DEPARTMENT OF THE ARMY TECHNICAL MANUAL **TM 11-5805-250-10**

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER **TO31W1-2TCC-171**

OPERATOR'S MANUAL

TELEGRAPH

TERMINALS

AN/TCC-4 AND

AN/TCC-20

This copy is a reprint which includes current pages from Changes 3 and 4.

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

AUGUST 1959

WARNING

HIGH VOLTAGE

is used in this equipment.

DEATH ON CONTACT

**may result if safety precautions
are not observed.**

All operating adjustments of this equipment are made with the power on. Be careful when working on the inside of the equipment. Be careful not to contact the high-voltage input connections.

**EXTREMELY DANGEROUS POTENTIALS
EXIST IN ALL PANELS OF THE EQUIPMENT
DON'T TAKE CHANCES**

Changes in force: C3 and C4

TM 11-5805-250-10
TO31W1-2TCC-171
***C4**

CHANGE NO. 4 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 8 January 1984

OPERATOR'S MANUAL TELEGRAPH TERMINALS
AN/TCC-4 (NSN 5805-00-537-7387) AND
AN/TCC-20 (NSN 5805-00-338-4451)

TM 11-5805-250-10/TO31W1-2TCC-171, 21 August 1959, is changed as follows:

Cover. The title is superseded as shown above.

Page 3. Delete paragraphs 1.1, 2 and 2.1 and substitute;

1.1. 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.

2. 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.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 73511-2/DLAR 4140.55/NAVMATINST 4355.73A/ AFR 400-54/MCO 4430.3F.

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 4610.33C/ AFR 75-18/MCO P4610.19D/DLAR 4500.15.

2.1. 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) 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.

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

Add paragraphs 2.2, 2.3 and 2.4 after paragraph 2.1.

2.2. Reporting Equipment Improvement Recommendations (EIR)

a. Army. If your telegraph terminal 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.

*This change supersedes C2, 15 August 1963.

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

2.3. 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 are covered in chapter 5 and TM 740-90-1.

2.4. Destruction of Army Electronics Materiel

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

Page 60. Delete section I and substitute:

Section I. OPERATOR'S PREVENTIVE MAINTENANCE

53. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Telegraph. Terminals AN/TCC-4 and AN/ TCC-20 are listed below, together with a reference to the paragraphs covering the specific maintenance functions. These duties do not require special tools or test equipment.

a. Preventive maintenance (para 54).

b. Preventive maintenance checks and services chart (para 54.2).

c. Visual inspection (para 55).

d. Troubleshooting (para 56).

e. Replacement of defective tubes, lamps, lighting arresters and fuses (para 57).

f. Checking cable, line and loop connections (paras 26 through 30).

54. Preventive Maintenance

NOTE

Refer to TM 750-244-2 for proper procedures for destruction of this equipment to prevent enemy use.

a. Operator/crew preventive maintenance is the systematic care, servicing and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to maintain equipment in serviceable condition. To be sure that your telegraph terminal is always ready for your mission, you must do scheduled preventive maintenance checks and services (PMCS).

(1) BEFORE OPERATION, perform you B PMCS to be sure that your equipment is ready to go.

(2) When an item of equipment is reinstalled after removal, for any reason, perform the necessary B PMCS to be sure the item meets the readiness reporting criteria.

(3) Use the ITEM NO. column in the PMCS table to get the number to be used in the TM ITEM NO. column on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) when you fill out the form.

b. Routine checks like CLEANING, DUSTING, WASHING, CHECKING FOR FRAYED CABLES, STOWING ITEMS NOT IN USE, COVERING UNUSED RECEPTACLES, CHECKING FOR LOOSE NUTS AND BOLTS, AND CHECKING FOR COMPLETENESS are not listed as PMCS checks. They are things that you should do any time you see they must be done. If you find a routine check like one of those listed in your PMCS, it is because other operators reported problems with this item.

NOTE

When you are doing any PMCS or routine checks, keep in mind the warnings and cautions.

WARNINGS

- **Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor 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 immediately.

- **Compressed air is dangerous and can cause serious bodily harm if protective means or- methods are not observed to prevent a chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel. Goggles must be worn at all times while cleaning with compressed air. Compressed air shall not be used .for cleaning purposes except where reduced to less than 29 pounds per square inch gage (psig) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when trichlorotrifluoroethane has been used.**

NOTES

The PROCEDURES column in your PMCS charts instruct how to perform the required checks and services. Carefully follow these instructions and, if tools are needed or the chart so instructs, get organizational maintenance to do the necessary work.

If your equipment must be in operation all the time, check those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

c. Deficiencies that cannot be corrected must be reported to higher, category maintenance personnel. Records and reports of preventive maintenance must be made in accordance with procedures given in TM 38-750.

54.1. Operator/Crew Preventive Maintenance Checks and Services

Perform before operation PMCS if you are operating the item for the first time.

NOTE

The checks in the interval column are to be performed in the order listed.

54.2. Operator/Crew Preventive Maintenance Checks and Services Chart

B - Before

Item No.	Interval B	Item to be Inspected	Procedures - Check for and have repaired or adjusted as necessary	Equipment is not Ready/Available If:
1	*	Telegraph Terminal AN/TCC-4 and AN/TCC-20	Perform operational checks as described in paragraph 45.	

* Do this check before each deployment to a mission location. This will permit any existing problems to be corrected before the mission starts. The check does not need to be done again until redeployment.

Page 61. Figure 24 deleted.

Page 62. Figure 25 deleted.

Page 73. Change the title of chapter 5 to "SHIPMENT AND LIMITED STORAGE."

Delete section II in its entirety.

Page 74. Delete appendix I and substitute:

APPENDIX I

REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
TM 11-655	Fundamentals of Telegraphy (Teletypewriter).
TM 11-5815-206-12	Operator's and Organizational Maintenance Manual for Teletypewriter Sets AN/PGC-1 and AN/PGC-3 and Teletypewriters TT-4A/TG, TT-4B/TG, TT-4C/TG, TT-335/TG, TT-537/TG, TT-698/TG, TT-698A/TG, TT698B/TG, TT-722/TG and TT-722A/TG.
TM 43-0139	Painting Instructions for Field Use.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use.

By Order of the Secretaries of the Army and the Air Force:

JOHN A. WICKHAM JR.
General, United States Army
Chief of Staff

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Major General, United States Army
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DISTRIBUTION:

To be distributed in accordance with DA Form 12-51A-1, Operator Maintenance requirements for AN/TCC-4 and AN/TCC-20.

TM 11-5805-250-10
C3

CHANGE
NO. 3 ,

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 8 January 1984

Operator's Manual
TELEGRAPH TERMINALS AN/TCC-4 AND AN/TCC-20

TM 11-5805-250-10/TO31W1-2TCC-171, 21 August 1959, is changed as follows:

Page 3. Delete paragraph 1.1 and substitute:

1.1 Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

Delete paragraph 2 and substitute.

2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58/NAVSUP PUB 378/AFR 71-4/MCO P4030.29, and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF361) as prescribed in AR 55-38/NAVSUPINST 4610.33/AFM 75-18/MCO P4610.19A, and DSAR 4500.15.

2.1. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and Forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-C, Fort Monmouth, NJ 07703.

Page 6, paragraph 5. After subparagraph *b* add:

c. Items Comprising an Operable Equipment

FSN	*QTY*	*Nomenclature*
		Terminal, Telegraph AN/TCC-4
5805-503-1068	1	Modern, Telegraph TH-14/T
		Terminal, Telegraph AN/TCC-20
5805-356-2633	1	Telegraph Terminal Group TH-13/T: c/o Amplifier-Filter Assembly AM-683/T and Power Supply-Test Set PP-812/T: provides power supply measuring facilities, channel filters, line amplifier and line termination for tg modems.
5805-503-1069	1	Telegraph Modem Assembly TH-15/T: consists of Telegraph Modems TH-16/T and TH-17/T; transmitting freq channels 382.5 to 1657.5 Hz; 100 wmp speed of circuits
		Telegraph Terminal Group TH-13/T
5805-351-7410	1	Amplifier-Filter Assembly AM-683/T: input impedance 600 ohms; output impedance 600 ohms; filter assembly and bandpass filters; 18-1/16 in. lg x 15-7/32 in. W x 6-5/16 in. h
6625-569-0325	1	Power Supply-Test Set PP-812/T: level measurements: tg bias, and power source measurements; power output 12.6v and 6.8v as; 115/230v, 50/60 Hz, single phase; 18-1/16 in. lg x 15-7/32 in. W x 7-3/4 in. H
		Telegraph Modem Assembly TH-15/T
5805-503-1067	1	Modem. Telegraph TH-16/T: 2 tg channels; 2 crt; transmitting

FSN	QTY	Nomenclature
		freq 1062.5 to 1657.5 Hz; 100 wpm speed of ckt; 18-1/16 in. lg x 15-7/32 in. W x 7-1/32 in. h
5805-501-4625	1	Modem. Telegraph TH-17/T: 2 tg channels 2 ckt; transmitting freq. channel on one line 382.5 to 977.5 Hz; 100 wpm for 7.4 unit code; 18-1/16 in. lg x 15-7/32 in. w x 7-1/32 in. h

Page 75. Delete appendix II (including figure 1,2, and 3) and substitute:

APPENDIX II
BASIC ISSUE ITEMS LIST (BIIL) AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST (ITIAL)

Section I. INTRODUCTION

1. Scope

This appendix lists only basic issue items required by the crew/operator for installation, operation, and maintenance of Telegraph Terminals AN/TCC-4, and AN/TCC-20.

2. General

This Basic Issue Items and Items Troop Installed or Authorized List is divided into the following sections:

a. Basic Issue Items List -Section II. A list, in alphabetical sequence, of items which are furnished with, and which must be turned in with the end item.

b. Items Troop Installed or Authorized List - Section III. Not applicable.

3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration. Not applicable.

b. Federal Stock Number. Indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

d. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code used to identify the manufacturer, distributor, or Government agency, etc., and is identified in SB 70842.

e. Description. Indicates the Federal item name and a minimum description required to identify the item.

f. Unit of Measure (U/M). Indicates the standard of basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, (e.g., ea, in., pr, etch. When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

g. Quantity Furnished with Equipment (Basic Issue Items Only). Indicates the quantity of the basic issue item furnished with the equipment

Section II. BASIC ISSUE ITEMS UST

(1) Illustration (A) Fig No.	(1) Illustration (B) Item No.	(2) Federal stock number	(3) Part number	(4) FSCM	(5) Description Usable on code	(6) Unit of meas	(7) Qty furn with equip
		5920-356-2103	SC-B-63039	80063	AMPLIFIER-FILTER ASSEMBLY AM-683/T ARRESTOR, LIGHTING MODEM, TELEGRAPH TH-16/T	EA	1
		5920-356-2103	SC-B-63039	80063	ARRESTOR, LIGHTNING MODEM, TELEGRAPH TH-17/T	EA	2
		5920-356-2103	SC-B-63039	80063	ARRESTOR, LIGHTNING	EA	2

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

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USAIS (2)
USAES (2)
USAINTCS (3)
WRAMC (1)
ATS (1)
Ft Gordon (10)
Ft Huachuca (10)
WSMR (1)
Ft Carson (5)
Ft Richardson (ECOM Ofc) (2)
Army Dep (1) except
LBAD (14)
SAAD (30)
TOAD (14)
ATAD (10)
GENDEP (2)
Sig Sec GENDEP (2)
Sig Dep (2)
SigFLDMS (1)
USAERDAA (1)
USAERDAW (1)
MAAG (1)
USARMIS (1)
Units org under fol TOE:
(1 cy each)
11-15
11-16
11-18
11-75
11-85
11-95
11-97
11-117
11-302
11-500(AA-AC)
32-56
32-57

NG: State AG, AL, MI, NY - 3 copies each.
USAR: None
For explanation of abbreviations used, see AR 31050.

TECHNICAL MANUAL
No. 11-805-250-10
TECHNICAL ORDER
No. 31W1-2TCC-171

DEPARTMENT OF THE ARMY
AND THE AIR FORCE

WASHINGTON 25, D. C., *21 August 1959*

TELEGRAPH TERMINALS AN/TCC-4 AND AN/TCC-20 OPERATOR'S MANUAL

* This manual supersedes so much of TM 11-2242/TO 31W4-2TCC-1, 13 January 1955, including C1, 31 December 1958, C2, 4 September 1957, and C3, 23 June 1958, as pertains to operation and installation; and the first echelon portion of Department of the Army Supply Manual SIG 7&8 AN/TCC-4/TO 31W4-2TCC-4, 25 February 1955, including C1, 11 August 1955, C2, 8 March 1956, C3, 29 November 1956, and C4, 9 May 1957.

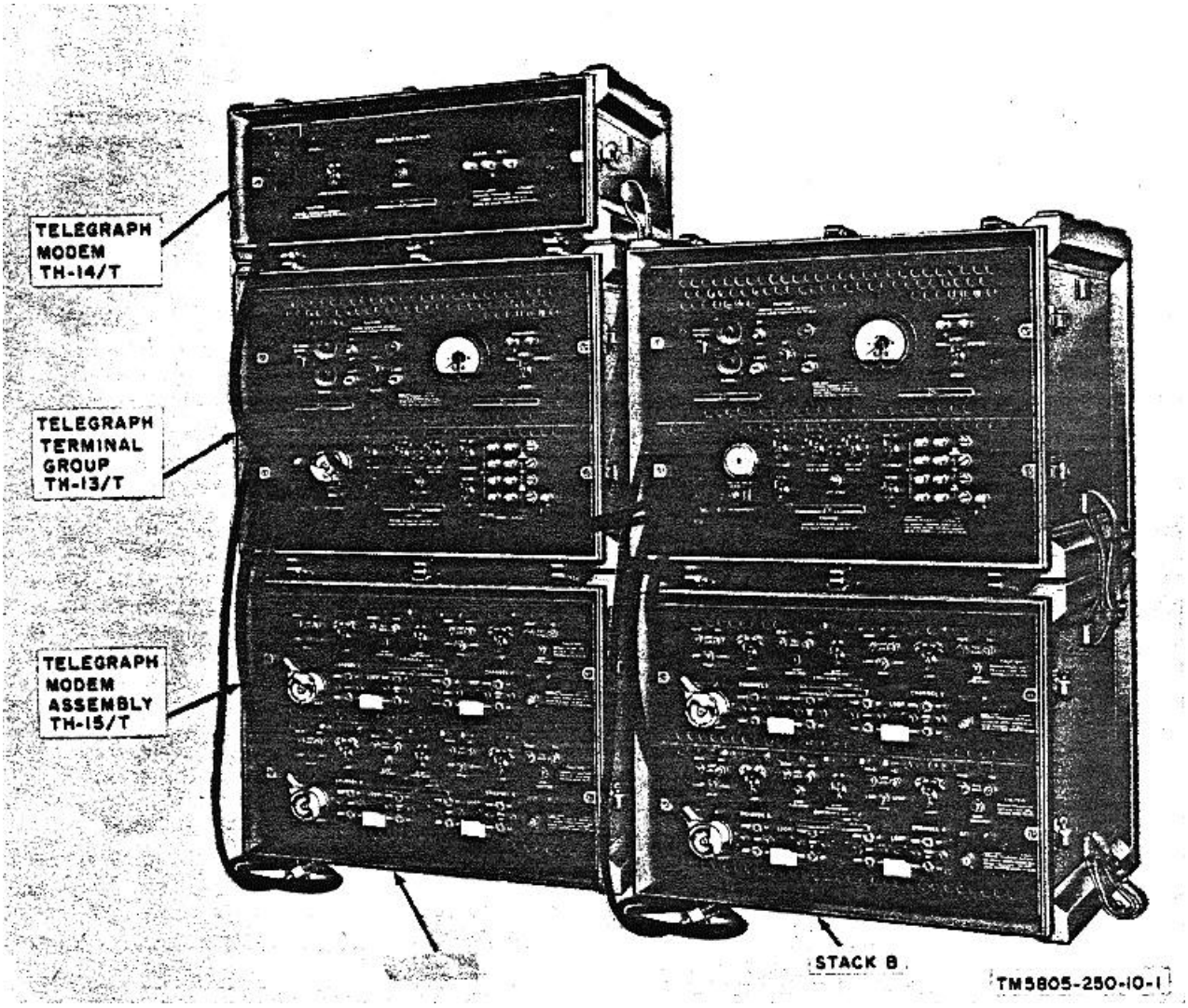


Figure 1. Telegraph Terminal AN/TCC-4, less technical manuals and case covers.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

This manual describes Telegraph Terminals AN/TCC-4 and AN/TCC-20 and covers their installation, operation, and operator's maintenance. It includes instructions for operation under usual and unusual conditions, cleaning and inspection of the equipment, and replacement of parts available to first echelon maintenance.

2. Forms and Records

a. Unsatisfactory Equipment Reports.

(1) Fill out and forward DA Form 468, Unsatisfactory Equipment Report, to the Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700-38.

(2) Fill out and forward AF TO Form 29, Unsatisfactory Report, to the Commander, Air Materiel Command, Wright-Patterson Air Force Base, Ohio, as prescribed in AF TO 00-35D-54.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6, Report of Damaged or Improper Shipment, as prescribed in AR 700-58 (Army), Navy Shipping Guide, Article 1850-4 (Navy), and AFR 71-4 (Air Force).

c. Preventive Maintenance Form. Prepare DA Form 11-238 (fig. 24 and 25), Maintenance Check List for Signal Equipment (Sound Equipment, Radio, Direction Finding, Radar, Carrier, Radiosonde and Television), in accordance with instructions on the form.

d. Parts List Form. Forward DA Form 2028, Recommended Changes to DA Technical Manual Parts Lists or Supply Manuals 7, 8, and 9, direct to the Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J., with comments on parts listings in Appendix II.

e. Comments on Manual. Forward all other comments on this publication direct to the Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

Section II. DESCRIPTION AND DATA

3. Purpose end Use

a. Telegraph Terminals AN/TCC-4 (fig. 1) and AN/TCC-20 (fig. 2) are terminal equipments for use on voice frequency (vf) telegraph communications systems. Telegraph Terminal AN/TCC-4 contains terminal facilities for eight channels; Telegraph Terminal AN/TCC-20 contains terminal facilities for four channels.

b. The terminals provide frequency-shift keying, carrier telegraph communication, up to 100 words per minute, within the vf band of 300 to 3,100 cycles per second (cps) over two-wire or four-wire circuits. The terminals can be arranged to provide either vf or 20-milliampere (ma), direct current (de) loop circuits to the terminating teletypewriter equipment.

c. The telegraph terminals may be used in point-to-point systems, telegraph-through-telephone carrier systems, and telegraph-through-radio link systems (par. 14). The various arrangements of the terminal equipment are described in paragraph 15.

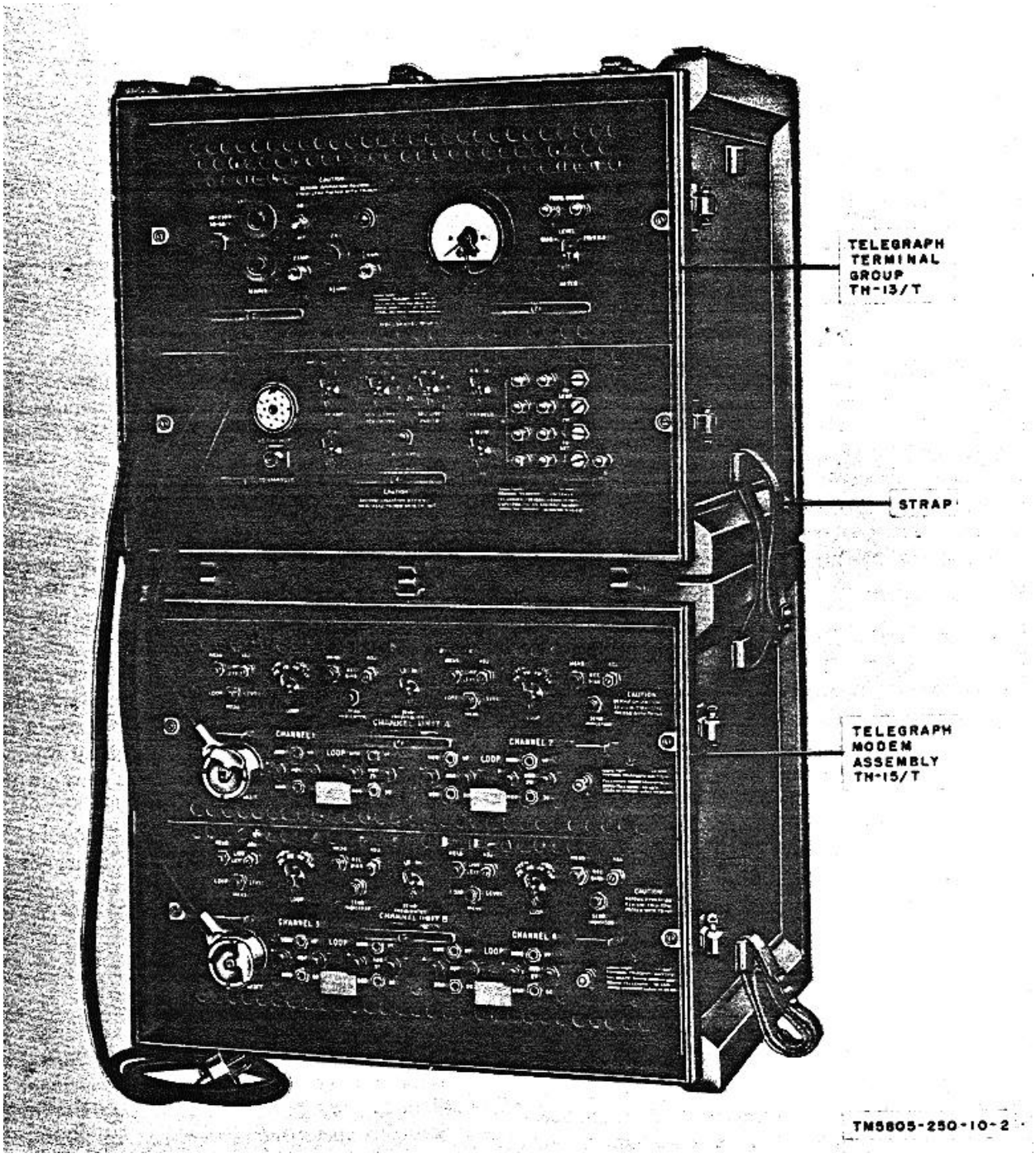


Figure 2. Telegraph Terminal AN/TCC-20, less technical manuals and case covers.

4. Technical Characteristic

a. Number of Channels.

4	AN/TCC-20 at each terminal operated over two-wire or four-wire line facility.
8	AN/TCC-4 at each terminal operated over two-wire or four-wire line facility. Two each AN/TCC-20 at each terminal operated over four-wire line facility.
16	Two each AN/TCC-4 at each terminal operated over four-wire line facility.

b. Line Side of Terminal.

Type of modulation	Frequency-shift keying.
Type of termination	Two wire or four wire.
Terminal impedance	600 ohms.
Terminal transmitting maximum output level (per channel).	0 dbm, adjustable in 3-db steps from 0 to -24 dbm per channel.
Terminal receiving sensitivity (per channel)	25 dbm.
Filter attenuation to adjacent channels	40 db.
Telegraph transmission speed	100 words per minute, maximum.
Frequency range (AN/TCC-4 using its Telegraph Modem TH-14/T).	425 cps to 2,975 cps mean frequencies, spaced at 170-cps intervals. Mark and space deviations +42.5 and -42.5 cps, respectively, for each channel. (See chart below.)
Frequency range (AN/TCC-20 or AN/TCC-4 without using its Telegraph Modem TH-14/T).	425 to 1,615 cps mean frequencies, spaced at 170-cps intervals. Mark and space deviations +42.5 and -42.5 cps, respectively, for each channel. (See chart below.)

Channel	Mean frequencies (cps)	
	Output of TH-15/T	Output of TH-14/T (AN/TCC-4)
1	425 595	2,975 2,805
2	765 935	2,635 2,465
3	1,105 1,275	2,295 2,125
4	1,445 1,615	1,955 1,785

Note. Throughout this manual the channel mean frequency reference is used to identify the band of channel frequencies used.

c. Loop Circuits.

Type of loop operation:

Vf two-wire	Half duplex.
Vf four-wire	Full duplex.

Do four-wire	Neutral full duplex. Positive 20-ma mark current (0 space current) supplied by terminal.
Dc tandem	Neutral full duplex. Positive 50 volts mark signal, 0 volt space signal (20-ma mark, 0 space current) supplied to loop by receiving terminal.
Types of transmission	Frequency-shift or do telegraph signals.
Frequency of vf loops	1,325 cps, mark, and 1,225 cps, space.
Terminal impedances of vf loops	600 ohms ±10% for frequencies of 1,000 to 1,600 cps (1,500 to 2,500 ohms at 20 cps).
Receiving sensitivity to signals from vf loop-	0 dbm to -40 dbm. For signals below -48 dbm, channel is automatically held in mark (standby) condition.
Output level to vf loop	0 dbm ±2 db.

d. Power Requirements.

Power source	115 volts or 230 volts, 50-60 cps, single phase.
Power drain from ac source	240 watts per four-channel stack.

e. Test Facilities.

Metering	Meter and test switches provided for measurements of of loop and line levels, ac and de signal bias, and de voltage supply.
Test signal source	Crystal-controlled 20.4 kc ±2.5 cps and 85 cps ±.01 cps frequency standards.

f. Signaling and Ringing.

Ringing in vf loop circuits	115 volts, 20 cps from terminal to loop equipment. 15 volts minimum, 20 cps, from loop equipment to terminal.
Signaling in line circuit	Channel space frequency, operated I second, minimum.
Break-in on vf two-wave channels	Channel space frequency, operated 3 seconds, minimum.

5. Components of Telegraph Terminals AN /TCC-4 and AN /TCC-20

a. Major Components.

(1) *Telegraph Terminal AN/TCC-4* (fig. 1).

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Unit weight (lb)
1	Telegraph Modem TH-14/T	9	18 1/8	20 5/8	49
2	Telegraph Terminal Group TH-13/T consisting of: Power Supply-Tat Set PP-812/T Amplifier-Filter Assembly AM-83/T	16 7/8	18 1/8	20 5/8	104
2	Telegraph Modem Assembly TH-15/T consisting of: Telegraph Modem TH-17/T Telegraph Modem TH-16/T	16 7/8	18 1/8	20 5/8	82
4	Patch cord (fig. 3)			6 ft (lg)	
2	Technical manual TM 1152802-10.				
1 set	Running spares (*b* below).				

(2) *Telegraph Terminal AN/TCC-20* (fig. 2).

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Unit weight (lb)
1	Telegraph Terminal Group TH-13/T ..... consisting of: Power Supply-Test Set PP-812/T Amplifier-Filter Assembly AM-683/T	16 7/8	18 1/8	20 5/8	104
1	Telegraph Modem Assembly TH-15/T-..... consisting of: Telegraph Modem TH-17/T Telegraph Modem TH-16/T	16 7/8	18 7/8	20 5/8	82
2	Patch cord (fig. 3)			6 ft (lg)	
1	Technical Manual TM 115805-250-10.				
1 set	Running spares (b below).				

b. Running Spares. The following running spares are mounted on the chassis of each Power Supply Test Set PP-812/T (fig. 28) except the telephone protector blocks which are not stored in any particular location.

Quantity	Item
1	Electron tube, 6AU6WA or 6AU6[a]
3	Electron tube, 12AU7
1	Electron tube, 5751 (for V1002 in TH-14/T)'
3	Electron tube, 12AX7
1	Electron tube, 6X4W or 6X4*
1	Electron tube, 5R4WGY or 5R4GY[a]
1	Electron tube, 6080
1	Electron tube, 0A3
5	Fuse FU-11, 20 amperes, 250 volts[a]
5	Fuse, 634 amperes, 250 volts
5	Fuse, 2 amperes, 250 volts
5	Fuse, A ampere, 125 volts
5	Fuse, 3 ampered, 250 volts'
3	Incandescent lamp, 120 volts, 6 watts
1	Incandescent lamp, 6 to 8 volts, 1 watt
5	Telephone protector block (lightning arrester)

* Refer to paragraph 12*a*.

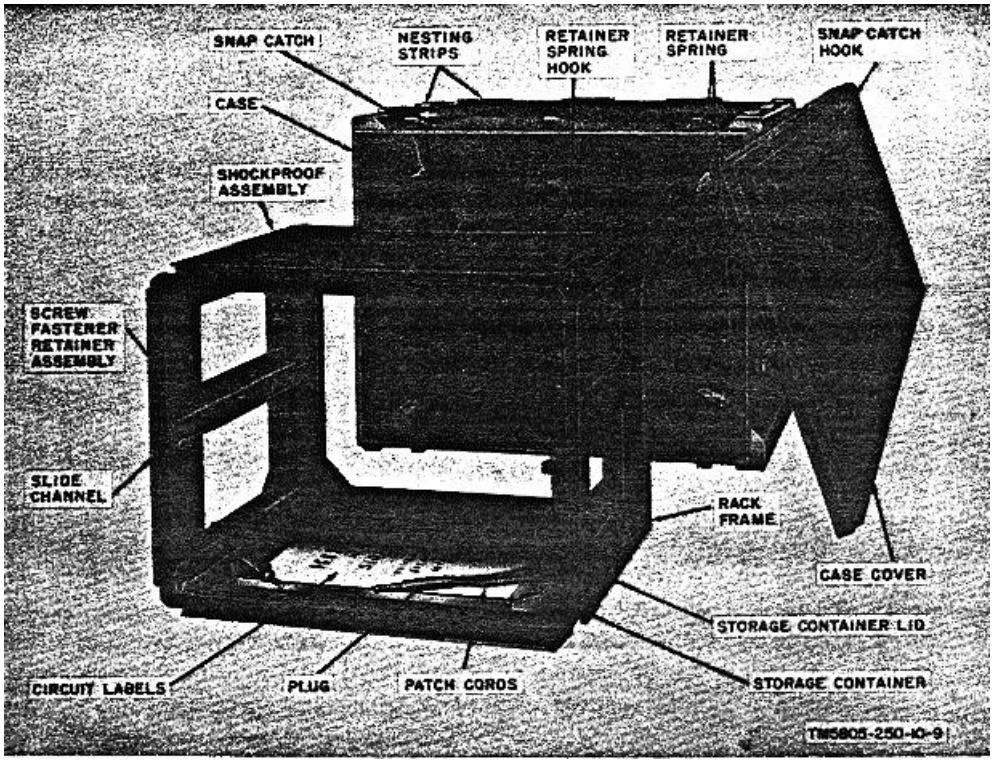
6. General Description of Telegraph Terminals AN/TCC-4 and AN/TCC-20

The components of Telegraph Terminals AN/TCC-4 (fig. 1) and AN/TCC-20 (fig. 2) are mounted in cases which provide weatherproof protection for shipment and storage. Nesting strips along the top and bottom of each case provide for stacking the components. Each component, except the TH-14/T, contains two drawer-type chassis which are mounted on rack frames in the case. The TH-14/T has one drawer-type chassis. Paragraphs 7 through 9 contain a description of the nomenclatured components of the telegraph terminal. Points of similarity in components are given in a through c below.

a. Case. The case (fig. 3), with the attached front cover and the rack frame (b below), provides a waterproof assembly for transit or storage. Snap catches on the front edges hold the cover in place. Carrying straps and strap hangers are provided on the sides. Retainer spring assemblies in each inside corner are used to secure the rack frame within the case.

b. Rack Frame. The rack frame (fig. 3) is secured within the case by retainer springs hooked over retainer spring hooks on the frame section members. The frame is made of metal strips or sections. Rubber strips mounted between parallel frame sections shock-mount the panel-and-chassis assemblies. Slide channels for the roller slides on the chassis are mounted on the sides of each rack frame.

c. Drawer-Type Chassis (fig. 4 through 6). Each drawer-type chassis consists of a front panel, connected to a chassis assembly. The chassis slides into the proper compartment of the rack frame on roller slides attached to its sides. The panel-and-chassis assembly is secured to the frame by panel fastener screws. Latches on the roller slides (fig. 17) prevent the chassis from being pulled out more than three-fourths of the way unless the latches are released. Operation of the latches permits removal of the chassis from the frame. All electrical connections between the equipment units are made by interconnecting cables and panel-mounted multicontact connectors.



