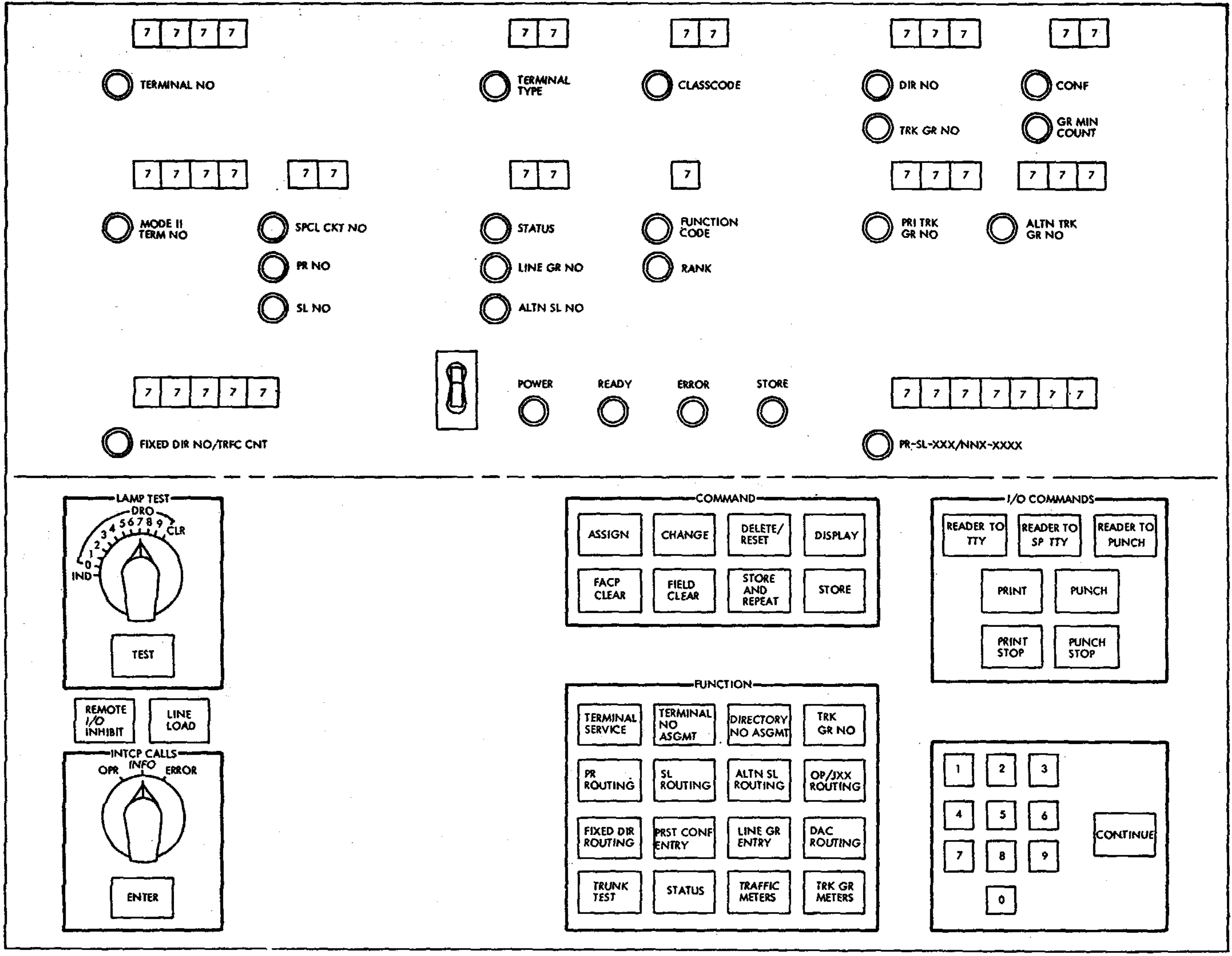


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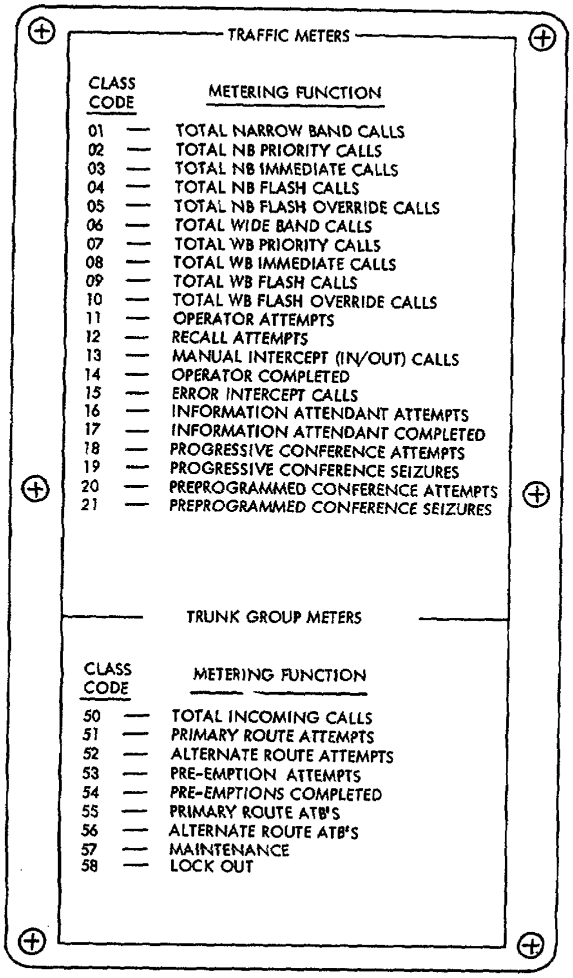
Figure 3-9 (1) Functional assignment control panel, front panel (sheet 1 of 2).



TRAFFIC METERS

CLASS CODE	METERING FUNCTION
01	— TOTAL NARROW BAND CALLS
02	— TOTAL NB PRIORITY CALLS
03	— TOTAL NB IMMEDIATE CALLS
04	— TOTAL NB FLASH CALLS
05	— TOTAL NB FLASH OVERRIDE CALLS
06	— TOTAL WIDE BAND CALLS
07	— TOTAL WB PRIORITY CALLS
08	— TOTAL WB IMMEDIATE CALLS
09	— TOTAL WB FLASH CALLS
10	— TOTAL WB FLASH OVERRIDE CALLS
11	— OPERATOR ATTEMPTS
12	— RECALL ATTEMPTS
13	— MANUAL INTERCEPT (IN/OUT) CALLS
14	— OPERATOR COMPLETED
15	— ERROR INTERCEPT CALLS
16	— INFORMATION ATTENDANT ATTEMPTS
17	— INFORMATION ATTENDANT COMPLETED
18	— PROGRESSIVE CONFERENCE ATTEMPTS
19	— PROGRESSIVE CONFERENCE SEIZURES
20	— PREPROGRAMMED CONFERENCE ATTEMPTS
21	— PREPROGRAMMED CONFERENCE SEIZURES

TRUNK GROUP METERS

CLASS CODE	METERING FUNCTION
50	— TOTAL INCOMING CALLS
51	— PRIMARY ROUTE ATTEMPTS
52	— ALTERNATE ROUTE ATTEMPTS
53	— PRE-EMPTION ATTEMPTS
54	— PRE-EMPTIONS COMPLETED
55	— PRIMARY ROUTE ATB'S
56	— ALTERNATE ROUTE ATB'S
57	— MAINTENANCE
58	— LOCK OUT

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Figure 3-9 (2) Functional assignment control panel, front panel (sheet 2 of 2)

Control indicator, connector	*Function*
ERROR lamp	Turned on by I/O programs when a detectable error is discovered. Turned on during an input sequence only after all the digits for a particular field have been entered and CONTINUE is pressed. Turned on during display sequence after last entry is displayed.
STORE lamp	Turned on at the end of all input sequences except display. Indicates to FACP operator that another action is required.

Control indicator, connector	*Function*
LAMP TEST rotary switch	Selects indicator lamps (INY position) or digital readout (DRO position) for test when TEST switch is depressed. Selects digit to be displayed on all digital readouts simultaneously. When set to CLR. TEST switch clears all digital readouts.
LAMP TEST indicator switch.......	Lights all FACP lamps and indicator switches while depressed when rotary switch is set to IND. Displays digit selected by rotary switch on all digital readouts when depressed. Digit remains displayed until rotary switch is set to CLR and Test Switch is depressed again. Indicator switch lighted while depressed.
REMOTE I/O INHIBIT push-button switch	Prevents response to control signals from the TTY and spare TTY channels and causes program to turn on REMOTE I/O INHIBITED lamp on system status panel. Message is printed at both channels indicating that input channels are inhibited. Maintenance printouts and data trans. mission from tape reader to these channels remain possible. Depressing switch a second time removes inhibit, turns off REMOTE I/O INHIBITED lamp, and prints message at both channels indicating inhibit is removed.
LINE LOAD push-button switch	Sets or resets switchboard's line load control status, depending on whether LINE LOAD SET lamp on system status panel is on or off. Message is printed at remote TTY and spare TTY. When line load control is set, subscriber access to trunks is restricted by program.
INTCP CALLS rotary switch........	Selects method for disposing of intercept calls. OPR position directs intercept calls to operator; INFO position directs intercept calls to in. formation attendant; and ERROR generates error signal to caller. Switch position entered by depressing INTCP CALLS ENTER switch.
INTCP CALLS ENTER indicator switch	Enters the intercept call disposal method selected by INTCP CALLS rotary switch. Lighted when depressed. Program acknowledge receipt by turning off lamp and printing message at local and

Control Indicator, connector	*Function*
	remote page printers indicating new disposition of intercept calls.
TRAFFIC METERS/TRUNK GROUP METERS instruction plate	Lists classcode for each traffic and trunk group meter.
COMMAND push-button switches	Used to start and end all FACP input/output sequences except those controlled by the I/O COMMANDS PRINT and PUNCH switches.
ASSIGN push-button switch	Used to initiate all assignment procedures. Operator attempt to make an assignment where one already exists turns on the ERROR lamp.
CHANGE push-button switch	Used to initiate all change procedures. Operator attempt to change an assignment where no assignment exists turns on ERROR lamp.
DELETE/RESET push-button switch	Used to initiate delete or reset an entry. If no entry exists, the request is ignored.
DISPLAY push-button switch	Used to initiate display procedures, including those which sequentially display entries in a particular table being accessed. When used to sequence through table, only assigned entries are displayed.
FACP CLEAR push-button switch	Causes FACP sequence in progress to be cancelled to terminated. Used after punch option during assign, change, and delete procedures to cancel the sequence when only a punch tape of the entry is wanted. Used to terminate any display sequence. Used to clear FACP when an error is discovered in a field that can no longer be corrected.
FIELD CLEAR push-button switch	Clears field currently being addressed by program. Used to make corrections during input sequence so operator need not always start again. Must be used before CONTINUE switch is depressed, or when ERROR is lit.
STORE AND REPEAT push-button switch	Performs same function as STORE switch but also in. forms program that operator wants to repeat the same type of input sequence.
STORE push-button switch	Terminates all input/output sequences initiated by print, punch, assign, change, and delete/reset commands. Informs program that entry is valid and that data should be stored as part of program data base or that the order given should be executed. Program clears all readouts and related indicators.
FUNCTION push-button switches	Used in conjunction with COMMAND and I/O COMMANDS switches to indicate the program the nature of the input/output operation to be performed. Refer to table 2-2 for a list of acceptable combinations.
TERMINAL SERVICE push-button service	Used for terminal assignments, changes, and deletions. Also used in conjunction with COMMAND DISPLAY switch to display all information entered during terminal service assignment procedures.
TERMINAL NO ASGMT push-button switch	Used to change or display a terminal number assignment.
DIRECTORY NO ASGMT push-button switch	Used to change, display, or print a directory number assignment.
TRK GR NO push-button switch	Used with DELETE/RESET switch to delete trunk group from all routing tables. Also used to display or print terminal numbers of trunks assigned to selected trunk group.
PR ROUTING push-button switch	Used to make PR routing assignments and deletions. Also used to display or print PR routing information.
SL ROUTING push-button switch	Used to make SL routing assignments and deletions. Also used to display or print SL routing information.
ALTN SL ROUTING push-button switch	Used to make alternate SL routing assignment and deletions. Also used to display or print SL routing in. formation.
OP/JXX ROUTING push-button switch	Used to route operator calls to another location or information calls to the operator. Also used to assign routing to a JXX number (700-999) when route is trunk group. Used to display or print 7-digit directory number to which operator calls are routed when all operator positions are unstaffed or routing assignment for 700-999 directory numbers.
FIXED DIR ROUTING push-button switch	Used to assign, change, or delete routing for mobile subscribers with fixed directory numbers. Also used to display, print, or punch the assignments.
PRST CONF ENTRY push-button switch	Used to assign or delete a subscriber to or from a preset conference bridge. Also used to display or print directory numbers of preset conference members.

Control indicator, connector	*Function*
LINE GR ENTRY push-button switch	Used to assign or delete a subscriber to or from a line group. Also used to display or print directory numbers of line group members.
DAC ROUTING push-button switch	Used to change the 7-digit directory number to which a selected DAC (direct access or hotline) subscribers calls are routed. Also used to display or print DAC subscribers and corresponding called parties.
TRUNK TEST push-button switch	Used with ASSIGN switch to request trunk test on one trunk, a group of trunks, or all trunks.
STATUS push-button switch	Used with CHANGE switch to mark terminal or trunk group in-service or out-of-service. Also used to display dynamic status of line or trunk (table 2-5).
TRAFFIC METERS push-button switch	Used to print or sequentially display switchboard traffic counts. Used with DELETE/RESET switch to reset eleven switchboard traffic meters.
TRK GR METERS push-button switch	Used to sequentially display traffic meters for selected trunk group or to print traffic meters for all trunk groups. Used with DELETE/RESET switch to reset traffic meters for selected trunk group or all trunk groups. Used with CHANGE switch to establish threshold for lost call alarm for each trunk group.
I/O COMMANDS push-button switches	Provide manual on-line control over system peripheral devices.
READER TO TTY indicator switch	Causes tape placed on high speed tape reader to be transmitted to remote TTY with program performing any required character code translation. Lamp is turned on when tape transmission is complete.
READER TO SP TTY indicator switch	Causes tape placed on high speed tape reader to be transmitted to spare TTY with program performing any required character code translation. Lamp is turned on when switch is depressed and turned off when tape transmission is complete.
READER TO PUNCH indicator switch	Causes tape on tape reader to be duplicated on paper tape punch exactly as punched. Lamp is turned on when depressed and turned off at end of transmission.
PRINT push-button switch	Used as a command in conjunction with selected FUNCTION switch to cause printout on local and remote page printer of a selected data base table or portion thereof. Also used as an option in a display sequence to cause printout of displayed data entry.
PUNCH push-button switch	Used as a command in conjunction with selected FUNCTION switch to cause selected program data base to be punched on paper tape punch.
PRINT STOP push-button switch	Causes local and remote page printers to step printing operation after printing of current character.
PUNCH STOP push-button switch	Causes paper tape punch to stop punch operation after entry currently being punched is completed.
1-9 and 0 digit switches	Used to key in data. When switch is depressed, digit code is transmitted to program. Program retransmits digit to FACP for display.
CONTINUE push-button switch	Used to indicate that operator has verified digits being displayed and the sequence may continue. Used during change procedure to indicate that operator does not wish to change a particular parameter.

o. Tape Winder (fig -3-10).

Control indicator, connector	*Function*
1 AMP fuse	Protects 110 VAC motor.
Brake Lever Switch (S1)	When out, connects 110 VAC to motor. When in, disconnects 110 VAC from motor and brakes drive wheel.
Tape stop arm	Stops motor when tape is tight. Starts motor when tape is slack.

p. Patch Plug/Cable Tester (fig. 3-11).

Control indicator, connector	*Function*
GO lamp (white)	Lights when TEST SELECT switch is on CONTINUITY, patch cord on plug is inserted in 2-WIRE- 4-WIRE jack and circuit is good.
NO GO lamp (red)	Lights when TEST SELECT switch is in SHORT 1 or 2 position, patch cord or plug is inserted in 2-WIRE - 4-WIRE jack and circuit is shorted.
TEST SELECT Rotary switch	
OFF position	Disconnects test circuit.
LAMP position	Test lamps.
CONTINUITY	Test continuity of card or plug wiring.
SHORT 1 and 2	Tests for shorts in card or plug wiring.
1.0 AMP fuse	Protects test circuit.

Control indicator. Connector	Function
2-WIRE, 4-WIRE connector	Connector used for holding cards or plugs under test. Correct orientation of 4-wire and 2-wire cards shown in B and C.
q. Power Subsystem Upper Cover (fig. 3-12).	
EXT AC PWR ON lamp (white) DS13	Indicates external ac power is on.
FAULT press-to-test indicator (white) DS27	Indicates if transient protector is defective. Test function checks both lamp and 25 AMP fuse.
25 AMP fuse F18	Protects system 24-volt dc bus if transient protector fails. **CAUTION** It is possible to overcharge batteries in the equalize charge mode.
EQL lamp (yellow) DS26	Lights when FLOAT/EQL switch on power subsystem control panel is set to EQL (equalize).

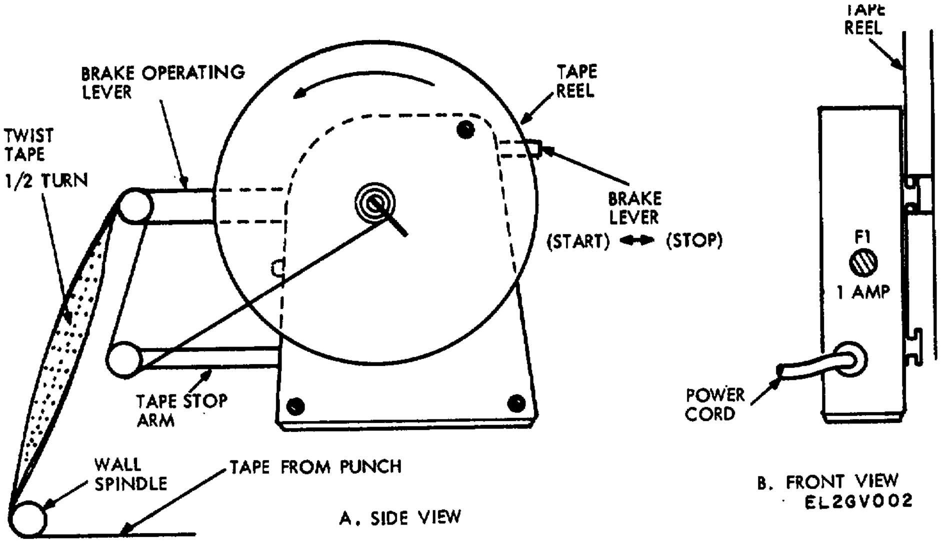

Figure 310. Tape winder.

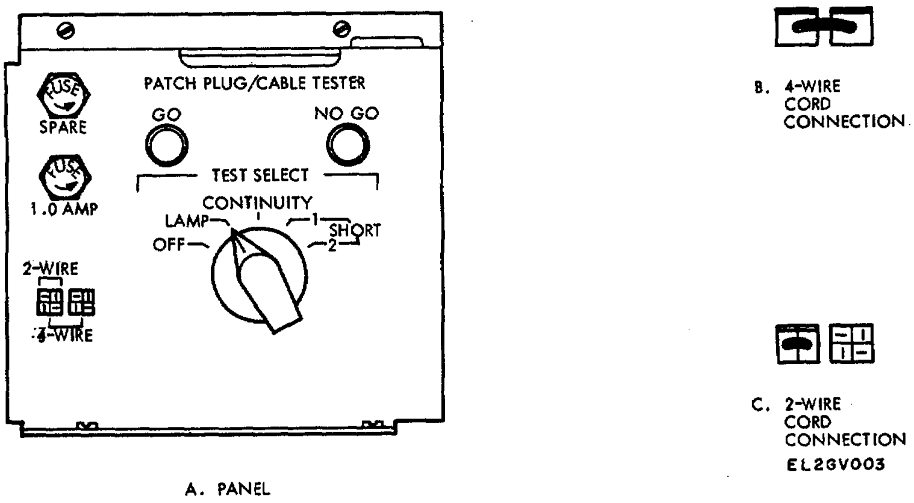

Figure 3-11. Patch plug/cable tester, panel.

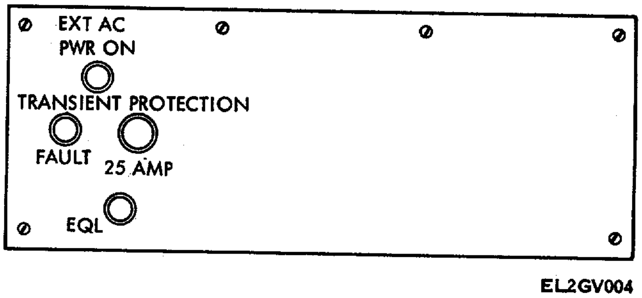

Figure 3-12. Power subsystem upper cover.

Section II. OPERATION UNDER USUAL CONDITIONS

3-3. Preliminary Starting Procedure

Set all controls as indicated below to establish shutdown condition prior to startup. Then check for proper installation of the ground rod to the power entry panel ground stud.

Control	setting
Power entrance panel (FO-1)	
CB5/A36 circuit breaker	OFF
CB6/A39 circuit breaker	OFF
Shelter controls	
LIGHTS ON/OFF	ON
LIGHTS FLOUR/EMER	FLOUR
BATTERY POWER circuit breaker	ON (depressed)
Power subsystem control panel (FO-6)	
BLACKOUT BYPASS toggle switch	ON
PHASE SELECT rotary switch	OFF
MODE rotary switch	OFF
PHASE FAULT indicator switch	OFF (extinguished)
MAIN AC circuit breaker	OFF
FLOAT/EQL toggle switch	EQL
CHGR CUR/LOAD CUR toggle switch	LOAD CUR
DC POWER ON indicator switch	OFF (extinguished)
EXTERNAL DC guarded toggle switch	OFF
CIRCUIT BREAKER FAULT indicator switch	OFF (extinguished)
BATTERY CHARGER FAULT indicator switch	OFF (extinguished)
BATTERY STORAGE FAULT indicator switch	OFF (extinguished)
DC CONTROL circuit breaker	OFF
DC/AC INVERTERS 1, 2 circuit breakers	OFF
UTILITY OUTLETS circuit breaker	OFF
FLOURLIGHTS circuit breaker	OFF
EMER FAN toggle switch	OFF
PROCESSOR/MEMORY 1, 2 circuit breakers	OFF
PRIMARY 300 LINE circuit breaker (AN/TTC-38(V)2 only)	OFF
NTS Power control Panel (fig. 3-6)	
NTS POWER CONTROL toggle switches (all)	OFF
Air conditioners A38 and A39 (FO-1)	
CONTROL CIRCUIT BREAKER	OFF
MODE SELECTOR switch	OFF
Dc to dc converters (all PS3 through PS23 ON/OFF toggle switches) (FO-7)	ON
Operator position (an) (fig. 3-5) PWR/LOGIC ON/OFF guarded toggle switches	OFF
Functional assignment control panel circuit breaker (fig. 3-9)	OFF
Paper tape read (FO-1) POWER switch	OFF
Modem (fig. 3-8)	
POWER switch (power supply)	OFF
Mode switches (two)	NOR

3-4. Startup Procedures

NOTE

Controls are located on power subsystem control panel (FO-6) unless otherwise specified.

a. Verify that all controls are set according to paragraph 3-3 (shutdown condition).

b. Turn on generator or other power source according to applicable technical manual.

c. When generator power is applied to shelter EXT AC POWER ON lamps (2) go on. One is on side of power subsystem control panel; other is on power cabinet panel.

d. Set MAIN AC circuit breaker to ON position. PHASE DETECTING A, B, C lamps go on.

e. Set PHASE SELECT switch to position A. Ac voltmeter indicates 103 to 132 vac. Ac ammeter indicates 0 amperes.

f. Repeat step (e) for PHASE SELECT switch positions B and C.

g. Set PHASE SELECT switch to OFF position.

h. Under Blackout condition, set BLACKOUT BYPASS switch to OFF. When door is opened, blue lamp will go on providing light switch S4 near door is on.

i. Set FLUOR LIGHTS circuit breaker to ON. Fluorescent lamps go on.

NOTE

If temperature in the assemblage is too low for the fluorescent ceiling lights to operate, set the FLUOR-EMER LIGHTS switch to EMER to operate the incandescent ceiling lights. When the assemblage is heated sufficiently for the fluorescent lights to operate, set the switch to FLUOR.

j. Set MODE switch to correct position, 50/60 Hz or 400 Hz, according to power source frequency. 50/60 Hz or 400 Hz lamp goes on. PHASE FAULT lamp goes on.

k. Depress PHASE FAULT switch. PHASE FAULT lamp goes off.

l. Set UTILITY OUTLETS circuit breaker to ON (optional).

m. On power entry panel, set CB5 and CB6 circuit breakers to ON.

n. Turn on and adjust air conditioners. Refer to TM 5-4120-243-14: or if air-conditioners are not (to be used, operate EMER FAN switch to ON.

o. Set BATTERY CHARGER circuit breaker to ON.

p. Observe that dc voltmeter indicates approximately 28 vdc.

q. Observe that dc ammeter indicates approximately 0 amperes.

r. Depress DC POWER ON switch. DC POWER ON lamp goes on, CIRCUIT BREAKER FAULT and BATTERY CHARGER FAULT lamps go on, and audible alarm sounds.

s. Depress CIRCUIT BREAKER FAULT and BATTERY CHARGER FAULT switches. Audible alarm goes off. CIRCUIT BREAKER FAULT and BATTERY CHARGER FAULT lamps stay on.

t. Set DC CONTROL circuit breaker to ON.

WARNING

If BATTERY STORAGE FAULT alarm occurs, external cover for battery vent has not be opened. Open it.

u. Set DC/AC INVERTERS 1 and 2 circuit breakers to ON. Lamps 1 and 2 go on.

NOTE

Printer and punch will run open until following step, or step x.

v. Set all DC-DC CONVERTERS circuit breakers to ON in any sequence.

w. Depress CIRCUIT BREAKER FAULT and BATTERY CHARGER FAULT switches, both lamps go off.

x. On system status panel, (fig. 3-3) set all RESET SELECT switches to ON, and depress RESET switch. Then return all RESET SELECT switches to OFF.

y. On NTS power control panel, (fig. 3-6) set all toggle switches to ON. For ANMITC-38(V)l, use switches A25 through A33.For AN/TC-38(V)2, also use switches A40, A42, A44, and A45. Lamp above each switch goes on.

z. Turn on power switches on following equipment:

(1) Operator positions (both local and remote) (fig. 3-5).

(2) Functional assignment control panel (fig. 3-9) (3) Paper tape-reader (if required) (FO-1).

(4) Modem (if required((fig. 3-8).

aa. Check charge in batteries by switching CHGR CUR/LOAD CUR switch to both positions. If DC AMPERES meter indicates approximately the same in both positions, batteries are charged: set FLOAT/EQL switch to FLOAT. Leave in EQL position if CHGR CUR is significantly lower than LOAD CUR. It takes approximately three hours to fully charge batteries. BATTERY CHARGER FAULT lights and audible alarm sounds to indicate when FLOAT/EQL switch should be set to FLOAT.

3-5. Normal Common Control Startup

Use these procedures to startup common control subsystem after short periods of shutdown.

a. Apply power (para 3-4).

b. See that PRCS HALT is illuminated on both maintenance control panels(fig. 3).

c. Set CONTROL TRANSFER-AUTO ENABLE/DISABLE to DISABLE (fig. 3-2).

d. Set both REGISTER SELECT switches to CPS (fig 3-1). See which panel has BUS INDICATOR bit 23 in. This processor is connected to the network terminal subsystem.

e. (Optional) to switch processors press CONTROL TRANSFER-MANUAL (fig. 3-2).

If Start .or restart program (para 2-181)

3-6. Operator Position Procedures (fig. 3-5)

Use these procedures for both local and remote operator positions.

a. Power Turn On.

(1) Set PWR/LOGIC switch to ON position.

(2) Depress and release P-WILOGIC RESET switch.

(3) Set MODE switch to STAFFED position.

b. Answering an Incoming Call. Incoming calls are indicated by the STATUS QUEUE lamp flashing (precedence) or going on steady (routine), along with ringing.

(1) Depress QUEUE ADVANCE switch.

(2) After one second, CALL/SEIZE and QUEUE ADVANCE lamps go on, and COMMON RELEASE and STATUS QUEUE lamps go off.

(3) Talk to calling party.

(4) Answer next call in queue, indicated by STATUS QUEUE lamp flashing or on steady, by depressing QUEUE ADVANCE switch.

c. Extending a Call. Use this procedure when a calling party asks to be extended.

(1) Depress CALL/SEIZE switch. CALL/SEIZE lamp goes on.

(2) When you hear dial tone, key called party directory number.

(3) You may drop out of call now (see step (4))or you may monitor call for ringback, busy, or error tones If called party does not answer or if busy or error tone is heard, depress CLEAR/WIPEOUT switch. When called party answers, drop out of call.

(4) Depress QUEUE ADVANCE switch to answer next call in queue, or depress COMMON RELEASE switch to bypass calls in queue and return to released state.

d. Releasing a Call. Use one of the three following methods to release a call, depending on-what task you must perform after release.

(1) *Releasing and advancing the queue*. Use this procedure to release a call and answer next call in queue. If no call is waiting in queue, the operator position reverts to the released state.

(*a*) Depress QUEUE ADVANCE switch. QUEUE ADVANCE lamp goes off and COMMON

RELEASE lamp goes on, QUEUE ADVANCE and CALL SIEZE lamps go on, COMMON RELEASE and STATUS lamps go off.

(*b*) Talk to calling party.

(2) *Releasing and bypassing queue*. Use this procedure to release a call and bypass calls waiting in queue. This leaves you free to perform such tasks as call booking, or retrieving a call placed on hold.

(*a*) Depress COMMON RELEASE switch.

(*b*) COMMON RELEASE lamp goes on, and QUEUE ADVANCE and CALL/SEIZE lamps go off.

(*c*) You are in released state.

(3) Selective releasing. Use this procedure to release one party, such as required during recall. You must first determine which party to release.

(*a*) Ask if recalling party wishes to be extended.

(*b*) If answer is "yes," depress RELEASE 2 switch. If answer is "no," depress RELEASE 1 switch. Depressed lamp goes on for one second, then off.

(*c*) Extend call or process incoming call.

e. Initiating a Call. Use this procedure to initiate a call. The operator position must be in the released state.

(1) Depress CALL/SEIZE switch. CALL/SEIZE and QUEUE ADVANCE lamps go on, and COMMON RELEASE lamp goes off.

(2) When you hear dial tone, key called party directory number.

(3) Listen for ringback, error, or busy tone. If called party does not answer, or if you hear busy or error tone, depress CLEAR/WIPEOUT switch.

(4) When called party answers, conversation may take place.

f. Extending Precedence. Use this procedure to grant any level of precedence to a party on any line on trunk or a one-time basis.

(1) Depress CALL/SEIZE switch. CALL/SEIZE and QUEUE ADVANCE lamps go on.

(2) When you hear dial tone, depress appropriate precedence keyset switch (FO, F, I, or P).

(3) When dial tone goes off, key called party directory number.

(4) When you hear ringback, you may drop out of call, or listen until called party goes off hook.

(5) Drop out of call by depressing COMMON RELEASE or QUEUE ADVANCE switch.

g. Setting up a Conference. Use this procedure to set up a conference for a calling party, or as a booked conference.

(1) Depress CALL/SEIZE switch. CALL/SEIZE lamp goes on.

(2) When you hear dial tone, depress C keyset switch. Dial tone goes off.

(3) When you hear dial tone again, key directory number of conference party.

(4) Listen for ringback, busy, or error tone. If called party does not answer, or if you hear busy or error tone, depress CLEAR/WIPEOUT switch and depress C keyset switch again. If called party answers, he is connected to conference circuit.

(5) Repeat steps (2), (3), and (4) above to add all conferees to conference circuit.

(6) If conference is a booked call, depress CALL/SEIZE switch. Then repeat steps (3) and (4) above to add conference requester to circuit.

(7) Drop out of call by depressing COMMON RELEASE or QUEUE ADVANCE switch.

h. Placing a Call on Hold. Use this procedure to place a call on hold temporarily. When a call is placed on hold, you are free to initiate or answer calls.

(1) Depress HOLD switch until HOLD lamp goes on.

(2) QUEUE ADVANCE lamp goes off and COMMON RELEASE lamp goes on.

(3) Operator position is in released state.

i. Retrieving a Call on Hold. Use this procedure to retrieve a call being held. The operator position must be in the released state before retrieving a call.

(1) Depress HOLD switch until HOLD lamp goes off. QUEUE ADVANCE lamp goes on and COMMON RELEASE lamp goes off.

(2) Conversation may now take place. If however, the controlling party of a conference call goes on hook while being held, there will be no voice response.

j. Booking a Call. Use this procedure to place a call at a designated time. The operator position must be in the released state when booking a call.

(1) Depress CALL/SEIZE switch. CALL/SEIZE and QUEUE ADVANCE lamps go on, and COMMON RELEASE lamp goes off.

(2) When you hear dial tone, key called party directory number.

(3) Listen for ringback, error, or busy tone. If called party does not answer, or if you hear busy or error tone, depress CLEAR/WIPEOUT switch.

(4) When called party answers, depress CALL/SEIZE switch. CALL/SEIZE lamp goes on.

(5) When you hear dial tone, key directory number of party requesting booked call.

(6) When requesting party answers, he may talk to called party.

(7) Drop out of call by depressing COMMON RELEASE or QUEUE ADVANCE switch.

k. Keying Dc Closure Lines. Use this procedure when you have a request to access a dc closure line.

(1) Depress CALL/SEIZE switch. CALL/SEIZE and QUEUE ADVANCE lamps go on, and COMMON RELEASE lamp goes off.

(2) When you hear dial tone, if call is to be given precedence and calling party has not already keyed precedence, depress appropriate precedence keyset switch.

(3) Key dc closure line directory number IXX or OXX.

(4) When you hear second dial tone, key twodigit access code if required. Then key called party directory number. If you make a keying error, depress CLEAR/WIPEOUT switch then return to step (1).

(5) Depress C keyset switch to signify end of digits.

(6) When third dial tone is heard, depress R keyset switch.

(7) If access code was required to step (4), listen for fourth dial tone, then depress R keyset switch again.

(8) You may complete call now or you may wait until called party answers, by depressing COMMON RELEASE or QUEUE ADVANCE switch.

(9) If called party is busy or does not answer, release dc closure line by depressing RELEASE 1 switch until lamp goes off. You may now call again starting with step (1) above, or you may release calling party by depressing COMMON RELEASE or QUEUE ADVANCE switch.

l. Dc Closure Dial Wipeout. If you make a keying error before depressing the C keyset switch, you may clear or wipe out keyed digits. Depress CLEAR/WIPEOUT switch and repeat call from beginning.

m. Monitoring Dc Closure Lines. You may monitor any dc closure line to determine if it is idle or busy. The operator position must be in the released state. If not, you will hear error tone in the following procedure.

(1) Depress CALL/SEIZE switch. CALL/SEIZE and QUEUE ADVANCE lamps go on, and COMMON RELEASE lamp goes off.

(2) When you hear dial tone, key two-digit special circuit number of dc closure line. Then depress C keyset switch.

(3) You may now monitor dc closure line and any party on it.

(4) Dropout by depressing COMMON RELEASE or QUEUE ADVANCE switch.

n. Reringing. Use this procedure to rering a ringdown line or trunk which does not answer your call.

(1) Depress and hold RERING switch for at least one second, then release RERING.

(2) When you hear a two-second burst of ringback.

o. Clearing. Tones and Errors. Use the CLEAR/WIPEOUT switch to stop ringing, error tone, busy tone, or dial tone. Depress switch until tone stops.

NOTE

If you were extending a call, depress CALL/SEIZE switch before keying called party again. If you were setting up a conference, depress C keyset switch until you hear dial tone before keying conferee.

p. Using the Intercom. Use the intercom circuit to communicate with other operators.

(1) *Initiating intercom calls*.

(*a*) Depress INTERCOM switch. INTERCOM lamp goes on.

(*b*) When an operator answers, conversation may take place.

(*c*) Depress INTERCOM switch again to release call INTERCOM lamp flashes until all other operators release, then goes off.

(2) *Answering intercom calls*.

(*a*) When INTERCOM lamp flashes, indicating an incoming call, depress INTERCOM switch. INTERCOM lamp goes on.

(*b*) Conversation may now take place.

(*c*) Release call by depressing INTERCOM switch. INTERCOM lamp flashes until all other operators release, then goes off.

q. Keying AUTOVON Lines. Use this procedure when you are requested to extend a call into the AUTOVON network.

(1) Depress CALL/SEIZE switch.

(2) When you hear dial tone, if call is to be given precedence depress appropriate precedence keyset switch.

(3) Depress keyset switches R, and 9 sequentially, then key called party directory number (AUTOVON number).

(4) Complete call by depressing COMMON RELEASE or QUEUE ADVANCE switch.

r. Standby (Unstaffed) Operation. Place the operator position in the unstaffed mode by setting MODE switch to UNSTAFFED-position. Incoming calls are now routed properly.

s. Power Turn Off. Turn off operator position by setting PWR/LOGIC switch to OFF position.

3-7. Information Attendant Procedures

Use the procedures in paragraphs 3-8 and 3-9 to operate a subset (TA-341(*)/TT) which is assigned the information attendant function. This subset receives information requests from subscribers. It also receives intercept calls when the INTCP CALLS switch on the FACP is set to INFO. An intercept call is a call which the switch is unable to complete. As many as six information and/or intercept calls are held in a queue which is shared by all information attendants. You can also use the subset to initiate calls. However you cannot initiate any call which requires the use of the R key.

3-8. Answering Incoming Calls by Information Attendant

Use this procedure to service incoming calls to a subset which is assigned the information attendant function.

a. When your subset is on-hook, an incoming call will cause the subset to ring. A precedence intercept call will cause a precedence ring. All other calls will cause a routine ring.

b. Lift handset from cradle and listen for dial tone (425 Hz).

c. Depress R key. Dial tone will stop, you will hear answer tone (2600 Hz), and you will be connected to first calling party in queue.

d. After servicing call, depress R key to be connected to next calling party in queue. Each connection is preceded by answer tone. If no callers are in queue, there will be no response when you depress R key, and you may place headset in cradle.

3-9. Initiating Calls by Information Attendant

Use this procedure to initiate an outgoing call from a subset which is assigned the information attendant function. You can initiate a call at any time regardless of the status of the queue. However, you cannot initiate any call which requires the use of the R key.

a. If servicing a call, replace handset in cradle. If calls are waiting in queue, your subset will ring.

b. Regardless of whether or not subset is being rung, remove handset from cradle and listen for dial tone (425 Hz).

c. Key directory number for called party. Do not attempt to place call which requires use of R key since this will connect you to calling party in queue.

d. After reaching called party, you may call the operator by depressing the R key. Depressing the R key will not connect you to the next calling party in the information attendant queue until after you have gone on-hook.

e. Upon completion of call, replace handset in cradle. You must go on-hook before you can answer incoming calls or initiate another outgoing call.

3-10. FACP Display Procedure

Use this procedure in conjunction with the data in paragraph 3-11 to display selected data on the FACP digital readouts. After you have initiated a particular display, you may sequence through several entries in a table by 'depressing the COMMAND DISPLAY switch (repeat option). Terminate the display sequence by depressing the COMMAND-FACP CLEAR switch. You may also use the display sequence in conjunction with the print option to obtain a printout of data currently displayed, or in some cases, a printout of several entries associated with a single input. The printout format is specified in paragraphs 3-12 and 3-13, unless otherwise specified in the Remarks column of paragraph 3-11. Before starting a display sequence, refer to paragraph 3-11 for the required input data, and the data display to be expected. The Remarks column also explains error conditions and special cases that may exist for each type of display.

a. Depress COMMAND-DISPLAY switch.

b. When READY lamp goes on, depress appropriate FUNCTION switch.

c. When field indicator lamp goes on (if any), key in appropriate digits. Verify that displayed digits are correct, and depress CONTINUE switch.

d. Requested data is now displayed.

e. You may exercise the print option to print the data displayed, or in some cases several data entries associated with the input, by depressing I/O COMMANDS-PRINT switch. In some cases you may not exercise the repeat option of step f after the print option has been used. Consult Remarks column of paragraph 3-11 for the particular input.

f. You may display the next entry in the table or the next entry associated with the selected input by depressing COMMAND-DISPLAY switch (except for unstaffed operator routing display).

g. Repeat steps e and f above as necessary.

h. Terminate display sequence by depressing COMMAND-FACP CLEAR switch.

3-11. FACP Display Procedure Data

Display requested	FUNCTION switch (step b)	Input data (step c)	Data displayed (step d)	Remarks
Terminal Service	TERMINAL SERVICE	TERMINAL NO	TERMINAL TYPE CLASSCODE DIR NO CONF SPCL CKT NO STATUS PR-SL-XXX/ NNX-XXXX TRK GR NO MODE II TERM NO	DIR NO of 000 indicates no directory number assigned. Lowest DIR NO displayed if more than one DIR NO is assigned to TERMINAL NO. Print option causes printout of data currently displayed. Repeat option displays data for next assigned TERMINAL NO. Repeat option causes ERROR lamp to go on if there are no more assigned terminals.
Terminal Number Assignment	TERMINAL NO ASGMT	TERMINAL NO	DIR NO	DIR NO of 000 indicates call forwarding to another terminal number; thus no directory number is assigned to this terminal number. ERROR lamp goes on if terminal is a trunk or if terminal number is unassigned. You may not exercise the repeat option after the print option has been

Display requested	FUNCTION switch (step b)	Input data (step c)	Data displayed (step d)	Remarks
				used; ERROR lamp will go on. Print option causes printout of all terminal numbers associated with terminal number in following format: DIR F-G-TN XXX X=X-XX Repeat option displays next higher DIR NO for the same TERMINAL NO. Repeat option causes ERROR lamp to go on if no more entries exist for same TERMINAL NO. If directory number is not assigned next higher assigned number is displayed.
Director Number Assignment	DIRECTORY NO ASGMT	DIR NO	TERMINAL NO	ERROR lamp goes on if there are no DIR NO assigned in table. Print option causes printout of data currently displayed. Repeat option displays next TERMINAL NO for DIR NO if more than one TERMINAL NO exists; if not, next assigned DIR NO and associated TERMINAL NO is displayed. Repeat option causes ERROR lamp to go on if no more entries exists in DIR NO table.
Trunk Group Number	TRK GR NO	TRK GR NO	TERMINAL NO	You may not exercise the repeat option after the print option has been used; ERROR lamp will go on. Print option causes printout of all TERMINAL NO in the trunk group. Repeat option displays TERMINAL NO of next trunk in group. Repeat option causes ERROR lamp to go on if there are no more entries in the trunk group.
PR Routing	PR ROUTING	PR NO	FUNCTION CODE PRI TRK GR NO ALTN TRK GR NO	FUNCTION CODE of 0 indicates that initially selected PR is unassigned. Print option causes printout of data currently displayed. Repeat option displays data for next PR NO. Repeat option causes ERROR lamp to go on if there are no more entries in the PR table.
SL Routing	SL ROUTING	SL NO	FUNCTION CODE PRI TRK GR NO ALTN TRK GR NO	FUNCTION CODE of O indicates that initially selected SL is unassigned. Print option causes printout of data currently displayed. Repeat option displays data for next assigned SL NO. Repeat option causes ERROR lamp to go on if there are no more entries in the SL table.
Alternate SL Routidg	ALTN SL ROUTING	PR NO	ALTN SL NO FUNCTION CODE PRI TRK GR NO ALTN TRK GR NO	ERROR lamp goes on if PR is unassigned or does not have an alternate home table. You may not exercise the repeat option after the-print option is used; ERROR lamp will go on. Print option causes printout of data currently displayed, and all other entries for the selected PR NO.

Display requested	FUNCTION switch (step b)	Input data (step c)	Data displayed (step d)	Remarks
				Repeat option displays next ALTN SL NO and routes for the selected PR NO. Repeat option causes ERROR lamp to go on if no more entries exist for the selected PR NO.
Unstaffed Operator Routing	OP/JXX ROUTING	DIR NO	PR-SL-XXX/ NNX- XXXX	In step c, key in 000 when DIR NO lamp goes on. In step d, the 7-digit directory number to which unstaffed operator calls are routed is displayed. 0000000 indicates that unstaffed operator routing is not assigned. Print option causes printout of data currently displayed. Repeat option is not allowed; ERROR lamp will go on.
JXX Routing	OP/JXX ROUTING	DIR NO (JXX Number 700-999)	TERMINAL NO or PRI TRK GR NO	In step c, key in 3-digit JXX number (700-999) when DIR NO lamp goes on. ERROR lamp goes on if no JXX number is assigned. Print option causes printout of data currently displayed. Repeat option displays data for next assigned JXX number. Repeat option causes ERROR lamp to go on if there are no more JXX entries assigned.
Fixed Directory Routing	FIXED DIR ROUTING	FIXED DIR NO/TRFC CNT (PXJXX or XXIXX)	PR-SL-XXX/ NNX-XXXX	In step c, key in 5-digit fixed directory number (FDSL-PXJXX or FDUL-XXIXX). ERROR goes on if no fixed directory number is assigned. For FDSL (PXJXX) numbers, when both PR and SL are home, display will indicate OOOOXXX, where XXX is local directory number; when either PR or SL are foreign, display will indicate PRSLOOO. For FDUL (XXIXX) numbers, display will indicate PRSLIXX, where IXX is last 3 digits of FDUL (XXIXX) number. Print option causes printout of data currently displayed. Repeat option displays next assigned entry in FDSL or FDUL table; however it is not possible to sequence from FDSL to FDUL or vice versa. To display both tables, repeat entire procedure. Repeat option causes ERROR lamp to go on if there are no more assigned entries in the appropriate table.
Preset Conference Entry	PRST CONF ENTRY	CONF	DIR NO FUNCTION CODE	ERROR lamp goes on if conference number is unassigned. You may not exercise the repeat option after the print option is used; ERROR lamp will go on. Print option causes printout of data currently displayed, and all other entries for the selected 6onference number.

Display requested	FUNCTION switch (step b)	Input data (step c)	Data displayed (step d)	Remarks
				Repeat option displays next entry in the selected conference number. Repeat option causes ERROR lamp to go on if there are no more entries in the selected conference number.
Line Group Entry	LINE GR ENTRY	LINE GR NO	DIR NO TERMINAL NO	You may not exercise the repeat option after the print option is used; ERROR lamp will go on. Print option causes printout of data currently displayed, and all other entries in the line group. Repeat option displays data for next entry in line group. Repeat option causes ERROR lamp to go on if there are no more entries in line group.
DAC Routing	DAC ROUTING	TERMINAL NO or 0000	PR-SL.XXX/NNX-XXXX	In step c. key in 0000 to sequence through entire DAC routing table. ERROR lamp will go on if requested entry is not in table. Print option causes printout of data currently displayed. Repeat option displays data for next entry in DAC table. Repeat option causes ERROR lamp to go on if there are no more entries in DAC table.
Status	STATUS NO	TERMINAL	STATUS	Dynamic status of line or trunk is displayed, see table C for status codes. Print option causes printout of data currently displayed in following format: F-G-TN/TGN STAT X-X-XX XX Repeat option displays current dynamic status of selected line or trunk.
Traffic Meters	TRAFFIC METERS	CLASS CODE		
		01	TOTAL NARROWBAND	Indicates total narrowband calls completed from both lines and trunks. Includes operator-initiated calls, call extensions and conference calls (not including conference request).
		02	TOTAL NB PRIORITY CALLS	Indicates narrowband calls completed which were authorized priority precedence.
		03	TOTAL NB IMMEDIATE CALLS	Indicates narrowband calls completed which were authorized immediate precedence.
		04	TOTAL NB FLASH CALLS	Indicates narrowband calls completed which were authorized flash precedence.
		05	TOTAL NB FLASH OVERRIDE CALLS	indicates narrowband calls completed which were authorized flash override precedence.
		06	TOTAL WIDEBAND CALLS	Indicates total wideband calls completed from both lines and trunks. Includes extensions of wideband calls.
		07	TOTAL WB PRIORITY CALLS	Indicates wideband calls completed which were authorized priority precedence.
		08	TOTAL WB IMMEDIATE CALLS	Indicates wideband calls completed which were authorized immediate precedence.
		09	TOTAL WB FLASH CALLS	Indicates wideband calls completed which were authorized flash precedence.
		10	TOTAL WB FLASH OVERRIDE CALLS	Indicates wideband calls completed which were authorized flash override precedence.
		11	OPERIATOR ATTEMPTS	Indicates: number of attempts made to call operator.
		12	RECALL ATTEMPTS	Indicates: number of valid recalls, attempted.
		13	MANUAL INTERCEPT (IN/OUT) CALLS DAC	Indicates number of calls placed from non-terminals classmarked for operator intercept incoming, number of incoming calls from DC closure circuits-, and number of incoming calls directed to terminals classmarked for operator intercept outgoing (including calls to type B DAC).

Display requested	FUNCTION switch (step b)	Input data (step c)	Data displayed (step d)	Remarks
		14	OPERATOR COMPLETED	Indicates number of calls removed from operator queue and successfully connected to operator.
		15	ERROR INTERCEPT CALLS.............	Includes attempts to access nonexistent directory numbers, requests from trunks to route Autovon and SF commercial calls when the switchboard is not programmed for it, and wideband calls directed to a line or trunk not classmarked for wideband service.
		16	INFORMATION ATTENDANT .... ATTEMPTS	Indicates number of attempts de to call information attendants.
		17..........................	INFORMATION ATTENDANT .... COMPLETED	Indicates number of calls removed from information attendant's queue and successfully connected to information attendant.
		18	PROGRESSIVE CONFERENCE....... ATTEMPTS	Indicates authorized requests for progressive conference bridges.
		19	PROGRESSIVE CONFERENCE....... SEIZURES	Indicates number of times authorized progressive conference originators are successfully connected to progressive conference circuits.
		20	PREPROGRAMMED CONFER-......... ENCE ATTEMPTS	Indicates authorized requests for preprogrammed conferences.
		21	PREPROGRAMMED CONFER-......... ENCE SEIZURES	Indicates number of times authorized preprogrammed conference originators are successfully connected 9-party preprogrammed conference circuits.
				Repeat option causes sequential display of TRAFFIC METERS in order listed under Data Displayed column. Print option causes printout of meter currently displayed. Traffic meters are reset to zero when program is started.
Trunk Group Meters	TRK GR METERS	TRK GR NO CLASS CODE	50......TOTAL INCOMING CALLS	Indicates number of seizures received from trunks in groups.
			51......PRIMARY ROUTE AT-............. TEMPTS	Indicates number of attempts to route calls over trunk group as primary route.
			52......ALTERNATE ROUTE AT-......... TEMPTS	Indicates number of attempts to route calls over trunk group as alternate route.
			53......PREEMPTION ATTEMPTS	Indicates number of attempts to find preemptable or recently idle trunk in group.
			54......PREEMPTIONS COMPLETED.	Indicates number of times a preemptable or recently idle trunk is found for preempt attempts.
			55......PRIMARY ROUTE ATB'S..........	Indicates number of times trunk group is designated as primary route and no idle in-service trunks were available.
			56......ALTERNATE ROUTE ATB'S	Indicates number of times trunk group is designated as alternate route and no idle in-service trunks were available.
			57......MAINTENANCE	indicates number of times trunks m group are marked for maintenance routining. Includes number of times nonroutinable trunks are placed on lockout due to signaling error.
			58......LOCK OUT.................................	Indicates number of. times routinable trunks in group are placed on lockout due to unsuccessful maintenance routing Includes number of times nonroutinable trunks ae placed on lockout due to signaling error.

Display requested	FUNCTION switch (step b)	Input data (step c)	Data displayed (step d)	Remarks
				Repeat option causes sequential display Of TRUNK GR TRAFFIC meters in order listed under Data Displayed column, for a selected trunk group. You may not exercise the repeat option after the print option is used; ERROR lamp will go on. PrinWoption causes printout of meter currently displayed and all other meters for the selected trunk group.

3-12. FACP Print Procedure

Use this procedure in conjunction with the data in paragraph 3-13 to initiate printouts of selected tables. Printouts will occur at both local and remote page printers. The starting point for the printout of a table is determined by the data entered in step c. If the ERROR lamp goes on, check this data to insure that it falls within the allowable range for the parameter being entered.

a. Depress I/O COMMANDS-PRINT switch.

b. When READY lamp goes on, depress FUNCTION switch specified in paragraph 3-13 for the printout desired.

c. When field indicator lamp goes on, key in data specified in paragraph 3-13 for printout desired. This data determines the starting point of the printout and is subject to the restrictions listed in the remarks column of paragraph 3-13. Verify that displayed digits are correct, and depress CONTINUE switch.

d. When STORE lamp goes on, depress COMMAND STORE switch.

e. Observe printout at local and remote page printers as described in paragraph 3-13.

3-13. FACP and TTY Print Procedure Data

Printout requested	FUNCTION switch or TTY code (step b)	Input data (step c)	Data printed step e)	Remarks
Terminal Service	TERMINAL SERVICE or TMS	TERMINAL NO or F-G-TN=	See example 1.	Printout consists of assigned terminals from starting point determined by entered 4-digit terminal number (frame, group, and terminal number).
Directory number assignment	DIRECTORY NO ASGMT or DIR	DIR NO or DIR=	DIR TBL DIR F-G-TN 100 6-7-03 101 3.5-06 216 4-3-06 699 1.4-02 945 6-3-02 END TBL	Printout consists of local subscriber directory numbers and terminal assignments from starting point determined by entered directory number to end of table. Does not include unassigned numbers or JXX numbers assigned to trunk groups.
Trunk Group	TRK ORNO or TGN	TRK GR NO or TGN=	TRK GR TBL TGN F-GO-TN 001 5-1-10 001 5.2-01 034 2-2-02 034 2-2-03 END TBL	Printout consists of terminal numbers of all trunks listed by trunk groups from starting point determined by entered trunk group number. Only assigned trunk groups are printed. Terminal number order for any trunk group reflects order in which they were assigned.
PR routing	PR ROUTING or PRR	PRNO or PR=	PR RTG TBL PR FUNC PTG ATG 96 1 056 067 97 2 112 999 98 3 143 000 99 0 END TBL	Printout includes all routing information for each PR from starting point determined by entered PR number. Unassigned PR's are printed with function code of zero.

Printout requested	**FUNCTION switch or TTY code (step b)**	**Input data (step c)**	**Data printed step e)**	**Remarks**
SL muting	SL ROUTING or SLR	SL NO or SL=	SL RTG TBL SL FUNC PTGATG 00 0 02 2 023 067 04 1 21 3 056 057 87 2 016 017 99 2 024 116 END TBL	Printout includes all routing information for each SL from starting point determined by entered SL number. Unassigned SL's are not printed except requested SL is printed with function code of zero if unassigned.
Alternate SL routing	ALTN SL ROUTING or SLA	PR NO or PR=	ALTN SL TBL PR SLA FUNCPTG ATG 73 23 2 061 062 73 56 3 061 062 73 44 2 062 061 END TBL	Printout includes all alternate SL routing table entries for selected PR.
JXX routing	OP/JXX ROUTING or OPJ	DIR NO or DIR E (JXX only)	JXX RTG TBL JXX TGN 700 065 701 013 740 043 857 096 999 114 END TBL	Printout includes all JXX numbers in directory table which are routed to trunk group from starting point determined by entered JXX directory number.
Fixed directory routing	FIXED DIR ROUTING of FXD	FIXED DIR NO or FDN=	FDUL RTG TBL DIR NO PR-SL-XXX 00100 74-22-100 01100 83-67-100 46100 94-13-100 88100 83-51-100 END TBL or FDSL RTG TBL DIR NO PR-SL-XXX 70700 00-00-413 70701 81-27-000 70742 71.43.000 71853 00-00-621 END TBL	Printed is either the FDUL (fixed directory unit list) or FDSL (fixed directory subscriber list) table from the requested starting fixed directory number if assigned on the next assigned number. Table printed is determined by type of number entered. Procedure must be used twice to print both tables.
Preset Conference	PRST CONF ENTRY or PRC	CONF or CONF=	PRST CONF TBL CONF FUNC PR-SL- XXX/ NNX.XXXX 10 1 76-22-101 10 1 76-62-600 10 1 83-45-302 10 2 231-2463 10 2 231-2573 10 1 94-65-243 11 1 83-65-552 19 1 96-32-176 END TBL	Printout lists all preset conference list starting with the entered conference number.
Line Group	LINE GR ENTRY or LGR	LINE GR NO or LGN=	LINE GR TBL LGR RK F-G-TN DIR 01 1 1-2-06 621 01 2 4-6-07 623 01 3 5-1-03 622 01 4 6-2-05 627 02 1 2-4-05 434 30 4 3-5-01 201 END TRL	Printout lists all line group subscriber lists starting with the entered line group number. The order in which. each line group entry is printed indicates its order in the group.

Printout requested	**FUNCTION switch or TTY code (step b)**	**Input data (step c)**	**Data printed step e)**	**Remarks**
DAC routing	DAC ROUTING or DAC	TERMINAL NO or F-G-TN= (0000 for entire table)	DAC RTG TBL F-G-TN DAC NO/ CONF NO 4.2-05 72-43-602 4-8-09 11 3-1-05 87-22-324 2-7-10 357-2564 7-4-09 15 END TBL	Printout lists DAC subscribers and their corresponding called party (preset conference or subscriber) starting entered terminal number (frame, group, and terminal number). Each entry in the table is in the order in which it was programmed. To commence printing the table at any point other than at the beginning requires that a terminal number of a known DAC be entered. Otherwise the ERROR will go on. Key in 0000 to print entire table.
Traffic meter	TRAFFIC METERS or TFM	None	TRFC MTR TBL CODE COUNT 01 XXXXX 02 XXXXX 03 XXXXX 04 XXXXX 05 XXXXX 06 XXXXX 07 XXXXX 08 XXXXX 09 XXXXX 10 XXXXX 11 XXXXX 12 XXXXX 13 XXXXX 14 XXXXX 15 XXXXX 16 XXXXX 17 XXXXX 18 XXXXX 19 XXXXX 20 XXXXX 21 XXXXX END TBL	Printout lists contents of all switchboard traffic meters. See paragraph 3-11 or FACP TRAFFIC METERS plate for key to code.
Trunk group meters	TRK GR METERS or TGM	TRK GR NO or TGN =	See example 2.	Printout includes all traffic counts for all trunk group meters starting with entered trunks group number. Includes meters for unassigned trunk groups.

Example 1:

Terminal Service Printout.

```
TERM SVC TBL
   F-G-TN    TYPE CLASS    DIR     TGN CONF     MOD II     SPCKT     STAT     DAC NO
   1-1-01        00
   1-3-06     01    23     416     - - -  12     - - -       - -      01       - - -
   1-6-07     34    13     278     - - -  17     - - -       - -      01     74-22-163
   1-6-02     04    19     168     - - -  - -    - - -       - -      01     445-7126
   2-6-07     09    - -    - - -   016    - -    3-7-08      - -      01       - - -
END OF TBL
```

Example 2:

Trunk Group Meters Printout.

```
TRK GR MTR TBL

    TGN     -50-    -51-    -52-    -53-    -54-    -55-    -56.    -57-    -58-
    001     XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX
    002     XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX


    120     XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX    XXXX
END TBL
```

3-14. Displaying and Printing Status

There are several different procedures for displaying status (para 3-11) or printing out status (para 3-13). Use caution when interpreting the status reported because some methods report current dynamic status, while other methods report only gross status. The only way to display current dynamic status from the FACP is with a DISPLAY-STATUS command and function. The FACP print option can be used to print the current dynamic status. Lockout/out-of-service tables (para 5-21) also report current dynamic status. The detailed status displayed and printed distinguishes between terminals which are inservice and operating (status code 01) and terminals which are in-service but on lockout (status code 03). Status code 02 indicates that a terminal is marked out-of-service. All other displays, changes, and deletions which provide a status report, only report the gross status of the terminal. Gross status only indicates in-service (01) and out-of-service (02). Locked-out terminals are reported as in-service (01). Procedures which provide a gross status report include change terminal service, change terminal number assignment, change status, and display terminal service.

3-15. FACP Punch Procedures

Only three punch procedures are provided from the FACP. The first causes the entire program data base (current directory set) to be punched on paper tape. Selective punching of parts of the data base for reloading is not possible. The second and third procedures punch the content of the traffic counters in a format suitable for printing. The tape winder may be used when punching any of these tapes (para 3-16).

3-16. Tape Winding Procedure

(fig. 3-10)

To wind punched paper tape on a reel using the tape winder, obtain several feet of slack from the running end of the paper tape. Route the tape under the wall spindle, make one half turn of tape, under the tape stop arm and out of the tape reel. Rotate the tape reel counterclockwise by hand to secure tape to the reel. Take up the slack. Pull the brake lever out.

3-17. Punch Current Directory Set

Normally a current directory set tape should be punched using the maintenance control panel and the standby processor (para 2-18*o*). The punch and memory-to-memory channel should be marked out of service from the on-line processor (para 5-17). This prevents interruption of the punching by the on-line program. Use this procedure to punch the entire program data base from the on-line processor.

a. Depress I/O COMMANDS-PUNCH switch.

b. When READY lamp goes on, depress FUNCTION-TERMINAL SERVICE switch.

c. When STORE lamp goes on, depress COMMAND-STORE switch.

d. The entire program data base will be punched on tape in a format suitable only for use by the tape reader.

e. Verify tapes (para 5-19.1).

f. Mark punch and memory-to-memory channel in service from on line processor (para 517).

3-18. Punch Traffic Meters

Use this procedure to punch on paper tape the contents of the switchboard traffic meters.

a. Depress I/O COMMANDS-PUNCH switch.

b. When READY lamp goes on, depress FUNCTION-TRAFFIC METERS switch.

c. When STORE lamp goes on, depress COMMAND-STORE switch.

d. The contents of the switchboard traffic meters will be punched on tape in a format suitable for printing.

3-19. Punch Trunk Group Meters

Use this procedure to punch on paper tape the contents of either a selected trunk group's meters or the meters of all trunk groups.

a. Depress I/O COMMANDS-PUNCH switch.

b. When READY lamp goes on, depress FUNCTION-TRK GR METERS switch.

c. When STORE lamp goes on, depress COMMAND-STORE switch.

d. The contents of the selected trunk group meters will be punched on tape in a format suitable for printing.

3-20. Remote TTY Print Procedure

Use this procedure in conjunction with the data in paragraph 3-13 to initiate printouts of selected tables at the remote TTY or remote spare TTY. The printout occurs only at the teletype requesting it. Perform the access procedure (para 1-85c) to gain I/O access from the TTY before performing the TTY print procedure. The starting point for the printout of a table is determined by data entered in step c below. If ERR is printed to indicate an error, check the data entered in step c to insure that it falls within the allowable range for the parameter being entered.

a. Type CCC followed by PRT. Observe that CCC PRT is printed.

b. Type TTY function code specified in paragraph 3-13 for printout desired. Observe that switch responds by skipping space and printing function code.

c. When switch prints TTY field identifier code, type data specified in paragraph 3-13 for printout desired. This data determines the starting point of the printout and is subject to the restrictions listed in the remarks column of paragraph 3-13. Observe that data is printed.

d. When switch prints Z, type STR. Observe that STR $ STR is printed indicating receipt and execution of store command.

e. Observe printout at teletype as described in paragraph 3-13. To obtain a printout of single line of data at the teletype, request printout of table containing entry at the point of that entry in table. After entry is printed, type Z to terminate printout.

3-21. TTY Punch Procedure

The TTY print and punch commands are essentially the same command. The only difference is that the. punch command directs the program to punch the data on the paper tape punch in the assemblage. This allows a tape to be prepared for later transmission to one of the remote teletypes. Use the TTY punch procedure in conjunction with the data in paragraph 3-13 to initiate a punch of a selected table. Perform the access procedure (para 2-85 c) to gain I/O access from the TTY before performing the TTY punch procedure. If ERR is printed to indicate an error, check the data entered in step c to insure that it falls within the allowable range for the parameter being entered.

a. Type CCC followed by PCH. Observe that CCC PCH is printed.

b. Type TTY function code specified in paragraph 3-13 for punch desired. Observe that switch responds by skipping space and printing function code.

c. When switch prints TTY field identifier code, type data specified in paragraph 3-13 for punch desired. This data determines the starting point of the punch and is subject to the restrictions listed in the remarks column of paragraph 313. Observe that data is printed.

d. When switch prints Z, type STR. Observe that STR $ STR is printed, indicating receipt and execution of store command.

e. Data is now punched on paper tape punch in shelter.

3-22. Resetting Audible Alarms

a. General. Use these procedures to reset audible alarms on the power subsystem control panel and system status panel after maintenance personnel hare been notified about the alarm condition. Alarm lamps on the power subsystem control panel, system status panel, and operator position continue to signal the fault until corrective measures have been taken (para 5-7).

b. Power Subsystem Control Panel. One of the following lamps goes on when the audible alarm sounds: PHASE FAULT, CIRCUIT BREAKER FAULT, BATTERY CHARGER FAULT, OR BATTERY STORAGE FAULT. Depress illuminated indicator once to silence alarm.

c. System Status Panel. Depress AUDIO ALARM RESET to silence audible alarm.

3-23. Stopping Procedure for Shutdown

NOTE

Failure to halt processor before shutting off processor or memory power will interrupt memory and the program must be reloaded (para 2-18). Therefore, perform step a. below in the sequence shown.

a. Press NORMAL HALT on both maintenance control panels. Depress DC POWER ON switch. DC POWER ON lamp goes out. The following circuit breakers trip: DC CONTROL; DC/AC. INVERTERS 1 and 2; all DC-DC CONVERTERS circuit breakers.

b. Set MODE switch to OFF position. Audible alarm sounds, and PHASE FALUT lamp lights.

The following circuit breakers trip: BATTERY CHARGER and UTILITY OUTLETS.

c. Set FLUOR LIGHTS circuit breaker to OFF. Emergency incandescent lamps go on.

d. Set MAIN AC circuit breaker to OFF. Depress PHASE FAULT lamp and associated audible alarm goes off.

e. Set ON/OFF light switch near door to OFF. Emergency lamps go off.

3-24. Preparation for Movement

(fig. FO-2 and FO-3)

a. Check to insure that the dust brush, lantern, and hammer are in their proper location. Check that all equipment panels are in place and secured tightly with all screws.

b. Remove all patch cords and patch plugs from the patch panels and store them in the patch plug tester drawer and on front curbside wall.

c. Remove the punched paper tape from the paper tape winder, reader, and punch. Store all paper tape reels in the storage cabinet.

d. Remove the flexible chad box from the chad chute. Store the chad box and clamp in its proper location.

e. Remove the tape winder from vertical post 2 and secure in its stowage position.

f. Fasten the teleprinter print mechanism in place using wire or tape. Install printer and punch hardware marked "T" in figures FO-2 and FO-3.

WARNING

Be sure the 110 VAC supply is off by shutting off DC/AC INVERTERS 1 and 2 circuit breakers.

g. Disconnect the remote operator's position if supplied. Secure the unit in its case. Remote operator's position is shipped separately from assemblage.

h. Shut down the power as described in paragraph 3-23.

WARNING

Make certain external power is off.

i. Disconnect the stub end of power cable W300 from the power source. (When cable W299 is used, remove cable W299 by unplugging both ends.) Disconnect cable W300 from the shelter (if applicable). Fasten watertight covers on cable ends and on power entry connector J1. Roll cable W300 on the wire reel RC-435/U and store in proper position. Store cable W299 on reel RC-405 (FSN 8130-711-0537) and mount on generator or otherwise store separately from assemblage.

WARNING

Make certain external dc power is off.

j. Disconnect positive lead from dc power source if connected from POS E13 at power entry panel. Disconnect negative lead from NEG E14 at power entry panel.

k. Disconnect the ground strap from the ground rod. Remove the ground rod and store it under the airconditioner at the front of the assemblage. Remove the ground strap from the power entry panel terminal GND E2 and store it in the patch plug tester drawer (A22).

l. Fold down the dust cover over the airconditioner condenser coils and snap in place. Tighten straps.

m. Close battery exhaust vent cover and lock in place.

n. Remove signal cable plugs from signal entry panel. Secure connector covers in place. Close signal entrance panel cover and secure in place.

o. Secure accessory shelves, maintenance shelf and maintenance phone in their stowage position.

p. Fasten the operator's chairs in the center of the shelter floor and bolt in place.

q. Store dust brush, technical manuals, hammer, rotary card file, lantern, fire extinguisher, waste basket, axe, first aid kit.

r. Close and secure door vent cover and emergency fan vent cover.

s. Close and latch the entry door.

t. Store the boarding ladder on left-rear of shelter using the clamping bar to secure it.

u. Close the truck tail gate (when trunk mounted). Shelter is now ready for movement.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

3-25. Operation Under Extreme Environmental Conditions

The AN/TTC-38(V)1 and AN/TTC-38(V)2 are fully insulated and weather-proofed for operation in hot, cold, or moderate climates. The shelter facility provides complete protection from the elements for personnel and equipment; however, under extreme conditions, the following precautions are necessary:

a. Cold Climates. Extreme cold causes cables to become hard, brittle, and difficult to handle. Be careful when handling the cables and connecting them to the assemblage so that kinks and unnecessary loops will not result in permanent damage. Make sure that all connectors are free of frost, snow, and ice. Replace the covers on the receptacles, and close the entrance box covers when they are not in use. Open the hood shields and lower the covers when the entrance boxes are open. Replace the connector cover as soon as a cable is disconnected. Never drag or place an open connector in the snow.

NOTE

When starting up equipment in extreme cold, heater MIL-H-52641(ME) (FSN 4520-177-6198) may be used to speed warm-up. Use utility outlets in assemblage to power heater.

b. Hot Climates. In hot, dry climates, connectors, and receptacles are subject to damage from dust or dirt. Replace the covers on the connectors and the receptacles, and close the covers on entrance boxes when the entrance boxes are not in use. Never place an open connector on the ground.

c. Warm Damp Climates. In warm, damp climates, the equipment is subject to damage from moisture and fungi. Wipe all moisture and fungi from the equipment with a lint free cloth.

d. *Air Conditioner Failure*. If air conditioners fail, operate EMER FAN switch to ON.

3-26. Emergency Shutdown

NOTE

Use this procedure only for emergency. This procedure will interrupt memory and the program must be reloaded (para 2-18).

a. Press DC POWER ON.

b. Set MAIN AC circuit breaker to OFF.

3-27. Emergency Operation Using Internal Battey Bank

(table 3-1)

When ac prime power fails, the BATTERY CHARGER and UTILITY OUTLETS circuit breakers on the power subsystem control panel and the circuit breakers (CB5/A38 and CB6/A39) on the air conditioners trip to the off position. The CIRCUIT BREAKER FAULT, BATTERY CHARGER FAULT, and PHASE FAULT alarms go on, and the associated audible alarms sound. At the same time, the shelter fluorescent lights go off, and the emergency incandescent lights go on. Prepare for dc operation using internal battery bank as follows. These procedures allow you to operate one-hour in AN/TTC-38(V)1 or one-half hour in AN/TTC-38(V)2.

a. Set MODE switch to OFF. (Controls and indicators are on power subsystem control panel (FO-6) unless other wise stated.)

b. Depress BATTERY CHARGER FAULT, PHASE FAULT and CIRCUIT BREAKER FAULT switch to disable audible alarms. Lamps remain on.

c. MAJOR FAULT AC PWR alarm on system status panel (fig. 3-2) goes on and audio alarm sounds.

d. Depress AUDIO ALARM RESET switch on system status panel to disable audio alarm. MAJOR FAULT AC PWR lamp remains on.

c. Press NORMAL HALT switch to standby maintenance control panel (fig. 3-1).

f. Set DC-DC CONVERTERS circuit breaker (FO-6) for PROCESSOR/MEMORY which is on standby to OFF.

g. MAJOR FAULT DC PWR alarm on system status panel (fig. 3-2) goes on and audio alarm sounds.

h. Set NETWORK TERMINAL SUBSYSTEM BACK UP circuit breaker to off (FO-6).

i. Depress AUDIO ALARM RESET switch on system status panel (fig. 3-2) to disable audio alarm. MAJOR FAULT DC PWR lamp remains on.

j. Set EMER FAN switch to ON to turn on emergency fan (FO-6).

k. Low battery voltage sensor will shut down system automatically when battery voltage decreases below 21 vdc. All loads will be turned off except for emergency fan and incandescent light. Turn off fan by setting EMER FAN switch to OFF. Turn off lights by setting LIGHTS ON/OFF switch rear door to off.

Table 3-1. DC Power Consumption (Watts)

Equipment	Mode of operation			
	AN/TCC-38(V)1 normal	AN/TTX-38(V)1 normal	AN/TTC-38(V)2 normal	AN/TTC-38(V)2 normal
DC control and blowers	505.2	505.2	505.2	505.2
CCS dc-dc converters (PS-3-8)	1735.2	993.6	1735.2	993.6
NTS dc-dc converters (PS9.18) (300 lines)	2232.0	2112.0	2172.0	2052.0
NTS dc-dc converters (PS14-23) (add 300 lines)	0.0	0.0	1569.6	1596.6
Inverter, dc-ac (PS1)	465.6	465.6	465.6	465.6
Inverters, dc-ac (PS2)	520.8	400.8	520.8	400.8
Paper tape reader	96.0	0.0	0.0	96.0
Emergency fan	13.2	13.2	13.2	13.2
Emergency lights	98.4	98.4	98.4	98.4
Batteries	648.0	0.0	0.0	648.0
Total	6314.4	4588.8	7824.0	6098.4

3-28. Power Turn-On Using External DC Source

Perform power turn-on using an external dc source as follows:

a. Verify that EXTERNAL DC switch is set to OFF (FO-6).

CAUTION

Internal batteries must be disconnected before external dc power is connected. Damage to batteries, battery fuse or external dc generator may result.

b. Disconnect internal batteries by shutting BATTERY POWER circuit breaker off (FO-1).

c. Connect dc power cables to power entrance panel NEG E13, POS E14 dc terminal studs.

d. Set EXTERNAL DC switch to ON.

e. Perform the procedures in paragraph 3-27 to use external dc power.

CHAPTER 4

FUNCTIONING OF EQUIPMENT

Section I. AN/TTC-38(V)(*) SYSTEM

4-1. AN/TTC-38(V)(*) Block Diagram

(fig. FO-8)

a. The AN/TTC-38(V)(*) consists of three subsystems: the network terminal subsystem (NTS), the common control subsystem (CCS), and the power subsystem (PSS). The systems operate together to perform the automatic telephone switching functions of the AN/TTC-38(V)(*). The basic telephone interconnection, supervision, and signaling functions are executed by the network terminal subsystem. However, every step of call processing by the NTS is controlled by the operational program in the common control subsystem.

b. All field equipment (lines and trunks) is connected by cables to the signal entry panels. Standard signals are then routed through the patch panels to line terminals. Adapters can be patched into the circuit to handle nonstandard equipment. Scanners monitor the line terminals for supervisory requests and report the requests to the common control subsystem. All signals between the NTS and CCS flow through the distribution box. The matrix connects telephone field equipment circuits to other field equipment or to common equipment such as system bus ringers, sender/receivers, and conference bridges. The latter two devices are patched on the common equipment panel through service terminals to the matrix. Terminal status circuits monitor both line terminals and service terminals for busy status and report the status to the CCS. The path required to connect two devices is identified by the common control subsystem and sent to the matrix drivers. The drivers in turn close the appropriate crosspoint circuits in the matrix and make the path. Disconnect commands are sent from the CCS directly to the switching matrix which breaks the path.

c. All tones required, except 20 Hz, are generated by the tone sources. Tones are routed to the system bus ringers, sender/receivers, auxiliary sender/receivers, and adapters for use. The system bus ringers develop four ring signals (routine ring, priority ring, ringback, and seize or release trip). The matrix connects the bus ringers to terminals on command of the CCS. Senders gate various DTMF and single frequency tones selected by the CCS through the matrix to field equipment. Receivers detect incoming tones and report receipt of the tones to the CCS. The adapters gate tones to field equipment or to network terminals as required by the type of adapted nonstandard circuit. If the adapted circuit requires 20 Hz ringing the output of the 20 Hz ringer is also gated by the adapter. Common battery (CB) DTMF line terminals may be substituted for some of the standard SF/DC line terminals which are supplied with the AN/TTC-38. The CB DTMF line terminals route the 20 Hz ring to connected lines. The normal SF/DC line terminals do not use 20 Hz ringing.

d. The ANMTTC-38(V)(*) is capable of service by up to three operators. One operator position is permanently mounted within the assemblage. It is connected through the patch panel to line terminals and operates with NTS circuits much the same as normal lines and trunks. Remote operator positions (Switchboard Remote Control C-9438/TTC-38(V)) are functionally identical to the installed position. The remote positions are connected to the signal entry panel using field cable; signals are then routed to line terminals through the patch panels. The service telephone is patched through the common equipment panel and patch panel either to a line terminal or a field line. The LS-147C/FI is patched directly to a field line.

e. One of the processors in the common control subsystem is always connected to the network terminal subsystem by the control transfer relays. The control transfer logic determines which processor to connect based on control transfer switch settings, signals from each processor to the control transfer logic and programmed decisions. Each processor has a maintenance control panel for manual control. Each processor also has a separate memory which is used to store operational or diagnostic programs. The programs are loaded into memory from the punched tape reader through the device synchronizers. Device synchronizers control timing and allow timesharing of peripheral devices by both processors. Other peripheral devices in the assemblage are the punch and printer. Each is driven through a motor control which provides short duty cycle operation of device motors. Three other peripheral devices may be remotely located: remote teletype, spare remote teletvype, and remote printer. These devices may be direct (low level bipolar dc) connected or modem (fsk) connected. Common equipment panel patching and synchronizer switches determine the type of remote device connection. The functional assignment control (FACP) panel is also a peripheral device. It permits manual entry and display of various types of telephone directory and supervisory data into the operational program. The FACP contains a synchronizr and therefore it is directly connected to both processors. Signals from the processors and the power subsystem are routed through the alarm register to light alarm indicators on the system status panel.

4-2. Standard Subset Line-to-Line Calls

(figs. 4-1 and FO-8)

The following describes a typical simple call sequence from an ac supervised subset as handled by the NTS under control of the CCS. There are numerous optional sequences of events, such as busy and dialing errors, which are not covered. In all cases, the decision of tones to be sent or subsequent courses of action is made by the operational program which causes the N'I'S to perform functions similar to those described here.

a. Connect (fig. 4-1).

NOTE

Connection is similar for a dc supervised subset except that steps (5) through (8) are omitted.

(1) During the operation of the AN/TT(C-: 38(V)(*) a scan circuit is sequentially monitoring each of' the line terminals in the system.

(2) When a subscriber desires to make a call, he removes the handset from its cradle (off hook).

(3) This action causes a seize signal to be generated within the equipment and transmitted to the central office.

(4) The scan circuit recognizes the seize signal and transmits this data to the on-line CCS processor.

(5) The processor connects the line terminal associated with the calling party to the system ring bus through a matrix interconnection.

(6) The connection to the ring bus causes a seize trip signal to be transmitted to the calling party.

(7) The scan circuit which is constantly monitoring the terminal recognizes the removal of the seize signal and informs the on-line processor.

(8) When the seize signal is removed, the on-line processor disconnects the line terminal from the ring bus.

.(9) The processor then connects the line terminal through the matrix and a service terminal to a sender/receiver.

(10) The sender portion of the service terminal transmits dial tone to the calling party.

(11) Upon receipt of the dial tone, the calling party dials the first digit of the called party's number.

(12) Receipt of the first digit by the receiver portion of the sender/receiver causes the on-line processor to cease transmitting dial tone to the calling party.

(13) The calling party continues to dial the digits until the complete number is received by the on-line processor.

(14) The on-line processor recognizes that the digits are complete and disconnects the sender/receiver.

(15) The on-line processor connects both the calling party's line terminal and the called party's line terminal through the matrix to the ring buses.

(16) Ring is transmitted from the ring bus to the called party; and ringback tone is transmitted to the calling party.

(17) The scan circuit continues to monitor all lines and is alerted when the called party answers the call by lifting his handset.

(18) The raising of the handset results in a seize (ring trip) signal being transmitted from the called party to his line terminal which is being scanned.

(19) Upon detection of the seize (ring trip) signal, the on-line processor disconnects the ring bus from the called party and disconnects the ringback bus from the calling party.

(20) If the called party is an ac supervised subset, connect him to the ring bus.

(21) A seize (ring trip) trip signal is transmitted to the called party to cause the seize signal to be removed.

(22) The scan circuit recognizes the loss of seize tone from the line and informs the on-line processor.

	CALLING PARTY	AN/TTC-38(V) (*)	CALLED PARTY
(1)		SCAN	
(2)	OFF HOOK	SCAN	
(3)	SEIZE	SCAN	
(4)		RECEIVE SEIZE	
(5)		CONNECT TO SYSTEM RINGBUS	
(6)		SEIZE TRIP	
(7)	DISCONTINUE SEIZE	SCAN DETECTS NO SEIZE	
(8)		DISCONNECT SEIZE TRIP	
(9)		CONNECT TO SENDER/RECEIVER	
(10)		DIAL TONE	
(11)	KEY FIRST DIGIT		
	SEND DTMF SIGNALS	RECEIVE DIGIT	
(12)		STOP DIAL TONE	
(13)	KEY REMAINING DIGITS (DTMF)	RECEIVE DIGITS	
(14)		DISCONNECT SENDER/RECEIVER	
(15)		CONNECT RINGBUS	
(16)		RINGBACK	RING No
(17)		SCAN	OFF HOOK
(18)		SCAN	4 SEIZE
(19)		DISCONNECT RING/RINGBACK	
(20)		CONNECT RINGBUS	
(21)		SEIZE TRIP	-
(22)		SCAN DETECTS NO SEIZE	DISCONTINUE SEIZE
(23)		DISCONNECT SEIZE TRIP	
(24)		CONNECT TERM TO TERM	
(25)	TRANSMIT AND RECEIVE VOICE		TRANSMIT AND
		RECEIVE VOICE	
(26)		SCAN	

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Figure 4-1. Connecting a standard line-to-line call

(23) The on-line processor disconnects the seize (ring trip) trip signal from the called party.

(24) The on-line processor then connects both the calling and called parties together by connecting their inlet and outlet circuits through the matrix.

(25) Both the calling party and the called party are able to communicate.

(26) The scan circuit continues to monitor the lines for eventual release or other supervisory requests.

b. Disconnect (fig. 4-2). This scanner circuit is constantly monitoring all line terminals in the NTS. When a call is in process, the circuit is monitored for the presence of release tone. The release sequence for an ac supervised subset is as follows: (1) The scan circuit searches each line terminal fior the presence of 2600 Hz release tone.

(2) When the phone is placed on-hook, the release tone is generated at the subscriber's equipment and transmitted to the AN/TTC-38(V)(*).

(3) The scanner circuit detects the release tone and informs the CCS which then disconnects the terminal-to-terminal matrix connection.

(4) Both parties are connected to individual sender/receivers for supervisory purposes.

(5) A test is made to determine which party, (calling or called) originated the release tone. (When this is determined, see steps (6) through (10). The other connection is described in steps (11) through (21).) (6) When it is determined which party originated the release tone, the sender/receiver circuit is disconnected from that line terminal.

(7) The line terminal is connected, to the ring bus.

(8) A release trip signal is transmitted to the phone.

	FIRST PARTY ON HOOK	AN/ TC-38(V)(*)	SECOND PARTY ON-HOOK
(1)		SCAN	
(2)	ON HOOK RELEASE-	SCAN	
(3)		DISCONNECT TERM-TERM	
(4)		CONNECT SENDER/RECEIVERS (2)	
(5)		DETERMINE ON-HOOK (OPTION TO (11II))	
(6)		DISCONNECT SENDER/RECEIVERS	
(7)		CONNECT RING BUS (TRIP) TO ON-HOOK PHONE	
(8)		RELEASE TRIP	
(9)	DISCONTINUE RELEASE	SCAN DETECTS NO RELEASE	
(10)		DISCONNECT RELEASE TRIP	
(11)		SCAN	
(12)		NO RELEASE DETECTED	BUSY TONE 110 SEC MAX)
(13)		NO RELEASE DETECTED MARK LOCKOUT	ERROR TONE (60 SEC MAX)
(14)		SCAN	ON HOOK
(15)		SCAN	RELEASE
(16)		DISCONNECT SENDER/RECEIVER	
(17)		CONNECT RING BUS(TRIP)	
(18)		RELEASE TRIP s	
(19)		SCAN DETECTS NO RELEASE	DISCONTINUE RELEASE
(20)		DISCONNECT TRIP BUS	
(21)		CAN	EL 5805-628-12-TM-135

Figure 4-2. Disconnecting a standard line-to-line call

(9) The scan circuit monitors the line until the release signal disappears.

(10) The line terminal is disconnected from the ring bus and the call is complete.

(11) The line circuit containing the party which had not gone on-hook is constantly being scanned by the scan circuit.

(12) The sender/receiver transmits a busy tone for 10 seconds to this phone.

(13) If a release tone is not scanned within the 10 second interval, an error tone is transmitted from the sender/receiver for a period of 60 seconds. After 60 seconds the line is marked on lockout. No calls can be sent to this off-hook phone until it sends release to the central office.

(14) The scan circuit continues to monitor the circuit for an on-hook condition.

(15) When the phone is placed on-hook, the scan circuit detects a release tone.

(16) The line circuit is disconnected from the sender/receiver.

(17) The line circuit is connected to the ring bus.

(18) A release trip signal is transmitted to the phone.

(19) The phone, upon receipt of the release trip tone, discontinues the release tone.

(20) When the scan circuit no longer detects the release tone the line circuit is disconnected from the ring bus.

(21) The scan circuit continues to monitor all lines.

4-3. System Trunking

(fig. 4-3)

a. The communication network is divided into areas (PR), switchboards (SL) and subscriber lines (IXX, JXX). The basic numbering plan reflects this division and is shown below.

PR	Primary area	70-98
PR	Roving user prefix	99
SL	Switchboard locator....	00-99
IXX	3-digit subscriber (used-alone for abbreviated keying).	100-699 (see note)

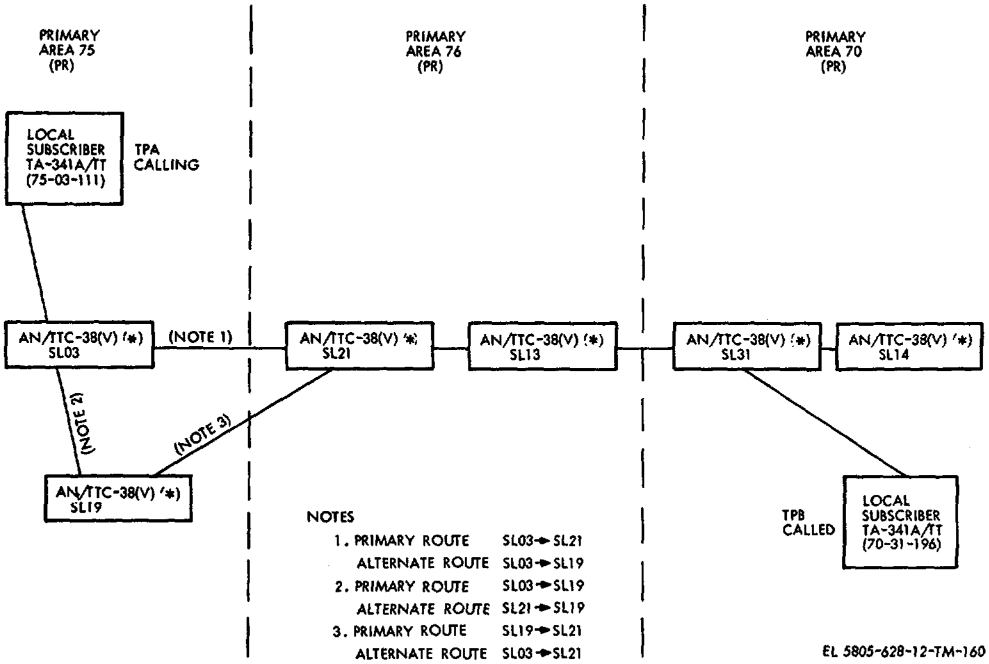

Figure 4-3. Typical trunk call, block diagram.

NOTE

The codes 1XCX = 0, 1,---, 9 are used for pre-programmed conference calls.

0	Local operator	0
OXX	Remote operator (preceded by PR-SL).	000-099
JXX	Switchboard or subscriber (cannot be used for abbreviated keying)	700-999
PXJXY	Fixed directory subscriber	7070Y-9999Y Y = 0-3
XXIXX	Fixed directory unit	00100-99699

b. All switchboards are connected together either directly or indirectly through tandem offices. Any switchboard can be utilized as a tandem office. Calls between switchboards normally have a primary route and an alternate route. This routing is assigned as part of the initial network configuration. For types of equipment to be connected in the system, see technical characteristics, paragraph 1-7c. See also FACP trunk assignments (para 2-14).

c. Any route consists of one or more trunks in a trunk group which interconnect two switchboards.

Each trunk appearance at the switchboard uses a line terminal and perhaps an adapter. Within the operational program, the trunk is identified by its frame, group, and terminal number (4 digits); its terminal type (2 digits from table 2-3); and its trunk group number (3 digits). Also within the operational program is a PR table. This table lists all primary area codes (2 digits), each containing a function code (1 digit). The function code indicates whether the PR is home (local) or foreign; and if foreign, whether there is a primary route only or a primary route and an alternate route. When an alternate route is available, the table contains a 3-digit trunk group number associated with the alternate route. The same type of table data is provided for the switchboard location (SL), i.e.: 2-digit SL, 2-digit function code, 3-digit trunk group, and (optionally) 3-digit alternate trunk group number.

d. Although all calls can be connected by the subscriber dialing all seven digits (and precedence code if subscriber has one), local IXX calls (within the home switchboard) need only dial precedence (if any) and the last three digits to complete the call. Most trunk calls require seven digits preceded by a precedence digit. Note, if the call does not have precedence, the ROUTINE precedence digit is generated. The switchboard may receive these digits through confirmation signaling or tone burst signaling. Whichever method is used, the transfer of tone data must be synchronized between switchboards. Confirmation signaling is described in h below, and tone burst signaling is described in i and j below.

e. Each switchboard involved in routing a call operates in the manner prescribed by the-decoding of the incoming trunk termination type code (c above, para 2-14, and table 2-3). Both the type of signaling and whether the office functions as an originating office or noncontrolling tandem office are indicated in the termination type code. In table 2-3, the terms originating office control and progressive office control termination type codes indicate respectively that incoming trunk calls must be processed as the digit groups arrive, or must be processed after all digits are received. Tone burst signaling always results in progressive office control, since the nature of tone burst signaling demands that the receiving office function in that manner.

f. In figure 4-3, assume a call is to be placed from subscriber 75-03-111 (TPA) to subscriber 70-31196 (TPB). TPA transmits the trunk precedence digit and all seven digits to central office SL03. Upon receipt of all digits, SL03 examines the PR digits. In this case, the called number is found to be foreign (out of this area). The foreign PR number is examined and a primary trunk group number is obtained and a trunk seized. When all trunks in the primary trunk group are busy, an alternate route is used. In either case, the call, precedence, and 7 digits are extended to SL21. Assume that a primary route trunk was available. Either SL03 or SL21 may be a controlling office. This is classmarked for the trunk. Assume that at SL21 the termination type code on the incoming trunk is 13. Thus SL21 will be a controlling office. In this event, all digits are requested from SL03. Then at SL03, because all digits have been forward, it extends the connection through itself so that TPA is connected to SL21. At SL21, the first 2 digits are examined and, in the call being described, it recognizes that the PR number (70) is foreign. As such, it selects the route and seizes a trunk to SL13. The digits are transferred from SL21 to SL13 where once again the first two digits are examined. Assuming this is a noncontrolling tandem office, SL13 locates a trunk to SL31 and seizes the trunk. Then, SL13 completes the call through its network and disassociates itself from the call. Assume that SL31 is a controlling office. Then, it transmits a restart signal back to SL21. All digits are transferred from SL21 to SL31. SL21 connects the trunk through and disassociates itself from the call. At SL31, the PR digits are examined and are found to be home. Then, the SL digits are examined and are also found to be home. (If the SL number were 14, the call would be extended to SL14 and the call would be processed at SL14.) The last three digits are processed in SL31 and the telephone 70-31-196 is rung (if idle). SL31 also sends ringback to the calling party. The voice path is connected by SL31 when the called party, TPB, answers. At this time, SL31 switches the call through.

g. The priority for transfer of data between switchboards is accomplished as a result of precedence assigned by the calling party. It is necessary that the calling party key in precedence if he wants it and is cleared for it. Precedence information is determined at the home switchboard. Thus when a call is being made, the precedence code is transmitted before the telephone number whether it be requested or assigned. As a result, a minimum of eight digits are transmitted between offices. However, the trunk precedence digits are decoded as precedence and are not confused with the directory number.

h. Confirmation signaling (fig. 4-4) is the process of receiving one signaling digit at a time and verifying its receipt by returning a complement of the digit; then, receiving an interdigit and verifying the interdigit with a proceed or restart signal.

Signaling tone frequency (Hz)	Confirmation tone (complement) (Hz)
697	941
770	852
852	770
941	697
1209	1633
1336	1477
1477	1336
1633	1209

e.g., 697/1336 has confirmation digit 941/1477.

(1) All switchboards are constantly scanning the terminals for service. When calling switchboard SLA desires a trunk, a 2250-Hz seize signal is transmitted to called switchboard SLB where it is scanned.

(2) SLB detects the seize signal and inspects the classmark (termination type) of the incoming trunk to determine the sequence of operation to be followed in servicing the incoming call.

(3) A seize acknowledge signal (also called restart) of' 825/1209 Hz is returned to SLA.

(4) Upon receipt of the seize acknowledge the first digit is transmitted to SLB. This will be a digit representing the precedence code.

(5) The digit complement is returned to SLA to indicate that the digit has been received.

(6) At this time an interdigit is transmitted to SLB for the purpose of removing the digit complement. This is necessary to insure that when two successive numbers of the same" value have been transmitted that the returning digit complement is indeed applicable to the digit just received and not a carryover from the previous digit.

(7) SLB transmits the proceed tone. This tone may be delayed in being transmitted, giving the SLB processor time to examine the digit or digits received.

(8) Upon receipt of the proceed tone, SLA transmits the next digit,.

(9) The digit complement is sent to SLA indicating the receipt of the digit.

(10) The interdigit is transmitted to SLB to clear the complement tone.

(11) The proceed signal is returned to SLA. Each of the following digits to be transferred follows the same procedure.

(12) When the last digit is transmitted, SLB is aware of the number of digits it has received.

(13) The digit complement is returned to SLA to complete the sequence for SLB.

(14) The interdigit is returned to SLB and SLB removes the digit complement. Since this is the last digit, the proceed signal is not returned.

(15) The processor in SLB processes the received digits. If SLB were a noncontrolling tandem office, either the receipt of the PR or SL digits would be enough to process the call and the proceed signal would not be returned by SLB to SLA. Instead, SLB would determine which outgoing trunk to use and would send a seize signal to SLC. SLC would detect the seize and return restart (seize acknowledge). SLB would detect the restart, stop sending seize, and cut' through the connection from SLA to SLC. SLA would detect the restart signal and would begin transmitting digits from the beginning, starting with the precedence digit, in the same way as it had done with SLB.

i. Tone burst signaling differs from confirmation signaling in that once the digits are transmitted, all digits are transmitted sequentially at the rate of 70millisecond tone and 70-millisecond null periods. There is no digit-by-digit confirmation from the called office. On 7-digit tone burst trunks (described below), the last digit is followed by an interdigit, signaling the end of transmission. The interdigit is not used on incoming 3-digit tone burst trunks (j below), but is used on outgoing 3-digit tone burst trunks (described below). Figure 4-5 illustrates the signaling sequence for 7-digit incoming/outgoing trunks and 3-digit outgoing trunks (from AN/TCC-38(V)(*).

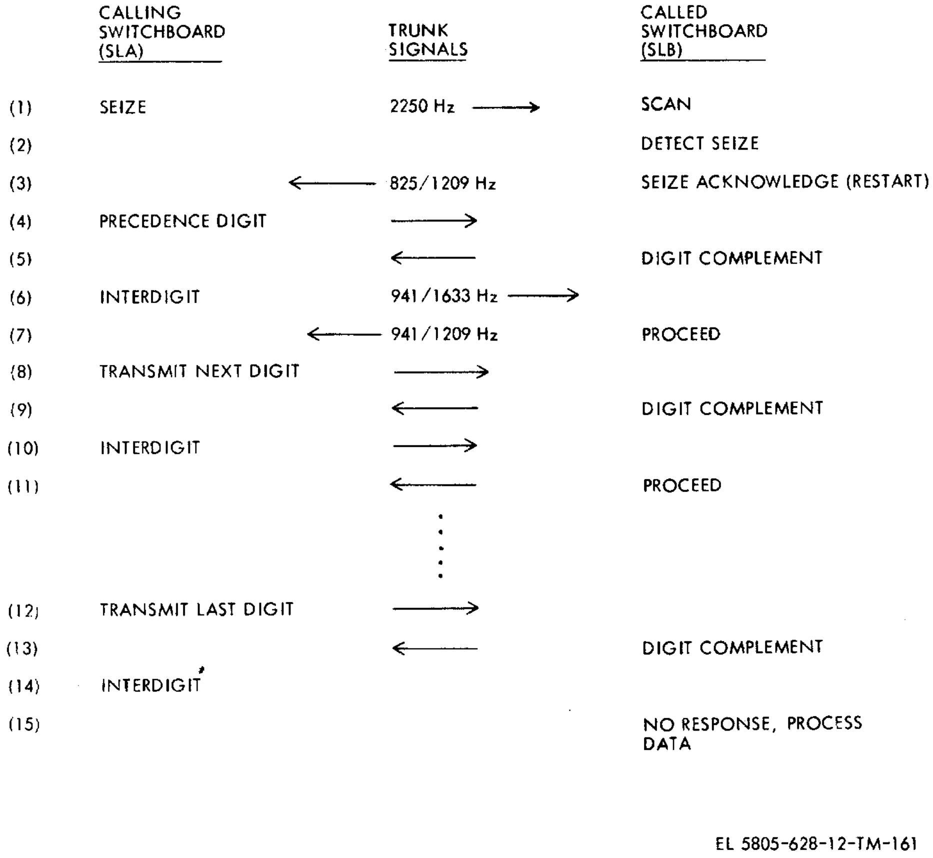

Figure 4-4. Confirmation signaling

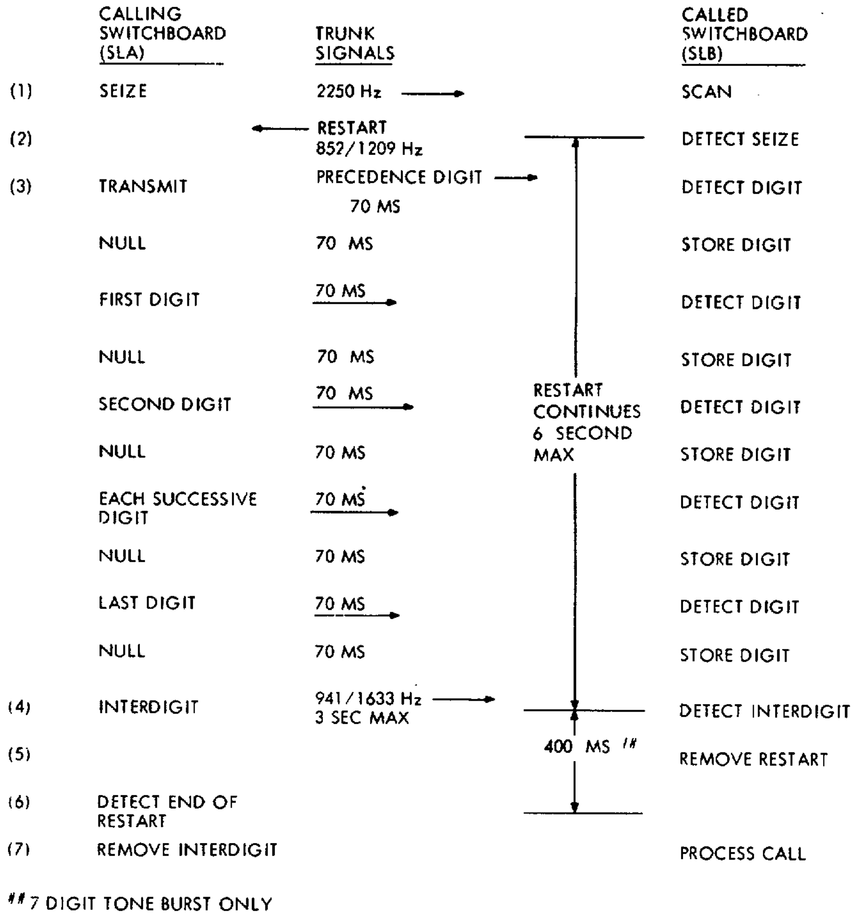

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Figure 4-5. Seven-digit and three-digit outgoing tone burst signaling

(1) When a call is to be extended, SLA transmits a 2250-Hz seize tone to SLB which is scanning all lines and trunks for service.

(2) When SLB detects the seize signal, it transmits a restart signal of 852/1209 Hz to SLA.

(3) SLA transmits all digits, including precedence.

(4) When all digits have been transmitted, the last tone to be transmitted is the interdigit tone (941/1633 Hz).

(5) The interdigit tone will last for 3 seconds maximum, but the restart signal is removed by SLB when the interdigit tone is received.

(6) The removal of the restart signal is detected by SLA and must be detected within 400 milliseconds from the transmission of the interdigit on the 7-digit tone burst trunk and 3-digit satellite trunk.

(7) When the restart signal is removed and detected by SLA, the interdigit is removed, and SLB processes the call.

NOTE

Fault messages are printed when sequences exceed the programmed time limit.

j. Figure 4-6 illustrates the seize and signaling sequence for 3-digit tone bursts incoming to the AN-TTC-38(V)(*). The sequence is described below.

(1) A seize signal of 2250 Hz is transmitted from SLA and detected at SLB.

(2) SLB transmits a 570-Hz seize acknowledge signal to SLA where it is detected.

(3) SLA removes the seize tone. The removal of seize tone causes SLB to sustain the seize acknowledge signal for 250 milliseconds before it is removed.

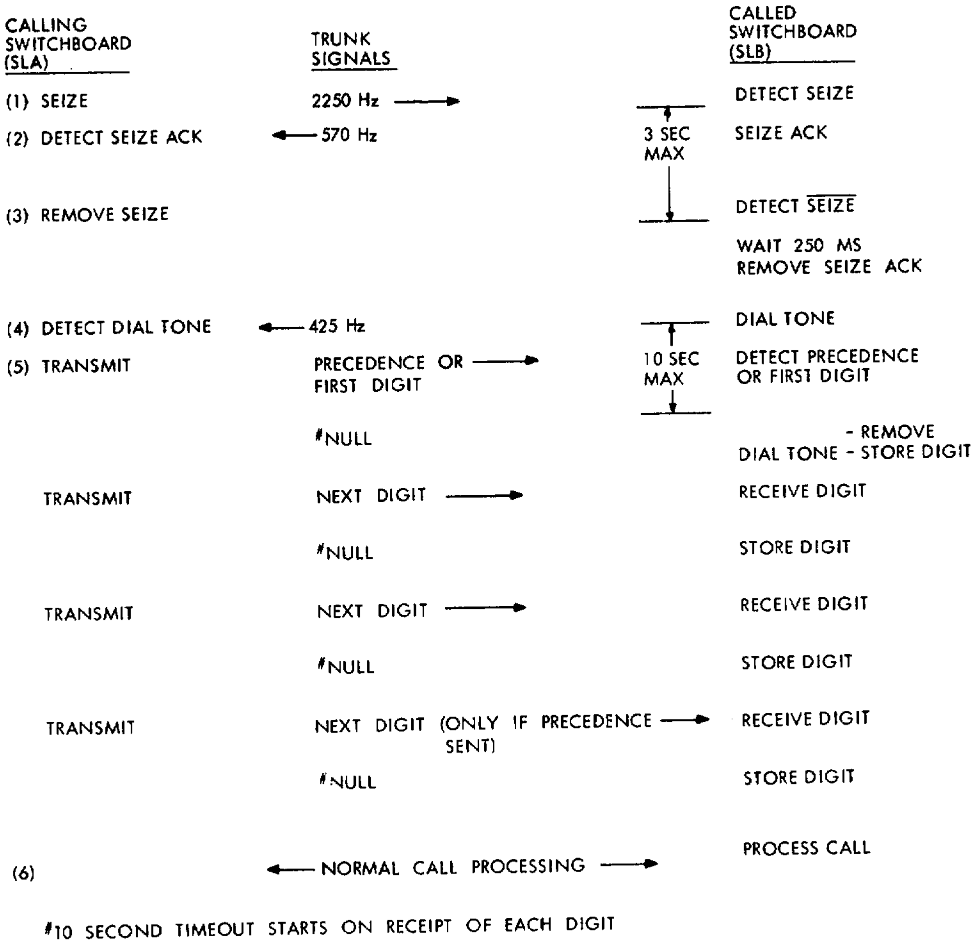

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Figure 4-6. Incoming three-digit tone burst signaling

(4) Dial tone (425 Hz) is transmitted to SLA indicating SLB is ready to receive digits.

(5) SLA transmits its data in tone burst fashion; i.e., 70 ms tone and 70 ms null. When SLB receives the first digit, dial tone is removed. Each digit is stored at SLB when it is received. Precedence digits are the first two digits received.

(6) SLB maintains count of the incoming digits and processes the call when all digits have been received.

4-4. Wideband Functions (fig. 4-7)

a. Wideband operation is used for transmitting digital data at frequencies of up to 50 kilobaud through the AN/TCC-38(V)(*). This is accomplished in two modes: MODE I-4-wire single circuit transmission; MODE II-8-wire dual circuit transmission. The wideband circuit may be a terminating line or trunk. In either case any combination of line or trunk or MODE I or MODE II operations can be interconnected through the switchboard.

b. MODE I operation is a single wideband frequency path through the switchboard where both audio and digital data use the same path alternately. MODE II operation consists of two separate transmission paths through the switchboard, one path is used for audio and the other path is used for transmission of digital data. In MODE II operation, once the digital data path is connected, the audio path is released. This means that no recall is possible. Both ends must terminate transmission and reestablish the connection if audio is desired.

c. The trunking through the communications network is accomplished in the same manner as any other trunk call and can use either confirmation trunks or tone burst trunks to establish the connec-

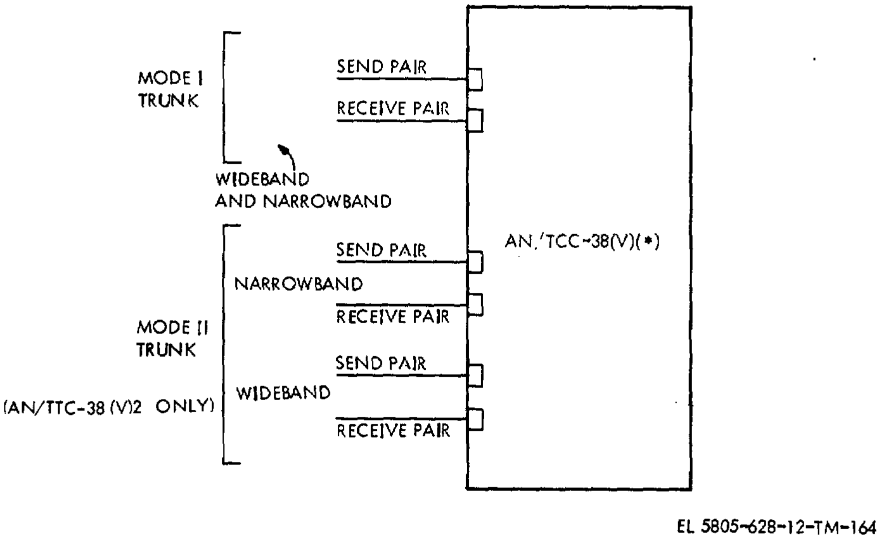


Figure 4-7. Wideband terminations

tion. The calling party must use an access code of R6. Failure of the called party to have a wideband access classmark results in error tone being returned to the caller or intercept operator.

d. Once the audio path is established for MODE I or MODE II operation, conversation can take place. To transfer to wideband operation, in either mode, the R key is depressed for about 2 seconds, or until a tone response is heard. One or both R keys may be depressed. The R tones are detected by all switchboards through which the path is connected; the wideband path is then connected. For MODE I operation the original path remains as the wideband path.

e. Release of a wideband connection is similar to any other connection with the exception that preempt tone is used in place of busy and error tone.

4-5. Common Battery DTMF Call Processing

The CB DTMF call processing sequence differs from the SF/DC call processing in that the methods of seize detection and ringing are different. The description of the call initiation and release of this type call (CB DTMF calling CB DTMF) is described below. It is assumed that a normal condition exists and the call is completed.

a. *Normal Connect* (fig. 4-8)

(1) The scan circuit is constantly monitoring all line terminals sequentially.

(2) When a CB DTMF phone is raised off-hook, a dc path is completed to the telephone from the line circuit.

(3) The AN/TTC-38(V)(*) detects the dc seize signal and informs the on-line processor.

NOTE

This is accomplished by converting the dc closure to dc seize in the DTMF terminal card. The dc seize is then detected by the scanner.

(4) The processor connects a sender/receiver to the calling line.

(5) The sender transmits dial tone to the calling party.

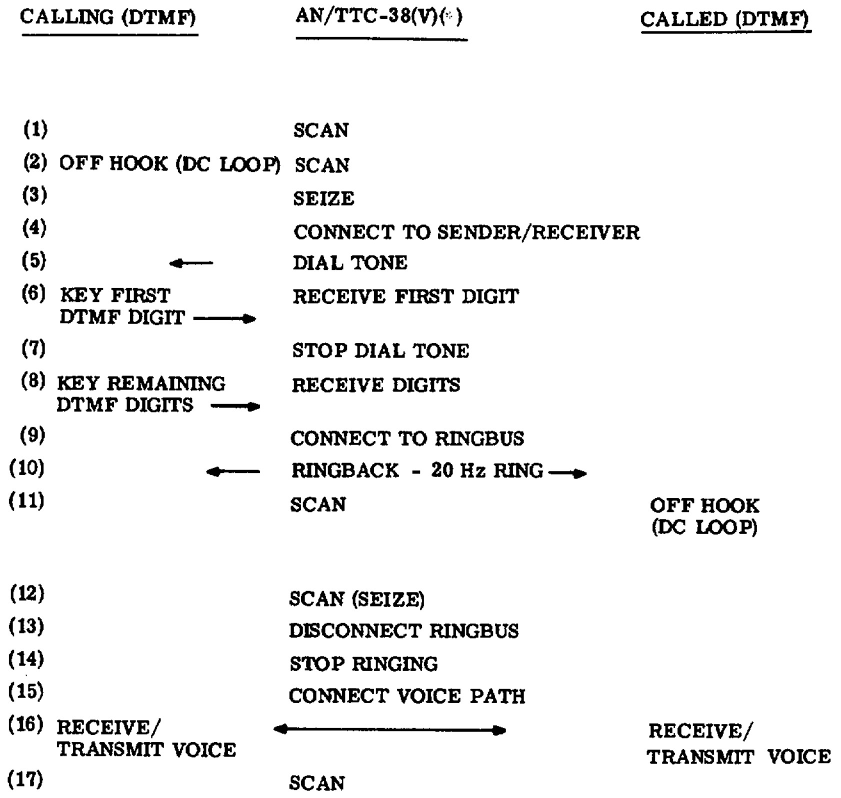
(6) Upon receipt of the dial tone, the calling party keys in the first digit. This is detected by the receiver portion of the sender/receiver circuit.

(7) The on-line processor discontinues the sending of the dial tone from the sender.

(8) The calling party continues to key in the digits until all digits are received. This is recognized by the processor program.

(9) At this time, the calling party's line terminal is connected to the ringbus through the matrix.

(10) The ringback tone is transmitted to the calling party from the ringbus. At the same time, the called party's line terminal is addressed by the processor and 20-Hz ringing current is extended from the line terminal to the called line.



EL 5805-628-12-TM-165

Figure 4-8. Connecting CB DTMF call

(11) The scan circuit monitors the calling party's line to insure the seize signal is present and monitors the called party's line for presence of the dc seize condition. When the called party answers, a dc loop is completed.

(12) The dc closure circuit causes the dc seize signal to be generated in the line terminal. When the scan circuit detects the seize signal, it notifies the online processor.

(13) The on-line processor disconnects the calling line from the ring bus. This removes the ringback tone from the calling party's line and frees the line terminal from the matrix connection.

(14) The called line terminal is addressed by the processor and the ring current disconnected. This removes the ringing current from the called line.

(15) The on-line processor connects both the calling and called party's lines through the matrix.

(16) Both parties are able to talk. Transmission battery is supplied to them from their individual line terminals.

(17) The scan control circuit continues to monitor the line terminals. The loss of the dc signal indicates an on-hook condition.

b. Disconnect (fig. 4-9)

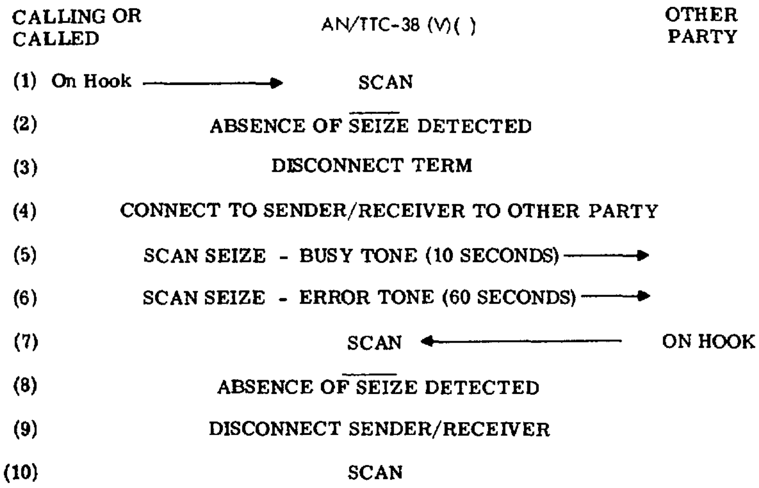
(1) When either party hangs up, the dc loop to the DTMF line terminal is opened. This removes the seize mark from the scan circuit.

(2) The scan circuit scans this line and reports to the on-line processor that the seize signal is gone. This indicates a disconnect signal.

(3) The on-line processor disconnects the terminal-to-terminal connection.

(4) The program in the processor identifies the origin of the on-hook station by the scan address and connects the line terminal of the other party to a sender/receiver.

(5) The busy tone is transmitted to the off-hook line terminal for 10 seconds or until he goes on-hook. Meanwhile, the line is constantly scanned for seize tone.



EL 5805-628-12-TM-166

Figure 4-9. Disconnecting CB DTMF call

(6) If seize tone is still present after 10 seconds, the on-line processor causes the busy tone to be replaced with error tone. This will last for 60 seconds unless the party hangs up.

(7) When the party hangs up, the dc loop to the line terminal is opened.

(8) The loss of the dc loop causes the seize mark to be removed from the scan circuit. The scan circuit informs the on-line processor of the condition.

(9) The on-line processor disconnects the line terminal from the sender/receiver circuit, and the call is complete.

(10) The scan circuit continues to monitor all line terminals.

4-6. Nonstandard Lines and Trunks

Calls being extended through the AN/TTC-38(V)(*) from nonstandard lines or trunks are interfaced with the switchboard through adapter circuits. Paragraph 1-7 describes the adapter circuits and lists the nonstandard equipment with which they are associated. A description of the sequencing of calls through the adapter circuits is described in paragraph 4-12.

4-7. On-Line Operational Program Modes (fig. 4-10)

The on-line operational program operates in two modes: the short loop and the long loop. In the short loop, the program performs only basic input/output, maintenance, and processor self-check functions. In 4-12 the long loop, the program also performs line supervision and call processing.

a. Short Loop Mode. The short loop mode is normally limited to the standby processor, but it can be used in the on-line processor. The on-line processor is always placed in the short loop mode before it enters the call processing mode. In the short loop mode, the program performs processor, address decoder, and error group exercises not requiring the network. All processor and input/output operations not requiring the network can also be performed. In addition, special network exercises can be requested from the maintenance control panel in this mode if the processor is on-line (connected to the network). The processor enters the short loop mode whenever a program start-up (para 2-18l) is performed. It can be returned to the short loop mode from the long loop mode by entering function code 02 (para 5-14). One of the options available in the short loop mode is the full exercise option. This option is used only when the processor is connected to the network. It allows automatic programmed network exercises to be-performed. This option is selected by entering function code 01 with bit 23 of the ADDRESS SWITCH REGISTER set to 0 (para 5-13).

b. Long Loop Mode. The long loop or call processing mode provides call processing with full exercise operation. It is the standard on-line mode. The on-line processor is switched from the short loop mode to the long loop mode (including full exercise) by entering function code 03 (para 2-18p). The program enters the long loop mode automatically if it is switched from standby to on-line by the control transfer logic. One of the options available in the long loop mode is

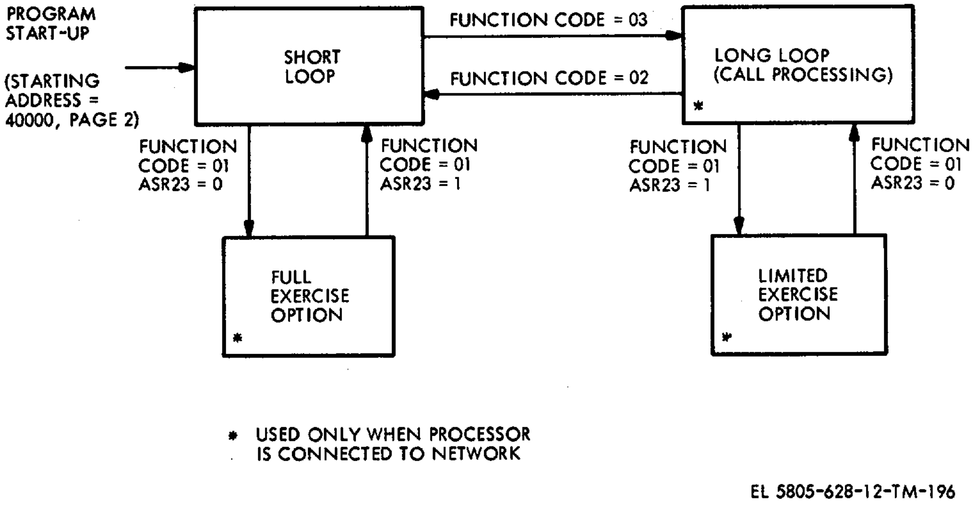


Figure 4-10. On-line operational program modes

the limited exercise option. This option is used to limit the exercises performed by the processor to those normally performed in the short loop mode. Call processing is not affected. This option is selected by entering function code 01 with bit 23 of the ADDRESS SWITCH REGISTER set to 1 (para 5-13).

c. Control transfer. The on-line processor can be operated in either of the two modes; the standby processor can be operated only in the short loop mode. When an automatic or manual control transfer occurs (para 4-31), the standby processor is connected to the network and enters the long loop mode automatically. At the same time, the on-line processor is disconnected from the network and halts. A program start-up (para 2-18p) is required to place it on standby and in the short loop mode. Therefore, the processor selected to be on-line is generally connected to the network before the program start-up procedure is performed at either processor. This is accomplished by depressing the CONTROL TRANSFER MANUAL switch and monitoring CPS23 at the selected processor (para 2-18k).

Section II. NETWORK TERMINAL SUBSYSTEM

4-8. Scanning

Scanning is the process whereby the central office periodically checks the status of supervisory signals at line terminals. Service terminals used to connect sender/receivers and conference bridges to the matrix are not scanned. Scanned terminals are checked by the CCS for the presence of seize and release signals approximately every 200 milliseconds. These signals include dc seize, 2250-Hz seize tone, and 2600-Hz release tone. Tones associated with telephones, the R (recall: 941 and 1209 Hz) and C (conference: 941 and 1477 Hz) keys are checked every 600 milliseconds and reported to the common control subsystem. All 300 or 600 terminals of the central office are always scanned in this manner, even though a terminal may be unassigned or out of service. The operational program determines the appropriate action to be taken when supervisory signals are received. Each group of line terminals has a scanning circuit associated with it. The scanning circuit consists of 'two cards: the scan receiver and the scan detector. Each four scanning circuits are controlled by one scan control logic card. This provides two scan control cards per frame.

a. Scanning Order. The general scheme of scanning is under the control of the operational program. The sequence of scanning is as follows:

(1) All like numbered terminals in the central office are connected to the scanners; e.g., terminal number 1 in all groups and frames.

(2) The dc seize signal status for these terminals in frames 1 through 4 is reported to the CCS over the signaling buffer register buses.

(3) 2250-Hz seize for frames 1 through 4 is reported.

(4) 2600-Hz release for frames 1 through 4 is reported.

(5) Every third scan 941 Hz for frames 1 through 4 is reported.

(6) Every third scan 1209 Hz for frames 1 through 4 is reported.

(7) Every third scan 1477 Hz for frames 1 through 4 is reported.

(8) In the AN/TTC-38(V) 2 the six signals (steps (2) through (7) are next reported for frames 5 through 8.

(9) The next terminal number in all groups is then connected and reported in accordance with steps (2) through (8).

(10) The scanning process continues until all terminals have been connected and reported. The operational program then repeats the sequence.

b. Signal Flow Diagram. Figure FO-9 shows how scanner signals flow through a typical path. Specific card reference designators, pin numbers and signals associated with frame 1, group 1, and terminal number 1 are used in this example. To use this diagram for other terminals, refer to the terminal matrix assembly card map (fig. FO-36) for card reference designators, pin numbers and refer to the following tables for address and bus organization.

(1) *Scanned signal selection*.

Outlet address register signal outlet terminal no.)	*Signal selected*
OT01	DC seize.
OT02	2250 Hz seize.
OT03	2600 Hz release.
OT07.	941 Hz.
OT08.	1209 Hz.
OTO9	477 Hz.

(2) *SRB assignments and frame selection*.

Outlet address register signals		**Scan detector**		**Signaling buffer register bus and bit**
Outlet frame-OFE	**Outlet group**	**Frame**	**Group**	
01	01	01	01	SRBA 12
01	01	01	04	SRBA 11
01	01	01	07	SRBA 10
01	01	02	01	SRBA 09
01	01	02	04	SRBA 08
01	01	02	07	SRBA 07
01	01	03	01	SRBA 06
01	01	03	04	SRBA 05
01	01	03	07	SRBA 04
01	01	04	01	SRBA 03
01	01	04	04	SRBA 02
01	01	04	07	SRBA 01
01	02	01	02	SRBB 12
01	02	01	05	SRBB 11
01	02	01	08	SRBB 10
01	02	02	02	SRBB 09
01	02	02	05	SRBB 08
01	02	02	08	SRBB 07
01	02	03	02	SRBB 06
01	02	03	05	SRBB 05
01	02	03	08	SRBB 04
01	02	04	02	SRBB 03
01	02	04	05	SRBB 02
01	02	04	08	SRBB 01
01	03	01	03	SRBC 12
01	03	01	06	SRBC 11
01	03	02	03	SRBC 09
01	03	02	06	SRBC 08
01	03	03	03	SRBC 06
01	03	03	06	SRBC 05
01	03	04	03	SRBC 03
01	03	04	06	SRBC 02
05	01	05	01	SRBA 12
05	01	05	04	SRBA 11

Outlet address register signals		Scan detector		Signaling buffer register bus and bit
Outlet frame- OFE	Outlet group	Frame	Group	
05	01	05	07	SRBA 10
05	01	06	01	SRBA 09
05	01	06	04	SRBA 08
05	01	06	07	SRBA 07
05	01	07	01	SRBA 06
05	01	07	04	SRBA 05
05	01	07	07	SRBA 0'4
05	01	08	01	SRBA 03
05	01	08	04	SRBA 02
05	01	08	07	SRBA 01
05	02	05	02	SRBB 12
05	02	05	05	SRBB 11
05	02	05	08	SRBB 10
05	02	06	02	SRBB 09
05	02	06	05	SRBB 08
05	02	-06	08	SRBB 07
05	02	07	02	SRBB 06
05	02	07	05	SRBB 05
05	02	07	08	SRBB 04
05	02	08	02	SRBB 03
05	02	08	05	SRBB 02
05	02	08	08,	SRBB 01
05	03	05	03	SRBC 12
05	03	05	06	SRBC 11
05	03	06	03	SRBC 09
05	03	06	06	SRBC 08
05	03	07	03	SRBC 06
05	03	07	06	SRBC 0.5
05	03	08	03	SRBC 03
05	03	08	06	SRBC 02

(3) *DC seize detection*. The AC ADAPTER/DC switch on each SF/DC terminal card must be set to the DC position for any standard TA-341(*)/TT terminals using DC supervision. In this position the switch connects a +15-volt source through the inlet transformer to both the inlet tip and ring leads (INT, INR) and a -15-volt source through the outlet transformer to both the outlet tip and ring leads (OTT, OTR). When the connected subset goes off-hook, seize current from this source flows into the outlet tip and ring (OTT, OTR) leads through the outlet transformer and AC ADAPTER/DC switch to the dc seize detector circuit.

(4) *AC input path*. Audio from the inlet pair is coupled to the scan gates by the inlet transformer.

(5) *Terminal connection*. The program connects' the scanner to terminal number one by applying the scanner connect command (SCONN-) from the central processor command lines. Terminal number one is addressed from the central processor which activates the inlet address register terminal 1 line (ITOI-). The terminal interface card buffers ITO1-. Active SCONN- and ITO1- signals cause the scan terminal one (STO1) signal from the scan control card to enable the dc seize detector on the SF/DC terminal card and the ST01- signal from the scan control to activate the terminal 1 scan gate on the scan receiver card. When thus addressed the dc seize detector output goes to the active state if dc seize current is flowing in the outlet pair. Signal ST01- also gates terminal 1 audio through the scan gates into filter and detector circuits in the scan receiver and scan detector cards. There the five supervisory tones are selectively read.

(6) *Signal reporting*. The output gates on the scan detector card control the reporting of supervisory signals over the signaling buffer register lines. To request a report the computer activates the scanner enable line (SCANEN-) and addresses the lower four frames with the OFE1- signal. The specific supervisory signal to be reported is selected by the outlet address register signals. If the OT1- signal is applied to the scan control card scanned signal select logic activates the SD1 signal. This signal causes the output of the dc seize detector to be routed onto the signaling buffer register bus A bit 12 (SRBA 12),

4-9. Sending and Receiving (fig. FO-10)

There are several situations during the course of a call when the central office must send and receive tones (table 4-1), for example, when a subscriber line is sent dial tone or when a subscriber keys in a telephone number. To accomplish this the common control subsystem on-line processor selects an available sender/receiver and connects it through the matrix to the line or trunk. The block diagram shows a typical path where sender/receiver no. 1 has been connected to send to and receive from frame 1, group 1, terminal 1. This example assumes that sender/receiver no. 1 has been patched and assigned to the service terminal at frame 1, group 1, terminal 11.

a. Sending. Once a sender (SR(S)) is connected, the CCS on-line processor can select any tone or pair of tones listed in note 4 of the block diagrams. Selection of tones is made by activating the appropriate signaling register bus (SRB) bits. Either bus A or bus B is used as shown in table 4-1. Also, the processor addresses a specific sender/receiver by means of the OT13 (outlet terminal 13), and applicable address signals: OG (outlet group number) and OFE (outlet frame enable number). Table 4-1 identifies addresses for all sender/receivers. All signals from the processor to the selected sender card are amplified or logically gated by interface cards. The processor sends a set sender command (SSREN*-) to trigger the gates and drivers on the selected sender card. Once the set sender command is given the sender card starts sending the selected tones from the tone source cards out of the selected sender output. The tones flow through the common equipment panel patch, the service terminal cards inlet terminal circuit, the matrix A, B, C, and D stages, and the outlet terminal circuit of the connected line circuit. From here the tones are routed through the patch panel to the line or trunk. The sender continues to send the tone until another set sender command is received from the processor.

b. Receiving. The receiver portion of a sender/receiver consists of a receiver card SR(R), a low band detector card SR(DL), a high band detector SR(DH), and control circuits on the sender card SR(S). Once connected by the processor tones on the receive pair flow through the line terminal card inlet terminal circuit, the matrix A, B, C, and D stages, the outlet circuit of the service terminal card, and through the common equipment panel patch to the receiver card. The receiver card amplifies the signal and separates the high and low tone bands. Each band is routed to the appropriate detector card. Here

Table 4-1. Sender/Receiver Addressing and Bus Assignments

Outlet address register signals		Scan detector		Signaling buffer register bus and bit
Outlet frame-OFE	Outlet group	Frame	Group	
01	01	01	13	SRBA.
02	01	02	13	SRBA
03	01	03	13	SRBA
04	01	04	13	SRBA
05	01	05	13	SRBA
06	01	06	13	SRBA
07	01	07	13	SRBA
08	01	08	13	SRBA
09	02	01	13	SRBB
10	02	02	13	SRBB
11	'02	03	13	SRBB
12	02	04	13	SRBB
13	02	05	13	SRBB
14	02	06	13	SRBB
15	02	07	13	SRBB
16	02	08	13	SRBB
17	03	01	13'	SRBA
18	03	02	13	SRBA
19	04	01	13	SRBB
20	04	02	13	SRBB
XSR1A	03	05	13	SRBA
XSR1B	03	06	13	SRBA
XSR2A	04	05s	13	SRBB
XSR2B	04	06	13	SRBB

filters and detectors determine if specific tones are present. The detector outputs are not enabled until the processor requests a report of tones received. The processor makes this request by addressing the sender/receiver with the OT13, OFE1, and OG1 signals. The processor then sends a read receiver command (RCVREN*) which results in active RCVP*1 and 2 outputs from the sender card. The RCVP*1 and 2 signals enable any active detector outputs indicating tone presence to be gated over the SRB to the processor. The correspondence of receiver detected tones and SRB bus bits is given in note 5 of the block diagram.

4-10. System Bus Ringer (fig. FO-11)

a. The system bus ringer is a duplexed tone supply which provides the AN/ITC-38(V) (*) with ring tone, ringback tone, priority ring tone, and trip tone. The characteristics of the tones are listed below.

Tone	Link	Level	Timing	Function
570	22	-4+ 2 dbm	50 ms on 50 ms off 2 sec on 4 sec off	Ring.
570 425	23	-4 + 2 dbm	50 ms 570 50 ms 425 1 sec on 1 sec off	Priority ring.
425	21	-4 + 2 dbm	same as	Ringback. ring
570	24	-14 + 2 dbm	continuous	Trip.

b. The ringer network consists of two identical supply circuits, each generating identical outputs. One supply is identified as A and provides the tones to one half of the switchboard D matrices. The other supply is B and supplies the tones to the remaining D matrices.

c. Each supply also generates timing pulses used throughout the NTS. These timing pulses differ in on/off pulse width and are listed below.

25/25 msec	1/1 sec
50/50 msec	2/2 sec
250/1750 msec	2/4 sec

d. The 2/2 second pulse and 2/4 second pulse both have multiple outputs, each being out of phase with each other.

e. The tones and timing pulses are applied to the system through bus crossover relays. Should one generator fail, the relays are operated under program control so that the other generator carries the entire NTS load.

f. During operation, the on-line processor can determine the status of the supplies. This is accomplished by addressing the supply and monitoring the A and B outputs.

g. The ring bus links are connected to a terminal by addressing the RBDPA or RBDPB matrix drivers and the link number at the ringer amplifier. A TST command provides the verification test pulse which is monitored in the associated outlet circuit.

h. The system tone sources procede the 570-Hz and 425-Hz tones. The 570-Hz tone is used to drive a bus ringer timing network which produces the timing signals used in the NTS. The 570 Hz and 425 Hz are also applied to the ringer amplifier to provide the four ring tones.

4-1 1. Connecting and Disconnecting (fig FO-12)

a. General. A connect sequence occurs between two terminals or a terminal and a ring bus. The terminals may be line terminals or service terminals. The text that follows describes the matrix network and the functions which take place when two line terminals are connected through the matrices.

(1) The diagram illustrates two line terminals and the associated matrix network through which the path is connected. The line terminals are arbitrarily selected as terminal 1, group 1, frame 1 being connected to terminal 4, group 4, frame 4. This data is contained in the on-line processor as a result of the original seize from terminal 1, group 1, frame 1, and the subsequent dialing of the digits into the switchboard.

(2) The transmission paths through the matrix network are identified as the transmit path and receive path as oriented to the calling party: In this case, terminal 1, group 1, frame 1. Each path traverses four matrices:

A matrix	five 12 x 4 crosspoint cards arranged in a 12 x 20 array.
B matrix	one 8 x 8 crosspoint card. (twenty cards maximum)
C matrix	one 8 x 8 crosspoint card. (twenty cards maximum)
D matrix	three 8 x 8 crosspoint cards and two 12 x 14 crosspoint cards arranged in a24 x 12 array.

(3) Each matrix crosspoint consists of two junctions which when activated provide a circuit for tip and ring conductors of the transmission path. Each crosspoint requires a coincident P + and P drive potential to turn it on. Once on, the crosspoint sustaining potentials are provided from the terminal inlet circuit and outlet circuit. The P+ and P- potentials are applied from matrix drivers so connected that only one crosspoint is activated in each matrix array.

(4) There is one A matrix and one D matrix for each group (12 terminals). In each group, terminals 1 through 10 are line terminals; 11 and 12 are service terminals. Each A and D matrix contain up to 20 links. There are up to 20 A-B links and 20 C-D links per frame. The D matrix contains four more links than the A matrix. These are links 21 through 24, known as the system ring bus.

(5) The up to 20 B matrices in each frame are associated with the 20 A matrix links within the frame. Each of the eight groups within the frame are connected to the associated B matrix input level, i.e., in the diagram, the group 1, link 5 output appears on the number 1 input level of the link 5 B matrix.

(6) The up to 20 C matrices in each frame are associated with the 20 D matrix links in the same relationship as the A-B links; i.e., the output levels of the C matrix are applied to the associated group D matrix links. In the diagram the link 5 C matrix output is connected to group 1 D matrix link 5 from output level 1.

(7) All transmission paths leaving a frame exit from the B matrix. The eight outputs of each of the 20 B matrix links are applied to the frame associated with the B matrix output level; i.e., output level 4 goes to frame 4.

(8) All transmission paths entering a frame connect to the C matrix. The eight input levels on the C matrix denote the frame from which the connection is established. In the diagram, the frame 4, C matrix, level 1 comes from frame 1.

(9) The interconnection of frames is accomplished through B-C links. Link assignments are accomplished by the processor. Thus, when a specific link is assigned to one frame, the same link number will be used in any other frame. As shown in the diagram, link 5 in both frame 1 and frame 4 are connected. The transmit and receive pairs may be connected through different link numbers.

(10) The association of matrix crosspoint drivers at each of the matrices is identified with relationship to the P+ and P-requirements of the matrix. Observe 4-18 in the diagram that the A matrix P+ and P- potentials are associated with a descriptive term. These terms (such as AMDPLL) are shown in table 4-2 and illustrate the matrix driver addressing requirements. These terms are directly decipherable as A matrix Minus, D matrix Plus, link low (AMDPLL), etc.

b. Connect Sequence. The connect sequence is a series of events consisting of addressing the logic elements, performing tests and monitoring the result of the test, connecting the network, and performing a transmission test and monitoring the results. The connect sequence is run twice for a fall 4-wire connection; once for the transmit path and a second time for the receive path.

(1) Line terminals and the required matrix drivers are addressed as follows:

(a) Connect inlet 1-1-01 to outlet 4-4-04.

Circuit (location)	*Inlet address*	*Outlet address*
Line terminal card 1-1-01	IT1, IFE1, IG1	
Line terminal card 4-4-04		OT4, OFE4, OG4
APDMGL (common)	IT1, ITL, IG1 (AP)	OT4, OTL, OG4 (DM)
AMDPLL (frame 1)	IFE1, LKL, LK5 (AM)	
BPCMLL (frame 1)	IFE1, IG1, LKL (BP)	
BMCPLK (common)	OFD4, LK5, OV (BM)	IFD1, LK5, OV (CP)
BPCMLL (frame 4)		OG4, OFE4, LKL (CM)
AMDPLL (frame 4)		LK5, LKL, OFE4 (DP)

(b) Connect into 4-4-04 to outlet 1-1-01.

Circuit (location)	*Inlet address*	*Outlet address*
Line terminal card 1-1-01		OT1, OFE1, OG1
Line terminal card 4-4-04	IT4, IFE4, IG4	
APDMGL (common)	IT4, ITL, IG4 (AP)	OT1, OTL, OG1 (DM)
AMDPLL (frame 1)		LK5, LKL, OFE1, (DP)
DPCMLL (frame 1)		OG1, OFE1, LKL (CM)
BMCPLK (common)	OFD1, LK5, OV (BM)	IFD4, LK5, OV, (CP)
BPCMLL (frame 4)	IFE4, IG4, LKL (BP)	
AMDPLL (frame 4)	IFE4, LKL, LK5 (AM)	

	Driver		Enables			(Data (Inlet)								
	NAME	TYPE	CONNECT	G1	G2	D1	D2	D3	D4	D5	D6	D7	D8	
COMMON DRIVER	APDMGL$_i$	AP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{IG}_i}$	$\overline{\mathrm{ITL}}$	$\overline{\mathrm{IT1}}$	$\overline{\mathrm{IT2}}$	$\overline{\mathrm{IT3}}$	$\overline{\mathrm{IT4}}$	$\overline{\mathrm{IT5}}$	$\overline{\mathrm{IT6}}$	–	–	$\overline{\mathrm{MTO}}$
		DP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{OG}_i}$	$\overline{\mathrm{OTL}}$	$\overline{\mathrm{OT1}}$	$\overline{\mathrm{OT2}}$	$\overline{\mathrm{OT3}}$	$\overline{\mathrm{OT4}}$	$\overline{\mathrm{OT5}}$	$\overline{\mathrm{OT6}}$	–	–	$\overline{\mathrm{MTO}}$
	APDMGH$_i$	AP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{IG}_i}$	$\overline{\mathrm{ITH}}$	$\overline{\mathrm{IT7}}$	$\overline{\mathrm{IT8}}$	$\overline{\mathrm{IT9}}$	$\overline{\mathrm{IT10}}$	$\overline{\mathrm{IT11}}$	$\overline{\mathrm{IT12}}$	–	–	$\overline{\mathrm{MTO}}$
		DP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{OG}_i}$	$\overline{\mathrm{OTH}}$	$\overline{\mathrm{OT7}}$	$\overline{\mathrm{OT8}}$	$\overline{\mathrm{OT9}}$	$\overline{\mathrm{OT10}}$	$\overline{\mathrm{OT11}}$	$\overline{\mathrm{OT12}}$	–	–	$\overline{\mathrm{MTO}}$
FRAME DRIVER	AMDPLL$_j$	AP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{IFE}_j}$	$\overline{\mathrm{LKL}}$	$\overline{\mathrm{LK1}}$	$\overline{\mathrm{LK2}}$	$\overline{\mathrm{LK3}}$	$\overline{\mathrm{LK4}}$	$\overline{\mathrm{LK5}}$	$\overline{\mathrm{LK6}}$	$\overline{\mathrm{LK7}}$	$\overline{\mathrm{LK8}}$	$\overline{\mathrm{MTO}}$
		DP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{LKL}}$	$\overline{\mathrm{LK1}}$	$\overline{\mathrm{LK2}}$	$\overline{\mathrm{LK3}}$	$\overline{\mathrm{LK4}}$	$\overline{\mathrm{LK5}}$	$\overline{\mathrm{LK6}}$	$\overline{\mathrm{LK7}}$	$\overline{\mathrm{LK8}}$	$\overline{\mathrm{MTO}}$
	AMDPLM$_j$	AP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{IFE}_j}$	$\overline{\mathrm{LKM}}$	$\overline{\mathrm{LK9}}$	$\overline{\mathrm{LK10}}$	$\overline{\mathrm{LK11}}$	$\overline{\mathrm{LK12}}$	$\overline{\mathrm{LK13}}$	$\overline{\mathrm{LK14}}$	$\overline{\mathrm{LK15}}$	$\overline{\mathrm{LK16}}$	$\overline{\mathrm{MTO}}$
		DP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{LKM}}$	$\overline{\mathrm{LK9}}$	$\overline{\mathrm{LK10}}$	$\overline{\mathrm{LK11}}$	$\overline{\mathrm{LK12}}$	$\overline{\mathrm{LK13}}$	$\overline{\mathrm{LK14}}$	$\overline{\mathrm{LK15}}$	$\overline{\mathrm{LK16}}$	$\overline{\mathrm{MTO}}$
	AMDPLH	AP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{IFE}_j}$	$\overline{\mathrm{LKH}}$	$\overline{\mathrm{LK17}}$	$\overline{\mathrm{LK18}}$	$\overline{\mathrm{LK19}}$	$\overline{\mathrm{LK20}}$	–	–	–	–	$\overline{\mathrm{MTO}}$
		DP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{LKH}}$	$\overline{\mathrm{LK17}}$	$\overline{\mathrm{LK18}}$	$\overline{\mathrm{LK19}}$	$\overline{\mathrm{LK20}}$	–	–	–	–	$\overline{\mathrm{MTO}}$
FRAME DRIVER	BPCMLL$_j$	BP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{IFE}_j}$	$\overline{\mathrm{LKL}}$	$\overline{\mathrm{IG1}}$	$\overline{\mathrm{IG2}}$	$\overline{\mathrm{IG3}}$	$\overline{\mathrm{IG4}}$	$\overline{\mathrm{IG5}}$	$\overline{\mathrm{IG6}}$	$\overline{\mathrm{IG7}}$	$\overline{\mathrm{IG8}}$	$\overline{\mathrm{MTO}}$
		CP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{OFE}_j}$	LKL	$\overline{\mathrm{OG1}}$	$\overline{\mathrm{OG2}}$	$\overline{\mathrm{OG3}}$	$\overline{\mathrm{OG4}}$	$\overline{\mathrm{OG5}}$	$\overline{\mathrm{OG6}}$	$\overline{\mathrm{OG7}}$	$\overline{\mathrm{OG8}}$	$\overline{\mathrm{MTO}}$
	BPCMLM$_j$	BP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{IFE}_j}$	$\overline{\mathrm{LKM}}$	$\overline{\mathrm{IG1}}$	$\overline{\mathrm{IG2}}$	$\overline{\mathrm{IG3}}$	$\overline{\mathrm{IG4}}$	$\overline{\mathrm{IG5}}$	$\overline{\mathrm{IG6}}$	$\overline{\mathrm{IG7}}$	$\overline{\mathrm{IG8}}$	$\overline{\mathrm{MTO}}$
		CP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{LKM}}$	$\overline{\mathrm{OG1}}$	$\overline{\mathrm{OG2}}$	$\overline{\mathrm{OG3}}$	$\overline{\mathrm{OG4}}$	$\overline{\mathrm{OG5}}$	$\overline{\mathrm{OG6}}$	$\overline{\mathrm{OG7}}$	$\overline{\mathrm{OG8}}$	$\overline{\mathrm{MTO}}$
	BPCMLH$_j$	BP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{IFE}_j}$	$\overline{\mathrm{LKH}}$	$\overline{\mathrm{IG1}}$	$\overline{\mathrm{IG2}}$	$\overline{\mathrm{IG3}}$	$\overline{\mathrm{IG4}}$	$\overline{\mathrm{IG5}}$	$\overline{\mathrm{IG6}}$	$\overline{\mathrm{IG7}}$	$\overline{\mathrm{IG8}}$	$\overline{\mathrm{MTO}}$
		CP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{LKH}}$	$\overline{\mathrm{OG1}}$	$\overline{\mathrm{OG2}}$	$\overline{\mathrm{OG3}}$	$\overline{\mathrm{OG4}}$	$\overline{\mathrm{OG5}}$	$\overline{\mathrm{OG6}}$	$\overline{\mathrm{OG7}}$	$\overline{\mathrm{OG8}}$	$\overline{\mathrm{MTO}}$
FRAME COMMON DRIVER	BMCPLK$_k$	BP-	$\overline{\mathrm{CONNP-}}$	$\overline{\mathrm{LK}_k}$	0v	$\overline{\mathrm{OFD1}}$	$\overline{\mathrm{OFD2}}$	$\overline{\mathrm{OFD3}}$	$\overline{\mathrm{OFD4}}$	$\overline{\mathrm{OFD5}}$	$\overline{\mathrm{OFD6}}$	$\overline{\mathrm{OFD7}}$	$\overline{\mathrm{OFD8}}$	$\overline{\mathrm{MTO}}$
		CP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{LK}_k}$	0v	$\overline{\mathrm{IFD1}}$	$\overline{\mathrm{IFD2}}$	$\overline{\mathrm{IFD3}}$	$\overline{\mathrm{IFD4}}$	$\overline{\mathrm{IFD5}}$	$\overline{\mathrm{IFD6}}$	$\overline{\mathrm{IFD7}}$	$\overline{\mathrm{IFD8}}$	$\overline{\mathrm{MTO}}$
FRAME DRIVER	RBDPA$_j$	RBDP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{RBA}}$	$\overline{\mathrm{LK21}}$	$\overline{\mathrm{LK22}}$	$\overline{\mathrm{LK23}}$	$\overline{\mathrm{LK24}}$	–	–	–	–	$\overline{\mathrm{MTO}}$
	RBDPB$_j$	RBDP+	$\overline{\mathrm{CONNP+}}$	$\overline{\mathrm{OFE}_j}$	$\overline{\mathrm{RBB}}$	$\overline{\mathrm{LK21}}$	$\overline{\mathrm{LK22}}$	$\overline{\mathrm{LK23}}$	$\overline{\mathrm{LK24}}$	–	–	–	–	$\overline{\mathrm{MTO}}$

Table 4-2. Matrix Driver Addressing.

