TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS)

TECHNICAL CONTROL, PATCH AND TEST FACILITY, PENTAGON, WASHINGTON, DC

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1979

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HEADQUARTERS
DEPARTMENT OF THE ARMY
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List of Illustrations

* Fold-in pages located in back of manual.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

a. This manual describes the patch and test facility (P&T) of the technical control facility (TCF) at the Pentagon, Washington, DC. Included are description and data; station application and equipment function; station operation; and maintenance instructions.

b. Publications that cover individual equipment and systems used with the P&T are listed in appendix A. Appendix B defines abbreviations used in this technical manual; appendix C provides a listing of P&T components; and appendix D is a site repair parts listing.

1-2. 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.

1-3. 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 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Record (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Record (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

d. Station Operation and Maintenance. Also use forms and records in accordance with instructions in the station Standard Operating Procedures (SOP).

1-4. Administrative Storage

This P&T is expected to be incontinuous operation. Therefore, procedures, forms and records, and inspections required during periods of administrative storage are not applicable.

1-5. Destruction of Army Materiel

Destruction of Army materiel to prevent enemy use shall be as prescribed in TM 750-244-2.

Section II. DESCRIPTION AND DATA

1-6. Purpose and Use

a. The Pentagon technical control facility is the main Army TCF serving the Washington DC area. The facility provides many high priority circuits to and from various local government users to locations scattered throughout the free world and to the Kremlin. Users and connecting sites often change. Typical Pentagon users are shown in figure 1-1.

b. The patch and test facilities of the TCF provide access to each circuit for monitoring, rerouting, and testing. Access is provided to both the black (encrypted) and the red (clear) sides of the circuits.

1-7. Tabulated Data

NOTE

See individual technical manuals (appendix A) for technical characteristics of installed facility components.

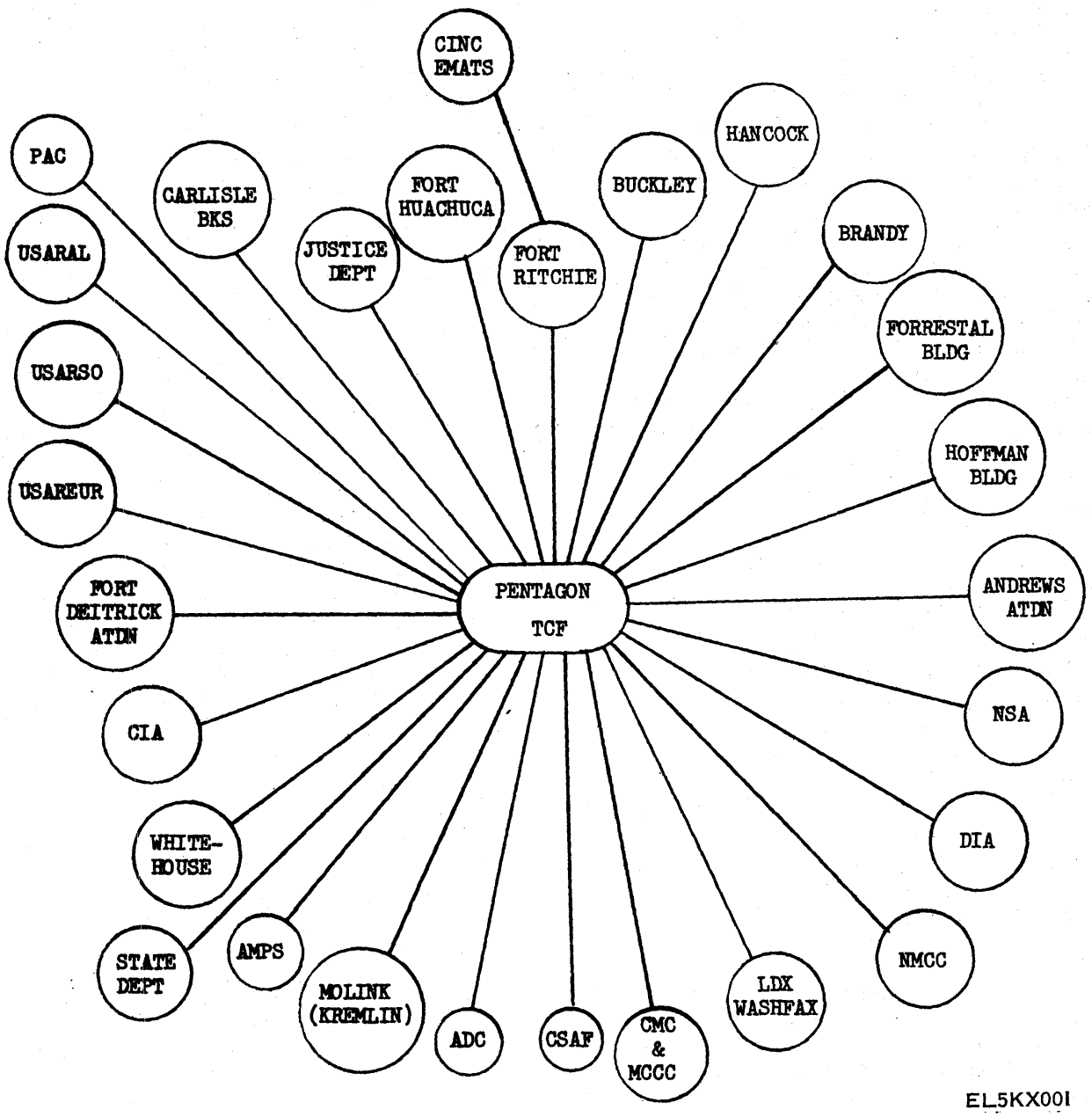


Figure 1-1. Typical Pentagon TCF Users.

a. VF Patching Facilities:

Red VF Jack Appearances (2-wire) .....264 ea
Black VF Jack Appearances (2-wire) .....960 ea
Nominal Test Tone Signal Level .....-2 dbm
Nominal Circuit Impedance .....600 ohms
Normal Send Signal Level .....+8 dbm
Normal Receive Signal Level .....-13 dbm

b. DC Patching Facilities:

Red DC Jack Sets .....912 ea
Black DC Jack Sets .....1,296 ea
Nominal Signal Level .....±6 vdc

c. Video Patching Facilities:

Red Video Jack Appearances.....160 ea
Black Video Jack Appearances .....100 ea
Nominal Circuit Impedance .....75 ohms

d. AC Power Requirements:

208/120 vac, 3 phase, 60 Hz.

e. DC Power Supplies:

6 VDC ..... 4 ea: 2 Red, 2 Black
24 VDC .....4 ea: 2 Red, 2 Black
48 VDC .....4 ea: 2 Red, 2 Black

1-8. Facility Components

The P&T components are listed in paragraph 1-13 by major assemblies. The test equipment listed and discussed through this manual may be changed as required by the P&T mission or due to the availability of new equipment. The list includes all permanently wired components and the number of plug-in items that may be mounted in associated shelves.

1-9. General Description of P&T

a. The Patch and Test facilities of the TCF was installed in accordance with Lexington-Blue Grass Army Depot drawing list DL-54260. The equipment is housed in two different rooms. All of the P&T components (except the quality assurance (QA) equipment) are located in TCF, room 5A910 (fig. FO-1). There are three bays of QA equipment in the Electronic Maintenance Room (para 1-12).

b. As shown in figure FO- 1, the P&T of the TCF consists of two rows of equipment bays, a red cable vault, and red and black ground and power distribution boxes. In addition the room contains Crypto equipment, modems, voice frequency carrier telegraph (VFCT) equipment, etc. Equipment rows No. 1 and No. 2 are described in paragraphs 1-10 and 1-11.

1-10. Description of Equipment Row No. 1

a. General. Equipment row No. 1 contains 21 bays of P&T equipment and four bays of DCL/MOLINK equipment. Bays 1.22 through 1.24 (DCL/MOLINK) are covered in (C) PDEP 11-5895-832-14(2). Row No.1 is called the black equipment row, because bays 1.1 through 1.21 connect to unsecure or encrypted circuits.

b. Black VF and Digital IDF Bays. Bay 1.1 consists of two intermediate distribution frame (IDF) bays. Bay 1.10 consists of three IDF bays. Each bay contains a front door to allow access to a patch cord type cross connect matrix. The IDF's are similar and discussed in chapter 2.

c. Black VF Patch Bays (figs. 1-2 and 1-3). Bays 1.2, 1.3, 1.4, 1.6, and 1.7 are the VF patch bays. Each of these contains eight 2-wire audio patch panels and an interbay patch (INT) panel. Bay 1.2 has an R-390 radio receiver in the bay below the patch panels. Bays 1.3 and 1.7 each have a 60-station voice order wire panel, that are furnished and maintained by the telephone company. Bays 1.4 and 1.6 have dual speaker panels and AM-911/FG audio frequency amplifiers mounted below the patch panels.

d. Black VF Test Bay 1.5 (fig. 1-2). This bay contains various test equipment as shown in figure 1-2. There is a writing shelf with a miscellaneous (MISC) and INT panel above the shelf. In addition there are two test equipment connection panels. Test equipment without rear test lead connectors are connected to the MISC panel through the test equipment connection panels.

e. Video Monitor and Station Clock Bays 1.8 and 1.9 (fig. 1-3). Bay 1.8 has two video monitors at the top, used to monitor the TCF door and outside hall. A panel with a push-button switch for unlocking the door is below the monitors. There are five TWINAX wide band patch panels in the bay. The remainder of the bay is used to mount test equipment. Bay 1.9 is a TDS-2 Station Clock Bay.

f. Black Digital Patch Bays (figs. 1-4 through 1-7). Bays 1.11, 1.12, 1.13, 1.15, 1.16, 1.17, 1.19, 1.20, and 1.21 are the black digital patch bays. Each bay has a i 15 vdc meter mounted in a panel at the top. There are six universal digital patch panels and a INT panel with 48 lamps in each bay. The bottom bay 1.11 mounts the black -48 vdc power system; consisting of two 48 vdc power supplies, an alarm panel, and a fused power distribution panel. Bays 1.12 and 1.19 each contain an order-wire panel. Bays 1.13 and 1.15 have writing shelves with AN/FGG-80 teletypewriter sets mounted on the shelves. One 24 vdc power supply is in bay 1.16 with a second unit in bay 1.17. Bay 1.16 contains the 24 vdc meter panel, alarm panel and fused power distribution panel. Bay 1.17 also contains the black 6 vdc power system; consisting of two power supplies (with alarms), meter panel, and fused power distribution panel. Bay 1.21 includes the black indicating equipment; consisting of a MAJOR/MINOR alarm panel, audible alarm panel and two crypto ancillary unit/common control unit (CAU/CCU) alarm panels.

g. Black Digital Test Bays (figs. 1-5 and 1-6). Bays 1.14 and 1.18 are the black digital test bays. The bays are similar in configuration. Each bay contains a ±150 vdc meter panel, a 601 Data Transmission Test Set, HP180BR Oscilloscope with connection panel, AN/GGM-15 (V) Telegraph Test Set, INT panel with 48 lamps, and a writing shelf.

1-11. Description of Equipment Row No. 2

a. General. Equipment row No. 2 contains 20 bays of equipment and four bays of IDF patch cord cross connect matrixes (fig. FO- 1). The four IDF bays are all numbered 2.21 and described in chapter 2. Row No. 2 is called the red equipment row, because the circuits may carry secure information in clear text. Bays 2.1 through 2.20 are described in b through f below.

b. Special Intelligence Bay 2.1 (fig. 1-8). SI bay 2.1 is isolated from the rest of the P&T facility. The bay contains a color video monitor at the top with eight video distribution amplifiers, and three 75 ohms patch panels. Between the monitor and amplifiers there are two universal dc patch panels (digital patch panels) and three 2-wire audio patch panels (VF patch panels). The bay also has its own IDF consisting of two rows of patch cord cross connect matrixes.

c. Red Digital Patch Bays (figs. 1-9 through 1-12). The red digital patch bays are 2.3 through 2.6, 2.8 through 2.11 and 2.13 through 2.16. Each of these bays has a ±15 vdc meter mounted in a panel at the top of the bay. Below the meter panel there are six digital patch panels and a INT panel with 48 lamps. Bays 2.11, 2.13,

and 2.14 each contain a writing shelf used to mount AN/FGC-80 teletypewriter sets. Each bay has blank panels below the patch panel. The blank panels may be removed to allow installation of equipment as required.

d. Red Digital Test Bays (figs. 1-8, 1-10, and 1-12). Bays 2.2, 2.7, and 2.12 are the red digital test bays. Each of these test bays is used to mount test and monitor equipment as shown in figures 1-8, 1-10, and 1-12. In addition, there is an INT panel with 48 lamps and a writing shelf in each bay.

e. Red Power and Video Monitor Bays (fig. 1-13). Bay 2.17 mounts six dc power supplies (two 48 volt, two 24 volt and two 6 volt), along with associated fused distribution panels and alarm panels. The 6 vdc and 24 vdc supplies do not contain current and volt meters. Therefore, a meter panel is provided to measure the output of these supplies. At the top of this bay there is a MAJOR/MINOR alarm panel along with an associated audible alarm panel. Video monitor bay 2.18 has a monitor unit at the top with eight video distribution amplifiers and a 1485R video waveform monitor below the monitor unit. There are five 75-ohm video patch panels in the bay along with an INT panel. The INT panel has six jacks that are connected to the QA test center (para 1-12).

*f: Red VF Patch and Test Bays (*fig. 1-14). Bay 2.19 is the red vf patch panel. This panel contains eight 2-wire audio patch panels and an INT panel. The red vf test bay (2.20) contains an INT panel and a MISC panel. Test equipment is mounted above the INT panel as shown in figure 1-14. A writing shelf is below the MISC panel and the station clock dual digital line isolators are below the writing shelf.

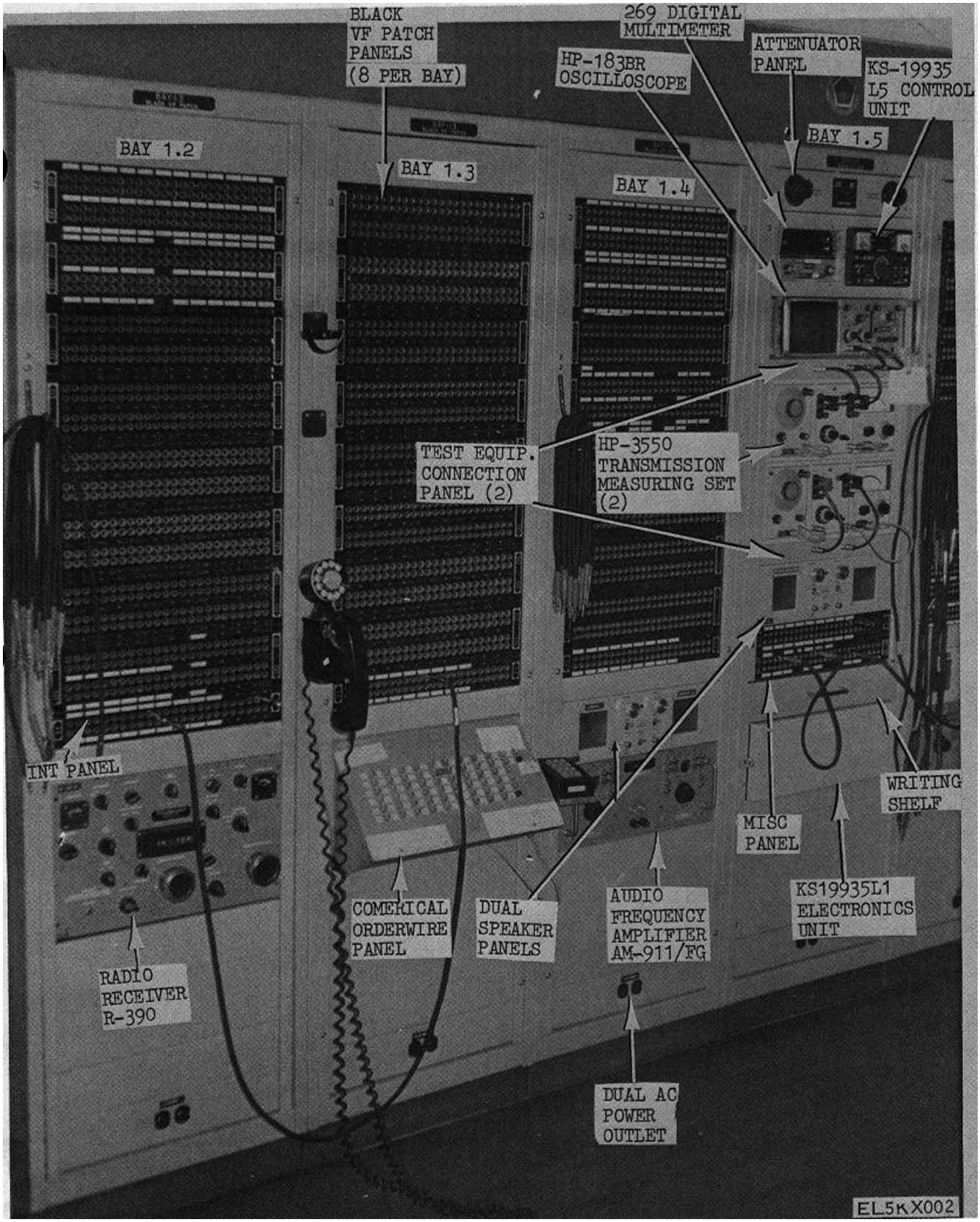


Figure 1-2. Black VF Patch Bays 1.2 Through 1.4 and Test Bay 1.5, Equipment Locations.

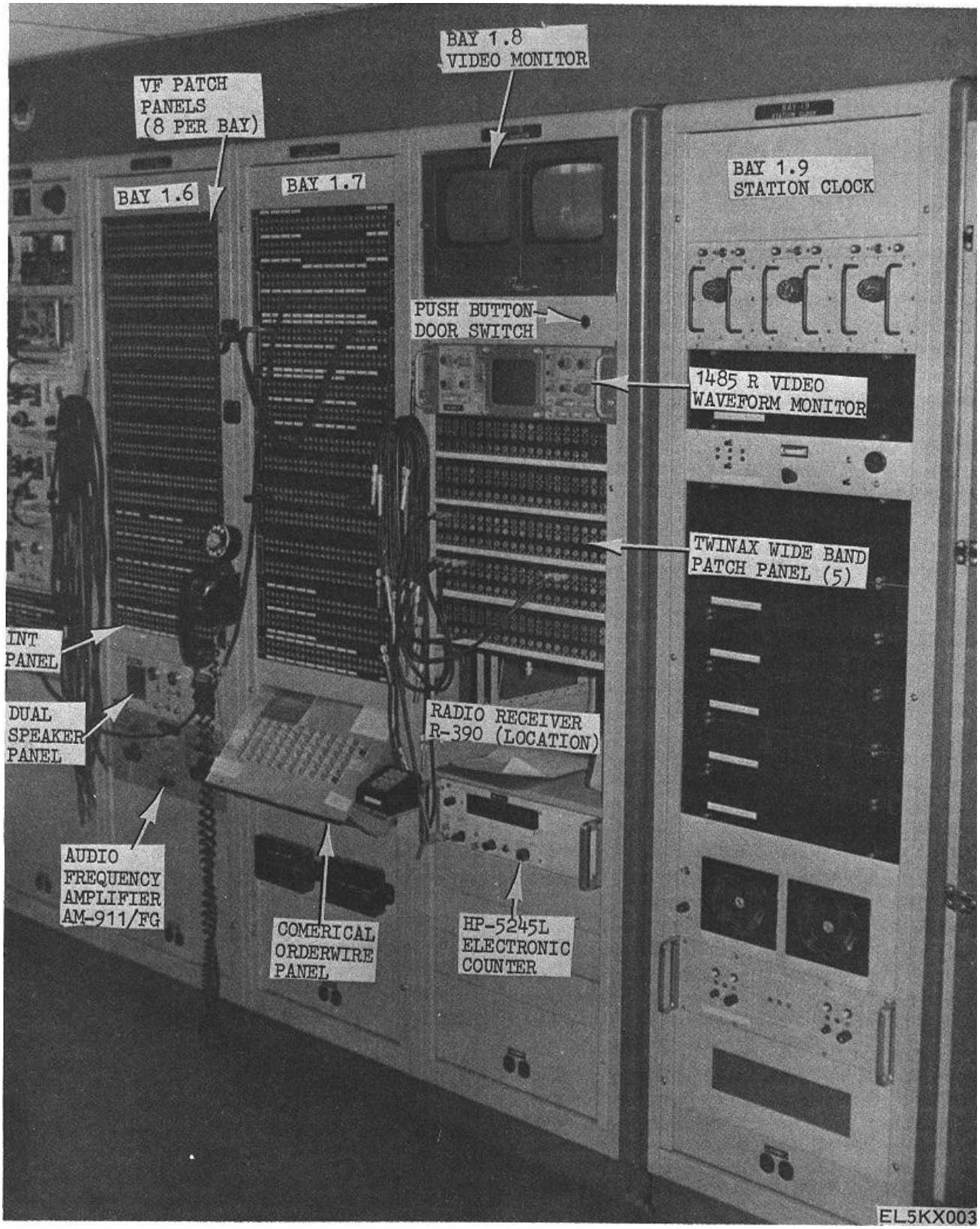


Figure 1-3. Black VF Patch Bays 1.6 and 1. 7, Video Monitor Bay 1.8 and Station Clock Bay 1.9, Equipment Locations.