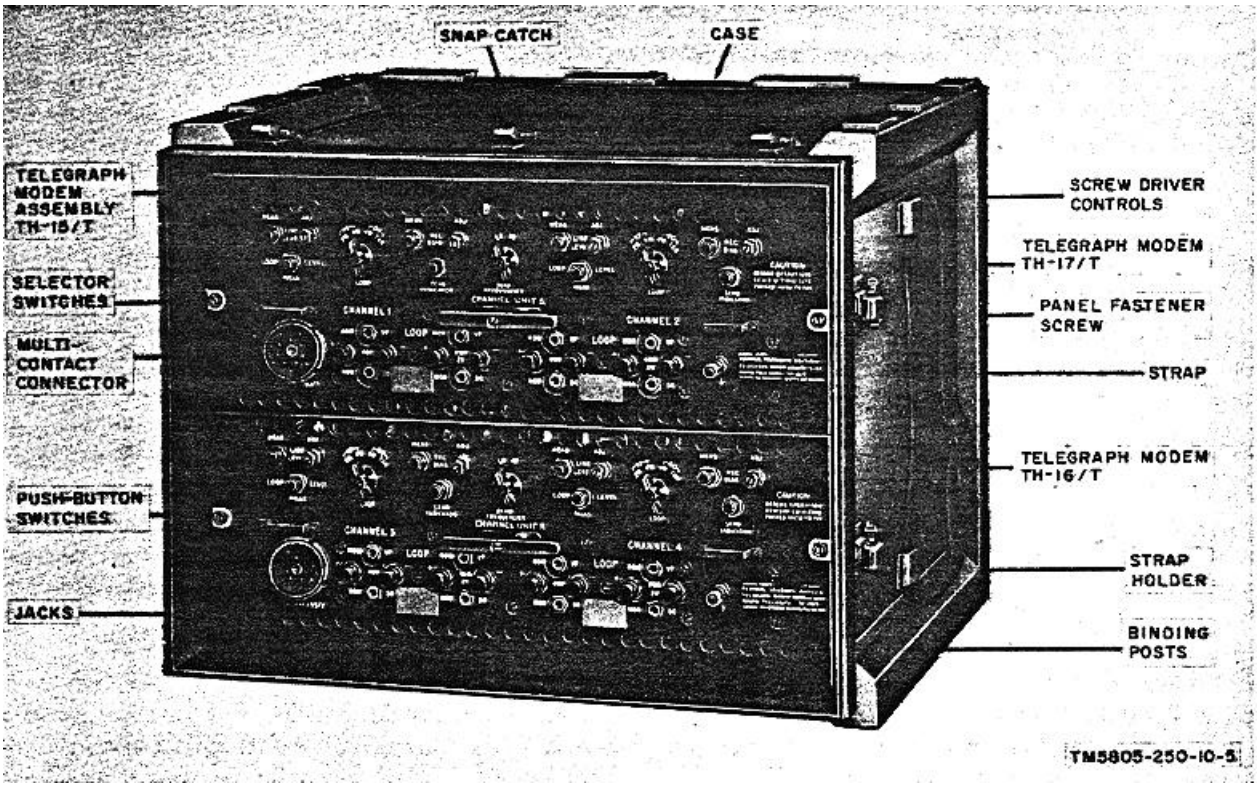


Figure 4. Telegraph Modem Assembly TH-15/T, case cover removed.

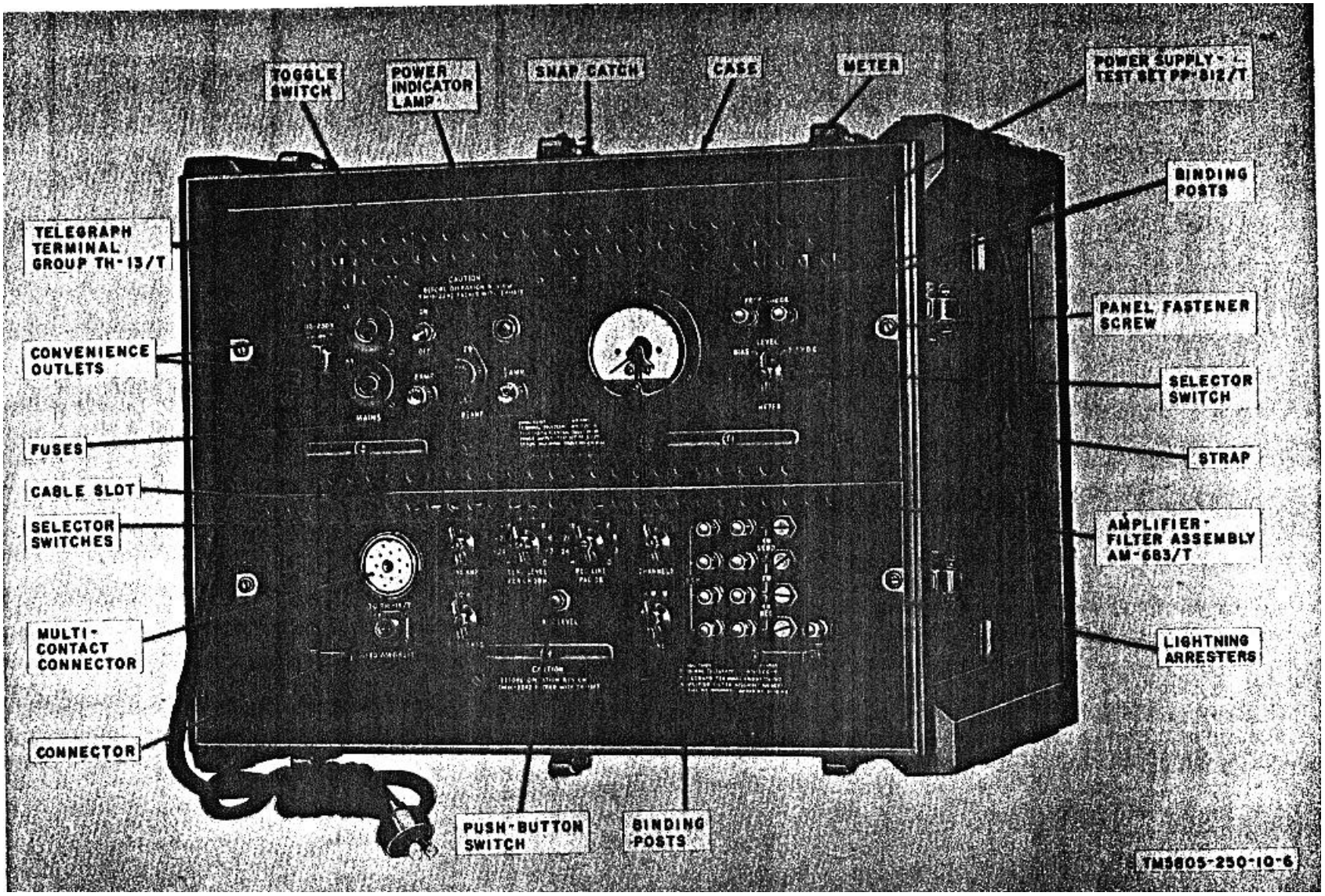


Figure 5. Terminal TH-13T, case cover removed.

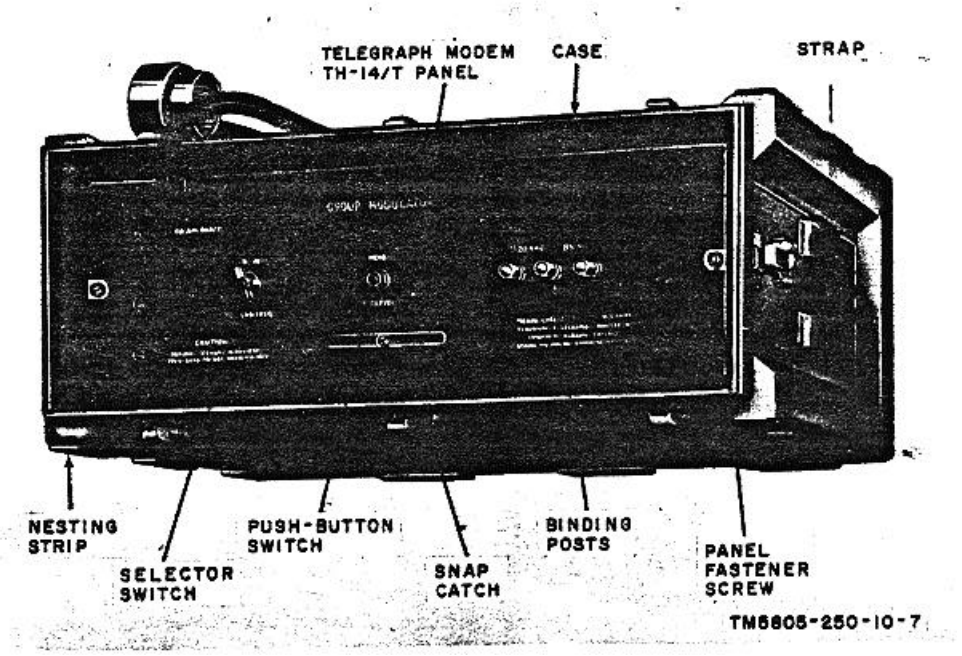


Figure 6. Telegraph Modem TH-14/T, case cover removed.

7. Description of Telegraph Modem Assembly TH-15 /T

(fig. 4)

a. Telegraph Modem Assembly TH-15/T consists of upper assembly Telegraph Modem TH-17/T and lower assembly Telegraph Modem TH-16/T. Except for the frequencies used and the values of the frequency-determining parts, the two assemblies are identical in circuit arrangement and description.

b. On the front panel of each assembly are a multicontact connector, switches, controls, binding posts, and jacks. On each side of the chassis of each assembly (fig. 17) are screw-driver controls, a pushbutton switch (REC BIAS CAL 56) and lightning arresters.

8. Description of Terminal Group TH-1 3/T

(fig. 5)

Terminal Group TH-13/T consists of Power Supply-Test Set PP-812/T and Amplifier-Filter Assembly AM-683/T mounted in a single case.

a. PP-812/T. The PP-812/T contains the 215-volt dc power supply, 2D-cps ringing supply, and metering circuits for a single stack of a telegraph terminal It also contains the running spares for one TH-14/T, one TH-13/T, and one TH-15/T. On the front panel are switches, a meter, fuses, testing binding posts, convenience outlets, and a power cable. On the chassis (fig. 28) are spare fuses and tubes, a power-switch (115 v-230v) (fig. 20), and a screw-driver control. Some equipment is provided also with an EXT-INT switch with associated binding posts (fig. 20).

b. AM-683/T. On the front panel are selector switches, a push-button switch, multicontact connectors, binding posts, and lightning arresters. A slot for the interconnecting cables is located on the top left corner of the panel. Facilities for storing the interconnecting cables are provided on the chassis (fig. 27).

9. Description of Telegraph Modem TH-14/T

(fig. 6)

The group modem is a single drawer-type unit mounted in a case. A selector switch, a push-button switch, and three binding posts are located on the front panel. Facility for storing the interconnecting cable is provided on the chassis (fig. 29).

10. Description of Minor Components

(fig. 3)

a. Two patch cords are provided with each TH-15/T. The patch cords are used to make connections from the monitoring jacks on the TH-17/T and the TH-16/T to the binding posts of a Telegraph Terminal TH-5/TG used as station monitoring equipment. The electrical cord assemblies (patch cords) are 6 feet long, and each is equipped with a plug at one end and a pair of tinned wire tips at the other end. The cords are stored in the compartment

located in the rack frame below the TH-16/T. The compartment is made accessible by removing the TH-16/T from the rack frame.

b. One copy of the circuit labels and over-all operating instructions is stored in the compartment located in the rack frame below the TH-16/T. The circuit label for the TH-15/T is a composite of the four channel circuits of the unit. Separate circuit labels are provided for the AM-A83/T, PP-812/T, and TH-14/T. The operating instructions summarize the procedures for installing and operating the telegraph terminal.

11. Additional Equipment Required

The equipments listed in a and b below are not supplied as part of the AN/TCC-4 or AN/TCC-20 but are required for their installation and operation.

a. Teletypewriter. A teletypewriter such as Teletypewriter TT-4A/TG (TM 11-5815-206-12) is required for monitoring at each terminal. The teletypewriter must have a selector magnet capable of operating on 20-ma dc current (for neutral operation).

b. Telegraph Terminal TH-5/TG. A TH-5/TG is required for monitoring vf loop-operated channels of the telegraph. terminal. The TH-5/TG is a component of Telegraph-Telephone Terminal AN/TCC-14 (TM 11-2239):

12. Differences in Equipment

Differences in equipment which are significant to the operator are given in a and b below.

a. PP-812/T. On some panels (fig. 28) the following components are provided; in others the components are not provided.

(1) Spare electron tube type 12AX7 in place of electron tube type 5751. It is used for V1002 in the TH-14/T.

(2) Electron tube type 6X4 in place of electron tube type 6X4W (V901, V902, and spare 6X4W).

(3) 1/8 AMP fuse (F908) (fig. 20).

(4) EXT-INT switch and binding posts E918 and E919 (fig. 20).

(5) 20 AMP fuse (F907) (fig. 20).

b. AM-683/T. In some equipment, the AM-683/T cable is stored in a metal compartment; in others (fig. 27), no metal compartment is provided.

c. TH-14/T. Some equipment contain electron tube type 12AX7 for V1002 (fig. 29). Others contain electron tube type 5751, the ruggedized equivalent of type 12AX7. Replacement of V1102 is covered in paragraph 57a.

Section III. SYSTEM APPLICATION

13. General

Telegraph Terminal AN/TCC-4 or AN/TCC-20 is used as a terminal unit in a telegraph carrier system. The telegraph terminals can be used alone or in conjunction with other equipment to form various communication systems. These equipments must meet the requirements listed in paragraphs 16 and 17.

14. Telegraph Carrier Systems

a. Point-to-point System (fig. 9). Point-to-point arrangements include direct land line connections between the telegraph terminals without the use of 'intermediate equipment. They may be interconnected by open-wire lines, telephone cable, or spiral-four cable on a two- or four-wire basis.

b. Telephone Carrier System. (fig. 7). Any telegraph terminal arrangement (fig. 9) may be connected to a channel of a telephone carrier terminal (par. 17a). The interconnecting facility between the telephone carrier terminals (wire, cable, repeater, or radio relay) is determined by the requirements of the telephone carrier terminal. Refer to the technical manual on the particular telephone carrier terminal for information on interconnections and system arrangements.

c. Vf Repeater or Radio Relay System. Vf repeaters or duplex radio relay systems (fig. 8) may be used to extend the range between the telegraph terminals. The number of vf repeaters or radio relay hops is determined by the technical considerations listed in paragraph 16b and c.

d. Tandem Application (D, fig. 10). When it is necessary to drop one or more channels of an AN/TCC-4 or AN/TCC-20 system at an intermediate point, two telegraph terminals are inserted at the intermediate point (par. 17d). Those channels not being dropped are connected through on a four-wire basis, and at the terminals are operated on a two- or four-wire basis as required.

e. With Other Telegraph Carrier Terminals. The AN/TCC-4 and AN/TCC-20 may be interconnected with a telegraph carrier terminal that uses frequency shift keying in the frequency range of the AN/TCC-4 and AN/TCC-20 (par. 4b). For other system applications for the AN/TCC-4 and AN/TCC-20, refer to TM 11-486-3.

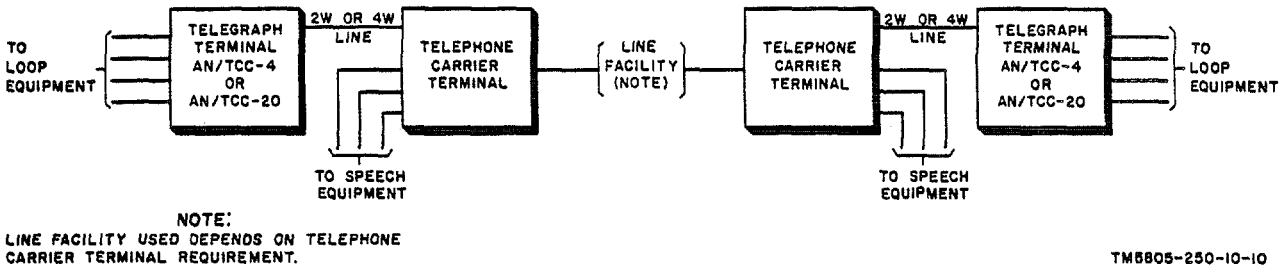


Figure 7. Typical system application using telephone carrier terminals, block diagram.

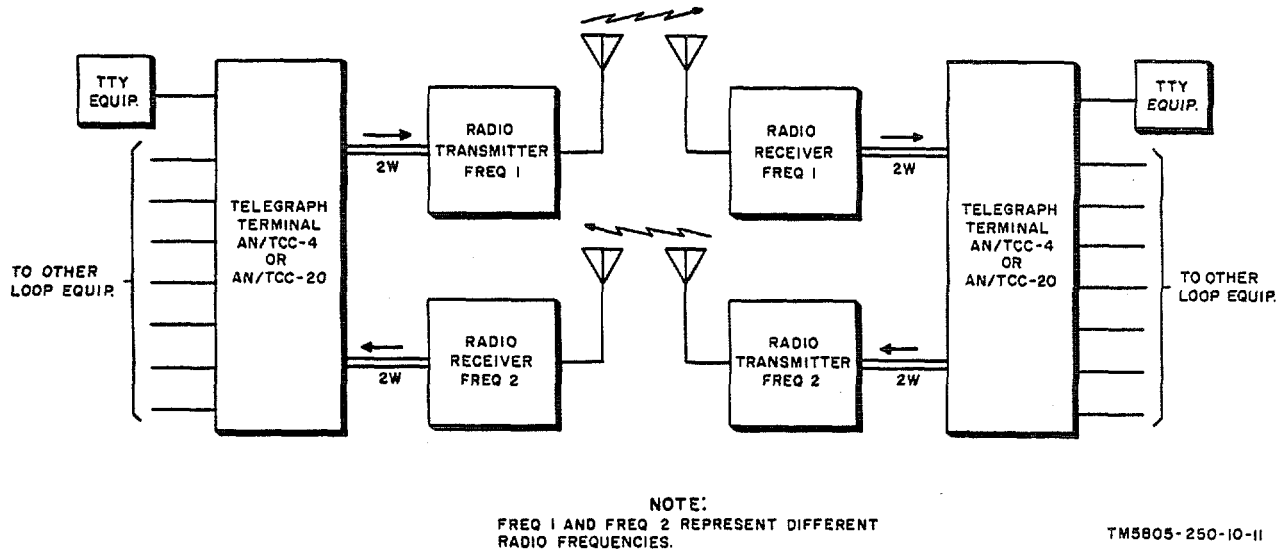


Figure 8. Typical system application using radio relay system, block diagram.

15. Terminal and Loop Arrangements (fig. 9)

a. Terminal Arrangements. The AN/TCC-4 and the AN/TCC-20 may be used in several types of terminal arrangements as described in (1) through (4) below.

(1) Four channel, two- and four-wire arrangements (A, fig. 9). Each terminal consists of one AN/TCC-20. The four-channel, two-wire and the four-channel four-wire arrangements are identical, except for the arrangement of the line terminating circuit in the AM-683/T and the type of line operation used.

(2) Eight-channel, four-wire arrangement (B, fig. 9). Each terminal consists of two interconnected AN/TCC-20's, or of one AN/ TCC-4 in which the TH-14/T is not used. This arrangement is equivalent to two four-channel stacks ((1) above) interconnected for operation over one four-wire line.

(3) Eight-channel, two-wire arrangement (B, (fig. 9). Each terminal consists of one AN/TCC-4. The primary difference between this arrangement and the eight-channel, four-wire arrangement ((2) above) is the addition of the TH-14/T which permits operation on a two-wire line facility.

(4) Sixteen-channel four-wire arrangement (C, fig. 9). Each terminal consists of two interconnected AN/TCC-4's. This arrangement is equivalent to two eight-channel, two-wire terminal ((3) above) interconnected for operation over a four-wire line.

b. Loop Equipment Arrangements. (fig. 10). Each channel of the telegraph terminal may be used with

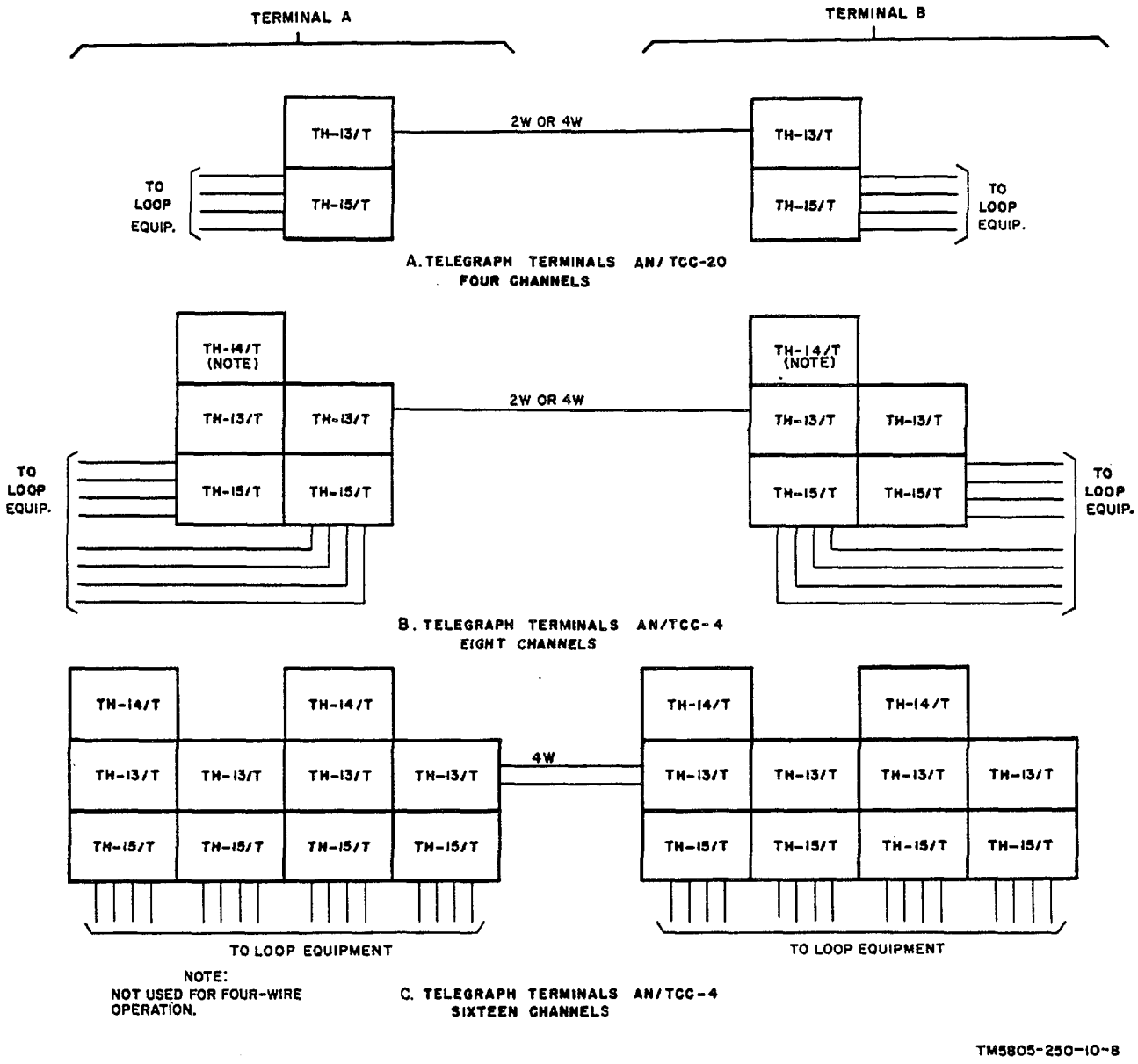


Figure 9. Terminal arrangements for AN/TCC-4 and AN/TCC-20, block diagram.

any one of the loop arrangements described in (1) through (4) below. The different types of loop arrangements are selected by the LOOP switch on each channel.

(1) *Vf two-wire loop (VF SW).*

(a) A vf loop, obtained by using a TH-5/TG and a teletypewriter, is shown in A, figure 10. Other TH-5/TG's may be connected in parallel on the loop line.

(b) A vf, loop connected to Electrical Filter Assembly F-8/U is shown in C, figure 10. With a telephone circuit connected to the F-98/U, simultaneous telegraph telephone service (TM 11-2239, Telegraph-Telephone Terminal AN/TCC-14) is provided.

(c) A vf loop connected to a switchboard is shown in E, figure 10. Manual Telephone Switchboard SB-22/PT (TM 11-2202) (or equivalent) should be used because the 20-cps break-in signal feature can pass through this switchboard without interruption. The switchboard operator has a TH-5/TG and a teletypewriter to

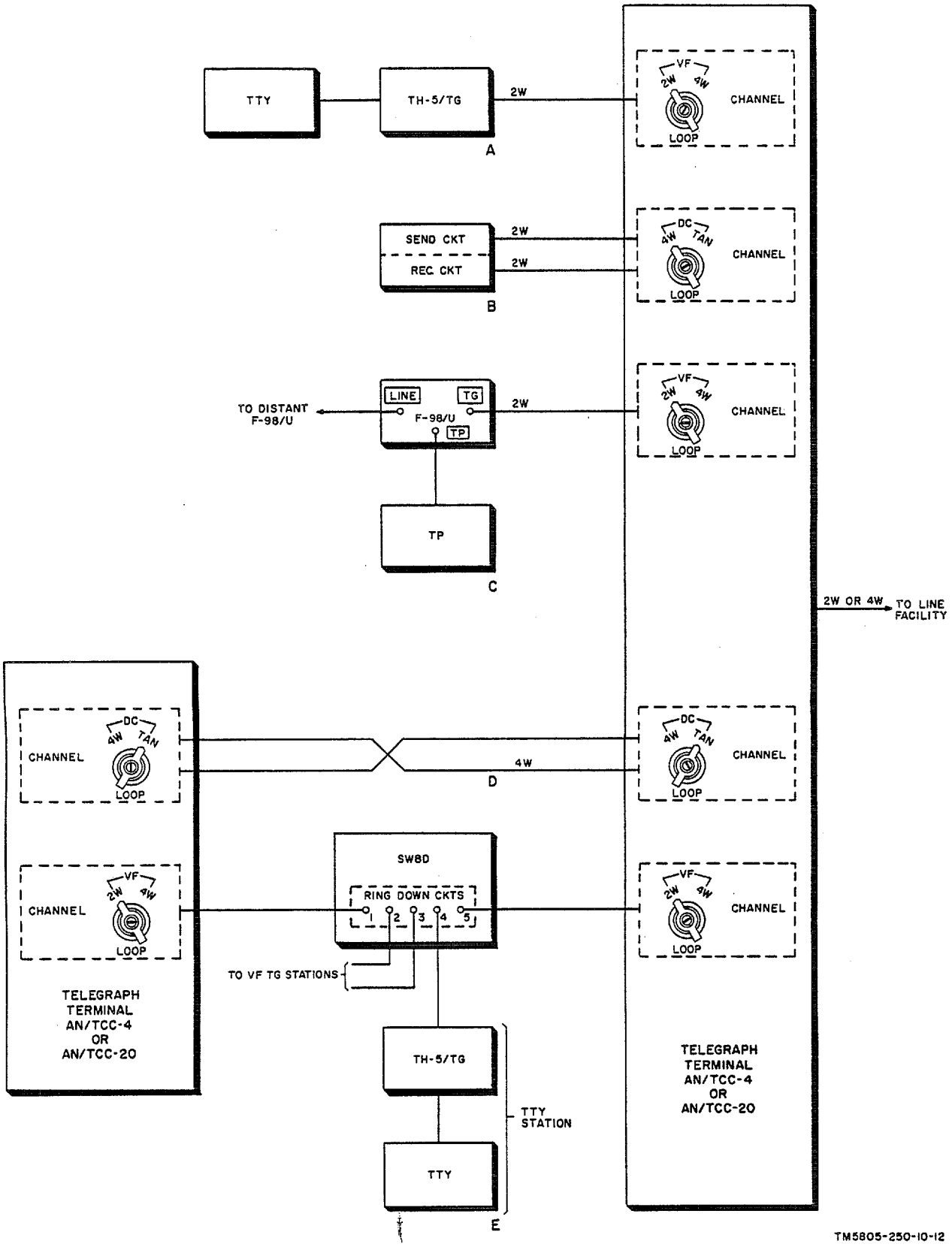


Figure 10. Telegraph terminal, typical loop arrangements, block diagram.

communicate with the vf telegraph loop circuits connected to the switchboard.

(*d*) The vf loop may be connected to a channel of another telegraph terminal ((4) below).

(2) *Vf four-,ire loop*. A vf, four-wire, frequency shift loop (VF 4W) provides full-duplex type of operation with 20-cps ringing feature. A vf loop equipment arrangement, obtained by using the TH-5/TG and a teletypewriter on a four-wire basis, is identical with that shown in A, figure 10 except that the loop switch is in the VF 4W position. Other TH-5/TG's may be connected in parallel on the loop line.