(2) Once the addresses are applied, the CONNP- command is present on all driver cards. The line terminals are not affected. At the driver cards, all cards in the system receive this pulse. The error summary cards (table 4-3) monitor the driver outputs. Should a driver card which has not been addressed turn on one of its drivers, a logical 1 (0-volt, error condition) is reported over the SRB bus to the processor. Should a card which has been addressed not turn on a driver or turn on two drivers (both error conditions), a logical 1 (0-volt, error indication) appears on the SRB bus. Thus when everything is functioning properly, the SRB bus is at logical 0 in all positions. All error summary outputs are shown in tables 4-3 and 4-4. The CONNP-command is then removed.

(3) The CONNP+ command is applied to all driver circuits. The CONNP+ at the line terminals

Table 4-3. Network Driver Error Summary Card Output Bus Assignments

SRB bus assignment	Error Summary card signal
SRBA16	ERSUMP8
SRBA15	
SRBA14	ERSUMP6
SRBA13	
SRBA12	ERSUMP4
SRBA11	ERSUMP3
SRBA10	ERSUMP2
SRBA09	ERSUMP1
SRBA08	ERSUMM8
SRBA07	
SRBA06	ERSUMM6
SRBA05	
SRBA04	ERSUMM4
SRBA03	ERSUMM3
SRBA02	ERSUMM2
SRBA01	ERSUMM1

Table 4-4. Network Driver Error Summary Card Inputs

During CONNP+					During CONNP-				
Input no.	Summary card no. 1	Summary card no. 2	Summary card no. 3	Summary card no. 4	Input no.	Summary card no. 1	Summary card no. 2	Summary card no. 3	Summary card no. 4
01	AP+G1ITL	BP+F1LKL	CP+LK1	DP+F1LKL	21	DP-G10TL	CP-F1LKL	BP-LK01	AP-F1LKL
02	AP+G1ITH	BP+F1LKM	CP+LK2	DP+F1LKM	22	DP-G10TH	CP-F1LKM	BP-LK02	AP-F1LKM
03	AP+G2ITL	BP+F1LKH	CP+LK3	DP+F1LKH	23	DP-G20TL	CP-F1LKH	BP-LK03	AP-F1LKH
04	AP+G2ITH	BP+F2LKL	CP+LK4	DP+F2LKL	24	DP-G20TH	CP-F2LKL	BP-LK04	AP-F2LKL
05	AP+G3ITL	BP+F2LKM	CP+LK5	DP+F2LKM	25	DP-G30TL	CP-F2LKM	BP-LK05	AP-F2LKM
06	AP+G3ITH	BP+F2LKH	CP+LK6	DP+F2LKH	26	DP-G30TH	CP-F2LKH	BP-LK06	AP-F2LKH
07	AP+G4ITL	BP+F3LKL	CP+LK7	DP+F3LKL	27	DP-G40TL	CP-F3LKL	BP-LK07	AP-F3LKL
08	AP+G4ITH	BP+F3LKM	CP+LK8	DP+F3LKM	28	DP-G40TH	CP-F3LKM	BP-LK08	AP-F3LKM
09	AP+G5ITL	BP+F3LKH	CP+LK9	DP+F3LKH	29	DP-G50TL	CP-F3LKH	BP-LK09	AP-F3LKH
10	AP+G5ITH	BP+F4LKL	CP+LK10	DP+F4LKL	30	DP-G50TH	CP-F4LKL	BP-LK10	AP-F4LKL
11	AP+G6ITL	BP+F4LKM	CP+LK11	DP+F4LKM	31	DP-G60TL	CP-F4LKM	BP-LK11	AP-F4LKM
12	AP+G6ITH	BP+F4LKH	CP+LK12	DP+F4LKH	32	DP-G60TH	CP-F4LKH	BP-LK12	AP-F4LKH
13	AP+G7ITL	OPEN	CP+LK13	RBP+F1A	33	DP-G70TL	OPEN	BP-LK13	OPEN
14	AP+G7ITH	OPEN	CP+LK14	RBP+F1B	34	DP-G70TH	OPEN	BP-LK14	OPEN
15	AP+G8ITL	OPEN	CP+LK15	RBP+F2A	35	DP-G80TL	OPEN	BP-LK15	OPEN
16	AP+G8ITH	OPEN	CP+LK16	RBP+F2B	36	DP-G80TH	OPEN	BP-LK16	OPEN
17	OPEN	OPEN	CP+LK17	RBP+F3A	37	OPEN	OPEN	BP-LK17	OPEN
18	OPEN	OPEN	CP+LK18	RBP+F3B	38	OPEN	OPEN	BP-LK18	OPEN
19	OPEN	OPEN	CP+LK19	RBP+F4A	39	OPEN	OPEN	BP-LK19	OPEN
20	OPEN	OPEN	CP+LK20	RBP+F4B	40	OPEN	OPEN	BP-LK20	OPEN

During CONNP+			During CONNP—		
Input no.	Summary card no. 6	Summary card no. 8	Input no.	Summary card no. 6	Summary card no. 8
01	BP+F5LKM	DP+F5LKL	21	CP-F5LKL	AP-F5LKL
02	BP+F5LKM	DP+F5LKM	22	CP-F5LKM	AP-F5LKM
03	BP+F5LKH	DP+F5LKH	23	CP-F5LKH	AP-F5LKH
04	BP+F6LKL	DP+F6LKL	24	CP-F6LKL	AP-F6LKL
05	BP+F6LKM	DP+F6LKM	25	CP-F6LKM	AP-F6LKM
06	BP+F6LKH	DP+F6LKH	26	CP-F6LKH	AP-F6LKH
07	BP+F7LKL	DP+F7LKL	27	CP-F7LKL	AP-F7LKL
08	BP+F7LKM	DP+F7LKM	28	CP-F7LKM	AP-F7LKM
09	BP+F7LKH	DP+F7LKH	29	CP-F7LKH	AP-F7LKH
10	BP+F8LKL	DP+F8LKL	30	CP-F8LKL	AP-F8LKL
11	BP+F8LKM	DP+F8LKM	31	CP-F8LKM	AP-F8LKM
12	BP+F8LKH	DP+F8LKH	32	CP-F8LKH	AP-F8LKH
13	OPEN	RBP+F5A	33	OPEN	OPEN
14	OPEN	RBP+F5B	34	OPEN	OPEN
15	OPEN	RBP+F6A	35	OPEN	OPEN
16	OPEN	RBP+F6B	36	OPEN	OPEN
17	OPEN	RBP+F7A	37	OPEN	OPEN
18	OPEN	RBP+F7B	38	OPEN	OPEN
19	OPEN	RBP+F8A	39	OPEN	OPEN
20	OPEN	RBP+F8B	40	OPEN	OPEN

have no effect. The error summary cards monitor the drivers. Only drivers which have not been addressed, should not turn on. If one does (an error condition) the SRB bus will be marked with a logical 1 (0-volt). At drivers which have been addressed, either no drivers turn on (error conditions) or more than one driver turns on (error condition) which cause a logical 1 (0volt) at the SRB bus. Thus when everything is functioning properly, the SRB bus is at logical 0 (+5 volts) in all positions.

(4) The CONNP+ command remains and the CONNP- command is reapplied. This action provides the coincident drive pulses to each of the addressed matrix crosspoints, turning them on. At the same time, at each of the addressed line terminals, the presence of both CONNP+ and CONNP- causes the outlet circuit to be set. The outlet circuits of the line terminals provide the bias current to maintain the crosspoint connection. A constant bias voltage is applied by the inlet circuits to complete the current

path. The CONNP+ and CONNP- drive pulses are removed.

(5) The processor then issued the TST command. This action causes a test pulse to be applied to the inlet circuit and monitored at the outlet circuit in the device connected to the transmission path. In the diagram, the test pulse applied at terminal 1, group 1, frame 1 inlet circuit passes over the transmit path, through the A, B, C, and D matrices and is monitored at terminal 4, group 4, frame 4 outlet circuit. This is the verify pulse VF.

(6) The.test pulse travels over both the tip and the ring of the transmission paths. If either side is open, the VF signal will not be received at the outlet end. The VF signal is applied to the terminal status return card and applied to the SRB bus for processor monitoring (table 4-5). When both inlet terminal circuit and the outlet terminal circuit are set, each provides a busy condition (IB and OB). These signals are also sent to the processor over the SRB bus from the terminal status card. The TST command is removed, and the.address data is removed. The calling and called parties are now connected in one direction. The entire connect sequence must be repeated to provide a talk path in the other direction.

Table 4-5. Terminal Status Card Bus Assignments

Terminal Status Card	SBR Bus Assignment
F1, G1 to G4	SRBA14-16
F1, G5 to G8	SRBB14- 16
F2, G1 to G4	SRBC14-16
F2, G5 to G8	SRBA14-16-
F3, G1 to G4	SRBB14-16
F3, G5 to G8	SRBC14- 16
F4, G1 to G4	SRBA14- 16
F4, G5 to G8	SRBB14-16
F5, G1 to G4.	SRBC14-16
F5, G5 to G8	SRBA14-16
F6, G1 to G4	SRBB14-'16
F6, G5 to G8	SRBC14- 16
F7, G1 to G4	SRBA14-16
F7, G5 to G8	SRBB14-16
F8, G1 to G4	SRBC14-16
F8, G5 to G8	SRBA14-16

SBR08 = SRBA16 = SRBB16 = SRBC16:
Verify return (V)
SBRO9 = SRBA15 = SRBB15 = SRBC15:
Outlet busy (OB)
SBR10 = SRBA14 = SRBB14 = SRBC14:
Inlet busy (IB)

c. Disconnect. During transmission, the communication path through the matrices is maintained by the line terminal inlet and outlet circuits. Prior to the disconnect, a test is made for the IB condition at the terminal status card only to insure that the circuit is still connected.

(1) To disconnect, only the line terminals are addressed as described in b(1) above. The DISC command is issued from the processor. The DISC command resets the line terminal outlet circuit. This action removes the IB and OB marks.

(2) The DISC command is removed and the TST command is applied to the terminal circuits. The terminal status card is monitored. The VF, IB, and OB levels should not be present.

(3) The TST command and address data is removed, and the line terminals are ih the idle condition.

d. Error Summary and Fault Isolation. When a matrix driver fails during a connect sequence, one of the SRB bits goes to logical 1. This is an error condition, and is reported to the error summary cards. The output of the error summary cards is applied to the on-line processor. The program exercises each of the matrix drivers using the EGRPN enabling commands during a connect P+ and connect P- condition. The status of each of the drivers is reported to the on-line processor over SRBB and SRBC. This data is illustrated in table 4-6. The results of the EGRP tests lead to a printout of the defective driver identification.

4-12. Adapters

A maximum of 48 adapter circuits can be used in the AN/TTC-38(V)(*). The adapter circuits are used with the SF/I5C terminal card. The adapter circuits are patched in series with the field equipment and its associated line terminal. The adapter is used to match the SF/DC line terminal with the equipment connected to the adapter. Adapters are identified by an assigned special circuit numbers from 01 to 48. The adapters are addressed over signal register buses A or B and are identified by frame number, group number, and terminal number 13. The adapter addressing is shown in table 4-7. Each of the adapter circuits is described below.

a. 20-Hz Ringdown Line/Trunk Adapter (fig.4-11). This adapter is used on 20-Hz ringdown lines or trunks where both ringdown and ring-off supervision may be required. The adapter circuit consists of a 20-Hz detector, a 20-Hz ringing supply, and a 4-wire to 2-wire balanced bridge hybrid circuit.

(1) There are minor differences in the operation of the adapter when connected to a line or a trunk: When functioning as a trunk, the adapter sends 1050Hz tone to the trunk when it is idle. This is not so on lines.

Table 4-6. Driver Card Error Groups and Bus Assignments

SBR bit	Bus assignment	During $\overline{\text{CONNP}}$+				Bus assignment	During $\overline{\text{CONNP}}$—			
		EGRP1	EGRP2	EGRP3	EGRP4		EGRP1	EGRP2	EGRP3	EGRP4
08	SRBB16	AP+G1ITL	BP+F1LKL	CP+LK01	DP+F1LKL	SRBC16	DP-G10TL	CP-F1LKL	BP-LK16	AP-F1LKL
09	SRBB15	AP+G1ITH	BP+F1LKM	CP+LK02	DP+F1LKM	SRBC15	DP-G10TH	CP-F1LKM	BP-LK15	AP-F1LKM
10	SRBB14	AP+G2ITL	BP+F1LKH	CP+LK03	DP+F1LKH	SRBC14	DP-G20TL	CP-F1LKH	BP-LK14	AP-F1LKH
11	SRBB13	AP+G2ITH	BP+F2LKL	CP+LK04	DP+F2LKL	SRBC13	DP-G20TH	CP-F2LKL	BP-LK13	AP-F2LKL
12	SRBB12	AP+G3ITL	BP+F2LKM	CP+LK05	DP+F2LKM	SRBC12	DP-G30TL	CP-F2LKM	BP-LK12	AP-F2LKM
13	SRBB11	AP+G3ITH	BP+F2LKH	CP+LK06	DP+F2LKH	SRBC11	DP-G30TH	CP-F2LKH	BP-LK11	AP-F2LKH
14	SRBB10	AP+G4ITL	BP+F3LKL	CP+LK07	DP+F3LKL	SRBC10	DP-G40TL	CP-F3LKL	BP-LK10	AP-F3LKL
15	SRBB09	AP+G4ITH	BP+F3LKM	CP+LK08	DP+F3LKM	SRBC09	DP-G40TH	CP-F3LKM	BP-LK09	AP-F3LKM
16	SRBB08	AP+G5ITL	BP+F3LKH	CP+LK09	DP+F3LKH	SRBC08	DP-G50TL	CP-F3LKH	BP-LK08	AP-F3LKH
17	SRBB07	AP+G5ITH	BP+F4LKL	CP+LK10	DP+F4LKL	SRBC07	DP-G50TH	CP-F4LKL	BP-LK07	AP-F4LKL
18	SRBB06	AP+G6ITL	BP+F4LKM	CP+LK11	DP+F4LKM	SRBC06	DP-G60TL	CP-F4LKM	BP-LK06	AP-F4LKM
19	SRBB05	AP+G6ITH	BP+F4LKH	CP+LK12	DP+F4LKH	SRBC05	DP-G60TH	CP-F4LKH	BP-LK05	AP-F4LKH
20	SRBB04	AP+G7ITL	CP+LK17	CP+LK13	RBP+F1A	SRBC04	DP-G70TL	BP-LK20	BP-LK04	RBP+F3A
21	SRBB03	AP+G7ITH	CP+LK18	CP+LK14	RBP+F1B	SRBC03	DP-G70TH	BP-LK19	BP-LK03	RBP+F3B
22	SRBB02	AP+G8ITL	CP+LK19	CP+LK15	RBP+F2A	SRBC02	DP-G80TL	BP-LK18	BP-LK02	RBP+F4A
23	SRBB01	AP+G8ITH	CP+LK20	CP+LK16	RBP+F2B	SRBC01	DP-G80TH	BP-LK17	BP-LK01	RBP+F4B

SBR bit	Bus assignment	During $\overline{\text{CONNP}}$+		Bus assignment	During $\overline{\text{CONNP}}$—	
		EGRP6	EGRP8		EGRP6	EGRP8
08	SRBB16	BP+F5LKL	DP+F5LKL	SRBC16	CP-F5LKL	AP-F5LKL
09	SRBB15	BP+F5LKM	DP+F5LKM	SRBC15	CP-F5LKM	AP-F5LKM
10	SRBB14	BP+F5LKH	DP+F5LKH	SRBC14	CP-F5LKH	AP-F5LKH
11	SRBB13	BP+F6LKL	DP+F6LKL	SRBC13	CP-F6LKL	AP-F6LKL
12	SRBB12	BP+F6LKM	DP+F6LKM	SRBC12	CP-F6LKM	AP-F6LKM
13	SRBB11	BP+F6LKH	DP+F6LKH	SRBC11	CP-F6LKH	AP-F6LKH
14	SRBB10	BP+F7LKL	DP+F7LKL	SRBC10	CP-F7LKL	AP-F7LKL
15	SRBB09	BP+F7LKM	DP+F7LKM	SRBC09	CP-F7LKM	AP-F7LKM
16	SRBB08	BP+F7LKH	DP+F7LKH	SRBC08	CP-F7LKH	AP-F7LKH
17	SRBB07	BP+F8LKL	DP+F8LKL	SRBC07	CP-F8LKL	AP-F8LKL
18	SRBB06	BP+F8LKM	DP+F8LKM	SRBC06	CP-F8LKM	AP-F8LKM
19	SRBB05	BP+F8LKH	DP+F8LKH	SRBC05	CP-F8LKH	AP-F8LKH
20	SRBB04	....	RBP+F5A	SRBC04	....	RBP+F7A
21	SRBB03	....	RBP+F5B	SRBC03	....	RBP+F7B
22	SRBB02	....	RBP+F6A	SRBC02	....	RBP+F8A
23	SRBB01	....	RBP+F6B	SRBC01	....	RBP+F8B

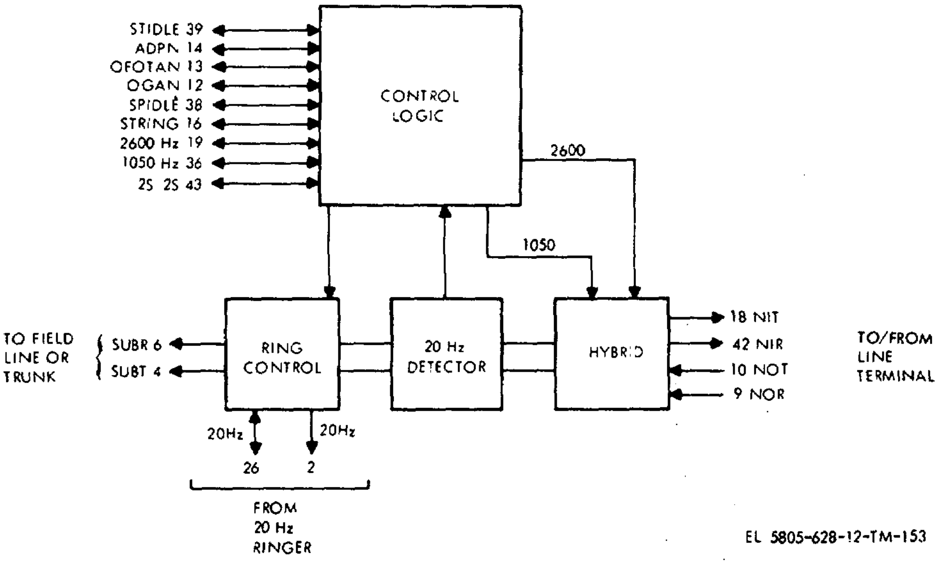


Figure 4-11. 20-Hz ringdown line/trunk adapter, block diagram.

Table 4-7. Special Circuit Number to Adapter Address Conversion

Special circuit number	Adapter address			Bus	Special circuit number	Adapter address			Bus
	OFE	OG	OT			OFE	OG	OT	
01	01	01	13	SRBA	25	04	01	13	SRBB
02	01	02	13	SRBA	26	04	02	13	SRBB
03	01	03	13	SRBA	27	04	03	13	SRBB
04	01	04	13	SRBA	28	04	04	13	SRBB
05	01	05	13	SRBA	29	04	05	13	SRBB
06	01	06	13	SRBA	30	04	06	13	SRBB
07	01	07	13	SRBA	31	04	07	13	SRBB
08	01	08		SRBA	32	04	08	13	SRBB
09	02	01	13	SRBB	33	05	01	13	SRBA
10	02	02	13	SRBB	34	05	02	13	SRBA
11	02	03	13	SRBB	35	05	03	13	SRBA
12	02	04	13	SRBB	36	05	04	13	SRBA
13	02	05	13	SRBB	37	05	05	13	SRBA
14	02	06	13	SRBB	38	05	06	13	SRBA
15	02	07	13	SRBB	39	05	07	13	SRBA
16	02	08	13	SRBB	40	05	08	13	SRBA
17	03	01	13	SRBA	41	06	01	13	SRBB
18	03	02	13	SRBA	42	06	02	13	SRBB
19	03	03	13	SRBA	43	06	03	13	SRBB
20	03	04	13	SRBA	44	06	04	13	SRBB
21	03	05	13	SRBA	45	06	05	13	SRBB
22	03	06	13	SRBA	46	06	06	13	SRBB
23	03	07	13	SRBA	47	06	07	13	SRBB
24	03	08	13	SRBA	48	06	08	13	SRBB

(2) On incoming calls, a 20-Hz ringdown signal is detected. This causes the control logic to: remove the 1050-Hz idle tone from the trunk; transmit 2600-Hz tone to the line terminal for scanner detection; and terminates the hybrid to prevent the 20-Hz signal from entering the line terminal. Once the 20 Hz has been detected, subsequent rings will have no supervisory effect until the ringing stops. At this time the transmission path is connected to the line.

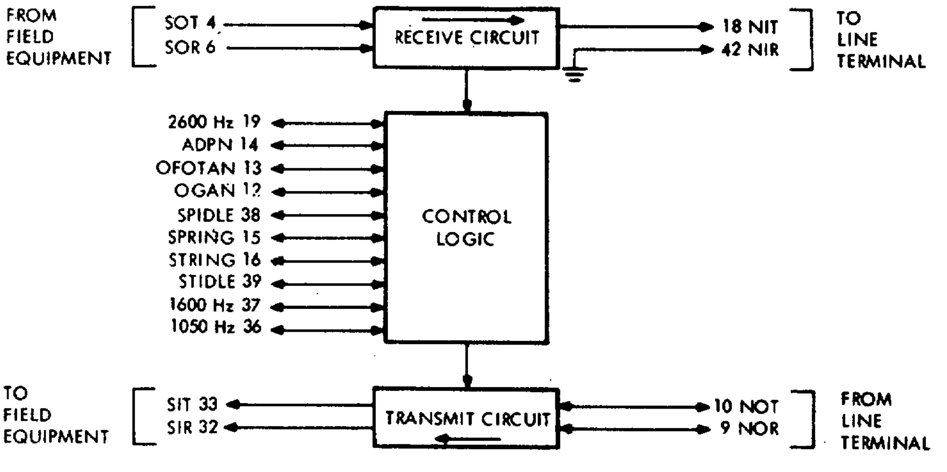
(3) Detection of the 2600-Hz tone at the NTS scanner circuit causes this line/trunk to be connected to the operator for servicing. On trunk circuits the adapter is addressed through the control logic and a SPIDLE (STOP IDLE) command disconnects the 1050-Hz tone from the transmission path. This is accomplished as a result of ADPN, OFOTAN, OGAN, and SPIDLE signals from the adapter interface card, where N is the adapter number.

(4) further supervision of the call is determined by either ringoff from the ringdown trunk or automatic release from the other subscriber. Ring off from the ringdown line or trunk reapplies the 2600-Hz tone to the scan circuit. This action results in the online program disconnecting both parties. On a ringdown trunk, the adapter is addressed with ADPN, OFOTAN, OGAN, and STIDLE, where STIDLE is start idle. This causes the 1050-Hz tone to be transmitted over the 2-wire trunk as idle tone. In the event a ringdown line fails to ring off when a disconnect is established, the line terminal is connected to a sender/receiver and 10 seconds of busy tone followed by 10 seconds of error tone is transmitted to the ringdown line, unless ring-off is received. Should the ring-off not come within the 20 seconds, the line will be disconnected' and subsequent incoming rings will be treated as incoming calls. Trunks are automatically sent ring-off when the other party rings off or goes on-hook.

(5) On outgoing calls, the adapter is addressed with ADPN, OFOTAN, OGAN, STRING, and (on trunks) SPIDLE. This command operates a ring control relay which transmits a two-second burst of 20-Hz ringing current over the line under control of the 2S/2S timing signal from the system bus ringer. It also removes the idle tone from the trunk. A sender/receiver also sends ringback to the calling party. The parties are then connected.

(6) The disconnect of the call described in (5) above is identical to that described in (4) above.

b. 1600-Hz Ringdown Adapter (fig. 4-12). This adapter is used on 4-wire lines or trunks which utilize a 1600-Hz signaling frequency. These lines or trunks may be equipped with tone keyers compatible with the ANfTTC-38(V)(*). When this is the case, direct keying within the system is permissible. Otherwise, the calls are routed to the operator.



EL 5805-628-12-TM-154

Figure 4-12. 16-Hz ringdown adapter, block diagram.

(1) During a trunk idle condition, a 1050-Hz tone is sent from the adapter. When a call is initiated, a 1600-Hz ringing tone is applied from the calling party's equipment to the adapter circuit. The adapter circuit detects the 1600-Hz tone and transmits a 2600Hz seize tone to the line terminal over the NIT and NIR transmission path. The 2600-Hz tone is detected by the scanner circuit which results in the adapter being addressed by the on-line program with the ADPN, OGAN, OFOTAN, and SPIDLE signals. This action removes the 1050-Hz idle tone (if any) from the transmission path, and connects the line to the operator or, if keying is permitted, causes the associated line terminal to function as described for a normal call.

(2) Disconnect for this circuit is a result of ringoff from the calling party or hang-up from the called party. When the calling party (the 1600-Hz line) rings off, the presence of the 1600-Hz tone causes the 2600-Hz seize tone to be detected by the scanner circuit. The on-line processor disconnects the voice path. The adapter is then addressed with the ADPN, OGAN, OFOTAN, and STRING signals. This causes a 1600Hz tone to be transmitted to the calling line or trunk, as ring-off. This address is followed by the ADPN, OGAN, OFOTAN, SPRING, and STIDLE signals. This command removes the 1600-Hz tone and replaces the 1050-Hz idle tone on the trunk.

(3) On a disconnect originating in the AN/TTC-38(V)(*), the local subscriber originates the ring-off procedure. The line is rung down only once. On ring-off, the 1600-Hz tone is preceded by an error and busy tone for 20 seconds. Failure of the AN/TTC-38(V)(*) to receive a ring-off within the 20 seconds results in the presence of the next incoming ringdown being interpreted as a new call.

(4) Calls originating from the AN/TTC-38(V)(*) are established as a result of the adapter circuit being addressed with the ADPN, OGAN, OFOTAN, and SPIDLE signals. This command removes the 1050-Hz idle tone from the line/trunk. This command is followed by the ADPN, OGAN, OFOTAN, and STRING signals. This action transmits 1600-Hz ringdown tone to the field equipment.

(5) Disconnect of the call established in (4) above is accomplished as described in (2) and (3) above.

c. Dc Closure Adapter (fig. 4-13). The dc closure adapter provides termination for a one way ringdown/one way automatic trunk to a distant central office. Incoming calls to the AN/TTC-38(V)(*) are ringdown. This adapter consists of a 2-wire to 4wire balanced bridge hybrid, a 20-Hz detector, and control logic for providing interconnection. These trunk circuits are routed directly to the operator's position in the AN/TTC-38(V)(*).

(1) Seizure of the adapter circuit from a distant central office is accomplished as a result of the adapter circuit detecting a 20-Hz ringdown signal. This results in a 2600-Hz seize tone being extended over the NIT-NIR lines into the associated line terminal. The scanner circuit detects the presence of the 2600-Hz and the on-line processor sends the ADPN, OFOTAN, OGAN, and SZE signals to the adapter. The notch filter circuit : prevents the 2600-Hz seize tone from returning to the distant central office. This command I places a dc closure on the SUBR and SUBT lines and removes the 2600-Hz seize tone. The line is then placed : in the operator queue.

(2) Disconnect of the circuit can be accomplished only from the AN/TTC-38(V)(*) sub-

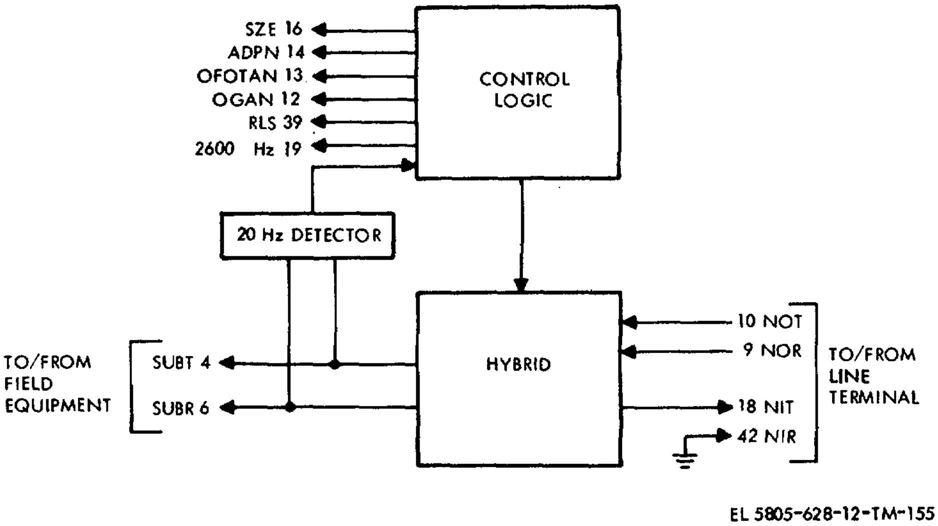


Figure 4-13. Dc closure adapter, block diagram.

scriber. When he goes on-hook, the on-line processor sends the ADPN, OFOTAN, OGAN, and RLS signals. These remove the dc closure from the line.

(3) When the dc closure adapter is seized by the AN/TC-38(V)(*) operator, the adapter circuit is addressed by the on-line processor with the ADPN, OFOTAN, OGAN, and SZE signals. These cause a dc loop seizure across the SUBT-SUBR circuit. Outward DTMF or dial pulse signaling then occurs. When the distant office responds, transmission can take place.

(4) Disconnect of the seizure described in (3) above is identical to that described in (2) above.

d. Common Battery Line Adapter (fig. 4-14). The common battery line adapter provides access to the AN/TTC-38(V)(*) for 2-wire common battery telephones. Dialing is accomplished by discrete pulsing. During an idle condition, 2600 Hz is present on the NIT-NIR lines into the line terminal.

(1) During the idle period, 48 volts dc is present on the SUBR-SUBT lines, 2600 Hz is present at the line terminal, and the receive side of the hybrid network is shunted to ground to prevent incoming ringing signals from being present on the 2600-Hz tone presented to the network. When the subscriber goes off-hook, the 48 vdc circuit is complete. This results in relay operation and the 2600-Hz signal being removed from the NIT-NIR path along with the shunt circuit being removed. The absence of this signal causes the on-line processor to connect to the line and transmit dial tone to the subscriber.

(2) Discrete dialing is detected by a pulse detector and shaping circuit which reapplies the 2600 Hz tone to the line terminal. The on-off application of

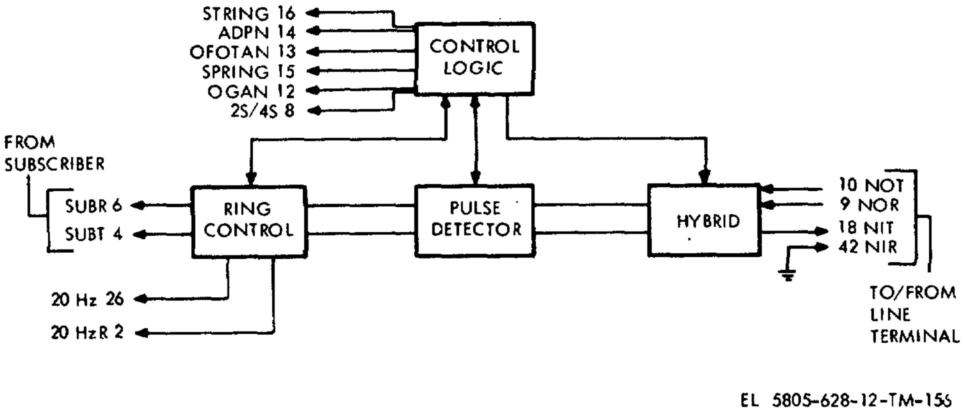


Figure 4-14. Common battery line adapter. block diagram.

the 2600-Hz tone is detected by a sender/receiver and recorded in the on-line processor until all digits have been received. At that time, the transmission path is completed through the NTS.

(3) When the common battery subscriber hangs up, the 2600 Hz is reapplied to the line terminal. The presence of this tone in excess of 100 milliseconds is determined to be a disconnect. The on-line processor disconnects the voice path. When the called subscriber releases first, the on-line processor transmits busy then error tone to the common battery subscriber until he hangs up. On-.hook is recognized by the presence of 2600 Hz in the scan circuit.

(4) Calls originating from standard subscribers are extended to the common battery subscriber as follows. The adapter is addressed with the ADPN, OFOTAN, OGAN, and STRING signals. These cause 20-Hz ringing current to be applied to the line under control of the 2S/4S timing signal. Since the subscriber can answer the call during a ringing period or non-ringing period, the ring control circuit and the pulse detection circuit both are capable of detecting the off-hook status. Both functions result in the removal of the 2600-Hz signal from the line terminal and the removal of the shunt circuit from the NIT-NIR leads. The removal of the 2600-Hz signal is detected by the on-line processor as an answer signal. The processor then clears the ring flip-flop by 'sending the ADPN, OFOTAN, OGAN, and SPRING signals. The voice path is then connected.

(5) The disconnect sequence for calls established as described in (4) above is the same as that described in (3) above.

e. AUTOVON/SF Adapter (fig., 4-15). The AUTOVON/SF adapter circuit is contained on three logic cards. Parallel switches are provided for selection of AUTOVON,NATO or single frequency (SF) operation. This description first describes the AUTOVON operation ((1) through (14) below) and then describes the single frequency application ((15) through (20) below). NATO operation is described in paragraphs (21) through (26) below.

(1) During the idle state, 2600 Hz is received from the AUTOVON network and retransmitted into the line terminal. Also, the adapter transmits 2600 Hz to the AUTOVON network.

(2) On calls originating at the AUTOVON network, the 2600 Hz is removed from the incoming circuit. This action results in two actions: 2600 Hz is removed from the transmission path to the line ter-

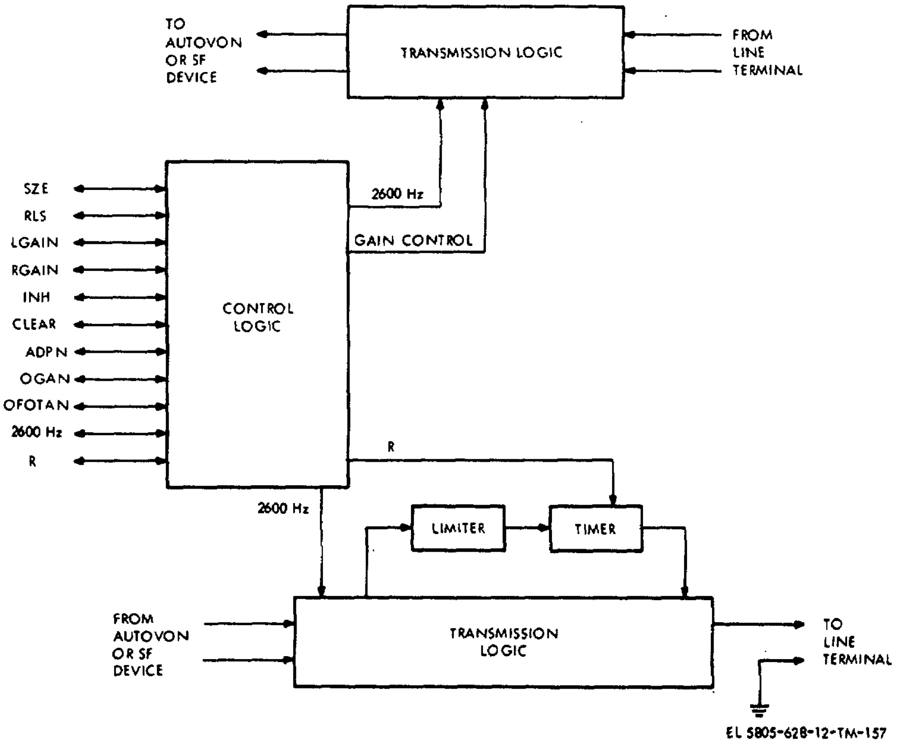


Figure 4-15. AUTOVON/SF adapter, block diagram.

minal in the AN/TTC-38(V)(*), and a command of ADPN, OGAN, OFOTAN, and SZE removes the 2600-Hz idle tone being transmitted to AUTOVON. This is followed after a 200-millisecond delay by ADPN, OGAN, OFOTAN, and RLS command reestablishing the 2600 Hz to the AUTOVON line. This action is called a wink, and functions as an acknowledge signal that the seize condition has been recognized by the on-line program.

(3) The AUTOVON network forwards single frequency dial pulses which are forwarded to the sender/receiver circuits.

(4) When the called party answers the call, an ADPN, OGAN, OFOTAN, and SZE command removes' the 2600-Hz tone from the AUTOVON path and allows transmission to take place.

(5) Calls originating at the ANMTC-38(V)(*) are connected after the 2600-Hz idle tone to AUTOVON is removed. This is accomplished as a result of the ADPN, OFOTAN, OGAN, and SZE command. This removes the 2600-Hz signal from being transmitted to the AUTOVON network. The AUTOVON network returns a wink; i.e., removes the 2600-Hz signal from the adapter receive lines and then reapplies the signal.

(6) The adapter removes the 2600-Hz signal from the line terminal as a result of an ADPN, OFOTAN, OGAN, and INH command.

(7) The on-line processor then issues the command ADPN, OGAN, OFOTAN, and LGAIN. This action decreases the output volume of the adapter circuit so that DTMF digits will be sent at a reduced level.

(8) After the DTMF digits have been transmitted, the on-line processor issues an ADPN, OGAN, OFOTAN, and RGAIN command, restoring the adapter output amplifier gain to normal.

(9) The AUTOVON network, upon receipt of the DTMF digits removes the 2600-Hz idle tone from the line to the adapter.

(10) The voice path is next connected.

NOTE

2600 Hz will not pass through the transmission path in either direction.

(11) Release of the transmission path is a result of the AUTOVON party hanging up. This results as a steady 2600 Hz being present on the lines from AUTOVON. This 2600 Hz is regenerated in the adapter circuit and is transmitted to the line .terminal. As a result of an ADPN, OGAN, OFOTAN, and RLS command, both paths are marked idle.

(12) At any time, the AUTOVON network can exercise a precedence request of the AUTOVON trunk. This can occur only during voice transmission. As described in (10) above, the 2600-Hz signal cannot pass over the voice network through the adapter. This tone is constantly being monitored. The monitoring of the tone results in the recognition of a precedence call by the fact that the 2600 Hz signal is detected as: loss of 2600 Hz, generation of 2600 Hz with a high amplitude, followed by 2600 Hz with a standard amplitude, followed by loss of 2600 Hz. All signals have a pulse width of known duration.

(13) The high level 2600-Hz tone is limited, detected, and applied to a timing circuit. This circuit causes the voice path in the adapter to be opened and an R (941/1209 Hz) tone to be transmitted into the line terminal. This is followed by the command of ADPN, OGAN, OFOTAN, and RLS. The adapter circuit transmits a 2600-Hz idle tone to the AUTOVON network for 750 ms. This is followed by an ADPA, OGAN, OFOTAN, and SZE command and then 200 ms later an ADPN, OGAN, OFOTAN, RLS. This is called a wink signal to the AUTOVON network. At this time the command ADPN, OGAN, OFOTAN, and INH removes the 2600 Hz from being transmitted to the line terminal.

(14) receipt of the wink signal the AUTOVON network transmits SF pulses which the adapter routes to the NTS. When the called party answers, the 2600-Hz tone is removed from the transmission path and transmission can take, place. This is a result of an ADPN, OGAN, OFOTAN, and SZE command. The release is the same as that described in (11) and (12) above.

(15) When the adapter is used to terminate a single-frequency device, the AUTOVONSF switches are | placed in the SF position. This action disconnects the LGAIN and RGAIN network, otherwise, the circuit operation is similar. During the idle period both the SF equipment and the NTS are receiving 2600-Hz tone.

(16) When a call is initiated from the single-frequency device, the 2600 Hz is removed from the adapter input. This results in the adapter removing the 2600 Hz from the line terminal. The scanner circuit and on-line processor recognize this condition as a seize condition.

(17) The on-line processor issues an ADP, OGAN, OFOTAN, and SZE command. This action opens the circuit to the SF device, removing the 2600Hz idle tone from the SF device. This is followed by an ADPN, OGAN, OFOTAN, and RLS command which replaces the 2600 Hz on the line. At this time, the SF device will either wait 600 ms and then spill out the digits, or it will wait until the 2600-Hz signal is removed. This occurs after a sender/receiver is connected to the line terminal associated with the adapter. These methods are described as nonstop dial or delay dial, respectively. However, whichever system is used, after a sender/receiver is assigned, an ADPN, OGAN, OFOTAN, and SZE command removes the 2600 Hz from the line to the SF device. Also, an ADPN, OGAN, OFOTAN, INH command removes 2600 Hz from being transmitted back to the line terminal.

(18) The release of the adapter from this circuit is a result of either party hanging up. The SF device returns 2600 Hz to the adapter. The on-line program issues an ADPN, OGAN, OFOTAN, and CLEAR, followed by an ADPN, OGAN, OFOTAN, and RLS. These commands extend 2600 Hz to the SF device marking this line idle, and allow 2600 Hz to be transmitted to the line terminal.

(19) Calls originating from standard subscribers are actuated as a result of the ADPN, OGAN, OFOTAN, and SZE command which removes the 2600 Hz from the transmission path to the SF device.

(20) The SF device removes the 2600 Hz from the adapter circuit, which removes the tone from being transmitted to the line circuit. At this time the NTS can transmit pulses to the SF device.

(21) When the adapter is used to terminate a NATO INTERFACE UNIT (NIU) Converter (CV 3478), the AUTOVON-SF switches are placed in the SF position. This action disconnects the LGAIN and RGAIN network, otherwise, the circuit operation is similar. During the idle period both the NIU equipment and the NTS are receiving' 2600 Hz tone.

(22) When a call is initiated from the NIU device, the 2600 Hz is removed from the adapter input. This results in the adapter removing the 2600 Hz from the line terminal. The scanner circuit and on-line processor recognize this condition as a seize condition.

(23) The on-line processor delays for 2.8 seconds before issuing an ADP, OGAN, OFOTAN and SZE command. This occurs after a sender/receiver is connected to the line terminal associated with the adapter. The NIU will send the adapter digits in the form of a 2600 Hz burst of 60 milliseconds on and 40 milliseconds off. The on-line processor integrates pulse for 16 to 31 milliseconds for relay bounce.

(24) The release of the adapter from this circuit is a result of either party hanging up. The NIU device returns 2600 Hz to the adapter. The on-line program issues ADPN, OGAN, OFOTAN and RLS.

(25) Calls originating from standard subscribers are actuated as a result of the ADPN, OGAN, OFOTAN and SZE command which removes the 2600 Hz from the transmission path to the NIU device.

(26) The NIU device removes the 2600 Hz from the adapter circuit, which removes the tone from being transmitted to the line circuit. For the on-line processor to detect this as a valid seize acknowledge it must occur between 2.5 seconds and 5.5 seconds after seizing trunk at which time it can transmit pulse to the NIU. If the on-line processor detects if before 2.5 seconds, it will consider it a double seizure and release trunk. If it is not detected after 5.5 seconds, the on-line process will consider it timed out.

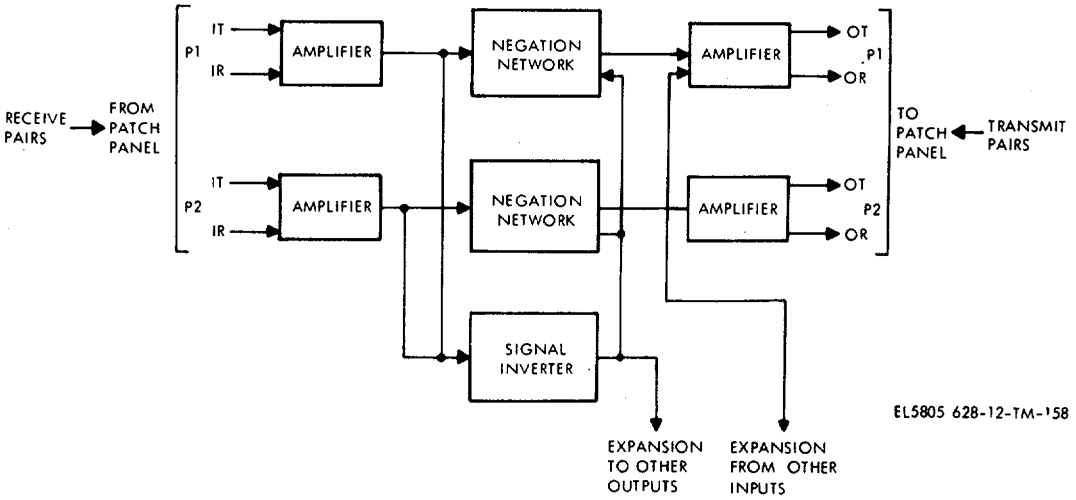


Figure 4-16. Conference bridge, block diagram.

4-13. Conference Bridge (fig. 4-16)

a. In the simplified block diagram of the conference bridge only two ports are shown. Each conference bridge circuit card has five ports which are similarly connected. The 9-party bridge merely extends the same type of connection to a second card. Each port is patched to a service terminal. There is no control logic involved. The connection to the conference bridge is performed in by the NTS by the operational program. The parties are connected to the conference bridge through individual service terminals.

b. Incoming audio signals are applied on the IT and IR leads and are amplified. The output of the amplifier is applied to two paths. One path is connected to a negation network, while the other path is connected through a signal inverter and then applied to the negation network. Within port 1 negation network, the two applied signals are 180° out of phase. This results in cancellation of port 1 signals in port 1. The signals from other ports pass freely. This cancellation action takes place at each port negation network. The output of each port is returned to the subscriber connected to the port and contains all audio signals other than its own.

4-14. Auxiliary Sender/Receiver (fig. FO-13)

a. The auxiliary sender/receiver (XSR) is used for maintenance functions. It contains a standard sender/receiver network and has an auxiliary sender/receiver amplifier and detector. The function of the detector is to monitor frequencies not filtered by the standard sender/receiver. The auxiliary sender/receiver amplifier, in addition to amplifying the mid-band frequencies (LM), also provides a voltage sensitive ladder for determining the strength, of' incoming signals. These outputs are coded to indicate signal strength ranges as shown.

b. The auxiliary sender/receiver is addressed through its associated service terminal and is commanded in the same manner as the standard sender circuit. The output of its detector circuit is enabled from the control logic in the auxiliary sender/receiver amplifier. The outputs are applied to the SRB bus in two sequential instructions and are shown in the table on the diagram.

4-15. Dual 20-Hz Generator Network (fig. 4-17)

a. The 20-Hz ringing current used in the network/terminal subsystem is provided by a dual 20Hz generator supply located in assembly A50. The 20Hz current is used on 2-wire commercial lines, common battery lines, and ringdown lines and trunks.

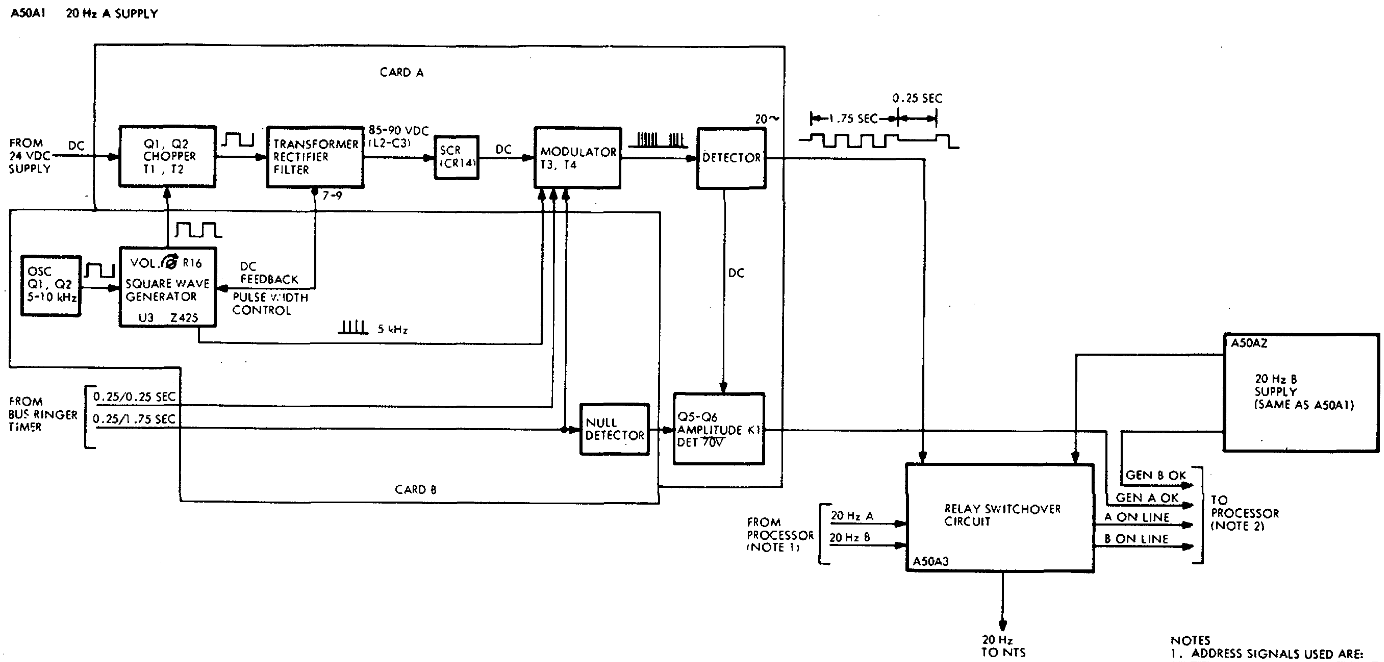
b. The two 20-Hz supplies are identified as A and B. Each supply contains a 20-Hz generator and 20-Hz voltage and frequency sensing circuit. Both supplies provide an output to a relay switchover circuit which selectively applies the output of generator A or B to the buses which distribute the ringing current through the network/terminal subsystem. Each generator output is selectable by control logic (fig. 4-17, note 1) from the SRB bus. The status of the generators is readable by the on-line processor from the control logic (fig. 4-17, note 2) on the SRBA bus.

c. Each supply contains an oscillator Q1, Q2 which provides a 5 to 10 kHz output. Square wave generator U3 converts this signal to a variable width square wave. Chopper Q1, Q2, T1, T2 on card A is driven by the square wave and chops the. 24 vdc power input. The chopped dc is stepped up and rectified by T1, L2, and C3 resulting in 85 to 90 volts dc. Feedback from T1 is sensed by the square wave generator, which determines the width of the chopper output according to the adjustment of R16.

d. The 85-90 vdc output is monitored by an SCR (CR14) which conducts when the voltage gets too high. This protects the control logic at the modulator. The modulator, consisting of transformers T3 and T4 with, associated diodes and transistors, comprises a bridge network controlled by the input 0.25 ms/0.25 ms pulse, the 5 kHz of the oscillator and the 85-90 vdc input. The modulation results in bursts of 5 kHz pulses each 0.25 ms in duration with an amplitude of 85-90 volts. The 5 kHz component from the modulator is removed by the detector and a 20-Hz square wave is applied to the line.

e. A timing pulse of 0.25/1.75 seconds is also applied to the modulator circuit causing a null point in the 20 cycle output. This null point is used for synchronizing relay switching in the NTS. The 20-Hz tone, including the null period, appears at the input of amplitude detector Q5 and Q6 on the A card. As long as the 20-Hz tone exceeds 70 volts, relay K1 remains operated. Operated K1 applies a ground on the GEN A OK line indicating proper operation.

f. The 0.25/1.75 second pulse is applied to a detector circuit so that its loss will result in an alarm condition. Either loss of 20-Hz voltage or loss of the 0.25/1.75 second Hz signal results in a transfer to the other supply.



NOTES

1. ADDRESS SIGNALS USED ARE:

FUNCTION	READ/SET ADDRESS		
	OFE	OG	OT
20 Hz B	05	05	13
20 Hz A	05	06	13

2. BUS ASSIGNMENTS ARE:

SRBA BIT	20 Hz RINGBUS CONTROLLER
13	GEN A OK
12	GEN B OK
11	A ON-LINE
10	B ON-LINE

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Figure 4-17. Dual 20-Hz generator, block diagram.

Section III. MISCELLANEOUS EQUIPMENT

4-16. Tape Winder (fig. 4-18)

a. The tape winder power cord plug P1 is inserted into utility receptacle J9 which extends 110 vac (fig. 4-18) to the motor circuit through fuse Fl. When the tape is slack, switch S2 is closed. When the tape tightens, the tape stop arm opens switch S2 and the circuit to the motor. Switch S1 is operated when the brake lever is pulled out. This action causes the motor to run until all slack is removed from the tape and the tape arm opens the circuit to the motor. Under normal operation, the paper tape punch feeds slack into the paper tape causing switch S2 to close. The motor operates and takes up the slack which shuts the motor off.

b. When the winder is used to wind loose tape, the brake lever can be, pushed in and out to control the motor circuit. Two actions take place: electrically, the motor circuit is closed and opened; mechanically, when pushed in, the brake lever presses against the motor pulley, stopping the motor.

4-17. Patch Plug/Cable Tester A22 (fig. 4-19)

Switch S1 is a 2-wafer 5-position rotary switch. Each position establishes a unique connection of the 2-WIRE and 4-WIRE connector J1 pins. One position, OFF, disconnects power (+12V) from all internal circuits. Each of the other circuits is described below.

a. Lamp. The LAMP position connects 12 volts through resistors to the lamps for lamp-test purposes.

b. Continuity. The CONTINUITY position connects each of the pins of J1 in a series network such that when a plug or cord is inserted in J1 and its internal circuits are good, the GO lamp (DS1) lights while the NO-GO lamp is shunted by ground potential. When the circuit is open, the NO-GO shunt is removed and the lamp lights.

c. Short 1. The SHORT 1 position deliberately connects JI terminals Al and B1 together and A2 and B2 together such that if there is a short in the plug or cord under test, the DS2 (NO-GO) lamp lights. This tests the C1-C2 pair since a short on D1 D2 would automatically complete the circuit. The GO lamp is shunted when a short exists. On good circuits, the GO lamp lights.

d. Short 2. This position tests pairs A1-A2 and BI-B2 for shorts. This is accomplished by cross connecting the two pairs, Al and B2, and A2 and B1. Thus, if' a short exists on A1-A2 or B1-B2, the circuit would be complete to the NO-GO lamp. The GO lamp is shunted (extinguished) on shorted circuits and lighted on good circuits.

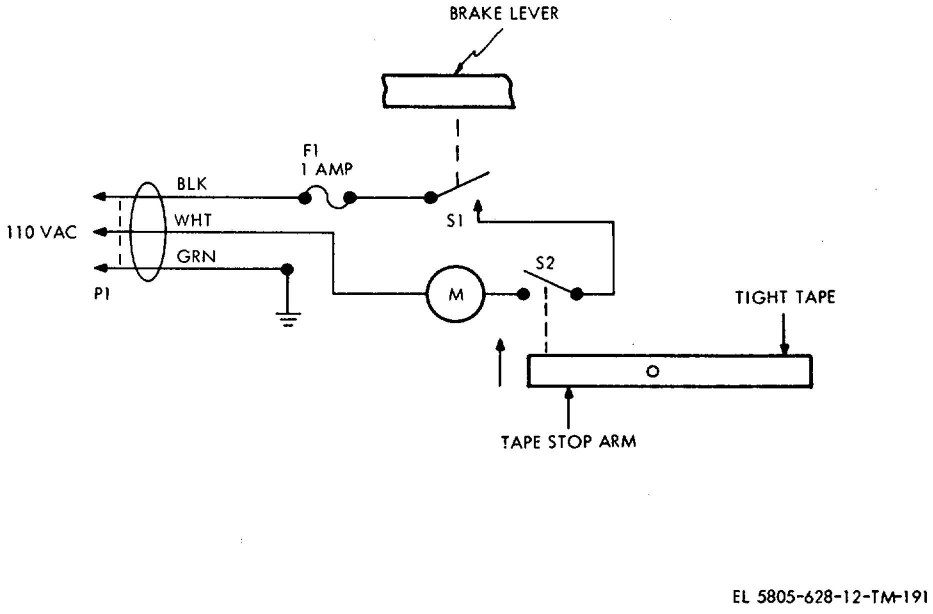
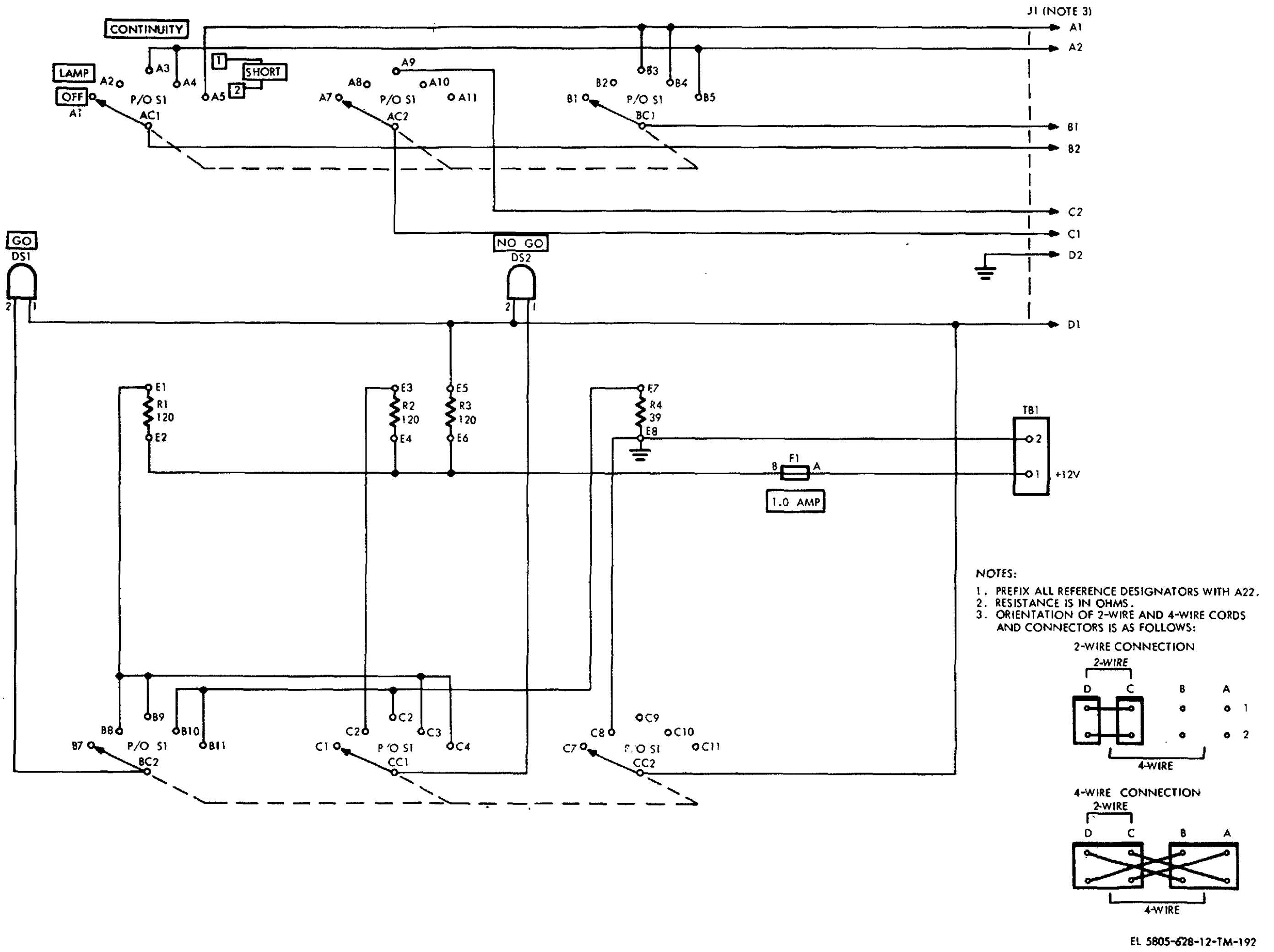


Figure 4-18. Tape winder, schematic diagram.



NOTES:

1. PREFIX ALL REFERENCE DESIGNATORS WITH A22.
2. RESISTANCE IS IN OHMS.
3. ORIENTATION OF 2-WIRE AND 4-WIRE CORDS AND CONNECTORS IS AS FOLLOWS:

2-WIRE CONNECTION

4-WIRE CONNECTION

Figure 4-19. Patch plug/cable tester, schematic diagram.

Section IV. CENTRAL PROCESSOR AND MAINTENANCE CONTROL PANEL

4-18. Central Processor Characteristics

The central processor has a word length of 24 bits for both data and instructions. Storage is provided by a 48K memory and a number of addressable registers. General purpose instructions include arithmetic, logical, shift, rotate, data move, bit manipulation, transfer and jump, index register manipulation, and initiation of input/output sequences. Special purpose instructions are provided for network control.

a. Data Format. Data is represented by a sign and magnitude notation consisting of a single sign bit and 23 magnitude bits.

b. Instruction Format. An instruction word is distinguishable from a data word only by the point in time at which it is retrieved from storage. Figure 4-20 shows the word format of most central processor instructions. The bit positions in the 24-bit word are numbered from 0 to 23, counting to the right with bit 23 as the low order bit. The instruction word is divided into three fields: the operation code (OP), the tag field (I) and the address field (Y).

(1) *Operation code*. The operation code or OP field, consisting of bits 0 to 5 defines the instruction. For example, a bit configuration of 001101 binary or 15 octal is decoded to indicate a subtract magnitude (SBM) instruction.

(2) *Tag field*. The 3-bit tag or I field occupies bits 6 through 8. The function of the I field depends on the instruction. Most instructions are class I with the I field being used address modification. It may specify indexing, indirect addressing, or a constant or literal operand. Instructions used to manipulate index registers.are labeled class II (HLT instruction 778 is the only exception). The I field of these instructions indicates which index register to use. It can also, under certain circumstances, specify indirect addressing.

('3) *Address field*. The 15-bit address of Y field occupies bit positions 9 through 23. It may be used directly as an effective address, or it may be used to compute an effective address as directed by the I field.

Modification of the Y field to compute an effective address can include indexing, or indirect addressing, or both. The Y field is indexed when a specified value is added to it. Indirect addressing replaces the Y field with the value stored in the location specified by the Y field. The effective address is normally the address of an operand located in memory or in an addressable register. However, it can also be used as the operand, as the address for a store operation, as a count for a shift or rotate instruction, or for some other purpose associated with a particular instruction. Bit 9 of the Y field is the page control bit (c below). It can be changed through indirect addressing but not by indexing. The remaining bits allow the Y field to contain any address up to 37777_8. The central processor uses several instructions whose functions require a 2-word instruction format specify all the parameters.

c. Addressing. Each storage location (memory or addressable register) has an address. This address is specified by a 17-bit field. The 17-bit address field includes two EOAX bits which define the memory page, one page control bit which indicates if the EOAX bits are to be considered, and fourteen address bits which define the word location within the page. The page bits can be changed through indirect addressing which retrieves 17 bits from storage; they cannot be changed through indexing which is a 14-bit add to the address bits.

(1) *Core memory*. The 64K core memory is divided into four pages numbered 0 through 3. If the page control bit is a ZERO, page 0 is specified. If the page control hit is a ONE, the EOAX page bits specify the page. For example, 00 specifies page 0, and 01 specifies page 1. Each page includes 16,384 addressable locations. Addresses for these locations are 40000_8 through 77777_8. Addresses 37740_8 through 37777_8 are reserved for addressable central processor registers. Figure 4-21 is a diagram of page 0 of the memory. Pages 1, 2, and 3 are of the same size but have no reserved locations.

(2) *Addressable registers*. Central processor registers listed in table 4-8 are assigned addresses

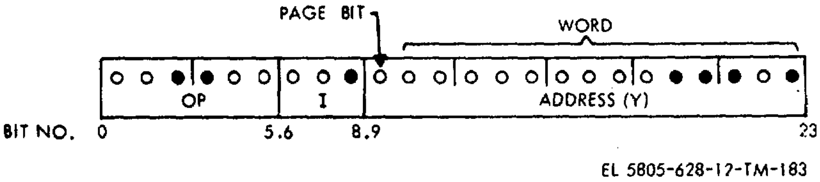


Figure 4-20. Instruction word format.

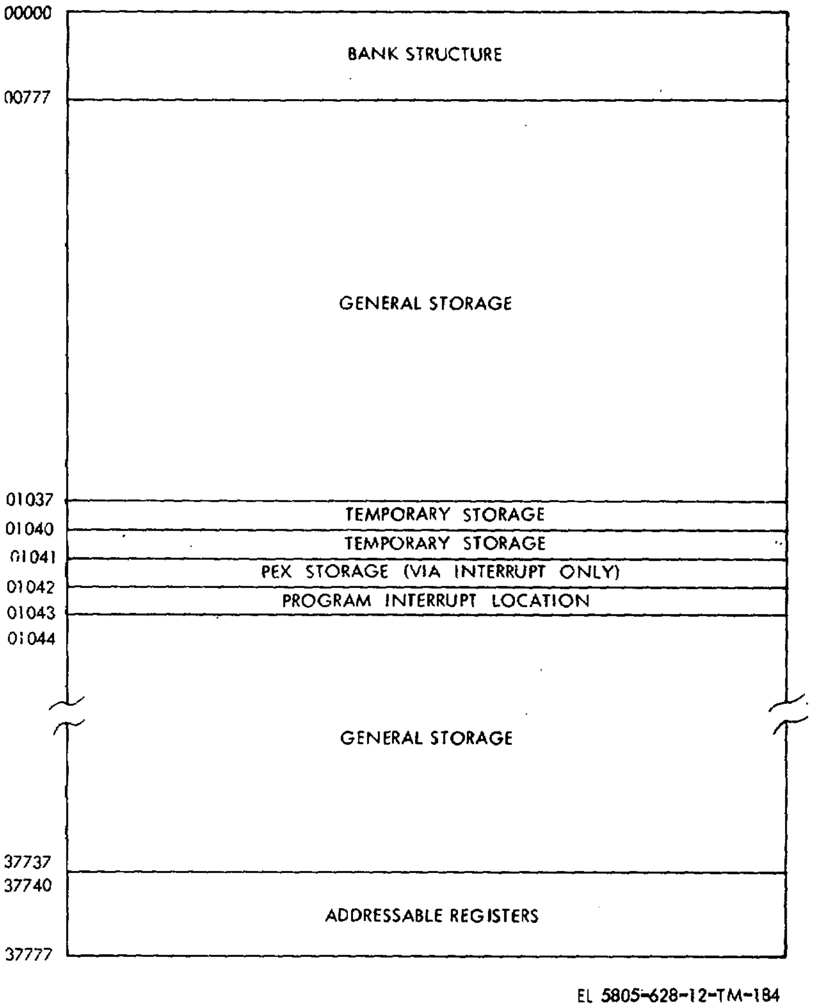


Figure 4-21. Core memory page 0 map.

37740_8 through 37777_8. The page control and EOAX bits are not used with these addresses. Note that the first eight registers are actually soft registers with core memory locations determined by the contents of the bank register. The.remaining registers are hard registers. However FAS and WSR are actually maintenance control panel switches. They can be read from but. not written into.

d. Instruction Repertoire. Table 4-9 is a complete list of the central processor instructions. Refer to the counter descriptions in TM 11-5805-628-34 for a detailed explanation of the instructions.

4-19. Central Processor Description

a. General. The central processor consists of control and timing logic; registers for data manipulation and storage; buses for data transfer between registers and between processor and memory; and interfaces with the network and the input/output devices. These elements are shown in two block diagrams. Figure FO-14 shows the timing and control logic and the major control signals. Figure FO-15 shows the registers, buses, and external interfaces. The central processor operates on data as directed by the program. The program consists of sets of instruction words stored in memory; the data is stored in memory or obtained from the network and input/output. devices. The processor executes a program by performing a sequence of steps for each instruction in the program. The main control in this sequence is the program counter which contains the memory address of the next instruction to be executed. The sequence is in three phases: instruction access, address modification, and instruction execution.

(1) *Instruction access*. To access an instruction, the processor transfers the contents of the memory location specified by the program counter to the instruction register. The first six bits (OP'code)

Table 4-8. Addressable Registers

Address	Mnemonic	Register
37740	IR1	*Index register 1
37741	IR2	*Index register 2
37742	IR3	*Index register 3
37743	IR4	*Index register 4
37744	PCS	*Program counter store
37745	BRL I	*Bank register location I
37746	BRL II	*Bank register location II
37747	BRL III	*Bank register location III
37750	ACC	A or accumulator register
37751	QRG	Q or quotient register
37752	PC	Program counter
37753	BR	Bank register
37754	PEX	Program counter and page (EOAX) register
37755	MMA	Major/minor alarm register
37756	FAS	**Function code and address switch register
37757	DSP	Display register
37760	CPD	Central -processor decision register
37761	CPS	Central processor status register
37762	RTC	Real time clock
37763		Spare
37764	SBR	Signal buffer register
37765	IAR	Inlet address register
37766	OAR	Outlet address register
37767	LSR	Link select register
37770	....	Spare
37771	....	Spare
37772	....	Spare
37773	....	Spare
37774	WSR	**Word switch register
37775	....	Spare
37776	....	Spare
37777	....	Spare

*Soft registers located in memory.
**Maintenance control panel switches. Can be sampled but not modified by program.

Table 4-9. Instruction Repertoire

Op Code	Mnemonic	Class	Counter	Description
00	HLT	1	KC	Halt
01	SSS	1		Start input/output
02	LGM	1	KC	Logical multiply
03	LGA	1	KC	Logical add
04	LGN	1	KB	Logical negate
05	LGE	1	KC	Exclusive OR
06				
07	MPF	1	KF	Bit manipulation
10	SLI	1		Set loop indicator
11				
12	ADD	1	KB	Add
13	ADM	1	KB	Add magnitude
14				
15	SBM	1	KB	Subtract magnitude
16	SUB	1	KB	Subtract
17				
20				
21	TRP	1	KC	Transfer on positive

Table 4-9. Instruction Repertoire

Op Code	Mnemonic	Class	Counter	Description
22	TRU	1	KC	Transfer unconditional
23	TRN	1	KC	Transfer on negative accumulator
24	TRZ	1	KC	Transfer on zero accumulator
25	TRY	1	KC	Transfer on overflow
26	TSA	1	KD	Transfer and save address.
27	LMK	1	KD	Load mask
30	SLS	1	KA	Shift left short
31	SLL	1	KA	Shift left long
32	SRS	1	KA	Shift right short
33	SRL	1	KA	Shift right long
34	RLS	1	KA	Rotate left short
35	RLL	1	KA	Rotate left long
36	RRS	1	KA	Rotate right short
37	RRL	1	KA	Rotate right long
40	RLQ	1	KA	Rotate Q left
41	NRM	1	KA	Normalize
42	NRL	1	KA	Normalize long
43				
44				
45				
46				
47	SMK	1	KD	Store mask
50	CSM	1	KB	Clear and subtract magnitude
51	CLL	1	KD	Clear and add long
52	LDQ	1	KD	Load Q
53	RPA	1	KD	Replace address
54	EXS	1	KD	Exchange accumulator with storage
55	CLA	1	KC	Clear and add
56	CLS	1	KB	Clear and subtract
57	CAM	1	KB	Clear and add magnitude
60	STR	1	KD	Store accumulator
61	STL	1	KD	Store long
62	STQ	1	KD	Store Q
63	LKI	1	KL	Network fault isolation
64	NET	1	KL	Network control
65	TEST	1	KL	Network test
66	RRC	1	KL	Read receiver
67	SSN	1	KL	Set sender
70	LXA	2	KJ	Load index from address
71				
72	IXA	2	KJ	Increment index from address
73				
74	JXA	2	KJ	Transfer if index exceeds address
75				
76	JXD	2	KJ	Transfer if index exceeds address, then decrement
77	HLT	2	KC	Halt

of the instruction word specify the operation to be performed. The remaining bits (I and Y fields) are used during address modification to obtain an effective address and/or an operand.

(2) *Address modification*. The I and Y fields are employed during address modification to determine the effective or actual address of the operand required by the instruction; the effective address for a store operation specified by the instruction; a literal operand (the effective address is the operand); or some other value peculiar to the requirements of a 4-36 particular instruction. The effective address is obtained by operating on the Y field as directed by the I field. The Y field can be used directly; it can be used indirectly as the address of the effective address; it can be indexed by some value; or it can be indexed and then used indirectly. At the end of the address modification sequence, an operand is fetched if required by the instruction; the program counter is incremented so that it contains the address of the next instruction; and processor control is turned over to the execution counter responsible for executing the instruction.

(3) *Instruction execution*. The execution counter generates register transfer gates, memory request signals, and commands in the sequence required to perform the arithmetic, logical, and interface operations required by the instruction. After the instruction has been executed, the counter generates an END signal to initiate the next instruction access phase. The processor assumes that instructions are stored in the sequence in which they are to be executed. However the program can employ instructions to alter the sequence. Instructions can be repeated, skipped, or executed conditionally. The processor can also be directed to jump to a completely new set of instructions stored in another area of memory.

b. Timing and Operation States Control (fig. FO-14). This logic provides the processor clock pulses and establishes basic operating conditions under the control of switches on the maintenance control panel.

(1) *Clock*. The basic central processor clock pulses are generated by a ring counter and decoder which are driven by a 12.5-MHz oscillator.

(2) *Pulse control*. Clock pulse distribution is controlled by the pulse control logic. Three modes can be selected from the maintenance control panel: single pulse, single train (one complete set of clock pulses), and continuous.

(3) *Start control*. The start flip-flops are set and reset in a particular sequence when the INITIATE switch on the maintenance control panel is depressed. The flip-flop outputs time both the pulse control and the operation states logic as processor operation is initiated.

(4) *Operation states control*. The operation states logic establishes the conditions required for the operational mode selected. The modes include halt, compute, control panel instruction, memory display, store, and store sequentially. They are selected from the maintenance control panel.

(5) *Memory manual mode control*. The memory manual mode logic controls the memory cycles required by the display memory, store memory, and store sequential modes of operation.

(6) *Halt flip-flop*. The halt flip-flop can be set from the maintenance control panel or by any of several other conditions. It forces the processor to halt at the end of the current instruction.

(7) *Clear control*. The clear control logic clears the central processor registers and control flip-flops 12/NAVELEX 0967-462-8070 when the CLEAR switch is depressed with the processor halted or when power is applied. Depressing the IMMED HALT switch on the maintenance control panel clears only the control flip-flops.

c. Maintenance Control Panel (fig. FO-14). The maintenance control panel is used to select the processor mode of operation, initiate or halt processor operation, indicate processor status, and allow manual insertion and/or display of data. The controls and indicators are described in conjunction with the logic with which they are associated. Refer to paragraph 3-2a for a brief description of each control and indicator.

d. Processor Bus Structure (fig. FO-15). The central processor buses and interfaces are used to transfer data from register to register within the processor and between the processor and external devices and systems. The central processor bus (CPB) is used to transfer data between registers within the processor. The system bus (SB) allows the transfer of data between the memory and the B register and from the memory to the instruction register. The input/output bus (IOBUS) is similarly employed to transfer data between the B register and the input/output device synchronizers. The SRB buses transfer data between the network and the processor via the signal buffer register (SBR). Data transfer via a bus generally requires at least three levels: one to place the data in one register on the bus, another to apply the data on the bus to the toggle flip-flops of the second register, and a third to generate a gate to transfer the data from the register toggle flip-flops to the register main flip-flops. For example, the transfer of data from the B register to the EOA register requires TROBCPB-, TRIEOACPB-, and SEOAG-, TROBCPB gates the contents of the B register on to the CP bus; TRIEOACPB allows a P1 clock pulse to gate the data from the bus into the EOA register toggle flip-flops; and SEOAG sets the EOAG processor gate flip-flop to allow a P2 clock pulse to gate the data from the toggle flip-flops into the EOA register main flip-flops.

e. Arithmetic Unit (fig. FO-14 and FO-16). The arithmetic unit consists of several registers and adders which, under the direction of the execution counters, perform the addition, subtraction, data manipulation, and logical operations required by the instruction repertoire. The arithmetic unit includes the B register which acts as a buffer register for operands being read from or written into memory and for data being transferred between the processor and the input/output device synchronizers. Data transfer paths are indicated in figure FO-16. Data can be transferred from one register to another via the CP bus. Data can also be transferred directly from the accumulator register into the B register. Data from the processor carry network and the AB logical gates is applied directly to the accumulator; data from the mask is applied directly to the B register. The shift counter (SHC) register, although not shown in figure FO-16, is frequently employed in conjunction with the arithmetic unit to execute instructions.

(1) *B register*. The B register is a buffer register between the memory and the processor. It holds operands read from or being stored in memory. It also holds data being transmitted to or received from the input/output device synchronizers via the IOBUS. The B register is used as a working register for arithmetic unit operations since it holds one of the operands applied to the processor carry network or adder. It also holds one of the operands applied to the AB logic gates in the arithmetic unit and to the B + AR carry network in the address logic. The 24-bit B register is divided into three sections: the sign bit (BOO) gated by BZG, the N field (BO1-08) gated by BNG, and the Y field (B09-23) gated by BYG. This allows for selective gating of data into the register.

(2) *Accumulator*. The accumulator or A register is the main register of the arithmetic unit. It holds both one of' the operands for an arithmetic or logical operation and the result of the operation. The accumulator is used by itself for short rotate and shift operations and in conjunction with the Q register for long rotate and shift operations. The sign bit (A0O) and the magnitude bits (A01-23) are gated independently by AZG and AMG from the processor gate flip-flops.

(3) *Q register*. The quotient or Q register is an auxiliary 24-bit register. It is used as a masking register for SMK and LMK instructions. It is also used in conjunction with the accumulator for double-length shift and rotate instructions. The sign bit (Q00) and the magnitude bits (Q01-23) are gated independently by QZG and QMG from the processor gate flip-flops.

(4) *Processor carry network*. The processor carry network is the main processor adder. It adds the contents of' the A and B registers and applies the sum to the input of' the A register. Subtraction is accomplished by adding the 2's complement of the data in the B register to, the data in the A register. The carry network also forms the exclusive OR of the contents of the A and B registers.

(5) *Mask*. The mask is employed in the execution of SMK and LMK instructions. These instructions require that the portions of the B register data specified by the Q register be replaced by accumulator data.

(6) *AB logic gates*. The AB logic gates from the logical product of the contents of the A and B registers. Their output is applied to the accumulator and is also used in conjunction with the exclusive OR output of the processor carry network to form the logical sum of' the contents of the A and B registers.

(7) *AS flip-flop*. The AS (add/subtract) flip-flop is used to supply a carry into the least significant stage of both the processor and B +AR carry networks. This carry is required for subtract operations.

(8) *Overflow flip-flop*. The overflow (OF) flip-flop is set when there is a carryout of the most significant stage of the processor carry network.

(9) *Shift counter register and carry network* (fig. FO-15). The shift counter (SHC) register holds the shift or rotate count whenever a shift or rotate instruction is being executed. The carry network (ADD 1) increments the register by one each time a shift is performed. The SHC register is also used to store the secondary OP code of a 2-word instruction.

f. Instruction Register (fig. FO-14). The instruction register consists of four discrete registers which accept the instruction word when it is fetched from memory. These registers store the three instruction word fields: the D or OP code field (bits 0-5), the I or G field (bits 6-8), and the Y or address field (bits 9-3). The registers are loaded from memory via the system bus.

(1) *I) register*. The D register stores bits 0 to 5 of the instruction word. These bits comprise the OP code. They are decoded to identify the instruction and enable the sequence counter responsible for its execution. The shift counter (SHC) register is used to store bits 0 to 5 of the second word of a 2-word instruction so that the instruction OP code remains unchanged.

(2) *G register*. The G register stores bits 6 to 8 of the instruction word. These bits comprise the I or tag field which is decoded and used during address modification to indicate how the Y' or address field is to be used.

(3) *GS register*. The GS register also stores bits 6 to 8 of the instruction word. It is used mainly for indexed type instructions (class II) which clear the G register. The GS register remembers the initial tag field under these circumstances.

(4) *AR register*. The AR register stores bits 9 to 23 of the instruction word. These bits comprise the Y or address field of the instruction and are used to compute an effective address as directed by the I field. The contents of the register are changed so that they are the effective address at the end of the address modification sequence. Bits 10 to 23 are the memory address; bit 9 is the page control bit and is used in conjunction with the page bits in the EOAX register to specify the page being addressed. The effective address generally specifies the address of data to be used or stored by the instruction. However, the effective address can also be used as an operand or to specify the number of shifts required for a shift or rotate instruction or for some other purpose.

g. Address Logic (fig. FO-15). The address logic consists of the registers which are responsible for supplying an address to the memory when a memory read or write cycle is required. The AR register is part of the instruction register but is closely associated with the address logic. The EOAX and EOAXST page registers are also related to the address registers but are described with the memory control logic.

(1) *EOA register*. The effective operand address (EOA) register supplies the memory address to the address lines (MA01-14) for memory read and write operations. The EOA register is a 15-bit register. EOA010-23 define the address; EOA09 is the page control bit and is used in conjunction with the EOAX register to define the page. An EOA decoder indicates if the address in the register specifies a hard register rather than a core memory location. When this occurs, the memory control logic generates the transfer levels required to accomplish the transfer to or from the B register or to the instruction register.

(2) *Program counter*. The program counter (PC) register is the main control register of the central processor. It contains the address of the next instruction to be executed. Once a program is started, the program counter counts sequentially unless a transfer or jump instruction is executed. The counter is normally advanced by one each time an instruction is fetched. However, a 2-word instruction causes the counter to be incremented by two, and jump instructions may cause the counter to skip an instruction. Transfer and jump instructions conditionally or unconditionally modify the contents of the program counter during their execution. In the case of a transfer instruction, the program counter is set to the address specified by the instruction and is again stepped sequentially from the new address. The program counter is a 15-bit register (PC09-23) but PC09 is a page control bit and cannot be altered by the PC carry network. The next consecutive address following 37777_8 is 00000_8.

(3) *PEX register*. The PEX register consists of the program counter (PC) register and the page (EOAX) register. These registers are described in (1) and (2) above.

(4) *Bank register*. The bank (BR) register holds the address of the memory locations which are currently serving as the processor's index and program counter store registers. The six bits in the bank register are gated on to CPB15-20 so that they can be transferred into bit positions 15 through 20 of the EOA register. Additional bits must be supplied to EOA21 through 23 to specify the particular soft register being addressed.

(5) *B + AR carry network*. The B + AR carry network adds bit 10 through 23 of the B and AR registers and applies the sum to the EOA register. Major uses of this carry network include indexing and execution of index instructions.

h. Memory Control. The memory control logic reads data from memory or writes data into memory whenever a read or write request is generated within the central processor.

(1) *Read/write control logic* (fig. FO-14). The read/write control logic exercises processor control over the memory read and write cycles. It generates the memory control levels, gates the address from the EOA register on to the memory address lines, and gates the data on to the-system bus from the B register for a write operation or into the B or instruction register from the system bus for a read operation. if the effective address in the EOA register specifies a hard register, the read/write logic generates the gates required to transfer the data to or from the selected register via the central processor bus. The memory control levels generated by the read/write logic indicate if the operation is a write and specify the page being addressed.

(2) *Page control logic*. The memory is divided into three pages. If page control bit EOA09 is a ZERO, page 0 is being addressed. If EOA09 is a ONE, the page bits in the EOAX register define the page. These bits are used by the read/write logic to generate a start read (SR) level for the page being addressed. The page bits in the EOAX register can be changed during indirect addressing. When this occurs, the original page bits are stored in the EOAXST register so that they can be returned to the EOAX register prior to accessing the next instruction.

(3) *Parity check logic*. The parity check logic adds a parity bit via system bus line 24 to any word written into core memory and performs a parity check on any word read from core memory.

i. Instruction Access Logic (fig. FO-14). The instruction access logic initiates a memory read cycle which fetches an instruction word from the memory location specified by the program counter. The word is gated into the instruction register (consisting of the D, G, GS, and AR register). The instruction access sequence is initiated by a start from halt in either the compute or the control panel instruction mode. It is also initiated by an END signal generated at the completion of an instruction execution sequence.

j. Address Modification Logic (fig. FO-14). The address modification logic uses bits 6 through 23 of the instruction word to compute an effective address for use during the instruction execution sequence. The Y or address field in the AR register is manipulated as directed by the I or tag field in the G register. The content of the AR register can be used directly without modification or indirectly as the address of an address. It can also be indexed and then used either directly or indirectly. Only indirect addressing can change the page bits in the EOAX register. The computed effective address can be used as an operand (literal), as the address of an operand, as the address for a store operation, or for some other purpose peculiar to the instruction being executed. Address modification always follows the instruction access sequence and precedes the instruction execution sequence. When address modification is complete, an SKI,L signal is generated to enable the appropriate instruction execution counter. The address modification logic also increments the program counter, fetches an operand (if required), and initiates an interrupt sequence if the required conditions are met.

k. Instruction Execution Counters (fig. FO-14). The instruction execution counters generate the transfer levels, commands, and interface signals required to execute the instruction repertoire. Each counter is responsible for executing a specific set of instructions. The counter selected by the decoded D register levels is enabled by an SKL1 signal from the address modification logic. Upon completion of the instruction execution sequence, the enabled counter generates an END signal to initiate another instruction access sequence.

l. Interrupt Control (fig. FO-14 and FO-15). The interrupt logic generates an interrupt (INC) level when an allowable interrupt condition is detected. This level is monitored by the address modification logic. When it is detected, the address modification logic generates an SKL2 signal to initiate a program interrupt routine under the control of the KF counter. An interrupt is allowed when corresponding decision (CPD) and status (CPS) register bits are set and the interrupt enable bit (CPD00) is set. Refer to table 4-10.

Table 4-10. Interrupt Conditions

Bit	Register		Description
	CPD	CPS	
00	X	....	Enable program interrupt.
01	X	X	Data parity error.
02	X	X	Real time clock fixed interval.
03	X	X	Real time clock overflow.
04	X	X	Remote TTY interrupt.
05	X	X	Instruction parity error.
06	X	X	Illegal instruction or nonexistent memory.
07	X	X	Write lockout violation.
08	X	X	Processor not operational (failure to execute SLI instruction on time.)
09	X	X	Program halt.
10	X	X	Input/output time-out.
11	X	X	Processor transfer initiated.
12		X	READ switch depressed.
16	X	X	Spare remote TTY interrupt.
22	......	X	CPS08 status in other processor.
23	......	X	Processor connected to network (active).

(1) *CPD register*. The central processor decision (CPD) register indicates which, if any, conditions are allowed to interrupt the program. No interrupts are allowed unless CPD00 is set. If CPD00 is set, only those conditions for which a flip-flop is set are allowed to cause an interrupt. For example, an instruction

parity error indication can cause an interrupt only when both CPDOO and CPD05 are set.

(2) *CPS register*. The central processor status (CPS) register records and stores interrupt conditions and events as indicated in table 4-10. A specific flip-flop, when set, can initiate an interrupt routine only if both the corresponding CPD flip-flop and the interrupt enable (CPDOO) flip-flop are set. CPS flip-flops without corresponding CPD flip-flops are used by the processor to monitor certain noninterrupt conditions.

m. Input/Output Control (fig. FO-14). The input/output control logic transmits commands and data to and receives status information and data from the synchronizer associated with each input/output device. The input/output interface includes both discrete signal and common bus lines. Data is transmitted and received via the B register and the IOBUS. An input/output operation is initiated by a start input/output sequence (SSS) instruction executed by the input/output control logic in conjunction with the KC counter.

n. Network Interface Registers and Decoders (fig. FO-14 and FO-15). The network interface registers and decoders operate in conjunction with the KL counter to supply address data and commands to and accept receiver and test data from the network.

(1) *Inlet address register*. The inlet address register (IAR) is a 12-bit register which holds three 4bit fields. The fields are decoded to provide inlet frame, group, and terminal address lines to the network. When the register is addressed, both the register contents and the re-encoded decoder outputs are placed on the CP address register (OAR) is a 12-bit register which operates in the same way as the inlet address register except that it supplies outlet frame, group, and terminal data.

(3) *Link select register*. The link select register (LSR) is a 6-bit register which supplies link address information to the network. LSR 19-23 is decoded to enable one of twenty-four link address lines.LSR18 is used only in the 300-line system to specify that an alternate link is being used.

(4) *Signal buffer register*. The 16-bit signal buffer register (SBR) transmits digital commands to and receives digital data (both receiver and test data) from the network. Data is transferred between the SBR and the network via four buses (SRBA, B, C, and D). Data is gated from the register to the network over all four buses simultaneously; data can be gated from the network into the SBR over any one or all of buses SRBA, B, and C.

o. Real Time Clock (fig. FO-14). The real-time clock (RTC) is a 22-stage counter which is advanced at a 1-millisecond rate by a 1-kHz oscillator. The counter is an addressable register and is employed by the program to measure time-outs.

Section V. MEMORY

4-20. General

(fig. FO-17)

The 48K memory operates under the direct control of its associated processor. The processor supplies the memory address data, selects the page, indicates if the operation is a read/rewrite or clear/write, and either supplies data to or accepts data from the memory. The memory is divided into three pages, each containing 16K 25-bit word locations. The memory consists of four printed circuit boards: one timing control logic (TCL) board, one primary data loop (DLP) board, and two expanded data loop (DLX) boards. The DLP and DLX boards each contain a 16K x 25 planar stack and associated sense amplifiers, inhibit selection switches, and X-Y decoders and sink switches. Each stack represents one page of memory. The DLP board also contains the inhibit drivers and the memory data register which accepts data to be written into memory or stores data read from memory. The TCL board contains the basic timing logic, the stack select circuits, the address registers and logic, the X and Y driver decoders and switches, the dc to dc converter and regulator, the data guard network, and the XYZ bus regulators.

4-21. Memory/Processor Interface

Three -sets of interface lines comprise the memory/processor interface: command lines, address lines, and data lines. The command lines are designated SR1, SR2, SR3, and WR- from the processor and are called CSR1L, CSR2L, CSR3L, and CWR2 within the memory. SR1, SR2, or SR3 specifies that a memory cycle is requested by the processor, and it selects page 0, 1, 2, or 3. WR- indicates a clear/write cycle when it is low; otherwise a read/restore cycle takes place. The address lines, MA01-MA14 (called A002-A132 within the memory), supply the memory address for the read/restore or clear/write operation from the effective operand address (EOA) register in the processor to the memory. The address value selects one of 16,384 locations in the page (stack) specified by the SR level. The 25 data lines, SB00-SB24, comprise the system bus. This bus provides for the transfer of 24 data bits and one parity bit between the memory and the processor registers (fig. FO-15). Temporary storage for words written into or read from memory is provided by the data register on DLP board All.

4-22. Timing and Control Logic

a. Data Sequencing/Stack Selection. The data sequencing circuits control basic system timing by generating the strobe signals required to transfer data for both read/restore and clear/write cycles. The TCL board accepts the SR1-3 and WR- levels supplied by the processor. SR1-3 initiates the memory cycle and specifies the stack (page). WR- indicates that a clear/write cycle is required. The control signals are as follows:

Strobe	*Description*
TINDH	Strobes data word through inhibit drive switches for entry into selected memory page.
TDISH	Strobes incoming data word into data register via input/output data logic.
TODSH	Strobes outgoing data word on to system bus via input/output data logic.
TMRCL	Clears data register at start of each memory cycle.
TSASH	Strobes data word from sense amplifiers into data registers.
TSK0L	Selects page 0.
TSK1L	Selects page 1.
TSK2L	Selects page 2.

b. Addressing the fourteen address bits, MA01-14, from the processor are stored in the address register and distributed to the X-Y drive decoders on the TCL board and the X-Y sink decoders on the DLP and DLX boards. These decoders generate a unique output for any one binary address input. The decoder outputs enable a drive and sink switch which allows drive currents into specific X and Y lines in the selected stack.

4-23. Primary Data Loop

The DLP board, A11, includes X-Y sink decoders and switches, sense amplifiers, inhibit switches, data input/output logic, and data register, and a 16K x 25 planar stack. The DLP receives 25 bits of data from the processor via the system bus during a write cycle. This data is stored in the data register and then written into the selected stack. During a read/restore cycle, data is read from the stack, stored in the data register, and then gated on to the system bus to the processor. The DLP also provides an X and Y drive-to-sink current path by decoding and selecting X and, Y sink switches. The DLP also contains the inhibit pre-drivers, the inhibit current regulators, and the drive switches.

4-24. Expanded Data Loop

The DLX boards, A12 and A13, expand the basic 16K x 25 configuration consisting of one TCL and one DLP board to the full 48K x 25 configuration. Each DLX board includes one 16K x 25 planar stack. The DLX board also includes sense amplifiers, inhibit selection switches, and X-Y sink switches. The DLX board senses core signals and transmits this information to the memory data register on the DLP board via the sense expansion lines. The DLX also steers inhibit current supplied by the DLP board to its core plane and provides X and Y drive current paths to the core plane by decoding and selecting X and Y sink switches.

4-25. Read/Restore

In a read/store operation, data is taken from a selected address and delivered to the processor/ memory interface. The same data is then rewritten into the same memory address. During the read half of the cycle, the TCL board delivers timing and control signals to the DLP-and DLX boards. Data is read out of the selected address and stored in the data register on the DLP board. Data is then strobed into the data-out lines for delivery to the system bus. During the restore half of the cycle, timing signals from the TCL write the data back into the core stack at the same address.

a. Timing and Control - Read/Restore. Only one of the SR lines may be active at any one time. When an SR command is received at the TCL board, a timing clock is started, and the memory cycle starts. Various enabling and drive signals are generated in a specific sequence and supplied to the DLP and DLX boards. If WR- is high, a read/restore cycle is started. During read time, the X-Y read sink and X-Y read drive signals are developed. They provide coincident read current at a specific stack address. TMRCL clears the memory data register, and TSASH strobes data from selected sense amplifiers into the register. TDOSH controls the transmission of data to the interface. During the restore half of the cycle, X-Y write sink and drive signals are developed to provide coincident write current to write the data from memory data register back into the core stack.

b. Data Channel-Read/Restore. The core outputs are applied to the memory data register through individual sense amplifiers. Each sense/inhibit line is typical for one data bit on a given stack. Only one core out of 16,384 on the line is selected and driven by coincident current during a read or write cycle. There are 25 sense/inhibit lines in each stack. Only one of the stacks is enabled in any operating cycle. During the read half of an operating cycle, one selected core on the selected sense/inhibit line is driven to the logic ZERO state. The sense amplifier monitors the differential voltage on the sense inhibit line. If the core was previously a ONE, it switches state and induces a voltage pulse on the line. The resulting sense amplifier output is stored in the data register. If the core was previously a ZERO, no voltage pulse is sensed. The data in the stack is delivered to the system bus and held in the data register. The data register controls the restore half of the cycle. If a particular bit is a ONE, the core for that bit underwent a flux reversal and must be driven back to its original state. This is accomplished by not turning on its associated inhibit drivers and allowing the X-Y currents to switch the core. If the register bit position contains a ZERO, the core was not switched, and the inhibit drivers must be turned on during write time to prevent core switching.

4-26. Clear/Write

The clear/write operation is similar to the read/restore operation except that data read from memory during the first half cycle is ignored, and new data supplied by the processor is written into memory during the second half cycle. The read half of the cycle serves to clear the cores.

a. Timing and Control-Clear/Write. The clear/write mode is similar to the read/restore mode except that TDISH is enabled and TSASH is inhibited. The clear/write operation is initiated by an SR level and WR-. During read (clear) time, the data from the sense amplifier is not gated into the data register since TSASH is absent. At the same time, TDISH gates new data on the system bus into the data register. The write half of the cycle is the same as the restore half of the read/restore cycle.

b. Data Channel-Clear/Write. The data flow is the same as described for a read/restore operation except that TSASH is not generated. This blocks data from the stack, and TMRCL clears the data register. New data comes in from the system bus and is gated into the data register by TDISH.

Section VI. SYNCHRONIZER AND SYSTEM STATUS PANEL

4-27. Input/Output Device Interface
(fig. 4-22)

The input/output interface consists of up to nine synchronizers in A16 and functional assignment control panel (FACP) A7. The interface provides communication capability between the two processors or either processor and any peripheral device, including the FACP.

a. Input/Output Bus (fig. 4-23). Each processor has an eight line data bus (IOBUS A0-7 and IOBUS B0-7) common to all synchronizers and the FACP. The data bus is used in the exchange of commands, data, and status between the processor and any selected synchronizer.

(1) *Commands*. A combination of three input/output bus lines, IOBUS A3-5 or IOBUS B3-5, are used to transmit five instructions to the synchronizer.

(*a*) The read status command results in the synchronizer transferring the contents of the status register to the IOBUS.

(*b*) The read data command results in the synchronizer transferring one character to the IOBUS.

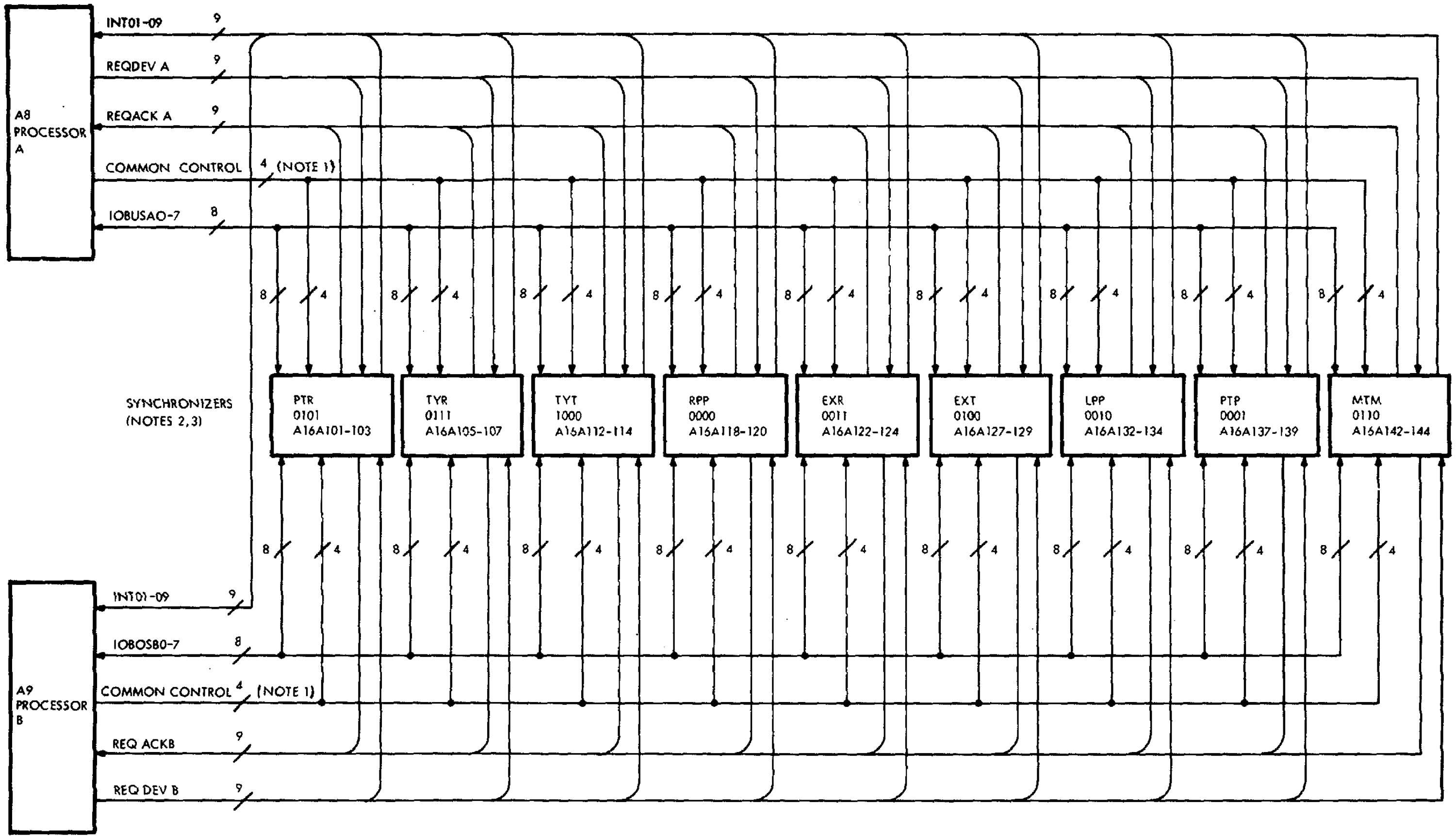
(*c*) The write status command results in the synchronizer transferring the status information from the IOBUS to the synchronizer's status register.

(*d*) The write data command results in the synchronizer transferring one character from the IOBUS to internal storage.

(*e*) The read status and set busy bit command results in the synchronizer transferring the contents of its status register including current state of the busy bit to the IOBUS. If the busy bit is not set, this command will set it.

(2) Data. During data transfer, IOBUS AO-7 or IOBUS BO-7 is used to input or output an eight-bit character between processor and synchronizer.

(3) Status. Five bits of status can be transferred between processor and synchronizer on IOBUS AO-5 or IOBUS BO-5. Status bits indicate timing read



NOTES:

1. COMMON CONTROL BUS

PROC A	PROC B
DATSTRA	DATSTRB
READENA	REAEN B
COMSTRA	COMSTRB
RESDEVA	RESDEVB

2. FOUR DIGIT BINARY NUMBER IS SYNCHRONIZER ADDRESS

3. PTR - PAPER TAPE READER
TYR - REMOTE TTY RECEIVE
TYT - REMOTE TTY TRANSMIT
RPP - REMOTE PAGE PRINTER
EXR - SPARE TTY RECEIVE
EXT - SPARE TTY TRANSMIT
LPP - LOCAL PAGE PRINTER
PTP - PUNCH
MTM - MEMORY TO MEMORY

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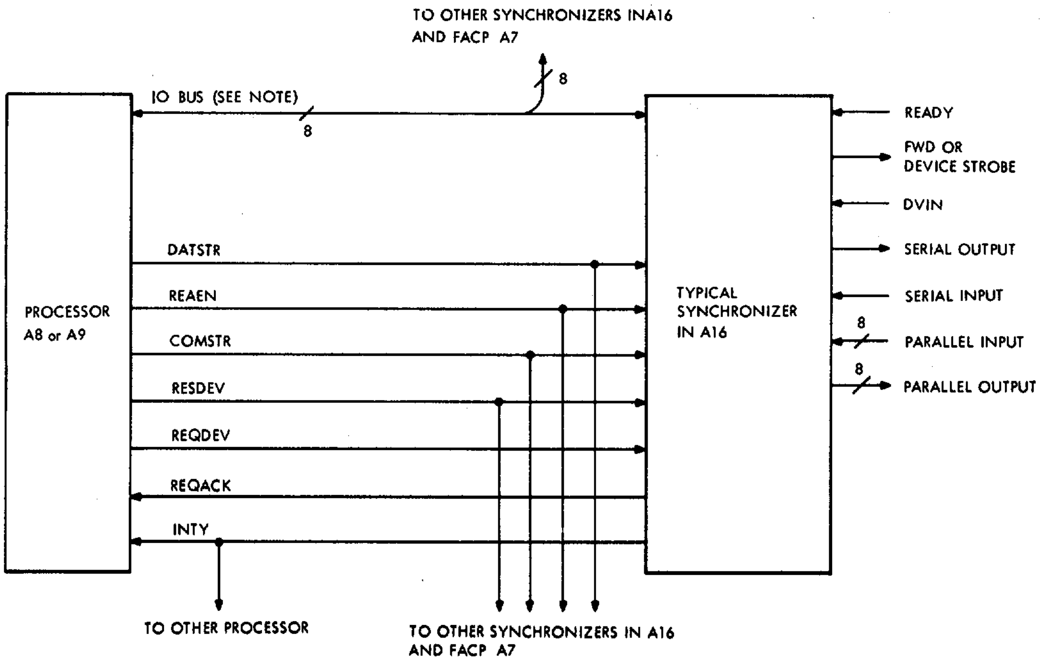
Figure 4-22. Processor-device synchronizer interface, block diagram.



NOTE: IO BUS DATA ASSIGNMENTS

FUNCTION	IO BUS BIT NUMBER							
	0	1	2	3	4	5	6	7
DATA								
MACHINE LANGUAGE	← 8-BIT BITE →							
ASCII	← ASCII CODE →							
BAUDOT				← BAUDOT CODE →				
STATUS	TRE	DVA	CH RDY	BB	CH LST			
COMMAND				BB	READ WRITE	STATUS DATA		

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Figure 4-23. Synchronizer interface.

errors, device alarm, character available for input or output, synchronizer busy, and that an input character has been lost.

b. Common Control Bus. Each processor has a four-line central bus common to all synchronizers and the FACP. The bus carries control signals from the processor to any selected synchronizer.

NOTE

A and B signal name suffixes designate A or B processor.

(1) *Read enable (REAENA, REAENB)* This line gates the synchronizer bus (SYNCBUS 00-07) to the IOBUS.

(2) *Command strobe (COMSTRA, COMSTRB).* This line gates the IOBUS to the SYNCBUS and loads the command word into the command register.

(3) *Data strobe (DATSTRA, DATSTRB).* This line controls input and output data transfers between the processor and synchronizer.

(4) *Reset device (RESDEVA, RESDEVB).* This

line resets and initializes synchronizer logic. The synchronizer is put in a condition ready to receive data from the peripheral device.

c. Unique control lines. Each processor has three control lines to each synchronizer and the FACP. These lines identify the synchronizer in communication with the processor.

(1) *Request device (REQDEVA, REQDEVB)*. Each synchronizer has a unique request device line from each processor. The line is used by the processor to select that synchronizer for communication with its peripheral device.

(2) *Request acknowledge (REQACKA, REQA CKB)*. Each synchronizer has a unique request acknowledge line to each processor. The line is used to indicate that the synchronizer is not in communication with the other processor and honors the request.

(3) *Interrupt (INTY)*. Each synchronizer has a unique interrupt line common to both processors. The line is used to indicate a peripheral device has initiated an input operation.

4-28. Synchronizer Input/Output Operation
(fig. 4-24 and FO-18)

Communication with a peripheral device involves both an input or output operation, where data is transferred between processor and synchronizer, and a device data transfer in or out, where data is transferred between peripheral device and synchronizer. The basic components of each synchronizer are three logic card types; MOS1, MOS2, and MOS3. Figure 4-24 shows the functioning of these three cards for all synchronizers. Figure FO-18 shows the detailed interconnections of synchronizers to specific devices.

a. Output Operation. The output operation is initiated by the processor with a device request signal.

(1) *Device request (REQDEV).* Processor A raises REQDEV to the synchronizer. If the synchronizer has not already acknowledged REQDEV from processor B, the request will be honored with REQACK to processor A. Raising REQACK halts the commutator flip-flop (CFF), preventing the synchronizer from acknowledging requests from processor B until REQACK is dropped.

(2) *Read status and set busy bit* (fig. 4-25). Processor A responds to REQACK by placing the read status and set busy bit command on IOBUSA 0-7 and sending a command strobe (COMSTR). The command register is loaded and the command flip-flop set. Decoding read status in the command register gates the status register to SYNCBUS 00-07. The processor raises read enable (READEN), gating SYNCNBUS to IOBUS A. Data strobe (DATSTR) from the processor resets the command flip-flop and drops REQACK. If the busy bit (BB) was not set at the start of the instruction it is set at this time. The processor scans the status word receiver from the synchronizer. If the busy bit was not set, processor A now has control of the synchronizer.

(3) *Write data* (fig. 4-26). To start the data transfer, the processor raises REQDEV. When REQACK is returned, the processor places the write data command on IOBUS A and sends COMSTR. The command is loaded in the command register and the command flip-flop is set. The processor then places the data character on IOBUS A and sends a DATSTR. Decoding the write data command gates the IOBUS to the SYNCBUS and the SYNCBUS to the buffer register. The command flip-flop is reset and character ready (CH RDY) is set in the status register, REQACK is dropped, and the transfer is complete. When the processor is ready to send another character it will send a read status command, checking for the condition of the CH RDY status bit.

(4) *Read status* (fig. 4-27). To check the status of CH RDY, the processor raises REQDEV. When REQACK is returned, the processor places the read status instruction in IOBUS A and sends COMSTR. The command is loaded in the command register, and the command flip-flop is set. Decoding read status in the command register gates the status register to the SYNCBUS. The processor raises READEN, gating SYNCBUS to IOBUS A. DATSTR resets the command flip-flop, and the synchronizer drops REQACK. The processor scans the CH RDY bit. If it is reset, indicating the device data transfer is complete, another data character is sent to the synchronizer. When the last character is transferred, the processor terminates the output operation by resetting the BB status bit with a write status command.

(5) *Write status* (fig. 4-28). To reset BB the processor raises REQDEV. When the synchronizer responds with REQACK, the processor places the write status command on IOBUS A and sends COMSTR. The command is loaded into the command register, and the command flip-flop is set. The processor then places the status word on IOBUS A and sends DATSTR. Decoding the write status command gates IOBUS A to SYNCBUS and SYNCBUS to command register. BB is set, and the command flip-flop is reset. The synchronizer drops REQACK.

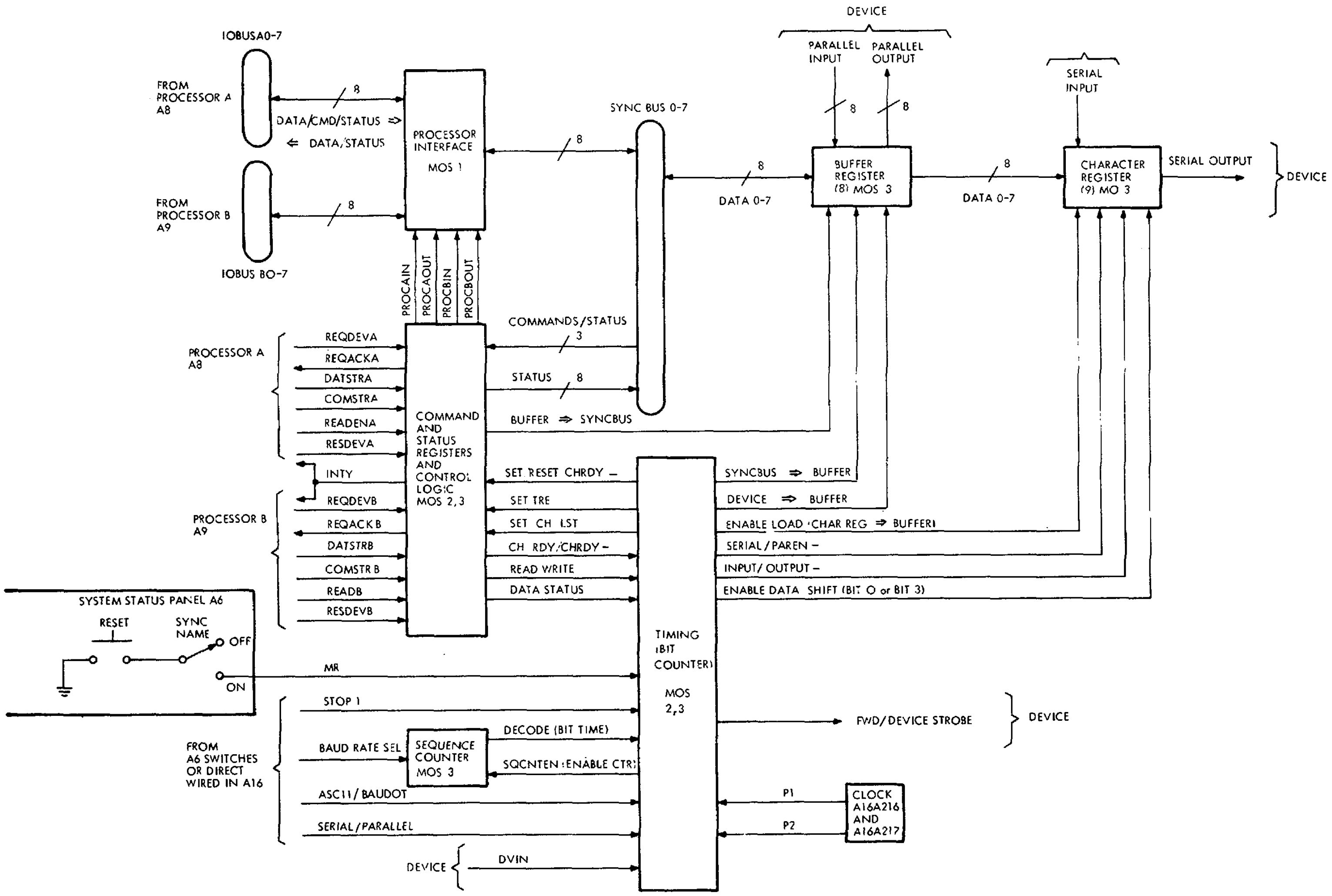

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Figure 4-24. Typical synchronizer, block diagram.

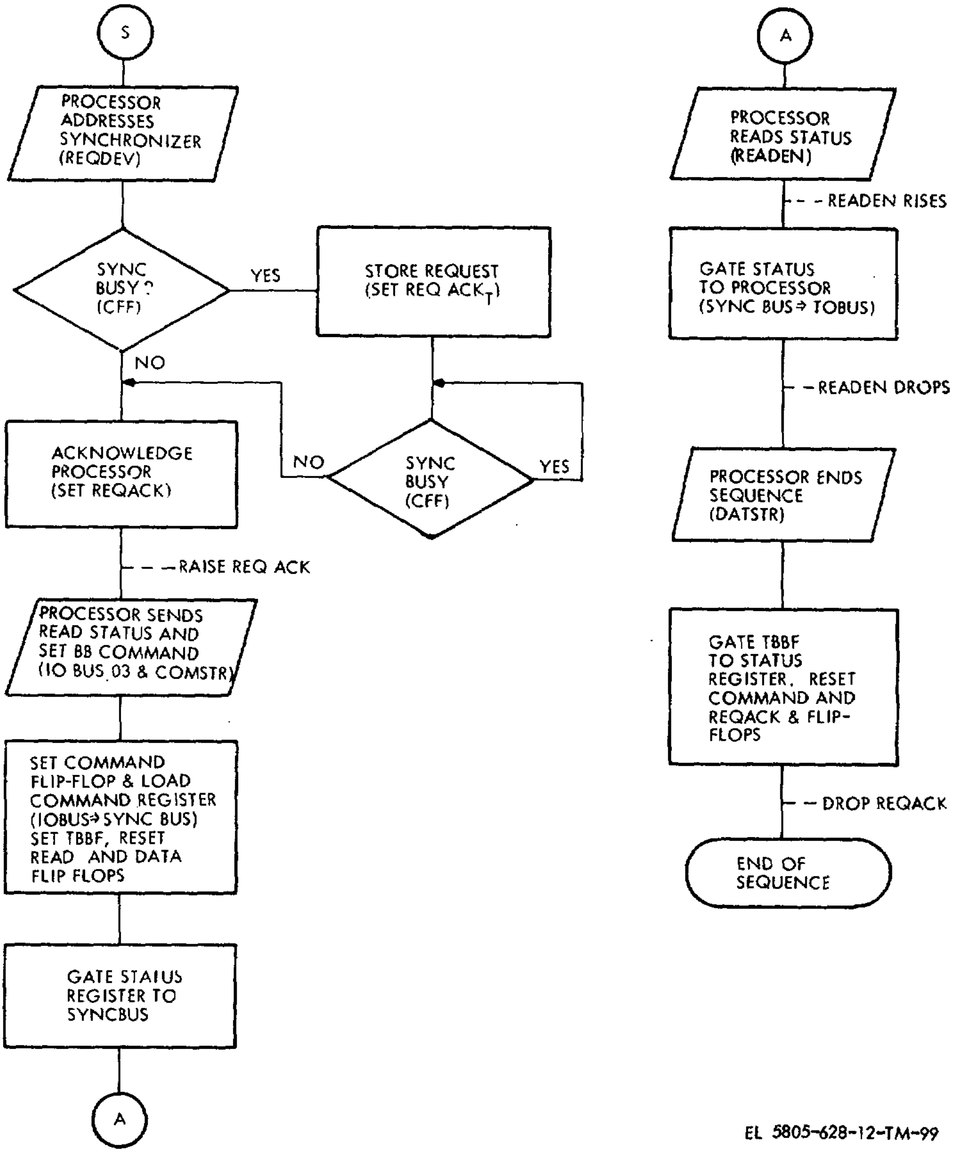

Figure 4-25. Read status and set busy bit flow diagram.

b. Input Operation. An input operation can be initiated by either the processor or a peripheral device.

(1) *Processor initiated input*. Prerequisite to a processor initiated input is that the input device is in a ready state and a character has been received by the synchronizer. The processor raises DEVREQ, -and the synchronizer responds with REQACK. The processor places a read status and set busy bit command on the IOBUS and sends a COMSTR. If BB was clear, the processor gains control of the synchronizer. CH RDY status is checked, and the processor initiates' the read operation.

(a) Read data (fig. 4-29). To start the data 4-48 transfer, the processor raises REQDEV, and the synchronizer responds with REQACK. A read data command is placed on the IOBUS and is accompanied by COMSTR. The command is loaded in the command register, and the command flip-flop is set. The processor then raises READEN, gating the SYNCBUS to the IOBUS. Decoding read data gates the buffer register to SYNCBUS, and the character is transferred. DATSTR resets the command flip-flop and the CH RDY bit, and the synchronizer drops REQACK. Resetting CH RDY strobes the next character from the input device.

(b) Read status. The processor sends read status commands and COMSTR pulses until it finds the CH RDY status bit set. Each time the read status

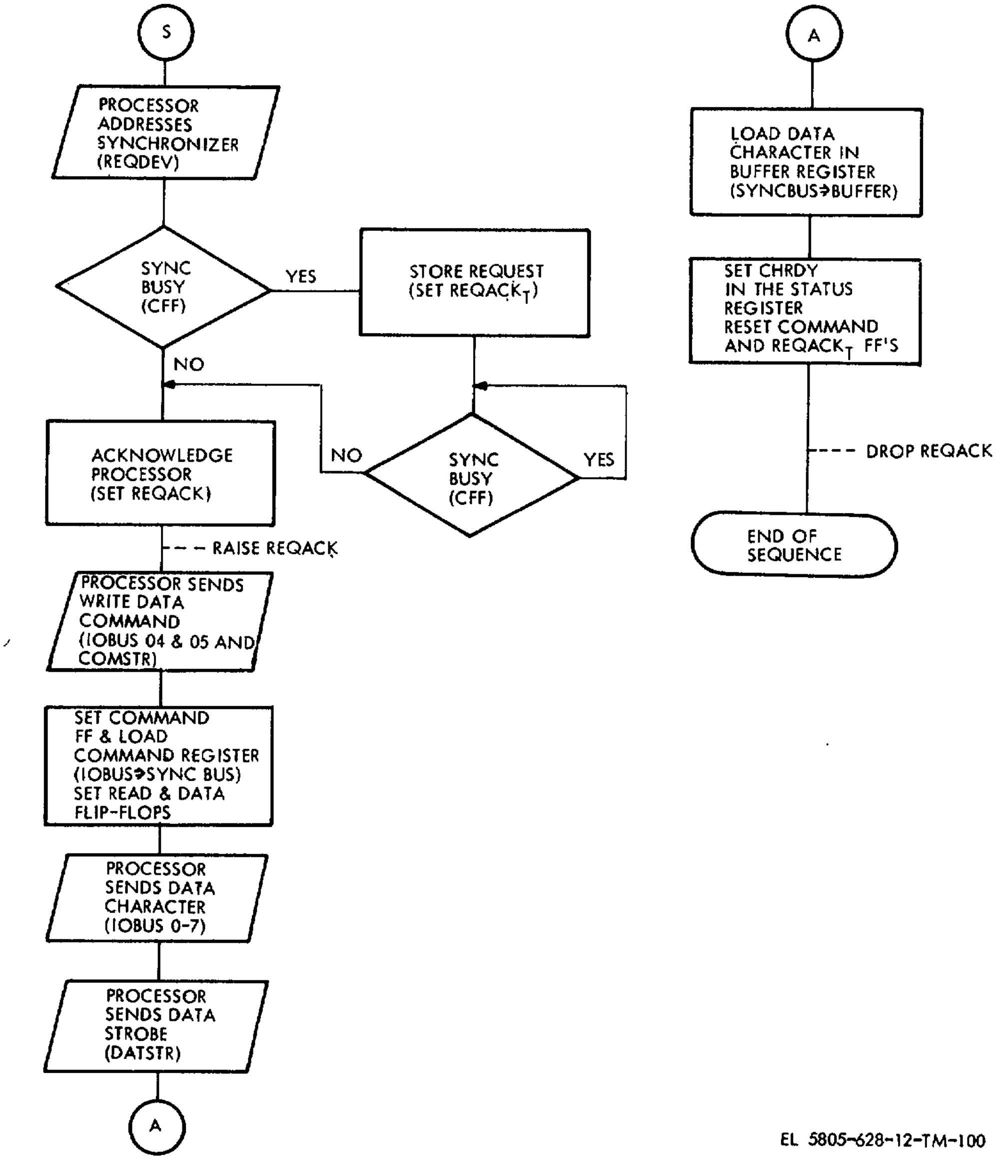

Figure 4-26. Write data flow diagram.

command detects CH RDY set a read data command inputs the next character. When the processor determines the completed message has been received, it terminates the input operation.

(*c*) *Write status*. To reset BB, the processor raises REQDEV. When the synchronizer responds with REQACK, the processor sends the write status command, resetting BB in the status register.

(*d*) *Device idle*. At any time during the input operation, if the processor does not read the character in the synchronizer, the input device is halted. The character remains in the buffer register and CH RDY is set.

(2) *Device initiated input*. At initialization and whenever the synchronizer is not under control of a processor, the synchronizer idles in the read data mode. This allows the peripheral device to initiate an input operation.

(*a*) *Interrupt (INTY*). When the last bit of an incoming character is received from a device, the character is transferred from the character register to the buffer register, and CH RDY is set in the status register. With CH RDY set and BB clear, the synchronizer can raise INTY to the processors. The processor responds to the interrupt with a read status and set busy bit command. Finding CH RDY set, the processor transfers incoming characters with read data and read status commands until the completed

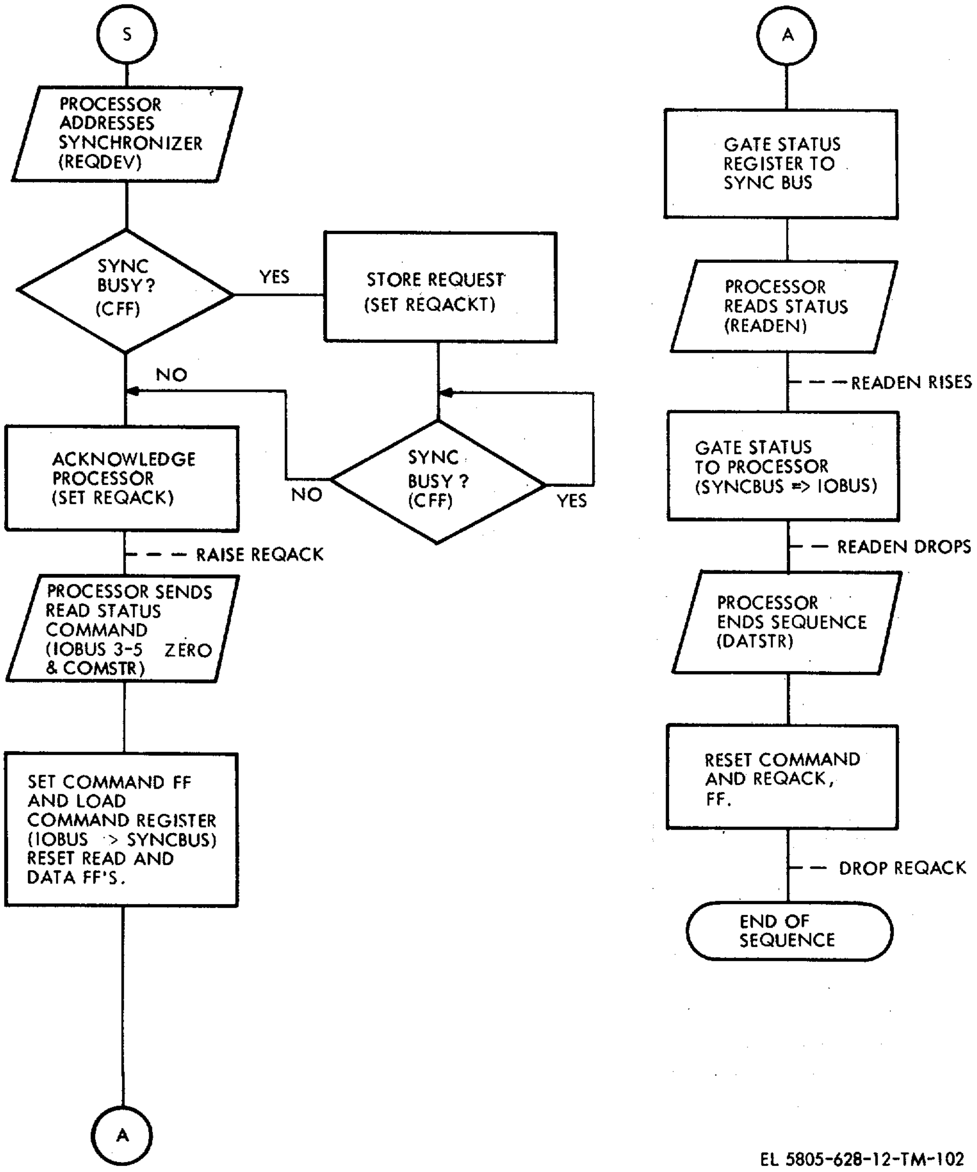

Figure 4-27. Read status flow diagram.

message is received. The operations is terminated with the write status command to reset BB.

(*b*) *Character lost (CHLST*). During the device-initiated input operation,, should the synchronizer detects an error in the data stream; i.e., in-before CH RDY is reset by the processor, the character in the buffer register is lost, the CHLST is set in the status register.

(*c*) *Timing read error (TRE*). If the synchronizer detects an error in the data stream; i.e., incorrect character length, missing stop bits, incorrect baud rate, for wrong code, the TRE bit is set in the status register.

4-29. Device Data Transfers

The synchronizer transfers data to or from a peripheral device, in serial or parallel in either BAUDOT or ASCII code, or 8-bit binary format.

a. Serial Output Data Transfer (fig. 4-30). The output data transfer begins with the write data command from the processor. Decoding write data drops the INPUT/OUTPUT line, the output character is in the buffer register, and CH RDY is set in the status register. With the serial mode selected (SERIAL F), INPUT and CH RDY set the sequence counter enable flip-flop (SQCNTEN), starting the sequence counter. The sequence counter generates DECODE signals at the cycle rate determined by baud rate selection. The

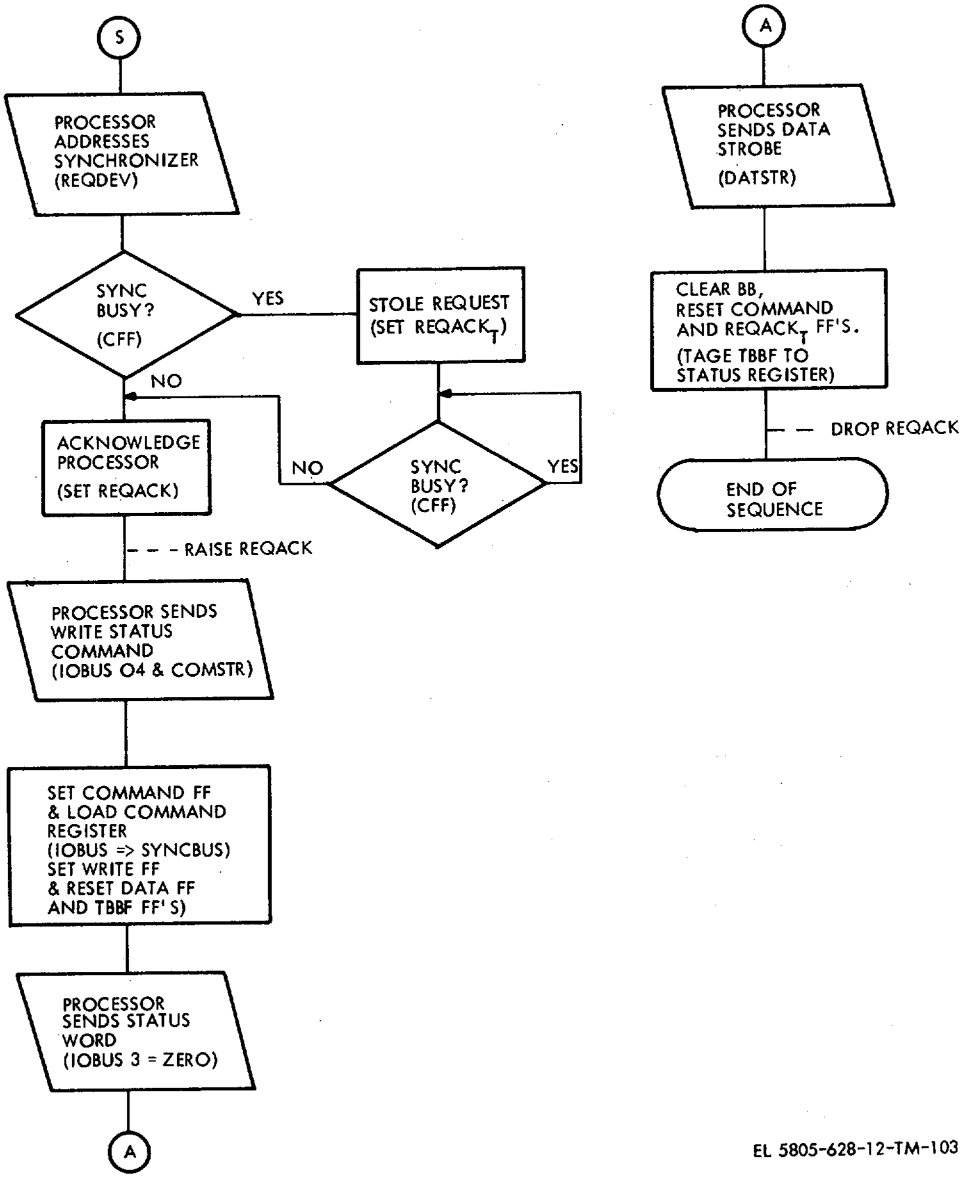

Figure 4-28. Write status flow diagram.

first DECODE pulse gates the buffer register into the character register (ENABLE LOAD • ENABLE DATA SHIFT-), resets CH RDY in the status register and steps the bit counter to one. The next DECODE steps the bit counter to two. The next DECODE shifts the character register (ENABLE LOADENABLE DAYTA SHIFT), transmitting the start bit, and steps the bit counter to three. The next DECODE steps the bit counter. Data transfer continues with each DECODE occurring when the bit counter has an even count, shifting the character register and transmitting the next bit. Data transfer is halted when the last bit has been sent. The number of shifts and transfers' depends on code selection and number of stop bits required. The ASCII and STOPI inputs to bit counter decoding determine when data transfer halts. Terminating shifts also resets the bit counter. If another character has been received from the processor, the next DECODE pulse gates the buffer register to the character register, and another output transfer occurs. If another character has not been received, SQCNTEN is dropped, halting the sequence counter.

b. Parallel Output Data Transfer. (fig. 4-31). The write data command loads the buffer register and sets CH RDY in the status register. In the parallel output mode, PAREN- and CH RDY enable the bit counter which steps at P2 pulse rates. As soon as the bit count is greater than zero, the buffer register is gated to the output device. At a bit count of five, DEVICE STROBE is raised, and at a count of six it is dropped,

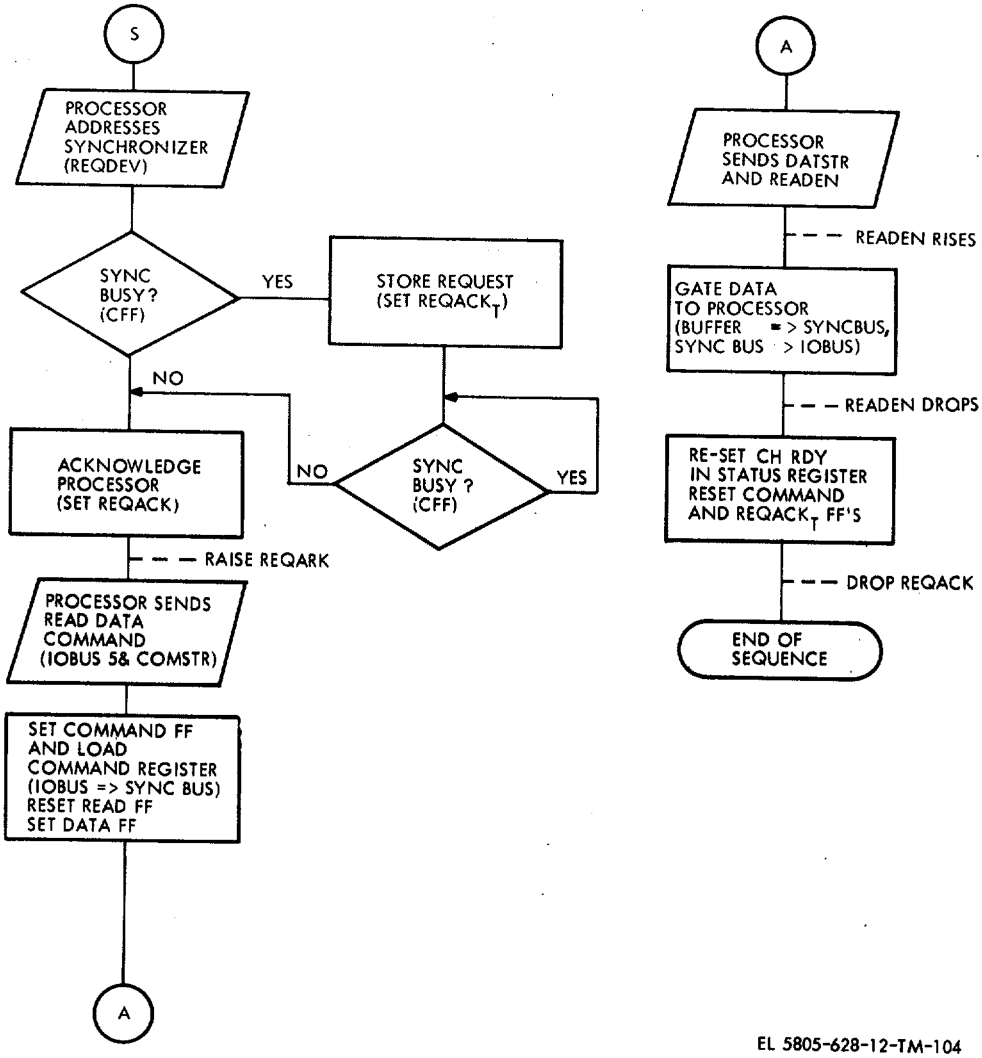

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Figure 4-29. Read data flow diagram.

sending an 8-microsecond strobe to the device. At a count of eight, CH RDY is reset, removing the data from the output device and resetting the bit counter. Subsequent write data commands initiate data transfers until terminated by the processor.

c. Serial Input Data Transfer (fig. 4-32). With the serial input mode selected (SERIAL • INPUT), an incoming start bit (space) sets SQCTEN, starting the sequence counter. Depending upon code selection (ASCII or BAUDOT), the incoming serial data is gated into character register bit 0 or bit 3. The sequence counter generates DECODE signals at the cycle rate determined by the baud rate selection input. Each DECODE steps the bit counter. When the bit counter is at two, the next DECODE shifts the character register (ENABLE LOAD ENABLE DATA SHIFT), gating the first data bit to bit position 0 or 3, and steps the bit counter to 3. Data input continues with each DECODE, occurring when the bit count is even. The number of bits shifted in depends on code selection (ASCII • STOPI) inputs to the bit counter. When the last bit has been received, data transfers are halted, the bit counter is reset, and the character register is gated to the buffer register. If the stop bit is received (mark), the CH RDY flip-flop is set, and the synchronizer waits for another start bit.

(1) *Character lost*. If the processor fails to input the previously received character, CH RDY will not be cleared when the stop bit is received. The character in the buffer register at the start of this input transfer has been lost, and the CH LST bit is set in the status register.

(2) *Timing and error*. If the synchronizer fails to find the proper stop bit(s) in the incoming character format, CH RDY is not set. The character is available in the buffer register, and the TRE bit in the status register is set.

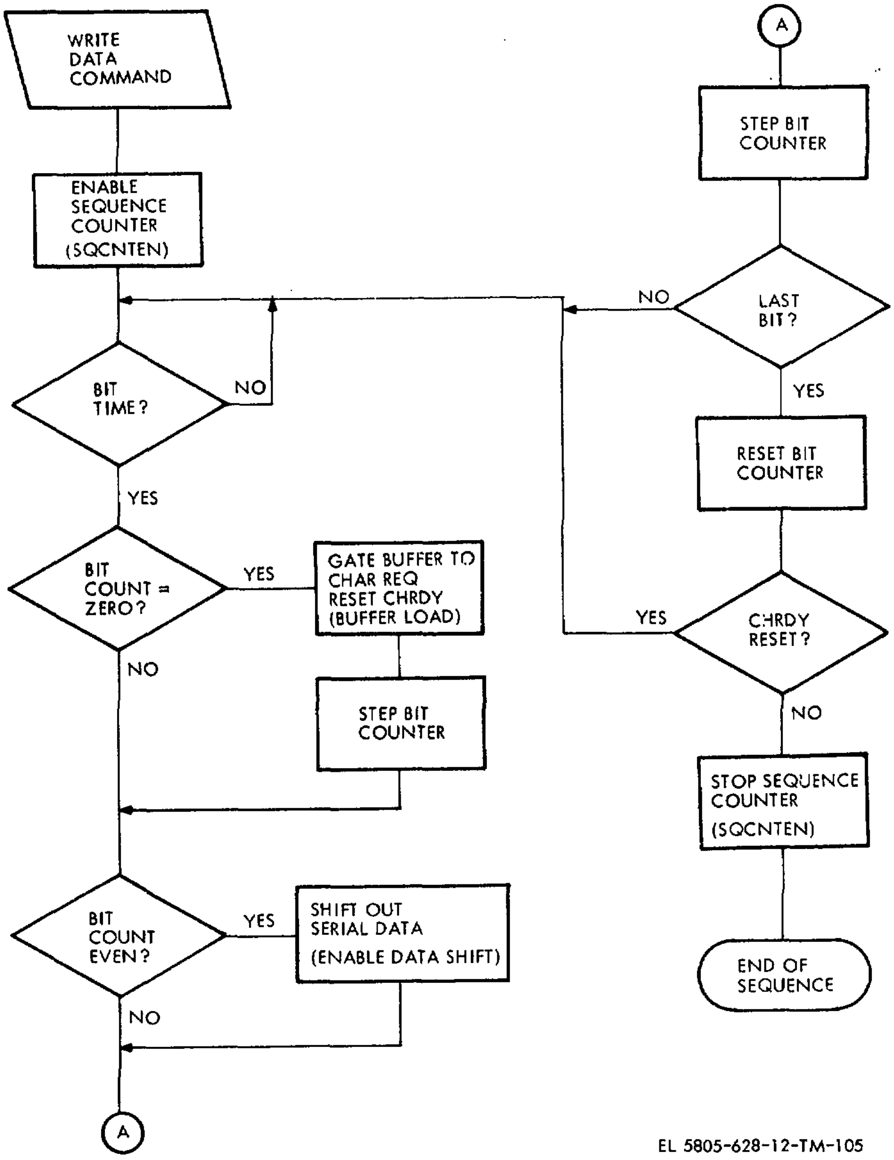


Figure 4-30. Serial output data transfer flow diagram

(3) *Interrupt*. When the stop bit is received, BB in the status register is checked. If the bit is clear, INTY is raised to the processors.

d. Parallel Input Data Transfer (fig. 4-33). In the parallel input mode (PAREN-·• INPUT) with the CH RDY bit in the status register reset, data transfer is started with device ready or detecting a sprocket hold (DVIN). DVIN sets the parallel enable flip-flop (PAREN-). With PAREN set and CH CH RDY clear, the device data is gated to the buffer register (DEVICE⇒ BUFFER), and the CH RDY bit is set. FWD/DEVICE STROBE is raised, indicating to the device that data was accepted. The device drops DVIN. Setting CH RDY allows resetting PAREN. If the processor transfers the data and resets CH RDY before the next DVIN, the above sequence is repeated. If CH RDY is still set when DVIN rises, the FWD flip-flop is reset. The sequence resumes when CH RDY is reset.