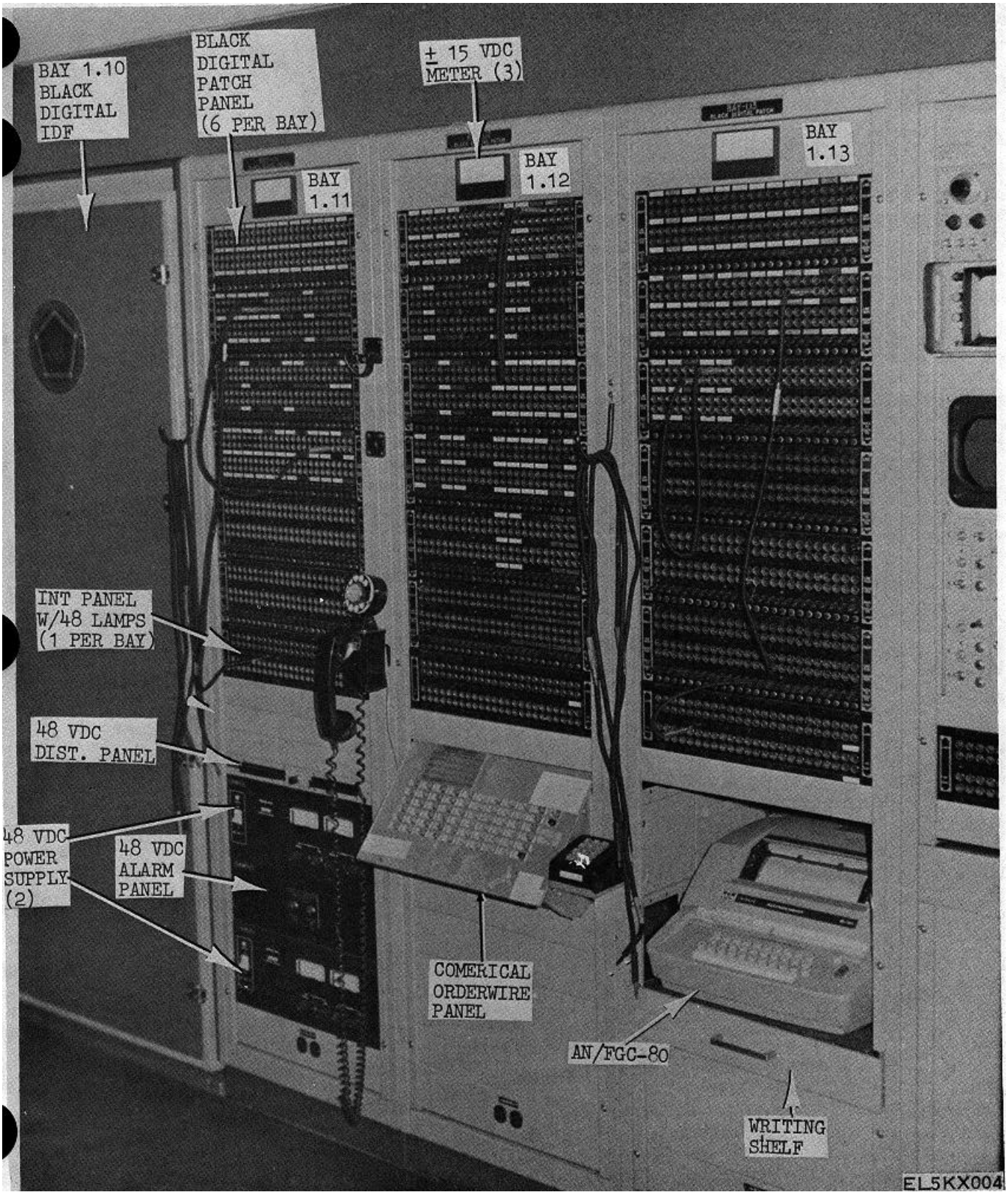


Figure 1-4. Black Digital IDF Bay 1.10 and Patch Bays 1.11 Through 1.13, Equipment Locations.

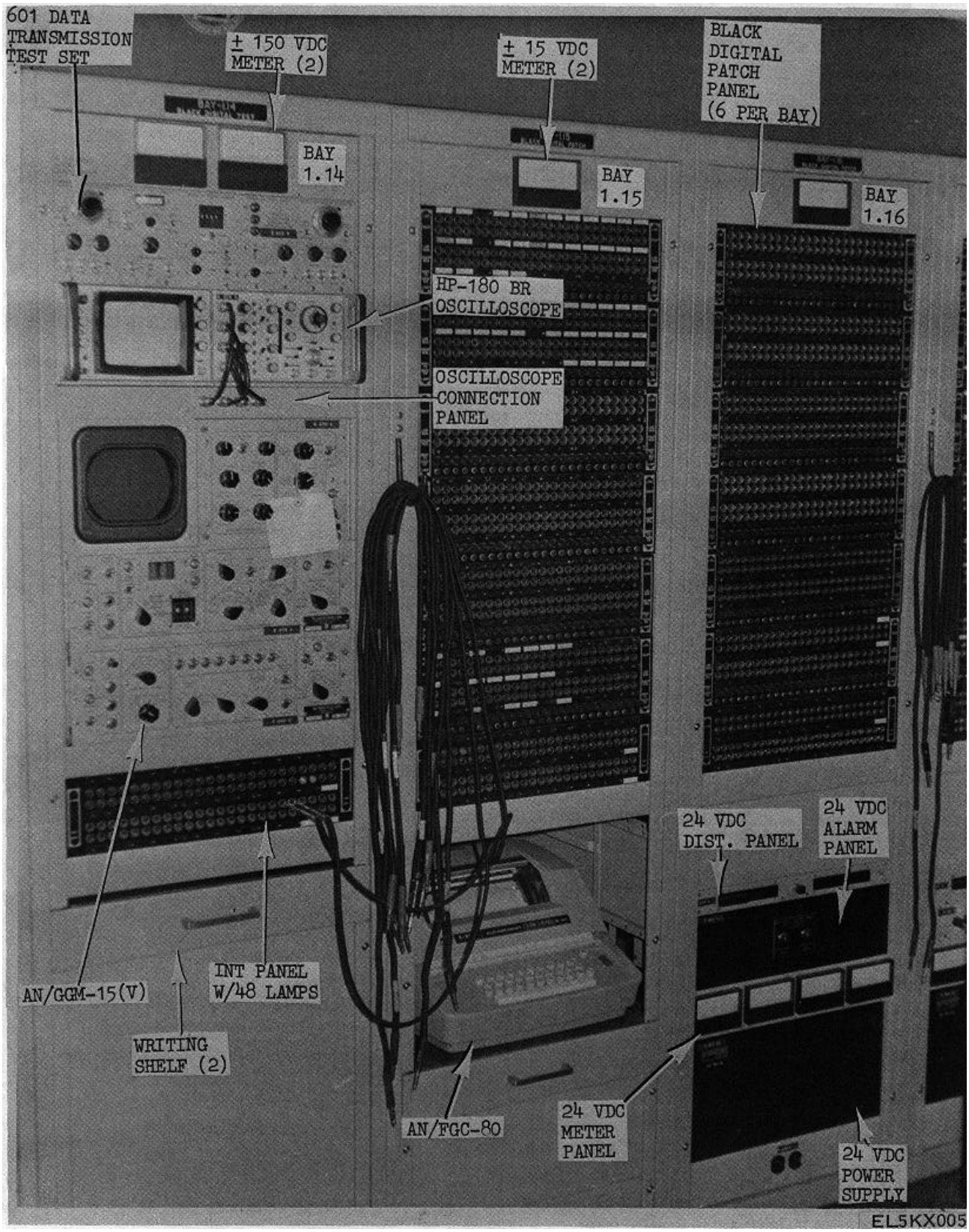


Figure 1-5. Black Digital Test Bay 1.4 and Patch Bays 1.15 and 1.16, Equipment Locations.

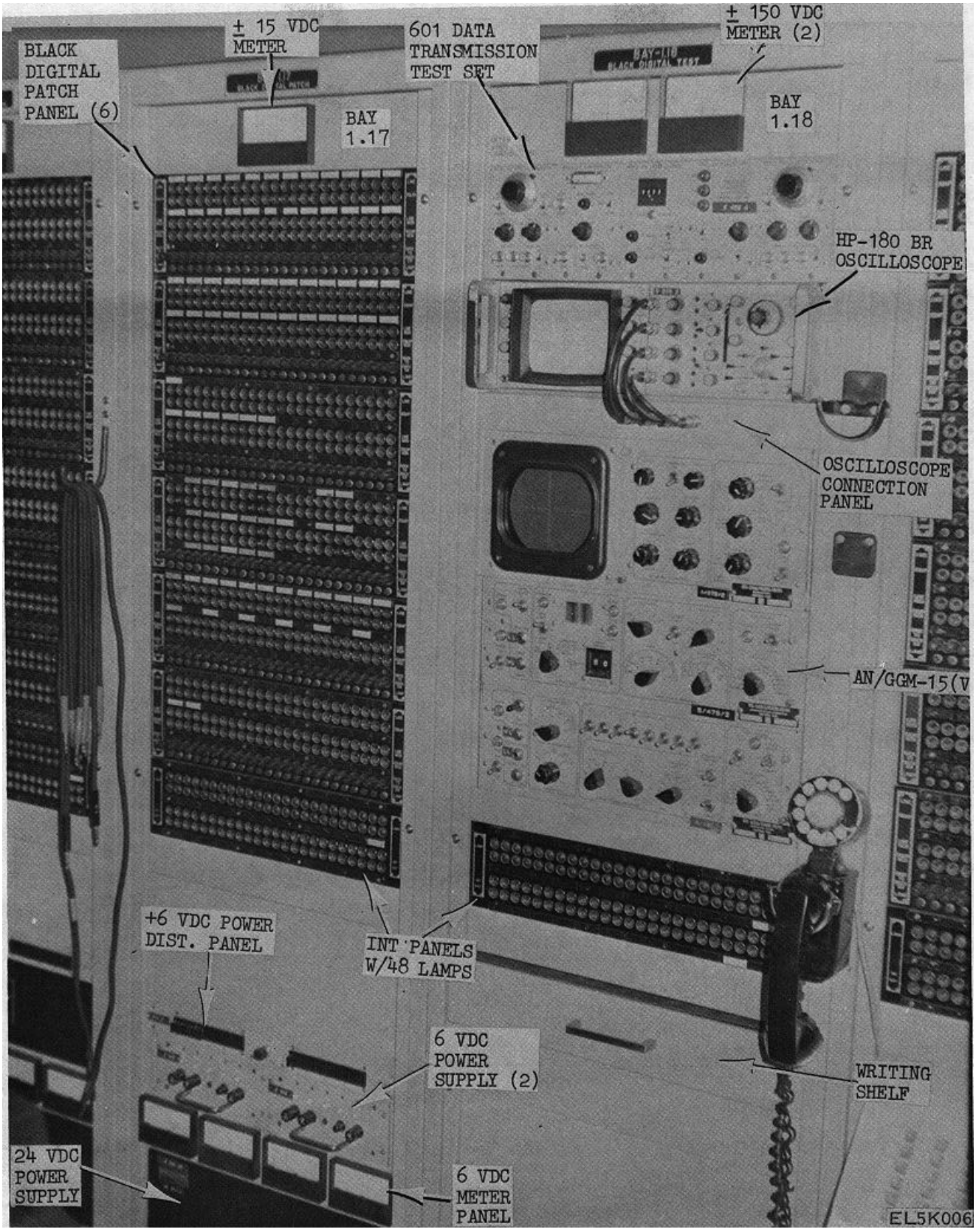


Figure 1-6. Black Digital Patch Bay 1.17 and Test Bay 1.18, Equipment Locations.

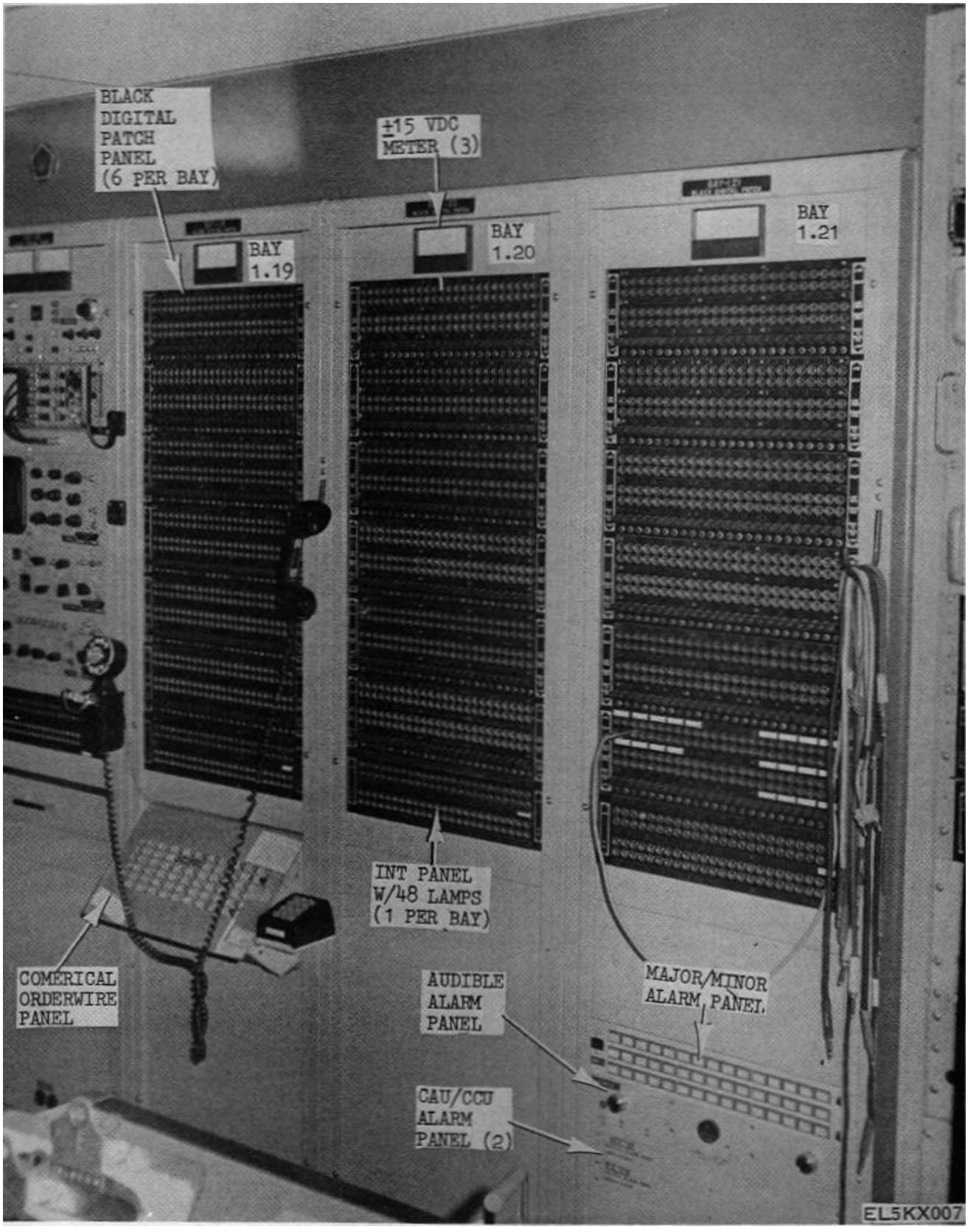


Figure 1-7. Black Digital Patch Bays 1.19, 1.20, and 1.21, Equipment Locations.

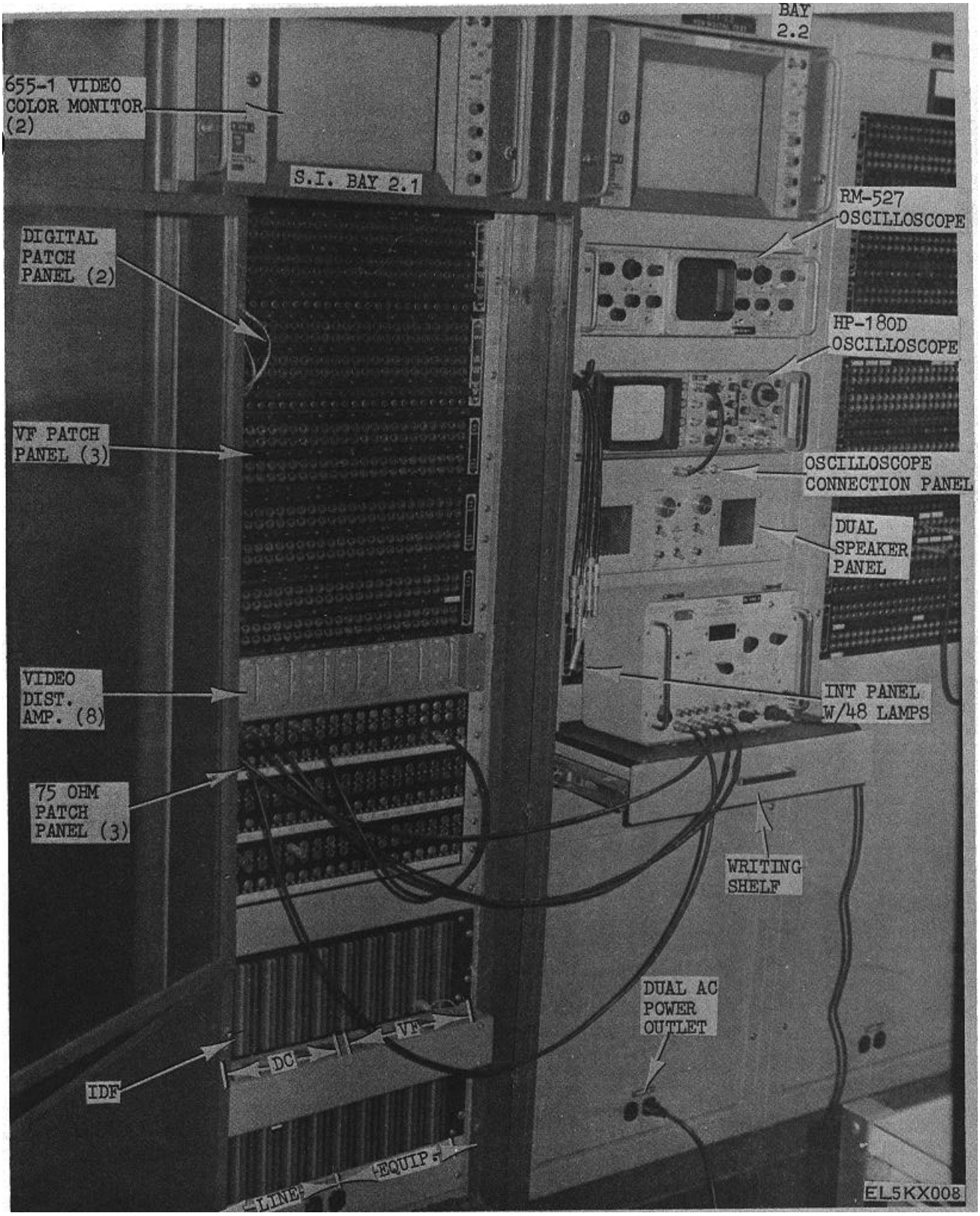


Figure 1-8. Red S.I. Bay 2.1 and Digital Test Bay 2.2, Equipment Locations.

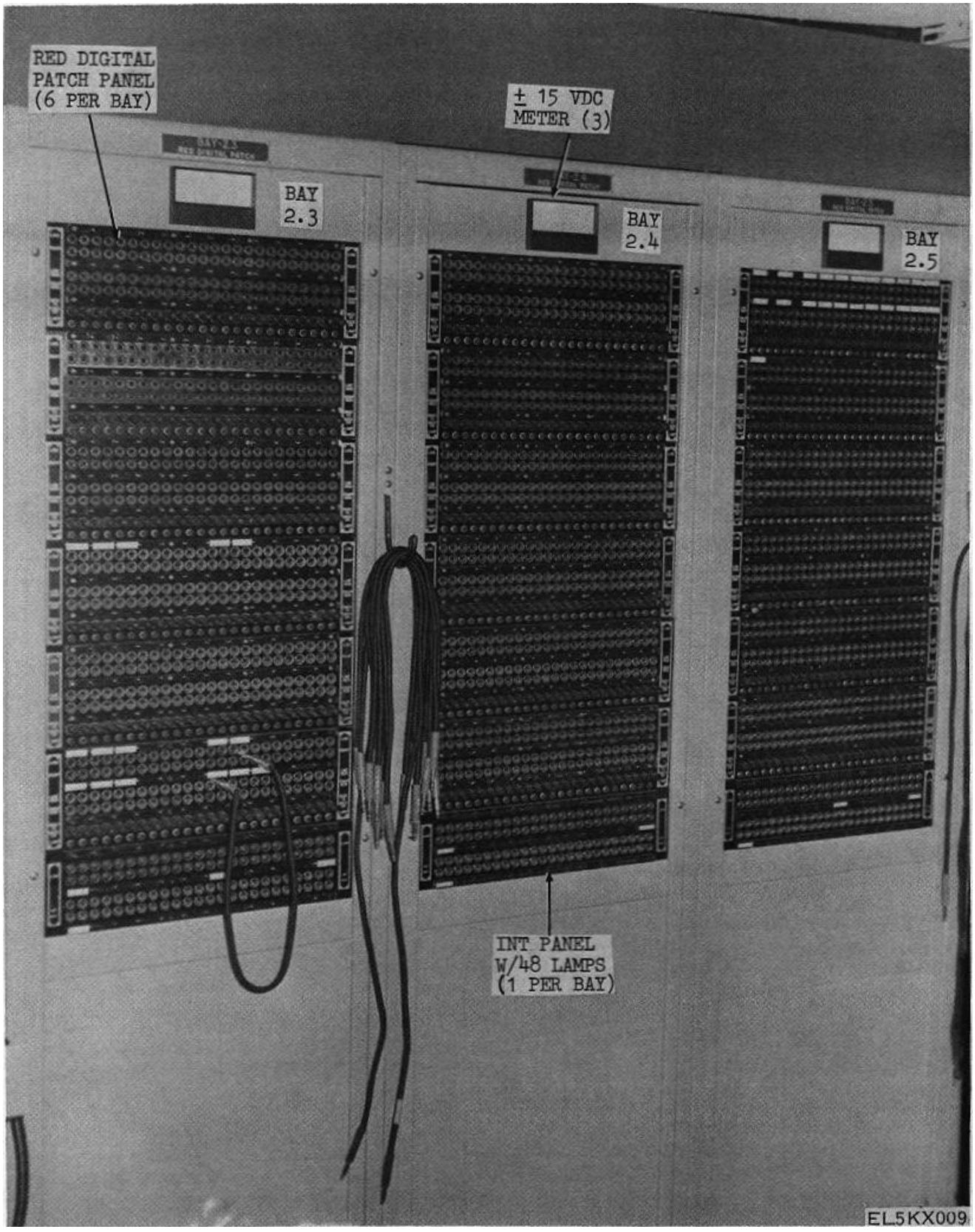


Figure 1-9. Red Digital Patch Bays 2.3, 2.4, and 2.5, Equipment Locations.