(3) *Dc four-wire loop.* A dc four-wire (DC 4W) telegraph loop terminated at a teletypewriter may be used (B, fig. 10). This loop arrangement provides for neutral, full-duplex operation. Half-duplex operation is not possible. Current for 'the operation of the loop station equipment is provided by the telegraph terminal. Other teletype writers may be connected in series with each send and receive circuit if the total resistance of the wires and equipment does not exceed 2,500 ohms.

(4) *Tandem Loop.* Any channel of the telegraph terminals may be interconnected with any channel of another telegraph terminal system on a neutral, full-duplex basis (DC TAN) to provide for through (back-to-back operation (D, fig. 10). This arrangement makes it possible to integrate two telegraph carrier systems, provide communication between the end stations in the system, and extend the range of the communication beyond the normal limits of a single terminal-to-terminal system. Vf two-wire and vf four-wire tandem connections may also be used. For example, line 1 and line 5 may be interconnected at the switchboard on a two-wire basis (E, fig. 10).

CHAPTER 2

INSTALLATION

Section I. SYSTEM PLANNING

16. System Layout and Planning Considerations

Careful consideration must be given to system layout for the AN/TCC-4 and AN/TCC-20, because planning has an important part on the subsequent performance of the system.

a. Some of the factors to be considered in planning a telegraph system are given in (1) through (3) below.

(1) Technical characteristics, operational requirements, and limitations of the telegraph terminal (par. 4).

(2) Types of operation, number of channels, type of loop circuits desired, and the distance between telegraph terminals.

(3) Availability and types of existing line and loop facilities, such as telephone carrier, voice-frequency or radio link equipments, and telegraph station equipments.

b. The performance characteristics and operating requirements of the lines, loops, and equipments used with the telegraph terminal must be carefully analyzed and coordinated with the telegraph terminal requirements. Some of the factors to be considered are given in (1) through (7) below. Refer to paragraph 18 for loop considerations.

(1) Equipment gains and losses.

(2) Equipment input and output levels.

(3) Line and loop losses.

(4) Line and equipment impedance characteristics.

(5) Noise and cross talk in lines and associated equipment.

(6) Coordination of power levels in the system and in adjacent systems.

(7) Geographic location and climatic conditions.

c. Any type of interconnecting facility (par. 14) which meets the requirements given in (1) through (6) below may be used as a transmission medium between two telegraph terminals.

(1) The transmission medium must be capable of passing frequencies between approximately 300 and 3,100 cps (the maximum operating frequency band of the telegraph terminal) for the AN/TCC-4, and between 300 and 1,700 cps for the AN/TCC-20. The frequency response of the transmission medium must be flat to within 4 decibels (db) over the 300- to 3,100-cps (AN/TCC-4) or 300- to 1,700-cps band (AN/TCC-20).

(2) The line or other interconnecting circuits used must have an over-all circuit net loss not exceeding 25 db over the operating frequency range of the telegraph terminals. This value includes all losses in the line, determined by the rated attenuation per mile, losses due to impedance mismatch, leakage to ground, and other line characteristics. The distance in miles over which communication may be obtained depends on the type of line used, spacing between line wires, and temperature, weather, and humidity.

(3) The wire line must be relatively free from interference from telegraph, telephone and ac power systems.

(4) The line circuit should present an impedance of approximately 600 ohms to the line terminals of the telegraph terminal; otherwise, impedance mismatch and reflection loss will increase the attenuation in the line and thus will reduce the maximum permissible distance range described in (2) above. Repeating coils or loading may be used to build out the line impedance to 600 ohms.

(5) When a telephone carrier channel or a radio relay system is used as a transmission medium, the oscillators of the telephone carrier channel or of the radio equipment at each end of the circuit must be stable enough to maintain frequency synchronism tion within ±3 cps.

(6) The transmission medium interconnecting the telegraph terminal must be continuous at all. times and must not be interrupted by .operations such as ringing or switching, since the line side of the telegraph terminal uses *tone-on-line* type of transmission for the idle (standby) condition. Interruption of the tone causes false operation in the receiving circuits of the terminals.

17. Technical Considerations for Operation Through Different Systems

a. Telephone Carrier System. A telegraph terminal system using a channel of a telephone carrier system as a transmission medium must meet the requirements outlined in paragraph 16. The telegraph system is connected to the vf side of the telephone channel. Because the telegraph frequencies occupy the major portion of the telephone band, the telephone channel cannot be used for simultaneous telephone and telegraph communication. The adjustment of signal levels between the telegraph terminal and the telephone terminal must be made at both the telegraph and the telephone terminal equipment. Each channel of the telegraph terminal must be adjusted so that the output level of the telegraph terminal meets the requirements of' the telephone channel input circuit.. The output level of the telephone terminal channel used for telegraph transmission must be adjusted to meet the requirements of the telegraph terminal input circuits. To prevent overloading, the total power transmitted from the telegraph terminal into the telephone carrier channel must not exceed the maximum input level requirements of the telephone channel. Conversely, the output level of the telephone channel must be adjusted to meet the input sensitivity limits of the telegraph terminal. Refer to the technical manual for the particular telephone carrier equipment used, to determine the permissible input levels for the telephone channel used for telegraph transmission.

b. Point-To-Point System. The terminal transmitting output level normally is adjusted for the maximum available power of 0 decibel (referred to 1 milliwatt in 600 ohms) (dbm) per channel. Because the maximum receiving sensitivity of the telegraph terminal is -25 dbm per channel, the maximum permissible attenuation of the line is 25 db. This attenuation limit of the line and the system layout planning considerations (par. 16) determine the maximum permissible length of the circuit between telegraph terminals.

c. Radio Relay System. The telegraph system using a radio relay system as the transmission medium must meet the requirements outlined in paragraph 16. The radio system must be operated on a full-duplex basis. Four wire line operation must be used (par. 15) with two wires connected to the transmitter and two wires connected to the receiver. The input level requirements of the radio transmitter must be within the limits of the power output capabilities of the telegraph terminal. The output level of the radio receiver must be within the limits of the input level requirements of the telegraph terminal. Refer to the technical manual for the particular radio equipments used to determine permissible transmitter input levels, receiver output levels, and other pertinent data.

d. Telegraph Carrier Tandem System. The total number of links that may be used is governed by the total distortion tolerable at the extreme ends of the network system. For planning and alignment purposes, the telegraph carrier circuit of each system or link is treated as an independent problem. Each line may use any one of the transmission media described in paragraph 14. The technical requirements for each link are the same as those described in paragraph 16.

18. Loop Considerations

Each channel of the telegraph terminal may be used in any one of the loop arrangements described in paragraph 15*b*. The selected loop arrangement depends on the type of equipment used at the teletypewriter station. Technical considerations of the vf loops are given in a below; the considerations for the dc loop are given in b below. Usually, if a channel of a telegraph terminal uses a particular type loop, the corresponding channel at the distant telegraph terminal uses the same type loop.

a. Vf Loop.

(1) The Vf loop equipment should meet the requirements given in paragraph 4*c* and *f.*

(2) In the idle condition, the vf two-wire loop arrangement uses no tone-on-line type of transmission and the-vf four-wire loop uses tone-on-line for both the send and receive circuits. Since both the loop and the channel respond to changes in frequency (mark and

space signals), switching (through a telephone switchboard) (E, fig. 10) and patching can be.. performed on these circuits without affecting the distant end of the telegraph carrier system.

(3) The vf two-wire loop provides half-duplex type of operation with 20-cps ringing and break-in feature. The vf four-wire loop provides full-duplex type of loop operation with 20-cps ringing feature.

b. Dc Loop.

(1) The do four-wire loop supplies 20-ma mark current and O-ma space current for operation of the loop equipment.

(2) The total resistance of the wires and loop equipment must not exceed 2,500 ohms.

(3) In the idle condition, both the send and receive loop circuits are in a marking condition.

19. Computation of Total Power Level

a. The total power level transmitted to the line or received from the line depends on the number of channels of the AN/TCC-4 or AN/TCC-20 which feed their output power to the line. The power level of 0 dbm (1 milliwatt of power fed into a 600-ohm circuit) is used as a reference. Power levels (given in dbm) other than 0 dbm represent a certain amount of power below or above 1 milliwatt. For example, when the transmitting level is 0 dbm per channel, each channel of the terminal applies 1 milliwatt of actual power into the line circuit. Two channels feed a total of 2 milliwatts of power into the line; four channels feed a total of 4 milliwatts of power into the line. When the number of channels is doubled, the total power applied to the line is doubled. By converting power ratios to decibels, the doubling of the power is equivalent to raising the power level by 3 db. Similarly, reducing the power by half reduces the power level by 3 db.

b. The following chart indicates how the line level increases above the level specified for a single channel (dbm per channel) as the number of channels used is increased.

Number of channels transmitting	Increase in line level above per-channel-level (db)
1	O
2	+3
4	+6
8	+9
16	+12

c. The following examples illustrate how to use the chart (b above). The decibel values are added algebraically.

(1) If eight channels, each operating at a 0 dbm level, are used, the total power transmitted to the line is (O dbm) plus (+9 db) +9 dbm.

(2) If four channels, each operating at a level of -6 dbm, are used, the total power transmitted to the line is (-6 dbm) plus (+6 db) =0 dbm.

d. The information in the chart (b above) can be used to convert total power levels into power levels per channel, considering that the power is distributed equally among the several channels. Note the following examples:

(1) If the total power level entering the terminal receiving path is -25 dbm and there are eight channels, the level per channel is (-25 dbm) minus (+9 db)=-34 dbm.

(2) If the total power entering the terminal has a level of +6 dbm and the number of channels is 16, the level per channel is (+6 dbm) minus (+ 12 db)--6 dbm.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

20. Unpacking

a. Packaging Data. The components of an AN/TCC-4 are packed for shipment in three wooden boxes. The components of an AN/TCC-20 are packed for shipment in one wooden box. The components are packaged individually in a water-resistant fiberboard carton and then packed in the wooden boxes. Figure 11 shows the packaging details of a box packed 18 for export. The cutaway view of packaging details of the TH-15/T is typical for each component of the telegraph terminal. The dimensions, weight, and volume of each of the three boxes are listed in (1) below. The contents of each box are listed in (2) below. The complement of boxes required for each of the different terminal arrangements is tabulated in (3) below.

(1) *Dimensions, volume, and weight of wooden boxes packed for shipment.*

Box No.	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Unit Weight (lb)
1 of 2	20 1/4	36 3/8	20 1/4	10.4	266
2 of 3	20 1/4	36 3/8	20 1/4	10.4	266
3 of 3	11 1/8	24 1/2	20 1/4	3.2	85.2

(2) *Contents of each box.* The following list indicates the contents of each box for the AN/TCC-4 when packed for shipment. See the packing list that accompanies each box for exact contents. The components of an AN/TCC-20 are packed in a box identical with box No. 1 of 3 in the following chart.

Box No.	Item	Quan-tity	Notes
1 of 3	TH-15/T	1	Includes circuit labels and operating instructions and two patch cords.
	TH-13/T	1	Includes one set of running spare parts for one TH-15/T, TH-13/T, and TH-14/T (par. 5*b*).
	TM-11-5805-250-10	2	
2 of 3	TH-15/T	1	Same as above (box No. 1).
	TH-13/T	1	
	TM-11-5805-250-10	2	
3 of 3	TH-14/T		

(3) Boxes required for each terminal arrangement of AN/TCC-4 and AN/TCC-O.

Number of channels	Type of line operation	Box 1 of 3	Box 2 of 3	Box 3 of 3
4	2- or 4 wire	1	0	0
8	4- wire	1	1	0
8	2- wire	1	1	1
16	4- wire	2	2	2

b. Removing Contents (fig. 11). When unpacking equipment packed in wooden boxes for export shipment, perform the procedures given in (1) through (6) below. When unpacking equipment packed for domestic shipment, omit the procedure given in (1)below.

(1) Cut the steel straps just below the box cover and fold them back.

(2) Remove the nails from the top cover with a nail puller. Remove the top. Do not attempt to pry it off. This procedure may damage the equipment.

(3) Remove the packaged technical manuals from the waterproof paper bag.

(4) Remove the fiberboard cartons from the wooden box.

(5) Open the top of each fiberboard carton and remove the component with its fiberboard sleeve.

(6) Slit each fiberboard sleeve and remove the equipment.

21. Checking Unpacked Equipment

a. Inspect the equipment for any loss or damage that may have occurred during shipment. If the equipment has been damaged or is incomplete, refer to paragraph 2*a* or *b*.

b. Check the equipment against the accompanying packing list, the table of components (par. 5), and/or the packaging data (par. 20*a*). However, the absence of a minor component, which does not affect the functioning of the equipment, need not prevent the equipment from being used.

c. Check the cable assemblies and the drawer slides to be sure that they are in good condition.

d. If the equipment has been used or reconditioned, check to see whether it has been changed by a modification work order (MWO). If modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see that the MWO number appears on the schematic diagram circuit label located in the rack frame (fig. 3) of the TH-15/T.

22. Siting

Wherever possible, place the equipment in a shelter or a sheltered location.

a. External Requirements. The best location for an AN/TCC-4 or AN/TCC-20 may depend on the tactical situation or local considerations such as the following: the need to house the equipment where its shelter cannot be seen; the terrain; and the necessity of easy access by messengers. If possible, select a location on high ground, clear of densely wooded areas. See that drainage is adequate to prevent flooding the interior of the shelter.

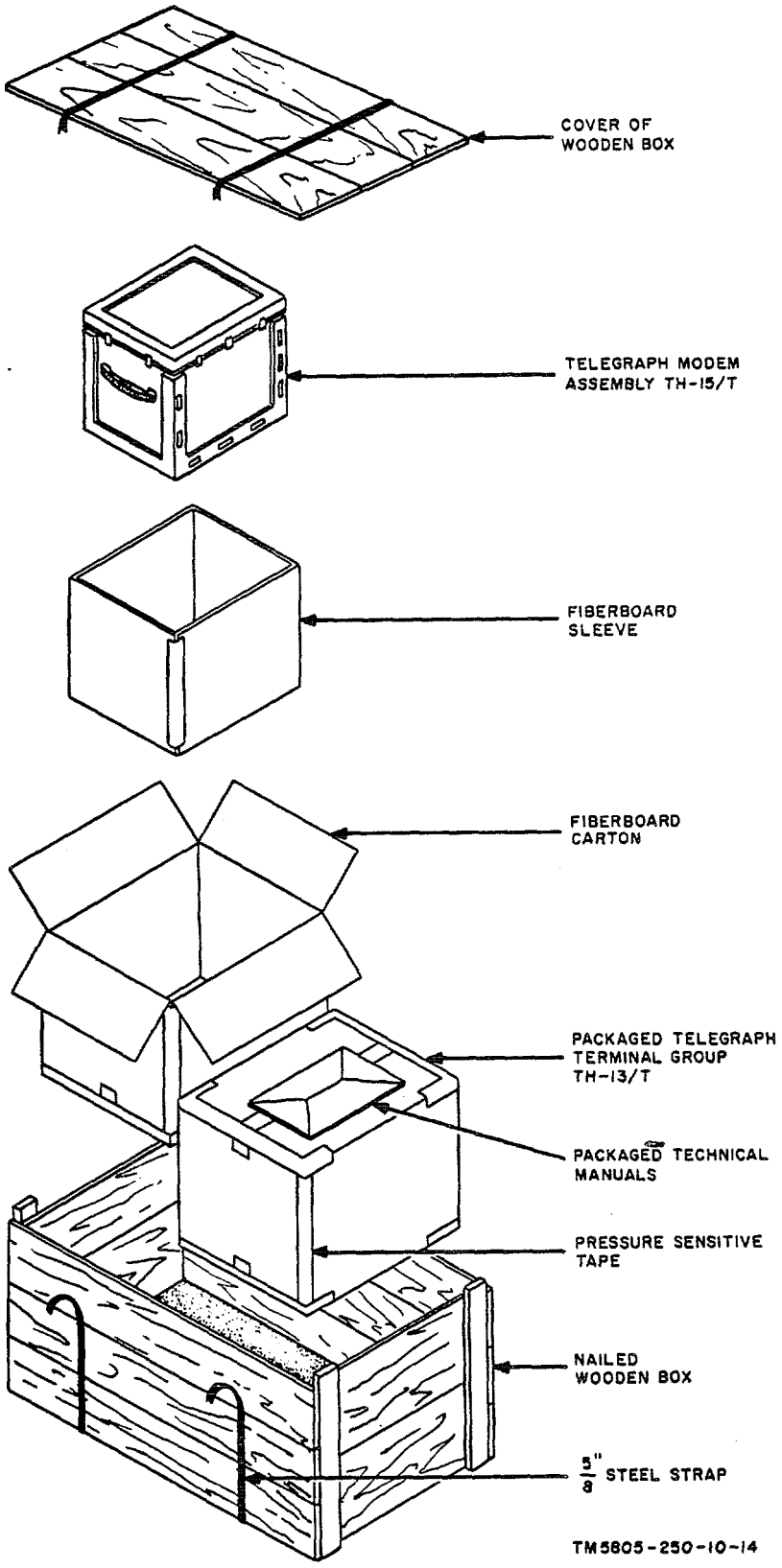


Figure 11. AN/TCC-20 or part of An/TCC-4, packing and packaging diagram.

b. Interior Requirements.

(1) Place the equipment on a dry, firm footing or support. The support must be capable of sustaining the weight of the equipment without vibration.

(2) Set the component unit cases with the front covers facing out. If several telegraph terminals are located at the same point, arrange them so that each system can be maintained with a minimum of interference to other systems.

(3) Make sufficient space available in front and on the side of the equipment to permit satisfactory operation and maintenance. Allow at least a 3-foot space in front of the equipment to permit withdrawal of panel-and chassis assemblies for occasional adjustment of internal controls. Allow at least an 8 inch space between a wall and the side of the end stacks to allow adjustment of internal controls located on the sides of the chassis in each TH-17/T and TH-16/T. No clearance is required at the rear of the equipment, since all operations, interconnections, and operational adjustments are made from the front.

(4) Locate the equipment near an alternating current (ac) power outlet. A 6-foot power cord is supplied as part of the equipment. If the ac outlet is located at a greater distance from the equipment, extension cords must be provided.

(5) If possible, provide adequate lighting for both day and night operation. Position the equipment so that panel designations can be read easily; artificial lighting should be installed so that light falls directly on the panels. If possible, provide a portable drop lamp and extension cord for use by the operating and maintenance personnel.

23. Identification Designations of Stacks and Channels for AN/TCC-4 Terminal Arrangements

The following terminal, stack, and channel references are assigned, based on the information in paragraph 24.

a. Terminal (fig. 9). Without regard to geographic location, the terminal at one end of a system is designated as terminal A, and the terminal at the other end is designated as terminal B. Terminal A is designated as the control terminal.

b. Stack (fig. 15). Starting from the left stack, the stacks of a terminal are designated as A, B, C, and D, respectively. An eight-channel terminal uses stacks A and B. A sixteen-channel uses stacks A through D.

c. Channels. The channels in stack A are designated as A 1 through A 4, those in stack B as BI through B4, those in stack C as C1 through C4, and those in stack D as D1 through D4. The channel numbering will correspond to channels 1 through 16, respectively. Thus, the third channel in stack C is channel 11. The second channel in stack B is channel 6, etc. A blank write-in surface, located between the sets of monitoring jacks and loop binding posts, may be used for channel designations and other information pertaining to the particular channel with which it is associated.

24. Mounting Equipment (fig. 9)

To mount the components of a terminal in stacks, follow the procedures in a through d below for each stack as applicable.

a. Open the snap catches on the top, bottom, and sides of the outer case (fig. 3) of each equipment unit of the stack, and remove the front cover of each case. Fold back the snap catches into the recesses provided for them. Store the case covers.

b. Place the TH-15/T on the footing or support so that the operating controls face the operator.

c. Place the TH-13/T on top of the TH-15/T, so that the operating controls face the operator (fig. 1). The nesting strips on the bottom of the TH-13/T case interlock with the nesting strips on top of the TH-15/T case. The nesting strips prevent lateral motion of the units with respect to each other.

d. If the TH-14/T is used, place it on top of the TH-13/T case in stack A, so that the operating controls face the operator, and the nesting strips on the bottom of its case interlock with the nesting strips on the top of the TH-13/T case. A TH-14/T is not used in stack B. Similarly, a TH-14/T is used with stack C and none with stack D in a sixteen-channel terminal.

e. Connect and tighten the straps between the strap holders (fig. 4) of the cases as shown in figures 1 and 2.

25. Installation of Tubes, Fuses, Lightning Arresters, and Lamps

The telegraph terminal may be shipped with the tubes, fuses, lightning arresters, and indicator lamps installed.

a. Tubes. Check the installation of the proper tubes in each panel assembly; use the chart below and refer to figures 26 through 29 as appropriate. Check to see that the tube clamps and retainers are in place in the PP-812/T and that all tube shields are locked in place on their tubes.

Component	Tube Symbol	Electron tube type
TH-17/T and TH-16/T[a] (fig 26)	V1, V15	12AX7
	V2 through V14	12AU7
AM-683/T (fig 27)	V801, V802	12AU7
PP-812/T (fig 28)	V901, V902	6X4W or 6X4[b]
	V903, V904	5R4WGY[b] or 5R4GY[b]
	V905, V906	6080
	V907	6AU6WA or 6AU6[b]
	V908	0A3
TH-14/T	V1002	5751 or 12AX7[c]
	V1003, V1005, V1006	12AU7
	V1004	12AX7

[a] Refer to paragraph 56*a* for channel components reference symbols.
[b] Refer to paragraph 12*b*.
[c] Refer to paragraph 12*c*.

b. Fuses. Check to see that the proper value fuses are inserted in the fuse holders and that spare fuses are in place in their holders. The following chart lists the fuses in the PP-812/T. All fuses are rated at 250 volts. Spare fuses are mounted in brackets in the PP-812/T (fig. 20 and 28).

Panel designation	Fuse symbol	Fuse rating (amp)
2 AMP (fig. 19)	F902	2
1/2 AMP (fig. 19)	F903	1/2
6 1/4 AMP (fig. 19)	F901	6 1/4
20 AMP[a] (fig. 20)	F907	20
1/8 AMP[a] (fig. 20)	F908	1/3

[a] Some units are not supplied with these fuses (para 12*a*).

c. Lamps. Check to see that all lamps are in place. The following chart lists the lamps in the telegraph terminal. Spare lamps are mounted in the PP-812/T chassis (fig. 28).

Component	Lamp symbol	Lamp rating
PP-812/T (fig. 19)	I 901	6-8 volts
TH-17/T (fig. 26)	I 1 (chan 1), I 201 (chan 2)	6 w
TH-16/T[a]	I 401 (chan 3), I 601 (chan 42)	6w

[a] Similar to TH-17/T.

d. Lightning Arresters. Check to see that the lightning arresters are in place and screwed -down tightly in the AM-683/T (fig. 18) and in each channel (fig. 17). Five spare lightning arresters are not mounted on the equipment. These are provided separately.

Section III. CONNECTIONS

26. Cable-connecting Procedure, General

The following cable-connecting procedures apply' to all the components of a telegraph terminal.

a. Primary.

(1) Use a screw driver to loosen the panel fastening screws that secure the panel to the rack frame of the transit case.

(2) Withdraw the panel from the "transit case far enough to reach the cables.

Caution:

Do not pull out two panels (drawers) at the same time in any stack of equipment.

(3) Turn the wing bolt located on the top of the connector until the plug is free.

(4) If the telegraph terminal includes more than one stack, unscrew the threaded cable connector bushing on two-conductor AM683/T connecting cable from the dummy connector in the storage compartment in the AM-683/T (fig. 27). Route the cable through the cutout in the upper left-hand corner of the panel.

(5) Check to be sure that the rectangular armored connector on the cable, which extends from the chassis of the AM-683/T (fig. 27), is plugged properly into the rectangular multiconnector on the bottom of the chassis of the PP-812/T.

Caution:

Be extremely careful when handling the rectangular armored connector on the AM-683/T connector cable and the rectangular multiconnector on the PP-812/T.

Make sure that the rectangular armored connector on the cable is flat. Adjust the assembly chassis. When restoring the panel-and-chassis assembly (either the AM-683/T or the PP-812/T) into the rack frame compartment, be sure that the connectors clear the top edge of the AM-683/T.

(6) Withdraw the cable folds from the cable brackets (fig. 27 and 29) and route the cables to the outside of the panel through the slots in the front panel.

(7) Push the panel until it is properly positioned in the rack frame.

(8) Use a screw driver to tighten the panel fastener screws.

b. Interpanel Connections. Paragraph 27 contains a table of cable connections. Connect the panel and cable connectors as follows:

(1) Fit the cable connector into the panel connector.

(2) Rotate the cable connector so that the key lines up with the key slot.

(3) Secure the connectors by turning the wing bolt on the cable connector until the bolt is fingertight.

27. Table of Interpanel Cable Connections

The following chart lists the cables and connectors of the AN/TCC-4 and AN/TCC-20 and the panels to which they are connected:

Terminal arrangements	Cable from panel	Connector designation	Connect to panel	Connector receptacle designation
Four-channel two-wire or four-wire (fig. 12)	AM-683/T	TO TH-17/T	TH-17/T	TO AM-683/T
	AM-683/T	TO TH-16/T	TH-16/T	TO AM -683/T
Eight-channel four-wire (fig. 13)	AM-683/T, stack A	TO TH-17/T	TH-17/T, stack A	TO AM-683/T
	AM-683/T, stack A	TO TH-16/T	TH-16/T, stack A	TO AM -683/T
	AM-683/T, stack A (AM-683/T connecting cable)	.....	AM-683/T, stack B	TO AM-683/T
	AM-683/T, stack B (AM-683/T connecting cable)	.....	AM-683/T, stack A	TO AM-683/T
	AM-683/T, stack B	TO TH-17/T	TH-17/T, stack B	TO AM-683/T
	AM-683/T, stack B	TO TH-16/T	TH-16/T, stack B	TO AM-683/T
Eight-channel, two wire (fig. 14)	Same as for eight-channel, four-wire above			
	TH-14/T, stack A (TH-14/T connecting cable)	.....	AM-683/T, stack A	TO TH-14/T
Sixteen-channel four-wire (fig. 15)	Stacks A and B same as eight-channel, two-wire above			
	Stacks C and D same as eight-channel, two-wire above, except substitute C for A and D for B			
	AM-683/T, stack A, using field wire or equivalent	16CH (binding posts) A B C D	AM-683/T, stack C	16CH (binding posts) A B C D

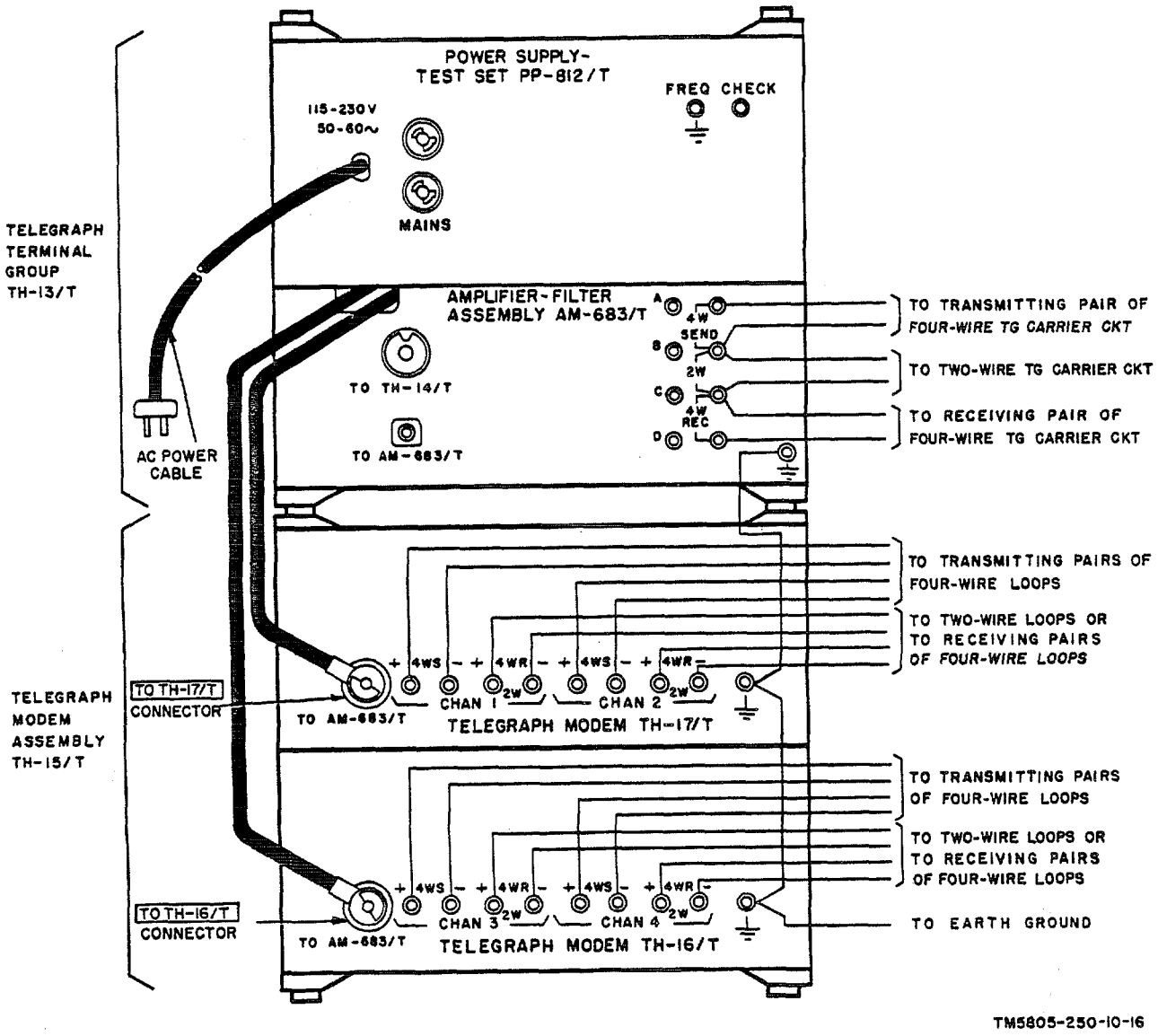


Figure 12. AN/TCC-20, four-channel, two or four-wire terminal, interunit and external connections.