4-30. System Alarms Register
(fig. 4-34)

Synchronizer assembly A16 contains the system alarms register, audible alarm decoding, and gating for paper tape reader rewind. These circuits control alarm indicators on system status panel A6.

a. Power Failure Alarms. The ac, dc power failure alarms are set and reset by hardware. Power subsystem (fig. FO-23) failure circuits develop

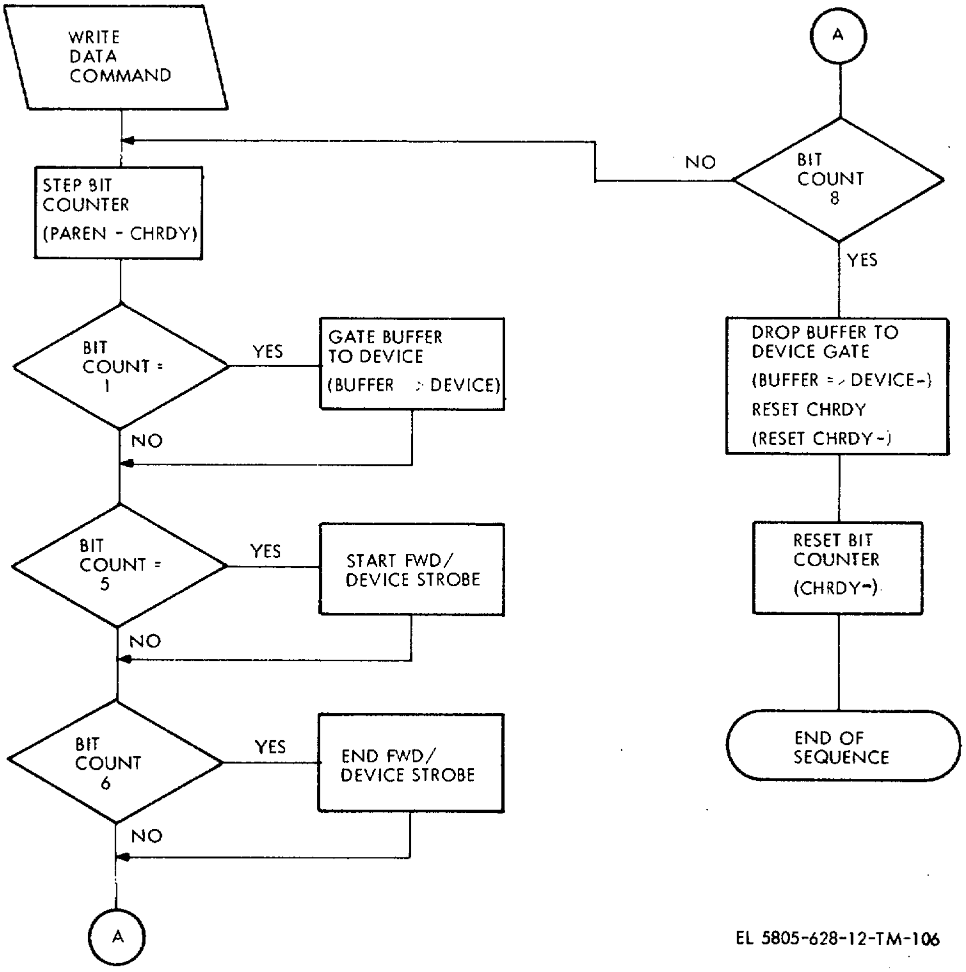


Figure 4-31. Parallel output data transfer flow diagram.

APSACDS (prime ac failure) and APSDCDS (dc failure) which set unique latches in the alarm register. The latches light A6 AC PWR and DC PWR alarm indicator when set and sound the audible alarm. When the condition causing the alarm is corrected, the APSACDS and APSDCDS signals drop, resetting the latches.

b. Program Detected Alarms. The remaining ten alarms on A6 are set and reset by the on-line processor. The central processor bus (CPB) line corresponding to the detected alarm is raised. The processor also raises ATRIA which gates the CPB into the alarm register,, setting the alarm latch. The latch is reset when the processor drops the CPB line and raises ATRIMA. The program detected alarm latches can also be reset manually: set the ALARM REGISTER toggle switch on the SYSTEM STATUS PANEL A6 to ON and press RESET. The low level AALMCLR- resets the alarm register with the exception of the supervisory alarm. This alarm is reset by a separate supervisory ALARM RESET pushbutton.

c. Audible Alarms. The ac, dc power failure and seven of the program detected alarms will sound the A6 audible alarm. The AAUDALR signal raised by detecting any of the nine alarms sets the audible alarm latch associated with the detected alarm. Audible alarms may be reset without resetting the alarm register by pressing the AUDIO ALARM RESET pushbutton on A6 which sends the AUDALR signal to the system alarm register.

d. Alarm Indicators. Each alarm register latch controls an indicator on system status panel A6. Setting the alarm register latch lights the lamp associated with the alarm. Resetting the audible alarm does not extinguish the alarm lamp.

e. Alarm Register Readout. The processor can read the content of the alarm register by raising ATROMMA. The signal gates the contents of the alarm register to the CPB.

f. Paper Tape Rewind. The paper tape reader can

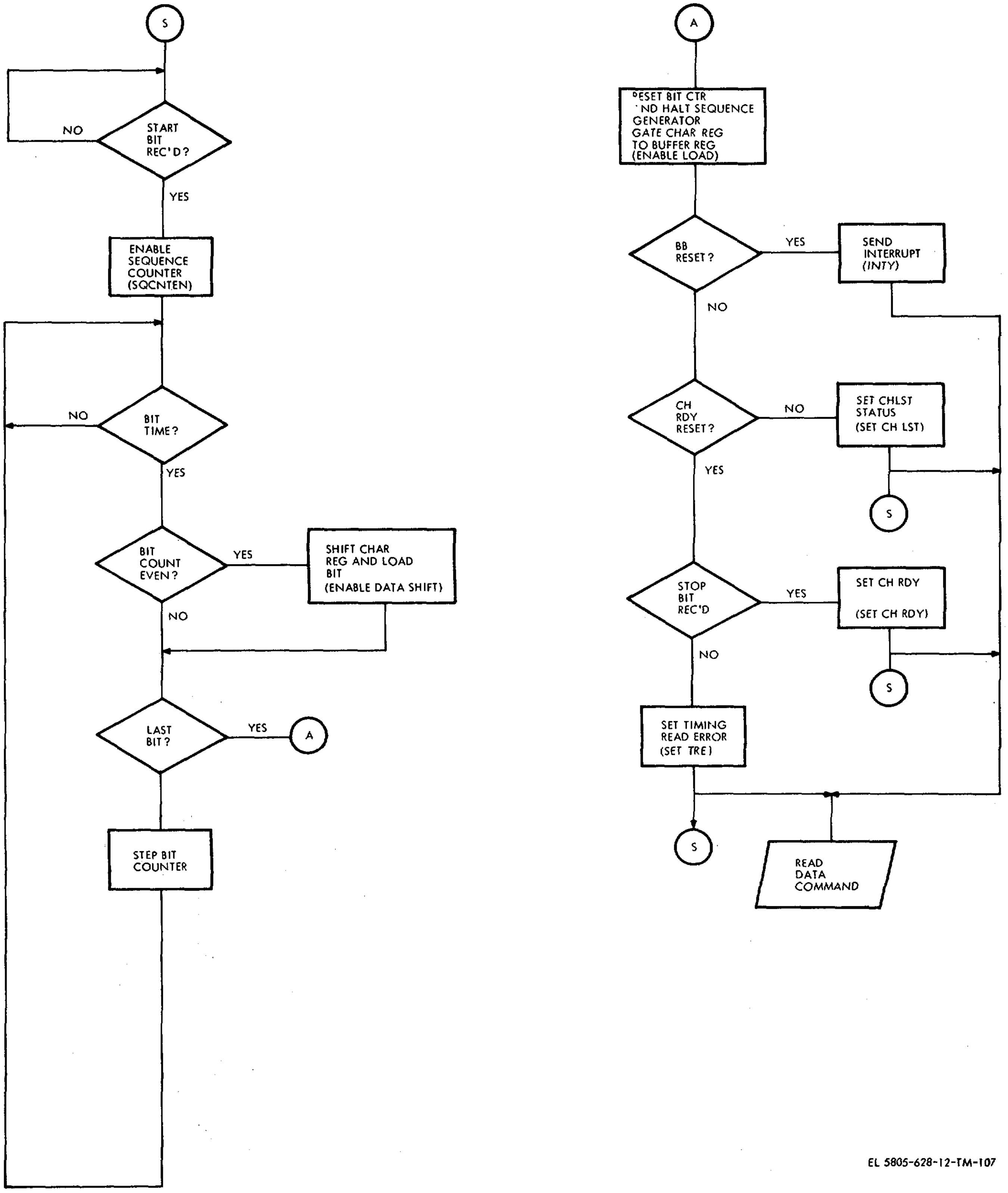


Figure 4-32. Serial input data transfer flow diagram.

be rewound from system status panel A6. Setting the TAPE READER REWIND switch to ON drops AFOR and ASLOW and raises ASTRT to the paper tape reader. The reader continues to rewind until the switch is returned to the OFF position.

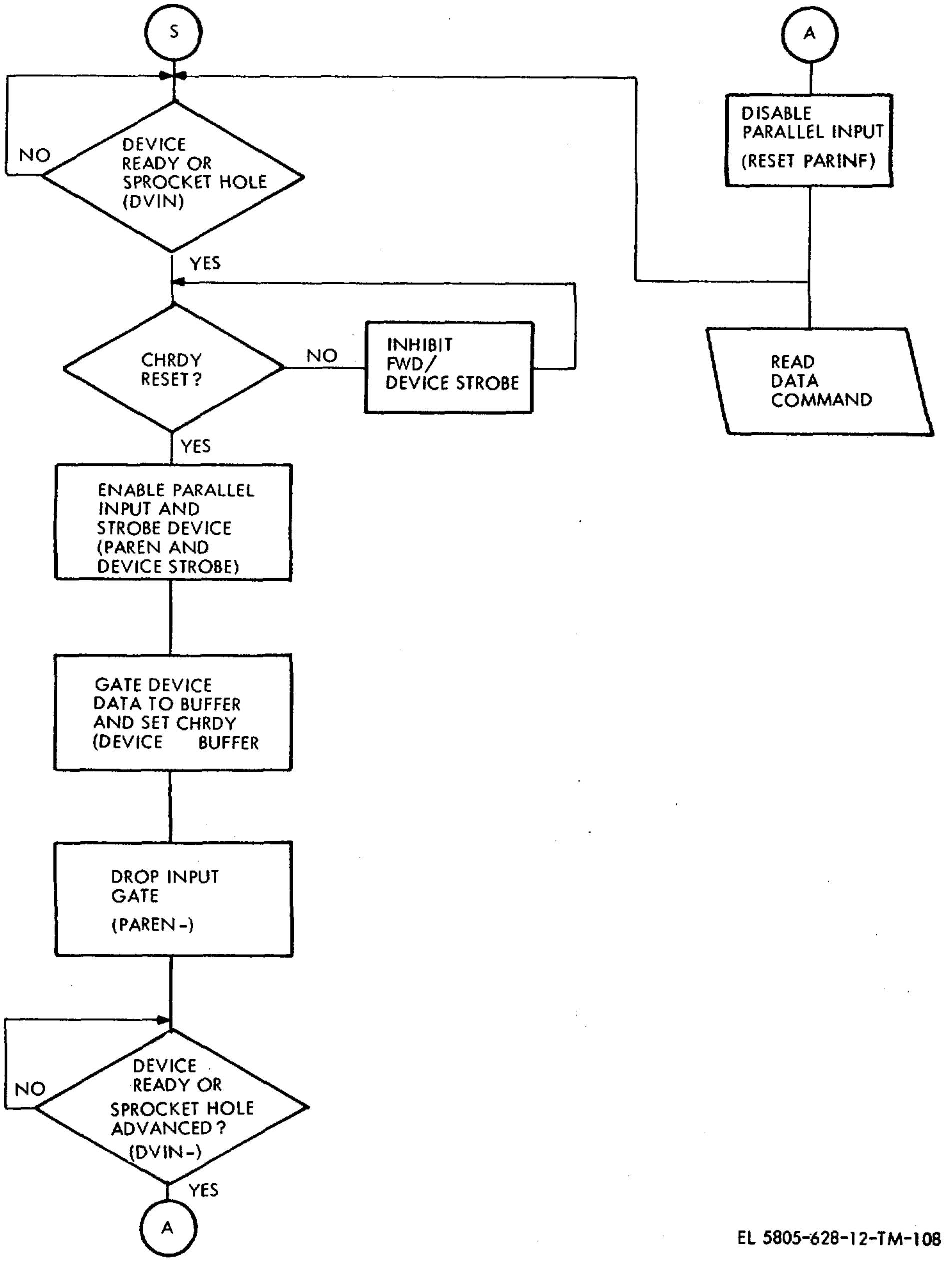
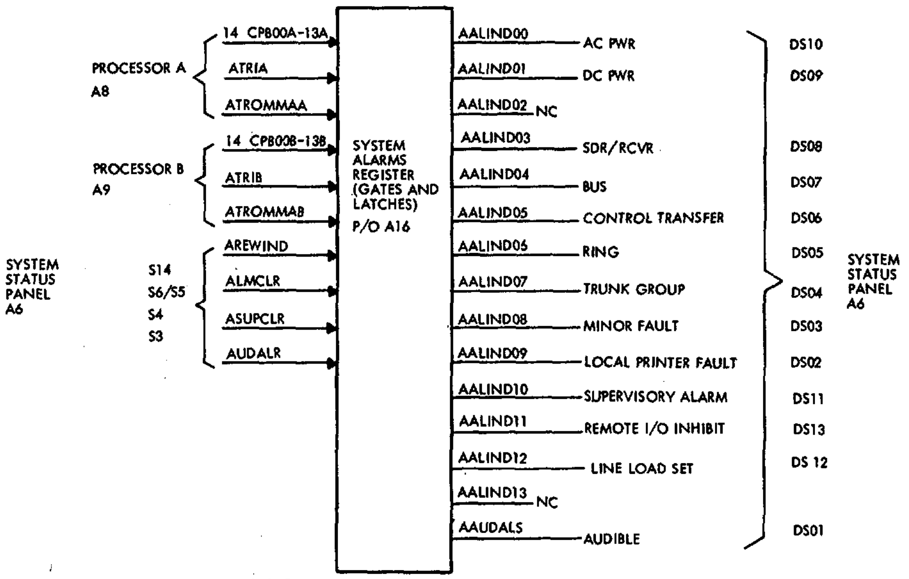


Figure 4-33. Parallel input data transfer flow diagram.



NOTES:
1. CPB NUMBER CORRESPONDS TO AALIND NUMBER.
2. AUDIBLE ALARM SOUNDED BY ALL ALARMS EXCEPT:
   SUPERVISORY ALARM
   REMOTE I/O INHIBIT
   LINE LOAD SET
3. AALIND02 AND AALIND13 ARE NOT USED

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Figure 4-34. System alarms register, block diagram.

Section VII. CONTROL TRANSFER

4-31. Control Transfer Description

(fig. FO-19)

The control transfer logic and relays interface with the network and both central processors as shown in figure FO-19. If a failure occurs in the on-line processor, network control is transferred automatically by the control transfer logic to the standby processor. Automatic transfer occurs only when the active processor fails and the inactive processor is operable and available. The system status panel includes provisions for disabling the automatic transfer logic and manually transferring control of the network.

4-32. Control Transfer of Processors

There are two central processors: processor A at A8 and processor B at A9. Only one processor is connected to the network at any one time. The other processor may be in the standby mode or off-line. Network control can only be transferred to a standby processor. Program and parametric (class of service, directory number tables, etc.) data is maintained by both the on-line and standby processors. However, call establishment and connection information is present only in the online memory and is lost at the time of transfer. Any calls in the process of establishment must be reinitiated. Calls that are already established are saved since the connections already exist. However a network recovery routine is required to acquire the call connection information for memory. The processor can determine which inlets are connected to which outlets, but it cannot determine which links are being used to make the connections. Therefore, the processor breaks the connections and reconnects them using its own precalculated links.

a. On-Line Processor. The on-line processor is the only processor connected to the network. It performs all call processing. The on-line processor can communicate with the standby processor via an input/output (memory-to-memory) synchronizer. This allows it to forward any changes in the parametric data to the standby processor. Call connection data is not forwarded.

b. Standby Processor. The standby processor is not connected to the network. However it does operate under the control of the operational program. The program performs self-checking and data base updating, using data supplied via the input/output link with the other processor. This allows the standby processor to assume an active role if a transfer is required.

c. Status Register. The central processor status (CPS) register is the control interface with the control transfer logic.CPS08 is set to indicate a processor failure and initiate a control transfer if the processor is on-line. CPS08 is set when the processor fails to execute an SLI instruction, or it can be set by the program. Its setting is simulated to the control transfer logic when a processor power failure occurs. CPS11 is set by the control transfer logic to indicate that a transfer is being initiated. Both CPS11 and CPS08 can initiate program interrupts. CPS22 and CPS23 are not flip-flops. They are gates which are driven directly by levels from the control transfer logic. CPS22 is CPS08 from the other processor and indicates the status of that processor. CPS23 indicates which is the active processor. It reflects the state of the transfer flip-flop (XFRF) in the control transfer logic.

d. Processor/Network Interface. Four registers and their associated logic are used in conjunction with the KL counter logic to transmit data and commands to and receive data from the network. The interface lines are connected to the network from the on-line processor via the control transfer relays.

e. Maintenance Control Panel. The ON-LINE and STANDBY indicators on the maintenance control panel are controlled by the control transfer logic. The ON-LINE indicator is illuminated when the transfer flip-flop indicates the associated processor is on-line and CPS08 indicates the processor is operational. The STANDBY indicator is illuminated for the other processor when CPS08 from that processor indicates that it is operational. The OFF-LINE indicator is illuminated when CPS08 is set.

4-33. Transfer Relays

Network control is switched from one processor to the other by the control transfer relay unit (A19). This unit includes thirty-two 6-pole, double-throw, latching relays (K1-32). These relays connect the network interface lines to either processor A or processor B. The relays are operated by four other relays (K33-36) as directed by the control transfer logic. Relay K35 operates relays K1-16, and relay K33 operates relays K17-32 to connect processor A to the network. Relay K36 operates relays K1-16, and relay K34 operates relays K17-32 to connect processor B to the network.

4-34. Control Transfer Logic

The control transfer logic (A16) initiates a transfer automatically when CPS08 of the on-line processor is set, CPS08 from the other processor is reset to indicate it is on standby and operational, and the CONTROL TRANSFER AUTO ENABLE/DISABLE switch on the system status panel is set to ENABLE. A transfer can be manually initiated without regard to the status of the two processors by depressing the CONTROL TRANSFER MANUAL switch on the system status panel. In either case, the transfer logic sets CPS11 at both processors and energizes the appropriate control relays at A19 for 50 milliseconds.

a. Control Transfer Flip-Flops. The control transfer toggle (XFRT) and main (XFRF) flip-flops are reset when processor A is on-line and set when processor B is on-line. The states of the two flip-flops are reversed by either the manual or auto transfer logic when the conditions required for a transfer are met. The main flip-flop outputs (XFRF and XFRF-) select the control relays to be energized by the 50-millisecond one shot, control the CPS23 bits at the two processors, and illuminate the STANDBY and ON-LINE indicators at the two maintenance control panels (provided that the associated CPS08 bits are not set).

b. Relay Control. The transfer toggle and main flip-flops are switched in sequence when a traffic is initiated. This sets the RF flip-flop. The RF flip-flop in turn sets CPS11 at both processors and triggers the 50-millisecond one shot. The one shot energizes the control relays selected by the transfer (XFRF) flip-flop.

c. Auto Transfer. An automatic transfer is initiated when CPS08 of the on-line processor is set, provided that CPS08 of the standby processor is not set and the auto transfer logic is enabled (ENABLE/DISABLE switch set to ENABLE). The auto transfer logic initiates the transfer sequence by switching the transfer toggle (XFRT) flip-flop.

d. Manual Transfer. A transfer can be initiated manually by depressing the MANUAL pushbutton switch on the system status panel, provided that the AUTO ENABLE/DISABLE switch is set to DISABLE. This switches the transfer (XFRT and XFRF) flip-flops.

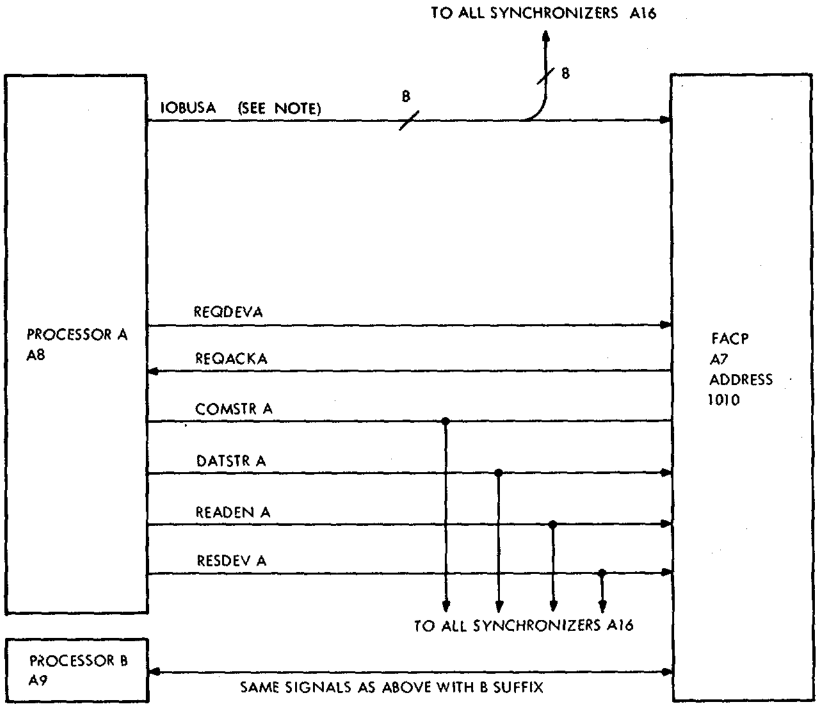
e. Clock. The clock pulses required by both the control transfer logic and the synchronizers are generated by a 500-kHz oscillator and ring counter with decoder. Operation is the same as for the central processor clock except that the clock produces three 1microsecond clock pulses occurring at 2-microsecond intervals. These pulses (P1-3) are repeated once every eight microseconds.

Section VIII. FUNCTIONAL ASSIGNMENT CONTROL PANEL

4-35. Functional Assignment Control Panel (FACP)

The FACP is part of the input/output device interface (para 4-27), sharing the data and common control buses with the synchronizers.

a. Input/Output Bus (fig. 4-35). Each processor has an eight-line data bus (IOBUSAO-7 and IOBUSBO-7) common to the FACP and all synchronizers. The data bus is used in the exchange of commands, data, and status between the processor and the FACP.



NOTE: IO BUS DATA ASSIGNMENTS

FUNCTION	IO BUS BIT NUMBER							
	0	1	2	3	4	5	6	7
DATA	FROM PROCESSOR - 8 BIT ADDRESS AND DATA CODES TO PROCESSOR - 8 BIT FACP GENERATED CODES							
STATUS				BB	CH RDY	ERRF		
COMMAND				BB	READ = 1 WRITE = 0	STATUS = 1 DATA = 0		

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Figure 4-35. FACP interface.

(1) *Commands*. A combination of these data bus lines (IOBUS 3-5) are used to receive five instructions from the processor.

(*a*) The read status command results in the FACP transferring the contents of the FACP status register to the IOBUS.

(*b*) The read data command results in the FACP transferring one character to the IOBUS.

(*c*) The write status command results in the FACP loading the status information from the IOBUS to the FACP status register.

(*d*) The write data command results in the FACP loading either an address or a data character from the IOBUS into internal storage.

(*e*) The read status and set busy bit (BB) command results in the FACP transferring the contents of the FACP status register (including the current state of the BB) to the IOBUS. If the BB is not set, this command will set it.

(2) *Data*. During data transfer, IOBUSAO-7 or IOBUSBO-7 is used to input or output an 8-bit character between processor and FACP (tables 4-11 through 4-13).

(3) *Status*. Three bits of status can be transferred between processor and FACP on IOBUSA 3-5 or IOBUSB 3-5. Status bits indicate FACP busy (BB) character available for input (CH RDY), or error has occurred (ERRF).

b. Common Control Bus. Each processor has a four-line control bus common to the FACP and all synchronizers.

(1) *Read enable (READENA, READENB)*. This line gates either the FACP status register or the read buffer to the IOBUS. Gating is dependent on whether the accompanying command is read status or read data.

(2) *Command strobe (COMSTRA, COMSTRB)*. This line gates IOBUS 3-5 to the command register.

(3) *Data strobe (DATSTRA, DATSTRB)*. This line controls input and output data transfers between processor and FACP.

(4) *Reset device (RESDEVA, RESDEVB)*. This line resets FACP logic. All operations are terminated and communication must be reestablished.

c. Unique Control Lines. Each processor has two control lines to the FACP and each synchronizer. These lines identify the FACP as the device in communication with the processor.

(1) *Request device (REQDEVA, REQDEVB)*. The FACP and each synchronizer have a unique request device line from each processor. The processor initiates communication with the FACP on the request device line.

(2) *Request acknowledge (REQACKA, REQACKB)*. The FACP and each synchronizer have a unique request acknowledge line to each processor. The FACP acknowledges communications with the processor on the request acknowledge line.

4-36. Functional Assignment Control Panel Operation

(fig. FO-20)

Functional assignment control panel operation is initiated at the FACP and consists of pushbutton command, function, and data entries and processor replies.

a. Pushbutton Entries. When an FACP pushbutton is pressed, its corresponding data word is loaded into the debounce register (DBNCFO-7). When any debounce register stage is set, the CH RDY bit in the status register (SWF) is set. Also, read buffer clock RDBFRCLK gates the debounce register content into an eight-bit read buffer. The read buffer content can be gated on to IOBUSA or B by TROBFRA or B when the appropriate processor sends a read data command.

b. Indicator Addressing. The processor usually responds to a pushbutton entry by flashing an indicator. The flashing indicator means the processor is sending data, a pushbutton entry is required, or a data entry is necessary.

(1) *First indicator address*. The processor sends a write data command. When REQACK is raised, the write data command is placed on IOBUS 0-7, and the processor sends COMSTR. The command is loaded in the command register. The processor then puts the indicator address on the IOBUS and sends DATSTR. This gates IOBUS 0-7 to the write buffer (TRIWBFR). Bit 0 of all indicator addresses is 1. Therefore, when bit 0 of the write buffer (WRTBFRO) is set, an indicator is being addressed. Set WRTBRFO causes the control circuits to gate (TRIFIR) the decoded current address register (CAR) content into the function address register (FIR). This transfer has

Table 4-11. FACP Generated Data Code

Pushbutton name	IOBUS bit number
	0 1 2 3 4 5 6 7
READER TO TTY	0 0 1 0 0 0 0 1
READER TO SP TTY	0 0 1 0 0 0 1 0
READER TO PUNCH	0 0 1 0 0 0 1 1
PRINT	0 0 1 0 0 1 0 0
PUNCH	0 0 1 0 0 1 0 1
PRINT STOP	0 0 1 0 0 1 1 0
PUNCH STOP	0 0 1 0 0 1 1 1
ASSIGN	0 1 0 0 0 0 0 1
CHANGE	0 1 0 0 0 0 1 0
DELETE/RESET	0 1 0 0 0 0 1 1
DISPLAY	0 1 0 0 0 1 0 0
FACP CLEAR	0 1 0 0 0 1 0 1
FIELD CLEAR	0 1 0 0 0 1 1 0
STORE	0 1 0 0 0 1 1 1
STORE AND REPEAT	0 1 0 0 1 0 0 0
CONTINUE	0 1 0 0 1 0 0 1
TERMINAL SERVICE	0 1 1 0 0 0 0 1
TERMINAL NO ASGMT	0 1 1 0 0 0 1 0
DIRECTORY NO ASGMT	0 1 1 0 0 0 1 1
TRK GR NO	0 1 1 0 0 1 0 0
PR ROUTING	0 1 1 0 0 1 0 1
SL ROUTING	0 1 1 0 0 1 1 0
ALTN SL ROUTING	0 1 1 0 0 1 1 1
OP/JXX ROUTING	0 1 1 0 1 0 0 0
FIXED DIR ROUTING	0 1 1 0 1 0 0 1
PRST CONF ENTRY	0 1 1 0 1 0 1 0
LINE GR ENTRY	0 1 1 0 1 0 1 1
DAC ROUTING	0 1 1 0 1 1 0 0
TRUNK TEST	0 1 0 1 1 0 1
STATUS	0 1 1 0 1 1 1 0
TRAFFIC METERS	0 1 1 0 1 1 1 1
TRK GR METERS	0 1 1 1 0 0 0 0
REMOTE I/O INHIBIT	1 0 0 0 0 0 0 1
LINE LOAD	1 0 0 0 0 0 1 0
OPR-ENTER	1 0 0 0 0 0 1 1
INFO-ENTER	1 0 0 0 0 1 0 0
ERROR-ENTER	1 0 0 0 0 1 0 1
0	1 0 1 0 0 0 0
1	1 0 1 0 0 0 1
2	1 0 1 0 0 1 0
3	1 0 1 0 0 1 1
4	1 0 1 0 1 0 0
5	1 0 1 0 1 0 1
6	1 0 1 0 1 1 0
7	1 0 1 0 1 1 1
8	1 0 1 1 0 0 0
9	1 0 1 1 0 0 1

no significance the first time an indicator is addressed. The control circuits then gate (TRICAR) the write buffer content into the current address register. CAR decoder output SXX identifies the indicator to be flashed and gates the 2-Hz flashing signal through a lamp gate to that indicator. Set WRTBFRO also resets the address counter.

(2) *Subsequent addressing of same indicator*. The second and subsequent times a specific indicator is addressed, the CAR to FIR transfer loads the flashing indicator's decoded address into the FIR. Output signal FIRXXX for that indicator bypasses the 2 Hz-flashing signal in the lamp gate and holds the indicator on continuously.

(3) *Other indicator addresses*. When a different indicator address is read in as described in (1) above, prior decoded addresses (FIR XXX) remain stored in FIR. Therefore, prior indicators remain on while a new indicator is being flashed.

Table 4-12. Processor to FACP Address Data

Indicator or function	IOBUS bit number
	0 1 2 3 4 5 6 7
Turn off indicator	1 0 0 0 1 0 0 0
READY	1 0 0 1 0 0 0 0
ERROR	1 0 0 1 1 0 0 0
STORE	1 0 1 0 0 0 0 0
READER TO TTY	1 1 0 0 1 0 0 0
READER TO TTY	1 1 0 1 0 0 0 0
READER TO SP TTY (on)	1 1 0 1 1 0 0 0
READER TO SP TTY (off)	1 1 1 0 0 0 0 0
READER TO PUNCH (on)	1 1 1 0 1 0 0 0
READER TO PUNCH (off)	1 1 1 1 0 0 0 0
FUNCTION CODE	1 0 0 0 0 0 0 1
RANK	1 0 0 0 1 0 0 1
TERMINAL TYPE	1 0 0 0 0 0 1 0
CLASSCODE	1 0 0 0 1 0 1 0
CONF	1 0 0 1 0 0 1 0
LINE GR NO	1 0 0 1 1 0 1 0
GR MIN COUNT	1 0 1 0 0 0 1 0
SPCL CKT NO	1 0 1 0 1 0 1 0
PR NO	1 0 1 1 0 0 1 0
SL NO	1 0 1 1 1 0 1 0
STATUS	1 1 0 0 0 0 1 0
ALTN SL NO	1 1 0 0 1 0 1 0
DIR NO	1 0 0 0 0 0 1 1
TRK GR NO	1 0 0 0 1 0 1 1
PRI TRK GR NO	1 0 0 1 0 0 1 1
ALTN TRK GR NO	1 0 0 1 1 0 1 1
TERMINAL NO	1 0 0 0 0 1 0 0
MODE II TERM NO	1 0 0 0 1 1 0 0
FIXED DIR NO/TRFC CNT	1 0 0 0 0 1 0 1
PR-SL-XXX/NNX-XXXX	1 0 0 0 0 1 1 1

Table 4-1. Processor-to-FACP Digit Data

Digit	IOBUS bit number							
	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
5	0	0	0	0	0	1	0	1
6	0	0	0	0	0	1	1	0
7	0	0	0	0	0	1	1	1
8	0	0	0	0	1	0	0	0
9	0	0	0	0	1	0	0	1
BLANK	0	0	0	0	1	1	1	1

c. DRO Addressing. After addressing the indicator associated with a DRO display, the processor sends digital data to the DRO's. The indicator continues flashing during the transfer.

(1) *Unit digit*. The processor first sends a write data command and then a data word for each DRO digit. When REQACK is raised, the write data command is placed on IOBUS 0-7, and the processor sends COMSTR. The command is loaded in the command register. The processor then places the digit code on the IOBUS and sends DATSTR. The IOBUS is gated to the write buffer. IOBUSO is 0 for all digit codes; this causes WRTBFRO to be reset. With WRTBFRO reset, gating into the CAR and FIR is inhibited. Reset WRTBFRO also gates (TRIDRO) the address counter state (SDR 0-7) and the CAR decoder output (SXX) through DRO addressing gates (TRDROXYX). With the address counter initially cleared SDROO identifies that the least significant DRO (units) is addressed (TRDROXYO). SXX is the address of the DRO from a prior indicator read. WRTBFRO reset also enables the DRO bus (LITDRO), gating the digit-identifying code from the write buffer (WRTBFR 4-7) to DRO storage and incrementing the address counter (AICNTR). The DRO STORAGE directly drives each readout digit.

(2) *Last-digit*. The processor continues sending digits until the last digit is transferred. When the next indicator address is sent to the FACP (IOBUSO site) a checking circuit verifies that the right number of digits was received for the DRO's addressed (COMP). An incorrect count sets ERRF in the status register. Also set WRTBFRO gates the address of the DRO just filled into the FIR. The indicator changes from flashing to steady on. The new address is loaded into the CAR and the address counter is cleared.

d. Error Detection. At each data transfer, a check 4-62 is made for excessive data transfers. A comparison is made between the address counter (CNTR 0-7), which is incremented by each data transfer, and the current address register (CAR 4-7) which contains the correct data count. If they compare (COMP), ERRF is set. Each time an indicator is addressed, the last data transfer is checked for insufficient data transfers. If the address counter and CAR do not compare, EFFR is set. At the next status check, the processor detects ERRF set and addresses the ERROR indicator, which flashes.

e. Clearing FACP. When an error is made during an entry, only the data just entered requires clearing. Press FIELD CLEAR. The processor will clear DRO storage (BLNKDRO) and turn off the indicator for the last entry. If the error occurs after CONTINUE has been pressed or as a result of incorrect data from the processor, the entry must be terminated. Press FACP clear. This resets FACP logic, including BB and CH RDY, and terminates the entry.

f. Lamp Test. Depressing TEST while the LAMP TEST rotary switch is set to IND applies a test voltage to all lamp gates. This causes all indicators to light. Depressing TEST while the LAMP TEST rotary switch is in one of the DRO positions causes two sets of signals. The first set of signals is applied to the DRO gates. They specify the digit to be displayed and simulate the LITDRO signal. The second set of signals are applied to the DRO addressing circuits and cause all addresses to be simultaneously generated. This results in the selected digit being stored in all DRO storage locations and displayed on all DRO's.

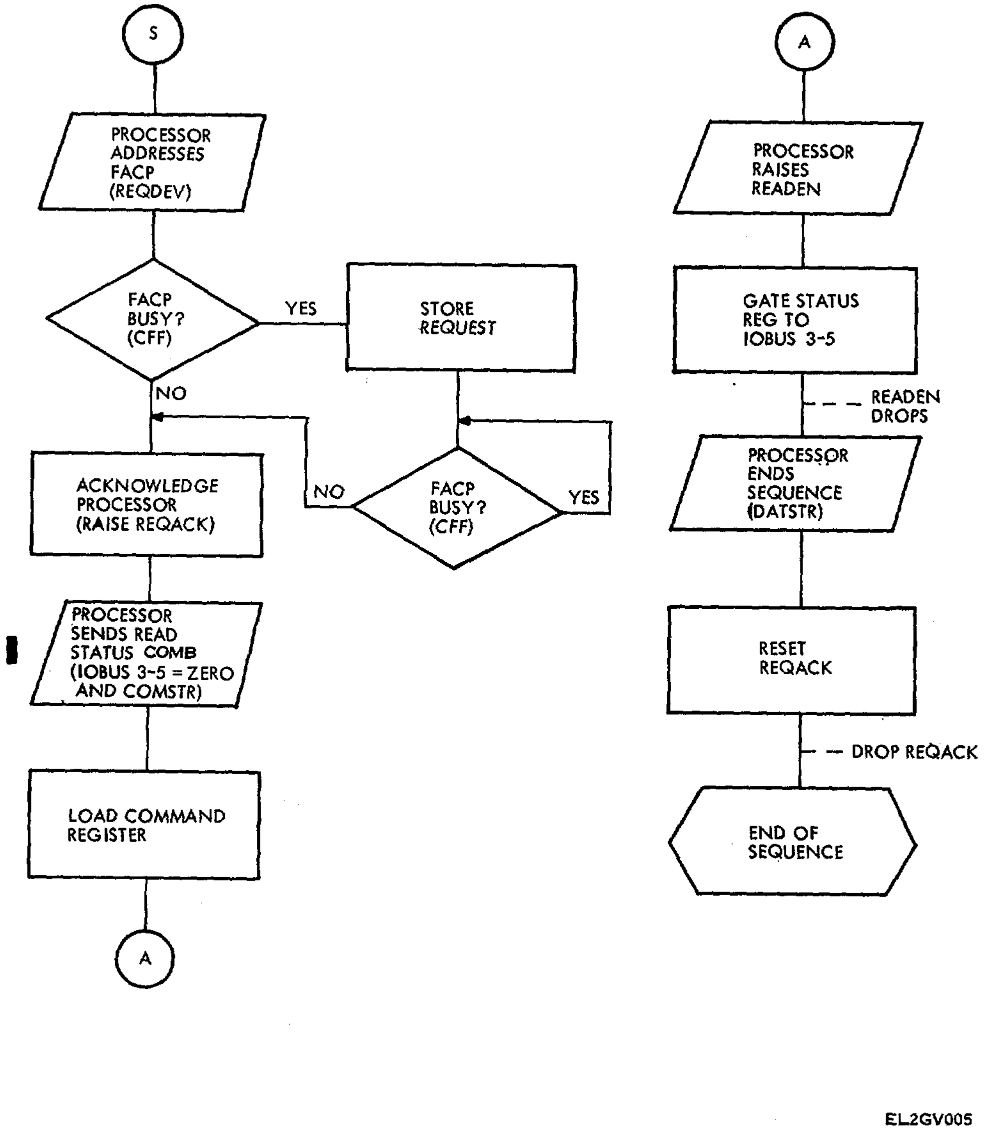
4-37. Functional Assignment Control Panel Entry Sequence

Functional assignment control panel entries consist of a series of pushbutton entries, indicator replies, and data transfers. A typical example is a request for directory number(s) for a particular terminal.

a. Checking Status (fig. 4-36). To determine when the FACP requests an entry, the processor continually monitors the CH RDY bit in the status register.

(1) *REQDEV*. The Processor raises a device request (REQDEV) to the FACP. If the alternate processor is not using the FACP (CFF), the FACP honors the request with REQACK. Raising REQACK halts the commutator flip-flop (CFF), preventing the FACP from acknowledging REQDEV from the alternate processor until the present operation is completed.

(2) *Read status*. The processor responds to



REQACK by placing the read status command on IOBUS 3-5 and sending a command strobe (COMSTR). The command is loaded in the command register. The processor raises READEN. The command register connent and READEN, gate the status register to OIBUS 3-5.

b. Access FACP (4-37). To gain control of the FACP, the processor send a read status and set buty bit (BB) command in response to REQACK. The command is loaded in the command register. The processor raises READEN. Decoding read status and READEN gates the status register to the IOBUS. The DATSTR pulse, which resets REQACK, also sets the busy bit (BB).

c. Read Entry (fig. 4-38). After gaining control of the FACP, the processor sends a read data command to input the switch configuration loaded into the read buffer. The command is loaded in the command registers. The processor raises READEN. This and decoding the read data command gates the READ BUFFER to IOBUS 0-7 (TRORBFR). The DATSTR pulse which resets REQACK also resets CH RDY in the status register.

d. Indicator Reply (fig. 4-39). In reply to an entry request, the processor flashes an indicator. In response to REQACK, a write data command is placed on the IOBUS, and COMSTR is sent. The command is loaded into the command register. The processor then places the indicator address on the IOBUS and sends a DATSTR. The IOBUS gated to the write buffer (TRIWBFR). AIIFACP indicator addresses have IOBUS set. This results in write buffer bit zero being set (WRTBFR0). WRTBFR0 set gates

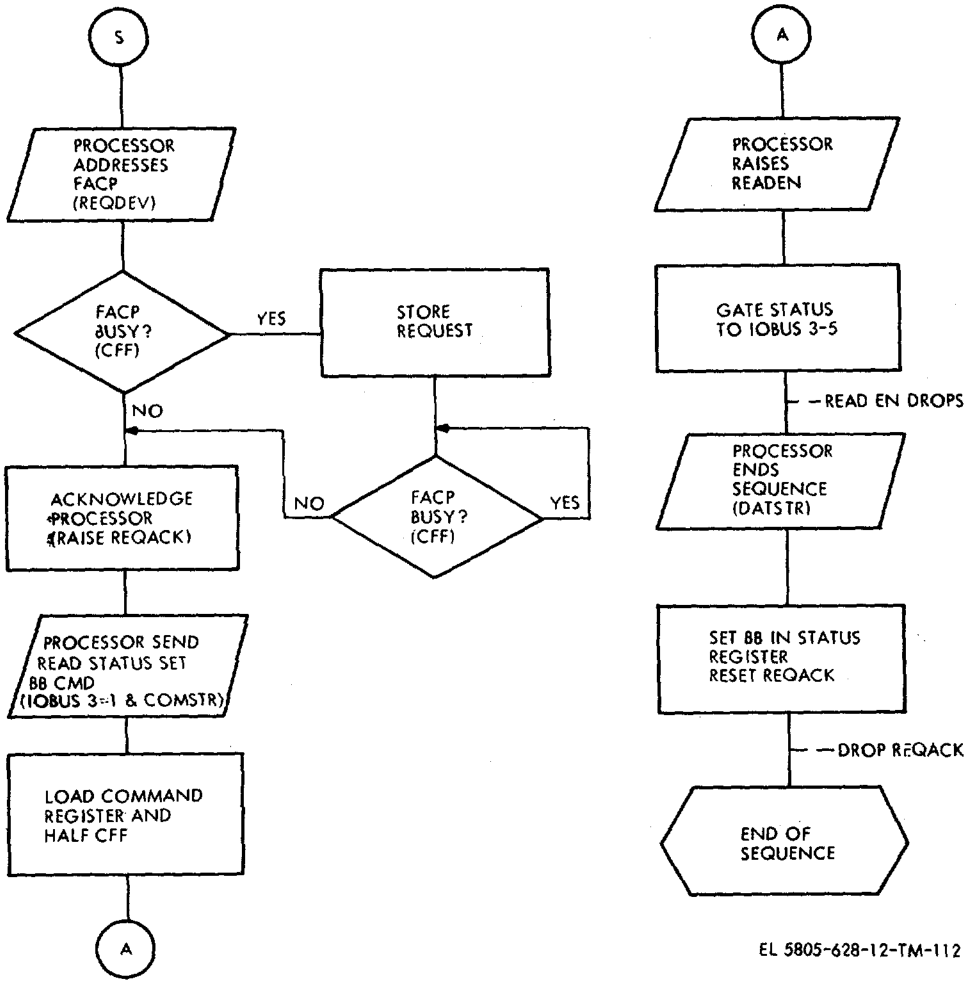


Figure 4-37. FACP access flow diagram.

the current address register (CAR) to the function indicator register (FIR) (THIFIR). If this is the first indicator addressed during an entry, the CAR is clear, and TRIFIR has no effect. WRTBFR0 being set also gates the write buffer to the CAR (TRICAR), resets the address counter (CLRCNTR) and, if the indicator addressed is a DRO indicator, the DRO's concerned are cleared (BLKDRO). The outputs of the CAR are decoded and applied to lamp gates (SXX) where a 2Hz oscillator flashes the addressed indicator. If the indicator addressed is not the first of this entry, the CAR to FIR transfer causes the previously addressed indicator to stop flashing and remain on.

e. DRO Loading (fig 4-40). DRO loading is accomplished by either the processor or the FACP panel. When the operation requires a digit entry, you key in the correct numbers. As each digit is pressed, the processor detects CYRDY set and reads the digit code from the read buffer. The processor then initiates a write data command to load the digit in the proper DRO. The command is loaded into the command register. The processor then places the digit code on the IOBUS and sends DATSTR. The IOBUS is gated to the write buffer (TRIWBFR). All digit codes have IOBUS reset. This results in WRTBFRO being reset, which inhibits CAR-to-FIR and write-buffer-to-CAR transfers. The DRO digit position is addressed (TRDROXYX) according to the count in the address register. WRTBFRO reset also enables the DRO bus (LITDRO), gating the digit to the DRO. At each data transfer, the address counter is incremented.

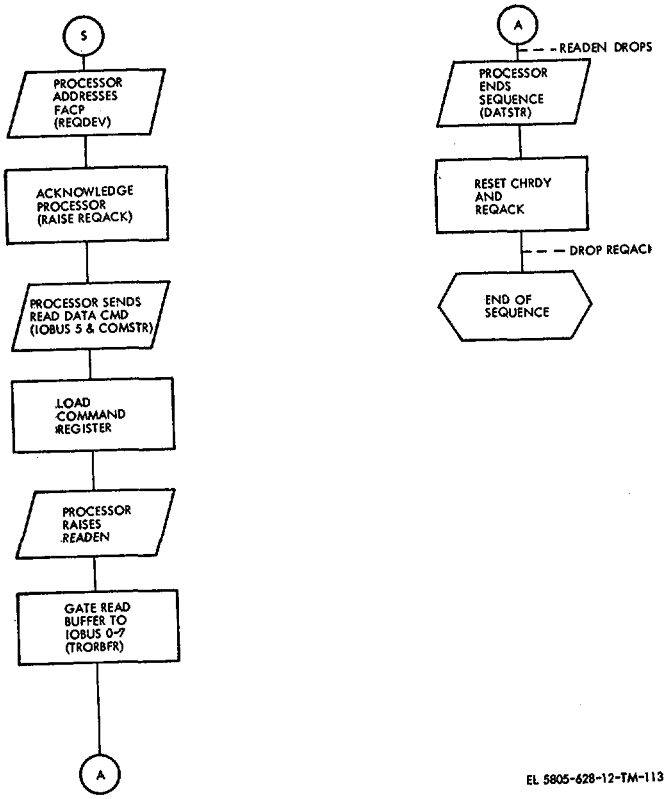


Figure 4-38. Read entry flow diagram.

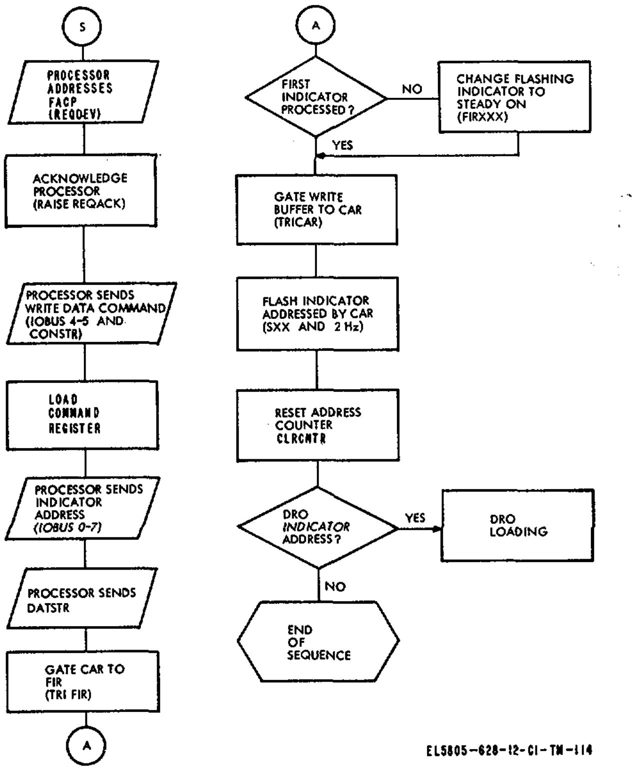


Figure 4-39. Indicator reply flow diagram.

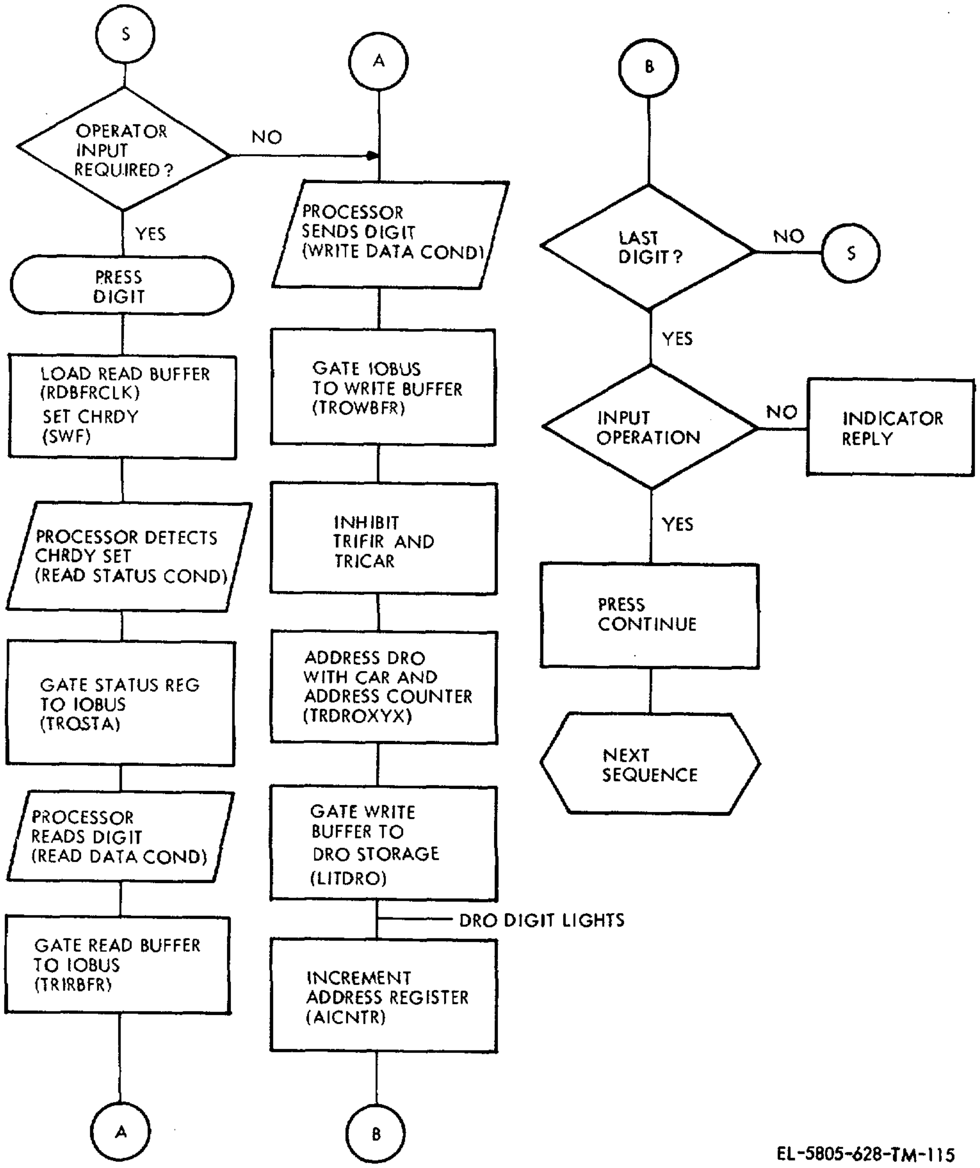


Figure 4-40. DRO loading flow diagram.

Section IX. PUNCHED TAPE READER

4-38. Punched Tape Reader
(fig. FO-21)

Punched tape reader A12 consists of four functional groups: tape drive controls, tape spooling, tape data conversion, and self test. These functional groups respond to externally originated pulses which represent operational modes of run, forward-reverse, and step. After the punched tape is read, the resulting data is expressed in digital form as eight data bits and a timing pulse.

4-39. Tape Drive Controls

The tape drive functional group consists of input logic A4, motor sequencer A3, motor driver A1, and stepper motor B1.

a. Input logic A4 accepts four remote control signals: slow/fast, stop/start, step input, and forward/reverse. These signals are filtered and buffered. The step input capability is not used by either the AN/TCC-38(V)l or AN/TTC-38(V)2. An oscillator is constructed with cross coupled one shots. This oscillator is gated on and off by various signals. The motor clock output of the oscillator drives the motor sequence logic. The oscillator output also triggers an adjustable one shot. The adjustable one shot output gates a voltage regulator between two different output voltages. The resulting motor drive and reference level signals provide motor drive to stepper motor B1. A ramp generator controls the frequency of the oscillator. This feature is used to drive the stepper motor at the fast speed.

b. Motor sequencer A3 contains logic that times the drive signal (OA, OB, OC, ODO which are required by the four-phase stepper motor. A counter and phase-decoder, which are stepped by the motor clock, maintain these drive signals so that two phases are always on, and two phases are always off. A damping pulse is added to the last energized phase, turning it on for a short period of time following its normal duration.

c. The four phases are applied to motor driver Al to condition them to drive the inductive stepper motor.

d. Stepper motor B1 has a 90 degree step; however the gear head reduces 6 to 1 to provide 15 degrees per step.

4-40. Tape Spooling

The tape spooling functional group consists of supply servo feedback potentiometer R1, take-up servo feedback potentiometer R2, servo amplifier A6, supply filter FL1, take-up filter FL2, supply motor B2, and take-up motor B3. The tape spooling functional group provides smooth bi-directional control of the supply and take-up motors.

a. The supply servo feedback potentiometer and the take-up servo feedback potentiometer are mechanically coupled to the sensing arms of the supply motor and take-up motor, respectively. Movement of the sensing arms is represented by a proportional displacement of the wipers on the feed back potentiometers. The position of the feedback potentiometer wiper arm sets a voltage between 0 and 28 vdc which represents a corresponding sensing arm position between 0 and 35 degrees. Representative voltages of sensing arm positions are applied to the servo amplifier.

b. Servo amplifier A6 has independent driving circuits for the supply motor and the take-up motor. These circuits control the bi-directional on and off operations of both motors.

c. The circuits of these separate servos are identical; only the supply reel (left) servo is described here. Potentiometer R1 follows the position of the supply sensing arm, which is proportional to tape tension. Therefore, R1 wiper arm voltage is proportional to tape tension at the supply reel. A linear amplifier receives the wiper voltage and proportionately adjusts the output of a current source. The pass transistor of this current source is shut off in strip mode. A polarity sensing circuit controls the direction of this drive current providing the capability of reel drive, either forward or reverse. Current source output level adjusts B2 motor speed. For the supply reel, slack tape causes motor slow-down, whereas excess tension causes motor speed-up. The converse is true for the take-up reel servo. These servos maintain constant tension at the reels, preventing tape breakage or entanglement due to excess slack.

4--41. Tape Data Conversion

The data conversion functional group consists of a light emitting diode (LED) assembly and a photo transistor assembly, both attached to the read head, and photo amplifier A5.

a. The LED assembly contains an array of lightemitting diodes, one aligned to each data column on the punched tape, and one aligned to the sprocket column.

b. The photo transistor assembly contains an array of photo transistors, aligned in the same manner as the LED's but facing the opposite side of the punched tape. This alignment permits a punched hole to be sensed by optical coupling between an. LED and its corresponding photo transistor in any of the data channels, or the sprocket channel. An LED emits light which excites a photo transistor into conduction. Where there are no holes in a tape channel, the light path is broken and the photo transistor does not conduct.

c. Photo amplifier A5 contains eight identical amplifier circuits, one for each data channel, and one amplifier circuit with a no-bounce latch for the sprocket timing pulse. The on and off limits for each amplifier are separately adjustable. Occurrence of a sprocket pulse indicates that a data frame is in the proper position to be read. The adjustable current sources for both the data channel and sprocket channel LED's are contained on the photo amplifier card. The card also includes a reference voltage supply which adjusts the output level of all of the amplifiers. The data amplifier and sprocket amplifier outputs are available at external connector J1.

4-42. Self Test

The self-test function is performed by circuits contained on error detector and motor sequencer A3 which receives signals from other functional groups. These inputs are combined in various logic configurations to generate self-test alarm signals (error 1, 2 or 3) which are available at external connector J1.

a. The error 1 signal is generated if the reader is running with no run signal, or when there is a run signal and the reader is not running. Inputs for the error 1 detector both come from input logic A4. They are the run signal and the sprocket pulses. The sprocket pulses are stretched by a one-shot to provide a level when the tape is actually running. This level is logically compared with the run signal to detect either of the error 1 conditions stated above.

NOTE

The error 1 signal is used as a device available control by the tape reader synchronizer in A16.

b. The error 2 signal is generated when the forward/reverse signal is forward and the reader is running reverse, or the forward/reverse signal is reverse and the reader is running forward. Inputs for the error 2 signal are: the forward and the reverse remote commands buffered on input logic A4, and the spooler forward and spooler reverse signals generated by polarity sensor circuits on servo amplifier A6. These signals are logically compared to detect either of the error 2 conditions stated above. The stretched sprocket pulses must be present, and the spool mode active, to enable the error 2 indication.

NOTE

The error 2 signal is not used in AN/TTC-38(V)(*).

c. The error 3 signal is generated if the MODE switch located on the front panel is set to REEL and a no-tape signal is present. Servo amplifier A6 provides all inputs necessary for the error 3 and detection logic. The strip mode signal is inverted and combined with either the right or left no-tape signal, producing an error 3 output. Whenever the remote start/stop command is switched, the run signal from input logic A4 pulses a one-shot whose output disables indication of all three error signals until the tape is running up to speed. This is logically accomplished by including an error disable input term to AND gates whose outputs provide the error 1, 2 and 3 alarm signals.

NOTE

The error 3 signal is not used in the AN/TC -38(V)(*)

Section X. MODEM

4-43. Modem 13

The modem provides one simplex and up to two duplex channels for interfacing low level data signals over voice frequency (VF) lines using frequency shift keying (fsk).

a. Remote Teletype (fig. 4-41). A typical duplex channel uses a keyer-converter combination and can operate in three modes.

(1) *Normal operation.* During normal operation, the keyer converts low level data (+6V mark, -6V

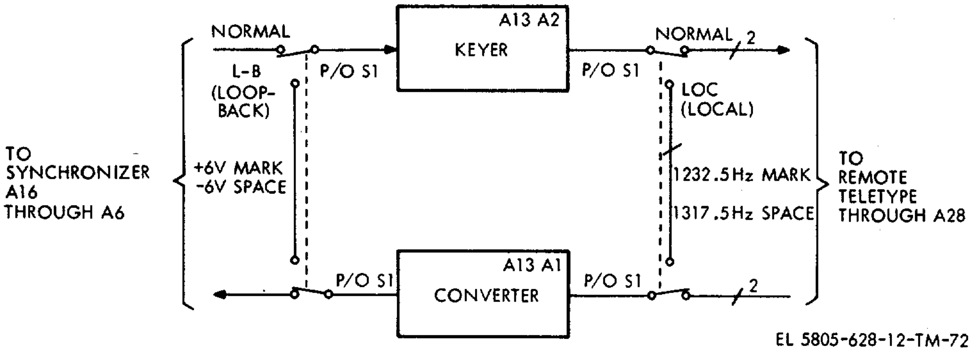


Figure 4-41. Duplex modem, block diagram.

space) received from synchronizer A16 and transmits it as normal fsk (1232.5-Hz mark, 1317.5-Hz space) signals to a remote teletype. The converter receives fsk signals from teletype and converts them to low level data which is sent to synchronizer A16.

(2) *Loop-back*. Setting rotary switch S1 to loopback (L-B) connects the low level data interfaces of the keyer-converter, allowing you to test modem operation from the remote teletype. Fsk signals transmitted from teletype are converted to low level data in the converter and applied to the keyer input. The keyer converts the low level data back to fsk signals, which are returned to the teletype.

(3) *Local*. the local (LOC) setting on rotary switch S1 allows you to test modem operation from the common control subsystem. By connecting the keyer-converter fsk interfaces, low level data from synchronizer A16 is converted to fsk signals in the keyer and applied to the converter input. The converter returns low level data to synchronizer A16 for verification by the program.

b. Spare Teletype Channel. A second duplex channel can be added by installing another keyerconverter combination in the spare teletype channel slots. Operation is identical to the remote teletype channel with rotary switch S2 providing mode control.

c. Remote Page Printer. A typical channel uses only a keyer module. Low level data received from synchronizer A16 is converted to fsk signals and transmitted over nf transmission lines to the remote page printer.

4-44. Keyer Module

(fig. 4-42)

Strapping arrangement on the keyer module allows use of the modem with normal or reverse fsk signals.

a. Normal Strapping. The keyer is supplied with the normal (N) output of the difference amplifier strapped to the frequency selector. This causes a low level mark input to select the lower oscillator frequency. The 1232.5 Hz signal is amplified and coupled to the VF transmission line. A low level space input selects the higher (1317.5 Hz) oscillator frequency.

b. Reverse Strapping. With the reverse (R) output of the difference amplifier connected to the level selector, a low level mark input will select the higher frequency and a low level space will select the lower frequency. Reverse fsk would be used only if the remote teletype uses an older type of modem.

c. Adjustments. Screwdriver LEVEL adjustment, on the front panel, allows you to set the basic sensitivity of the keyer module. Four test points, also on the front panel, allow you to monitor input and output signals.

4-45. Converter Module

(fig. 4-43)

Strapping arrangement on the converter module allows the modem to convert normal or reverse fsk signals.

a. Normal Strapping. With normal (N) strapping an fsk mark (1232.5 Hz) input signal develops a low level mark (+6v) output. An fsk space (1317.5 Hz) develops a low level space (-6v) output. The input signal is filtered and applied through the input amplifier, to a discriminator and phase shift network. The phase shift network detects input frequency and controls discriminator output. The normal fsk mark frequency results in the difference amplifier normal output selecting the low level mark. The fsk space frequency selects the low level space output.

b. Reverse Strapping. With the reverse (R) output of the difference amplifier connected to the level

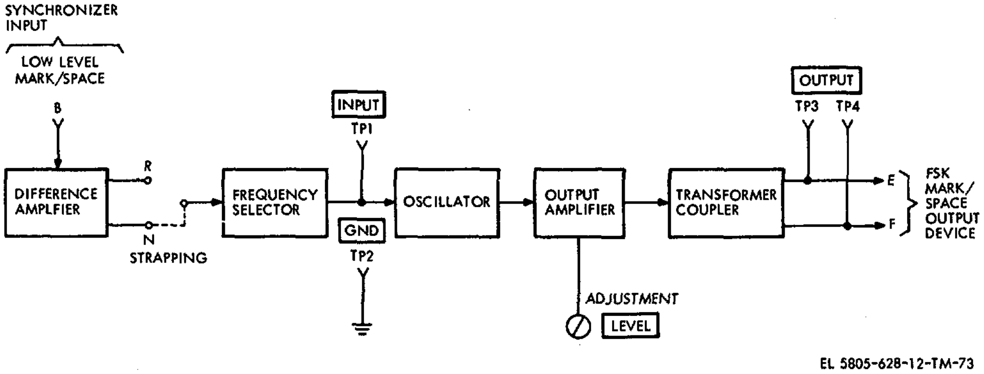


Figure 4-42. Keyer module, block diagram.

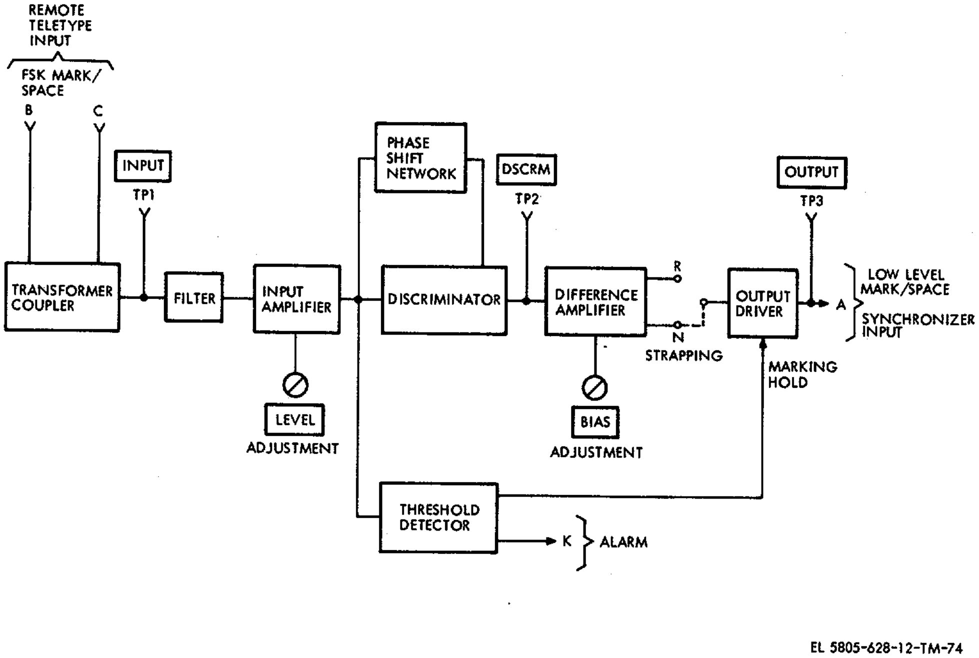


Figure 4-43. Converter module, block diagram.

selector, an fsk mark input selects the low level space output and an fsk space input results in a low level mark output.

c. Mark Hold and Output Alarm. The input amplifier output is applied to a threshold detector. Should the fsk signal fall below the desired level (LEVEL adjustment), the threshold detector forces a continuous low level mark (16v) output through the output driver. The detector also raises the output alarm line.

d. Adjustments. Screwdriver LEVEL and BIAS adjustments, on the front panel, allow you to set the basic sensitivity of the converter module and control output distortion. Four test points, also on the front panel, allow you to monitor input signals, output signals and the output of the discriminator network.

4-46. Power Supply

(fig. 4-44)

The power supply operated on 100 to 130 vac, 60 Hz to produce regulated +12 and -12 vdc.

a. Operator. Power switch S1 applies primary power to the input transformer through fuse Fl. The output of the transformer is rectified and applied to + 12v and -12v regulators which supply operating voltages for the modem. An indicator lamp, DS1, lights when' primary power is applied to the transformer.

b. Voltage Checking. Three test points on the front! panel allow you to monitor the +12v and -12v regulator outputs.

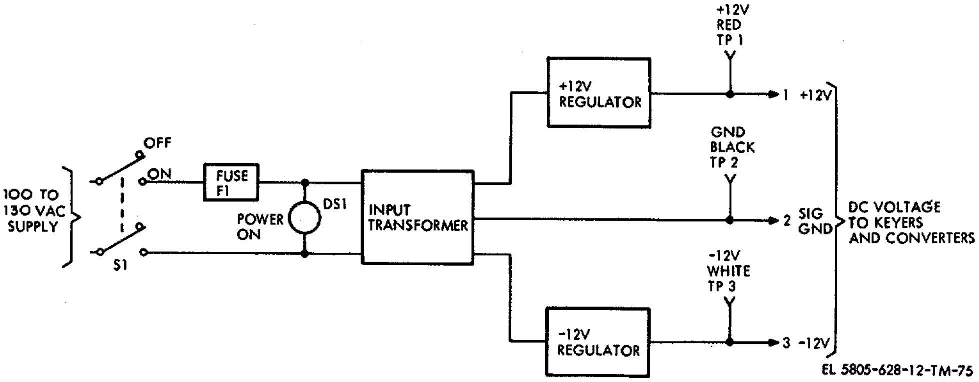


Figure 4-44. Modem power supply module, block diagram.

Section XI. OPERATOR POSITION

4-47. Operator Position Description
(fig. FO-22)

All interface signals are connected at terminals El through E16. There are four terminals (receive tip and ring, and transmit tip and ring) for each of four interface ports (port 1, port 2, signal port, and intercom port). All interface terminals are connected to gas discharge low voltage protectors A5E1 through A5E8 and ASE11 through A5E18. All receive signals are applied to inlet transformers and operational amplifiers before entering logic and detection circuits. All transmitted signals are applied to operational amplifiers and outlet transformers after being gated or switched on to the appropriate output.

4-48. Signaling Interface

The signals received and transmitted by the operator position are included in paragraph 1-7e, which defines all signaling in the central office. The operator position signals are discussed in paragraph 4-49.

4-49. Functional Signal Flow

The operator position performs the basic functions of signaling, voice communication, and operator's intercommunication. The signaling function is essentially that. of receiving signals to light lamps and depressing pushbuttons to send signals and light lamps. Signaling also includes reception of audible signals. Voice communication is the bridge interconnection of the operator microphone and earphone with subscribers on port 1 and/or port 2. The operator's intercom connects all operators together over an independent voice and signaling circuit.

a. Receive Signaling. DTMF signals are applied at the signal receive port, E5 and E6 from senders under program control. On card Al the signals are amplified and fed through band reject filters. The low and high band outputs of the: filters are sent to DTMF receiver card A3, which performs analog-to-digital conversion. Presence of one or more of eight frequencies in the input cause digital signals on the corresponding outputs of card A3. Decoders on card A4 sense the various combinations of dual input frequencies and activate flip-flops in the lamp and control logic which control front panel indicators. For example, when initiating a call with the CALL/SEIZE pushbutton depressed, 2250-Hz seize signal is transmitted out of port 2. Detection of seize signal by a scan receiver causes the program to send 570-Hz call/seize trip signal to the operator position signal receive port. Detection of 570 Hz through the process described above sets a flipflop which turns on CALL/SEIZE and QUEUE ADVANCE lamps and turns off COMMON RELEASE lamp. The same flip-flop sends earphone enable to card A2, enabling the operator earphone for dial tone which is forthcoming. The call/seize trip presence also resets a flip-flop which disables 2250-Hz seize signal out of port 2. Since the detection process is similar for all signals coming in the signal receive port, the following table lists each signal along with the resulting indications.

b. Receive Signal Functions.

Signal received	Event	Turns on lamp	Turns off lamp	Other results
Call/seize trip (570 Hz)	Initiating call, program response to seize.	CALL/SEIZE, QUEUE ADVANCE.	COMMON RELEASE	Disables 2250-Hz seize out port 2.
Hold kill (697/1477 Hz) (HOLD lamp turn off).	Retrieving call on hold, program response to hold.	CALL/SEIZE, QUEUE ADVANCE.	COMMON RELEASE, HOLD.	Hold kill also sent when held party goes on hook and after control transfer.
Queue advance trip (852/1209 Hz).	1) Releasing call, program response to queue advance.	1) Disables 2250-Hz queue advance out signal port.		
	2) Answering call, program response to queue advance.	2)* CALL/ SEIZE QUEUE ADVANCE (if QUEUE lamp is on).	2)* COMMON RELEASE, STATUS QUEUE (if QUEUE lamp is on).	2) Disables 2250-Hz queue advance out signal port,

*After one second delay.

Signal received	Event	Turns on lamp	Turns off lamp	Other results
Common release trip (852/1336).	Releasing call, program response to common release.	COMMON RELEASE.	CALL/SEIZE, QUEUE ADVANCE.	Disables 2600-Hz Common release out signal port.
Hold trip (770/1336) (HOLD lamp turn on).	Placing call on hold, program response to hold.	HOLD, COMMON RELEASE.	QUEUE ADVANCE, CALL/SEIZE.	
Routine (697/1209)	Incoming call-routine.	STATUS QUEUE (steady).		Program sends 570 Hz routine ring to port 1 and ringer.
Priority (770/1209)	Incoming call-priority.	STATUS QUEUE (flashing).		Program sends 570/425 Hz priority ring to port 1 and ringer.
Queue lamp off (852/1477 Hz).	Party in queue goes on hook, or call is answered by another operator.		STATUS QUEUE	
Selective release trip (697/1336 Hz).	Release port 1 or 2, program response to elective release.		*RELEASE 1 or RELEASE 2.	Disables 2600 Hz selective release out port 1 or 2.
Master clear (770/1477 Hz)	Control transfer.	COMMON RELEASE.	All others	Initializes all logic.
Alarm (697/1633 Hz)	Major or minor alarm.	STATUS ALARM.		
Alarm negate (770/1633 Hz).	Alarm condition cleared.		STATUS ALARM	

*After one second delay.

c. Transmit Signaling. DTMF signals are transmitted out of port 1, port 2, and signal transmit port. Signals originate in the keyset DTMF oscillator on card A1, and in the 2250 and 2600-Hz oscillators an card A2. Some signals also light lamps. All transmitted signals are gated to transmit amplifiers on card A2. Transmit signals are available at terminals E15 and E16 (port 1), E11 and E12 (port 2), and E7 and E8 (signal port). A typical transmit signal is initiated by depressing a keyset digit pushbutton. The appropriate DTMF signal appears on the keyout output of the DTMF oscillator on card Al. The signal is sent directly to the port 2 transmit amplifier, and appears at port 2 (E11 and E12). Since all signals are transmitted in a similar manner, the following table lists all switches along with associated lamps and transmit signals.

d. Transmit Signal Functions.

Switch	Event	Turns on lamp	Turns off lamp	Other results
RELEASE 1	Selective release of port 1 (recall or dc closure).	RELEASE 1		Enables 2600-Hz selective release out port 1.
RELEASE 2	Selective release of port 2 (recall or dc closure).	RELEASE 2		Enables 2600-Hz selective release out port 2.

Switch	Event	Turns on lamp	Turns off lamp	Other results
CALL/ SEIZE.	Initiate or extend call.	seize out port 2.	Enables 2250-Hz	
QUEUE ADVANCE.	Release and answer next call in queue.	COMMON RELEASE.	QUEUE ADVANCE, CALL/SEIZE.	Enables 2250-Hz queue advance out signal port.
COMMON RELEASE.	Release call and return to idle.			Enables 2600-Hz common release out of signal port.
RESET	Initiate logic	COMMON RELEASE.	All others	Initializes all logic in operator position.
MODE (UN-STAFFED position).				Enables 2250-Hz unstaffed signal out port 1.
HOLD	Placing call on hold, or retrieving call on hold.			Enables 941/1209-Hz hold out port 1.
RERING	Rering 20 or 1600-Hz ringdown line or trunk. (on recall or call extension).			Enables 941/1209-Hz rering out port 2, disables microphone.
CLEAR/ WIPEOUT.	Stop ringback, error, busy, or dial tone.			Enables 941/1209-Hz clear/wipeout out of signal port.
KEYSET (0-9, F, FO, I, P, C,R).	Key called party directory number,			Enables DTMF digits out of port 2.

e. Audible Signaling. Audible signals under program control are received at port 1 (E13 and E14) and/or port 2 (E9 and E10) and sent through low voltage protectors on module A5. On card A2, received signals are amplified and applied to the bridge circuit. The bridge circuit output is amplified and connected to. the operator earphone. This is the same path for voice signals when port 1 and/or port 2 are connected to subscribers. Audible signals to the earphone are: ringback, busy, error, answer, and dial tones. The priority or routine ring signal, which accompanies the flashing or steady STATUS QUEUE lamp, is received at port 1. On card A2, instead of going to the bridge circuit ring signal is applied through a limiter to card A1. Then it is filtered and level detected to activate the night ringer.

f. Voice Communications. Voice communications with the operator takes place over a three-party conference bridge circuit when subscribers are connected to port I and/or port 2. The operator microphone and headset are considered one party on the bridge. All voice transmissions enter the bridge circuit on card A2. Voice signals from either the operator microphone, port 1, or port 2 pass through amplifiers to the bridge. The bridge design provides for cancellation of output to the party where the voice originates. For example, if-the party on port 1. is talking, his voice is transmitted to port 2 and to the operator, and is canceled at transport port 1. If the operator answers, his voice is transmitted to port 1 and port 2. Thus the talking party does not hear himself, but the other connected parties hear him.

g. Intercom. The intercom is an all-call type of intercom. That is, when an operator depresses the INTERCOM pushbutton, the INTERCOM lamp on all other operator positions flashes, and his INTERCOM lamp goes on steady. At each receiving operator position, when the operator depresses his INTERCOM pushbutton his INTERCOM lamp goes on steady and he is connected to the intercom circuit. After conversation, when each operator depresses his INTERCOM pushbutton again, he is disconnected from the intercom circuit. The intercom circuits of each operator position include trasmit and receive signaling and voice circuit. A conference bridge interconnecting the voice circuits in located in common equipment nest A27. Signal flow is described below.

(1) *Intercom signaling*. When the INTERCOM pushbutton is depressed initially, the INTERCOM lamp goes on. A one-shot multivibrator on card A4 sends a 50-ms burst of intercom enable to an analog gate on card A3. This enables 2600-Hz intercom seize signal out of intercom transmit port E3 and E4 to all other operator positions. At the same time, the operator's microphone and earphone are connected to the intercom transmit and receive ports respectively through the INTERCOM switch. At the other operator positions, the intercom seize signal is received at intercom receive port El and E2. Seize signal is amplified and limited on card A2. Then it is filtered and level detected on card A1. The receive flash output of card Al sets a flip-flop in the lamp and control logic on card A4. This enables a 2-Hz square wave to flash the INTERCOM lamp. When the called operators depress their INTERCOM pushbutton, their INTERCOM lamp goes on steady and their microphones and earphones are connected to their intercom transmit and receive ports. After conversation, depressing the INTERCOM pushbutton turns off the INTERCOM lamp and resets the flip-flop which enabled the flashing INTERCOM lamp, turning it off. The operator microphone and earphone are also disconnected from the intercom ports and reconnected to the operator circuits.

(2) *Intercom voice*. The operator microphone is connected through the INTERCOM switch to the intercom transmit amplifier. The earphone is similarly connected to the intercom receive port. The intercom transmit and receive ports of all operator positions are connected to a remote conference bridge. The bridge design enables any one operator to be heard by all other operators.

SECTION XII. POWER SUBSYSTEM

4-50. Power Subsystem Description

(fig. FO-23)

The AN/TCC-38(V)(*) is normally powered from all external 115/208-volt, 50, 60 or 400-Hz three-phase power source. Failure of this power source causes internal batteries to provide operating power. An alternate power source of + 28v may also be used.

a. Ac Distribution. External ac power is connected to S1 on the power entry panel. Circuit breakers CB5 and CB6 on the power entry panel provide power to the air conditioners. MAIN AC circuit breaker CB1 energizes the ac meters and lamps, phase sequence relays K1-K3, utility outlets J2 and J3, lighting circuits, and battery charger A24.

(1) *Ac meter and lamps*. Ac prime power is connected across PHASE DETECTING lamps DS5-DS7, and to PHASE SELECT switch S2 for metering. Switch positions select each phase, for monitoring ac voltage (Ml) and current (M2).

(2) *Phase faults*. MODE switch S3 must be set to the frequency of the power source (50/60 Hz or 400 Hz). With proper input frequency and phasing, one of three phase sequence relays K1-K3 is energized and the appropriate MODE lamp (50/60 Hz or 400 Hz) is on. If input phasing is improper, PHASE FAULT lamp DS4 goes on, audible alarm DS3 sounds, and circuit breakers CB2, CB3, CB5, and CB6 are tripped. This deenergizes the utility outlets, air conditioners, and the battery charger. Audible alarm DS3 is turned off by depressing PHASE FAULT pushbutton S1, but lamp DS4 stays on. After the input phasing fault is corrected, and S1 is depressed again, both the lamp and audible alarm stay off.

(3) *Lighting circuits*. FLUOR LIGHTS circuit breaker CB4 turns on power supply PS24. The + 12v output energized fluorescent lamps DS8-DS12 on the ceiling and DS13 near page printer A21 when the two switches near the door (S4 and S7) are on and either the door is closed or BLACK-OUT BYPASS switch S6 is on. If S6 is off, the blue blackout lamp goes on when the door is opened and the fluorescent lamps go off. If ac power or power supply PS24 fail, battery voltage is automatically switched onto incandescent lamps DS14 and DS15 on the ceiling. At low temperatures the fluorescent lamps may not light; switch S7 applies battery voltage to incandescent lamps DS14 and DS15.

(4) *Battery charger*. Circuit breaker CB3 turns on battery charger A24. The +24-volt output charges batteries BT1 through BT4. Switch S10 sets the battery charger to either EQL (equalize fast charge) or FLOAT (normal) operation. EQL indicator DS26 lights while in the equalize mode to caution the operator not to overcharge the batteries. Diode CR23 protects the 24-volt dc bus from high voltage transients. The system 24-volt bus is protected by fuse F18 if CR23 should short circuit FAULT lamp DS27 will light if such a short-occurs.

b. Primary DC Distribution. Primary +24v from the battery charger or internal batteries provided power for circuits described in the following paragraphs.

(1) *Dc meters*. In the LOAD CUR position, switch SI I places dc ammeter M4 across meter shunt R1 to indicate load current. In the CHGR CUR position, M4 indicates total battery charger output current. The dc voltmeter monitors the primary +24v.

(2) *Battery charger and battery fans*. Auxiliary contacts of BATTERY CHARGER circuit breaker CB3 energize relay K10. Relay K10 applies prime +24v to battery charger fan A24B1, battery box power supply A17PS1, and fan A17B1.

(3) *Battery storage fault circuits*. The external battery vent cover must be removed before the battery charger is turned on. If not, interlock switch S9 causes BATTERY STORAGE FAULT lamp DS 18 to light and audible alarm DS20 to sound. Depressing BATTERY STORAGE FAULT pushbutton S13 turns off the alarm, but the lamp stays on. After the battery vent cover is opened, depressing the pushbutton again turns off the lamp, and the alarm does not sound. Also, fan vane switch S1 inside battery box A17 opens when the fan goes on. If the fan cover is closed at this time, lamp DS18 goes on and audible alarm DS20 sounds. Depressing BATTERY STORAGE FAULT pushbutton S13 turns off the alarm, but the lamp stays, on. After the fan cover is opened, depressing the pushbutton again turns off the lamp and the alarm does not sound.

(4) *Emergency fan*. Turning on EMER FAN switch S16 connects +24v to emergency fan A18, starting the fan.

(5) *DC POWER ON switch*. Depressing DC POWER ON pushbutton S12 energizes ELAPSED TIME meter M5, DC POWER ON lamp DS17, low voltage detector E17, and the battery charger(2 above) and breaker fault circuits. Low voltage detector E17 trips circuit breaker CB7 when prime dc voltage drops below the proper functioning level. This would occur after operation ;on internal batteries for a prolonged time. BATTERY CHARGER FAULT lamp DS21 and audible alarm DS19 are energized by an ac fault signal from battery charger A24. These fault signals are activated by the back contacts of K101 in the battery charger when K101 is de-energized by loss of prime power. CIRCUIT BREAKER FAULT lamp DS22 and audible alarm DS19 go on when circuit breakers CB3 or any of CB8-CB16 are tripped. Depressing the respective pushbutton turns off the audible alarm but the light remains on. The ac fault in the battery charger must be cleared, or the tripped circuit breaker must be reset. Then the Respective lamp goes off, and the audible alarm stays off when the appropriate pushbutton is depressed again.

(6) *Dc control circuits*. Closing DC CONTROL circuit breaker CB7 applies +24v to the equipment listed below. Blower assembly A57 for dc to ac inverters PS1 and PS2.

(*a*) Auxiliary contacts on CB7 enable EXTERNAL DC switch S8 to be turned on if operating from external +28 vdc.

(*b*) 20-Hz ring generator A50.

(*c*) NTS blower assemblies A53-A56' (and A52 on ANRTC-38(V)2) through fuses on NTS power control A23.

(*d*) FACP (A7).

(*e*) Central processors (A8, A9).

(*f*) Memories (A10, All).

(*g*) 1/0 synchronizer (A16).

(*h*) Power relay assembly (A51).

(*i*) Control transfer (A19).

(*i*) Power supply A17PS1 and external battery vent cover switch S9. These are initially powered when the battery charger is turned on, and continue to function if ac power is lost.

(7) *Dc to ac inverters*. Closing circuit breaker CB8 energizes paper tape reader A12 and dc to ac inverter PSI. The inverter provides 115 vac to lamp DS23(1), motor controller A14 and page printer A21, modem A13, intercom A3, and operator position A1. Closing circuit breaker CB9 energizes dc to ac inverter PS2. This provides 115 vac to lamp DS24(2), motor controller A15 and paper tape punch A20, and two remote operator positions (A2 and A49). Power cables for A2 and A49 are connected to J7 and J8 on the power entry panel.

(8) *Dc to dc converters*.

(a) Common control subsystem. PROCESSOR/MEMORY 1 circuit breaker CB11 energizes dc to dc converters PS3 and PS4. These provide dc power for maintenance control panel A4, central processor A8, memory A10 and patch plug cable tester A22. PROCESSOR/MEMORY 2 circuit breaker CB14 energizes PS7 and PS8 which provide power for maintenance control panel A5, central processor A9, and memory All. I/O, SYNCHRONIZERS A and B circuit breakers CB12 and CB15 energize dc to dc converters PS5 and PS6 respectively. The corresponding outputs of each converter module are tied together in redundant fashion

and drive control transfer A19, system status A6, I/O synchronizer A16, and FACP A7. This redundancy allows either PS5 or PS6, or individual modules, to be individually switched off, as long as one is on. A dc fault monitoring line from each converter (PS3-PS8) is fed to I/VO synchronizer A16, along with fault lines from NTS dc to dc converters. The fault lines are connected together so that a ground results if any converter module output is lost. An ac fault line .to /VO synchronizer A16 from the battery charger is grounded if the battery charger stops functioning. A +24v input is also provided to the central processors, memories, control transfer, I/O synchronizer, and FACP from DC CONTROL circuit breaker CB7.

(b) Network terminal subsystem. PRIMARY 300 LINE circuit breaker CB10 energizes dc to dc convertersPS9-PS13. On AN/TTC-38(V)2 only, ADDITIONAL 300 LINE circuit breaker CB16 energizes PS19-PS23. Dc to dc converters PS14-PS18, energized by BACK UP circuit breaker CB13, provide redundant outputs, which are paralleled with both the CB10 and CB16 converter outputs. This redundancy feature allows CB13 to be turned off if required to conserve power or to replace dc to dc converter modules. Also, any of PS9-PS13 modules may be individually switched off while the corresponding converter module in PS14-PS18 is on, and vice-versa, to facilitate replacement of a converter. In AN/TTC-38(V)2, any of PS19-PS23 converter modules may be individually switched off while the corresponding converter module in PS14-PS18 is on, and vice versa. All converter outputs are connected to relay contacts in power relay assembly A51. Three operating voltages for 20-Hz ringer A50 are provided by redundant outputs of PS10/PS15, PS12/PS17, and PS13/PS18. The 20-Hz ringer also receives +24v through the power relay assembly from CB7, and provides the 20-Hz output to relay contacts in A51. The relays are activated by switches on NTS power control A23, connecting power and 20 Hz to individual NTS nests. Each dc to dc converter PS9-PS23 has a dc fault monitoring output which goes to 1O synchronizer A16, along with fault lines from dc to dc converters for the common control subsystem. The fault lines are connected together so that loss of any converter module output grounds the fault line.

c. Internal Battery Operation. Batteries BT1-BT4 provide power for the central office when external ac power fails. Power conservation is effected by turning off redundant power supplies and the standby processor. Battery operation continues for one hour for AN/ITC-38(V)1 and one-half hour for AN/ TTC-38(V)2. When the battery voltage drops to a point where the central office cannot function, the equipment is automatically shut off. Only the conditions which are present in battery operation are discussed in the following paragraphs. Otherwise, the same conditions exist as for external ac power source operation.

(1) *Ac power loss-initial conditions*. Audible alarm DS19 and BATTERY CHARGER FAULT lamp DS21 go on. Fluorescent lamps DS8-DS13 go off, ■ and incandescent lamps DS14 and DS15 go on. The emergency fan A18 starts if EMER FAN switch S16 is turned on.

(2) *Operator actions*. The operator turns off ac circuit breakers CB1-CB6 and turns off MODE switch S3 to initialize the ac power circuits. CIRCUIT BREAKER/FAULT lamp DS22 goes on. He depresses BATTERY CHARGER FAULT and CIRCUIT BREAKER FAULT pushbuttons S14 and S15 to turn off the audible alarm; the lamps stay on. To reduce the battery load, he turns off PROCESSOR/ MEMORY 2 and BACK UP circuit breakers CB14 and CB13 respectively. The central office is now operating on internal battery without the standby processor and the NTS redundant dc to dc converters.

(3) *Battery life*. Low voltage detector E17 detects the point at which battery voltage decreases below proper functioning level. Circuit breaker CB7 is tripped, which in turn trips CB8-CB16, turning off, all dc to dc converters and dc to ac inverters. The only equipment energized is emergency lighting, emergency fan, and the battery fan alarm switches in the battery box. The BATTERY STORAGE FAULT lamp DS18 and audible alarm DS20 are turned on until the fan cover is closed. This prevents battery fumes from backing up into the central office when the fan is off.

d. External Dc Operation. The central office may operate from an external source of dc power when there is no ac power source available. The external dc is connected to E14(+) and E13(-) on the power entry panel. With EXTERNAL DC switch S8 turned on, DC POWER ON pushbutton S12 depressed, and DC CONTROL circuit breaker CB7 turned on, relay K9 is energized. This connects the external dc power to the battery +24v output. The primary dc distribution is the same as for external ac operation (b above). There is no fluorescent lighting, but incandescent lamps are on. The air conditioners are off, but the emergency fan provides ventilation.

4--51. Operator Position Power Supply

(fig. FO-24)

a. The operator position power supply converts input line voltage of 115 vac at 60 Hz to three regulated, isolated outputs: +6 vdc at 2 amperes, +12 vdc at 0.5 ampere, and -12 vdc at 0.5 ampere. It is used in both the local and remote operator positions. Dc conversion is accomplished by the six potted modules (Al through A6) in the supply as described below.

b. Input power, applied to external pins 1 and 2, is fed to an electromagnetic interference (EMI) balanced filter in module A1. The ac filter output is wired to Al -7 and -8 where it is capacitor-bypassed to the Al case.

c. The ac is the applied to A2-1 and -2 and passes through surge limiting resistors to a full wave bridge rectifier. A filter smoothes the pulsating dc rectifier output producing a dc level with low ripple. The filter has an over-voltage Zener diode and bleeder resistor connected across its output. An unregulated voltage of approximately 160 vdc at output pins A2-3 and -5 is then applied to input pins A3-3 and 1.

d. Module A3 functions as a pre-regulator, holding a constant 80 vdc output with variation in line input voltage from 95 to 132 vac.

e. A Zener diode and filter capacitor (located on module A2 between plus A2-4 and -6) are connected across the 80-vdc output of module A3. These components function together as an overvoltage limiter.

f. Module A3 output is also applied to module A4 input at pins A4-3 and -1. Module A4 is a dc to ac inverter that changes the 80 vdc input to a square wave output of 20 volts peak in a frequency range between 20 and 40 kHz. The 20-volt square wave appears between pin A4-1, the output transformer centertap, and either of the end taps connected to A4-4 and -6. These end taps provide the output which is fed in parallel to modules A5 and A6.

g. The square wave input at A5-3 and -1 is stepped down and isolated by an input transformer. The secondary of this transformer operates into a full wave center-tapped rectifier which provides a dc input to the linear series pass regulator. The +6 vdc regulator output at A5-4 and its return at A5-6 is routed to module A1.

h. Module A6 also receives the square wave input, at A6-7 and -9, which is stepped down and isolated by an input transformer. The operation of A6 is similar to that of A5, except that A6 contains two regulated converters; one providing a +12 vdc output at A6-4 and the other providing a -12 vdc output at A6-3. These regulator outputs are routed to module A1, and share the common return routed from A5-6.

i. Module A1 receives the regulated supply voltages (+6 vdc, +12 vdc) and provides zener diode overvoltage limiting for each. The diodes are connected between the supply output voltage and the common return line in each instance. Also, each supply voltage is capacitor-bypassed to the Al case.

j. The supply output voltages are wired from Al to external pins, where they are available for connection to the operator position loads.

4-52. Dc-Ac Power Inverters

(fig. FO-25)

a. *Power Circuits*.

(1) Dc power is delivered through input EMI filter Al. The main power flow is through reverse voltage protection diode A5CR1, power switching transistors A5Q4-Q5, current driver transformer A5T1, output power transformer T2, a low-pass filter (L2 and C3), current sensing transformer T3, and finally through output EMI filter A2.

(2) The power switching stage provides alternately switched dc, through the current driver transformer, to the output power transformer. Power switching transistors A5Q4 and A5Q5 operate in pushpull, which alternately connects each end of the center-tapped primary winding of T2 to the positive side of the dc input. Since the center-tap is connected to the minus side of the dc input, the effect is that of applying square wave voltage. Power transformer T2 steps up the applied voltage amplitude, and its output voltage is then fed to the low-pass filter (L2, C3) which produces a sine wave output.

(3) The primary windings of current driver transformer A5T1 have opposing connections in the emitter circuits of the power switching transistors. This connection is for push-pull drive of the transformer. A similar connection is also made from the power switching transistors to the primary windings of output power transformer T2. Being operated in the current mode, the secondary of A5T1 supplies current, in direct proportion to its primary current, to the driver transistors (A5Q3 and A5Q6) and the predriver transistors (A5Q2 and A5Q7). This operation provides drive signal for the power switching transistors proportional to the current demanded by the load. This results in adequate drive for the power switching transistors when load current demand is high, and efficient power delivery to the load when the current demand is low.

(4) The +28 vdc input is filtered by-capacitors C1 and C2. Resistor R1 functions in this power filter as a bleeder resistor.

b. Regulator and Waveform Synthesizer. Pulse width modulation (PWM) techniques are employed to achieve output voltage regulation and initial rejection of harmonics from the unfiltered output voltage. The circuits employed are contained on cards A3 and A4 and provide the PWM drive signals to the power driver circuit located on heat-sink assembly A5. Output current and voltage samples, and an input voltage sample, modify the)PWM signal to provide regulation.

(1) The 3600-Hz oscillator, consisting of transistors A4Q15-Q17 and associated components, is tuned by adjustment of inductor A4L1. Transistor A4Q18 buffers the 3600-Hz pulse train to the input of frequency divider A4V1-V5.

(2) The lowest frequency output of the divider, a 60-Hz symmetrical square wave, is fed to inverter A4Q1-Q4 which drives a series filter (A4C1, A4C20) tuned to 60 Hz by adjustment of inductor L3. The current through the inverter and filter is sampled to provide a continuous half sine wave output voltage. This output is fed to a waveform comparator (A4Q7, A4Q8).

(3) Another frequency divider output, an 1800Hz symmetrical square wave, is fed to a triangle wave generator (A4Q5-Q6, A4Q19-Q21). The 1800-Hz triangle wave output is fed to a waveform comparator (A4Q7, A4Q8) where it is compared with the half sine wave signal. The comparator output, an 1800-Hz, pulse-width modulated signal, is sent to a signal splitter where it is summed by transistor A4Q9 and inverted by transistor A4Q10. Both transistor outputs are routed from the signal splitter to the blanking gates contained in A4U4 where they are combined with steering signals from the frequency divider. Complementary phases of the 1800-Hz split signal are blanked by complementary phases of the 60-Hz steering signals. The resulting waveforms, alternately blanked at 60 Hz, are combined by a gate in A4U5 to form the drive A signal. This signal is the pulse-width modulated analog of a 60-Hz sine wave and is routed to card A3.

(4) The drive A signal is applied to a signal splitter (A3U1, A3Q1) where it is split and conditioned, providing complementary output signals. These output signals perform push-pull control of drive signal switching stage A3Q2-Q9 which is connected to the primary winding of transformer T1. This transformer has tw6 secondary windings which are connected to resistive dividers. The secondary output signals, complementary PWM drive signals A and B, are applied to the power driver located on heatsink assembly A5. Predriver transistors A5Q2 and A5Q7 4-78 and driver transistors A5Q3 and A5Q6 control power switching transistors A5Q4 and A5Q5 to operate in push-pull.

(5) Voltage sensing transformer T4 senses ac output voltage, and a sample is sent to a full wave rectifier (A4CR6) and filter (A4C8) which produces a proportionate dc output voltage sample. This sample is then compared to a reference voltage developed in resistive divider A4R33-R35. A comparator (A4Q13, A4Q14) produces an output which is the difference ,between the reference voltage and the dc output voltage sample. The comparator output is inversely proportional to load voltage amplitude and is sent to a waveform comparator (A4Q7, A4Q8) where it is summed with the half sine wave input. In this way the half sine wave is superimposed on a dc level.

(6) A sample of the output ac current is sent from current-sensing transformer T3 to full wave rectifier CR7. The rectified output current sample is applied to the modulation-index regulator (A4Q22, A4Q23, R67). The unregulated dc input voltage is also sampled by this regulator. Using these two samples, the 1800-Hz triangle wave amplitude is regulated in direct proportion to dc input voltage and in inverse proportion to output current. The modulation-index is the ratio of peak-to-peak amplitudes of the triangle wave and the half sine wave. Modulation-index regulation is necessary to achieve minimum distortion of the fundamental (60 Hz) component over a wide range of. inverter input voltage/output load conditions.

c. Low Voltage Supply Regulator. Circuits contained on cards A3 and A4 require +15 vdc supply voltage. Transistor A5Q1, a series dissipative regulating element, is controlled by the low voltage supply regulator located on card A3 to reduce the unregulated dc input to 15 volts. Transistor A3Q10 is a driver, and A3Q11 is the negative feedback regulating element.

d. Protection Circuits. The protection circuits are critical functions which prevent the inverter from being damaged when subjected to otherwise catastrophic conditions. They also allow the inverter, after being turned off for any reason, to turn on at approximately half of the rated voltage output, and then over a short period of time gradually increase to the full rated output voltage. This start programming reduces any inrush surge currents to the inverter loads and also allows the regular circuits enough time to be fully functional at turn-on.

(1) Fault signals are derived from inverter dc input voltage, ac output voltage, and ac output current.

The inverter shuts down when a fault is sensed and does not restart until the fault condition is removed.

(*a*) Inverter dc input voltage is routed through thermal sensing switch A5S1 to the fault sensors.

1. Input overvoltage is sensed when the dc input exceeds a given level (30-40 volts). Input dc voltage is applied to a resistive divider (A3R55, A3R56) and the divided voltage is conducted through diode A3CR14 to a lockout flip-flop (A3Q13, A3Q14). Excessive input voltage causes a dc input overvoltage fault signal which turns on the lockout flip-flop. This causes shutdown of the inverter. Returning the inverter dc input voltage to a normal level allows the lockout flip-flop to reset and the inverter to restart.

2. Input undervoltage is sensed when the dc input is beneath a given level (15-21 volts). The divider voltage from A3R55, A3R56 is again divided by R51, R52, and the latter divided voltage is then compared to a reference voltage in the dc input undervoltage sensor (A3Q17): When the voltage level from the resistive divider (R51, R52) falls below the reference voltage provided by zener diode A3 CR12, the dc input undervoltage sensor sends a fault signal through diode A3CR13 to turn on the lockout flip-flop. This causes shutdown of the inverter. Returning the inverter dc input to a normal level allows the lockout flip-flop to reset, and the inverter to restart.

3. Thermal sensing switch A5S1 opens when heatsink assembly A5 overheats, causing the input dc sensing signal to fall to zero volts. As a result, the dc input undervoltage sensor sends a fault signal to set the lockout flip-flop. When the heatsink assembly cools sufficiently, A5S1 closes, restoring the input dc sensing signal and allowing the inverter to restart.

(*b*) The output voltage sample from full wave rectifier and filter A4CR6 is applied to a resistive divider (A3R53, A3R58), and the divided voltage is conducted through diode A3CR16 to the lockout flipflop. Excessive output voltage causes an output overvoltage fault signal which turns on the lockout flipflop. This causes the inverter to stop operating and the output voltage to fall. This removes the output overvoltage fault signal. Due to operation of the starting circuit, the inverter then attempts to restart. Upon removal of the high voltage cause, the inverter restarts into normal operation. If the high output voltage condition is still present after restarting, the protection circuit again operates to shut down the inverter. This cycle will continue as long as the overvoltage cause is present.

(*c*) The output current sample from full wave rectifier A4CR7 is applied to a resistive divider (A3R54, A3R57) and the divided voltage is conducted through diode A3CR15 to the lockout flip-flop. Excessive output current causes an output overcurrent fault signal which turns on the lockout flip-flop. This causes the inverter to stop operating and the output current to stop flowing, remaining the output overcurrent fault signal. Due to operation of the starting circuit, the inverter then attempts to restart. Upon removal of the high current cause, the inverter restarts into normal operation. If the high output current condition is still present after restarting, the protective circuit again operates to shut down the inverter. This cycle will continue as long as the overcurrent cause is present.

(2) The lockout flip-flop, which is normally in its reset state, is set by detection of any fault signal. The lockout timer (A3C4, A3Q12) generates a reset signal for the lockout flip-flop. The reset signal occurs within 5-15 seconds after the fault signal. The lockout flipflop output is buffered by A3Q15 and A3Q16 to produce the lockout signal, which is a logic ZERO only during lockout time. The lockout signal is sent from this starting circuit to the signal splitter, where it prevents drive signals from passing through A3U1. The lockout signal is also applied to the start programmer (Q11, Q12) the output of which is connected to the waveform comparator. During lockout time, when the lockout signal is a logic zero, the start programmer output reduces the dc level of the half sine wave input to the waveform comparator. This, in turn, causes a minimum modulation of the 1800-Hz carrier frequency, resulting in a low value of inverter output voltage. After lockout time has elapsed, the lockout signal becomes a logic one. This causes the start programmer output to slowly raise the dc level of the half sine wave input to the waveform comparator. As a result, the inverter output voltage increases slowly up to its full rated amplitude in the period of time immediately after inverter turn-on, or restart.

(3) Protection from reverse polarity connection on the dc input is provided by diodes A5CR1 and A5CR2. Diode A5CR1 is connected in series with the dc input and allows current to flow only in the proper direction. Diode A5CR2 is connected across the dc input in a normally non-conducting polarity. Should the dc input polarity by reversed, A5CR1 blocks current flow, and A5CR2 conducts whatever leakage current A5CR1 might pass, preventing reverse voltage in excess of one volt from entering the inverter circuits.

4-53. Battery Charger

(fig. 4-45)

The battery charger (A24) provides +24 volts primary power for the central office. At the same time it main-

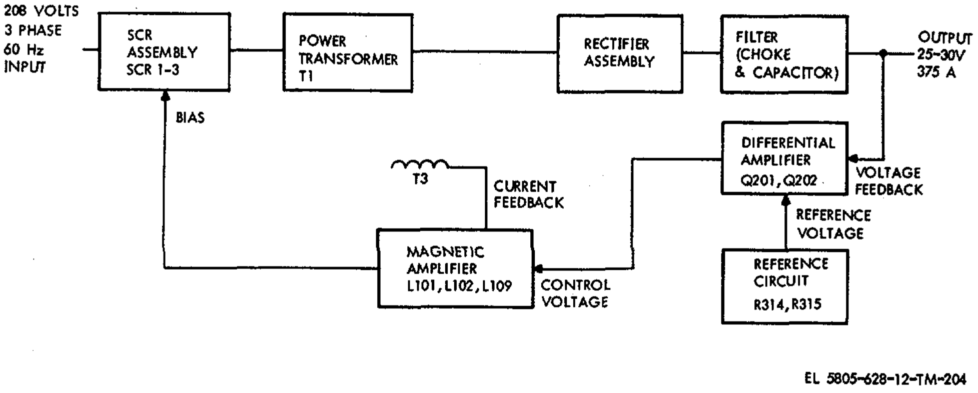


Figure 4-45. Battery charger, block diagram.

tains the level of charge on the internal batteries. The input to the battery charger is 208 volts, 3-phase, 60 Hz. The input phase is controlled by an SCR assembly SCR 1-3 and fed to a 3-phase wye-delta power transformer T1. The transformer output is rectified by the 3-phase bridge rectifier assembly, and the dc output from the bridge is filtered and applied to the +24-volt bus.

a. SCR Assembly. The SCR assembly consists of three paried silicon rectifier diodes, one for each phase. The diodes are controlled by magnetic amplifiers L101, L102, and L109. The output across each primary of T1 is maintained at 154 vac.

b. Bias Circuit. Dc control windings of the magnetic amplifiers provide operating bias.

c. Control Circuits. Voltage errors are sensed at the battery charger output and applied to differential amplifier Q201-Q202. Q202 is the reference amplifier using the reference provided by R314 or R315, depending on mode selection. If the output voltage decreases, the magnetic amplifiers conduct. The firing angle of the SCR assembly is increased, resulting in increased output voltage proportional to the initial voltage drop.

d. Current Limiting. Ac current flow is sensed across transformer T3. Excessive current turns off the magnetic amplifiers.

4-54. Dc-to-Dc Converters

(fig. FO-26 through FO-33)

There are eight type of dc-to-dc converters used in-the AN/rTC-38(V)(*). All of them convert 24 vdc battery power to voltage levels required by various equipments in the assemblage. All converters operate in a similar manner, differing only in output voltage and power requirements as described in *a* through *h* below. Paragraph 4-55 describes the functioning of a typical converter (type 7). Paragraph 4-56 describes some differences in circuits found in other converters.

a. Type 1.

(1) Part number: SM-A-742458-1.

(2) First output: +12v, 5 amp.

(3) Second output: -6v, 2.5 amp.

(4) Third output: +24v, 8 amp.

b. Type 2.

(1) Part number: SM-A-742458-2.

(2) Output: +5v, 50 amp.

c. Type 3.

(1) Part number: SM-A-742458-3.

(2) First output: +5v, 40 amp.

(3) Second output: -10v, 1 amp.

(4) Third output: -13v, 0.1 amp.

d. Type 4.

(1) Part number: SM-A-742458-4.

(2) Output: +5v, 95 amp.

e. Type 5.

(1) Part number: SM-A-742458-5.

(2) Output: +12v, 15 amp

f. Type 6.
- (1) Part number: SM-A-742458-6.
- (2) First output: +15v, 22 amp.
- (3) Second output: -6v, 6 amp.
- (4) Third output: -15v, 11 amp.

g. Type 7.
- (1) Part number: SM-A-742458-7.
- (2) First output: +9v, 1.5 amp.
- (3) Second output: -12v, 10 amp.

h. Type 8.
- (1) Part number: SM-A-742458-8.
- (2) Output: +50v, 10 amp.

4-55. Dc-to-Dc Converter Type 7

(fig. FO-32)

a. Preregulation. Variations in the dc input line (21 to 30 vdc) are eliminated by an input regulator circuit. Dc input power is applied across filter C1 and reverse voltage protector CR3 through choke L1. Shunt chopper A3Q1-Q4 periodically shorts the choke output to the negative dc input return. The varying field in L1 causes voltage peaks larger than the dc input voltage to be applied to charging circuit CR1, C2, R5. This causes the charging circuit output voltage to build up to a level which is higher than the dc input voltage. The voltage level is determined by the frequency at which the shunt chopper operates.

b. Chopping Frequency. Input regulation is achieved by varying the chopping frequency, Multivibrator AZQ13 generates a train of pulses which turn on the shunt chopper. The pulse frequency is controlled by the positive dc input voltage level applied to pulse rate control A2Q33-Q34 and by feedback from the charging circuit output applied to bias control A2VR1. As the dc input voltage falls the multivibrator frequency increases. As the charging circuit output voltage increases the multivibrator frequency decreases. Preregulation adjustment A2R57 determines the constant charging circuit output level (approximately 32 vdc) which results from these actions. The pulses from the multivibrator are amplified and widened in driver and pulse stretcher A2Q14-Q16 'before being applied to the shunt chopper.

c. Dc-to-AC Conversion. The constant voltage output of the charging circuit is again chopped at a 1 kHz rate by AlQ9-Q12 and A1T2. The resulting 1 kHz square wave driver the primary of transformer T1. The voltage level is stepped down in two secondary windings of T1 to levels needed for the dc output requirements.

d. Minus 12-Volt Regulator. Ac power from the first rl secondary is rectified by CR32 and CR33 to produce a 14-vdc level. This voltage is then dropped by series pass regulator A2Q17-Q20 to produce the required -12v output level. Note that this regulator is in the common return of the -12v supply. The -12v outputs are split and connected through isolation diodes CR35 and CR36. These diodes permit paralleling of the supply with two other 12v supply circuits. The isolation diodes prevent either output line from being dropped down by a failure or turnoff of the supply. The output voltage level is controlled by regulator driver A2Q23-Q26. The regulator driver monitors both outputs and compares them with a reference dc level supplied by rectifier A2CR14-CR15. The reference level is adjusted by front panel volt ADJ -12V control. By this comparison process the regulator driver is able to hold the output at a constant dc voltage. A current limit circuit, adjustable with A2R26, is also built into the regulator driver.

e. Plus 9-Volt Regulator. The +9v regulator is driven by the second secondary winding of T1. Operation is similar to d above except that components are rearranged to produce a positive output.

f. Fault Lamp Circuit. Undervoltage conditions in the -12v circuit are detected by -12v sensor A4VR10 and A4U2. Undervoltage detection activates driver A4Q31 which turns on the front panel -12V FAULT lamp. The +9V FAULT lamp is similarly driven by +9v sensor A4U1, A4VR7 and driver A4Q30 from the +9v regulator output.

g. Overvoltage Protection. Outputs of both regulators are applied to an overvoltage protector circuit. In this circuit -12v overvoltage conditions are detected by A4Q38 and A4VR9 and +9v overvoltage is detected by A4Q36 and A4VR8. The detection voltage is adjustable. When either circuit detects an overvoltage condition shunt silicon controlled rectifier (SCR) A4Q41 is turned on. While conducting, the SCR shorts both supplies, together forcing them to a low (undervoltage) level.

h. Alarm Circuit. The outputs of both regulators are also applied to -12v and +9v undervoltage detectors A4Q37 and A4Q35. If either detects an undervoltage condition, alarm gate A4Q39-Q40, and A4VR11 is activated and an alarm signal is applied to the alarm interconnection output.

i. Pulse Circuit Power Supply. Power for the input regulator pulse generating circuits is developed by a separate power supply. Ac from the T1 first secondary is coupled through transformer A3T3 and then rectified by AC CR10-13 to provide this power.

j. Power Switch. Power switch S1 shuts off the converter by applying ground from the dc input line to the shunt chopper and 1 kHz chopper. This ground signal, biases both circuits into cutoff and thereby shuts off the converter. When the power switch is set to ON the ground is removed; this allows both choppers to operate.

4-56. Differences in Dc-to-Dc Converters

a. Input Regulation. Some dc-to-dc converters perform regulation at the input to the 1-kHz chopper instead of in the output dc circuit. Type 2 is an example of this type of converter (fig. FO-27). Series pass regulator A5Q5 is placed in the negative return leg of the 1 kHz chopper circuit. The +5v output is monitored by regulator driver consisting of A2Q17, A2Q19, A2Q24-Q26 and A3U1. The regulator driver adjusts the amount of conduction through the series pass regulator and thereby controls the amplitude of the chopped signal driving the T1 primary. This in turn corrects +5v output level variations. The pulse repetition frequency of multivibrator A2Q13 is controlled by the voltage at the input to the series pass regulator. To accomplish this, pulse rate and bias control A2VR3 and A2Q22-Q23 monitors the series pass regulator input level. The output of charging circuit C2, CR2, CR3 is, therefore, controlled indirectly by the converter output level.

b. Blowers. Several of the converts, such as type 4 (fig. FO-29) contain blowers. Blower B1 is driven by blower power PS1 which converts dc input to ac to drive the blower. The blower operates whenever dc input is present, even if the power switch is OFF.

c. Alarm Outputs. The dc-to-dc converters supply two types of alarm outputs to signal detection of undervoltage conditions. The first type is the alarm interconnection output described for the type 7 converter (para 4-55h). Type 2 and type 4 converters (fig. FO-27 and FO-29) also supply alarm interconnection signals. The alarm interconnection signals are routed to other converters which in turn report the fault to the system. Dc-to-dc converter type 6 (fig. FO-31) is an example of a converter which reports faults to the system. The three fault lamp drive signals are applied to alarm gate A2CR11, A2CR19-CR20. If an undervoltage condition is sensed in the type 6 converter, the alarm gate output is activated. The active output is passed through alarm sensor A2U4 and shuts off relay driver A2Q83. Relay A2K1 is normally energized when power is on and no undervoltage faults are detected. This results in normally open contacts across the alarm output. The contacts close when relay A2K1 is deenergized as described above. The alarm interconnection signal from another dc-to-dc converter is also applied to alarm sensor A2U4. If the alarm interconnection signal indicates an undervoltage fault, relay A2K1 is also deenergized, causing the closed contact alarm signal. The ,alarm signals from all converters except types 2, 4, and 7 are sent to the common control system alarm register to signal a dc fault condition (para 4-30).

d. Overvoltage Protection. Several different schemes of overvoltage protection are employed. All involve interruption of the circuit by means of a shunt SCR. The scheme used in the type 7 converter (fig. FO-32) involves shorting positive and negative dc outputs of approximately equal' amplitude to each other; this forces both to a low level. A second scheme is to merely short the dc output level to the ground or return line. The type 2 converter is an example of this scheme (fig. FO-27). A third scheme involves interruption of the kHz chopper. The type 4 converter is an example of this type of protection (fig. FO-29). The 1-kHz chopper requires feedback from transformer T1 to operate. Shunt SCR A2Q35 shorts the feedback leads together when triggered by the overvoltage protector. This action stops the 1-kHz chopper and thereby eliminates the converter output voltage.

CHAPTER 5

MAINTENANCE

Section I. OPERATOR/CREW AND ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) AND SYSTEM READINESS CRITERIA

5-1. GENERAL.

a. Maintenance Forms and Records. The forms and records you fill out have several uses, including: (1) a permanent record of the services, repairs, and modifications made on your equipment; (2) reports to the next level of maintenance and to your commander; and (3) a checklist for you when you want to know the status of the equipment after its last use, and whether faults, if any, have been fixed. For information on forms and records, see DA PAM 738-750 (if USMC, see TM-4700-15/ld).

b. Routine Checks. Routine checks, such as cleaning, dusting, washing, stowing items not in use, covering unused receptacles, and checking for damage, are not listed as PMCS checks. They are things you should do any time you see they must be done. Ensure that all discrepancies are noted and corrected.

c. Operator PMCS. Operator's PMCS are the required periodic inspections and actions necessary to keep your equipment in good operating condition.

d. Organizational PMCS. Organizational preventive maintenance procedures are designed to help maintain equipment in serviceable condition. They include what items should be checked and how to check them. These checks and services are described in paragraph 5-5, outline inspections that are to be made at specific (W) weekly, (M) monthly, (Q) quarterly, (S) semiannually and (A) annual intervals.

e. System Readiness Criteria. System Readiness Criteria are those standard, specific requirements your system must meet for it to be mission-capable.

5-2. PMCS Table (paragraph 5-3). The PMCS table lists all the scheduled maintenance tasks required for your system.

a. Explanation of Columns.

(1) Item No. This column contains a number for each procedure to be performed. When reporting malfunctions or failures on DA Form 2404, Equipment Inspection and Maintenance Worksheet, place this number in the "TM Item No." column.

(2) Interval. These columns tell you when to do a procedure. Each column that applies will contain an asterisk (*). Some procedures will have asterisks in more than one column.

(3) Item to be inspected/procedure. This column contains the name of the item to be inspected and tells how to perform the required checks and services on it. Carefully follow these instructions and perform them in the order listed.

(4) Equipment is not ready/available if:. This column tells you the conditions which will cause the equipment to be classified as not ready (red) for readiness reporting.

NOTE

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

b. Instructions.

(1) Do your before (B) preventive maintenance just before you operate your equipment. Pay attention to CAUTIONS and WARNINGS.

(2) Do your during (D) preventive maintenance while the equipment and/or its components systems are in operation.

(3) Do your after (A) preventive maintenance right after operating the equipment. Pay attention to the CAUTIONS and WARNINGS.

(4) Do your weekly (W) preventive maintenance once a week.

(5) Do your monthly (M) preventive maintenance once a month.

(6) If something doesn't work, troubleshoot it with the instructions in this manual and notify your supervisor.

(7) Always do your preventive maintenance in the same order.

(8) If anything goes wrong and you can't fix it, write it on your DA Form 2404, or applicable form. If you find something seriously wrong, report it to the next level of maintenance IMMEDIATELY.

WARNINGS

Never operate the generator or shelter until it has been properly grounded. Electrical defects in the load lines or equipment can cause DEATH by electrocution when contact is made with an ungrounded system.

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame, the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should be avoided. When necessary use gloves which the solvent cannot penetrate. If the solvent is taken internally, consult a physician.

Compressed air shall not be used for cleaning purposes except where reduced to less than 29 psi and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

5-3..Operator Preventive Maintenance Checks and Services

Item No.	INTERVAL					Item to be inspected Procedure	Equipment is not ready/available if:
	B	D	A	W	M		
1						Truck (1) 2 1/2 Ton (M35A2) Follow PMCS procedures in TM 9-2320-209-10.	Truck is inoperative and no substitute is available.
2						Generator Set AN/MJQ-10A (2 generators in set) Follow PMCS procedures in TM 5-6115-594-14&P	Both generators are inoperative and no substitutes are available.
3	*			*		Grounding Rod MX-148/G Check grounding system to see that it is properly installed. Tighten loose ground connections.	Unable to ground properly.
4	*					Shelter Door Air Filter Clean or replace as necessary.	
5	*	*				Shelter Blowers Check for proper air flow. Clean as necessary.	Blowers fail to operate.
6	*					Battery Exhaust Blower Inspect battery exhaust/ intake for obstructions. Clean as necessary.	
7	*	*				Heater Check for proper heat output.	

5-3. Operator Preventive Maintenance Checks and Services (cont'd)

Item No.	INTERVAL					Item to be inspected Procedure	Equipment is not ready/available if:
	B	D	A	W	M		
8						Air Conditioner, 18000 BTU, 208V, MAC6H18-208-1201-02 (A28,A29) Follow PMCS procedures in TM 5-4120-243-14.	Inside temperature cannot be maintained between 55-85 degrees Fahrenheit and humidity between 20 and 80%.
9	*					Intercommunication Station LS-147C/FI Check to see that power cord is connected to equipment ground.	

5-4. System Readiness Criteria table (paragraph 5-4.1). The System Readiness Criteria table is your "checklist" for determining the mission readiness of your system.

a. Explanation of Columns.

(1) Item No. This column contains a number for each readiness-reportable item. When reporting, on DA Form 2404, Equipment Inspection and Maintenance Worksheet, malfunctions or failures that cannot be repaired "on-the-spot," place this number in the "TM Item No." column.

(2) Subsystems and Components. This column lists all system equipments which are required for readiness reporting.

(3) Equip Model ID #. This column contains the equipment model identification number (type-classification) of each equipment.

(4) Qty. This column tells you the quantity of equipment/items furnished as part of, or with, your system.

(5) Remarks. This column contains other information/special instructions and will alert you to any exceptions to the requirements, designed to give you maximum mission flexibility.

b. Instructions. Perform the following steps to determine system readiness:

(1) BEFORE starting your mission, ensure that listed equipments/items are on hand and operational. If necessary, perform operational checks in applicable TM's to determine the condition of your equipment.

(2) Take note of REMARKS column. This column contains exceptions and special instructions to help you tailor your requirements to your mission.

(3) If any required equipment/item is not on hand and operational, your entire system is deadlined (unless otherwise noted in the REMARKS column).

(4) Correct any discrepancies, then re-check all equipments/items on list. When all required equipment/items are on hand and operational, your system is mission-ready.

(5) AFTER completing your mission, and before moving to a new location, ensure that all listed equipments/items are on hand.

5-4.1. SYSTEM READINESS CRITERIA

System ratings: Fully Mission Capable (FMCC)
Not Mission Capable (NMC)

Item No.	AN/TTC-38(V) 1 & 2 Subsystems and Components	Equip Model ID #	Qty	Remarks
1R	Shelter, Electrical Equipment (wired with the following components):	S-280	1	System may be rated FMC with component(s) rated NMC if that/those component(s) are not required to support the mission.
2R	Adapter Terminal Assembly	1		
3R	Battery Charger		1	
4R	Blower Assembly		2	
5R	Central Processor		2	System may be rated FMC if one central processor is rated NMC.
6R	Common Matrix Driver Assembly		1	
7R	Common Terminal Equipment Assembly		1	
8R	Connector Assembly		2	
9R	Control Transfer Assembly		1	
10R	Distribution Panel		1	
11R	Functional Assignment Control		1	
12R	Headset, Microphone	H-325	1	
13R	Heater		1	
14R	Intercommunication Station	LS-147C/FI	1	System may be rated FMC if LS-147C/FI is rated NMC.
15R	Maintenance Control Panel		2	System may be rated FMC if one maintenance control panel is rated NMC.

5-4.1. SYSTEM READINESS CRITERIA (cont'd)
System ratings: Fully Mission Capable (FMCC)
Not Mission Capable (NMC)

Item No.	AN/TTC-38(V) 1 & 2 Subsystems and Components	Equip Model ID #	Qty	Remarks
16R	Memory Unit 48K		2	System may be rated FMC if one memory unit is rated NMC.
17R	Operator's Position		1	System may be rated FMC if operator's position is rated NMC and C-9434 is rated FMC.
18R	Switchboard, Remote-Control	C-9434	1	System may be rated FMC if C-9434 is rated NMC and operator's position is rated FMC.
19R	Paper Tape Reader		1	
20R	Patch Panel		1	
21R	Power Control Panel		1	
22R	Power Supply [for (V)l]		21	System may be rated NMC if two of the SAME type are rated NMC.
23R	Power Supply [for (V)2]		31	System may be rated NMC if four of the SAME type are rated NMC.
24R	Ringer (20 Hz)		2	System may be rated FMC if one ringer is rated NMC.
25R	Synchronizer-Alarm Transfer		1	
26R	System Status Panel		1	
27R	Teleprinter	ASR-33	2	System may be rated FMC if one ASR-33 is rated NMC.
28R	Terminal/Matrix Frame		4/8	

5-4.1. SYSTEM READINESS CRITERIA (cont'd)
System ratings: Fully Mission Capable (FMC)
Not Mission Capable (NMC)

Item No.	AN/TTC-38(V) 1 & 2 Subsystems and Components	Equip Model ID #	Qty	Remarks
29R	Voltage Protector Assembly		2/4	
30R	Air Conditioner, 18000 BTU		2	System may be rated FMC if inside temperature can be maintained between 55-85 degrees Fahrenheit and humidity between 20-80%.
31R	Electrical Grounding Cable (125 FT)	W307	1	
32R	External Power Electrical Cable Assy (50 FT) SM-D-744663	W299	2	
33R	External Power Electrical Cable Assy (25 FT) SM-D-744664	W300	1	
34R	Generator Set (2 generators in set)	AN/MJQ-10A	1	System may be rated FMC if one generator is rated NMC.
35R	Ground Rod	MX-148 /G	2	System may be rated FMC if one MX-148/G is rated NMC.
36R	Reel, Cable (for W300, W307)	RC-435/U	2	
37R	Reel, Cable (for W299)	RC-405	1	
38R	Truck (2 1/2 Ton)	M35A2	1	System may be rated FMC if appropriate substitute is available.

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5-5. Organizational Preventive Maintenance Checks and Services

Item No.	Interval			Item to be Inspected	Procedures Check and have repaired or adjusted as necessary
	W	M	Q		
				EXTERIOR	
1		X		Shelter facility skin	Check for skin punctures, cracks, or open seams that could permit moisture to enter wall.
2			X	Entrance door	a. Lubricate door locks and latches with grease molybdenumdisulfide (GMD); lubricate hinges with lubricating oil, general purpose, FED-VV-L-800 or lubricating oil, engine (MIL-L-2104). b. Apply gasket cement on loose gaskets. c. Replace defective rubber gaskets, broken hinges and latches (TB 750-240).J
3		X		Blower screens and vents	Clean blower screens; make sure blower vents are clear of obstructions. Check blower operation (para 5-2d).
4			X	Power and signal entrance panel covers	Lubricate piano-type hinges of covers with oil (FED-VV-L-2104).
				INTERIOR	
5		X		Fire extinguisher	Refill if weight of contents is less than prescribed.
6			X	Walls, ceiling and floor	Check for skin punctures and cracked seams.
7		X		Emergency blower	Turn on EMER FAN and check for inoperative or noisy blower motor.
8		X		Emergency lights	Turn on emergency lights; see that incandescent lights operate properly.
9		X		Light tightness	Close door, but leave vents open; inspect for light tightness.
10		X		Blackout lamp	Turn on fluorescent lights; set BLACKOUT BYPASS switch to OFF; open door. See that fluorescent lights go out and that blackout lamp lights.
11		X		Exhaust blowers	Clean motor and fan housings. (para 5-2).
12			X	Punched tape reader A-12	At two-year intervals, during quarterly maintenance, refer tape reader to higher category maintenance for photo amplifier adjustment.
13			X	Tape winder	Semiannually, during quarterly maintenance, lubricate tape winder with one drop of oil (FED-VV-L-800) in each of the following locations: a. Mechanism (1) Tape stop arm pivot (2) Tape stop arm roller (remove excess oil)

5-5. Organizational Preventive Maintenance Checks and Services - Continued

Item No.	Interval			Item to be Inspected	Procedures Check and have repaired or adjusted as necessary
	W	M	Q		
					(3) Braking wedge bushing (4) Brake operating lever detent spring at spring guide. b. Motor bearing pivot point on front and rear plates.
				BATTERIES **WARNING** **Lead-Acid and Nickel-Cadium batteries must be kept separated from each other. Tools and materials used in the maintenance of these types of batteries must not be interchanged.** **LEAD-ACID-BATTERIES**	
14	X			Electrolyte level	Add water to any cell that is low. Do not overfill.
15		X		Battery terminals	Make sure all battery terminals are clean.
16		X		Vent plugs	Vent plugs should be clear of obstructions.
				NICKEL-CADIUM BATTERIES **CAUTION** **Do not add water to a discharged battery until after a new charging cycle has been completed.**	
17		X		Modifications	Make sure all MWOs have been applied. Refer to DA PAM 310-1.

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5-7. Troubleshooting Charts

a. General. The following troubleshooting charts identify malfunction symptoms and corrective measures. The charts are grouped by different functions within the assemblage. Each chart lists symptoms and maintenance printouts which relate to the function. Refer any malfunctions which are not corrected by actions prescribed in the charts to a higher category of maintenance. Refer to the maintenance allocation chart (app B) for maintenance functions authorized at each repair level. Most maintenance and supervisory messages printed out by the operational program are preceded by the following header:

AAAA B CCC

where:

AAAA is 24. hour time.

B is time zone.

CCC identifies which processor sent the message:

ACT indicates on-line processor.

SBY indicates standby processor.

b. Power Subsystem

Malfunction	Probable cause	Corrective action
1. PHASE FAULT, CIRCUIT BREAKER FAULT, and BATTERY CHARGER FAULT lamps go on and audible alarms sound. NOTE Depress fault lamps to turn off alarms. Lamps stay on. Depress lamps again after corrective action. Lamps go off (and alarm is reset).	*a*. Input power phase fault	*a*. Open BATTERY CHARGER circuit breaker and check ac power source.
	b. Open ∅A CONT or ∅C CONT fuse	*b*. Check fuses FI and F3.
2. CIRCUIT BREAKER FAULT lamp goes on and audible alarm sounds. NOTE Depress fault lamp to turn off alarm. Lamp stays on. Depress lamp again after corrective action. Lamp goes off (and alarm is reset).	*a*. Tripped BATTERY CHARGER circuit breaker.	*a*. Check following: (1) Battery charger A24. (2) Ac power source and phase fault lamps, fuses FI-F3 and relays K1-K3
	b. Tripped DC/AC INVERTERS 1 circuit breaker.	*b*. Check following: (1) Dc to ac inverter PS1. (2) Paper tape reader A12.
	c. Tripped DC/AC INVERTERS circuit breaker.	*c*. Check dc to ac inverter PS2.
	d. Tripped DC CONTROL and all DC-DC CONVERTERS circuit .breakers.	*d*. Check following: (1) Blower A57. (2) Plug tester A22. (3) +24 .V supply to A7, AS, A9, A10, A11, and A16.
	e. Tripped DC-DC CONVERTERS circuit breaker (any of seven).	*e*. Replace dc to dc converter which has red FAULT light on.
3. BATTERY CHARGER FAULT lamp goes on and audible alarm sounds. AC PWR lamp on system status panel is on and audible alarm sounds.	*a*. Loss of ac input power	*a*. Check ac power source.
	b. Battery charger malfunction (Check battery charger current on DC ammeter.)'	*b*. Refer malfunction to higher category maintenance.

Malfunction	Probable cause	Corrective action
NOTE Depress fault lamp to turn off alarm. Lamp stays on. Depress lamp again after corrective action. Lamp goes off and alarm is reset.		
4. BATTERY STORAGE FAULT lamp goes on and audible alarm sounds.	External battery vent cover is closed when system is operating on battery.	Open external battery vent cover.
NOTE Depress fault lamp to turn off alarm. Lamp stays on. Depress lamp again after corrective action. Lamp goes off (and alarm is reset).		
5. NTS blower off	*a*. Open nest fan fuse on NTS power control A23.	*a*. Check following: (1) Fuse A52 for blower A52 (AN/TTC- 38(V)2 only). (2) Fuse A53 for blower A53. (3) Fuse A54 for blower A54. (4) Fuse A55 for blower A55. (5) Fuse A56 for blower A56.
	b. Blower malfunction	*b*. Check blower.
6. Emergency fan does not go on when EMER FAN switch is on.	*a*. Open EMER FAN fuse	*a*. Check fuse F14.
	b. Inoperative EMER FAN switch	*b*. Check switch S16.
7. Remote operator complaint that remote position is inoperative.	Remote power loss	Check RMT OPER fuse F15.
8. Incandescent lamps DS14 and DS15 fails to go on under any of the following conditions: AC power loss, LIGHTS circuit, breaker CB4 open, and power supply PS24 failure.	Open LTG CONT fuse	Check fuse F4.
9. Loss of all NTS nest power. All NTS PWER CONTROL lamps go off.	Open NTS PWR CONT fuse	Check fuse F8.
10. Battery charger blower A24B1 and battery storage fan A17B1 both fail to operate.	*a*. Open DC CONTROL 1 fuse	a. Check fuse F7.
	b. Open DC CONTROL 2 fuse	b. Check fuse F12.
11. Battery storage fault alarm fails to occur when conditions warrant the alarm.	Open BATTERY STORAGE ALARM fuse.	Check fuse F9.
12. Sudden failure of external dc input (applied at power entry panel) to power the system.	*a*. Open EXT DC fuse	a. Check fuse F6.
	b. Open fuse F5	*b*. Check fuse F5.
13. Sudden failure of batteries BT1-BT4 to power the system.	Open battery fuse.	Check 400A fuse F11 located on power distribution panel (behind power sub-system control panel).
14. Absence of one of the following. nest input voltages: 4899V, -V 99V, -6V, 12V, 15V, -12V, -15V. 5V,	Power relay in A 5 1	*a*. Refer malfunction to higher category maintenance.
	b. NTS POWER CONTROL switch on A23.	*b*. Refer malfunction to higher category maintenance.
15. DC PWR major fault on A6 lights.	One of dc-to-dc converters (PS3-PS23) failed. If failure is in PS3-PS8 converter used with on-line processor, control of central office is automatically switched	Allow system to operate on other processor or redundant dc-to-dc converter. Determine which converter has red FAULT light on and set ON/OFF switch

Malfunction	Probable cause	Corrective action
	to other processor. If failure is in PS9-PS23, NTS will continue to operate on redundant dc-to-dc converter.	to OFF. Replace this converter.
16. Multiple network subsystem fault printouts. Car replacement procedures havenot cleared the malfunction; printouts persist.	Blown fuse	Analyze. printouts to determine which NTS assembly is causing the malfunction. If possible, also determine which rows (A1, A2, etc.) contain the inoperative cards (fig. FO-36 through FO-39). Refer to power subsystem block diagram (fig. FO-23) to determine which fuses feed power to the rows suspected of malfunction, and replace any blown fuse.
17. FACP blower off	Open fan fuse F3	Check fuse F3 on FACP blower assembly.
18. I/O synchronizer blower off	Open fan fuse FS	Check fuse F3 on I/O synchronizer blower assembly.
19. Central processor blower off blower assembly.	Open fan fuse F9	Check fuse F9 on central processor
20. Memory blower off assembly.	Open fan fuse Fl	Check fuse F1 on memory blower
21. Inverter blower Open fan fuse F1I cabinet panel.		Check INV FAN fuse F16 on power
22. FAULT lamp on power subsystem upper cover lights.	*a*. Defective TRANSIENT PROTEC. TION fuse. *b*. Defective TRANSIENT PROTECTION diode. *c*. Defective battery charger.	*a*. Check 25 AMP fuse F18 (fig. 8-12). *b*. Have higher category maintenance check and replace diode CR23 as necessary. *c*. Check DC VOLTS meter. Voltage should be 24 to 30 volts dc.

c. Operator Position.

Malfunction	Probable cause	Corrective action
1. RESET switch does not turn off all lamps except COMMON RELEASE.	Defective reset logic	Replace A4.
2. Lamp does not light when LAMP TEST switch is depressed.	Defective lamp	Replace lamp.
3. No lamps go on when LAMP TEST switch is depressed.	*a*. Defective fuse *b*. Defective lamp test logic *c*. Defective power supply	*a*. Replace Fl. *b*. Replace A4. *c*. Replace PS1.
4. LAMP INTENSITY control does not vary illumination level of lamps.	Defective lamp voltage supply	Replace A4.
5. No tones heard in earphone when keyset switches and pushbutton switches are depressed.	*a*. Defective earphone. *b*. Defective headset amplifier	*a*. Replace HT. *b*. Replace A2.
6. All tones not heard in earphone when keyset, HOLD, RERING, and CLEAR/WIPEOUT switches are depressed.	*a*. Defective transmit *b*. Defective DTMF oscillator	*a*. Replace A2. *b*. Replace A1.
7. All tones not heard in earphone when CALL/SEIZE, RELEASE 1 and 2, INTERCOM, QUEUE ADVANCE, and COMMON RELEASE switches are depressed.	*a*. Defective switch logic *b*. Defective oscillator, tone gate, or transmit amplifier.	*a*. Replace A4. *b*. Replace A2.
8. No tone heard in earphone when MODE switch is set to UNSTAFFED.	Defective oscillator or transmit amplifier.	Replace A2.
9. Incorrect lamp response after depressing CALL/SEIZE switch (and no dial tone).	*a*. Seize signal not transmitted *b*. Seize trip signal not received *c*. Detected, or *d*. Decoded.	*a*. Replace A4. Replace A2. *b*. Replace Al. *c*. Replace A3. *d*. Replace A4.
10. Incorrect lamp response after depressing CALL/SEIZE switch (dial tone heard).	Defective lamp logic	Replace A4.

Malfunction	Probable cause	Corrective action
11. Dial tone not heard after depressing CALL/SEIZE switch (lamps correct).	Seize signal output not stopped	Replace A4.
12. RELEASE 1, RELEASE 2, or INTERCOM lamp does not go on when respective switch is depressed.	Defective lamp logic	Replace A4.
13. Incorrect lamp response after depressing QUEUE ADVANCE, COMMON RELEASE, RELEASE 1, RELEASE 2, or HOLD switches.	*a*. All switches-lamp signal not received *b*. Some switches-lamp signal not detected or decoded. *c*. Some switches-switch signal not transmitted.	*a*. Replace A1. *b*. Replace A3. Replace A4. *c*. Replace A2. Replace A4.
14. In a three-way conversation, all three parties cannot hear and be heard by each other.	Defective voice circuit	Replace A2.
15. STATUS QUEUE lamp does not flash or go on steady for incoming call.	*a*. Lamp signal not received *b*. Lamp signal not detected *c*. Lamp signal not decoded	*a*. Replace A1. *b*. Replace A3. *c*. Replace A4.
16. STATUS QUEUE lamp is not updated (for example: does not go off if calling party goes on hook before operator answers, or if another operator answers).	Same as 15.	Same as 15.
17. Night ringer does not ring for incoming call.	*a*. Ring signal not received *b*. Ring signal not detected	*a*. Replace A2. *b*. Replace A1.
18. INTERCOM lamp does not flash for incoming call.	*a*. Intercom seize signal not received. *b*. Intercom seize signal not detected. *c*. Intercom seize signal not decoded.	*a*. Replace A2. *b*. Replace A1. *c*. Replace A4.
19. In intercom conversation, all parties cannot hear and be heard by each other.	*a*. Defective intercom voice circuit *b*. Defective intercom voice bridge	*a*. Replace A2. *b*. Replace A27A148 in common equipment nest.
20. Incorrect response of STATUS ALARM lamp during monthly checkout of status panel A6.	*a*. Lamp signal not received *b*. Lamp signal not detected *c*. Lamp signal not decoded	*a*. Replace A1. *b*. Replace A3. *c*. Replace A4.
21. Incorrect response to control transfer (master clear).	Same as 20	Same as 20.

d. Subscriber Complaints and Adapted Circuits

Malfunction	Probable cause	Corrective action
1. Verbal complaint received, equipment failure or degradated service. On adapted circuits a printout may occur with the following format: X- X-XX LOCKOUT where: X- X- XX identifies frame-group-terminal number of locked out terminal NOTE Display terminal service (para 3-11) to find a directory	*a*. Switchboard equipment failed and corrections made as a result of printout data. Trouble report no longer valid. persists, proceed to steps c through h. *b*. Outside plant defective or being worked on trouble report may or may not be valid. *c*. Patch cord not inserted properly or in wrong location.	*a*. Monitor previous printouts. Determine possibility of fault being corrected as a result of prior maintenance. If trouble *b*. Check with maintenance crew to correlate outside plant status applicable to suspected line faults. When suspected line is not affected, proceed to steps c through h. *c*. Determine associated terminal number and check original command assignments for trunks and/or lines and correct erroneous patching.

Malfunction	Probable cause	Corrective action
number or adapter special circuit number when only terminal number is known. Display directory number assignment to find terminal number when only directory number is known.	*d*. Line or trunk classmark incorrect	*d.* Verify assignments using FACP terminal service display procedure (para 3-10). Correct data if necessary using FACP change procedures (para 2-51).
	e. Outside plant faulty, restricting normal communications.	*e.* Use standard procedures for field line testing. Repair faulty lines or use spare pairs in cable.
	f. Defective subscriber telephone or distant switchboard appearance.	*f.* Report defect to appropriate maintenance crew. Repair or replace defective equipment.
	g. Faulty terminal card, scanner, or adapter. Fault not detected as a result of operational routines.	*g*. Perform scanning test (steps a through g and s, para 5-43). If test fails, replace terminal card (fig. FO- 36) or 'troubleshoot scanner fault (para 5-7e). If test, results are satisfactory and an adapter is used in circuit replace adapter card. Attempt calls to and from remote termination using maintenance telephone.
	h. Faulty DTMF terminal card. Fault not detected as a result of operational routines.	*h*. Connect CB/DTMF maintenance telephone to the network side of the patch panel. Perform a self ring exercise. Call. If test fails, replace the terminal card and repeat test.
2. Single subscriber complaint on adapted circuit.	*a*. Faulty adapter	*a*. If not known, identify adapter special circuit number by displaying directory number and terminal service (para 3-11). Replace adapter (fig. FO-39).
	b. Faulty network circuits	*b*. Perform scanner test on complaining terminal (para 5-43). If test fails refer to paragraph 5-7e.
3. Several subscriber complaints from different adapted circuits.	Faulty adapter interface card	Identify special circuit numbers of complaining directory numbers (para 3-11). See if all adapters involved are on same bus (A or B) in adapter assembly A25 (fig. FO- 39). If they are, replace adapter interface card on that bus. If not on same bus troubleshoot as individual faults (2 above).

e. Scanners

Malfunction	Probable cause	Corrective action
1. Scanner test (para 5-43) is performed. Single dc supervised terminal fails test.	Since scanner functions with similar type line terminals, fault is peculiar to line terminal scan circuit. Most probable cause is defective line terminal card or scan receiver card.	*a.* Replace line terminal card (fig. FO-36) and perform scanner test (para 5-43). *b.* Replace scan receiver card (fig. FO-36) and perform scanner test (para 5-43).
2. Scanner test (para 5- 43) is performed. Single dc supervised terminal fails test.	Since scanner functions with similar type line terminals, fault is peculiar to this line terminal scan circuit. Most probable cause is defective line terminal card.	Replace line terminal card (fig. FO- 36) and perform scanner test (para 5-43).
3. Scanner test (para 5-43) is performed. All ac supervised terminals in one group fail test.	Since all line terminals in one group fail, fault is peculiar to common equipment associated with the defective group.	*a.* Replace scan receiver card (fig. FO-36) and perform scanner test (para 5- 43).