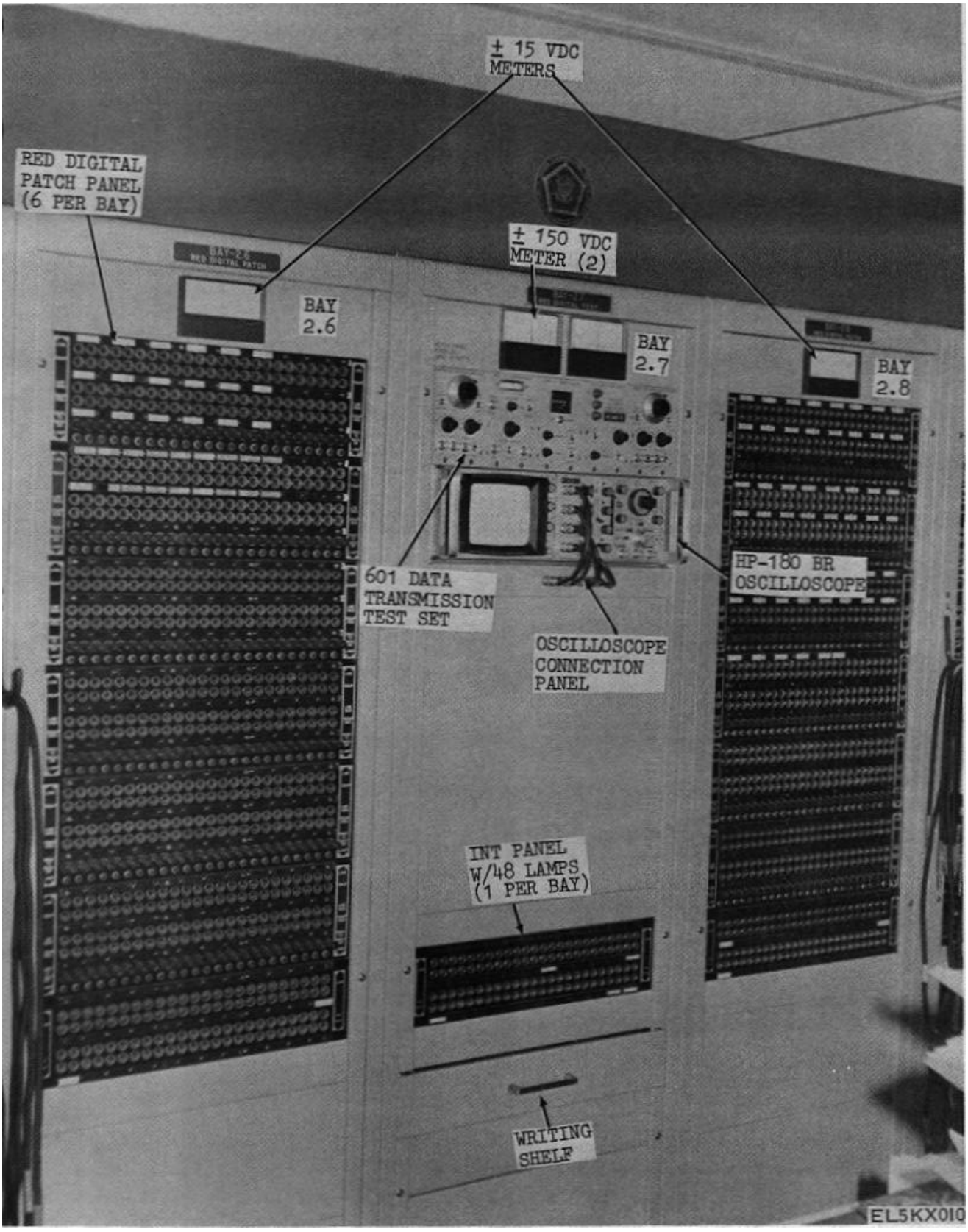


Figure 1-10. Red Digital Patch Bays 2.6 and 2.8 and Digital Test Bay 2.7, Equipment Locations.

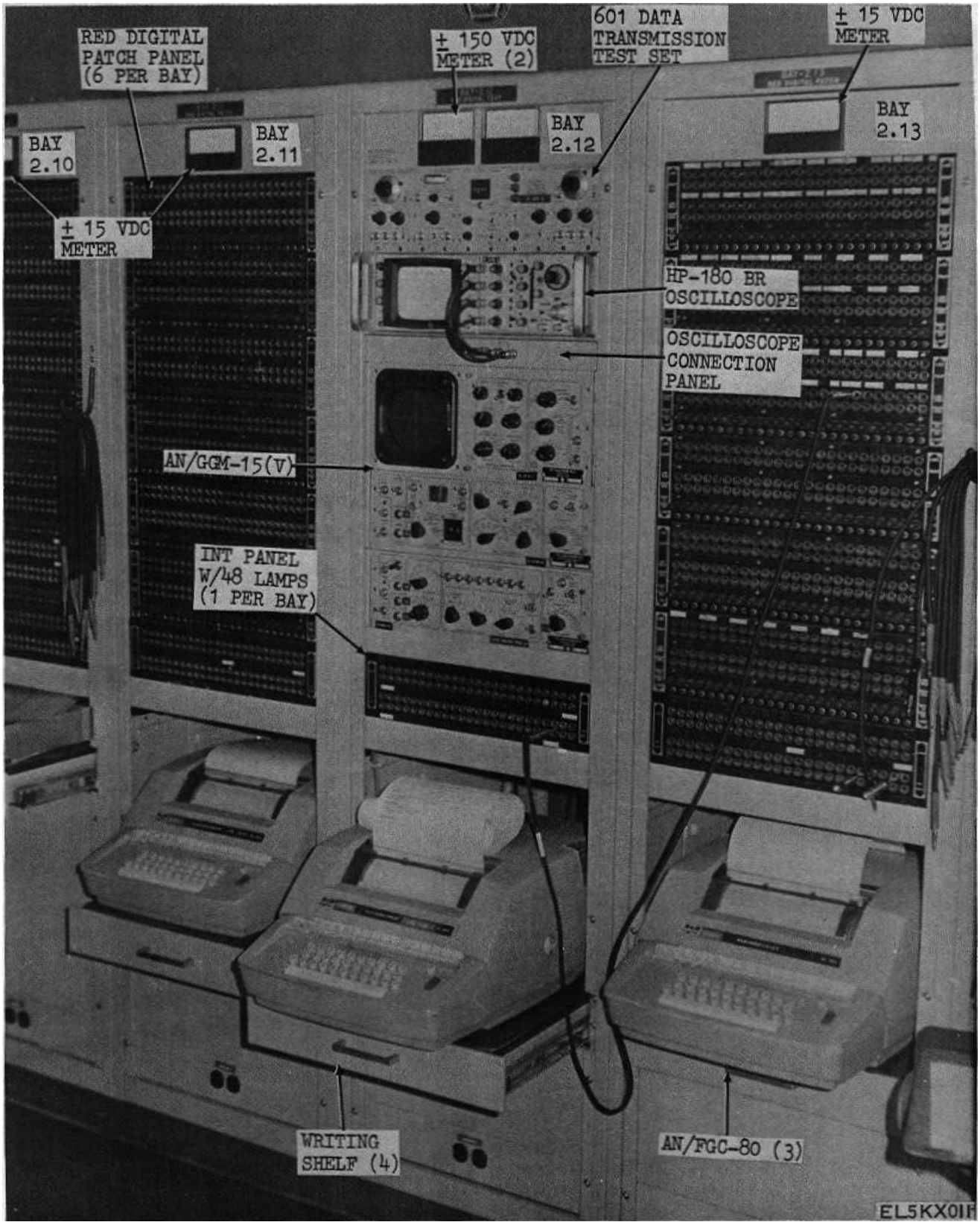


Figure 1-11. Red Digital Patch Bays 2.10, 2.11, and 2.13 and Digital Test Bay 2.12, Equipment Locations.

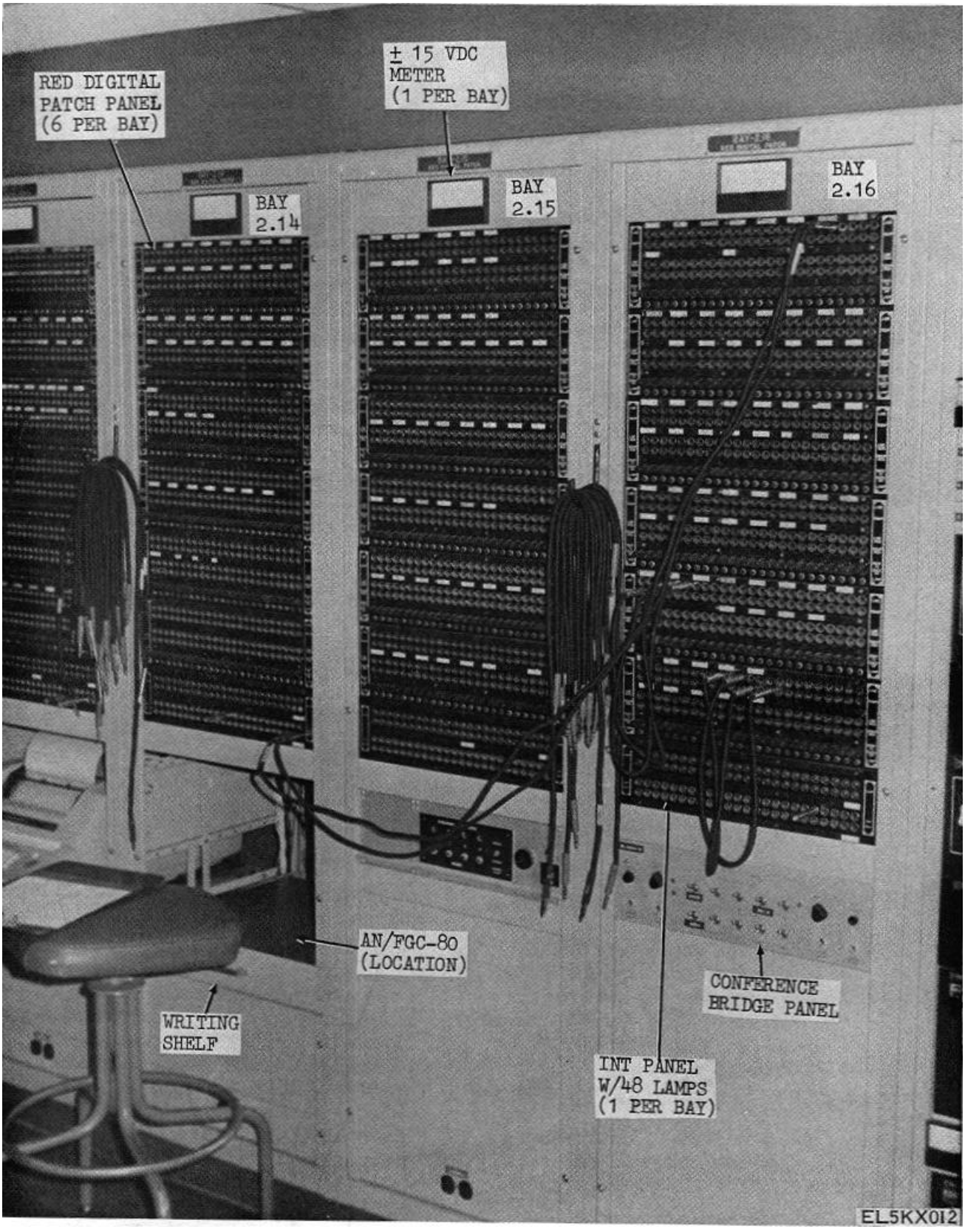


Figure 1-12. Red Digital Patch Bays 2.14, 2.15, and 2.16, Equipment Locations.

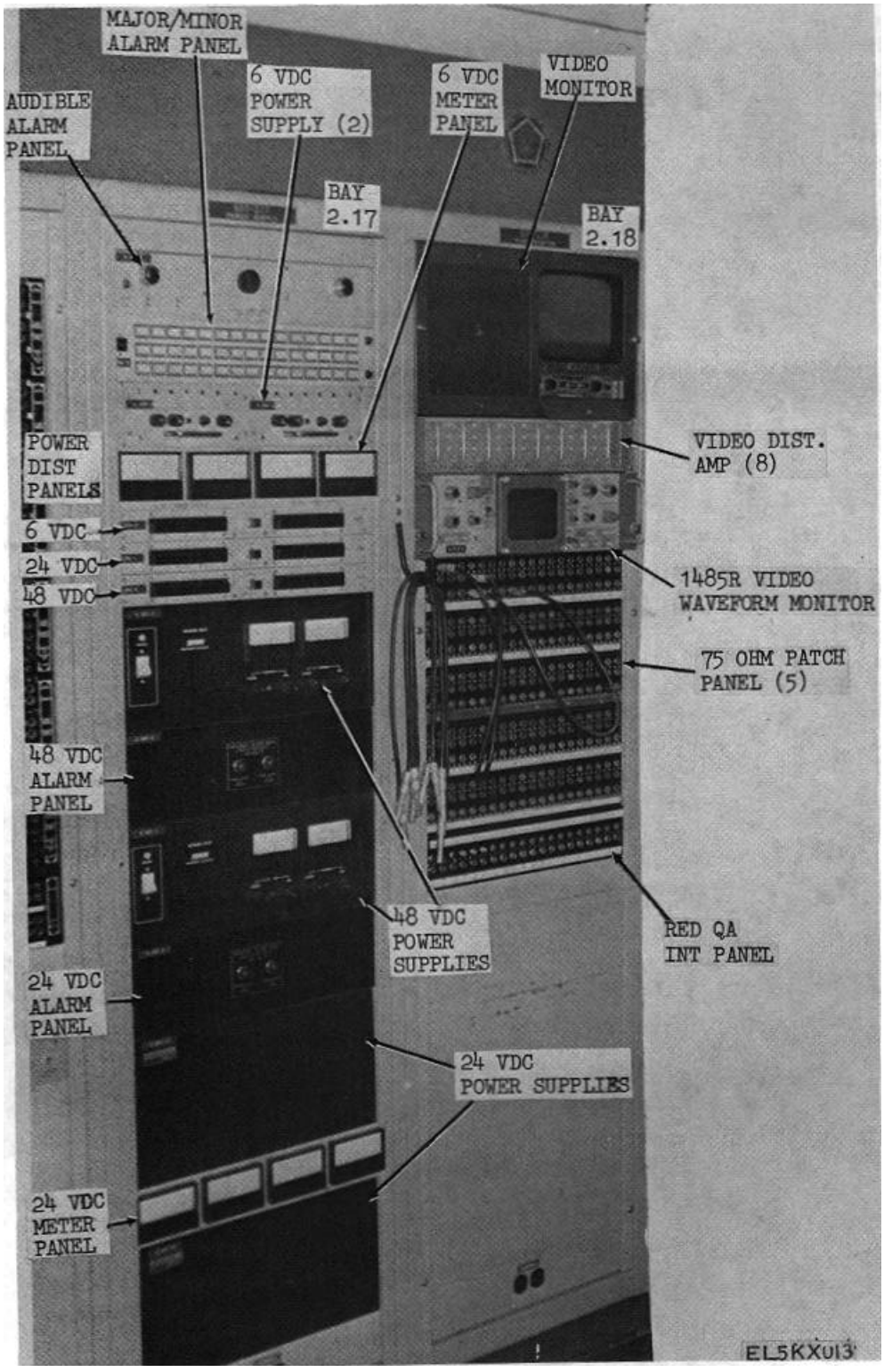


Figure 1-13. Red Power Supply Bay 2.17 and Video Monitor Bay 2.18, Equipment Locations.

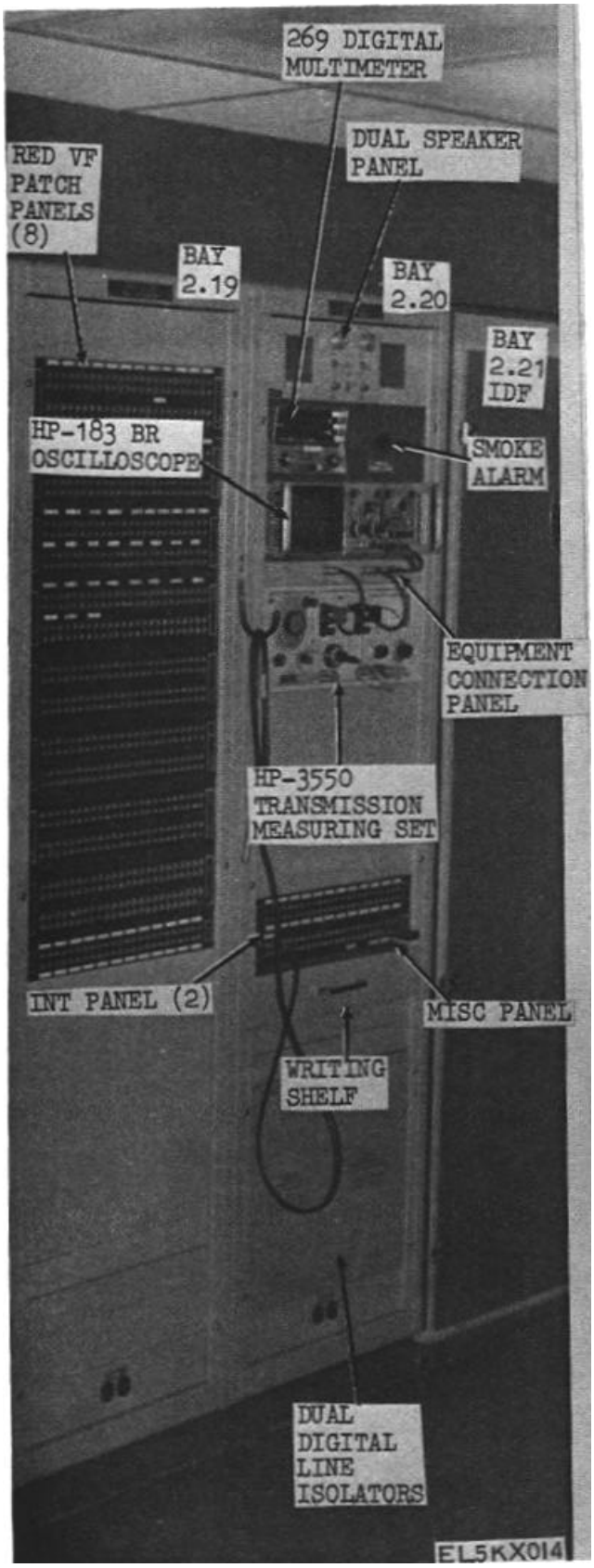


Figure 1-14. Red VF Patch Bay 2.19, Test Bay 2.20, and IDF Bay 2.21, Equipment Locations.

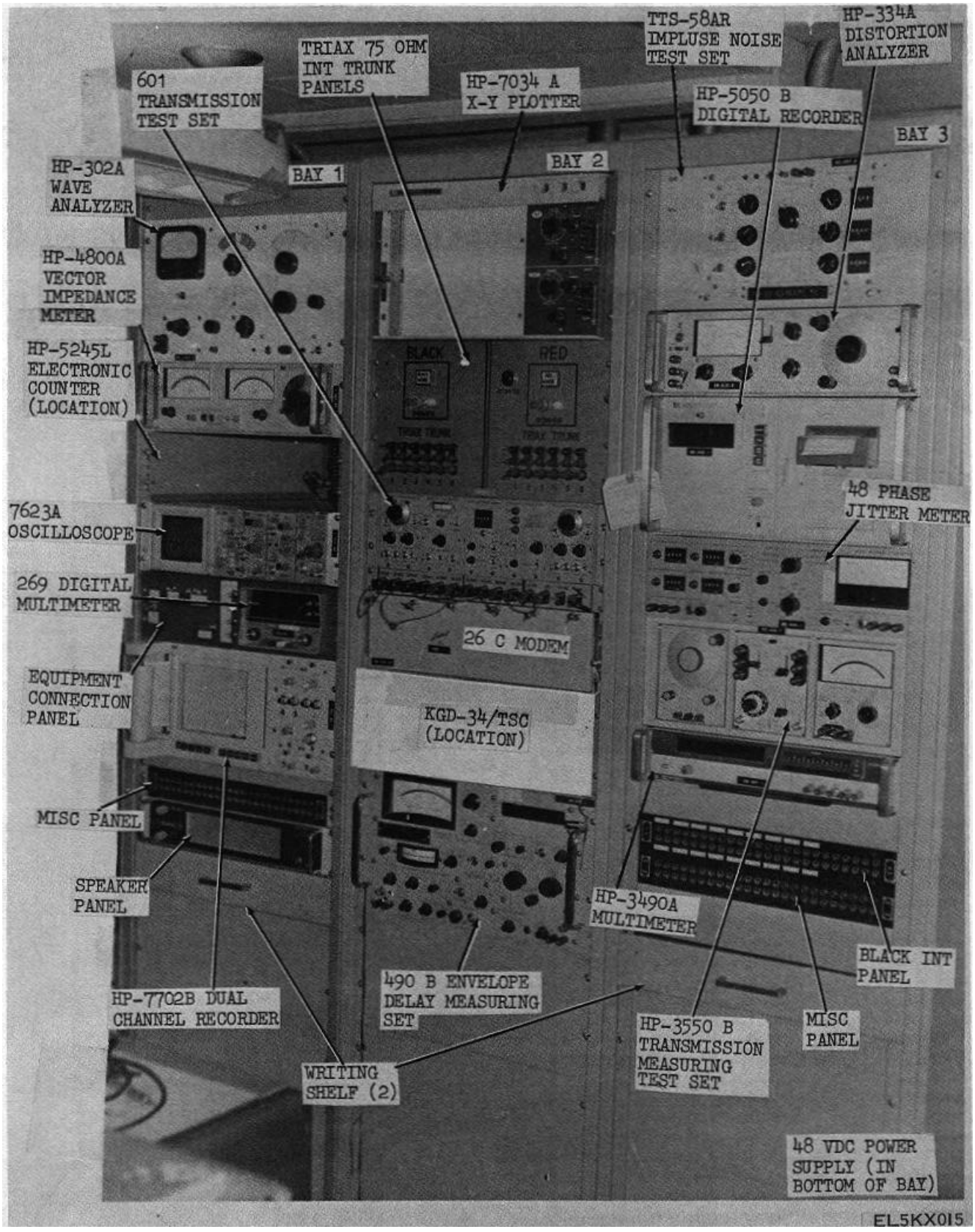


Figure 1-15. Quality Assurance Test Center, Equipment Locations.

1-12. Description of Quality.-Assurance Test Center (fig. 1-15)

The QA test center consists of three bays located in the Electronic maintenance room. The bays contain test equipment and panels as shown in figure 1-15. The test enter is connected to red circuits in the P&T through the RED TRIAX 75 ohm INT TRUNK in bay 2. Black P&T circuits are connected to the QA test center through the black INT panel in bay 3.