28. Grounding Connections

A good earth ground is required at the telegraph terminal location to insure proper operation of the equipment and to protect personnel and equipment from lightning and other sources of high voltage. The ground is also necessary to reduce cross fire and noise pick-up.

a. The ground resistance should be as low as practicable and, if possible, should not exceed 5 ohms.

b. Use a common ground for the earth ground facility.

c. Run individual leads from the ground binding post on each AM-683/T to the common earth ground (fig. 12 through 15). Avoid ground loops because they create circulating ground currents resulting in voltage drops in equipment ground circuits and in cross fire from one equipment unit to another one.

d. Use 14# gage or larger wires to connect the ground posts of the equipment in each stack to the earth ground.

e. Make the ground connections strong and durable. Loose ground connections may cause noise disturbance in the equipment.

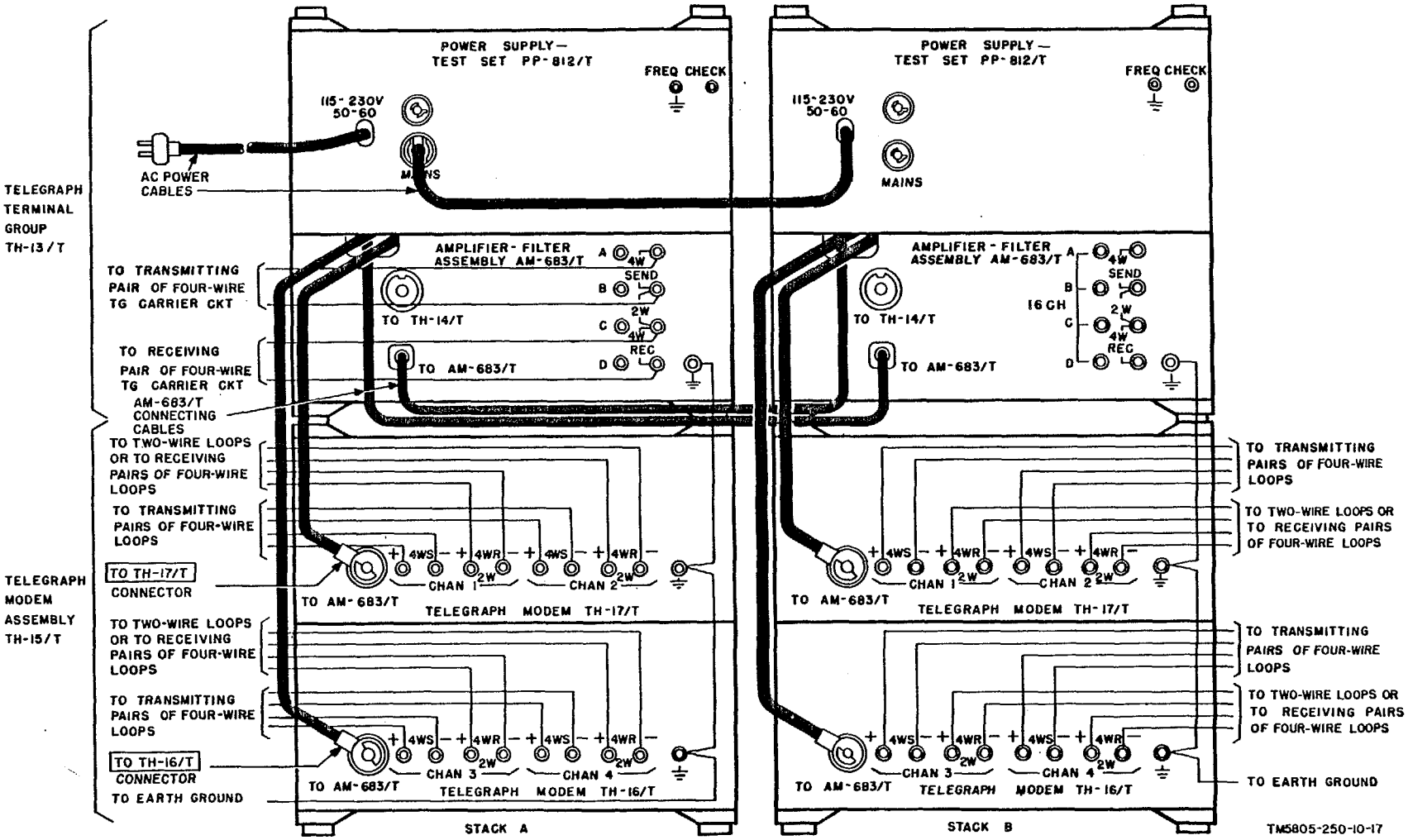


Figure 13. Two AN/TCC-20's, eight channel, four wire terminal, interunit and external connections.

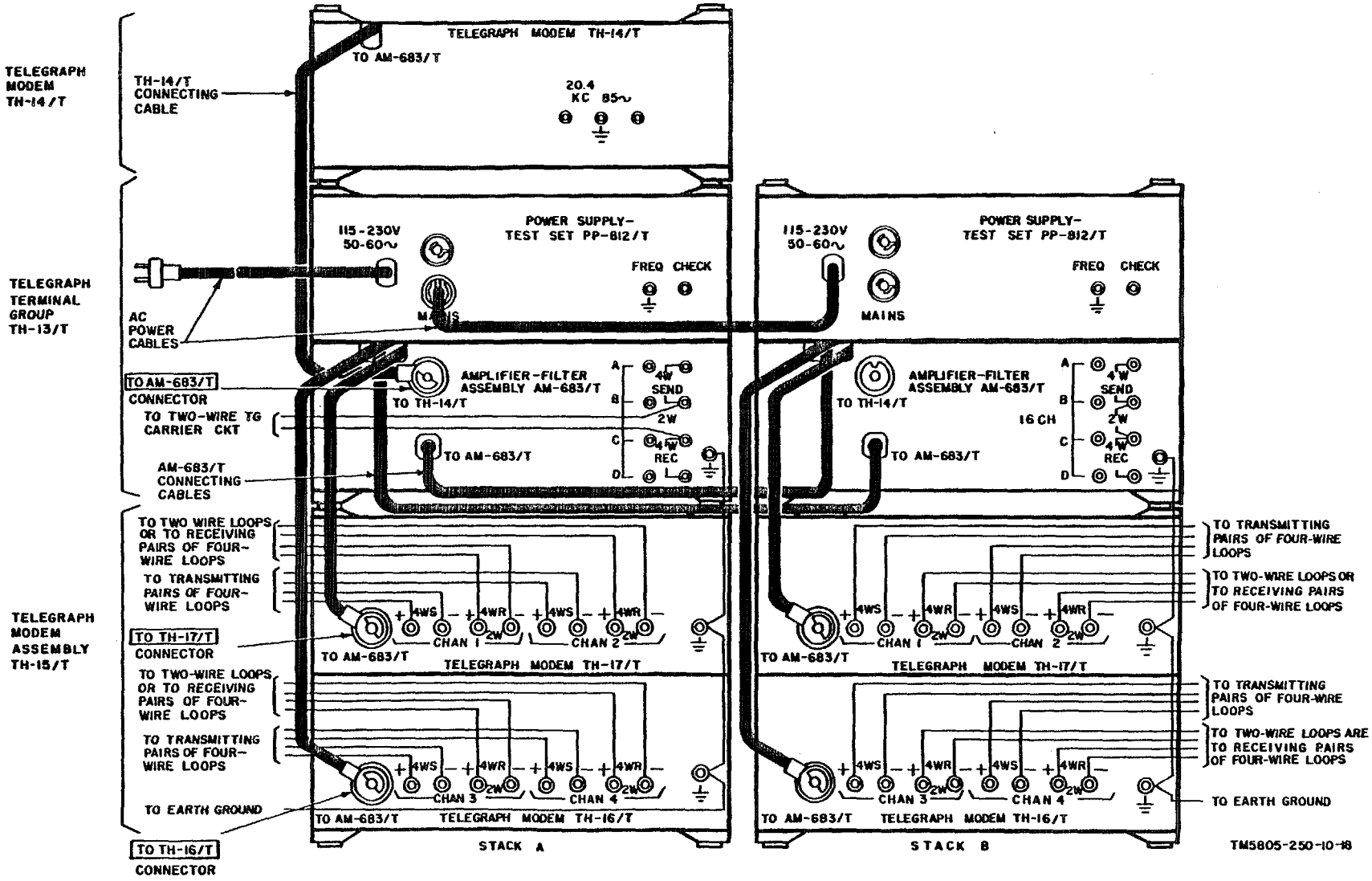


Figure 14. AN/TCC-4, eight-channel, two-wire terminal, interunit and external connections.

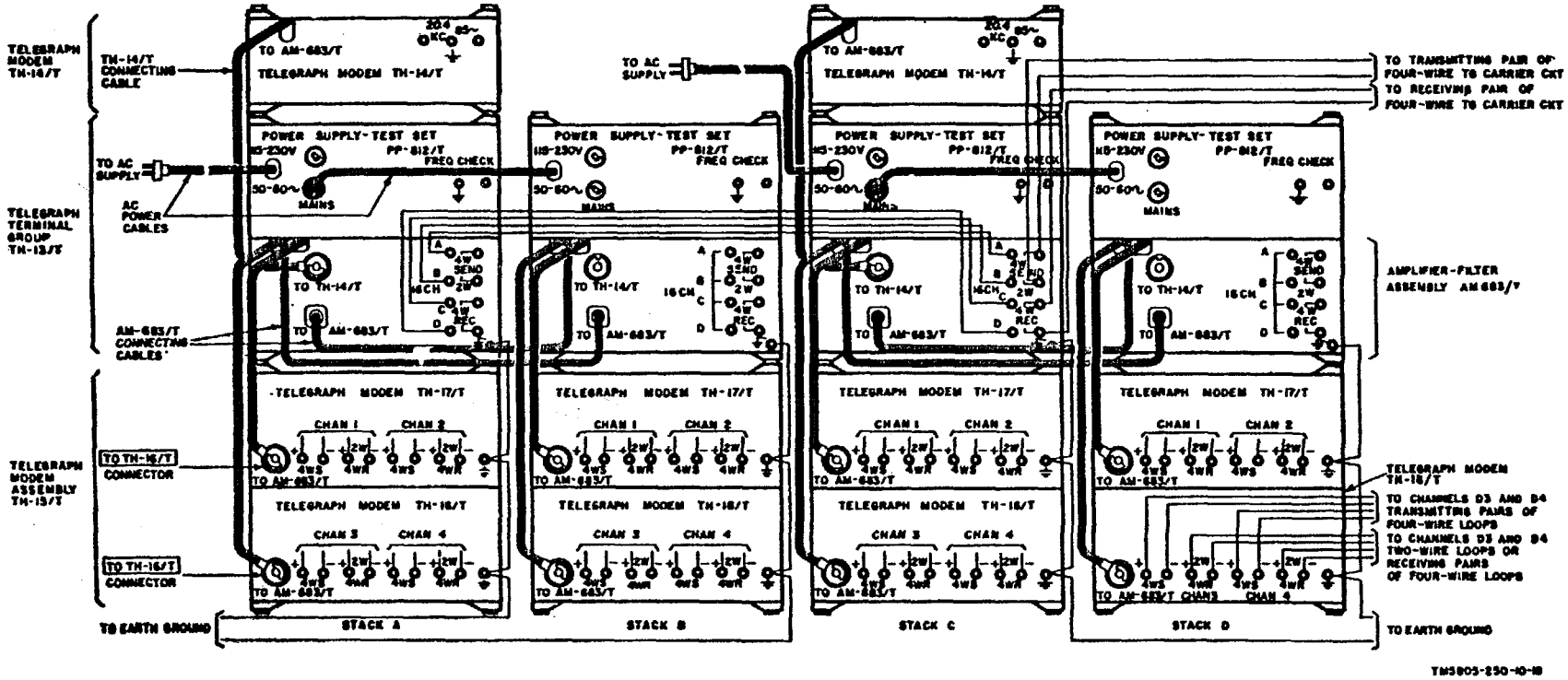


Figure 16. Two AN/TCC-4's, sixteen-channel, four-wire terminal, interunit and external connections.

f. Use buried metal water pipes or ground rods driven into moist earth to provide the earth ground.

(1) Under certain conditions, currents from aerial lines may cause a rise in potential between the protectors and the equipment ground. This may happen particularly where the path to ground from the protectors has a considerable resistance. Contact with equipment or conductors connected to the aerial lines may result in a severe electric shock. When working on open-wire lines or field wire of considerable length, or on lightning arresters during lightning storms, or when the weather is damp, use rubber gloves or well-insulated pliers.

(2) To insulate the personnel from the earth near the equipment, use a platform of dry wood or other insulating material. If such a platform is not available, spread wire mesh or other metallic screening on the ground next to the equipment and connect it to the station grounding system. This will serve to reduce the chances of shock from large potentials.

29. Line Connections

The right-hand column of binding posts on the AM-683/T is used for making the line connections. To connect a line wire to a binding post, press against the head of the post, fit the bared end of the wire into the groove on the body of the post, and release the pressure. The wire will be gripped firmly within the binding post. Connect the lines as required (*a* through *c* below).

a. Two-wire Arrangements, Four- or Eight-channel Terminals (figs. 12 and 14). For two-wire operation, connect the line leads to the 2W binding posts on the AM-683/T in stack A.

b. Four-wire Arrangement, Four- or Eight-channel Terminals (fig. 12 and 13). For four-wire operation of a four-channel or eight-channel terminal, connect the line transmitting pair to the 4W SEND binding posts and the line receiving pair to the 4W REC binding posts on the AM-683/T in stack A.

c. Four-wire Arrangement, Sixteen-channel Terminals (fig. 15). For four-wire operation of a sixteen-channel terminal, connect the line transmitting pair to the 4W SEND binding posts and the line receiving pair to the 4W REC binding posts on the AM-683/T in stack C.

30. Loop Connections

The loop connections are made to the channel binding posts on the TH-17/T. and TH-16/T. Each panel has sets of binding posts for two channels. For each channel, determine the type of loop arrangement to be used (par. 18*b*), and follow the applicable procedure given in a through d below. Refer to figures through 15 for applicable loop connections.

a. *Vf Two-wire Loop.* Connect the pair of loop wires to the 4WR-2W binding posts of the channel.

b. *Vf Four-wire Loop.* Connect each channel to be operated with a vf four-wire, loop, as follows:

(1) Connect the two leads from the transmitting pair (signals transmitted from the loop to the terminal channel circuits) to the 4WS binding posts of the channel.

(2) Connect the two leads from the receiving pair (signals transmitted from terminal channel circuits to the loop) to the 4WR2W binding posts of the channel.

Note

Operate the LOOP switch on every channel that is not connected to loop or monitor equipment to VF 4W or VF 2W position. An unterminated channel with its LOOP switch in the DC 4W or DC TAN position sends a steady space (ringing signal), causing the distant terminal 20-cps ringing generator (in the PP-812/T) to operate continuously.

c. Dc Four-tire Loop.

(1) Connect the two leads from the transmitting apparatus of the de loop equipment to the 4WS binding posts of the channel.

(2) Connect the two leads from the receiving apparatus of the loop equipment to the 4WR-2W binding posts of the channel.

Warning:

Binding posts E3 and E4 of the 4WR-2W pair carry a 215-volt potential when ac power is applied to the stack and the LOOP switch is in the DC 4W position Use caution when touching metal parts of the binding posts, particularly in humid or wet weather.

d. Dc tandem Loop (D, fig. 10). In this arrangement, a channel of one terminal is connected on a back-to-back basis to a channel of another terminal. The polarity of the connections must be carefully observed. Interconnect the binding posts of the two

terminal channels to be linked in a tandem connection as tabulated in the chart below.

Connect tandem terminal binding post toward A terminal		To tandem terminal binding post toward B terminal	
Panel marking	Panel symbol	Panel marking	Panel symbol
4WS	+ - + -	4WR-2W 4WS 	+ - + -
4WR-2W			

31. Power Connections

Before connecting the power cords from the telegraph terminal to the ac outlet, turn the power ON-OFF switch on each PP-812/T to the OFF position. Follow the procedure given in a through d below.

a. Check whether the ac source is 115 or 230 volts.

b. Operate the 115V-230V switch at the back of the front panel of each PP-812/.T (fig. 20) to the position corresponding to the ac power source.

c. Connect the ac power cables from each PP812/T to the ac power source. If a sufficient number of ac power source outlets are not available, the power cord from the power supply in one stack may be connected to one of the convenience outlets (labeled MAINS) on the PP-812/T of an adjacent stack (fig. 13-15). Not more than two stacks may be operated from a single ac power source connection.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. CONTROLS, METER, INDICATOR, CONNECTOR, AND JACKS

32. Telegraph Modem Assembly TH-15/T, Controls, Connectors, and Jacks

The controls, connectors, and other facilities provided on the TH-17/T and TH-16/T, and the description and function of each, are listed in the chart below. Except for the SEND FREQUENCIES switch and the TO AM-683/T connector, common to the two channels mounted on the same panel, the facilities provided for one channel are duplicated for the other. The controls and binding posts for the odd-numbered channel are mounted to the left of the SEND FREQUENCIES switch, and the controls and binding posts for the even-numbered channel are to the right of the switch. Figures 16 and 17 show the external and internal controls, connectors, and other facilities provided on the TH-17/T (designated CHANNEL UNIT A). Becase the TH-16/T provides facilities identical with those of the TH-17/T use figures 16 and 17 as a reference for both panels.

Note

The TH-16/T is designated CHANNEL UNIT B The individual channels are designated CHANNEL 3 and CHANNEL 4 and are functionally identical with CHANNEL 1 and CHANNEL 2 of the TH-17/T (fig. 16 and 17).

a. Front Panel, TH-17/T (fig. 16).

Control, connector, or jack	Function
SEND FREQUENCIES switch	Two-position, rotary switch. Used to select operating frequencies (par. 4b) for the transmitting and receiving branches of both channels mounted on the panel. *SW pos* — *Action* LO — Arranges channels to transmit lower frequency and receive higher frequency. HI — Arranges channels to transmit high frequency and receive lower frequency.
LOOP switch	Four-position rotary switch. Used to select type of loop operation for the channel. *SW pos* — *Action* VF 2W — Arranges channel for operation with two-wire vf loop equipment. VF 4W — Arranges channel for operation with four-wire vf loop equipment. DC 4W — Arranges channel for operation with four-wire dc telegraph loop equipment (full-duplex). DC TN — Arrange channel for operation on tandem basis (par. 15B(4)).
4WS binding posts	Two binding posts; provide connection for transmitting circuit of four-wire loop equipment to the channel transmitting branch.

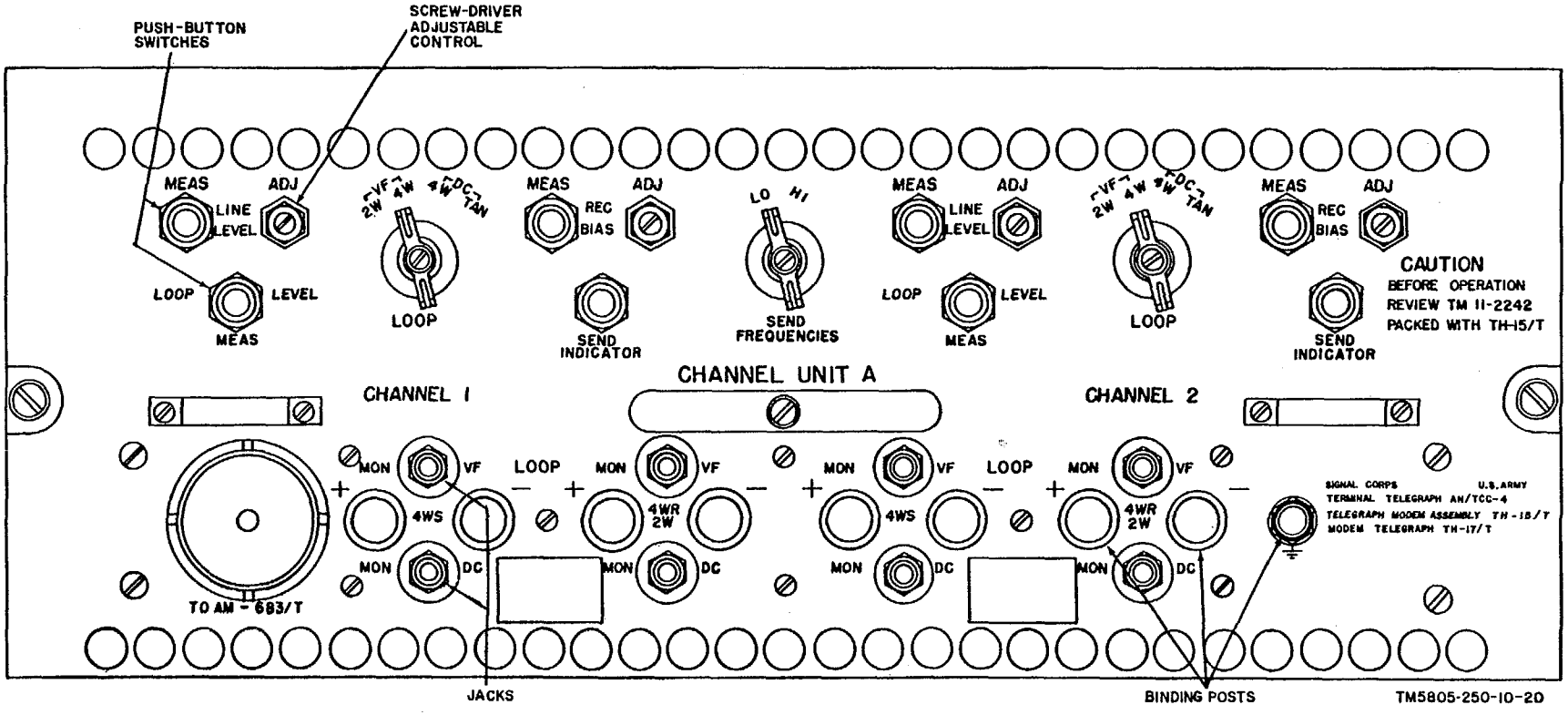


Figure 16. Telegraph Modem TH-17/T, panel controls, connectors, and jack.

Control, connector, or jack	Function
4WR-2W binding poet	Two binding posts: Four-wire operation-provide connection for the receive circuits of vf four-wire loop equipment to the channel receiving branch. Two-wire operation-provide connection for the vf two-ire loop equipment to the channel transmitting and receiving branches.
MON VF 4W8 jack	Provides connection for monitor equipment to the channel transmitting circuit.
MON VF 4WR-2W jack	Provides connection from monitor equipment to the channel receiving circuit on four-wire vf or dc loop arrangement; or for monitor equipment to both the transmitting and channel receiving circuits on vf two-wire loop arrangement.
MON DC 4WS jack	Provides connection for monitor equipment to the channel transmitting circuit on dc four-wire loop arrangement.
MON DC 4WS-2W jack	Provides connection for monitor equipment to the channel receiving circuit on dc four-wire loop arrangement.
LINE LEVEL MEAS switch	Two-position, nonlocking, push-button switch. When depressed, permits measurement of channel transmit output level to AM-683/T.
REC BIAS MEAS switch	Two-position, nonlocking, push-button switch. When depressed, permits measurement of channel receive bias distortion.
LOOP LEVEL MEAS switch	Two-position, nonlocking, push-button switch. When depressed, permits measurement of channel output level to vf four-wire or two-wire loop equipment.
SEND INDICATOR switch	Two-position, nonlocking, push-button switch. When depressed, provides indication of channel line oscillator keying by signals transmitted from the loop.
REC BIAS ADJ control	Adjustable, screw-driver control; adjusts channel receiving circuit to remove bias distortion (in conjunction with the operation of the REC BIAS MEAS control).
LINE LEVEL ADJ control	Adjustable, screw-driver control; adjusts channel trait level output (in conjunction with the operation of the LINE LEVEL MEAS switch).
Ground binding post	Provides connection for grounding the panel.
To AM-683/T connector	Multicontact connector provides connection for cable from the AM-83/T for power, metering, and signal transmission paths between the AM-683/T and the TH-17/T.

b. Side Panel, TH-17/T (fig. 17).

Control or connector	Function
DC LOOP CURRENT R59 control ***Note.* This control is identified as DC BIAS CAL on some equipment.**	Adjustable screw-driver control; adjusts de four-wire loop operated channel to establish a reference point on the meter for checking do bias distortion measurement

Control or connector	Function
VF LOOP R75 control ***Note.* This control is Identified as VF BIAS CAL on some equipments.**	Adjustable screw-driver control; adjusts vf loop operated channel to set the meter needle on the F. S. mark for making bias measurements and checks.
REC BIAS CAL S6. switch	Two-position, nonlocking, push-button switch. When depressed, permits calibration of meter for bias measurements (in conjunction with DC LOOP CURRENT R59 or VF LOOP R75).

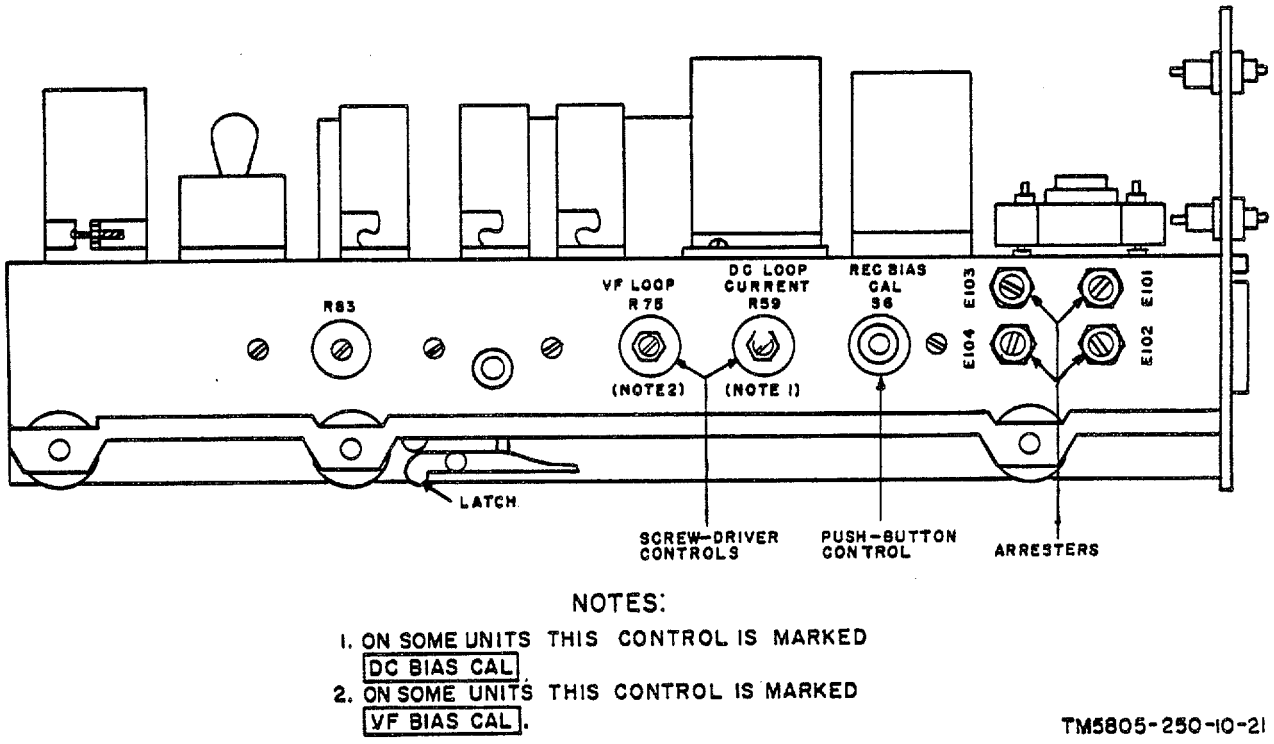
Note. R83 is adjusted as required at time of manufacture or at fled maintenance level.

33. Telegraph Terminal Group TH-1 3/T, Controls, Meter, Connectors, and Jack

The TH-13/T consists of two panel and chassis assemblies (AM-683/T and PP-812/T), each with its own controls, connectors, and other operating facilities.

a. Am-683/T (fig. 18).

Control or connector	Function
SEND FREQ switch	Two-position, rotary switch. *SW pos* — *Action* HI — Arranges channel band-pass filters to transmit the high group of frequencies to the line and to receive the low group of frequencies (par. 4b). Lo — Arranges the channel band-pass filters to transmit the low group of frequencies to the line and to receive the high group of frequencies.
LINE AMPL switch **Note. This switch is identified as LINE AMP in some equipment.**	Two-position, rotary switch. Provides for inclusion or exception of the TH-14/T in the transmitting and receiving paths of the AM-673/T. *SW pos* — *Action* 1 — Excludes TH-14/T 2 — Includes TH-14/T
CHANNELS switch	Two-position, rotary switch. *SW pos* — *Action* 4S — Provides line impedance mach for operation with 4 or 8 channels. 16 — Provides line impedance match for operation with 16 channel
LINE switch	Two-position, rotary switch. *SW pos* — *Action* 2W — Provides line impedance match for two-wire line operation. 4W — Provides line impedance match for four-wire line operation.



NOTES:

1. ON SOME UNITS THIS CONTROL IS MARKED DC BIAS CAL.
2. ON SOME UNITS THIS CONTROL IS MARKED VF BIAS CAL.

TM5805-250-10-21

Figure 17. Telegraph Modem TH-17/T, internal controls

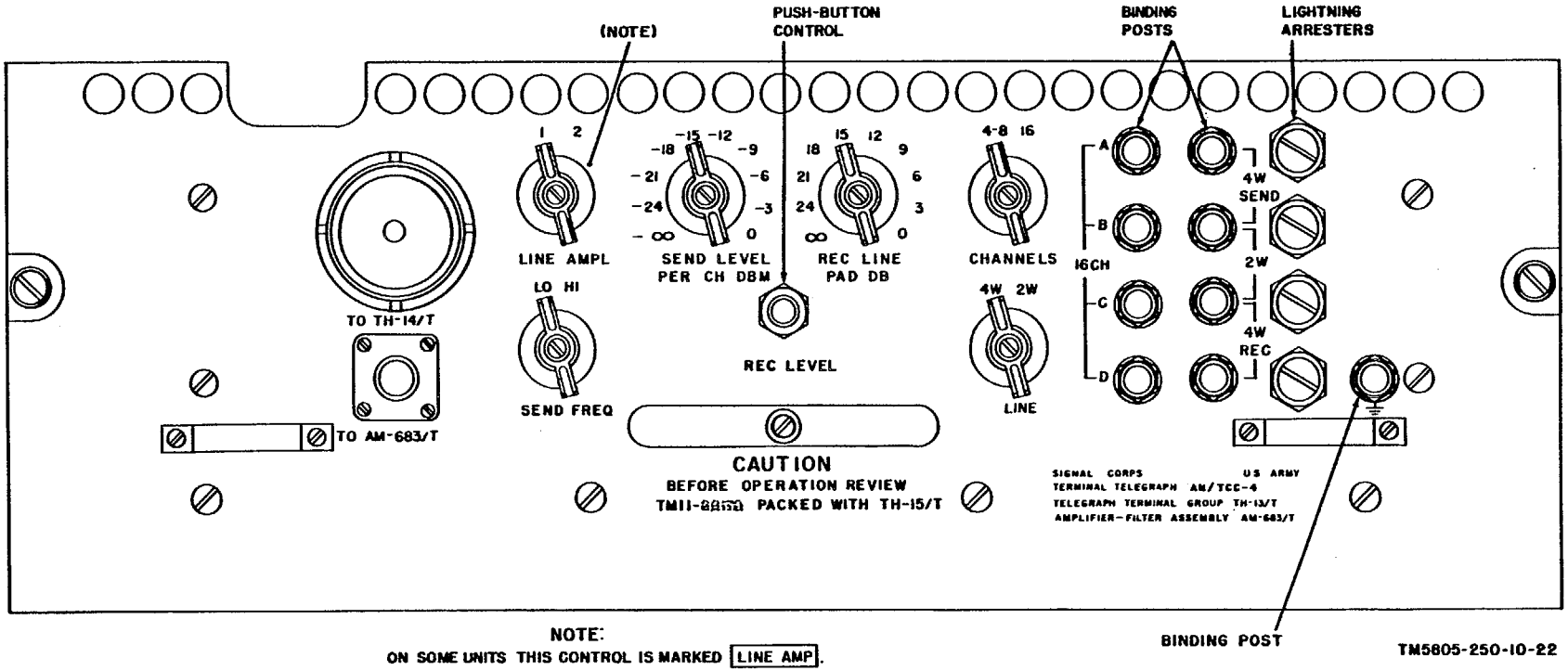


Figure 18. Amplifier-Filter Assembly AM-683/T, panel controls and connectors.