Malfunction	Probable cause	Corrective action
	Most probable cause is scan receiver card.	*b*. Replace scan detector card (fig. FO-36) and perform scanner test (para 5-43).
4. Scanner test (para 5-43) is performed. All dc supervised terminals fail in one group.	Since all terminals in one group fail, fault is peculiar to common equipment associated with that group.	Replace scan detector card (fig. FO- 36) and perform scanner test (para 5-43).
5. Scanner test is performed (para 5-43). Many line terminals fail in one frame.	When many scan circuit failures occur in one frame determine whether they are in high groups (5, 6, 7, or 8) or low groups (1, 2, 3, or 4). When they are all in one group (high or low) it indicates defective control circuit. When faults appear between groups, it may be peculiar to each individual line terminal.	*a*. When faults are specified to be in one group, replace the scan control card (fig. FO- 36) and perform the scanner test (para 5-43). *b*. When faults are scattered between groups, isolate in accordance with the procedures described in 1 through 4 above.
6. Scanner test is performed (para 5-43). All terminals in a group fail R or C Tests but pass seize and release tests.	Scan detector failed	Replace scan detector card for frame and group (fig. FO-36). Perform scanner test (para 5-43).

f. Terminal Circuits

Malfunction	Probable cause	Corrective action
NOTE You can determine directory numbers assigned to terminals X-X-XX or Y-Y-YY in following printouts by displaying terminal service on FACP (para 3-11).		NOTE Refer to following paragraphs for further troubleshooting: Matrix-paragraph 5-40. ITC and OTC-paragraph 5- 39. SBR-paragraph 5-7p. Ringer-paragraph 5-7m. CCS (KL)- paragraph 5-7n.
1. Minor alarm and single message printed. NT FLT SBR IFGT RRRRRR X-X- XX TYPE OFGT ABC C2 Y-Y-YY WVV where: RRRRRR is octal contents of SBR X-X-XX is inlet terminal (ITC) C2. C2 denotes failure to verify connect attempt. Y-Y-YY is outlet terminal (OTC) W, when 1; alternate link used. when 0; alternate link not used. VV BC link number (01- 20) used during connect attempt.	Program attempted to connect path X-X-XX, Y-Y-YY, W, VV but could not verify connection. Therefore, connection was made through another path. Fault may be in matrix card or terminal card. Also fault may be transient.	If RRRRRR is 000000, troubleshoot matrix. For any other value of RRRRRR, Check A, figure 5-1, for course of action.
2. Minor alarm and single message is printed. NT FLT SBR IFGT RRRRRR MMMMMM TYPE OFGT C2 Y-Y-YY W VV	Failure detected during connect attempt to ringbus. No other link available, call abandoned. Fault may be in matrix card, terminal card, SRBBUS, KL counter, or ringer fault may be transient. A B C	Check C, figure 5-1, for course of action.

Malfunction	Probable cause	Corrective action
or NT FLT SBR IFGT RRRRRR 0-0-00 TYPE OFGT A BC C2 Y-Y-YY W VV where: SBR, TYPE, OFGT, A BC are defined in 1 above, and; MMMMMM is a ringbus link (21- 24) as shown: RG BCK (21) ROU RG (22) PRI RG (23) TRIP (24)		
3. Minor alarm and two NT FLT messages are printed with link number different: NT FLT SBR IFGT RRRRRR X- X- XX TYPE OFGT A BC C2 Y-Y-YY W VV NT FLT SBR IFGT RRRRRR X- X- XX TYPE OFGT A BC C2 Y-Y-YY W' V'V' where parameters are defined in 1 above and W' V'V' ≠ W VV (different link numbers)	Failure detected during verify test of network connect instruction (NET) second attempt also failed. Most probable cause is terminal card. Program attempted to connect X-X-XX to Y-Y-YY through link W VV then through W' VV'. Both attempts failed to verify. Terminal card probably failed.	Check A, figure 5-1, for course of action.
4. Minor alarm and multiple printouts occur with the format described in above except message printouts are different.	Several failures occur while attempting to connect to ring bus cards.	When VV are same in each printout, or combination of 21-22 or 23-24 exist, troubleshoot ringer. If fault persists refer to C, figure 5-1, for course of action.
5. Minor alarm and single message is printed: NBR FLT SBR IFGT RRRRRR X-X-XX TYPE OFGT A BC DIS Y-Y-YY W VV or D where: D or DIS = disconnect and other parameters are defined in 1 above.	Program attempted to disconnect X-X-XX from Y-Y-YY but verified connection still present after disconnect. Terminal card is probably faulty.	Refer to B (fig. 5-1) for course of action. After fault is corrected, mark links IFGT, and OFGT in-service.
6. Minor alarm and single message printed with format described in .2 above, except Type D or DIS printed instead of C2.	Program failed to disconnect ringbus link VV from Y-Y-YY. Outlet terminal card is probably faulty.	Refer to D, figure 5-1, for course of action. After fault is corrected, mark OFGT in-service.

Malfunction	Probable cause	Corrective action
7. Minor alarm and two successive messages are printed; NT FLT SBR IFGT RRRRRR MMMMMM TYPE OFGT A BC C2 Y-Y-YY W VV NT FLT SBR IFGT RRRRRR MMMMMM TYPE OFGT A BC DIS Y-Y-YY W VV or D where X- X- XX and Y- Y-YY are same for both messages and W - VV are 0 00.	Two successive failures detected during verification test of NET instruction to connect to ringbus. Failures occurred during connect and disconnect modes of NET sequence. Most probable cause is defective outlet terminal card.	Refer to D, figure 5-1, for course of action.
8. Minor alarm and two successive messages are printed: NT FLT SBR IFGT RRRRRR X- X-XX TYPE OFGT A BC C2 Y-Y-YY W VV NT FLT SBR IFGT RRRRRR X-X-XX TYPE OFGT A BC D Y-Y-YY W VV or DIS where parameters have been previously defined.	Program failed to connect and disconnect ringbus link VV to terminal Y-Y-YY. Outlet terminal card is probably faulty.	Refer to B, figure 5-1, for course of action. After faulty card is replaced, mark links, OFGT, and IFGT in-service.
9. Minor alarm and several messages are printed: NT FLT SBR IFGT 000000 X-X-XX TYPE OFGT A BC C2 Y-Y-YY W VV In all messages two of the address numbers in X-X-XX or Y-Y-YY are the same.	Terminal interface card failed. Repeated X-X-XX or Y-Y-YY numbers identify faulty card.	Determine from printout whether repeated numbers are in inlet frame address X- X- XX or outlet frame address Y-Y-YY and thus determine faulty frame. See if repeated numbers fall in low numbered groups (1, 2, 3, or 4) or high numbered groups (5, 6, 7, 8). In faulty frame replace applicable inlet or outlet low or high group terminal interface card (fig. FO- 36).
10. Printout: X- X- XX TP TGN SZ TRIP FAILED where: X-X-XX identifies frame-group terminal TP is terminal type code (table 2- 3). TGN identifies assigned trunk group number. TGN is not printed if X-X-XX is a line.	Terminal X-X-XX did not respond to seize trip sent by central office. *a*. Phone or equipment failed. *b*. If several of these printouts occur and RING FAILS message prints out eventually, system ring bus failed. *c*. If this is single printout, terminal card X- X-XX probably failed.	*a*. Check external equipment. *b*. Test system ring bus if in doubt (para 5- 34). Troubleshoot ringer (para 6-7*m*). *c*. Replace terminal card X-X-XX (fig. FO- 36). Call faulty terminal and make communication check to verify corrective action.

Malfunction	Probable cause	Corrective action
11. Printouts: X-X-XX TP TGN ERROR TONE TIMEOUT followed by: X.X-XX TP TGN LK OUT where: X-X-XX identifies frame-group terminal number. TP is terminal type code (table 2-3). TGN identifies assigned trunk group number. TGN is not printed if X-X-XX is a line.	Telephone connected to terminal X-X-XX requested service (off-hook) but never dialed. Central office sent error tone and then locked out terminal.	
	a. Outside plant problem: off-hook phone or shorted de-supervised line.	*a*. Disconnect patch cord or plug from patch panel network connector X-X-XX. for a moment. Reconnect patch and see if in-service message occurs, then lockout messages repeats. Occurrence of theme messages indicates outside plant fault.
	b. Faulty terminal card (dc-supervised lines only).	*b*. Replace -terminal card X-X-XX (fig. FO-36). Call terminal X-X-XX and make communication check to verify corrective action.
12. Printout X-X-XX TP TGN SIG ERR Where: X-X-XX identifies frame-group-terminal. TP is terminal type code (table 2-3). TGN is a trunk group number. N identifies type of signalling error:	Operational program detected N signalling error type N on trunk at terminal X-X-XX.	
	a. Fault may be transient and self correcting. For example, fault may be caused by fade in carrier transmission link.	*a*. Monitor printer for other messages. MAINT message indicates central office is testing trunk. LK OUT message' indicates trunk failed tests and has been locked out (central office will accept incoming calls on trunk but will not initiate calls over trunk). IN SVC indicates trunk passed tests and is in service. Perform trunk test (para 2-46) if other messages of this type are not present
N 1. Release confirmation not received. 2. Received release did not turn off within allotted time.	*b*. Fault may be in outside plant cable or transmission facilities.	*b*. Notify appropriate outside plant maintenance activity.
3. Received release confirmation did not stay on for allotted time.	*c*. Fault may be in distant central office.	*c*. Notify distant central office of type of fault noted.
4. Received release confirmation did not turn off within allotted time. 5. Error during seize sequence of out-going trunk call. For converter trunk (TP=29) seize acknowledge not received or not turned off. For SF trunks (TP=40 - 51) release not turned off (no. wink). 6. Error during signalling sequence of outgoing trunk call. 7. On converter trunk (TP=29) or PABX trunk ITP=17 -22), incoming seize or release could not be tripped. 8. Error in either incoming seize or release sequence.	*d*. If trunk is newly installed or assigned, incorrect assignment may have been made.	*d*. Display terminal service for X-X-XX and check for correct assignment (para 3-10).
13. Minoralarm and multiple messages are printed: NT SBR IFGT TYPE OFGT A BC RRRRRR X-X.XX DIS Y-Y-YY W VV or preceded by and/or followed by X-X-XX TP TGN OUT SVC TGN printed only if TP indicates trunk.	Signaling buffer register fault.	Perform SBR bus special exercise test (para 5-36). If test is successful troubleshoot each fault as described above.

SBR	STATUS			MOST PROBABLE FAULT CHOICES		
RRRRRR	VF	OB	IB	FIRST	SECOND	THIRD
000000	0	0	0	OTC	ITC	MATRIX
020000	0	0	1	OTC		
040000	0	1	0	ITC	MATRIX	
060000	0	1	1	OTC	ITC	MATRIX
100000	1	0	0	OTC & ITC		
120000	1	0	1	OTC		
140000	1	1	0	ITC	MATRIX	
160000	1	1	1	CCS(KL)		

A. C2 TYPE FAULTS

SBR	STATUS			MOST PROBABLE FAULT CHOICES		
RRRRRR	VF	OB	IB	FIRST	SECOND	THIRD
000000	0	0	0	OTC	MATRIX	
020000	0	0	1	SRB	OTC*	MATRIX*
040000	0	1	0	OTC	RINGER	
060000	0	1	1	SRB*	OTC*	
100000	1	0	0	OTC		
120000	1	0	1	SRB*	OTC	
140000	1	1	0	CCS(KL)		
160000	1	1	1	SRB	CCS(KL)	

C. C2 TYPE SYSTEM RINGBUS FAULTS

SBR	STATUS			MOST PROBABLE FAULT CHOICES		
RRRRRR	VF	OB	IB	FIRST	SECOND	THIRD
000000	0	0	0	CCS(KL)		
020000	0	0	1	ITC		
040000	0	1	0	OTC		
060000	0	1	1	OTC		
100000	1	0	0	OTC		
120000	1	0	1	OTC		
140000	1	1	0	OTC		
160000	1	1	1	OTC		

B. DIS OR D TYPE FAULTS

SRB	STATUS			MOST PROBABLE FAULT CHOICES		
RRRRRR	VF	OB	IB	FIRST	SECOND	THIRD
000000	0	0	0	CCS(KL)		
020000	0	0	1	SRB		
040000	0	1	0	OTC		
060000	0	1	1	SRB	OTC	
100000	1	0	0	OTC		
120000	1	0	1	SRB	OTC	
140000	1	1	0	OTC		
160000	1	1	1	SRB	OTC	

D. DIS OR D TYPE SYSTEM RINGBUS FAULTS

NOTES

1. CHARTS A AND B ARE APPLICABLE TO ALL CONNECT (C2) AND DISCONNECT (DIS OR D) PRINTOUTS EXCEPT FOR SYSTEM RINGBUS PRINTOUTS WHICH ARE COVERED BY CHARTS C AND D. ON APPLICABLE CHART FIND ROW WITH SAME RRRRRR NUMBER AS PRINTOUT. THEN TROUBLESHOOT IN ORDER OF MOST PROBABLE FAULT CHOICES. ASTERISK INDICATES DUAL FAULT IS PROBABLE: TROUBLESHOOT ALL CHOICES.

ITC	-	INLET TERMINAL CARD X-X-XX.
OTC	-	OUTLET TERMINAL CARD Y-Y-YY.
MATRIX	-	OPEN MATRIX CROSSPOINTS.
SBR	-	LOOK FOR AND TROUBLESHOOT FROM SBR FAULT PRINTOUTS.
CCS(KL)	-	STATUS INDICATED SHOULD RESULT IN GO CONDITION. KL COUNTER IN ON-LINE PROCESSOR IS PROBABLY FAULTY. IF KL COUNTER IS FAULTY, MANY OTHER MESSAGES WILL PROBABLY BE PRINTED.
RINGER	-	TROUBLESHOOT SYSTEM RINGBUS CONNECTED TO FRAME.

2. STATUS COLUMN SHOWS STATE OF STATUS BITS RETURNED ON SRB BUS WHICH CAUSE RRRRRR PRINTOUT·

VF = 0	VERIFY PULSE NOT DETECTED
VF = 1	VERIFY PULSE DETECTED
OB = 0	OUTLET NOT BUSY
OB = 1	OUTLET BUSY
IB = 0	INLET NOT BUSY
IB = 1	INLET BUSY

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Figure 5-1. C2, DIS, or D network fault guide.

g. Type C1 Network Faults.

Malfunction	**Probable cause**	**Corrective action**
NOTE If type M and/or Z faults are being printed, disable network M and Z tests (para 5-37.1). Then enable them at completion of troubleshooting.		
1. MINOR FAULT alarm lamp goes on, audible alarm sounds,and printout occurs with either of the following formats: NT FL SBR IFGT TYPE OFGT aaaaaa X-X-XX C1 Y-Y-YY ABC U VV bbbbbb cccccc or NT FL SBR IFGT TYPE OFGT aaaaaa MMMMMM C1 Y-Y-YY A BC U VV. bbbbbb cccccc where X-X-XX is inlet frame group terminal number. MMMMMM indicates ring bus link (21-24): RG BCK (21) ROU RG (22) PRI RG (23) TRIP (24) Y-Y-YY is outlet frame-group-terminal number. U= 1 indicates alternate link used (AN/TTC-38(V) 1 only). U=O indicates primary link used. VV, is BC link used. C1 indicates crosspoint driver test failed. aaaaaa, bbbbbb,, and cccccc are octal representations of contents of signal buffer register (SBR). bbbbbb and/or cccccc may not appear in printout. These are defined as follows: aaaaaa is output of error summary cards and indicates which error summary card reported failure during connect attempt. bbbbbb is individual error outputs of crosspoint drivers whose outputs are summarized by error summary card reporting failure in aaaaaa, cccccc-in case of DP +, BP-, CP + drivers, a second printout of individual error returns is required	*a*. System has detected fault while attempting to make connection. Program has examined initial error return (aaaaaa) and has executed fault isolation instructions.	*a*. Using driver fault initialization procedure (par 5-37.2), obtain several more printouts, then compare bbbbbb and cccccc for all printouts. If all bbbbbb and cccccc are the same in all printouts obtained, go to b below. If not, go to c below. If bbbbbb = 000000 cccccc parameters need not be same on each printout, if they give same Y coordinate (c, fig. 5-2).
	b. All bbbbbb in each printout agree with all other bbbbbb and all cccccc each printout agree with all other cccccc. Probable cause is failed crosspoint driver card. Other possible causes are SBR fault and multiple crosspoint driver fault.	*b*. Perform following in sequence, in referring to figure 5-2. (1) Obtain X coordinate, using aaaaaa. If X is **, troubleshoot for SB fault (para 5-7p). (2) Obtain Y coordinate, using cccccc if bbbbbb=000000. Otherwise use bbbbbb. If bbbbbb ≠ 000000 and does not match entry in B, figure 5-2, troubleshoot for multiple crosspoint driver faults (para 5-41). If bbbbbb=000000 and last two digits of cccccc do not match entry in C, figure 5-2, troubleshoot for multiple crosspoint driver faults (para 5-41). (3) Use X and Y coordinates to determine location of faulty card. (4) Replace card. Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special Exercise tests (para 5-27). If fault remains, go to d. If no fault is detected, enable driver fault initialization procedure (para 5-37.1).

Malfunction	Probable cause	Corrective action
since more than 16 driver cards are being summarized by error summary c card reporting failure in aaaaaa. This printout also contains error returns from other driver cards. Ignore these.		
	c. bbbbbb and/or cccccc are different for majority of fault printouts. P driver has failed and is causing P + fault indication. Other possible causes are SBR fault and loose cable connection.	*c*. Perform following in sequence, referring to figure 5.2. (1) Obtain X coordinate, using aaaaaa. If X is ** troubleshoot for SBR fault (para 5-7p }). Convert X coordinate to new X coordinates). (2) Refer to D, figure 5-2. Replace first card in column under new X coordinate. Perform driver fault initialization procedure (para 65 37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 56 27). If no fault is detected, enable driver fault initialization procedure (para 5-37.1). (3) If fault remains, replace next card on list with card just removed. Perform driver fault initialization procedure (pars 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (pars 5-27). Continue procedure until fault is corrected, going on to column for second new X coordinate if necessary. After fault is corrected, perform driver fault initialization procedure (pars 5-37.2). Then enable network M and Z tests (pars 5-37.1}). (4) If all cards in new X coordinate columns have been replaced and fault remains, check for loose cable connections (especially if cards being replaced are in A32). After fault is corrected, perform driver fault initialization procedure (pars 5-37.2). Then enable network M and Z tests (pars 5-37.1).
	d. aaaaaa. bbbbbb. and/or cccccc all indicate that single P + or P- driver has failed but replacement of driver does not correct fault. Probable cause is a short in a crosspoint, causing a driver fault indication.	*d*. Obtain X and Y coordinates as in b above. Refer to A of figure 5-3 to determine which driver is reporting fault. Go to step (e through I) corresponding to driver reporting fault. Certain crosspoint failure modes will give bbbbbb equal to 000000 and/or cccccc equal to XXXX00 or 000040 or 000020, making it impossible to obtain Y coordinates for these messages. Ignore these messages and use the bbbbbb or cccccc parameters in other fault printouts to obtain the Y coordinate. Repeat driver fault initialization a number of, times to obtain a usable fault- message if necessary.
	e. AP + driver reporting fault. Probable cause is failed crosspoint on any A stage matrix card for group driven by driver in any frame.	*e*. Perform following in sequence, referring to figure 5-3.

Malfunction	Probable cause	Corrective action
		(1) Determine group driven by driver from A of figure 5-3. (2) Refer to group column in B, figure 5-3. Starting in frame 1, remove first card listed in column (ignore C2 failures which occur for affected links). Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5-27). If fault disappears, replace card. If not, reseat the card and repeat procedure for next card in column. Repeat as required for the remaining cards in the column. After fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1). (3) If fault remains, repeat step 2 for additional frames until fault is located.
	f. BP + driver reporting fault. Probable cause is failed crosspoint on any B stage matrix card for set of links in a particular frame.	*f*. Perform following in sequence, referring to figure 5-3. (1) Determine which set of links (LKL, LKM, or LKH) and which frame (F1, F2, etc.) the driver card drives from A, figure 5-3). (2) Refer to C, figure 5-3, for list of eight. (LKL or LKM) or four (LKH) cards. Remove first card in list for affected group in affected frame (ignore C2 failures which occur for affected link). Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5-27). If fault disappears, replace card. If not, reseat card and repeat procedure for next card in list. Repeat as required for remaining cards in list. After fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1).
	g. CP + driver reporting fault. Probable cause is failed crosspoint on C stage matrix card for particular link in any frame.	*g*. Perform following in sequence, referring to figure 5-3. (1) Determine which link (LKO1, LK02, etc.) is being driven by driver from A of figure 5-3. This indicates a single card in D, figure 5-3. (2) Remove card from frame 1 (ignore C2 failures for affected link). Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5.27). If fault remains, remove same card in frame 2. Repeat until fault clears, and replace faulty card. After fault is corrected, perform driver initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1).

Malfunction	Probable cause	Corrective action
	h. DP + or RBDP + driver reporting fault. Probable cause is failed crosspoint on one of D stage matrix cards in same frame as driver and only for links driven by driver.	*h*. Perform following in sequence referring to figure 5-3. (1) Determine from A, figure 5-3, which set of links (LKL, LKM, LKH or RB) is involved. Note frame in which driver is located. (2) Determine from E. figure 5-3, which horizontal rows are to be used. Note that in A there are 2 RBDP + drivers for each frame: A and B. The A driver is used for groups 1-4; the B driver for groups 5-8. Only those D stage matrix cards in the respective groups need be checked when RBDP + driver indicates matrix fault. (3) Partially remove first card specified in row of E for frame that drive is in (ignore C2 failures for affected links). Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (pars 5-27). If fault clears, replace card. If not, reseat card and remove next card in row. Repeat procedure until fault is corrected. After ,fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1).
	i. AP- driver reporting fault. Probable cause is failed crosspoint in A stage matrix in same frame as driver and one of links in set driven by driver.	*i*. Perform following in sequence, referring to figure 5-3. (1) Determine from A, figure 5.3, which set of links (LKL, LKM, or LKH) are driven by driver and which frame is involved. Select one or two horizontal rows from B, figure 5-3, for that set of links. (2) Partially remove first card listed in the same frame as affected driver (ignore C2 failures for affected links). Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5-27). If fault disappears, replace card, If not, reseat card, and remove next card in list. Repeat procedure with each card in row or rows until fault disappears. After fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (pars 5-37.1).
	j. BP- driver reporting fault. Probable cause is failed crosspoint on B stage matrix card with same link number as crosspoint driver but in any frame.	*j*. Perform following in sequence, referring to figure 5-3. (1) Determine from A, figure 5-3, which link the driver drives. Then refer to C for card location for this link number. (2) Partially remove this H stage matrix card in frame 1 (ignore C2 failures for affected link). Perform driver fault initialization procedure (para 5-37 .2) and monitor page

Malfunction	Probable cause	Corrective action
		printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5-27). If fault disappears, replace card. If not, reseat card, and repeat procedure for same card in next frame. Continue until fault is corrected. After fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests- (para 5-37.1).
	k. CP- driver reporting fault. Probable cause is failed crosspoint in C stage matrix cards in same frame as driver reporting fault.	*k*. Perform following in sequence, referring to figure 5-3. (1) Determine from A, figure 5-3, which set of links (LKL, LKM, or LKH) and which frame are involved. Select list from D for this set of links. (2) Remove first card listed in frame in which driver is located (ignore C2 failures for affected link). Perform driver fault initialization procedure (para 5.37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5-27). If fault disappears, replace card, If not, reseat card. Repeat procedure for each card in list until fault is corrected. After fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1).
	l. DP- driver reporting fault. Probable cause is failed crosspoint in D stage matrix card in group driven by driver in any frame.	*l*. Perform following in sequence, referring to figure 5.3. (1) Determine from A, figure 6-3, which group is involved and if driver is OTL driver. Refer to column in E for that group. If driver is OTL driver, omit cards in second and fourth rows from following procedure. (2) Remove first card listed from frame 1 (ignore C2 failures for affected links and terminals). Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute, perform matrix driver special exercise tests (para 5-27). If fault disappears, replace card. If not, reseat card, and repeat procedure for next card in column. When all cards in column have been checked, repeat for frame 2. Continue with. remaining frames until fault is corrected. After fault is corrected, perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1).
NOTE If type M and/or Z faults are being printed disable network M and Z tests (para 5.37.1). Then enable them at completion of troubleshooting.		

Malfunction	Probable cause	Corrective action
2. MINOR FAULT alarm lamp goes on, audible alarm sounds, and one or more of following printout occurs: NT FLT SBR IFGT TYPE OFGT aaaaaa X-X-XX C1 Y-Y-YY A BC U VV where aaaaaa is contents of SBR in octal form. X-X-XX is inlet frame-group terminal address. Y-Y-YY is outlet frame-group-terminal address. U indicates if alternate link is being used (U=L, AN/TTC-38(V)1 only) or not (U-O). VV is BC link number used. C1 indicates that crosspoint driver test failed.	*a*. System has detected fault while attempting to make connection. aaaaaa=OO000000. Probable cause is KL counter malfunction.	*a*. Perform manual control transfer (para 2-18q). Report KL counter malfunction to higher category maintenance.
	b. aaaaaa return indicates more than one error summary card is reporting fault. Probable cause is more than one crosspoint driver failure.	*b*. Perform following procedure: (1) Convert aaaaaa from octal to binary. Each SRB bit set to 1 indicates an error summary card reporting in error. See E, figure 5-2. If card location for error summary cards reporting faults are the same go to c. If not. disable M and Z test (pars 5-37.1). (2) Pull all but one of error summary cards reporting faults 1-2 inches from fully seated position. (3) Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute. perform matrix driver special exercise tests (para 5-27). Monitor printout for type C1 faults of the form given for malfunction 1 above and troubleshoot accordingly. (4) After first fault is corrected. reseat next error summary card. (5) Repeat steps (3) and (4) until all failures have been corrected. (6) After fault is corrected. perform driver fault initialization procedure (para 5-37.2). Then enable network M and Z tests (para 5-37.1).
	c. aaaaaa parameter when decoded from octal to binary indicates that same error summary card is Reporting faults. Probable cause failed error summary card.	*c*. Using binary decoded form of aaaaaa, determine card location of faulty error summary card from E. figure 5-2. Replace card. Perform driver fault initialization procedure (para 5-37.2) and monitor page printer. If type C1 printout does not occur within one minute. perform matrix driver special exercise tests (para 5-27). If no fault is detected, enable driver fault initialization procedure (para 5-37.1).

h. Type Z Network Faults.

Malfunction	Probable cause	Corrective action
1. MINOR FAULT lamp is illuminated, audible alarm sounds, and one or more messages are printed with following format. NT FLT SBR IFGT TYPE OFGT aaaaaa X-O-O0 Z1 Y-OOO A BC 0 00 where: aaaaaa is octal representation of signal buffer register contents. X is inlet frame. Y is outlet frame. Z1 indicates that AP-, DP + and RBDP + drivers are being tested.	*a*. Program has detected failure during driver zero test for AP-, DP + and RBDP + crosspoint drivers. Either single or multiple failures have occurred involving one of these drivers. Proceed with corrective action *a*; also refer to figure 5-4 which contains printout and fault isolation examples.	*a*. Disable M and Z tests (para 5-37.1). Find expected SBR return listed in A, figure FO-34, for X and Y printed and compare it with aaaaaa. If more than one digit differs, isolate multiple crosspoint driver fault as in paragraph 5-41. If only a single digit differs refer to E. figure FO.34, and see if printed value of digit is legal for its corresponding expected value. If illegal, isolate multiple crosspoint driver fault as in paragraph 5-41. If legal, a single driver fault has occurred. If-printed value is less than expected, go to *b*. If printed value is more than expected, go to *c*.

Malfunction	Probable cause	Corrective action
	b. Single driver fault, printed value less than expected value.	*b*. Find faulty card listed in F, figure FO-34, for X, Y and aaaaaa printed. Replace faulty card and perform driver ZCK special exercise test (para 5.28). When faulty' card has been replaced, enable M and Z tests (para 5-37.1).

SBR						
a	a	a	a	a	a	X
0	0	0	0	0	1	01
0	0	0	0	0	2	02
0	0	0	0	0	4	03
0	0	0	0	1	0	04
0	0	0	0	4	0	05
0	0	0	2	0	0	06
0	0	0	4	0	0	07
0	0	1	0	0	0	08
0	0	2	0	0	0	09
0	0	4	0	0	0	10
0	2	0	0	0	0	11
1	0	0	0	0	0	12
0	0	0	0	2	0	**
0	0	0	1	0	0	**
0	1	0	0	0	0	**
0	4	0	0	0	0	**

A. X COORDINATE FROM aaaaaa.

SBR						
b	b	b	b	b	b	Y
1	0	0	0	0	0	01
0	4	0	0	0	0	02
0	2	0	0	0	0	03
0	1	0	0	0	0	04
0	0	4	0	0	0	05
0	0	2	0	0	0	06
0	0	1	0	0	0	07
0	0	0	4	0	0	08
0	0	0	2	0	0	09
0	0	0	1	0	0	10
0	0	0	0	4	0	11
0	0	0	0	2	0	12
0	0	0	0	1	0	13
0	0	0	0	0	4	14
0	0	0	0	0	2	15
0	0	0	0	0	1	16

B. Y COORDINATE FROM bbbbbb.

SBR						
c	c	c	c	c	c	Y
x	x	x	x	1	0	17
x	x	x	x	3	0	17
x	x	x	x	5	0	17
x	x	x	x	2	4	18
x	x	x	x	4	4	18
x	x	x	x	0	4	18
x	x	x	x	2	2	19
x	x	x	x	4	2	19
x	x	x	x	0	2	19
x	x	x	x	2	1	20
x	x	x	x	4	1	20
x	x	x	x	0	1	20

C. Y COORDINATE FROM cccccc.

(x DENOTES DON'T CARE)

Y COORD.	X COORDINATE											
	1	2	3	4	5	6	7	8	9	10	11	12
1	A32A105	A31A328	A32A138	A31A325	A44A328	A44A325	A32A105	A31A328	A32A122	A31A325	A44A328	A44A325
2	A32A109	A31A329	A32A137	A31A326	A44A329	A44A326	A32A109	A31A329	A32A123	A31A326	A44A329	A44A326
3	A32A114	A31A330	A32A136	A31A327	A44A330	A44A327	A32A114	A31A330	A32A124	A31A327	A44A330	A44A327
4	A32A118	A33A328	A32A135	A33A325	A45A328	A45A325	A32A118	A33A328	A32A125	A33A325	A45A328	A45A325
5	A32A106	A33A329	A32A134	A33A326	A45A329	A45A326	A32A106	A33A329	A32A126	A33A326	A45A329	A45A326
6	A32A110	A33A330	A32A133	A33A327	A45A330	A45A327	A32A110	A33A330	A32A127	A33A327	A45A330	A45A327
7	A32A115	A29A328	A32A131	A29A325	A40A328	A40A325	A32A115	A29A328	A32A128	A29A325	A40A328	A40A325
8	A32A119	A29A329	A32A130	A29A326	A40A329	A40A326	A32A119	A29A329	A32A129	A29A326	A40A329	A40A326
9	A32A107	A29A330	A32A129	A29A327	A40A330	A40A327	A32A107	A29A330	A32A130	A29A327	A40A330	A40A327
10	A32A111	A30A328	A32A128	A30A325	A42A328	A42A325	A32A111	A30A328	A32A131	A30A325	A42A328	A42A325
11	A32A116	A30A329	A32A127	A30A326	A42A329	A42A326	A32A116	A30A329	A32A133	A30A326	A42A329	A42A326
12	A32A120	A30A330	A32A126	A30A327	A42A330	A42A327	A32A120	A30A330	A32A134	A30A327	A42A330	A42A327
13	A32A108	-	A32A125	-	-	-	A32A108	-	A32A135	A31A324	-	A44A324
14	A32A112	-	A32A124	-	-	-	A32A112	-	A32A136	A31A331	-	A44A331
15	A32A117	-	A32A123	-	-	-	A32A117	-	A32A137	A33A324	-	A45A324
16	A32A121	-	A32A122	-	-	-	A32A121	-	A32A138	A33A331	-	A45A331
17	-	-	A32A142	-	-	-	-	-	A32A139	A29A324	-	A40A324
18	-	-	A32A141	-	-	-	-	-	A32A140	A29A331	-	A40A331
19	-	-	A32A140	-	-	-	-	-	A32A141	A30A324	-	A42A324
20	-	-	A32A139	-	-	-	-	-	A32A142	A30A331	-	A42A331

D. CROSSPOINT DRIVER CARD REPLACEMENT CHART

SRB BIT	SBR						ERROR SUMMARY CARD LOCATION	DRIVER TYPES SUMMARIZED	
	a	a	a	a	a	a			
16	1	0	0	0	0	0	A32A145	DP(+)	FRAMES 5-8
14	0	2	0	0	0	0	A32A146	BP(+)	FRAMES 5-8
12	0	0	4	0	0	0	A32A143	DP(+)	FRAMES 1-4
11	0	0	2	0	0	0	A32A132	CP(+)	ALL FRAMES
10	0	0	1	0	0	0	A32A144	BP(+)	FRAMES 1-4
09	0	0	0	4	0	0	A32A113	AP(+)	ALL FRAMES
08	0	0	0	2	0	0	A32A145	AP(-)	FRAMES 5-8
06	0	0	0	0	4	0	A32A146	CP(-)	FRAMES 5-8
04	0	0	0	0	1	0	A32A143	AP(-)	FRAMES 1-4
03	0	0	0	0	0	4	A32A132	BP(-)	ALL FRAMES
02	0	0	0	0	0	2	A32A144	CP(-)	FRAMES 1-4
01	0	0	0	0	0	1	A32A113	DP(-)	ALL FRAMES

E. ERROR SUMMARY CARD REPLACEMENT CHART

OLD X	NEW X
07	04
07	06
08	03
09	02
09	05
10	01
11	03
12	01

F. OLD/NEW X COORDINATES

INSTRUCTIONS:

1. OBTAIN X COORDINATE FROM A, USING aaaaaa.
2. IF bbbbbb 000000, OBTAIN Y COORDINATE FROM C, USING cccccc. OTHERWISE OBTAIN Y COORDINATE FROM B, USING bbbbbb.
3. USE F TO OBTAIN NEW X COORDINATE FROM OLD WHEN SPECIFIED.
4. USE E TO DETERMINE LOCATION OF FAULTY ERROR SUMMARY CARD FROM aaaaaa WHEN SPECIFIED.

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Figure 5- 2. Type C1 network fault driver card replacement data.

Y COORD.	X COORDINATE											
	1	2	3	4	5	6	7	8	9	10	11	12
1	DP-G1OTL	CP-F1LKL	BP-LK16	AP-F1LKL	CP-F5LKL	AP-F5LKL	AP+G1ITL	BP+F1LKL	CP+LK01	DP+F1LKL	BP+F5LKL	DP+F5LKL
2	DP-G1OTH	CP-F1LKM	BP-LK15	AP-F1LKM	CP-F5LKM	AP-F5LKM	AP+G1ITH	BP+F1LKM	CP+LK02	DP+F1LKM	BP+F5LKM	DP+F5LKM
3	DP-G2OTL	CP-F1LKH	BP-LK14	AP-F1LKH	CP-F5LKH	AP-F5LKH	AP+G2ITL	BP+F1LKH	CP+LK03	DP+F1LKH	BP+F5LKH	DP+F5LKH
4	DP-G2OTH	CP-F2LKL	BP-LK13	AP-F2LKL	CP-F6LKL	AP-F6LKL	AP+G2ITH	BP+F2LKL	CP+LK04	DP+F2LKL	BP+F6LKL	DP+F6LKL
5	DP-G3OTL	CP-F2LKM	BP-LK12	AP-F2LKM	CP-F6LKM	AP-F6LKM	AP+G3ITL	BP+F2LKM	CP+LK05	DP+F2LKM	BP+F6LKM	DP + FGLKM
6	DP-G3OTH	CP-F2LKH	BP-LK11	AP-F2LKH	CP-F6LKH	AP-F6LKH	AP+G3ITH	BP+F2LKH	CP+LK06	DP+F2LKH	BP+F6LKH	DP+F6LKH
7	DP-G4OTL	CP-F3LKL	BP-LK10	AP-F3LKL	CP-F7LKL	AP-F7LKL	AP+G4ITL	BP+F3LKL	CP+LK07	DP+F3LKL	BP+F7LKL	DP+F7LKL
8	DP-G4OTH	CP-F3LKM	BP-LK09	AP-F3LKM	CP-F7LKM	AP-F7LKM	AP+G4ITH	BP+F3LKM	CP+LK08	DP+F3LKM	BP+F7LKM	DP+F7LKM
9	DP-G5OTL	CP-F3LKH	BP-LK08	AP-F3LKH	CP-F7LKH	AP-F7LKH	AP+G5ITL	BP+F3LKH	CP+LK09	DP+F3LKH	BP+F7LKH	DP+F7LKH
10	DP-G5OTH	CP-F4LKL	BP-LK07	AP-F4LKL	CP-F8LKL	AP-F8LKL	AP+G5ITH	BP+F4LKL	CP+LK10	DP+F4LKL	BP+F8LKL	DP+F8LKL
11	DP-G6OTL	CP-F4LKM	BP-LK06	AP-F4LKM	CP-F8LKH	AP-F8LKM	AP+G6ITL	BP+F4LKM	CP+LK11	DP+F4LKM	BP+F8LKM	DP+F8LKM
12	DP-G6OTH	CP-F4LKH	BP-LK05	AP-F4LKH	CP-F8LKM	AP-F8LKH	AP+G6ITH	BP+F4LKH	CP+LK12	DP+F4LKH	BP+F8LKH	DP+F8LKH
13	DP-G7OTL	-	BP-LK04	-	-	-	AP+G7ITL	-	CP+LK13	RBDP+F1A	-	RBDP+F5A
14	DP-G7OTH	-	BP-LK03	-	-	-	AP + G7ITH	-	CP+LK14	RBDP+F1B	-	RBDP+F5B
15	DP-G8OTL	-	BP-LK02	-	-	-	AP+G8ITL	-	CP+LK15	RBDP+F2A	-	RBDP+F6A
16	DP-G8OTH	-	BP-LK01	-	-	-	AP+G8ITH	-	CP+LK16	RBDP+F2B	-	RBDP+F6B
17	-	-	BP-LK20	-	-	-	-	-	CP+LK17	RBDP+F3A	-	RBDP+F7A
18	-	-	BP-LK19	-	-	-	-	-	CP+LK18	RBDP+F3B	-	RBDP+F7B
19	-	-	BP-LK18	-	-	-	-	-	CP+LK19	RBDP+F4A	-	RBDP+F8A
20	-	-	BP-LK17	-	-	-	-	-	CP+LK20	RBDP+F4B	-	RBDP+F8B

SEE NOTE

A DRIVER REPORTING FAULT

	LINKS	GROUP 1	2	3	4	5	6	7	8
LKL	1-4	A304	A332	A309	A337	A314	A342	A319	A347
	5-8	A305	A333	A310	A338	A315	A343	A320	A348
LKM	9-12	A306	A334	A311	A339	A316	A344	A321	A349
	13-16	A307	A335	A312	A340	A317	A345	A322	A350
LKH	17-20	A308	A336	A313	A341	A318	A346	A323	A351

A STAGE CARD LOCATIONS

LINK	LOCATION	
01	A104	LKL
02	A105	
03	A106	
04	A107	
05	A108	
06	A109	
07	A110	
08	A111	
09	A112	LKM
10	A113	
11	A114	
12	A115	
13	A116	
14	A117	
15	A118	
16	A119	
17	A120	LKH
18	A121	
19	A122	
20	A123	

C. B STAGE CARD LOCATIONS

LINK	LOCATION	
01	A132	LKL
02	A133	
03	A134	
04	A135	
05	A136	
06	A137	
07	A138	
08	A139	
09	A140	LKM
10	A141	
11	A142	
12	A143	
13	A144	
14	A145	
15	A146	
16	A147	
17	A148	LKH
18	A149	
19	A150	
20	A151	

D. C STAGE CARD LOCATIONS

LKL	LKM	LKH	RB	LINKS	1	2	3	4	5	6	7	8	OTL	OTH
✓				1-8	A204	A232	A209	A237	A214	A242	A219	A247	X	X
✓	✓			1-12	A205	A233	A210	A238	A215	A243	A220	A248		X
	✓			9-16	A206	A234	A211	A239	A216	A244	A221	A249	X	X
	✓	✓	✓	13-24	A207	A235	A212	A240	A217	A245	A222	A250		X
		✓	✓	17-24	A208	A236	A213	A241	A218	A246	A223	A251	X	X

E. D STAGE CARD LOCATIONS

NOTE:
FOR RING-BUS RBDP+
DRIVERS:
A DENOTES OUTLET
GROUPS 1 - 4
B DENOTES OUTLET
GROUPS 5 - 8

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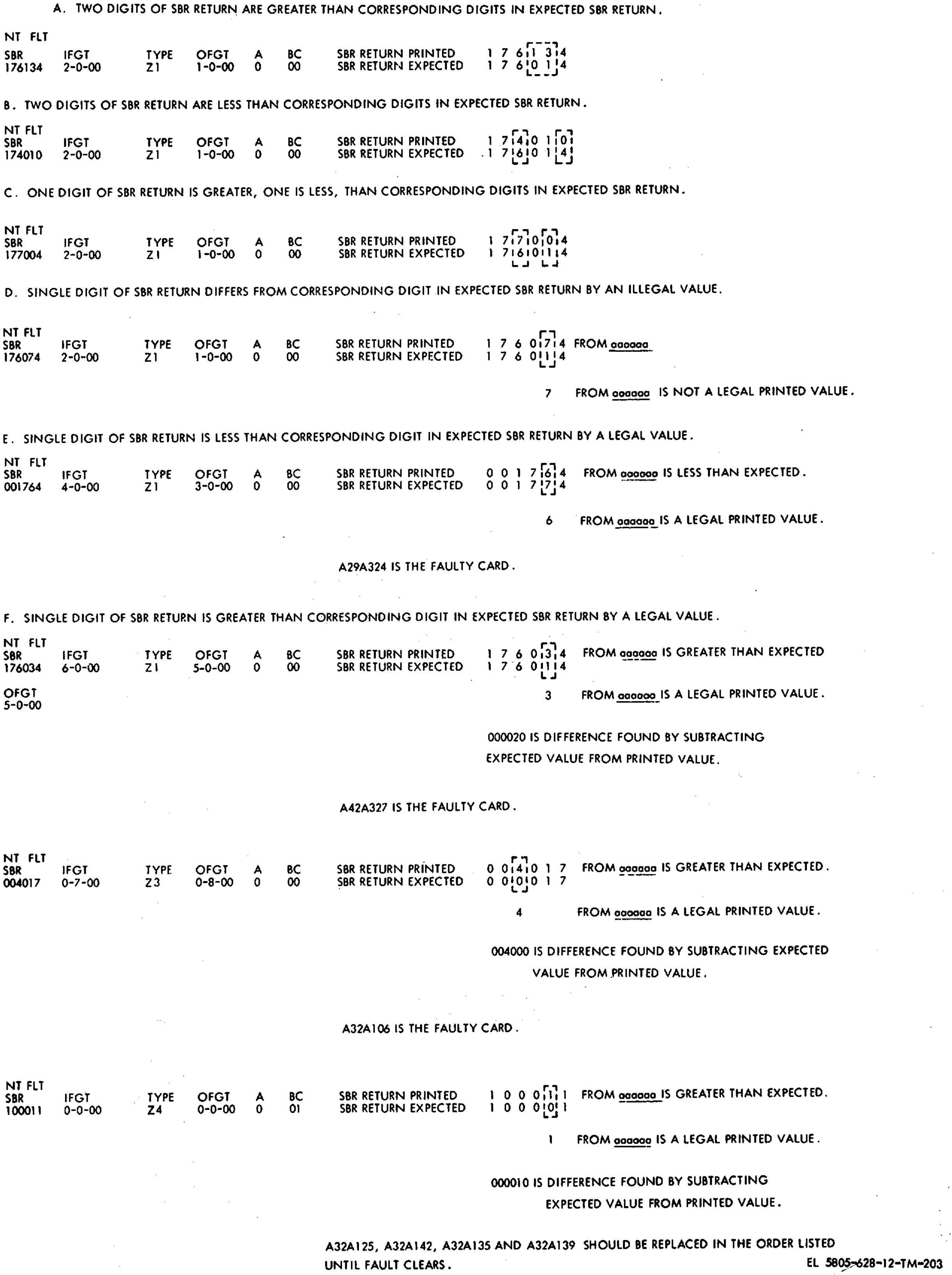
Figure 5-3. Type C1 network fault cross-point card replacement guide.

Malfunction	Probable cause	Corrective action
NOTE Printout may occur mixed with types of network fault printouts. If C1, M1, or M2 types occur, defer using this procedure and troubleshoot the C1, M 1, or M2 type failure first.	*c*. Single driver fault, printed value greater than expected value.	*c*. Subtract expected ;value of SBR return from printed value. Five digits of the resulting difference are 0, and one digit is a 4, 2, or 1. Find faulty card using J, figure FO-34. Column A of Z1 is for X and Y between 1 and 4; column B is for X and Y between 5 and 8. The faulty card appears in column A or B under Z1 heading in that containing the difference found above. In cases where second card is listed for difference value, either of cards listed may be causing fault. Replace faulty card and perform driver ZCK special exercise test (para 5-28). If test fails, and second card is listed in J, figure FO.S4 reinstall first card. The replace second card, and repeat ZCK test. When faulty card has been replaced, enable M and Z tests (para 5.87.1).
2. MINOR FAULT lamp is illuminated, and audible alarm sounds, and one or more messages are printed with following format. NT FLT SBR IFOT TYPE OFOT aaaaaa X-0-00 Z2 Y-0-00 A BC 0 00 where: aaaaaa is the octal representation of signal buffer register contents. X is inlet frame. Y is outlet frame. Z2 indicates that BP + and CP- drivers are being tested.	*a*. Program has detected failure during driver zero test for BP + and CP- crosspoint drivers. Either single or multiple failure has occurred involving one of these drivers. Proceed with corrective action a; also refer to figure 5-4 which contains printout and fault isolation examples.	*a*. Disable M and 2 tests (para 5 37.1). Find expected SBR return listed in B, figure FO.34, for X and Y. printed and compare it with aaaaaa. If more than one digit differs, isolate multiple crosspoint driver fault as in paragraph 5.41. If only a single digit differs, refer to E, figure FO34, and see if printed value of digit is legal for its corresponding expected value. If illegal, isolate multiple crosspoint driver fault as in paragraph 5-41. If legal, single driver fault has occurred. If printed value is less than expected, go to b. If printed value is more than expected, go to c.
NOTE Printout may occur mixed with other types of network fault printouts; but if C1, M1, or M2 types occur, defer using this procedure and troubleshoot the C1, M1, or M2 type failure first.	*b*. Single driver fault, printed value less than expected value.	*b*. Find faulty card listed in G, figure FO-34, for X, Y, and aaaaaa printed. Replace faulty card and perform driver ZCK special exercise test {para 56-28). When faulty card has been replaced, enable M and Z tests (para 5.37.1).
	c. Single driver fault, printed value greater than expected value.	*c*. Subtract expected value of SBR return from printed value. Five digits of resulting difference are 0, and one digit is 4, 2, or 1. Find faulty card using J, figure FO-34. Column A of Z2 is for X and Y between 1 and 4; B column is for X and Y between 5 and 8. The faulty card appears in column A or B under Z2 heading in that row containing difference found above. Replace faulty card, and perform driver ZCK special exercise test (para 5-28). When faulty card has been replaced, enable M and Z tests (para 6-37.1).
3. MINOR FAULT lamp is illuminated, audible alarm sounds, and one or more messages are printed with following format. NT FLT SRB IFGT TYPE OFGT aaaaaa 0-X-00 Z3 0-Y-00 A BC 0 00	*a*. Program has detected failure during driver zero test for AP + and DP- crosspoint drivers. Either single or multiple failure has occurred involving one of these drivers. Proceed with corrective action *a*, also refer to figure 5-4 which contains printout and fault isolation examples.	*a*. Disable M and Z tests (para 5-37.1). Find expected SBR return listed in C of figure FO-34 for X and Y printed and compare with aaaaaa. If more than one digit differs, isolate multiple crosspoint driver fault as in paragraph 5.-41. If only single digit differs, refer to E, figure 5-41, and see if printed value of the digits is

Malfunction	Probable cause	Corrective action
where: aaaaaa is the octal representation of signal buffer register contents. X is inlet group. Y is outlet group. ZS3 indicates that AP + and DP- drivers are being tested. NOTE Printout may occur mixed with other types of network fault printouts; but if C1, M1 or M2 types occur, defer using this procedure and troubleshoot the C1, MI, or M2 type failure first.		legal for its corresponding expected value. If illegal, isolate multiple crosspoint driver fault as in paragraph 5-41. If legal, single driver fault has occurred. If printed value is less than expected, go to b. If printed value is more than expected, go to c.
	b. Single driver fault, printed value less than expected value.	b. Find faulty card listed in H. figure FO-34, for X, Y, and aaaaaa printed. Replace faulty card and perform dirver ZCK special exercise test (para 5-28). When faulty card has been replaced, enable M and Z tests (pars 5-37.1).
	c. Single driver fault, printed value greater than expected value.	c. Subtract expected value of SBR return from printed value. Five digits of resulting difference are 0, and one digit is a 4, 2, or 1. Find faulty card using J, figure FO-34. Faulty card appears under Z3 heading in the row containing difference found above. Replace faulty card and perform driver ZCK special exercise test (para 5-28). When faulty card has been replaced, enable M and Z tests (para 5-37.1).
4. MINOR FAULT lamp is illuminated, audible alarm sounds, and one or more messages are printed with following format. NT FLT SBR IFGT TYPE OFGT aaaaaa 0-0-00 Z4 0.0-00 A BC 0 VV where: aaaaaa is the octal representation of signal buffer register contents. VV is BC link used for test. Z4 indicates that CP + and BP- drivers are being tested. NOTE Printout may occur mixed with other types of network fault printouts; but if C1, M1 or M2 types occur, defer using this procedure and troubleshoot the C1, MI, or M2 type failure first.	A Program has detected failure during driver zero test for CP + and BP- crosspoint drivers. Either single or multiple failure has occurred involving one of these drivers. Proceed with corrective action e, also refer to figure 5-4 which contains printout and fault isolation examples.	a. Disable M and Z tests (para 5-37.1). Find expected SBR return listed in D, figure FO-34, for W printed and compare it with aaaaaa. If more than one digit differs, isolate multiple crosspoint driver fault as in paragraph 5-41. If only a single digit differs refer to E, figure FO-34, and see if printed value of the digit is legal for its corresponding expected value. If illegal, -isolate multiple crosspoint driver fault as in paragraph 6-41. If printed value is less than expected, go to b. If printed value is more than expected, go to c.
	b. Single driver fault, printed value less than expected.	b. Find faulty card listed in I, figure FO-34, for VV and aaaaaa printed. Replace faulty card and perform driver ZCK special exercise test (pars 6-28). When faulty card has been replaced, enable M and Z tests (pars 5-37.1).
	c. Single driver fault, printed value greater than expected value.	c. Subtract value of SBR return from printed value. Five digits of resulting difference are 0, and one digit is 4, 2, or 1. Find faulty card using J, figure FO-34. Faulty card appears under Z4 heading in row containing the difference found above. Replace card listed in column A and perform driver ZCK special exercise test (pars 5-28). If test fail, return card, replace card listed in column B, and retest. Continue this procedure with the cards in columns C -and D, as required, until test is successful. When faulty card has been replaced, enable M and Z (pars 5-67.1).



A. TWO DIGITS OF SBR RETURN ARE GREATER THAN CORRESPONDING DIGITS IN EXPECTED SBR RETURN.

```
NT  FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    1 7 6 1 3 4
176134   2-0-00    Z1     1-0-00  0   00    SBR RETURN EXPECTED   1 7 6 0 1 4
```

B. TWO DIGITS OF SBR RETURN ARE LESS THAN CORRESPONDING DIGITS IN EXPECTED SBR RETURN.

```
NT FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    1 7 4 0 1 0
174010   2-0-00    Z1     1-0-00  0   00    SBR RETURN EXPECTED   1 7 6 0 1 4
```

C. ONE DIGIT OF SBR RETURN IS GREATER, ONE IS LESS, THAN CORRESPONDING DIGITS IN EXPECTED SBR RETURN.

```
NT FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    1 7 7 0 0 4
177004   2-0-00    Z1     1-0-00  0   00    SBR RETURN EXPECTED   1 7 6 0 1 4
```

D. SINGLE DIGIT OF SBR RETURN DIFFERS FROM CORRESPONDING DIGIT IN EXPECTED SBR RETURN BY AN ILLEGAL VALUE.

```
NT FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    1 7 6 0 7 4  FROM aaaaaa
176074   2-0-00    Z1     1-0-00  0   00    SBR RETURN EXPECTED   1 7 6 0 1 4

                                                           7   FROM aaaaaa IS NOT A LEGAL PRINTED VALUE.
```

E. SINGLE DIGIT OF SBR RETURN IS LESS THAN CORRESPONDING DIGIT IN EXPECTED SBR RETURN BY A LEGAL VALUE.

```
NT  FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    0 0 1 7 6 4   FROM aaaaaa IS LESS THAN EXPECTED.
001764   4-0-00    Z1     3-0-00  0   00    SBR RETURN EXPECTED   0 0 1 7 7 4

                                                            6   FROM aaaaaa IS A LEGAL PRINTED VALUE.

                                A29A324 IS THE FAULTY CARD.
```

F. SINGLE DIGIT OF SBR RETURN IS GREATER THAN CORRESPONDING DIGIT IN EXPECTED SBR RETURN BY A LEGAL VALUE.

```
NT  FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    1 7 6 0 3 4   FROM aaaaaa IS GREATER THAN EXPECTED
176034   6-0-00    Z1     5-0-00  0   00    SBR RETURN EXPECTED   1 7 6 0 1 4

OFGT                                                        3   FROM aaaaaa IS A LEGAL PRINTED VALUE.
5-0-00

                                            000020 IS DIFFERENCE FOUND BY SUBTRACTING
                                            EXPECTED VALUE FROM PRINTED VALUE.

                                A42A327 IS THE FAULTY CARD.
```

```
NT  FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    0 0 4 0 1 7   FROM aaaaaa IS GREATER THAN EXPECTED.
004017   0-7-00    Z3     0-8-00  0   00    SBR RETURN EXPECTED   0 0 0 0 1 7

                                                        4         FROM aaaaaa IS A LEGAL PRINTED VALUE.

                                            004000 IS DIFFERENCE FOUND BY SUBTRACTING EXPECTED
                                                 VALUE FROM PRINTED VALUE.

                                A32A106 IS THE FAULTY CARD.
```

```
NT FLT
SBR      IFGT      TYPE   OFGT    A   BC    SBR RETURN PRINTED    1 0 0 0 1 1   FROM aaaaaa IS GREATER THAN EXPECTED.
100011   0-0-00    Z4     0-0-00  0   01    SBR RETURN EXPECTED   1 0 0 0 0 1

                                                            1   FROM aaaaaa IS A LEGAL PRINTED VALUE.

                                            000010 IS DIFFERENCE FOUND BY SUBTRACTING
                                                 EXPECTED VALUE FROM PRINTED VALUE.

                                A32A125, A32A142, A32A135 AND A32A139 SHOULD BE REPLACED IN THE ORDER LISTED
                                UNTIL FAULT CLEARS.
```

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Figure 5-4. Type Z network fault examples..

i. Type M1 and M2 Network Faults.

Malfunction	Probable cause	Corrective action
1. MINOR.FAULT alarm lamp goes on, audible alarm sounds, and one or more printouts occur with following format: NT FLT SBR IFGT TYPE OFGT aaaaaa X-X-XX M1 Y-Y-YY A BC U VV where: X.X-XX is the inlet frame-group-terminal number. Y-Y-YY is the outlet frame-group-terminal number. U= 1 indicates alternate link used (AN/TTC-38(V) 1 only). U= O indicates primary link used. VV is the BC link used. aaaaaa is octal representation of contents of signal buffer register (SBR); represents outputs of error summary cards. M1 indicates that set of P- drivers specified by path coordinates are being tested. M2 denotes that set of P + drivers specified: by path coordinates are being tested. M test checks driver error detection circuit's ability to detect that more. than one driver is turned on. NOTE If type C1 NT FLT messages are also being printed, troubleshoot them before using this procedure. See paragraph 5-7g.	*a*. System has detected fault during the more than-one test of network exercise. Possible causes include shorted crosspoint, faulty error summary card, multiple driver fault, failed memory location, or faulty crosspoint driver.	a. Perform following in sequence before referring to the probable causes. (1) Disable M and Z tests (para 56-37.1) Tests can be enabled temporarily to obtain more' printouts for fault analysis. M and Z tests must be enabled before running Ml and M2 special exercise tests. Compare aaaaaa parameters from fault print outs to' determine if they are same or different. If different go to (2); otherwise go to (3). (2) For each unique aaaaaa parameter printed, perform steps (3) through (7) below to determine X and Y coordinates.: Compare all X and Y coordinate pairs obtained. If X coordinates are different, troubleshoot each fault separately as described in steps (3) through (8) below.. If X coordinates are same, but Y coordinates are different, go to cause c below. If X coordinates are same, and Y coordinates are same, go to cause b below. (3) Compare aaaaaa parameter to those in A, figure FO-35, using inlet frame (IF) and outlet frame (OF) parameters from fault message. If there is exact match, go to cause d below. If not, proceed to step (4). (4) Using IF and OF parameters of fault message, compare a. aaaaaa parameters to C, figure FO-35, and determine an X coordinate. If aaaaaa parameter does not match any in figure, refer to paragraph 5-41. (5) Using X coordinate, refer to E, figure FO-35, and determine required address parameters needed from the fault message for next step. (6) Using X coordinate and required address parameters, refer to A, figure 5-3, and determine which driver is reporting fault. From left column of figure, read Y coordinate of driver. (7) Reexamine fault printouts with same aaaaaa parameter to see if any of required address parameters are changing such that, if step (6) were repeated for other message(s), a new Y coordinate would be obtained. If new Y coordinate is obtained, go to cause c. (8) Use X and Y coordinates, and go to cause *b*.
	b. Procedure a has been followed, and X and Y coordinates have been obtained. Probable cause is failed P- crosspoint driver card. Another possible cause is shorted matrix crosspoint.	b. Perform following in sequence: (1) Using X and Y coordinates, refer to D, figure 5-2, and replace card designated by coordinates. (2) Perform M1 matrix driver special exercise test (para 5-27). If fault persists, restore driver card and refer to cause *i*, *j*, *k*, or *l* in paragraph 5-7g 1 as appropriate.

Malfunction	Probable cause	Corrective action
	c. Multiple fault printouts have occurred, and procedure of a above has been performed. X coordinates for all (most) of printouts are same, but there are several values for Y coordinate. An error summary card has probably failed. Another possible cause is multiple crosspoint driver failure.	*c*. Perform following in sequence: (1) Using X coordinate, refer to G, figure FO.35 and determine error summary card reporting fault. (2) Replace error summary card, perform M1 matrix driver special exercise test (para 6-27), and monitor the page printer to see if fault remains. (3) If fault remains, treat each X and Y coordinate pair as a separate fault and go to cause b above. If fault is corrected, enable M and Z tests (para 5-37.1).
	d. Comparison of aaaaaa parameter in A, figure FO-35, is an exact match for the IF and OF parameters. A memory location in page 0 has failed or been inadvertently destroyed.	*d*. Perform following in sequence: (1) Perform manual control transfer (para 2-18q). (2) Read in blank data base and current- directory set (pars 2-18h and n). (3) Repeat step (1), enable M and Z tests (para 5-37.1), and monitor for same failure messages. If none occur, fault is corrected. Otherwise repeat manual control transfer. Check that standby processor is running before attempting control transfer. (4) Run memory diagnostic in halted processor (para 5-50).
2. MINOR FAULT alarm lamp goes on, audible alarm sounds and one or more printouts occur with following format: NT FLT SBR IFGT TYPE OFGT aaaaaa X-X-XX M2 Y-Y-YY A BC U VV where X-X-XX is the inlet frame-group-terminal number Y-Y-YY is the outlet frame-group-terminal number. U = 1 indicates alternate link used (AN/TTC-38(V)1 only). U = O indicates primary link used. VV is the, BC link used aaaaaa is octal representation of contents of signal buffer register (SBR); represents outputs of error summary cards. M1 indicates that set of P- drivers c. below. If X coordinates are same specified by path coordinates are being tested. M2 denotes that set of P + drivers specified by path coordinates are being tested. M test checks driver error detection circuits ability to detect that more than one driver is turned on. NOTE If type C1 NT FLT messages If type C1 NT FLT messages are also being printed, troubleshoot them before using this procedure. See paragraph 657g.	a. System has detected fault during the more-than-one test of network exercise. shorted crosspoint, faulty error summary card, multiple driver fault, failed memory location, or faulty crosspoint driver.	a. Perform following in sequence before referring to other probable Possible causes include causes. (1) Disable M and Z tests (para 5-37.1). Tests can be enabled temporarily to obtain more printouts for fault analysis. M and Z tests must be enabled before running M1 and M2 special exercise tests. Compare aaaaaa parameters from fault printouts to determine if they are same or different. If different, go to step (2); otherwise to step 3. (2) For each unique aaaaaa parameter printed, perform steps (3) through (7) below to determine X and Y coordinates. Compare all X and Y coordinate pairs obtained. If X coordinates are different, troubleshoot each fault separately as described in steps (3) through (8) below. If X coordinates are same but Y coor. dinates are different, go to cause and Y coordinates are same, go to cause b. (3) Compare aaaaaa parameter to those in B, figure FO35, using inlet frame (IF) and outlet frame (OF) parameters from fault message. If there is an exact match, refer to cause d below. If not, go to next (4) Using IF and OF parameters of fault message, compare the aaaaaa parameters to D, figure FO-35 and determine an X coordinate. If aaaaaa

Malfunction	Probable cause	Corrective action
		parameter does not match any in figure, refer to paragraph 5.41. (5) Using X coordinate, refer to F, figure FO-35 and determine required address parameters needed from fault message for next step. (6) Using X coordinate and required address parameters, refer to A, figure 5-3, and determine which driver is reporting fault. From left column of figure, read the Y coordinate of driver. (7) Reexamine fault printouts with same aaaaaa parameter to see if any of required address parameters are changing such that, if step (6) were repeated for other message(s), a new Y coordinate would be obtained. If new Y coordinate is obtained, see cause c. (8) Using X and Y coordinates, go to cause b.
	b. Procedure a has been followed, and X and Y coordinates have been obtained. Probable cause is failed P + crosspoint driver card. Another possible cause is shorted matrix crosspoint.	*b*. Perform following in sequence: (1) Using X and Y coordinates, refer to D, figure 6-2 and replace card designated by coordinates. (2) Perform M2 matrix driver special exercise test (pars 5-27). If fault persists, replace driver card and refer to cause *e, f, g*, or *h* of paragraph 5-7g 1 as appropriate.
	c. Multiple fault printouts have occurred and procedure -a above has been performed. X coordinates for all (most) of printouts are same, but there are several values for Y coordinate. An error summary card has probably failed.. Other possible causes are P- crosspoint. driver causing P + driver fault indications, or a multiple fault.	*c*. Perform following sequence: (1) Using X coordinate, refer to G, figure FO-35, and determine error summary card reporting fault. (2) Replace error summary card, perform M2 matrix driver special exercise test (para 5-27), and monitor page printer to see if fault has been corrected. (3) If fault remains, select one of X and Y coordinate pairs and troubleshoot as described in b above. If fault disappears, troubleshoot each pair in same way. If fault remains go to (4). (4) Convert X coordinate(s) to new X coordinate using F, figure 5-2. Then follow procedure c, paragraph 56-7g 1 from step (2) to the end.
	d. Comparison of aaaaaa parameter in A, figure FO-35, is exact match for IF and OF parameters. Memory; location in page 0 has failed or has been inadvertently written over.	*d*. Perform following in sequence: (1) Perform manual control transfer (para 2-18q). (2) Read in blank data set and current direction (para 2-18h and n 1). (3) Repeat step (1), enable M and Z tests (para 5-37.1), and monitor for same failure messages. If none occur, fault is corrected. Otherwise repeat the manual control transfer. Check that standby processor is running before attempting control transfer - (4) Run memory' diagnostic in halted processor (para 5-60).

j. Shorted Matrix Crosspoints.

Malfunction	Probable cause	Corrective action
1. Printout: NT FLT SBR IFGT TYPE RRRRRR X-X-XX IBF OFGT A BC Y-Y-YY W VV where RRRRRR is SBR content X-X-XX identifies inlet frame, group, and terminal. Y- Y-YY identifies outlet frame, group, and terminal. W indicates alternate link if 1 AN/TTC- 38(V) 1 only or basic link if 0. VV is link number.	Program detected an inlet busy failure (IBF) when path identified in printout was disconnected. This failure probably also caused an existing connection to breakdown, therefore, subscriber complaints may occur.	
	a. Failure is probably not serious to system operation Wait for more information before replacing cards.	*a*. Log all IBF, BTF, and incorrectable C2 faults which are probably due to crosspoint shorts. When enough data is available, troubleshoot matrix as described in b through e below. It may take several days or weeks to accumulate data. After taking corrective action, continue to check for messages on same paths.
	b. Several messages occur in same inlet frame and group X-X; terminal numbers may be different; link numbers are all associated with one matrix A stage card (fig. FO- 36).	*b*. Replace A stage card containing associated link numbers in frame and group X- X (fig. FO- 36).
	c. Several messages occur with same link number W VV; inlet frame number X and outlet frame number Y also repeats.	*c*. Replace B stage link VV card in frame X (fig. FO- 36).
	d. Several messages occur with same link number; outlet frame number Y also repeats.	*d*. Replace C stage link VV card in frame Y (fig. FO- 36).
	e. Several messages occur with same outlet frame, group and terminal number Y-Y-YY.	*e*. Replace either three 8 x 8 or two 12 x 4 matrix D stage cards carrying associated numbers in frame-group-terminal Y-Y-YY (fig. FO- 36).
	f. If you cannot wait for more printouts to occur, all matrix cards in identified path may be replaced as a group.	*f.* Batch replace following matrix cards: (1) A stage card in frame group X- X for link VV. (2) B stage link VV card in frame X. (3) C stage link VV card in frame Y. (4) Either two or three D stage cards in frame-group Y- Y associated with terminal YY.
2. Printout NT FLT SBR IFGT TYPE OFGT 000000 MMMMMM BTF Y-Y-YY A BC 0 00 where Y-Y-YY identifies outlet frame, group and terminal MMMMMM is abbreviated name of ring bus: RG BCK (link 21) ROU RG (link 22) PRI RG (link 23) TRIP (link 24)	Program detected ring bus test failure (BTF) when it disconnected identified ring bus from terminal Y- Y- YY. Failure is probably due to shorted crosspoint.	Replace D stage 8 x 8 or 12 x 4 matrix cards containing links 21- 24 for terminal y-y-yy.

k. Sender/Receiver and Auxiliary Sender/Receiver.

Malfunction	Probable cause	Corrective action
1. MINOR FAULT lamp lit and audible alarm and failure printout: SR VV TO XSR WW FAILS XXXXXX YYYYYY ZZZZZZ Where: VV indicates sender/receiver (SR) involved in test failure, WW indicates auxiliary sender/receiver (XSR) involved in test failure. XXXXXX indicates tone frequency sent, YYYYYY indicates tone frequency received, ZZZZZZ indicates level of tones received.	a. Sender/receiver VV failed to pass programmed periodic automatic test. Sender/receiver VV was marked out-of-service. Auxiliary sender/receiver WW has passed loop test. Sender portion of sender/receiver VV probably failed.	a. If YYYYYY is not 000000 and ZZZZZZ is 000000 go to step b. Otherwise perform sender/receiver special exercise test (para 5- 29) with SR VV and XSR WW. If the malfunction remains, replace card SR(S) R VV (fig. FO- 37). Repeat sender/receiver special exercise test.
	b. Auxiliary sender/receiver signal level detector probably failed. Indicated by ZZZZZZ equal to zero and. XXXXXX equal to YYYYYY.	b. Perform sender/receiver special exercise test (para 5-29) with SR VV and SXR WW. If malfunction persists, replace XSR (AMP) card for XSR WW (fig. FO- 37). Repeat sender/receiver special exercise test.
2. MINOR FAULT lamp lit and audible alarm and failure printout: XSR WW TO SR VV FAILS XXXXXX YYYYYY Where: WW, VV, XXXXXX YYYYYY are defined in 1 above	a. Sender/receiver VV failed to pass programmed test which is automatically performed periodically. Sender/receiver VV has been marked out-of-service. Auxiliary sender/receiver WW passed loop test. Receiver portion of sender/receiver VV probably failed.	a. Perform sender/receiver special exercise test (para 5- 29) using SR VV and XSR WW. If malfunction persists, replace card SR(R) for SR VV (fig. FO- 37). Repeat sender/receiver special exercise test. If malfunction persists examine XXXXXX and YYYYYY. If any of the following are indicated go to step b. Otherwise go to step c. (1) XXXXXX is in group L of figure 5-5 and YYYYYY is 000000. (2) XXXXXX is in group L and YYYYYY indicates more than one group L tone received. (3) XXXXXX is in group H and YYYYYY shows that both group H and group L tones received.
	b. Receiver low band filter card failed.	b. Replace card SR(DL) or SR VV (fig. FO-37). Repeat sender/receiver special exercise test.
	c. Receive high band filter card failed.	c. If any of following are indicated, replace card SR (DH) of SR VV (fig. FO-37). Repeat test (para 5-29). (1) XXXXXX is in group H of figure 5-5 and YYYYYY is 000000. (2) XXXXXX is in group H and YYYYYY shows more than one group H tone received. (3) XXXXXX is in group L and YYYYYY indicates both group L and group H tones received.
3. MINOR FAULT lamp lit, audible alarm, and failure printout: SR VV TO XSR WW FAILS XXXXXX YYYYYY ZZZZZZ Followed by second printout: XSR WW TO XSR WW FAILS XXXXXX YYYYYY	a. Sender/receiver VV failed to pass automatic programmed test. Auxiliary sender/receiver WW failed to pass the subsequent automatic loop test. Both sender/receiver VV and auxiliary sender/receiver WW have been marked out-of-service. Receiver portion of auxiliary sender/receiver WW probably failed.	a. Examine XXXXXX, YYYYYY and ZZZZZZ in first printout. If XXXXXX equals YYYYYY and ZZZZZZ is not per figure 5-5, go to step b. Otherwise go to step c.

Malfunction	Probable cause	Corrective action
Where: WW, VV, XXXXXX YYYYYY and ZZZZZZ are defined' in 1 above.	*b*. Auxiliary sender/receiver amplifier card failed.	*b*. Replace card XSR (AMP) for XSR WW (fig. FO- 37). Loop test XSR WW (para 5-30). Test SR VV (para 5-29).
	c. Auxiliary sender/receiver receiver card failed.	*c*. Replace card XSR(R) for XSR WW. Loop test XSR WW (para 5- 30). If malfunction persists, examine the printout from the loop test and go to steps d, e, and f. If loop test is passed, test SR VV (para 5-29).
	d. Auxiliary sender/receiver low band filter card failed.	*d*. If any of following are indicated, replace XSR (DL) card of XSR WW (fig. FO- 37). Loop test XSR WW (para 5- 30). Test SR VV (para 5-29). (1) XXXXXX is in group L (fig. 5-5) and YYYYYY is 000000. (2) XXXXXX is in group L and YYYYYY shows more than one group L tone received. (3) XXXXXX is in group L and YYYYYY shows both group H and group L tones received.
	e. Auxiliary sender/receiver high band filter card failed.	*e*. If any of following are indicated, replace XSR (DH) card of XSR WW. Loop test XSR WW para 5- 30. Test SR VV para 5- 29. (1) XXXXXX is in group H and YYYYYY is 000000. (2) XXXXXX is in group H and YYYYYY indicates more than group H tone received. (3) XXXXXX is in group L and YYYYYY indicates both group L and group H tones received.
	f. Auxiliary sender/receiver medium band filter card failed.	*f*. If any of following are indicated, replace XSR (DM) card of XSR WW. Loop test XSR WW. Test SR VV. (1) XXXXXX is in either group H or group L and YYYYYY shows group M tone received in addition to group H or L tone. (2) XXXXXX is in group M and YYYYYY is 000000. (3) XXXXXX is in group M and YYYYYY indicates more than one group M tone received.
4. MINOR FAULT lamp lit, audible alarm, failure printout: XSR WW TO SR VV FAILS XXXXXX YYYYYY Followed by failure printout: XSR WW TO XSR WW FAILS XXXXXX YYYYYY Where WW, VV, XXXXXX, and YYYYYY are defined in 1 above.	Sender/receiver VV failed to pass the periodic programmed test. Auxiliary sender/receiver WW failed loop test. Both sender/receiver VV and auxiliary sender/receiver WW were marked out-of-service. Failure of sender portion of auxiliary sender/receiver WW probably failed.	Replace XSR(S) card of auxiliary sender/receiver WW (fig. FO-37). Loop test XSR WW (para 5- 30). Test SR VV (para 5- 29).

Malfunction	Probable cause	Corrective action
5. MINOR FAULT lamp lit, audible alarm and failure printouts followed within several minutes by a series of additional printouts and SDR/RCVR MAJOR FAULT lamp and audible alarm. Series of printouts are as follows: SR VV TO XSR WW FAILS XXXXXX YYYYYY ZZZZZZ XSR WW TO XSR WW FAILS XXXXXX YYYYYY SR W* TO XSR WW* FAILS XXXXXX YYYYYY ZZZZZZ Where XL WW, XXXXXX YYYYYY, and ZZZZZZ are defined in 1 above. VV* indicates other sender/receiver numbers. WW* indicates other auxiliary sender/receiver numbers. An sender/receiver numbers (VV, VV*, etc). and XSR WW are on same bus (fig. FO-37). All printouts have identical XXXXXX numbers and YYYYYY= 000000 and ZZZZZZ=000000 in all cases.	Tone source on bus containing all failed sender/receivers and XRS WW failed. This caused all sender/receivers on that bus to fail the programmed periodic automatic test and to be marked out-of-service. It also caused XSR WW to fail its loop test and to be marked out-of-service.	Determine the frequency of the failed tone from the XXXXXX number and figure 6-65. Replace the tone source card for the appropriate frequency and bus (fig. FO.37). Loop test (auxiliary sender receiver WW (para 5-30). Test all failed sender/receivers (para 5-29).

1. Conference Bridge.

Malfunction	Probable cause	Corrective action
MINOR FAULT alarm is lit, audible alarm is on, and following printout occurs. CONF N-N-NN FAILS FGT FGT TN X-X-XX Y-Y-YY YYYYYY LVL ZZZZZZ Where: N-N-NN is master port conference bridge frame-group-terminal. X-X-XX is service terminal injecting tone (bridge inlet). Y-Y-YY is service terminal receiving tone (bridge outlet). YYYYYY indicates tone received by auxiliary sender/receiver (fig. 5-5 and 5-6). ZZZZZZ is level of tone received fig. 6-6 and 5-6).	*a*. Conference bridge failed automatic programmed, conference bridge test and has been marked out-of-service. Fault may have been transient.	*a*. Perform conference bridge special exercise test (para 5-31). If conference bridge passes test, it will automatically be marked in-service. If it fails, go to step b.
	b. Bridge may have failed test due to improper signal input. Auxiliary sender/receiver may have failed.	*b*. Perform special exercise test on both auxiliary sender/receiver no. 21 and 22 (para 6-30). If either fails test, repair it (para 5-7k). Then repeat the conference bridge-special exercise test to mark the conference bridge in-service. Also test ring bus A or B (para 5-34).
	c. Conference bridge with master port assigned to N-N-NN failed.	*c*. At common equipment panel A28 locate conference bridge with master port assigned to N-N-NN. Replace applicable conference bridge card (fig. FO-37). Repeat conference bridge special exercise test. If test is completed successfully, conference bridge will be automatically marked in-service.
	d. Service terminal associated with X-X-XX or Y-Y-YY failed.	*d*. Repatch different ports of bridge to different service terminals (para 2-17). If fault does not move, replace service terminal associated with X-X-XX or Y-Y-YY (fig. FO-36) and retest.
	e. Matrix D stage cards for Y-Y-YY failed.	*e*. Replace both matrix D stage cards for Y-Y-YY (fig. FO-36). Repeat conference bridge test (para 5.31).
	f. Matrix A stage cards for X-X-XX failed.	*f.* Replace 5 matrix A stage cards for X-X-XX (fig. FO.36},-Repeat conference bridge test (pars 5-31).

	SIGNAL TONES		FREQUENCY (4) (5)						MIN RECEIVE LEVEL (4)					
	FREQUENCY	LEVEL(1)	X Y	X Y	X AND Y	X Y	X Y	X Y	-0.5 dbm Z	-3.5 dbm Z	-7.5 dbm Z	-10.5 dbm Z	-17.5 dbm Z	-21.5 dbm Z
GROUP M CARD XSR(DM)	1600 Hz	(2)	0	1	0	0	0	0	0	0	0	0	0	0
	1050 Hz	-14 dbm(3)	0	1	0	0	0	0	0	0	0	0	1	1
	425 Hz	-14 dbm(3)	0	0	4	0	0	0	0	0	0	0	1	1
	2250 Hz	-7 dbm(3)	0	0	2	0	0	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
GROUP L CARD SR(DL)	570 Hz	-14 dbm	0	0	1	0	0	0	0	0	0	0	1	1
	697 Hz	-7 dbm	0	0	0	4	0	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
	770 Hz	-7 dbm	0	0	0	2	0	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
	852 Hz	-7 dbm	0	0	0	1	0	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
	941 Hz	-7 dbm	0	0	0	0	4	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
GROUP H CARD SR(DH)	1209 Hz	-7 dbm	0	0	0	0	2	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
	1336 Hz	-7 dbm	0	0	0	0	1	0	0 0	0 0	0 OR 1	1 1	1 1	1 1
	1477 Hz	-7 dbm	0	0	0	0	0	4	0 0	0 0	0 OR 1	1 1	1 1	1 1
	1633 Hz	-7 dbm	0	0	0	0	0	2	0 0	0 0	0 OR 1	1 1	1 1	1 1
	2600 Hz	-7 dbm	0	0	0	0	0	1	0 0	0 0	0 OR 1	1 1	1 1	1 1

NOTE 1. ALL TONE SIGNALS SENT BY XSR AT -25 dbm (ZZZZZZ = 000000)
2. 1600 Hz SIGNAL NCT SENT OR RECEIVED BY SR.
3. 1050, 425 AND 2250 Hz NOT RECEIVED BY SR.
4. PROPER TEST RESULTS. SEVENTH ZERO IS PRESENT TO LEFT ON CONFERENCE BRIDGE TEST PRINTOUTS.
5. VALUES IN THIS COLUMN ADD IF MORE THAN ONE FREQUENCY IS FAULTY. FOR EXAMPLE, YYYYYY = 000030 INDICATES BOTH 1209 Hz AND 1336 Hz TONES WERE RECEIVED.

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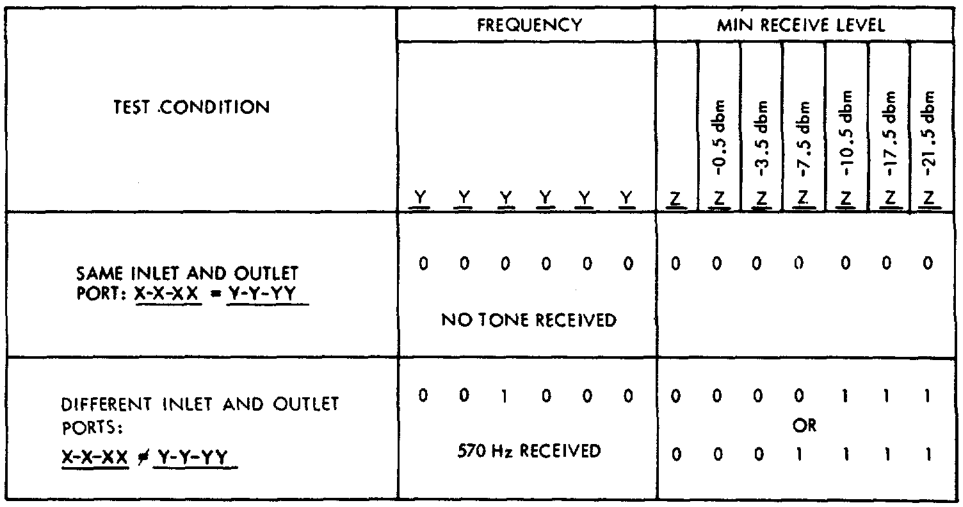
Figure 5-5. Sender/receiver frequency and amplitude printouts.

Malfunction	Probable cause	Corrective action
	g. Matrix B or C stage cards may not be seated properly thereby causing occasional link faults. Other types of network fault messages may also identify this problem.	*g.* Seat all B stage cards in frame X. Seat all C stage cards in frame Y. Repeat conference bridge test Spars 5-31) to mark bridge in service. Continue to monitor for CONF FAILS printouts.

m. Ringer.

Malfunction	Probable cause	Corrective action
1. MAJOR FAULT RING lights, audible alarm sounds, and following printout occurs:	*a.* Bus ringer failed automatic programmed test and was switched off-line. Other bus ringer is now driving bus of failed ringer. Fault may be transient.	*a.* Mark failed ringer back in service (para 5-33). Perform system ring bus special request test (para 5-34).



TEST CONDITION	FREQUENCY						MIN RECEIVE LEVEL						
	Y	Y	Y	Y	Y	Y	Z	Z -0.5 dbm	Z -3.5 dbm	Z -7.5 dbm	Z -10.5 dbm	Z -17.5 dbm	Z -21.5 dbm
SAME INLET AND OUTLET PORT: X-X-XX = Y-Y-YY	0	0	0	0	0	0	0	0	0	0	0	0	0
	NO TONE RECEIVED												
DIFFERENT INLET AND OUTLET PORTS: X-X-XX ≠ Y-Y-YY	0	0	1	0	0	0	0	0	0	0	1	1	1
										OR			
	570 Hz RECEIVED						0	0	0	1	1	1	1

NOTE: PROPER TEST RESULTS ARE SHOWN.

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Figure 5-6. Conference bridge test frequency and amplitude printouts.

Malfunction	Probable cause	Corrective action
RING FAILS OFGT LK RG TN X-X-XX YY UV yyyyy LV ZZZZZZZ Where: X-X- XX indicates outlet frame group and terminal of auxiliary sender/receiver	*b.* Auxiliary sender/receiver used to test bus ringer may have failed.	*b.* Test any sender/receiver using auxiliary sender/receiver no. 21 if X- X-XX indicates odd numbered frame or auxiliary sender/receiver no. 22 if X- X- XX indicates even numbered frame (para 5-29). Troubleshoot per paragraph 5-7*k*. Repeat step a after auxiliary sender/receiver repair.
used for test. Odd numbered frames (bus A) use auxiliary sender/receiver no. 21. Even numbered frames (bus B) use auxiliary sender/receiver no. 22. YY identifies ring bus D stage link tested (fig. 5-7). U indicates status of bus A ringer when	*c.* Bus ringer amplifier card may have failed.	*c.* From printout identify whether failed ringer is on bus A or B and which link is involved. Replace associated bus ringer amplifier card in A27 (fig. FO- 37). Mark bus ringer back in service (para 5-33). Perform bus ringer special request test (para 5-34)
failure occurred. 0 = off-line. (bus A failed) 1 = on-line.	*d.* Bus ringer timing card may have failed.	*d.* Replace bus timer timing card for applicable bus in A27 (fig. FO-37). Perform bus ringer special request test (para 5-34).
V indicates status of bus B ringer when failure occurred. O = off-line (bus B failed) 1 = on-line. YYYYYY indicates tone received during test (fig. 5-7). ZZZZZZZ indicates level of received tone (fig. 5-7).	e. If yyyyy is per figure 5- 7 but ZZZZZZZ does not conform to figure 5-7, matrix D stage card for auxiliary sender/receiver at terminal X-X-XX may be faulty.	e. Refer to figure FO- 36 and replace B stage matrix card for ring bus links for terminal X-X-XX. Perform ring bus test (para 5-34).
2. MAJOR FAULT RING lights, audible alarm sounds, and following printout occurs: 20-HZ STATUS ABCC	Operational program periodically checks status of 20-Hz generators. Message shown is printed whenever a change in status is noted.	
Where: A indicates operable status of 20-Hz ringer A:	*a.* Fault may be due to transient conditions.	*a.* Wait approximately six seconds for the program to check the 20-Hz ringer again. If it checks good, a second message is printed showing A or B is now operating.

Malfunction	Probable cause	Corrective action
1: operating 0: failed B indicates operable status of 20-Hz ringer B. CC indicates operable status of 20-Hz ringer B. 01: ringer B is on line 10: ringer A is on line.	*b.* 20-Hz ring generator module fuse may have blown.	*b.* For ringer A failure, check fuse A50A1Fl. For ringer B, failures check fuse A60A2F1. After replacement, wait About 6 seconds for new status report.
	c. 20-Hz generator module may have failed.	*c.* If printout indicates 20-Hz ringer A failed, replace A50A1. If B failed, replace A50A2. After replacement, wait about 6 seconds for new status report on replaced module.
	d. 20Hz generator relay card may have failed.	*d.* Replace A560A2. After replacement, wait about 6 seconds for new status report.

RING SIGNAL TEST	TEST PERIOD	FREQUENCY						MIN. RECEIVE LEVEL						
								1600 Hz PRESENT	-0.5 dbm	-3.5 dbm	-7.5 dbm	-10.5 dbm	-17.5 dbm	-21.5 dbm
		Y	Y	Y	Y	Y	Y	Z	Z	Z	Z	Z	Z	Z
LINK 21 RING BACK	4.2 SEC	0	0	4	0	0	0	0	0	0	0	0	1	1
				425 Hz										
LINK 22 NORMAL RING	4.2 SEC	0	0	1	0	0	0	0	0	0	1	1	1	1
				570 Hz							OR			
								0	0	1	1	1	1	1
LINK 23 PRIORITY RING	1.2 SEC	0	0	5	0	0	0	0	0	0	1	1	1	1
				570 Hz AND 425 Hz							OR			
								0	0	1	1	1	1	1
LINK 24 SEIZE TRIP	50 MS	0	0	1	0	0	0	0	0	0	0	1	1	1
				570 Hz							OR			
								0	0	0	1	1	1	1

NOTE: CORRECT TEST RESPONSES ARE SHOWN.

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Figure 5-7. Bus ringer test frequency and amplitude printouts.

n. On-line Common Control Subsystem.

Malfunction	Probable cause	Corrective action
1. A printout occurs with the following format: SSS FAILED DEVICE O	a. Remote printer is in-service and idle and fails to respond to I/O command.	a. Reset device from system status panel. Check device for proper installation. Check fuses and mechanical adjustments. Repeat procedure which generated printout.
	b. Remote printer fails to be reset from the system status panel. (Printout occurs repeatedly.)	*b.* Mark printer out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2- 18*q*). Perform in sequence the following from halted processor: (1) Common control synchronizer diagnostic (para 5-53). (2) Remote device synchronizer diagnostic (para 5-54). (3) Processor diagnostic (para 5 - 48). When fault persists, refer fault to higher maintenance (e.g.) for bootstrap diagnostic.
2. A printout occurs with the following format: SSS FAILED DEVICE 1	a. Paper tape punch is in-service and idle and fails to respond to I/O Command.	*a.* Reset the device from system status panel. Check device for proper installation. Check fuses and mechanical settings. Repeat procedure which generated printout.
	b. Paper tape punch fails to be reset from system status panel. Printout occurs on repeated procedures.	*b.* Mark paper tape punch out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2-18*q*). Perform in sequence the following from halted processor: (1) Common Control/synchronizer diagnostic (para 5-53). (2) Paper tape reader/punch diagnostic (para 5- 55). (3) Processor diagnostic (para 5-48). When the fault persists, refer fault to higher maintenance (e.g., for bootstrap diagnostic).
3. A printout occurs with the following format: SSS FAILED DEVICE 2	*a.* Local Printer is in-service and idle and fails to respond to I/O command.	*a.* Reset device from system status panel. Check device for proper installation. Check fuses and mechanical adjustments. Repeat procedure which generated printout.
	b. Local printer fails to be reset from system status panel. Printout occurs on repeated procedures.	*b.* Mark printer out-of-service from active processor (para 5-17). Transfer control to standby processor (2-18q). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5-53). (2) Remote device synchronizer diagnostic (para 5-54). (3) Processor diagnostic (para 5-48). When fault persists, refer fault to higher, maintenance for bootstrap diagnostic.
4. A printout occurs with the following format: SSS FAILED DEVICE 3	a. Spare teletype is idle and in-service and fails to respond to I/O command.	a. Reset device from system status panel. Check device for proper installation. Check fuses and mechanical adjustment. Repeat procedure which generated fault.

Malfunction	Probable cause	Corrective action
	b. Spare teletype fails to be reset from system status panel. Printout occurs on repeated procedures.	*b.* Mark spare teletype out-of-service at active processor (para 5-17). Transfer control to standby processor (para 2-18q). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5- 53). (2) Remote device synchronizer diagnostic (para 5-54). (3) Processor diagnostic (para 5-48). When fault persists, refer fault to higher maintenance for bootstrap diagnostic.
5. A printout occurs with the following format: SSS FAILED DEVICE 4	*a.* Paper tape reader is idle and in-service and fails to respond to I/O command.	*a.* Reset device from system status panel. Check device for proper installation. Check fuses and mechanical adjustment. Repeat procedure which generated printout.
	b. Paper tape reader fails to be reset from system status panel. Printout occurs on repeated procedures.	*b.* Mark paper tape reader out-of-service at active processor (para 5-17). Transfer control to standby processor (para 2-18q). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5-53). (2) Paper tape reader/punch diagnostic (para 5-55). (3) Processor diagnostic (para 5-48). When fault persists, refer fault to higher maintenance for bootstrap diagnostic.
6. A printout occurs with the following format: SSS FAILED DEVICE 5	*a.* Memory-to-memory channel is idle and in-service and fails to respond to I/0 commands.	*a.* Reset memory-to-memory channel from system status panel. Repeat procedure which generated printout.
	b. Memory-to-memory channel fails to be reset from system status panel. Printout occurs on repeated procedures. System cannot be shut down.	*b.* Mark memory-to-memory channel out-of-service at both processors (para 5-17). Use PUNCH option on all ASSIGN, CHANGE, and DELETE operations from FACP or remote teletype. Load punched paper tape into standby processor to keep it up to date. Refer to c below.
	c. Memory-to-memory channel defective (b above). System can be shut down.	*c.* Take entire system off-line. Run memory-to-memory diagnostic (para 5-49) from both processors. When fault persists, restore system to previous punched mode immediately. Notify higher maintenance.
7. A printout occurs with the following format: SSS FAILED DEVICE 6	*a.* Remote teletype is idle and in-service and fails to respond to I/O command.	*a.* Reset device from system status panel. Check device for proper installation. Check fuses and mechanical adjustments. Repeat procedures which generated printout.
	b. Remote teletype fails to be reset from system status panel. Printout occurs on repeated procedure.	*b.* Mark remote teletype out-of-service at active processor (para 5-17). Transfer control to standby processor (para 2-18*q*). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5-53). (2) Remote device synchronizer diagnostic (para 5-54).

Malfunction	Probable cause	Corrective action
		(3) Processor diagnostic (para 5-48). When fault persists, refer fault to higher maintenance for bootstrap diagnostic.
8. A printout occurs with the following format: SSS FAILED DEVICE 7	a. FACP power off	*a.* Restore FACP power.
	b. FACP is in-service and fails to respond to I/O commands.	*b.* At the FACP panel, press FACP CLEAR. Repeat procedure which generated printout.
	c. FACP fails to be reset. Printout occurs on repeated procedure.	*c.* Mark FACP out-of-service from standby processor (para 5-17. Transfer control to standby processor (para 2-18q). Perform in sequence the following from halted processor. (1) Common control/synchronizer diagnostic (para 5- 53). (2) FACP diagnostic (para 5-56). (3) Processor diagnostic (para 5-48). When fault persists, refer fault to higher maintenance for bootstrap diagnostic.
9. A printout occurs with the following format: I/0 FAILED DEV 0 generated the printout.	*a.* Remote printer fails to return character ready or other status return. Input or output function not completed.	*a.* Reset the remote printer at the system status panel. Check device for proper installation, blown fuses, improper adjustment, etc. Repeat procedure which
	b. Remote printer fails to respond. Printout occurs on repeated procedure.	*b.* Mark printer out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2-18*q*). Perform the following in sequence from halted processor: (1) Common control/synchronizer diagnostic (para 5-53). (2) Remote device/synchronizer diagnostic (para 5-54).
10. A printout occurs with following format: I/O FAILED DEV 1	*a.* Paper tape punch fails to return character ready or other status return. Input/output function not completed.	*a.* Reset paper tape punch at system status panel. Check device for proper installation, blown fuses, improper adjustment, etc. Repeat procedure which generated printout.
	b. Paper tape punch fails to respond. Printout occurs on repeated procedure.	*b.* Mark punch out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2-18q). Perform the following in sequence from halted processor: (1) Common control/synchronizer diagnostic (para 5- 53). (2) Paper tape reader/punch diagnostic (para 5-55).
11. Minor alarm sounds and local printer light at system status panel for local printer lights.	*a.* Local printer fails to return proper status return. Input/output function not completed.	*a.* Reset and set local printer alarm at MCP using paragraph 2-18. Check device for proper installation, blown fuses, improper adjustment, etc. Repeat procedure which generated alarm.
	b. Local printer fails to respond. Alarm occurs on repeated procedure.	*b.* Mark printer out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2-18*q*). Perform in sequence the following from halted processor:

Malfunction	Probable cause	Corrective action
		(1) Common control/synchronizer diagnostic (para 5-53). (2) Remote device/synchronizer diagnostic (para 5-54).
12. A printout occurs with the following format: I/O FAILED DEV 3	*a.* Spare teletype fails to return proper status return. Input/output function not completed.	*a.* Reset device from system 'status panel. Check device for proper installation, blown fuses, improper adjustment, etc. Repeat procedure which generated printout.
	b. Spare teletype fails to respond. Printout occurs on repeated procedure.	*b.* Mark teletype out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2-18*q*). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5-53). (2) Remote device/synchronizer diagnostic (para 5-54).
13. A printout occurs with the following format: I/O FAILED DEV 4 TAPE ERR 03	*a.* Paper tape reader fails to return proper status return. Input/output. function not completed.	*a.* Reset device from system status panel. Check device for proper installation, blown fuses, improper adjustment, etc. Repeat procedure which generated printout.
	b. Paper tape reader fails to respond. Printout occurs on repeated procedure.	*b.* Mark paper tape reader out-of-service from active processor (para 5-55). Transfer control to the standby processor (para 2-18q). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5-48). (2) Remote device/synchronizer diagnostic (para 5-55).
14. A printout occurs with the following format: I/O FAILED DEV 5	*a.* Memory-to-memory fails to return proper status return. Input/output function not completed.	*a.* Reset device from system status panel. Repeat procedure which generated printout.
	b. Memory-to-memory channel fails to respond. Printout occurs on repeated procedure. System cannot be shut down.	*b.* Mark memory-to-memory channel out-of-service at both processors (para 5-17). Use punch option on all ASSIGN, CHANGE, and DELETE operations from FACP or remote teletype. Load punched paper tape into standby processor to keep it up to date.
15. Printout: I/O FAILED DEV 6	*a.* Remote teletype channel lost synchronization.	*a.* On A16 set RESET SELECT-TTY switch to ON and press RESET. Set RESET SELECT-TTY to OFF. Ask remote TTY to repeat procedure they were attempting or perform daily remote channel access test (no. 46, para 5-4).
	b. Failure detected on remote teletype channel may be outside plant fault or Modem A13 fault.	*b.* Set modem selector switch A13S1 to L-B. Communicate with remote teletype location and request a loopback typing test. If characters typed are not printed on remote TTY: (1) Check outside plant-cable to remote teletype. (2) Replace converter A13A1. (3) Replace keyer A13A2. (4) Check modem fuse A13A7F1.

Malfunction	Probable cause	Corrective action
	c. Failure in synchronizer, or device channel.	*c.* Mark remote teletype out of service in active processor (para 5-17). Transfer control to standby processor (para 2-18*q*). Perform common control synchronizer off-line diagnostic (para 5- 53). Perform remote device off-line diagnostic (para 5-54).
16.--A printout occurs with the following format: I/O FAILED DEV 7	*a.* FACP fails to return proper status return. Input/output function not completed.	*a.* At FACP press FACP CLEAR. Repeat procedure which generated printout.
	b. FACP fails to respond. Printout occurs on repeated procedure.	*b.* Mark FACP out-of-service from active processor (para 5-17). Transfer control to standby processor (para 2-18q). Perform in sequence the following from halted processor: (1) Common control/synchronizer diagnostic (para 5-53). (2) FACP diagnostic (para 5-56).
17. A printout occurs with the following format: TAPE ERR 00	*a.* The processor detected a device alarm or time-out on first read of paper tape reader.	*a.* Check switch or fuse at paper tape reader. Set switch to ON. Repeat the procedure which generated the printout.
	b. Paper tape reader fails to function. Printout occurs during repeated procedure.	*b.* Check paper tape reader mechanically and electrically. Recheck all control settings. Repeat the procedure which generated the printout.
	c. Paper tape reader fails to function. Printout occurs during repeated procedure.	*c.* Mark paper tape reader out-of-service from on-line processor (para 5-16). Run the reader portion of tape reader/punch diagnostic from the off-line processor (para 5-55).
	d. Paper tape reader fails to function. Printout occurs during repeated procedure.	*d.* Restore operational program in off-line processor. Start program and manually transfer control (para 2-18*q*). Run CPU diagnostic.
17.1. A printout occurs with the following format: TAPE ERR 01	Program rejected tape because tape header does not properly identify ASCII or compressed format for tapes loaded using FUNCTION CODE 13 (para 5-19).	
	a. Tape was loaded improperly	a. Check that tape is not loaded upside down or from wrong end.
	b. Wrong tape is being loaded using FUNCTION CODE 13.	*b.* Use FUNCTION CODE 13 only to load current directory, data base update, or ASCII (program patch) tapes.
	c. Tape is punched incorrectly	c. Verify or repunch tape.
	d. False character in tape leader............................	*d.* Inspect tape to see that reading starts at all-one's character. Mask off false characters in leader.
18. A printout occurs with the following format: TAPE ERR 02	*a.* A checksum error has been detected on tape address block.	*a.* Verify that tape is legitimate and is mounted properly. Perform an electrical and mechanical check of tape reader. Repeat the procedure which generated the printout.
	b. Checksum error continues to exist. Printout occurs during repeated procedure.	*b.* Mark paper tape reader out-of-service from the on-line processor (Para 5-16). Run the reader portion of the tape/reader punch diagnostic from the off-line processor. (para 5-55).

Malfunction	Probable cause	Corrective action
	c. Checksum error continues to exist. Printout occurs during repeated procedure.	c. Restore operational program in off-line processor. Start program and manually transfer control (para 2-18q). Run CPU diagnostic (para 5-48).
18.1. A printout occurs with the following format: TAPE ERR 03	Punched tape data failed to read-in properly. Some bad data may have been stored in memory.	
	a. Error may be transient	*a.* Try to read tape again.
	b. Synchronizer or Reader may be faulty.	*b.* Look for other printouts which indicate these conditions (13 above, I/O FAILED DEV 4).
19. A printout occurs with the following format: TAPE ERR 04	a. A checksum error has been detected when tape has been read.	a. Verify that tape has been read before. Check that tape has been properly punched. Repeat procedure which generated printout.
	b. Checksum error continues to exist. Printout occurs during repeated procedure.	*b.* Mark paper tape reader out-of-service from on-line processor (para 5-16). Run the reader portion of the tape reader/ punch diagnostic from the off-line processor (para 5-55).
	c. Checksum error continues to exist. Printout occurs during repeated procedure.	*c.* Restore operational program in off-line processor. Start program and manually transfer control (para 2-18q). Run CPU diagnostic (para 5-48).
19.1. A printout occurs with the following format: TAPE ERR 05	Procedural error using FUNCTION CODE 13 (para 5-19). **NOTE** **Normally ILLEGAL I/O ORDER will printout instead of TAPE ERR 05.**	*a.* Check that only one ADDRESS SWITCH REGISTER bit is set. *b.* Check that ADDRESS SWITCH REGISTER is correctly set to identify type of tape (fig. 5-19) and that correct tape is on reader.
20. A printout occurs, a control transfer, major alarm exists but transfer is not accomplished. CPU ERR 1 ON-LINE CPU IN NET RECVR	Standby processor not available. The printout and the presence of the DATA WORD light on MCP indicates a data parity error.	When possible place standby processor to active (para 2-18q). Run CPU diagnostic (para 5-48) or memory diagnostic (para 5-50) on processor that failed. When fault persists, refer to higher maintenance, (e.g., for bootstrap diagnostic).
21. A printout occurs, a control transfer major alarm exists but transfer is not accomplished. CPU ERR 5 ON-LINE CPU IN NET RECVR	Standby processor not available. The printout and presence of INSTR WORD light on MCP indicates memory parity error.	When possible, place standby processor to active (para 2-18q). Run CPU diagnostic (para 56-48) or memory diagnostic (para 5-50) on processor that failed. When fault persists, refer to higher maintenance for bootstrap diagnostic.
22. A printout occurs, a control transfer major alarm exists, but transfer is not accomplished. CPU ERR 6 ON-LINE CPU IN NET RECVR	Standby processor not available. An illegal instruction or access to non-existent memory error is detected.	When possible, place standby processor to active (para 2-18q). Run CPU diagnostic (para 5-48) or memory diagnostic (para 5-50) on processor that failed. When fault persists, refer to higher maintenance for bootstrap diagnostic.
23. A printout occurs, a control transfer major alarm exists, but transfer is not accomplished. CPU ERR 7 ON-LINE CPU IN NET RECVR	Standby processor not available. A write attempt into protected memory has been detected.	When possible, place standby processor to active (para 2-18q). Run CPU diagnostic (para 5- 48) or memory diagnostic (para 5- 50) on processor that failed. When fault persists, refer to higher maintenance for bootstrap diagnostic.
24. Major alarm sounds, green (on) and yellow (standby) lights on both processors blink on and off.	Control transfer is attempted between processors and fails, but continues to transfer.	Place entire system off-line. Perform CPU diagnostic (para 5-48) on each processor. Perform memory-to-memory off-line test (para 5-49). Place the system on-line. When fault persists, refer to higher maintenance for bootstrap diagnostic.

Malfunction	Probable cause	Corrective action
25. A printout occurs with the following format: ILLEGAL I/O ORDER	*a.* This is most probably an operator error.	*a.* Check, and carefully reinitiate order.
	b. Order reinitiated but fault persists.	*b.* Transfer control to other processor if necessary. Run MCP diagnostic (para 5- 52 or 5- 51) from applicable processor.
26. A printout occurs with the following format: INVALID OP	a. This most probably an operator error at the FACP.	a. Check carefully and reinitiate order.
	b. Order reinitiated, printout occurs again.	*b.* Mark FACP out-of-service from the active processor (para 5-17). Run FACP diagnostic (para 5-56) on the off-line processor.
27. The I/O devices cannot be addressed or controlled.	Processor logic defective	Run common control/synchronizer diagnostic (para 5-53) from off-line processor.
28. CONTROL TRANSFER lights and printout occurs: ON-LINE CPU IN NET RECVR	*a.* Self-check routine in operational program of processor which is now off-line detected fault and transferred control to processor which is not on-line. Processor or memory is probably faulty.	*a.* Allow central office to operate from on-line processor. Record off-line processor status in maintenance records (para 5- 59). Test processor (para 5- 48). Test memory (para 5-50). If trouble persists refer fault to higher level maintenance.
	b. If DC PWR alarm also lights, dc-dc converter may have failed and caused transfer.	*b.* See if red FAULT light on PS3 through PS8 is illuminated. Troubleshoot power fault (para 5-7b) before checking processor.
29. A control transfer major alarm exists. A printout occurs with the following format: ON-LINE CPU IN NET RECVR followed by DCDR FLT (decoder fault) printouts.	Decoder faults were detected in previously on-line processor. On-line control was automatically transferred to other processor.	Allow central office to operate on on-line processor. Troubleshoot decoder fault in off-line processor (para 5-7q).
30. Major and or minor alarms indicators are on, audible alarm and many printouts of the following types occur: ON-LINE CPU IN NET RECVR NT FLT SBR IFGT TYPE 160000 X-X-XX C2 OFGT A BC Y-Y-YY U VV and/or NT FLT SBR IFGT 000000 X-X-XX TYPE OFGT A BCC D(IS) Y-Y-YY U VV and/or NT FLT SBR IFGT 140000 0-0-00 TYPE OFGT A BC C2 Y-Y-YY 0 VV and/or 0 NT FLT SBR IFGT TYPE 140000 MMMMMM C2 OFGT A BC Y-Y-YY 0 00	The error return checking logic in CCS KL counter (network control logic) falsely reported error during a check of network connect or disconnect instruction causing the fault messages to be printed. There is no fault in the network. SBR contents in formats at left are correct returns. The CCS KL counter has failed.	If a control transfer has not already occurred, transfer control to standby processor (para 2-18q). Refer fault to higher level of maintenance.

Malfunction	Probable cause	Corrective action
and/or NT FLT SBR IFGT TYPE 000000 MMMMMM D OGGT A BC Y-Y-YY 0 00 and/or NT FLT SBR IFGT 000000 0-0-00 TYPE OFGT A BC DIS Y-Y-YY 0 VV		
31. Printer A21 does not operate during operational situations such as: Printout requested from FACP or MCP. Assignments stored from FACP. MAJOR or MINOR FAULT (except power) or SUPERVISORY ALARM lights on A6. Procedural errors made when operating FACP or MCP.	*a.* Printer controls not set correctly.	*a.* See that printer A21 is loaded with paper and that controls are set for line operation.
	b. Printer channel not synchronized......................	*b.* On A6 set RESET SELECT-LOCAL PRINTER switch to ON and press RESET. Set RESET SELECT-LOCAL PRINTER to OFF.
	c. Faulty synchronizer or printer	*c.* Mark printer out-of-service from on-line MCP (para 5-17). Run off-line synchronizer diagnostic (para 5- 53) and printer portions of punched tape reader/ paper tape punch off-line diagnostic (para 5-55).
32. Following message is printed while a data base update is being made from FACP, tape reader, or remote teletype. UPDATE ERR NO X Where X is a digit identifying type of error.	Program detected operational or hardware error type X as described below.	
	a. X = 1. Tape reader input failed checks. An illegal directory update has been attempted.	*a.* Check applicable checks paragraph in chapter 2 for possible illegal data base entry. Reload current directory in on-line processor.
	b. X = 2. Memory-to-memory channel input failed checks.	*b.* Reload current directory in standby processor (para 5-19).
	c. X = 4. Standby processor took too long to accept data base update. Standby processor probably has memory-to-memory channel marked out of service.	*c.* Mark memory-to-memory channel in service from standby processor (para 5-17).
	d. X = 5. Tape reader input data passed initial checks but failed subsequent checks. Processor or memory is probably faulty.	*d.* Transfer control to other processor (para 2-18q). Perform off-line processor and memory tests on previously on-line processor (para 5- 48 and 5- 50).
	e. X = 6. Memory-to-memory channel data passed initial check but failed subsequent checks. Processor or memory is probably faulty.	*e.* Same as *d*.
	f. X = 7. Manual input data (FACP or remote teletype) passed initial checks but failed subsequent checks. Processor or memory is probably faulty.	*f.* Same as *d*.
	g. X = 8. Standby processor not available. Only data base in on-line processor was updated.	*g.* Punch update tape or otherwise record change so that standby processor data base can be updated when available.
	h. X = 9. Terminal involved in data base change is currently busy. Operational program will not change data base for busy terminal.	*h.* Repeat data base update procedure at later time.

Malfunction	Probable cause	Corrective action
		NOTE **If data base update involved many terminals, non-busy terminals will be updated and only busy terminals will be rejected by this error message. Only busy terminals so flagged need to have data base update repeated.**

o. Processor Error Group Enable Gates.

Malfunction	Probable cause	Corrective action
1. MINOR FAULT lit and following message printed: XXX NT FLT IFGT TYPE OFGT BC ACC 0-0-00 Eb 0-0-00 00 aaa where: b = 1 or b = 0 and denotes which test of EGRP enable gates failed, and aaa is octal representation of bits 08 to 15 of accumulator *XXX* identifies processor reporting fault: ACT On-line processor SBY Standby processor	Program detected failure during automatic testing of processor error group (EGRP) enable gates. One of cards listed in b(l) through (11) probably failed.	a. If on-line processor reported fault, transfer control to standby processor (para 2-18*q*). *b.* In sequence replace processor XXX cards in following list. If b is 1 and aaa is 000, start with (4); otherwise start with (1). Press NORMAL HALT before replacing card. Start up processor (para 4-10*l*) and perform error group enable gates test (para 5- 37) after replacement to verify correction action. (1) A201 (2) A232 (3) A236 (4) A746 (5) A206 (6) A226 (7) A240 (8) A244 (9) A124 (10) A220 (11) A145

p. Signaling Buffer Register.

Malfunction	Probable cause	Corrective action
1. MAJOR FAULT - CONTROL TRANSFER lit, audio alarm sounds and printouts: SRB A FAILS RRRRRR SRB B FAILS RRRRRR SRB C FAILS RRRRRR ON-LINE CPU IN NET RECVR Where: RRRRRR is octal value of signaling buffer register which identifies failed bit or bits.	Previously on-line processor detected error in same bit position on all three busses (SRBA, SRBB, and SRBC). Control transfer to other processor was initiated. Present-on-line processor program is going through network recovery preparing to process calls. Signaling buffer register failed.	Examine value of RRRRRR number and determine failed bit or bits (A, fig 5-8). Replace cards in failed processor which corresponds to failed bit number, (B, fig. 5-8). Test SBR in failed processor after each card replacement (para 5 - 36).
2. MAJOR FAULT - BUS lit, audio alarm sounds, and printout: SRB A FAILS RRRRRR Where: A identifies signaling register bus which failed (A, B, or C).	*a.* On-line program detected an error on signaling register bus identified in printout. Fault may be transient. *b.* Fault may be caused by a short on an interface card in network/terminal subsystem.	*a.* Perform SBR bus special exercise test (para 5- 36). If no error printed out, disregard and reset alarm (para 5- 22). If an error reported, go to step b. *b.* Troubleshoot for shorted bus interfacing cards (para 5-38).

Malfunction	Probable cause	Corrective action
RRRRRR is octal value of signaling buffer register which identifies failed bit or bits.	*c.* Fault may be caused by SBR card in processor.	*c.* Transfer control of central office to other processor (para 2-18q). Using printout RRRRRR number determine faulty bit number and related. processor circuit cards (A, B, fig. 5-8). Sequentially replace each card and retest (para 5-36) until fault is corrected.

	SRBA, SRBB, OR SRBC PRINTOUT						
VALUE OF R	R	R	R	R	R	R	
0	NO FAULT						
1	16	13	10	7	4	1	FAULTY SRBA, SRBB, SRBC BIT NUMBER
2	-	14	11	8	5	2	
3	-	13,14	10,11	7,8	4,5	1,2	
4	-	15	12	9	6	3	
5	-	13,15	10,12	7,9	4,6	1,3	
6	-	14,15	11,12	8,9	5,6	2,3	
7	-	13,14,15	10,11,12	7,8,9	4,5,6	1,2,3	

A. FAULTY SRB BIT IDENTIFICATION

FAULTY SRBA, SRBB, SRBC BIT NUMBER	PROCESSOR CIRCUIT CARDS
1 THROUGH 8	A119, A114, A113
9 THROUGH 16	A120, A114, A113

B. CARD REPLACEMENT GUIDE

SRBA, SRBB SRBC	SBR	CPB
1	23	23
2	22	22
3	21	21
4	20	20
5	19	19
6	18	18
7	17	17
8	16	16

SRBA, SRBB SRBC	SBR	CPB
9	15	15
10	14	14
11	13	13
12	12	12
13	11	11
14	10	10
15	9	9
16	8	8

C. BIT CORRESPONDENCE

NOTES

1. INSTRUCTIONS
   - a. IDENTIFY NUMBER OF FAULTY BIT FROM RRRRRR NUMBER IN PRINTOUT USING TABLE A.
   - b. IN TABLE B DETERMINE IF FAULTY BIT NUMBER FALLS BETWEEN 1 AND 8 OR 9 AND 16.
   - c. REPLACE FIRST CARD LISTED IN TABLE B IN FAILED PROCESSOR A8 OR A9.
   - d. PERFORM SBR BUS SPECIAL REQUEST TEST TO VERIFY CORRECTIVE ACTION.
   - e. IF FAULT PERSISTS REPLACE NEXT CARD, REPEAT TEST, ETC.
2. EXAMPLE
   - a. PRINTOUT: SRBA FAILS 002000
   - b. TABLE A SHOWS THAT SRBA 11 FAILED.
   - c. TABLE B SHOWS THAT CARDS A120, A114, OR A113 SHOULD BE REPLACED IN SEQUENCE.

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Figure 5-8. Signaling Buffer Register Troubleshooting Guide.

q. Decoders.

Malfunction	Probable cause	Corrective action
1. MAJOR FAULT-CONTROL TRANSFER lit, audio alarm sounds and printout. DCDR FLT IF-IG-IT OF-OG-OT BC A X-X-XX Y-Y-YY VV U ZZ U	a. Previously on-line processor detected decoder link fault during automatic test and initiated control transfer. Present on-line processor is going through network recovery and will take over central office control. Fault may be transient.	a. Perform program start-up (para 2-181) on off-line processor. If no decoder fault messages print out, processor may be placed back on-line by performing a manual control transfer (para 2-18*q*).
ON-LINE CPU IN NET RECVR	b. Processor link select register (LSR) may have failed. If test is passed, go to c.	b. Test LSR (para 5- 57). If test is failed, replace card A229 and repeat LSR test.
Where: X- X- XX is inlet frame, group, and terminal number.	*c.* If W is not equal to U, alternate link decoder or encoder may have failed.	*c.* Replace card A208. Perform program start-up (para 2-181).
Y- Y- YY is outlet frame, group, terminal number.	*d.* Other LSR encoder or decoder faults.	*d.* Troubleshoot per paragraph 5 - 58.
VV is BC link number. W in AN/TTC- 38(V)1 indicates alternate link if 1, normal link if 0. ZZ is re-encoded BC link number. U is re-encoded alternate link bit.	*e.* If printout does not indicate any special enable errors, link encoder failed.	*e.* In sequence replace each of following cards. Repeat program start-up after each replacement to see if fault is corrected. (1) A149 (2) A227 (3) A215 (4) A227 (5) A228
	f. If printout does not indicate any IF or OF errors, link decoder failed.	f. In sequence replace each of following cards. Repeat program start-up after each replacement to see If fault is corrected. (1) A204 (2) A231 (3) A230 (4) A219 (5) A232
	g. If printout indicates IF or OF errors, intermediate decoder failed.	*g.* In sequence replace each of following cards. Repeat program start-up after each replacement to see if fault is corrected. (1) A205 (2) A206
2. MAJOR FAULT-CONTROL TRANSFER lit, audio alarm sounds, and printout. DCDR FLT IF-IG-IT OF-OG-OTBC A X-X-XX Y-Y- YY VV W SSSSSSSSS ON LINE CPU IN NET RECVR Where: X-X-XX, Y-Y-YY, VV and W are defined In 1 above.	*a.* Previously on-line processor detected decoder special enable signal fault during automatic test and initiated control transfer. Present on-line processor is going through network recovery and will take over central office control. Fault may be transient. **NOTE** **You must interpret the printout to identify the following causes. Paragraph 5-58 explains interpretation of decoder fault printouts.**	*a.* Perform program start-up (para 2-181) on off-line processor. If no decoder fault messages print out, processor may be placed back on-line by performing a manual control transfer (para 2-S18q).
SSSSSSSSS identifies special enable signals generated during address decoding.	b. If SSSSSSSSS indicates bit 8, 9, or 10 errors special enable decoder is faulty.	b. In sequence replace each of following cards. Perform program start-up after each replacement to verify corrective action. (1) A208 (2) A207 (3) A210 (4) A234 (bits 8 and 9 only) (5) A239 (bit 10 only)

Malfunction	**Probable cause**	**Corrective action**
	c. If SSSSSSSSS indicates bit 11 or 12 errors, outlet address register (OAR) may be faulty.	*c.* Test OAR (para 5-57). If OAR passes test, go to step *f*. If OAR fails test replace following cards. Repeat OAR test after each replacement. (1) A216 (2) A219 (3) A217 (4) A215
	d. If SSSSSSSSS indicates bit 13 or 14 errors, OAR may be faulty.	*d.* Test OAR (para 5- 57). If OAR passes test, go to step g. If OAR fails test replace following cards. Repeat OAR test after each replacement. (1) A216 (2) A219 (3) A217 (4) A215
	e. If SSSSSSSSS indicates bit 6 or 7 errors inlet address register (IAR) may be faulty.	*e.* Test IAR (para 5-57). If IAR passes test, go to step *h*. If IAR fails test replace following cards. Repeat IAR test after each replacement. (1) A218 (2) A219 (3) A217 (4) A215
	f. See if there are any outlet group OG errors for faulty paths.	*f.* Perform following:
	(1) OG errors indicate faulty OG decoders.	(1) Replace following cards. Repeat program start-up after each replacement. *(a)* A223 *(b)* A219
	(2) Absence of OG errors indicates faulty special enable circuits.	(2) Replace following cards. Repeat program start-up after each replacement. *(a)* A208 *(b)* A238 *(c)* A207
	g. See if there are any outlet terminal OT errors for faulty paths.	*g.* Perform following:
	(1) OT errors indicate faulty OT decoders.	(1) Replace following cards. Repeat program start-up after each replacement. *(a)* A107 *(b)* A108 *(c)* A220 *(d)* A115 *(e)* A210
	(2) Absence of OT errors indicates faulty special enable decoders.	(2) Replace following cards. Repeat program start-up after each replacement. *(a)* A208 *(b)* A235
	h. See if there are any inlet terminal IT errors for faulty paths.	h. Perform following:
	(1) IT errors indicate faulty OT decorders.	(1) Replace following cards. Repeat program start-up after each replacement. *(a)* A106 *(b)* A108 *(c)* A115 *(d)* A220
	(2) Absence of IT errors indicates faulty special enable decoders.	(2) Replace following cards. Repeat program start-up after each replacement. *(a)* A208 *(b)* A234

Malfunction	Probable cause	Corrective action
3. MAJOR FAULT-CONTROL TRANSFER lit, audio alarm sounds, and printout: DCDR FLT IF-IG-IT OF-OG-OTBC A X-X-XX Y-Y-YY VV W T-T-P ON LINE CPU IN NET RECVR Where: X- X- XX, Y- Y- YY, VV, and W are defined in 1 above. T-T is re-encoded outlet frame and group numbers. P if 0, indicates no parity error in outlet terminal number; if 1, indicates outlet terminal number parity error.	*a.* Previously on-line processor detected decoder outlet address fault during automatic test and initiated control transfer. Present on-line processor is going through network recovery and will take over central office control. Fault may be transient. **NOTE** **Paragraph 5- 58 explains how to interpret decoder fault printouts.**	*a.* Perform program start-up (para 2-18*l*) off-line processor. If no decoder fault messages print out, processor may be placed back on-line by performing a manual control transfer (para 2-18*q*).
	b. Outlet address register (OAR) may be faulty.	*b.* Test OAR (para 5- 57). If OAR passes test, go to step c. If OAR fails test, replace following cards. Repeat program start-up after each replacement to check corrective action. (1) A216 (2) A219 (3) A217 (4) A215
	c. If only fault is P = 1, parity circuit is faulty.	*c.* Replace card A101. Repeat program start-up.
	d. See if first fault reported for path is outlet group (OG) or outlet frame (OF).	*d.* Perform following:
	(1) Initial OG fault indicates faulty OG encoder.	(1) replace following cards. Repeat program start-up after each replacement. *(a)* A228 *(b)* Al15 *(c)* A225 *(d)* A226
	(2) Initial OF fault requires further analysis.	(2) Go to step *e*.
	e. See if there are any special enable errors in bits 8, 9, 10, 11, or 12 of faulty path.	*e.* Perform following:
	(1) If there are no special enable errors, outlet frames (OF) encoder is faulty.	(1) Replace following cards. Repeat program start-up after each replacement. *(a)* A228 *(b)* A124 *(c)* A226
	(2) Special enable errors indicate intermediate OF decoder fault.	(2) Replace following cards. Repeat program start-up after each replacement. *(a)* A203 *(b)* A328 *(c)* A22z *(d)* A110 *(e)* A103
4. MAJOR FAULT-CONTROL TRANSFER lit, audio alarm sounds, and printout: IF-IG-IT OF-OG-OT BC A X-X-XX Y-Y-YY VV W T-T-P ON LINE-CPU IN NET RECVR Where-: X-X-XX, Y-Y- YY, VV, and W are defined in 1 above.	*a.* Previously on-line processor detected decoder inlet address fault during automatic test and initiated control transfer. Present on-line processor in going through network recovery and will take over central office control. Fault may be transient. **NOTE** **Paragraph 5-58 explains how to interpret decoder fault printouts.**	*a.* Perform program start-up (para 2-181) off-line processor. If no decoder fault messages print out, processor may be placed back on-line by performing a manual control transfer (para 2- 18q).

Malfunction	Probable cause	Corrective action
T-T are re-encoded inlet frame and group numbers. P if 0, indicates no parity error in inlet terminal number; if 1, indicates inlet terminal parity error.	*b.* Inlet address register may be faulty.	*b.* Test IAR (para 5-57). If IAR passes, go to step *c*. If IAR fails test, replace following cards. Repeat program start-up after each replacement to check corrective action. (1) A218. (2) A219. (3) A217. (4) A215.
	c. If only fault is P = 1, parity circuit is faulty.	*c.* Replace card A102. Repeat program start-up.
	d. See if first fault reported for path is inlet group (IG) or inlet frame (IF).	*d.* Perform following:
	(1) Initial IG fault indicates faulty IG encoder or decoder.	(1) Replace following cards. Repeat program start-up after each replacement. *(a)* A224. *{b)* A226. *(c)* A124. *(d)* A11S. *(e)* A228.
	(2) Initial OF fault requires further analysis.	(2) Go to step *e*.
	e. See if there are any special enable errors in bits 8, 9, 10, 11, or 12.	*e.* Perform following:
	(1) Absence of special enable errors indicates IF encoder faults.	(1) Replace following cards. Repeat program start-up after each replacement. *(a)* A228. *(b)* A225. *(c)* A124.
	(2) Special enable errors indicate intermediate IF decoder fault.	(2) Replace following cards. Repeat program start-up after each replacement. (*a*) A326. (*b*) A202. (*c*) A221. (*d*) A109. (*e*) A110. *(f)* A201.
5. Decoder fault messages (1 through 4 above) with identical Addresses are printed by both computers.	Address line in network terminal subsystem is shorted.	Refer fault to higher category maintenance.

r. Memory.

Malfunction	Probable cause	Corrective action
1. No program will load.		**NOTE** **All assemblies replaced are in memory A10 or A11. Only reference designator of circuit card assembly is shown below.**
	a. Faulty TCL assembly A10 (clock circuit malfunction).	*a.* Replace TCL assembly A10; then make another attempt to load program.
	b. Faulty DLP assembly A11 (data register clear strobe or inhibit drive switch strobe malfunction).	*b.* Replace DLP assembly A11; then make another attempt to load program.
	c. Faulty processor.	c. Refer malfunction to higher category maintenance.

Malfunction	Probable cause	Corrective action
NOTE **Malfunctions 2 through 9 are based on printouts from offline memory test (para 5-50).**		
2. Error messages indicate write/read malfunction in two or more memory pages.	Faulty DLP assembly A11 (memory data register stage failure).	Replace DLP assembly A11; then repeat test.
3. Error message indicates write/read malfunction in memory page 1.	Faulty DLX assembly A12 (inhibit select switch or sense amplifier malfunction).	Replace DLX assembly A12; then repeat test.
4. Error message indicates write/read malfunction in memory page 2.	Faulty DLX assembly A13 (inhibit select switch or sense amplifier malfunction).	Replace DLX assembly A13; then repeat test.
5. Error message indicates write/read malfunction in memory page 0.	Faulty DLP assembly A11 (inhibit select switch or sense amplifier malfunction).	Replace DLP assembly A11; then repeat test.
6. Data parity error (DPE) messages occur on two or more memory pages.	Faulty DLP assembly A11 (memory data register parity bit stage failure).	Replace DLP assembly A11; then repeat test.
7. Data parity error (DPE) messages occur in memory page 1.	Faulty DLX assembly A12.	Replace DLX assembly A12; then repeat test.
8. Data parity error (DPE) occurs in memory page 2.	Faulty DLX assembly A13.	Replace DLX assembly A13; then repeat test.
9. Data parity error (DPE) occurs in memory page 0.	Faulty DLP Assembly A11.	Replace DLP assembly A11; then repeat test.

s. Maintenance Control Panel

Malfunction	Probable cause	Corrective action
1. During system operation incorrect responses occur when performing operations on maintenance control panel.	1. Faulty maintenance control panel or processor.	1. Switch control central office to other processor (pare 2-18q). Run programmed MCP test (para 6-52) or manual MCP test (para 5-51).
2. During manual MCP testing (para 5-51, 5-52) following errors occur.		
a. Indicator fails to light during lamp test.	*a.* Faulty indicator bulb.	*a.* Replace indicator bulb.
b. All indicators fail to light.	*b.* Fuse blown.	*b.* Check panel fuse.
c. Other manual tests fail.	*c.* Processor fault.	*c.* Refer malfunction to higher category maintenance.
3. While running MPC off-line tests the following printouts may occur before END OF MCP TEST printout. MP XX-YY where XX is 01 through 11 and YY is 01 through 13.	3. Processor fault.	3. Refer malfunction to higher category maintenance.

t. System Status Panel.

Malfunction	Probable cause	Corrective action
1. While performing system alarms test (para 5-64) following failures may occur.		All cards are located in synchronizer assembly A16.
a. Audible sounds but indicator fails to light.	*a.* Lamp driver faulty.	*a.* Replace A154 card, repeat test.
b. Indicators light but audible fails to sound on all tests.	*b.* Audible alarm detector faulty.	*b.* Replace following cards in sequence. Repeat test after each replacement. (1) A251. (2) A250. (3) A248.
c. Indicator fails to light, audible fails to sound, all tests.	*c.* Register select gate faulty.	*c.* Replace A248 card, repeat test.

Malfunction	Probable cause	Corrective action
d. Audible fails to sound any single test.	*d.* Audible alarm latch faulty.	*d.* Replace audible alarm latch card (table 5-1) for alarm tested. Repeat test.
e. Indicator fails to light during any single test.	*e.* System alarm register faulty.	*e.* Replace following cards (table 5-1) in sequence for alarm tested. Repeat test after each replacement. (1) alarm latch (2) alarm gate (3) bus driver
2. Single indicator does not light during lamp test.	*a.* Faulty bulb. *b.* Faulty lamp driver circuit card in A16.	*a.* Replace bulb. *b.* Replace A16A154.
3. All indicators do not light during lamp test.	Faulty fuse.	Check fuse A16F1.

Table 5-1. System Status Panel Card Location in A16

Alarm	Audible alarm latch	Alarm latch	Alarm gate	Bus driver
AC PWR	A235	A237	A234	A233
DC PWR	A235	A237	A234	A233
SDR/RCVR	A238	A240	A236	A233
BUS	A238	A240	A236	A233
CONTROL TRANSFER	A238	A240	A236	A233
RING	A243	A240	A239	A233
TRUNK GROUP	A243	A240	A239	A233
MINOR FAULT	A243	A246	A239	A233
LOCAL PAGE PRINTER	A245	A246	A244	A233
SUPERVISORY ALARM	N/A	A246	A244	A248
REMOTE I/O INHIBIT	N/A	A246	A244	A248
LINE LOAD SET	N/A	A250	A249	A248

u. Off-line Synchronizer Test Printouts.

Malfunction	Probable cause	Corrective action
While running the synchronizer off-'line test, any of the following printouts may occur before the END OF PIO printout.		
1. PIOCS 01-XX where XX is two-digit number.	Processor timeout fault.	Use other processor to control central office. Refer malfunction to higher category maintenance.
2. PIOCS02-01	Data read from paper tape reader (PTR) synchronizer buffer differs from data written into it by test program.	Replace following cards in sequence. Rerun test after each replacement. (1) A16A103 (2) A16A102 (3) A16A101
3. PIOCS03-XX-YYY where XX is 01 through 12, XX and YYY both identify faulty synchronizer. For XX = 77 see 10 below. XX YYY 01 RPP (remote page printer) 02 PTP (paper tape punch) 03 LPP (local page printer) 04 EXR (extra receive) 05 EXT (extra transmit) 06 PTR (paper tape reader) 07 MTM (memory to memory)	Data read from synchronizer YYY buffer differs from data written into it by test program.	Replace following synchronizer YYY cards in sequence (fig. 5-9). Rerun test after each replacement. (1) MOS 3 (2) MOS 2 (3)MOS 1

Malfunction	Probable cause	Corrective action
XX YYY 10 TYR (Teletype receive) 11 TYT (Teletype transmit) 12 FAC (FACP)		
4. PIOCS04-XX-YYY where XX is 01 through 12, refer to 3 above. For XX and YYY. For XX = 77 see 10 below.	Busy bit (BB) failed to set in synchronizer YYY.	Replace synchronizer YYY MOS 2 Card. Rerun test. Find card location in fig. 5-9.
5. PIOCS05-XX-YYY where XX is 01 through 12, refer to 3 above for XX and YYY, for XX = 77 see 10 below.	Busy bit (BB) failed to reset in synchronizer YYY.	Replace synchronizer YYY MOS 2 card. Rerun test. Find card location in fig. 5-9.
6. PIOCS06-XX-YYY where XX is 01 through 12, refer to 3 above for XX and YYY, for XX = 77 see 10 below.	Character ready (CH RDY) failed to set in synchronizer YYY.	Replace synchronizer YYY MOS 2 card. Rerun test. Find card location in fig. 5- 7.
7. PIOCS07-XX-YYY where XX is 01 through 12, refer to 3 above for XX and YYY, for XX = 77 see 10 below.	Character ready (CH RDY) failed to rest in synchronizer YYY.	Replace synchronizer YYY MOS 2 card. Rerun test. Find card location in fig. 5-9.
8. PIOCS08 -XX-YYY-DO = XXX where XX is 01 through 04 XX and XXX identify data sent to synchronizer buffer by test program. For XX = 77 see 10 below. XX XXX 01 200 02 325 03 352 04 277 Refer to 3 above for YYY.	Data read from synchronizer YYY buffer differs from data written into it. Data written was XXX.	Replace the following synchronizer YYY cards in sequence. Rerun test after each replacement. (1) MOS 3 (2) MOS 2 (3) MOS 1
9. PIOCSO9 - XX- FAC where XX is a two-digit number.	Error indicator malfunction in FACP.	Use other processor to control central office. Refer malfunction to higher category maintenance.
10. PIOCS XX TMO AT LOC XXXXX PGE 00 PIOCS XX-77-YYY	Synchronizer YYY did not respond in time when executing instruction at XXXXX during test XX.	Replace synchronizer YYY MOS 2 card. Rerun test. Find card location in figure 5-9.

v. Functional Assignment Control Panel.

Malfunction	Probable cause	Corrective action
1. During normal operation one or more indicators or DRO's may fail to light or extinguish.	*a.* Faulty indicator or DRO.	*a.* Perform FACP lamp test (para 5-4, sequence no. 27 *c-f*).
	b. Faulty FACP circuit.	*b.* Test FACP (para 5- 56).
2. During FACP lamp test one or more of following errors occur.		**NOTE** **All replacements are in FACP A7.**
a. Any single indicator fails to light.	*a.* Defective (1) bulb (2) lamp driver	*a.* Replace (1) bulb, retest (2) lamp driver card for failing indicator or group. Repeat test. Find card location in table 5-3.
b. Any single indicator or group of related indicators fails to light or extinguish.	*b.* Defective lamp driver.	*b.* Replace lamp driver card for failing indicator or group. Repeat test. Find card location in table 5-3.

A2	NOTE 2		A1	NOTE 2	
		01	PTR MOS 1	SM–C–743 893	01
		02	PTR MOS 2	894	02
		03	PTR MOS 3	126	03
		04			04
		05	TYR MOS 1	893	05
		06	TYR MOS 2	894	06
		07	TYR MOS 3	126	07
		08			08
		09	TYT/RPP DRIVER	145	09
		10			10
		11			11
		12	TYT MOS 1	893	12
		13	TYT MOS 2	894	13
		14	TYT MOS 3	126	14
		15	PTR INPUT GATES	231	15
TIMING	SM–C–743 384	16	LOAD RESISTORS	228	16
TIMING GATES	258	17	TYR, EXR, PTR RECEIVERS	231	17
		18	RPP MOS 1	893	18
		19	RPP MOS 2	894	19
CONTROL TRANSFER	585	20	RPP MOS 3	126	20
CONTROL TRANSFER	258	21	LOAD RESISTORS	228	21
CONTROL TRANSFER	581	22	EXR MOS 1	893	22
CONTROL TRANSFER	258	23	EXR MOS 2	894	23
CONTROL TRANSFER	245	24	EXR MOS 3	126	24
CONTROL TRANSFER	581	25			25
		26	EXT DRIVER	145	26
		27	EXT MOS 1	893	27
		28	EXT MOS 2	894	28
		29	EXT MOS 3	126	29
		30			30
		31			31
		32	LPP MOS 1	893	32
ALARM 00-08 GATES	244	33	LPP MOS 2	894	33
ALARM 00-02 GATES	258	34	LPP MOS 3	126	34
ALARM 00-02 LATCHES	258	35			35
ALARM 03-05 GATES	258	36	LPP DRIVER	512	36
ALARM 00-03 LATCHES	239	37	PTP MOS 1	893	37
ALARM 03-05 LATCHES	258	38	PTP MOS 2	894	38
ALARM 07-08 GATES	258	39	PTP MOS 3	126	39
ALARM 04-07 LATCHES	239	40			40
ALARM 00-06 GATES	231	41	PTP DRIVER	512	41
		42	MTM MOS 1	893	42
ALARM 06-08 LATCHES	258	43	MTM MOS 2	894	43
ALARM 09-11 GATES	258	44	MTM MOS 3	126	44
ALARM 09, 11, 12 LATCHES	258	45			45
ALARM 08-11 LATCHES	239	46			46
ALARM 07-13 GATES	231	47			47
ALARM 09-13 GATES	244	48			48
ALARM 12-13 GATES,13 LATCH	258	49			49
ALARM 12-13 LATCHES	239	50			50
ALARM AUDIBLE	242	51			51
		52			52
		53			53
		54	ALARM OUTPUT GATES	250	54

NOTE:

1. EXR	-	SPARE TTY RECEIVE SYNCHRONIZER
EXT	-	SPARE TTY TRANSMIT SYNCHRONIZER
LPP	-	LOCAL PAGE PRINTER SYNCHRONIZER
MTM	-	MEMORY-TO-MEMORY SYNCHRONIZER
PTP	-	PAPER TAPE PUNCH SYNCHRONIZER
PTR	-	PUNCHED TAPE READER SYNCHRONIZER
RPP	-	REMOTE PAGE PRINTER SYNCHRONIZER
TYR	-	REMOTE TTY RECEIVE SYNCHRONIZER
TYT	-	REMOTE TTY SEND SYNCHRONIZER

2. PREFIX ALL NUMBERS IN THIS COLUMN WITH SM–C–743

EL2GV007

Figure 5-9 Synchronizer A16 functional card map.

Malfunction	Probable cause	Corrective action
c. Any DRO or related group of DRO's fail to display selected digit or blank out.	*c.* Defective (1) DRO storage (2) DRO address gate (3) DRO	*c.* Replace (1) DRO storage card. Find card location in table 6-2. Repat test. (2) DRO address gate card Repeat test. (3) DRO. Repeat test.
d. Any group of DRO's fail to display 000 digit.	*d.* Defective DRO bus gates.	*d.* Replace A222 card, repeat test.
e. All DRO's fail to display digits 8 and 9.	*e.* Defective DRO bus or address gates (1) DRO bus-gates (2) DRO address gates	*e.* Replace gate card: (1) A238 card. Repeat test. (2) A221 card. Repeat teat.

Malfunction	Probable cause	Corrective action
f. All DRO's fail to display a digit 0 through 7.	*f.* Defective DRO bus or address gates. (1) DRO bus gates (2) DRO address gates	*f.* Replace gate card: (1) A138 card. Repeat test. (2) A221 card. Repeat test.
g. Any single DRO or group of DRO's fail to display combination of numbers not listed above.	*g.* Defective bus gates.	*g.* Replace A223 card. Repeat test.
3. While running FACP off-line test (para 5 - 56) any of following printouts occur before END of FACP TEST printout.		**NOTE** **All replacements are in FACP A7.**
a. FPO1-XX where XX is 01, 02 or 03.	*a.* Status register fault..	*a.* Replace A230 card. Repeat test.
b. FP01-04	*b.* BB failed to set.	*b.* Replace A230 card. Repeat test.
c. FP02-XX where XX is 01 or 02.	*c.* Status register failed to clear.	*c.* Replace A230 card. Repeat test.
d. FP03-01.	*d.* FACP failed to detect program error.	*d.* Replace following cards in sequence. Repeat test after each replacement. (1) A238 (2) A233 (3) A227 (4) A127 (5) A140
e. FP04-XX where XX is 01 or 02.	*e.* FACP failed to detect program error.	*e*. Replace A140 card. Repeat test.
f. FP04-04	*f.* ERRF failed to reset.	*f.* Replace A230 card. Repeat test.
g. FP05-01	*g.* CH RDY failed to reset.	*g*. Replace A230 card. Repeat test.
h. FP05-02	*h.* Pushbutton entry for CONTINUE failed.	*h*. Replace following cards in sequence. Repeat test after each card replacement. (1) Group 1 for CONTINUE switch. (2) Group 2 for CONTINUE switch. Find card locations in table 5-4.
i. FP05-03	*i.* CH RDY failed to reset.	*i.* Replace A230. Repeat test.
j. FP06-01 Relate this printout to errors during test no. 6 of indicators listed in table 5-18:	*j.* Related to indicator errors recorded during test.	*j.* Replace cards related to errors recorded during test.
(1) DRO correct but indicator failed.	(1) Lamp gates.	(1) Replace following cards in sequence, for failing indicator. Repeat test after each replacement. *(a)* Indicator driver *(b)* Indicator gate *(c)* Field indicator register *(d)* CAR decoder Find card location in table 5-3.
(2) Incomplete DRO display with correct indicator lit.	(2) Address counter.	(2) Replace following cards in sequence. Repeat test after each replacement. *(a)* A240 *(b)* A138 *(c)* A135 *(d)* A136 *(e)* A137 *(f)* A134 *(g)* A140 *(h)* A127
(3) Incorrect DRO display with correct indicator lit and all DRO's lit.	(3) Write buffer.	(3) Replace A123 card. Repeat test.
(4) Incorrect indicator lights and correct display appears in wrong DRO's.	(4) Indicator addressing.	(4) Replace addressing or switch decoding cards.
	(a) Address decoding.	*(a)* Replace following cards in sequence. Repeat test after each replacement. 1 A237 2 A238

Malfunction	Probable cause	Corrective action
		3 A240 4 A243 5 A239
	(b) Switch decoding.	*(b)* Replace following cards in sequence. Repeat test after each card replacement. 1 Group 1 for failing switch. 2 Group 2 for failing switch. 3 Group 3 for failing switch. First card location in table 5-4.
(5) No errors recorded during test.	(5) Counter.	(5) Replace following cards in sequence. Repeat test after each replacement. *(a)* A240 *(b)* A138 *(c)* A135 *(d)* A136 *(e)* A137 *(f)* A134 *(g)* A140 *(h)* A127
k. FP07-01 This printout should only occur when testing ERROR and STORE indicators.	*k.* ERRF failed to set.	*k.* Replace A140 card. Repeat test.
l. FP07-02 Relate this printout to errors recorded during test no. 7 of indicators listed in table 56-19.	*l.* Related to indicator errors recorded during test.	*l.* Replace cards related to error recorded during test.
(1) DRO correct but indicator failed.	(1) Lamp gates.	(1) Replace following cards in sequence, for the failing indicator. Repeat test after each replacement. (*a*) Indicator driver (*b*).Indicator gate (*c*) Field indicator register (*d*) CAR decoder Find card location in table 5- 3.
(2) Incomplete DRO display.	(2) Address counter.	(2) Replace following cards in sequence. Repeat test after each replacement. *(a)* A240 *(b)* A138 *(c)* A135 *(d)* A136 *(e)* A137 *(f)* A134 *(g)* A140 *(h)* A127
(3) Incorrect DRO display with correct indicator lit and all DRO's lit.	(3) Write buffer	(3) Replace A123 card. Repeat test.
(4) Incorrect indicator lights and correct display appears in wrong DRO's.	(4) Indicator addressing.	(4) Replace addressing or switch decoding.
	(a) Address decoding.	*(a)* Replace following cards in sequence. Repeat test after each replacement. 1 A237 2 A238 3 A240 4 A243 5 A239
	(b) Switch decoding.	*(b)* Replace following cards in sequence. Repeat test after each card replacement. *1* Group 1 for failing switch. *2* Group 2 for failing switch. *3* Group 3 for failing switch. Find card location in table 5- 4.
(5) No errors recorded during test.	(5) Address counter	(5) Replace following cards in sequence. Request test after each replacement. *(a)* A240 *(b)* A138 *(c)* A135 *(d)* A136 *(e)* A137 *(f)* A134 *(g)* A140 *(h)* A127

Malfunction	Probable cause	Corrective action
m. FP08-01 PRI TRK GR NO displays 3 digit code.	*m.* Incorrect code entry.	*m.* Repeat test to insure you made correct entry, then replace following cards in sequence. Repeat test after each card replacement. (1) Group 1 for failing switch. (2) Group 2 for failing switch. (3) Group 3 for failing switch. Find card location in table 5-4.
n. FP08-02 Relate this printout to errors recorded during test no. 8 of indicators listed in table 5- 20.	*n.* Related to indicator errors recorded during test.	*n.* Replace cards related to error recorded during test.
(1) DRO correct but indicator failed.	(1) Lamp gates.	(1) Replace following cards in sequence, for the failing indicator. Repeat test after each replacement. *(a)* Indicator driver *(b)* Indicator gate *(c)* Field indicator register *(d)* CAR decoder Find card location in table 5- 3.
(2) Incomplete DRO display.	(2) Address counter.	(2) Replace following cards in sequence. Repeat test after each replacement. *(a)* A240 *(b)* A138 *(c)* A135 *(d)* A136 *(e)* A137 *(f)* A134 *(g)* A140 *(h)* A127
(3) Incorrect DRO Display with correct indicator lit and all DRO's lit.	(3) Write buffer.	(3) Replace A123 card. Repeat test.
(4) Incorrect indicator lights and correct display appears in wrong DRO's.	(4) Indicator addressing. decoding.	(4) Replace addressing or switch
	(a) Address decoding.	*(a)* Replace following cards in sequence. Repeat test after each replacement. 1 A237 2 A238 3 A240 4 A243 5 A239
	(b) Switch decoding.	*(b)* Replace following cards in sequence. Repeat test after each card replacement. 1 Group 1 for failing switch. 2 Group 2 for failing switch. 3 Group 3 for failing switch. Find card location in table 5 - 4.
(5) No errors recorded during test.	(5) Address counter	(5) Replace following cards in sequence. Repeat test after each replacement. *(a)* A240 *(b)* A138 *(c)* A135 *(d)* A136 *(e)* A137 *(f)* A134 *(g)* A140 *(h)* A127
o. FP08-03	*o.* BB failed to set.	*o.* Replace A230 card. Repeat test.
p. FP08-77	*p.* CH RDY failed to set.	*p.* Replace A230 card. Repeat test.
q. FP09-01	*q.* Incorrect digit entry.	*q.* Replace following cards in sequence. Repeat test after each card replacement. (1) Group 1 for failing digit (2) Group 2 for failing digit (3) Group 3 for failing digit Find card location in table 5-4.
r. FP09-02	*r.* Address counter.	*r.* Replace following cards in sequence. Repeat test after each replacement.