1-13. List of TCF Components

Table 1-1 is a listing of components installed in the Technical Control, Patch and Test Facility, Pentagon, Washington, DC:

Table 1-1. List of TCF Components

NSN/Part Number	Item Description	Qty	Fig. No.
LBAD-D-54374-1	Rack assembly - EMCORE 127	9	
LBAD-D-54374-2	Rack assembly - EMCORE 127	25	
LBAD-D-54374-3	Rack assembly - EMCORE 127	2	
LBAD-D-33674	Patch panel assembly - 2 wire audio	52	1-2
LBAD-D-33679	Patch panel assembly - interbay	8	1-2
LBAD-D-33700	Patch panel assembly - interbay w/48 lamps	27	1-4
LBAD-D-33684-3	Patch panel assembly - miscellaneous	4	1-2
LBAD-D-33440-3	Patch panel assembly - twinax w/b 75-ohm	12	1-3
LBAD-D-52178	Patch panel assembly - universal dc xmit/rec	128	1-4
LBAD-D-33161	Panel, major/minor	2	1-7
LBAD-D-54393-2	Alarm panel assembly, universal 48VDC	2	1-4
LBAD-D-52158	Alarm panel, audible	2	1-7
LBAD-D-54393-3	Alarm panel, 24VDC	2	1-5
LBAD-D-52170-5	Meter panel, 24VDC	2	1-13
	Panel, speaker, dual, Engineering Devices, Lexington, Kentucky	4	1-2
LBAD-D-54327	Alarm panel assembly, CAU/CCU	2	1-7
5805-00-103-7136/ 676D	Power supply - 6 VDC/PP-6062/G	4	1-6
LBAD-D-52731	Meter panel, volt & amp - PORM 0-150	3	1-6
# 218217	Power supply - 24 VDC	3	1-5
DCR 60-30	Power supply - 48 VDC	4	1-4
FP 40	Panel, distribution - 6 VDC	2	1-6
FP 40	Panel, distribution - 24 VDC	2	1-5
FP 40	Panel, distribution - 48 VDC	2	1-4
LBAD-D-52170-1	Meter panel - 6 VDC	2	1-6
281048	Power supply - 48 VDC	1	1-15
26 C	MODEM	1	1-15
	Intertrunk panel, 75-ohm Triax	1	1-15
LBAD-D-52721	Meter panel - FORM 15 VDC	21	1-4
230-1858-01	Panel, connectorized crossconnect	74	2-1
LBAD-D-59292	Outlet, convenience ac	38	
5815-00-941-0063	Teletypewriter - AN/FGC-80	6	1-3
	VF Orderwire; 400 key, 60-button consol. Chesapeake-Potomac Telephone Co.	3	1-2
5805-00-503-0914	Amplifier, audio frequency - AM-911/FG	2	1-2
3206-A1	Amplifier, video distribution	16	1-8
	Panel, attenuator	1	1-2
5521RS12	Monitor, video (control), monitor switches, outside & door release	3	1-3
TCTS-2A	Telegraph carrier test set	1	1-2
TDS-2	Station clock c/o	1	1-3
97170004-00	Power supply	1	1-3
COA-3C	Clock oscillator	3	1-3
	Comparator & switch assembly	1	1-3
87170000-000	Divider assembly	1	1-3
8717001-000	Output assembly	5	1-3
Mark IV	Fans: 50/60 Hz, 115 VAC	2	1-3
TEK 1485R	Monitor, Waveform Dual Standard PAL/NTSC	2	1-3
TEK 655-1	Video Monitor	2	1-8
6625-00-167-9861/ HP4800	Vector Impedance Meter	1	1-15
HLI-48	Meter, Phase Jitter, Heklimian Laboratories Inc., Rockville, Maryland	1	1-15
TEK-R-7623	Oscilloscope, Storage	1	1-15
6625-00-140-7389/ TTS-58-AR	Counter, Impulse Noise	1	1-15

Table 1-1. List of TCF Components-Continued

NSN/Part Number	Item Description	Qty	Fig. No.
6625-00-411-9620/ HP 5050B	Recorder, Digital	1	1-15
6625-00-799-8539/ HP 334A	Analyzer, Distortion, TS-2947	1	1-15
HP3490A	Multimeter, Digital	1	1-15
6625-00-973-4837/ HP 5245L	Counter, Frequency	1	1-15
6625-00463-(042	Plotter, X-Y, RO-437/U	1	1-15
6625-00-464-2957	Recorder, Dual Channel, RO-460(V) I1/U	1	1-15
S-9903D	Speaker panel, Communications Electronic Inc. (CEI)	1	1-15
	Panel, equipment connection	1	1-15
490B	Measuring Set, Envelope Delay	1	1-15
6625-00-409-4572/ HP 302A	Voltmeter, Frequency Selective, TS-1827(#)/U	1	1-15
HP 183 BR	Oscilloscope	2	1-2
HP 180 D	Oscilloscope	5	1-5
6625-00-740-0344/ HP 3550	Transmission Measuring Set	4	1-2
269	Digital Multimeter	3	1-2
#601	Data Transmission Test Set	6	1-5
6625-00-464-1702	Analyzer, Digital Data AN/GGM-15(V)	5	1-5
152-10 (2 ft long)	Patchcord, twinax	30	
152-10 (3 ft long)	Patchcord, twinax	30	
5995-00-935-5135/ PJ-82 (2 ft)	Patchcord	200	
5995-00-089-4500/ PJ-84 (4 ft)	Patchcord	200	
5995-00-246-9792/ PJ-86 (6 ft)	Patchcord	200	
230-1754-010	Patchcord (orange)	150	
230-1754-020	Patchcord (red)	150	
230-1754-030	Patchcord (pastel blue)	200	
230-1754-040	Patchcord (yellow)	200	
230-1754-050	Patchcord green)	200	
230-1754-060	Patchcord (tan)	200	
230-1754-070	Patchcord (moss green)	200	
230-1753-010	Patchcord (orange)	100	
230-1753-020	Patchcord (red)	100	
230-1753-030	Patchcord (pastel blue)	100	
230-1753-040	Patchcord (yellow)	100	
230-1753-050	Patchcord (green)	100	
230-1753-060	Patchcord (tan)	100	
230-1753-070	Patchcord (moss green)	100	
230-1752-010	Patchcord (orange)	200	
230-1752-020	Patchcord (red)	200	
230-1752-030	Patchcord (pastel blue)	200	
230-1752-040	Patchcord mellow)	200	
230-1752-050	Patchcord (green)	200	
230-1752-060	Patchcord (tan)	200	
230-1752-070	Patchcord (moss green)	200	
230-1751-010	Patchcord (orange)	75	
230-1751-020	Patchcord (red)	75	
230-1751-030	Patchcord (pastel blue)	75	
230-1751-040	Patchcord (yellow)	75	
230-1751-050	Patchcord (green)	75	
230-1751-060	Patchcord (tan)	75	
230-1751-070	Patchcord (moss green)	75	

CHAPTER 2
STATION APPLICATION AND EQUIPMENT FUNCTION

Section I. STATION APPLICATION

2-1. Introduction

(fig. FO-2(1) and FO-2(2))

a. Pentagon Telecommunications Center. The US Army Communications Command (USACC) Pentagon Telecommunications Center (ITC) is a terminal station that provides a transmission system interface with the Defense Communications Systems (DCS) for Army, Department of Defense, and other Government agencies located at the Pentagon and surrounding areas near Washington DC. The PTC provides various users with high priority voice, data, and video service, most of which is encrypted. The transmission media utilized are military-owned microwave, commercial-owned baseband radio, and commercial cable. In addition, a large number of "in-house" cables are used to provide connectivity for the user locations throughout the Pentagon building complex.

b. Technical Control Facility. The Army Technical Control Facility (TCF) at the Pentagon provides technical control over RED and BLACK-VF, DC, DIGITAL, and VIDEO circuits appearing at the TCF. These are comprised of military-owned VRCT systems and leased DC and data circuits. The high speed data circuits are in the !400 to 50K BAUD range. The low speed circuits are pre/dominantly secure circuits. Test and maintenance is also provided on Government-owned lines and circuits.

2-2. Patch and Test Facility

a. The P&T function includes the monitoring of circuits and equipment within a station, as well as the selection and application of station facilities and associated equipment, as needed to keep the station's operating and standby communications links and circuits at peak efficiency. The technical controller coordinates changes in communications services at the station, performs alternate routings, directs the correction of malfunctions, restores service when outages occur, and coordinates link and station tests. The P&T facility within the station encompasses these areas which are equipped with jacks, and test instruments to provide access to the circuits for the purpose of performing monitor, patch and test operations.

b. To efficiently perform the technical control functions required to keep all communication links at their peak operating condition, all personnel must be thoroughly familiar with the station capabilities and the functions of all /equipment in the station. In addition, familiarization with circuit links of related technical controls is required. This chapter discusses the station capabilities, typical circuits in and through the TCF and the functions of equipment. Refer to DCS publications to become familiar with other types of communication circuits and links.

2-3. Intermediate Distribution Frames

a. General. There are four IDF's in the P&T area. They are an integral part of the technical control. As shown in figures FO-2.1 and FO-2.2 each equipment's signaling input and output connections are terminated at an IDF. In addition, the input and output signals of each patch panel and circuit line are also terminated at an IDF. (Wide band circuits are not connected through IDF's.)

b. Description. Each IDF (fig. 2-1) consists of a matrix made up of rows of cross-connect panels. A panel contains ten jack type patch modules (A through H, and J and K). Each module (fig. 2-2) has six multicolored rows of 26 jacks. The color of the jack rows at the front of the modules, from left to right are: Red (A), white (B), blue (C), yellow (D), black (E), and orange (F). Each of the 156 jacks is connected to a pin on one of three associated connectors mounted on the rear of the panel. The first 48 jacks on the module are connected to pins 1 through 48 on connector J1. Module jacks 49 through 96 are connected to pins 1 through 48 on connector J2. Module jacks 97 through 144 are connected to pins 1 through 48 on connector J3. Module jacks 145 through 156 are also connected to connectors J1, J2, and J3. Four jacks to each connector. The connectors are cabled to patch panels, land lines, and equipment. Circuits are built by cross-connecting between the jacks of the circuit component modules with cross-connect patch cords.

c. Black VFIDF, Bay 1.1. Bay 1.1 (fig. 2-3) *is actually two bays*. Each bay contains eight cross-connect panels (b above). Cable details (at the time of installation) are shown in figures 2-4 and 2-5.

d. Black Digital IDF, Bay 1.10. Bay 1.10 (fig. 2-6) consists of three bays of eight cross-connect panels (b above). Cable details (at the time of installation) are shown in figures 2-7, 2-8, and 2-9.

e. Red Digital and VF IDF, Bay 2.21. Bay 2.21 (fig. 2-10) consists of four bays of eight cross-connect panels (b above). Cable details (at the time of installation) are shown in figures 2-11 through 2-14.

f. Special Intelligence IDF, Bay 2.1. There are two cross-connect panels (fig. 2-15) at the bottom of the S.I. bay.

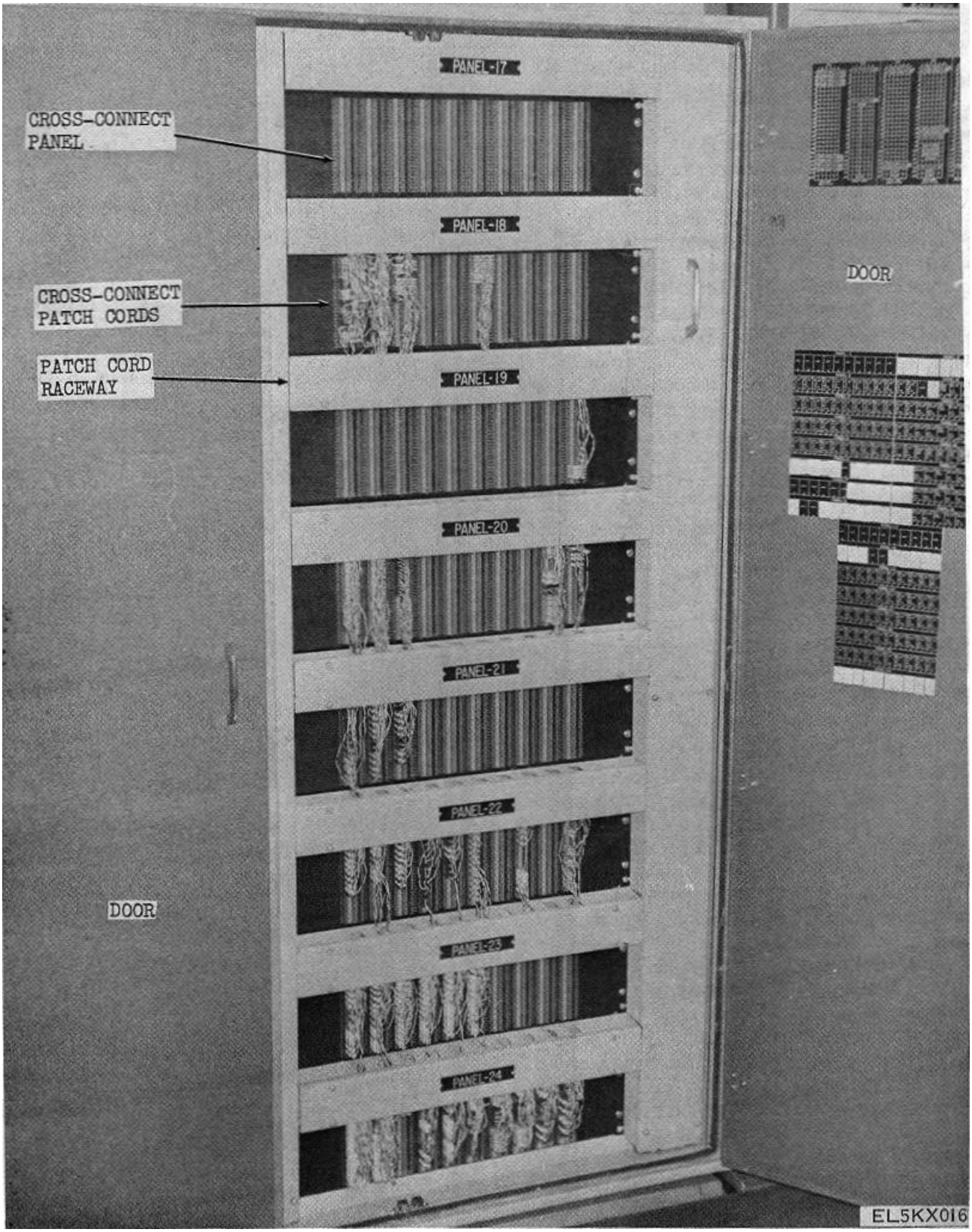


Figure 2-1. Typical IDF Bay, Front View.

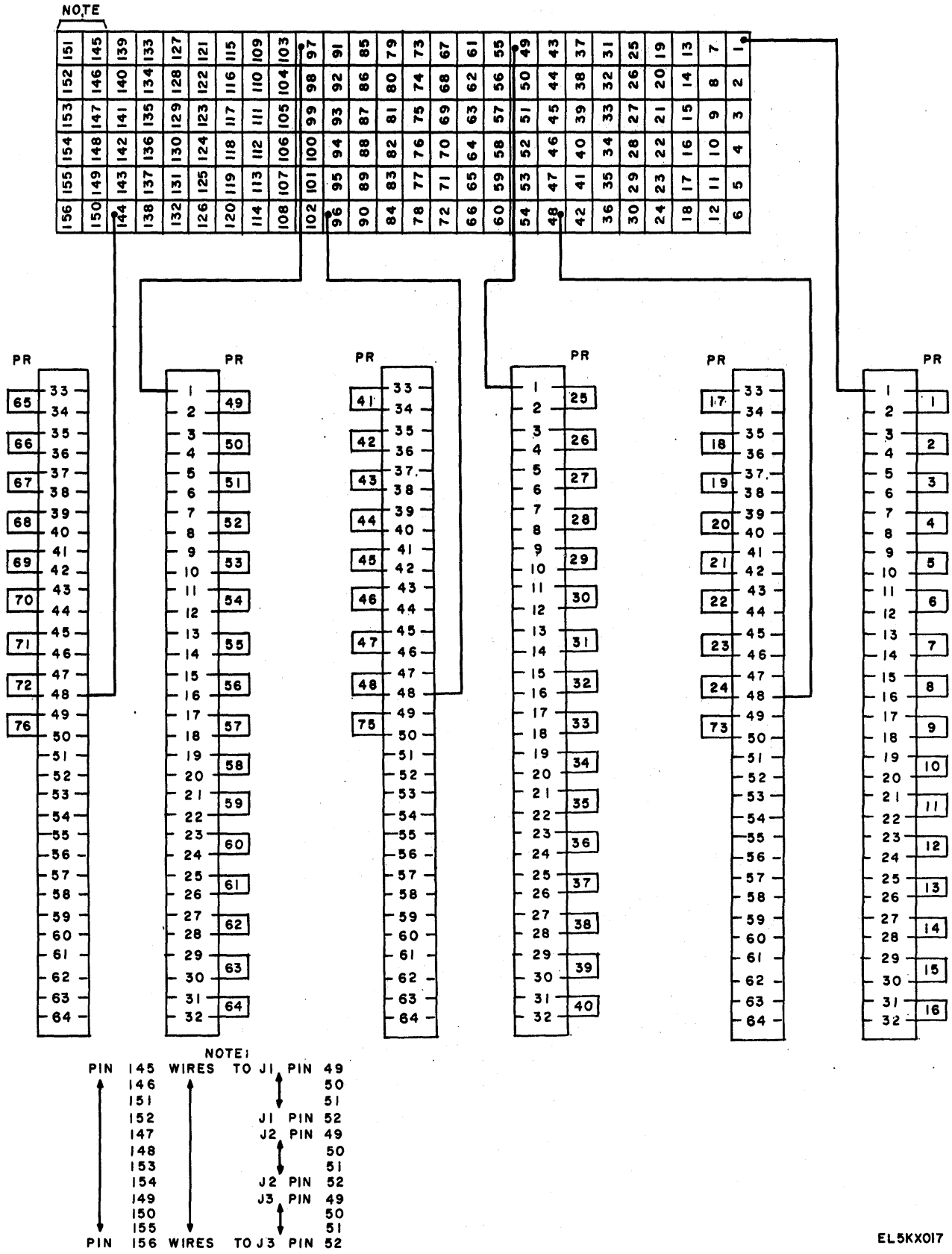


Figure 2-2. Connectorized Cross-Connect Panel, Module Wiring Diagram.

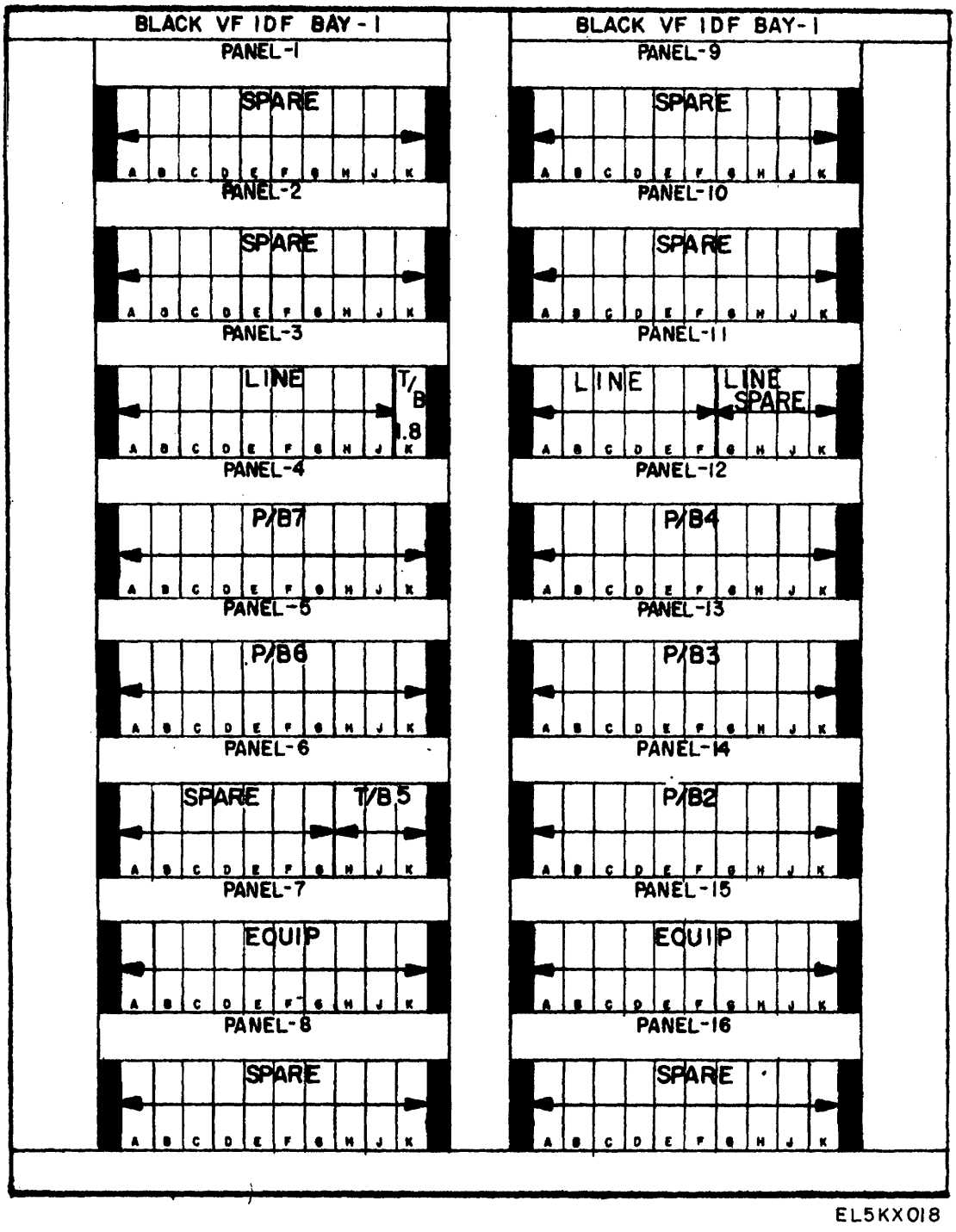


Figure 2-3. Black VF, IDF Bays, Front View.

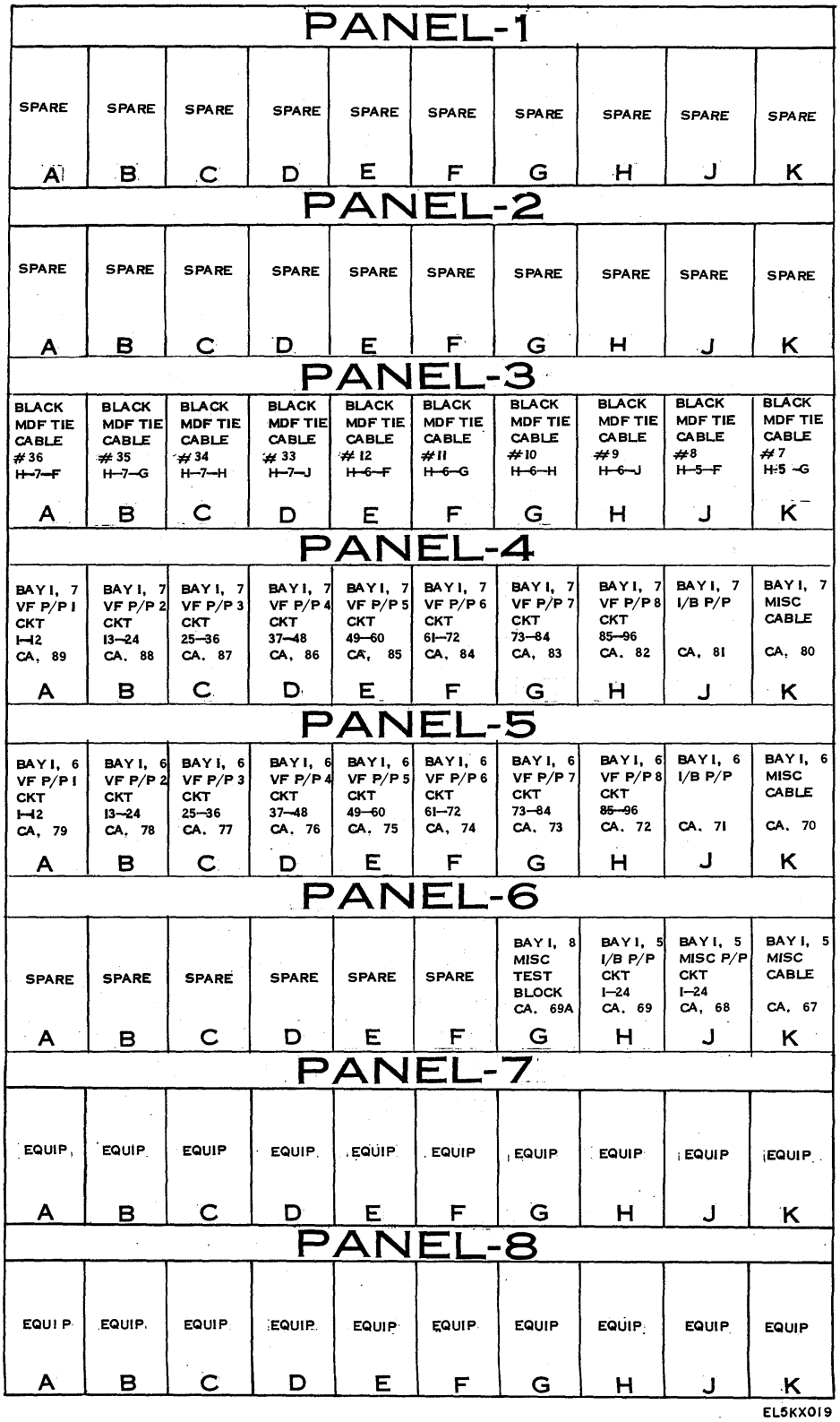


Figure 2-4. Black VF, IDF Panels 1 Through 8, Cable Details.