Control or connector	Function
REC LEVEL witch	Two-position, nonlocking, push-button switch. When depressed, permits measurement of receive signal level from line.
SEND LEVEL PER CH DBM control	10-position, locking, rotary control. *SW pos* — *Action* 0, -3, -6, -9, -12. -15, -18, -21, -24, ∞. — Adjusts the transmitting signal level (dbm) per channel by the amount indicated on the switch.
REC LINE PAD DB control	10-position, locking rotary control. *SW pos* — *Action* 0, 3, 6, 9,12, 15, 18, 21, 24, ∞ — Adjusts the received signal level (dbm) per channel by the amount indicated on the witch.
TO TH-14T connector	Provides interconnection for power, metering, and signal transmission on paths between the AM-683/T and the TH-14/T.
TO AM-683T connector	Provides interconnection between two groups of four-channel, band-pan filters of each AM-683/T in two tacks.
4W SEND binding pest	Two binding posts; provide connection for the transmitting pair of a four-wire line.
4W REC binding post	Two binding poets; provide connection for the receiving pair of a four-wire line.
2W binding pots	Two binding pose; provide connection for a two-wire line.
16 CH A, B, C, and D binding pots	Four binding posts; provide for interconnection of the line terminating circuits of stacks A and C, and stacks C and D, for a sixteen-channel terminal.
Ground binding post	Provides connection for grounding the panel.

b. PP-812/T.

(1) *Front panel* (fig. 19).

Control or connector	Function
ON-OFF switch	Two-position, toggle switch. *SW pos* — *Action* ON — Connects ace power to the PP-812/T. OFF — Disconnect ac power from the PP-812/T.
Meter	Dc microammeter; used for voltage, bias, and transmission measurements.
METER switch	Three-position, rotary switch. *SW pos* — *Action* BIAS — Arranges meter for measurement of signal bias distortion. LEVEL — Arranges meter for measurement of signal levels in vf portions of the terminal. 215V DC — Arranges meter for measurement of 215-volt dc power supply.

Control or connector	Function
Zero adjust control	Provides adjustment of position of meter needle.
FREQ CHECK binding posts	Two binding pots; provide connection for external test equipment to measure the channel frequency signals.
Power indicator lamp	Lights when ON-OFF switch is in ON position, indicating application of ac power.

(2) *Internal* (fig. 20).

Control or connector	Function
115V-230V witch	Two-potion, toggle switch. *SW pos* — *Action* 115V — Arrange the PP-812/T for operation from a 115-volt ac power source. 230V — Arrange the PP-812/T for operation from a 230-volt ac power source.
218V DC ADJ control	Adjustable crew-driver control; rotation adjusts 215-volt de output of the power supply.
EXT-INT switch[a]	Two-position toggle switch. *SW pos* — *Action* EXT — Connects panel meter across binding posts E918 and E919 disconnects the panel meter from the internal measuring circuits. INT — Connects the panel meter across the METER switch.
E918 and E919 binding posts	Two binding posts; provide for external connection of test equipment for check and adjustment of channel receive bias.

[a] These components are not provided on some equipment.

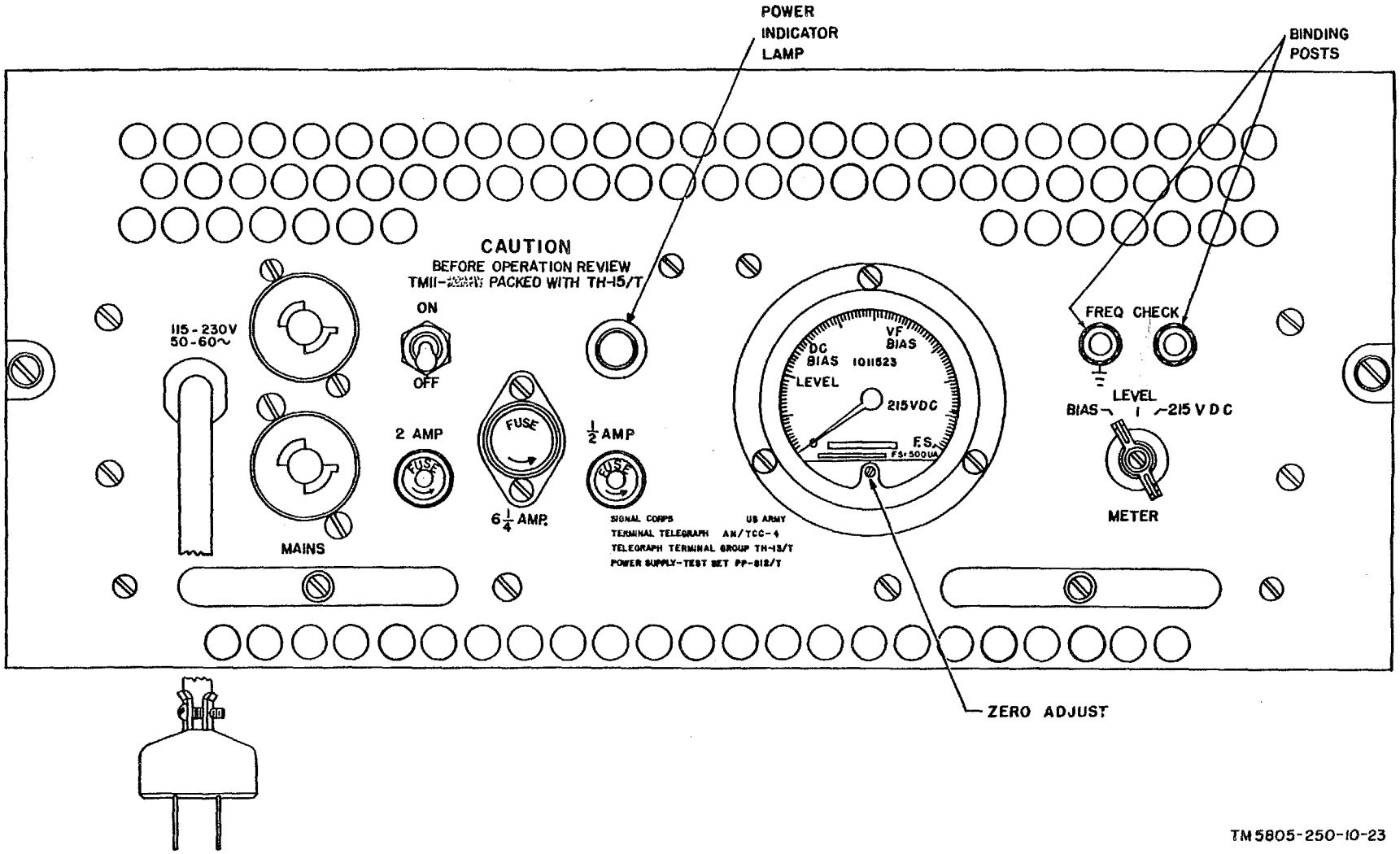


Figure 19. Power Supply-Test Set PP-812/T, panel controls, meter, connectors, and indicator.

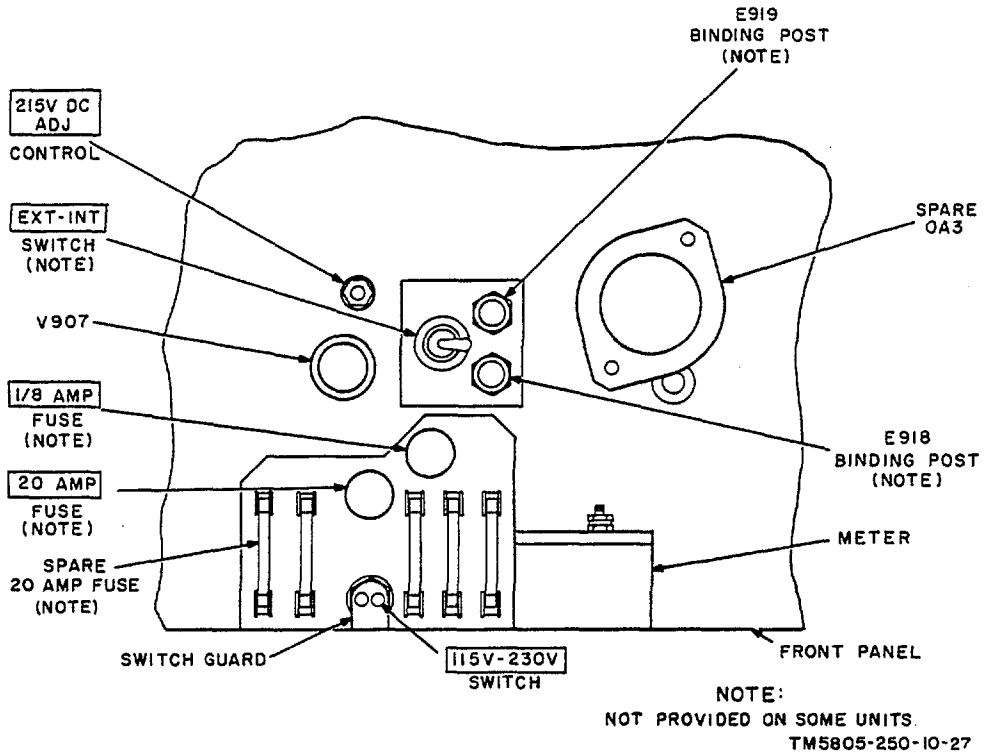


Figure 20. Power Supply-Test Set PP-812/T, internal controls and connectors.

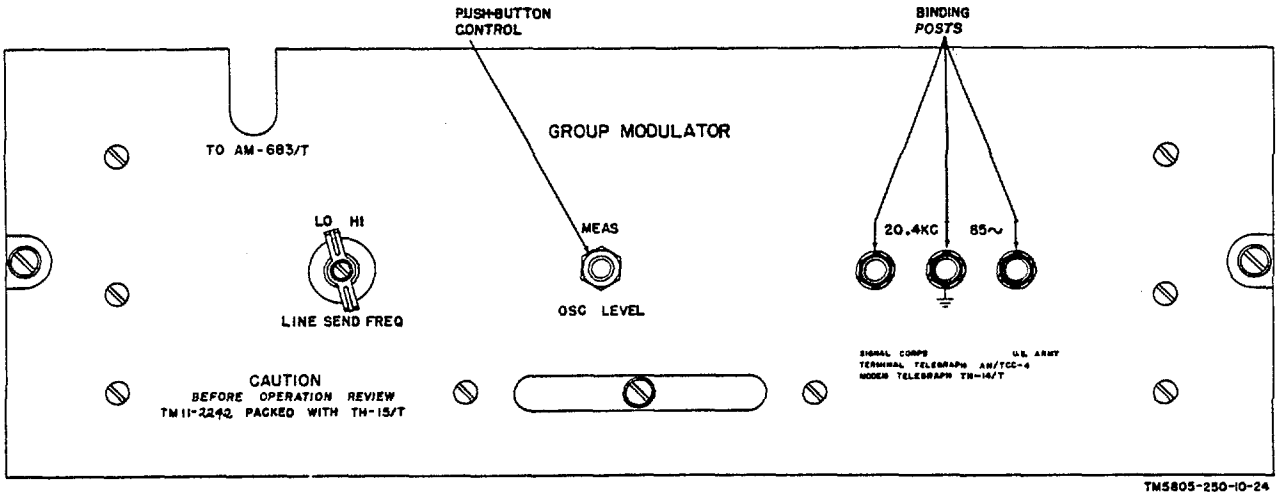


Figure 21. Telegraph Modem TH-14/T, panel controls and connectors.

34. Telegraph Modem TH-1 4 /T, Controls end Connections (fig. 21)

Control or connector	Function
LINE SEND FREQ	Two position, rotary switch; *SW pos* HI — Arranges the TH-14/T to modulate the band of channel- transmitting frequencies (par. 4b) to a higher band of frequency and to pass the band of channel receiving frequencies without change. LO — Arranges the TH-14/T to pass the band of channel transmitting frequencies (par. 4b) without change and to demodulate the band of receiving frequencies to the original channel frequency band.
MEAS 08C LEVEL switch	Two-position, nonlocking, push-button switch. When depressed, permits measurement of the 3,40-cps carrier signal.
20.4KC binding poets	Provide connection to 20.4-kc standard test frequency provided by the TH-14/T for test purpose.
86 ~ binding posts	Provide connection to 85-cps standard test frequency provided by the TH-14/T for test purpose.

Section II. SYSTEM LINE-UP PROCEDURES

35. General

Perform the applicable local and terminal-to-terminal line-up operations before placing the telegraph terminal in operation in an overall system.

a. General Procedures.

(1) Perform the system line-up operations (par. 36 through 42) after the interconnecting line facilities (par. 14) have been lined up and connected to the telegraph terminals.

(2) Make the line-up from terminal A toward terminal B (AB direction). Repeat the procedures in the BA direction. Perform the terminal and channel transmitting line-up procedures (par. 38 and 39*a* and *b*) at both terminals. Then perform the terminal and channel receiving procedures at terminal B (par. 39c and 40) and then at terminal A. When channels are to be used for dc tandem operation (par. 42*c*), each telegraph carrier system is lined up as a separate system before the channels are interconnected in tandem.

Note

Line-up procedures given in paragraphs 38 through 40 are applicable to each stack of a terminal arrangement unless otherwise specified.

(3) Keep records of all readings and adjustments for reference in subsequent line-ups and system trouble shooting.

(4) The transmission signals required for lineup are provided by monitoring equipment (par. 46).

b. Controls.

(1) Loosen the panel fastener screws on the front panels of the components of the telegraph terminal so that the panels may be pulled out for convenient adjustment of the internal controls.

(2) Adjust the' screw-driver controls (held in place by lock nuts) as follows:

(a) Loosen the lock nut.

(b) Adjust the control with the screw driver until the electrical requirement is met.

(c) Tighten the lock nut fingertight to hold the control in the adjusted position.

c. Test Equipment. In addition to the monitoring equipment (par. 46), Teletypewriter Test Set S659/UG (or equivalent) is required. If a teletypewriter test set is not available, a teletypewriter capable of transmitting undistorted repeated space signals may be used.

36. Switch and Control Settings for Telegraph Terminal Arrangements

Set the various switches and controls as appropriate for the particular arrangement (*a* through *f* below) after the desired operating options have been determined and the control terminal has been designated.

a. Four-channel, Four-wire Terminal. Set the switches of the terminals of a four-channel, four-wire system as indicated below.

Panel and figure reference	Switch designations	Switch setting at A terminal	Switch setting at B terminal
AM-83/T (fig. 18).	SEND FREQ.	LO	HI
	CHANNELS	4-8	4-8
	LINE AMPL	1	1
	LINE	4W	4W
	SEND LEVER PER CH DBM	0[a]	0[a]
	REC LINE PAD DB	0[a]	0[a]
PP-812/T (fig. 19 and 20)	METER	215V DC	215V DC
	EXT-INT[b]	INT	INT
	ON-OFF	OFF	OFF
TH-17/T (fig. 16)	SEND FREQUENCIES LOOP (*f* below).	LO	HI
TH-16/T (fig. 16)	SEND FREQUENCIES LOOP (*f* below).	LO	HI

[a] Switches are subject to resetting during the line-up procedure.
[b] Not provided on some equipment (par. 12*a* (4)).

b. Four-channel, Two-wire Terminal. Set the switches of the terminals of a four-channel, two-wire system as indicated below.

Panel and figure reference	Switch designations	Switch setting at A terminal	Switch setting at B terminal
AM-M83/T (fig. 18).	SEND FREQ	LO	HI
	CHANNELS	4-8	4-8
	LINE AMPL	-1	1
	LINE:	2W	2W
	SEND LEVEL PER CH DBM	0[a]	0[a]
	REC LINE PAD DB	0[a]	0[a]
PP-812/T (fig. 19 and 20).	METER	215V DC	215V DC
	EXT-INT[b]	INT	INT
	ON-OFF	OFF	OFF
TH-17/T (fig. 16).	SEND FREQUENCIES LOOP (*f* below).	LO	HI
TH-16/T (fig. 16).	SEND FREQUENCIES LOOP (*f* below).	LO	HI

[a] Switches are reset when performing line-up procedures.
[b] Not provided on some equipment (par. 12*a*(4)).

c. Eight-channel, Four-wire Terminal. Set the switches of stack A and B od the terminals of an eight-channel, four-wire system as indicated below.

Panel and figure references	Switch designations	Switch setting at A terminal		Switch setting at B terminal	
		Stack A	Stack B	Stack A	Stack B
AM-683/T (fig. 18)	SEND FREQ	LO	HI	HI	LO
	CHANNELS	4-8	4-8	4-8	4-8[b]
	LINE AMPL	1	2	1	2
	LINE	4W	4W	4W	4W
	SEND LEVEL PER CH DRM.	0[a]	Infinity[b]	0[a]	Infinity[b]
	REC LINE PAD DB	0[a]	Infinity[b]	0[a]	Infinity[b]
P-812/T (fig. 19 and 20).	METER	215V DC	215V DO	215V DC	215V DC
	EXT-INT[c] .-	INT	INT	INT	INT
	ON-OFF	OFF	OFF	OFF	OFF
TH-17/T (fig. 16).	SEND FREQUENCIES LOOP (*f* below).	LO	HI	HI	LO
TH-16/T (fig. 16),	SEND FREQUENCIES LOOP (*f* below).	LO	HI	HI	LO

[a] Switches are reset when performing line-up procedure.
[b] The amplifiers in stacks B are not in the circuits. The settings of these controls are arbitrary.
[c] Not provided on some equipment (par. 12a(4)).

d. Eight-channel, Two-wire Terminals. Set the switches of stacks A and B of the terminals of an eight-channel, two-wire system as indicated below.

Panel and figure references	Switch designations	Switch setting at A terminal		Switch setting at B terminal	
		Stack A	Stack B	Stack A	Stack B
AM-683/T (fig. 18).	SEND FREQ	LO	HI	HI	LO
	CHANNEL	4-8	4-8	4-8	4-8
	LINE AMPL	2	2	2	2
	LINE	2W	4W	2W	4W
	SEND LEVEL PER CH DBM.	0[a]	Infinity[b]	0[a]	Infinity[b]
	REC LINE PAD DB	0[a]	Infinity[b]	0[a]	Infinity[b]
PP-812/T (fig. 19 and 20	METER	215V DC	215V DC	215V DC	215V DC
	EXT.-INT[c]	INT	INT	INT	INT
	ON-OFF	OFF	OFF	OFF	OFF
TH-17/T (fig. 16)	SEND FREQUENCIES LOOP.(*f* below).	LO	HI	HI	LO
TH-16/T (fig. 16)	SEND FREQUENCIES LOOP (*f* below).	LO	HI	HI	LO
TH-14/T (fig. 21)	LINE SEND FREQ	HI	None used	LO	None used

[a] Switches are reset when performing line-up procedure.
[b] The amplifiers in stacks B are not in the circuits. The settings of these controls are arbitrary.
[c] Not provided on some equipment (par. 12a(4)).

e. Sixteen-channel, Four-wire Terminals. Set the switches of stacks A through D of the terminals of a sixteen-channel, four-wire system as indicated below. Note that the switch setting of stacks A and B are those of stacks C and D, respectively, except that the CHANNELS switches are set to include the four stacks as a single working assembly.

Panel and figure references	Switch designation	Switch setting at A terminal				Switch setting at B terminal			
		Stocks				Stocks			
		A	B	C	D	A	B	C	D
AM-683/T (fig. 18).	LINE FREQ	LO	HI	LO	HI	HI	LO	HI	LO
	CHANNELS.....	16	16	16	16	16	16	16	16
	LINE AMPL	2	2	2	2	2	2	2	2
	LINE.....	4W	4W	4W	4W	4W	4W	4W	4W
	SEND LEVEL PER CH DBM....	0[a]	Infinity[b]	0[a]	Infinity[b]	0[a]	Infinity[b]	0[a]	Infinity[b]
	REC LINE PAD DB....	0[a]	Infinity[b]	0[a]	Infinity[b]	0[a]	Infinity[b]	0[a]	Infinity[b]
PP-812/T (fig. 19 and 20).	METER	215V DC	215V DC	215V DC	215V DC	215V DC	215V DC	215V DC	215V DC
	EXT-INT[c]	INT	INT	INT	INT	INT	INT	INT	INT
	ON-OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TH-17/T (fig. 16)	SEND FREQUENCIES LOOP (*f* below.)	LO	HI	LO	HI	HI	LO	HI	LO
TH-16/T (fig. 16).	SEND FREQUENCIES LOOP (*f* below).	LO	HI	LO	HI	HI	LO	HI	LO
TH-14/T (fig. 21).	SEND FREQUENCIES	HI	None used	LO	None used	LO	None used	HI	None used

[a] Switches are reset when performing line-up procedure.
[b] The amplifiers in stacks B are not in the circuits. The settings of these controls are arbitrary.
[c] Not provided on some equipment (par. 12a(4)).

f. LOOP Switches. Determine the loop operating option selected for each channel and set the LOOP witch of the channel to the corresponding position.

37. Starting Procedure

After the initial settings of switches and controls have been made (par. 36), perform the following procedures on the PP-812/T in each stack to turn on and adjust the 215-volt de power supply output.

Step No.	Control	Action	Indication and action
1	ON-OFF switch	Operate to ON position	Power indicator lamp lights. Rotate the dimmer control (mounted on the hub of the indicator lamp holder) to adjust the light to the desired intensity.
2	Zero adjust control on meter	Rotate	Adjust until meter needle points to 0 on the meter scale.
3	METER switch	Operate to 215V DC position	Meter needle indicates 215V DC.
4	215V DC ADJ control (fig. 20)	Rotate	If the meter indication is not 2156V DC, loosen the panel fastening screws and withdraw the panel-chassis assembly. Loosen the nut that locks the potentiometer in position. Rotate the control until the meter indication is met. Lock the nut on the control. Slide the panel-chassis assembly back in place.

38. Channel Transmitting Checks and Adjustments

To check and adjust the output signal of each channel transmitting to the AM-683/T perform the procedures given in *a* and *b* below.

a. Channel Transmitting Signal Level. Repeat the procedures for each stack in the terminal arrangement beginning with stack A.

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T	METER switch	Operate to LEVEL position	
2	Each channel in TH-15/T	LINE LEVEL MEAS switch.	Depress	PP-812/T meter in stack A indicates LEVEL
		LINE LEVEL ADJ control.	Rotate:	If the requirement in *a* above is not met, rotate (while depressing the LINE LEVEL MEAS switch) until meter needle indicates LEVEL. This reading corresponds to a signal level of 0 dbm.

b. Send Indication Check. Perform the following procedures for each channel to determine whether the channel carrier oscillator is keyed by loop signals.

Note:

The proper indication for vf two-wire loop operation cannot be obtained unless the interconnecting facilities between the telegraph terminals are properly connected and lined up, and an idle signal is received from the distant telegraph terminal (par. 39*c*).

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T	METER switch	Operate to BIAS position	
2	Monitor or loop teletype-writer.	.....	.....	Connect the sending circuit of the Monitor equipment (par. 46) or loop equipment (par. 31) to the channel.
3	Each channel in TH-15/T.	LOOP switch	Set as applicable to the type of loop operation for the channel (par. 36*f*).	Transmit repeated space signals from loop or monitor equipment.
		SEND INDICATOR switch.	Depress	PP-812/T meter needle in the stack of the channel under test indicates VF BIAS. No adjustment is provided.

39. Terminal-to-Terminal Transmitting and Receiving Checks and Adjustments, and TH-14/T 3,400-cps Output

Perform the transmitting and receiving signal level checks (a and c below) in stacks A for four- and eight-channel terminal arrangements (par: 15). Perform these checks in stacks A and C for sixteen-channel terminal arrangements.

a. Terminal Transmitting Signal Level. The combined power level of all the channels at the telegraph terminal line binding posts is tabulated below for the various settings of the SEND LEVEL PER CH DBM switches in stacks A and C.

SEND LEVEL PER CH DBM switch settings, stack A and C[a]	Combined power level of channels in telegraph terminal (dbm)		
	Four-channel terminal	Eight-channel terminal	Sixteen-channel terminal
0	+6	+9	+12
-3	+3	+6	+9
-6	0	+3	+6
-9	-3	0	+3
-12	-6	-3	0
-15	-9	-6	-3
-18	-12	-9	-6
-21	-15	-12	-9
-24	-18	-15	-12
Infinity	No output	No output	No output

[a] This switch is set to the *infinity* position for stacks B and D (par. 36).

(1) *Point-to-point system.* In a point-to-point system (par. 14a), set the SEND LEVEL PER CH DBM switch to .the 0 position in stacks A and C. If a signal of this level would interfere with near-by line circuits, set the switch to a position to reduce the signal level so as not to cause interference.

(2) *Telephone carrier terminal or radio relay system.* Determine the permissible input line level requirement of the telephone

channel or the radio transmitter and set the LINE LEVEL PER CH DBM switch to the position that provides this level. When the line level requirement of the telephone channel or radio transmitter is not known or cannot be determined, the data given in the chart below may be used as a *guide*.

Typical interconnecting telegraph carrier circuit	Typical input requirement	SEND LEVEL PER CH DBM switch setting[a], stacks A and C		
		Four-channel terminal	Eight-channel terminal	Sixteen-channel terminal
Channel of a telephone carrier system	-9 dbm	-15	-18	-21
Radio transmitter	0 dbm	-6	-9	-12

[a] Set this switch in stacks B and D to infinity position.

b. TH-14/T, 3,400 cps Output. To check the 3,400-cps output of the TH-14/T, perform the following procedures.

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T	METER switch	Operate to LEVEL position.	
2	TH-14/T	MEAS OSC LEVEL switch.	Depress.	PP-812/T meter needle in stack containing TH-14/T indicates LEVEL, ± 5 scale divisions. No adjustment is provided.

c. Terminal Receiving Signal Level. To check and adjust the level of the signals received from the distant telegraph terminal, telephone carrier terminal, or radio receiver, perform the procedures given below.

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T	METER switch	Operate to LEVEL position.	
2	AM-683/T	REC LEVEL switch	Depress.	PP-812/T meter needle indicates LEVEL. This reading corresponds to a received signal level of -5 dbm.

Step No.	Component	Control	Action	Indication and further action
		REC LINE PAD DB control.[a].	Move one step at a time.	Set the switch at the position that provide a meter indication at LEVEL. If a low- or no-reading is obtained, perform the receive bias check and adjustment on a channel: selected at random in the stack (par. 40). If the receive bias check is met, the incoming signal level may be considered satisfactory. **Note. A low- or no-reading does not necessarily mean the incoming signal is too low for adequate operation. The specified minimum receiving level is 25 dbm. However satisfactory operation is sometimes possible for levels as low as -40 dbm.**

[a] Set this control stacks B and D to *infinity* position.

40. Channel Receive Bias, Loop Level Checks and Adjustments

Calibrate the meter measuring circuits each time (*a* below) before making the receive bias measurements and adjustment (*b* below).

a. Meter Calibration; for Channel Receive Bias Measurement. Determine the type of loop operation for each channel, and then use the procedures given in the charts below that apply to that type of operation. For equipment not provided with the EXT-INT switch, use the procedures given in (1) below on all types of loop operation. For equipment provided -with the EXT-INT switch, use the procedures given in (2) below only for *vf loop* operated channels; for *dc loop* operated channels, use the procedures given in (1) below. After the meter has been calibrated for each channel, proceed directly to the receive bias adjustment (*b* below). The meter calibration must be performed with the loop in the idle condition (no message being received from the distant terminal).

(1) *Equipment not provided with EXT-INT switch.* Use the following operations for equipment not provided with the EXT-INT switch. Use the following operations also for equipment *provided with* the switch on channels being operated on *dc four-wire* or *tandem* loops by operating the EXT-INT switch to the INT position. Repeat the following procedures every time the receive bias is required. For dc tandem loop operated channels, change the channel LOOP switch to the DC 4W position (step 3a below) and adjust the receive bias as for dc four-wire loop channel. Restore the LOOP switch to the DC TAN position after the receivebias adjustment is completed (*b*(1), step 3 below).

Note

In the case of *dc four-wire loops* (step 3 in chart below), the calibration and receive bias adjustment is required when the total resistance of the dc loop is changed by the insertion or removal of tandem teletypewriters and when the mode of loop operation changes from *station* to *local* operation or vice versa. Local operation means that only the monitor teletypewriter is connected to the channel loop circuit (par. 46*c*).