Malfunction	Probable cause	Corrective action
		(1) A240 (5)A137 (2) A138 (6) A134 (3) A135 (7) A140 (4) A136 (8) A127
s. FP09-03 Relate this printout to errors recorded during test no. 9 of indicators listed in table 5-21.	*s.* Related to indicator errors recorded during tests.	*s.* Replace cards related to error recorded during test.
(1) Odd digits fail.	(1) Switch decoding.	(1) Replace following cards in sequence. Repeat test after each replacement. *(a)* A114 *(b)* A109
(2) Digits 4, 5, 6, and 7 failing.	(2) Switch decoding.	(2) Replace following cards in sequence. Repeat test after each replacement. *(a)* A103 *(b)* A104
(3) Random digit errors.	(3) Switch decoding.	(3) Replace following cards in sequence. Repeat test after each replacement. *(a)* A103 *(c)* A114 *(b)* A104 *(d)* A109
(4) No errors recorded during test.	(4) Address counter.	(4) Replace following cards in sequence. Repeat test after each replacement. *(a)* A240 *(e)* A137 *(b)* A138 *(f)* A134 *(c)* A135 *(g)* A140 *(d)* A136 *(h)* A127
t. FP09-04	*t.* CH RDY failed to set.	*t.* Replace A230 card. Repeat test.
u. FP10-01 PRI TRK GR NO displays 3 digit code. Relate printout to errors recorded during test no. 10 of indicators listed in table 5- 22.	*u.* Incorrect command entry.	*u.* Repeat test to insure you make the correct entry.
(1) INTCP CALLS OPR fails.	(1) Switch decoding.	(1) Replace following cards in sequence. Repeat test after each card replacement. *(a)* Group 1 for OPR switch. *(b)* Group 2 for OPR switch. *(c)* Group 3 for OPR switch. Find card locations in table 5- 4.
(2) INTCP CALLS INFO fails.	(2) Switch decoding.	(2) Replace following cards in sequence. Repeat test after each card replacement. *(a)* Group 1 for INFO switch. *(b)* Group 2 for INFO switch Find card location in table 5-4.
(3) INTCP CALLS ERROR fails.	(3) Switch decoding.	(3) Replace following cards in sequence. Repeat test after each card replacement. *(a)* Group 1 for ERROR switch. *(b)* Group 2 for ERROR switch. *(c)* Group 3 for ERROR switch. Find card location in table 5-4.
v. FP10-02	*v.* Address counter.	*v.* Replace following cards in sequence. Repeat test after each replacement. (1) A240 (5) A137 (2) A138 (6) A134 (3) A135 (7) A140 (4) A136 (8) A127
w. FP10-77	*w.* CH RDY failed to set.	*w.* Replace A230 card. Repeat test.

DRO		DRO address	DRO store	Address gate
TERMINAL NO	UNITS	4A0	A211	A202
	TENS	4A1	A211	A202
	HUNDREDS	4A2	A211	A202
	THOUSANDS	4A3	A211	A202
TERMINAL TYPE	UNITS	2A0	A207	A216
	TENS	2A1	A207	A216
CLASSCODE	UNITS	2B0	A207	A216
	TENS	2B1	A207	A216
DIR NO/TRK GP NO	UNITS	3A0	A208	A218
	TENS	3A1	A209	A218
	HUNDREDS	3A2	A209	A219
CONF/GR MIN CT	UNITS	2C0	A207	A217
	TENS	2C1	A208	A217
MODE II TERM NO	UNITS	4B0	A212	A203
	TENS	4B1	A212	A203
	HUNDREDS	4B2	A212	A203
	THOUSANDS	4B3	A212	A203
SPCL CKT NO/PR NO/SL NO	UNITS	2D0	A208	A217
	TENS	2D1	A208	A217
STATUS/LINE GR NO/ALTN	UNITS	2EO	A208	A218
SL NO	TENS	2E1	A208	A218
FUNCTION CODE/RANK		1A0	A207	A202
PRI TRK GP NO	UNITS	3B0	A209	A219
	TENS	3B1	A209	A219
	HUNDREDS	3B2	A209	A219
ALTN TRK GP NO	UNITS	3C0	A209	A204
	TENS	3C1	A211	A204
	HUNDREDS	3C2	A211	A203
FIXED DIR NO/TRFC CNT	UNITS	5A0	A212	A204
	TENS	5A1	A212	A204
	HUNDREDS	5A2	A213	A204
	THOUSANDS	5A3	A213	A204
	TEN THOUSANDS	5A4	A213	A206
PR- SL-XXX/NNX-XXXX	SL UNITS	7A4	A214	A206
	SL TENS	7A5	A214	A206
	SL HUNDREDS	7A6	A214	A206
	NN UNITS	7A0	A213	A205
	TENS	7A1	A213	A205
	HUNDREDS	7A2	A213	A205
	THOUSANDS	7A3	A214	A205

Table 5-3. FACP Indicator Card Replacement

Indicator	Indicator address	Lamp driver	Lamp gate	Field indicator register	CAR decoder
TERMINAL NO	ID 204	A153	A149		
TERMINAL TYPE	ID 202	A152	A150		
CLASSCODE	ID 212	A152	A150		
DIR NO	ID 203	A153	A149		
TRK GR NO	ID 213	A153	A149		
CONF	ID 222	A152	A150		
GR MIN COUNT	ID 242	A152	A150		
MOD II TERM NO	ID 214	A153	A148		
SPCL CKT NO	ID 252	A152	A150		

Indicator	Indicator address	Lamp driver	Lamp gate	Field indicator register	CAR decoder
PR NO	ID 262	A152	A160		
SL NO	ID 272	A152	A150		
STATUS	ID 302	A153	A150		
LINE GR NO	ID 232	A152	A150		
ALTN SL NO	ID 312	A153	A151		
FUNCTION CODE	ID 201	A152	A161		
RANK	ID 211	A152	A151		
PRI TRK OR NO	ID 223	A153	A149		
ALT TRK GR NO	ID 233	A153	A149		
FIXED DIR NO/TRFC CNT	ID 205	A153	A148		
PR-SL.XXX/NNX.XXXX	ID 207	A153	A148		
READY	ID 220	A152	A149		
ERROR	ID 230	A152	A148		
STORE	ID 240	A152	A148		
READER TO TTY		A152		A144	
READER TO SPTTY		A162		A144	
READER TO PUNCH		A152		A144	
INTCP CALLS ENTER		A152		A146	

Table 5-4. FACP Pushbutton Card Replacement

Pushbutton	Code	Group 1	Group 2	Group 3
READER TO TTY	041	A113,A103,A114,A108	A109,A133	-
READER TO SPTTY	042	A113,A103,A114,A108	A107,A104,A109	-
READER TO PUNCH	043	A113,A103,A114,A108	A107,A104,A109	A133
PRINT	044	A113,A103,A114,A108	A107,A104	A109,A133
PUNCH	045	A113,A103,A114,A108	A107,A104	-
PRINT STOP	046	A113,A103,A114,A108	A107,A104	-
PUNCH STOP	047	A113,A103,A114,A108	A107,A104	A109,A133
ASSIGN	101	A132,A133,A114	A109	
CHANGE	102	A132,A133,A114	A107,A103,A104,A108	-

Pushbutton	Code	Group 1	Group 2	Group 3
DELETE/RESET	103	A132,A133, A114	A107,A103, A104,A108	A109
DISPLAY	104	A132,A133, A114	A107,A103, A104,A108	-
FACP CLEAR	105	A132,A133, A114	A107,A103, A104,A108	A109
FIELD CLEAR	106	A132,A133, A114	A107,A103, A104,A108	-
STORE AND REPEAT	107	A132,A133, A114	A107,A103, A104,A108	A109
STORE	110	A132,A133, A114	A113,A109, A108	-
CONTINUE	111	A132,A133, A114	A113,A109, A108	-
TERMINAL SERVICE	141	A132,A133, A114	A113,A103, A108	A109
TERMINAL NO ASGMT	142	A132,A133, A114	A113,A103, A108	A107,A104
DIRECTORY NO ASGMT	143	A132,A133, A114	A113,A103, A108	A107, A104, A109
TRK GR NO	144	A132,A133, A114	A113,A103, A108	A107,A104
PR ROUTING	145	A132,A133, A114	A113,A103, A108	A107,A104, A109
SL ROUTING	146	A132,A133, A114	A113,A103, A108	A107,A104
ALTN SL ROUTING	147	A132,A133, A114	A113,A103, A108	A107,A104, A109
OP/JXX ROUTING	150	A132,A133, A114	A113,A103, A108,A109	-
FIXED DIR ROUTING	151	A132,A133, A114	A113,A103, A108,A109	-
PRST CONF ENTRY	152	A132,A133, A114	A113,A103, A108,A109	A107,A104
LINE GR ENTRY	153	A132,A133, A114	A113,A103, A108,A109	A107,A104
DAC ROUTING	154	A132,A133, A114	A113,A103, A108,A109	A107,A104
TRUNK TEST	155	A132,A133, A114	A113,A103, A108,A109	A107,A104
STATUS	156	A132,A133, A114	A113,A103, A108,A109	A107,A104
TRAFFIC METERS	157	A132,A133, A114	A113,A103, A108,A109	A107,A104
TRK GR METERS	160	A132,A133, A114	A113,A103, A108	-
REMOTE I/O INHIBIT	201	A132,A103, A108	A109,A133, A114	-
LINE LOAD	202	A132,A103, A108	A107,A104	-
INTCP CALLS 0PR	203	A132,A103, A108	A107,A104	A109,A133, A114
INTCP CALLS INFO	204	A132,A103, A108	A107,A104	-

Pushbutton	Code	Group 1	Group 2	Group 3
INTCP CALLS ERRROR	205	A132,A103, A108	A107,A104	A109,A133 A114
ENTER	210	-	-	-
0	240	-	-	-
1	241	A132,A103, A108	A109,A133, A114	-
2	242	A132,A103, A108	A107,A104	-
3	243	A132,A103, A108	A107,A104	A109,A133, A114
4	244	A132,A103, A108	A107,A104	-
5	245	A132,A103, A108	A107,A104	A109,A133, A114
6	246	A132,A103, A108	A107,A104	-
7	247	A132,A103, A108	A107,A104	A109,A133, A114
8	250	A132,A103, A108	A113,A109	-
9	251	A132,A103, A108	A113,A109	A133,A114

W. Off-line Remote Devices.

Malfunction	Probable cause	Corrective action
1. While running remote devices off-line test 4 (para 5-54) printing errors may be observed on device associates with synchronizer A.		**NOTE** **For all replacements listed below figure 5- 9 identifies MOS cards for specific synchronizers. Table 5-6 identifies driver and receiver cards and modem modules. Some modem keyer and converter faults may be corrected by adjustment by higher category maintenance.**
a. Printing errors accomplished by error message.	*a.* Transmit failure.	*a.* Refer to error message (3 below).
b. Printing errors not accompanied by error message.		
(1) Configuration no. 7.	(1) Data transmit failure.	(1) Replace following cards in LPP data path. Repeat test after each replacement. *(a)* MOS3 *(b)* Driver
(2) Configuration no. 1-6.	(2) Requires further testing.	(2) Run test 11.
2. While running remote devices off-line test 12 (para 5-54) printing errors may be observed on device associated with synchronizer B.	2. Input or output data transfer.	2. Isolate error to input or output.
	a. Input data transfer.	*a.* Replace service A modem. Repeat test.
	b. Output data transfer.	*b.* Replace device B modem. Repeat test;
3. While running remote devices off-line test (para 5-54) any of following printouts may occur before END TEST printout.		

Malfunction	Probable cause	Corrective action
a. IODVA-XX-XXX where XX = 01 or 02 and XXX = 001 or 002.	*a.* Status register failed.	*a.* Replace MOS2 card synchronizer A. Repeat test.
b. IODVA-XX AT LOC XXXXXX PGE 00 IODVA-XX-077 where XX = 01, 02 or 03 and XXXXXX identifies an address in memory page 0.	*b.* Synchronizer A did not respond in time when executing instruction at XXXXXX.	*b.* Replace MOS2 card synchronizer A. Repeat test.
c. IODVA-03-XXX where XXX is 000, 125, 252 or 377 and represents data sent to buffer register by test program.	*c.* Data read from synchronizer A buffer register differs from data written. Data written was XXX.	*c.* Replace following synchronizer A cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2 (3) MOS1
d. IODVA- 04- XXX. With CODE SELECT switches set to ASCII XXX = 001 through 203 and identifies ASCII character which failed. With switches set to 75 BAUD XXX - 001 through 037 and identifies Baudot character which failed. Finding failing character in table 5- 5.	d. Data read from synchronizer A buffer register differs from data written. Data written is identified by XXX.	d. Replace MOS3 synchronizer A.
e. IODVA-04-775	*e.* Incorrect timing for full ASCII or BAUDOT table.	*e.* Replace following cards in sequence. Repeat test after each replacement. (1) MOS3 synchronizer A (2) A7A216
f. IODVA-04-776	*f.* Incorrect timing for single character.	*f.* Replace following cards in sequence. Repeat test after each replacement. (1) MOS3 synchronizer A (2) A16A216
g. IODVA- 04-TMOAT LOC XXXXXX PGEOO IODVA- 04- 777 where XXXXXX identifies an address in memory page 00.	*g.* Synchronizer A did not respond in time when executing instruction at XXXXXX.	*g.* Replace MOS2 card synchronizer A. Repeat test.
h. IODVB-XX-XXX where XX = 05 or 06 and XXX = 001 or 002.	*h.* Status register failed.	*h.* Replace MOS2 card synchronizer B. Repeat test.
i. IODVB-XX-TMO AT LOC XXXXXX PGE 00 IODVB- XX-077 where XX = 05, 06 or 07 and XXXXXX identifies an address in memory page 0.	*i.* Synchronizer B did not respond in time while executing instruction at XXXXXX.	*i.* Replace MOS2 card synchronizer B. Repeat test.
j. IODVB-07-XXX where XXX = 000, 125, 252 or 377 and represents data sent to buffer register by test program.	*j.* Data read from synchronizer differs from data written. Data written was XXX.	*j.* Replace following synchronizer B cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2 (3) MOS1
k. IODVB- 08- XXX where XXX = 001 or 003.	*k.* Status register failed.	*k.* Replace MOS2 card synchronizer B. Repeat test.
l. IODVB-08-002 (1) Test 4 failed. (2) Test 4 did not fail.	*l.* Related to results of test 04. (1) Refer to test 4. (2) Interrupt failure.	*l.* Relate to results of test 04. (1) Perform corrective action required for test 4 failure (1 above). (2) Replace following device B cards in sequence. Repeat test after each replacement. *(a)* MOS3 *(b)* MOS2 *(c)* Receiver *(d)* Modem

Malfunction	Probable cause	Corrective action
m. IODVB-08-TMO-AT LOC XXXXXX PGEOO where XXXXXX identifies an address in memory page 0.	*m*. Illegal interrupt.	*m*. Replace following synchronizer B cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2
n. IODVB-XX-TMD AT LOC XXXXXX PGEOO IODVB- XX- 077 where XX = 08, 09 or 10 and XXXXXX identifies an address in memory page 0.	*n*. Synchronizer did not respond in time when executing instruction at location XXXXXX. (2) MOS2 synchronizer B	*n*. Replace following cards in sequence. Repeat test after each replacement. (1) MOS2 synchronizer A
o. IODVB-09-001	*o*. Related to result of test 4.	*o*. Related to result of test 4.
(1) Test 4 failed.	(1) Refer to test 4.	(1) Perform corrective action required for test 4 failure (1 above).
(2) Test 4 did not fail.	(2) Character lost (CHLST) failed.	(2) Replace the following device B cards in sequence. Repeat after each replacement. *(a)* MOS3 *(b)* MOS2 *(c)* Receiver *(d)* Modem
p. IODVB-09-002	*p*. Status register failed.	*p*. Replace MOS2 card synchronizer B. Repeat test.
q. IODVB-01-001	*q*. Related to result of test 4.	*q*. Related to result of test 4.
(1) Test 4 failed	(1) Refer to test 4.	(1) Perform corrective action required for test 4 failure.
(2) Test 4 did not fail.	(2) Read timing error failed.	(2) Replace following device B cards in sequence. Repeat test after each replacement. *(a)* MOS3 *(b)* MOS2 *(c)* Receiver *(d)* Modem
r. IODVB-10-002 Repeat test.	*r*. Status register failed.	*r*. Replace MOS2 card synchronizer B.
s. IODVB- 11- XXX. With CODE SELECT switches set to ASCII XXX = 001 through 203 and identifies ASCII character which failed with the switches set to 75 BAUD XXX = 001 through 037 and identifies Baudot character which failed. Find failing character in table 5-5.	*s*. Related to result of test 4.	*s*. Related to result of test 4.
(1) Test 4 failed.	(1) Refer to test 4.	(1) Perform corrective action required for test 4 failure (1 above).
(2) Test 4 did not fail.	(2) Data transfer failure.	(2) Replace following device B cards in sequence. Repeat test after each replacement. *(a)* MOS3 *(c)* Receiver *(b)* MOS2 *(d)* Modem
t. IODVB-XX-774 where XX = 11 or 12.	*t*. Status register failed.	t. Replace following cards in sequence. Repeat test after each replacement. (1) MOS2 synchronizer B (2) MOS2 synchronizer A
u. IODVB-11- 776 *u*. Timing error.	*u*. Replace following cards in sequence.	Repeat test after each replacement. (1) MOS1 synchronizer B (2) MOS3 synchronizer B (3) A7A216 (4) MOS1 synchronizer A (5) MOS3 synchronizer A

Malfunction	Probable cause	Corrective action
v. IODVB-XX-TMO at LOC XXXXXX PGEOO IODVB-XX- 777 where XX = 11 or 12.	*v*. Synchronizer did not respond in time when executing instruction at location XXXXXX.	*v*. Replace following cards in sequence. Repeat test after each replacement. (1) MOS2 synchronizer B (2) MOS2 synchronizer A

Table 5-5. Remote Devices Tests 4 and 11 ASCII Baudot Code Printouts

XXX	ASCII	Baudot Key	XXX	ASCII	XXX	ASCII	XXX	ASCII
001	NUL	A	047	+	116	M	163	P
002	SOH	B	050	.	117	N	164	Q
003	STX	C	051	(	120	O	165	R
004	ETX	D	052	)	121	P	167	S
005	EOT	E	053	*	122	Q	170	T
006	ENQ	F	054	+	123	R	171	U
007	ACK	G	055	,	124	S	172	V
010	BEL	H	056	-	125	T	173	W
011	BS	I	057	•	126	U	174	X
012	HT	d	060	1	127	V	175	Y
013	LF	K	061	0	130	W	176	Z
014	VT	L	062	1	131	X	177	(
015	FF	M	063	2	132	Y	200	/
016	CR	N	064	3	133	Z	201	)
017	SO	O	065	4	134	(	202	
020	S	P	066	5	135	1	203	DEL
021	DLE	Q	067	6	136	)		
022	W1	R	070	7	137			
023	W2	S	071	8	140	-		
024	DC3	T	072	9	141			
025	DC4	W	073	0	142	a		
026	NAK	V	074		143	b		
027	SYN	W	075	)	144	c		
030	ETB	X	076	=	145	d		
031	CAN	Y	077	,	146	e		
032	EM	Z	100		147	F		
033	SUB	LETTERS SHIFT	101		150	CR		
034	ESC	FIGURES SHIFT	102	A	161	LF		
035	FS	SPACE	103	B	152	G		
036	GS	CARRIAGE RETURN	104	C	153	H		
037	RS	LINE FEED	105	D	154	I		
040	US		106	E	155	J		
041	SP		107	F	156	K		
042	-		110	G	157	L		
043			111	H	160	M		
044	=		112	I	161	N		
045	$		113	J	162	O		
046	(		114	K				
		1	115	L				

Synchronizer	Driver Cards	Receiver Cards	Modem Modules
TYR		A16A109, A16A117, A16A116	A13A1
TYT	A16A109	A13A2	
RPP	A16A109	A13A3	
EXT	A16A126	A13A4	
EXR		A16A126, A16A117, A16A116	A13A5
LPP	A16A136		
PTP	A16A141		
PTR		A16A116, A16A117, A16A115	

x. Off-line Paper Tape Reader/Paper Tape Punch.

Malfunction	Probable cause	Corrective action
1. While running PTP off-line test (para 5-55d) errors may be observed on the punched tape.		Find MOS card location in figure 5-9. Find driver/receiver card location in table 5-6.
a. Punch errors accompanied by error message.	*a.* Refer to error message.	*a.* Refer to error message.
b. Punch errors not accompanied by error message.	*b.* Output timing, driver, or PTP.	*b.* Replace the following in sequence. Repeat test after each replacement. (1) PTP synchronizer MOS3 card. (2) PTP Driver cards (3) Paper tape punch.
2. While running PTR/PTP off-line test (para 5-55*c* and *d*), any of the following printouts may occur before END OF PT printout.		
a. Set WSR to CHAR.	*a.* WORD SWITCH REGISTER not set properly for PTR timing test.	*a.* Set tape format code in WORD SWITCH REGISTER bits 14- 23 from table 5-15 and press INITIATE.
b. PT XX-01 where XX is 01, 02 or 03.	*b.* Status register failed.	*b.* Replace following PTR synchronizer cards in sequence. Repeat test after each replacement. (1) MOS2 (2) MOS3
c. PT XX- 02 where XX is 01, 02 or 03.	*c.* PTR not ready.	*c.* Check reader for tape and position of LOOP/REEL switch. (1) Replace PTR synchronizer MOS2 card. Repeat test. (2) Replace PTR. Repeat test.
d. PT XX-03 where XX is 02 or 04.	*d.* Status register failed.	*d.* Replace following PTR synchronizer cards in sequence. Repeat test after each replacement. (1) MOS2 (2) MOS3
e. PT XX-01 where XX is 04 or 05. LOOP/REEL switch.	*e.* PTR not ready.	*e.* Check reader for tape and position of (1) Replace PTR synchronizer MOS2 card. Repeat test. (2) Replace PTR. Repeat test.
f. PT 04 - 02.	*f.* Buffer register failed to clear.	*f.* Replace following PTR cards in sequence. Repeat test after each replacement. (1) MOS3

Malfunction	Probable cause	Corrective action
		(2) MOS2 (3) MOS1
g. PT 04 - 04.	*g*. PTR not ready.	*g*. Check reader for tape and position of LOOP/REEL switch. (1) Replace PTR synchronizer MOS2 card. Repeat test. (2) Replace PTR. Repeat test.
h. PT 05 - 02.	*h*. Status register failed.	*h*. Replace following PTR synchronizer cards in sequence. Repeat test after each replacement. (1) MOS2 (2) MOS3
i. PT 05 - XX where XX is 03, 04, 05 or 06.	*i*. Data read from PTR synchronizer buffer differs from data written into it by test program. Data written was as follows: XX = 03 data was 377 XX = 04 data was 252 XX = 05 data was 125 XX = 06 data was 000	*i*. Replace following PTR synchronizer cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2 (3) MOS1
j. PT 06 - XX where XX is 01 or 08.	*j*. CH RDY set too fast.	*j*. Replace following PTR synchronizer cards in sequence. Repeat after each replacement. (1) MOS3 (2) MOS2
k. TE PTR TOOK AAAA MS FOR CH RDY to SET. PT 06 - XX where XX is 02, 09 or 77, and AAAA is actual time between characters received.	*k*. CH RDY failed to set within allotted time.	*k*. Replace following in sequence. Repeat test after each replacement. (1) Receiver cards (2) PTR synchronizer MOS3 card (3) PTR synchronizer MOS2 card (4) Paper tape reader
l. PT 06 - XX where XX is 05 or 10.	*l*. Status register failed.	*l*. Replace following PTR synchronizer cards in sequence. Repeat test after each replacement. (1) MOS2 (2) MOS3
m. PT 06 - 07	*m*. No start character received. (1) Data buffer. (2) PTR error.	*m*. Check tape to ensure start character (377) is present and passed under read head. (1) Replace PTR synchronizer MOS3 card. Repeat test. (2) Replace PTR. Repeat test.
n. PTR READ ERROR DATA XXX DATA EXPECTED YYY DELAY ZZZ MS PT06 - 12 where XXX is format code for character read and YYY is format code for character expected. ZZZ is actual delay between characters received. Find XXX and YYY for ASCII codes in table 5-5.	*n*. Format selection, data input or PTR. (1) Data input (2) PTR error.	*n*. Check that format selection (WSR 14-23) is correct for tape being read. (1) Replace following PTR cards in sequence. Repeat test after each replacement. (*a*) Receivers (*b*) MOS3 (*c*) MOS1 (2) Replace PTR. Repeat test.
o. PT XX - 01 where XX is 07, 08, 09, 10 or 11.	*o*. Status register failed.	*o*. Replace following PTP synchronizer cards in sequence. Repeat test after each replacement. (1) MOS2 (2) MOS3
p. PT 08-02	*p*. Status register failed.	*p*. Replace following PTP synchronizer cards in sequence. Repeat test after each replacement.

Malfunction	Probable cause	Corrective action
		(1) MOS2 (2) MOS3
q. PT 10-02	*q*. Buffer register failed to clear.	*q*. Replace following PTP synchronizer cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2 (3) MOS1
r. PT 10 - 03	*r*. Status register failed.	*r*. Replace following PTP synchronizer cards in sequence. Repeat test after each replacement. (1) MOS2 (2) MOS3
s. PT 11 - XX where XX is 02, 03, 04 or 05.	*s*. Data read from PTP synchronizer buffer differs from data written into it by test program. Data written was as follows: XX = 02 data was 377 XX = 03 data was 252 XX = 04 data was 125 XX = 05 data was 000	*s*. Replace following PTP synchronizer cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2 (3) MOS1
t. PT 12 - XX where XX is 01 or 02.	*t*. Timing error	*t*. Replace following PTP synchronizer cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2
u. PT 13 - 01	*u*. PTR not ready.	*u*. Check reader for tape and position of LOOP/REEL switch. (1) Replace PTR synchronizer MOS2 card. Repeat test. (2) Replace PTR. Repeat test.
v. PT 13 - XX where XX is 02 or 08.	*v*. CH RDY set too fast.	*v*. Replace following PTR synchronizer cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS2
w. PTR READ ERROR DATA XXX DATA EXPECTED YYY DELAY ZZZ MS PT 13 - 03 where XXX is format code for character read and YYY is format code for character expected, ZZZ is actual delay between characters received. Find XXX and YYY for ASCII characters in table 5- 5.	*w*. Format selection, data input or PTR. (1) Data input. (2) PTR error.	*w*. Check that format selection (WSR 14- 23) is correct for tape being read. (1) Replace following PTR cards in sequence. Repeat test after each replacement. (*a*) Receivers (*b*) MOS3 (*c*) MOS1 (2) Replace PTR. Repeat test.

y. Off-line Memory-to-Memory

Malfunction	Probable cause	Corrective action
1. During memory-to-memory testing (para 5-49) REC PROC IDLE may be printed by printed B.		
a. Processor A is not halted.	*a*. Tag not received from Processor A.	*a*. Replace following A16 cards in sequence (fig. 5-9). Repeat test after each replacement. (1) MOS3

Malfunction	Probable cause	Corrective action
		(2) MOS1 (3) MOS2
b. Processor B halted.	*b*. Waiting for entry.	*b*. Check PEX for halt location. Make entry if required. Press INITIATE. If error occurs or program fails to continue, halt both processors and restart test.
2. While assigning processors (para 5-49*c*). CPS 23 fails to set in either processor.	1. Control transfer logic.	1. Replace following synchronizer A16 cards in sequence (fig. 5-9). Repeat test after each replacement. (1) A225 (2) A222 (3) A223 (4) A224
3. While running memory-to-memory test (para 5- 49) any of following printouts may occur prior to END OF MEM-MEM XFR TEST printout.		**NOTE** Card replacements refer to memory-memory synchronizer. Find card location in figure 5- 9, all cards are in A16.
a. MMMT XX-YY where XX = 01 through 04 and YY = 01 or 02.	*a*. Status register failed.	*a*. Replace MOS2 card. Repeat test.
b. MMMT 05-01	*b*. Data buffer failed to clear.	*b*. Replace following cards in sequence. Rerun test after each replacement. (1) MOS3 (2) MOS1
c. MMMT 05-02	*c*. Command decoding.	*c*. Replace MOS2 card. Repeat test.
d. MMMT XX-01 where XX is 06 or 07.		*d*. Command decoding.
e. MMMT-XX-02 where XX is 06 or 07.	*e*. Data read buffer register differs from data written. Data written was: XX = 06 data was 377. XX = 07 data was 000.	*e*. Replace following cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS1
f. MMMT-XX-01 where XX is 10, 11, 12 or 13.	*f*. Data returned from processor B differs from data sent by processor A. Data sent was: XX = 10 data was 377. XX = 11 data was 252. XX = 12 data was 125. XX = 13 data was 000.	*f*. Replace following cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS1
g. MMMT-XX-77 where XX is 10, 11, 12 or 13.	*g*. Processor B did not accept data.	*g*. Replace MOS2 card. Repeat test.
h. MMDR-01 (reported by processor B)	*h*. Data received by processor B differs from data expected. Data expected was 377, 252, 125 and 000 in that order.	*h*. Replace following cards in sequence. Repeat test after each replacement. (1) MOS3 (2) MOS1
i. MMDR-76 (reported by processor B)	*i*. Processor A failed to send character to buffer register.	*i*. Replace MOS2 card. Repeat test.
j. MMMT14-XX	*j*. Attempt to send a block of data containing 22 transmissions of 377,	*j*. Refer to XX condition.

Malfunction	Probable cause	Corrective action
	252, 125 and 000. How processor A to processor B failed.	
(1) Where XX is 74 or 75.	(1) Processor B failed to accept data.	(1) Replace MOS2 card. Repeat test.
(2) Where XX is 76.	(2) Processor B failed to return data.	(2) Replace MOS2 card. Repeat test.
(3) Where XX is 77.	(3) Data returned from processor B differs from data sent by processor A.	(3) Replace following cards in sequence. Repeat test after each replacement. (*a*) MOS3 (*b*) MOS1
m. MMBL-XX (reported by processor B)	*m*. Attempt by processor B to receive and return a block of data containing 22 transmissions of 377, 252, 125 and 000 failed.	*m*. Refer to XX condition.
(1) Where XX is 74	. (1) Processor A did not accept returned data.	(1) Replace MOS2 card. Repeat test.
(2) Where XX is 76.	(2) Processor A failed to send data.	(2) Replace MOS2 card. Repeat test.
(3) Where XX is 77. ment.	(3) Data received by processor B differs from data expected.	(3) Replace following cards in sequence. Repeat test after each replace- (*a*) MOS3 (*b*) MOS1
4. While running control transfer test (para 5-49*h*) any of following printouts may occur prior to END OF CTL XFR TEST printout.		**NOTE** Find system alarm card location in in table 5-1. All cards located in synchronizer A16 (fig. 5-9).
a. CT01-XX where XX is 01 through 04.	*a*. Processor A control transfer logic.	*a*. Refer malfunction to higher category maintenance.
b. CT01-05	*b*. Alarm register.	*b*. Replace following system alarm cards in sequence. Repeat test after each replacement. (1) Remote I/O inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (2) Line load set alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers.
c. CT02-XX where XX is 01 through 05.	*c.* Control transfer logic processor A failed during automatic control transfer processor A to processor B.	*c*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
d. CT02-06 inhibit alarm cards in sequence. Repeat test after each replacement.	*d.* Alarm register.	*d*. Replace following Remote I/O

Malfunction	Probable cause	Corrective action
		(1) Alarm latch. (2) Alarm gate. (3) Bus drivers.
e. CT03-XX where XX is 06, 07, or 10. transfer processor B to processor A.	*e*. Control transfer logic. Processor A failed during automatic control ment.	*e*. Replace following cards in sequence. Repeat test after each replace- (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
f. CT03-11	*f*. Alarm register.	*f*. Replace following system alarm cards in sequence. Repeat test after each replacement. (1) Line load set alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (2) Remote I/O inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (3) Spare alarm. (*a*) A247 (*b*) A248 (*c*) A249 (*d*) A250
g. CT04-XX where XX is 01 through 03.	*g*. Processor A control transfer logic.	*g*. Refer malfunction to higher category maintenance.
h. CT04-04	*h*. Alarm register.	*h*. Replace following system alarm cards in sequence. Repeat test after each replacement. (1) Spare alarm. (*a*) A247 (*b*) A248 (*c*) A249 (*d*) A250 (2) Remote I/O inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (3) Line load set alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers.
i. CT04-77	*i*. Automatic control transfer inhibit logic processor A.	*i*. Replace A222 card. Repeat test.
j. CT05-XX where XX is 01 through 04.	*j*. Control transfer logic Processor A failed during manual control transfer processor A to processor B.	*j*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
k. CT05-05	*k*. Alarm register.	*k*. Replace following system alarm cards in sequence. Repeat test after each replacement.

Malfunction	Probable cause	Corrective action
		(1) Line load set alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus driver. (2) Remote I0 inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus driver. (3) Spare alarm (*a*) A247 (*b*) A248 (*c*) A249 (*d*) A250
l. CT06-XX where XX is 06, 07, or 10.	*l*. Control transfer logic. Processor A failed during manual control transfer processor B to processor A.	*l*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
m. CT06-11	*m*. Alarm register.	*m*. Replace following system alarm cards in sequence. Repeat test after each replacement. (1) Remote I/O inhibit alarm. (a) Alarm latch. (b) Alarm gate. (c) Bus driver. (2) Spare alarm. (a) A247 (b) A248 (c) A249 (d) A250
n. CT07-XX where XX is 70 or 71. This printout occurs only when WORD SWITCH REGISTER bit 3 option is selected. (1) A224	*n*. Control transfer logic processor A.	*n*. Replace following cards in sequence. Repeat test after each replacement. (2) A221 (3) A223 (4) A222 (5) A220
o. MMAC-XX (reported by processor B) where XX is 07, 10 or 11.	*o*. Control transfer logic processor B during automatic control transfer processor A to processor B.	*o*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
p. MMAC-12 (reported by processor B)	*p*. Alarm register.	*p*. Replace following remote I/O inhibit alarm cards in sequence. Repeat test after each replacement. (1) Alarm latch. (2) Alarm gate. (3) Bus drivers.
q. MMAC-XX (reported by processor B) where XX is 13 through 15.	*q*. Automatic control transfer inhibit logic processor B.	*q*. Replace A222. Repeat test.
r. MMAC-16 (reported by processor B). inhibit alarm cards. Repeat test after each replacement.	*r*. Alarm register.	*r*. Replace following remote I/O (1) Alarm latch. (2) Alarm gate. (3) Bus drivers.

Malfunction	Probable cause	Corrective action
s. MMRC-XX (reported by processor B) where XX is 01 through 05.	*s.* Control transfer logic processor B during automatic control transfer processor B to processor A.	*s.* Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
t. MMRC-06 cards in sequence. Repeat test after each replacement.	*t.* Alarm register.	*t.* Replace following system alarm (1) Line load set alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (2) Remote I/O inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (3) Spare alarm. (*a*) A247 (*b*) A248 (*c*) A249 (*d*) A250
u. MMC-XX (reported by processor B) where XX is 06, 07 or 10.	*u*. Control transfer logic processor B during manual control transfer processor A to processor B.	*u*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223. (4) A222 (5) A220
v. MMC-11 (reported by processor B)	*v*. Alarm register.	*v*. Replace following system alarm cards in sequence. Repeat test after each replacement. (1) Line load set alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (2) Remote I/O inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers. (3) Spare alarm. (*a*) A247 (*b*) A248 (*c*) A249 (*d*) A250
w. MMRM-XX (reported by processor B) where XX is 01 through 04.	*w*. Control transfer logic processor B during manual control transfer processor B to processor A.	*w*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220
x. MMRM-05 (reported by processor B)	*x*. Alarm register.	*x*. Replace following system alarm cards in sequence. Repeat test after each replacement. (1) Remote I/O inhibit alarm. (*a*) Alarm latch. (*b*) Alarm gate. (*c*) Bus drivers.

Malfunction	Probable cause	Corrective action
		(2) Spare alarm. (a) A247 (b) A248 (c) A249 (d) A250
y. MMAT-XX (reported by processor B) where XX is 70 or 71. This printout occurs only when WORD SWITCH REGISTER bit 3 option is selected.	*y*. Control transfer logic processor B.	*y*. Replace following cards in sequence. Repeat test after each replacement. (1) A224 (2) A221 (3) A223 (4) A222 (5) A220

z. Tape Winder.

Malfunction	Probable cause	Corrective action
1. Tape winder fails to start when brake lever is pulled out.	Switch S1, S2, or motor M1 defective.	Check to insure that ac power is present and that the plug is properly seated in utility receptacle J9. Check fuse Fl. When trouble persists, replace switch 81, S2, or motor after analyzing circuit.
2. Tape winder runs but does not shut off on tight tape condition.	Switch S2 defective.	Check operation of tape stop arm. When switch appears to be activated but circuit is not opened, replace switch S2.

aa. Patch Plug/Cable Tester.

Malfunction	Probable cause	Corrective action
1. Both lamps fail to light in LAMP position.	Fuse F1 is operated or 12 vdc supply is missing.	Check for presence of 12 vdc. When present, replace fuse F1. When trouble persists, suspect S1 contacts.
2. One lamp fails to light in LAMP position.	Defective lamp.	Replace lamp.
3. GO lamp fails to light when testing a good plug.	Dirty contacts of switch S1.	Check seating of plug in J1. If trouble persists, rotate S1 over several positions to wipe contacts. If trouble persists, clean or replace switch S1.
4. NO-GO lamp fails to light when testing bad plug.	Dirty contacts of switch S1.	Check seating of plug in J1. If trouble persists, rotate S1 over several positions. If trouble persists, clean or replace switch S1.

5-8. Removal and Replacement Procedure

a. Fuses.

(1) *Panel-mounted fuses*.

(*a*) Unscrew and remove fuse cover from panel.

(*b*) Remove fuse from fuse cover.

(*c*) Insert replacement fuse in fuse cover.

(*d*) Insert fuse and cover in panel and turn to tighten.

(2) *Fuses mounted on NTS assemblies (except A32).*

(*a)* On NTS power control panel, operate switch to remove power from NTS assembly.

(*b*) Remove screws from cover and remove cover.

(*c*) Use handles and pull the card nest out on slides. Then rotate nest sideways on hinge, providing access to rear of nest. Rotation is to left, except that A40 and A42 nests rotate to right.

(*d*) Check fuses on rear and sides of nest. Remove and replace any blown fuse.

(*e*) To replace NTS assembly to its original position press release catch on lower slide, slide in drawer, and replace cover.

(3) *Fuses mounted on A32 common matrix driver assembly.*

(*a*) On NTS power control panel, operate switch to remove power from A32 and A31 assemblies.

NOTE

To check 5-volt fuses on A32, remove power from A29 and A32 assemblies.

(*b*) Remove bolts, lock washers, and flat washers attaching A29 and A31 assemblies to its mounting frame.

(*c*) Pull out A31 (or A29) as described in (2c) above for access to rear of A32.

(*d*) Slide A31 or A29 assembly outward as far as possible without stressing cables. Fuses on rear of A32 may be inspected by leaning through the A31 or A29 opening. Five volt fuse on side of A32 may be inspected by leaning through A29 opening.

(*e)* Replace A31 or A29 assembly in reverse order of removal.

(4) *Blower assembly fuse*. Replacement is identical to that for panel-mounted fuses. Two of the blower assembly fuses are not located where they can easily be seen

(*a*) FACP blower fuse F3 (1.5A) is located underneath FACP mounting shelf.

(*b*) I/O synchronizer blower fuse F3 (1.5A) is located underneath I/O synchronizer.

(5) *External +28-volt input fuse F5 (325A).*

(*a*) Remove power cabinet panel (i below).

(*b*) On power subsystem control panel, set EXTERNAL DC guarded switch to OFF.

(*c*) Disconnect dc power at external source.

(*d*) In power cabinet, locate fuse F5 on plate attached to wall of shelter.

(*e*) Remove two nut, five wires, and fuse F5.

(*f*) Install replacement fuse on studs. Then install five wires and two nuts.

(*g*) Install power cabinet panel in its mounted position.

(6) *20 Hz ring generator module fuse*. Gain access to 20-Hz ringer A50 as described in *d*(1) below. It is not necessary to shut off 20-Hz rings power while checking and replacing fuses. The fuse are plug-in cartridge types located on ring generator modules A50A1 and A50A2.

b. Lamps (Table 5. 7).

(1) *Panel-mounted indicator lamps.*

(*a*) Unscrew lamp lens and remove from panel.

(*b*) Remove defective lamp from lens and replace.

(*c*) Screw replacement lens and lamp into panel.

(2) *Indicator switch lamps*.

(*a*) On operator's position and FACP panels:

1. Remove pushbutton knob (including lamp) by pulling knob directly out from panel.

2. Remove defective lamp from knob and replace.

3. Push replacement knob (and lamp) into switch until it engages switch.

CAUTION

Do not interchange type 7333 and 3168 lamps. Type 3158 used in 7333 location will burn out.

(*b*) On power subsystem control panel:

1. Insert finger nails in slots on sides of lens and pull out lens.

2. Turn lens one-quarter turn vertically.

	Type	Identifying No.
Maintenance Control panel (see caution)	5V	7333
System Status Panel Functional Assignment Control Panel		
Operator's position		
NTS Power Control Panel	5V	3158
Power Subsystem	24V	327
Control Panel push button indicators		
Dc to dc converters		
Power Subsystem	110V	C7A(NE-2D)
Control Panel neon		
Power Cabinet panel neon		

3. Press in slightly and pull out until entire lens and lamps swivel down on hinge.

4. Remove and replace defective lamp.

5. Push assembly in while turning lens back to proper position.

c. Circuit Cards.

(1) Gain access to nest by performing one of the following procedures:

(*a*) *Processor*. Remove bolts. Pull drawer out on slide. Loosen screws on cover bottom retaining clip. Disengage latches and remove cover.

(*b*) *FACP.* Release quarter turn fasteners and open hinged panel. Loosen screws on cover bottom retaining clip. Disengage latches and remove cover.

(*c*) *NTS.* Remove bolts and lift off cover.

(*d*) *Synchronize*r. Loosen screws on cover bottom retaining clip. Disengage latches and remove cover.

(2) Insert hooks of extraction tool into holes in circuit card.

(3) Rest extraction tool against nest frame and turn tool until card is removed from connector.

(4) Remove hooks of tool from card and pull card manually out of card guides.

(5) Slide replacement card into card guides and press firmly into connector.

(6) Replace cover by reversing the procedure in step (1).

d. A50 20-Hz Ringer Circuit Card and Modules.

WARNING

Remove connector from A50J1 before working on 20-Hz ringer. This removes primary 24-volt power to ringer and shuts ringer off. High voltage (80 volts) is present on the ringer when operating. Also damage will result to module connectors if ringer is not off during removal.

(1) Extend A31 terminal matrix assembly on its slides and rotate on hinge. Access is thereby provided to the A50 assembly mounted on curbside wall of ,shelter.

(2) Shut off ringer power by disconnecting cable from A50J1.

(3) Remove and replace module A50A1 or A50A2 as follows:

(a) Loosen cable connector screws and remove connector from module.

(b) Loosen four captive screws.

(c) Remove module.

(d) Replace module in reverse order of removal.

(4) Remove and replace circuit card A50A3 as follows:

(*a*) Remove screws and lower cover from A50.

(*b*) Remove cable connector from card.

(*c*) Remove four nuts and flat washers holding card on to standoffs.

(*d*) Remove circuit card.

(*e*) Replace circuit card in reverse order of removal.

e. A13 Modem Modules.

(1) On modem power supply module, set POWER switch to OFF.

(2) Loosen two screws, located at top and bottom of module.

(3) Slide module out of front of modem assembly.

(4) Replace in reverse order of removal. When sliding module into modem, carefully mate rack-and-panel connector at rear of module.

f. PS1, PS2 Inverters.

(1) Remove power cabinet panel (i below).

(2) Remove power from inverter:

(*a*) Open DC/AC inverters 1 circuit breaker if removing inverter PS1.

(*b*) Open DC/AC inverters 2 circuit breaker if removing inverter PS2.

(3) Remove screws from inverter mounting flanges.

(4) Remove inverter by sliding it out of its mounting position. Part of air duct remains attached to inverter.

(5) Disconnect two cable connectors located at rear of inverter.

(6) Remove eight screws attaching air duct to inverter. Remove air duct.

(7) Attach air duct to replacement inverter.

(8) Replace inverter by reversing steps (1) to (5) above.

g. A12 Punched Tape Reader.

WARNING

Use two people to support and remove reader. Reader will drop when supporting screws are removed.

(1) Remove two cable connectors.

(2) While supporting reader, remove eight screws holding reader to its mounting position.

(3) Remove tape reader.

(4) Replace tape reader in reverse order of removal.

h. A 14, A 15 Motor Controllers.

(1) Remove power from motor controller:

(*a*) Open DC/AC INVERTER 1 circuit breaker if removing printer motor controller A14.

(*b*) Open DC/AC INVERTER 2 circuit breaker if removing punch motor controller A15.

(2) Unplug two standard 3-prong line card plugs.

(3) Unlace harness that routes black line card from motor controller to area behind synchronizer A16 where its connection is made. Disconnect black line cord cable connector.

(4) Remove terminal strip cover. Remove wires connected at terminal strip.

(5) Remove nuts and bolts along with associated flat washers and lock washers.

(6) Remove motor controller.

(7) Replace motor controller in the reverse order of removal.

i. Power Cabinet Panel.

WARNING

Shut off power at external source when working in power cabinet. High voltage (110 volts) is present on the panel and in the cabinet. Resistors R1 and R2 on the power cabinet panel and inverters PS1 and PS2 operate hot. To avoid burns, allow to cool before working with these items.

(1) Shut off power at external source.

(2) Set both DC/AC INVERTERS 1 and 2 circuit breakers to OFF.

(3) Remove nine screws attaching panel to power cabinet structure.

(4) Swing panel away from power cabinet opening to gain access to cabinet interior.

j. BT1-BT4 *Batteries (fig. 5.10).*

WARNING

Shut off BATTERY POWER circuit breaker before removing batteries. High current (300 amperes) flows through battery circuit.

CAUTION

The battery being removed is not a common lead-acid type. Do not use tools which have been used for maintenance of lead-add batteries. Also, never add lead-acid battery electrolyte. Refer to TM 11-6140-203-15-8 for maintenance of batteries.

(1) Disconnect battery circuit by tripping BATTERY POWER circuit breaker above battery box to off (FO-1).

(2) Disconnect vent hose clamp and disconnect hose.

(3) Unlatch and remove battery compartment cover.

(4) Remove four nuts and flat washers holding retaining bar of battery.

(5) Observe electrical connection of battery. It is connected in series with one of the other batteries. Positive terminal of one of batteries (of the serial connection) is connected to +24-volts, bus; negative terminal of other battery is connected to ground bus. Both buses are located on side of the battery compartment.

(*a*) Disconnect negative terminals of both batteries connected to ground bus.

(*b*) Disconnect terminals of battery to be removed.

(6) Remove battery.

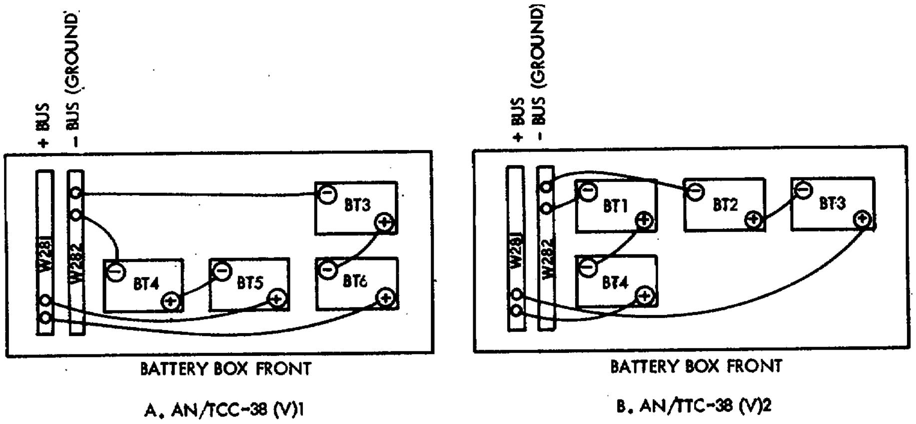


Figure 5-10. Battery connection diagram.

(7) Replace battery in reverse order of removal. When performing electrical connection, make the ground bus connection last.

k. PS3-PS23DC/DC Converters.

NOTE

Always halt applicable processor before

shutting off power at PROCESSOR/MEMORY 1 or 2 circuit breakers or dc to dc converters PS3, 4, 7, or 8. Failure to do so will cause loss of program, requiring program to be reloaded (para 2-18).

(1) Open circuit breaker which controls power to dc/dc converter:

Circuit breaker	**Dc to dc Converter**
PROCESSOR/MEMORY 1	PS3, PS4
I/O SYNCHRONIZERS A	PS5
I/O SYNCHRONIZERS B	PS6
PROCESSOR/MEMORY 2	PS7, PS8
PRIMARY S00 LINE	PS9-PS13
BACK-UP	PS14-PS18
ADDITIONAL 300 LINE	PS19-PS23

(2) Loosen screws on front panel of converter.

(3) Slide converter out of its mounting position.

CAUTION

When replacing converter, make sure the circuit breaker which controls power to the DC/DC converter is still open and the converter on/off switch is set to OFF. Use the attaching screws to seat DC/DC converters. Do not press converter in because connector can be damaged.

(4) Replace converter in reverse order of removal. When sliding unit into place, carefully mate rack-and-panel connector at rear of converter. Then secure converter firmly into place by alternately turning attaching screws on front panel.

l. Cable Assemblies Removal and Replacement.

(1) Disconnect Teradyne cable connector as follows:

(*a*) Turn knob to begin unscrewing cable connector.

(*b*) Carefully pull cable connector outward, directly perpendicular to mounting surface.

(2) After disconnecting all cable connectors of cable assembly, unlace harness where necessary and remove cable assembly.

(3) Install replacement cable assembly into harness and replace harness.

NOTE

Connectors are keyed. If connector does not fit, check cable tag for correct mating jack number.

(4) Connect Teradyne cable connector as follows:

(*a*) Carefully start insertion of connector pins.

(*b*) Turn knob so as to start cable connector screw threading into mating connector.

(*c*) Continue turning knob until cable connector is firmly mated.

m. High voltage Protectors (fig. 1-1 and FO-43).

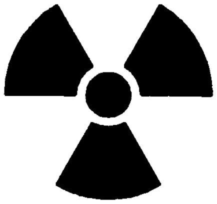
CAUTION

The high voltage protectors contain small amounts of radioactive material. When replacing the protectors, do not throw away the replaced units. Place them together in a container and label with the following information:

CAUTION

Radioactive material. Controlled disposal required. Each unit contains 3.0 microcuries of Promethium-147. Part number SM-A-742461.

Sketch the symbol below on the label and return all replaced devices, with the above labeling attached, to the depot.



(1) Remove screws from signal entrance panel cover, and remove cover from curbside external wall of shelter.

(2) Remove high voltage protector from beneath spring contact. When, network is in operation a 48-vdc potential may be present across high voltage protector and its contacts. Therefore do not use electrically conductive tools, such as metal screwdriver, which will short contacts of the high voltage protector holder.

(3) Clip the replacement high voltage protector into place underneath spring contact. Again, be careful not to place a short across the high voltage protector or its contacts if the network is active.

(4) Replace screws to attach signal entrance panel cover.

n. Memory Circuit Card (fig. 5-11).

CAUTION

Shut off power to memory before replacing cards or damage will result.

(1) *Removal.*

(*a*) Press NORMAL/HALT for associated processor.

(*b*) Set PROCESSOR/MEMORY circuit breaker 1 or 2 to OFF.

(*c*) If the circuit card is a TCL assembly (card A10) proceed to step (d). If it is a DLP (card A11) or DLX (card A12 or A13), proceed to step (d).

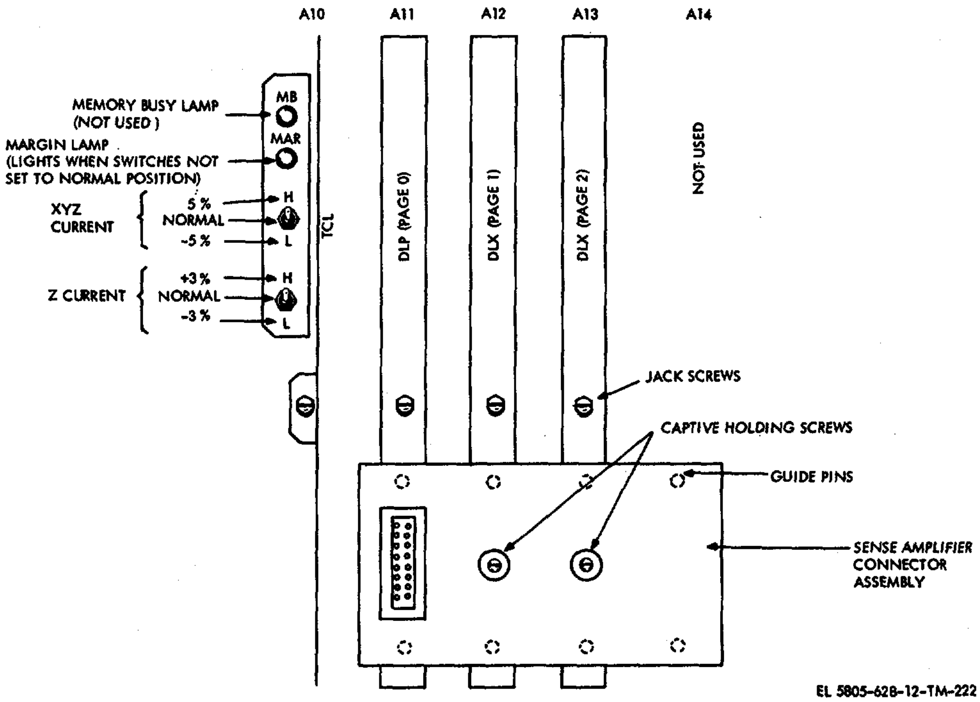


Figure 5-11. Memory circuit card location.

(*d*) Disengage both captive holding screws on the sense amplifier connector assembly.

(*e*) Pull outward on top flange while maintaining hold on plate until sense amplifier connector assembly is free from circuit card assembly.

(*f*) Using a screwdriver, completely loosen jack screw until assembly is free of connector plate.

(*g*) Remove circuit card assembly by hand.

(2) *Replacement.*

(*a*) Insert circuit card assembly in guide slots and push inward until contact is made with connector plate at rear of chassis.

(*b*) Engage jack screw and turn manually while exerting hand pressure on circuit card assembly.

(*c*) Using screwdriver, tighten jack screw until circuit card connector is fully inserted in connector plate. This completes replacement of TCL (card A10) assembly. Proceed to step (d) for other cards.

(*d*) Position plate of sense amplifier connector assembly by aligning guide pins. Be sure rectangular opening is on left hand side.

(*e*) Manually push plate onto board.

(*f*) Using screwdriver, alternately tighten captive holding screws.

(*g*) Turn on power at circuit breaker and see that MAR does not light. If it does light check each H-L switch for center (normal) position.

(*h*) Replace cover by inserting side rear port over knurled thumb screws and then other side.

(*i*) Tighten quarter-turn fasteners.

o. Dc Lights Power Supply PS24.

(1) Shut off power at external source.

(2) Shut off power to PS24 by setting FLUOR LIGHTS circuit breaker to off.

(3) Remove wires connected to PS24 TB1 and TB2.

(4) While supporting PS24, remove screws which secure PS24 base flanges to wall plate. PS 24 will drop out.

(5) Replace PS24 in reverse order of removal.

p. Fluorescent Lamp Replacement.

(1) Remove screws securing shield, and remove shield.

(2) Slide tube locking tabs all the way up tube connector.

(3) Rotate tube one-quarter turn and slide down.

(4) Replace in reverse order.

q. Operator Position and Side Panel.

To gain access to the relay power panel and power distribution. panel or to replace parts on the power subsystem control panel, the side panel must be removed.

WARNING

Shut off power at external source when working behind power subsystem control panel or power cabinet.

(1) Loosen thumbscrews and remove intercom.

(2) Remove nuts, lockwashers, and flat washers attaching intercom rack to structure of shelter and remove intercom rack.

(3) Unplug headset from operator's position.

(4) Remove screws attaching operator's position to shelf.

(5) Lift operator's position to shelf.

(6) Remove screws and washers attaching side panel to structure, and remove side panel.

(7) Replace side panel in reverse order of removal.

r. Battery Fuse F11 (400A).

(1) Gain access to power distribution panel by removing the panel to the right of, and behind, the power subsystem control panel (para 5-8*q*).

(2) Loosen nuts and flat washers from the bus bar that clamps bottom end of fuse F11.

(3) Loosen hut and two terminal lugs from the stud holding top end of fuse F11.

(4) Remove fuse F11 from mounting studs by twisting to side.

(5) Replace fuse F11 in the reverse order of removal.

s. Air Conditioner.

(1) Shut off power at power entrance panel using circuit-breaker CB5/A38 or CB6/A39 as applicable.

(2) Remove screws which secure exhaust filter and remove exhaust filter by prying out.

(3) Working through exhaust filter hole, remove screws which secure boot to duct. Carefully loosen boot.

(4) Gain access to air conditioner fresh air port by opening sliding access door or removing air flow register.

(5) Remove filter from fresh air port by removing screws and prying filter off.

(6) Remove screws which secure fresh air port boot, and loosen boot from assemblage duct.

(7) Working through duct access door, disconnect air conditioner control cable W302 or W303 by unscrewing holding screw.

(8) Remove screws which secure shock mounts to mounting bracket.

(9) Loosen web belts from air conditioner and mounting brackets.

(10) Untie drain hose, and slide out drain hose.

WARNING

At least four men are required to lift the air conditioner. The air conditioner weighs 265 lbs.

(11) Slide air conditioner back for access to connectors from outside assemblage.

(12) Disconnect power connector and ground strap.

(13) Lift air conditioner from mounting bracket.

(14) The air conditioner may now be worked on. If it is to be replaced, remove shock mounts and boots. On replacement of air conditioner, remove intake and exhaust vents and install boots and shock mounts. Install intake and exhaust vents on defective air conditioner for return to higher category maintenance.

(15) Install replacement or repaired air conditioner in reverse order.

t. Air Conditioner Remote Control Unit.

(1) Shut off power at the power entrance panel. Using circuit breaker CB5/A38 or CB6/A39 as applicable.

(2) Raise the cover of the control unit, unscrew the retaining screw, and gently pull the control unit forward until it disengages from the connectors. DO NOT attempt to pull it all the way out of the housing because of the capillary tube.

(3) Remove the screws and washers that secure the air conditioner intake filter to the shelter wall and, remove the filter.

(4) Unscrew the brackets securing the capillary tube to the frame.

(5) Loosen the screws securing the control box housing to the shelter wall.

(6) Loosen the nut that secures the control box housing to the pipe fastened to the air conditioner intake filter port.

(7) Gently lower the control box and the control box housing while feeding the capillary tube through the pipe.

(8) Replace the control box by reversing the above procedures.

u. Punch A20 and Printer A21.

(1) Remove bolts from front of shelf.

(2) Slide shelf forward to gain access to wiring.

(3) Disconnect connectors:

(a) Printer A21

A21J1 from W128P1
A21P1 from A14J2
A21P2 from A14J3

(b) Punch A20

A20J1 from W127P1
A20P1 from A15J2
A20P2 from A15J3

(4) Remove screws on bottom of shelf which secure printer or punch. Lift shelf if necessary to gain access to screws.

(5) Remove printer or punch.

(6) Replace printer or punch in reverse order. Be sure guide pins on rear of shelf engage guide holes when sliding shelf back.

Section II. OPERATOR POSITION MAINTENANCE

5-9. General

This section covers maintenance of the operator position, including unique replacement procedures, and testing.

5-10. Replacement Procedures

WARNING

High voltage (115 vac) is present in operator position. Set PWR/LOGIC switch to off before replacing parts.

a. Circuit Cards.

(1) Remove screws, flat washers, and lock washers securing card cover to top of operator position, at left of control panel. Remove card cover.

(2) Use two card pullers. Engage one puller on each corner of circuit card and lift up ,evenly.

(3) Install replacement circuit card by placing it in guide plates and pushing evenly, down until seated. Replace card cover and secure hardware.

b. Fuses (fig. 3-6).

(1) Twist and remove 1-1/4A fuse cover from control panel.

(2) Remove fuse from fuse cover.

(3) Insert replacement 1-1/4A ampere fuse in fuse cover and install fuse and cover in fuseholder. Turn to tighten.

c. Lamps (fig. 3-6).

(1) *STATUS Lamps*. Unscrew ALARM or QUEUE lamp lens. Separate lens from lamp. Insert replacement lamp in lens, and install both in lampholder by twisting until seated.

(2) Pushbutton lamps. Remove pushbutton knob and lamp by pulling knob directly up from panel. Pull lamp out of knob. Insert replacement lamp in knob, and push knob onto switch until it engages switch.

d. Power Supply.

(1) Remove screws, flat washers, and lockwashers securing control panel to top of operator position.

(2) Gently lift panel away from operator position as far as wiring permits.

(3) Unscrew (and tag if necessary) power supply leads from terminal board TB1.

(4) Remove nuts, flat washers, and lockwashers securing power supply A1 PS1. Remove power supply.

(5) Install replacement power supply by reversing steps (1) through 4.

e. High Voltage Protector.

(1) Remove control panel (d above).

(2) Pry high voltage protector out of spring clip.

(3) Press replacement high voltage protector into spring clip.

5-11. Operator Position Test

Use this procedure to check out an installed operator position after repair, and as an aide to troubleshooting. When you complete this procedure, the operator position is functioning properly. If you cannot perform a step, refer to paragraph 5-7 for corrective action.

a. Power On Observations.

(1) Set PWR/LOGIC switch to ON, if not already set.

(2) Depress RESET switch.

(3) COMMON RELEASE lamp is on. All other lamps are off.

b. Lamp Test.

(1) Depress LAMP TEST switch.

(2) All lamps go on.

(3) Turn LAMP INTENSITY control from LO to HI.

(4) Intensity of all lamps varies from full off to full on. Adjust LAMP INTENSITY control for a comfortable level of illumination.

c. Keyset Pushbuttons Check.

(1) Depress 1 pushbutton and listen for tone in earphone.

(2) Repeat for remaining keyset pushbuttons.

d. Pushbutton Switches and Lamps.

(1) Depress CALL/SEIZE switch and listen for tones in earphone. After one second delay, CALL/SEIZE lamp and QUEUE ADVANCE lamp go on and COMMON RELEASE lamp goes off. Listen for dial tone.

(2) Depress COMMON RELEASE switch and listen for tones in earphone. CALL/SEIZE and QUEUE ADVANCE lamps go off and COMMON RELEASE lamp goes on.

(3) Depress RELEASE 1 switch and listen for tones in earphone. RELEASE 1 lamp lights for approximately two seconds.

(4) Depress RELEASE 2 switch and listen for tones in earphone. RELEASE 2 lamp lights for approximately two seconds.

(5) Repeat step (1).

(6) Depress QUEUE ADVANCE switch and listen for tones in earphone. COMMON RELEASE lamp goes on and QUEUE ADVANCE and CALL/SEIZE lamps go off if there is no call in queue. If a call is in queue, after one second the COMMON RELEASE lamp goes off, and QUEUE ADVANCE and CALL/SEIZE lamps remain on.

(7) Depress HOLD switch and listen for tones in earphone.

(8) Depress RESET switch.

(9) Depress CLEAR/WIPEOUT switch and listen for tones in earphone.

(10) Depress RERING switch and listen for tones in earphone.

(11) Set MODE switch to UNSTAFFED position and listen for tones in earphone. Return MODE switch to STAFFED position.

(12) Depress INTERCOM switch and listen for tone burst in earphone.

(13) Depress INTERCOM switch again. See that INTERCOM lamp goes off.

e. Voice Circuits.

(1) Call maintenance phone in assemblage.

(2) When called party answers, place call on hold by depressing HOLD switch. HOLD lamp goes on. COMMON RELEASE lamp goes on and CALL/SEIZE and QUEUE ADVANCE lamps go off.

(3) Retrieve call from hold by depressing HOLD switch again. HOLD lamp goes off. CALL/SEIZE and QUEUE ADVANCE lamps go on, and COMMON RELEASE lamp goes off.

(4) Extend call to information attendant. Three-way conversation may now take place.

(5) Instruct maintenance phone attendant to make two calls to operator after release, as follows: (a) A precedence call, and on-hook before operator answers.

(*b*) A routine call.

(6) Release each party individually by just depressing RELEASE 1 switch. RELEASE 1 lamp goes on for one second, then off. Depress RELEASE 2 switch. RELEASE 2 lamp goes on for one second, then off.

(7) Wait for incoming call (*f* below).

f. Incoming Calls. Wait for incoming calls in response to your request in *e* above.

(1) STATUS QUEUE lamp flashes to indicate incoming precedence call.

(2) STATUS QUEUE lamp goes off. This indicates calling party has gone on-hook before being answered, or another operator has answered.

(3) STATUS QUEUE lamp goes on steady to indicate incoming routine call.

(4) Answer call by depressing QUEUE ADVANCE switch. Verify that maintenance phone has performed calls as instructed in e above.

(5) Release call by depressing COMMON RELEASE switch. COMMON RELEASE lamp goes on and QUEUE ADVANCE and CALL/SEIZE lamps go off.

g. Intercom Circuit.

(1) Depress INTERCOM switch. INTERCOM lamp goes on.

(2) When call is answered by another operator, instruct him to call back after release.

(3) Depress INTERCOM switch; lamp goes off.

(4) INTERCOM lamp flashes to indicate incoming call.

(5) Depress INTERCOM switch; lamp goes on steady.

(6) Release call by depressing INTERCOM' switch; lamp goes off.

h. Alarm Lamp. Check the alarm circuit while performing monthly checkout of status panel A6. Verify that STATUS ALARM lamp on each operator position goes on when alarm condition is simulated, and that lamp goes off when alarm is reset.

i. Master Clear. Check the master clear circuit during a control transfer. Find out when the next periodic check involving control transfer is scheduled. Before the transfer is accomplished, have each operator depress CALL/SEIZE switch. After control transfer, all lamps go off except COMMON RELEASE, which goes on.

Section III. ON-LINE MCP PROCEDURES

5-12. Number Conversion

a. General. Operation and maintenance procedures for the AN/ITC-38(V)(*) require you to convert between various types of number systems. Many of these procedures involve the maintenance control panel WORK SWITCH REGISTER, BUS INDICATOR, FUNCTION CODE. and ADDRESS SWITCH REGISTER switches. In each of these a single switch on lamp controls or indicates a single binary digit (bit). These bits are used by the processor, memory, and programs to perform their function. You may have noticed that these switches and lamps are spaced into groups of three. This arrangement permits you to quickly enter or read octal numbers. In this technical manual numbers to be entered or read from these registers are always given in octal unless otherwise indicated. Several other types of data are also given in octal, such as memory addresses and content of certain memory words. Many printouts also use octal numbers.

b. Octal Number Conversion. The table in A, figure FO-40, shows you how to convert octal digits into binary digits. It takes three binary digits to represent one octal digit. You can see from the table that octal 4(48) equals binary 100. Therefore, a two digit octal number requires six binary digits and an eight digit octal number requires 24 binary digits (G and H, fig. FO-40). Convert each octal digit individually using the octal number table.

c. BCD Conversion. Binary coded decimal (BCD) table B of figure FO-40, shows you how to convert decimal digits into BCD. It takes four binary digits to represent one decimal digit. For example, decimal eight equals BCD 1000. Therefore, it takes eight binary digits to represent a two-digit decimal number in BCD. Convert each decimal digit individually into BCD format using the table. You must mentally group switches and lamps into blocks of four to do this (I, fig. FO-40). In this TM figures are presented with procedures to help you do this.

d. Binary Conversion. The decimal-to-binary table (C of' fig. FO-40) shows you how to convert decimal numbers into binary. The basic difference between binary and BCD is that in binary all decimal digits are converted to a single unique group of binary digits, whereas for BCD each decimal digit converts to a group of four binary digits. For example, decimal 20 converts to 10100 in binary and to 0010 0000 in BCD. The table show you how to convert up to five-digit binary numbers; this is the largest binary number you will need to know for the AN/TTC-38(V)(*). Binary numbers can be longer than this for larger numbers.

e. Bit Conventions and Examples. The positions of bit toggle switches and lamp indications on the maintenance control panel registers represent whether a bit in the computer is binary I or 0 (also sometimes call logical 1 of 0 when referring to a single signal level). See D, figure FO-40. Setting the switch up means that a binary 1 will be read into the bit position in the computer with a number corresponding to the number of the switch. Also on the BUS INDICATOR when a bit lamp lights it means that the numbered bit in the selected computer circuit was binary 1. Samples of typical instructions in this TM and the correct switch settings which should result are illustrated (E thru I, fig. FO-40). In each case the switch setting or lamp indication must be read as a 1 or 0 and then converted using tables A, B, and C, figure FO-40.

f. Selective Fields. Procedures in this TM sometimes require that you set or read numbers into selected portions (fields) of registers or indicators. I, figure FO-40, shows an example of a TM instruction which requires several BCD, binary, and individual bit settings in the WORD SWITCH REGISTER. Note that you must carefully read the instructions to find the type of number used for each entry. You must then partition the bank of switches and set in the appropriate number using the conversion tables (A, B, and C, fig. FO-40).

5-13. Limited Full Exercise Options (fig. 5-12).

Use these procedures to select the limited and full exercise options from the long loop and short loop operational program modes (para 4-7). When the limited exercise option is selected and the processor is operating in the long loop (call processing) mode, exercising is limited to processor and first-level decoder

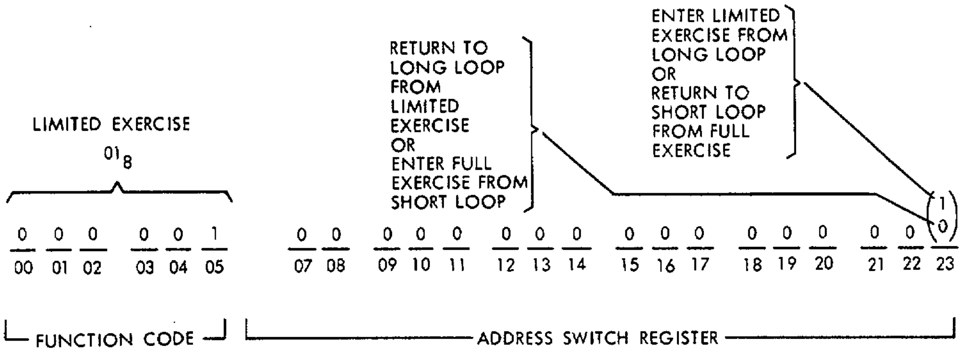


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Figure 5-12. MCP switch settings for limited/full exercise options.

checks. Call processing is not affected. When the full exercise option is selected and the processor is operating on-line in the short loop mode, full exercise operation is initiated, but no call processing is performed.

a. Long Loop. Initiate the limited exercise option from the long loop mode as follows:

(1) Set FUNCTION CODE to 01.

(2) Set ADDRESS SWITCH REGISTER bit 23 to 1.

(3) Press READ.

(4) Return to full exercise by repeating steps (1) through (3) with ADDRESS SWITCH REGISTER bit 23 set to 0.

b. Short Loop. Initiate the full exercise option from the short loop mode as follows:

(1) If required, place the processor on-line (para 2-18*l*) and perform a program start-up (para 2-18*l*).

(2) Set FUNCTION CODE to 01.

(3) Set ADDRESS SWITCH REGISTER bit 23 to 0.

(4) Press READ.

(5) Return to limited exercise by performing steps (2) through (4) above with ADDRESS SWITCH REGISTER bit 23 set to 1.

5-14. Return to Short Loop

Use these procedures to return to the short loop mode from the long loop mode. The first procedure returns the operational program to the short loop with the full exercise option enabled. The second procedure returns the operational program to the short loop with the full exercise option disabled. Both procedures assume that the processor is on-line and remains there.

a. Short Loop With Option. Perform this procedure to terminate call processing while allowing programmed maintenance routines to continue. This type of operation can also be entered from the short loop mode by initiating the full exercise option (para 5-13b). The processor must be allowed to remain online.

(1) Set FUNCTION CODE to 02 (fig. 5-13).

(2) Press READ.

(3) Monitor printout for maintenance messages. The program requires approximately an hour to cycle through all periodic tests. You may perform /VO request tests and make current directory entries during this period.

(4) If you want to restore call processing, set FUNCTION CODE to 03 and press READ.

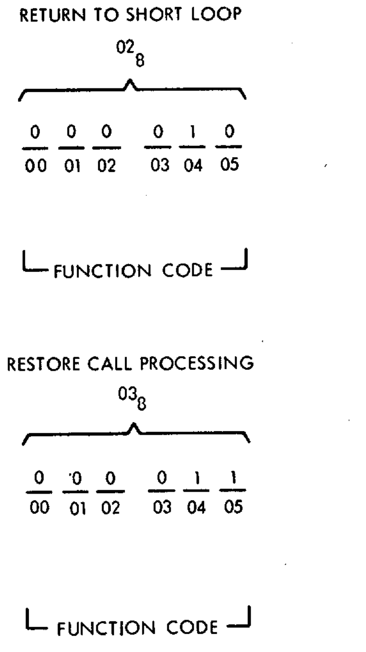

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Figure 5-13. MCP switch settings for return to short loop.

b. Short Loop Without Option. Perform this procedure to terminate both call processing and full exercise routines while allowing the processor to remain on-line.

(1) Set FUNCTION CODE to 02 (fig. 5-13).

(2) Press READ.

(3) Set FUNCTION CODE to 01 (fig. 5-12).

(4) Set ADDRESS SWITCH REGISTER bit 23 to 1.

(5) Press READ.

(6) The processor is now performing only processor and decoder checks. You may perform I/O request tests and make current directory entries.

(7) If you want to restore call processing, set FUNCTION CODE to 03 and press READ.

5--5. Setting 24 Hours Clock Time
(fig. 5-14 and 5-15)

Use this procedure whenever you want to set the 24 hour clock in each processor. The processor must be ACTIVE with the operational program loaded and in either the STANDBY or ON LINE state. The procedure is performed from the on-line standby maintenance control panel of the processor containing the clock to be set. The clock in each processor stops when the processor halts. Therefore you should reset the clock after a halt.

a. Set FUNCTION CODE to 06.

b. Set ADDRESS SWITCH REGISTER bits 08-23 to hours and minutes of 24 hour time desired in binary coded decimal format.

c. Set WORD SWITCH REGISTER bits 17 through 23 to 7-bit ASCII representation of time zone character.

d. Press READ.

5-16. Modifying TTY I/O Access Code
(fig. 5-16)

Use this procedure to enter or modify the TTY 1/0 access code. The first four digits must be numerals and are loaded into the ADDRESS SWITCH REGISTER. The second four digits are letters or numerals and are entered into the WORD SWITCH REGISTER (Z is not accepted).

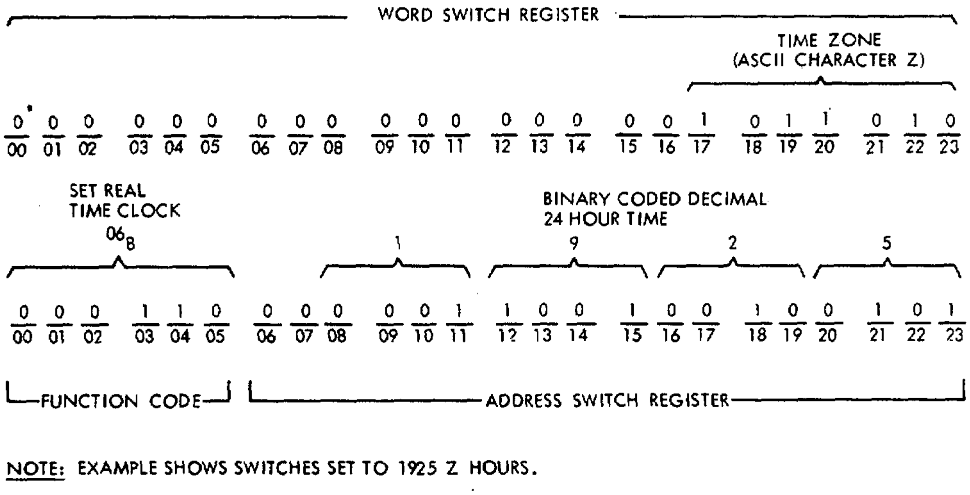
a. Set FUNCTION CODE to 16.

b. Set ADDRESS SWITCH REGISTER and WORD SWITCH REGISTER as shown in figure 5-16 using codes in figure 5-15.

c. Press READ.

5-17. Classmarking I/O Channels
(fig. 5-17)

Use this procedure whenever you want to mark an input/output device in-service or out-of-service. The procedure also allows you to set the type of connection (direct or modem) and the type of code (Baudot or ASCII) used by the remote teletypewriter or spare remote teletypewriter. You do not need to mark any I/O devices supplied in the assemblage in service or select codes during installation; this is accomplished automatically when the operational program is loaded. You should mark any I/O device out-of-service when it is being tested by an off-line diagnostic programmed test. Doing so prevents the operational program in the on-line processor from breaking in and using the device. The on-line operational program could confuse the results of the off-line test by breaking in. Perform this procedure from the on-line maintenance control panel to setup I/O conditions in the on-line system. The procedure may also be performed on the standby maintenance control panel to setup I/O conditions for the standby processor. Only one type of classmark may be entered at a time. For example, the procedure must be repeated three times to select connection, select code, and mark a remote teletypewriter in-service. You do not need to select the connection mode for a remote page printer. The switches on the back of system status panel A6 ac-



NOTE: EXAMPLE SHOWS SWITCHES SET TO 1925 Z HOURS.

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Figure 5-14. Typical MCP switch settings to set 24 hour clock.

CHARACTER	BIT NO. 7	6	5	4	3	2	1
0	0	1	1	0	0	0	0
1	0	1	1	0	0	0	1
2	0	1	1	0	0	1	0
3	0	1	1	0	0	1	1
4	0	1	1	0	1	0	0
5	0	1	1	0	1	0	1
6	0	1	1	0	1	1	0
7	0	1	1	0	1	1	1
8	0	1	1	1	0	0	0
9	0	1	1	1	0	0	1
A	1	0	0	0	0	0	1
B	1	0	0	0	0	1	0
C	1	0	0	0	0	1	1
D	1	0	0	0	1	0	0
E	1	0	0	0	1	0	1
F	1	0	0	0	1	1	0
G	1	0	0	0	1	1	1
H	1	0	0	1	0	0	0

NOTE 1

NOTE 2

CHARACTER	BIT NO. 7	6	5	4	3	2	1
I	1	0	0	1	0	0	1
J	1	0	0	1	0	1	0
K	1	0	0	1	0	1	1
L	1	0	0	1	1	0	0
M	1	0	0	1	1	0	1
N	1	0	0	1	1	1	0
O	1	0	0	1	1	1	1
P	1	0	1	0	0	0	0
Q	1	0	1	0	0	0	1
R	1	0	1	0	0	1	0
S	1	0	1	0	0	1	1
T	1	0	1	0	1	0	0
U	1	0	1	0	1	0	1
V	1	0	1	0	1	1	0
W	1	0	1	0	1	1	1
X	1	0	1	1	0	0	0
Y	1	0	1	1	0	0	1
Z	1	0	1	1	0	1	0

NOTE 1

NOTE 2

NOTES:
1 TRUNCATED 4-BIT ASCII USES ONLY BITS 1 THROUGH 4.
2 TRUNCATED 6-BIT ASCII USES ONLY BITS 1 THROUGH 6.
3 NORMAL ASCII USES ALL 7 BITS.

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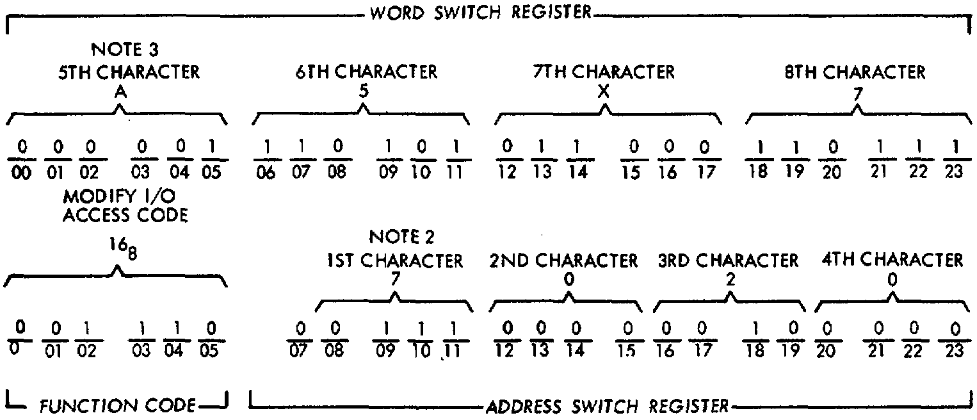
Figure 5-15. Abbreviated list of ASCII alphanumeric character codes.



NOTE: 1. THIS EXAMPLE SHOWS SWITCH SETTINGS FOR ACCESS CODE 7020A5X7.
2. CHARACTERS 1 THROUGH 4 ARE TRUNCATED 4-BIT ASCII.
3. CHARACTERS 5 THROUGH 8 ARE TRUNCATED 6-BIT ASCII.

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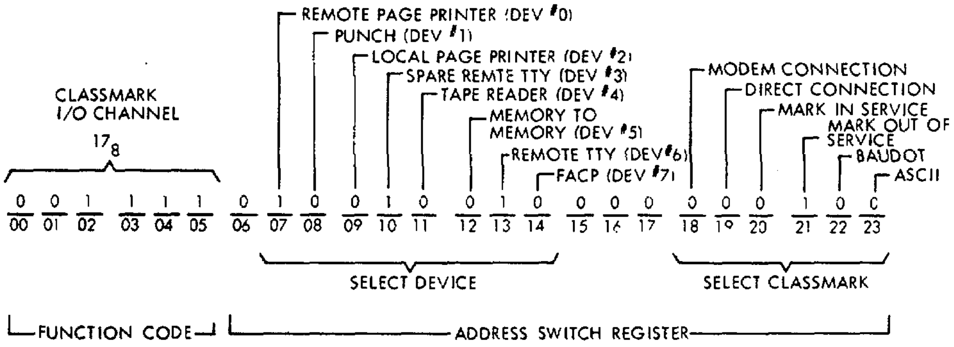
Figure 5- 16. Typical MCP switch settings for TTY I/O access code.

	Code		Connections		Status	
Device	**ASCII**	**BAUDOT**	**Direct**	**Modem**	**In-service**	**Out-of-service**
Remote page printer	X		NA	NA	X	
Punch	NA	NA	NA	NA	X	
Local page printer	NA	NA	NA	NA	X	
Spare remote TTY	X			X		X
Tape reader	NA	NA	NA	NA	X	
Mem-mem data channel	NA	NA	NA	NA	X	
Remote TTY	X			X		X
FACP	NA	NA	NA	NA	X	



NOTE: THIS EXAMPLE SHOWS SWITCHES SET TO SIMULTANEOUSLY MARK ALL THREE REMOTE DEVICES OUT OF SERVICE.

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Figure 5-17. Typical MCP switch settings for classmarking I/O channels.

complish this. However, you must select the code (ASCII or BAUDOT) for the remote page printer from the MCP.

NOTE

The operational program has the device channels initially classmarked as indicated below. If the configuration of your switch differs from that in the table, then the I/O channels will have to be classmarked whenever the program is loaded.

a. Set FUNCTION CODE to 17.

b. Set all ADDRESS SWITCH REGISTER bits to 0.

c. Select device or devices to be classmarked by setting associated ADDRESS SWITCH REGISTER bits listed below. In and out-of-service classmarking may be applied to more than one device simultaneously, whereas connection and code classmarks must be entered separately for individual devices.

Bit	*Device*
07	Remote page printer
08	Punch
09	Local page printer
10	Spare remote teletypewriter
11	Tape Reader
12	Memory-to memory data channel
13	Remote teletypewriter
14	FACP.

d. Select type of classmark to be entered for selected devices by setting one of following ADDRESS SWITCH REGISTER bits to 1.

Bit	*Classmark*
18	Select modem connection for remote teletypewriter or spare remote teletypewriter.

Bit	*Classmark*
19	Select direct connection for remote teletypewriter or spare remote teletypewriter.
20	Mark in-service
21	Mark out-of-service
22	Select Baudot character code
23	Select ASCII character code.

e. Press READ.

f. If system status panel SUPERVISORY ALARM lights and page printer prints ILLEGAL I/O ORDER, you have made one of the following types of errors and the program rejected the command.

(1) More than one classmark was selected. Only one of ADDRESS SWITCH REGISTER bits 18-23 may be set.

(2) You tried to change the character code for an assemblage I/O device. ADDRESS SWITCH REGISTER bits 18 and 19, only apply to remote teletypewriters. ADDRESS SWITCH REGISTER bits 22 and 23 apply only to remote teletypewriters and remote printer.

(3) More than one device was selected for classmarking and the order was not for marking the devices in- or out-of-service. (ASR bits 18, 19, 22 or 23 were set.)

5-18. Optional Paper Tape Reader I/O Commands

(fig. 5-18)

Use this alternate procedure when you want to transmit a punched tape to the remote teletypewriter, the spare remote teletypewriter, or the local punch. Normally these actions are performed from the FACP using the READER TO TTY, READER TO SPTTY, or READER TO PUNCH I/O COMMANDS pushbuttons (para 3-2*n*). However, if the FACP is busy or. malfunctioning you may use this alternate procedure from the standby or on-line maintenance control panels. If run from the standby, you may mark the remote device out-of-service (para 5-17) from the on-line maintenance control panel to prevent any break-in by the on-line operational program.

a. Determine that remote channel or punch is not busy and ready to receive.

b. Load tape to be transmitted on reader.

c. Set FUNCTION CODE to 15.

d. Select one remote channel or punch. by setting one of ADDRESS SWITCH REGISTER bits 21, 22 or 23 to 1. All other bits must be set to 0.

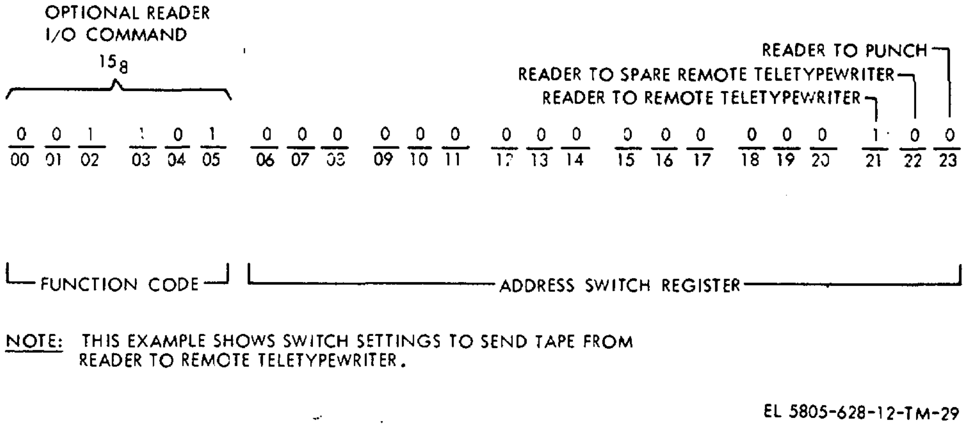
e. Press READ.

f. See that tape on reader starts to move.

g. Wait for tape reader to stop and check with remote location to see if tape was received.

5-19. Reading Tapes Into Memory

Use this procedure to load current directory and data base update tapes. A current directory tape (para 2-18*o*) contains the entire program data base known as the current directory set. It can be loaded into the memory of either an on-line or a standby processor



NOTE: THIS EXAMPLE SHOWS SWITCH SETTINGS TO SEND TAPE FROM READER TO REMOTE TELETYPEWRITER.

Figure 5- 18. Typical MCP switch settings for optional tape reader I/O commands.

provided that the operational program is in the short loop. mode with option (para 5-14*a*). A data base update tape is produced from FACP (para 2-21) or teletype (para 2-85) punch options. It makes changes to an existing current directory set. An update tape can be loaded into the memory of a processor which is in either the short loop or long loop (call processing mode of the operational program. The processor may be either on-line or on standby. If the processor is online, the data base update will also be incorporated into the data base of the standby processor. The loading procedure is performed at the maintenance control panel of the selected processor. However, loading can be performed only if the higher priority I/O channels (FACP, remote teletype, and remote spare teletype) are not supplying inputs to the processor.

a. Load tape on reader (para 2-18*f*).

b. Set FUNCTION CODE to 13 (fig. 5-19).

c. Identify type of tape by setting one of following ADDRESS SWITCH REGISTER bits to 1 as required by the type of tape.

(1) Bit 21 for the current directory tape.

(2) Bit 23 for the data base update tape.

d. Press READ. Tape starts reading in.

e. When tape stops, rewind it (para 2-18g (14) thru (16)).

5-19.1. Verifying Punched Tape
(fig. 5-19)

Always verify current directory set and data base update tapes punched in the AN/TTC-38(V)(*). The following verification procedure may be performed using either the on-line or standby processor is preferred. Do not use any other I/O devices (FACP, remote teletypewriter) while verifying a tape. If necessary, mark these devices out of service while verifying the tape and mark in service when verification is complete (para 5-17). Perform the procedure from the maintenance control panel of the selected processor.

a. Load tape on reader (para 2-18f).

b. Set FUNCTION CODE to 13.

c. Request tape verification by setting ADDRESS SWITCH REGISTER bit 20 to 1 and bits 21 23 3 for the tape to be verified.

d. Press READ. Tape starts reading in.

e. Monitor reader and printer. If tape stops at end and no tape errors have been detected, there will be no printout.

NOTE

On update tapes it may be necessary to press READ for each update block punched on the tape if blank space was left between blocks.

f. If TAPE ERR messages printout, the tape is defective (para 5-7*n*).

NOTE

Sometimes a punch will add characters to the tape leader when motor is turned on. These are false characters and will cause a TAPE ERR 01 printout. The true start character for current directory or update tapes is an all one's character (all holes punched). You may be able to

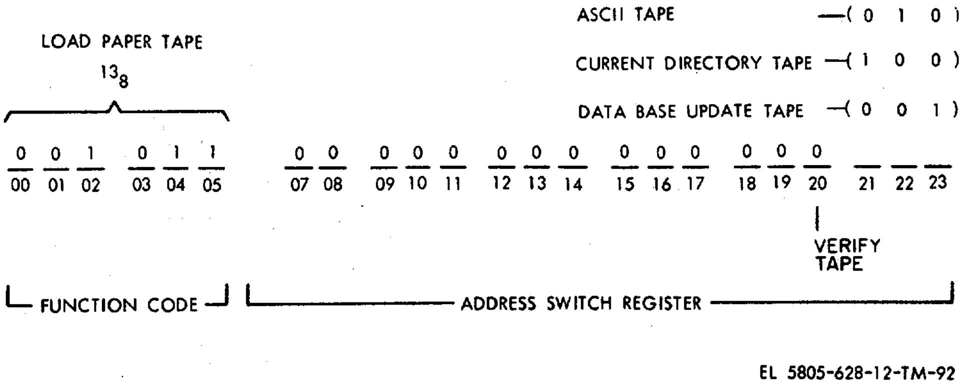


Figure 5- 19. MCP switch settings for loading paper tape.

use a tape which verifies after the start character but contains false leader characters. Either mask off the false characters or insert such a tape in the reader so that the false character is past the read head.

g. if ILLEGAL I/O ORDER prints out, check for correct switch settings.

5-19.2 Reloading Operational Program

Starting with Operational Program Tape Deck 34, the tape deck consists of three pages, each on a separate reel. These are designated pages 0, 1, and 2. The bootstrap loader program and operational program have been punched on the tape to reduce the loading time required by the user to reload part or all of the deck. Pages 1 and 2 have memory protection; therefore most of the time the AN/TTC-38(V) system can be recovered just by reloading page 0, according to the procedure in a below. To reload page 1 or page 2, follow the procedure in *b* below.

a. Loading Page 0.

NOTE

Always clear page 0 before attempting to load page 0.

(1) Set all WSR toggle switches to O's.

(2) Set MEMORY guarded switch to PROTECTED.

(3) Set RUN/ONE INSTR toggle switch to RUN.

(4) Set REGISTER SELECT switch to MEM and OPERATIONAL CONTROL to STORE SEQL.

(5) Press COORDINATE and INITIATE pushbutton switches simultaneously and observe that ACTIVE indicator lights. Halt processor a few seconds later.

(6) Install page 0 reel on paper tape reader.

(7) Set paper tape reader MODE SELECT switch to REEL, and POWER ON/OFF switch to ON.

(8) Press system status panel RESET pushbutton several times and observe that tape moves.

(9) Set WSR toggle switches to 00277600.

This is the starting address of the Operational Program loader 'strip that is now punched on page 2 of deck 34.

(10) Set OPERATIONAL CONTROL rotary switch to STORE and REGISTER SELECT to PEX.

(11) Set RUN/ONE INSTR toggle switch to ONE INSTR.

(12) Press INITIATE pushbutton and observe that BUS INDICATOR displays 00277600.

(13) Set RUN/ONE INSTR toggle switch to RUN.

(14) Set OPERATIONAL CONTROL switch to CMPT.

(15) Press INITIATE pushbutton and observe:

(*a*) Tape loads into memory.

(*b*) PRGM HALT indicator lights at end of loading.

(*c*) BUS INDICATOR displays 00277657 t verify successful load with good checksum.

(16) Set system status panel TAPE REWIND switch to ON.

(17) After the tape is rewound, remove tape reel from tape reader.

b. Loading Page 1 or Page 2.

(1) Install tape reel (page 1 or page 2) on paper tape reader.

(2) Set paper tape reader MODE SELECT to REEL and POWER ON/OFF switch to ON.

(3) Press system status panel RESET several times and observe that tape moves.

(4) Set WSR toggle switches to 00277600.

(5) Set OPERATIONAL CONTROL to STORE and REGISTER SELECT to PEX.

(6) Set RUN/ONE INSTR switch to ONE INSTR.

(7) Press INITIATE and observe that BUS INDICATOR displays 00277600.

(8) Set MEMORY guarded switch to UNPROTECTED.

(9) Set RUN/ONE INSTR toggle switch to RUN.

(10) Set OPERATIONAL CONTROL switch to CMPT.

(11) Press INITIATE pushbutton and observe that:

(*a*) Data base tape (page 1 or 2) loads into memory.

(*b*) PRGM HALT indicator lights at end of load.

(*c*) BUS INDICATOR displays 00277657 to verify a successful load with good checksum.

(12) Set MEMORY guarded switch to PROTECTED.

(13) Set system status panel TAPE REWIND switch to ON.

(14) Remove tape reel from tape reader.

5-20. Halting I/O Operations

(fig. 5-20)

Use this procedure to stop an input/output operation such as reading tapes, punching tapes, or printing. Perform this procedure from the maintenance control panel on which the I/O operation was initiated.

a. Set FUNCTION CODE to 10.

b. Press READ.

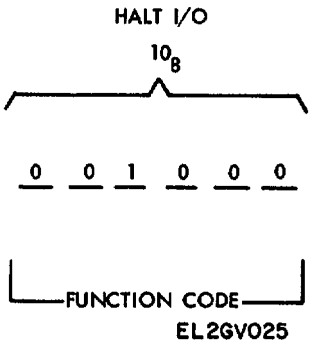


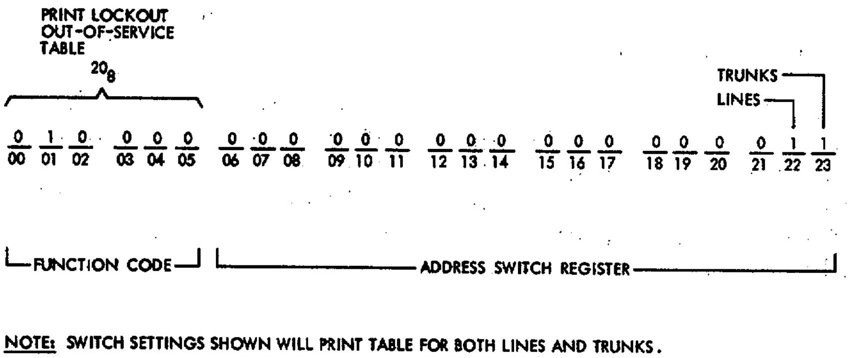
Figure 5-20. MCP switch for halting I/O operations.

6-21. Printing Lockout/Out-of Service Table
(fig. 5-21)

Use this procedure to printout a table of all terminals (lines and trunks) which currently have an out-of-service or lock-out status. The table presents frame, group, and terminal number and the associated status code. Status code 02 indicates that the terminal is out-of-service; the central office will neither accept incoming service nor initiate outgoing service to there terminals. Status code 08 indicates that the terminal is locked out; the central office will accept incoming service from this terminal but will not initiate outgoing service. Printing of this table is a low priority event in the operational program. The program will reject this request if the printer is busy. Also the program may break in on the printing of the table and print other maintenance messages or printouts requested by the FACP or remote teletypewriters. Enter requests for this table from the on-line maintenance control panel as follows.

a. Set FUNCTION CODE to 20.

b. Set ADDRESS SWITCH REGISTER bit 22 to 1 if the table should include lines and bit 23 to 1 if the table should include trunks. Both may be set if desired. All other bits must be set to zero.



NOTE: SWITCH SETTINGS SHOWN WILL PRINT TABLE FOR BOTH LINES AND TRUNKS.

EL2GV026

Figure 5-21. Typical MCP switch settings for printing lockout/out-of-service table.

c. Press READ.

d. Monitor printer for table in the following format.

```
LINE/TRK          LKOUT/OUT-OFSVC TBL
FGT/TGN                  STAT

 1-2-10                   02
 1--06                    02
 . . .
 8 7-09                   03
 END TBL
```

NOTE

Trunk group numbers (TGN) are not printed in this table.

5-22. Resetting and Setting Alarms from MCP
(fig. 5-22) .

Use this procedure to reset system status panel alarm lamps. The procedure may also be used to set alarms for test purposes. The procedure is not applicable to AC PWR and DC PWR MAJOR FAULT lamps which reset immediately when the fault is corrected. Audible alarms must be shut off manually using the appropriate pushbutton (para 3-22). The ALARM lamp on operator positions is shut off by the operational program when all system status panel alarm lamps are reset. Perform this procedure from the on-line maintenance control panel.

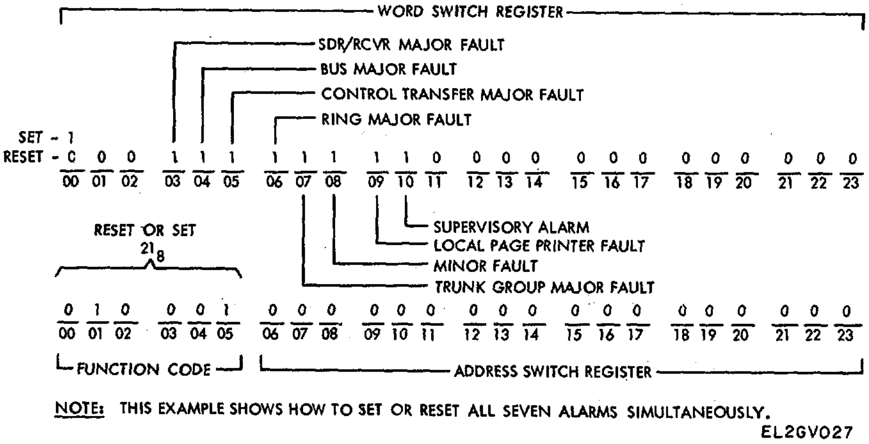
a. Set FUNCTION CODE to 21.

b. Set WORD SWITCH REGISTER bit 0 to O to reset alarm or to 1 to set alarm.

c. Select alarms to be reset by setting appropriate WORD SWITCH REGISTER bits to 1. Set all other bits to 0.

d. Press READ.

e. See that selected alarm lamp on system status panel A6 is set (illuminated) or reset (extinguished.).



NOTE: THIS EXAMPLE SHOWS HOW TO SET OR RESET ALL SEVEN ALARMS SIMULTANEOUSLY.

Figure 5-22. Typical MCP switch settings for resetting alarms

5-23. Marking Links Out-of-Service (fig. 5-24)

This procedure allows you to selectively mark AB, BC, or CD links out-of-service from the on-line maintenance control panel. Two of the situations leading you to do this are when you want to perform tests on an entire matrix path or when you want to remove a matrix card and avoid interruptions to service. In the first case all data defining the path is entered and all three-link types are marked out-of-service by one execution of this procedure. For matrix card replacement the procedure must be repeated several times until all links used by the card are marked out-of-service. The table in a below summarizes the data which must be entered and identifies the required repetitions of the disconnect procedure needed for different matrix card replacement cases. The individual steps of the procedure are given in b below.

a. Application Guide.

Goal	Number of cycles	Specify Links	enter topology
Mark entire path out-of-service (notes 1, 2)	1	Single link number	IF, IG, OF, OG
Mark A-stage card out-of-service	4	4 link numbers used by card	IF, IG
Mark B-stage card out-of-service	8	Link number of B-stage card	IF AN/TTC- 38(V)1: OF = 1 to 4, both basic and alternate links (note 3) AN/TTC- 38(V)2: OF = 1
Mark C-stage card out-of-service	8	Link number of C-stage	OF AN/TTC-38(V)1: IF = 1 to 4, both basic and alternate links (note 3) AN/TTC-38(V)2: IF = 1 to 8
Mark 8 x 8 D-stage card out-of-service	8 or	Link numbers used by card 1-8 9-16 17-20 (notes 1, 2)	OF, OG
Mark 12 x 4 D stage card out-of-service	12 or 8	Link numbers used by card 1-12 or 13-20 (notes 1, 2)	OF, OG

NOTES

1. Do not mark D-stage ring bus links (21-24) out-of-service. This will cause ring signal interruption to other terminals in group which are not connected to card.

2. AN/TTC-38(V)1 uses links 1-17. AN/TTC-38(V)2 uses links 1-19. Do not mark unused links out-of-service.

3. When marking B-stage or a C-stage card out-of-service for the AN/TTC-38(V)1, cycle through outlet or inlet frames 1 through 4 respectively for B and C stages with the alternate link bit set to 0. Then repeat with set to 1.

b. Procedure.

(1) Set FUNCTION CODE to 23.

(2) Specify link types to be marked out-of-service by setting applicable ADDRESS SWITCH REGISTER bits 09-11 to 1; set to 0 if not to be marked out-of-service.

(a) AB link, bit 09

(b) BC link, bit 10

(c) CD link, bit 11

(3) In AN/TTC-38(V)1 if alternate link number is used set ADDRESS SWITCH REGISTER bit 18 to 1; otherwise set to 0.

(4) Set binary representation of link number into ADDRESS SWITCH REGISTER bits 19-23.

(5) Set ADDRESS SWITCH REGISTER bits 07 and 08 to 01, indicating out-of-service command.

(6) Set remaining ADDRESS SWITCH REGISTER bits (06, 12-17) to 0.

(7) Determine which frame and group numbers must be specified for type of links being marked out-of-service.

(a) AB links are specified by IF and IG numbers.

(b) BC links are specified by IF and OF numbers.

(c) CD links are specified by OF and OG numbers.

NOTE

If more than one link is being marked out-of-service, all related numbers must be specified.

(8) Set WORD SWITCH REGISTER switches to BCD representation of frame and group identifying numbers:

(a) Inlet frame number, bits 00-03.
(b) Inlet group number, bits 04-07.
(c) Outlet frame number, bits 12-15.
(d) Outlet group number, bits 16-19.

NOTE

Set these bits to 0 if numbers do not need to be specified for selected link types.

(9) Set unused WORD SWITCH REGISTER bits (08-11, 20-23) to 0.

(10) Press READ.

(11) Monitor printer for one of the following messages.

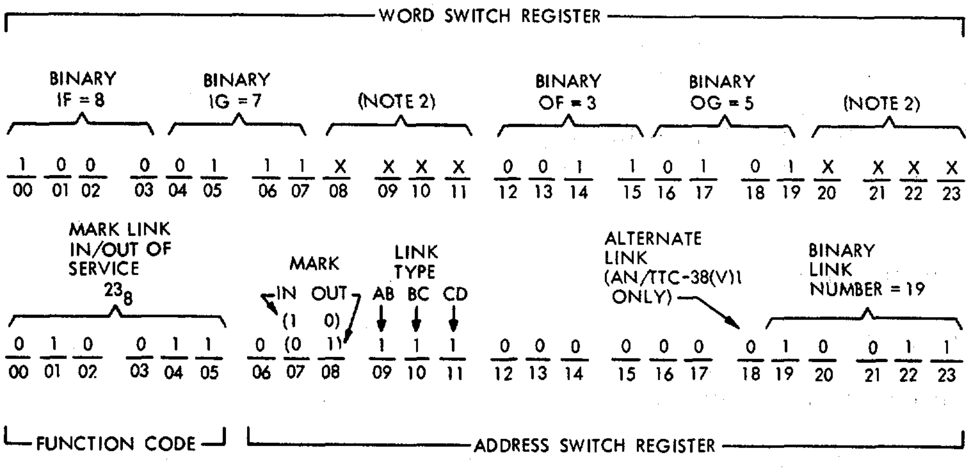
(a) LINKS BUSY. One or more of the requested links was busy or already marked out-of-service and the special request was not executed. Repeat order, except attempt to mark only one portion (either AB, BC, or CD) of parts out-of-service. If only one link was specified, repeat attempt every 20 or 30 seconds. If unsuccessful after several attempts assume link to already be out-of-service.

(b) ILLEGAL I/O ORDER. An invalid request was made. Check for correct switch settings. Check that only required frame and group number are entered in the WORD SWITCH REGISTER.

5-24. Marking Links In-Service (fig. 5-23)

Use this procedure to mark busy or out-of-service AB, BC and CD links in-service from the MCP. Links must be marked back in-service after disconnect failures have been corrected or after the links have been manually marked out-of-service. This special request will be executed even though some or all of the specified links are already in-service. The procedure is performed from the on-line maintenance control panel.

a. Set FUNCTION CODE to 23.



NOTES: 1. THIS EXAMPLE SHOWS HOW TO MARK THE ENTIRE LINK 19 PATH FROM IFG-8-7 TO OFG 3-5 IN OR OUT OF SERVICE.
2. X INDICATES DON'T CARE. BINARY TERMINAL NUMBER MAY BE ENTERED.

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Figure 5-23. Typical MCP switch settings for link-in- and out-of-service markings.

b. Specify link types to be marked in-service by setting applicable ADDRESS SWITCH REGISTER bits 09-11 to 1; set to O if not to be marked in-service:

(1) AB link, bit 09

(2) BC link, bit 10

(3) CD link, bit 11

c. In AN/TTC-38(V)l if alternate link number is used set ADDRESS SWITCH REGISTER bit 18 to 1; otherwise set to 0.

d. Set binary representation of link number into ADDRESS SWITCH REGISTER bits 19-23.

e. Set ADDRESS SWITCH REGISTER bits 07 and 08 to 10, indicating in-service command.

f. Set remaining ADDRESS SWITCH REGISTER bits (06, 12-17) to 0.

g. Determine which frame and group numbers must be specified for type of links being marked in-service.

(1) AB links are specified by IF and IG numbers.

(2) BC links are specified by IF and OF numbers.

(3) CD links are specified by OF and OG numbers.

If more than one link type is specified, all related frame and group numbers must be specified.

h. Set WORD SWITCH REGISTER switches to binary representation of frame and group numbers. If unused set to 0.

(1) Inlet frame number, bits 00-03.
(2) Inlet group number, bits 04-07.
(3) Outlet frame number, bits 12-15.
(4) Outlet group number, bits 16-19.

i. Set unused WORD SWITCH REGISTER bits (08-11, 20-23) to 0.

j. Press READ.

k. The following message may printout.

ILLEGAL I/O ORDER
An invalid request was made. Check for
incorrect switch settings.

5-25. Network Connect Request (fig. 5-24)

Use this procedure whenever you want to connect a path through the matrix using a specific inlet terminal, link and outlet terminal. Perform this procedure from the on-line maintenance control panel.

a. Mark inlet terminal and outlet terminal out-of service from FACP (para 2-65).

b. Mark AB, BC and CD links for selected path out-of-service from MCP (para 5-23).

c. Set FUNCTION CODE to 24.

d. Set ADDRESS SWITCH REGISTER bit 13 to 1.

e. Set ADDRESS SWITCH REGISTER bits 15 and 16 to 10 to indicate connect.

f. In AN/rTC-38(V)1 if alternate BC link number is selected, set ADDRESS SWITCH REGISTER bit 18 to 1. Otherwise set bit 18 to 0.

g. Set binary representation of BC link number into ADDRESS SWITCH REGISTER bits 19 to 23.

h. Set WORD SWITCH REGISTER to binary representations of selected inlet and outlet terminals:

(1) Inlet frame number, bits 00 to 03.
(2) Inlet group number, bits 04 to 07.
(3) Inlet terminal number, bits 08 to 11.
(4) Outlet frame number, bits 12 to 15.
(5) Outlet group number, bits 16 to 19.
(6) Outlet terminal number, bits 20 to 23.

i. Press READ.

j. Printer prints one of the following messages:

(1) PATH X-X-XX W VV Y-Y-YY CONCTD

where

X-X-XX is the inlet frame, group, and terminal number.

VV is the link number.

Y-Y-YY is the outlet frame group and terminal number.

W if 1, indicates alternate link on AN/ TTC-38(V) 1.

This message means that the indicated path is connected. This path can be disconnected only from the MCP (para 5-26).

(2) ILLEGAL I/O ORDER. This means that an illegal request was made. Check that the correct function code was entered and that only the required ADDRESS SWITCH REGISTER bits are set for 1. Verify that the terminals and links are marked out-of-service.

(3) COORDS BUSY. Some or all of selected path links or terminals are not marked out-of-service.

Mark entire path out-of-service (para 5-23 and 2-65).

(4) C/D TST CMPT test was completed.

(5) NT FLT TYPE C1 or TYPE C2. Path failed to connect. Refer to troubleshooting chart (para 5-7).

Links are automatically marked back in-service. If you want to repeat test, mark links out-of-service (para 5-23).

5-26. Network Disconnect Request (fig. 5-24)

Use this procedure to disconnect a test path previously established using the network connect request. Use the on-line maintenance control panel.

a. Set FUNCTION CODE to 24.

b. Set ADDRESS SWITCH REGISTER bit 13 to 1 to indicate network diagnosis request.

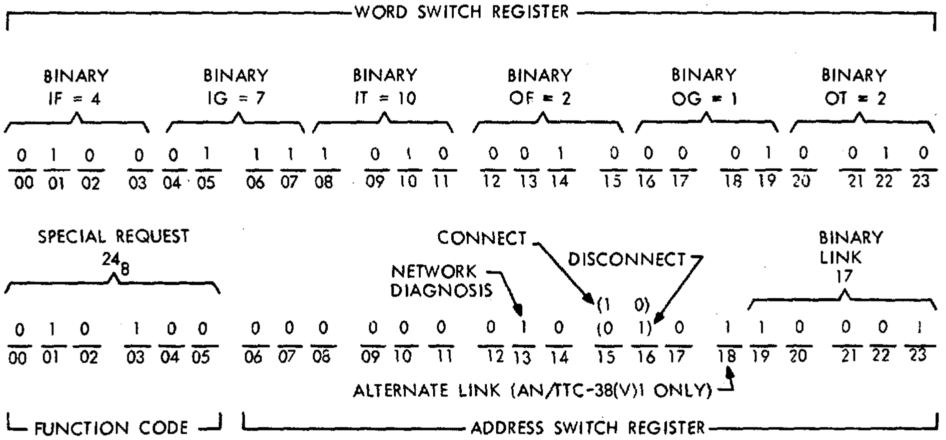
c. Set ADDRESS SWITCH REGISTER bits 15 and 16 to 01 to indicate disconnect.

d. If AN/TTC-38(V)1 alternate link number is used in path, set ADDRESS SWITCH REGISTER bit 18 to 1. Otherwise set bit 18 to 0.

e. Set binary representation of BC link number into ADDRESS SWITCH REGISTER bits 19 to 23.

f. Set WORD SWITCH REGISTER to binary representation of inlet and outlet terminal numbers:

(1) Inlet frame number, bits 00 to 03
(2) Inlet group number, bits 04 to 07
(3) Inlet terminal number, bits 08 to 11
(4) Outlet frame number, bits 12 to 15
(5) Outlet group number, bits 16 to 19



NOTE: THIS EXAMPLE SHOWS HOW TO CONNECT OR DISCONNECT A PATH THROUGH IFGT 4-7-10, ALTERNATE LINK 17, AND OFGT 2-1-2 IN THE AN/TTC-38(V)1.

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Figure 5-24. Typical MCP switch settings for network diagnostic request.

(6) Outlet terminal number, bits 20 to 23.

g. Press READ.

h. Printer prints one of the following messages.

(1) PATH X-X-XX VV W Y-Y-YY DSCONCTD

where

X-X-XX is inlet frame, group, and terminal number.

BC is link number

Y-Y-YY is outlet frame, group, and terminal.

W indicates AN/TTC-38(V)1 alternate link of 1.

NOTE

The indicated path has been disconnected. However, the inlet and outlet terminals and link are still marked out-of-service.

(2) ILLEGAL I/O ORDER. An illegal request was made from the MCP. Check that the FUNCTION CODE and ADDRESS SWITCH REGISTER bits are set correctly. Check that the path was previously connected from the MCP.

(3) C/D TST CMPT. Test complete. See other message for test results.

i. If desired, mark link in-service from MCP (para 5-24).

j. If desired, mark inlet and outlet terminals in-service from FACP (para 2-65).

5-27. More-Than-One (MTO) MI, M2, and Driver Exercise Tests

These options provide circuit exercises restricted to a particular network path. Select the M1 option to test a P- driver, the M2 option to test a P+ driver, or the driver special exercise to test error detection circuits, for all drivers in the specified path. Select a path containing the circuits to be tested. If you are testing a circuit because failure was indicated by the on-line network diagnostics, select the path printed in the failure message. Initiate the test from the on-line MCP as follows, referring to figure 5-25.

a. Set FUNCTION CODE switches to 24.

b. Set ADDRESS SWITCH REGISTER bit 11 to 1 for selection of matrix driver exercise.

c. Select test option with ADDRESS SWITCH REGISTER bits 15 and 16, as follows:

ASR bits		
15	16	
1	1	MTO test M2
1	0	MTO test MI
1	0	driver exercise

d. Set binary representation of selected BC link address into ADDRESS SWITCH REGISTER bits 19-23.

e. Set ADDRESS SWITCH REGISTER bit 18 to 1 if alternate BC link is desired (AN/TTC-38(V)1 only).

f. Set WORD SWITCH REGISTER to binary representations of selected inlet and outlet matrix path:

(1) Inlet frame number, bits 00-03.
(2) Inlet group number, bits 04-07.
(3) Inlet terminal number, bits 08-11.
(4) Outlet frame number, bits 12-15.
(5) Outlet group number, bits 16-19.
(6) Outlet terminal number, bits 20-23.
(7) Press READ.
(8) Observe that printer prints one of the following messages:

(a) DRVR M1 (or M2) TST

```
IFGT   BC  A              OFGT
X-X-XX VV  U    Y-Y-YY    CMPT
```

NOTE

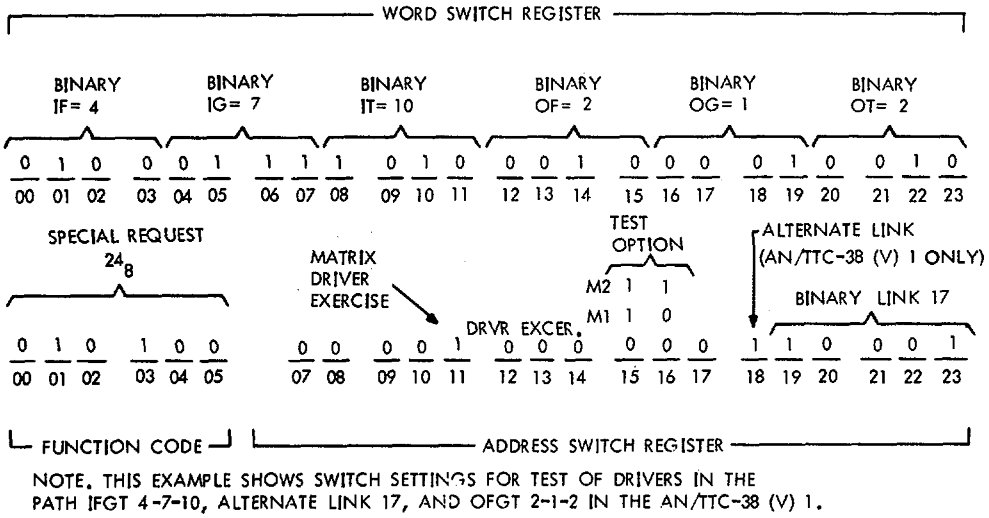
CMP indicates test complete. M1 indicates MTO M1 test; in its place, M2 indicates MTO M2 test; no characters printed in this space indicates driver exercise test.

(9) NT FLT

```
SBR    IFGT TYPE     OFGT   A BC
aaaaaa X-X-XX M1 or M2 Y-Y-YY U VV
```

NOTE

MI indicates failure during MTO M1 test; M2 indicates failure during MTO M2 test.



NOTE. THIS EXAMPLE SHOWS SWITCH SETTINGS FOR TEST OF DRIVERS IN THE PATH IFGT 4-7-10, ALTERNATE LINK 17, AND OFGT 2-1-2 IN THE AN/TTC-38 (V) 1.

EL 5805-628-12-TM-207

Figure 5-25. Typical MCP switch settings for matrix driver special exercise tests MI, M2, or driver exercise.

where

X-X-XX is inlet frame - group - terminal number.

Y-Y-YY is outlet frame - group - terminal number.

U = 1 indicates primary link used (AN/ TTC-38(V)1 only).

U = O indicates primary link used.

VV is BC link used.

aaaaaa is octal output of error summary cards.

5-28. Driver-Zero (ZCK) Special Exercise Test

a. Set FUNCTION CODE switches to 24.

b. Set ADDRESS SWITCH REGISTER bit 11 to 1 for selection of matrix driver exercise.

c. Set ADDRESS SWITCH REGISTER bit 15 to 0 and bit 16 to 1 for selection of ZCK special exercise.

d. Press READ.

e. Printer prints the following message if test passed:

NTWK O TST CMPT

NOTE

Failure messages can be any of those which occur during on-line network exercise tests Z1-Z4 (para 5-7h).

5-29. Sender/Receiver Special Exercise Test (fig. 5-26)

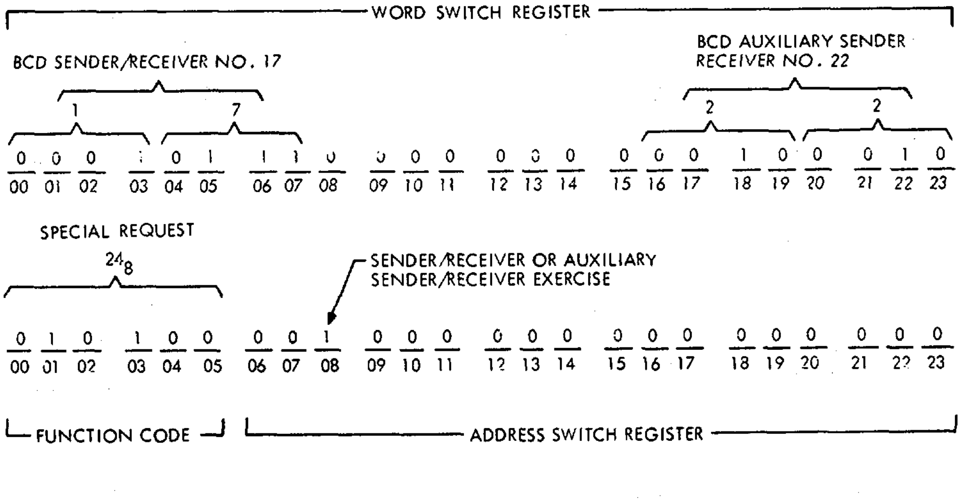
Perform this test whenever you want to checkout a specific sender/receiver. Both in-service and out-of-service sender/receivers can be tested. If an out-of-service sender/receiver is found to be good by the test, it will be automatically marked in-service. Also, an in-service sender/receiver which fails the test is automatically marked out-of-service. You must specify the auxiliary sender/receiver used to test the sender/receiver. You may want to checkout the auxiliary sender/receiver (para 5-30) before proceeding with this test. Sender/receiver and auxiliary sender/receiver numbers which you will need are shown in figure FO-37. Enter the sender/receiver special exercise test from the maintenance .control panel of the on-line processor as follows:

a. Set FUNCTION CODE to 24.

b. Set ADDRESS SWITCH REGISTER bit 08 to 1.

c. Set WORD SWITCH REGISTER bits 00-07 to the binary coded decimal representation of the sender/receiver number.

d. Set WORD SWITCH REGISTER bits 16-23 to the binary coded decimal representation of the auxiliary sender receiver number.



NOTE: THIS EXAMPLE SHOWS SENDER/RECEIVER NO. 17 TESTED BY AUXILIARY SENDER/RECEIVER NO. 22.

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Figure 5-26. Typical MCP switch settings for sender/receiver special exercise test.

e. Press READ. Monitor the page printer for the following printouts.

f. SR VV TO XSR WW GOOD. The sender/receiver passed the test.

g. SR VV BUSY. The selected sender/receiver VV was busy and could not be interrupted for this test. Try test again after a few seconds by pressing READ.

h. XSR WW UNV. The selected auxiliary sender/receiver WW was busy and could not be interrupted for this test. Try test again after a few seconds by pressing READ.

i. SR VV TO XSR WW FAILS.

XXXXXX YYYYY ZZZZZZ

NOTE

The sender/receiver failed the send portion of the test. Number XXXXXX indicates the tone frequency which should have been sent. Number YYYYYY indicates the frequency that was received. Number ZZZZZZ indicates the amplitude of the tone that was received. Figure 5-5 shows how to interpret these numbers. Refer to troubleshooting chart for corrective action (para 5-7k).

j. XSR WW TO SR VV FAILS.

XXXXXX YYYYYY

NOTE

The sender/receiver failed the receive portion of the test. Number XXXXXX indicates tone frequency sent. Number YYYYYY indicates the frequency detected by the sender/receiver. Figure 5-5 shows how to interpret these numbers. Refer to troubleshooting chart for corrective action (para 5-7k).

k. ILLEGAL I/O ORDER. The test was entered incorrectly. One of the following errors may have been made.

(1) An invalid sender/receiver number VV was entered in the WORD SWITCH REGISTER. Check figure FO-37 for valid numbers display terminal service (para 3-10).

(2) An unassigned invalid auxiliary sender/receiver number WW was entered in the WORD SWITCH REGISTER. Check figure FO-37 for correct numbers display terminal service (para 3-10).

(3) Incorrect ADDRESS SWITCH REGISTER setting, only bit 8 should be set.

(4) The off-line processor maintenance control panel was used. Perform this test only with the on-line processor.

i. SR TST CMPT. Sender/receiver test complete.

5-30. Auxiliary Sender/Receiver Special Exercise Test (fig. 5-27)

Perform this test whenever you want to checkout an auxiliary sender/receiver. The test can be performed on both in-service and out-of-service auxiliary sender/receivers. The tested auxiliary sender/receiver will automatically be marked in-service if it passes the test or out-of-service if it fails the test. The test can be run either by looping the sender and receiver)portions of the same auxiliary sender/receiver or by checking the entire circuit back-to-back against the other auxiliary sender/receiver. Normally, the loop test is preferred. It is a shorter test and quickly checks overall capability. If the back-to-back test is performed, checkout the comparison auxiliary sender/receiver using the loop test first. Enter the auxiliary sender/receiver special exercise test from the maintenance control panel of the on-line processor as follows:

a. Set the FUNCTION CODE to 24.

b. Set ADDRESS SWITCH REGISTER bit 08 to 1. All other bits are zero.

c. Set WORD SWITCH REGISTER bits 00-07 to the binary coded decimal equivalent of the auxiliary sender/receiver number to be tested.

d. Set WORD SWITCH REGISTER bits 16-23 to the binary coded decimal equivalent of test comparison auxiliary sender/receiver. For loop test this should be the same number as entered in step c. For back-to-back test, the number of the other auxiliary sender receiver should be entered.

e. Press READ. Monitor the page printer for following printouts.

f. XSRWW to XSR UU GOOD. The auxiliary sender/receiver passed the test. WW is the auxiliary sender/receiver under test. UU identifies the comparison auxiliary sender/receiver. WW and UU are the same number for a loop test.

g. XSR WW UNV. Auxiliary sender/receiver WW was busy and could not be interrupted to be placed under test. Try test again after a few seconds by pressing READ.

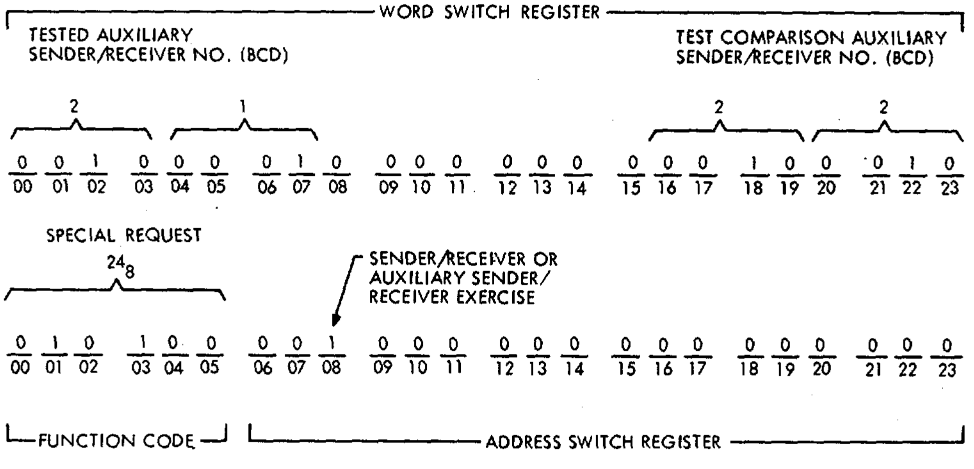
h. XSR UU UNV. The selected comparison auxiliary sender/receiver UU was busy and could not be interrupted for this test. Try test again after a few seconds by pressing READ.

i. XSR WW TO XSR WW FAILS.

XXXXXX YYYYYY

NOTE

The auxiliary sender/receiver failed the loop test. XXXXXX indicates the tone frequency which should have been sent. YYYYYY indicates the frequency which was received. Figure 5-5 shows how to interpret these numbers. If you have no other information concerning this fault, run a back-to-back test with a comparison aux-



NOTE: THIS EXAMPLE SHOWS AUXILIARY SENDER/RECEIVER NO. 21 BEING TESTED BY AUXILIARY SENDER/RECEIVER NO. 22.

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Figure 5-27. Typical MCP switch settings for auxiliary sender/ receiver special exercise test.

iliary sender/receiver to further diagnose the problem. Refer to troubleshooting chart for corrective action (para 5-7k). If this printout occurs following an associated sender test fault, refer to corrective actions in paragraph 5-7k3. If this printout occurs following an associated receiver test fault, refer to the corrective action of paragraph 5-7k4.

j. XSR WW TO XSR UU FAILS.
XXXXXX YYYYYY'

NOTE

The sender portion of a back-to-back test fail where WW and UU are defined in f above. Replace the' ASR(s) card of auxiliary sender/receiver WW (fig. FO--37) and repeat the test.

k. XSR UU 1'TO XSR WW FAILS.
XXXXXX YYYYYY

NOTE

The receiver portion of a back-to-back test failed where WW and UU are defined in f above. Refer to troubleshooting chart for corrective action (para 5-7k).

l. ILLEAGAL ORDER. The test was entered incorrectly. One of the following errors may have been made.

(1) An unassigned invalid auxiliary sender receiver number was used. Check figure FO-37 for valid numbers. Study paragraph 5-12 for BCD conversion.

(2) ADDRESS SWITCH REGISTER setting was incorrect.

m. XSR ITST CMPT. Test complete.

5-31. Conference Bridge Special Exercise Test (fig. 5-28)

Perform this test whenever you want to checkout one of the four 5-party conference bridges or the 9-party conference bridge. Each conference bridge is identified by the service terminal number to which its master port is patched and assigned. To determine conference bridge master port assignments (if it cannot be identified on circuit records), trace the patch cord wiring from the conference bridge master port connector (green) on common equipment panel A27 to its network connection (yellow). Then read the frame, group, and terminal number for the network connector on the panel. You can verify that this FGT number is a master port by displaying terminal service on the FACP (para 3-11). Terminal type 57 is displayed if this terminal is assigned to a 5-part(conference bridge master port; terminal type 59 indicates the 9-party master port. Terminal types 58 and 60 indicate party ports which cannot be used to identify a conference bridge in this test. Conference bridges which pass this test are marked in-service. Failure of the test causes the conference bridge to be marked out-of-service. The test is performed from the on-line maintenance control panel as follows:

a. Set FUNCTION CODE to 24.

b. Set ADDRESS SWITCH REGISTER bit 09 to 1.

c. Set WORD SWITCH REGISTER bits as follows to specify master port of tested conference bridge in binary format.

(1) Bits 00-03 = Frame number.
(2) Bits 04-07 = Group number.
(3) Bits 08-11 = Terminal number.

d. Set all other MCP switches to 0.

e. Press READ. Monitor page printer for following printouts.

f. CONF N-N-NN GOOD CONF TST CMPT.

NOTE

The test has been successfully completed. The conference bridge was marked in-service.

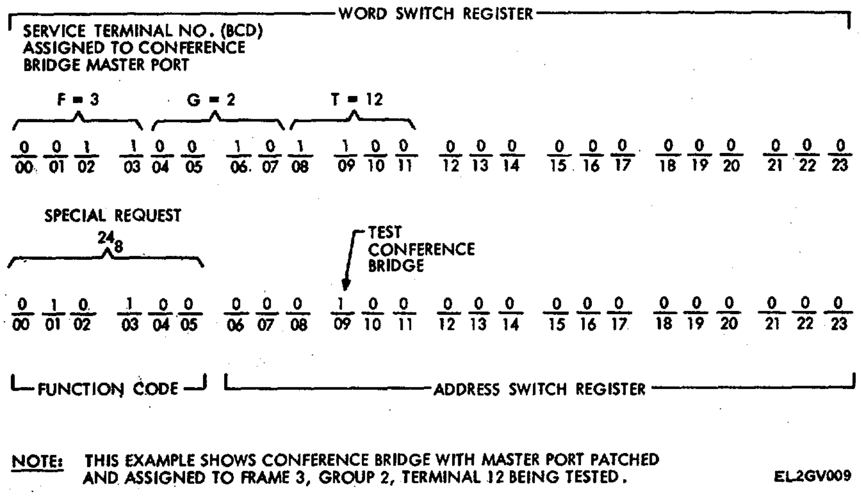
g. CONF N-N-NN FAILS.

```
FGT    FGT  TN    LVL
X-X-XX Y-Y-YY YYYYYY ZZZZZZZ
```

NOTE

The conference bridge failed the special exercise test, and was marked out-of-service (para 5-7l).

h. CONF N-N-NN BUSY. Th, conference bridge was busy. Wait several minutes and press READ again.



NOTE: THIS EXAMPLE SHOWS CONFERENCE BRIDGE WITH MASTER PORT PATCHED AND ASSIGNED TO FRAME 3, GROUP 2, TERMINAL 12 BEING TESTED.

Figure 5-28. Typical MCP switch settings for conference bridge special exercise test.

i. ILLEGAL I/O ORDER. The test was initiated improperly. Check that the frame-group-terminal is entered properly, and that all other switches are in their proper position.

j. CONF TST COMPT. Test complete.

5-32. Displaying System Ring Bus Status (fig. 5-29)

Use this procedure whenever you want to determine the out-of-service and bus connection status of bus ringers. The procedure is performed using switches and the BUS INDICATOR display lamps of the online maintenance control panel as follows:

a. Set FUNCTION CODE to 22.

b. Set all ADDRESS SWITCH REGISTER bits to O.

c. Set ADDRESS SWITCH REGISTER bit 8 to 1.

d. Set ADDRESS SWITCH REGISTER bit 13 to 1.

e. Depress READ.

f. Observe BUS INDICATOR bits 13-16 and interpret display.

5-33. Marking System Bus Ringers In - or Out-of-Service (fig. 5-30)

Use this procedure whenever you want to mark a system bus ringer in- or out-of-service. The program guards against marking both A and B ringers out of-service. Display the status of ringers before and after using this procedure (para 5-32). This procedure only marks a ringer in-service, not online. To connect a system bus ringer on-line, perform a special request test on it (para 6-84).

These procedures are performed from the on-line maintenance ,control panel.

a. Set FUNCTION CODE to 22.

b. Select system bus ringer by setting ADDRESS SWITCH REGISTER bits 07 and 08 to 01.

c. Select generator A or B using ADDRESS SWITCH REGISTER bits 09 or 10.

d. Select in-service or out-of-service marking by using bits 11 or 12.

e. Press READ.

f. Observe SUPERVISORY ALARM on A7. If lighted check printer for message: ILLEGAL I/O ORDER

NOTE

This message indicates that you tried to mark a ringer out-of-service and that the other ringer is also out-of-service. It may also mean incorrect switch settings. Check switch settings and display status if in doubt.

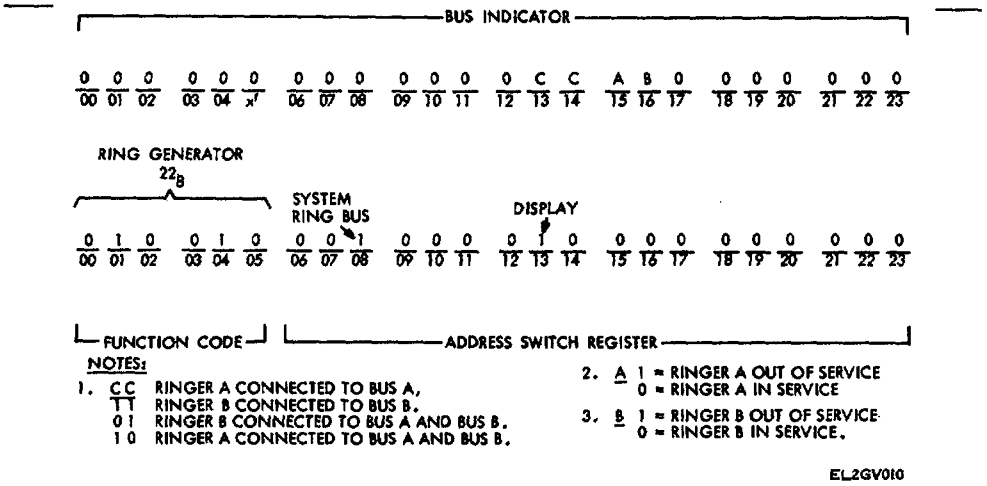


Figure 5-29. MCP switch settings and interpretation of system ring bus status display

g. Display status of ringer to assure requested marking was accomplished (para 5-32).

5-34. System Ring Bus Special Request Test (fig. 5-81)

Perform this teat whenever you want to check out system bus ringer A or B. The ringer need not be connected to the bus to perform the test but it must be marked in-service (par 6-83). If in doubt about the connection or in-service status of ringers, display this information on the maintenance control panel (para 6-82). A bus ringer which is not connected before the test is run, will be connected to its bus automatically if it passes the test. The test is performed on the on-line maintenance control panel as follows:

a. Set FUNCTION CODE to 24.

b. Set all ADDRESS SWITCH REGISTER bits to 0.

c. Set ADDRESS SWITCH REGISTER bit 12 to 1.

d. Set ADDRESS SWITCH REGISTER bits 15 and 16 to select r to be tested.
10 select bus ringer A.
01 select bus ringer B.

e. Press READ. Monitor page printer for following messages.

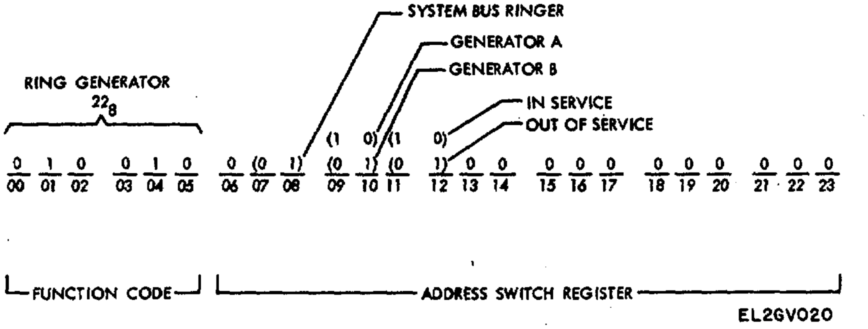


Figure 5-30. MCP switch setting for ringer in-and out-of-service marking.

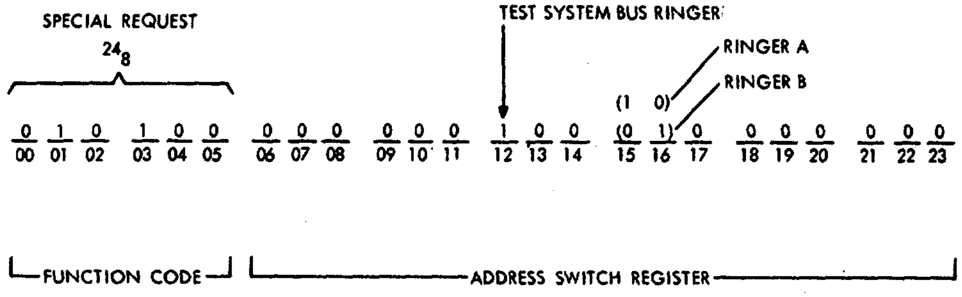


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Figure 5-31. MCP switch settings for system ring bus special

f. RING TST COMPT. The selected ringer passed the test and is connected to its bus.

g. RING FAILS.

OFGT LK RG TN LV
X-X-XX YY UV YYYYYY ZZZZZZZ

NOTE

The selected ringer failed the test; refer to troubleshooting chart (para 5-7m).

h. ILLEGAL I/O ORDER. The A7 SUPERVISORY ALARM lights when this printout occurs.

(1) Check for correct switch setting of ADDRESS SWITCH REGISTER bits 15 and 16.

(2) See that the selected ringer is marked in-service.

(3) The auxiliary sender/receiver used for the test may have been busy, try test again by pressing READ.

(4) See that the auxiliary sender/receiver on the same lettered bus is in-service and assigned.

5--35. Switching 20-Hz Ring Generators (fig. 5-32)

Use this procedure whenever you want to switch the 20-Hz ring generator connected to the 20-Hz ring bus.

The program prevents you from making errors in 20Hz ringer connections: only one ringer can be connected to the bus and you cannot switch a bad generator onto the bus if a good generator is presently connected. The program senses failures of 20-Hz ringer A or B and automatically connects the operating generator on-line. Therefore, you do not need to perform this procedure if one of the generator fails. You may want to perform this procedure to find out which generator is on line because status is also printed. The switchover procedure is requested from the on-line maintenance control panel as follows:

a. Set FUNCTION CODE to 22.

b. Set all ADDRESS SWITCH REGISTER bits to 0.

c. Set ADDRESS SWITCH REGISTER bit 07 to 1.

d. Set ADDRESS SWITCH REGISTER bits 09 and 10 to select 20 Hz ringer to be connected.

e. Set ADDRESS SWITCH REGISTER bit 11 to 1.

f. Press READ. Monitor system status panel and printer for following indications.

g. System status panel SUPERVISORY ALARM lights and printer prints: ILLEGAL I/O ORDER.