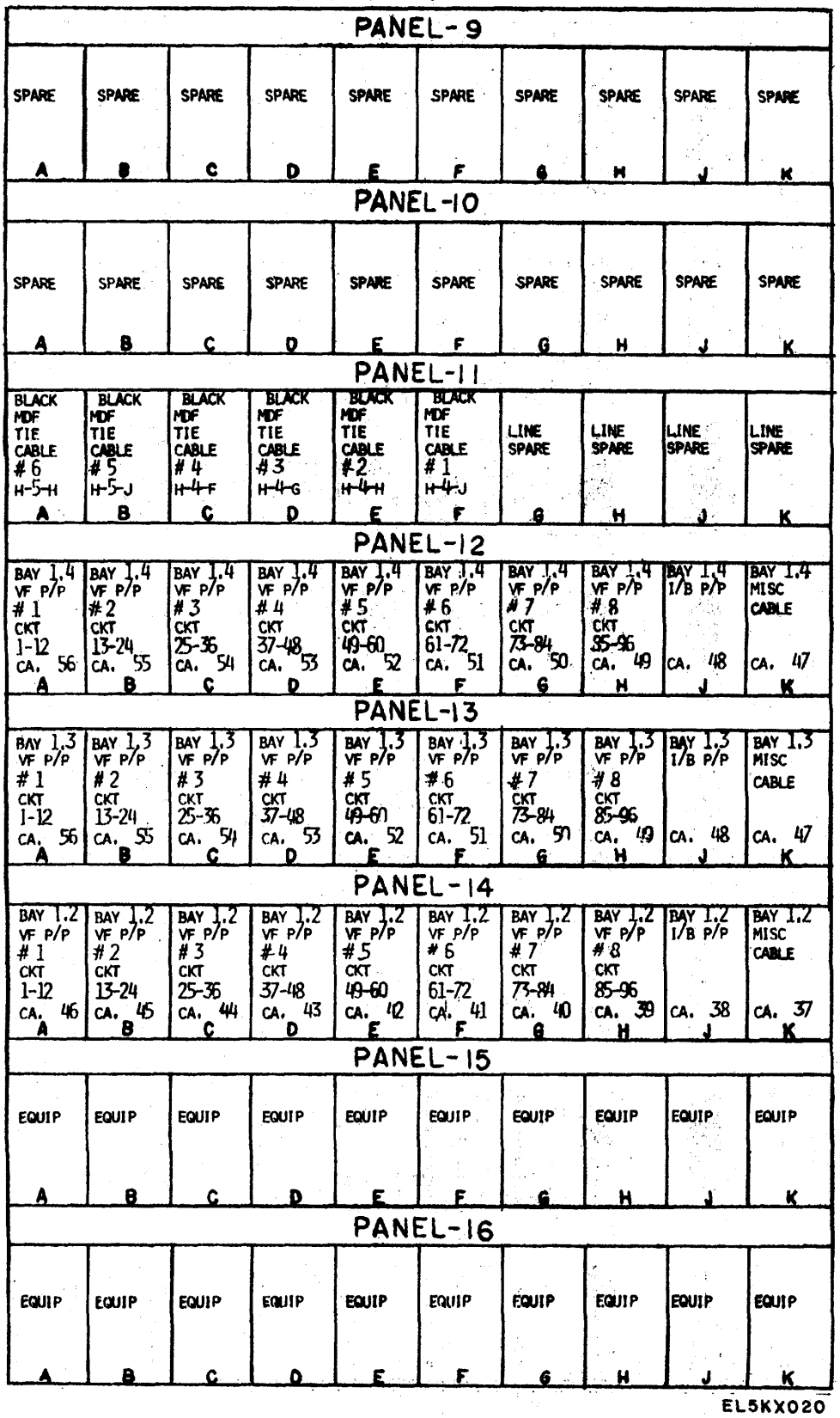


Figure 2-5. Black VF, IDF Panels 9 Through 16, Cable Details.

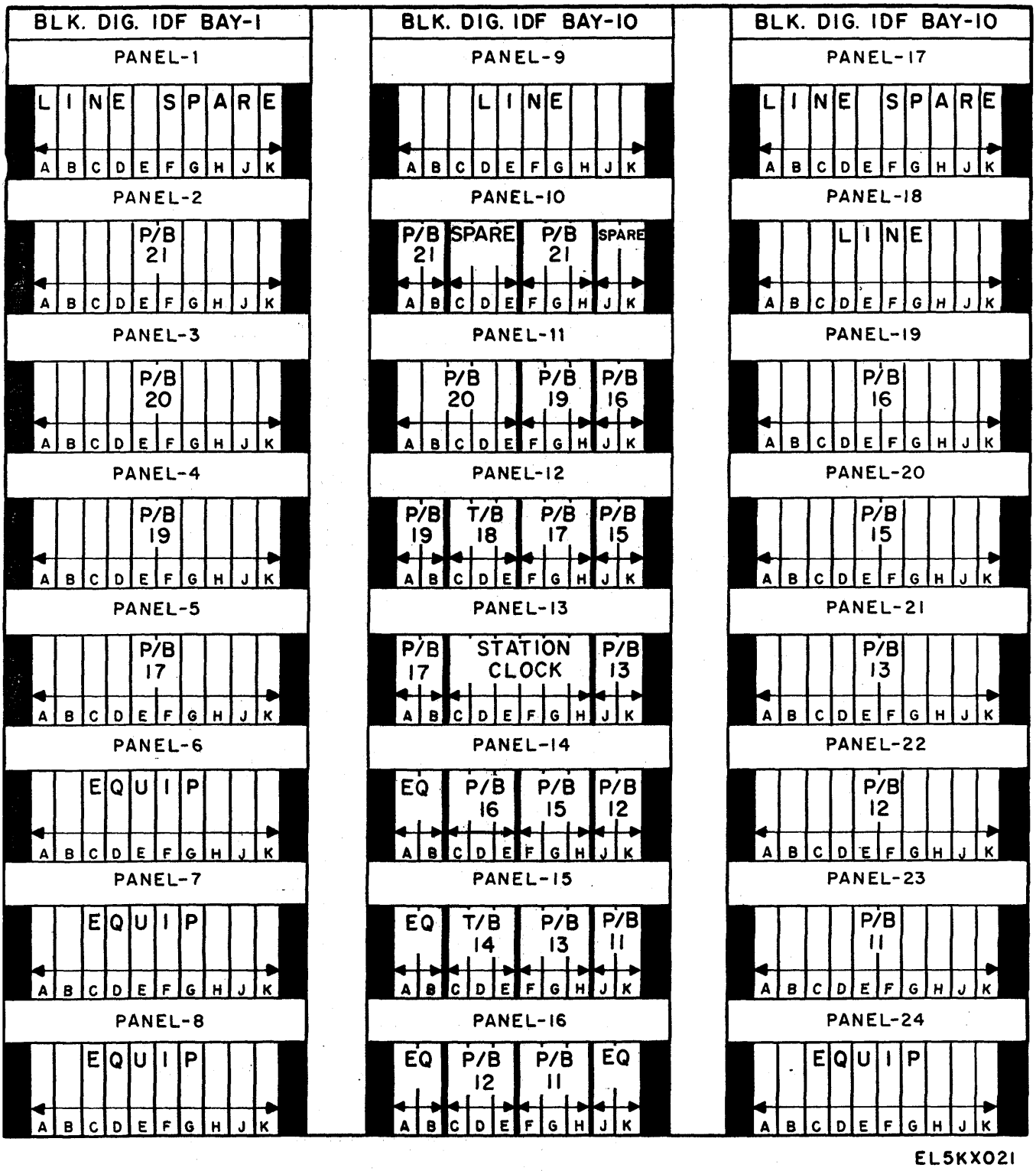


Figure 2-6. Black Digital IDF Bays, Front View.

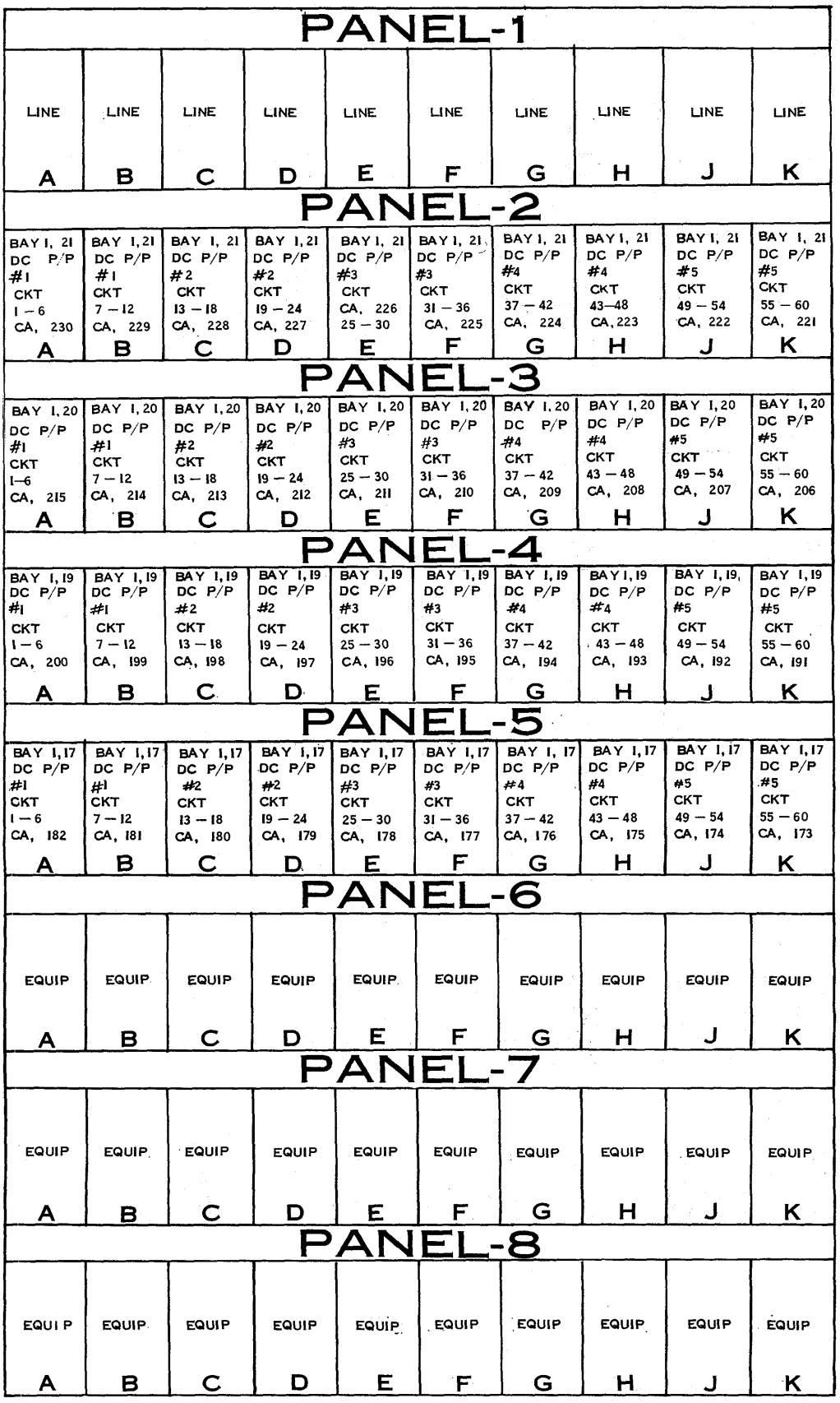


Figure 2-7. Black Digital IDF Panels 1 Through 8, Cable Details.

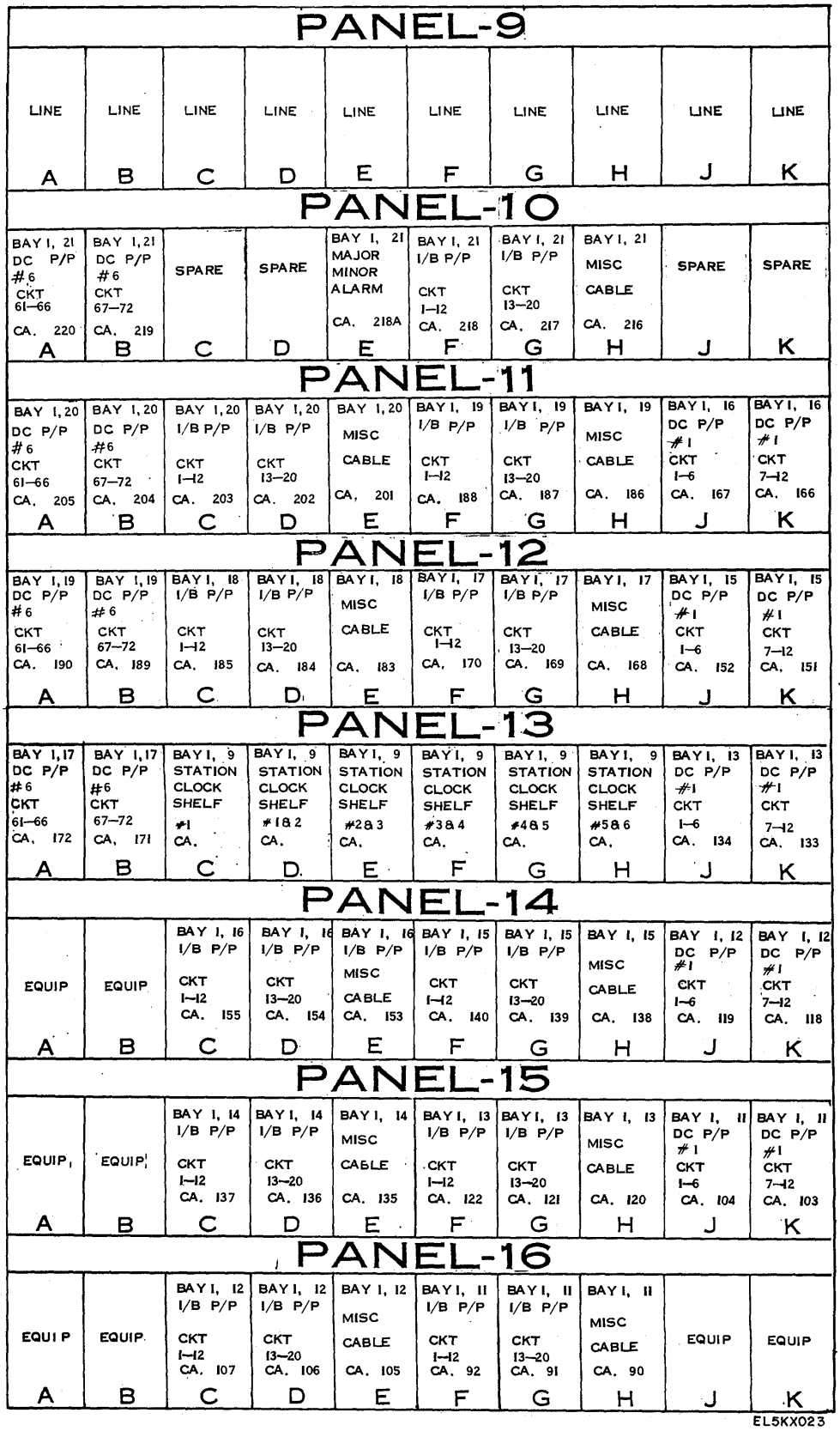
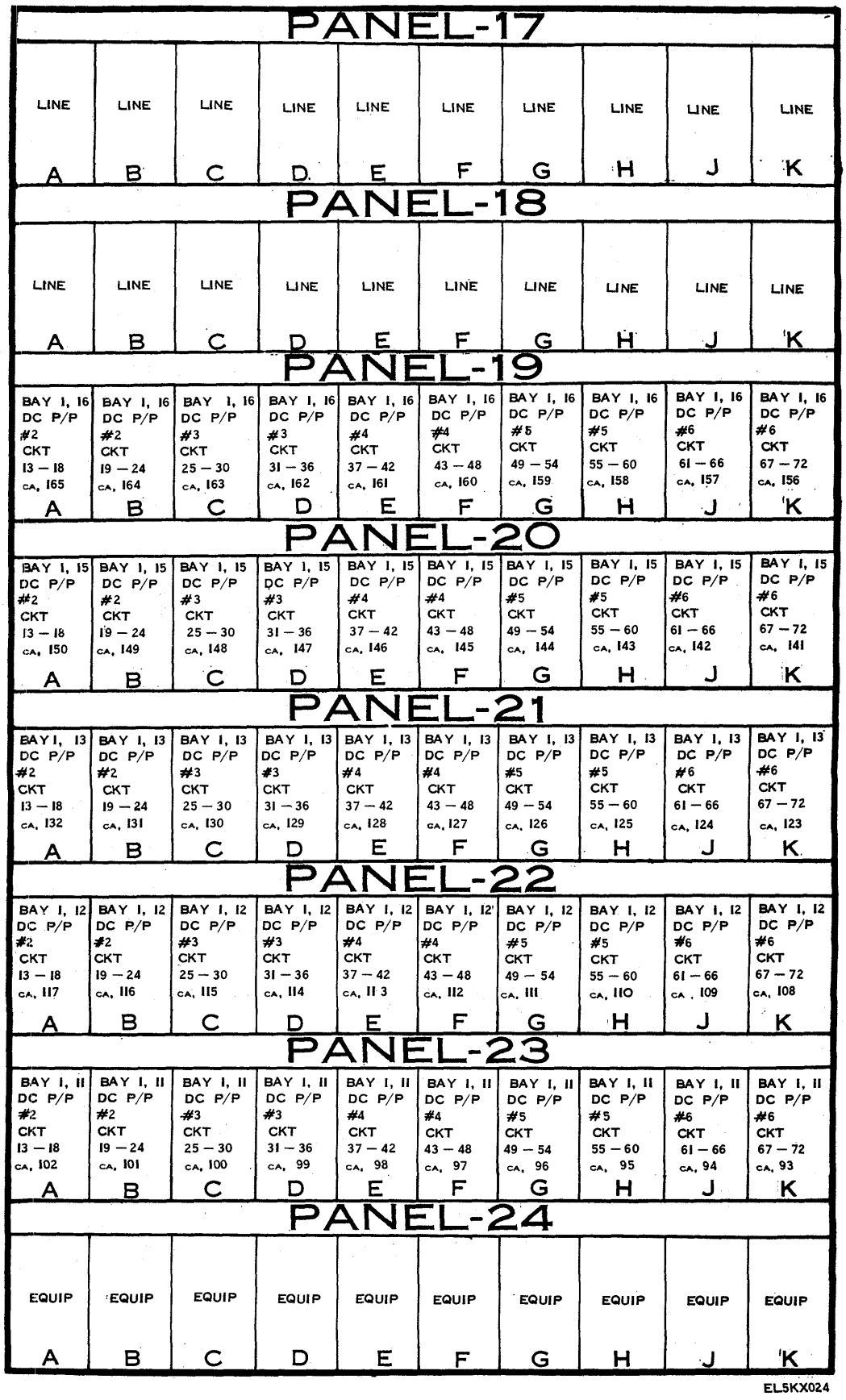


Figure 2-8. Black Digital IDF Panels 9 Through 16, Cable Details.



EL5KX024

Figure 2-9. Black Digital IDF Panels 17 Through 24, Cable Details.