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T in stack of channel being tested.	METER switch	Operate to 215V DC position, Operate to BIAS position	Recheck power supply voltage and readjust if necessary (par. 37). Check and adjust bias calibration (steps 2 and 3 below).
2	Channel being tested, vf two-wire or vf four-wire loop operation.	LOOP switch	VF 2W or VF 4W position	Partially withdraw the chassis from the case to gain access to controls on the side of the chassis
		REC BIAS CAL switch	Depress	PP-812/T meter needle indicate F.S. (full scale).
		VF LOOP control (VF BIAS CAL on some equipments).	Rotate.	If the requirement in *b* above is not met, rotate until meter needle indicates F.S.
3	Channel being tested, dc four-wire loop or dc tandem loop operation.	LOOP switch	Operate to DC 4W position	The loop receiving circuit must be closed either with the station equipment or with the monitor teletypewriter (par. 46*b* and *c*).
		REC BIAS CAL switch	Depress.	PP-812/T meter needle indicates F.S.
		DC LOOP CURRENT control (DC BIAS CAL on some equipments).	Rotate.	If the requirement given in *b* above is not met, rotate until meter needle indicates F.S. ***Note.*** **If unable to obtain F.S. meter indication, adjust the current control on the teletypewriter connected as the monitor teletypewriter (or request the teletypewriter operator at the station to adjust the current control on his teletypewriter) until the meter needle indicate F.S. Keep the loop (or monitor) equipment connected for receive bias adjustment (*b*(1) below).**

(2) *Equipment provides with EXT-INT switch.* Use the following procedures for equipment provided with this switch only for channels to be used for *vf two-wire* or *vf four-wire* loop operation. For *dc four-wire* and *tandem* operated channels, operate the EXT-INT switch to the INT position and follow the procedures given in (1) above. After calibration, proceed directly to the measurement and adjustment of the receive bias (*b*(2) below).

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T in stack of channel being tested.	EXT-INT switch	Operate to EXT position	Partially withdraw the panel drawer from the case to gain access to the switch and binding posts E918 and E919 (fig. 20).

Step No.	Component	Control	Action	Indication and further action
2	Channel under test, vf two-wire or vf four-wire loop operation.	LOOP switch	VF 2W or VF 4W position, depending on type of loop operation.	
3	TS-659/UG (or equivalent) (or teletypewriter).	.....	.....	Connect to TH-6/TG SEND jack (A, fig. 22).
4	TH-65/TG	4W-2W-TEL switch	Operate to 2W position.	This operation connects the output of the TH 5/TG transmitting branch to the Input of the TH-5/TG receiving branch.
5	Patch cord.	.....	.....	Connect the patch cord (A, fig. 22).
6	TS-659/UG (or equivalent) (or teletypewriter).	.....	.....	Send repeated space signals Note and record the PP-812/T meter indication. This is the *reference point* on the meter for the receive bias measurement and adjustment of the channel (b (2) below). Disconnect the TS-659/UG (or equivalent), (or teletypewriter).

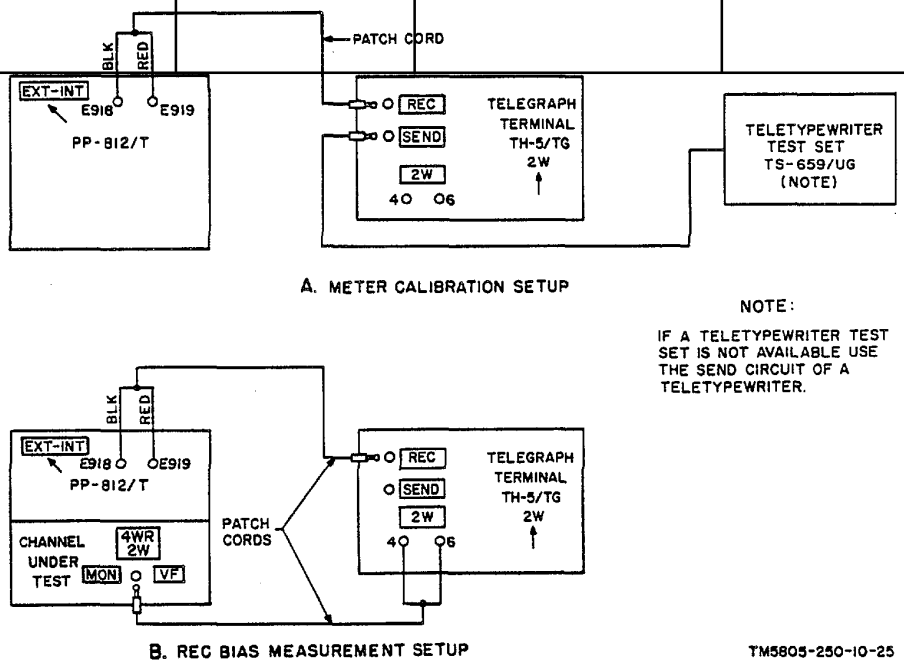


Figure 23. Receive bias calibration and measurement connections (of loop operated channels), using EXT-INT switch and binding posts E918 and E919.

b. Channel Receive Bias Measurement and Adjustment. After the meter has been calibrated (a above), perform the operations in (1) or (2) below to measure and adjust the receive bias of each channel.

(1) *Equipment not provided with EXT-INT switch.* Use the following procedures for all types of loop operation.

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T in stack of channel under test	METER switch	Operate to BIAS position.	
2	Channel under test, vf two-wire or vf four-wire loop operation.	LOOP switch	VF 2W or VF 4W position	Request the distant terminal operator to send repeated space signals on the channel being tested.
		REC BIAS MEAS switch.	Depress.	PP-812/T meter needle Vibrates on VF BIAS.
		REC BIAS ADJ control	Rotate.	If the requirement (b above) is not met, rotate until the meter needle vibrates on VF BIAS.
3	Channel under test, dc four-wire loop (and any channel to be operated de tandem).	LOOP switch	Operate to DC 4 W position.	Request the distant terminal operator to send repeated space signals on the channel being tested.
		REC BIAS MEAS switch	Depress.	PP-812/T meter needle vibrates on DC BIAS.
		REC BIAS ADJ control	Rotate	If the requirement (b above) is not met, rotate until the meter needle vibrates on DC BIAS.
				Request the distant terminal operator to stop sending the test signal.

(2) *Equipment provided with EXT-INT switch.*

Use the following procedures for *vf two- and four-wire* loop operated channels. For dc *four-wire* and *tandem* loop operated channels, use the procedures given in (1) above, operating the EXT-INT switch to the INT position.

(a) Connect the equipment to the channel under test (B, fig. 22). This connects the receiving path of the TH-5/TG between the output of the receiving path of the channel being tested and the calibrated meter in the PP-812/T.

(b) Operate the EXT-INT switch to the EXT position.

Use these procedures also on equipment provided with the EXT-INT switch for *dc four-wire* and *tandem* loop operated channels; operate the EXT-INT switch to the INT position.

(c) Request the distant telegraph terminal operator to send repeated space signals to the channel under test.

(d) The PP-812/T meter needle vibrates around the *reference* point obtained in the callibration test 9a92) (b) above).

(e) If the meter needle does not vibrate around the meter reference mark, adjust the REC BIAS ADJ control on the channel under test until the requirement is met.

(f) Disconnect the test equipment.

(g) Operate the EXT-INT switch to the INT position.

c. Loop Signal Level Check. To check the level of the signal being transmitted to the loop equipment on *vf two-* and *four-wire* loop operated channels, perform the operations given below.

Step No.	Component	Control	Action	Indication and further action
1	PP-812/T in stack of channel being checked.	METER switch	Operate to LEVEL position.	
2	Channel under test.	LOOP switch	VF 2W or VF 4W position.	
		LOOP LEVEL MEAS switch.	Depress	PP-812/T meter needle in stack of channel under test indicates LEVEL. No adjustment is provided. The channel receiving output into the vf loop is fixed at 0 dbm.

41. Line-up Checks

At the completion of the system line-up (par. 36 through 49) in both directions, use the monitor equipment to check the ringing and transmission over each channel. The receiving teletypewriters should be oriented by adjusting the range controls.

a. Ringing. Perform the ringing check over each channel arranged for vf two-wire or vf four-wire loop operation.

(1) At both ends of the circuit, connect a TH5/TG with the associated teletypewriter into the monitoring jacks of the particular channel. (par. 46a and b).

(2) At the A terminal, operate the RING switch on the .TH-5/TG.

(3) At the B terminal, the buzzer in the TH5/TG operates to give a ringing signal and the teletypewriter runs open.

(4) Repeat the procedure given in (2) above at the B terminal. The results given in (3) above are observed at the A terminal.

b. Message Transmission. Perform the message transmission and reception checks over each channel of the terminal.

(1) Connect the monitor equipment (par. 46), depending on the type of loop operation for the particular channel.

(2) Transmit a message from the teletypewriter at the A terminal.

(3) Determine if error-free copy is received at the B terminal. Refer to paragraph 6e items 9 or 10.

(4) Repeat the procedures given in (2) above at the B terminal, and the procedure given in (3) above at the A terminal.

42. Placing System in Service

After the checks and adjustments given in paragraphs 36 through 41 have been satisfactorily completed, the system is ready to be placed in service. Up to this point, all checks, transmission, and reception have been performed from terminal to terminal. Now the system is ready for association with the telegraph stations in the loop circuits of the system.

a. Loop Connections.

(1) Disconnect any straps that may be connected across the loop binding posts.

(2) Connect the loop equipment lines to the channel loop binding posts (par. 30).

(3) For de four-wire loop operated channels, repeat the procedures-given in paragraph 40. This serves to adjust the current in the loop circuit and takes into account the total resistance of the loop, including all tandem-connected teletypewriters.

b. Operational Checks. The teletypewriter station operators perform the ringing, transmission and reception, and the teletypewriter range adjustments (par. 44).

c. Dc Tandem Line-up.-Channels to be used with do tandem loops were tested and adjusted by using the .procedures for dc four-wire loops (par. 40a(i), step 3, and b(1), step .3).

(1) Reconnect the de tandem operating channels back-to-back (par. 30d).

(2) Operate the channel LOOP switches to the DC TAN position.

(3) Request the distant B terminal operator or the loop station operator at that terminal to transmit repeated space signals.

(4) At the tandem-connected terminal (towards

A terminal) perform the send indication check (par. 38b).

(5) At the A terminal, perform the receive bias calibration and adjustment applicable to the type of loop operation being used on that channel (par. 40).

(6) Repeat the procedures given in (3) through (5) above in the AB direction; A terminal operator (or loop station) sends a test signal; tandem-connected terminal (towards B terminal) performs the send indication check; B terminal performs *receive bias* calibration and adjustment.

Section III. OPERATION UNDER USUAL CONDITIONS

43. General

a. After the system has been lined up (par. 36 through 41) and placed into service (par. 42), operation is automatic as far as the telegraph terminals are concerned.

b. Procedures for operating the loop equipment are described in the technical manual for the equipment used.

(1) The loop station equipment for vf loops usually consist of components of Telephone Telegraph Terminal AN/TCC-14 (TM 11-2239) and a teletypewriter (such as Teletypewriter TT-4A/TG, TM 11-5815206-12). Refer to the technical manual supplied for the teletypewriter used.

(2) The loop station receiving equipment for dc loops must be capable of operating on 20 ma dc.

c. Procedures for operating the station equipments for message transmission and reception through the telegraph system are given in paragraph 44. Procedures for operating the monitoring equipment at the telegraph terminal are given in paragraph 46.

d. Operator's line-up checks that can be performed with the system inoperation. are given in paragraph 45.

44. Operation Procedures at Loop Station

Depending on the type of loop operation, the operating procedures described in a through c below are performed at the loop station.

a. Vf Two-wire Loop Operated Channels. If the loop connected to a particular channel of the telegraph terminal is a vf two-wire loop, operation is half-duplex with break-in.

(1) Standby. While the channel is idle, either teletypewriter operator may start transmission of a message.

(2) Message transmission. Message transmission should be preceded by the transmission of a ringing signal. This is done either by operating the BREAK key on the teletypewriter 52 or by operating the RING switch on the TH-5/TG. Message transmission should be fairly continuous, with breaks between characters not exceeding 3 seconds. If longer breaks are permitted, the transmitting teletypewriter operator may lose control of the channel, and the receiving teletypewriter operator may break in without previous notice. The transmitting teletypewriter operator has, control of the channel as long as transmission proceeds as indicated above, and until he either stops sending for more than 3 seconds or until the receiving teletypewriter breaks in ((4) below). To maintain control of the circuit when a break period of more than 3 seconds is required, hold the space bar down.

(3) *Message reception.* Reception is entirely automatic. The receiving teletypewriter operator cannot start transmitting while a message is coming in, and for 3 seconds after the message has stopped coming in.

He can break in, however, by following the procedure outlined in' (4) below.

(4) Break-in. The receiving teletypewriter operator may break in, while a message is being received, by performing the following procedures:

(a) Transmit a ringing signal for not less than 4 seconds.

(b) Immediately following the end of ringing signal transmission, start transmission of the message.

b. Vf Four-wire Loop Operated Channels. In vf four-wire loop operated channels, simultaneous transmission and reception in both directions (full-duplex) is possible. Ringing is done in the same manner as described in a(2) above. No waiting period is necessary before starting transmission. The requirement for continuing transmission without breaks (a(2) above) does not apply. Signal by

operating the RING key in the TH-5/TG or the teletypewriter BREAK key.

c. DC Four-wire Loop Operated Channels. In dc four-wire loop operated channels, simultaneous transmission and reception in both directions (full-duplex) is possible. No waiting period is reception before transmission starts. Signal by operating the teletypewriter BREAK key.

d. Dc Tandem Operated Channels. No telegraph equipment is connected to the channels at the terminal connected back-to-back. The telegraph equipment at both ends of the system, connected to the back-to-back circuit, is operated according to the type of loop operation connected to the channel (a through c above).

45. Operator's Checks

The checks listed in the chart below can be performed by the telegraph terminal operator without interrupting message transmission. Perform these operations as often as necessary to insure proper transmission and reception. Refer to paragraph 56 when proper indications are not obtained.

Note. The PP-812/T used in the following tests corresponds to the stack in which the component unde. Test is located.

Item No.	Description	Component	Switch or control	Action	Further action or indication
1	215-volt de power supply output (par. 87).	PP-812/T	METER switch posi-	Operate to 214V DC tion.	Meter needle indicates 216V DC.
		PP-812/T	215V DC ADJ control	Rotate.	Adjust until meter needle indicates 215V DC.
2	8,400-ps output (par. 89b)	PP-812/T	METER switch	a. Operate to LEVEL po- sition.	None.
		TH-14/T	MEAS OSC LEVEL switch	Depress.	Meter needle Indicates LEVEL. No Adjust- ment provided.
3	Channel transmitting signal	PP-812/T	METER switch	Operate to LEVEL position level (par. 88a).	None.
	Channel under test.	LINE LEVEL MEAS	Depress. switch.	Meter needle indicates LEVEL	
4	Channel send indication Loop operated channel only (par. 40c)	PP-812/T	METER switch	Operate to BIAS position.	None.
		Channel under test.	SEND INDICATOR switch.	Depress.	When a message is being transmitted from the loop (or monitor) equip- ment the meter needle vibrates indiscriminately. If space repeats are being transmitted, the meter needle vibrates around VF BIAS. No adjust- ment is provided.
5	Channel loop signal level, loop operated channel only (par. 40c).	PP-812/T	METER switch	Operate to LEVEL position.	None.
		Channel under test.	LOOP LEVEL MEAS	Depress.	The meter needle indicates
		Channel under test.	LOOP LEVEL ADJ control.	Rotate.	Rotate until meter needle indicates LEVEL.
6	Channel receiving indication (par. 40b(1)).	PP-812/T	METER switch	Operate to BIAS position.	None.
		Channel under test (except dc tandem loop operated channel).	REC BIAS MEAS switch (on side of channel chasis).	Depress.	When a message is being received from the distant Terminal, the meter needle vibrates indis- criminately. However,' if repeated space signals are being received, the meter needle vibrates

					around VP BIAS for vf loop operated channels and around DC BIAS for de four-wire loop operated channels.
7	Terminal receive signal level (par. 39c).	PP-812/T stacks A and C	METER switch	Operate to LEVEL position.	None.
		AM-683/T stacks A and C	REC LEVEL switch	Depress.	Meter needle indicates LEVEL.
		AM-683/T stacks A and C	REC LINE PAD DB con-	Rotate.	Rotate until meter needle indicates LEVEL. (See the note in paragraph 39c, step 2b.)

46. Monitoring

Monitoring equipment is used to -send and receive messages through any channel of the telegraph terminal. For vf loop operated channels, a Telegraph Terminal TH-5/TG and a teletypewriter, such as Teletypewriter TT-4A/TG are required. The TH5/TG is not used to monitor de loop operated channels. Use the procedures given in a through d below that are applicable to the operation used on the particular channel.

a. Channel Arranged for Vf Two-wire Loop Operation (A, fig. 23). Connect the TH-5/TG with the associated TT-4A/TG as follows to transmit or receive messages. Operating procedures are given in paragraph 44a.

(1) Arrange the TH-5/TG for operation on a two-wire basis.

(2) Connect the TT-4A/TG to the TH-5/TG SEND and REC jacks. If Teletypewriter Test Set T-659/UG is being used, connect it to -the SEND jack on the TH-5/TG.

(3) Use the patch cords (fig. 3) to connect the TH-5/TG 2W line binding posts to the MON VF 4WR-2W jack on the channel being monitored.

b. Channel Arranged for Vf Four-wire Loop Operation (B, fig. 23). Connect the TH-.5STG and associated TT-4A/TG as follows to transmit and receive messages. Operating procedures are given in paragraph 44b.

(1) Arrange the TH-5/TG for operation on a four-wire basis.

(2) Connect the TT-4A/TG to the TH-5/TG SEND and REC jacks. If the TS659/UG is being used for transmission test, connect it to a SEND jack on the TH-5/TG.

(3) Use the patch cords (fig. 3) and make the following connections for the desired operation.

Item No.	Operation	TH-5/TG circuit	Jack on TH-17T or TH-16/T channel
1	Transmitting to loop station.	Send	MON VF 4WR-2W
2	Transmitting distant telegraph terminal and distant loop station.	Send	MON VF 4WS
3	Receiving from loop station.	Receive	MON VF 4WS
4	Receiving from distant telegraph terminal and distant loop station.	Receive	MON VF 4WR-2W

c. Channel Arranged for Dc Four-wire Operation (C, fig. 23). Connect the TT-4A/TG as follows to transmit and receive messages. Operating procedures re given in paragraph 44c.

(1) Use the patch cords to connect the send and receive circuits of the TT-4A/TG to the channel. The TT-4A/TG must be arranged for operation on 20 ma.

(2) To connect the monitor TT-4A/TG to channels that are terminated in loop equip ment, make the connections given in the chart below for the desired operation. Use the patch cords (fig. 3) to make these connections. Use the procedures given in (3) or (4) below for channels not connected to loop station equipment.

Item No.	Operation	Teletypewriter circuit	Jack on TH-17T or TH-16/T channel
1	Transmitting to loop station	Send	MON DC 4WR-2W
2	Transmitting to distant telegraph terminal	Send	MON DC 4WS
3	Receiving from loop station	Receive	MON DC 4WS
4	Receiving from distant telegraph terminal	Receive	MON DC 4WR-2W

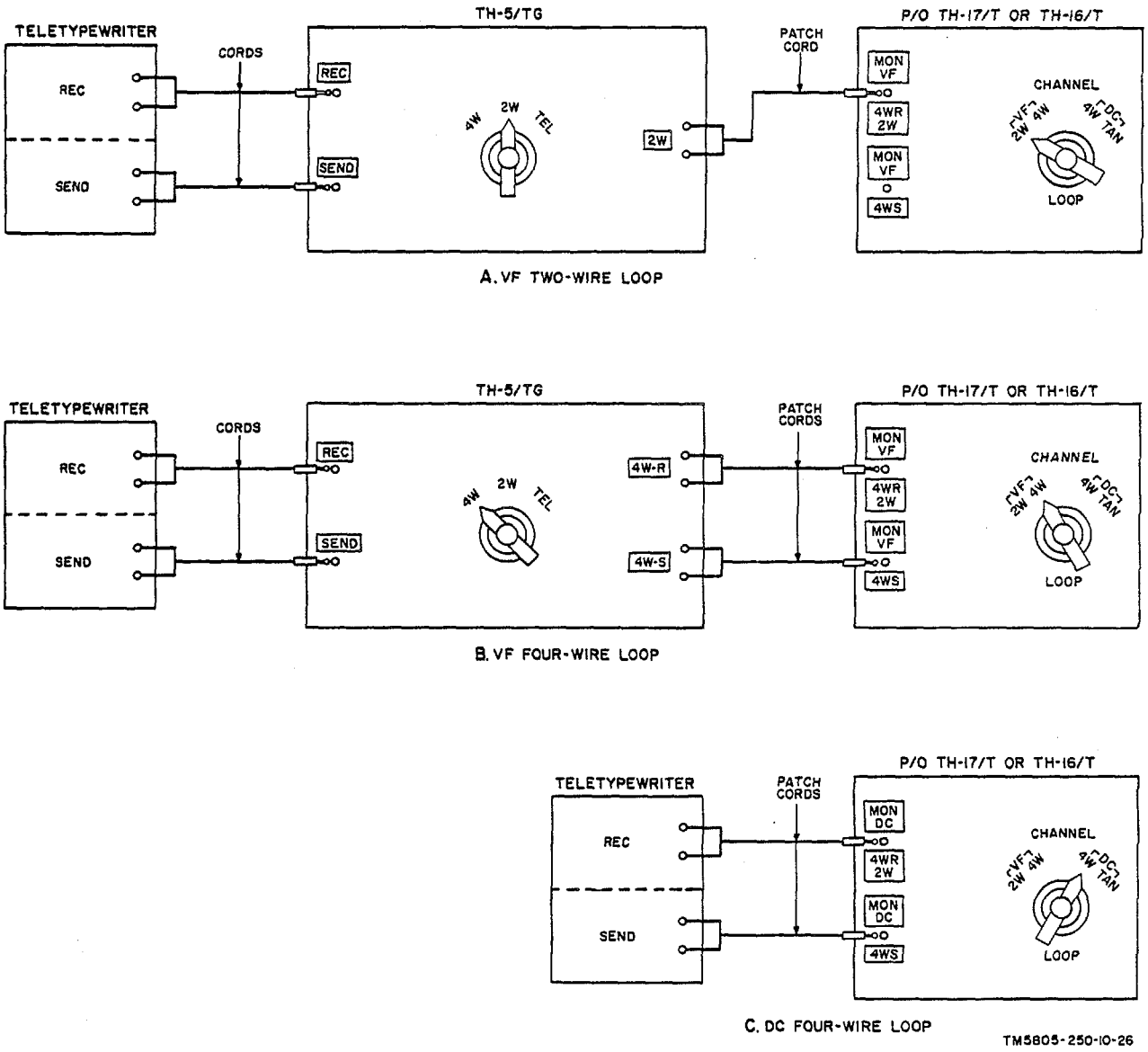


Figure 23. Typical monitoring equipment connections.

(3) To connect the monitor T'T-4A/TG to channels that are not terminated in loop station equipment, make the following connections for the desired operation; use the patch cords (fig. 3).

(a) Connect a strap between the channel 4WS binding posts; connect another strap between the channel 4WR-2W binding posts.

(b) Use the procedures given in the chart in (2) above to connect the TT-4A/TG to the channel.

(c) Perform receive bias calibration and adjustment (par. 40*a*(1)mand *b*(1).

(4) Another method of connecting the monitor TT-4A/TG to a channel that is not terminated in loop station equipment is to substitute the send and receive circuits of the monitor TT-4A/TG for the TH-Y/ TG for the desired operation as given in the chart in b(3) above, then perform receive bias calibration and adjustment (par. 40a(1) and *b*(1)).

d. Channel Arranged for Dc Tandem Operation.

No provision is made on the telegraph terminal for monitoring the 'channel connected in tandem without interrupting' the tandem connection. If transmission or reception is desired, however, follow .the procedures given below.

(1) Disconnect the wires that connect the channel back-to-back.
(2) Connect the monitoring equipment; follow the procedures given in *c*(3) or (4) above.
(3) At the end of the monitoring procedures, disconnect the monitoring equipment and reconnect the wires between the tandem operated channels (par. 31*d*).

Caution:

To prevent damage to the channel components, never operate the channel LOOP switch to the DC TAN position until any straps connected across the channel loop binding posts are removed.

47. Stopping Procedure

To remove the telegraph terminal from operation, notify the operators at the loop teletypewriter stations that operation will be discontinued. Operate the ON-OFF switch on each PP-812/T to the OFF position.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

48. General

The operation of Telegraph Terminal AN/TCC-4 and AN/TCC-20 may be difficult in regions where extreme cold, heat, humidity or other moisture, sand conditions, etc, prevail. Although every precaution is taken in the design of the equipment to maintain its technical characteristics over a wide temperature and humidity range, adverse conditions may cause poor transmission unless additional precautions are taken. Paragraphs 49 through 51 provide procedures that minimize the effects of these unusual climatic conditions.

49. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Keep the equipment warm and dry.

b. When equipment that has been exposed to the cold is brought into a warm room, moisture will gather on the equipment; this may cause a change in operating characteristics. When the equipment reaches room temperature, dry it thoroughly. After applying the power to the equipment, allow it to warm up for about 2 hours before performing the line-up procedures.

50. Operation in Tropical Climates

When the telegraph terminal is operated in tropical climates, it may be installed in tents, huts, or in underground dugouts. When equipment is installed below ground and in swampy areas, moisture conditions are more acute than normal. Ventilation usually is very poor, and the high relative humidity causes condensation on the equipment, whenever the temperature of the equipment becomes lower than that of the surrounding air. To minimize this condition, provide as good ventilation as possible. Dry this equipment thoroughly before operating it.

51. Operation in Desert Climates

a. The main problem that arises with equipment operation in desert areas is the large amount of sand, dust, or dirt that enters the moving parts.

b. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (par. 53 and 54). This equipment does not need lubrication and should be kept free from oil and grease. Excessive amounts of dust, sand; or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

Caution:

When operating the equipment at temperature over'130° F, pull out the lower drawers of the TH-13/T and the TH-15/T about 2 inches 52. Emergency Operation (fig. 12-15) To maintain the system in operation while the AM-83/T in stack A or C, in a 8-channel or 1channel terminal arrangement is being checked, or repaired, transfer operation to the line amplifiers in stack B or D. Follow the procedures in a, b, or c below.

a. Eight channel, Four-wire Terminal.

(1) Operate the SEND LEVEL PER CH DMB, REC LINE PAD DB, LINE AMPL, and LINE controls of stack B AM-83/T to the normal settings found on stack A.

(2) Transfer the line wires from stack A AM683/T to the corresponding line binding posts on stack B AM-683/T.

Note.

Do not disconnect the interunit AM-683/T connecting cable from stack A AM-83/T unless absolutely necessary. This retains stack A band-pass filters in the system. To maintain the system in partial operation, operate both terminals on a four-channel, two- or four-wire basis (par. 36a or b).

(3) Perform system line-up necessary to maintain the system in operation (pars. 39 and 40).

b. Eight-channel, Two-wire Terminal.

(1) Perform the operations given in a above.

(2) Disconnect the TH-14/T connecting cable from the stack A AM-83/T. Connect the

(3) TH-14/T connecting cable to the TO TH-14/T connector on stack B AM -83/T.

c. Sixteen-channel, Four-;wire Terminal. To maintain the system in operation while stack C AM683/T is being checked, or repaired, transfer the operation to the line amplifiers in stack D AM683/T as follows:

(1) Perform the operations given in b above but substitute stack D for stack B, and stack C for stack A.

(2) Transfer the leads from binding posts A, B, C, and D of stack C AM-83/T to the corresponding binding posts in stack D AM-683/T.

Note

To maintain partial system operation while the TH-14/T in stack C is being checked or repaired, operate both terminals of the system on an eight channel, two- or four-wire basis (par. 36*c* or *d*).

CHAPTER 4

MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE

53. Scope of Operator's Maintenance

a. The following is a list of maintenance duties normally performed by the operator of the telegraph terminal. These procedures do not require special tools or test equipment.

b. Operator's maintenance for the telegraph terminal consists of the following:

(1) Preventive maintenance (par. 54).
(2) Troubleshooting (par. 55 and 56).
(3) Replacement of defective tubes, lamps, lightning arresters, and fuses (par. 57).
(4) Checking cable, line, and loop connections (par. 26-30).
(5) System line-up checks (par. 41).

54. Preventive Maintenance

a. DA Form 11-238. Items on DA Form 11-238 (figs. 23 and 24) constitute the preventive maintenance checklist to be used by the operator. Items not applicable to the equipment are lined out in the figures. References in the ITEM block in the figures are to items which contain additional are to items which contain additional information pertinent to the particular item. Instructions for the use of the form appear on the form.

b. Items. The information shown in this subparagraph is supplementary to DA Form 11-238.

The item numbers correspond to the ITEM numbers on the form.

Item	Maintenance procedure
1	Inspect to see that all electron tube shields and tube retainers are on tight and in place.
5	Inspect seating of the cases and tightness of the straps (par. 24).
7	Inspect the connection between the connector underneath the PP-812/T channels and the connector on the cable from the AM-683/T to see that they are seated tightly and that they clear the top edge of the lower panel (par. 26a(5), caution).
10	Inspect the fuse caps for tight fit. Inspect spare fuse holders (fig. 28) for tightness of the clips.

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
26. ~~INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.~~	
27. ~~CHECK FOR NORMAL OPERATION.~~	
28. ~~BEFORE SHIPPING OR STORING, REMOVE BATTERIES.~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

ITEM 4. UNABLE TO OBTAIN CHANNEL SEND INDICATION FOR 4W DC LOOP OPERATION ON CHANNEL A3. REPORTED TO HIGHER ECHELON MAINTENANCE FOR REPAIR.

MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT

SOUND EQUIPMENT, RADIO, DIRECTION FINDING
RADAR, CARRIER, RADIOSONDE AND TELEVISION
(AR 750-625)

EQUIPMENT NOMENCLATURE: TELEPHONE TERMINAL AN/TCC-4

EQUIPMENT SERIAL NUMBER: 1001

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue.