NOTE

Program is not in long loop (full call processing) or incorrect maintenance control panel switch settings.

h. Printer prints:

20-HZ STATUS A B CC:

NOTE

The present status of the 20-Hz ringers is indicated by A B CC:

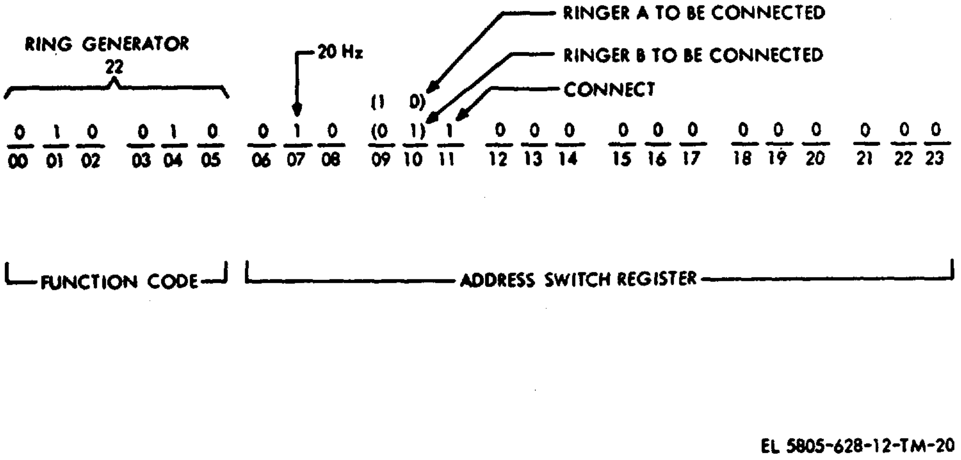

Figure 5-32 MCP switch settings for 20-Hz ringer switchover.

A - 1 if ringer A is operating.

B - 1 if ringer B is operating.

CC = 10 if ringer A is on line.

CC = 01 if ringer B is on line.

5-36. SBR Bus Special Exercise (fig. 5-33)

Use this test whenever you want to test signaling register buses. The test may be initiated in the online, standby, or off-line processors which have the operational program loaded and running. The same test is automatically performed every half second in the on-line and standby processors. The automatic test only generates a printout if errors are detected. However you must request the operational program in an off-line active processor to perform the test from the maintenance control panel as follows:

a. On A6 set CONTROL TRANSFER toggle switch to DISABLE.

b. Set FUNCTION CODE to 24.

c. Set ADDRESS SWITCH REGISTER bit 07 to].

d. Press READ.

e. Monitor printer for following messages.

(1) SRB TST CMPT

The test was passed; busses SRBA, SRBB and SRBC are operating properly.

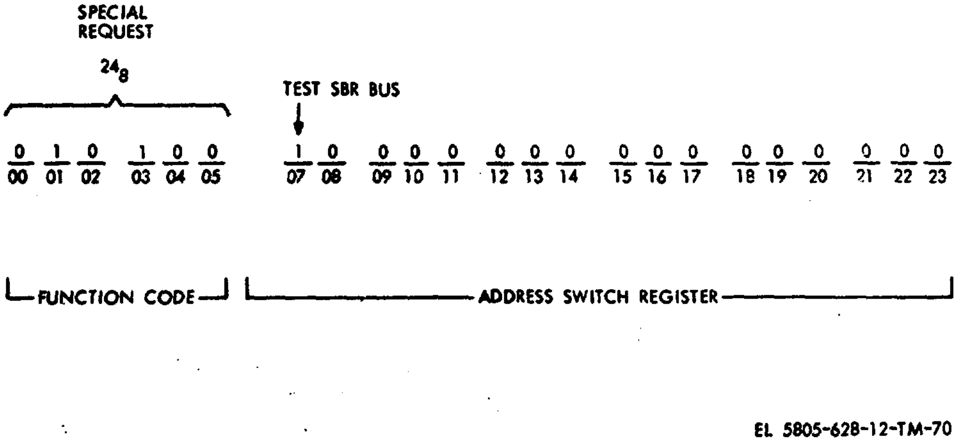

Figure 5-33. MCP switch settings for SBR bus test.

(2) SRB A FAILS

RRRRRR

Where: A identifies the bus (A, B, or C), RRRRRR identifies bits which failed to pass the test (para 5-7p and A, fig. 5-8).

f. When testing or working on the SBR and bus is complete, set A6 CONTROL TRANSFER toggle switch to AUTO ENABLE.

5-37. Error Group Enable Gates Test (fig. 5-34)

This test causes the exercise programs to test the processor error group (EGRP) enable gates. Two tests are performed. The first test causes all EGRP gates to be enabled and any gate which does not go to a logical 1 will cause a fault message. The second test is performed with all EGRP gates disabled, thus any gate which does not go to a logical 0 will cause a fault message. The test is performed in the following manner at the MCP of the processor being tested.

a. Set FUNCTION CODE to 24.

b. Set ADDRESS SWITCH REGISTER bit 10 to 1 and all other bits to 0.

c. Press READ. Monitor printer for follow messages:

(1) EGRP TEST CMPT (ACT OR SBY) Processor XXX has completed the test. If no type EI or EO messages are printed before message, the processor passed the test.

(2)

NT FLT IFGT' TYPE OFGT BC ACC aaa

EI 0-0-00-00 indicates that the ones test failed.

(3) IFGT TYPE OFGT BC ACC aaa

EO 0-00-00 indicates that the zero test failed.

Number -M is the octal content of accumulator bits 08 to 15 which identifies the failing EGRP signal (fig. 5-35).

(4)

ILLEGAL I/O ORDER Check FUNCTION. CODE and ADDRESS SWITCH REGISTER for incorrect settings.

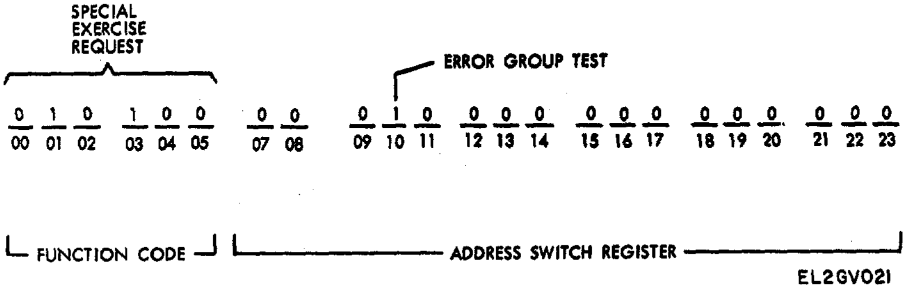

Figure 5-34. MCP switch settings for error group enable test.

PRINTOUT DIGIT	a		a			a		
GO E1 PRINTOUT AN/TTC-38 (V) 1	3		6			0		
GO E1 PRINTOUT AN/TTC-38 (V) 2	3		7			7		
GO E0 PRINTOUT AN/TTC-38 (V) (X)	0		0			0		
ACCUMULATOR BIT	08	09	10	11	12	13	14	15
ERROR GROUP SIGNAL	ERGP1	ERGP2	ERGP3	ERGP4	ERGP5	ERGP6	ERGP7	ERGP8
VALUE	2	1	4	2	1	4	2	1

NOTES:

1. NORMAL GO PRINTOUT FOR E1 (ONES) TEST IS aaa = 360 IN AN/TTC-38 (V) 1 AND aaa = 377 IN AN/TTC-38 (V) 2, NORMAL GO PRINTOUT FOR E0 (ZEROS) TEST IS aaa = 000 IN BOTH SYSTEMS.

2. TO IDENTIFY FAILED ERROR GROUP SIGNALS IN E0 TEST, SEE WHICH VALUES IN ABOVE TABLE MUST BE ADDED TO DIGIT IN aaa TO PROVIDE VALUE OF DIGIT PRINTED. FOR EXAMPLE IN AN/TTC-38 (V) 2 IF aaa = 105, ERROR GROUP SIGNALS ERGP2, ERGP6, AND ERGP8 FAILED.

3. TO IDENTIFY FAILED ERROR GROUP SIGNALS IN E1 TEST, SEE WHICH VALUES MUST BE SUBTRACTED FROM NORMAL GO PRINTOUT TO FORM aaa DIGITS PRINTED. FOR EXAMPLE IN AN/TTC-38 (V) 1 IF aaa = 160, ERROR GROUP SIGNAL ERGP1 FAILED.

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Figure 5-35. Error group signal analysis

5-37.1. Enable/Disable M and Z Tests (fig. 5-35.1)

This procedure allows you toe disable the network M and Z tests performed by the operational program. This should only be done to prevent excessive fault message printouts during troubleshooting and repair. During normal operation the M and Z tests must be enabled. More-than-one exercise tests (para 5-27) can not be run while the disable is applied. The M and Z tests are enabled or disabled from the on-line maintenance control panel as follows:

a. Set FUNCTION CODE to 26.

b. Set ADDRESS SWITCH REGISTER bit 23 to 1 for disable or 0 for enable.

c. Press READ.

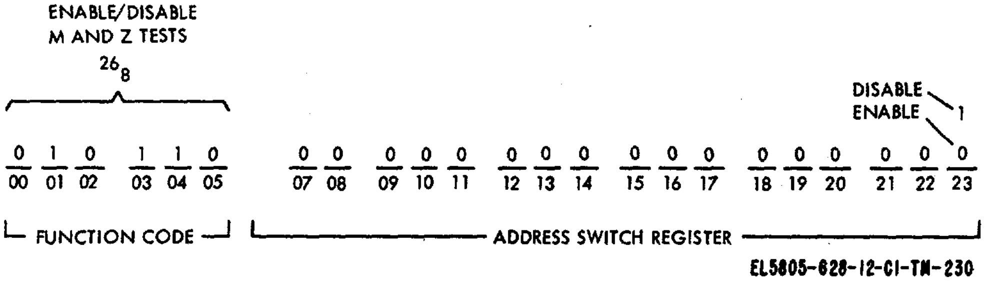

Figure 5-36. 1. MCP switch settings for enable/disable M and Z tests.

5-37.2. Driver Fault Initialization Procedure (fig. 5-35.2)

When troubleshooting type C1 network faults (para 5-7g) it is necessary to compare several messages. The maintenance portion of the operational program automatically prints a new C1 message only if the aaaaaa number changes. Use the following procedure to request additional messages from the on-line maintenance control panel.

a. Set FUNCTION CODE to 21.

b. Set WORD SWITCH REGISTER bits 81 and 23 to 1

c. Press READ and monitor printer for fault message.

d. After printer stops, press READ again for each new message desired.

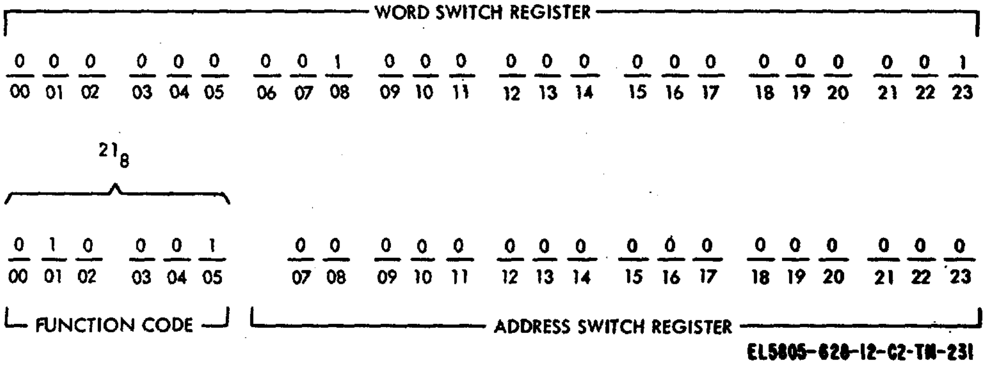

Figure 5-35.2. MCP switch settings to request additional type C1 fault messages.

Section IV. NTS MAINTENANCE

5-38. Troubleshooting SBR Bus Shorts.

A shorted network terminal subsystem circuit card which interfaces with signaling buffer register busses SRBA, SRBB, or SRBC is detected by on-line program automatic tests. Because many cards interface with each bus bit line, it is necessary to sequentially disconnect each card using that bit until the fault is cleared. The following procedures guide you through this sequence. While you are lifting cards in the online network terminal subsystem you may cause several other types of error printouts to occur and other equipments to be marked out-of-service. Therefore, after the bus short is repaired you must study all printouts which occurred during troubleshooting and repair, identify items marked out-of-service, and mark them back in-service.

a. Study the **RRRRRR** number in SRB A FAILS printout and identify faulty SRB bit number (A, fig. 5-8).

b. Tables A, B, and C in figure FO-41 show which cards are connected to busses SRBA, SRBB, and SRBC. On applicable table locate bit number found in step a and read across row to identify all network terminal subsystem cards which connect to bit.

c. Starting with cards marked with * in sequence disconnect each card by pulling out one inch. Test bus after each card is pulled to see if fault has been removed (page 5-36). If fault message repeats, reinsert card into its connector and try next card. If test reports no fault replace disconnected card and retest.

d. If fault message repeats after an * marked card is replaced, replaced card is not at fault. Reinsert original card but do not seat it (leave pulled out 1 inch). Fault was propagated onto bus from a card which drives the replaced card D, figure FO-41, identifies bus interfacing cards and the cards from which they can propagate faults.

e. One of the bits between SRBO1 and SRB13 indicates a fault. The faulty card is located in the common equipment assembly (A27). Refer to PROPAGATES FAULT FROM column of D, figure FO-41, for a list of cards. See figure FO-37 for the location of these cards. Then follow the procedure below for the current call activity level. Switch to the other procedure if the activity level changes.

(1) High call activity level. Proceed as follows:

(a) Pull out the SR(DH) and SR(DL) cards for the first designated sender/receiver on the bus. Also pull out the SR(DM) card if the first designated sender/receiver is an auxiliary.

(b) Insert interface card (marked with *) pulled in *d* above. Then perform SBR bus special exercise (para 5-36).

(c) If fault remains, pull out the interface card, and repeat steps (a) and (b) above for the next sender/receiver, reseating the sender receiver cards previously pulled out. Repeat for each sender/receiver until the fault disappears.

(d) When fault disappears, reseat one of the cards pulled out, and perform the SBR bus special exercise (para 5-36). If the fault rear-'ears, the card just reseated is faulty. Replace the card, and repeat the bus test. If the fault does not reappear, repeat until it does.

(e) Mark all equipment which has been marked out-of-service back in-service.

(2) Low call activity level. Proceed as follows:

(a) Reinsert bus interface card pulled in step d above.

(b) Sequentially pull each SR(DH), SR(DL), and SR(DM) card on the affected bus, performing an SBR bus special exercise test (para 5-36) after each is pulled, until the fault disappears.

(c) When fault disappears, replace last card pulled, and repeat SBR bus test to check that fault has been corrected.

(d) Mark all equipment which has been marked out-of-service back in-service.

f. SBR bit 14, 15, or 16 indicates a fault. The faulty card is located in the same network frame assembly as the pulled interface card. Refer to PROPAGATES FAULT FROM column of D, figure FO-41, for the four groups in which the faulty card is located. Then follow the procedure below for the current call activity level. Switch to the other procedure if the activity level changes.

(1) High call activity level. Proceed as follows:

(a) Pull out the 10 SF/DC and one service terminal cards for the first designated group in the frame. Then reinsert the interface card pulled in d above, and perform the SBR bus special exercise test (para 5-36).

(b) If the fault remains, pull out the interface card, reinsert the 11 terminal cards, and repeat (a) above for the next group. Continue until the fault disappears.

(c) When fault disappears, sequentially reinsert each pulled card, performing an

SBR bus special exercise test -after each is reinserted. When the fault reappears, the card just inserted is faulty. Replace this card, and repeat the SBR bus test.

(d) If the fault does not reappear after all eleven cards -have been reinserted, select any path through the matrix, and perform a -network connect request (para 5-25) and a network disconnect request (para 5-26) for each terminal in the group. Perform the SBR bus special exercise test (para 5-36) after the path is connected and again after the path is disconnected. When a failure is reported, replace the card being tested.

(e) Mark all equipment which has been marked out-of-service back in-service.

(2) Low call activity level. Proceed as follows:

(a) Reinsert the interface card pulled out in *(d)* above. Then sequentially pull each SF/DC terminal card in the affected four groups. Perform an SBR bus special exercise test (para 5-36) after each card is pulled until the fault disappears.

(b) When the fault disappears, replace the card just removed, and repeat the bus test to check that the fault has been corrected.

(c) Mark all equipment which has been marked out-of-service back in-service.

5-39. Troubleshooting Terminal Circuit Faults

Figure 5-1 illustrates the probable faults which may occur during C2 type network faults. When either inlet or outlet terminal circuits are suspected in any network fault, follow the procedures below for fault isolation.

a. Determine the terminal circuit card number from X-X-XX and Y-Y-YY in printout. Locate the card using the card nest map (fig. FO-36).

b. Mark the terminals out-of-service (para 2-65). Replace suspected terminal card.

c. Mark the link indicated by the W, W_ parameters of the network fault printout out-of-service (para 5-23).

d. Perform a special network connect exercise (para 5-25). When the trouble is cleared a printout; of PATH X-X-XX W YV Y-Y-YY CONCTD will be present. When this occurs, the trouble is cleared, proceed to step f. When the trouble is not cleared, proceed to step e.

e. Consult figure 5-1 for the next possible cause and troubleshoot accordingly. Proceed to step f.

f. Perform a special network disconnect exercise (para 5-26). When the test is complete, place the links (para 5-24) and line terminals (para 2-61) in-service. When the fault persists and no other option is available, leave the terminals and links out-of-service and notify higher level maintenance personnel.

5-39.1. Suppression of Printing of Error and Maintenance Messages

To allow for the suppression of trunk signaling error messages and/or for the suppression of trunk lockouts, perform the following:

a. Set the FUNCTION CODE toggle switch to 27.

b. Set ASR bit 23 to 1 to suppress the printing of trunk signaling and maintenance messages; reset otherwise.

c. Set ASR bit 23 to 1 to inhibit trunks from being locked out; reset otherwise. If bit 23 is set, the trunks will be temporarily locked out (approximately 3 minutes) for routing, then restored to service. The exception would be the AUTOVON and SF trunks due to the 2600 Hz supervision.

5-39.2. On/Off Line Multiple Connect/Disconnect Test

This test is performed whenever it has been determined that a terminal card or a group of terminal cards are failing on disconnecting, but the trouble cannot be further isolated with existing information.

a. Set the FUNCTION CODE to 01.

b. Set ASR toggle switch bit 23 to 1 and wait for local page printer to stop outputting messages.

c. Analyze the printed fault messages for a pattern of failure such as outlined below:

```
0223Z ACT
NT FLT
FLT
SBR    IFGT  TYPE OFGT A    BC
020000 2-2-01      D   3-2-03 0        05

0223Z  ACT
NT FLT
SBR    IFGT  TYPE OFGT A    B C
020000 3-2-01      D   1-2-06 0        06

0223Z ACT
NT FLT
SBR    IFGT  TYPE OFGT A    BC
020000 4-2-01      D   2-2-08 0        03
```

d. Set FUNCTION CODE to 30.

e. Set WSR toggle switches 13 and 23 to a valid Frame Group-Terminal (F-G-T) number, preferable the first one that failed when the system attempted to disconnect that particular terminal (c above).

f. Press the READ pushbutton switch an observe the network fault messages generated the local page printer. If the prograrn detects defective terminal card, both the inlet and out terminals are marked out-of-service, the SBR will equal zero, and the address of the defective terminal card will appear in both the input and output address register fields as follows:

```
D024Z ACT
1-1-01  01  OUT SVC
0024Z ACT
NT FLT
SBR     IFGT  TYPE OFGT A     BC
000000 1-1-01        D    1-1-01  0          04
0024A   ACT
NTKMC TST  CMPT
```

g. Completion of the test is indicated by the generation of the NTKMC TST CMPT message on the local page printer.

h. Set the FUNCTION CODE to 01 and reset ASR bit 23 to 0.

i. Press the READ pushbutton and monitor the local page printer for further type D network fault messages.

NOTE

If no additional disconnect failures are detected, mark all out-of-service terminals, indicated before entering I/O Order 30, back-in-service from the FACP.

5-40. Troubleshooting Open Matrix Crosspoints (fig. 5-36)

a. The matrix test is performed during fault isolation to locate a defective matrix card within a specified link. Performing this test reduces effect of card substitution. This test should be performed as a result of a single C2 type failure of the format:

```
SBR      IFGT TYPE OFGT  A    BC
RRRRRR XX-X  C2  Y.Y-YY W  W
```

where: RRRRRR is the octal contents

X-X-XX inlet terminal number
Y-Y-YY is outlet terminal number

W is 1 = Alternate link used
is 1 = (AN/TCC-38(V)I only)
0 = Alternate link not used.
VV is link number (1.20) to be tested.

b. This is an interruptive type test and the lines connected to the terminals to be used during the test.

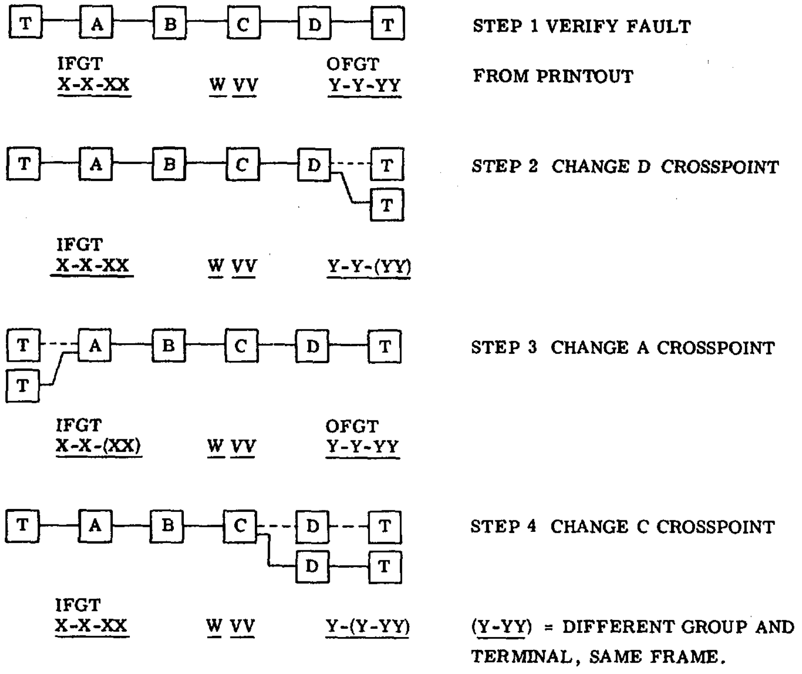

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Figure 5-36. Open matrix crosspoint troubleshooting.

may be reassigned to other terminals. This test uses the special network connect request (para 5-25) and special network disconnect request (para 5-26), and the X-X-XX and Y-Y-YY parameters of the printed output with modifications. The purpose of the test is to sequentially isolate the AB, BC, and CD links until the faulty matrix card is identified. This test requires that the transmission path defined in a above be marked out-of-service and two additional terminals, X-X-(XX) and Y-Y-(YY), be also marked out-of-service: where (XX) and (YY) are equipped terminals in the same group. These terminals are preferred to be not-in-use. Also, an additional terminal in a different group of the same frame as that identified by Y-Y-YY should also be marked out-of-service.

c. With the above procedures accomplished, perform a network connect request (para 5-25) using the parameters contained in the printout (a above). When the test is completed and the path is good, a printout of PATH X-X-XX VV W Y-Y-YY CONCTD is received. When the path is not connected, proceed to step d.

Otherwise, perform a network disconnect request (para 5-26) and mark the links and terminals in-service.

d. Disconnect the path established in c above using the network disconnect request (para 5-26) and perform a network connect request (para 5-25) using the parameter Y-Y-(YY) defined in a and b above. This test removes the original D matrix crosspoint. When a CONCTD printout is received, it indicates that the original D matrix is bad. Perform a network disconnect request (para 5-26) and replace the defective matrix card. Otherwise, proceed to e below.

e. Disconnect the path described in d above using the network disconnect request (para 5-26)and perform a network connect request (para 5-25) using the parameter X-X-(XX) defined in a and b above. This test removes the original A matrix crosspoint. When a CONCTD printout is received, it indicates that the original A matrix crosspoint was defective. Perform a network disconnect request (para 5-26) and locate and replace the defective matrix card. Otherwise, proceed to step f below.

f. Disconnect the path described in e above using the network disconnect instruction (para 5-26). Perform a network connect request (para 5-25) using the Y-(Y-YY) parameters defined in a and b above. This test removes the original C matrix crosspoint. When a CONCTD printout is received, it indicates the original C matrix crosspoint is defective. When a CONCTD printout is not received, it indicates that the B matrix is defective. In either case, perform a network disconnect request (para 5-26) and locate and replace the defective card. Proceed to step g below.

g. When the defective card is replaced, perform a network connect request (para 5-25) using the printout parameters a above. If a CONCTD printout is not obtained, perform a network disconnect request (para 5-26), refer the problem to a higher echelon, mark all of the equipment back in-service except the defective link.

5-41. Troubleshooting Multiple Crosspoint Driver Faults

a. Type C1 Faults. When bbbbbb or cccccc parameters do not correspond to those shown in B or C, figure 5-2, more than one crosspoint driver is reporting a fault. Use the following procedure to determine which drivers are reporting the fault.

(1) Determine X coordinate as described in step lb(4), paragraph 5-7g.

(2) Convert bbbbbb or cccccc, whichever is applicable, from octal coding to binary form.

(3) Select any bit which is 1, and assume that all remaining bits are 0.Then convert back to octal coded form.

(4) Repeat step (3) for all bits which are 1 with .the following exception. If X =10 or X =12, and cccccc is being used, process only the last 4 binary digits according to step (3). Ignore all other bits.

(5) Refer to B or C, figure 5-2, as applicable, and determine the Y coordinate for each new octal representation obtained from steps (3) and (4).

(6) Using common X coordinate and the individual Y coordinates obtained from step (5) above, refer to D, figure 5-2, to determine drivers reporting fault.

(7) Troubleshoot each driver as described instep lb(4), paragraph 5-7g.

b. Type Z Faults. A multiple crosspoint driver fault may be indicated during the Z tests in a number of ways. The printed value of a digit may not correspond to one of the values listed for that digit in E, figure FO-34. More than one digit in the <u>aaaaaa</u> parameter may have a value which is greater or less than its expected value. Or there may be a combination of these indications. Interpret the printed return as follows in order to isolate the multiple faults.

(1) Convert expected SBR return as obtained from A, B, C, or D, figure FO-34, to its binary coded form.

(2) Convert printed <u>aaaaaa</u> parameter from fault message to its binary coded form.

(3) Compare each binary digit of expected SBR return with corresponding bit in decoded <u>aaaaaa</u> parameter. There are three possible results as listed below. Process all bits as described below going to step (4).

(a) If binary digits are same, ignore this digit, and compare next pair of digits.

(b) If digit is O when expected value is 1, do the following.

1. Set all bits in decoded <u>aaaaaa</u> parameter to their expected value except bit which is 0 but is supposed to be 1. This bit will return value of 0.

2. Convert this modified SBR return into octal form. Treat this modified SBR return in step (4) as though it were printed <u>aaaaaa</u> parameter in fault message.

3. Compare next pair of digits.

(c) If digits is 1 when expected value is 0, do the following.

1. Set all bits in decoded <u>aaaaaa</u> parameter to 0 except bit which is 1 but is supposed to be 0.

2. Convert this modified SBR return into octal form. Treat this modified SBR return in step (4) below as if it were difference obtained in step c, paragraph 5-7h(1) thru h(4).

3. Compare next pair of digits.

(4) When all bits have been compared and SBR returns have been constructed as described in step (3), perform the following steps.

(a) Refer to appropriate section of paragraph 5-7h.

(b) Troubleshoot all SBR returns constructed in step (3) (b) according to procedure in b, paragraph 5-7h (1) thru h (4), as appropriate. Replace all faulty cards.

(c) Troubleshoot all SBR returns constructed in step (3) (c) according to procedure in c, paragraph 5-7h(1) thru (4), as appropriate. Refer directly to applicable part of J, figure FO34. Replace all faulty cards, except as follows. When more than one card is specified as possible cause of fault or a particular SBR return, replace only one of cards.

(d) Perform driver ZCK special exercise test (para 5-27).

(e) Troubleshoot any remaining faults, using appropriate procedure.

c. Type M Faults. When the printed **aaaaaa** parameter does not correspond to one of those in C or D, figure FO-35, a multiple driver fault is indicated. Isolate the faulty drivers as follows:

(1) Convert printed Ma parameter from fault message to binary form.

(2) Using IF and OF parameters from fault message, refer to H (M1 faults or I (M2 faults), figure FO-35, for proper SBR return to be used in following steps.

(3) Determine which bits are 0 in proper SBR returns. Set corresponding bits in -Ha parameter to 0. These correspond to errors which are isolated by other troubleshooting procedures.

(4) For each bit in the modified decoded **aaaaaa** parameter which is 0 but is supposed to be 1 as indicated by the proper SBR return from figure FO-35, perform following steps.

(a) Set that bit in proper SBR return to 0.

(b) Convert modified proper SBR return to octal code form.

(c) Repeat steps (a) and (b) until all such bits have been processed.

(5) Treat each of SBR returns constructed in steps (4) above as if it were printed **aaaaaa** parameter, and troubleshoot according to paragraph 5-7i. If SBR returns do not match those in C (M1 faults) or D (M2 faults), figure FO35, check all conversions performed above for errors.

5-42. Troubleshooting Multiple Printout Faults.

a. General. A single fault can cause many printout messages. The messages may be all of the same general type with different variable numbers, or the group of messages may be all completely different. Unrelated messages may be mixed in with a group of related messages. Always perform an SBR special exercise test (para 5-36) first. If an error is reported, refer to paragraph 5-38. If not, study the entire group of messages to determine what corrective action to take. Wait several minutes after the first fault printout for related printouts. The following paragraphs contain general rules and some examples for handling certain multiple printout situations. The procedures for other multiple printout situations are described in the troubleshooting charts and instructions in both this and higher category maintenance TM's.

b. False First Message Example. The signal buffer register (SBR) busses are the means by which the network terminal subsystem reports test results to the common control subsystem. The operational program periodically tests these busses. The program also periodically tests sender/receivers. If a bus bit fails and a sender/receiver test is performed by the program before the bus is tested, at least three printouts will result.

SR VV TO XSR WW FAILS
XXXXXX YYYYYY ZZZZZZ
XSR WW TO XSR WW FAILS
XXXXXX YYYYYY ZZZZZZ
SRB A FAILS
RRRRR

According to the troubleshooting charts, the first two printouts indicate an auxiliary sender/receiver failure (para 5-7k (3)). The third printout indicates a bus failure (para 5-7k (2)). Since the bus is involved in the sender/receiver test, troubleshoot the bus first. After the bus is repaired, test auxiliary sender/receiver WW and sender/receiver VV (para 5-29 and 56-30). You will probably find that both are operating.

c. Multiple C1, Z, and M Network Faults. Certain driver and crosspoint .faults can cause numerous printouts identified by NT FLT TYPE C1, Z1 through Z4, M1, or M2 (para 5-7g, 5-7h, and 5-7i). If the group of printouts contains a mixture of types, always attack the faults in the following order: C1, M, and Z. This will save time and avoid confusing test results.

5-43. Scanner Test

Perform this test to check out the scanning of a specific terminal. This is an interruptive test; service to the tested terminal is disconnected during the test. Therefore, you may want to wait for a low traffic period to run the test. Also you can temporarily reassign the function of this terminal to an unused terminal (para 2-62) to avoid interruption. In addition to completely checking the tested terminal, the test provides a degree of confidence that all other terminals in the same group are being properly scanned. Portions of the test may be omitted when using the test to troubleshoot specific problems. For example, if it is suspected that dc scanning has failed on a specific terminal, only perform the initial setup (steps *a, b, c*) and the steps which check the dc scanning (*steps m through r*). A TA-341(*)/TT which can be connected to the patch panel is used to test the scanners as follows:

a. Disconnect patch cord (if any) from patch panel network side jack of terminal being tested.

b. Connect test telephone set to network side patch panel connector of terminal under test.

c. Record terminal service of the tested terminals using FACP terminal display procedure (para 3-10). Assign (para 2-21) or change (para 2-52) terminal service of tested terminal using terminal type 01 (4-wire ac supervised line), class code 37 (routine progressive conference), unused director number, and terminal status 01 (in-service) *d.* Set switch on applicable SF/DC terminal card (fig. FO-36) to AC ADAPTER position.

e. Set telephone MODE SELECTOR SWITCH to AC SUPV position.

f. Go off-hook and listen for dial tone. Receipt of dial tone indicates that scanner has detected 2250-Hz seize tone.

g. Key C and listen for dial tone to continue. Switchboard returns dial tone if a conference bridge is available. If busy is returned, all conference bridges are busy; wait, then repeat C test. Continuation of dial tone or receipt of busy tone indicates transmit and receive paths through terminal card are good.

h. Key O to ring operator.

i. When ringback is heard, key R to stop ring. Cessation of ringback indicates proper scanner detection of 941/1209-HZ R tones. .

j. Key C and listen for dial tone. Return of dial tone indicates proper detection of 941/1477-Hz C tones. Press C again to stop dial tone. Error tone is heard.

k. Depress telephone hook switch at least three seconds to release connection.

i. Release hook switch and listen for return of dial tone. Presence of dial tone indicates proper scanner detection of 2600-Hz release tones when hook switch was depressed in keyset.

m. Set the SF/DC terminal card (fig. FO-36) DC-AC/ADAPTER switch to DC.

n. Change line service (para 2-52) to terminal type 04 (4-wire dc supervised line).

o. Set telephone MODE SELECTOR SWITCH to DC SUPV position.

p. Go off-hook and listen for dial tone. Return of dial tone indicates proper scanner detection of dc seize current. Press C twice to stop dial tone. Error tone is heard.

q. Depress hook switch for at least three seconds to release connection.

r. Release hook switch and listen for return of dial tone. Presence of dial tone indicates proper response of scanner to absence of dc seize current when hook switch was depressed in q above.

s. Disconnect test TA-341(*)/IT from patch panel and restore original network connection and assignment recorded in c above.

5-43.1. CB DTMF Scanner Test

Use this procedure to check out terminals equipped for service with 2-wire, common-battery DTMF terminals. These are terminals assigned type code 742600 installed (fig. FO-36). The overall purpose of the test is the same as the normal scanner test covered in paragraph 5-43. However, the test must be performed using a 2-wire,, common-battery DTMF signaling telephone such as the TA-938/FT or Western Electric type 2500.

a. Disconnect patch cord (if any) from patch panel-network-side jack of the terminal being tested.

b. Patch test telephone to network side patch panel connector of terminal under test (F, fig.2-4).

c. If presently unassigned, assign service to this telephone and mark in service (para 2-21). The terminal must be class-marked for conference privilege.

d. Go off-hook and listen for dial tone. Receipt of dial tone indicates that scanner has detected dc seize signal.

e. Key C(or #) and listen for dial tone to continue. Switchboard returns dial tone if conference bridge is available. If busy is returned, all conference bridges are busy; wait, then repeat C test. Continuation of dial tone or receipt of busy tone indicates that transmit and receive paths through the terminal card are good.

f. Key 0 to ring operator.

g. When ringback is heard, key R (or *) of about 1 second to stop ring. Cessation of ringback indicates proper scanner detection of 941/1209 Hz R tones.

h. Key C(or #) for about 1 second and listen for dial tone. Return of dial tone indicates proper detection of 941/1477 Hz tones. Press C again to stop dial tone. Error tone is heard.

i. Press hook switch at least 3 seconds to release connection.

j. Release hook switch and listen for return of dial tone. Presence of dial tone indicates proper scanner detection of release and seize.

k. Disconnect test telephone and restore original network patch connection and service. 0 5-44. Patch Plug and Cord Tests (fig. 3-14) *a.* Two-wire Patch Cords.

(1) Insert one end of the two-wire patch cord into the left side of patch plug/cable tester A22, 2WIRE connector.

(2) Insert the other end of the two-wire patch cord into the right side of the 2-WIRE connector.

(3)Turn TEST SELECT switch clockwise through each position observing the test lamps as follows:

Position	*GO lamp*	*NO-GCO lamp*	*Test results*
LAMP	On	On	Good
CONTINUITY	On	Off	Good
	Off	On	Bad
SHORT-1	On	Off	Good
	Off	On	Bad
SHORT-2	On	Off	Good
	Off	On	Bad

(4) Return the TEST SELECT switch to OFF and disconnect patch cord.

b. Plug or Four-Wire Patch Cords.

(1) Insert plug in any position in patch plug/cable tester 4-wire connector. An alternative would be to insert one 4-wire patch cord connector into the left side of 4-wire connector such that the white indicator is at the fuse side.

(2) Insert the other half of the 4-wire patch cord into the right side of 4-wire connector such that the white indicator is at the fuse side.

(3) Perform steps a(3) and (4) above.

5-45. Off-Line Network Exercise Test

(fig. 5-36, 5-37, and 5-38)

Perform this test to check proper operation of the decoders, crosspoint drivers, driver error-checking circuits, and matrix crosspoints. During the exercise, driver zero tests are performed for the entire network, and then path tests are performed for the entire network, and then path tests are performed only on that portion of the network specified by the request entry. Request can also be made for continuous repetition of the entire test. Path tests consist of more-than-one (MTO) test, a connect-with-driver and verify test, and finally a disconnect-with-driver and verify test. Use this test when you desire to test all paths and crosspoints within the specified range. All call processing in the central office stops during the test, so it should only be performed at installation, to analyze a major network failure wherein the office is already out of service, or during scheduled downtime. When serious interruption to the central office operation must be avoided, use network connect request (para 5-25) and network disconnect requests (para 5-26) for selective path testing and driver special exercise requests (para 5-27) whereby the network TM 11-5805-628-12/NAVELEX 0967-462-8070 remains in operation. If the on-line program is not stored in the processor, load it. according to the instructions given in 2-18. Proceed with the request entry using the on-line maintenance control panel.

a. Start off-line network exercise portion of the online program as follows:

(1) Set CONTROL TRANSFER AUTO ENABLE/DISABLE to DISABLE.

(2) Press NORMAL HALT.

(3) See that PRCS HALT is illuminated.

(4) Press CLEAR.

(5) Set OPERATIONAL CONTROL to STORE.

(6) Set REGISTER SELECT to PEX.

(7) Set WORD SWITCH REGISTER to starting address (NETEX): 00240002 (AN/TTC-38(V)1) 60240002 (AN/TTC-38(V)2)

(8) Press INITIATE.

(9) Set OPERATIONAL CONTROL TO CMPT.

(10) Set RUN-ONE INSTR to RUN.

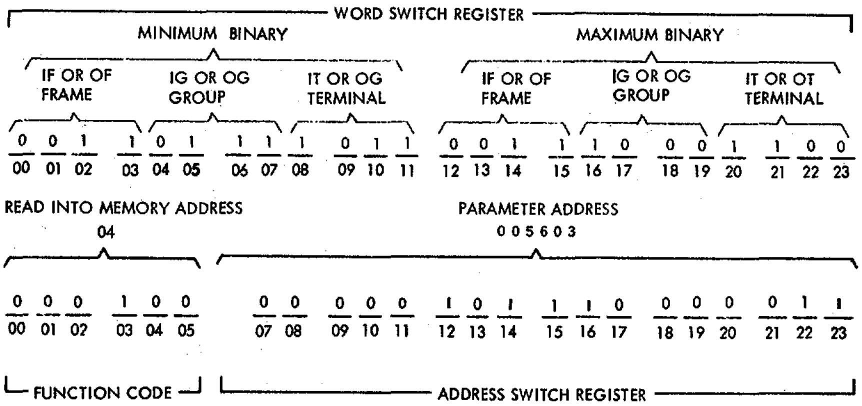
(11) Press INITIATE.

b. Set FUNCTION CODE to 04.

c. Specify parameters of paths to be tested for inlets, outlets and links. If the maximum and minimum numbers specified as parameters encompass the entire matrix, all crosspoints in the network will be tested (f and g below). Alternatively, if the maximum for each parameter is specified the same as the minimum for that parameter, only a single path will be tested. In the general case, the test on inlets, outlets and links will be restricted to testing only those within the requested range. To insure testing every crosspoint within the requested range, the rules in figure 5-40 must be followed in specifying maximum and minimum parameters. The request entry is made in four steps as follows:

NOTE

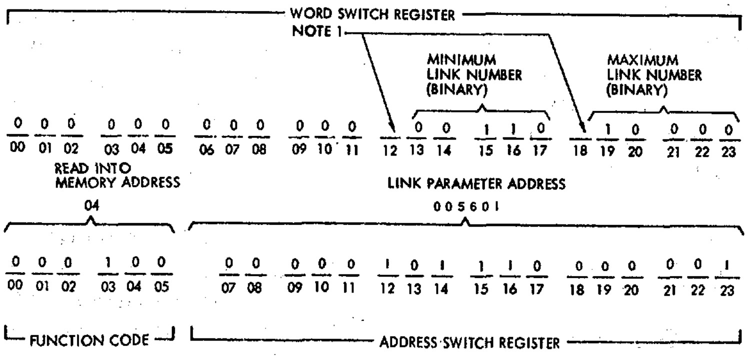
Be careful when entering numbers into ADDRESS SWITCH REGISTER. Errors will interrupt on-line program, and program will have to be reloaded (para 2-18).



NOTES:
1. THE EXAMPLE SHOWN IS FOR WORD SWITCH REGISTER ENTRY OF MINIMUM FGT 3-7-11 AND MAXIMUM FGT 3-8-12.
2. THE EXAMPLE SHOWS AN/TTC-38(V)(*)ADDRESS VESRQ4.

EL2GV011

Figure 5-37. Typical MCP switch settings for entering an inlet or outlet request for off-line network exercise test



NOTES:
1. THE EXAMPLE SHOWN IS FOR WORD SWITCH REGISTER ENTRY OF MINIMUM LINK 6 AND MAXIMUM LINK 16. BITS 12 AND 18 ALLOW TEST OF PRIMARY LINKS IF BOTH ARE SET TO 0, AND CAUSE TEST OF ALTERNATE LINKS IF BOTH ARE SET TO 1 (USE ON AN/TTC-38(V)1 ONLY).
2. THE EXAMPLE SHOWS AN/TTC-38(V)(*) ADDRESS SWITCH REGISTER ENTRY (VESRQ 2)(LINK REQUEST).

EL2GV012

Figure 5-38 Typical MCP switch settings for entering a link request for off-line network exercise test.

(1)request (fig. 5-37).

(*a*) Set ADDRESS SWITCH REGISTER to 00005603.

(*b*) Set WORD SWITCH REGISTER to binary representation of requested outlet minimum and maximum.

(*c*) Press READ.

(2) Inlet request (fig. 5-37).

(*a*) Set ADDRESS SWITCH REGISTER to 00005602.

(*b*) Set WORD SWITCH REGISTER to binary representation of requested inlet minimum and maximum.

(*c*) Press READ.

(3) Link request (fig. 5.38).

(a) Set ADDRESS SWITCH REGISTER to 00005601

(b) Set WORD SWITCH REGISTER to binary representation of requested link minimum and maximum. For testing AN/TTC-38(V) only: set bits 12 and 18 to 1 when you desire to test alternate links. Alternatively, set bits 12 and 18 to 0 to test the primary links. System ring bus links are always tested along with other links and need not be specified.

(c) Press READ.

(4) *Start/terminate or repeat/requests* (fig. 5.39).

(a) Set ADDRESS SWITCH REGISTER to 00005600

(b) The following WORD SWITCH REGISTER bits are assigned to test control. Set the bit to 1 if its function is desired:

1. Start, bit 0: causes start of network testing.
2. Terminate, bit 10: causes halt of network testing.
3. Repeat, bit 11: causes repeated performance of the entire test. When bit 11 is reset, test will halt at end of test.
4. Press READ to start test. (Terminate and repeat request bits do not require pressing READ while test is running.)

d. Upon network test failure, printer prints one of the following messages. Refer to troubleshooting chart (para 5-7).

NT	FLT				
SBR	IFGT	TYPE		A	BC
RRRRRR	X-X-XX	WWW	Y-Y-YY	W	ZZ

where:

X-X-XX identifies inlet F-G-T tested.
Y-Y-YY identifies outlet F-G-T tested.
ZZ identifies BC link tested.
W identifies alternate link.
RRRRRR is contents of SBR.
WWW' identifies failure type, as follows:

M1	MTO test, P(-) driver failed test
M2	MTO test, P(+) driver failed test
C1	Failure to pass driver test
C2	Failure on path verification when a connect attempt was made.
DIS	Disconnect test failure
Z1	Driver zero test on AP-, DP + and RBDP + drivers failed
Z2	Driver zero test on BP + and CP drivers failed
Z3	Driver zero test on AP + and DP drivers failed
Z4	Driver zero test on CP + and BP-drivers (frames 1-8 failed
IBF	Inlet busy test failed prior to a disconnect attempt
BTF	Verify outlet busy test failed prior to a disconnect attempt for system ring bus.

e. If every test in the off-line network exercise receives passing results, printer prints the following messages: NT'WK 0 TST CMPT (when zero test is complete) NTWK TST CMPT (when path test is complete)

f. A complete network exercise of the AN/TTC-38(V)1 system can be requested as follows:

(1) Inlet minimum F1, G1, T1; maximum F4, G8, T12.

(2) Outlet minimum F1, G1, T1; maximum F4, G8, T12.

(3) Link minimum 1; maximum 17. (Set bits 12 and 18 to O for test of primary links.)

(4) Start/terminate/repeat request: set start bit 00 to 1. After pressing READ, printouts will provide all information on test results.

(5) Repeat link request with bits 12 and 18 set to 1 for test of alternate links. Repeat start request (bit 00 to 1). Observe printouts for test results.

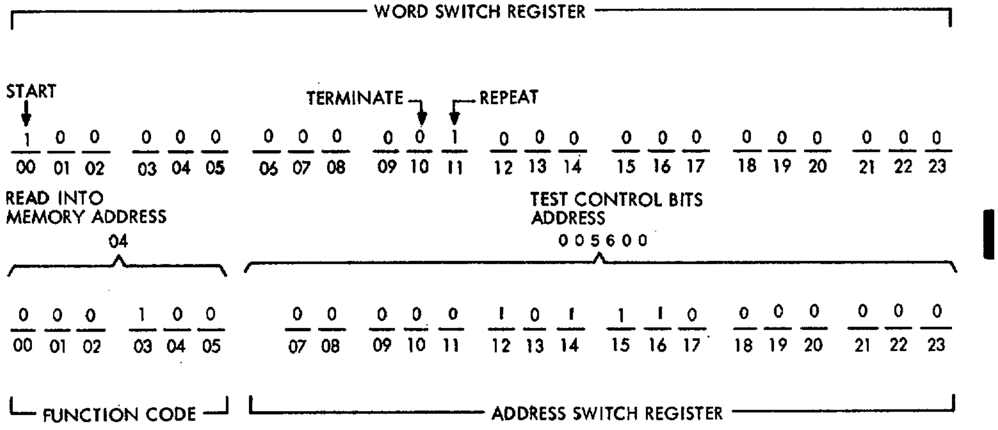
g. A complete network exercise of the AN/TTC38(V)2 system can be requested as follows:

(1) Inlet minimum F1, GI, T1; maximum F8, G8, T12.

(2) Outlet minimum F1, G1, T1; maximum F8, G8, T12.

(3) Link minimum 1; maximum 19.

(4) Continue as in f(4) above.



NOTE:
1. EXAMPLE SHOWN IS A REQUEST FOR NETWORK EXERCISE TO START AND TO REPEAT CONTINUOUSLY.
2. AN/TTC-38(V)(*) ADDRESS VESRQ1 IS SHOWN.

EL2GV013

Figure 5-39. Typical MCP switch settings for entering start/terminate/repeat request for off-line network exercise test.

$$IF_{min} \le IF_{max}$$

$$OF_{min} \le OF_{max}$$

$$IG_{min} \le IG_{max}$$

$$OG_{min} \le OG_{max}$$

$$IT_{min} \le IT_{max}$$

$$OT_{min} \le OT_{max}$$

$$(IG_{max} - IG_{min}) \le (OG_{max} - OG_{min})$$

$$(IF_{max} - IF_{min}) \times (IT_{max} - IT_{min}) \le (OF_{max} - OF_{min}) \times (OT_{max} - OT_{min})$$

EL2GV022

Figure 5-40. Off-line network exercise test rules.

5-45.1. Off-Line Multiple Connect/Disconnect Exercise Test

NOTE

The network exercise test specified in paragraph 5-45 must be performed at least once before performing this test.

a. Check to see that WSR toggle switches are set to 00240002.
b. Set FUNCTION CODE to 04.
c. Set ARS toggle switches to 5600.
d. Set WSR toggle switch bits 00 and 08 to 1. *e.* Press READ pushbutton and check to see that one of following messages are generated on local page printer:

(1) If the program detects a failure, both the inlet and outlet terminals are marked out-of service, the SBRfield will equal zero and the address of the defective terminal card will appear in both input and output address register fields as follows:

```
0025Z ACT
1-1-01-1OUT SVC
0024Z          ACT
NT             FLT
 SBR  IFGT     TYPE OFGT A    BC
 0000001-1-01  D    1-1-01 0  04
0025Z          ACT
NTWKMC         TST CMPT
```

(2) If the program is unable to connect any particular path, the appropriate C2 faults are generated on the local page printer. These messages will aid in the troubleshooting of shorts in the matrix which do not always appear when executing the off-line network exercise test.

(3) If no network faults are detected, only the NTWKMC TST CMPT message is generated on the local page printer.

Section V. CCS MAINTENANCE

5-46. Loading Off-Line Diagnostic Preloader Program

a. Press NORMAL HALT pushbutton and observe that PRCS HALT indicator lights.

b. Set OPERATIONAL CONTROL switch to STORE and REGISTER SELECT to PEX.

c. Set WSR switches to 00277750.

d. Press INITIATE switch and observe that BUS INDICATOR displays reading of 00277750.

e. Set OPERATIONAL CONTROL switch to CONT PNL INSTR and REGISTER SELECT to A.

f. Set WSR switches to 55137754.

g. Press INITIATE switch and observe that BUS INDICATOR agrees with entries specified in on-line program preloader instruction entries chart (para 2-18*d*). If entries are absent or disagree, on-line program preloader instructions must be loaded into memory..

h. Set RUN/ONE INSTR toggle switch to ONE INSTR.

i. Set MEMORY guarded switch to UNPROTECTED.

j. Set OPERATIONAL CONTROL switch to MEMORY DISPLAY and REGISTER SELECT o MEM.

k. Set ASR switches to 277772.

i Press INITIATE switch and observe that BUS INDICATOR displays reading of 277772.

m. Set WSR toggle switches to 62500476.

n. Set OPERATIONAL CONTROL switch to * 6ORE.

o. Press INITIATE pushbutton and observe that BUS INDICATOR displays 62500476.

p. Set OPERATIONAL CONTROL switch to MEMORY DISPLAY.

q. Press INITIATE pushbutton and observe that BUS INDICATOR displays reading of 62500476.

r. Set ASR toggle switches to 277774.

s. Press INITIATE pushbutton and observe that BUS INDICATOR displays 277774.

t. Set WSR switches to 74100235.

u. Set OPERATIONAL CONTROL switch to STORE.

v. Press INITIATE pushbutton and observe that BUS INDICATOR displays 74100235.

w. Set OPERATIONAL CONTROL switch to MEMORY DISPLAY.

x. Press INITIATE pushbutton and observe that BUS INDICATOR displays reading of 74100235.

5-47. Loading Off-Line Diagnostic Loader Tape.

NOTE

The off-line diagnostic preloader program (para 5-46) must be loaded before any of the off-line diagnostic program tapes can be loaded.

a. Load off-line diagnostic loader tape (SM-D 752126) on paper tape reader.

b. : Set paper tape reader MODE SELECT switch to STRIP and POWER ON/OFF to ON.

c. Set system status panel TAPE REAR RESET SELECT switch to ON.

d. Press system status panel RESET pushbutton several times and observe that loader tape moves.

e. Press NORMAL HALT pushbutton and observe that PRCS HALT indicator lights.

F Set OPERATIONAL CONTROL switch to STORE and REGISTER SELECT switch to PEX.

g. Set RUN/ONE INSTR switch to ONE INSTR.

h. Set WSR toggle switches to 00277750.

i. Press INITIATE pushbutton and observe that BUS INDICATOR displays 00277760.

j. Set OPERATIONAL CONTROL switch to CMPT.

k. Set RUN/ONE INSTR switch to RUN.

1. Press INITIATE pushbutton and observe:

(1) Off-line diagnostic loader tape strip loads.

(2) PRGM HALT indicator lights at completion of tape loading.

(3) BUS INDICATOR displays reading of 00277777.

m. Rewind loader tape by setting system status panel TAPE READER REWIND switch to ON.

n. Load diagnostic program tape (SM-D-751715) on paper tape reader.

o. Set paper tape reader MODE SELECT switch to REEL.

p. Press NORMAL HALT pushbutton switch and observe that PRCS HALT indicator lights and PRGM HALT indicator extinguishes.

q. Set OPERATIONAL CONTROL switch to STORE and REGISTER SELECT switch to PEX.

r. Set REAL TIME CLOCK guarded switch to DISABLE.

s. Set CONTROL TRANSFER ENABLE/ DISABLE switch to DISABLE.

t. Set PARITY ERROR HALT switch to OFF.

u. Set WSR toggle switches to 00000500.

v. Press INITIATE pushbutton and observe that BUS INDICATOR displays 00000500.

w. Set OPERATIONAL CONTROL to CMPT.

x. Press INITIATE pushbutton and observe:

(1) Diagnostic program tape loads.

(2) PRGM HALT indicator lights at completion of tape loading.

(3) L JS INDICATOR displays 00000631.

NOTE

If the diagnostic program tape stops loading before complete read-in and the observations specified in x above are correct, the tape has more than one segment. Press the INITIATE pushbutton until the entire diagnostic program is loaded into memory.

y. Set REAL TIME CLOCK guarded switch to INABLE.

z. Set CONTROL TRANSFER ENABLE/ ISABLE switch to ENABLE.

aa. Set PARITY ERROR HALT switch to ON.

ab. Rewind diagnostic program tape by setting system status panel TAPE READER REWIND toggle switch to ON.

5-48. Off-Line Central Processor Diagnostic Test

NOTE

The off-line diagnostic preloader program (para 5-46) must be loaded before any of the off-line diagnostic program tapes can be loaded.

a. A total of 112 individual tests makes up the entire central processor checkout procedure. Failure indications for a particular check appear as maintenance printouts on the local paper tape printer.

Load the central processor diagnostic program starting address into the program counter as follows:

(1) Set MEMORY guarded switch to UN PROTECTED.

(2) Set PARITY ERROR HALT switch to OFF.

(3) Set CLOCK OPERATE CONTROL to CONT.

(4) Set ADV-RPT switch to ADV.

(5) Set REAL TIME CLOCK guarded switch to DISABLE.

(6) Set REGISTER SELECT switch to PEX.

(7) Set CONTROL TRANSFER ENABLE/ DISABLE switch to DISABLE.

(8) Set printer motor control BYPASS switch to BYPASS.

(9) Press NORMAL HALT pushbutton and observe that PRCS HALT indicator lights.

(10) Press CLEAR pushbutton.

(11) Set RUN/ONE INSTR switch to ONE INSTR.

(12) Set OPERATIONAL CONTROL switch to STORE.

(13) Set WSR toggle switches to 00010000.

(14) Press INITIATE pushbutton and observe that BUS INDICATOR displays 00010000.

(15) Set system status panel RESET SELECT LOCAL PRINTER switch to ON.

(16) Press system status panel RESET pushbutton several times.

(17) Set RUN/ONE INSTR toggle switch to RUN.

(18) Set OPERATIONAL CONTROL rotary switch to CMPT.

(19) Press INITIATE pushbutton and observe:

(*a*) CP TEST message is generated on page printer.

(*b*) PRGM HALT indicator lights.

(*c*) BUS INDICATOR displays 00010017.

(21) Set WSR toggle switches to all O's.

(22) Press INITIATE pushbutton and observe:

(*a*) PRGM HALT indicator lights.

(*b*) BUS INDICATOR displays 00120244.

(23) Press INITIATE pushbutton and observe:

(*a*) PRGM HALT indicator lights.

(*b*) END OF CP message is generated on page printer.

(*c*) BUS INDICATOR: displays 00020276.

b. If the program halts at any other BUS INDICATOR reading or any other printouts occur before the END OF CP message is generated, refer to higher category maintenance.

5-49. Deleted

5-50. Off-Line Memory Diagnostic Test

a. Loading Tape. You must enter the off-line preloader (para 5-46) and loader (para 5-47a) prior to loading the memory diagnostic (para 5-47b). The three segments of the memory-to-memory diagnostic (first part of tape) must be loaded first. Next load the first segment (segment A) of the memory test.

Do not load the second segment (segment B) of the memory test until instructed to do so in the following procedures.

b. Initial Switch Settings. Set switches as indicated below before loading the memory diagnostic program starting address.

c. Loading Starting Address. Load memory diagnostic program starting address into program counter (PEX) as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Press CLEAR.

(4) Set OPERATIONAL CONTROL to STORE.

(5) Set RUN-ONE INSTR to ONE INSTR.

(6) Set WORD SWITCH REGISTER to 00002000.

(7) Press INITIATE.

(8) See that BUS INDICATOR displays 00002000 (memory page 0, location 02000).

d. Options. Select memory diagnostic program options listed in the following chart.

Switch	Location	Setting
MEMORY	Maintenance control panel	UNPROTECTED
PARITY ERROR HALT	Maintenance control panel	OFF
CLOCK OPERATE CONTROL	Maintenance control panel	CONT
ADV-RPT	Maintenance control panel	ADV
REAL TIME CLOCK	Maintenance control panel	DISABLE
REGISTER SELECT	Maintenance control panel	PEX
AUTO ENABLE/DISABLE	System status panel	DISABLE
BYPASS	Printer motor control	BYPASS

e. Execution. Execute the memory diagnostic routine as follows:

(1) Set RUN-ONE INSTR to RUN.

(2) Set OPERATIONAL CONTROL to CMPT.

(3) Press INITIATE. This starts execution of segment A which requires approximately 50 seconds for completion.

(4) See that the following end of segment A indications occur.

(*a*) PRGM HALT lights.

(*b*) BUS INDICATOR displays 00002507.

(*c*) Printer, if enabled, prints END MEMA .

(*d*) To loop segment A set WSR bit 00 and 06, press INITIATE.

(5) Load segment B of memory and starting address diagnostic test follows:

(*a*) Press NORMAL HALT.

(*b*) See that PRCS HALT is lighted.

(*c*) Press CLEAR.

(*d*) Set OPERATIONAL CONTROL to STORE.

(*e*) Set WORD SWITCH REGISTER to 00000506.

(*f*) Press INITIATE.

(*g*) See that BUS INDICATOR displays 00000506.

(*h*) Set OPERATIONAL CONTROL to CMPT.

(*i*) Press INITIATE (this loads sgment B of the memory diagnostic tape).

(*j*) See that the following indications occur when tape stops.

1. PRGM HALT indicator is lighted.
2. BUS INDICATOR displays 00000645.

(*k*) Load content of memory page 0 into memory page 2 as follows.

1. Press NORMAL HALT.
2. See that PRCS HALT is lighted.
3. Set OPERATIONAL CONTROL to STORE.
4. Set WORD SWITCH REGISTER to 00000664.
5. Press INITIATE.
6. Set OPERATIONAL CONTROL to CMPT. Press INITIATE. This stores a copy of the contents of memory page 0 in memory page 2.
7. See that PRGM HALT indicator is lighted.

8. See that BUS INDICATOR displays 00000702.

(*l*) Set OPERATIONAL CONTROL to STORE.

(*m*) Set WORD SWITCH REGISTER to 00242000.

(*n*) Press NORMAL HALT and see that PRCS HALT is lighted.

(6) Select option(s) as specified in paragraph 5-50.

(7) Set OPERATIONAL CONTROL to CMPT.

(8) Press INITIATE. This begins execution of segment B of the memory diagnostic which require approximately 25 seconds.

(9) See that the following end of segment B indications occur:

(*a*) PRGM HALT lights.

(*b*) BUS INDICATOR displays 00242507.

(*c*) Printer, if enabled, prints END MEM B.

(10) Set WORD SWITCH REGISTER bits 00 and 23.

Primary option			Sub option	
WORD SWITCH REGISTER bit number	Bit reset (0)	Bit set (1)	WORD SWITCH REGISTER bits/settings	Function
00	No options selected, run through entire test.	Perform options specified by other WORD SWITCH REGISTER bits. Do not set this bit unless at least one option is selected.	N/A	N/A
01	Enable printer.	Inhibit printer	N/A	N/A
02	Do not halt on error.	Halt on error.	N/A	N/A
03	Do not loop individual pattern test.	Loop individual pattern test specified by WORD SWITCH REGISTER bits 12 through 14.	12 13 14	Select test pattern that writes
			0 0 0	all zeroes.
			0 0 1	Select test pattern that writes all ones.
			0 1 0	Write special addressing pattern.
			0 1 1	Write complement of special addressing pattern.
			1 0 0	Select test pattern that writes all zeroes (for address with odd parity) n address bits 0, 3, 13 and writes all ones (for addresses with even parity) on address bits 3, 3, 13
04	Do not loop all pattern tests in specific memory page.	Loop all pattern tests in memory page specified by bits 10 and 11.	10 11	
			0 0	Select page 0 (Note 1).
			0 1	Select page 1.
			1 0	Select page 2 (Note 1).
05	Do not halt at end of pattern test (bit 03 set).	Halt at end of pattern test (bit 03 set).	N/A	N/A
06	Do not loop entire test on memory pages 1 and 2/memory page 0.	Loop entire test on memory pages 1 and 2 (memory diagnostic segment A). Loop entire test on memory page 0 (memory diagnostic segment B).	N/A	N/A
07	Store memory test patterns with single writes per location.	Store memory test patterns with ten (see note 2) writes per location.	N/A	N/A
23	Do not restore contents of memory page 0 following segment B test procedure.	Restore contents of memory page 0 following segment B test procedure.	N/A	N/A
08, 09, 15-22	Not used, always reset.	Not used.		

NOTES

1. You must not select memory page 0 when executing segment A. You must not select memory page 2 when executing segment B.

2. Write factor of ten is specified in memory location 00003107 and can be Altered at maintenance personnel discretion.

(11)Press INITIATE. This re-inserts the loader, pre-loader and segment B diagnostic routines from memory page 2 into memory page 0.

(12) See that the following end-of-check indications occur:

(*a*) PRGM HALT lights.

(*b*) BUS INDICATOR displays 00242074.

(*c*) To loop segment B,

press INITIATE. To repeat segment A, reload tape segment A and return to *c* above.

f. Memory Diagnostic Exit. Exit from the memory test in one of the following ways:

(1) If you want to repeat the entire test reload memory program tape.

(2) If you want to perform another off-line diagnostic test, refer to the applicable paragraph for loading and execution instructions.

g. Margin Testing. If you suspect intermittent memory failures, use the margin switches on the memory TCL card (A10) to isolate as follows:

(1) Gain access to memory cards (para 5-8s).

(2) Set both H-L switches to H and repeat memory diagnostic.

(3) Set both H-L switches to L and repeat memory diagnostic.

(4) Reset both switches to center (normal) positions after testing.

5--51. Manual MCP Test

Use this procedure to manually test an off-line maintenance control panel and associated functions in its processor. A taped program is not needed to perform the test. The entire test should be run in the order presented for a complete manual checkout. Yet, individual functions can be selectively tested so long as initial steps a, b, and c are performed first. Also, same tests contain initial condition references which must be performed when selectively running individual tests.

a. Set switches to following initial positions:

(1) MEMORY guarded switch to UNPROTECTED.

(2) PARITY ERROR HALT switch to OFF.

(3) CLOCK OPERATE CONTROL rotary switch to CONT.

(4) ADV-RPI" switch to ADV.

(5) REAL, TIME CLOCK guarded switch to DISABLE.

(6) RUN-ONE INSTR switch to RUN.

b. On system status panel A6 set CONTROL 'ITRANSFER guarded switch to DISABLE.

c. See that PROCESSOR STATUS OFF-LINE indicator is on.

d. Lamp test panel as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) See that ACTIVE indicator is off.

(4) Press and hold LAMP TEST.

(5) See that all maintenance control panel indicators except other PRCS IDENT light.

(6) Release LAMP TEST.

e. Test clock operate control functions as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) See that ACTIVE indicator is off.

(4) Set OPERATIONAL CONTROL rotary switch to MEMORY DISPLAY.

(5) Set CLOCK OPERATE CONTROL to SINGLE PULSE.

(6) Set ADV-RPT switch to RPT.

(7) Note whether P1, P2 or P3 is lighted.

(8) Press INITIATE.

(9) See that P1, P2 or P3 'lamp is still lighted.

(10) Set ADV-RPT switch to ADV.

(11) INITIATE.

(12) See that next higher numbered P1,. P2. or P3 lamp is lighted. If P3 is lighted in step (9), P1. should now light.

(13) Set ADV-RPT to RPT.

(14) Press INITIATE.

(15) See that same indicator as step (12) is lighted.

(16) Set ADV-RPT to ADV.

(17) Press INITIATE.

(18) See that next P1, P2, or P3 indicator lights.

(19) Set ADV-RPT to RPT.

(20) Press INITIATE.

(21) See that same P1, P2, or P3 indicator as step (18) stays lighted.

(22) Set CLOCK OPERATE CONTROL to CONT.

(23) Set ADV-RPT to ADV.

f. Test memory store and display functions as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) See that ACTIVE is off.

(4) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(5) Set RUN-ONE INSTR to ONE INSTR.

(6) Set REGISTER SELECT to MEM.

(7) Set ADDRESS SWITCH REGISTER to 010000.

(8) Press INITIATE.

(9) Note BUS INDICATOR which is now displaying content of memory address 10000. If the memory was cleared before performing this test display should be all 0.

(10) Set REGISTER SELECT to EOA.

(11) See that BUS INDICATOR displays 00010000. This is the effective operand address which was entered in steps (7) and (8).

(12) Set OPERATIONAL CONTROL to STORE.

(13) Set REGISTER SELECT to MEM.

(14) Set WORD SWITCH REGISTER to 77777777.

(15) Press INITIATE.

(16) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(17) Press INITIATE pushbutton.

(18) See that BUS INDICATOR displays 77777. This is the new content of memory address 010000 stored in (14) and (15) above.

g. Test sequential store functions as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) See that ACTIVE is off.

(4) Set' OPERATIONAL CONTROL to STORE.

(5) Set REGISTER SELECT to PEX.

(6) Set WORD SWITCH REGISTER to 00000000.

(7) Set ADDRESS SWITCH REGISTER to 000000.

(8) Press INITIATE.

(9) Set RUN ONE INSTR to RUN.

(10) Set OPERATIONAL CONTROL to STORE SEQLY.

(11) Set REGISTER SELECT to MEM.

(12) Set WORD SWITCH REGISTER to 77777777.

(13) Press and hold COORDINITIATE and then press INITIATE. Release both. See that PRCS HALT is off and ACTIVE is on.

NOTE

The above procedure causes step (12) setting to be stored in all memory addresses from address set in (6) and (7) above (memory page 0, address 0).

(14) Press NORMAL HALT.

(15) See that PRCS HALT lights and ACTIVE goes off.

(16) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(17) Set ADDRESS SWITCH REGISTER to 051000.

(18) Set RUN-ONE INSTR to ONE INSTR.

(19) Press INITIATE.

(20) See that BUS INDICATOR displays 77777777 (content of memory page 0, location 11000).

(21) Set ADDRESS SWITCH REGISTER to 151000.

(22) Press INITIATE.

(23) See that BUS INDICATOR displays 77777777 (contents of memory page 1 location 11000).

(24) Set ADDRESS SWITCH REGISTER to 251000.

(25) Press INITIATE.

(26) SEE that BUS INDICATOR displays 77777777 (contents of memory page 2, location 11000).

(27) Set ASR toggle switches to 55000.

(28) Press INITIATE pushbutton and observe that BUS INDICATOR displays all 7's.

(29) Set WSR toggle switches to 01234567.

(30) Set OPERATIONAL CONTROL switch to STORE.

(31) Press INITIATE pushbutton and observe that BUS INDICATOR displays 01234567.

h. Test WORD SWITCH REGISTER functions as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(4) Set RUN-ONE INSTR to ONE INSTR.

(5) Set ADDRESS SWITCH REGISTER to 037774.

(6) Set REGISTER SELECT to MEM and set WSR toggle switches to 01234567.

(7) Press INITIATE.

(8) Note BITQ INDICATOR display (01234567).

(9) Set JPERATIONAL CONTROL to STORE.

(10) Set WORD SWITCH REGISTER to 77777777.

(11) Press INITIATE.

(12) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(13) Press INITIATE.

(14) See that BUS INDICATOR displays 7 ,T77777.

(15) Set OPERATIONAL CONTROL to STORE.

(16) Set WORD SWITCH REGISTER to 00000000.

(17) Press INITIATE.

(18) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(19) Press INITIATE.

(20) See that BUS INDICATOR displays 00000000.

i. Test register selection as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set RUN-ONE INSTR to ONE INSTR.

(4) Set OPERATIONAL CONTROL to STORE.

(5) Set WORD SWITCH REGISTER to 77777777.

(6) In sequence perform following steps for each line on table.

(*a*) Set REGISTER SELECT to position shown.

(*b*) Press INITIATE.

(*c*) See that BUS INDICATOR displays number shown in following chart:

REGISTER SELECT setting	BUS INDICATOR display
SBR	00177777
LSR	01000077
OAR	03707777
IAR	03707777
MO	77777777
MEM	77777777
PEX	00377777
PC(	00077777
EOA	00077777
A	77777777
B	77777777
Q	77777777
IR	77777777
CPS	3777020X (Note)
CPD	77770200
BR	00000770
SHC	00O00000
RTC	17777777
SC1	XXXXXXXX
SC2	XXXXXXXX

NOTE

Bit 21 = 0. Note indications of bits 22 and 23 for later checks.

j. Test register clearing functions as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set REGISTER SELECT to PEX.

(4) Press CLEAR.

(5) In sequence set REGISTER SELECT to each position shown on following table and see that BUS INDICATOR displays number shown in table.

REGISTER SELECT setting	BUS INDICATOR display
SBR	00000000
LSR	00000000
OAR	00100000
IAR	00100000
MO	77777777
MEM	00000000
PEX	00000000
PC	00000000
EOA	00000000
A	00000000
B	00000000
Q	00000000
IR	00000000
CPS	0010000X (Note)
CPD	40000000
BR	00000000
SHC	00000000
RTC	00000000
SC1	XXXXXXXX
SC2	XXXXXXXX

NOTE

Bit 21 = 0. Note indications of bits 22 and 23 I for later checks.

k. Check values of CPS bits 22 and 23 observed in steps *i*(6) and *j*(5) by determining CPS bits 22 and 23 on other maintenance control panel as follows.

(1) If other maintenance control panel ACTIVE lamp is on, its CPS bit 23 = 1 and bit 23 of tested maintenance control panel must equal 0. If other ACTIVE lamp is off, bit 23 of tested maintenance control panel must equal 1.

(2) If other maintenance control panel and processor are on-line and operating properly, i.e., no control transfer trouble symptoms are occurring (para 5-7), its CPS bit 08=0 and tested bit 23 on tested panel must equal 0.

(3) If other processor is off-line, display CPS register using procedure of paragraph j above and determine values of CPS bits 08 and 23. For a valid

test, the indicated bit values must agree with that defined in the following table.

Tested maintenance control panel	Other maintenance control panel
CPS bit 22=0	CPS bit 08=0
CPS bit 22 = 1	CPS bit 08 = 1
CPS bit 23=1	CPS bit 23=0
CPS bit 23=0	CPS bit 23=1

l. Test control panel instruction function as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Press CLEAR.

(4) Deleted.

(5) Set OPERATIONAL CONTROL to CONT PNL INSTR.

(6) Set WORD SWITCH REGISTER to 12200001.

NOTE

This number represents an instruction (ADDC 10 which adds 1 to the content of the accumulator (A register).

(7) Set RUN-ONE INSTR to ONE INSTR.

(8) Press INITIATE.

(9) Set REGISTER SELECT to IR.

(10) See that BUS INDICATOR displays 12200001.

(11) Set REGISTER SELECT to A.

(12) See that BUS INDICATOR displays 00000001.

(13) Set RUN-ONE INSTR to RUN.

(14) Press INITIATE.

(15) See that PRCS HALT goes out and ACTIVE lights.

(16) Press NORMAL HALT.

(17) See that PRCS HALT lights and ACTIVE goes out.

(18) See that BUS INDICATOR indicates any number except 00000001.

NOTE

While the ACTIVE light was on, the processor repeatedly executed the ADDC 1 instruction; the number one was added to the accumulator many times. The number displayed in step (18) is the sum of this i repetitive addition process.

If 00000001 is displayed, repeat steps (13) through (18) at least once to assure that there is a malfunction.

m. Test one-instruction functioning as follows:

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) See RUN-ONE INSTR to ONE INSTR.

(4) Set WORD SWITCH REGISTER to 77777777.

(5) Set OPERATIONAL CONTROL to STORE.

(6) Set REGISTER SELECT to A.

(7) Press INITIATE.

(8) See that BUS INDICATOR displays 77777777.

(9) Set WORD SWITCH REGISTER to 000000O.

(10) Set REGISTER SELECT to MEM.

(11) Set ADDRESS SWITCH REGISTER to 00050000.

(12) Set OPERATIONAL CONTROL to MEM DISPLAY.

(13) Press INITIATE.

(14) Set WORD SWITCH REGISTER to 55037774.

(15) Set OPERATIONAL CONTROL to STORE SEQL.

(16) Press INITIATE.

(17) See that BUS INDICATOR displays 55037774.

(18) Set REGISTER SELECT to PEX.

(19) Set WORD SWITCH REGISTER to 00050000.

(20) Press INITIATE.

(21) Set WORD SWITCH REGISTER to 00000000.

(22) Set REGISTER SELECT to A.

(23) Set OPERATIONAL CONTROL to CMPT.

(24) Press INITIATE.

(25) See that BUS INDICATOR displays 00000000.

n. Test FUNCTION CODE and ADDRESS SWITCH REGISTER as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALF is lighted.

(3) Set OPERATIONAL CONTROL to CONT PNL INSTR.

(4) Set Run-ONE INSTR to ONE INSTR.

(5) Set WORD SWITCH REGISTER to 55037756.

(6) Set FUNCTION CODE to 77.

(7) Set ADDRESS SWITCH REGISTER TO 377777.

(8) Press INITIATE.

(9) Set REGISTER SELECT to A.

(10) See that BUS INDICATOR displays 77377777.

(11) Set FUNCTION CODE to 00.

(12) Set ADDRESS SWITCH REGISTER to 000000.

(13) Press INITIATE.

(14) See that BUS INDICATOR displays 00000000.

o. Test real time clock functions as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set RUN-ONE INSTR to ONE INSTR.

(4) Store program in following table by performing steps (*a*) through (*e*) and then repeating steps (*f*) through (*i*) for each line in table.

(*a*) Set OPERATIONAL CONTROL to STORE.

(*b*) Set REGISTER SELECT to PEX.

(*c*) Set WORD SWITCH REGISTER to 00044777 (location 044777).

(*d*) Press INITIATE.

(*e*) Set OPERATIONAL CONTROL to STORE SEQLY.

(*f*) Set REGISTER SELECT to MEM.

(*g*) Set WORD SWITCH REGISTER as shown in chart in i below.

(*h*) Press INITIATE.

(*i*) See that BUS INDICATOR displays WORD SWITCH REGISTER setting as follows:

BUS INDICATOR display IPEX address)	WORDSWITCH REGISTER settings (instruction word)
00044777	00160000
00045000	55230707
00045001	60144777
00045002	22045000

(5) Verify that REAL TIME CLOCK switch is set to DISABLE.

(6) Set REGISTER SELECT to RTC.

(7) See that BUS INDICATOR displays 00000000.

(8) Set OPERATIONAL CONTROL to STORE.

(9) Set REGISTER SELECT to PEX.

(10) Set WORD SWITCH REGISTER to 00045000 and operate MEMORY switch to UN PROTECTED.

(11) Press INITIATE.

(12) Set OPERATIONAL CONTROL to CMPT.

(13) Set RUN-INSTR to RUN.

(14) Press INITIATE.

(15) Press NORMAL HALT.

(16) Set REGISTER SELECT to RTC.

(17) See that BUS INDICATOR displays 00000000.

(18) Set REAL TIME CLOCK switch to ENABLE.

(19) Press INITIATE.

(20) Press NORMAL HALT.

(21) See that BUS INDICATOR does not display 00000000.

p. Test READ switch functioning as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set Run-ONE INSTR to ONE INSTR.

(4) If test o was not run previously store program in o (4) above.

(5) Set OPERATIONAL CONTROL to STORE.

(6) Set REGISTER SELECT to PEX.

(7) Set WORD SWITCH REGISTER to 00045000.

(8) Press INITIATE.

(9) Set OPERATIONAL CONTROL to CMPT.

(10) Set RUN-ONE UNST to RUN.

(11) Press INITIATE.

(12) Press READ.

(13) Press NORMAL HALT.

(14) Set REGISTER SELECT to CPS.

(15) See that BUS INDICATOR displays bit 12 = 1.

q. Test immediate halt switch as follows.

(1) Press NORMAL HALT.

(2) See that PRCS HALT is lighted.

(3) Set RUN-ONE INSTR to ONE INSTR.

(4) If test o was not run previously, store program in o (4) above.

(5) Set OPERATIONAL CONTROL to STORE.

(6) Set REGISTER SELECT to PEX.

(7) Set WORD SWITCH REGISTER to 00045000.

(8) Press INITIATE.

(9) Set OPERATIONAL CONTROL to CMPT.

(10) Set RUN-ONE INSTR to RUN.

(11) Press INITIATE.

(12) Press IMMED HALT.

(13) See that PRCS HALT is lighted.

(14) Set REGISTER SELECT to SC1.

(15) See that BUS INDICATOR displays 00000000.

(16) Set REGISTER SELECT to SC2.

(17) See that BUS INDICATOR displays 00000000.

NOTE

If steps 15 and 17 fail, repeat at least once to assure malfunction of immediate halt circuit.

r. Test memory protection as follows.

(1) Real time clock test (o above must be run before this test.

(2) Press NORMAL HALT.

(3) See that PRCS HALT is lighted.

(4) Press CLEAR.

(5) Set MEMORY switch to PROTECTED.

(6) Set RUN-ONE INSTR to ONE INSTR.

(7) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(8) Set ADDRESS SWITCH REGISTER to I160000 (memory page 1, location 20000).

(9) Set REGISTER SELECT switch to MEM.

(10) Press INITIATE.

(11) See that BUS INDICATOR displays 00030707.

(12) Set OPERATIONAL CONTROL to STORE.

(13) Set REGISTER SELECT to PEX.

(14) Set Word Switch REGISTER to 00045000 (memory page 0, location 5000).

(15) Press INITIATE.

(16) Set OPERATIONAL CONTROL to STORE SEQLY.

(17) Set REGISTER SELECT to MEM.

(18) Set WORD SWITCH REGISTER to 55200000.

(19) Press INITIATE.

(20) Set OPERATIONAL CONTROL to STORE.

(21) Set REGISTER SELECT to PEX.

(22) Set WORD SWITCH REGISTER to 50000.

(23) Press INITIATE.

(24) Set OPERATIONAL CONTROL to CMPT.

(25) Set RUN-ONE INSTR to RUN.

(26) Press INITIATE.

(27) Press NORMAL HALT.

(28) Set REGISTER SELECT to CPS.

(29) See that BUS INDICATOR bit 07 = 1.

(30) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(31) Set address switch register to 160000.

(32) Set REGISTER SELECT to MEM.

(33) Set RUN/ONE INSTR to ONE INSTR.

(34) Press INITIATE.

(35) See that BUS INDICATOR displays 00030707.

5-52. Tape Programmed MCP Test

Use this procedure to check out an off-line maintenance control panel and associated functions in its processor. The programmed portion of the test requires frequent manual interaction with the program. You must monitor the content of the PEX counter as displayed on the BUS INDICATOR to,!: keep track of test progress. Each programmed halt (PRGM HALT light on) location number (PEX BUS INDICATOR display) which is listed in the programmed portion of the test indicates that the programmed test passed the function tested immediately before the halt. No/go indications occur both as halt location not listed in this procedure and as maintenance printouts. Refer to the troubleshooting charts for these. The WORD SWITCH REGISTER options in step *f* normally are used by higher category maintenance for troubleshooting. They provide flexibility to programmed portions of the test by permitting looping and other special features.

a. On system status panel A6 set CONTROL TRANSFER switch to DISABLE. Set printer motor control BYPASS switch to BYPASS.

b. Set maintenance control panel under test switches to initial positions:

(1) Set MEMORY switch to UNPROTECTED.

(2) Set PARITY ERROR HALT to OFF.

(3) Set CLOCK OPERATE CONTROL rotary switch to CONT.

(4) Set ADV/RPT to ADV.

(5) Set REAL TIME CLOCK TO DISABLE.

(6) Set RUN/ONE INSTR to RUN.

(7) See that PROCESSOR STATUS OFFLINE is lit.

c. Load maintenance control panel off-line diagnostic tape (para 5-46 and 5-47). You must load past the two bootstrap segments on the tape as follows.

(1) Load bootstrap first segment from starting PEX address of 00000500.

(2) First segment halts at PEX equals 00000631.

(3) Load bootstrap second segment from starting PEX address of 00000506.

(4) Second bootstrap segment halts at 00000631.

(5) Load single MCP test segment from starting PEX address of 00000500.

(6) See that program halts at end of load is 00000631.

(7) Press NORMAL HALT pushbutton switch.

(8) Set OPERATIONAL CONTROL switch to MEMORY DISPLAY and REGISTER SELECT to MEM.

(9) Set ASR toggle switches to 00011314.

(10) Set WSR toggle switches to 00047000.

(11) Set RUN-ONE INSTR to ONE INSTR.

(12) Press initiate pushbutton and check to see that BUS INDICATOR d;00lays 00042000.

(13) Set OPERATION,,, CONTROL to STORE.

(14) Press INITIATE and check to see that BUS INDICATOR displays 00047000.

(15) Set RUN/ONE INSTR to RUN.

(16) Set OPERATIONAL CONTROL CMPT.

d. Store starting location (page 0, location 10000) in PEX counter as follows:

(1) Press NORMAL HALT. See that PRCS HALT lights.

(2) Set OPERATIONAL CONTROL to STORE.

(3) Set RUN/ONE INSTR to ONE INSTR.

(4) Set REGISTER SELECT to PEX.

(5) Set WORD SWITCH REGISTER to 00010000.

(6) Press INITIATE.

e. Start program as follows:

(1) Set OPERATIONAL CONTROL to CMPT.

(2) Set RUN/ONE INSTR to RUN.

(3) Press INITIATE.

(4) See that ACTIVE lights.

f. Perform WORD SWITCH REGISTER halt procedure as follows: (1) See that PRGM HALT lights and that ACTIVE stays lighted.

(2) See MCP TEST prints out and that BUS INDICATOR displays 000010014 (MPHTO1). This indicates a halt at page 0, location 10014.

(3) Set WSR toggle switches to all zeros.

(4) Press INITIATE.

g. Test store sequential mode as follows:

NOTE

Store sequential test cannot be executed unless manual store sequential is performed (para 5-51).

(1) See that PRGM HALT lights and BUS INDICATOR displays 00010055 (MCPOO).

(2) If you want to bypass this test press NORMAL HALT and then press INITIATE.
Proceed to step *h.*

(3) Press INITIATE to continue with store sequential test.

(4) See that PRGM HALT lights and that no printouts occur; this indicates go test.

(5) See that BUS INDICATOR displays 00010070 if error is detected while reading all ones.

(6) Press INITIATE to continue test.

(7) See that PRGM HALT lights and that BUS INDICATOR displays 00010205 if an error is detected while reading the 01234567 data.

(8) Select WORD SWITCH REGISTER options if desired.

(9) Press INITIATE to continue test.

(10) See that PRGM HALT lights and BUS REGISTER displays 00010214 if test is executed successfully.

(11) Select WORD SWITCH. REGISTER options if desired.

(12) Press INITIATE to continue test.

h. Test WORD SWITCH REGISTER as follows:

(1) See that PRGM HALT lights and BUS INDICATOR displays 00010232 (MPHT02).

(2) Set WORD SWITCH REGISTER to 77777777.

(3) Press INITIATE.

(4) See that PRGM HALT lights and BUS INDICATOR displays 00010254 (MPHT3OS).

(5) Set WORD SWITCH REGISTE switches to all zeros.

(6) Press INITIATE to continue.

(7) See that PRGM HALT lights and BUS INDICATOR displays 00010272 (MPHT3A).

i. Test WORD SWITCH REGISTER as follows.

(1) Press INITIATE.

(2) See that PRGM HALT lights and BUS INDICATOR displays 00010300 (MPHT06).

(3) Select WORD SWITCH REGISTER options if desired.

(4) Press INITIATE to continue.

j. Test control panel instruction functioning as follows.

(1) See that PRGM HALT lights and BUS INDICATOR displays 00010316 (MPHT06).

(2) Set RUN-ONE INSTR to ONE INSTR.

(3) Press NORMAL HALT.

(4) Set WORD SWITCH REGISTER to 550377774.

(5) Set OPERATIONAL CONTROL to CONT PNL INSTR.

(6) Press INITIATE.

(7) Set OPERATIONAL CONTROL to CMPT.

(8) Set RUN-ONE INSTR to RUN.

(9) Press INITIATE.

(10) See that PRGM HALT lights and that BUS INDICATOR displays 00010324 (MPHTO7).

(11) Select WORD SWITCH REGISTER options or set all bits to 0.

(12) Press INITIATE.

k. Test REGISTER SELECT switch as follows.

(1) See that PRGM HALT lights 'and that BUS INDICATOR displays 00010375 (MPHT08).

(2) Set REGISTER SELECT switch to each position in following table and see that BUS INDICATOR displays corresponding number shown in table.

REGISTER SELECT setting	BUS INDICATOR display
SBR	00037764
LSR	57405067
OAR	03607766
IAR	03607765
MO	00010375
MEM	00000000
PEX	00010375
PC	00010375
EOA	00010375
A	37750377
B	00000000
Q	37751377
IR	00010375
CPS	3X340XOX (Note)

REGISTER SELECT position	BUS INDICATOR setting
CPD	37630200
BR	00000770
SHC	00000000
RTC	17737762
SC1	XXXXXXXX (Note)
SC2	XXXXXXXX (Note)

NOTE

X means don't care. CPS bit 21 = 0.Paragraph 5-51 explains correct value of CPS bits 22 and 23.

(3) Set REGISTER SELECT to PEX.

(4) Press INITIATE.

l. Test CLEAR switch as follows.

(1) See that PRGM HALT lights and that BUS INDICATOR displays 00010532.

(2) Press NORMAL HALT.

(3) Press CLEAR.

(4) Set REGISTER SELECT to each position in following table and see that BUS INDICATOR displays corresponding number shown in table.

REGISTER SELECT position	BUS INDICATOR setting
SBR	00000000
LSR	00000000
OAR	00100000
IAR	00100000
MO	77777777
MEM	00000000
PEX	00000000
PC	00000000
EOA	00000000
A	00000000
B	00000000
Q	00000000
IR	00000000
CPS	0010000X (Note)
CPD	40000000
BR	00000000
SHC	00000000
RTC	00000000
SC1	XXXXXXXX
SC2	XXXXXXXX

NOTE

CPS bit 21 = 0. Paragraph 5-51k explains correct value of 'CPS bits 22 and 23.

(6) Store 00010532 in PEX counter as follows.

(*a*) Set OPERATIONAL CONTROL to STORE.

(*b*) Set RUN-ONE INSTR to ONE INSTR.

(*c*) Set REGISTER SELECT to PEX.

(*d*) Set WORD SWITCH REGISTER to 00010532 (MPHTO9).

(*e*) Press INITIATE.

(*f*) See that BUS INDICATOR displays 00010532 (MPHTO9).

(*g*) Set OPERATIONAL CONTROL to CMPT.

(*h*) Set RUN-ONE INSTR to RUN.

(7) Press INITIATE.

m. Test one instruction functioning as follows.

(1) See that PRGM HALT lights and that BUS INDICATOR displays 00010714 (MPHT10).

(2) Press NORMAL HALT.

(3) Set RUN-ONE INSTR to ONE INSTR.

(4) Press INITIATE.

(5) See that BUS INDICATOR displays 00010715 and PRCS HALT lights.

(6) Set RUN-ONE INSTR to RUN.

(7) Press INITIATE.

n. Test memory protection and read function as follows.

(1) See that PRGM HALT lights and that BUS INDICATOR displays 00011020 (MPHT11).

(2) Set MEMORY guarded switch to PROTECTED.

(3) Press INITIATE, then immediately press READ.

(4) Set MEMORY switch to UNPROTECTED.

o. Test FUNCTION CODE and ADDRESS SWITCH REGISTER as follows.

(1) See that PRGM HALT lights and that BUS INDICATOR displays 00011121 (MPH1OA).

(2) Deleted.

(3) Set FUNCTION CODE to 77 and ADDRESS SWITCH REGISTER to 377777.

(4) Press INITIATE.

(5) See that PRGM HALT lights and that BUS INDICATOR displays 00011133 (MPH12).

(6) Set FUNCTION CODE to 00 and ADDRESS SWITCH REGISTER to 000000.

(7) Press INITIATE.

p. Test REAL TIME CLOCK switch as follows.

(1) See that PRGM HALT lights and that BUS INDICATOR displays 00011200 (MPHT13).

(2) Set REAL TIME CLOCK to ENABLE.

(3) Press INITIATE.

q. Test NORMAL HALT functioning as follows.

(1) See that PRGM HALT lights and that BUS INDICATOR displays 00011225 (MPHT14).

(2) Press INITIATE and NORMAL HALT i turn and see that:

(*a*) If successful, BUS INDICATOR will display address range between 00011230 and 00011233.

(*b*) If unsuccessful, BUS INDICATOR will display address 00012106 and END OF MP TEST is generated on local printer.

(3) Set OPERATIONAL CONTROL to TORE.

(4) Set WSR toggle switches to 00011236.

(5) Press INITIATE.

(6) Set WSR toggle switches to all zeros.

(7) Press INITIATE.

(8) See that following end-of-test indications occur.

(*a*) PRGM HALT lights.

(*b*) BUS INDICATOR displays 00011256 (ENDMCP).

(*c*) Printer prints: END OF MP TEST.

r. Exit from test in one of the following ways:

(1) If you want to repeat tape programmed portions of test, execute following instructions.

(*a*) Set RUN/ONE INSTR switch to ONE INSTR.

(*b*) Set REAL TIME CLOCK to DISABLE.

(*c*) Set OPERATIONAL CONTROL to MEMORY DISPLAY and REGISTER SELECT to MEM.

(*d*) Set ASR toggle switches to 20000.

(*e*) Press INITIATE and see that BUS INDICATOR displays 00020000.

(*f*) Set WSR toggle switches to all 7's.

(*g*) Set OPERATIONAL CONTROL to STORE.

(*h*) Press INITIATE and see that BUS INDICATOR displays 77777777.

(*i*) Set OPERATIONAL CONTROL to STORE.

(*i*) Set ASR toggle switches to 160000.

(*k*) Press INITIATE and see that BUS INDICATOR displays 22222222.

(*1*) Set OPERATIONAL CONTROL switch to STORE.

(*m*) Press INITIATE and see that BUS INDICATOR displays 77777777.

(*n*) Set OPERATIONAL CONTROL to MEMORY DISPLAY.

(*o*) Set ASR toggle switches to 260000.

(*p*) Press INITIATE and see that BUS INDICATOR displays 33333333.

(*q*) Set OPERATIONAL CONTROL to STORE.

(*r*) Press INITIATE and see that BUS INDICATOR displays 77777777.

(*s*) Precede to *d* above.

(2) If you wish to repeat the entire test, go to a above.

(3) If you wish to perform another off-line diagnostic or load the on-line operational program, refer to the applicable loading instruction.

5-53. Off-Line Synchronizer Test

This test is run whenever you encounter memory-to-memory, FACP or peripheral device data transfer problems. The test checks processor-synchronizer interface and data handling. Successful completion of this test verifies synchronizer control logic, the buffer register and data steering circuits.

a. Loading Tapes. Load synchronizer test tape as directed in para 5-46, 6-47a and 5-47b. There must be no tape on the tape reader while running this test or error printouts will occur.

b. Initial Switch Settings.

(1) Set PARITY ERROR to OFF.

(2) Press NORMAL HALT.

(3) Set CLOCK OPERATE to CONT.

(4) Set REAL TIME CLOCK to ENABLE.

c. Loading Starting Address (Location 20000 page 0).

(1) Set REGISTER SELECT to PEX.

(2) Set RUN-ONE INSTR to ONE INSTR.

(3) Set OPERATIONAL CONTROL to STORE.

(4) Set WORD SWITCH REGISTER to 00020000.

(5) Press INITIATE.

(6) See that BUS INDICATOR displays 00020000 (memory page 0, location 20000).

d. Options. No options are available. This test is run with the WORD SWITCH REGISTER se to all zeros.

e. Reset Synchronizers.

(1) Set all system status panel RESET SELECT switches to ON.

(2) Press RESET.

(3) Return RESET SELECT switches to OFF.

f. Starting Test.

(1) Set OPERATIONAL CONTROL to CMPT.

(2) Set RUN-ONE INSTR to RUN.

(3) Press INITIATE.

(4) Printout CS TEST indicates test started.

g. Test Results.

((1) With all zeroes WORD SWITCH REGISTER option the off-line synchronizer will run completely through once and printout END CS. Also PRGM HALT lights at end of test. Final halt location 00063212 (CS09LA) is displayed on PEX register.

(2) To run the test again, repeat c through f above. The start of test message is not repeated but the end of test message is printed after each run.

(3) Errors detected during the test cause printouts on the local page printer. Refer troubleshooting charts for error messages and corrective actions. A typical error message is

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5-54. Off-Line Remote Devices Test

This test is run whenever you encounter data transfer problems with the remote page printer, remote teletype or spare remote teletype operation.

The test may also be used to check local page printer operation. Successful completion/of this test verifies synchronizer, modem, lines and device operation for the configuration selected. The test is performed from the off-line maintenance central panel. Mark remote devices out of service from the /on-line maintenance control panel before testing (para. 5-17).

a. Loading Test Tape. Load the single segment synchronizer test portion of tape. Then load single segment remote devices test tape, paragraphs 5-46 and 5-47 a and b.

b. Initial Switch Settings. Set the following switches as shown.

Switch	Location	Setting
POWER	Modem	ON
BOTH ROTARY SWITCHES	Modem	NOR
PARITY ERROR	Maintenance control panel	OFF
NORMAL HALT	Maintenance control panel	PRESS
CLOCK OPERATE CONTROL (ROTARY)	Maintenance control panel	CONT
REAL TIME CLOCK .	Maintenance control panel	ENABLE
CONTROL TRANSFER AUTO	Auto system status panel	DISABLE
BYPASS	Printer motor control	BYPASS

c. Starting Address (Location 25000, Page 0).

(1) Set REGISTER SELECT switch to PEX.

(2) Set RUN-ONE INSTR switch to ONE INSTR.

(3) Set OPERATIONAL CONTROL switch to STORE.

(4) Set WORD SWITCH REGISTER to 00025000.

(5) Press INITIATE.

d. Control Options. If this test is run with the WORD SWITCH REGISTER set to all zeros, the remote page printer (RPP) is designated ASCII synchronizer A and remote teletype receive (TYR) is designated synchronizer B. Refer to table 5-10 for options and switch settings and table 5-11 for allowable configurations. A comprehensive check of system operation can be made using the following tests and configurations.

Configuration	Test
7	1-4
3	1-9,11,12
6	1-9,11,12

Attempting to run any test with an unacceptable configuration results in a COMBO NG printout and a program halt. On A6 set all RESET SELECT switches to ON; press RESET.

e. Test Start.

(2) Set OPERATIONAL CONTROL switch to CMPT.

(3) Set RUN-ONE INSTR switch to RUN. If code select is BAUDOT, set WSR bit 10 to 1.

(4) Press INITIATE. Program prints DEVICE TEST on local page printer, indicating test has started and runs tests 1 through 4.

f. Test I through 4. These tests provide a comprehensive check of data transfer from the processor to the device associated with synchronizer A. Any errors occurring between processor and synchronizer A buffer register results in error messages on local page printer (para 5-7*w*). Operator at remote location must inspect printout and verify that it agrees with test message sent (fig. 5-41). If errors occur at remote location but are not reported on local page printer, perform test 11 or 12 to further isolate malfunction.

(1) At the completion of test 04, END TEST is printed and a program halt occurs at PEX = 00027576.

(2) Press RESET SELECT-RESET on A6.

(3) If configuration 7 has been selected, this is the end of testing. To repeat test or to test another configuration, repeat steps *c, d* and *e*.

g. Tests 5 through 9. These tests provide a comprehensive check of data transfer circuits within a selected loop. The test also check the ability of synchronizer B to handle data at random intervals.

Table 5-10. Remote Devices Test Control Options.

WORD SWITCH REGISTER bit	Bit set (1)	Bit reset (0)
00	Perform options selected by bits 01-06.	Ignore bits 0106.
01	Inhibit error printout.	Enable error printout.
02	Halt on error.	Do not halt on error.
03	Not used for this test.	Always 0
04	Not used for this test.	Always 0.
05	Not used for this test.	Always 0
06	Repeat remote devices test.	Perform remote devices test once and halt.
07	Not used for this test.	Always 0
08	Not used for this test.	Always 0
09	Perform test 12.	Do not perform tat 12.
10	Use 75 BAUD code.	Use ASCII code.
14-17	Binary address-Synchronizer A	RPP designated synchronizer A.
18	Not used for this test.	Always 0.
19	Not used for this test.	Always 0.
20-23	Binary address-synchronizer B	TYC designated synchronizer B.

Table 5-11. Remote Devices Test Configuration.

Configuration no.	Synchronizer				Allowable tests			
	Device A	Binary address (bits 14-17)	Device B	Binary address (bits 20-30)	1-4	5-9	10	11
0	RPP	0000	TYR	0000				
1	RPP	0000	EXR	0011	X	X	X	X
2	RPP	0000	TYR	0111	X	X	X	X
3	EXT	0100	EXR	0011	X	X		X
4	EXT	0100	TYR	0111	X	X	X	X
5	TYT	1000	EXR	0011	X	X	X	X
6	TYT	1000	TYR	0111	X	X	X	
7	LPP	0010		0000	X			

NOTE

TYR/TYT = TTY; EXR/EXT = SPTTY

(1) Make connections as directed in table 5-11 and figure 5-42A.

(2) Press INITIATE.

NOTE

Test 10 and 11 require that CODE SELECT switches on the rear of system status panel A6 be set to specific positions. If you want to bypass these tests, proceed as described in h and i below without setting these switches. In addition to printout shown in procedures, error messages will printout.

h. Test 10. This test checks the ability of synchronizer B to detect incorrect code.

(1) At beginning of test 10, CHANGE ASCII/BAUDOT SW WYNC A is printed and program halt occurs at PEX = 00031217.

(2) If allowed by configuration under test, set A6 CODE SELECT switch for synchronizer A to BAUDOT and synchronizer B to ASCII.

(3) If configuration does not allow step (2) above, test 10 is skipped and page printer generates TEST 10 OMITTED message.

(4) Press INITIATE.

(5) At end of test 10, CHANGE ASCII/BAUDOT SW SYNC A MAYBE is printed and program halt occurs at PEX = 00031457. If A6 CODE SELECT switch was changed in (2) above, restore to original setting.

i. Test 11. Set A6 CODE SELECT switches for both synchronizer A and B to ASCII. Press INITIATE.

!”#$%&'()*+ ,-./0123456789:;<-> ?@ABCDEFGHIJKLMNOPQRSTUVWXYZ [ ]†←-@ABCDEF
GHIJKLMNOPQRSTUVWXYZ [

A ASCII TEST MESSAGE

ABCDEFGHIJKLMNOPQRSTUVWXYZ

B BAUDOT TEST MESSAGE

NOTE:
1. TEST MESSAGE PRINTED (ASCII OR BAUDOT) DEPENDS ON CLASSMARKING OF REMOTE DEVICE.

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Figure 5-41. Remote devices test 04 test messages.

j. End of Test. Test 12 BYPASSED and END OF TEST messages are printed on local page printer and program halts at PEX address 00032252.

k. 12. This test provides a comprehensive check of data transfer within a selected external loop.

(1) Press NORMAL HALT. See that PRCS HALT-lights.

(2) Set REGISTER SELECT to PEX.

(3) Set OPERATIONAL CONTROL to STORE.

(4) Set WORD SWITCH REGISTER to 00032303 (starting address).

(5) Press INITIATE.

(6) See that BUS INDICATOR displays 00032303.

(7) Set OPERATIONAL CONTROL to CMPT.

(8) Set WORD SWITCH REGISTER bit 9 to 1 and bits 14 through 17 and bits 20 through 23 to identify configuration of devices A and B. If remote channel is baudot, set bit 10 to 1.

(9) Notify remote location operator that typing test is about to begin. Operator should type a test message and verify that correct characters are printed.

(10) Press INITIATE.

(11) See that WORD SWITCH REGISTER displays 00000014. This indicates that remote typing test is in progress.

(12) After the receipt of the last character (approximately 2 minutes), PRGM HALT lights with PEX = 00032252. END TEST prints out.

(13) Restore Common Equipment Panel to original configuration.

l. Repeating Test. To repeat the test or to test another configuration, repeat c through j. Also test 12(k) may be repeated independently.

m. Test Results. Many errors encountered during the remote devices result in a printout on the local

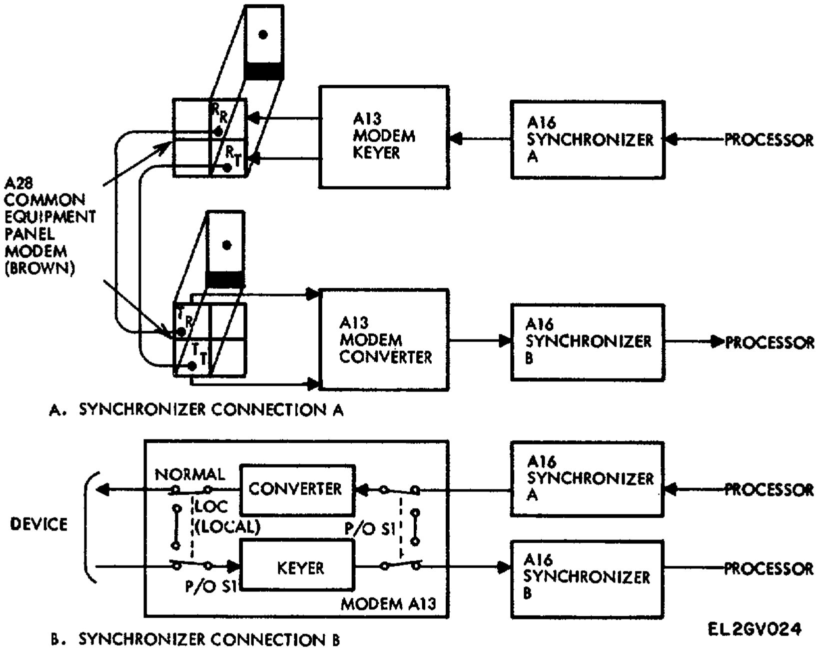

Figure 5-42. Remote devices test synchronizer connections.

(Next printed page is 5-146)

page printer. Both observed and printout error conditions are listed in the troubleshooting chart (para 5-7w) along with corrective actions. Evaluate all errors which occur during remote device test before taking corrective action.

5-55. Off-Line Paper Tape Reader/ Paper Tape Punch Tests

Perform these tests whenever you encounter data transfer problems with punched tape reader A12 (PTR) or paper tape punch A20 (PTP). The tests check processor-synchronizer and device-synchronizer interface. Successful completion of all tests verifies operation and data transfer capabilities of the paper tape punch and paper tape reader. The PTP/PTR off-line tests consist of four separate tests a, b, c and d below.

a. *Paper Tape Reader Manual Test.* This test provides a basic check of the PTR and should be run prior to loading from the reader if reliability is questionable.

(1) *Initial switch settings.* Set switches as follows:

"Switch	***Location***	***Position***
MEMORY	Off-line maintenance control panel	UNPROTECTED
PARITY ERROR	Off-line maintenance control panel	OFF
CLOCK OPERATE (rotary)	Off-line maintenance control panel	CONT
CLOCK OPERATE (toggle)	Off-line maintenance control panel	ADV
REAL TIME CLOCK	Off-line maintenance control panel	DISABLE
CONTROL TRANSFER AUTO	System status panel	DISABLE

(2) Test tape. Load a constant character test tape on paper tape reader.

NOTE

If such a tape is not available perform manual paper tape punch test (b below) first to prepare test tape.

(3) Test routine. Load test routine from Table 5-12 using procedure in paragraph 2-18d. Verify entry with procedure in paragraph 2-18e.

Table 5-12. Basic PTR Test Instruction Entries

Address	WORD SWITCH REGISTER setting (instruction)
002000	01002001
002001	00002400
002002	02200040
002003	24002000
002004	01002005
002005	00002404
002006	60037751
002007	05200XXX
002010	24002000
002011	00002000

NOTE

XXX is the octal equivalent of the test tape constant character, e.g., XXX would be 377 for an all-ones test tape.

(4) *Starting address* (location 2000 page 0)

(a) Set REGISTER SELECT to PEX.

(*b*) Set OPERATIONAL CONTROL to STORE.

(*c*) Set WORD SWITCH REGISTER to 002000.

(*d*) Press INITIATE.

(5) *Test start.*

(a) Set RUN-ONE INSTR switch to RUN.

(b) Set OPERATIONAL CONTROL to CMPT.

(c) Press INITIATE.

(6) *Errors*. If an error occurs during this test, the program halts with PEX =00002012. The accumulator contains the bits which failed to match and the Q register contains the character read from the PTR synchronizer.

(7) *Restart*. To continue testing after a program halt, return all switches to position at start of test and press INITIATE.

(8) *End of test*. To terminate the test press NORMAL HALT.

b. *Paper Tape Punch Manual Test*. This test provides a basic check of the PTP and should be run prior to preparing a tape if reliability is questionable.

(1) *Initial switch settings*. Set the following switches as shown.

Switch	Location	Position
MEMORY	Off-line maintenance control panel	UNPROTECTED
PARITY. ERROR	Off-line maintenance control panel	OFF
CLOCK OPERATE CONTROL (rotary)	Off-line maintenance control panel	CONT
ADV-RPT (toggle),	Off-line maintenance control panel	ADV
REAL TIME CLOCK control panel	Off-line maintenance	DISABLE
CONTROL TRANS. FER AUTO	System status panel	DISABLE

(2) Prepare PTP.

(a) Load sufficient supply of paper tape.

(b) Check feed operations.

(3) Test routine. Load test routine from table 5-13 using procedure in paragraph 2-18d. Verify entry with procedure in paragraph 2-18e,

(4) Starting address (Location 776 page 0).

(a) Set REGISTER SELECT to PEX.

(b) Set OPERATIONAL CONTROL to STORE.

Table 5-13. Basic PTP Test Instruction Entry.

Address	WORD SWITCH REGISTER setting (instructions)
000776	01200420
000777	00000000
001000	01001001
001001	00000400
001002	05020002
001003	24001005
001004	22001000
001005	55200XXX
001006	60037757
001007	01001007
001010	00000414

NOTE

XXX is the octal equivalent of the character to be repeatedly punched on the test, e.g., XXX would be 125 for a 001, 010, 101 punched character pattern, or 252 for a 010, 101, 010 punched character pattern.

(c) Set WORD SWITCH Register to 000776.

(d) Press INITIATE.

(5) *Start test*.

(a) Set RUN-ONE INSTR to RUN.

(b) Set OPERATIONAL CONTROL to COMPT.

(c) Press INITIATE. Punch starts punching tape of selected character,

(6) *Errors*. Inspect punching operation and paper tape to determine if errors are occurring.

(7) *End of test*. To terminate punching test press NORMAL HALT.

c. Paper Tape Reader (PTR) Test. The PTR test makes a comprehensive check of data transfer and timing for the PRT and synchronizer.

(1) *Test tape*. Load both segments of PTR/PTP test program tape into off-line processor paragraphs 5-46 and 5-47a and b.

(2) Initial switch settings. Set switches as shown:

Switch	Location	Position
MEMORY	Maintenance control panel	UNPROTECTED
PARITY ERROR	Maintenance control control	OFF
CLOCK OPERATE CONTROL (rotary)	Maintenance control panel	CONT
ADV-RPT (toggle)	Maintenance control panel	ADV
REAL TIME CLOCK	Maintenance control panel	DISABLE
CONTROL TRANS-FER AUTO	System status panel	DISABLE
BYPASS	Printer motor	BYPASS

(3) *Starting Address*. (location 10000 page 0).

(a) Press NORMAL HALT, see that PRCS HALT lights.

(b) Set REGISTER SELECT switch to PEX.

(c) Set OPERATIONAL CONTROL switch to STORE.

(d) Set WORD SWITCH REGISTER to 00010000.

(e) Press INITIATE.

(4) *Test start*.

(a) Set RUN-ONE INSTR to RUN.

(b) Set OPERATIONAL CONTROL to CMPT.

(c) Press INITIATE. Program runs then enters program halt with PEX = 00010014. PR TEST prints out.

(5) *Select options*. No options are used in this test. Set the WORD SWITCH REGISTER toggle switches to all zeros.

(6) *Load test tape*. Select OCTAL, ASCII o: CONSTANT VALUE test tape and load on PTR.

Table 5-14. (Deleted)

(7) *Enter format*. Set tape format code WORD SWITCH REGISTER bits 14-23 from table 5-15.

(8) *Select test.* At this program halt you have the option to run either paper tape reader (PTR test or paper tape reader timing (PTR timing) test

To run PTR timing test press -NORMAL HALT once and proceed to (10). To run PTR test continue to (9) below.

Table 5-15. Paper Tape Code Format

Tape code	WORD SWITCH REGISTER bit			
	13	14	15	16-23
Octal	0	1	0	Not used. Set to 0.
ASCII	0	0	1	Not used. Set to 0.
Constant value	0	0	0	Set to value to be read from or punched on tape.
Halt test using constant character tape.	1 1	0 or 0	0 1	Set to identify constant character.

(9) PTR test.

(*a*) Press INITIATE to start test. Program runs and PTR TEST is printed on local page printer.

(*b*) If ASCII test tape is used, all printable characters will appear on local page printer.

(*c*) If errors occur during PTR test, error message will be printed on local page printer and PRGM HALT will light, press initiate to continue test.

(*d*) When the PTR test is completed, END OF PTR-SYNC TEST is printed and a program halt is entered with PEX = 00011232.

(*e*) At this program halt you have the option to repeat the PTR test, run the PTR timing test or run the paper tape punch (PTP) test. To repeat the PTR test return to step (3) above. To run the PTP test, press NORMAL HALT twice and enter PTP test at d (4)(c). To run PTR timing test proceed to (10).

(10) *PTR timing test.*

(a) Press INITIATE to start test. Program buns then enters program halt with PEX = 00011274. Set WSR to CHAR prints out.

(b) Load a constant character tape on PTR.

(c) Set tape format code in WORD SWITCH REGISTER bits 14-23 from table 5-15.

(d) Press INITIATE. Program runs then enters program halt with PEX =00011300.

(e) At this program halt you have the option to select automatic or manual timing for the PTR timing test.

1. In automatic timing, the program reads blocks of ten characters from paper tape starting at 200 characters/second rate and decreasing to 5 character/second rate. This sequence is repeated until testing is manually terminated. by setting WORD SWITCH REGISTER .bit 13 to 1.

2. In manual timing you select the character/second read from paper tape with WORD SWITCH REGISTER bits 16-23. You can change the selection while the test is running.

(f) To select automatic timing, press NORMAL HALT once, then press INITIATE. List runs until halted by setting WORD SWITCH REGISTER as shown in table 5-15.

(g) To select manual timing press INITIATE only. Program runs then enters program halt with PEX =00011315.

(h) Select delay 'for character/second desired from table 5-16 and enter in WORD SWITCH REGISTER bits 15-23.

(i) Press INITIATE. Test runs until halted. WORD SWITCH REGISTER bits 15-23 may be changed as desired while test is running.

(i) If errors occur during PTR timing test, error messages are printed on local page printer.

(k) To terminate PTR timing test, set WORD WITCH REGISTER bit 13 to one. Program halts with PEX = 00011232.

(l) At this program halt you have the option to repeat the PTR timing test, run the PTR test or run the PTP test. To repeat PTR timing test return to (10)(a) above. To run 'the PTR test press NORMAL HALT twice and enter PTP test at d(4)(c).

Table 5-16. Characters per Second Selection

Characters per second	Time Delay(ms)	WORD SWITCH REGISTER bits 16-23
5	200	310
10	195	303
30	175	257
35	170	252
50	1.55	233
55	150	226
75	130	202
80	125	175
100	105	151
105	100	144
125	80	120
130	75	113
150	55	067
155	50	062
175	30	036
180	25	031
190	15	017

NOTE

WORD SWITCH REGISTER bits 16-23 permit time delay selections from zero through 255. However, character frequencies less than 5/second or greater than 200/second cannot be selected.

d. Paper Tape Punch (PTP) Test. The PTP test makes a comprehensive check of PTP and synchronizer data transfer.

(1) *Test tape.* If PTR test was not run, load both segments of PTR/PTP test program tape into off-line processor, paragraphs 5-46 and 5-47a and b.

(2) *Initial switch settings*. Set following switches as shown.

Switch	Location	Position
MEMORY	Maintenance control panel	UNPROTECTED
PARITY ERROR	Maintenance control panel	OFF
CLOCK OPERATE CONTROL (rotary)	Maintenance control panel	CONT
ADV-RPT (toggle)	Maintenance control panel	ADV
REAL TIME CLOCK	Maintenance control panel	DISABLE
CONTROL TRANSFER AUTO	System status panel	DISABLE
BYPASS	Printer motor control	BYPASS

(3) *Starting address* (Location 15000 page 0)

(*a*) Press NORMAL HALT. See that PRCS HALT lights.

(*b*) Set REGISTER SELECT to PEX.

(*c*) Set OPERATIONAL CONTROL TO STORE.

(*d*) Set WORD SWITCH REGISTER to 00015000.

(*e*) Press INITIATE.

(4) *Start test.*

(*a*) Set RUN-ONE INSTR to RUN.

(*b*) Set OPERATIONAL CONTROL to CMPT.'

(*c*) Press INITIATE. Program runs then enters program halt with PEX =00015014. PTP TEST prints out. (This is point of entry from PTR and PTR timing tests).

(5) *Select options*. Normally this test is run with WORD SWITCH REGISTER bits 00 through 06 set to zero. However, certain options are available to enhance troubleshooting.

(*a*) Set options in WORD SWITCH REGISTER bits 00 through 06 if desired.

(*b*) Press INITIATE. Program runs then enter program halt with PEX =..00015310.

(6) Enter format. Set format code for configuration to be punched on tape in WORD SWITCH REGISTER bits 14-23 from table 5-15.

(7) Restart test.

(*a*) Press INITIATE to start PTP test. PTP TEST is printed on local page printer.

(*b*) If ASCII code is punched, printable characters will appear on local page printer.

(*c*) Errors are determined by examining punched tape.

(8) *End of test*

(*a*) If a CONSTANT VALUE tape is being punched the test is terminated by setting WORD SWITCH REGISTER bit 13 to one.

(*b*) If ASCII or OCTAL code is being punched the PTR test halts automatically.

(*c*) At the end of test END OF PT is printed and a program halt is entered with PEX = 00015660.

(*d*) At this program halt you have the option to repeat the PTP test, return to start of PTR/PTP testing or terminate tests. To repeat PTP return to d (4)(c) above. To return to start of PTR/PTP tests press NORMAL HALT once and return to c(4)(c) above.

5-56. Off-Line Functional Assignment Control Panel (FACP) Test

This test is run whenever you encounter function entry or display and indicator problems. The test checks processor-FACP interface and FACP display and entry functions. Successful completion of this test verifies digital readouts (DRO), indicator switches and indicator functions, control circuits and push-button entries. Run the complete FACP test and note all errors before attempting troubleshooting (para 5-7v).

a. Loading Test Tape. Load FACP test tape, paragraph 5-46 and 5-47a and b.

NOTE

You must first load the two segments of the PTR/PTP test on the tape and then the single segment FACP test.

b. Initial Switch Settings. Set the following switches as shown:

Switch	Location	Setting
MEMORY	Maintenance control panel	UNPROTECTED
HALT ON PARITY ERROR	Maintenance control panel	OFF
CLOCK OPERATE CONTROL (rotary)	Maintenance control panel	CONT
ADV-RPT (toggle)	Maintenance control panel	ADV
REAL TIME CLOCK	Maintenance control panel	DISABLE
CONTROL TRANSFER	System status panel	DISABLE
BYPASS	Printer motor control	BYPASS

c. Loading Starting Address. (Location 10000, page 0).

(1) Press NORMAL HALT see that PRCS HALT lights.

(2) Press CLEAR.

(3) Set REGISTER SELECT switch to PEX.

(4) Set RUN/ONE INSTR switch to ONE INSTR.

(5) Set OPERATIONAL CONTROL switch to STORE.

(6) Set WORD SWITCH REGISTER to 00010000.

(7) Press INITIATE.

d. Lamp Test. The FACP lamp test must be successfully completed before proceeding with the off-line test (para 5-4, sequence no. 27c through f).

e. Test Start.

(1) Set OPERATIONAL CONTROL SWITCH to CMPT.

(2) Set RUN-ONE INSTR switch to RUN.

(3) Press INITIATE. Program halts with PEX register = 00010015.

(4) FACP TEST Printout indicates test started.

f. Control Options. No options are available for this test. Set all WORD SWITCH REGISTER toggle switches to 0.

Table -17. (Deleted)

g. Tests 1 Through 4.

(1) Press INITIATE. The program automatically performs tests 1 through 4.

(2) See that no maintenance messages printout.

(3) See that READY on FACP starts blinking after a few seconds. This indicates end of tests 1 through 4.

h. Tests 5, 6 and '.

(1) See that all indicators and digital readouts are off.

(2) Press CONTINUE.

(3) See that first indicator listed in table 5-18 starts flashing and its DRO starts filling with the listed number.

(4) When DRO is full see that indicator lights continuously for about four seconds.

(5) See that after four seconds DRO Rnd indicator extinguish.

(6) See that each other indicator and DRO sequentially filled with data and in the order shown in table 5-18.

NOTE

You may speed up the test by pressing CONTINUE after the DRO display is filled. The test program then starts to fill the next DRO without holding the display four seconds.

(7) After the last display in table 5-18 extinguishes, see that first indicator in table 5-19 starts flashing and STATUS DRO starts filling with listed number.

(8) When STATUS display is completed see that listed indicator lights continuously for about four seconds..

(9) After four seconds see that indicator and DRO extinguish.

(10) See that each other indicator listed in table 5-19 operates in the order shown and that correct number is displayed in STATUS DRO.

NOTE

Speed up test by pressing CONTINUE after display is filled.

(11) After last entry in table 5-19 is displayed, see that READY lights.

Table 5-18. FACP Test 6 Displays

Order	DRO and indicator	Displayed in DRO
1	TERMINAL NO	0101
2	TERMINAL, TYPE	02
3	CLASS CODE	03
4	DIR NO	404
5	TRK GR NO	506
6	CONF	06
7	GR MIN COUNT	07
8	MODE II TERM NO	0808
9	SPCL CKT NO	09
10	PR NO	10
11	SL NO	11
12	STATUS	12
13	LINE GP NO	13

Table 5-18. FACP Test 6 Displays-Continued

Order	DRO and indicator	Displayed in FPRC
14	ALTN SL NO	14
15	FUNCTION CODE	5
16	RANK	6
17	PRI TRK GR NO	017
18	ALTN TRK GR NO	018
19	FIXED DIR NO/TRFC CNT	19019
20	FIXED DIR NO/TRFC CNT	02020
21	PR-SL-XXX/NNX-XXXX	2121210

Table 5-19. FAC, Test 7 Displays

Order	Indicator	Status display (display is status DRO)
1		22
2		23
3		24
4		25
5		26
6		27
7		28
8		29
9		30
10		31
11		32
12		33
13		34
14		35
15		36
16		37
17	READY	38
18	ERROR (see note)	39
19	STORE	40
20	READER TO TTY	41
22	READER TO SP TTY	42

NOTE
ERROR lamp flashes until termination of test.

i. Test 8.

(1) Press one of pushbuttons listed in table 5-20.

(2) See that STATUS DRO displays corresponding number listed in table 5-20.

(3) See that ERROR indicator remains off and that no maintenance printouts occur. If there are errors, erroneous code generated by pushbutton is displayed in PRI TRK GRP NO digital readout.

(4) Repeat steps (1) through (3) for each other pushbutton listed in table 5-20. You may select, repeat, or omit pushbuttons to be tested in any order within this list.

(5) To exit from test 8, press CONTINUE; see that READY lights.

j. Test 9.

(1) Press one of digit pushbuttons listed in table 5-21.

(2) See that STATUS digital readout displays corresponding number listed in table 5-21. See that all other DRO digits display the selected digit.

(3) See that ERROR indicator remains off and that no maintenance printouts occur. Erroneous codes generated by selected pushbutton are displayed in PRI TRK GRP NO digital readout.

(4) Repeat steps (1) through (3) for each other pushbutton listed in table 5-21. You may select repeat, or omit pushbuttons to be tested in any order within this list.

(5) To exit from test 9, press CONTINUE; see that READY lights.

Table 5-20. FACP Test 8 Entries and Displays

Pushbutton	Status display
READER TO TTY	41
READER TO SPTTY	42
READER TO PUNCH	43
PRINT	44
PUNCH	45
PRINT STOP	46
PUNCH STOP	47
ASSIGN	48
CHANGE	49
DELETE/RESET	50
DISPLAY	51
FACP CLEAR	52
FIELD CLEAR	53
STORE AND REPEAT	54
STORE	55
REMOTE I/O INHIBIT	56
LINE LOAD	57
TERMINAL SERVICE	58
TERMINAL NO ASGMT	59
DIRECTORY NO ASGMT	60
TRK GR NO	61
PR ROUTING	62
SL ROUTING	63
ALTN SL ROUTING	64
OP/JXX ROUTING	63
FIXED DIR ROUTING	6
PRST CONF ENTRY	67
LINE GR ENTRY	68
DAC ROUTING	69
TRUNK TEST	70
STATUS	71
TRAFFIC METERS	72
TRK GR METERS	73

Table 5-21. FACP Test 9 Pushbuttons and Displays

Digit pushbutton	Status display
1	74
2	75
3	76
4	77
5	78
6	79
7	80
8	81
9	82
0	83

k. Test 10.

(1) Set INTCP CALLS switch to one of positions listed in table 5-22.

(2) Press ENTER.

(3) See that STATUS digital readout displays number corresponding to switch position listed on table 5-22.

(4) See that ERROR remains off and that no maintenance printouts occur. Erroneous codes are displayed in PRI TRK GP NO digital readout.

(5) Repeat steps (1) through (4) for other positions listed on table 5-22 in any order.

(6) Press CONTINUE to exit from test 10 and terminate FACP test. See that printer prints END OF FP.

NOTE

PRCS HALT Lights and BUS INDICATOR displays final halt location 00011612 with REGISTER SELECT set to PEX.

l. Test Rerun. To rerun FACP test, return to step g. The test start message (FACP TEST) is not repeated when the test is rerun.

Table 5-22. FACP Test 10 Settings and Displays

INTCP CALLS switch positions	Status display
OPR	84
INFO	85
ERROR	86

5-57. LSR, IAR and OAR Tests

Use this procedure to manually test the link select register (LSR), inlet address register (IAR) or outlet address register (OAR) of an off-line processor. The procedure does not disturb the memory. Therefore, it may be run with the operational program loaded. Perform this procedure from the maintenance control panel of the off-line processor to be tested.

a. See that PRCS HALT is on. If not, press NORMAL HALT.

b. Set CLOCK OPERATE CONTROL to CONT.

c. Set OPERATIONAL CONTROL to STORE.

d. Set RUN/ONE INSTR to ONE INSTR.

e. Set REGISTER SELECT to LSR, IAR, or OAR to select tested register.

f. Set WORD SWITCH REGISTER bits as shown on line 1 of A, figure 5-43 for LSR or B, figure 5-43 for IAR or OAR. Set all other bits to 0.

g. Press INITIATE.

h. See that BUS INDICATOR bits agree with line 1. This indicates that register can store properly.

i. Repeat steps fig, and h in sequence for lines 2 and 3.

j. Operational program may now be started (para 2-181).

5-58. Interpreting Decoder Fault Printouts

The following explains how to interpret printouts associated with decoder faults (para 5-7q).

a. Decoder Printout Table (FO-42). The decoder printout table lists all decoder paths that are checked by the periodic decoder test which is performed by the operational program. Note that different paths are checked in the AN/TTC-38(V)1 and AN/TTC-38(V)2. Use the appropriate table when troubleshooting. You will never see printouts which are exactly identical to lines on this table. This is because the program only provides a printout when there is an error in a path. Your job, therefore, is to determine which path the printout represents, and then to isolate the fault by seeing how the printout differs from the correct data in the table.

b. Decoder Test. The program checks a path by placing the IFGT, OFGT, link and alternate link data for the path in the processor address registers. The program then makes four separate checks to see if correct decoding of this data occurred. First, it checks for correctly re-encoded link and alternate link numbers. Second, it checks for correct special enable bits. Third, it checks for correct re-encoded outlet frame and group numbers and correct parity of the decoded outlet terminal number and fourth, it checks for correctly re-encoded inlet frame and group numbers and correct parity of decoded inlet terminal numbers. The four tests are made on each path in the table in the order listed. It takes about 14 seconds to complete all checks. In the on-line long loop (call processing) mode, a decoder failure printout corresponds to the particular path and test being performed when the fault is first noted by the program. The short loop mode exercise is performed after a program start-up with path number one. Therefore, a decoder fault message in the short loop mode always indicates the first faulty path and fault type on the table. There may be other faults present but they will not be printed because the program halts at the first error. Performing a program start-up the exercise to start at path one again.

c. Determining Path Tested. Each decoder fault printout identifies the path tested by means of inlet IF-IG-IT (<u>X-X-XX</u>) and outlet OF-OG-OT (<u>Y-Y-YY</u>)

LINE	WORD SWITCH REGISTER BUS INDICATOR BIT NO.					
	18	19	20	21	22	23
1	1	1	1	1	1	1
2	0	1	0	1	0	1
3	0	0	0	0	0	0

A. LSR TEST

LINE	WORD SWITCH REGISTER BUS INDICATOR BIT NO.											
	12	13	14	15	16	17	18	19	20	21	22	23
1	1	1	1	1	1	1	1	1	1	1	1	1
2	0	1	0	1	0	1	0	1	0	1	0	1
3	0	0	0	0	0	0	0	0	0	0	0	0

B. IAR AND OAR TEST

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Figure 5-43. MCP settings for LSR, IAR, and OAR tests.

addresses. Use these addresses to locate the path tested on the table. For example, if in an AN/TTC-38(V)1 the address printout is 0-0-00 1-5-05, path no. 17 is being tested.

d. Frame and Group Errors. In some decoder fault messages the re-encoded inlet or outlet frame and group number (T-T) are printed immediately below the actual address (X-X-XX or Y-Y-YY) for that path. Comparison between these two sets of numbers reveals that exact error. For example, if re-encoded outlet address 2-5-0 (T-T-P) is printed immediately below actual outlet address 1-5-05 (Y-Y-YY), the outlet frame (OF) decoder fault.

e. Terminal Errors. Decoded inlet (IT) and outlet (OT) terminal numbers are checked for odd parity. Only one IT or OT line should be decoded in any path (add number). If zero or two terminals should decode (even number) there is a fault in the decoders. For example, 1-5-1 (T-T-P) is printed immediately below actual outlet address 1-5-05 (Y-Y-YY), there is an outlet terminal number decoder fault.

f. BC Link Errors. The VV number indicates the BC link number inserted for decoding. The ZZ number indicates the results of decoding and re-encoding this number in the processor. You may have noticed that some BC link numbers are larger than numbers assigned to BC links in the network terminal subsystem. These are only test numbers used to check decoder circuits and are never used for actual network commands. An example of a BC link error is if in path 17 the VV printout is 17 but the ZZ printout is 16.

g. Alternate Link Errors. If the W number is 0, the basic BC link number was tested by the program. If W is 1, the alternate BC link was tested. U shows how this alternate link bit was decoded and re-encoded by the processor. If the two numbers are different there is an alternate link decoder or encoder fault.

h. Special Enable Errors. Several special enable signals are generated during the decoding process. These are identified by the SSSSSSSSS number. The decoder printout table shows what the correct SSSSSSSSS number should be for each path tested. Compare the number actually printed with the table to determine what was in error. For example, if in the AN/TTC-38(V)1 path 17 the number 100010001 is printed out, you can see from the table that the special enable signal called ITL (CP bus bit no. 6) was in error.

5-59. Control Transfer Observations

Whenever the operational program automatically transfers control, the status of the processor which is switched off-line should be observed and recorded. Make these observations before initiating any other tests, otherwise the information will be lost. The information recorded according to the following procedures is needed by higher-level maintenance personnel to troubleshoot the processor.

a. Set REGISTER SELECT TO CPS and record BUS INDICATOR display. The following numbers may be present.

Number	Meaning
20140000	Data parity error detected. PARITY ERROR DATA WORD light should be on.
01140000	Instruction word parity error detected. PARITY ERROR-INSTR WORD light should be on.
00540000	Illegal instruction or access to non-existent memory request detected.
00340000	Write lockout violation. Attempt was made to write into protected memory.
00140000	Processor self-test failed.

b. If PRGM HALT or PRCS HALT light is on, record which light is on. Then set RESISTER SELECT to PEX and record BUS INDICATOR display. (Halt address).

c. If ACTIVE is on, set REGISTER SELECT to IR and record BUS INDICATOR display (current instruction).

5-60. Interpreting Off-Line Memory Test Printouts

a. Write/Read Errors. Error printouts generated during the off-line memory test (para 5-50) employ a format which indicates the failed location and type of error. The following 3-part format is used for memory write/read printouts:

A-XXXXXX W-YYYYYYYY R-ZZZZZZZZ

where:

XXXXXX is a 6-digit address.

YYYYYYYY is word written into memory.

ZZZZZZZZ is word read from memory.

During execution of segment A of the memory check, the high order digit of the address indicates if the error is associated with memory page 1 or 2. A high order digit of 1 indicates page 1; a high order digit of 2 indicates page 2. Segment B of the memory check tests page 0. Therefore, any printout occurring during the execution of segment B is associated with page 0. The second highest order address digit contains a page control bit employed by the processor to indicate page 1 or 2 is being addressed. This can add a factor of 4 to the second highest order address digit. If the second highest digit of XXXXXX is 4, 5, or 6, subtract 4 to determine the actual location address. For example, both 151234 and 111234 identify page 1 location 11234.

b. Write/Read Error Example. A typical memory error message is as follows: A-256321 W-7777777 R77773777

where:

A indicates page 2, memory address 16321;

W indicates an all ONE's pattern to be written into the addressed memory location;

R indicates that a ONE was not read from bit 12 of the location.

c. Data Parity Errors. The off-line memory diagnostic program also provides printouts which identify data parity errors:

DPE XXXXXX

where XXXXXX identifies the page and location of the diagnostic program halt associated with the parity error. The address and data involved with the DPE printout is identified by a write/read printout (a above).

5-61. Memory Display Procedure

Use this procedure to display the content of any memory location when the processor is off-line and in the processor halt state (i.e., when maintenance control panel PRCS HALT light is on). Perform the procedure on the MCP of the applicable processor as follows:

a. Set CLOCK OPERATE CONTROL rotary switch to CONT.

b. If the PRCS HALT light is not on, press NORMAL HALT. If PRCS HALT still does not light, press IMMED HALT.

c. Set OPERATIONAL CONTROL rotary switch to MEMORY DISPLAY.

d. Set REGISTER SELECT rotary switch to MEM.

e. Set RUN-ONE INSTR to ONE INSTR.

f. Set ADDRESS SWITCH REGISTER switches to identify address of desired memory word.

g. Press INITIATE.

h. Observe content of memory location on BUS INDICATOR lamps.

NOTE

If you want to change contents of memory location displayed, set OPERATIONAL CONTROL to STORE. Set new data into WORD SWITCH REGISTER. Press INITIATE. New data is displayed on BUS INDICATOR.

i. Repeat steps f, g, and n to display other memory locations.

5-62. MCP Register Readout Procedure

Use this procedure to display any register listed on the maintenance control panel REGISTER SELECT switch except MEM. The procedure can only be used when the processor is halted and off-line, i.e., when either PRGM HALT or PRCS HALT light is on. The data displayed is the state of the selected register during the current halt condition. Perform the procedure on the MCP of the applicable processor as follows:

a. Set CLOCK OPERATE CONTROL rotary switch to CONT.

b. Do not press CLEAR switch unless you want to clear all registers before displaying their content.

c. Set other MCP switches to any position desired for test you are making.

d. Set REGISTER SELECT switch to position identifying register to be displayed.

e. Observe content of register displayed on BUS INDICATOR lamps.

f. Repeat d and e to display content of other registers at this halt location.

5-63. Loading Registers

Use this procedure whenever you want to load test data into registers listed on the maintenance control panel REGISTER SELECT switch or specific memory locations. The procedure may only be performed on an off-line, halted processor (i.e., PRCS HALT light on). Perform the procedure from the MCP of the applicable processor as follows:

a. Set CLOCK OPERATE CONTROL rotary switch to CONT.

b. Set OPERATIONAL CONTROL rotary switch to STORE.

c. Set RUN-ONE INSTR switch to ONE INSTR.

d. Set REGISTER SELECT switch to position identify register to be loaded.

e. If MEM (memory) position of REGISTER SELECT switch is used, set ADDRESS SWITCH REGISTER switches to identifying desired address in memory.

f. Set data to be loaded into WORD SWITCH REGISTER switches.

g. Press INITIATE.

h. Observe BUS INDICATOR lamps. Correct data word is displayed with register loaded properly.

i. Repeat from step d to load data into other registers or memory addresses.

5-64. Manual Alarm Test

Power failure alarms may be tested manually at any time. Program detected alarms can only be tested with the on-line processor. Press LAMP TEST pushbutton to check all indicators before performing tests.

a. Ac Power Failure Alarm.

(1) Set power subsystem control panel BATTERY CHARGER circuit breaker to OFF.

(2) AC PWR alarm on A6 indicator should light and audible alarm sounds.

(3) Set BATTERY CHARGER circuit breaker to ON.

(4) AC PWR alarm indicator should extinguish and audible alarm stops.

b. Dc Power Failure Alarm.

(1) Set ON/OFF switch on one dc-dc converter (select from PS14 through PS18) to OFF.

(2) DC PWR alarm on A6 indicator should light and audible alarm sounds.

(3) Set dc-dc converter ON/OFF switch to ON.

(4) DC PWR alarm indicator should extinguish and audible alarm stops.

c. Program Detected Alarms.

(1) Set one alarm (para 5-22) from maintenance control panel of on-line processor.

(2) Observe that indicator on system status .panel goes on and audible alarm sounds.

(3) Reset alarm (para 5-22) from maintenance control panel.

(4) Observe that indicator goes off and audible alarm is silenced.

(5) Repeat steps (1) through (4) for other alarms.

d. FACP Controlled Indicator Lamps.

(1) Depress REMOTE I/O INHIBIT on FACP.

(2) Observe that REMOTE I/O INHIBIT on system status panel goes on.

(3) Depress REMOTE I/O INHIBIT ON FACP.

(4) Observe that REMOTE I/O INHIBIT on system status panel goes off.

(5) Depress LINE LOAD on FACP.

(6) Observe that LINE LOAD SET on system status panel goes on.

(7) Depress LINE LOAD on FACP.

(8) Observe that LINE LOAD SET on FACP goes off.

5-65. Swapping Printer and Punch

Punch A20 contains a printing mechanism identical to Printer A21. Therefore, the punch may substitute as a printer in an emergency. While the units are swapped in this manner the capability to punch tapes locally is lost. The swap is performed by moving quick disconnect plugs from the normal to the cross-coupled connections as shown below. When using A20 as a printer, install a ribbon and paper and set the punch operate button to the off position.

a. Normal Connection.

Motor Control A14 W128P1 to Printer A21J1
Printer A21P1 to Motor Control A14J2
Printer A21P2 to Motor Control A14J3
Motor Control A15W127P1 to Punch A20J1
Punch A20P1 to Motor Control A15J2
Punch A20P1 to Motor Control A16J3

b. Cross Connection.

Motor Control A14 W128P1 to Punch A20J1
Punch A20P1 to Motor Control A14J2
Punch A20P2 to Motor Control A14J3

APPENDIX A
REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies and Equipment Used by the Army.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 5-4120-243-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Air Conditioner, Horizontal Compact: 18,000 BTU, 208V, 3 phase, 50/60 Hz (Trane Model MAC6H18-208-1201-02); (Harvey W. Hottel Model CH20-6-08); (American Air Filter Model CH618-2) (NSN 4120-00-411-3730); 208V, 3 phase, 400 Hz (Trane Model MAC4H18-208-1201-03); (Harvey W. Hottel Model CH20-4-08); (KECO Model F18H-4) (4120-00-411-3731); 230V, 1 phase, 50/60 Hz (Trane Model MAC 6H18-230-1201-01) and (KECO Model F18H) (4120-00-411-3729).
TM 5-4120-243-24P	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List for Air Conditioner, Horizontal Compact: 18,000 BTU (Trane Models) 208V, 3 phase, 50/60 Hz (Model MAC6H18-208-1201-02) (NSN 4120-00-411-3730); 208V, 3 phase, 400 Hz (Model MAC4H18-108-1201-03) (4120-00-411-3731); 208V, I phase, 50/60 Hz (Model MAC6H18-230-1201-01) (4120-00-411-3729); (Harvey W. Hottel Models), 208V, 3 phase, 50/60 Hz (Model CH20-6-08) (4120-00-411-3730); 208V, 3 phase, 400 Hz (Model CH20-4-08) phase, 50/60 Hz (4120-00-411-3730) and (KECO Model F18H-4) 208V, 3 phase, 400 Hz (4120-00-411-3731).
TM 11-2134	Manual Telephone Switchboard SB-86/P; Installation and Operation (NSN 5805-00-5032660).
TM 11-2139-10	Operator's Manual: Terminals, Telephone AN/TCC-7 and AN/TCC-50.
TM 11-2146	Central Office, Telephone, Manual, AN/TTC-7 (NSN 5805-00-395-9422) and AN/TTC7A (5805-00-820-9549): Telephone Central Office Group, Manual, AN/GTA-14(V) (5805-00-892-1081) and Telephone Circuit Trunk Relay TA-276A/TTC (5805-00-5033347).
TM 11-5410-213-14P	Operator's, Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance, Repair Parts and Special Tools) for Shelters, Electrical Equipment, S-280A/G (NSN 5410-00-999-6022) and S-280B/G (5410-00-117-2868).
TM 11-5805-201-12	Operator and Organizational Maintenance Manual: Telephone Set, TA-312/PT (NSN 5805-00-543-0012).
TM 11-5805-201-20P	Organizational Maintenance Repair Parts and Special Tools Lists for Telephone Set TA312/PT (NSN 5805-00-543-0012).
TM 11-5805-247-12	Organizational Maintenance Manual: Converter, Telegraph-Telephone Signal, TA-182/U.
TM 11-5805-247-20P	Organizational Maintenance Repair Parts and Special Tools Lists: Converter, Telegraph Telephone Signal, TA-182/U (FSN 5805-263-3326).·

TM 11-5805-262-12	Operator's and Organizational Maintenance Manual: Switchboards, Telephone, Manual, SB-22/PT (NSN 5805-00-257-3602) and SB-22A/PT (5805-00-715-6171) and Adapter, Tone Signalling, TA-977/PT (5805-01-040-9653).
TM 11-5805-356-12	Operator and Organizational Maintenance Manual (Including Repair Parts and Special Tools List): Terminal, Telegraph-Telephone AN/TCC-29 (NSN 5805-00-902-3087) (Including Terminal, Telegraph TH-22/TG (5805-00-907-8300) and Converter, Telegraph Telephone Signal CV-425/U (5805-00-985-9088).
FM 11-5805-367-12	Operator's and Organizational Maintenance Manual: Multiplexers, TD-202/U (NSN 5805-00-884-2176), TD-203/U (5805-00-884-2177), TD-204/U (5805-00-900-8200), TD352/U (5805-00-900-8199) and TD-353/U (5805-00-985-9153); Restorers, Pulse Form, TD-206/G (5805-00-868-8078) and TD-206B/G (5805-01-020-2251) and Converters, Telephone Signal, CV-1548/G (5805-00-069-8795) and CV-1548A/G (5805-00-069-8795).
TM 11-5805-384-12	Operator's and Organizational Maintenance Manual for Telephone Sets, TA-341/TT, TA-341A/TT (NSN 5805-00-910-8844) and TA-341B/TT (5805-01-039-3499).
TM 11-5805-386-12	Operator's and Organizational Maintenance Manual (Including Repair Parts and Special Tools Lists) for Converters, Telephone Signal CV-1919A/G (FSN 5805-229-5417).
TM 11-5805-471-12	Operator's and Organizational Maintenance Manual: Switchboards, Telephone, Cordless, Manual, SB-3082(V)1/GT (NSN 5805-00-235-5035) and SB-3082(V)2/GT (5805-00235-5034).
TM 11-5805-471-20P	Organizational Maintenance Repair Parts and Special Tools List for Switchboard, Telephone, Cordless, Manual, SB-3082(V)1/GT (NSN 5805-00-235-5035) and SB-3082(V)2/GT (5805-00-235-5034).
TM 11-5805-553-12	Operator's and Organizational Maintenance Manual (Including Repair Parts and Special Tools List): Converters, Telephone Signal CV-1918A(V)1/G (NSN 5805-00-504-9103), CV-1918A(V)2/G (5805-00-504-9107) and CV-1918A(V)3/G (5805-00-137-7674).
TM 11-5805-603-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual (Including Repair Parts and Special Tools List): Central Offices, Telephone, Manual, AN/TTC-35(V)l (NSN 5805-00-134-7092) and AN/TTC-35(V)2 (5805-00-134-7093).
TM 11-5820-401-12	Operator's and Organizational Maintenance Manual for Radio Sets, AN/VRC-12 (NSN 5820-00-223-7412), AN/VRC-43 (5820-00-223-7415), AN/VRC-44 (5820-00-223-7417), AN/VRC-45 (5820-00-223-7418), AN/VRC-46 (5820-00-223-7433), AN/VRC-47 (582000-223-7434), AN/VRC-48 (5820-00-223-7435), AN/VRC-49 (5820-00-223-7437), AN/VRC-54 (5820-00-223-7567); Mounting Kit, MT-1029/VRC (5820-00-893-1323) and MT-1898/VRC (5820-00-893-1324); Antenna Kit, AT-912/VRC (5820-00-897-6357); Control, Frequency Selector, C-2742/VRC (5820-00-892-3343) and Control, Radio Set C-2299/VRC (5820-00-892-3340).
TM 11-5830-221-12	Operator's and Organizational Maintenance Manual: Intercommunications Stations LS147A/FI, LS-147B/FI, LS-147C/FI, and LS-147D/FI (NSN 5830-00-752-5357).
TM 11-5830-221-24P	Organizational, Direct Support and General Support Maintenance Repair Parts and Special Tools Lists for Telecommunication Station LS-147C/FI (NSN 5830-00-752-5357).