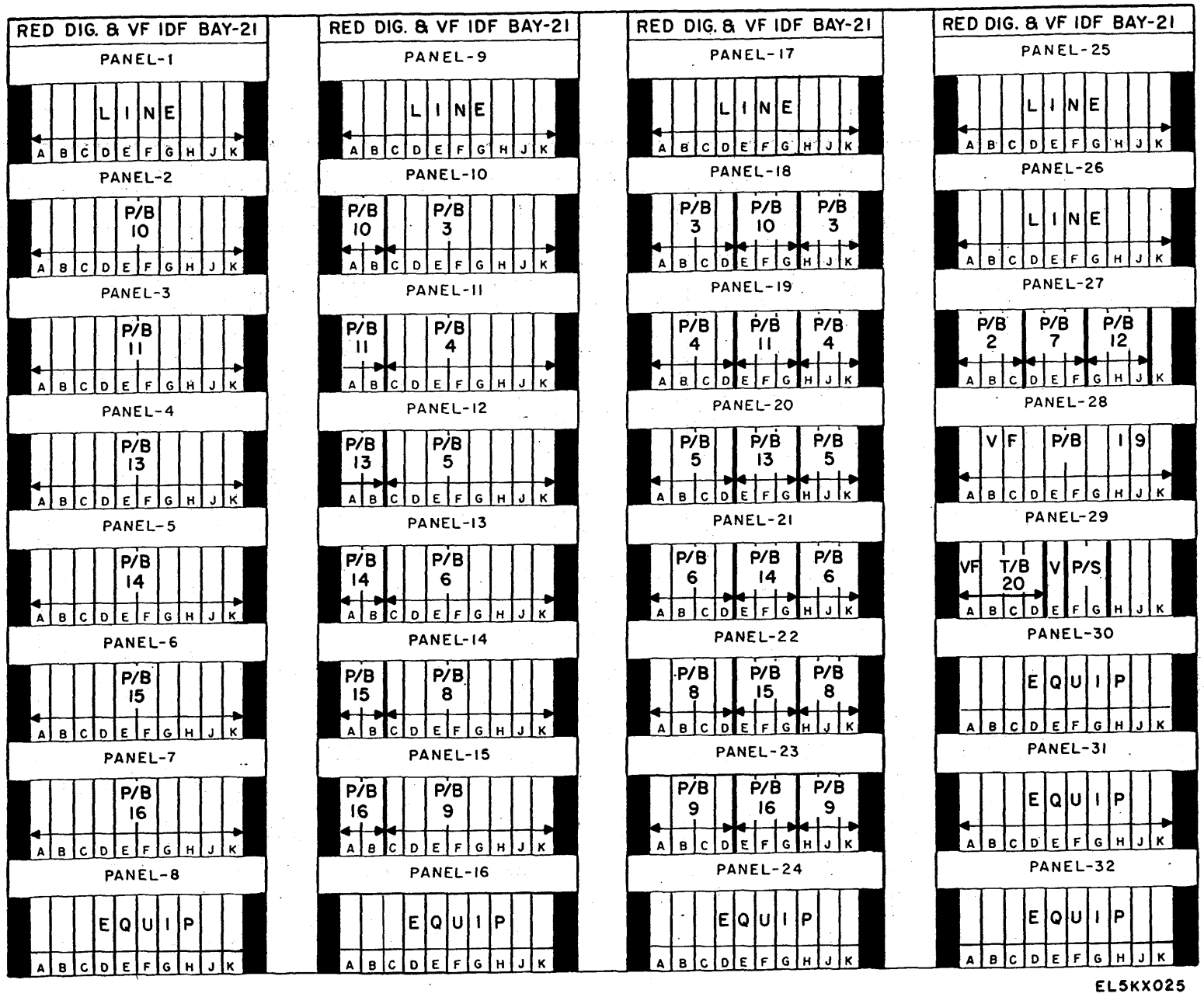
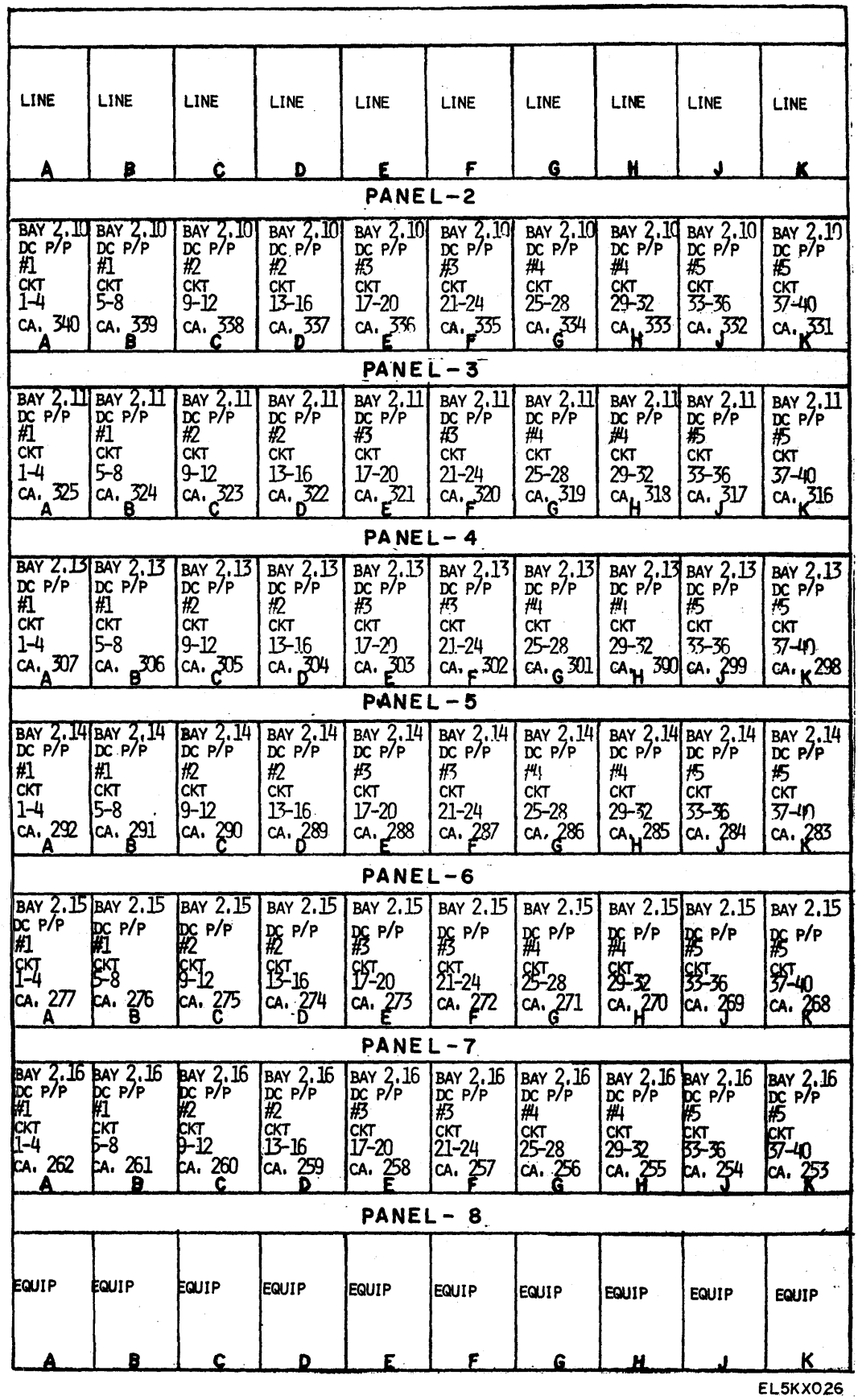


Figure 2-10. Red Digital and VF IDF Bays, Front View.



EL5KX026

Figure 2-11. Red Digital and VF IDF Panels 1 Through 8, Cable Details.

PANEL-9									
LINE A	LINE B	LINE C	LINE D	LINE E	LINE F	LINE G	LINE H	LINE J	LINE K
PANEL-10									
BAY 2.10 DC P/P #6 CKT 41-44 CA. A 330	BAY 2.10 DC P/P #6 CKT 45-48 CA. B 329	BAY 2.3 DC P/P #1 CKT 1-4 CA. C 433	BAY 2.3 DC P/P #1 CKT 5-8 CA. D 432	BAY 1.2 DC P/P #2 CKT 9-12 CA. E 431	BAY 2.3 DC P/P #2 CKT 13-16 CA. F 430	BAY 2.3 DC P/P #3 CKT 17-20 CA. G 429	BAY 2.3 DC P/P #3 CKT 21-24 CA. H 428	BAY 2.3 DC P/P #4 CKT 25-28 CA. J 427	BAY 2.3 DC P/P #4 CKT 29-32 CA. K 426
PANEL-11									
BAY 2.11 DC P/P #6 CKT 41-44 CA. A 315	BAY 2.11 DC P/P #6 CKT 45-48 CA. B 314	BAY 2.4 DC P/P #1 CKT 1-4 CA. C 418	BAY 2.4 DC P/P #1 CKT 5-8 CA. D 417	BAY 2.4 DC P/P #2 CKT 9-12 CA. E 416	BAY 2.4 DC P/P #2 CKT 13-16 CA. F 415	BAY 2.4 DC P/P #3 CKT 17-20 CA. G 414	BAY 2.4 DC P/P #3 CKT 21-24 CA. H 413	BAY 2.4 DC P/P #4 CKT 25-28 CA. J 412	BAY 2.4 DC P/P #4 CKT 29-32 CA. K 411
PANEL-12									
BAY 2.13 DC P/P #6 CKT 41-44 CA. A 297	BAY 2.13 DC P/P #6 CKT 45-48 CA. B 296	BAY 2.5 DC P/P #1 CKT 1-4 CA. C 403	BAY 2.5 DC P/P #1 CKT 5-8 CA. D 402	BAY 2.5 DC P/P #2 CKT 9-12 CA. E 401	BAY 2.5 DC P/P #2 CKT 13-16 CA. F 400	BAY 2.5 DC P/P #3 CKT 17-20 CA. G 399	BAY 2.5 DC P/P #3 CKT 21-24 CA. H 398	BAY 2.5 DC P/P #4 CKT 25-28 CA. J 397	BAY 2.5 DC P/P #4 CKT 29-32 CA. K 396
PANEL-13									
BAY 2.14 DC P/P #6 CKT 41-44 CA. A 282	BAY 2.14 DC P/P #6 CKT 45-48 CA. B 281	BAY 2.6 DC P/P #1 CKT 1-4 CA. C 388	BAY 2.6 DC P/P #1 CKT 5-8 CA. D 387	BAY 2.6 DC P/P #2 CKT 9-12 CA. E 386	BAY 2.6 DC P/P #2 CKT 13-16 CA. F 385	BAY 2.6 DC P/P #3 CKT 17-20 CA. G 384	BAY 2.6 DC P/P #3 CKT 21-24 CA. H 383	BAY 2.6 DC P/P #4 CKT 25-28 CA. J 382	BAY 2.6 DC P/P #4 CKT 29-32 CA. K 381
PANEL-14									
BAY 2.15 DC P/P #6 CKT 41-44 CA. A 267	BAY 2.15 DC P/P #6 CKT 45-48 CA. B 266	BAY 2.8 DC P/P #1 CKT 1-4 CA. C 370	BAY 2.8 DC P/P #1 CKT 5-8 CA. D 369	BAY 2.8 DC P/P #2 CKT 9-12 CA. E 368	BAY 2.8 DC P/P #2 CKT 13-16 CA. F 367	BAY 2.8 DC P/P #3 CKT 17-20 CA. G 366	BAY 2.8 DC P/P #3 CKT 21-24 CA. H 365	BAY 2.8 DC P/P #4 CKT 25-28 CA. J 364	BAY 2.8 DC P/P #4 CKT 29-32 CA. K 363
PANEL-15									
BAY 2.16 DC P/P #6 CKT 41-44 CA. 252 A	BAY 2.16 DC P/P #6 CKT 45-48 CA. 251 B	BAY 2.9 DC P/P #1 CKT 1-4 CA. 355 C	BAY 2.9 DC P/P #1 CKT 5-8 CA. 354 D	BAY 2.9 DC P/P #2 CKT 9-12 CA. 353 E	BAY 2.9 DC P/P #2 CKT 13-16 CA. 352 F	BAY 2.9 DC P/P #3 CKT 17-20 CA. 351 G	BAY 2.9 DC P/P #3 CKT 21-24 CA. 350 H	BAY 2.9 DC P/P #4 CKT 25-28 CA. 349 J	BAY 2.9 DC P/P #4 CKT 29-32 CA. 348 K
PANEL-16									
EQUIP A	EQUIP B	EQUIP C	EQUIP D	EQUIP E	EQUIP F	EQUIP G	EQUIP H	EQUIP J	EQUIP K

EL5KX027

Figure 2-12. Red Digital and VF IDF Panels 9 Through 16, Cable Details.

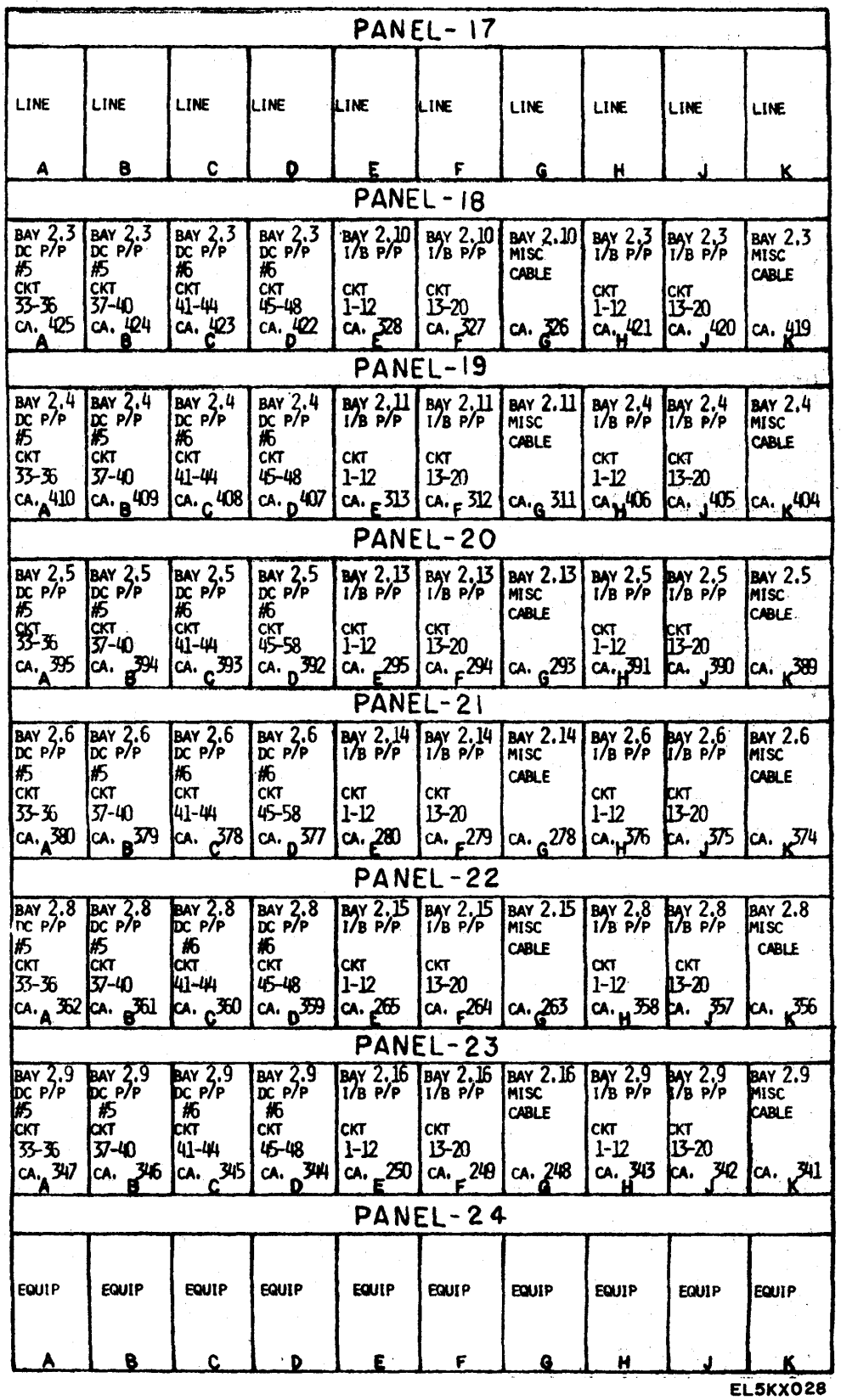


Figure 2-13. Red Digital and VFIDF Panels 17 Through 24, Cable Details.

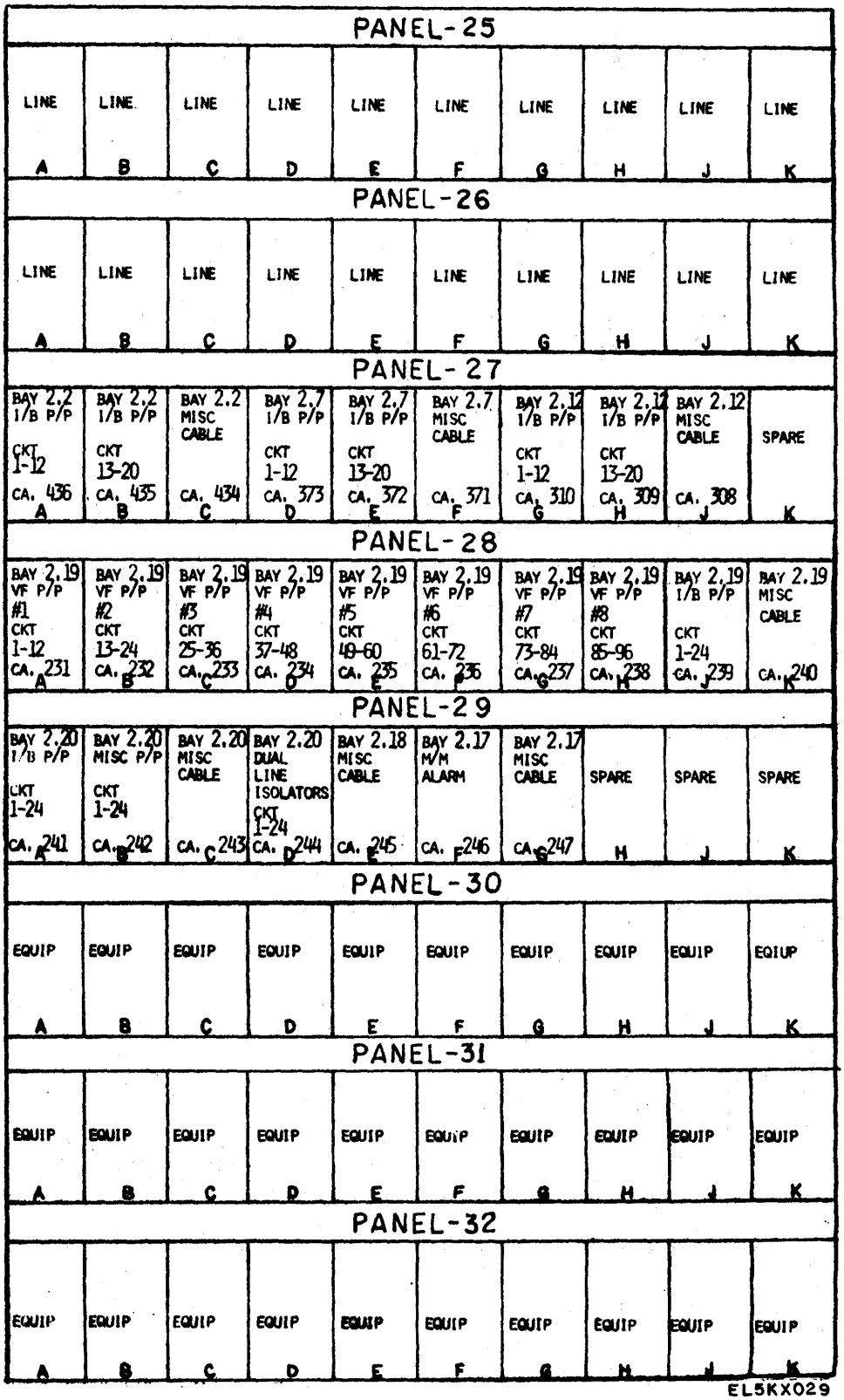


Figure 2-14. Red Digital and VF IDF Panels 25 Through 32, Cable Details.

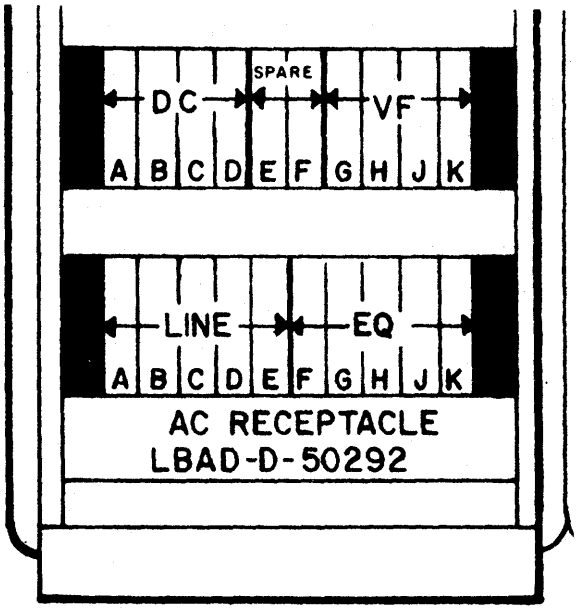


Figure 2-15. Special Intelligence Bay IDF, Front View.

Section II. TYPICAL VF CIRCUIT AND PATCH PANEL

2-4. Typical VF Circuit Connections

(fig. FO-3)

a. General. The circuit is one that is typical to the P&T at the Pentagon. The box in the top left hand corner of the diagram represents line connections to the telephone company or multiplex equipment. The box in the lower left hand corner, represents the equipment side of the circuit. The circuit is a two-way (transmit and receive) four-wire communications circuit.

b. Transmit Circuit. The transmit circuit begins with the cable pair from the equipment at the bottom of the diagram. The RECEIVE FROM pair is connected to pins 1 and 2 of connector J-1 on the rear of IDF panel 8 of bay 1.1. These two pins are connected to jacks 1 and 2 on cross-connect module A of panel 8. The pair for RECEIVE FROM wires are cross-mounted from panel 8 to jacks 3 and 4 of module A on panel 4, with a dual plug cross-connect patch cord. The first six jacks of module A on panel 4 are wired to jack set No. 1 (TRANS) of patch panel No. 1 in bay 1.7 as shown in the diagram. The equipment jacks are connected to jacks 3 and 4 of crossconnect module A in panel 4 of bay 1.1. The line jacks of the same patch. panel are connected to jacks 1 and 2 of the same cross-connect module. The EQUIP and LINE patch panel jacks are wired normal-through (para 2-5). This provides a complete circuit from jacks 3 and 4 of module A panel 4 to jacks 1 and 2 of the same module. To complete the circuit to the line equipment, a second cross-connect dual plug,, 1 and 2 of patch cord is connected from jacks 1 and 2 of module A, panel 4 to jacks 1 and 2 of module A on panel 1. Jacks 1 and 2 of module A, panel 1 are cabled to the send side of the line vf equipment.

c. Receive Circuit. The receive circuit is similar to the transmit circuit, except the signals travel in the opposite direction. The REC FROM VF EQUIP line, at the top of the diagram, is cabled to pins 3 and 4 of module A on panel 1. The second row of six jacks (7 through 12) of module A, panel 4 are cabled to the No. 2 set of jacks (REC) of patch panel No. 1 in bay 1.7. These jacks are normal through wired to provide a complete circuit from jacks 1 and 2 to jacks 3 and 4 of module A, panel 4. The receive side of the equipment (SEND TO) pair is cabled from jacks 3 and 4 of module A, panel 8 to the receive side of the equipment. To connect this circuit two dual-plug cross-connect patch cords are used at the IDF. One from jacks 3 and 4 of module A, panel 1 to jack 1 and 2, row 2 of module A, panel 4. The second cross-connect patch cord, is connected from jacks 3 and 4, row 2, module A, panel 4 to jacks 3 and 4, row 1, module A, panel 8.

2-5. VF Patch Panel

a. General. The VF patch panels are Lexington-Blue Grass Army Depot (LBAD) D-33674 Two-Wire Audio Patch Panels (fig. 2-16). Each patch panel has 24 sets of four jacks. One set of jacks is used to access a two-wire circuit. When a four-wire circuit (transmit and receive) is built, two sets of jacks are used. The description in b below covers the use of the panel in a four-wire circuit similar to that discussed in paragraph 2-4.

b. Description and Circuits. Each patch panel contains 12 channels. Each channel occupies a paired jackset (a jackset consists of 4 jacks arranged vertically) of the panel as shown in the schematic diagram, figure FO-4. The transmit circuit occupies the left jackset (odd numbered jacks) in each paired jackset, and the receive jackset occupies the right jackset (even numbered jacks); therefore, the jacks should be alternately labeled "TRANS" and "REC." The top row of jacks are labeled "LINE" and are electrically toward the line or away from the TCF equipment. The Second Row is labeled "EQUIP" and is electrically toward the local equipment. The top two rows, are normal-through wired to allow breaking of the circuit for testing and rerouting it via patch cords. The top allows the operation to be performed on the portion of the circuit toward the incoming or outgoing line, while the second row allows the operation to be performed on the portion of the circuit toward the local equipment. The jacks in rows 3 and 4 are parallel wired to monitor the jacks in rows 1 and 2 respectively. These jacks do not interfere with the circuit. The patch panels have two cable connectors mounted on the rear of the panel and are used to bring the transmit and receive circuit leads from the IDF into the panel.