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/ Chief for 1st echelon, or the Inspector for higher echelon:
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

FOLD

TYPE OF INSPECTION

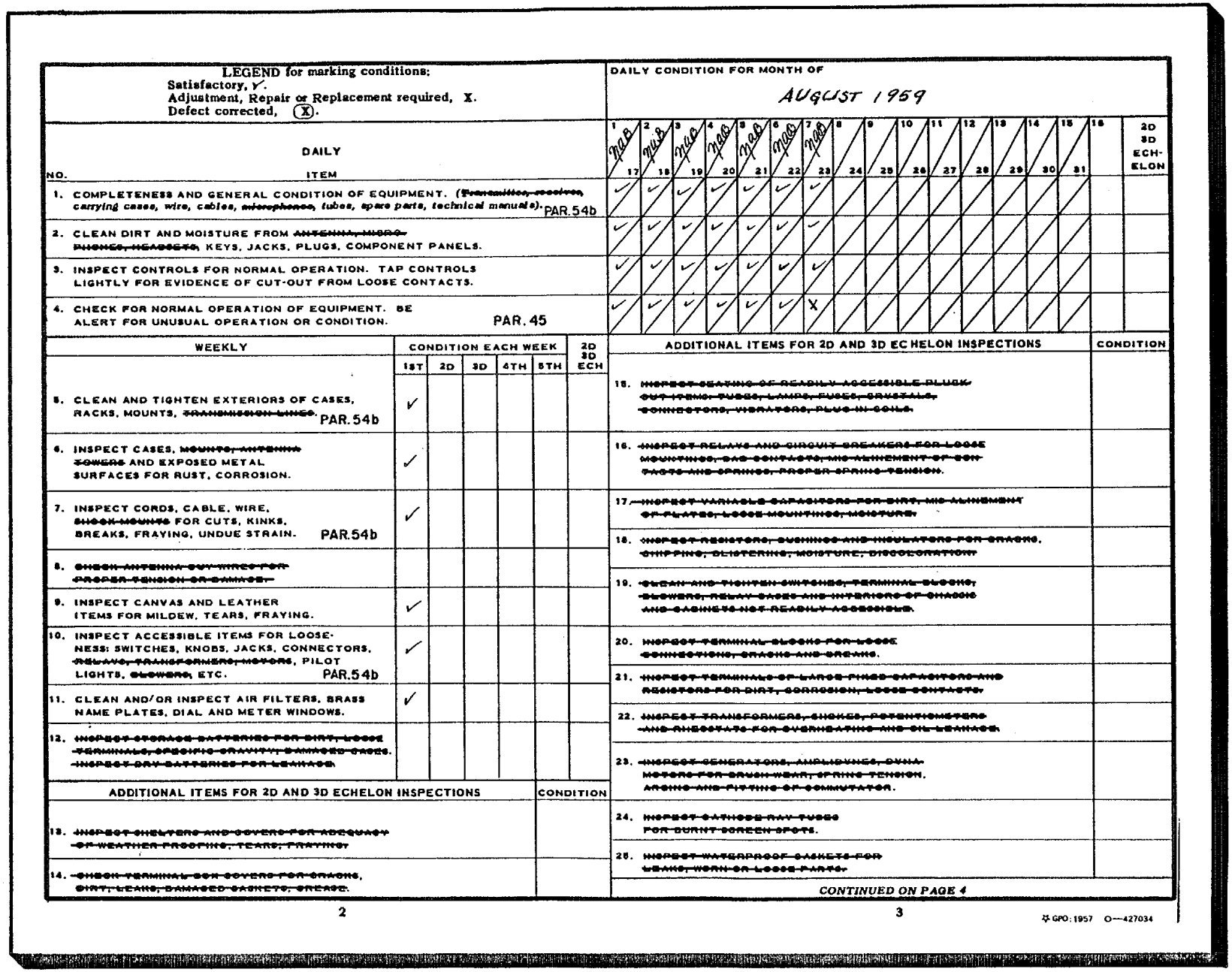
OPER-ATOR	2/3 ECH-ELON	DATE	SIGNATURE
✓		7 AUGUST '59	N.A. Bell

DA FORM 1 MAY 57 11-238

REPLACES DA FORMS 11-238, 1 NOV 55; 11-239, 11-244, 11-245, 11-248, 11-249, 11-250, AND 11-251; WHICH ARE OBSOLETE.

TM5805-250-10-35

Figure 24. DA Form 11-238, pages 1 and 4.



LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF AUGUST 1959

NO.	DAILY ITEM	1 17	2 18	3 19	4 20	5 21	6 22	7 23	8 24	9 25	10 26	11 27	12 28	13 29	14 30	15 31	16	2D 3D ECHELON
1.	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT. (~~Transmitter, receiver~~, carrying cases, wire, cables, ~~microphones~~, tubes, spare parts, technical manuals). PAR. 54b	✓	✓	✓	✓	✓	✓	✓										
2.	CLEAN DIRT AND MOISTURE FROM ~~ANTENNAS, INSIDE PHONES, HEADSETS~~, KEYS, JACKS, PLUGS, COMPONENT PANELS.	✓	✓	✓	✓	✓	✓	✓										
3.	INSPECT CONTROLS FOR NORMAL OPERATION. TAP CONTROLS LIGHTLY FOR EVIDENCE OF CUT-OUT FROM LOOSE CONTACTS.	✓	✓	✓	✓	✓	✓	✓										
4.	CHECK FOR NORMAL OPERATION OF EQUIPMENT. BE ALERT FOR UNUSUAL OPERATION OR CONDITION. PAR. 45	✓	✓	✓	✓	✓	✓	X										

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. CLEAN AND TIGHTEN EXTERIORS OF CASES, RACKS, MOUNTS, ~~TRANSMISSION LINES~~. PAR. 54b	✓					
6. INSPECT CASES, ~~MOUNTS, ANTENNA TOWERS~~ AND EXPOSED METAL SURFACES FOR RUST, CORROSION.	✓					
7. INSPECT CORDS, CABLE, WIRE, ~~SHOCK MOUNTS~~ FOR CUTS, KINKS, BREAKS, FRAYING, UNDUE STRAIN. PAR. 54b	✓					
8. ~~SHOCK ANTENNA GUY WIRES FOR PROPER TENSION OR DAMAGE~~						
9. INSPECT CANVAS AND LEATHER ITEMS FOR MILDEW, TEARS, FRAYING.	✓					
10. INSPECT ACCESSIBLE ITEMS FOR LOOSENESS: SWITCHES, KNOBS, JACKS, CONNECTORS, ~~RELAYS, TRANSFORMERS, MOTORS~~, PILOT LIGHTS, ~~BLOWERS~~, ETC. PAR. 54b	✓					
11. CLEAN AND/OR INSPECT AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS.	✓					
12. ~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, SPECIFIC GRAVITY, DAMAGED CASES. INSPECT DRY BATTERIES FOR LEAKAGE~~						

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
13. ~~INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER PROOFING, TEARS, FRAYING~~	
14. ~~SHOCK TERMINAL BOX COVERS FOR CRACKS, DIRT, LEAKS, DAMAGED GASKETS, GREASE~~.	

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. ~~INSPECT SEATING OF READILY ACCESSIBLE PLUG-IN ITEMS: FUSES, LAMPS, FUSES, CRYSTALS, CONNECTORS, VIBRATORS, PLUG-IN COILS~~.	
16. ~~INSPECT RELAYS AND CIRCUIT BREAKERS FOR LOOSE MOUNTINGS, BAD CONTACTS, MIS-ALINEMENT OF CON-TACTS AND SPRINGS, PROPER SPRING TENSION~~.	
17. ~~INSPECT VARIABLE CAPACITORS FOR DIRT, MIS-ALINEMENT OF PLATES, LOOSE MOUNTINGS, MOISTURE~~.	
18. ~~INSPECT RESISTORS, BUSHINGS AND INSULATORS FOR CRACKS, CHIPPING, BLISTERING, MOISTURE, DISCOLORATION~~.	
19. ~~CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES AND INTERIORS OF CHASSIS AND CASINGS NOT READILY ACCESSIBLE~~.	
20. ~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS~~.	
21. ~~INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR DIRT, CORROSION, LOOSE CONTACTS~~.	
22. ~~INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS AND RHEOSTATS FOR OVERHEATING AND OIL LEAKAGE~~.	
23. ~~INSPECT GENERATORS, AMPLIDYNES, DYNA-MOTORS FOR BRUSH WEAR, SPRING TENSION, ARCING AND PITTING OF COMMUTATOR~~.	
24. ~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS~~.	
25. ~~INSPECT WATERPROOF GASKETS FOR LEAKS, WORN OR LOOSE PARTS~~.	

CONTINUED ON PAGE 4

2 3

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TM5805-250-10-36

Figure 25. DA Form 11-238, pages 2 and 3.

Section II. TROUBLESHOOTING

55. Visual Inspection

a. When the equipment fails to perform properly, check for:

(1) Incorrect meter indications (par. 45).
(2) Incorrect setting of switches and controls (par. 36).
(3) Improper connection of line and loop wires and cable connectors (pars. 30 and 31).
(4) Shorted lighting arresters (par. 57d).
(5) Bad ground connection (par. 29).
(6) Improperly seated tubes and lamps.
(7) Burned-out fuses (which usually indicates some other fault).

b. If the above checks to not disclose the cause of failure, troubleshoot the equipment using operator's troubleshooting checklist (par. 56).

56. Operator's Troubleshooting Checklist

a. General. The operator's troubleshooting checklist is divided into three parts: power supply faults and failures (d below), channel faults or failures (e below), and AM-683/T and TH-14/T faults or failures (f below). Each part lists the symptoms which may be observed, the probable trouble that caused the fault or failure, and the corrective measure to be taken by the operator.

b. Procedure.

(1) When trouble is reported, check the following at the terminal before proceeding to the symptom given in the troubleshooting chart:
  (a) Line, loop, and monitor connections (pars. 29, 30 and 46).
  (b) Interconnecting cables (pars. 26 and 27).
  (c) Switches and controls for the type of terminal arrangement (par. 36).
(2) Locate the symptom and perform the corrective measure indicated in *d, e,* or *f* below. Replace tubes by substitution (par. 57a), one at a time in the sequence given in the chart.
(3) If the corrective measure given in the chart does not clear the trouble, additional maintenance must be performed by maintenance personnel having adequate tools, test equipment, and authority. This maintenance is covered in the appropriate technical manual. The operator should note on the repair tag how the equipment performed and what corrective measures were taken.

c. Reference Symbol Numbers.

(1) Reference symbol numbers given in the chart below are used to identify the components of the different panels. The following number assignments have been made.

Component in	Reference Symbol No.
Channel No. 1	1 through 199
Channel No. 2	201 through 399
Channel No. 3	401 through 599
Channel No. 4	601 through 799
AM-683/T	801 through 899
PP-812/T	901 through 999
TH-14/T	1001 through 1099

(2) An example of the reference symbol numbering scheme of a functionally identical tube for each channel is: V14 (channel 1), V214 (channel 2), V414 (channel 3), and V614 (channel 4).
(3) Throughout this manual, the reference symbol for components of channel 1 are used. The information is applicable to functionally identical components in other channels.

d. Dc Power Supply Faults or Failures (fig. 28).

Item No.	Symptom	Probable trouble	Correction
1	Power indicator lamp does not light.	Defective lamp.	Replace lamp. Replace 6 ¼ AMP Fuse.
2	No 215-volt dc indication.	215-volt dc power supply.	Check to see if power supply tubes are lighted. Replace any that are not lighted.

Item No.	Symptom	Probable trouble	Correction
			If no tubes are lighted, replace 6 ¼ AMP fuse.
			If all tubes are lighted, replace 2 AMP and ½ AMP fuses; replace tubes V903 and V904.
3	Unable to obtain exact 215-volt dc indication by adjustment Of 215V CD ADJ control.	215-volt dc regulator circuits.	Adjust the zero adjust control (par. 37, fig 190 on the meter.
			Replace tubes V905 through V908.

e. Channel Faults or Failure (fig. 26).

Item No.	Symptom	Probable trouble	Correction
1	Incorrect reading for send indication check.	Loop or monitor equipment.	Check loop or monitor transmitting circuit equipment.
			If using monitor equipment, replace patch cord between the monitor jack and the TH-5/TG or teletypewriter.
	Vf two-wire loop operated channal.	Distant terminal not transmitting Ting an idle (mark) signal.	Request distant terminal operator ator to see that channel is in idle condition and transmitting signal level (par. 38a).
		Interconnecting lines or line facility cility not connected or lined up.	Check terminal receiving signal level (par. 39c). If reading is Correct, perform checks of the channel receive circuit (items 4 and 7 below).
			Replace tubes V5, V2, V4, V1, and V3.
	Vf four-wire loop operated channel.	Channel transmitting circuit.	Replace tubes V5, V2, V4, V1, And V3.
	De four-wire loop operated chan Nel.	Channel transmitting circuit.	Replace tubes V5 and V2.
2	Incorrect reading for channel Transmitting signal level.	Channel line oscillator and output Put amplifier circuits.	Replace tube V6.
3	Incorrect loop signal level (*vf loop* operated channel).	Channel loop oscillator circuit.	Replace tube V11.
4	Incorrect reading for receive bias calibration on *vf loop op* erated channel.		

Item No.	Symptom	Probable trouble	Correction
	Using EXT-INT switch in EXT position.	TS-659/UG (or equivalent), TH-5/TG, or patch cord.	Check TS-659/UG (or equivalent) and TH-S5/TG. Replace patch cord. Substitute a teletypewriter and/or TH-S/TG known to be in good operating order.
	In equipment not provided with EXT-INT switch or using EXT-INT switch in the INT position.	Channel receive delay and loop modulator circuits.	Replace tubes V13 and V12.
5	Incorrect reading for receive bias calibration on dc loop operated channel:		
	No F. S. reading.	Receive loop circuit open.	Check lines to loop (or monitor) receive circuit for continuity.
		Defective dc loop amplifier circuit.	Replace tube V10.
	Unable to adjust to exact F. S. reading.	Current control in loop station (or monitor) receiving equipment requires adjusting.	Adjust current control in the loop station or monitor) receiving equipment.
		Defective de loop amplifier circult.	Replace tube V10,
6	Unable to obtain receive bias check and adjustment on more than one channel in a stack.	Signal level from distant terminal too low.	Check terminal receiving level (par. 39e). If reading is satisfactory, higher echelon maintenance required. If low or no reading is obtained, perform operations given in f below, item 2.
7	Incorrect reading for receive bias check and adjustment on of loop operated channel.		
	Using EXT-INT switch in EXT position.	Channel receive amplifier circuits	Replace tubes V12, V13, V14, and V15.
		TH-5/TG receive circuits.	Replace TH-5/TG with one known to be in good operating condition.
			Perform the calibration and receive bias measurement and adjustment by using procedures with the EXT-INT switch in the INT position (par. 40).
		Signal level from distant terminal in the system is too low.	Perform corrective measures given in item 6 above.
	In equipment not provided with the EXT-INT switch, or using the EXT-INT switch in the INT position.	Channel receive amplifier circuits.	Replace tubes Vt2, V1S, V7, V14, and V15.
		Signal level from distant terminal in system is too low.	Perform corrective measures given in item 6 above.

Item No.	Symptom	Probable trouble	Correction
8	Incorrect reading for receive bias check and adjustment on de loop operated channels.	Channel receive amplifier circuits.	Replace tubes V1, V14, V7, and V15.
		Signal level from distant terminal is too low.	Perform corrective measures given in item 6 above.
9	Distorted messages received on vf loop operated channel.	Range controls In receiving equipment.	Adjust range controls in receiving equipment.
		Receive bias circuits.	Perform receive bias operations (par. 40a and b).
		Vf loop circuits.	Perform loop signal level check check (par. 40c).
		Channel receive circuits.	Replace tubes V15, V7, V14, V13, V12, and V11. On *vf two-wire* loop circuits, replace tube V8 also.
10	Distorted messages received on dc four-wire loop operated channel.	Range controls on receiving equipment.	Adjust range controls in received four-re ing equipment.
		Receive bias circuit.	Perform receive bias operations (par. 40a and b).
		Channel receive circuit.	Replace tubes V15, V7, V14, and V10.
11	Distorted messages received at *the B terminal on dc tandem* connected channel in a system.	Same as item 9 or 10 above at 'the receiving terminal in the system.	Same as item 9 or 10 above at the receiving terminal in the System.
		Transmitting circuits in the tandem-connected B channel.	Replace tubes V2, V5, and V6.
		Receiving circuits in the tandem-connected A channel.	Replace tubes V15, V7, V14, and V10.
	Note. For the purpose of identification, the tandem-connected channels nearest the A terminal in the system is referred to s the A channel; and the channel nearest the B terminal in the system as the B channel.		
12	No ringing signal on all *vf loop* operated channels in a particular stack.	Low-voltage 20 cps power supply in PP-812/T in the stack.	Replace 4 AMP fuse, if provided.
			Replace tubes V901 and V902.
13	No ringing signal received on a vf loop operated channel.	Loop (or monitor) equipment.	Replace loop (or monitor) equipt ment with equipment known to be in good working condition.
		Ringing current limiter lamp	Replace lamp.
		Channel ringing control circuits.	Replace tubes V9 and V7. Vf two-wire loop channel, replace tube V8 also.

f AM-683/T and TH-14/T Faults or Failures (fig. 27 and 29).

Item No.	Symptom	Probable trouble	Correction
1	No transmission of signals from the telegraph terminal.		
	Four-channel terminal.	AM-688/T transmitting circults.	Replace tube V801.
	Eight-channel, four-wire terminal.	AM-688/T transmitting circults in stack A.	Replace tube V801 in stack A AM-683/T. Substitute stack B AM-683/T (par. 52a£.
	Eight-channel, two-wire terminal.	AM-683/T transmitting circuits In stack A.	Replace V801 in stack A AM-683/T. Substitute stack B AM-683/T (par. 52b).
		TH-14/T (when its LINE SEND FREQ switch is operated to HI position).	Perform 3,400-cps test (par. 39b). If the test is satisfactory, replace tubes V1004 and V1006
	Sixteen-channel, four-wire terminal.	AM-683/T transmitting circults in stack A for channels Al through B4.	Replace tube V801 in stack A AM-683/T.
		TH-14/T transmitting circuits in stack A (when its LINE SEND FREQ switch is operated to HI position).	Perform 3,400-cps test (par. 39b). If the test is satisfactory, replace tubes V1004 and V1005.
			Substitute stack B AM-683/T (par. 52c).
		AM-688/T transmitting circuits in stack C for channels C1 through D4.	Replace tube V801 in stack C AM-683/T.
		TH-14/T transmitting circuits In stack C (when its LINE SEND FREQ switch is operated to HI position).	Perform 3,400-cps test (par. 39b). If the test is satisfactory, replace tubes V1004 and V1005.
			Substitute stack D AM-688/T (par. 52c).
2	Low or no indication of terminal receiving level; receive bias tests and reception on channels also unsatisfactory.	Signal level from distant terminal too low.	Set REC LEVEL PAD DB in stacks A and C to 0 position.
			Request distant terminal operator to transmit a higher signal by setting the SEND LEVEL PER CH DBM in stacks A and C to a higher output position (par. 19). Request the operators of the interconnecting line facilities (telephone carrier terminal, radio relay stations, etc) to raise; the level of the signal In the failing direction.

Item No.	Symptom	Probable trouble	Correction
	Four-channel terminal.	AM-683/T receive circuits.	Replace tube V802.
	Eight-channel, four-wire terminal.	AM-683/T receive circuits in stack A.	Replace tube V802 in stack A AM-683/T. Substitute stack B AM-683/T (par. 52a).
	Eight-channel, two-wire terminal.	AM-683/T receive circuits in stack A.	Replace tube V802.
		TH-14/T (when its LINE SEND FREQ switch is operated to LO position).	Perform 3,400-cps test (par. 39b). If the test is satisfactory, replace tubes V1004 and V1005.
			Substitute stack B AM-6888/T (par. 52b).
	Sixteen-channel, four-wire terminal:		
	(1) Channels A 1 through B4 not receiving.	(1) AM-683/T in stack A.	(1) Replace tube V802.
		TH-14/T in stack A (when its LINE SEND FREQ switch is in LO position).	Perform 3,400-cps output test (par. 39b). If the test is satisfactory, replace tubes V1004 and V1005.
			Substitute stack B AM-683/T (par. 52c).
	(2) Channels C1 through D4	(2) AM-683/T receive circuits in stack C for channels C1 through D4.	Replace tube V802.
		TH-14/T in stack C (when its LINE SEND FREQ switch is operated to LO position).	Perform 3,400-cps test (par. 39b). If the test is satisfactory, replace tubes V1004 and V1005.
			Substitute stack D AM-88S/T (par. 52c).
3	Incorrect indication of 3,400-cps output of TH-14/T.	TH-14/T circuits	Replace tubes V1006, V1002, and V1003.

57 Replacement of Tubes, Lamps, Lightning Arresters, and Fuses

a. Tube Substitution. Replace a defective tube with a new one. If this does not correct the trouble, remove the new tube and replace the original. Repeat this procedure until the defective tube is located.

Caution:
Never rock or rotate a tube when removing it from a socket; pull it out straight;

(1) Preferred-type tubes. The preferred-type tubes for each nonpreferred type are listed in *(a)* and *(b)* below. Do not use a nonpreferred-type tube to replace a preferred type tube.

(a) The following tubes are in the PP-812/T:

Nonpreferred-type tube	Preferred-type tube
6X4	6X4W
6AU6	6AU6WA
5R4GY	5R4WGY

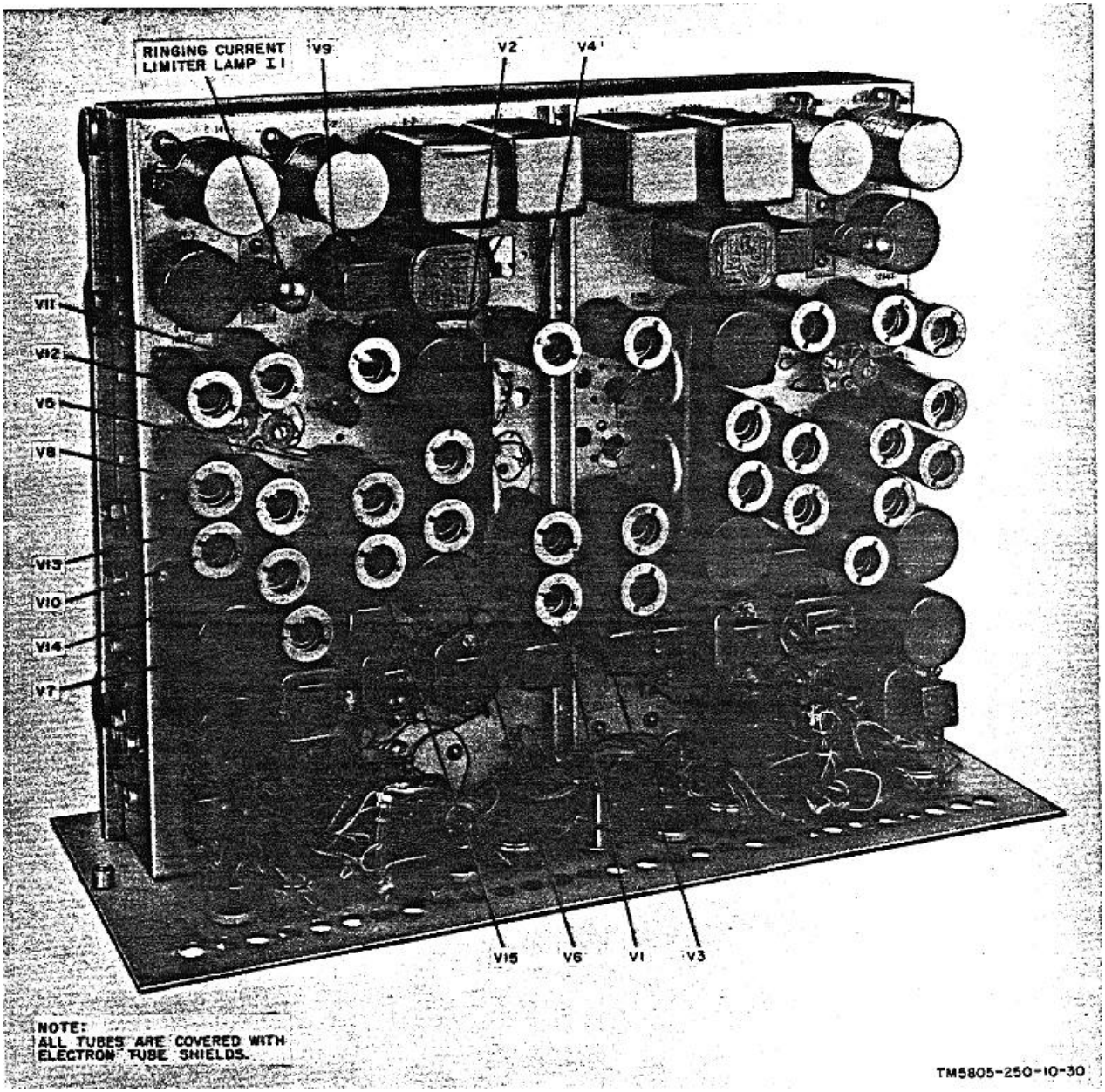

Figure 26. Telegraph Modem TH-17/T, top view of chassis.

(b) Use preferred-type tube 5751 for nonpreferred tube type 12AX7 for V1002 in the TH-14/T.

b. Lamps.

(1) Ringing current limiter lamp (fig. 26).

(a) Loosen the panel fastener screws (fig. 4) and pull out the panel drawer of the channel.

(b) Press and rotate the lamp to the left; remove it from its socket.

(c) Replace it with a good lamp.

(d) Push in the panel and tighten the panel fastener screws.

(2) Power indicator lamp (fig. 19).

(a) Unscrew the green indicator lamp lens.

(b) Press and twist the lamp to the left; remove it from its socket.

(c) Replace it with a good lamp and screw on th3 indicator lamp lens fingertight.

(c) Lightning Arresters. (fig. 17 and 18).

To replace the lightning arresters in the channels, perform the procedures given in (1) through (7)

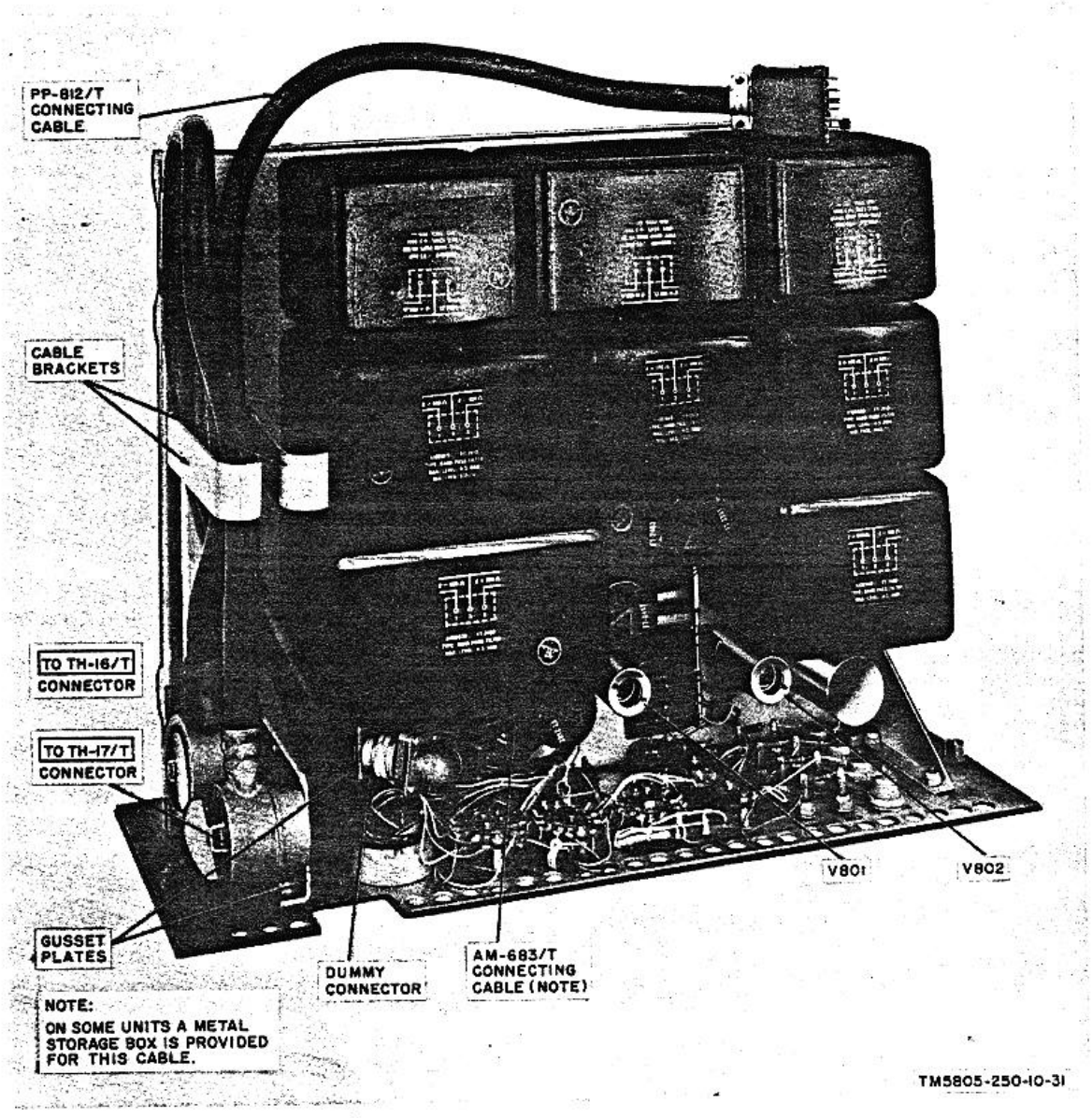

Figure 27. Amplifier-Filter Assembly AM-683/T, top view of chassis.

below. To replace the lightning arresters in the AM-683/T, perform the procedures given in (2) through (7) below.

(1) Loosen the panel fastener screws (fig. 4) and pull out the panel drawer of the channel.

(2) Unscrew the lightning arrester cap.

(3) Remove the round porcelain part from the cap.

(4) Remove the round carbon insert from the bottom of the cap.

(5) Insert a new carbon insert into the cap.