TM 11-5935-205-14P	Operator, Organizational, Field, and Depot Maintenance Repair Parts and Special Tool Lists: Connectors, Receptacle, Electrical U-187/G. and U-187A/G (FSN 5935-682-0381).
TM 11-5935-212-13P	Organizational, DS, GS, and Depot Maintenance Repair Parts and Special Tool Lists: Connectors, Plug, Electrical U-185/G, U-185A/G, U-185B/G (NSN 5935-00-045-9830).
TM 11-6140-203-14-1	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Aircraft and Nonaircraft Nickel-Cadmium Batteries (General).
TM 11-6140-203-14-2	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Aircraft Nickel-Cadmium Batteries.
TM 11-6140-203-14-3	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Nonaircraft Nickel-Cadmium Batteries.
TM 11-6625-366-15	Operator's, Organizational, DS, GS and Depot Maintenance Manual: Multimeter TS352B/U (NSN 6625-00-553-0142).
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TO-311W4-4-117-11	Operator and Maintenance Instructions, Teletypewriter, Model 33 (ASR/KSR).
TO-31W4-4-117-19	Alignment and Adjustment Procedures, Teletypewriter/Model 33 (ASR/KSR).

APPENDIX B
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations for AN/TTC-38(V)1 and AN/TTC-38(V)2. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/ or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of' maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning -to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

B-3. Column Entries.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime" figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C-Operator/Crew
O-Organizational
F-Direct Support
H-General Support
D-Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tools set (not individual tools) and special tools, test, and support equipment required to perform the designate function.

f. Column 6, Remarks. Column 6 contains an alphabetic cods which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

B-4. Tool and Test Equipment Requirements (Sec III).

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5digit) in parentheses.

B-5. Remarks (Sec IV)

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

(Neat printed page is B-3.)

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
00	AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TTC-38(V)1	Inspect	0.5	0.5				1	
	AND AN/TTC-38(V)2	Test	0.5						A
		Service	0.3	1.0				1	
		Install		2.0					
		Overhaul					200.0		
01	OPERATOR POSITION, A1	Repair		0.2				1	B
0101	CIRCUIT CARD, OPERATOR POSITION, 4	Replace		0.1				1,8	
	(SMD774308) (1 each)	Repair					2.0	18	
		Test					2.0	11 thru 25	
0102	CIRCUIT CARD, OPERATOR POSITION, 1 LOGIC	Replace		0.1				18	
	(SMD743177) (1 each)	Repair					2.0	18	
		Test					2.0	11 thru 25	
0103.	CIRCUIT CARD, OPERATOR POSITION, 2 LOGIC	Replace		0.1	1,8				
	(SMD743178) (1 each)	Repair					2.0	18	
		Test					2.0	11 thru 25	
0104	CIRCUIT CARD, OPERATOR POSITION, 3 LOGIC	Replace		0.1	1,8				
	(SMD743179) (1 each)	Repair					2.0	18	
		Test					2.0	11 thru 25	
02	OPERATOR CONSOLE, REMOTE, A2	Repair		0.2				1	B
0201	HEADSET-MICROPHONE H-325/TTC	Replace		0.1					
0202	CIRCUIT CARD, OPERATOR POSITION, 4								
	(SAME AS GROUP 0101) (1 each)								
0203	CIRCUIT CARD, OPERATOR POSITION, 1 LOGIC								
	(SAME AS GROUP 0102) (1 each)								
0204	CIRCUIT CARD, OPERATOR POSITION, 2 LOGIC								
	(SAME AS GROUP 0103) (1 each)								
0205	CIRCUIT CARD, OPERATOR POSITION, 3 LOGIC								
	(SAME AS GROUP 0104) (1 each)								
03	INTERCOMMUNUCATION STATION LS-147C/F1 (A3)	Install		0.1					
	(SEE TM 11-5830-221-12)								
04	MAINTENANCE CONTROL PANEL (A4)	Repair			1.0			18	
05	MAINTENANCE CONTROL PANEL (A5)								
	(SAME AS GROUP 04)								
06	SYSTEM STATUS PANEL (A6)	Repair			1.0			18	
07	FUNCTIONAL ASSIGNMENT CONTROL PANEL (FACP) (A7)								
0701	LOGIC FRAME, FACP (A7A1)	Repair			3.0			9,15,18, 30,37,38 39,40	
070101	NEST AI (A7AIA1)								
07010101	CIRCUIT CARD, 6, 4 INP and 2, 3 INP GATES	Replace		0.2	1,8				
	(SMC742239) (5 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
07010102	CIRCUIT CARD, BUS DRIVER NO. 10	Replace		0.2	1,8				
	(SMC742231) (5 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
07010103	CIRCUIT CARD, 1, 38 BIT TERMINATING	Replace		0.2	1,8				
	(SMC742228) (2 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
07010104	CIRCUIT CARD, 12, 2 INP GATES, INVT (SMC712258) (9 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010105	CIRCUIT CARD, 4, 8 INPUT GATES (SMC742241) (3 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010106	CIRCUIT CARD, INTERFACE INVERTER (SMC742244) (4 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010107	CIRCUIT CARD, 4 INP NAND INVERTER (SMC742242) (2 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010108	CIRCUIT CARD, 24 BIT LATCH RGTR (SMC742255) (2 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010109	CIRCUIT CARD, SINGLE RT GATE ROTR (SMC742246) (4 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010110	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SMC742240) (4 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010111	CIRCUIT CARD, PANEL BUS DRIVER (SMC742250) (2 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14. thru 29	
070102	NEST A2 (A7A1A2)								
07010201	CIRCUIT CARD, 6, 3 INP AND 1, 2 INP GATES (SMC742581) (9 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010202	CIRCUIT CARD, 6, 4 BIT FLIP-FLOP (SMC742805) (7 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010203	CIRCUIT CARD, 6. 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (3 each)								
07010204	CIRCUIT CARD, BUS DRIVER NO. 10 (SAME AS GROUP 07010102) (1 each)								
07010205	CIRCUIT CARD, LINE DRIVER (SMC742245) (3 each)	Replace	0.2					1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010206	CIRCUIT CARD, 1, 38 BIT TERMINATING (SAME AS GROUP 07010103) (1 each)								
07010207	CIRCUIT CARD, 4 INP NAND INVERTER (SAME AS GROUP 07010107) (4 each)								
07010208	CIRCUIT CARD, SINGLE, RT GATE RGTR (SAME AS GROUP 07010109) (2 each)								
07010209	CIRCUIT CARD, 4, 8 INPUT GATES (SAME AS GROUP 07010105) (1 each)								
07010210	CIRCUIT CARD, 12, 2 INPUT GATES :INVT (SAME AS GROUP 07010104) (3 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
07010211	CIRCUIT CARD, 2, 3 BIT DECODER (SMC742229) (2 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
07010212	CIRCUIT CARD, INTERFACE INVERTER (SAME AS GROUP 07010106) (2 each)								
07010213	CIRCUIT CARD, 12.5 MHZ CLOCK NO. 10 (SMC742236) (1 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					2.0	14 thru 29	
07010214	CIRCUIT CARD, 2 HZ OSCILLATOR (SMC743379). (1 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
0702	CONTROL PANEL (A7A2)								
070201	CIRCUIT CARD DISPLAY MDL, TYPE 1 (SMD744189j (1 each)	Replace			0.5			8,18	
		Repair					1.0	14 thru 29	
		Test					1.0	14 thru 29	
070202	CIRCUIT CARD, DISPLAY MDL, TYPE 2 (SMD744190) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
070203	CIRCUIT CARD, DISPLAY MDL, TYPE 3 (SMD744191) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
070204	CIRCUIT CARD, DISPLAY MDL, TYPE 4 (SMD744192) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
070205	CIRCUIT CARD, DISPLAY MDL, TYPE 5 (SMD744193) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
070206	CIRCUIT CARD, DISPLAY MDL, TYPE 6 (SMD744194) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
070207	CIRCUIT CARD, DISPLAY MDL, TYPE 7 (SMD744195) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
070208	CIRCUIT CARD, DISPLAY MDL, TYPE 8 (SMD744196) (1 each)	Replace			0.5			8,18	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
08	CENTRAL PROCESSOR, LEFT (A8)	Repair				3.0		5,9,15, 18,30,37 thru 40	
0801	NEST A1 (ASA1)								
080101	CIRCUIT CARD, 1, 24 BIT PARITY NTWK (SMC742527) (2 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
080102	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (3 each)								
080103	CIRCUIT CD, INTERFACE INVERTER (SAME AS GROUP 07010106) (7 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
080104	CIRCUIT CARD DECODER DRIVER	Replace		0.2				1,8	
	(SMC742247) (3 each)	Repair					1.0	18	
		Test					1.0	1, thru 29	
080105	CIRCUIT CARD, 12, 2 INP GATES, INVT								
	(SAME AS GROUP 07010104) (1 each)								
080106	CIRCUIT CARD, INVERTER, NO. 10	Replace		0.2				1,8	
	(SMC742243) (3 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080107	CIRCUIT CARD 4 QUAD GATED INTFC	Replace		0.2				1,8	
	(SMC7428005 (2 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080108	CIRCUIT CARD, BUS DRIVER	Replace		0.2				1,8	
	(SMC742257) (2 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080109	CIRCUIT CARD, 4 BIT LATCH RGTR	Replace		0.2				1,8	
	(SMC742714) (2 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080110	CIRCUIT CARD, BUS DRIVER, NO. 10								
	(SAME AS GROUP 07010102) (5 each)								
080111	CIRCUIT CARD, 1, 32 BIT TERMINATING	Replace		0.2				1,8	
	(SMC742277) (1 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080112	CIRCUIT CARD, 4 INP NAND INVERTER								
	(SAME AS GROUP 07010107) (6 each)								
080113	CIRCUIT CARD, COMMON SET, RESET	Replace		0.2				1,8	
	(SMC742235) (4 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080114	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES								
	(SAME AS GROUP 07010101) (5 each)								
080115	CIRCUIT CARD, PANEL BUS DRIVER								
	(SAME AS GROUP 07010111) (2 each)								
080116	CIRCUIT CARD, 2, 3 BIT DECODER								
	(SAME AS GROUP 07010211) (1 each)								
080117	CIRCUIT CARD, 4, 8 INPUT GATES								
	(SAME AS GROUP 07010105) (1 each)								
080118	CIRCUIT CARD, FOUR ONE SHOT, NO. 10	Replace		0.2				1,8	
	(SMC742237) (1 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
0802	NEST A2 (A8A2)								
080201	CIRCUIT CARD, 12, 2 INP GATES, INVT								
	(SAME AS GROUP 07010104) (5 each)								
080202	CIRCUIT CARD, DECODER DRIVER								
	(SAME AS GROUP 080104) (13 each)								
080203	CIRCUIT CARD, INTERFACE INVERTER								
	(SAME AS GROUP 07010106) (4 each)								
080204	CIRCUIT CARD, INVERTER, NO. 10								
	(SAME AS GROUP 080106) (2 each)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
080205	CIRCUIT CARD, BUS DRIVER, NO.10 (SAME AS GROUP 07010102) (4 each)								
080206	CIRCUIT CARD, COMMON SET RESET (SAME AS GROUP 080113) (1 each)								
080207	CIRCUIT CARD, 1, 32 BIT TERMINATING (SMCT428ol) (2 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	1 thru 29	
080208	CIRCUIT CARD, 2, 4 BIT LATCH ROTR (SAME AS GROUP 07010108) (3 each)								
080209	CIRCUIT CARD, SINGLE RT GATE ROTR (SAME AS GROUP 07010109) (1 each)								
080210	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (9 each)								
080211	CIRCUIT CARD, 4, 8 INPUT GATES (SAME AS GROUP 07010105) (3 each)								
080212	CIRCUIT CARD, BUS DRIVER (SAME AS GROUP 080108) (1 each)								
080213	CIRCUIT CARD, LINE DRIVER (SAME AS OROUI 07010205) (1 each)								
080214	CIRCUIT CARD, 4 INPUT NAND INVERTER (SAME AS GROUP 07010107) (1 each)								
080215	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (1 each)								
080216	CIRCUIT CARD, FOUR ONE SHOT, NO. 11 (SMC742327) (1 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
0803	NEST A3 (A8A3)								
080301	CIRCUIT CARD, DUAL RANK REGISTER (SMC742232) (4 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
080302	CIRCUIT CARD, BUS DRIVER (SAME AS GROUP 080108) (4 each)								
080303	CIRCUIT CARD, ANTICIPATED CRY CH (SMCT42233) (2 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
080304	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (1 each)								
080305	CIRCUIT CARD, LINE DRIVER (SAME AS GROUP 07010205) (2 each)								
080306	CIRCUIT CARD, INVERTER NO. 10 (SAME AS GROUP 080106) (7 each)								
080307	CIRCUIT CARD, 1, 32 BIT TERMINATING (SAME AS GROUP 080111) (2 each)								
080308	CIRCUIT CARD, COMMON SET RESET (SAME AS GROUP 080113) (3 each)								
080309	CIRCUIT CARD, BUS DRIVER NO. 10 (SAME AS GROUP 07010102) (7 each)								
080310	CIRCUIT CARD, SINGLE RT GATE RGTR (SAME AS GROUP 07010109) (3 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category C	O	F	H	D	(5) Tools and Equipment	(6) Remarks
080311	CIRCUIT CARD, INTERFACE INVERTER (SAME AS GROUP 0701010106) (5 each)								
080312	CIRCUIT CARD, 1, 32 BIT TERMINATING (SMC742256) (1 each)	Replace Repair Test		0.2			 1.0 1.0	1,8 18 14 thru 29	
080313	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (6 each)								
080314	CIRCUIT CARD, 4 INP NAND INVERTER (SAME AS GROUP 07010107) (3 each)								
080315	CIRCUIT CARD, 1, 24 BIT PARITY NTWK (SAME AS GROUP 080101) (1 each)								
0804	NEST A4 (A8A4)								
080401	CIRCUIT CARD, DUAL RANK RESISTER (SAME AS GROUP 080301) (7 each)								
080402	CIRCUIT CARD, BUS DRIVER (SAME AS GROUP 080108) (4 each)								
080403	CIRCUIT CARD, ANTICIPATED CRY CH (SAME AS GROUP 080303) (2 each)								
080404	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (3 each)								
080405	CIRCUIT CARD, INTERFACE INVERTER (SAME AS GROUP 07010106) (5 each)								
080406	CIRCUIT CARD, INVERTER, NO. 10 (SAME AS GROUP 080106) (3 each)								
080407	CIRCUIT CARD, BUS DRIVER, NO. 10 (SAME AS GROUP 07010102) (4 each)								
080408	CIRCUIT CARD, 1, 38 BIT TERMINATING (SAME AS GROUP 07010103) (1 each)								
080409	CIRCUIT CARD, 2, 3 BIT DECODER (SAME AS GROUP 07010211) (2 each)								
080410	CIRCUIT CARD, 4, 8 INPUT GATES (SAME AS GROUP 07010105) (2 each)								
080411	CIRCUIT CARD, COMMON SET RESET (SAME AS GROUP 080113) (5 each)								
080412	CIRCUIT CARD, 4 INP NARD INVERTER (SAME AS GROUP 07010107) (7 each)								
080413	CIRCUIT CARD, LINE DRIVER (SAME AS GROUP 07010205) (1 each)								
080414	CIRCUIT CARD, 12.5 MHZ CLOCK, NO. 10 (SAME AS GROUP 07010213) (1 each)								
080415	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (2 each)								
080416	CIRCUIT CARD, SINGLE RT GATE RGTR (SAME AS GROUP 07010109) (4 each)								
0805	NEST A5 (A8A5)								
080501	CIRCUIT CARD, DUAL RANK REGISTER (SAME AS GROUP 080301) (6 each)								
080502	CIRCUIT CARD, BUS DRIVER (SAME AS GROUP 080108) (4 each)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
080503	CIRCUIT CARD, ANTICIPATED CRY CH (SAME AS GROUP 080303) (3 each)								
080504	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (4 each)								
080505	CIRCUIT CARD, INVERTER, NO. 10 (SAME AS GROUP 080106) (5 each)								
080506	CIRCUIT CARD, 12, 2 INP GATES, INVT (SAME AS GROUP 07010104) (2 each)								
080507	CIRCUIT CARD, INTERFACE INVERTER (SAME AS GROUP 07010106) (3 each)								
080508	CIRCUIT CARD, BUS DRIVER, NO. 10 (SAME AS GROUP 07010102) (7 each)								
080509	CIRCUIT CARD, 1, 38 BIT TERMINATING (SAME AS GROUP 07010103) (2 each)								
080510	CIRCUIT CARD, LINE DRIVER (SAME AS GROUP 07010205) (2 each)								
080511	CIRCUIT CARD, 4, 8 INPUT GATES (SAME AS GROUP 07010105) (1 each)								
080512	CIRCUIT CARD, 4 INP NAND INVERTER (SAME AS GROUP 07010107) (7 each)								
080513	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (1 each)								
080514	CIRCUIT CARD, COMMON SET RESET (SAME AS GROUP 080113) (1 each)								
080515	CIRCUIT CARD, 2, 4 BIT SYN COUNTERS (SMC742252) (1 each)	Replace		0.2				1,8	
		Repair					1.0	18	
		Test					1.0	14 thru 29	
080516	CIRCUIT CARD, SINGLE RT GATE RGTR (SAME AS GROUP 07010109) (1 each)								
080517	CIRCUIT CARD, 2, 3 BIT DECODER (SAME AS GROUP 07010211) (1 each)								
0806	NEST A6 (A8A6)								
080601	CIRCUIT CARD, DUAL RANK REGISTER (SAME AS GROUP 080301) (7 each)								
080602	CIRCUIT CARD, BUS DRIVER (SAME AS GROUP 080108) (6 each)								
080603	CIRCUIT CARD, ANTICIPATED CRY CH (SAME AS GROUP 080303) (3 each)								
080604	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (1 each)								
080605	CIRCUIT CARD, INTERFACE INVERTER (SAME AS GROUP 07010106) (5 each)								
080606	CIRCUIT CARD, INVERTER, NO. 10 (SAME AS GROUP 080106) (4 each)								
080607	CIRCUIT CARD, BUS DRIVER, NO. 10 (SAME AS GROUP 07010102) (4 each)								
080608	CIRCUIT CARD, 2, 3 BIT DECODER (SAME AS GROUP 07010211) (1 each)								
080609	CIRCUIT CARD, 4 INP NAND INVERTER (SAME AS GROUP 07010107) (6 each)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
080610	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (3 each)								
080611	CIRCUIT CARD, 12, 2 DIP GATES, INNT (SAME AS GROUP 07010104) (6 each)								
080612	CIRCUIT CARD, LINE DRIVER (SAME AS GROUP 07010205) (1 each)								
080613	CIRCUIT CARD, 2, 4 BIT SYN COUNTERS (SAME AS GROUP 080515) (1 each)								
080614	CIRCUIT CARD, 1, 32 BIT TERMINATING (SAME AS GROUP 080111) (1 each)								
0807	NEST A7 (A8A7)								
080701	CIRCUIT CARD, 4 INP NAND INVERTER (SAME AS GROUP 07010107) (9 each)								
080702	CIRCUIT CARD, COMMON SET, RESET (SAME AS GROUP 080113) (4 each)								
080703	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (9 each)								
080704	CIRCUIT CARD, BUS DRIVER NO. 10 (SAME AS GROUP 07010102) (6 each)								
080705	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (1 each)								
080706	CIRCUIT CARD, INVERTER, NO. 10 (SAME AS GROUP 080106) (8 each)								
080707	CIRCUIT CARD, 1, 32 BIT TERMINATING (SAME AS GROUP 080111) (1 each)								
080708	CIRCUIT CARD, DUAL RANK REGISTER (SAME AS GROUP 080301) (1 each)								
080709	CIRCUIT CARD, ANTICIPATED CRY CH (SAME AS GROUP 080303) (1 each)								
080710	CIRCUIT CARD, 2, 4 BIT SYN COUNTERS (SAME AS GROUP 080515) (1 each)								
080711	CIRCUIT CARD, 12, 2 INP GATES, INPUT (SAME AS GROUP 07010104) (4 each)								
080712	CIRCUIT CARD, LINE DRIVER (SAME AS GROUP 07010205) (1 each)								
0808	NEST A8 (A8A8)								
080801	CIRCUIT CARD, INVERTER, NO. 10 (SAME AS GROUP 080106) (4 each)								
080802	CIRCUIT CARD, BUS DRIVER, NO. 10 (SAME AS GROUP 07010102) (4 each)								
080803	CIRCUIT CARD, 4 INP NAND INVERTER (SAME AS GROUP 07010107) (16 each)								
080804	CIRCUIT CARD, 6, DUAL 2 INP OR GATES (SAME AS GROUP 07010110) (1 each)								
080805	CIRCUIT CARD, 4, 8 INPUT GATES (SAME AS GROUP 07010105) (1 each)								
080806	CIRCUIT CARD, COMMON SET RESET (SAME AS GROUP 080113) (4 each)								
080807	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES (SAME AS GROUP 07010101) (2 each)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1)	(2)	(3)	(4) Maintenance Category					(5)	(6)
Group Number	Component/ Assembly	Maint Function	C	O	F	H	D	Tools and Equipment	Remarks
080808	CIRCUIT CARD REALTIME CLK-PWR CD	Replace	0.2					1,8	
	(SMC742778) (1 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080809	CIRCUIT CARD FOUR ONE SHOT, NO. 17	Replace	0.2					1,8	
	(SMC742778) (1 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
080810	CIRCUIT CARD, 2, 3 BIT DECODER (SAME AS GROUP 07010211) (1 each)								
080809	CIRCUIT CARD, INTERFACE INVERTER (SAME AS GROUP 07010106) (2 each)								
09	CENTRAL PROCESSOR, RIGHT (A9)	Repair				3.0		5,9,15, 18, 30,37 38 ,39,40	
0901	NEST A1 (A9A1) (SAME AS GROUP 0801)								
0902	NEST A2 (A9A2) (SAME AS GROUP 0802)								
0903	JOIST A3 (A9A3) (SAME AS GROUP 0803)								
0904	NEST A4 (A9A4) (SAME AS GROUP 0804)								
0905	NEST A5 (A9A5) (SAME AS GROUP 0805)								
0906	NEST A6 (A9A6) (SAME AS GROUP 0806)								
0907	NEST A7 (A9A7) (SAME AS GROUP 0807)								
0908	NEST A8 (A9A8) (SAME AS GROUP 0808)								
10	CORE MEMORY UNIT, LEFT (A10)	Repair				1.0		18	
1001	CIRCUIT CARD DATA LOOP ZIP	Replace		0.2				1	
	(SMD745067) (3 each)	Repair							C
1002	CIRCUIT CARD, DATA LOOP PRIME	Replace		0.2				1	
	(SMD745058) (1 each)	Repair							C
1003	CIRCUIT CARD, TWG CONT AND LOGIC	Replace		0.2				1	
	(SMD745052) (1 each)	Repair							C
11	CORE MEMORY UNIT, RI GH T (All) (SAME AS GROUP 10)								
12	PAPER TAPE READER (A12)	Replace		0.3	1				
		Repair				2.0		18	
		Adjust				2.0		2,14,15, 18, 26, 30	
		Test				2.0		2, 5, 8, 30	
1201	CIRCUIT CARD, ERROR DET AND NOT	Replace				0.3		18	
	(1 each)	Repair					2.0	18	
		Test					2.0	15,18,20, 28	
1202	CIRCUIT CARD, INPUT LOGIC	Replace				0.3		1	
	(1 each)	Repair					2.0	18	
		Test					2.0	15,16,19, 20,23,28	

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category C	O	F	H	D	(5) Tools and Equipment	(6) Remarks
1203	CIRCUIT CARD, MOTOR DRIVER	Replace				0.3		18	
	(1 each)	Repair					2.0	18	
		Test					1.0	15,23,28	
1204	CIRCUIT CARD, PHOTO AMPLIFIER	Replace				0.3		18	
	(1 each)	Repair					2.0	18	
		Test					1.0	10,15,20, 21	
1205	CIRCUIT CARD, SERVO AMPL	Replace				0.3		18	
	(1 each)	Repair					2.0	18	
		Test					2.0	15,19,20, 21,29	
13	MODEM, TELEPHONE (A13)	Adjust			1.0			11	
1301	CONVERTER, TELEPHONE SIGNAL	Replace		0.2			1		
		Repair						C	
1302	KEYER (2 each)	Replace		0.2			1		
		Repair						C	
1303	POWER SUPPLY	Replace		0.2			1		
		Repair						C	
14	MOTOR CONTROLLER (A14)	Replace		0.3			1		
		Repair			1.0			14,18	
15	MOTOR CONTROLLER (A15) (SAME AS GROUP 14)								
16	LOGIC FRAME, SYNCHRONIZER (A16)	Repair			3.0			9,15,18, 30,37 thru 40	
1601	NEST Al (A16A1)								
160101	CIRCUIT CARD MOS-1	Replace		0.2				1,8	
	(SMD742893) (9 each)	Repair					2.0	18	
		Test					2.0	14 thru 29	
160102	CIRCUIT CARD, MOS-2	Replace		0.2				1,8	
	(SMD742894) (9 each)	Repair					2.0	18	
		Test					2.0	14 thru 29	
160103	CIRCUIT CARD, MOS-3	Replace		0.2				1,8	
	(SMD743126) (9 each)	Repair					2.0	18	
		Test					2.0	14 thru 29	
160104	CIRCUIT CARD, 188C 1/0 AMPLIFIER	Replace		0.2				1,8	
	(SMC743145) (2 each)	Repair					2.0	18	
		Test					1.0	14 thru 29	
160105	CIRCUIT CARD, BUS DRIVER NO. 10 SAME AS GROUP 07010102) (2 each)								
160106	CIRCUIT CARD, 1, 38 BIT TERMINATING (SAME AS GROUP 07010103) (2 each)								
160107	CIRCUIT CARD TELETYPE INTERFACE	Replace		0.2				1,8	
	(SMC742512) (2 each)	Repair					1.0	18	
		Test					1.0	14 thru 29	
160108	CIRCUIT CARD, PANEL BUS DRIVER (SAME AS GROUP 07010111) (1 each)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
1602	NEST A2 (A16A2)								
160201	CIRCUIT CARD, 500 KHZ CLOCK	Replace		0.2				1,8	
	(SMC743384) (1 each)	Repair					2.0	18	
		Test					2.0	14 thru 29	
160202	CIRCUIT CARD, 12, 2 INP GATES, INVT								
	(SAME AS GROUP 07010104) (1.2 each)								
160203	CIRCUIT CARD, FOUR ONE SHOT, NO. 12	Replace		0.2				18	
	(SMC742585) (1 each)	Repair					1.0	1,8	
		Test					1.0	14 thru 29	
160204	CIRCUIT CARD, 6, 3 INP AND 1, 2 INP GATES								
	(SAME AS GROUP 07010201) (2 each)								
160205	CIRCUIT CARD, LINE DRIVER								
	(SAME AS GROUP 07010205) (1 each)								
160206	CIRCUIT CARD, INTERFACE INVERTER								
	(SAME AS GROUP 07010106) (2 each)								
160207	CIRCUIT CARD, 6, 4 INP AND 2, 3 INP GATES								
	(SAME AS GROUP 07010101) (4 each)								
160208	CIRCUIT CARD, BUS DRIVER, NO. 10								
	(SAME AS GROUP 07010102) (2 each)								
160209	CIRCUIT CARD, 4 INP NAND INVERTER								
	(SAME AS GROUP 07010107) (1 each)								
17	BATTERY EXHAUST (A17)	Repair			1.0			18	
18	BLOWER ASSEMBLY, BATTERY CHARGER (A18)	Repair			1.0			18	
19	CONTROL TRANSFER ASSEMBLY (A19)	Repair			2.0			14,18	
1901	COMPONENT BOARD ASSEMBLY	Replace			0.5			18	
	(SMC743140) (1 each)	Repair				1.0		18	
		Test				1.0		14	
20	PAPER TAPE PUNCH (A20)	Replace		0.3				1	D
		Adjust			1.0			18,31,32	
		Service			1.0			18,31,32	
		Repair				3.0		18,31,32	
21	PAGE PRINTER (A21)	Replace		0.3				1	D
		Adjust			1.0			18,31,32	
		Service			1.0			18,31,32	
		Repair				3.0		18,31,32	
22	PATCH PLUG/CABLE TESTER (A22)	Repair			1.0			14,18	
23	NTS POWER CONTROL PANEL (A23)	Repair			1.0			14,18	
24	BATTERY CHARGER (A24)	Replace			1.0			18	
		Repair			1.0			14,18,30	
		Adjust	1.0					1,30	
2401	CAPACITOR ASSEMBLY	Repair			1.0			18	
	(SMD743263)								
2402	CONTROL ASSEMBLY								
	(SMD743245)								
240201	ELECTRONICS COMPONENTS ASSY-1	Replace			1.0			18	
	(SMC743253)	Repair					2.0	14,18	
240202	ELECTRONICS COMPONENTS ASSY-2	Replace			1.0				
		Repair					2.0	14,18	
240203	ELECTRONICS COMPONENTS ASSY-3	Replace			1.0				
	(SMC743255)	Repair					2.0	14,18	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
2403	OUTPUT ASSEMBLY	Replace			1.0				
	(SMD743266)	Repair					2.0	14,18	
2404	RECTIFIER, ASSEMBLY, METALLIC	Replace			1.0				
	(SMD743248)	Repair					2.0	14,18	
2405	RECTIFIER, ASSEMBLY METALLIC	Replace			1.0				
	(SMD743249)	Repair					2.0	14,18	
25	ADAPTER TERMINAL (A25)	Repair			3.0			15,18, 30,36 thru 40	
2501	NEST A1								
250101	CIRCUIT CARD COM BTRY LINE ADPTR	Replace		0.2				1,8	
	(SMD742627) (2 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250102	CIRCUIT CARD 20 HZ RINGDOWN	Replace		0.2				1,8	
	(SMD742629) (2 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250103	CIRCUIT CARD 1600 HZ RINGDOWN	Replace		0.2				1,8	
	(SMD742630) (2 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250104	CIRCUIT CARD AUTOVON/SF ADPTR A	Replace		0.2				1,8	
	(SMD742635) (1 each)	Adjust			0.5			18,34	
		Repair					4.0	18	
		Test					3.0	10 thru 25	
250105	CIRCUIT CARD, AUTOVON/SF ADPTR B	Replace		0.2				1,8	
	(SMD742636) (1 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250106	CIRCUIT CARD, AUTOVON/SF ADPTR C	Replace		0.2				1,18	
	(SMD742637) (1 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250107	CIRCUIT CARD, DC CLOS LINE ADPTR A	Replace		0.2				1,18	
	(SMD742628) (1 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250108	CIRCUIT CARD, DC CLOSURE LINE ADAPTER								J
2502	NEST A2								
250201	CIRCUIT CARD, COM BTRY LINE ADPTR (SAME AS GROUP 250101) (2 each)								
250202	CIRCUIT CARD, 20 HZ RINGDOWN (SAME AS GROUP 250102) (2 each)								
250203	CIRCUIT CARD, 1600 HZ RINGDOWN (SAME AS GROUP 250103) (2 each)								
250204	CIRCUIT CARD, AUTOVON/SF ADPTR A (SAME AS GROUP 250104) (1 each)								
250205	CIRCUIT CARD, AUTOVON/SF ADPTR B (SAME AS GROUP 250105) (1 each)								
250206	CIRCUIT CARD, AUTOVON/SF ADPTR C (SAME AS GROUP 250106) (1 each)								
2503	NEST A3								
250301	CIRCUIT CARD, DC CLOS LINE ADPTR (SAME AS GROUP 250107) (1 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1)	(2)	(3)	(4) Maintenance Category					(5)	(6)
Group Number	Component/ Assembly	Maint Function	C	O	F	H	D	Tools and Equipment	Remarks
250302	CIRCUIT CARD, COM BTRY LINE ADPTR (SAME AS GROUP 250101) (2 each)								
250303	CIRCUIT CARD, 20 HZ RINGDOWN (SAME AS GROUP 205102) (2 each)								
250304	CIRCUIT CARD, 1600 HZ RINGDOWN (SAME AS GROUP 250103) (2 each)								
250305	CIRCUIT CARD, COM EQPT/ADPTR INTR	Replace		0.2				1,8	
	(SMD742609) (1 each)	Repair					4.0	18	
		Test					3.0	10 thru 25	
250306	CIRCUIT CARD, DC CLOSURE LINE ADAPTER								J
2504	NEST A4								
250401	CIRCUIT CARD, COM BTRY LINE ADPTR (SAME AS GROUP 250101) (2 each)								
250402	CIRCUIT CARD, 20 HZ RINGDOWN (SAME AS GROUP 250102) (2 each)								
250403	CIRCUIT CARD, 1600 HZ RINGDOWN (SAME AS GROUP 250103) (2 each)								
250404	CIRCUIT CARD, AUTOVON/SF ADPTR A (SAME AS GROUP 250104) (1 each)								
250405	CIRCUIT CARD, AUTOVON/SF ADPTR B (SAME AS GROUP 250105) (1 each)								
250406	CIRCUIT CARD, AUTOVON/SF ADPTR C (SAME AS GROUP 250106) (1 each)								
250407	CIRCUIT CARD, DC CLOS LINE ADPTR (SAME AS GROUP 250107) (1 each)								
250408	CIRCUIT CARD, COM EQPT/ADPTR INTR (SAME AS GROUP 250305) (1, each)								
250409	CIRCUIT CARD, DC CLOSURE LINE ADAPTER								J
2505	NEST AS (SAME AS GROUP 2502)								
2506	NEST A6								
250601	CIRCUIT CARD, DC CLOS LINE ADPTR (SAME AS GROUP 250107) (1 each)								
250602	CIRCUIT CARD, COM BTRY LINE ADPTR (SAME AS GROUP 250101) (2 each)								
250603	CIRCUIT CARD, 20 HZ RINGDOWN (SAME AS GROUP 250102) (2 each)								
250604	CIRCUIT CARD, 1600 HZ RINGDOWN (SAME AS GROUP 250103) (2 each)								
250605	CIRCUIT CARD,' DC CLOSURE ADAPTER								
26	PATCH PANEL ASSEMBLY (A26)	Repair			1.0			14,18	
27	COMMON TERMINAL EQUIPMENT (A27)	Repair			3.0			15,18, 30,36 thru 40	
2701	NEST A1 (A27A1) (AN/TTC-38(V)l ONLY)								
270101	CIRCUIT CARD, SEND/RECEIVER (S)	Replace		0.2				1,8	
	(SMD742648) (4 each)	Repair					3.0	18	
		Test					2.0	10 thru 25	
270102	CIRCUIT CARD, SEND/RECEIVER (DH)	Replace		0.2				1,18	
	(SMD742647) (5 each)	Repair					3.0	18	
		Test					3.0	10 thru 25	

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category C	O	F	H	D	(5) Tools and Equipment	(6) Remarks
270103	CIRCUIT CARD SEND/RECEIVER (DL)	Replace		0.2			1,8		
	(SMD742646) (5 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270104	CIRCUIT CARD, SEND/RECEIVER (R)	Replace		0.2				1,8	
	(SMD742645) (5 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270105	CIRCUIT CARD, TONE SOURCE (A)	Replace		0.2				1,8	
	(SMD742602) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270106	CIRCUIT CARD, TONE SOURCE (B)	Replace		0.2				1,8	
	(SMD742603) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270107	CIRCUIT CARD, COM EQPT/ADPTR INTR								
	(SAME AS GROUP 250305) (1 each)								
270108	CIRCUIT CARD, CONFERENCE BRIDGE	Replace		0.2				1,8	
	(SMD742606) (4 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
2702	NEST A2 (A27A2)								
	(AN/TTC-38(V)1 ONLY)								
270201	CIRCUIT CARD, SEND/RECEIVER (S)								
	(SAME AS GROUP 270101) (1 each)								
270202	CIRCUIT CARD, SEND/RECEIVER (DH)								
	(SAME AS GROUP 270102) (1 each)								
270203	CIRCUIT CARD, SEND/RECEIVER (DL)								
	(SAME AS GROUP 270103) (1 each)								
270204	CIRCUIT CARD, SEND/RECEIVER (R)								
	(SAME AS GROUP 270104) (1 each)								
270205	CIRCUIT CARD, TONE SOURCE (C)	Replace		0.2				1,8	
	(SM0742604) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270206	CIRCUIT CARD, TONE SOURCE (D)	Replace		0.2				1,8	
	(SMD742605) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270207	CIRCUIT CARD, COMMON EQPT.INTFC	Replace		0.2				1,8	
	(SMD742610) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
270208	CIRCUIT CARD, AUX SEND/RECEIVER (S)	Replace		0.2				1,8	
	(SMD742618) (1 each)	Repair					3.0	18	
		Test					3.0	10 thru 25	
270209	CIRCUIT CARD, AUX SEND/RECEIVER (DM)	Replace		0.2				1,8	
	(SMD742617) (1 each)	Repair					3.0	18	
		Test					3.0	10 thru 25	
270210	CIRCUIT CARD, AUX SEND/RECEIVER (AMPL)	Replace		0.2				1,8	
	(SMD742620) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
270211	CIRCUIT CARD, BUS RINGER TIMING (SMD742611) (1 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					2.0	10 thru 25	
270212	CIRCUIT CARD, BUS RINGER AMPL (SMD742612) (2 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					2.0	10 thru 25	
270213	CIRCUIT CARD, CONFERENCE BRIDGE (SAME AS GROUP 270108) (1 each)								
2703	NEST A3 (AN/TTC-38(V)1 ONLY) (A27A3)								
270301	CIRCUIT CARD, SEND/RECEIVER (S) (SAME AS GROUP 270101) (2 each)								
270302	CIRCUIT CARD, SEND/RECEIVER (DR) (SAME AS GROUP 270102) (3 each)								
270303	CIRCUIT CARD, SEND/RECEIVER (DL) (SAME AS GROUP 270103) (3 each)								
270304	CIRCUIT CARD, SEND/RECEIVER (R) (SAME AS GROUP 270104) (3 each)								
270305	CIRCUIT CARD, TONE SOURCE (A) (SAME AS GROUP 270105) (1 each)								
270306	CIRCUIT CARD, TONE SOURCE (B) (SAME AS GROUP 270106) (1 each)								
270307	CIRCUIT CARD, COM EQPT/ADPTR INTR (SAME AS GROUP 250305) (1 each)								
270308	CIRCUIT CARD, BUS CROSSOVER (A) (SMD742622) (1 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					3.0	10 thru 25	
270309	CIRCUIT CARD, BUS CROSSOVER (B) (SMD742623) (1 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					2.0	10 thru 25	
270310	CIRCUIT CARD, CONFERENCE BRIDGE (SAME AS GROUP 270108) (1 each)								
2704	NEST A4 (A27A4) (AN/TTC-38(V)I ONLY)								
270401	CIRCUIT CARD, SEND/RECEIVER (S) (SAME AS GROUP 270101) (4 each)								
270402	CIRCUIT CARD, SEND/RECEIVER (DH) (SAME AS GROUP 270102) (4 each)								
270403	CIRCUIT CARD, SEND/RECEIVER (DL) (SAME AS GROUP 270103) (4 each)								
270404	CIRCUIT CARD, SEND/RECEIVER (R) (SAME AS GROUP 270104) (4 each)								
270405	CIRCUIT CARD, TONE SOURCE (C) (SAME AS GROUP 270205) (1 each)								
270406	CIRCUIT CARD, TONE SOURCE (D) (SAME AS GROUP 270206) (1 each)								
270407	CIRCUIT CARD, COMMON EGPT INTFC (SAME AS GROUP 270207) (1 each)								
270408	CIRCUIT CARD, AUX SEND/RECEIVER (S) (SAME AS GROUP 270208) (1 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
270409	CIRCUIT CARD, AUX SEND/RCVR (IN) (SAME AS GROUP 270209) (1 each)								
270410	CIRCUIT CARD, AUX SEND/RECEIVER (AMPL) (SAME AS GROUP 270210) (1 each)								
270411	CIRCUIT CARD, BUS RINGER MTDIN (SAME AS GROUP 270211) (1 each)								
270412	CIRCUIT CARD, BUS RINSER AMPL (SAME AS GROUP 270212) (2 each)								
270413	CIRCUIT CARD, CONFERSCE BRIDGE (SAME AS GROUP 270108) (1 each)								
2705	NEST A1 (A27A1) (AN/TTC-38(v)2 ONLY)								
270501	CIRCUIT CARD, SEND/RECEIBER (S) (SAME AS GROUP 270101) (5 each)								
270502	CIRCUIT CARD, SEND/RECBIV (DE) (SAME AS GROUP 270102) (6 each)								
270503	CIRCUIT CARD, SEND/RECVR (DL) (SAME AS GROUP 270103) (6 each)								
270504	CIRCUIT CARD, SND/RECEIVER (R) (SAME AS GROUP 270104) (6 each)								
270505	CIRCUIT CARD, TONE SERVICE (A) (SAME AS GROUP 270105) (1 each)								
270506	CIRCUIT CARD, TORE SOURCE (B) (SAME AS GROUP 270106) (1 each)								
270507	CIRCUIT CARD, COMN EQPT/ADPTR INTR (SAME AS GROUP 250305) (1 each)								
270508	CIRCUIT CARD, CONFRBCCE BRIDGE (SAME AS GROUP 270108) (4 each)								
2706	NEST A2 (A27A2) (AD/TTC-38(V)2 0NLY)								
270601	CIRCUIT CARD, SEND/RECEIVER (S) (SAME AS GROUP 270101) (4 each)								
270602	CIRCUIT CARD, SEND/RECEIVER (D) (SAME AS GROUP 270102) (4 each)								
270603	CIRCUIT CARD, SEND/RECEIVER (DL) (SAME AS GROUP 270103) (3 each)								
270604	CIRCUIT CARD, SEND/ QPT (R) (SAME AS GROUP 270104) (4 each)								
270605	CIRCUIT CARD. TONE SURCE (C) (SAME AS GROUP 270205) (1 each)								
270606	CIRUIT CARD, TONE BWMRCE (D) (SAME As GROUP 270206) (1 each)								
270607	CIRCUIT CARD, CONON EQPT INTFC (SAME AS GROUP 270207) (1 each)								
270608	CIRCUIT CARD, AUX SEND/RECEIVER (8) (SAME AS GROUP 27208) (1 each)								
270609	CIRCUIT CARD, AUX SEND/RECEIVER (EN) (SAME AS GROUP 270r209) (1 each)								
270610	CIRCUIT CAD, AUX SWED/RIVR (AMPL) (SAME AS GROUP 270210) (1 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICES AN/TCC-38(V)1 AND AN/TCC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
270611	CIRCUIT CARD, RUS RINGER TIMING (SAME AS GROUP 270211) (1 each)								
2612	CIRCUIT CARD, BUS RINGER AMPL (SAME AS GROUP 270212) (2 each)								
270613	CIRCUIT CARD, CONFERENCE BRIIDGE (SAME AS ROUP '270108) (1 each)								
2007	TEST A3 (A27A3) (AN/TTC-38(V)2 OILY)								
270701	CIRCUIT CARD, SMWD/RECRIVYR (S) (SAME AS GROUP 270101) (2 each)								
270702	CIRCUIT CARD, SEND/RCBIVER (DR) (SAME AS GROUP 270102) (3 each)								
270703	CIRCUIT CARD, SI8D/RECEIVER (DL) (SAME AS GROUP 270103) (3' each)								
2O2707	CIRCUIT CARD, SEND/RIECEIVR (R) (SAME AS GROUP 27010) (3 each)								
270705	CIRCUIT CARD, TORE SOURCE (A) (SAME AS GROUP 270105) (1 each)								
20o706	CIRCUIT CARD, TONE SOURCE (B) (SAME AS GROUP 270106) (1 each)								
270707	CIRCUIT CARD, CON BQPT/ADPTR INTR (SAME AS GROUP 250305) (1 each)								
270708	CIRCUIT CARD, BUS CROSBVER (A) (SAME AS GROUP 270308) (1 each)								
270709	CIRCUIT CARD,.BUS CROSSOVER (B) (SAME AS GROUP 270309) (1 each)								
270T10	CIRCUIT CARD, CONFMRECE BRIDGE (SAME AS GROUP 27010o8) (1 each)								
2708	NEST A4 (A27A4) (AN/TTC-38(v)2 ONLY)								
270801	CIRCUIT CARD, SEND/RECEIVER (S) (SAME AS GROUP 270101) (4 each)								
270802	CIRCUIT CARD, SEND/RECEIVER (DH) (SAME AS GROUP 270102) (4 each)								
270803	CIRCUIT CARD, SEIP/RECRIVER (DL) (SAME AS GROUP 270103) (4 each)								
270804	CIRCUIT CARD, SEND/RECEIVER (R) (SAME AS GROUP 27Olo4) (4 each)								
270805	CIRCUIT CARD, TORE SOURCE (C) (SAME AS GROUP 270205) (1 each)								
270806	CIRCUIT CARD, TORE SOURCE (D) (SAME AS GROUP 270206) (1 each)								
270807	CIRCUIT CARD, COMMON EQPT INTFC (SAME AS GROUP 270207) (1 each)								
270808	CIRCUIT CARD, AUX SEND/RECEIVER (S) (SAME AS GROUP 270208) (1 each)								
270809	CIRCUIT CARD, AUX SEND/RECEIVER (DM) (SAME AS GROUP 270209) (1 each)								
270810	CIRCUIT CARD, AUX SEND/RECEIVER (AMPL) (SAME AS GROUP 270210) (1 each)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
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(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
270811	CIRCUIT CARD, BUS RINGER TIMING (SAME AS GROUP 270211) (1 each)								
270812	CIRCUIT CARD, BUS RINGER AMPL (SAME AS GROUP 270212) (2 each)								
270813	CIRCUIT CARD, CONFERENCE BRIDGE (SAME AS GROUP 270108) (1 each)								
28	PANEL, COMMON EQUIPMENT (A28)	Repair			1.0			18,37,38, 39,40	
29	TERMINAL/MATRIX FRAME ASSMBLY (A29)	Repair			3.0			15,18, 30,36,37 38,39,40	
2901	NEST A1 (A29A1) (AN/TTC-38(V)1 ONLY)								
290101	CIRCUIT CARD, MATRIX B	Replace		0.2				1,8	
	(SMDT42639) (34 each)	Repair					2.0	18	
		Test					8.0	10,21, 28,29	
2902	NEST A2 (A29A2) (AN/TTC-38(V)1 ONLY)								
290201	CIRCUIT CARD, MATRIX B (SAME AS GROUP 290101) (24 each)								
290202	CIRCUIT CARD, MATRIX A	Replace		0.2				1,8	
	(SMD742638) (16 each)	Repair					2.0	18	
		Test					8.0	10,21, 28,29	
2903	NEST AS (A29A3) (AN/TTC-38(V)l ONLY)								
290301	CIRCU-IT CARD, MATRIX A (SAME AS GROUP 290202) (40 each)								
290302	CIRCUIT CARD, CROSS POINT DRIVER	Replace		0.2				1,8	
	(SMD742640) (8 each)	Repair					2.0	18	
		Test					4.0	10 thru 25	
2904	NEST A4 (A29A4) (AN/TTC-38(V)l ONLY)								
290401	CIRCUIT CARD, SF/DC TERMINAL	Replace		0.2				1,8	
	(SMD742601) (20 each)	Repair					2.0	18	
	(May be replaced by Group 2904.02, if required for different termination)	Test					3.0	10 thru 25	
290402	CIRCUIT CARD, COML DTMF LINE CRT	Replace		0.2				1,8	
	(SMD742600)	Repair					3.0	18	
	(May replace up to 14 each of Group 290401, if required for different termination)	Test					3.0	10 thru 25	
290403	CIRCUIT CARD, SCAN RECEIVER (R)	Replace		0.2				1,8	
	(SMD742607) (2 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	
290404	CIRCUIT CARD, SCAN RECEIVER (D)	Replace		0.2				1,8	
	(SMD742608) (2 each)	Repair					3.0	18	
		Test					3.0	10 thru 25	
290405	CIRCUIT CARD, TERMINAL STATUS RTN	Replace		0.2				1,8	
	(SMD742614) (1 each)	Repair					2.0	18	
		Test					2.0	10 thru 25	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
290406	CIRCUIT CARD, TERMINAL INTERFACE (SMD742615) (1 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					2.0	10 thru 25	
2905	NEST AS (A29AS) (AN/TTC-38(V)1 ONLY)								
290501	CIRCUIT CARD, SF/DC TERMINAL (SAME AS GROUP 290401) (20 each) (May be replaced by Group 290502, if required for different termination)								
290502	CIRCUIT CARD, COML DTMF LINE CRT (SAME AS GROUP 290402) (May replace up to 14 each of Group 290501, if required for different termination)								
290503	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 290403) (2 each)								
290504	CIRCUIT CARD, SCAN RECEIVER (D) (SAME AS GROUP 290404) (2 each)								
290505	CIRCUIT CARD, SCAN CONTROL (SMD742616) (1 each)	Replace		0.2				1,8	
		Repair					2.0	18	
		Test					2.0	10 thru 25	
290506	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
290507	CIRCUIT CARD, SERVICE TERMINAL (SMD742621) (1 each)	Replace		0.2				1,8	
		Repair					3.0	18	
		Test					3.0	10 thru 25	
2906	NEST A6 (A29A6) (AN/TTC-38(V)I ONLY)								
290601	CIRCUIT CARD, SERVICE TERMINAL (SAME AS GROUP 290507) (2 each)								
290602	CIRCUIT CARD, SF/DC TERMINAL (SAME AS GROUP 290401) (20 each) (May be replaced by Group 290603, if required for different termination)								
290603	CIRCUIT CARD, COML DTMF LINE CRT (SAME AS GROUP 290402) (Hay replace up to 14 each of Group 290602, if required for different termination)								
290604	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 290403) (2 each)								
290605	CIRCUIT CARD, SCAN RECEIVER (D) (SAME AS GROUP 290404) (2 each)								
290606	CIRCUIT CARD, TERMINAL STATUS RTN (SAME AS GROUP 290405) (1 each)								
290607	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
2907	NEST A7 (A29A7) (AN/TTC-38(V)1 ONLY)								
290701	CIRCUIT CARD, SERVICE TERMINAL (SAME AS GROUP 290507) (2 each)								
290702	CIRCUIT CARD, SF/DC TERMINAL (SAME AS GROUP 290401) (20 each) (May be replaced by Group 290703, if required for different termination)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
290703	CIRCUIT CARD, COML DTMF LINE CRT SAME AS GROUP 290402) (May replace up to 14 each of Group 290702, if required for different termination)								
290704	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 290403) (2 each)								
290705	CIRCUIT CARD, SCAN RECEIVER (D) (SAME AS GROUP 290404) (2 each)								
290706	CIRCUIT CARD, SCAN CONTROL (SAME AS GROUP 290505) (1 each)								
290707	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
2908	NEST AI (A29A1) (AN/TTC-38(V)2 ONLY)								
290801	CIRCUIT CARD, MATRIX B (SAME AS GROUP 290101) (38 each)								
2909	NEST A2 (A29A2) (AN/TTC-38(V)2 ONLY (SAME AS GROUP 2902)								
291.0	NEST A3 (A29A3) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2903)								
2911	NEST A4 (A29A4) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2904)								
2912	NEST A5 (A29A5) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2905)								
2913	NEST A6 (A29A6) (AN/TTC-38(V) ONLY) (SAME AS GROUP 2906)								
2914	NEST A7 (A29A7) AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2907)								
30	TERMINAL/MATRIC FRAME ASSEMBLY (A30)	Repair			3.0			15,18, 30,36 thru 40	
30Q1	NEST AI (A3OA1) (AN/TTC-38(V)1 ONLY) (SAME AS GROUP 2901)								
3002	NEST A2 (A30A2)' (AN/TTC-38(V)I ONLY)								
300201	CIRCUIT CARD, MATRIX B (SAME AS GROUP 290101) (21 each)								
300202	CIRCUIT CARD, MATRIX A (SAME AS GROUP 290202) (14 each)								
3003	NEST A3 (A30A3) (AN/TTC-38(V)1 ONLY)								
300301	CIRCUIT CARD, MATRIX A (SAME AS GROUP 290202) (35 each)								
300302	CIRCUIT CARD, CROSS POINT DRIVE (SAME AS GROUP 290302) (8 each)								

SECTION II MAINTENANCE ALLOCATION CHART FOR

AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
3004	NEST A4 (A30A4) (AN/TTC-38(V)1 ONLY) (SAME AS GROUP 2906)								
3005	NEST AS (A30A5) (AN/TTC-38(V)I ONLY) (SAME AS GROUP 2907)								
3006	NEST A6 (A30A6) (ARI/3e(V)I ONLY) (SAME AS GROUP 2906)								
3007	MNST AT (A30A7) (AN/TTC-38(v)I ONLY)								
300701	CIRCUIT CARD, SERVICE TERMINAL (SAME AS OROUP 290507) (1 each)								
300702	CIRCUIT CARD, SF/DC TERMINAL (SAME AS GROUP 290401) (10 each) (May be replaced by Group 300703, if required for different termination)								
300703	CIRCUIT CARD, COML DTMF LINE CRT (SAME AS GROUP 290402) (May replace up to 10 each of Group 300702, if required for different termination)								
300704	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 29403) '(1 each)								
300705	CIRCUIT CARD, SCAN RECEIVER (D) (SAME AS GROUP 290404) (1 each)								
300706	CIRCUIT CARD, SCAN CONTROL (SAME AS GROUP 290505) (1 each)								
300707	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
3008	NEST AI (A30A1) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2908)								
3009	NEST A2 (A3A2) (AN/TTC-38(v)2 ONLY) (SAME As GROUP 2902)								
3010	NEST A3 (A30A3) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2903)								
3011	NEST A4 (A30A4) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 2906)								
3012	NEST A5 (A30A5) (A/T,C-38(V)2 ONLY) (SAME AS GROUP 2907)								
3013	NEST A6 (A30A6) (AR/TTC-38(V)2 ONLY)								
301301	CIRCUIT CARD, SERVICE TERMINAL (SAME AS OGROUP 29007) (1 each)								
301302	CIRCUIT CARD, 8S/DC TRMINAL (SAME AS GROUP 290401) (20 each) (May be replaced by Group 301303, if required for different termination)								
301303	CIRCUIT CARD, COML DTMF, LINE CKT (SAME AS GROUP -290402) (May replace up to 14 each of Group 301302, if required for different termination)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
301304	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 290403) (2 each)								
301305	CIRCUIT CARD, SCAN RECEIVE (D) (SAME AS GROUP 290404) (2 each)								
301306	CIRCUIT CARD, TERMINAL STATUS RTN (SAME AS GROUP 290405) (1 each)								
301307	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
3014	NEST A7 (A30A7) (AN/TTC-38(V)2 ONLY)								
301401	CIRCUIT CARD, SF/DC TERMINAL (SAME AS GROUP 290401) (20 each) (May be replaced by Group 301402, if required for different termination.)								
.3140o2	CIRCUIT CARD, COML DIME LINE CKT (SAME AS GROUP 290402) (May replace up to 14 each of Group 301401, if required for different termination)								
301403	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 290403) (2 each)								
301404	CIRCUIT CARD, SCAN RECEIVER (D) - (SAME AS GROUP 290404) (2 each)								
301415	CIRCUIT CARD, SCAN CONTROL (SAME AS GROUP 290505) (1 each)								
301406	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
31	TERMINAL/MATRIX FRAME ASSEMBLY (A31) (SAME AS GROUP 29)								
32	COMON MATRIX DRIVER (A32)	Repair			3.0			15,18, 30,36,37, 38,39,40	
3201	NEST Al (A32A1) (AN/TrC-38(V)1 ONLY)								
320101	CIRCUIT CARD, CROSS POINT DRIVER (SAME AS GROUP 290302) (33 each)								
320102	CIRCUIT CARD, ERROR RETURN SMY (SMD742641) (4 each)	Replace		0.5				1,8	
		Repair					2.0	18	
		Test					4.0	10 thru 25	
3202	NEST Al (A32A1) (AN/TTC-38(V)2 ONLY)								
320201	CIRCUIT CARD, CROSS POINT DRIVER (SAME AS GROUP 290302) (35 each)								
320202	CIRCUIT CARD, ERROR RETURN SMY (SAME AS GROUP 320102) (6 each)								
'33	TERMINAL/MATRIX FRAME ASSEMBLY (A33) (SAME AS GROUP 29)								
34	SIGNAL ENTRANCE BOX (AN/TTC-38(v)l ONLY) (A34)	Repair			2.0			18	
		Test		1.0				33	
35	SIGNAL ENTRANCE BOX (AN/TTC-38(V)1 ONLY) (A35) (SAME AS GROUP 34)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
36	CONNECTOR ASSEMBLY (A36)	Repair			2.0			18	
37	DISTRIBUTION PANEL (A37)	Repair			2.0			18	
38	AIR CONDITIONER, ROADSIDE (A38) (SEE TM '5-4120-243-14)	Install			1.0			18	
39	AIR CONDITIONER, CURBSIDE (SAME AS GROUP 38)								
40	TERMINAL/MATRIX FRAME ASSEMBLY (A40) (AN/TTC-38(V)2 ONLY)	Repair			3.0			15,18, 30,36 thru 40	
4001	NEST AI (A4OA1)								
400101	CIRCUIT CARD, MATRIX B (SAME AS GROUP 290101) (38 each)								
4002	NEST A2 (A40A2) (SAME AS GROUP 3002)								
4003	NEST A3 (A40A3) (SAME AS GROUP 3003)								
4004	NEST A4 (A40A4) (SAME AS GROUP 2904)								
4005	NEST AS (A40A5) (SAME AS GROUP 2905)								
4006	NEST A6 (A40A6) (SAME AS GROUP 2904)								
4007	NEST A7 (A40A7)								
400701	CIRCUIT CARD, SF/DC TERMINAL (SAME AS GROUP 290401) (10 each) (May be replaced by Group 400702, if required for different termination)								
400702	CIRCUIT CARD, COML DTMF LINE CKT (SAME AS 290402) (May replace up to 7 of Group 400701, if required for different termination)								
400703	CIRCUIT CARD, SCAN RECEIVER (R) (SAME AS GROUP 290403) (1 each)								
400704	CIRCUIT CARD, SCANSRECEIVER (D) (SAME AS GROUP 290404) (1 each)								
400705	CIRCUIT CARD, SCAN CONTROL (SAME AS GROUP 290505) (1 each)								
400706	CIRCUIT CARD, TERMINAL INTERFACE (SAME AS GROUP 290406) (1 each)								
41	TERMINAL/MATRIX FRAME ASSEMBLY (A42) (SAME AS GROUP 40)								
42	PATCH PANEL +300 LINE (A43) (AN/TTC-38(V)2 ONLY)	Repair			1.0			18	
43	TERMINAL/MATRIX FRAME ASSEMBLY (A44) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 29)								
44	TERMINAL/MATRIX FRAME ASSEMBLY (A45) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 40)								
45	SIGNAL ENTRANCE BOX (A46) (AN/TTC-38(V)2 ONLY) (SAME AS,GROUP 34)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
46	SIGNAL ENTRANCE BOX (A47)								
	(AN/TC-38(V)2 ONLY)								
	(SAME AS GROUP 34)								
47	CONNECTOR ASSEMBLY (A48)								
	(SAME AS GROUP 36)								
48	20 HZ RINGER (A5O)	Repair			3.0.			18	
4801	CIRCUIT CARD, 20 HZ GENERATOR RLY (A50A3)	Replace		0.7				18	
	(SMD742642)	Repair			2.0			18,30	
4802	MODULE ASSY, 20 HZ RING GEN (A50A1)	Replace		0.7				18	
	(SMD744873)	Repair			2.0			18,30	
4803	MODULE ASSY, 20 HZ RING GEN (A50A2.)								
	(SAME AS GROUP 4802)								
49	'POWER RELAY ASSEMBLY								
4901	POWER RELAY ASSEMBLY (A51)	Repair			2.0			18	
	AN/TTC-38(V)I ONLY)								
	(SMD745013)								
4902	POWER RELAY ASSEMBLY (A51)	Repair			2.0			18	
	AN/TTC-38(V)2 ONLY)								
	(SMD744887)								
50	BLOWER ASSEMBLY (A52)	Repair			1.0			18	
	(ANI/TTC-38(V)2 ONLY)								
	(SMD744954)								
51	'BLOWER ASSEMBLY (A53)								
	(SAME AS GROUP 50)								
52	BLOWER ASSEMBLY (A54)								
	(SAME AS GROUP 50)								
53	BLOWER ASSEMBLY (A55)								
	(SAME AS GROUP 50)								
54	BLOWER ASSEMBLY (A56)								
	(SAME AS GROUP 50)								
55	BLOWER ASSEMBLY (A57)	Repair			1.0			18	
	(SMD751984)								
56	BLOWER ASSEMBLY (A58)	Repair			1.0			18	
	(SMD751689)								
57	BLOWER ASSEMBLY (A59)								
	(SAME AS GROUP 56)								
58	TAPE WINDER, MOTOR DRIVEN (A60)	Replace		0.2				1	
	(SMD752037)	Repair				2.0		18	
59	HEADSET-MICROPHONE (HT-1)	Replace		0.1					
	(SMA742440-1)	Repair			1.0			18	
60	INVERTER ASSEMBLY (PS1)	Replace			1.0			i8	
	(SMD744038)	Repair				3.0		18	
		Test				1.0		2,3,14 thru 17,30	
6001	CIRCUIT CARD ASSEMBLY (PSIA3)	Replace				0.5		18	
	(SMD744040) (1 each)	Repair				2.0		18	
6002	CIRCUIT CARD ASSEMBLY (PS1A4)	Replace				0.5		18	
	(SMD744041) (1 each)	Repair				2.0		18	
6003	FILTER, RADIO INTERFERENCE (PS1Al)	Replace				0.5		18	
	(SMD744068)	Repair				1.0		18	
6004	FILTER, RADIO INTERFERENCE (PS1A2)	Replace				0.6		18	
	(SM0744069)	Repair				1.0		18	

SECTION IIMAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
6005	HEATSINK ASSEMBLY (PS1AS)	Repair				1.0		18	
	(SMD744039)								
61	INVRTER-ASSEMBLY (PS2)								
	(.SAME AS GROUP 60)								
62	CONVERTER, DC TO DC (PS3)	Replace		0.1				1	
	(SMA742458-2)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,14, 17,30	
6201	CIRCUIT CARD ASSEMBLY (PS3A6)	Replace				0.5		18	
	(SMC752052) (1 each)	Repair				2.0		18	
6202	CIRCUIT CARD ASSEBLY (PS3A1)	Replace				0.5		18	
	(SMD743431) (1 each)	Repair				2.0		18	
6203	CIRCUIT CARD ASSEMBLY CPS3A3	Replace				0.5		18	
	(SND743436)	Repair				2.0		18	
6204	CIRCUIT CARD ASSEMBLY (PS3A2)	Replace				0.5		18	
	(SMD743437) (1 each)	Repair.				2.0		18	
6205	CIRCUIT CARD ASSENBLY (PS3AS)	Replace				0.5		18	
	(SMD743507) (1 each)	Repair				2.0		18	
63	CONVERTER, DC TO DC (PS4)	Replace		0.1				1	
	(SMA742458-1)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,14, 17,30	
6301	CIRCUIT CARD ASSEMBILY (PS4A1)	Replace				0.5		18	
	(SMD743478) (1 each)	Repair				2.0		18	
6302	CIRCUIT CARD ASSEMBLY (PS4A2)	Replace				0.5		18	
	(SMD743480) (1 each)	Repair				2.0		18	
6303	CIRCUIT CARD ASSEBLY (PS4A3)	Replace				0.5		18	
	(SMD1743528) (1 each)	Repair				2.0		18	
64	CONVERTER, DC TO DC (PS5)	Replace		0.1				1	
	(SMA742458-3)	Adjust		0.2				1.30	
		Repair				4.0		18	
		Test				1.0		2,3,4, 17,30	
6401	CIRCUIT CARD ASSEMBLY (PS5AS)	Replace				0.5		18	
	(CNC743466) (1 each)	Repair				2.0		18	
6402	CIRCUIT CARD ASSEMBLY (P85A6)	Replace				0.5		18	
	(SMC752052) (1 each)	Repair				2.0		18	
6403	CIRCUIT CARD ASSEMBLY (PS5A1)	Replace				0.5		18	
	(SMD743454) (1 each)	Repair				2.0		18	
6404	CIRCUIT CARD ASSEMBLY (PS5A4)	Replace				0.5		18	
	(SMD743464) (1 each)	Repair				2.0		18	
6405	CIRCUIT CARD ASSEMBLY (PS5A2)	Replace				0.5		18	
	(SMD743522) (1 each)	Repair				2.0		18	
6406	CIRCUIT CARD ASSEMBLY (PS5A3)	Replace				0.5		18	
	(SMD743524) (1 each)	Repair				2.0		18	
65	CONVERTER, DC TO DC (PS6)								
	(SAME AS OROUP 64)								
66	CONVERTER, DC TO DC (PS7)								
	(SAME AS GROUP 63)								
67	CONYERTER, DC TO DC (PS8)								
	(SAME AS OROUP 62)								

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1)	(2)	(3)	(4) Maintenance Category					(5)	(6)
Group Number	Component/ Assembly	Maint Function	C	O	F	H	D	Tools and Equipment	Remarks
68	CONVERTER, DC TO DC (PS9)	Replace		0.1				1	
	(SMA74245-8-)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,4, 17,30	
6801	CIRCUIT CARD ASSEMBLY (PS9A1)	Replace				0.5		18	
	(SMD743460) (1 each)	Repair				2.0		18	
6802	CIRCUIT CARD ASSEMBLY (PS9A2)	Replace				0.5		18	
	(SMD743463) (1 each)	Repair				2.0		18	
69	CONVERTER, DC TO DC	Replace		0.1				1	
	(SA742458-7)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,4, 17,30	
6901	CIRCUIT CARD ASSEMBLY (PS1OA1)	Replace				0.5		18	
	(SMD743433) (1 each)	Repair				2.0		18	
6902	CIRCUIT CARD ARSSBLY (PS1OA2)	Replace				0.5		18	
	(SMD743509) (1 each)	Repair				2.0		18	
6903	CIRCUIT CARD ASSEMBLY (PS1OA3)	Replace				0.5		18	
	(SMD743516) (1 each)	Repair				2.0		18	
6904	CIRCUIT CARD ASS14BLY (PS10A4)	Replace				0.5		18	
	(5MD743537) (1 each)	Repair				2.0		18	
70	CONVERTER, DC TO DC (PS11)	Replace		0.1				1	
	(SMA742458-6)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,4, 17,30	
7001	CIRCUIT CARD ASSEMBLY (PSIl1)	Replace				0.5		18	
	(SMD743491) (1 each)	Repair				2.0		18	
7002	CIRCUIT CARD ASSEMBLY (PSIIA2)	Replace				0.5		18	
	(SMD743493) (1 each)	Repair				2.0		18	
7003	CIRCUIT CARD ASSEMBLY (PSIIA3)	Replace				0.5		18	
	(SMD743495) (1 each)	Repair				2.0		18	
7004	CIRCUIT CARD ASSEMBLY (PSIIA4)	Replace				0.5		18	
	(SMD743535) (1 each)	Repair				2.0		18	
71	CONVERTER, DC TO DC	Replace		0.1				1	
	(SMA742458-5)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,4, 17,30	
7101	CIRCUIT CARD ASSEMBLY (PS12A3)								
	(SAME AS GROUP 6903) (1 each)								
7102	CIRCUIT CARD ASSEMBLY (PS12A1)								
	(SAME AS GROUP 6901) (1 each)								
7103	CIRCUIT CARD ASSEMBLY (PS12A2)	Replace				0.5		18	
	(SMD743514) (1 each)	Repair				2.0		18	
72	CONVERTER, DC TO DC (PS13)	Replace		0.1				1	
	(SMA742458-4)	Adjust		0.2				1,30	
		Repair				4.0		18	
		Test				1.0		2,3,4, 17,30	
7201	CIRCUIT CARD ASSEMBLY (PS13A1)	Replace				0.5		18	
	(S(D743444) (1 each)	Repair				2.0		18	
7202	CIRCUIT CARD ASSEMBLY (PS13A2)	Replace				0.5		18	
	(SMD743446) (1 each)	Repair				2.0		18	

SECTION II MAINTENANCE ALLOCATION CHART FOR AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
7203	CIRCUIT CARD ASSEBCLY (PS13A3) (SMD743448) (1 each)	Replace				0.5		18	
		Repair				2.0		18	
73	CONVERTER, DC TO DC (PS14) (SAME As GROUP 68)								
74	CONVERTER, DC TO DC (Ps15) (SANE AS GROUP 69)								
75	CONVERTER, DC TO DC (PS16) (SAME AR GROUP To)								
76	CONVERTER, DC TO DC (Ps17) (SAME AS GROUP 71)								
77	CONVERTER, DC TO DC (PS18) (SAME AS GROUP 72)								
78	CONVERTER, DC TO DC (PSf9) (SAME AS GROUP 68)								
79	CONVERTER, DC TO DC (PS2O) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 69)								
80	CONVERTER, DC TO DC (PS21) (AN/TTC-38(V)2 ONLY) (SAME As GROUP 70)								
81	CONVERTER, DC TO DC (PS22) (AN/TTC-38(V)2 ONLY) (SAME AS GROUP 71)								
82	CONVERTER, DC TO DC (PS23), (AN/TTC-38(V)2 ONLY) -(SAME AS GROUP 72)								
83	BATTERIES, POWER AND LIGHTING	Service		1.0				1	E
		Repair			1.0			18	
84	PATCH CORDS AND PLUGS (AN/TTC-38(V)l ONLY)	Test		0.1					F
85	PATCH CORDS AND PLUGS (AN/TTC-38(V)2 ONLY)	Test		0.1					F
86	SHELTER-300 LINE (SME744366) (AN/TTC-38(v) i ONLY)	Repair			2.0			18	E
		Repair				5.0		18,35	I
8601	PANEL ASSEMBLY, POWER CABINET	Repair			1.0			18	
8602	PANEL ASSEMBLY, RELAY POWER	Repair			1.0			18	
860201	CIRCUIT CARD, LOW VOLTAGE DET(E17) (SMD742644) 1 each	Replace			1.0			18	
		Repair					2.0	18	
8603	COMPONENT ASSEMBLY, POWER SUBSYSTEM (SMD744953)	Repair			1.0			18	
8604	PANEL, POWER CONTROL (SM-D-745196)	Repair			1.0			18	

SECTION II MAINTENANCE ALLOCATION CHART
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Group Number	(2) Component/ Assembly	(3) Maint Function	(4) Maintenance Category					(5) Tools and Equipment	(6) Remarks
			C	O	F	H	D		
8605	PANEL, POWER DISTRIBUTION (SMD744861)	Repair			1.0			18	
87	SHELTER-600 LINE (SME74515T) (AN/TTC-38(V) 2 ONLY)	Repair Repair			2.0	 5.0		18 18,35	E I
8701	PANEL ASSEMBLY, POWER CABINET (SAME AS 8601)								
8702	PANEL ASSEMBLY, RELAY POWER (SAME AS 8602)								
870201	CIRCUIT CARD, LOW VOLTAGE DET(E1T7) (SMDT42644) 1 each (SAME AS GROUP 860201)								
8703	COMPONENT ASSEMBLY, POWER SUBSYSTEM (SAME As GROUP 8603)								
8704	PANEL, POWER CONTROL (SM-D-744857)	Repair			1.0			18	
88	TAPE STORAGE ASSEMBLY (SM-D-752012)	Repair			0.5			18	
89	CABLE ASSEMBLIES	Replace Repair			0.5 1.0			18 6,7,18	

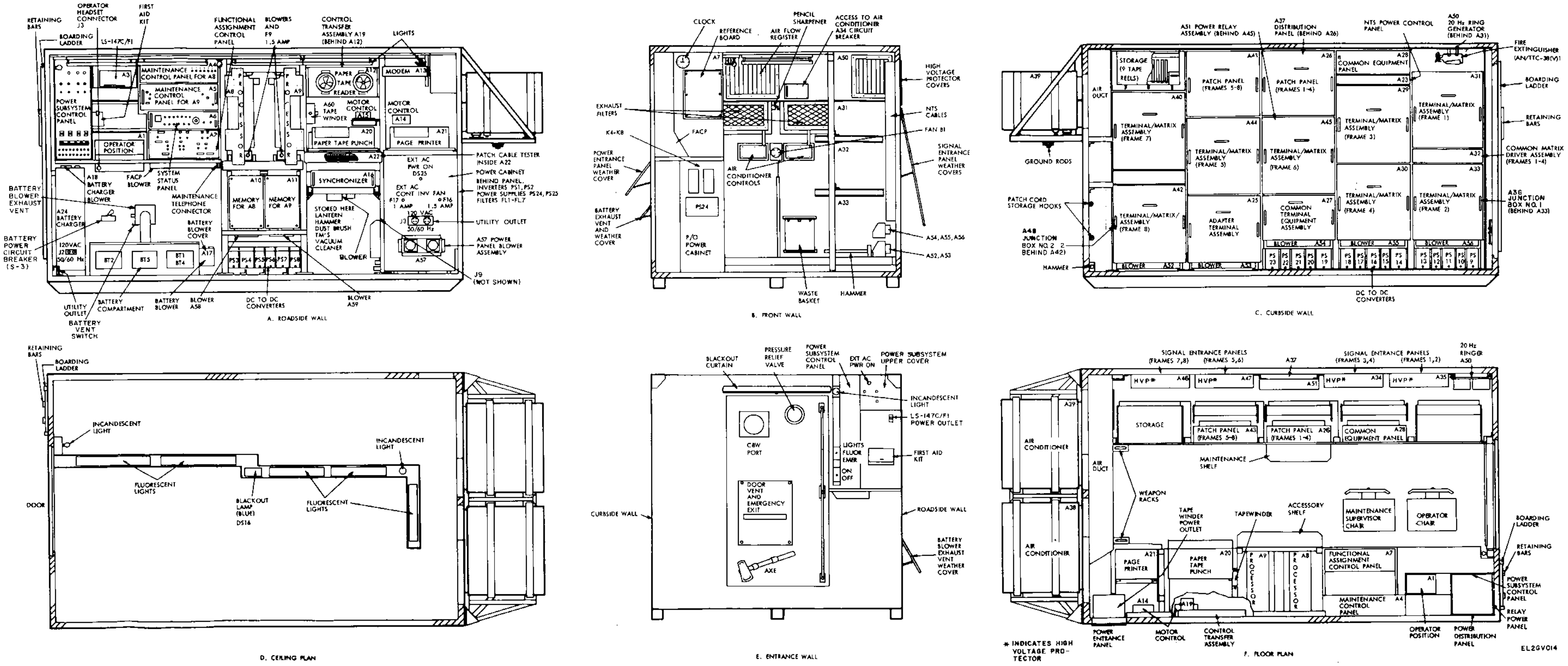
SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
AUTOMATIC TELEPHONE CENTRAL OFFICE AN/TTC-38(V)1 AND AN/TTC-38(V)2 - CONTINUED

(1) Tool or Test Equipment Ref Code	(2) Maintenance Category	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
1	0	TOOL KIT, ELECTRONIC EQUIPMENT TK-101/G	5180-00-064-5178	
2	F,H	DC POWER SUPPLY, HEWLETT-PACKARD 6268B, OPTION 26	6130-01-004-8974	
3	F,H	RESISTIVE LOAD BANK, TRANSISTOR DEVICES COMPANY DLR-50-60-1000		
4	F,H	VARIAC, VT8-GC	5950-00-617-9242	
5	O,F,H	DIAGNOSTIC TAPES (P/O AN/TTC-38)		
6	F,H	EXTRACTION TOOL		
7	F,H	INSERTION TOOL		
8	O,F,H	PRINTED CIRCUIT CARD EXTRACTOR		SMC743205 (80063)
9	F,H	EXTNDER CORD DIL	5805-00-134-2938	S(D780081 (80063)
10	F,H,D	GO1 ATOM, SIGNAL TS-421C	6625-00-435-2588	
11	O,F,D	NOISE MEASURING SET, NORTEAST ELECTRONICS TTS-37B	662500-918-5721	
12	D	RMS VOLTMETER, HEWLETT-PACKARD 3400A	6625-00-727-4706	
13	D	WAVEFORM ANALYZER AMC-1000		
14	O,F,H,D	MULTIMETER TS-352B	6625-00-553-0142	
15	'F,H,D	OSCILLOSCOPE AN/USM-296A	6625-00-115-9201	
16	F,H,D	COUNTER, ELECTRONIC, DIGITAL R OAN/UBM-207A	6625-00-044-3228	
17	F,H,D	AMDTER, MOD 2100, CATALOG .@17950		
18	F,H,D	TOOL KIT, ELECTRONIC EQUIPMTK-10/0	5180-00-610-8177	
19	D	WAVEFORM GENERATOR, WAVETEK TYPE 154		
20	D	POWER SUPPLY, LAMBDA LCS 3-02	6130-00-417-6201	
21	D	POWER SUPPLY, LAMBDA LCS 3-03	6130-00-179-9948	
22	D	VOLTMTER/COUNTER, HEWI ET-PACKARD 5326B	6625-00-478-1411	
23	D	POWER SUPPLY, TRYGON P32-1.5	6130-00-998-1060	
24	D	POWER SUPPLY, NEW JERSEDY ENGINEERING BY-36-30M		
25	D	P1 OER SUPPLY, HEWLETT-PACKARD 6267A	6130-00-408-4962	
26	F,K,D	PULSE GENERATOR, HEILETT-PACKARD 8011A	6625-01-022-2247	
27	D	DIGITAL VOLTAGE SOURCE, HNELETT-PACKARD 6130B		
28	D	PULSE GENERATOR, TEBKTRONIX TYPE 114	66P5-00-068-6884	
29	D	DIGITAL VOLTMETR, HEWLETT-PACKARD 3340A WITH 3445A PLUG-IN		
30	O,F,H	DIGITAL VOLTMETER, HEWLETT-PACKARD 970A	6625-00-2884768	
31	F,H	TOOL KIT, TELETYPE CORP.@185830	5180-00-454-1714	
32	F.H	TOOL EQUIPMENT, T-50B	5180-00-356-4602	
33	0	TEST SET, HIGH VOLTAGE PROTECTORS TS-3501/TTC-38	6625-00-148-8311	
34	F	TEST SET, TELEPHONE AN/USM-181A	6625-00-740-0344	
35	H	TOOL KIT, ELECTRONIC EQUIPMENT SNELTER TK-144/G	5180-00-973-4369	
36	F,H	EXTENDER CARD, NTS	5805-00-134-2939	SMD317291 (80063)
37	F,H	WIRE WRAPPING TOOL	5120-00-978-3493	
38	F,H	WIRE WRAPPING BIT	5120-00-451-5487	
39	F,H	WIRE WRAPPING SLEEVE **(26 ga.)**	5130-00-731-5941	
40	F,H	WIRE UNWRAPPING TOOL	5120-00-451-5452I	

SECTION IV. REMARKS

Reference Code	Remarks
A	Operational test.
B	By replacing printed circuit cards.
C	Return through supply channels to manufacturer.
D	See Air Force TO 31W4-4-ll7-14 with Army Supplement.
E	Service batteries.
F	Built in test equipment.
H	Replacement of internal piece parts. Emergency repair of holes and minor structural damage (TB 750-240).
I	Repair of door, skids, and permanent repair of holes and structural damage (TB. 750-240).
J	Maintenance functions, maintenance category, tools and test equipment are the same as that for FG 250107.

*U.S.GOVERNMENT PRINTING OFFICE:1989-242-451/ 05124



A. ROADSIDE WALL

B. FRONT WALL

C. CURBSIDE WALL

D. CEILING PLAN

E. ENTRANCE WALL

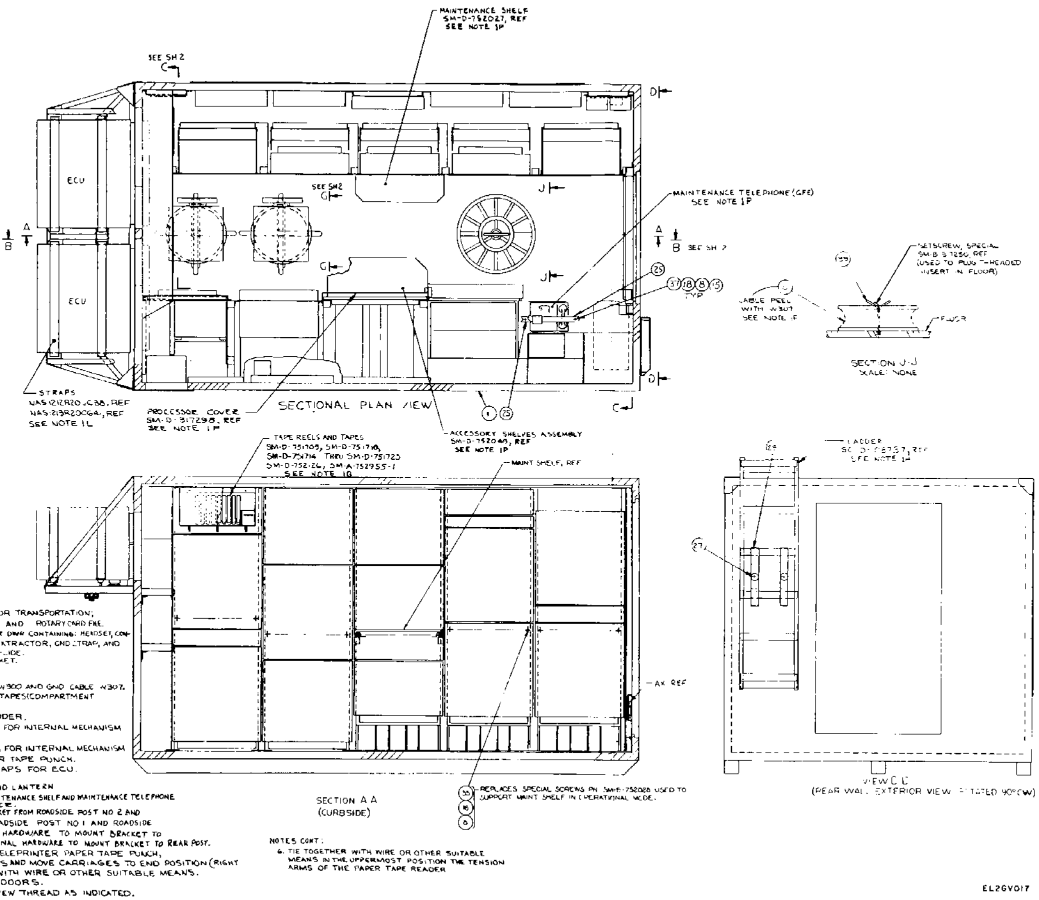
F. FLOOR PLAN

* INDICATES HIGH VOLTAGE PROTECTOR

Figure FO-1. Automatic Telephone Central Office AN/TCC-38(V)(*), floor plan and elevation diagram.

PARTS LIST

Find No.	Qty Req'd	Part or Identifying No.	Nomenclature or Description
1	X	DL SM-B-744369	Central Office, Telephone, Automatic AN/TTC-38 (V) 2
3	2	SM-D-768931	Bracket, Chair
4	2	SM-B-768933	Knob, Altered
5	2	RC-435( )/G	Reel, Cable
6	4	MS15795-807	Washer, Flat
7	3	MS15795-808	Washer, Flat
8	16	MS15795-810	Washer, Flat
9	2	MS15795-812	Washer, Flat
10	8	MS15795-818	Washer, Flat
11	2	MS24622-61	Screw, Tapping, Thd Forming, Type B, Pan Hd
12	3	MS24693-C279	Screw, Machine, Flat, CSK HD, 100°
13	2	MS35307-308	Screw, Cap, Hexagon Head
14	2	MS35338-137	Washer, Lock-Spring
15	2	MS35338-138	Washer, Lock-Spring
16	12	MS35338-139	Washer, Lock-Spring
18	2	MS15795-815	Washer, Flat
19	2	MS35649-284	Nut, Plain, Hex
20	2	MS51957-45	Screw, Machine-Pan Head
21	2	MS51957-46	Screw, Machine-Pan Head
22	5	MS51958-69	Screw, Machine-Pan Head
23	8	MS51972-5	Nut, Plain, Hex
24	2	NAS1201C10B12B	Chain Assembly
25	2	SM-A-744832-6	Strap, Webbing
26	4	NAS3108C9-16	Bolt-U
27	2	SC-B-543411	Knob Assembly
28	2	SC-D-582426	Bracket, Boarding Ladder
29	AR	Grade C	Sealing, Compound
33	3	MS24693-C277	Screw, Machine, Flat, CSK HD, 100°
34	3	MS51958-68	Screw, Machine-Pan Head
35	10	MS35307-308	Screw, Cap, Hexagon Head
37	2	MS51958-65	Screw, Machine-Pan Head
38	1	TM-5-4120-243-14	Manual, Maintenance/Operational Air Cond, 18000 BTU
39	1	SM-C-768930	Rod, Reel Tiedown



NOTES:

1. MISC EQPT TO BE SECURED FOR TRANSPORTATION;
   - A. DUST BRUSH, HAMMER AND ROTARY CARD FILE.
   - B. PATCH PLUG/CABLE TESTER DWR CONTAINING: HEADSET, CONNECTOR(PATCH)PLUGS, CARD EXTRACTOR, GND STRAP, AND 10 SPECIAL SCREWS FROM CURBSIDE.
   - C. PATCH CABLES AND WASTEBASKET.
   - D. GROUND ROD.
   - E. FIRE EXTINGUISHER.
   - F. REELS WITH AC PWR CABLE W300 AND GND CABLE W307.
   - G. NINE (9) TAPE REELS AND TAPES(COMPARTMENT DOOR CLOSED).
   - H. VEHICLE BOARDING LADDER.
   - J. FOUR (4) TIE DOWN BOLTS FOR INTERNAL MECHANISM FOR TELEPRINTER.
   - K. FOUR (4) TIE DOWN BOLTS FOR INTERNAL MECHANISM FOR TELEPRINTER PAPER TAPE PUNCH.
   - L. FOUR (4) TIE DOWN STRAPS FOR ECU.
   - M. TWO (2) CHAIRS
   - N. PLASTIC CHAD CHUTE AND LANTERN
   - P. ACCESSORY SHELVES, MAINTENANCE SHELF AND MAINTENANCE TELEPHONE AND PROCESSOR COVER.
2. REMOVE TAPE WINDER WITH BRACKET FROM ROADSIDE POST NO 2 AND RELOCATE BETWEEN ROADSIDE POST NO 1 AND ROADSIDE REAR POST. USE EXISTING HARDWARE TO MOUNT BRACKET TO POST NO 1 AND USE ADDITIONAL HARDWARE TO MOUNT BRACKET TO REAR POST.
3. LIFT TELEPRINTER AND TELEPRINTER PAPER TAPE PUNCH, HINGED PLASTIC COVERS AND MOVE CARRIAGES TO END POSITION (RIGHT OR LEFT) AND SECURE WITH WIRE OR OTHER SUITABLE MEANS.
4. SECURE ALL EXTERNAL DOORS.
6. APPLY FIND NO. 29 TO SCREW THREAD AS INDICATED.

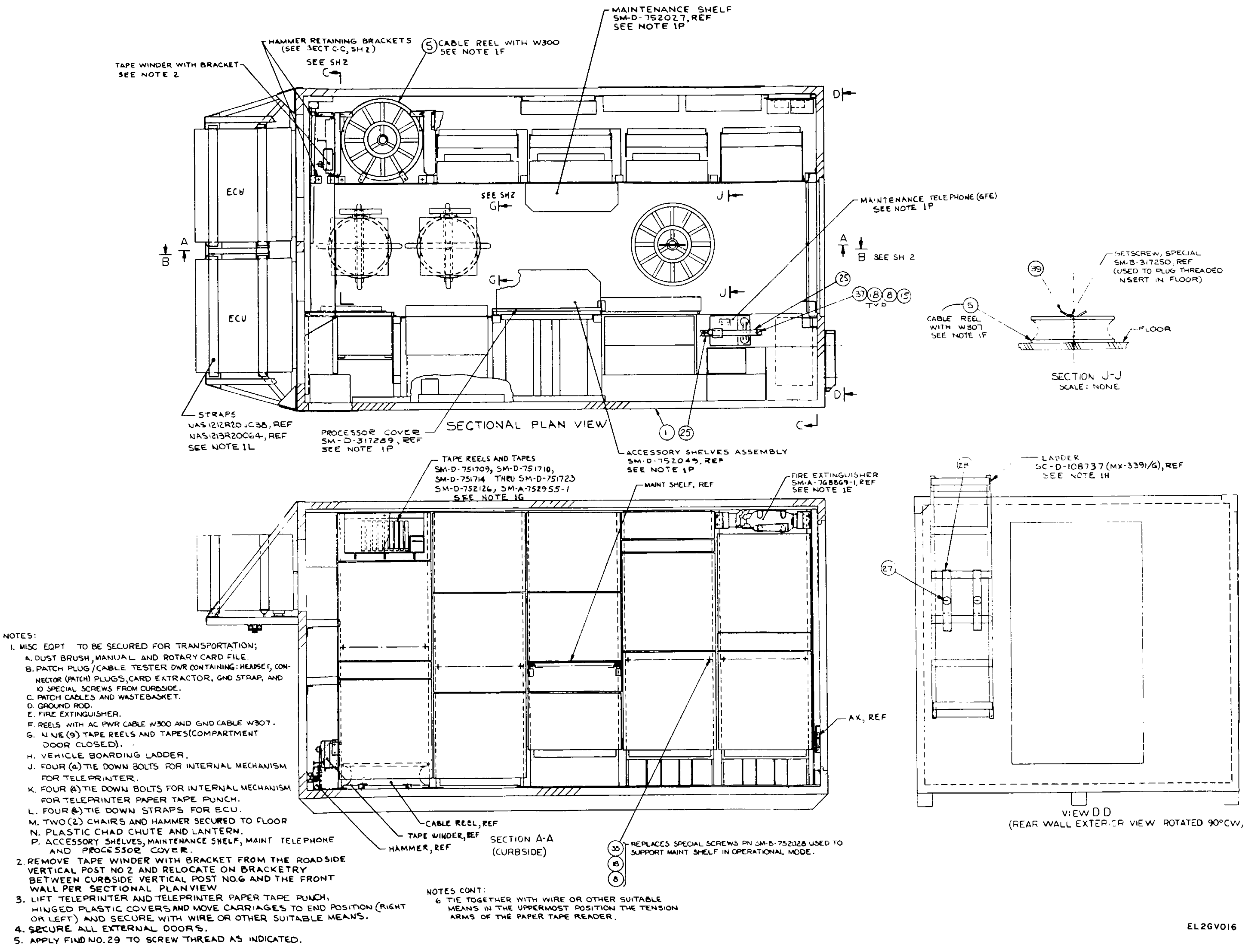
NOTES CONT:

6. TIE TOGETHER WITH WIRE OR OTHER SUITABLE MEANS IN THE UPPERMOST POSITION THE TENSION ARMS OF THE PAPER TAPE READER

TM 11-5803-628-12/NAVELEX 0967-462-8070 FO-3 (1) AN/TTC-38(V)2 component stowage positions (sheet 1 of 2)

Figure FO-3①. AN/TCC-38(V)2 component stowage positions.

Figure FO-2(1). AN/TCC-38(V)1 component stowage positions.



NOTES:

1. MISC EQPT TO BE SECURED FOR TRANSPORTATION;
   A. DUST BRUSH, MANUAL AND ROTARY CARD FILE.
   B. PATCH PLUG/CABLE TESTER DWR CONTAINING: HEADSET, CONNECTOR (PATCH) PLUGS, CARD EXTRACTOR, GND STRAP, AND 10 SPECIAL SCREWS FROM CURBSIDE.
   C. PATCH CABLES AND WASTEBASKET.
   D. GROUND ROD.
   E. FIRE EXTINGUISHER.
   F. REELS WITH AC PWR CABLE W300 AND GND CABLE W307.
   G. NINE (9) TAPE REELS AND TAPES (COMPARTMENT DOOR CLOSED).
   H. VEHICLE BOARDING LADDER.
   J. FOUR (4) TIE DOWN BOLTS FOR INTERNAL MECHANISM FOR TELEPRINTER.
   K. FOUR (4) TIE DOWN BOLTS FOR INTERNAL MECHANISM FOR TELEPRINTER PAPER TAPE PUNCH.
   L. FOUR (4) TIE DOWN STRAPS FOR ECU.
   M. TWO (2) CHAIRS AND HAMMER SECURED TO FLOOR
   N. PLASTIC CHAD CHUTE AND LANTERN.
   P. ACCESSORY SHELVES, MAINTENANCE SHELF, MAINT TELEPHONE AND PROCESSOR COVER.
2. REMOVE TAPE WINDER WITH BRACKET FROM THE ROADSIDE VERTICAL POST NO 2 AND RELOCATE ON BRACKETRY BETWEEN CURBSIDE VERTICAL POST NO.6 AND THE FRONT WALL PER SECTIONAL PLANVIEW
3. LIFT TELEPRINTER AND TELEPRINTER PAPER TAPE PUNCH, HINGED PLASTIC COVERS AND MOVE CARRIAGES TO END POSITION (RIGHT OR LEFT) AND SECURE WITH WIRE OR OTHER SUITABLE MEANS.
4. SECURE ALL EXTERNAL DOORS.
5. APPLY FIND NO. 29 TO SCREW THREAD AS INDICATED.

NOTES CONT:

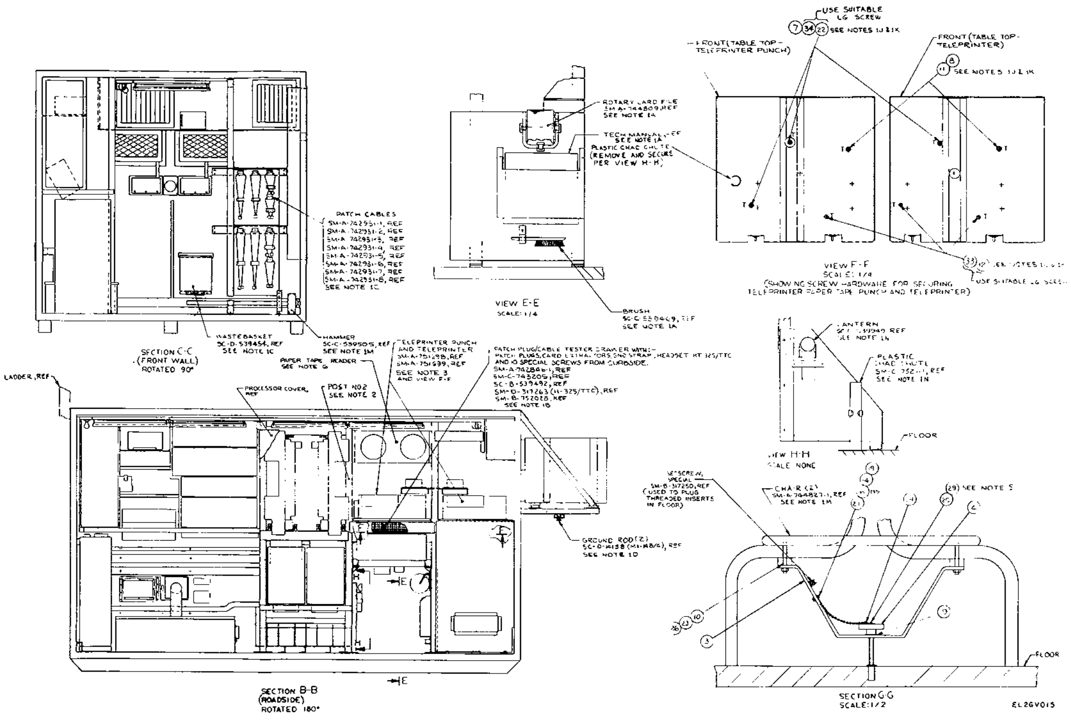
6. TIE TOGETHER WITH WIRE OR OTHER SUITABLE MEANS IN THE UPPERMOST POSITION THE TENSION ARMS OF THE PAPER TAPE READER.

TM 11-5805-628-12/NAVELEX 0967-462-8070

FO-2 (2) AN/TTC-38(V)1 component stowage positions (sheet 2 of 2)

Figure FO-2(2). AN/TCC-38(V)1 component stowage positions.

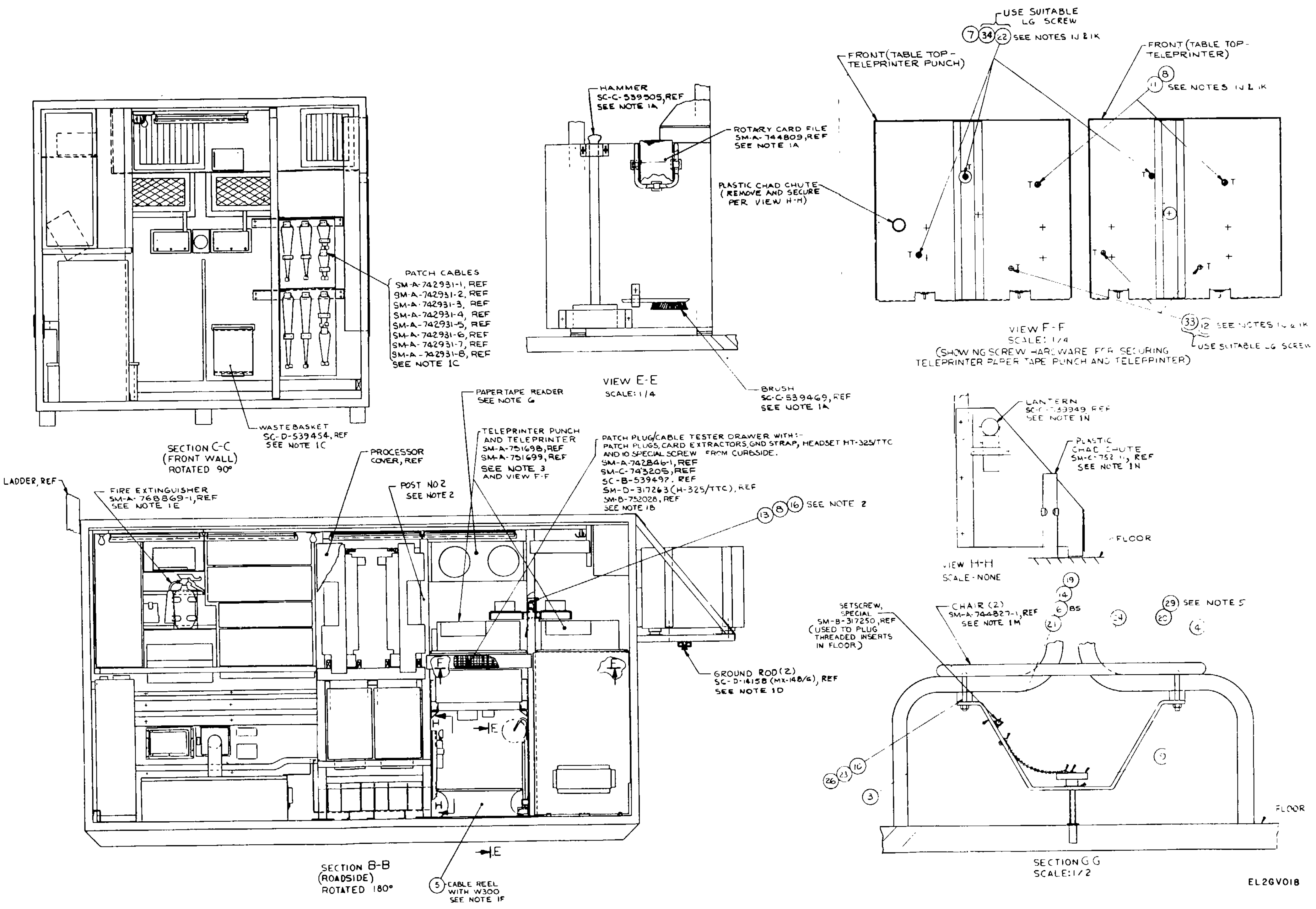
PARTS LIST			
Find No.	Qty Req'd	Part or Identifying No.	Nomenclature or Description
1	X	DL SM-B-742407	Central Office, Telephone, Automatic AN/TTC-38 (V)1
3	2	SM-D-768931	Bracket, Chair
4	2	SM-B-768933	Knob, Altered
5	2	RC-435 ( )/G	Reel, Cable
6	4	MS15795-807	Washer, Flat
7	3	MS15795-808	Washer, Flat
8	14	MS15795-810	Washer, Flat
9	2	MS15795-812	Washer, Flat
10	8	MS15795-818	Washer, Flat
11	2	MS24622-61	Screw, Tapping, THK Forming, Type B, Pan HD
12	3	MS24693-C279	Screw, Machine, Flat, CSK HD, 100°
14	2	MS35338-137	Washer, Lock-Spring
15	2	MS35338-138	Washer, Lock-Spring
16	10	MS35338-139	Washer, Lock-Spring
18	2	MS15795-815	Washer, Flat
19	2	MS35649-284	Nut, Plain, Hex
20	2	MS51957-45	Screw, Machine-Pan Head
21	2	MS51957-46	Screw, Machine-Pan Head
22	5	MS51958-69	Screw, Machine-Pan Head
23	8	MS51972-5	Nut, Plain, Hex
24	2	NAS1201C10B12B	Chain Assembly
25	2	SM-A-744832-6	Strap, Webbing
26	4	NAS3108C9-16	Bolt-U
27	2	SC-B-543411	Knob Assembly
28	2	SC-D-582426	Bracket, Boarding Ladder
29	AR	Grade C	Sealing Compound
33	3	MS24693-C277	Screw, Machine, Flat, CSK HD, 100°
34	3	MS51958-68	Screw, Machine-Pan Head
35	10	MS35307-308	Screw, Cap, Hexagon Head
37	2	MS51958-65	Screw, Machine-Pan Head
38	1	TM-5-4120-243-14	Manual, Maintenance/Operational Air Cond, 18000 BTU
39	1	SM-C-768930	Rod, Reel Tie Down



TM 11-5805-628-12/NAVELEX 0967-462-8070

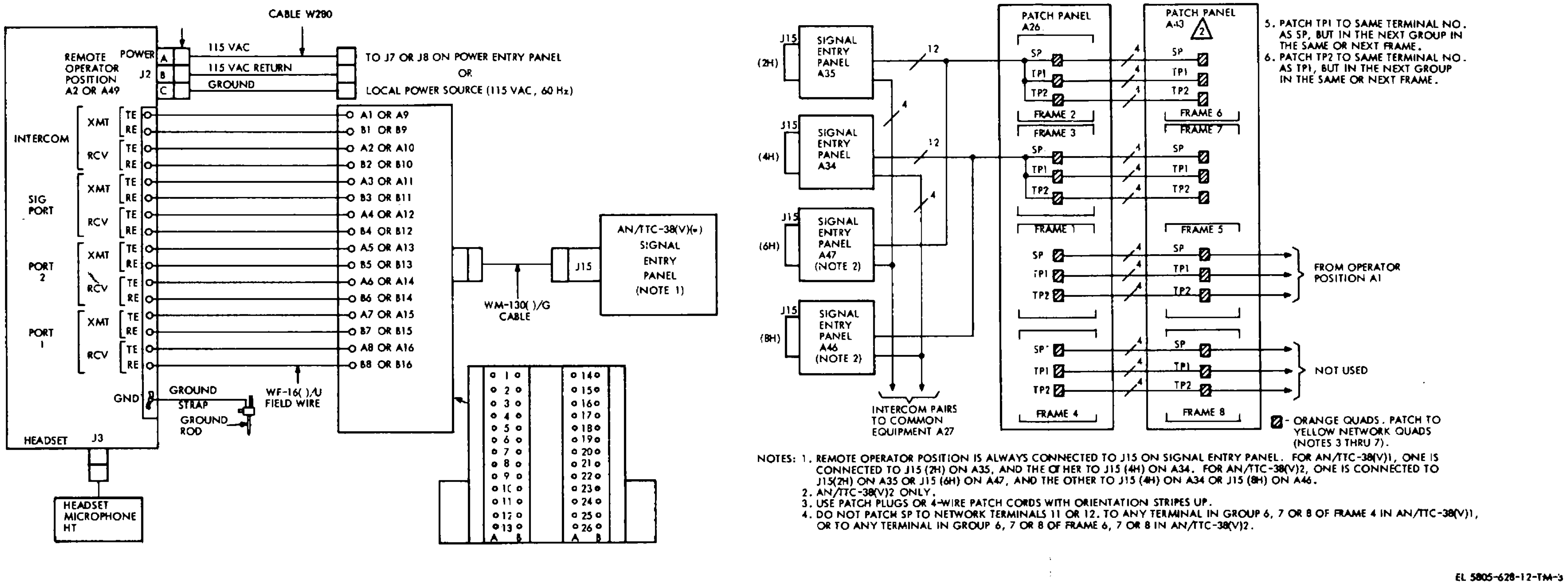
FO-2 (1) AN/TTC-38(V)1 component stowage positions (sheet 1 of 2)

Figure FO-3(1). AN/TCC-38(V)2 component stowage positions.



FO-3 (2) AN/TTC-38(V)2 component stowage positions (sheet 2 of 2)

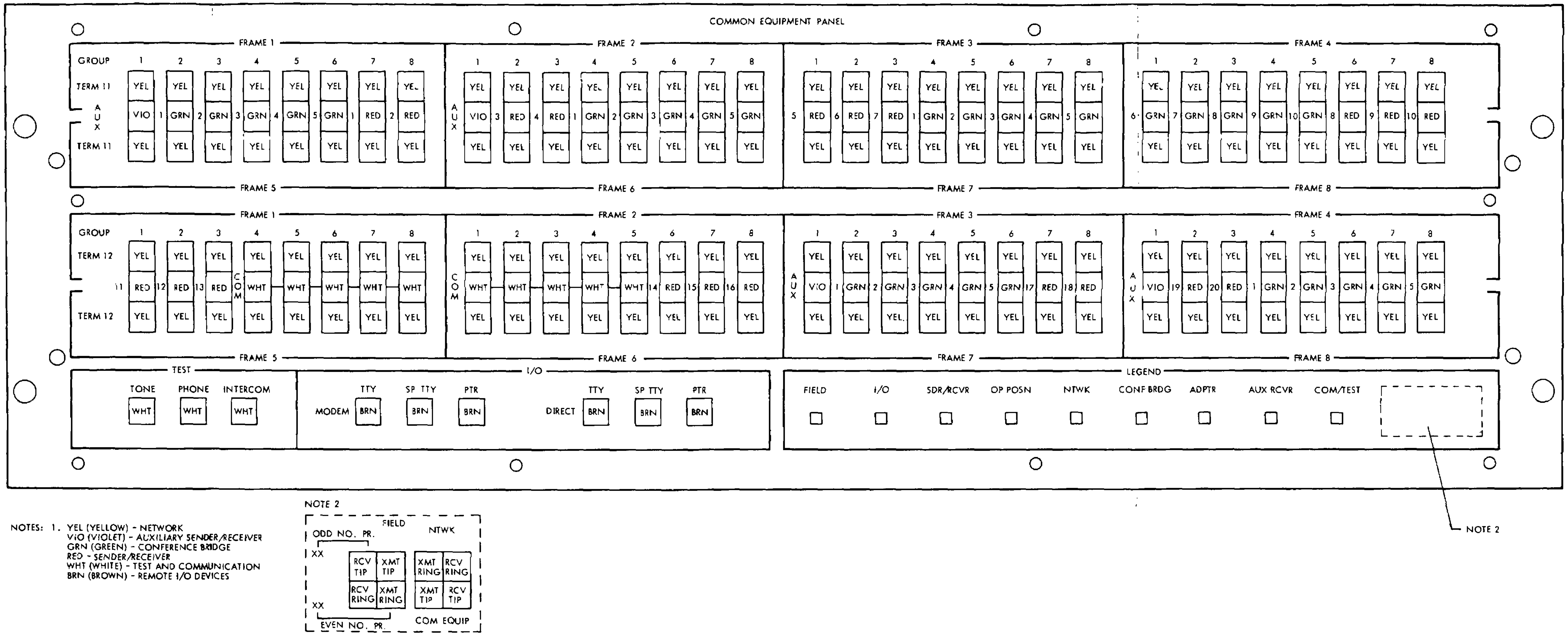
Figure FO-3(2). AN/TCC-38(V)2 component stowage positions.



5. PATCH TP1 TO SAME TERMINAL NO. AS SP, BUT IN THE NEXT GROUP IN THE SAME OR NEXT FRAME.
6. PATCH TP2 TO SAME TERMINAL NO. AS TP1, BUT IN THE NEXT GROUP IN THE SAME OR NEXT FRAME.

NOTES:
1. REMOTE OPERATOR POSITION IS ALWAYS CONNECTED TO J15 ON SIGNAL ENTRY PANEL. FOR AN/TTC-38(V)1, ONE IS CONNECTED TO J15 (2H) ON A35, AND THE OTHER TO J15 (4H) ON A34. FOR AN/TTC-38(V)2, ONE IS CONNECTED TO J15(2H) ON A35 OR J15 (6H) ON A47, AND THE OTHER TO J15 (4H) ON A34 OR J15 (8H) ON A46.
2. AN/TTC-38(V)2 ONLY.
3. USE PATCH PLUGS OR 4-WIRE PATCH CORDS WITH ORIENTATION STRIPES UP.
4. DO NOT PATCH SP TO NETWORK TERMINALS 11 OR 12. TO ANY TERMINAL IN GROUP 6, 7 OR 8 OF FRAME 4 IN AN/TTC-38(V)1, OR TO ANY TERMINAL IN GROUP 6, 7 OR 8 OF FRAME 6, 7 OR 8 IN AN/TTC-38(V)2.

Figure FO-4. Remote operator position installation.



NOTES: 1. YEL (YELLOW) - NETWORK
VIO (VIOLET) - AUXILIARY SENDER/RECEIVER
GRN (GREEN) - CONFERENCE BRIDGE
RED - SENDER/RECEIVER
WHT (WHITE) - TEST AND COMMUNICATION
BRN (BROWN) - REMOTE I/O DEVICES

EL 5805-628-12-TM-62

Figure FO-5. Common equipment panel, front panel.

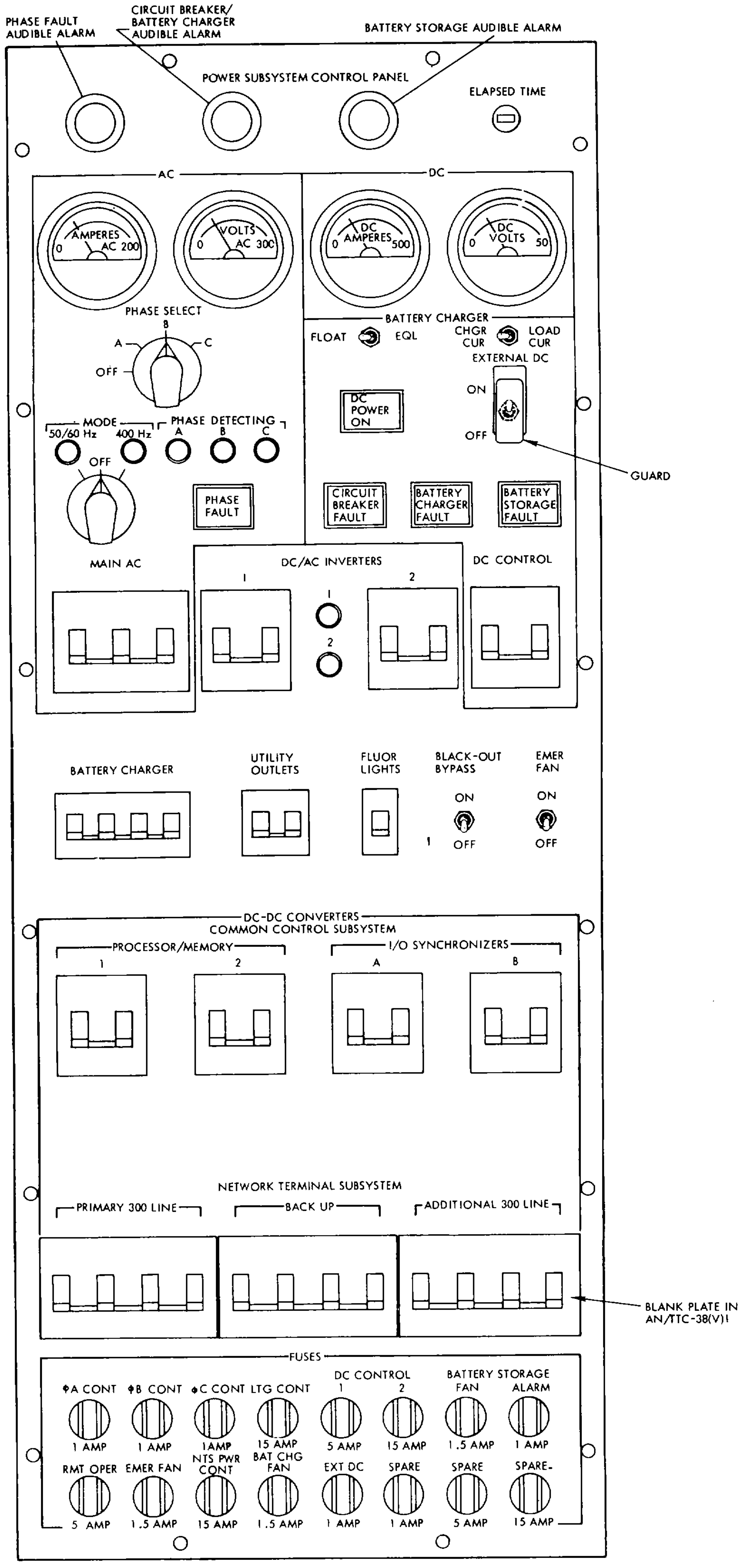
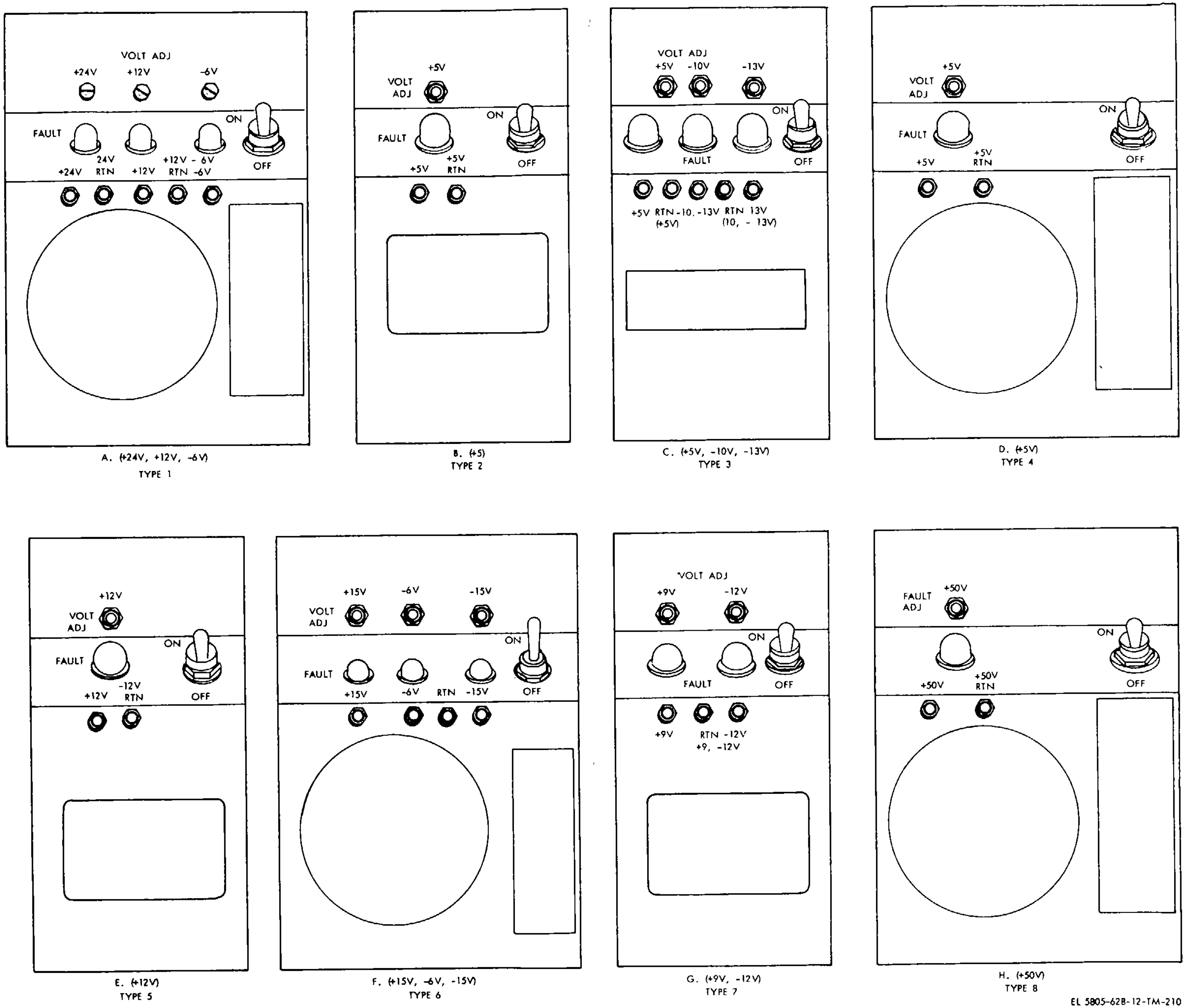


Figure FO-6. Power subsystem control panel.



A. (+24V, +12V, -6V)
TYPE 1

B. (+5)
TYPE 2

C. (+5V, -10V, -13V)
TYPE 3

D. (+5V)
TYPE 4

E. (+12V)
TYPE 5

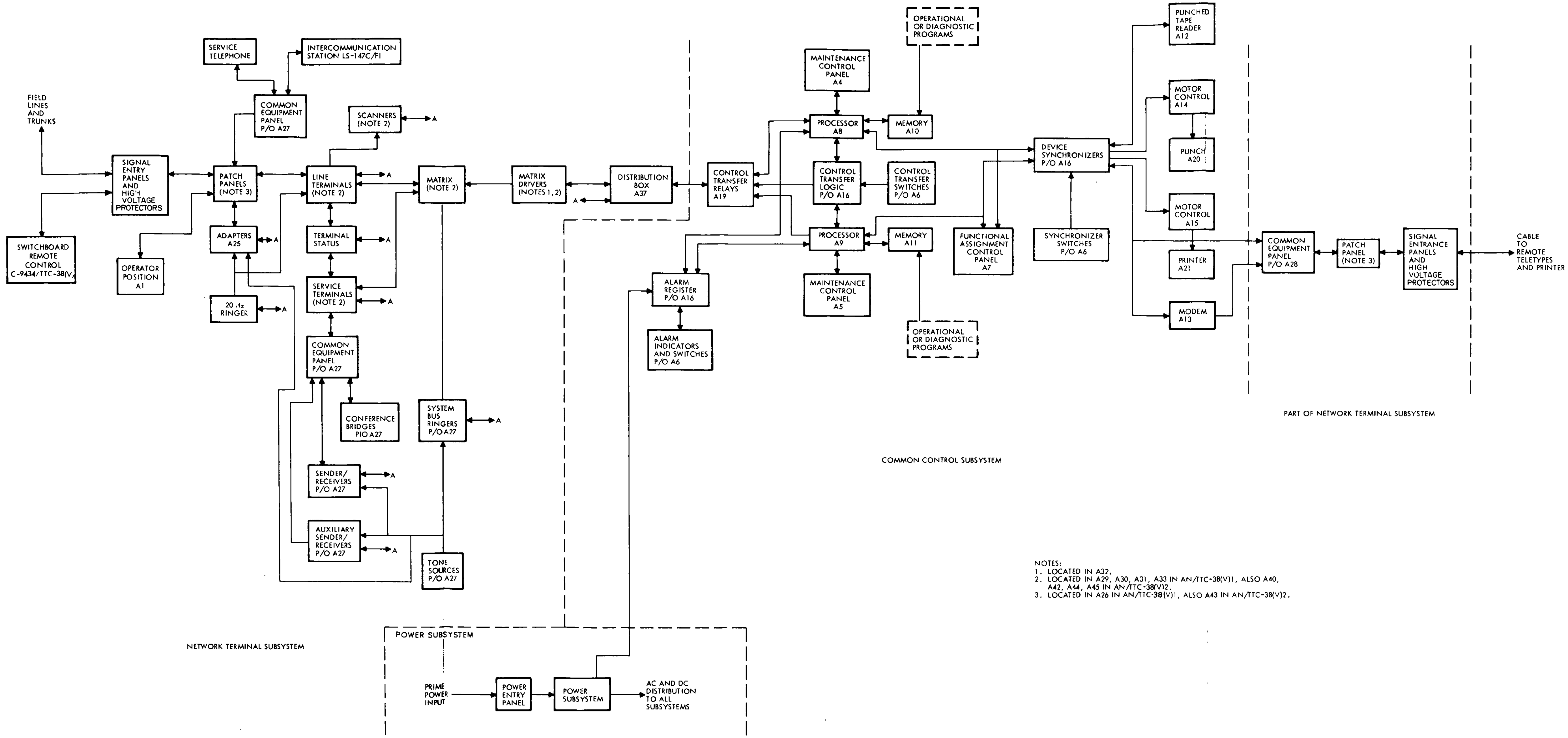
F. (+15V, -6V, -15V)
TYPE 6

G. (+9V, -12V)
TYPE 7

H. (+50V)
TYPE 8

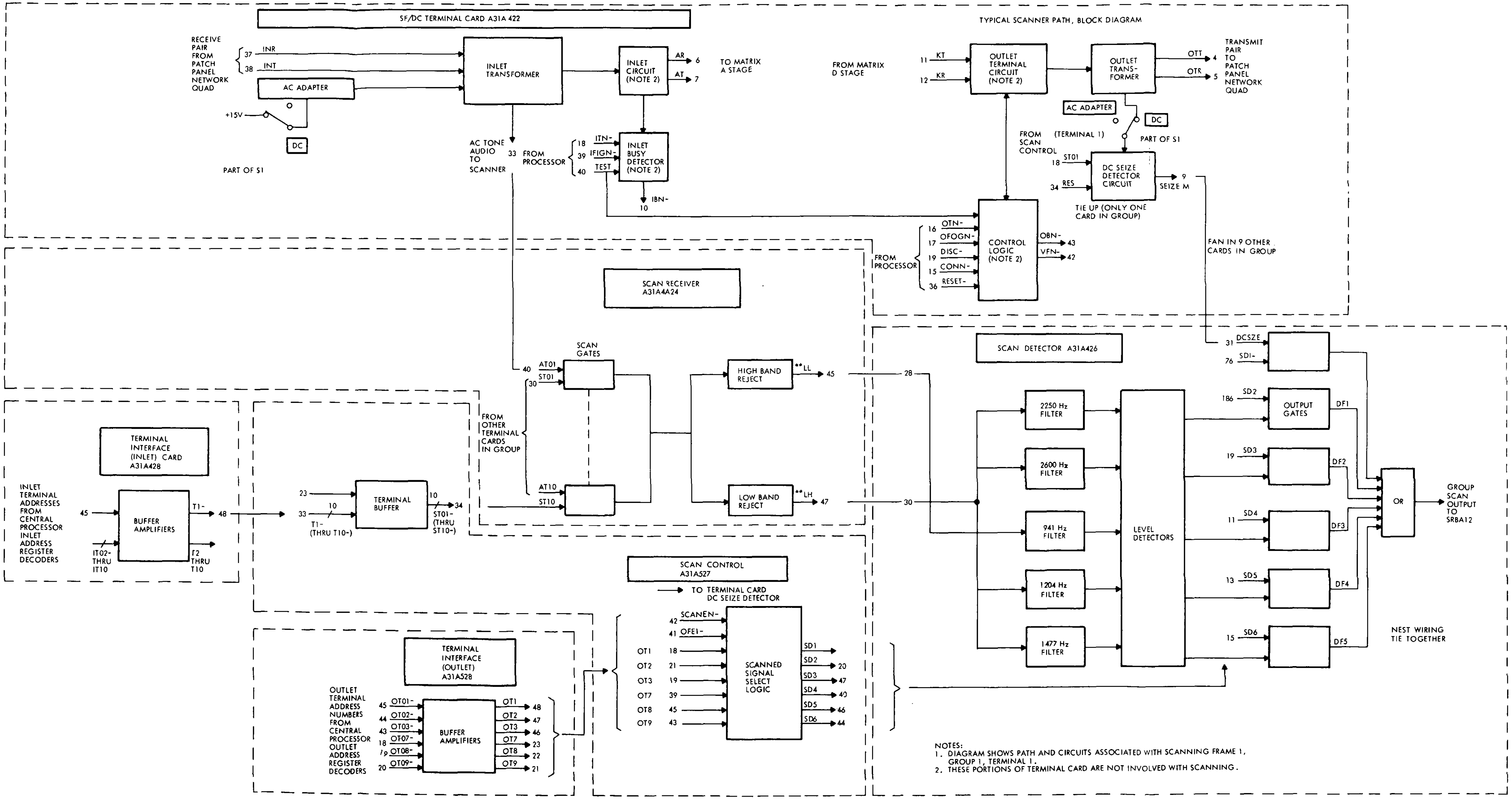
EL 5805-628-12-TM-210

Figure FO-7. Dc-to-dc converters, front panels.



NOTES:
1. LOCATED IN A32.
2. LOCATED IN A29, A30, A31, A33 IN AN/TTC-38(V)1, ALSO A40, A42, A44, A45 IN AN/TTC-38(V)2.
3. LOCATED IN A26 IN AN/TTC-38(V)1, ALSO A43 IN AN/TTC-38(V)2.

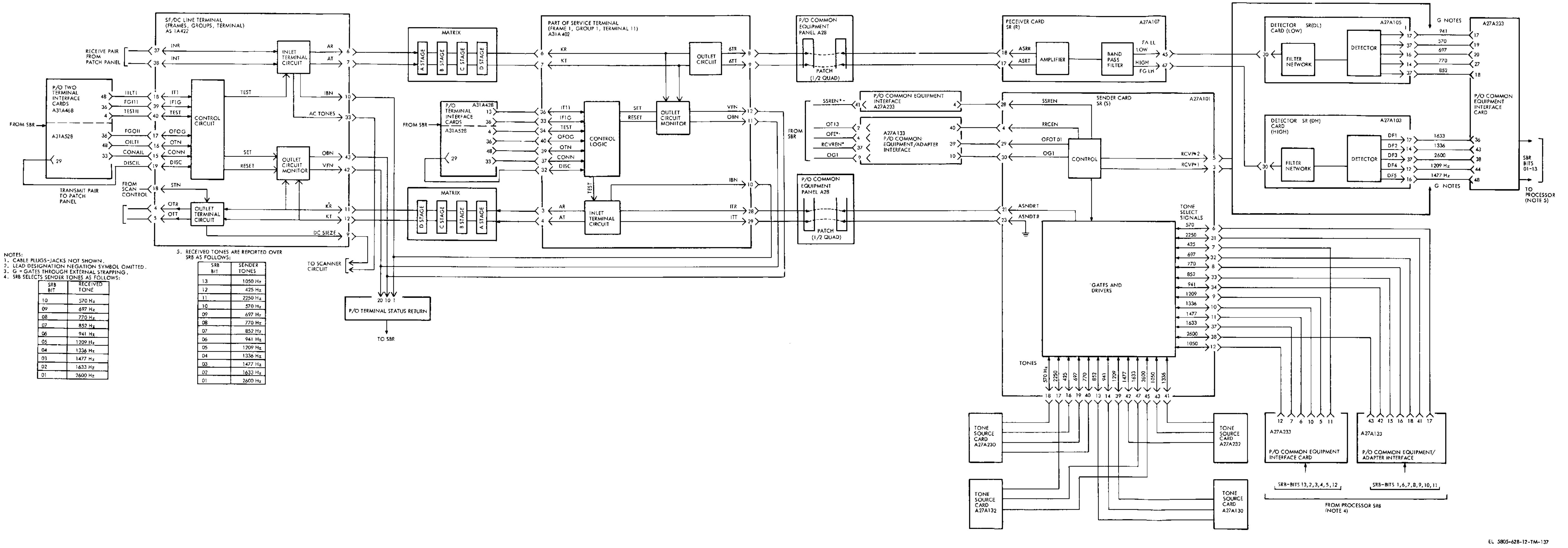
Figure FO-8. Automatic Telephone Central Office AN/TTC-38(V)(*), block diagram.



NOTES:
1. DIAGRAM SHOWS PATH AND CIRCUITS ASSOCIATED WITH SCANNING FRAME 1, GROUP 1, TERMINAL 1.
2. THESE PORTIONS OF TERMINAL CARD ARE NOT INVOLVED WITH SCANNING.

EL 5805-628-12-TM-136

Figure FO-9. Typical scanner path, block diagram.



NOTES:
1. CABLE PLUGS-JACKS NOT SHOWN.
2. LEAD DESIGNATION NEGATION SYMBOL OMITTED.
3. G = GATES THROUGH EXTERNAL STRAPPING.
4. SRB SELECTS SENDER TONES AS FOLLOWS:

SRB BIT	RECEIVED TONE
10	570 Hz
09	697 Hz
08	770 Hz
07	852 Hz
06	941 Hz
05	1209 Hz
04	1336 Hz
03	1477 Hz
02	1633 Hz
01	2600 Hz

5. RECEIVED TONES ARE REPORTED OVER SRB AS FOLLOWS:

SRB BIT	SENDER TONES
13	1050 Hz
12	425 Hz
11	2250 Hz
10	570 Hz
09	697 Hz
08	770 Hz
07	852 Hz
06	941 Hz
05	1209 Hz
04	1336 Hz
03	1477 Hz
02	1633 Hz
01	2600 Hz

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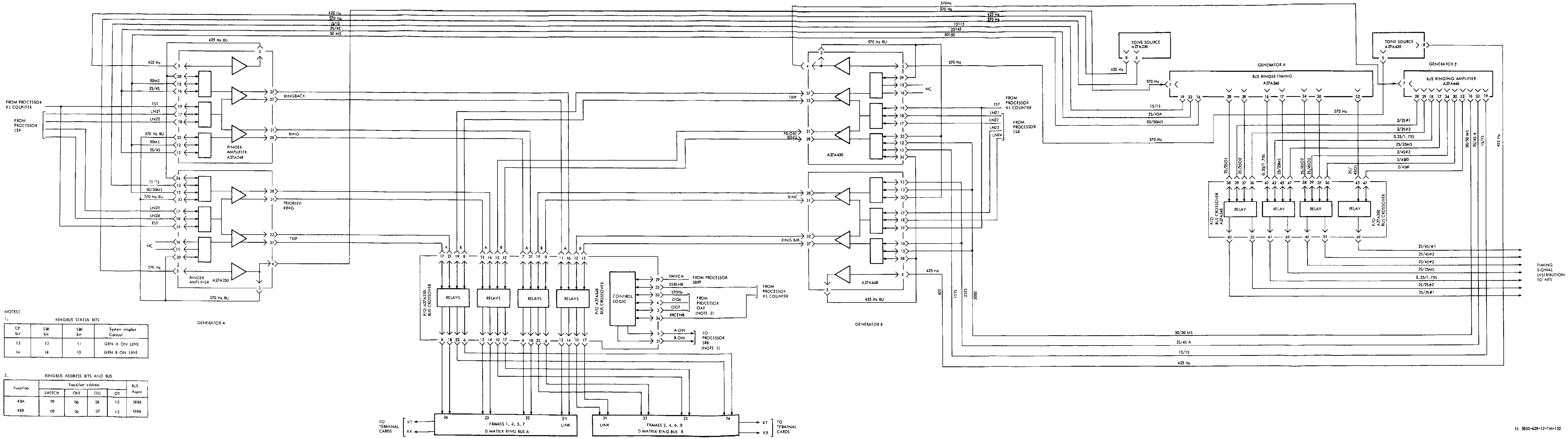
Figure FO-10. Typical sender/receiver path, block diagram.



NOTES:

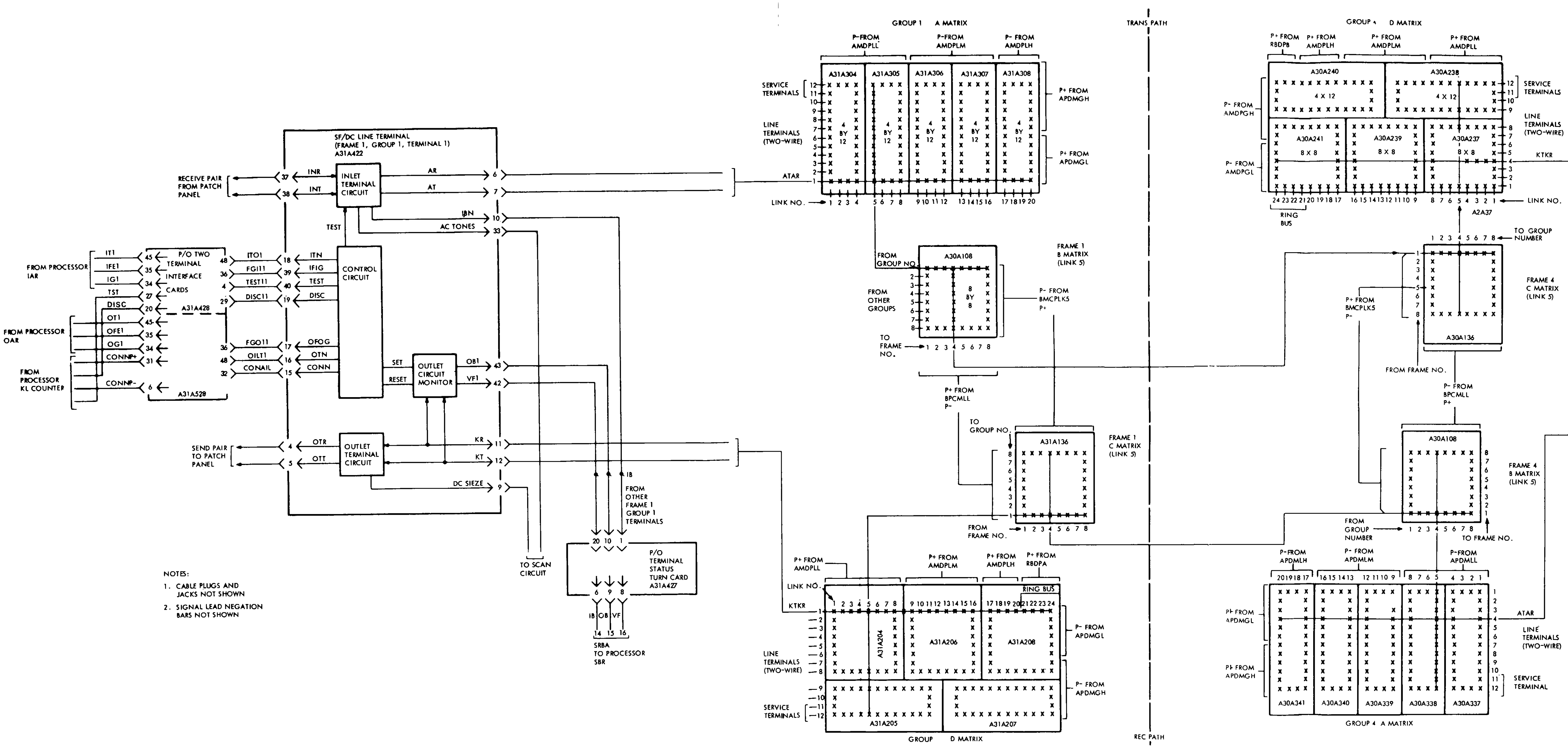
1. RINGBUS STATUS BITS

CP bit	SBR bit	SBR bit	System ringbus Control
13	13	11	GEN A ON LINE
14	14	10	GEN B ON LINE

2. RINGBUS ADDRESS BITS AND BUS

Function	Read/set address				BUS Asgmt
	SWITCH	OFE	OG	OT	
RBA	09	06	06	13	SRBB
RBB	09	06	07	13	SRBB

Figure FO-11. System bus ringer, block diagram.



NOTES:

1. CABLE PLUGS AND JACKS NOT SHOWN
2. SIGNAL LEAD NEGATION BARS NOT SHOWN

Figure FO-12(1). Typical network terminal voice path connection, block diagram (sheet 1 of 3).

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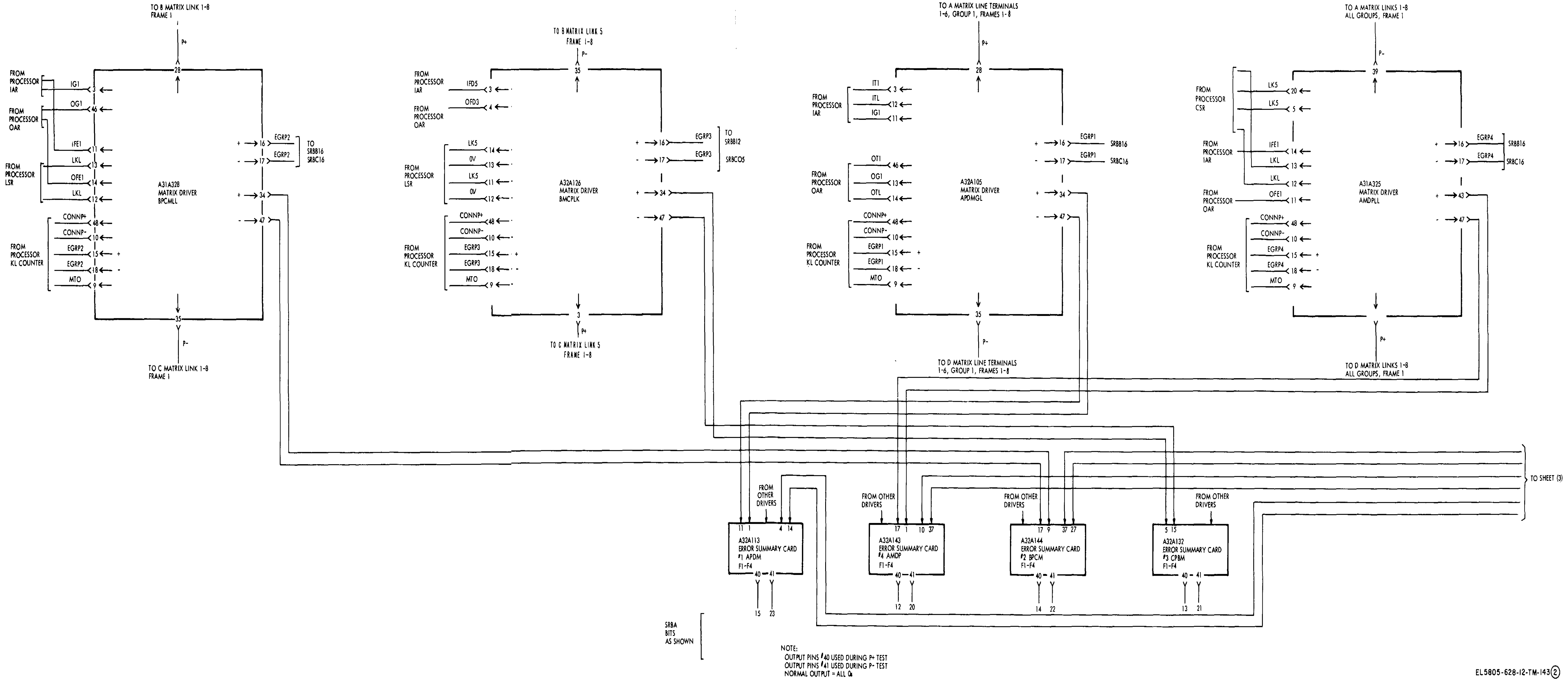


NOTE:
OUTPUT PINS #40 USED DURING P+ TEST
OUTPUT PINS #41 USED DURING P- TEST
NORMAL OUTPUT = ALL 0s

Figure FO-12(2). Typical network terminal voice path connection, block diagram (sheet 2 of 3).