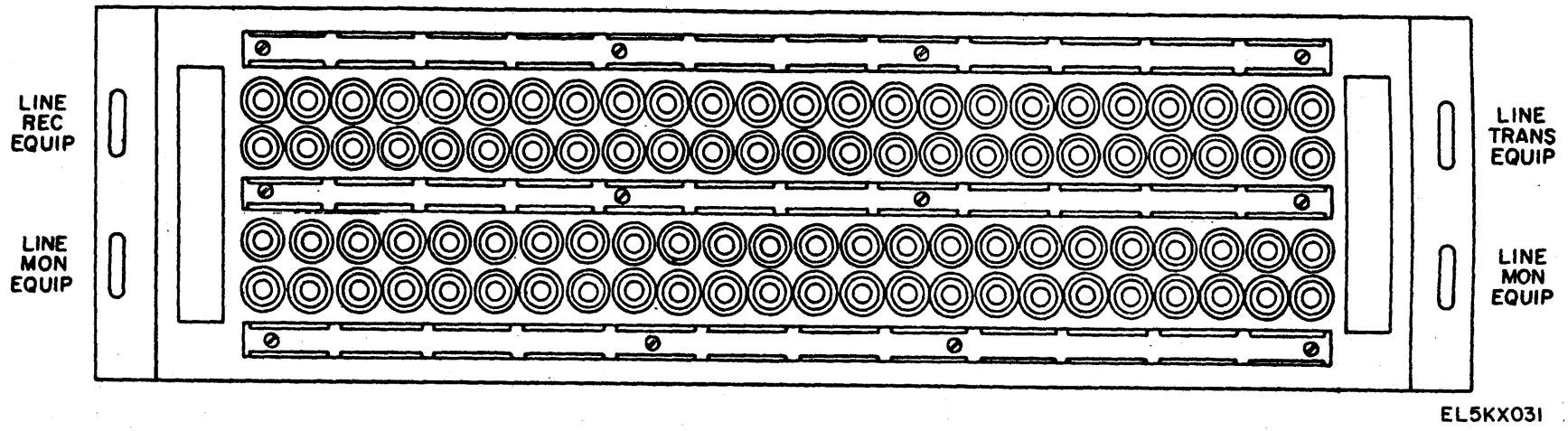


Figure 2-16. VF Patch Panel, Front View.

Section III. TYPICAL BLACK AND RED DIGITAL CIRCUITS AND PATCH PANEL CONFIGURATIONS

2-6. Digital Circuits, General

The P&T of the TCF provides cross-connection, monitoring, testing, circuit patching access, and timing clock for black and red digital circuits. Black and red circuits are discussed in paragraphs 2-7 and 2-8. As shown in figures FO-2.1 and FO-2.2, black and red circuits may be connected back to back at the P&T to bring a channel. through the TCF. Station timing clock isolation circuits are discussed in paragraph 2-9. All digital circuits are connected through a Universal Digital Patch Panel. The patch panel and its different configurations are discussed in paragraphs 2-10 and 2-11.

2-7. Typical Black Digital Circuit

(fig. FO-5)

a. General. In this example of a black digital circuit, the Universal Digital Patch Panel jack sets are programmed with a group 4 module in the send circuit and a group 5 module in the receive circuit. Refer to paragraph 2-11*e* and *f* for patch panel circuit details. This circuit is crossconnected in IDF bay 1.10. The local equipment (EQUIP side of circuit) is cabled to module A of panel 6. The line equipment (LINE side of circuit) is cabled to module A of panel 1. The jack sets of the Universal Digital Patch Panel are cabled to module A of panel 2. Optional devices are not used, but connections that could be used are shown.

b. Send Circuit. To complete the send circuit, dual-plug, cross-connect patch cords are installed as follows:

(1) Patch cord No. 4, from jacks 1 and 2, module A, panel 6 to jacks 1 and 2, row 2, module A, panel 2. This connects the transmit data output of the local equipment to pin 5 of patch panel connector C- 1. This is the jack sets tip (1) lead, which is normal-through wired to pin 1 (tipT) of patch panel connector C-1. Pin 1 of C-1 is cabled to jack 1 of row 1 in module A, panel 2. The transmit data return is also cross-connected with patch cord No. 4, and is connected to a common tie point.

(2) Patch cord No. 1, between jacks 1 and 2, row 1, module A, panel 2 and pins 1 and 2, row 1, module A, panel 1 completes the transmit data and transmit data return to the line equipment.

(3) Patch cord No. 5, from jacks 3 and 4, row 1, module A, panel 6 to jacks 3 and 4, row 2, module A, panel 2 connects the transmit clock through the R1 and R leads of the patch panel jack set, to jacks 3 and 4, row 1, module A, panel 2 of the IDF. The transmit clock return is also connected to the common tie point through patch cord No. 5.

(4) Patch cord No. 2, from jacks 3 and 4, row 1, module A, panel 2 to jacks 3 and 4, row 1, module A, panel 1 completes the transmit clock and transmit clock return to the line equipment.

c. Receive Circuit. To complete the receive circuit, dual cross-connect patch cords are installed as follows:

(1) Patch cord No. 7, from jacks 1 and 2, row 2, module A, panel 1 to jacks 1 and 2, row 3, module A, panel 2 connects the receive data line to the tip () lead of the patch panel receive jack set. The T lead is normal-through connected to the T1 lead of the patch panel jack set and cabled to jack 1, row 4, module A, panel 2 of IDF. The same patch cord connects the receive data return line to a common tie point and to jack 2, row 4, module A, panel 2 of the IDF.

(2) Patch cord No. 10, from IDF jacks 1 and 2, row 4, module A, panel 2 to jacks 1 and 2, row 2, module A, panel, 6 completes the receive data connection from the patch panel jack set to the receive pair of the local equipment.

(3) Patch cord No. 8, from jacks 3 and 4, row 2, module A, panel 1 to jacks 3 and 4, row 3, module A, panel 2 connects the receive clock to the ring (R) lead of the patch panel jack set. The R lead is normal-through wired to the R1 lead of the jack set and cabled to jack 3, row 4, module A, panel 2 of the IDF. The same patch cord also connects the receive clock return to a common tie point and to jack 4, row 4, module A, panel 2 of the IDF.

(4) Patch cord No. 11, from jacks 3 and 4, row 4, module A, panel 2 to jacks 3 and 4, row 2, module A, panel 6 completes the receive clock circuit to the local equipment.

2-8. Typical Red Digital Circuit

(fig. FO-6)

a. General. In this circuit the equipment and three patch panel jack sets in bay 2.10 are cabled to IDF bay 2.21. The line equipment is connected to module A of panel 1. The patch panel jack sets are wired to module A of panel 2. The local equipment is connected to module A of panel 8. Refer to paragraph 2-11 b, c, and d for patch panel circuit details. A red digital circuit is connected similar to a black digital circuit (para 2-7) except: (1) The circuit is located in equipment row 2 in place of equipment row 1; (2) A control jack set (third jack set) may be used when control functions are required (*b* below); (3) The station clock must be connected through a line isolation circuit (*c* below); (4) Timing clock circuits are not used.

b. Control Circuit. To complete the data inhibit and synchronize circuits, dual-plug cross-connect patch cords are installed as follows:

(1) Patch cord No. 13, from jacks 3 and 4, row 2,

module A, panel 1 to jacks 1 and 2, row 5, module A, panel 2 connects the data inhibit line to the T lead of the patch panel control jack set. The T lead is connected normal-through the jack sets tips to the T1 lead. The T1 lead is cabled to jack 1, row 6, of module A in panel 2. The data inhibit return is completed to jack 2, row 6 of module A in panel 2 by a common tie point connection.

(2) Patch cord No. 16, from jacks 1 and 2, row 6, module A, panel 2 to jacks 3 and 4, row 2, module A, panel 8 completes the data inhibit circuit to the local equipment.

(3) Patch cord No. 17, from jacks 5 and 6, row 2, module A, panel 8 to jacks 3 and 4, row 6, module A, panel 2 connects the synchronize initiate lead to the R1 lead of the patch panel jack set. The R1 lead is connected normal-through jack sets rings to the R lead. The R lead is cabled to jack 3, row 5 of module A in panel 2. The synchronize initiate return is completed to jack 4, row 5 of module A in panel 2 by a common tie point connection.

(4) Patch cord No. 14, from jacks 3 and 4, row 5, module A, panel 2 to jacks 5 and 6, row 2, module A, panel 1 completes the synchronize initiate circuit to the line equipment.

2-9. Station Clock Isolation Circuit

(fig. 2-17)

a. The station clock outputs are cabled to the black IDF. When timing signals from the station clock must be used in a red circuit, isolation between the red circuit and the black IDF is required.

b. Isolation is accomplished by cross-connecting the clock to a digital line isolator input module (located in bay 2.20). The digital line isolators output module is crossconnected to the red circuit at the red IDF.

c. One way optical coupling prevents anything from being fed from the red circuit back to the station clock.

2-10. Universal Digital Patch Panel

a. Description. The front of the patch panel (fig. 2-18) contains 24 sets of four jacks with a switch and lamp that is associated with each jack set. There are three rows of identification (ID) card holders. The card holders allow the circuit and equipment connected to the circuit to easily be identified. The rear of each patch panel (fig. 2-19), has two connectors (C1 and C2), that are used to connect the jack set circuits (through connectors J1 and J2) to the IDF.

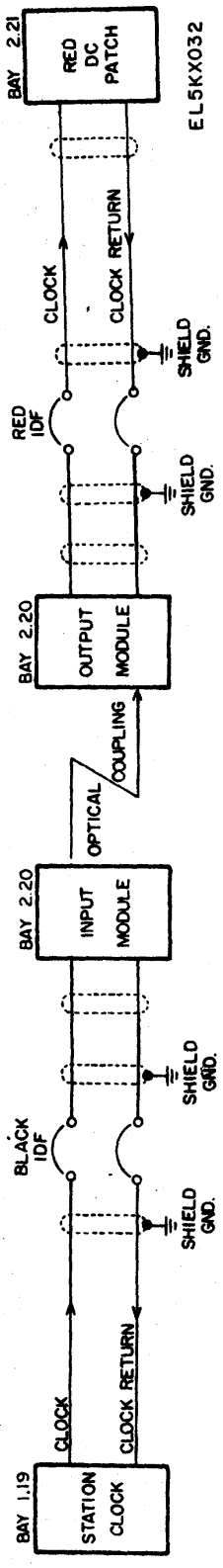


Figure 2-17. Digital Line Isolators, Wiring Diagram

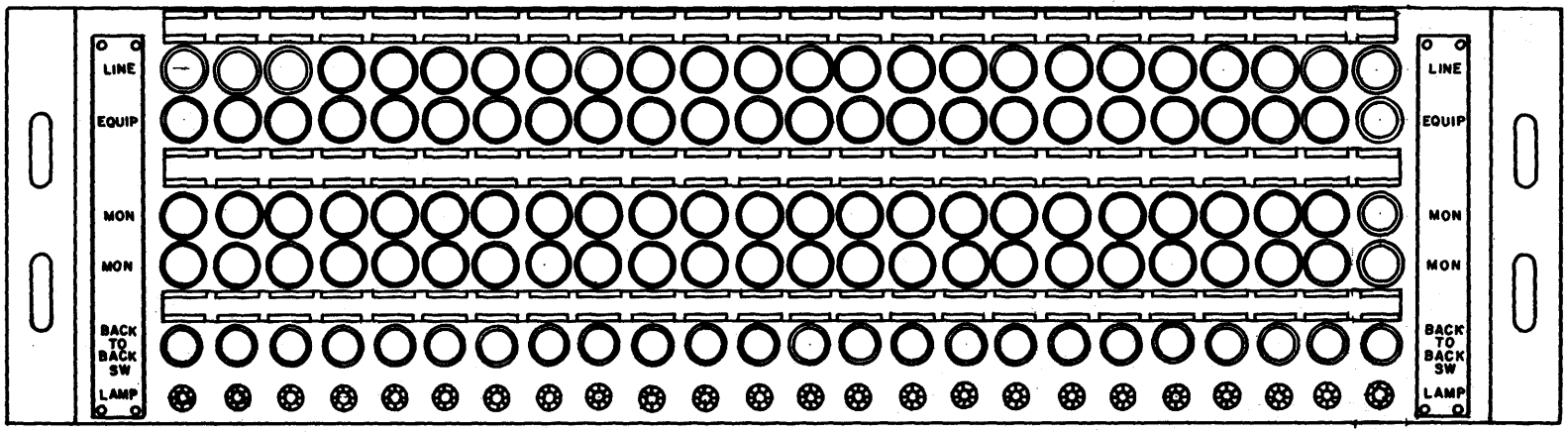


Figure 2-18. Universal Digital Patch Panel Front View.

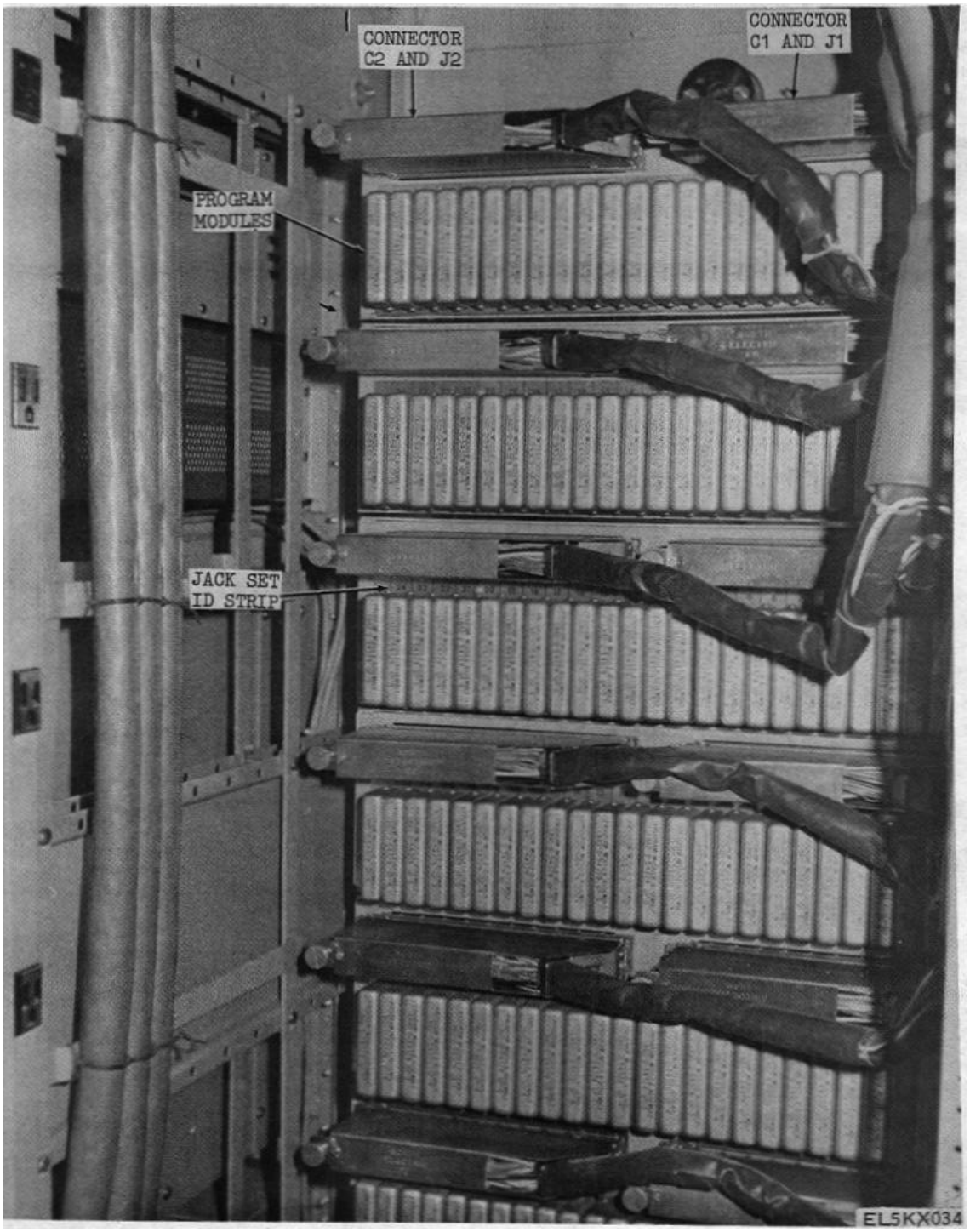


Figure 2-19. Universal Digital Patch Panel Bay, Rear View.

Below the connectors are 24 program modules. Between the connectors and program boards there is a jack set ID strip indicating the jack set associated with each program aboard.

b. Circuit Functions (fig. FO-7). Each jack set is connected (through a flexible printed circuit board) to a program board. The board is programmed by a program module (containing jumpers) to set up an operation circuit. The functions that may be performed by the circuits are given in (1) through (6) below. The actual circuits for which modules are available are given in paragraph 2-11.

(1) Provides a normal through path for digital signals when no patches are made.

(2) When patching in a replacement sending device, the patching configuration will terminate the interrupted sending equipment in an impedance equal to the input impedance of the receiving device.

(3) When patching in a replacement receiving device the patching configuration will hold the interrupted receiving equipment with a holding voltage or current equal to the mark voltage or current transmitted by the sending device.

(4) The patch panel will perform the above functions for all the following types of digital signals:

(*a*) Low level ± 6 VDC send and receive.

(*b*) Low level ± 3 VDC send and receive.

(*c*) High level polar or neutral send and receive.

(*d*) Low level receive with associated timing.

(e) Low level send with timing from sending to receiving device.

(f) Low level send with timing from receiving to sending device.

(g) Low level send with timing from an external standard to both sending and receiving devices.

(5) The patch panel also incorporates a special function for those circuits utilizing either an external timing standard or timing from a receiving device to a sending device. When a transmitted signal is to be patched back to the receiving portion of the same equipment for testing purposes, a problem would normally arise. Since external timing is necessarily introduced on the line side of a jack field, a line-send-to-line-receive (back to back line) patch required to perform the above test for equipment external to the TCF contains two timing signals (one injected into the send field and one received on the incoming line).
Conversely, an equipment send-to-equipment-receive (back to back equip) patch required to perform the test for equipment internal to the TCF contains no timing signal.
When timing is sent from a receiving device to a sending device the same problem can occur (i.e., two timing signals on a back to back line and none on a back to back equip). A push button "back-to-back" switch allows the removal of one of the two timing signals present in a back to back line patch and the introduction of timing in a back-to-back equip patch. An indicator light as well as switch position indicates the activation of this function in all cases.

(6) The signal common "ring" lead of an interrupted signal is never left open. It may be supplied DC ground or another program elected termination.

2-11. Universal Digital Patch Panel, Programs

a. General. There are 17 different program modules provided to be used with the patch panel. The modules are identified as PROGRAM MODULE ASSEMBLY LBAD-D-52724 GP-1 through GP-17. The circuit configuration for each group is shown in figures 2-20 through 2-36. The in module jumpers and jack functions are given in b through r below. The function of each group module is as follows:

Group No.	*Function*
1	Red Receive
2	Red Send
3	Red Control
4	Black Send
5	Black Receive
6	High Level Send
7	High Level Receive
8	Low Level Send W/Timing From External Standard To Both Sender & Data Receiver
9	Low Level Send W/Timing From Data Receiver To Data Sender
10	Low Level Send W/Timing From Data Sender To Data Receiver
11	Low Level Receive W/Timing (Always From Data Sender To Data Receiver).
12	Low Level ± 6 VDC Send
13	Low Level ± VDC Receive
14	Low Level Balanced (+3V and -3V) Send.
15	Low Level Balanced (±3V and -3V) Receive.
16	Black Send (Modified - Less Station Clock)
17	Black/Red Receive

NOTE

For terminal identification figures 2-20 through 2-36, refer to figure FO-7.

b. Red Receive Circuit, Program Module GP-1 (fig. 2-20).

(1) This programming module connects the following terminals:

B2 to E1
B1 to J3
C1 to F3
B3 to J1
D2 to K3
L1 to J1
F2 to F3
M3 to J3
H3 to El

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	Termination
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	Unterminated
R1	Unterminated

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	Unterminated
T1	From line equipment plugged
R1	From line equipment plugged

c. Red Send Circuit, Program Module GP-2 (fig. 2-21).

(1) This programming module connects the following terminals:

B3 to J1
C1 to F3
B1 to 33
B2 to E1
D2 to K3
L1 to J1
F2 to F3
M3 to J3
H3 to E1

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	Unterminated
R1	Unterminated

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	Unterminated
T1	To plugged line equipment
R1	To plugged line equipment

d. Red Control Circuit, Program Module GP-3 (fig. 2-22).

(1) This programming module connects the following terminals:

B2 to E1
B1 to J3
C1 to F3
B3 to J1
L1 to J1
F2 to F3
M3 to J3
H3 to E1
D2 to K3
C2 to D2
C3 to D1
C3 to K3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	Unterminated
R1	Unterminated

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	Unterminated
T1	From plugged line equipment
R1	From plugged line equipment

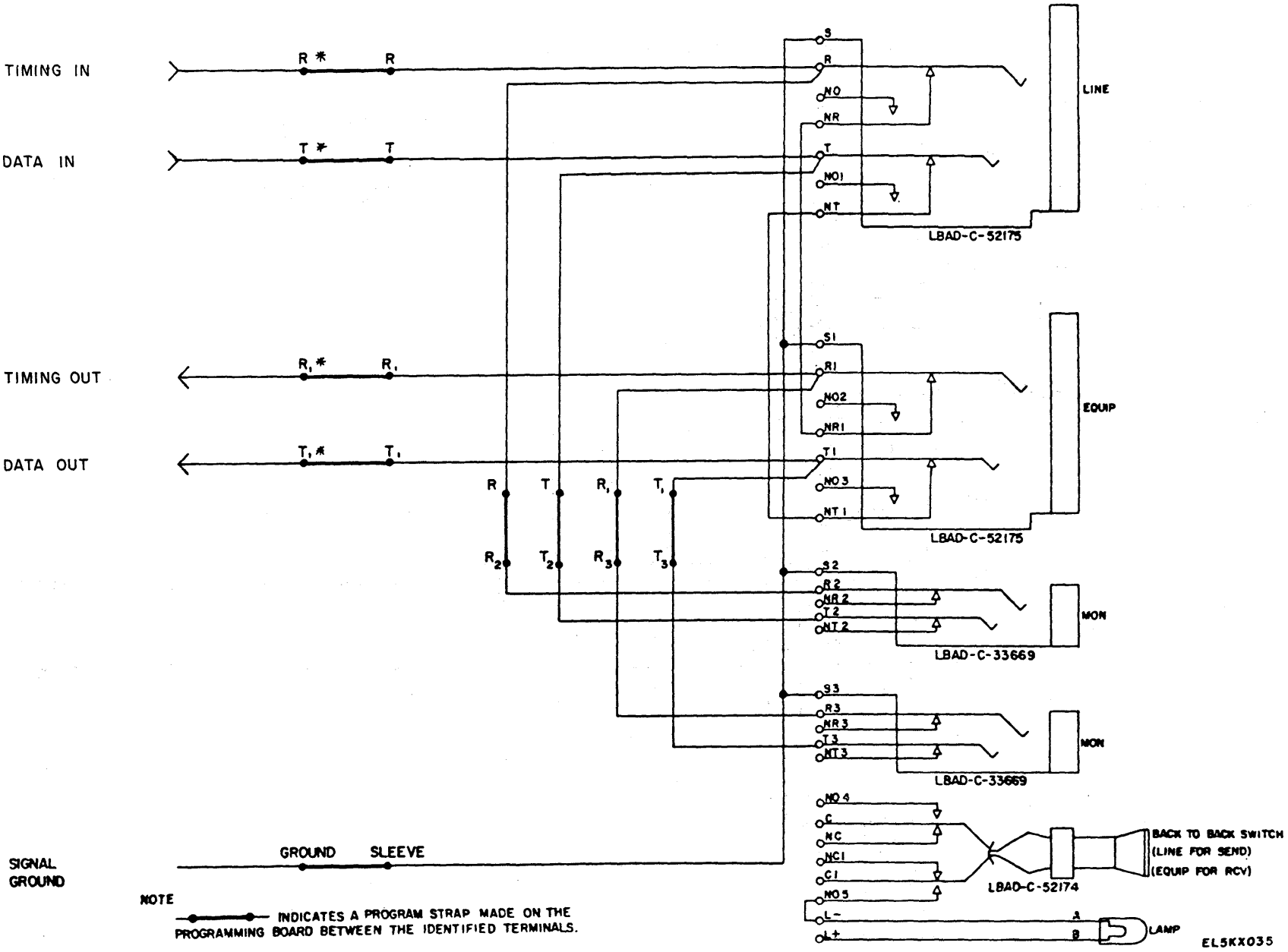


Figure 2-20. Universal Digital Patch Panel, Red Receive Circuit Schematic Diagram.