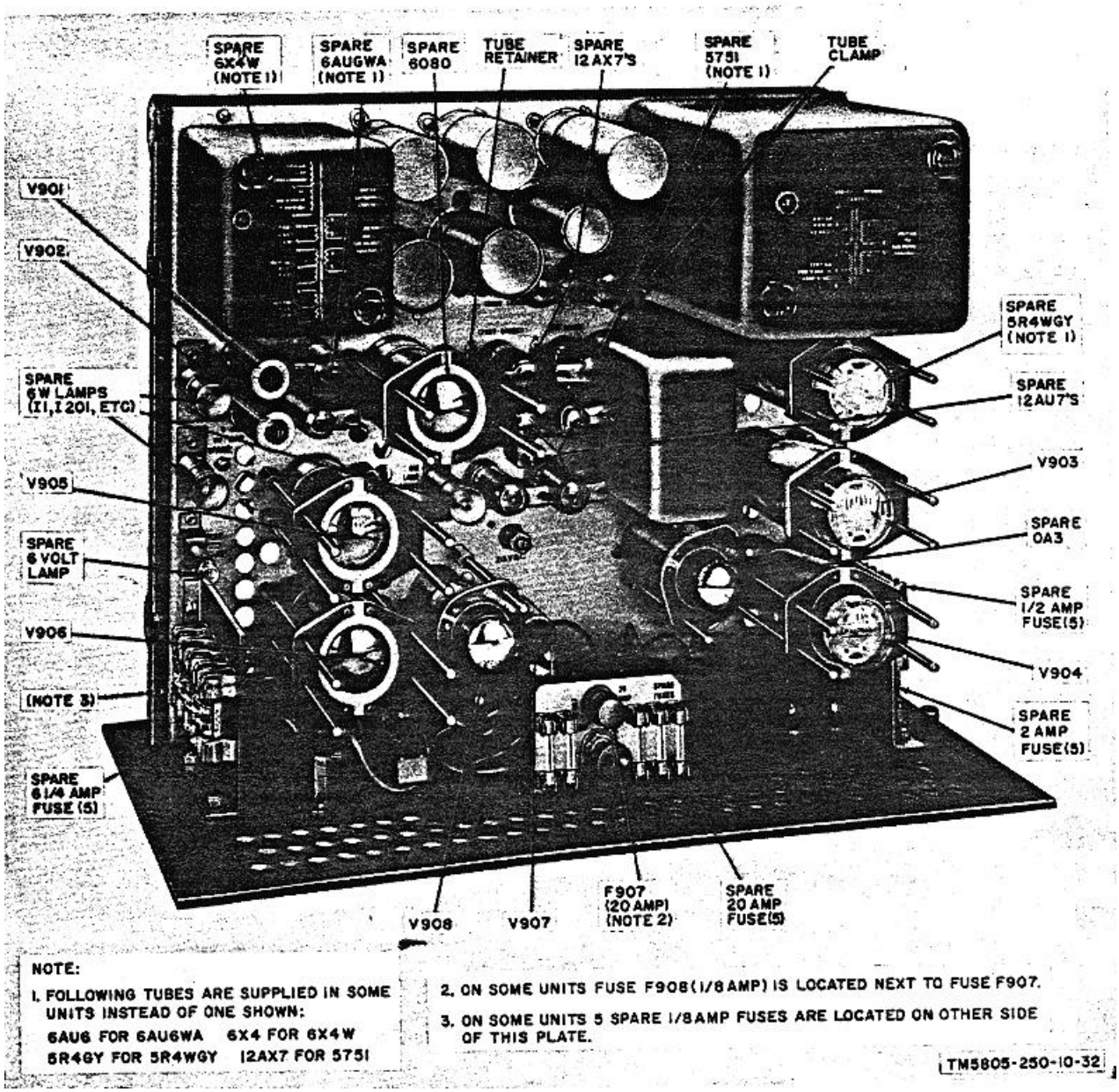

Figure 28. Power Supply-Test Set PP-812/T, top view of chassis.

(6) Insert a new porcelain part into the cap with the carbon in the porcelain sticking out of the cap.

(7) Screw the cap back tight into place.

d. Fuses (figs. 19 and 20).

(1) Press and twist the fuse cap to the left and remove the cap.

(2) Remove the fuse and replace it with a new one.

(3) Press and twit the fuse cap to the right into place.

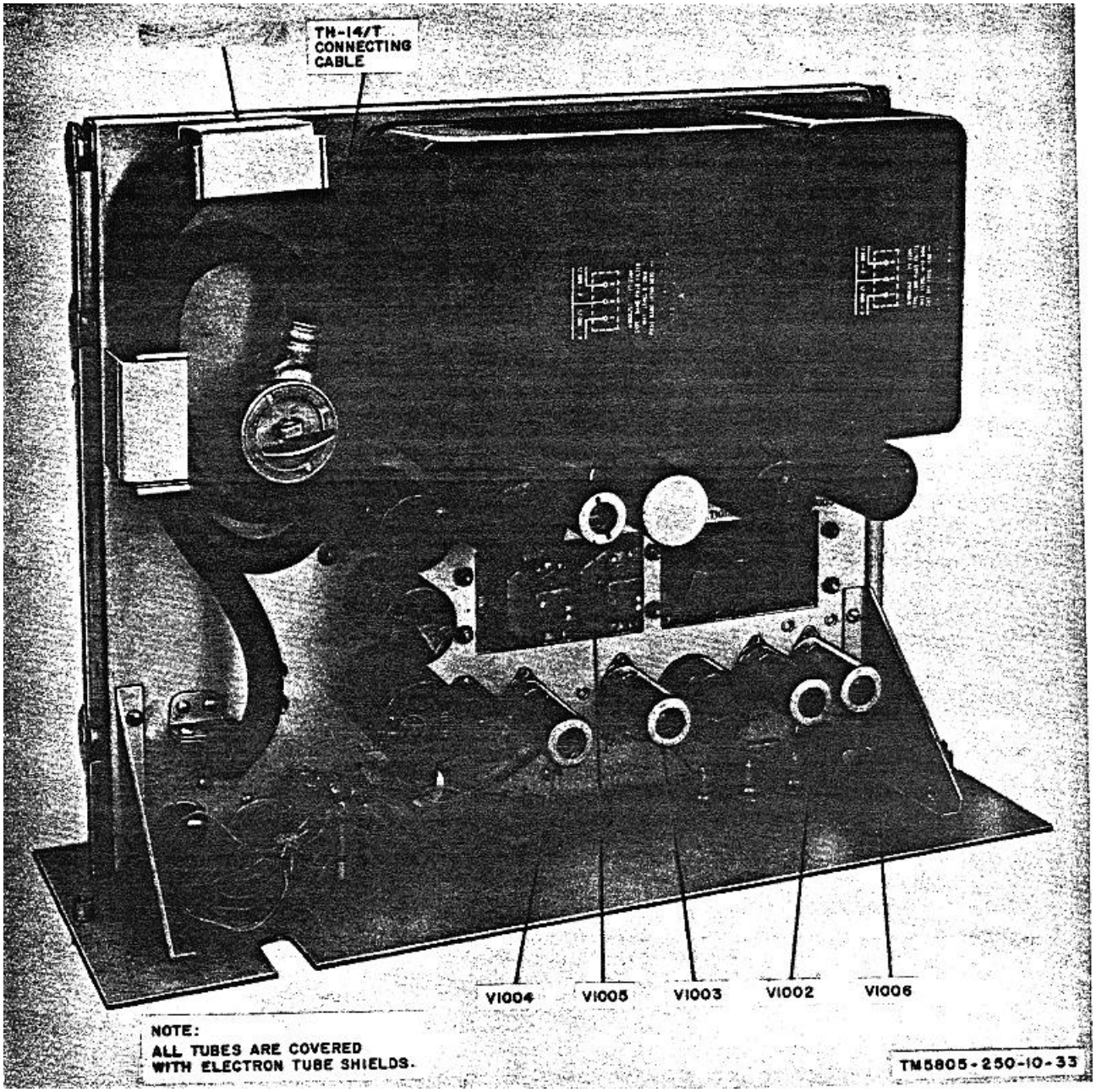

Figure 29. Telegraph Modem TH-14/T, top view of chassis.

CHAPTER 5
SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

58. Disassembly of Equipment

Disassemble the telegraph terminal as follows:

a. Disconnect the ac power cords from the ac power supply.

b. Disconnect all line, loop, and ground wires from the binding posts.

c. Disconnect the interpanel cables. Do not disconnect the internal cable connection between the AM-683/T and the PP-812/T.

d. Coil up the interconnecting cables in the respective chassis.

(1) On the AM-683/T (fig. 27), fold the cables between the cable brackets. Tighten the wing bolts on the TO TH-16/T and TO TH-17/T cable connectors until the connectors are tight against the gusset plate. Coil up the AM-683/T connecting cable lightly and press it down tightly by the dummy connector (on some equipment a metal compartment is provided). Tighter the cable connector on the two-conductor AM-683/T connecting cable to the dummy connector.

(2) On the TH-14/T (fig. 29), coil up the cable in the cable brackets. Tighten the wing bolt on the TH-14/T connecting cable connector.

e. Check to see that all tubes, lamps, tube shields, retainers, and clamps are tightly in place (fig. 26-29).

f. Push back all panels into the cases. Tighten the panel fastener screws (fig. 4-6).

g. Coil the ac power cord around the handles of the panels of the TH-15/T.

h. Remove the straps between the cases (fig. 2).

Tighten the straps between the strap holders of each case (fig. 4-6).

i. Replace the case covers on each case and fasten the snap catches (fig. 4-6).

59. Repacking of Telegraph Terminal for Shipment or Limited Storage

Repacking of the telegraph terminal is covered in TM 11-5805-250-20.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

60. Authority for Demolition

Demolition of the equipment will be accomplished only upon the order of the commander. The destruction procedures outlined in paragraph 61 will be used to prevent further use of the equipment.

61. Methods o Destruction

Use any of the following methods to destroy the equipment:

a. Smash. Smash the controls, tubes, coils, switches, capacitors, transformers, and meters; use sledges, axes, handaxes, pickaxes, hammers, or crowbars.

b. Cut. Cut the power and interconnecting cables; cut the cable forms on the chassis; use axes, handaxes or machetes.

c. Burn. Burn cords and technical manuals; use gasoline, kerosene, oil, flame throwers, or incendiary grenades.

d. Bend. Bend panels, chassis, and cases.

e. Explode. If explosives are necessary, use firearms, grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw them into streams.

APPENDIX I

REFERENCES

The following references are applicable to the operation of Telegraph Terminals AN/TCC-4 and AN/TCC20.

TM 11-486-3	Electrical Communication Systems, Engineering, Transmission and Circuit Layout
TM 11-2202	Manual Telephone Switchboard SB-22/PT
TM 11-2239	Telegraph-Telephone Terminal AN/TCC-14
TM 11-5815-206-12	Teletypewriter Set AN/PGC-1 and Teletypewriters TT-4A/TG and TT-4B/TG, Operation and Organizational Maintenance

APPENDIX II

OPERATOR MAINTENANCE REPAIR PARTS AND

SPECIAL TOOLS LIST

FOR

TELEGRAPH TERMINALS AN/TCC-4 AND AN/TCC-20

Section I. INTRODUCTION

1. Scope

a. This appendix lists items supplied for initial operation and for running spares. The list includes tools, accessories, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.*

(Not used).

(2) *Federal stock number.* The stock number column lists the 11-digit Federal stock number.

(3) Designation by model.

(Not used).

(4) Description. Nomenclature or the standard item name and brief identifying data for each item is listed in this column.

When requisitioning, enter the nomenclature and description on the requisition.

(5) Unit of issue. The unit of issue is the supply medium by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes. (6) Expendbility.

Expendable items are indicated by the letter X; nonexpendable items are indicated by NX.

(7) Quantity authorized. Under "Items Comprising an Operable Equipment the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spares and Accessory Items" the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment. (8)

Illustration (Figure No.). This column lists

the figure in this appendix in which the component is illustrated.

(9) Illustration (Item No.). This column lists the item number in the figure.

2. Running Spare Items

Running spare items for the AN/TCC-4 and AN/TCC-20 are located in the PP-812/T. The quantities of : running spares and accessory items listed are for the AN/TCC-20. When and AN/TCC4 is used, the quantities are doubled.

3. References

A Maintenance Allocation Chart showing all repair operations authorized to be performed by the respective echelons of maintenance is contained in TM 11-5805-250-20 Appendix II, Maintenance Allocation Chart for Telegraph Terminals AN/TCC4 and AN/TCC-20.

Section II. FUNCTIONAL PARTS LIST (1st Echelon)

(1) SOURCE MAINT AND RECOVER-ABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPEND-ABILITY	(7) QTY AUTH-ORIZED	(8) (9) ILLUSTRATIONS FIGURE NO.	ITEM NO.
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
			TELEGRAPH TERMINAL AN/TCC-4					
	5805-537-7387		TELEGRAPH TERMINAL AN/TCC-4	ea	NX		1	
	Order thru AGC		TECHNICAL MANUAL TM11-5805-250-10	ea	X	2		
	5805-503-1068		MODEM, TELEGRAPH TH-14/T	ea	NX	1	1	1
	5805-356-2633		TELEGRAPH TERMINAL GROUP TH-13/T	ea	NX	2	2	1
	5805-503-1069		TELEGRAPH MODEM ASSEMBLY TH-15/T	ea	NX	2	2	2
			MODEM, TELEGRAPH TH-14/T					
	5805-392-8063		COVER: for equip case; Fed Tel and Red part A10009783-1, dwg No. C-1009784	ea	X	1	3	1
	5805-393-2205		SLING, CARRYING BAG AND CASE: case carrying strap; Fed Tel and Red dwg No. C100011-1	ea	X	2	3	5
			TELEGRAPH TERMINAL GROUP TH-13/T					
	5805-351-7410		AMPLIFIER-FILTER ASSEMBLY AM-683/T	ea	NX	2	2	4
	5805-392-8064		COVER: for equip case: Sig dwg No. SC-D-104653	ea	X	2	3	2
	6625-569-0325		POWER SUPPLY-TEST SET PP-812/T	ea	NX	2	2	3
	5805-393-2206		SLING, CARRYING, BAG AND CASE; case carrying strap; Sig dwg No. SC-C-104663	ea	X	4	3	5
			TELEGRAPH MODEM ASSEMBLY TH-15/T					
	5805-632-0215		CIRCUIT LABEL ASSEMBLY; c/c 3 instruction plates; Sig dwg No. SC-C-104567	ea	X	2	3	3
	5995-279-1308		CORD ASSEMBLY, ELECTRICAL: Sig dwg No. SC-C-104667	ea	X	4	3	4
	5805-392-8064		COVER: for equip case: Sig dwg No. SC-D-10464653	ea	X	2	3	2
	5805-393-2206		SLING, CARRYING BAG AND CASE: case carrying strap; Sig dwg No. SC-C-104663	ea	X	4	3	5
	5805-503-1067		TELEGRAPH MODEM TH-16/T	ea	NX	2	2	6
	5805-501-4625		TELEGRAPH MODEM TH-17/T	ea	NX	2	2	5
			TELEGRAPH TERMINAL AN/TCC-20					
	8605-338-4451		TELEGRAPH TERMINAL AN/TCC-20	ea	NX		2	

AN/TCC-4 and AN/TCC-20 1 1

(1) SOURCE MAINT AND RECOVER-ABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPEND-ABILITY	(7) QTY AUTH-ORIZED	(8) ILLUSTRATIONS FIGURE NO.	(9) ILLUSTRATIONS ITEM NO.
			AN/TCC-4 and AN/TCC-20 (continued)					
	Order thru AGC		TECHNICAL MANUAL TM 11-5805-250-10	ea	X	2		
	5805-356-2633		TELEGRAPH TERMINAL GROU TH-13/T *	ea	NX	1	2	
	5805-503-1069		TELEGRAPH MODEM ASSEMBLY TH-15/T	ea	ea	NX	1	2
			TELEGRAPH TERMINAL GROUP TH-13/T					
	5805-351-7410		AMPLIFIER-FILTER ASSEMBLY AM-683/T	ea	NX	1	2	4
	5805-392-8064		COVER: for equip case; Sig dwg No. SC-D-104653	ea	X	1	3	2
	6625-569-0325		POWER SUPPLY-TEST SET PP-812/T	ea	NX	1	2	3
	5805-393-2206		SLING, CARRYING BAG AND CASE; case carrying strap; Sig dwg No. SC-C-104663	ea	X	2	3	5
			TELEGRAPH MODEM ASSEMBLY TH-15/T					
	5805-632-0215		CIRCUIT LABEL ASSEMBLY: c/o 3 instruction plates; Sig dwg No. SC-C-104567	ea	X	1	3	3
	5995-279-1306		CORD ASSENBLY, ELECTRICAL: Sig 9 dwg No. SC-C-104667	ea	X	2	3	4
	5805-392-8064		COVER: for equip case; Sig dwg No. SC-D-10463	ea	X	1	3	2
	5805-393-2206		SLING, CARRYING, BAG AND CASE; case carrying strap; Sig dwg No. SC-C-104663	ea	X	2	3	5
	5805-503-1067		TELEGRAPH MODEM TH-16/T	ea	NX	1	2	6
	5805-501-4625		TELEGRAPH MODEM TH-17/T	ea	NX	1	2	5
			RUNNING SPARES AND ACCESSORY ITEMS					
			POWER SUPPLY-TEST SET PP-812/T					
	5960-188-3565		ELECTRON TUBE: MIL type 083	ea	X	1	3	19
	5960-193-5111		ELECTRON TUBE: MIL type 5B4WGY	ea	X	1	3	20
	5960-262-0152		ELECTRON TUBE; MIL type 6AU6WA	ea	X	1	3	16
	5960-188-0880		E LECTRON TUBE: MIL type 6X4W	ea	X	1	3	18
	5960-166-7663		ELECTRON TUBE: MIL type 12Arr	ea	X	1	3	3
	5960-166-7664		ELECTRON TUBE: MIL type 12AX7	ea	X	1	3	14

(1) SOURCE MAINT AND RECOVER-ABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPEND-ABILITY	(7) QTY AUTH-ORIZED	(8) (9) ILLUSTRATIONS FIGURE NO.	ITEM NO.
			AN/TCC-1 and AN/TCC-20 (continued)					
	5960-193-5145		ELECTRON TUBE; MIL type 5751	ea	X	1	3	17
	5960-262-0180		ELECTRON TUBE: MIL type 6080	ea	X	1	3	21
	5920-356-2188		FUSE, CARTRIDGE: 1/8 AMP, 25 V DC: instantaneous; MIL type F03GB135A	ea	X	5	3	13
	5920-199-9498		FUSE, CARTRIDGE: ½ amp, 250 v dc: time delay; MIL type F03GB500B	ea	X	1	11	13
	5920-280-4466		FUSE, CARTRIDGE; 2 amp, 250 v dc: MIL type FOMG2B0	ea	X	5	3	10
	5920-199-4017		FUSE, CARTRIDGE: 6-1/1 amp, 250 v dc; time delay MIL type F09GB25B, part No.	ea	X	5	3	8
	5920-280-9529		FUSE, CARTRIDGE; 20 amp, 32 v, fuss type No. SFE-20	ea	X	5	3	9
	6240-155-8706		LAMP, INCANDESCENT; GE part No. 17	ea	X	1	3	6
	6240-143-3060		LAMP, INCANDESCENT; GE part No. 656DC(120)	ea	X	3	3	7
	5920-356-2103		BLOCK, TELEPHONE PROTECTOR: Sig dwg No. SC-B-63039 (This item is not chasis mounted	ea	X	5		
			TELEGRAPH TERMINAL AN/TCC-4 MODEM, TELEGRAPH TH-11/T TELEGRAPH TERMINAL GROUP TH-13/T TELEGRAPH MODEM ASSEMBLY TH-15/T TELEGRAPH TERMINAL AN/TCC-20 TELERRAPII TERMINAL GROUP TH-13/T TELEGRAPH MODEM ASSEMBLY TH-15/T					
			NO PARTS AUTHORIZED FOR STOCKAGE AT FIRST ECHELON					

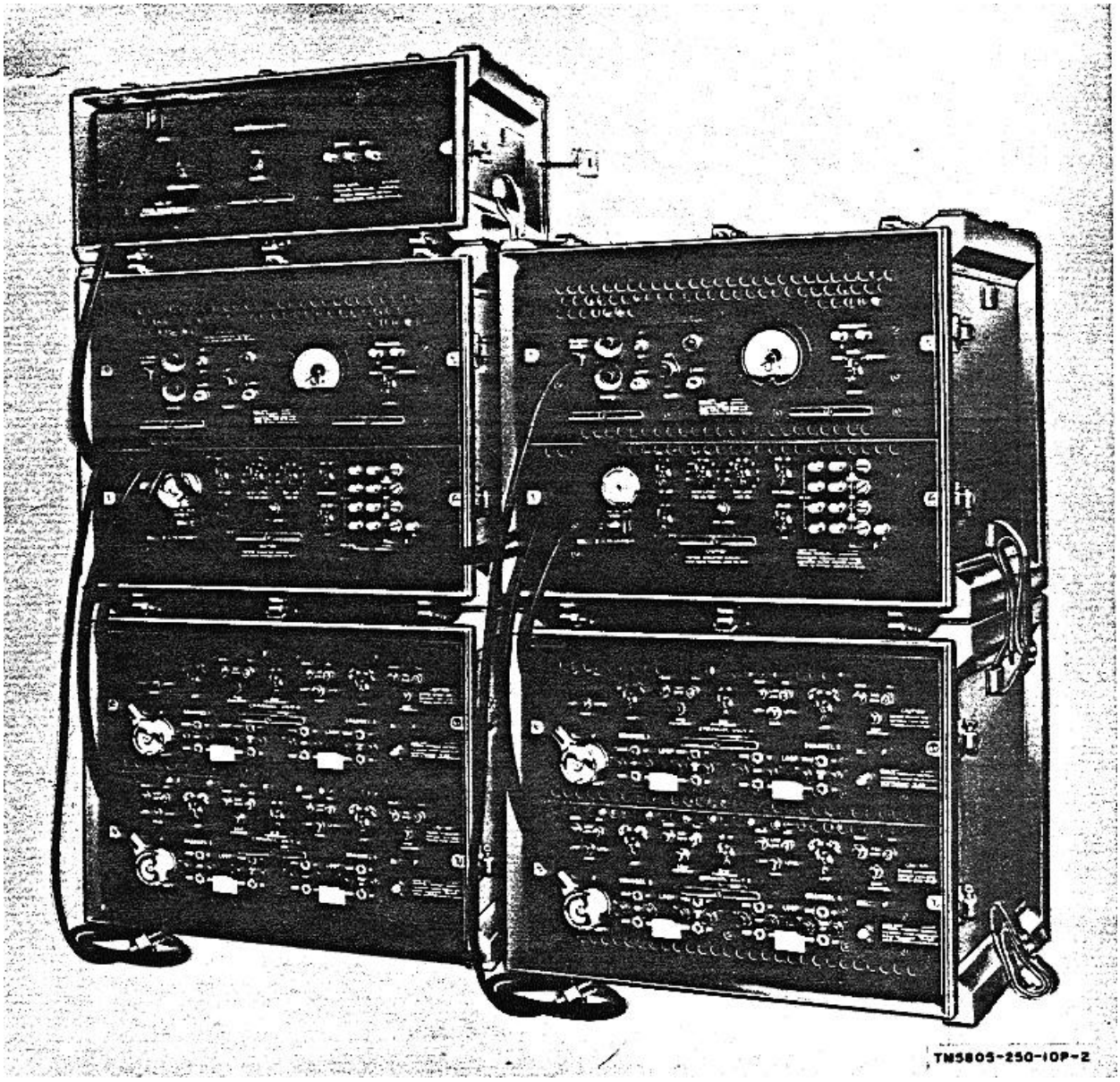

Figure 1.

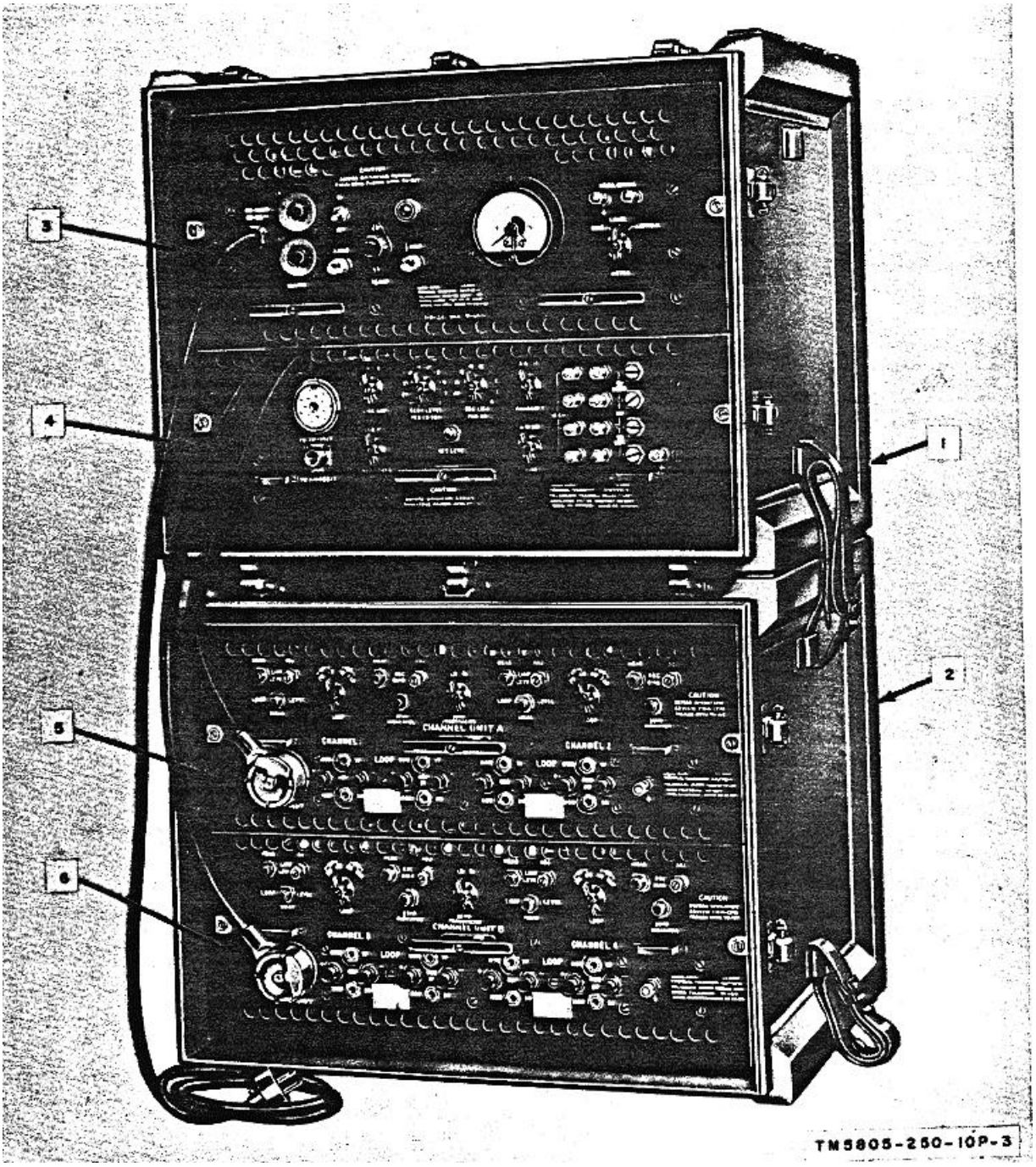

Figure 2

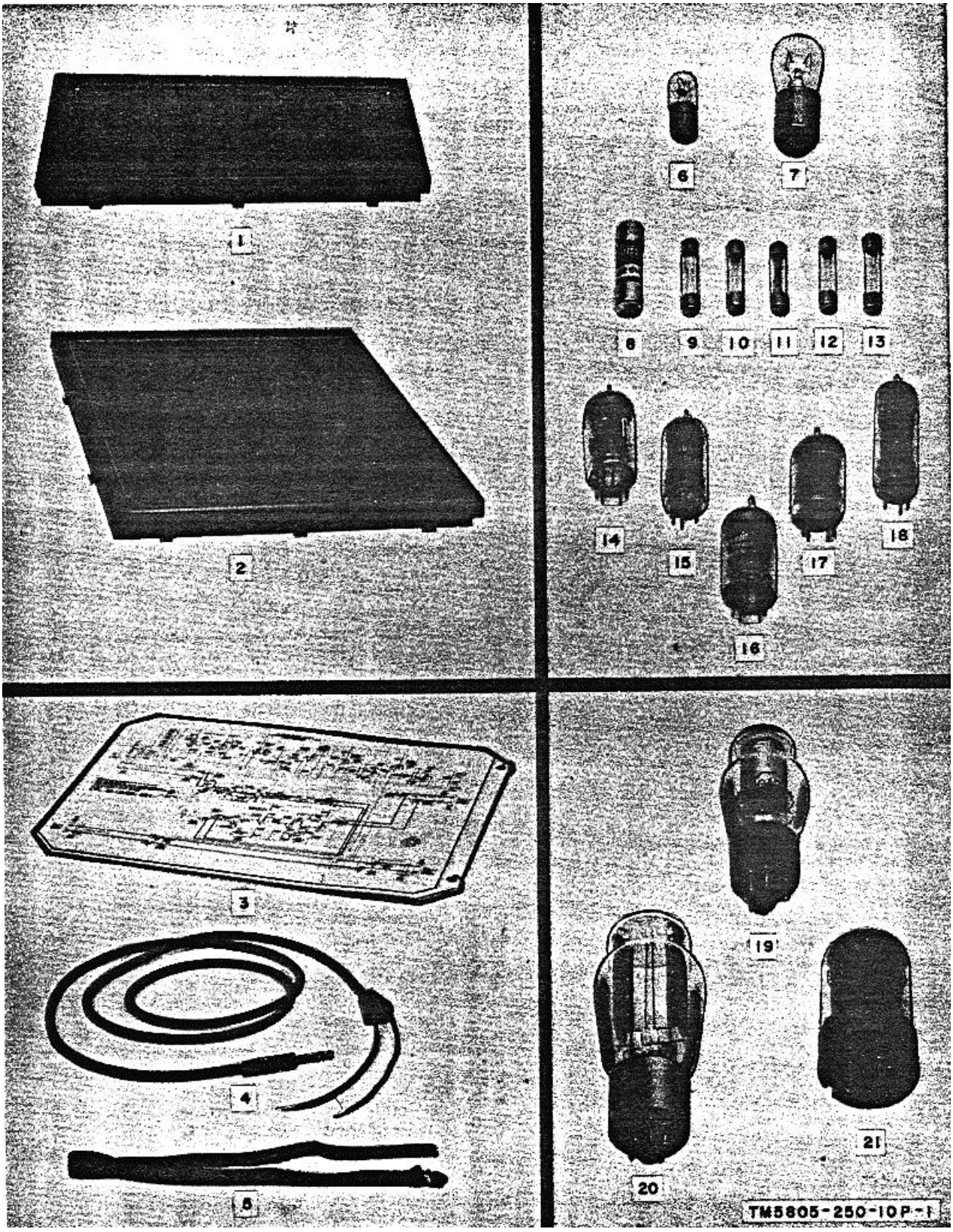

Figure 3

[AG 413.41 (31 July 59)]

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Sig Dep (17)
Army Pictorial Cen 92)
Engr Maint Cen (1)
USA Ord Mal Comd (3)
Fld Comd, Def Atomic Spt Agcy (5)
USASSA (15)
USASSAMRO (1)
USA Sig Pub Agcy (8)
USA Sig Engr Agcy (1)
USA Comm Agcy (2)
USA Sig Eqp Spt Agcy (2)
USA Sig Mal Spt Agcy (13)
WRAMC (1)
AFIP (q)
AMS (1)
Trans Terminal Comd (1)
Army Terminals (1)
OS Sup Agcy (1)
Yuma Test Sta (2)
USA Elct PG (1)
Sig Lab (5)
Sig Fld Maint Shops (3)
Mil Dist (1)
USA Corps (Res) (1)
Sector Comd, USA Corps (Res) (1)
JBUSMC (2)
Units org under fol TOE:

9-227	11-500 (AA-AE) (2)
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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

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