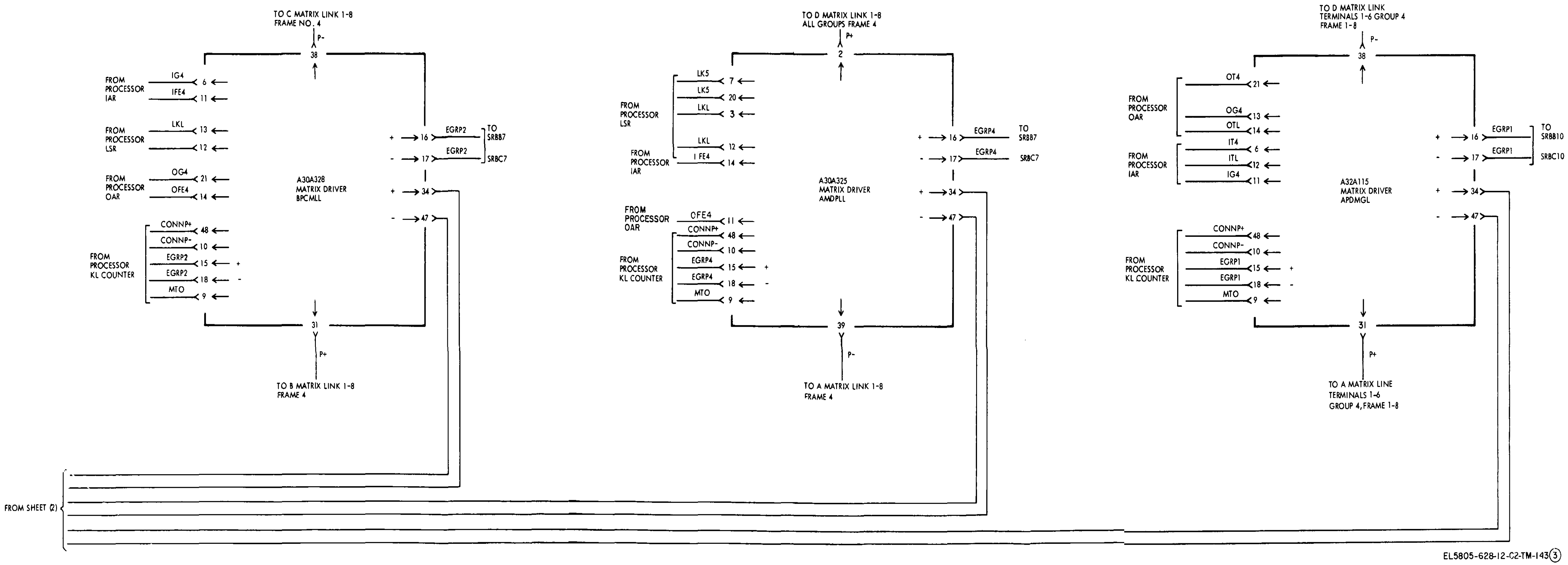
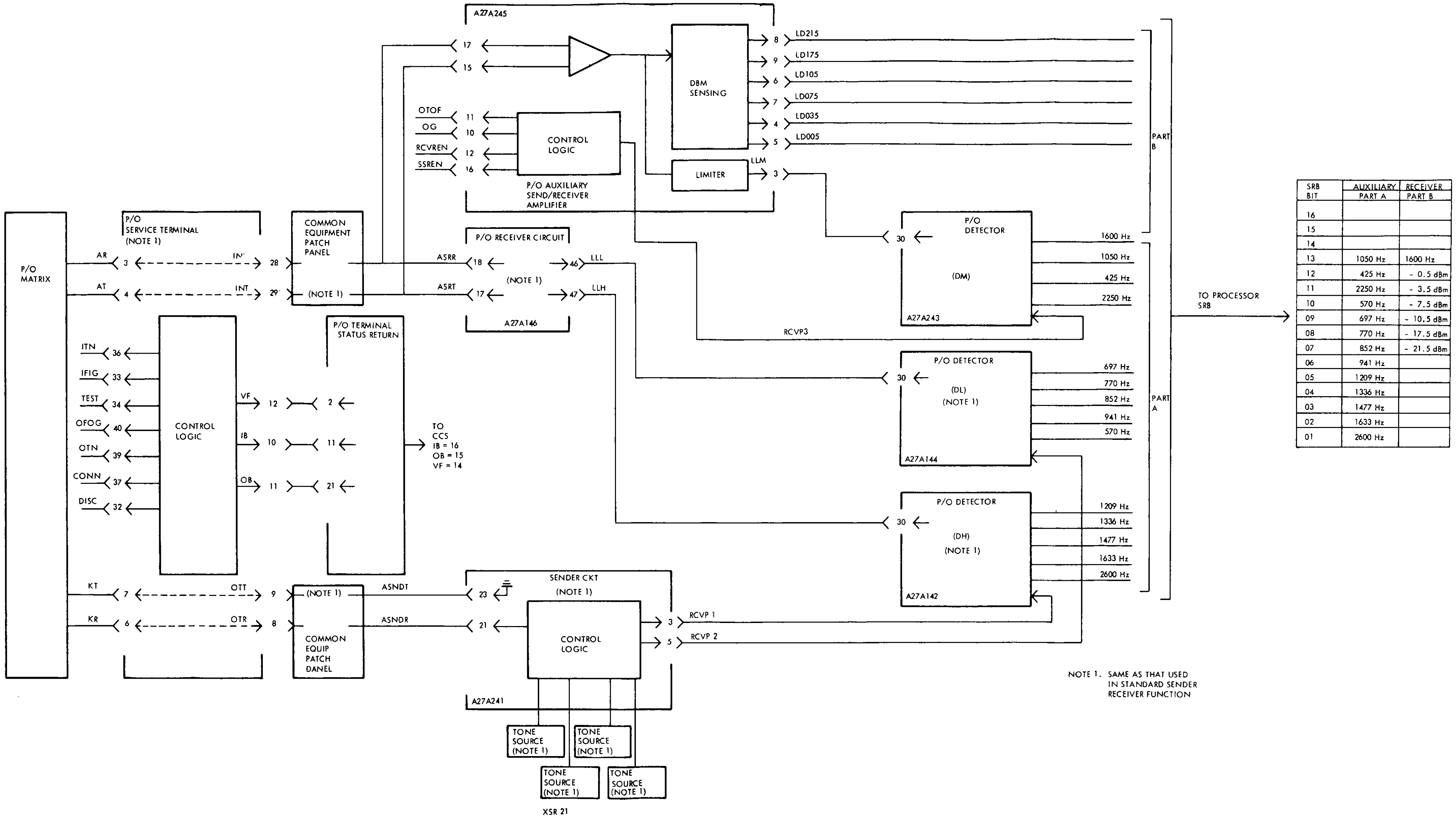


***Figure* FO-12(3). Typical network terminal voice path connection, block diagram (sheet 3 of 3).**

TM 11-5805-628-12/NAVELEX 0967-462-8070



SRB BIT	AUXILIARY PART A	RECEIVER PART B
16		
15		
14		
13	1050 Hz	1600 Hz
12	425 Hz	- 0.5 dBm
11	2250 Hz	- 3.5 dBm
10	570 Hz	- 7.5 dBm
09	697 Hz	- 10.5 dBm
08	770 Hz	- 17.5 dBm
07	852 Hz	- 21.5 dBm
06	941 Hz	
05	1209 Hz	
04	1336 Hz	
03	1477 Hz	
02	1633 Hz	
01	2600 Hz	

NOTE 1. SAME AS THAT USED IN STANDARD SENDER RECEIVER FUNCTION

Figure FO-13. Auxiliary sender/receiver, block diagram.

TM 11-5805-628-12/NAVELEX 0967-462-8070

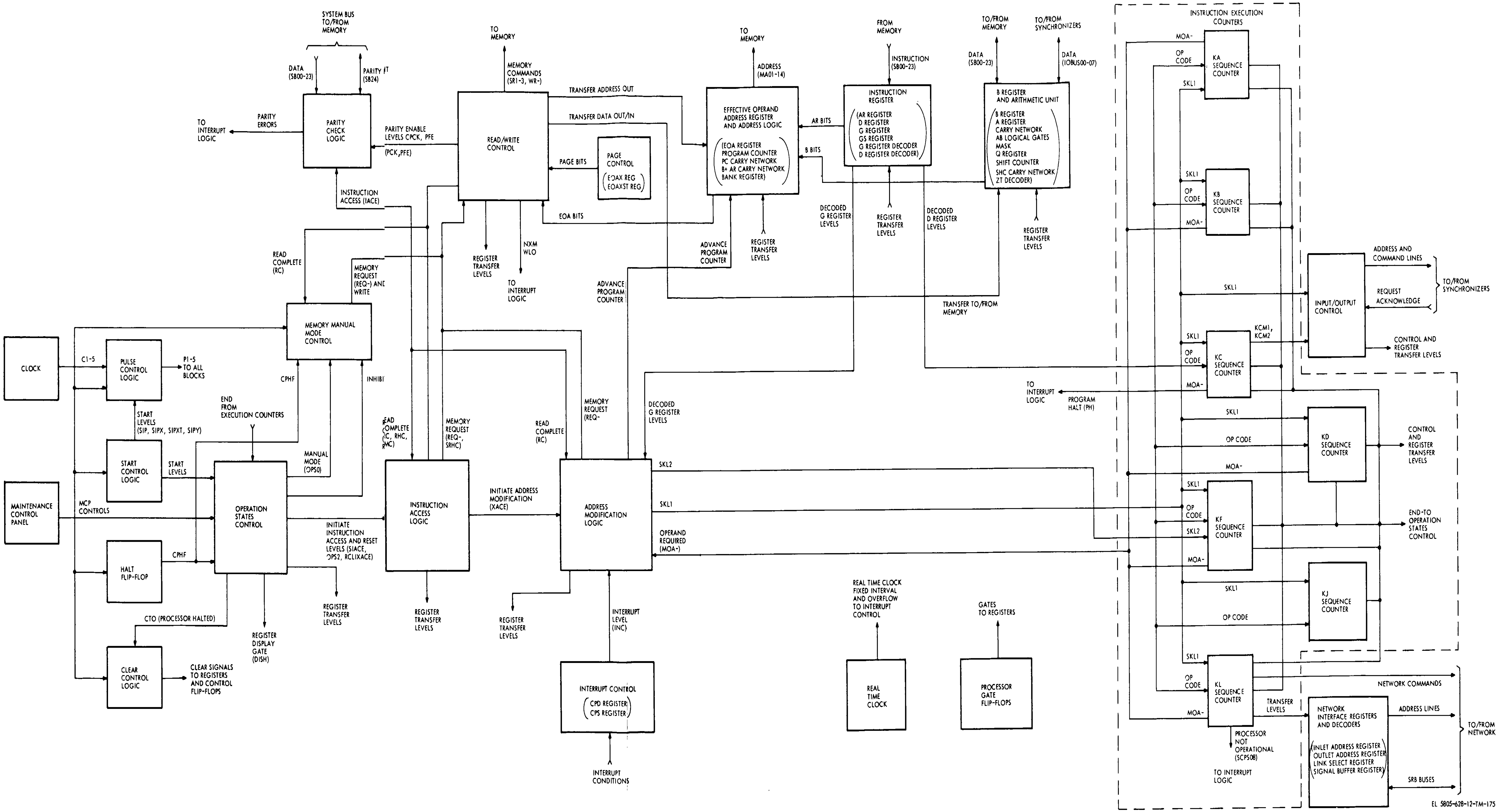


Figure FO-14. Central processor control logic, block diagram.

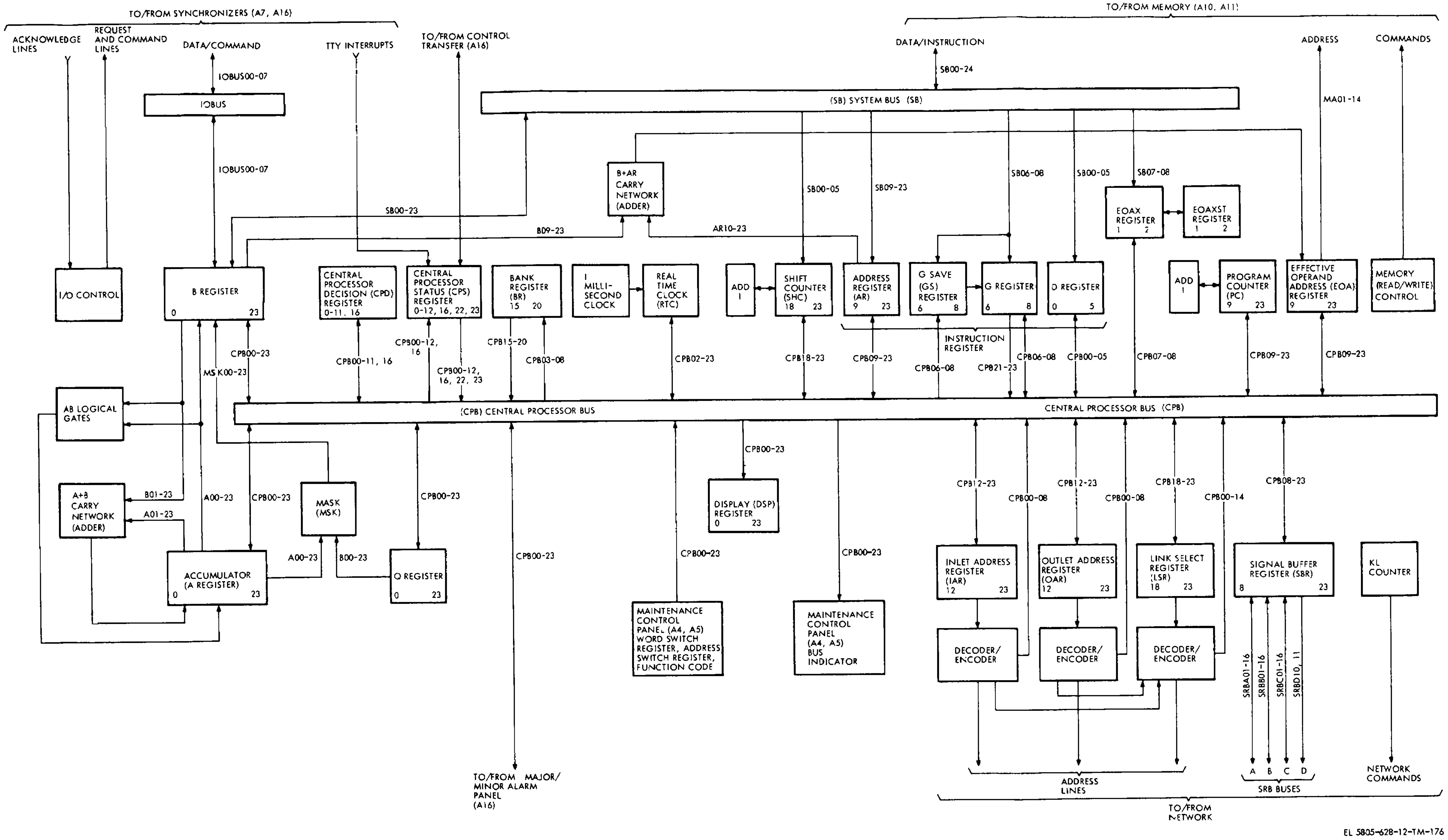
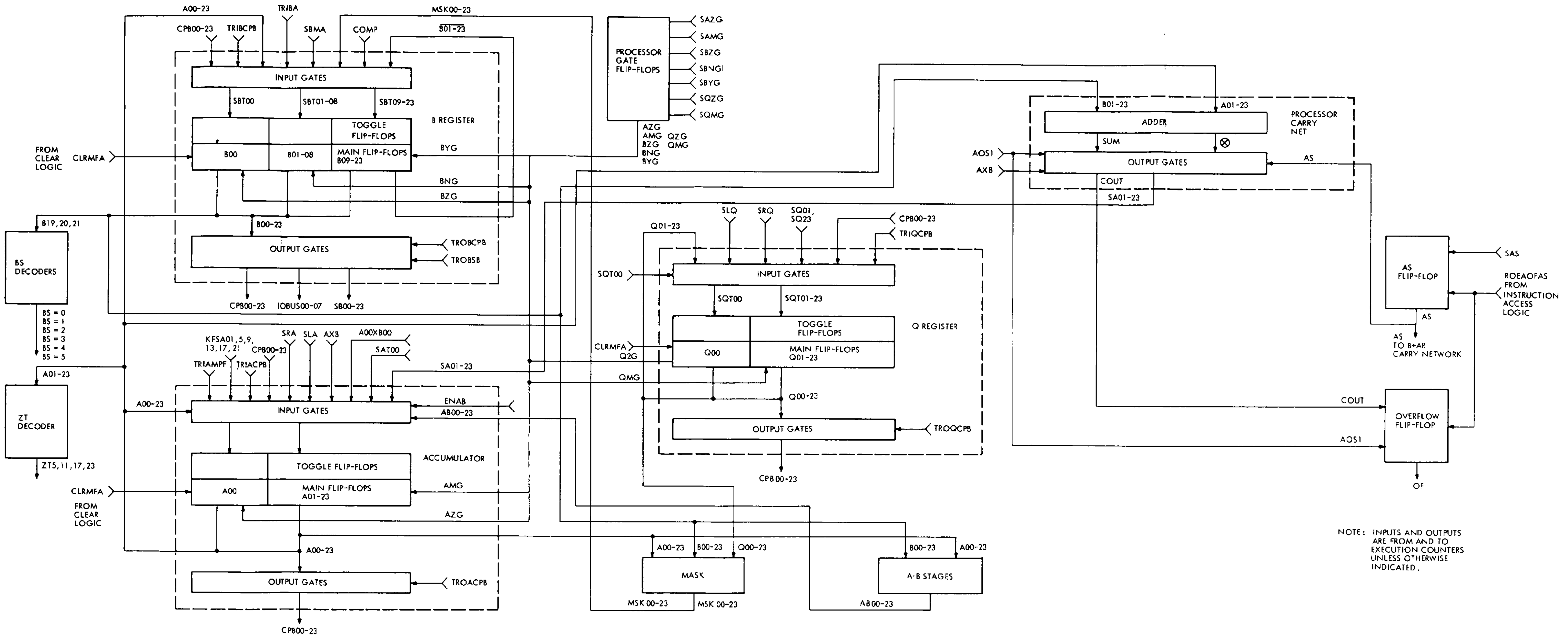


Figure FO-15. Central processor registers and buses, block diagram.



NOTE: INPUTS AND OUTPUTS ARE FROM AND TO EXECUTION COUNTERS UNLESS OTHERWISE INDICATED.

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Figure FO-16. Arithmetic unit, block diagram.

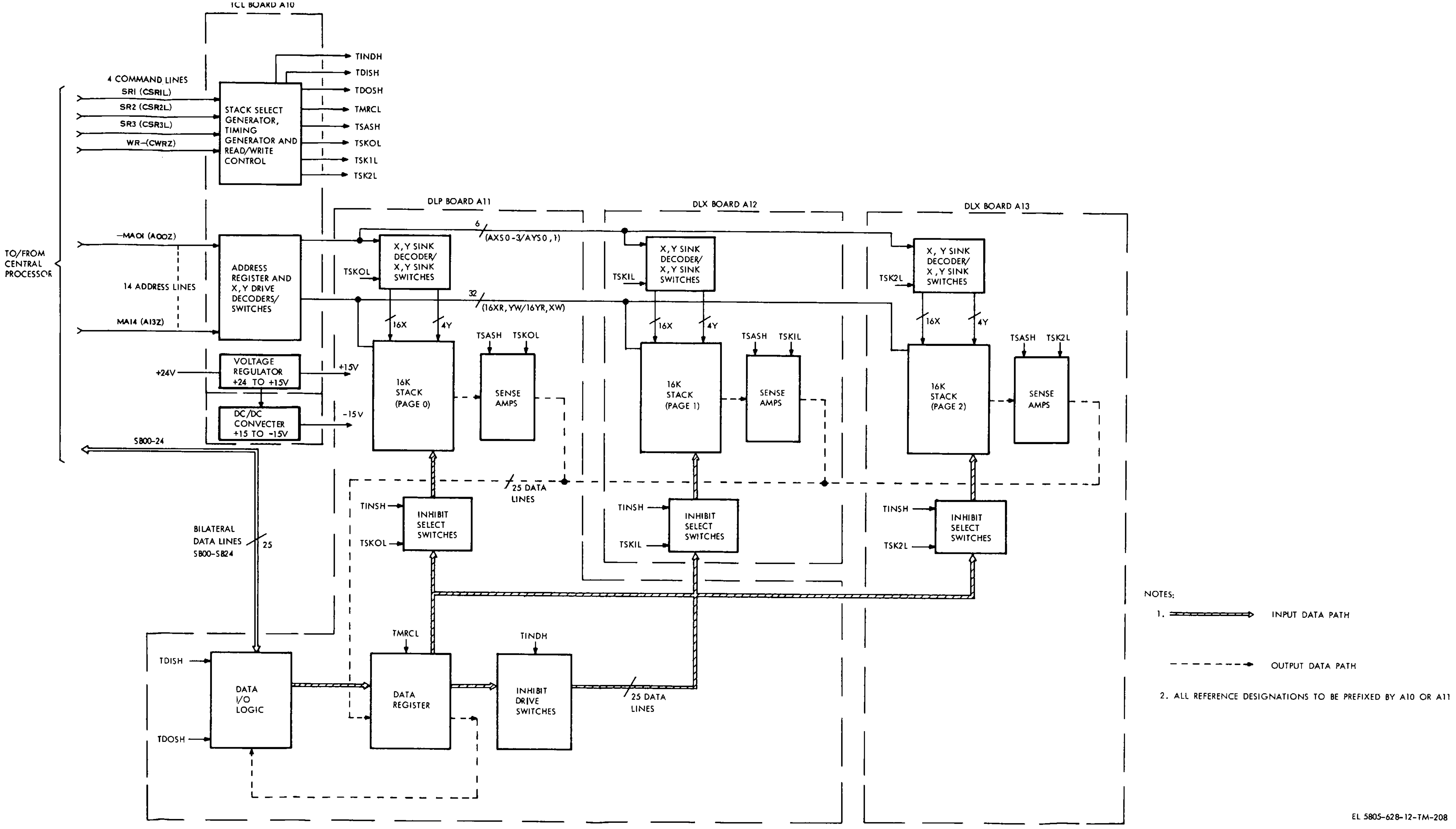


Figure FO-17. Memory, simplified block diagram.

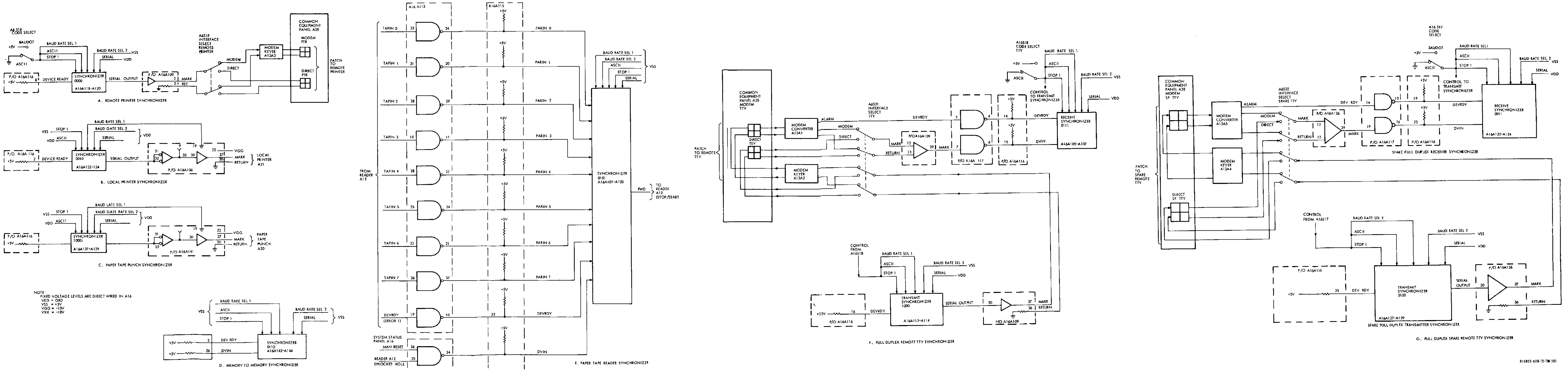


Figure FO-18. Detailed synchronizer interconnections, block diagram.

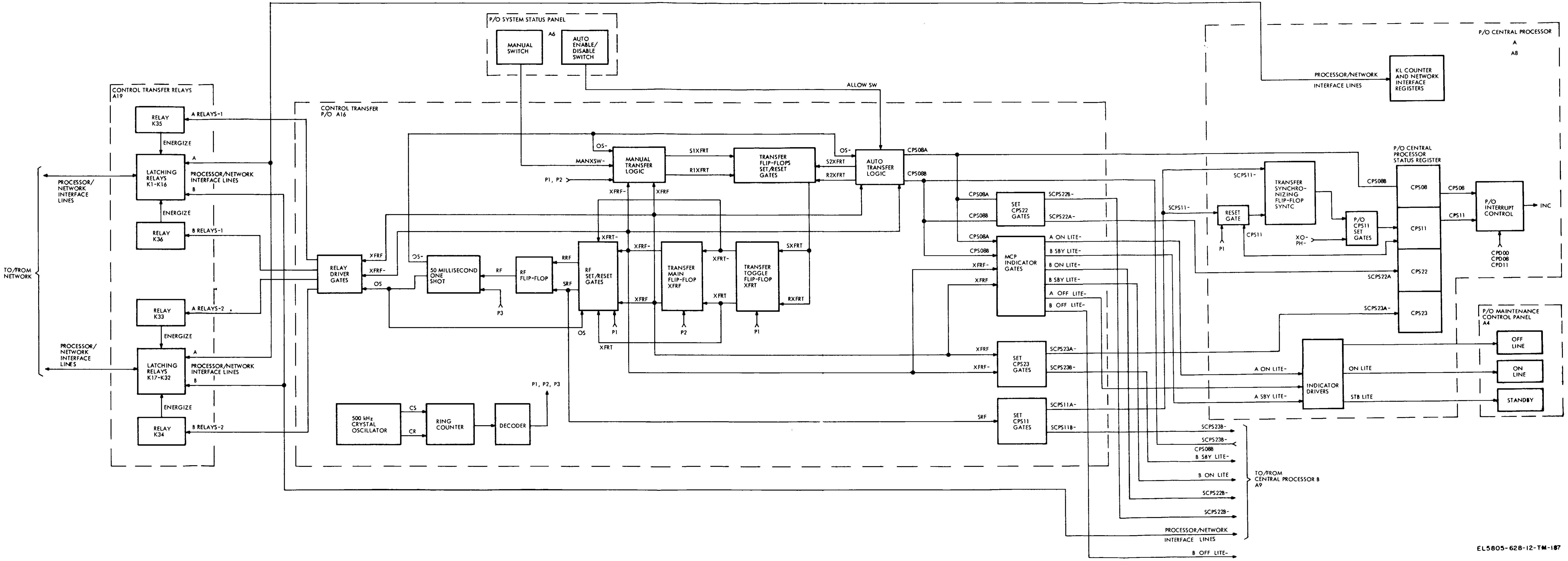
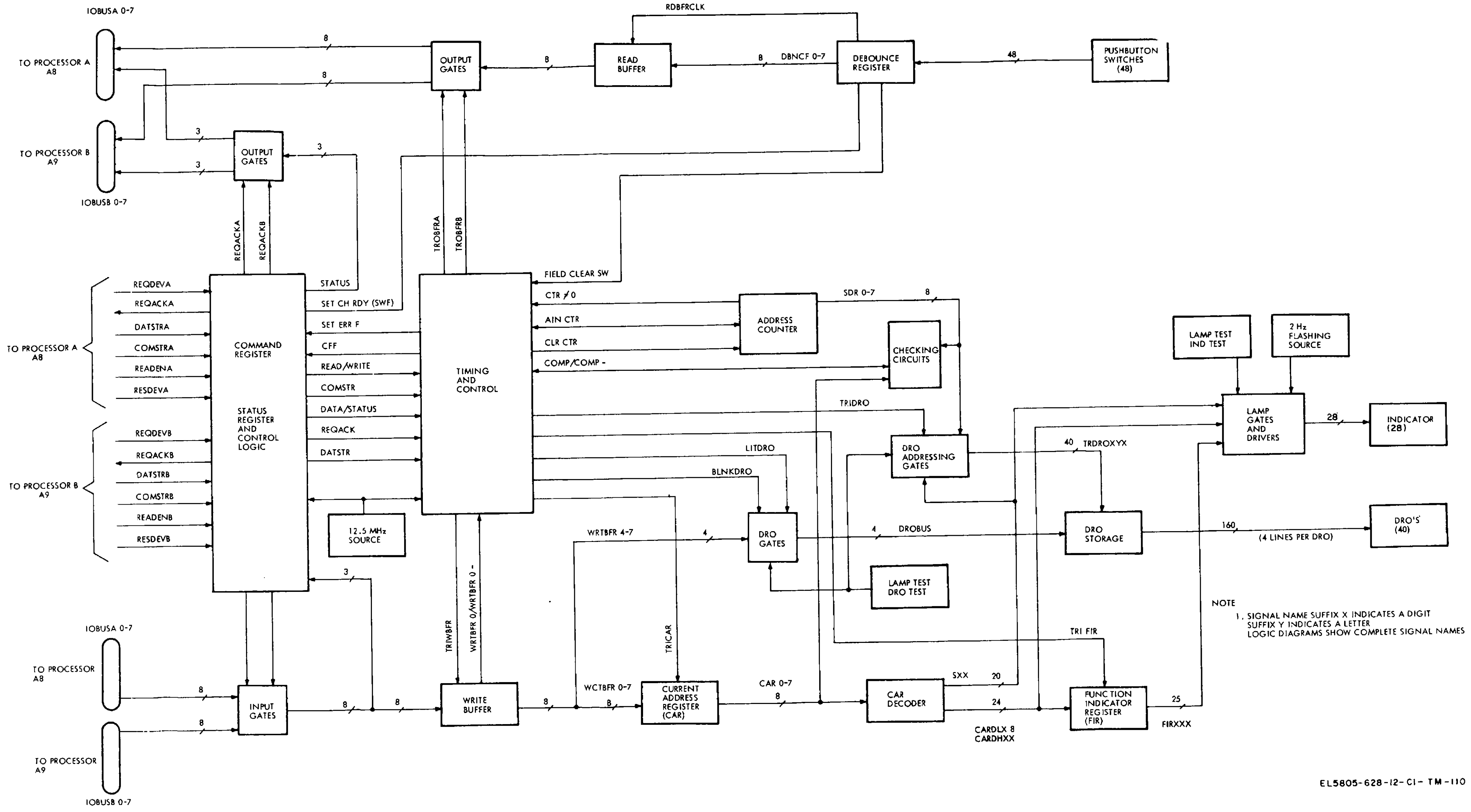


Figure FO-19. Control transfer, block diagram.



NOTE

1. SIGNAL NAME SUFFIX X INDICATES A DIGIT
SUFFIX Y INDICATES A LETTER
LOGIC DIAGRAMS SHOW COMPLETE SIGNAL NAMES

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Figure FO-20. Functional assignment control panel, block diagram.

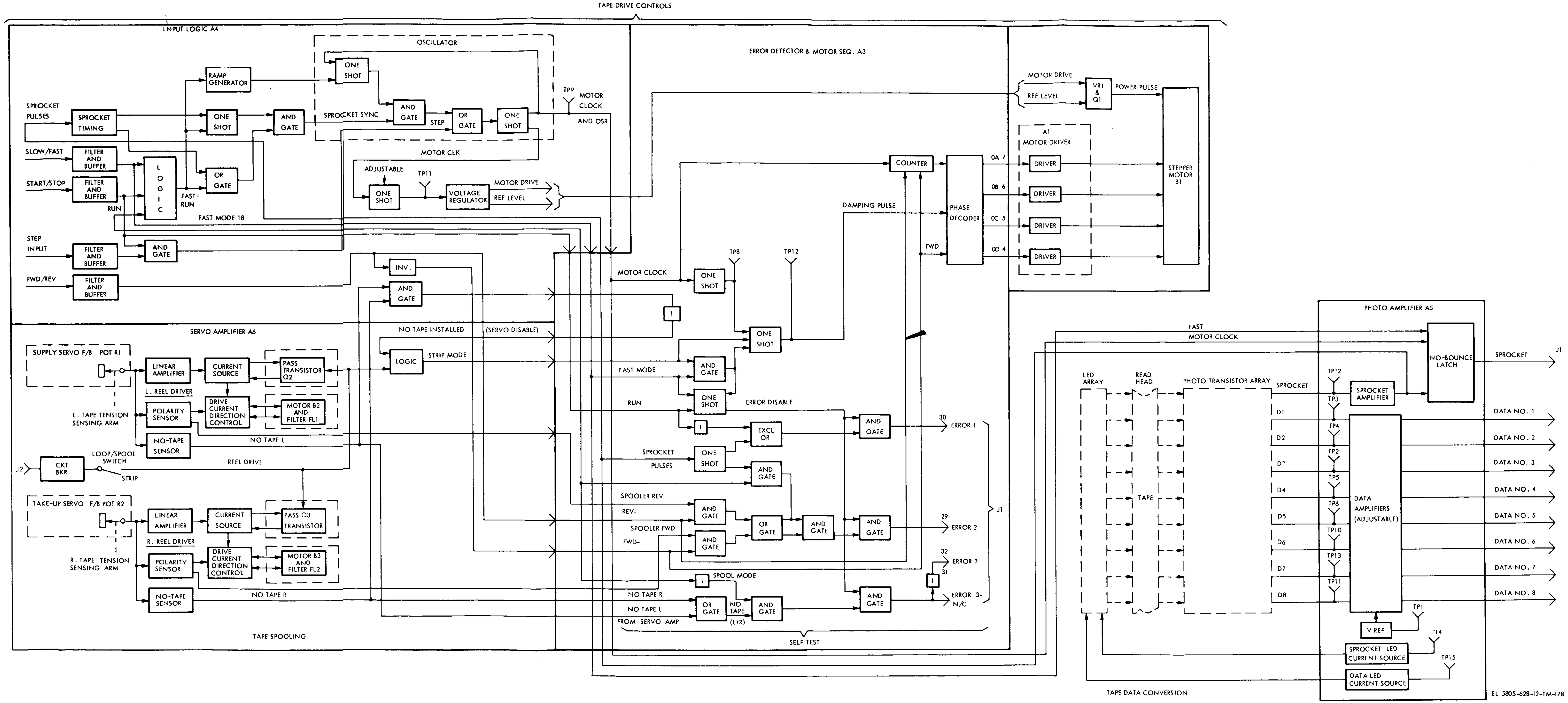
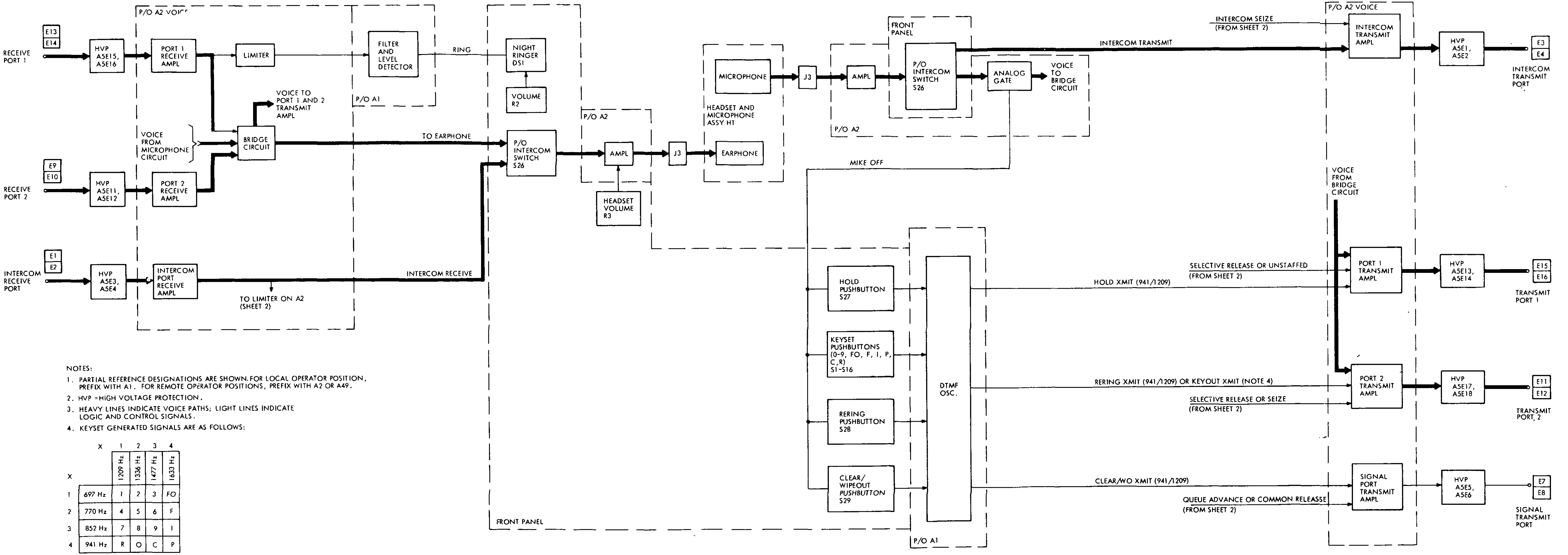


Figure FO-21. Punched tape reader, block diagram.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR LOCAL OPERATOR POSITION, PREFIX WITH A1. FOR REMOTE OPERATOR POSITIONS, PREFIX WITH A2 OR A49.
2. HVP =HIGH VOLTAGE PROTECTION.
3. HEAVY LINES INDICATE VOICE PATHS; LIGHT LINES INDICATE LOGIC AND CONTROL SIGNALS.
4. KEYSET GENERATED SIGNALS ARE AS FOLLOWS:

X		1	2	3	4
X		1209 Hz	1336 Hz	1477 Hz	1633 Hz
1	697 Hz	1	2	3	FO
2	770 Hz	4	5	6	F
3	852 Hz	7	8	9	I
4	941 Hz	R	O	C	P

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Figure FO-22(1). Operator position, block diagram (sheet 1 of 2).

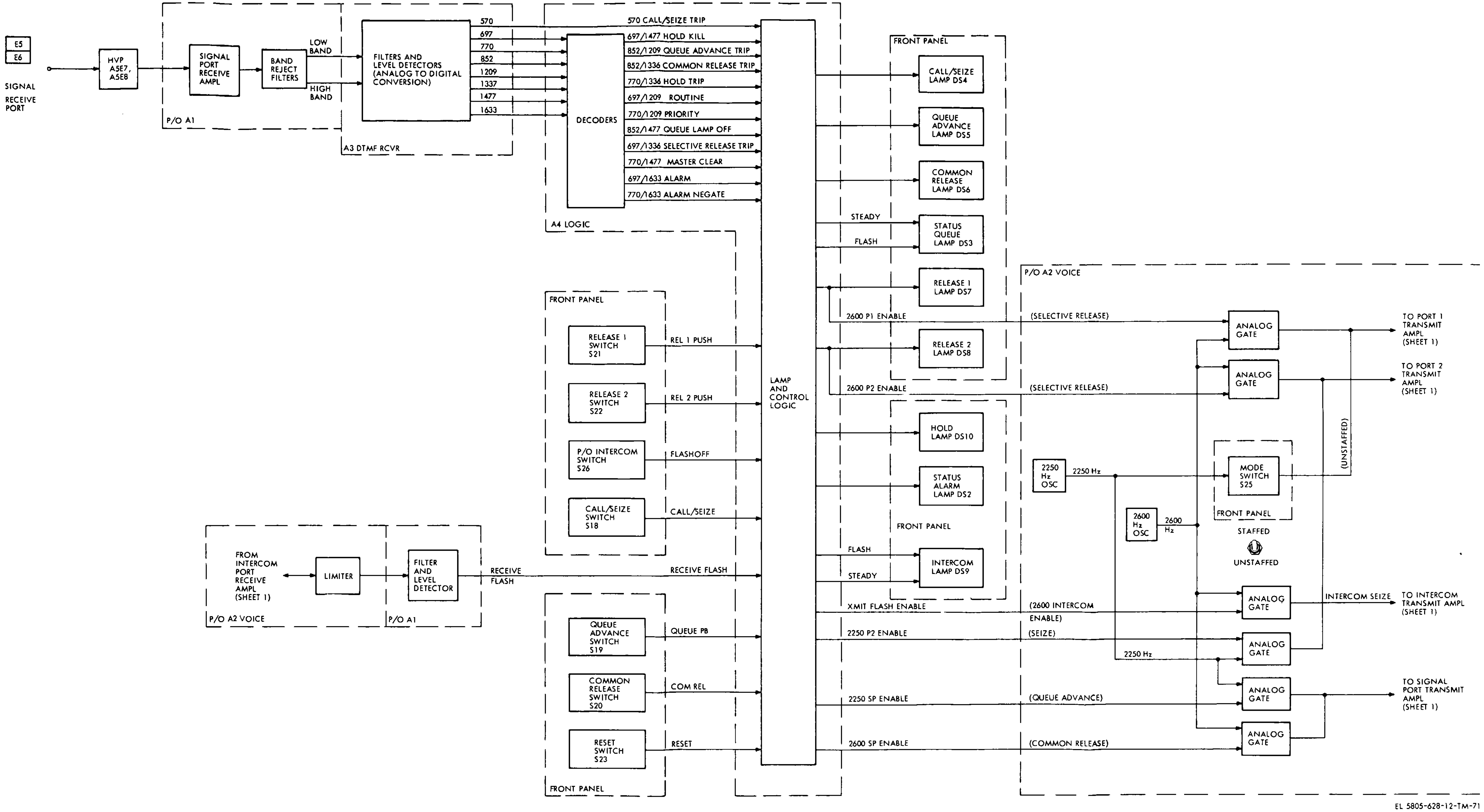
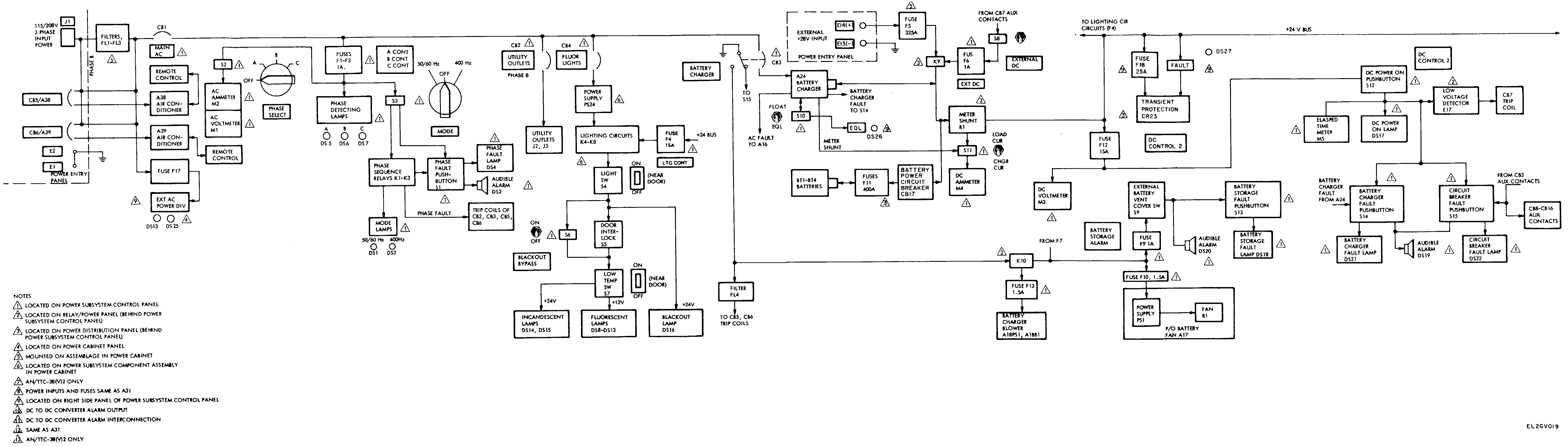


Figure FO-22(2). Operator position, block diagram (sheet 2 of 2).



NOTES

1. LOCATED ON POWER SUBSYSTEM CONTROL PANEL
2. LOCATED ON RELAY/POWER PANEL (BEHIND POWER SUBSYSTEM CONTROL PANEL)
3. LOCATED ON POWER DISTRIBUTION PANEL (BEHIND POWER SUBSYSTEM CONTROL PANEL)
4. LOCATED ON POWER CABINET PANEL
5. MOUNTED ON ASSEMBLAGE IN POWER CABINET
6. LOCATED ON POWER SUBSYSTEM COMPONENT ASSEMBLY IN POWER CABINET
7. AN/TTC-38(V)2 ONLY
8. POWER INPUTS AND FUSES SAME AS A31
9. LOCATED ON RIGHT SIDE PANEL OF POWER SUBSYSTEM CONTROL PANEL
10. DC TO DC CONVERTER ALARM OUTPUT
11. DC TO DC CONVERTER ALARM INTERCONNECTION
12. SAME AS A31
13. AN/TTC-38(V)2 ONLY

EL2GV019

Figure FO-23(1). Power subsystem, block diagram.

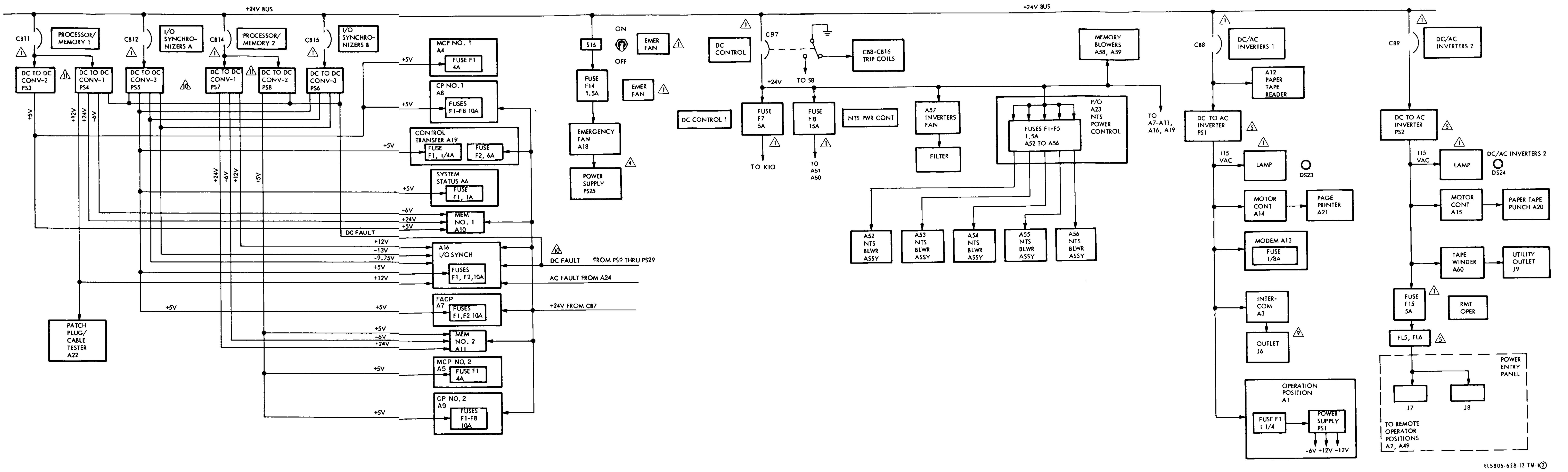


Figure FO-23(2). Power subsystem, block diagram (sheet 2 of 3).

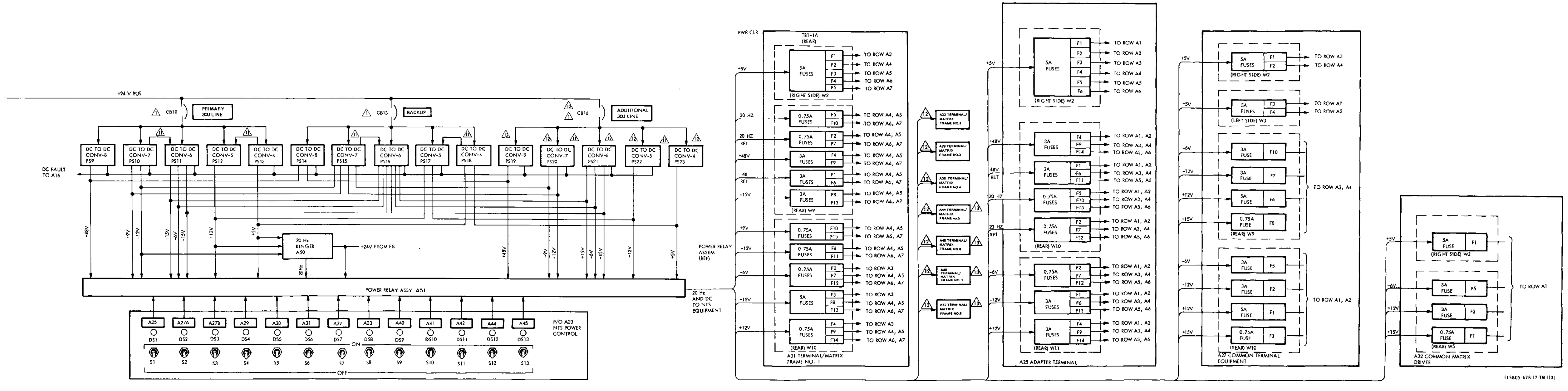


Figure FO 23(3). Power subsystem, block diagram (sheet 3 of 3)

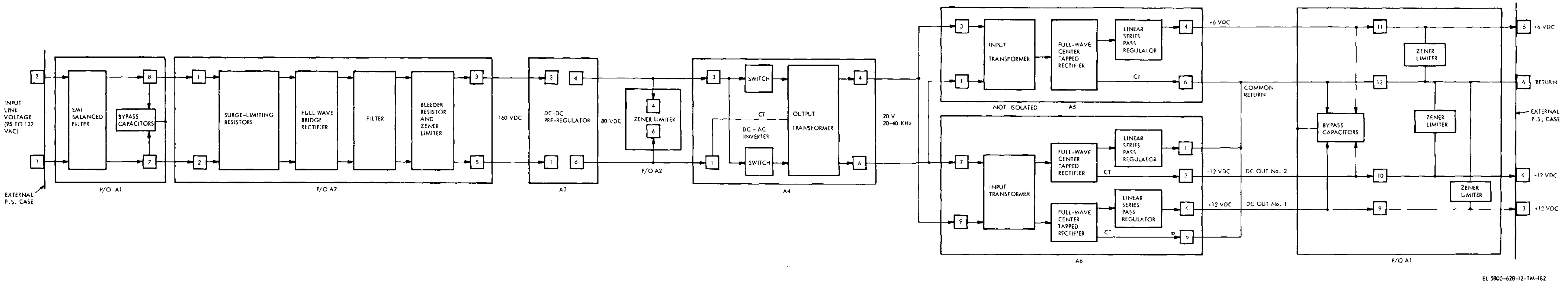
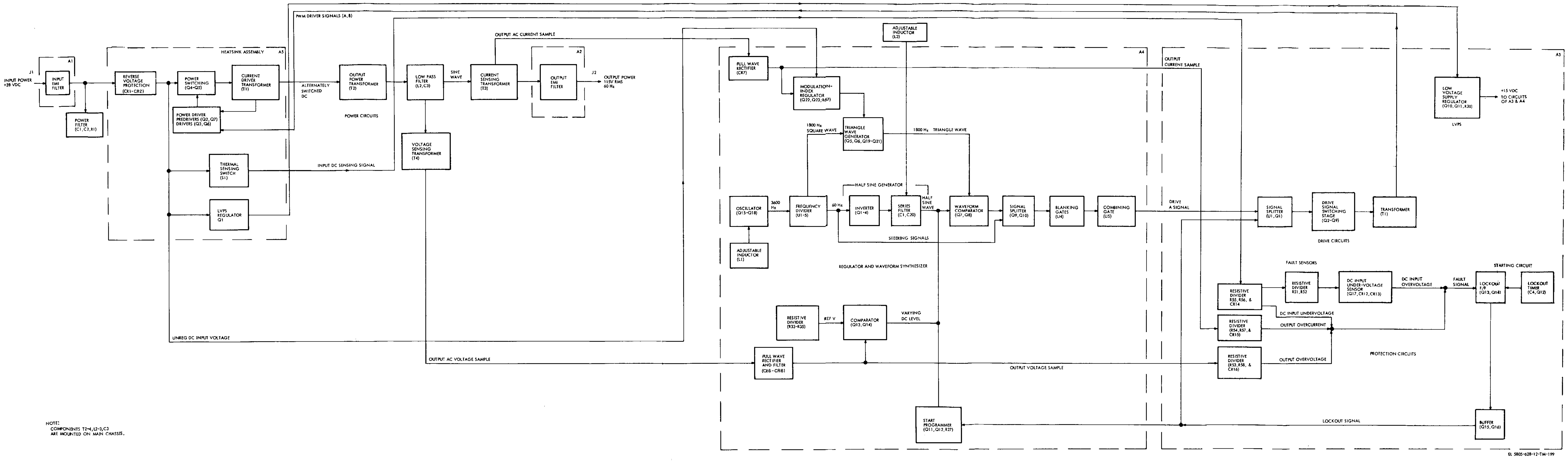


Figure FO-24. Operator position power supply, block diagram.



NOTE:
COMPONENTS T2-4,L2-3,C3
ARE MOUNTED ON MAIN CHASSIS.

Figure FO-25. Dc-ac power inverter, block diagram

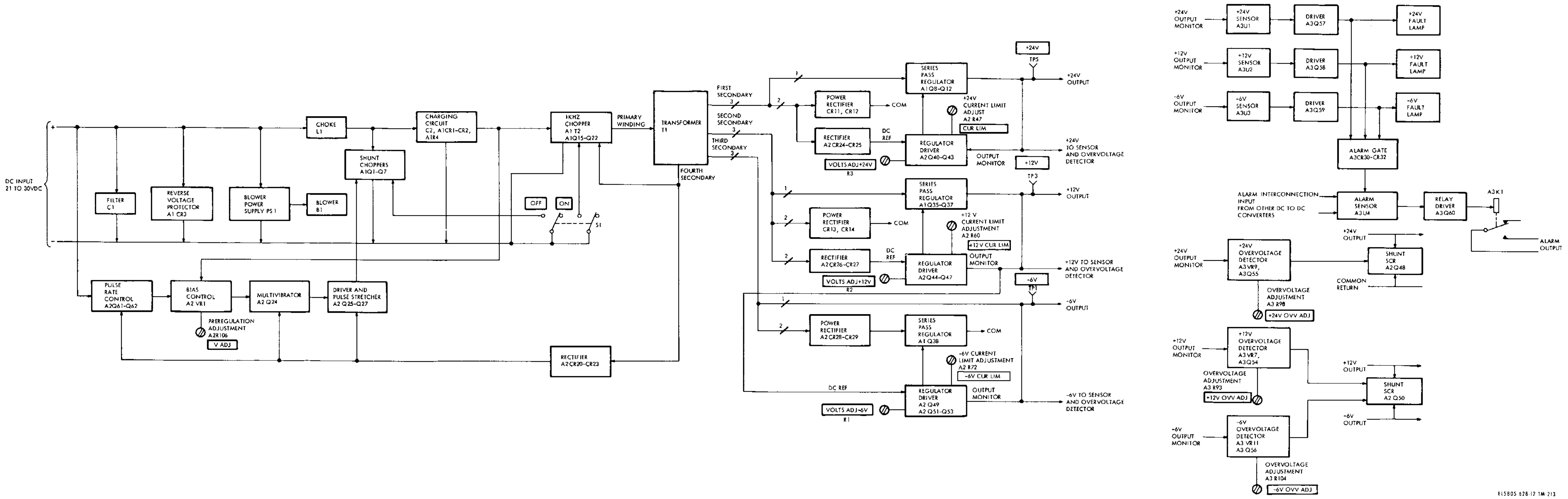


Figure FO-26. Dc-to-dc converter type 1, block diagram.

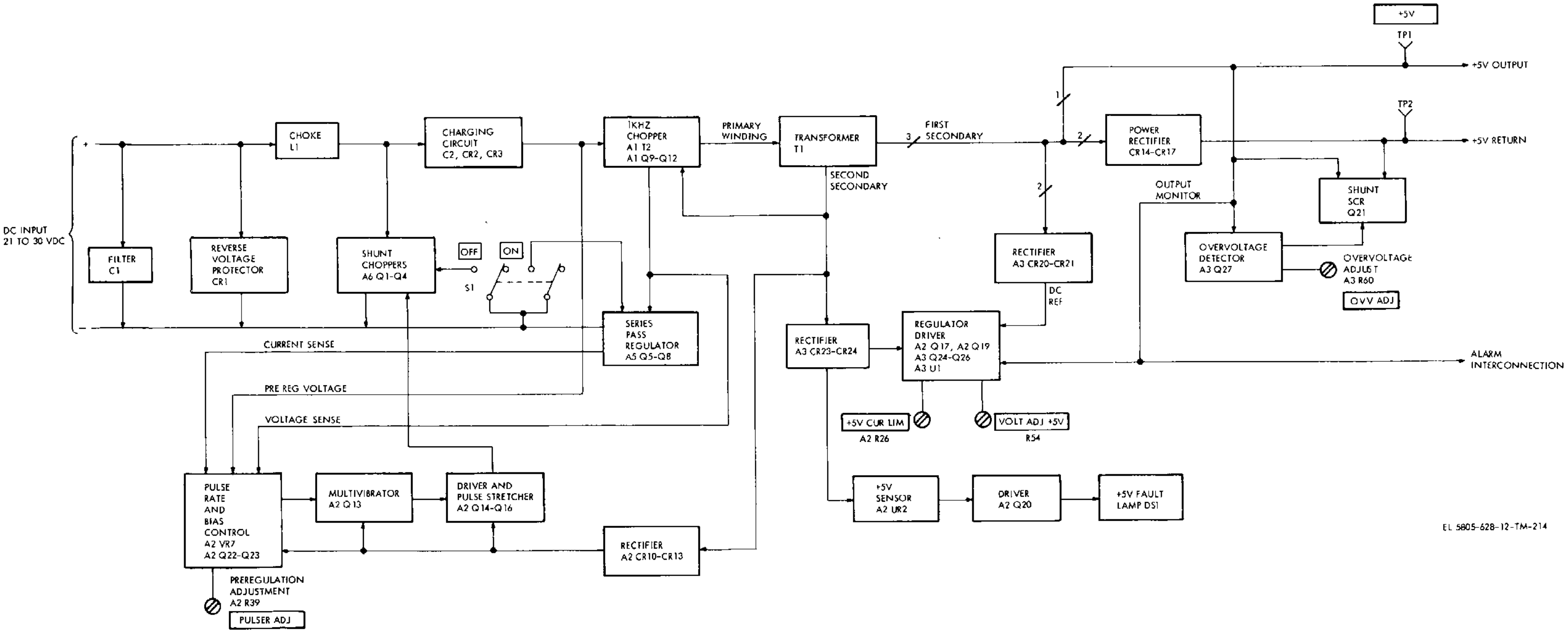


Figure FO-27. Dc-to-dc converter type 2, block diagram.

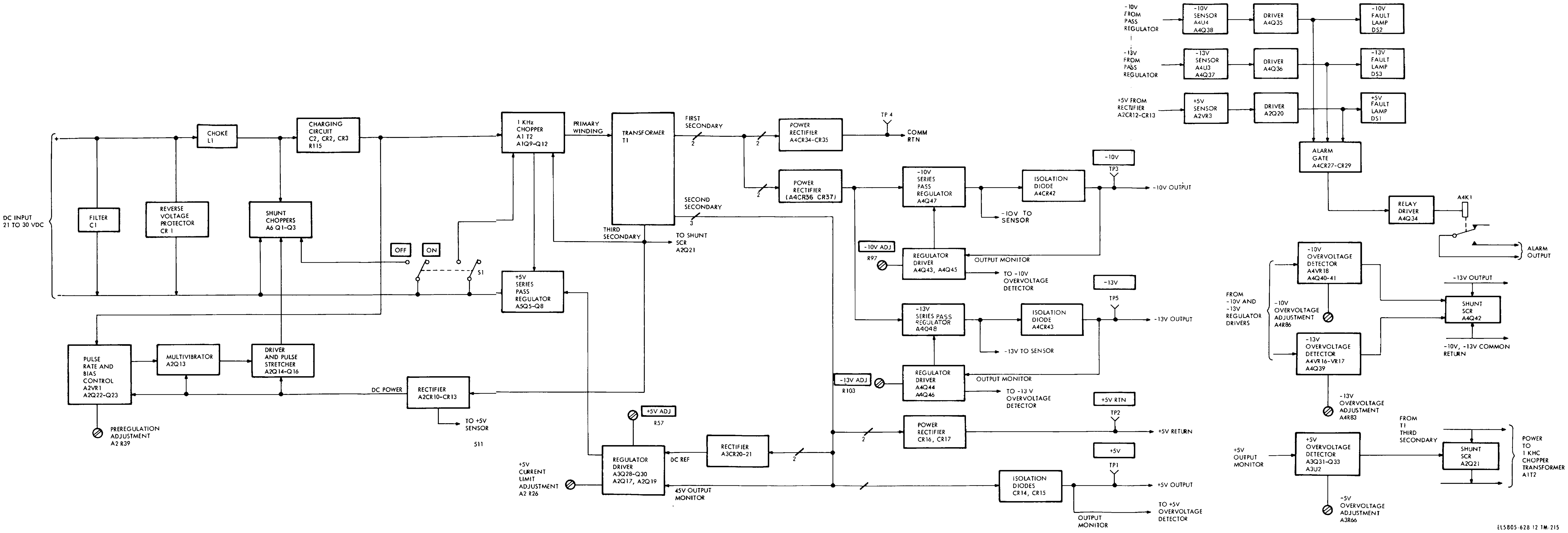


Figure FO-28. Dc to dc converter type 3, block diagram.

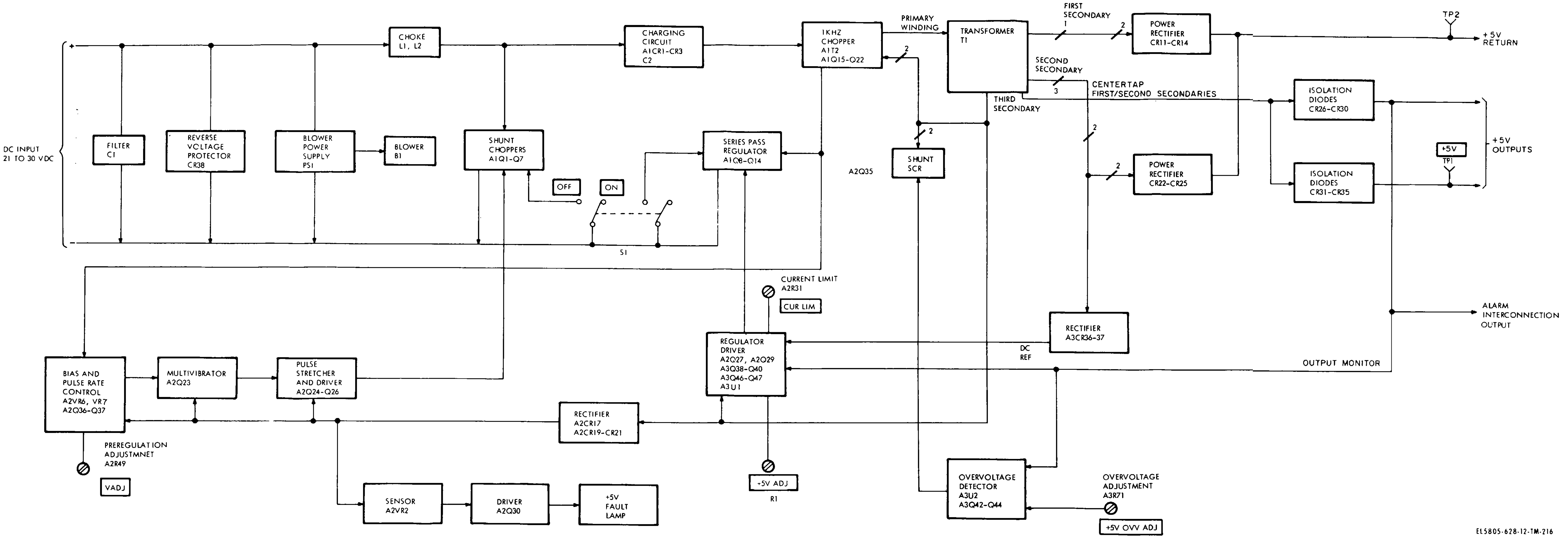


Figure FO-29. Dc to dc converter type 4, block diagram.

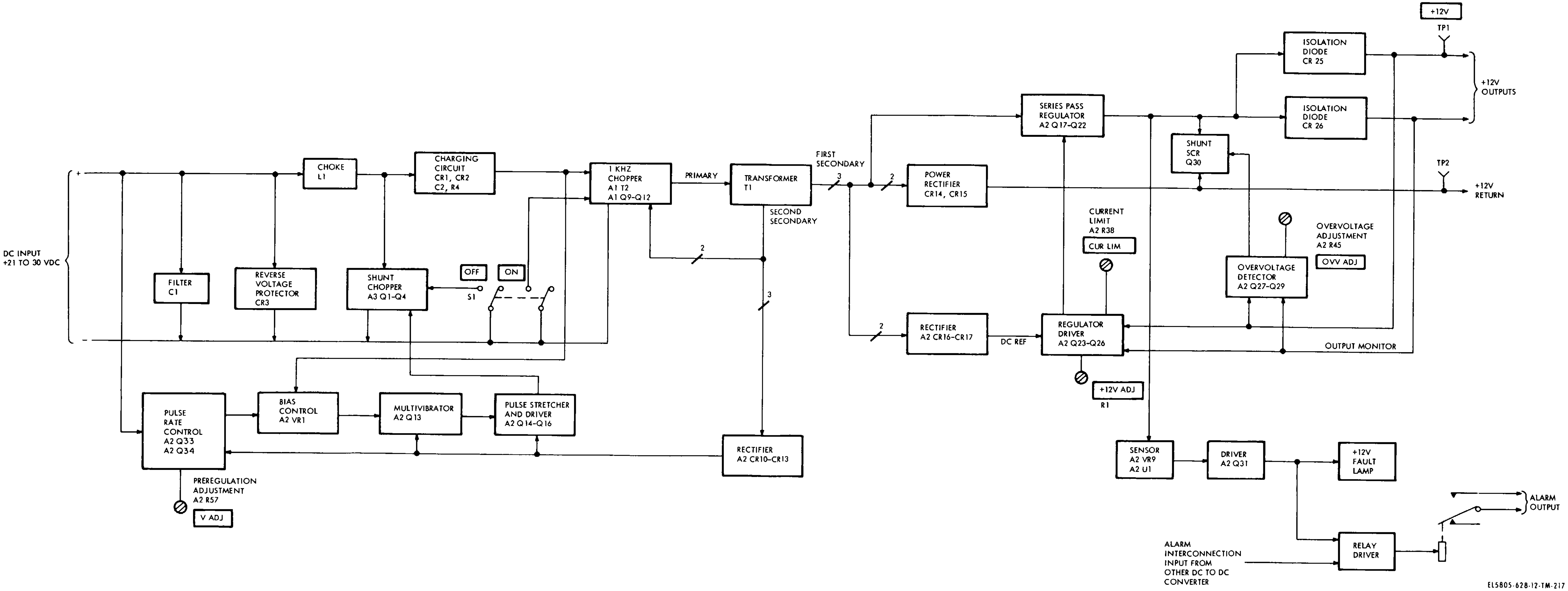


Figure FO-30. Dc to dc converter type 5, block diagram.

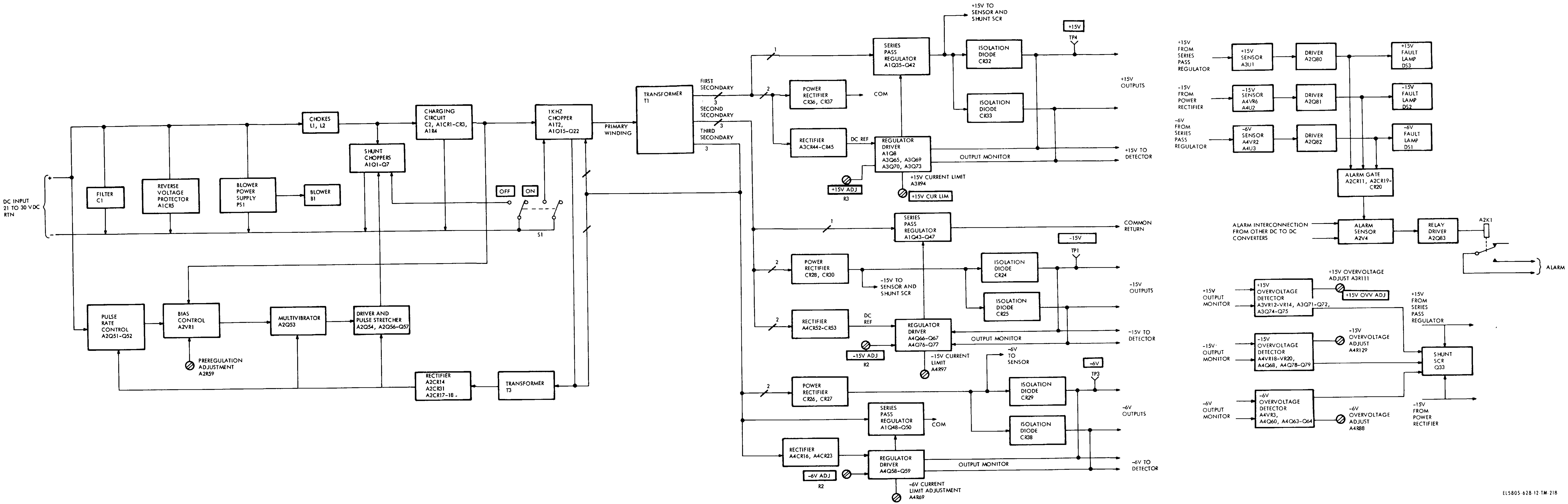


Figure FO-31. Dc to dc converter type 6, block diagram.

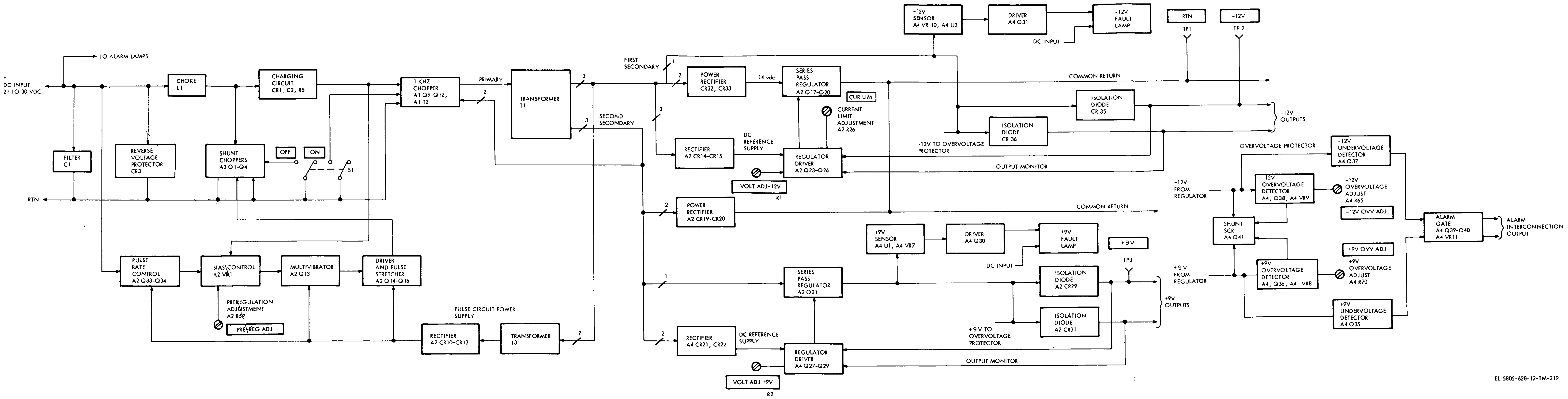


Figure FO-32. Dc to dc converter type 7, block diagram.

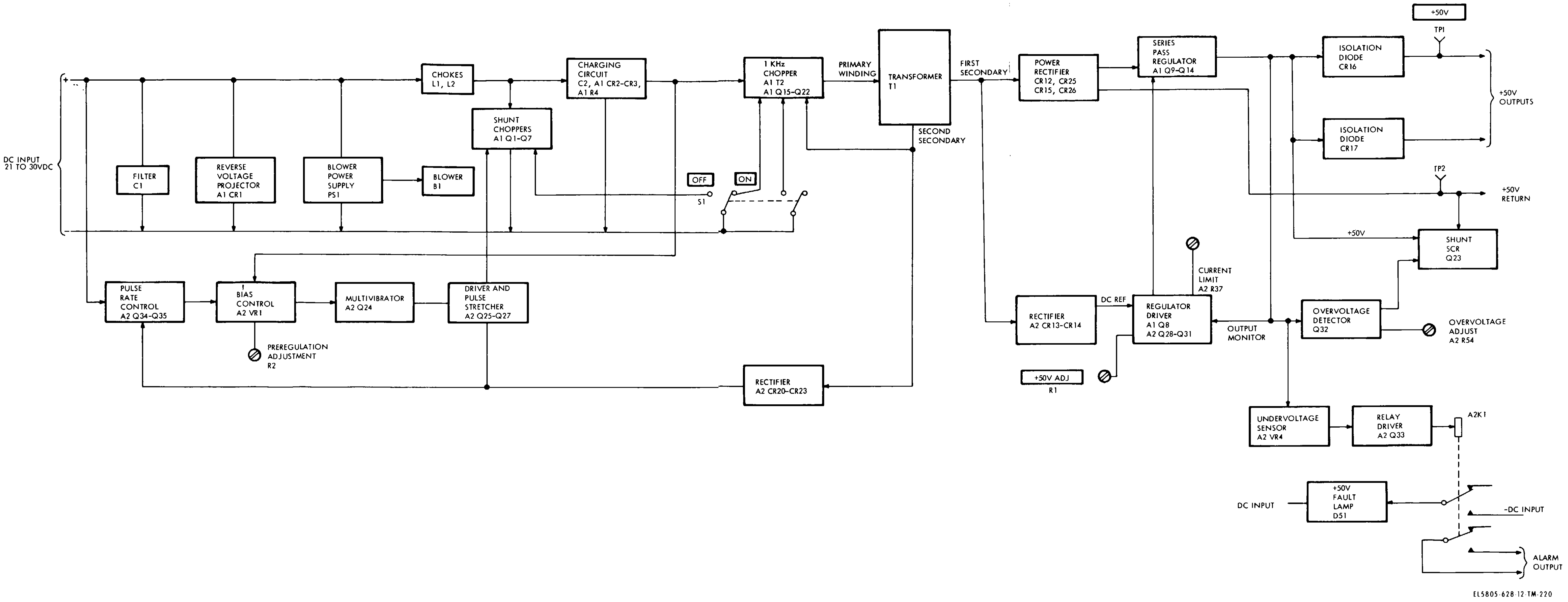


Figure FO-33. Dc-to-dc converter type 8, block diagram.

IF X	OF Y	Expected SBR Return
1	2	1 7 6 0 0 3
2	1	1 7 6 0 1 4
3	4	0 0 1 7 6 3
4	3	0 0 1 7 7 4
5	6	1 7 6 0 0 3
6	5	1 7 6 0 1 4
7	8	0 0 1 7 6 3
8	7	0 0 1 7 7 4

A. Z1 Returns

IF X	OF Y	Expected SBR Return
1	2	1 7 6 0 0 0
2	1	1 7 6 0 0 0
3	4	0 0 1 7 6 0
4	3	0 0 1 7 6 0
5	6	1 7 6 0 0 0
6	5	1 7 6 0 0 0
7	8	0 0 1 7 6 0
8	7	0 0 1 7 6 0

B. Z2 Returns

IG X	OF Y	Expected SBR Return
1	2	1 7 0 0 0 0
2	1	1 7 0 0 0 0
3	4	0 0 7 4 0 0
4	3	0 0 7 4 0 0
5	6	0 0 0 3 6 0
6	5	0 0 0 3 6 0
7	8	0 0 0 0 1 7
8	7	0 0 0 0 1 7

C. Z3 Returns

BC VV	Expected SBR Return
01	1 0 0 0 0 1
02	0 4 0 0 0 2
03	0 2 0 0 0 4
04	0 1 0 0 1 0
05	0 0 4 0 2 0
06	0 0 2 0 4 0
07	0 0 1 1 0 0
08	0 0 0 6 0 0
09	0 0 0 6 0 0
10	0 0 1 1 0 0
11	0 0 2 0 4 0
12	0 0 4 0 2 0
13	0 1 0 0 1 0
14	0 2 0 0 0 4
15	0 4 0 0 0 2
16	1 0 0 0 0 1
17	0 0 0 0 1 1
18	0 0 0 0 0 6
19	0 0 0 0 0 6
20	0 0 0 0 1 1

D. Z4 Returns

EXPECTED VALUE	LEGAL VALUES FOR PRINTED DIGIT
0	1,2,4
1	0,3,5
2	0,3,6
3	1,2,7
4	0,5,6
5	1,4,7
6	2,4,7
7	3,5,6

E. Legal Printed Values.

SBR a a a a a a	IF X	OF Y	CARD
0 7 6 0 0 3	1	2	A31A325
1 3 6 0 0 3	1	2	A31A326
1 5 6 0 0 3	1	2	A31A327
1 6 6 0 0 3	1	2	A33A325
1 7 2 0 0 3	1	2	A33A325
1 7 4 0 0 3	1	2	A33A325
1 7 6 0 0 1	1	2	A33A324
1 7 6 0 0 2	1	2	A33A331
0 7 6 0 1 4	2	1	A31A325
1 3 6 0 1 4	2	1	A31A326
1 5 6 0 1 4	2	1	A31A327
1 6 6 0 1 4	2	1	A33A325
1 7 2 0 1 4	2	1	A33A326
1 7 4 0 1 4	2	1	A33A327
1 7 6 0 0 4	2	1	A31A324
1 7 6 0 1 0	2	1	A31A331
0 0 0 7 6 3	3	4	A29A325
0 0 1 3 6 3	3	4	A29A326
0 0 1 5 6 3	3	4	A29A327
0 0 1 6 6 3	3	4	A30A325
0 0 1 7 2 3	3	4	A30A326
0 0 1 7 4 3	3	4	A30A327
0 0 1 7 6 1	3	4	A30A324
0 0 1 7 6 2	3	4	A30A331
0 0 0 7 7 4	4	3	A29A325
0 0 1 3 7 4	4	3	A29A326
0 0 1 5 7 4	4	3	A29A327
0 0 1 6 7 4	4	3	A30A325
0 0 1 7 3 4	4	3	A30A326
0 0 1 7 5 4	4	3	A30A327
0 0 1 7 6 4	4	3	A29A324
0 0 1 7 7 0	4	3	A29A331

SBR a a a a a a	IF X	OF Y	CARD
0 7 6 0 0 3	5	6	A44A325
1 3 6 0 0 3	5	6	A44A326
1 5 6 0 0 3	5	6	A44A327
1 6 6 0 0 3	5	6	A45A325
1 7 2 0 0 3	5	6	A45A326
1 7 4 0 0 3	5	6	A45A327
1 7 6 0 0 1	5	6	A45A324
1 7 6 0 0 2	5	6	A45A331
0 7 6 0 1 4	6	5	A44A325
1 3 6 0 1 4	6	5	A44A326
1 5 6 0 1 4	6	5	A44A327
1 6 6 0 1 4	6	5	A45A325
1 7 2 0 1 4	6	5	A45A326
1 7 4 0 1 4	6	5	A45A327
1 7 6 0 0 4	6	5	A44A324
1 7 6 0 1 0	6	5	A44A331
0 0 0 7 6 3	7	8	A40A325
0 0 1 3 6 3	7	8	A40A326
0 0 1 5 6 3	7	8	A40A327
0 0 1 6 6 3	7	8	A42A325
0 0 1 7 2 3	7	8	A42A326
0 0 1 7 4 3	7	8	A42A327
0 0 1 7 6 1	7	8	A42A324
0 0 1 7 6 2	7	8	A42A331
0 0 0 7 7 4	8	7	A40A325
0 0 1 3 7 4	8	7	A40A326
0 0 1 5 7 4	8	7	A40A327
0 0 1 6 7 4	8	7	A42A325
0 0 1 7 3 4	8	7	A42A326
0 0 1 7 5 4	8	7	A42A327
0 0 1 7 6 4	8	7	A40A324
0 0 1 7 7 0	8	7	A40A331

F. Z1 faulty card chart

SBR a a a a a a	IF X	OF Y	CARD
0 7 6 0 0 0	1	2	A31A328
1 3 6 0 0 0	1	2	A31A329
1 5 6 0 0 0	1	2	A31A330
1 6 6 0 0 0	1	2	A33A328
1 7 2 0 0 0	1	2	A33A329
1 7 4 0 0 0	1	2	A33A330
0 7 6 0 0 0	2	1	A31A328
1 3 6 0 0 0	2	1	A31A329
1 5 6 0 0 0	2	1	A31A330
1 6 6 0 0 0	2	1	A33A328
1 7 2 0 0 0	2	1	A33A329
1 7 4 0 0 0	2	1	A33A330
0 0 0 7 6 0	3	4	A29A328
0 0 1 3 6 0	3	4	A29A329
0 0 1 5 6 0	3	4	A29A330
0 0 1 6 6 0	3	4	A30A328
0 0 1 7 2 0	3	4	A30A329
0 0 1 7 4 0	3	4	A30A330
0 0 0 7 6 0	4	3	A29A328
0 0 1 3 6 0	4	3	A29A329
0 0 1 5 6 0	4	3	A29A330
0 0 1 6 6 0	4	3	A30A328
0 0 1 7 2 0	4	3	A30A329
0 0 1 7 4 0	4	3	A30A330

SBR a a a a a a	IF X	OF Y	CARD
0 7 6 0 0 0	5	6	A44A328
1 3 6 0 0 0	5	6	A44A329
1 5 6 0 0 0	5	6	A44A330
1 6 6 0 0 0	5	6	A45A328
1 7 2 0 0 0	5	6	A45A329
1 7 4 0 0 0	5	6	A45A330
0 7 6 0 0 0	6	5	A44A328
1 3 6 0 0 0	6	5	A44A329
1 5 6 0 0 0	6	5	A44A330
1 6 6 0 0 0	6	5	A45A328
1 7 2 0 0 0	6	5	A45A329
1 7 4 0 0 0	6	5	A45A330
0 0 0 7 6 0	7	8	A40A328
0 0 1 3 6 0	7	8	A40A329
0 0 1 5 6 0	7	8	A40A330
0 0 1 6 6 0	7	8	A42A328
0 0 1 7 2 0	7	8	A42A329
0 0 1 7 4 0	7	8	A42A330
0 0 0 7 6 0	8	7	A40A328
0 0 1 3 6 0	8	7	A40A329
0 0 1 5 6 0	8	7	A40A330
0 0 1 6 6 0	8	7	A42A328
0 0 1 7 2 0	8	7	A42A329
0 0 1 7 4 0	8	7	A42A330

G. Z2 faulty card chart.

SBR a a a a a a	IG X	OG Y	CARD
0 7 0 0 0 0	1	2	A32A105
1 3 0 0 0 0	1	2	A32A109
1 5 0 0 0 0	1	2	A32A114
1 6 0 0 0 0	1	2	A32A118
0 7 0 0 0 0	2	1	A32A105
1 3 0 0 0 0	2	1	A32A109
1 5 0 0 0 0	2	1	A32A114
1 6 0 0 0 0	2	1	A32A118
0 0 3 1 0 0	3	4	A32A106
0 0 5 1 0 0	3	4	A32A110
0 0 6 1 0 0	3	4	A32A115
0 0 7 0 0 0	3	4	A32A119
0 0 3 1 0 0	4	3	A32A106
0 0 5 1 0 0	4	3	A32A110
0 0 6 1 0 0	4	3	A32A115
0 0 7 0 0 0	4	3	A32A119
0 0 0 1 6 0	5	6	A32A107
0 0 0 2 6 0	5	6	A32A111
0 0 0 3 2 0	5	6	A32A116
0 0 0 3 4 0	5	6	A32A120
0 0 0 1 6 0	6	5	A32A107
0 0 0 2 6 0	6	5	A32A111
0 0 0 3 2 0	6	5	A32A116
0 0 0 3 4 0	6	5	A32A120
0 0 0 0 0 7	7	8	A32A108
0 0 0 0 1 3	7	8	A32A112
0 0 0 0 1 5	7	8	A32A117
0 0 0 0 1 6	7	8	A32A121
0 0 0 0 0 7	8	7	A32A108
0 0 0 0 1 3	8	7	A32A112
0 0 0 0 1 5	8	7	A32A117
0 0 0 0 1 6	8	7	A32A121

H. Z3 faulty card chart.

SBR a a a a a a	BC VV	CARD
0 0 0 0 0 1	1	A32A122
1 0 0 0 0 0	1	A32A122
0 0 0 0 0 2	2	A32A123
0 4 0 0 0 0	2	A32A123
0 0 0 0 0 4	3	A32A124
0 2 0 0 0 0	3	A32A124
0 0 0 0 1 0	4	A32A125
0 1 0 0 0 0	4	A32A125
0 0 0 0 2 0	5	A32A126
0 0 4 0 0 0	5	A32A126
0 0 0 0 4 0	6	A32A127
0 0 2 0 0 0	6	A32A127
0 0 0 1 0 0	7	A32A128
0 0 1 0 0 0	7	A32A128
0 0 0 2 0 0	8	A32A129
0 0 0 4 0 0	8	A32A129
0 0 0 2 0 0	9	A32A130
0 0 0 4 0 0	9	A32A130
0 0 0 1 0 0	10	A32A131
0 0 1 0 0 0	10	A32A131
0 0 0 0 4 0	11	A32A133
0 0 2 0 0 0	11	A32A133
0 0 0 0 2 0	12	A32A134
0 0 4 0 0 0	12	A32A134
0 0 0 0 1 0	13	A32A135
0 1 0 0 0 0	13	A32A135
0 0 0 0 0 4	14	A32A136
0 2 0 0 0 0	14	A32A136
0 0 0 0 0 2	15	A32A137
0 4 0 0 0 0	15	A32A137
0 0 0 0 0 1	16	A32A138
1 0 0 0 0 0	16	A32A138
0 0 0 0 0 1	17	A32A139
0 0 0 0 1 0	17	A32A139
0 0 0 0 0 2	18	A32A140
0 0 0 0 0 4	18	A32A140
0 0 0 0 0 2	19	A32A141
0 0 0 0 0 4	19	A32A141
0 0 0 0 0 1	20	A32A142
0 0 0 0 1 0	20	A32A142

I. Z4 faulty card chart.

DIFFERENCE	Z1		Z2		Z3	Z4			
	A	B	A	B	-	A	B	C	D
1 0 0 0 0 0	A31A325	A44A325	A31A328	A44A328	A32A105	A32A138	A32A122	A31A328	-
0 4 0 0 0 0	A31A326	A44A326	A31A329	A44A329	A32A109	A32A137	A32A123	A31A329	-
0 2 0 0 0 0	A31A327	A44A327	A31A330	A44A330	A32A114	A32A136	A32A124	A31A330	-
0 1 0 0 0 0	A33A325	A45A325	A33A328	A45A328	A32A118	A32A135	A32A125	A33A328	-
0 0 4 0 0 0	A33A326	A45A326	A33A329	A45A329	A32A106	A32A134	A32A126	A33A329	-
0 0 2 0 0 0	A33A327	A45A327	A33A330	A45A330	A32A110	A32A133	A32A127	A33A330	-
0 0 1 0 0 0	A29A325	A40A325	A29A328	A40A328	A32A115	A32A131	A32A128	A29A328	-
0 0 0 4 0 0	A29A326	A40A326	A29A329	A40A329	A32A119	A32A130	A32A129	A29A329	-
0 0 0 2 0 0	A29A327	A40A327	A29A330	A40A330	A32A107	A32A129	A32A130	A29A330	-
0 0 0 1 0 0	A30A325	A42A325	A30A328	A42A328	A32A111	A32A128	A32A131	A30A328	-
0 0 0 0 4 0	A30A326	A42A326	A30A329	A42A329	A32A116	A32A127	A32A133	A30A329	-
0 0 0 0 2 0	A30A327	A42A327	A30A330	A42A330	A32A120	A32A126	A32A134	A30A330	-
0 0 0 0 1 0	A31A324	A44A324	-	-	A32A108	A32A125	A32A142	A32A135	A32A139
0 0 0 0 1 0	A29A324	A40A324	-	-	-	-	-	-	-
0 0 0 0 0 4	A31A331	A44A331	-	-	A32A112	A32A124	A32A141	A32A136	A32A140
0 0 0 0 0 4	A29A331	A40A331	-	-	-	-	-	-	-
0 0 0 0 0 2	A33A324	A45A324	-	-	A32A117	A32A123	A32A140	A32A137	A32A141
0 0 0 0 0 2	A30A324	A42A324	-	-	-	-	-	-	-
0 0 0 0 0 1	A33A331	A45A331	-	-	A32A121	A32A122	A32A139	A32A138	A32A142
0 0 0 0 0 1	A30A331	A42A331	-	-	-	-	-	-	-

J. Z1-Z4 faulty card chart

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Figure FO-34. Type Z network fault card replacement chart.

IF	OF	Correct SBR Return
		a a a a a a
1-4	1-4	0 0 0 0 1 7
1-4	5-8	0 0 0 0 5 5
5-8	1-4	0 0 0 2 0 7
5-8	5-8	0 0 0 2 4 5
0-0-00	1-4	0 0 0 0 0 1
0-0-00	5-8	0 0 0 0 0 1

A. M1 Test NO ERROR Returns

IF	OF	Correct SBR Return
		a a a a a a
1-4	1-4	0 0 7 4 0 0
1-4	5-8	1 0 3 4 0 0
5-8	1-4	0 2 6 4 0 0
5-8	5-8	1 2 2 4 0 0
0-0-00	1-4	0 0 4 0 0 0
0-0-00	5-8	1 0 0 0 0 0

B. M2 Test NO ERROR Returns

IF	OF	Expected SBR Error Return	X Coordinate
		a a a a a a	
1-4	1-4	0 0 0 0 1 6	1
1-4	1-4	0 0 0 0 1 5	2
1-4	1-4	0 0 0 0 1 3	3
1-4	1-4	0 0 0 0 0 7	4
1-4	5-8	0 0 0 0 5 4	1
1-4	5-8	0 0 0 0 5 1	3
1-4	5-8	0 0 0 0 4 5	4
1-4	5-8	0 0 0 0 1 5	5
5-8	1-4	0 0 0 2 0 6	1
5-8	1-4	0 0 0 2 0 5	2
5-8	1-4	0 0 0 2 0 3	3
5-8	1-4	0 0 0 0 0 7	6
5-8	5-8	0 0 0 2 4 4	1
5-8	5-8	0 0 0 2 4 1	3
5-8	5-8	0 0 0 2 0 5	5
5-8	5-8	0 0 0 0 4 5	6
0-0-00	1-4	0 0 0 0 0 0	1
0-0-00	5-8	0 0 0 0 0 0	1

C. M1 X COORDINATE
FROM aaaaaa

IF	OF	Expected SBR Error Return	X Coordinate
		a a a a a a	
1-4	1-4	0 0 7 0 0 0	7
1-4	1-4	0 0 6 4 0 0	8
1-4	1-4	0 0 5 4 0 0	9
1-4	1-4	0 0 3 4 0 0	10
1-4	5-8	1 0 3 0 0 0	7
1-4	5-8	1 0 2 4 0 0	8
1-4	5-8	1 0 1 4 0 0	9
1-4	5-8	0 0 3 4 0 0	12
5-8	1-4	0 2 6 0 0 0	7
5-8	1-4	0 2 4 4 0 0	9
5-8	1-4	0 2 2 4 0 0	10
5-8	1-4	0 0 6 4 0 0	11
5-8	5-8	1 2 2 0 0 0	7
5-8	5-8	1 2 0 4 0 0	9
5-8	5-8	1 0 2 4 0 0	11
5-8	5-8	0 2 2 4 0 0	12
0-0-00	1-4	0 0 0 0 0 0	10
0-0-00	5-8	0 0 0 0 0 0	12

D. M2 X COORDINATE
FROM aaaaaa

X Coordinate	Required Address Parameters
1	OG, OT
2	OF, LK
3	LK
4	IF, LK
5	OF, LK
6	IF, LK

E. M1 Required Address Parameters

X Coordinate	Required Address Parameters	
7	IG, IT	
8	IF, LK	
9	LK	
10	OF, LK	NOTE
11	IF, LK	
12	OF, LK	

F. M2 Required Address Parameters

X	Error Summary Card	Driver Types Summarized
1	A32A113	DP - All Frames
2	A32A144	CP - Frames 1-4
3	A32A132	BP - All Frames
4	A32A143	AP- Frames 1-4
5	A32A146	CP- Frames 5-8
6	A32A145	AP- Frames 5-8
7	A32A113	AP+ All Frames
8	A32A144	BP+ Frames 1-4
9	A32A132	CP+ All Frames
10	A32A143	DP+ Frames 1-4
11	A32A146	BP+ Frames 5-8
12	A32A145	DP+ Frames 5-8

G. ERROR SUMMARY CARD REPLACEMENT

IF	OF	PROPER SBR RETURN					
		a	a	a	a	a	a
1-4	1-4	000	000	000	000	001	111
1-4	5-8	000	000	000	000	101	101
5-8	1-4	000	000	000	010	000	111
5-8	5-8	000	000	000	010	100	101
0-0-00	1-4	000	000	000	000	000	001
0-0-00	5-8	000	000	000	000	000	001

H. M1 TEST NO ERROR SBR RETURN IN BINARY FORM

IF	OF	PROPER SBR RETURN					
		a	a	a	a	a	a
1-4	1-4	000	000	111	100	000	000
1-4	5-8	001	000	011	100	000	000
5-8	1-4	000	010	110	100	000	000
5-8	5-8	001	010	010	100	000	000
0-0-00	1-4	000	000	100	000	000	000
0-0-00	5-8	001	000	000	000	000	000

I. M2 TEST NO ERROR SBR RETURN IN BINARY FORM

NOTE:
REQUIRED ADDRESS PARAMETERS ARE OF AND OG WHEN IF = 0-0-00

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Figure FO-35. Type M1/M2 network fault card replacement chart.

	1	2	3	4	5	6	7	8	9
A1				MATRIX B (8 X 8) STAGE LINK 1	MATRIX B (8 X 8) 2	MATRIX B (8 X 8) 3	MATRIX B (8 X 8) 4	MATRIX B (8 X 8) 5	MATRIX B (8 X 8) 6
A2				MATRIX D (8 X 8) STAGE GROUP 1 TERM 1-8 LINKS 1-8	MATRIX D (12 X 4) 1 9-12 1-12	MATRIX D (8 X 8) 1 1-8 9-16	MATRIX D (12 X 4) 1 9-12 13-24	MATRIX D (8 X 8) 1 1-8 17-24	MATRIX D (8 X 8) 3 1-8 1-8
A3				MATRIX A (12 X 4) STAGE GROUP 1 TERM 1-12 LINKS 1-4	MATRIX A (12 X 4) 1 5-8	MATRIX A (12 X 4) 1 9-12	MATRIX A (12 X 4) 1 13-16	MATRIX A (12 X 4) 1 17-20	MATRIX A (12 X 4) 3 1-4
A4		SERVICE TERMINAL GROUP 1 TERM. 11,12		DTMF, SF/DC TERMINAL 1 10		DTMF,SF/DC TERMINAL 1 9		DTMF,SF/DC TERMINAL 1 8	

	10	11	12	13	14	15	16	17	18
A1	MATRIX B (8 X 8) 7	MATRIX B (8 X 8) 8	MATRIX B (8 X 8) 9	MATRIX B (8 X 8) 10	MATRIX B (8 X 8) 11	MATRIX B (8 X 8) 12	MATRIX B (8 X 8) 13	MATRIX B (8 X 8) 14	MATRIX B (8 X 8) 15
A2	MATRIX D (12 X 4) 3 9-12 1-12	MATRIX D (8 X 8) 3 1-8 9-16	MATRIX D (12 X 4) 3 9-12 13-24	MATRIX D (8 x 8) 3 1-8 17-24	MATRIX D (8 X 8) 5 1-8 1-8	MATRIX D (12 X 4) 5 9-12 1-12	MATRIX D (8 X8) 5 1-8 9-16	MATRIX D (12 X 4) 5 9-12 13-24	MATRIX D (8 X 8) 5 1-8 17-24
A3	MATRIX A (12 X 4) 3 5-8	MATRIX A (12 X 4) 3 9-12	MATRIX A (12 X 4) 3 13-16	MATRIX A (12 X 4) 3 17-20	MATRIX A (12 X 4) 5 1-4	MATRIX A (12 X 4) 5 5-8	MATRIX A (12 X 4) 5 9-12	MATRIX A (12 X 4) 5 13-16	MATRIX A (12 X 4) 5 17-20
A4	DTMF,SF/DC TERMINAL 1 7		DTMF,SF/DC TERMINAL 1 6		DTMF,SF/DC TERMINAL 1 5		DTMF,SF/DC TERMINAL 1 4		SF/DC TERMINAL 1 3

	19	20	21	22	23	24	25	26	27
A1	MATRIX B (8 X 8) 16	MATRIX B (8 X 8) 17	MATRIX B (8 X 8) 18	MATRIX B (8 X 8) 19	MATRIX B (8 X 8) 20				
A2	MATRIX D (8 X 8) 7 1-8 1-8	MATRIX D (12 X 4) 7 9-12 1-12	MATRIX D (8 X 8) 7 1-8 9-16	MATRIX D (12 X 4) 7 9-12 13-24	MATRIX D (8 X 8) 7 1-8 17-24				
A3	MATRIX A (12 X 4) 7 1-4	MATRIX A (12 X 4) 7 5-8	MATRIX A (12 X 4) 7 9-12	MATRIX A (12 X 4) 7 13-16	MATRIX A (12 X 4) 7 17-20	DRIVER RING BUS GROUPS 1-4 RBDPA	DRIVER AMDPLL LINKS 1-8	DRIVER AMDDLM LINKS 9-16	AMDPLH LINKS 17-20
A4		SF/DC TERMINAL 1 2		SF/DC TERMINAL 1 1		SCAN RECEIVER 1		SCAN DETECTOR 1	TERMINAL STATUS GROUPS 1,2,3,4

	28	29	30	31	32	33	34	35	36
A1					MATRIX C (8 X 8) STAGE LINK 1	MATRIX C (8 X 8) 2	MATRIX C (8 X 8) 3	MATRIX C (8 X 8) 4	MATRIX C (8 X 8) 5
A2					MATRIX D (8 X 8) STAGE GROUP 2 TERM 1-8 LINKS 1-8	MATRIX D (12 X 4) 2 9-12 1-12	MATRIX D (8 X 8) 2 1-8 9-16	MATRIX D (12 X 4) 2 9-12 13-24	MATRIX D (8 X 8) 2 1-8 17-24
A3	BPCMLL LINKS 1-8	BPCMLM LINKS 9-16	BPCMLH LINKS 17-20	DRIVER RING BUS GROUPS 5-8 RBDPB	MATRIX A (12 X 4) STAGE GROUP 2 TERM 1-12 1-4	MATRIX A (12 X 4) 2 5-8	MATRIX A (12 X 4) 2 9-12	MATRIX A (12 X 4) 2 13-16	MATRIX A (12 X 4) 2 17-20
A4	TERMINAL INTERFACE GROUPS 1,2,3,4 INLET		SCAN DETECTOR GROUP 2		SCAN RECEIVER 2		SF/DC TERMINAL 2 TERM 1		SF/DC TERMINAL 2 2

	37	38	39	40	41	42	43	44	45
A1	MATRIX C (8 X 8) 6	MATRIX C (8 X 8) 7	MATRIX C (8 X 8) 8	MATRIX C (8 X 8) 9	MATRIX C (8 X 8) 10	MATRIX C (8 X 8) 11	MATRIX C (8 X 8) 12	MATRIX C (8 X 8) 13	MATRIX C (8 X 8) 14
A2	MATRIX D (8 X 8) 4 1-8 1-8	MATRIX D (12 X 4) 4 9-12 1-12	MATRIX D (8 X 8) 4 1-8 9-16	MATRIX D (12 X 4) 4 9-12 13-24	MATRIX D (8 X 8) 4 1-8 17-24	MATRIX D (8 X8) 6 1-8 1-8	MATRIX D (12 X 4) 6 9-12 1-12	MATRIX D (8 X 8) 6 1-8 9-16	MATRIX D (17 X 4) 6 9-17 13-24
A3	MATRIX A (12 X 4) 2 1-4	MATRIX A (12 X 4) 4 5-8	MATRIX A (12 X 4) 4 9-12	MATRIX A (12 X 4) 4 13-16	MATRIX A (12 X 4) 4 17-20	MATRIX A (12 X 4) 4 1-4	MATRIX A (12 X 4) 6 5-8	MATRIX A (12 X 4) 6 9-12	MATRIX A (17 X 4) 6 13-16
A4		SF/DC TERMINAL 2 3		DTMF, SF/DC TERMINAL 2 4		DTMF, S/F TERMINAL 2 5		DTMF, SF/DC TERMINAL 2 6	

	46	47	48	49	50	51	52	53	54
A1	MATRIX C (8 X 8) 15	MATRIX C (8 X 8) 16	MATRIX C (8 X 8) 17	MATRIX C (8 X 8) 18	MATRIX C (8 X 8) 19	MATRIX C (8 X 8) 20			
A2	MATRIX D (8 X 8) 6 1-8 17-24	MATRIX D (8 X 8) 8 1-8 1-8	MATRIX D (12 X 4) 8 9-12 1-12	MATRIX D (8 X 8) 8 1-8 9-16	MATRIX D (12 X 4) 8 9-12 13-24	MATRIX D (8 X 8) 8 1-8 17-24			
A3	MATRIX A (12 X 4) 6 17-20	MATRIX A (12 X 4) 8 1-4	MATRIX A (12 X 4) 8 5-8	MATRIX A (12 X 4) 8 9-12	MATRIX A (12 X 4) 8 13-16	MATRIX A (12 X 4) 8 17-20			
A4	DTMF, SF/DC TERMINAL 2 7		DTMF, SF/DC TERMINAL 2 8		DTMF, SF/DC TERMINAL 2 9		DTMF, SF/DC TERMINAL 2 10		SERVICE TERMINAL 2 11,12

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Figure FO-36(1). Terminal matrix frame functional card map (sheet 1 of 2).

	A5	A6	A7
1			
2	SERVICE TERMINAL GROUP 3 TERM. 11,12	SERVICE TERMINAL GROUP 5 TERM. 11,12	SERVICE TERMINAL GROUP 7 TERM 11,12
3			
4	DTMF, SF/DC TERMINAL 3 10	DTMF, SF/DC TERMINAL 5 10	DTMF SF/DC TERMINAL 7 10
5			
6	DTMF, SF/DC TERMINAL 3 9	DTMF, SF/DC TERMINAL 5 9	DTMF, SF/DC TERMINAL 7 9
7			
8	DTMF, SF/DC TERMINAL 3 8	DTMF, SF/DC TERMINAL 5 8	DTMF, SF/DC TERMINAL 7 8
9			
10	DTMF, SF/DC TERMINAL 3 7	DTMF, SF/DC TERMINAL 5 7	DTMF, SF/DC TERMINAL 7 7
11			
12	DTMF, SF/DC TERMINAL 3 6	DTMF, SF/DC TERMINAL 5 6	DTMF, SF/DC TERMINAL 7 6
13			
14	DTMF, SF/DC TERMINAL 3 5	DTMF, SF/DC TERMINAL 5 5	DTMF, SF/DC TERMINAL 7 5
15			
16	DTMF, SF/DC TERMINAL 3 4	DTMF, SF/DC TERMINAL 5 4	DTMF, SF/DC TERMINAL 7 4
17			
18	SF/DC TERMINAL 3 3	SF/DC TERMINAL 5 3	SF/DC TERMINAL 7 3
19			
20	SF/DC TERMINAL 3 2	SF/DC TERMINAL 5 2	SF/DC TERMINAL 7 2
21			
22	SF/DC TERMINAL 3 1	SF/DC TERMINAL 5 1	SF/DC TERMINAL 7 1
23			
24	SCAN RECEIVER 3	SCAN RECEIVER 5	SCAN RECEIVER 7
25			
26	SCAN DETECTOR 3	SCAN DETECTOR 5	SCAN DETECTOR 7
27	SCAN CONTROL GROUPS 1,2,3,4	TERMINAL STATUS GROUPS 5,6,7,8	SCAN CONTROL GROUPS 5,6,7,8
28	TERMINAL INTERFACE GROUPS 1,2,3,4 OUTLET	TERMINAL INTERFACE GROUPS 5,6,7,8 INLET	TERMINAL INTERFACE GROUPS 5,6,7,8 OUTLET
29			
30	SCAN DETECTOR GROUP 4	SCAN DETECTOR GROUP 6	SCAN DETECTOR GROUP 8
31			
32	SCAN RECEIVER 4	SCAN RECEIVER 6	SCAN RECEIVER 8
33			
34	SF/DC TERMINAL TERM 1	SF/DC TERMINAL GROUP 6 TERM 1	SF/DC TERMINAL 8 TERM 1
35			
36	SF/DC TERMINAL 4 2	SF/DC TERMINAL 6 2	SF/DC TERMINAL 8 2
37			
38	SF/DC TERMINAL 4 3	SF/DC TERMINAL 6 3	SF/DC TERMINAL 8 3
39			
40	DTMF, SF/DC TERMINAL 4 4	DTMF, SF/DC TERMINAL 6 4	DTMF SF/DC TERMINAL 8 4
41			
42	DTMF, SF/DC TERMINAL 4 5	DTMF, SF/DC TERMINAL 6 5	DTMF, SF/DC TERMINAL 8 5
43			
44	DTMF, SF/DC TERMINAL 4 6	DTMF, SF/DC TERMINAL 6 6	DTMF, SF/DC TERMINAL 8 6
45			
46	DTMF, SF/DC TERMINAL 4 7	DTMF, SF/DC TERMINAL 6 7	DTMF, SF/DC TERMINAL 8 7
47			
48	DTMF, SF/DC TERMINAL 4 8	DTMF, SF/DC TERMINAL 6 8	DTMF, SF/DC TERMINAL 8 8
49			
50	DTMF, SF/DC TERMINAL 4 9	DTMF, SF/DC TERMINAL 6 9	DTMF, SF/DC TERMINAL 8 9
51			
52	DTMF, SF/DC TERMINAL 4 10	DTMF, SF/DC TERMINAL 6 10	DTMF, SF/DC TERMINAL 8 10
53			
54	SERVICE TERMINAL 4 11,12	SERVICE TERMINAL 6 11,12	SERVICE TERMINAL 8 11,12

NOTES

1. REFERENCE DESIGNATORS ARE PREFIXED AS FOLLOWS:

	FRAME	REF. DES.
	1	A31
	2	A33
	3	A29
	4	A30
AN/TTC-38(V)2 ONLY	5	A44
	6	A45
	7	A40
	8	A42

2. CIRCUIT CARD IDENTIFICATION

CARD TYPE	NUMBER
MATRIX A (12 x 4)	SM-D-742638
MATRIX B (8 x 8)	SM-D-742639
DRIVER	SM-D-742640
SERVICE TERMINAL	SM-D-742621
DTMF TERMINAL	SM-D-742600
SF/DC TERMINAL	SM-D-742601
SCAN RECEIVER	SM-D-742607
SCAN DETECTOR	SM-D-742608
SCAN CONTROL	SM-D-747618
TERMINAL STATUS	SM-D-742614
TERMINAL INTERFACE	SM-D-742615

3. CARD SLOTS WITH NO DATA ENTERED ARE EMPTY.
4. FIGURE SHOWS FULL FUNCTIONAL ARRANGEMENT OF ASSEMBLY. NOTES 5 THROUGH 8 IDENTIFY SPECIFIC CARDS NOT SUPPLIED IN AN/TTC-38 (V)(*)
5. MATRIX B AND C STAGES FOR LINK 20 ARE NOT EQUIPPED IN AN/TTC-38 (V)(*)
6. MATRIX B AND C STAGES FOR LINKS 18 AND 19 ARE NOT EQUIPPED IN AN/TTC-38 (V) 1
7. GROUP 8 IS NOT EQUIPPED IN AN/TTC-38 (V) 1 FRAME 4 AND AN/TTC-38 (V) 2 FRAMES 6, 7, 8. THIS INCLUDES GROUP 8 MATRIX A STAGE, MATRIX D STAGE, SCAN DETECTOR, SCAN RECEIVER, SF/DC TERMINALS, SERVICE TERMINAL.
8. SERVICE TERMINALS ARE SUPPLIED ONLY IN FRAMES AND GROUPS MARKED X
9. DTMF LINE TERMINAL CARD (SM-D-742600) MUST NOT BE INSTALLED IN CARD SLOTS WHERE THE OPERATOR'S POSITION(s) IS ASSIGNED.

AN/TTC-38 (V) 1:

FRAME	GROUP 1	2	3	4	5	6	7	8
1				X	X	X	X	X
2				X	X	X	X	X
3				X	X	X	X	X
4	X	X	X	X	X	X	X	

AN/TTC-38 (V) 2:

FRAME	GROUP 1	2	3	4	5	6	7	8
1				X	X	X	X	X
2				X	X	X	X	X
3				X	X	X	X	X
4	X	X	X	X	X			
5				X	X	X	X	X
6								
7								
8								

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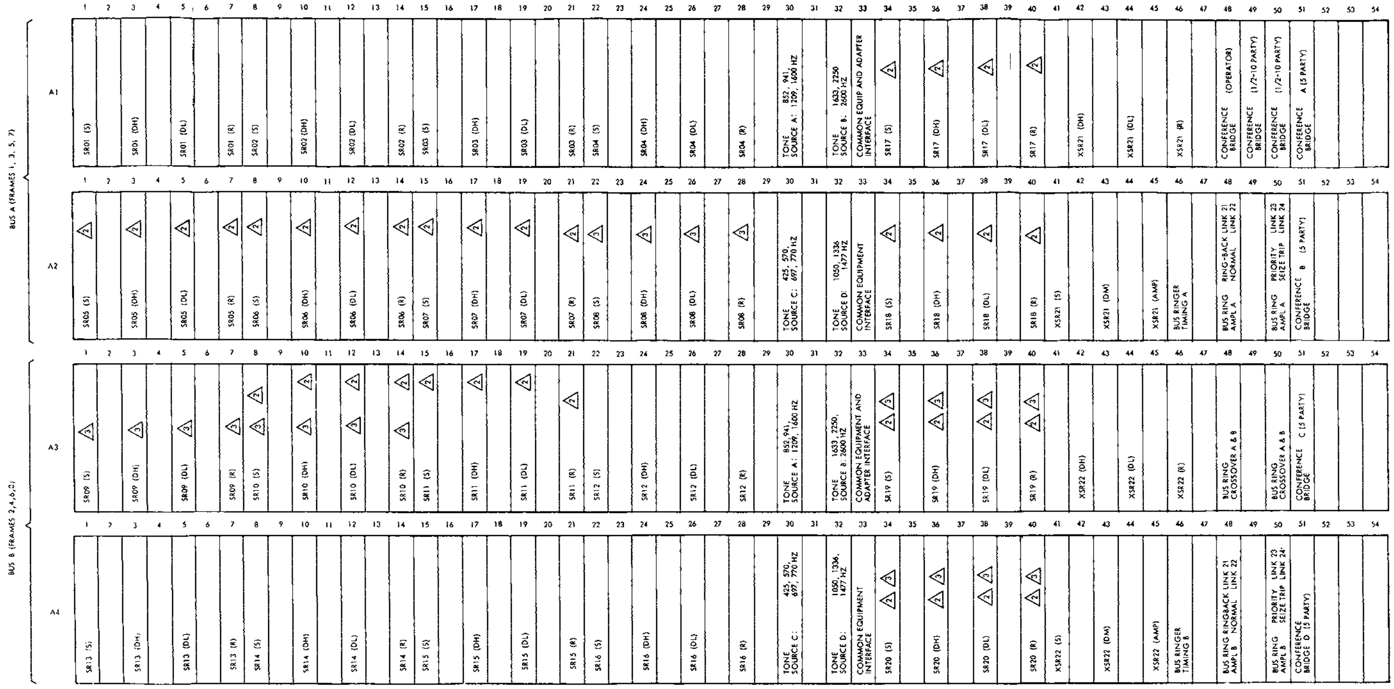
Figure FO-36(2). Terminal matrix frame functional card map (sheet 2 of 2).



NOTES:

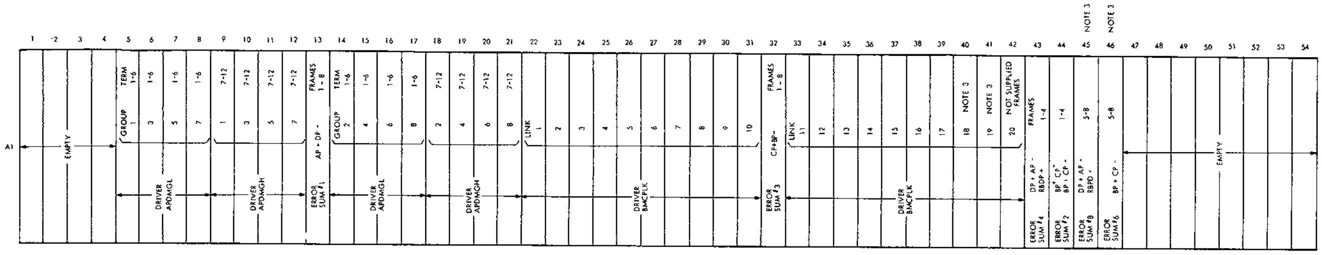
1. CARD SLOTS WITH NO DATA ENTERED ARE NOT USED.
2. EMPTY SLOT IN AN TTC-38(V)1
3. EMPTY SLOT IN AN TTC-38(V)2
4. PREFIX REFERENCENCE DESIGNATORS WITH A27.

5 CIRCUIT CARD IDENTIFICATION

CARD TYPE	IDENTIFYING NUMBER	CARD TYPE	IDENTIFYING NUMBER
SRXX (S)	SM-D-742648	TONE SOURCE D	SM-D-742605
SRXX (DH) AND XSRXX (DH)	SM-D-742647	COMMON EQUIPMENT INTERFACE	SM-D-742610
SRXX (DL) AND XSRXX (DL)	SM-D-742646	COMMON EQUIPMENT/ADAPTER INTERFACE	SM-D-742609
SRXX (R) AND XSRXX (R)	SM-D-742645	BUS RINGER TIMING	SM-D-742611
XSRXX (DM)	SM-D-742617	BUS RING AMPLIFIER	SM-D-742612
XSRXX (AMP)	SM-D-742620	CONFERENCE BRIDGE	SM-D-742606
TONE SOURCE A	SM-D-742602	ASRXX (S)	SM-D-742618
TONE SOURCE B	SM-D-742603		
TONE SOURCE C	SM-D-742604		

EL5805-628-12-C1-TM-172

Figure FO-37. Common equipment next assembly functional card map.



NOTES:

1. REFERENCE DESIGNATORS ARE PREFIXED WITH A32

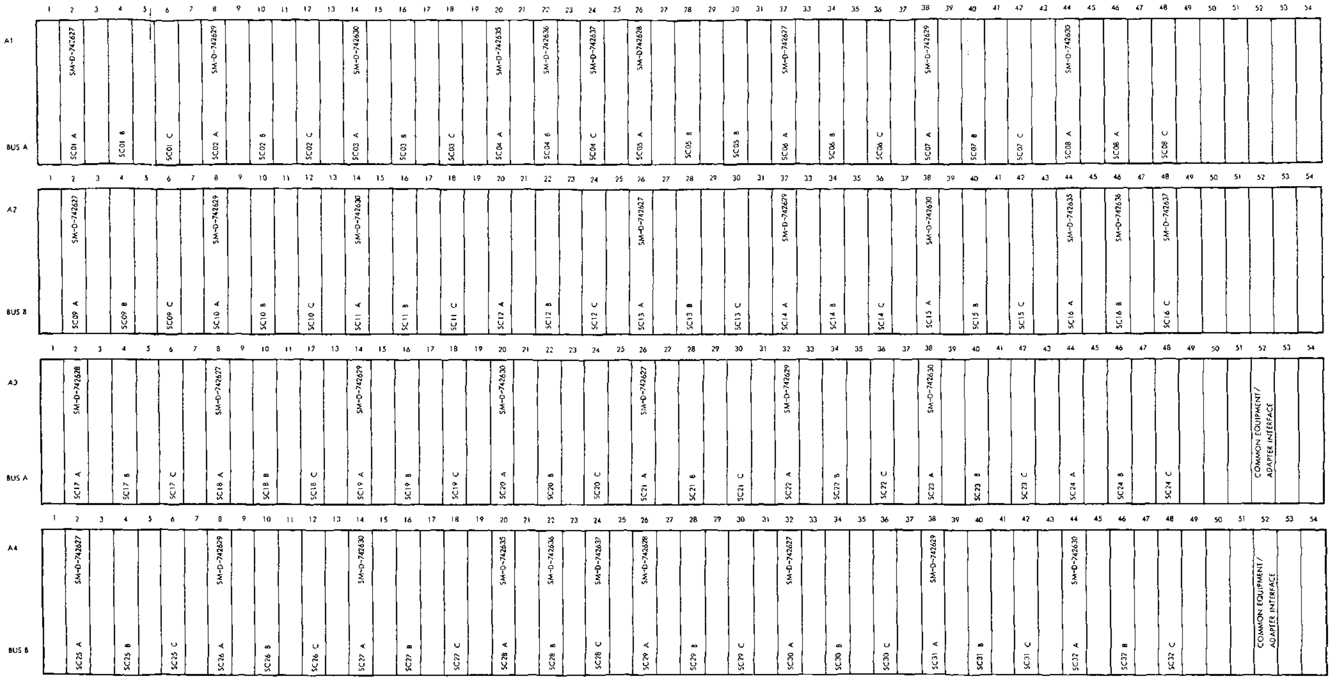
2. CIRCUIT CARD IDENTIFICATION

CARD TYPE	NUMBER
DRIVER	SM-D-742640
ERROR SUM	SM-D-742641

3. EMPTY SLOT IN AN/TTC-38 (V) 1

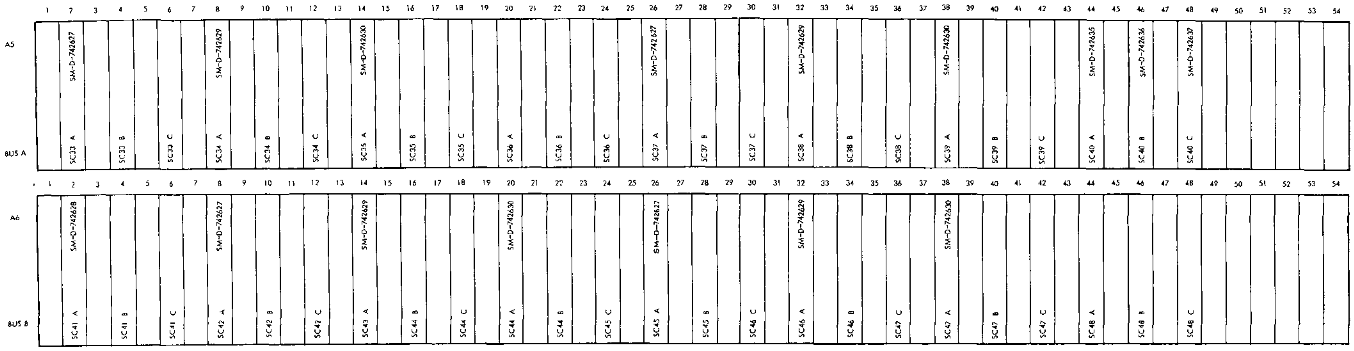
EL 5805-628-12-TM-173

Figure FO-38. Common driver next functional card map.



EL 5805-628-12-TM-174 (1)

Figure FO-39(1). Adapter assembly functional card map(sheet 1 of 2)



NOTES:

1. CARD SLOTS WITH NO DATA ENTERED ARE NOT USED
2. ANY ADAPTER TYPE MAY BE PLACED IN ANY SPECIAL CIRCUIT (SC) LOCATION. SINGLE CARD ADAPTERS USE ONLY SCXX CARD SLOT A. THREE CARD ADAPTERS USE SLOTS A, B, AND C. IDENTIFYING NUMBERS IN CARD SLOTS SHOW INITIAL DELIVERY LOCATION OF ADAPTERS.
3. ALL REFERENCE DESIGNATORS ARE PREFIXED WITH A25.
4. CIRCUIT CARD IDENTIFICATION

CARD TYPE	IDENTIFYING NUMBER
INTERFACE	SM-D-742609
COMMON BATTERY ADAPTER - SINGLE CARD	SM-D-742627
20-HZ RINGDOWN ADAPTER - SINGLE CARD	SM-D-742629
DC CLOSURE ADAPTER - SINGLE CARD	SM-D-742628
1600-HZ RINGDOWN ADAPTER - SINGLE CARD	SM-D-742630
AUTOVON PBX/SF DIAL ADAPTER A CARD	SM-D-742635
AUTOVON PBX/SF DIAL ADAPTER B CARD	SM-D-742636
AUTOVON PBX/SF DIAL ADAPTER C CARD	SM-D-742637

EL5805-628-12-C1-TM-174(2)

Figure FO-39(2). Adapter assembly functional card map (sheet 2 of 2).

OCTAL	BINARY		
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1
BIT VALUE	4	2	1

A. OCTAL NUMBER TABLE.

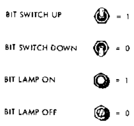
8. BINARY CODED DECIMAL TABLE

DECIMAL	BINARY			
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
BIT VALUE	8	4	2	1

B. BINARY CODED DECIMAL TABLE.

DECIMAL	BINARY				
0	0	0	0	0	0
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	0
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1
BIT VALUE	16	8	4	2	1

C. DECIMAL TO BINARY TABLE.



D. BIT SWITCH AND LAMP CONVENTION.

INSTRUCTION: SET FUNCTION CODE TO 24.

NOTE: FUNCTION CODES ARE ALWAYS IN OCTAL UNLESS OTHERWISE SPECIFIED.

RESULT:

0	1	0	1	0	0
00	01	02	03	04	05

FUNCTION CODE

E. SAMPLE FUNCTION CODE SETTING.

INSTRUCTION: SET ADDRESS SWITCH REGISTER TO 1 2 3 4 5 6.

NOTE: ADDRESS SWITCH REGISTER SETTINGS ARE ALWAYS IN OCTAL UNLESS OTHERWISE SPECIFIED.

RESULT:

0	0	1	0	1	0	0	1	1	1	0	0	1	0	1	1	1	0
06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

ADDRESS SWITCH REGISTER

F. SAMPLE ADDRESS SWITCH REGISTER SETTING.

INSTRUCTION: SET WORD SWITCH REGISTER TO 7 6 5 4 3 2 1 0.

NOTE: WORD SWITCH REGISTER SETTINGS ARE ALWAYS IN OCTAL UNLESS OTHERWISE SPECIFIED.

RESULT:

WORD SWITCH REGISTER

1	1	1	1	1	0	1	0	1	1	0	0	0	1	1	0	1	0	0	0	1	0	0	0
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

G. SAMPLE WORD SWITCH REGISTER SETTING.

INSTRUCTION: BUS INDICATOR DISPLAYS 5 3 7 1 4 3 2 0.

NOTE: BUS INDICATOR DISPLAYS ARE ALWAYS SPECIFIED IN OCTAL UNLESS OTHERWISE SPECIFIED.

RESULT:

BUS INDICATOR

1	0	1	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	18	18	19	20	21	22	23

H. SAMPLE BUS INDICATOR DISPLAY.

INSTRUCTION:

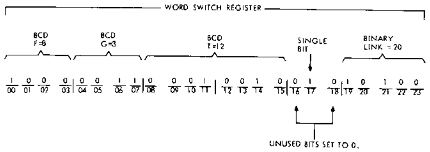
a. SET WORD SWITCH REGISTER TO IDENTIFY FRAME (8) GROUP (3) AND TERMINAL (12) IN BINARY CODED DECIMAL;

BITS 00 - 03 = FRAME NO.
BITS 04 - 07 = GROUP NO.
BITS 08 - 15 = TERMINAL NO.

b. SET WORD SWITCH REGISTER BIT 17 TO 1.

c. SET WORD SWITCH REGISTER BITS 19 TO 23 TO IDENTIFY LINK NUMBER (20) IN BINARY.

RESULT:



I. SAMPLE SELECTIVE FIELD SETTINGS.

EL5805 628 12 TM 10

Figure FO-40. Number conversion.

A. SRBA SHORTS, LOCATION GUIDE

SRBA BIT NUMBER	COMMON DRIVER A-32	COMMON EQUIPMENT A27	ADAPTER A25	MATRIX/ TERMINAL (FRAME 1) A31	MATRIX/ TERMINAL (FRAME 2) A33	MATRIX/ TERMINAL (FRAME 3) A29	MATRIX/ TERMINAL (FRAME 4) A30	(NOTE 1) MATRIX/ TERMINAL (FRAME 5) A44	(NOTE 1) MATRIX/ TERMINAL (FRAME 6) A45	(NOTE 1) MATRIX/ TERMINAL (FRAME 7) A40	(NOTE 1) MATRIX/ TERMINAL (FRAME 8) A42
1	A113	A133 A233*	A352				A726				A726
2	A144	A233*					A530				A530
3	A132	A233*					A426				A426
4	A143	A233*				A726				A726	
5		A233*				A530				A530	
6		A133, A233*				A426				A426	
7		A133, A233*	A352		A726				A726		
8		A133, A233*	A352		A530				A530		
9	A113	A133, A233*	A352		A426				A426		
10	A144	A133, A233*	A352	A726				A726			
11	A132	A133, A233*	A352	A530				A530			
12	A143	A233*		A426				A426			
13		A233*									
14				A427*	A627*		A427*	A627*		A427*	A627*
15				A427*	A627*		A427*	A627*		A427*	A627*
16				A427*	A627*		A427*	A627*		A427*	A627*

B. SRBB SHORTS, LOCATION GUIDE

SRBB BIT NUMBER	COMMON DRIVER A32	COMMON EQUIPMENT A27	ADAPTER A25	MATRIX/ TERMINAL (FRAME 1) A31	MATRIX/ TERMINAL (FRAME 2) A33	MATRIX/ TERMINAL (FRAME 3) A29	MATRIX/ TERMINAL (FRAME 4) A30	(NOTE 1) MATRIX/ TERMINAL (FRAME 5) A44	(NOTE 1) MATRIX/ TERMINAL (FRAME 6) A45	(NOTE 1) MATRIX/ TERMINAL (FRAME 7) A40	(NOTE 1) MATRIX/ TERMINAL (FRAME 8) A42
1	A121, A138 A142	A333, A433*	A452		A331, A324		A730		A331		A730
2	A117, A137 A141	A433*					A626		A324		A626
3	A112, A136 A140	A433*		A331			A430				A430
4	A108, A135 A139	A433*		A324		A730		A331		A730	
5	A120, A134	A433*				A626	A327, A330	A324		A626	A327, A330
6	A116, A133	A333, A433*				A430	A326, A329			A430	A326, A329
7	A111, A131	A333, A433*	A452		A730		A325, A328		A730		A325, A328
8	A107, A130	A333, A433*	A452		A626	A327, A330			A626	A327, A330	
9	A119, A129	A333, A433*	A452		A430	A326, A329			A430	A326, A329	
10	A115, A128	A333, A433*	A452	A730		A325, A328		A730		A325, A328	
11	A110, A127	A333, A433*	A452	A626	A327, A330			A626	A327, A330		
12	A106, A126	A433*		A430	A326, A329			A430	A326, A327		
13	A118, A125	A433*			A325, A328				A325, A328		
14	A114, A124			A327, A330, A627*		A427*	A627*	A327, A330	A427*	A627*	
15	A109, A123			A326, A329 A627*		A427*	A627*	A326, A329	A427*	A627*	
16	A105, A122			A325, A328, A627*		A427*	A627*	A325, A328	A427*	A627*	

C. SRBC SHORTS, LOCATION GUIDE

SRBC BIT NUMBER	COMMON DRIVER A32	COMMON EQUIPMENT A27	ADAPTER A25	MATRIX/ TERMINAL (FRAME 1) A31	MATRIX/ TERMINAL (FRAME 2) A33	MATRIX/ TERMINAL (FRAME 3) A29	MATRIX/ TERMINAL (FRAME 4) A30	(NOTE 1) MATRIX/ TERMINAL (FRAME 5) A44	(NOTE 1) MATRIX/ TERMINAL (FRAME 6) A45	(NOTE 1) MATRIX/ TERMINAL (FRAME7) A40	(NOTE 1) MATRIX/ TERMINAL (FRAME 8) A42
1	A121, A122 A139						A331				A331
2	A117, A123 A140						A324, A630				A324
3	A112, A124 A141					A331	A526			A331	
4	A108, A125 A142					A324				A324	
5	A120, A126					A630	A327, A330				A327, A330
6	A116, A127					A526	A326, A329				A326, A329
7	A111, A128						A325, A328				A325, A328
8	A107, A129				A630	A327, A330				A327, A330	
9	A119, A130				A526	A326, A329				A326, A329	
10	A115, A131					A325, A328				A325, A328	
11	A110, A133			A630	A327, A330				A327, A330		
12	A106, A134			A526	A326, A329				A326, A329		
13	A118, A135				A325, A328				A325, A328		
14	A114, A136			A327, A330	A427*	A627*		A427* A327, A330	A627*		A427*
15	A109, A137			A326, A329	A427*	A627*		A427* A326, A329	A627*		A427*
16	A105, A138			A325, A328	A427*	A627*		A427* A325, A328	A627*		A427*

D. PROPAGATED FAULT LOCATION GUIDE.

SRB BIT NO.	BUS INTERFACING CARD	PROPAGATES FAULTS FROM
A1-A13	A27A233	A27 BUS A SR(DL), SR(DH), AND XSR(DL), (DH), AND (DM) CARDS
A11-A13	A27A233	A27A243 A27A245 A50A3
B1-B13	A27A443	A27 BUS B SR(DL), SR(DH) AND XSR (DL), (DH) AND (DM) CARDS
B11-B13	A27A443	A27A443 A27A445 A27A348 A50A3
A, B, OR C 14-16	A427	SERVICE SF/DC, AND DTMF TERMINAL CARDS IN GROUPS 1, 2, 3, 4 OF FRAME
A, B, OR C 14-16	A627	SERVICE SF/DC, AND DTMF TERMINAL CARDS IN GROUPS 5, 6, 7, 8 OF FRAME.

NOTES:
1. AN/TTC-38(V)2 ONLY.
2. TRY CARDS MARKED * FIRST. THESE CARDS CAN PROPAGATE FAULTS WHICH LOOK LIKE SHORTS ON BUS.

EL5805-628-12-TM-76

Figure FO-41. Troubleshooting SBRbus shorts.

Path No.	Path tested								Special enable bits								
	IF	G	T	OF	G	T	BC Link	Alternate Link	S	S	S	S	S	S	S	S	S
									Signal Name								
	X	X	XX	Y	Y	YY	VV	W	ITL	ITH	LKL	LKM	LKH	RBA	RBB	OTH	OTL
	T	T		T	T		ZZ	U	CP bus bit no.								
									6	7	8	9	10	11	12	13	14
1	1	1	01	0	0	00	1	1	1	0	1	0	0	0	0	0	0
2	2	2	02	0	0	00	2	1	1	0	1	0	0	0	0	0	0
3	3	3	03	0	0	00	3	1	1	0	1	0	0	0	0	0	0
4	4	4	04	0	0	00	4	1	1	0	1	0	0	0	0	0	0
5	1	5	05	0	0	00	5	0	1	0	1	0	0	0	0	0	0
6	2	6	06	0	0	00	6	0	1	0	1	0	0	0	0	0	0
7	3	7	07	0	0	00	7	0	0	1	1	0	0	0	0	0	0
8	4	8	08	0	0	00	8	0	0	1	1	0	0	0	0	0	0
9	1	1	09	0	0	00	9	0	0	1	0	1	0	0	0	0	0
10	2	2	10	0	0	00	10	0	0	1	0	1	0	0	0	0	0
11	3	3	11	0	0	00	11	0	0	1	0	1	0	0	0	0	0
12	4	4	12	0	0	00	12	0	0	1	0	1	0	0	0	0	0
13	0	0	00	1	1	01	13	1	0	0	0	1	0	0	0	0	1
14	0	0	00	2	2	02	14	1	0	0	0	1	0	0	0	0	1
15	0	0	00	3	3	03	15	1	0	0	0	1	0	0	0	0	1
16	0	0	00	4	4	04	16	1	0	0	0	1	0	0	0	0	1
17	0	0	00	1	5	05	17	0	0	0	0	0	1	0	0	0	1
18	0	0	00	2	6	06	18	0	0	0	0	0	1	0	0	0	1
19	0	0	00	3	7	07	19	0	0	0	0	0	1	0	0	1	0
20	0	0	00	4	8	08	20	0	0	0	0	0	1	0	0	1	0
21	0	0	00	1	1	09	21	0	0	0	0	0	0	1	0	1	0
22	0	0	00	2	2	10	22	0	0	0	0	0	0	1	0	1	0
23	0	0	00	3	3	11	23	0	0	0	0	0	0	1	0	1	0
24	0	0	00	4	4	12	24	0	0	0	0	0	0	1	0	1	0
25	0	0	00	1	5	13	21	0	0	0	0	0	0	0	1	0	0
26	0	0	00	2	6	01	22	0	0	0	0	0	0	0	1	0	1
27	0	0	00	3	7	02	23	0	0	0	0	0	0	0	1	0	1
28	0	0	00	4	8	03	24	0	0	0	0	0	0	0	1	0	1

A. AN/TTC-38(V)1

Path No.	Path Tested								Special enable bits								
	IF	G	T	OF	G	T	BC Link	Alternate Link	S	S	S	S	S	S	S	S	S
									Signal Name								
	X	X	XX	Y	Y	YY	VV	W	ITL	ITH	LKL	LKM	LKH	RBA	RBB	OTH	OTL
	T	T		T	T		ZZ	U	CB bus bit no.								
									6	7	8	9	10	11	12	13	14
1	1	1	01	0	0	00	1	0	1	0	1	0	0	0	0	0	0
2	2	2	02	0	0	00	2	0	1	0	1	0	0	0	0	0	0
3	3	3	03	0	0	00	3	0	1	0	1	0	0	0	0	0	0
4	4	4	04	0	0	00	4	0	1	0	1	0	0	0	0	0	0
5	5	5	05	0	0	00	5	0	1	0	1	0	0	0	0	0	0
6	6	6	06	0	0	00	6	0	1	0	1	0	0	0	0	0	0
7	7	7	07	0	0	00	7	0	0	1	1	0	0	0	0	0	0
8	8	8	08	0	0	00	8	0	0	1	1	0	0	0	0	0	0
9	1	1	09	0	0	00	9	0	0	1	0	1	0	0	0	0	0
10	2	2	10	0	0	00	10	0	0	1	0	1	0	0	0	0	0
11	3	3	11	0	0	00	11	0	0	1	0	1	0	0	0	0	0
12	4	4	12	0	0	00	12	0	0	1	0	1	0	0	0	0	0
13	0	0	00	1	1	01	13	0	0	0	0	1	0	0	0	0	1
14	0	0	00	2	2	02	14	0	0	0	0	1	0	0	0	0	1
15	0	0	00	3	3	03	15	0	0	0	0	1	0	0	0	0	1
16	0	0	00	4	4	04	16	0	0	0	0	1	0	0	0	0	1
17	0	0	00	5	5	05	17	0	0	0	0	0	1	0	0	0	1
18	0	0	00	6	6	06	18	0	0	0	0	0	1	0	0	0	1
19	0	0	00	7	7	07	19	0	0	0	0	0	1	0	0	1	0
20	0	0	00	8	8	08	20	0	0	0	0	0	1	0	0	1	0
21	0	0	00	1	1	09	21	0	0	0	0	0	0	1	0	1	0
22	0	0	00	2	2	10	22	0	0	0	0	0	0	1	0	1	0
23	0	0	00	3	3	11	23	0	0	0	0	0	0	1	0	1	0
24	0	0	00	4	4	12	24	0	0	0	0	0	0	1	0	1	0
25	0	0	00	5	5	13	21	0	0	0	0	0	0	0	1	0	0
26	0	0	00	6	6	01	22	0	0	0	0	0	0	0	1	0	1
27	0	0	00	7	7	02	23	0	0	0	0	0	0	0	1	0	1
28	0	0	00	8	8	03	24	0	0	0	0	0	0	0	1	0	1

B. AN/TTC-38(V)2

EL 5805-628-12-TM-95

Figure FO-42. Decoder printout table.

HIGH VOLTAGE PROTECTOR ROW	SIGNAL ENTRY CONNECTOR	CABLE LETTER DESIGNATOR	FUNCTION
A1	J12	E	EVEN FRAME
A2	J15	NONE	OPERATOR
A3	J8	A	EVEN FRAME
A4	J11	D	EVEN FRAME
A5	J5	E	ODD FRAME
A6	J4	D	ODD FRAME
A7	J1	A	ODD FRAME
A8	J14	G	EVEN FRAME
A9	J13	F	EVEN FRAME
A10	J10	C	EVEN FRAME
A11	J9	B	EVEN FRAME
A12	J7	G	ODD FRAME
A13	J6	F	ODD FRAME
A14	J3	C	ODD FRAME
A15	J2	B	ODD FRAME

A. RELATIONSHIP OF SIGNAL ENTRY PANEL CONNECTORS TO HIGH VOLTAGE PROTECTOR ROWS

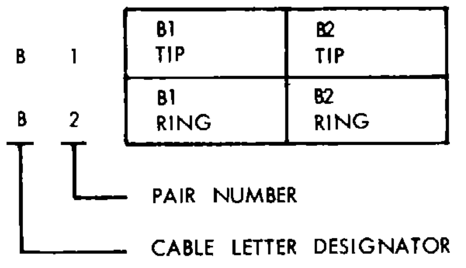
B. TERMINAL ARRANGEMENT OF HIGH VOLTAGE PROTECTOR OF ROWS A1, AND A3 THRU A15 (FRAME 1, ROW A15 IS SHOWN)

A15	E27 B2 TIP	E28 B2 RING	E29 B4 TIP	E30 B4 RING	E31 B6 TIP	E32 B6 RING	E51 B26 TIP	E52 B26 RING
	E1 B1 TIP	E2 B1 RING	E3 B3 TIP	E4 B3 RING	E5 B5 TIP	E6 B5 RING	E25 B25 TIP	E26 B25 RING

C. TERMINAL ARRANGEMENT OF HIGH VOLTAGE PROTECTOR ROW A2 (OPERATOR POSITION - CONNECTOR J15)

NOT USED	E45 INTERCOM XMT TIP	E46 INTERCOM XMT RING	E47 SIG PORT XMT TIP	E48 SIG PORT XMT RING	E49 TALK PORT 2 XMT TIP	E50 TALK PORT 2 XMT RING	E51 TALK PORT 1 XMT TIP	E52 TALK PORT 1 XMT RING
	E19 INTERCOM RCV TIP	E20 INTERCOM RCV RING	E21 SIG PORT RCV TIP	E22 SIG PORT RCV RING	E23 TALK PORT 2 RCV TIP	E24 TALK PORT 2 RCV RING	E25 TALK PORT 1 RCV TIP	E26 TALK PORT 1 RCV RING

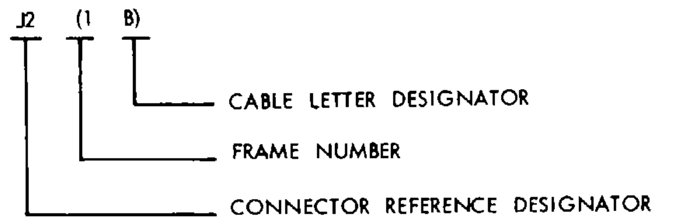
D. PATCH PANEL FIELD QUAD (BLACK) ARRANGEMENT



B 1	B1 TIP	B2 TIP
B 2	B1 RING	B2 RING

NOTES:

1. CABLE LETTER DESIGNATORS IDENTIFY PATCH PANEL AND SIGNAL ENTRY PANEL ENDS. OF 26 - PAIR CABLE CONNECTIONS.
2. SIGNAL ENTRY PANEL MARKINGS IDENTIFY CABLES AS FOLLOWS:



EL 5805-628-12-TM-229

Figure FO-43. Functional arrangement of high voltage protectors.

PROC	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A1	527	527	240	244	244	247	247	247	240	258	243	244	800	800	244	244	257	257
A2	258	247	247	247	258	244	243	231	235	247	247	247	801	801	231	255	246	255
A3	232	257	257	233	240	245	243	232	257	257	277	232	243	235	231	243	246	244
A4	232	257	257	233	240	244	243	232	257	257	231	232	240	240	228	232	233	232
A5	232	257	257	233	240	243	243	232	257	257	258	232	244	231	228	232	233	232
A6	232	257	257	233	240	244	243	232	257	257	231	232	257	257		232	233	232
A7	242	242	242	235	242	239	239	231	231	231	231	242	240	242	242	243	243	239
A8	243	243	231	231	231	242	243	242	242	242	242	240	241	242	235	239	242	231
FACP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A1			239	231	228		258	241	231	228		244	258	241		242		242
A2		581	581	581	581	581	805	805	805		805	805	805	805		581	581	581

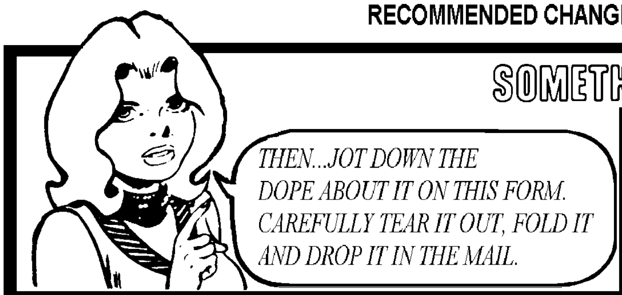
PROC	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
A1	714	714	231	240	277	244	242	231	231	231	242	235	239	239	239	242	244	235
A2	244	244	247	247	247	247	239	239	241	257	255	247	247	245	247	241	241	231
A3	256	246	232	277	233	244	231	244	245	244	239	231	242	244	243	235	527	239
A4	229	244	232	229	244	231	241	241	235	242	242	245	236	242	235	242	231	232
A5	245	241	244	240	240	240	242	243	239	242		245		242	235	242	231	232
A6	244	229	243	242	244	232	239	258	258	242	242	245		244	258	231	231	232
A7	239	235	243	277	243	242	235	243	239	243	243	243	239	231	231			
A8	242	242	242	242	242	242	235	239	242									
FACP	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
A1	255	244	231		255		231	258	241	239	239	258	231	258	239	244	298	246
A2	581	239	231	245	245	228		245	242	242	242	246			241	258	239	

PROC	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
A1	239	250	250		231	239	242	239	229	243	243	242	241	242	239		239	
A2	242	243	237	244	258	258	239	258	239	239	231	239	239	240	239			
A3	231	231	231	231	243	239	239	242	239	239	243	235	246	242		243		
A4	244	235	243	235	243	239	231	239	244	242	235	242	242	246		246	246	246
A5	233	252	242	242	243		228	231	231	231	246	229	244	258	242	243	231	221
A6	233	252	243	244	277			239	242	242	231	242	243	239		258	258	258
A7			232	233	252			258	258	235	239	239	239	242		258	245	258
A8	248							242	778		243	235	235	229	244	242		244
FACP	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
A1	239	244		258	246	258	246	246		258		240	240	240	240	250	250	
A2	229	244	246	229			244			242	239	258	258	236		379		

Figure FO-44. Processor/FACP card map.
Change 4

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH PUBLICATION



FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER

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DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 022074-000