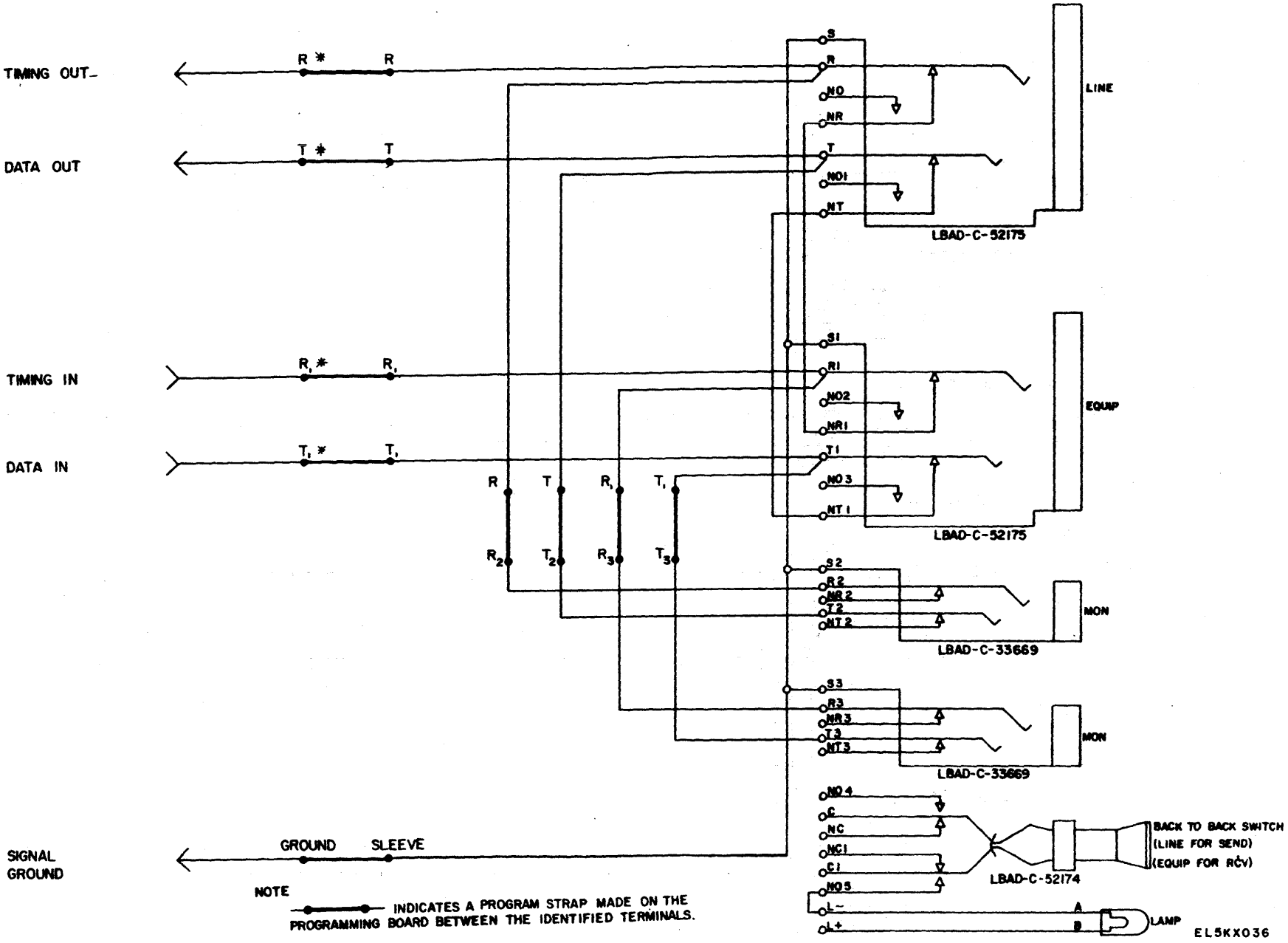


Figure 2-21. Universal Digital Patch Panel, Red Send Circuit, Schematic Diagram.

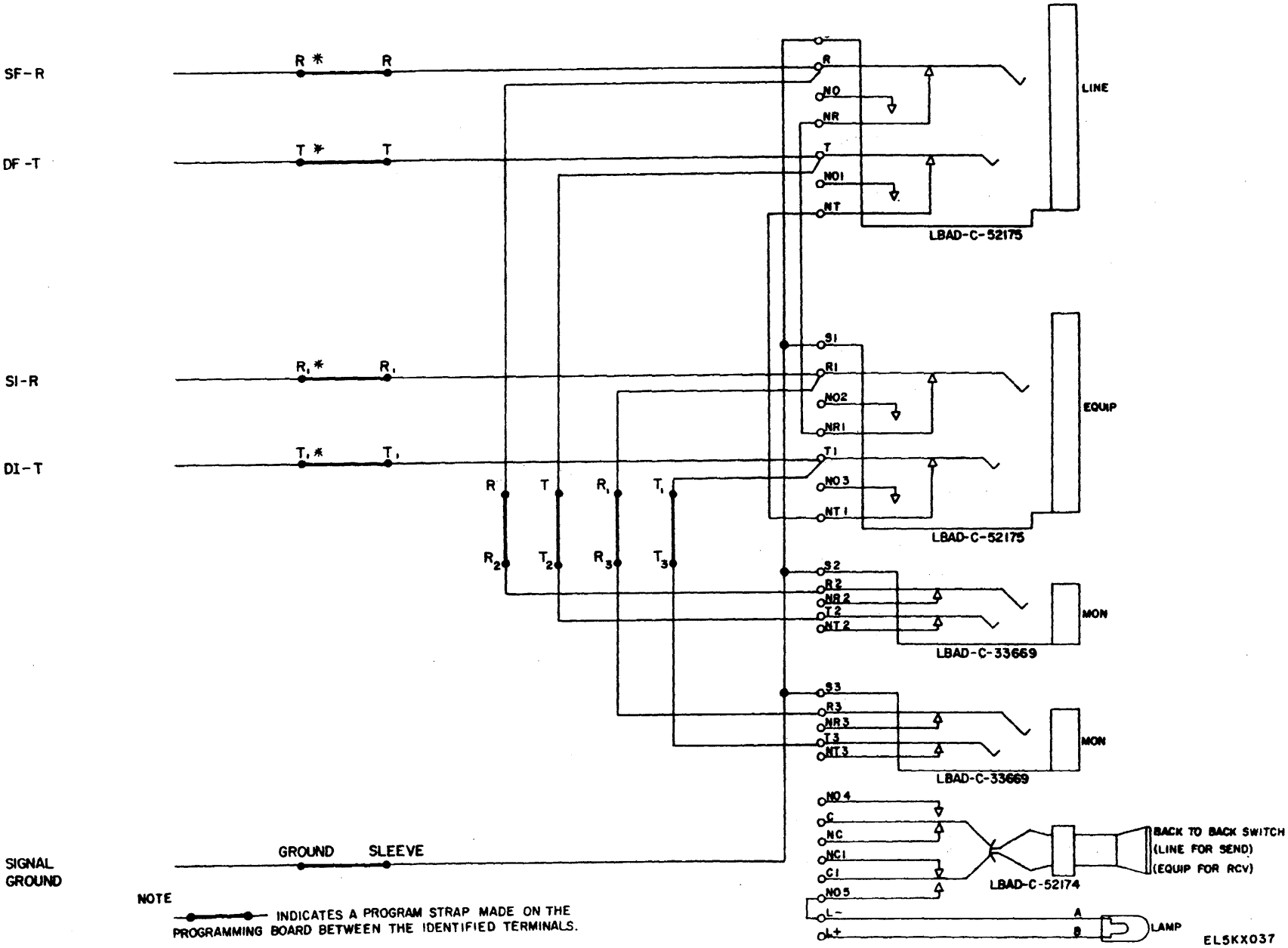


Figure 2-22. Universal Digital Patch Panel, Red Control Circuit, Schematic Diagram

e. Black Send Circuit, Program Module GP-4 (fig. 2-23).

(1) This programming module connects the following terminals:

B2 to E1
B1 to J3
C1 to F3
B3 to J1
C2 to N2
D2 to K3
D2 to M2
D3 to E2
M3 to J3
H3 to E1
L1 to J1
F2 to F3
H3 to N3
A1 to H1
A2 to M1
E3 to K1
H3 to N3
C3 to D1
C3 to K3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF plugged equipment
R	From TCF plugged equipment
T1	Unterminated
R1	External timing

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	External timing
T1	To plugged line equipment
R1	To plugged line equipment

f. Black Receive Circuit, Program Module GP-5 (fig. 2-24).

(1) This programming module connects the following terminals:

B2 to E1
B1 to J3
C1 to F3
B3 to J1
C2 to N2
D2 to K3
E3 to M2
D3 to E2
M3 to J3
H3 to E1
L1 to J1
F2 to F3
G1 to F3
C3 to D2
D1 to C3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	Unterminated
R1	Unterminated

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	Unterminated
T1	From plugged line equipment
R1	From plugged line equipment

g. High Level Send Circuit, Program Module GP-6 (fig. 2-25).

(1) This programming module connects the following terminals:

B3 to L1
C1 to F3
B1 to M3
B2 to El
D2 to L3
A3 to H1
D2 to M1
D1 toK1
J3 to H3
N1 to L2
J1 to F2
K2 to F1

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF plugged equipment
R	From TCF plugged equipment
T1	High level termination
R1	Grounded

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

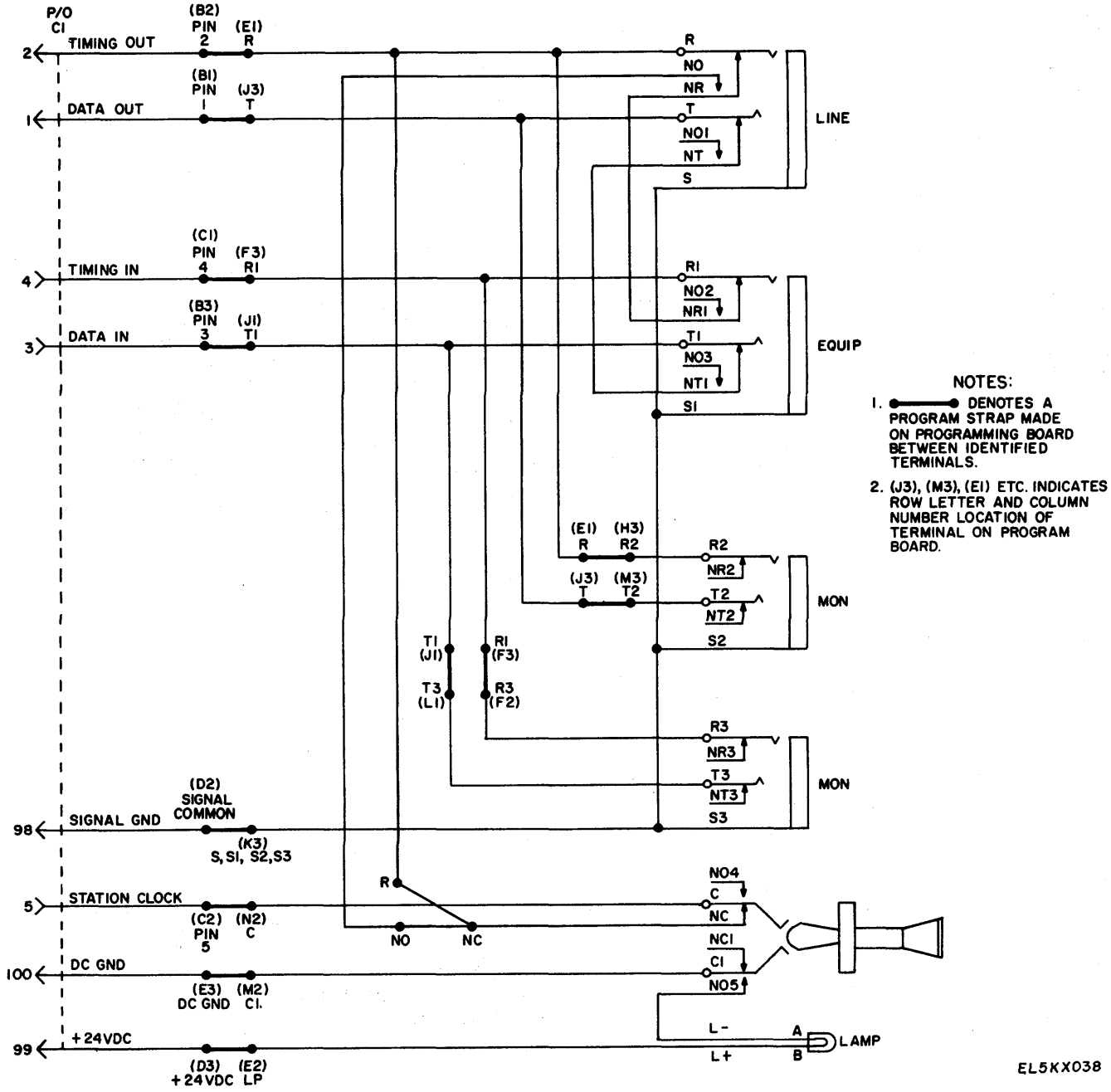


Figure 2-23. Universal Digital Patch Panel, Black Send Circuit, Schematic Diagram

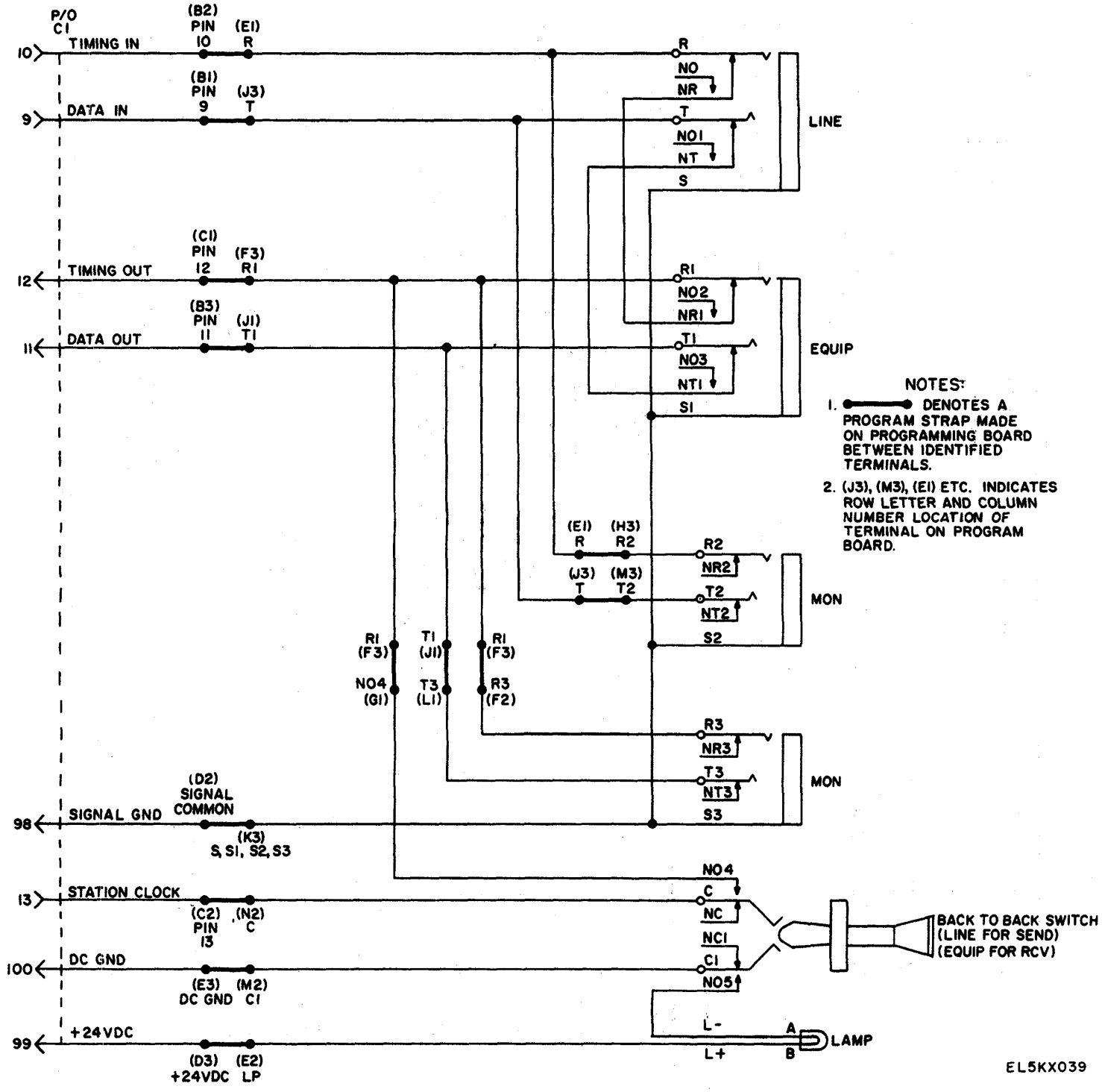


Figure 2-24. Universal Digital Patch Panel Black Receive Circuit, Schematic Diagram

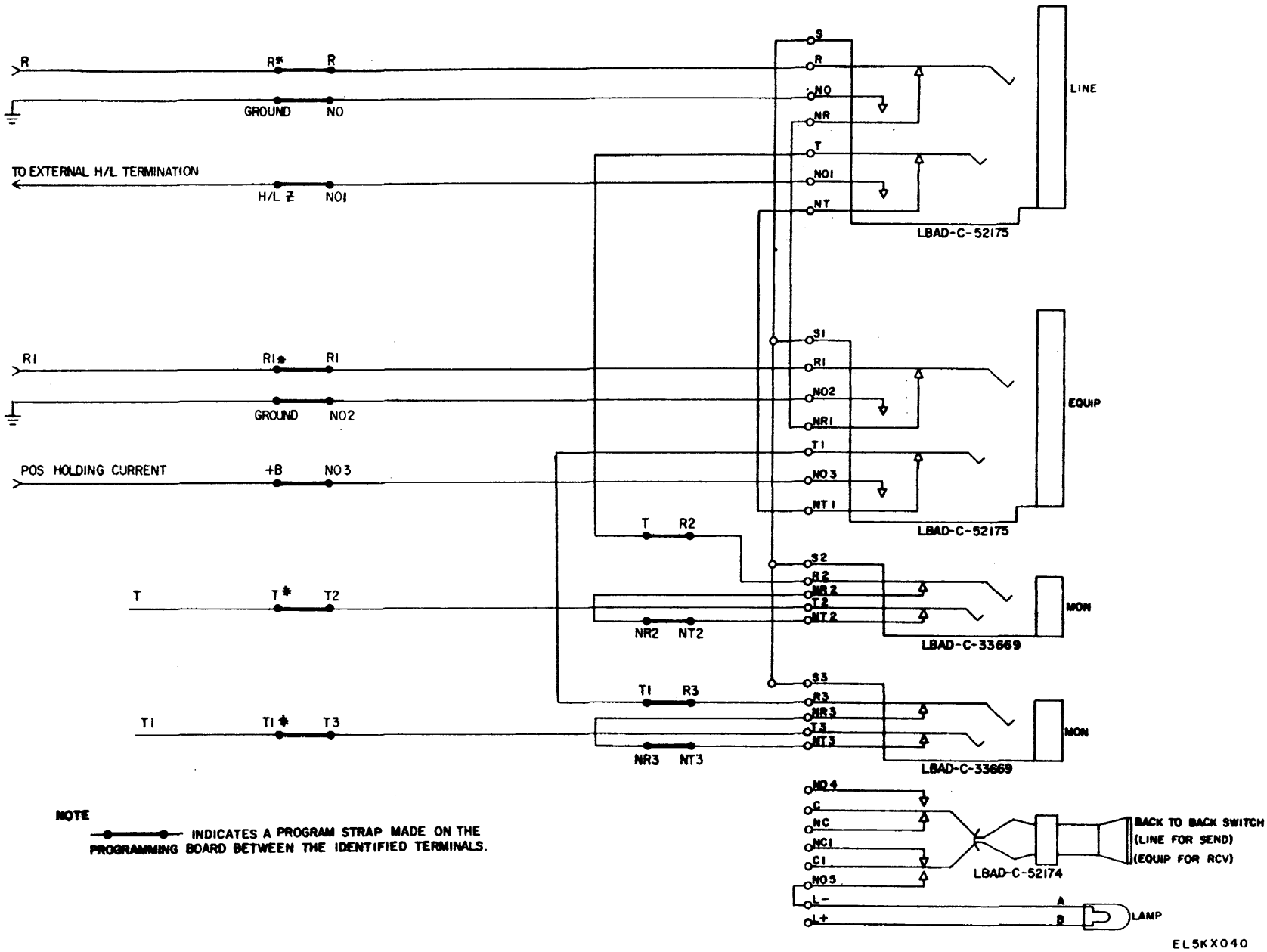


Figure 2-25. Universal Digital Patch Panel, High Level Send Circuit, Schematic Diagram

Terminal	*Termination*
T	POS hold battery
R	Grounded
T1	To plugged line equipment
R1	To plugged line equipment

h. High Level Receive Circuit, Program Module GP-7 (fig. 2-26).

(1) This programming module connects the following terminals:

B1 to M3
B2 to E1
B3 to L1
C1 to F3
D2 to L3
D1 to H1
D2 to M1
A3 to K1
J3 to H3
N1 to L2
J1 to F2
K2 to F1

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	POS hold battery
R1	Grounded

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	High level termination
R	Grounded
T1	From plugged line equipment
R1	From plugged line equipment

i. Low Level Send Circuit (with Timing from an External Standard to both Sender and Data Receiver). Program Module GP-8 (fig. 2-27).

(1) This programming module connects the following terminals:

B3 to J1
C1 to F3
B1 to J3
B2 to E1
A1 to H1
D1 to K1
C2 to L3
D2 to K3
E3 to M2
D3 to E2
J2 to J3
G3 to E1
G2 to J3
H2 to E1
E1 to N3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF equipment plugged
R	External timing to TCF equipment plugged.
T1	Terminated across 56K
R1	External timing

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	POS hold battery
R	External timing
T1	To line equipment plugged
R1	To line equipment plugged

j. Low Level Send Circuit (with Timing from Data Receiver to Data Sender). Program Module GP-9 (fig. 2-28).

(1) This programming module connects the following terminals:

B3 to J1
B2 to N2
B1 to J3
C1 to F3
C2 to L3
N3 to E1
A1 to H1
A2 to M1
D1 to K1
D2 to K3
E3 to M2
D3 to E2
J2 to J3
G3 to E1
G2 to J1
H2 to F3

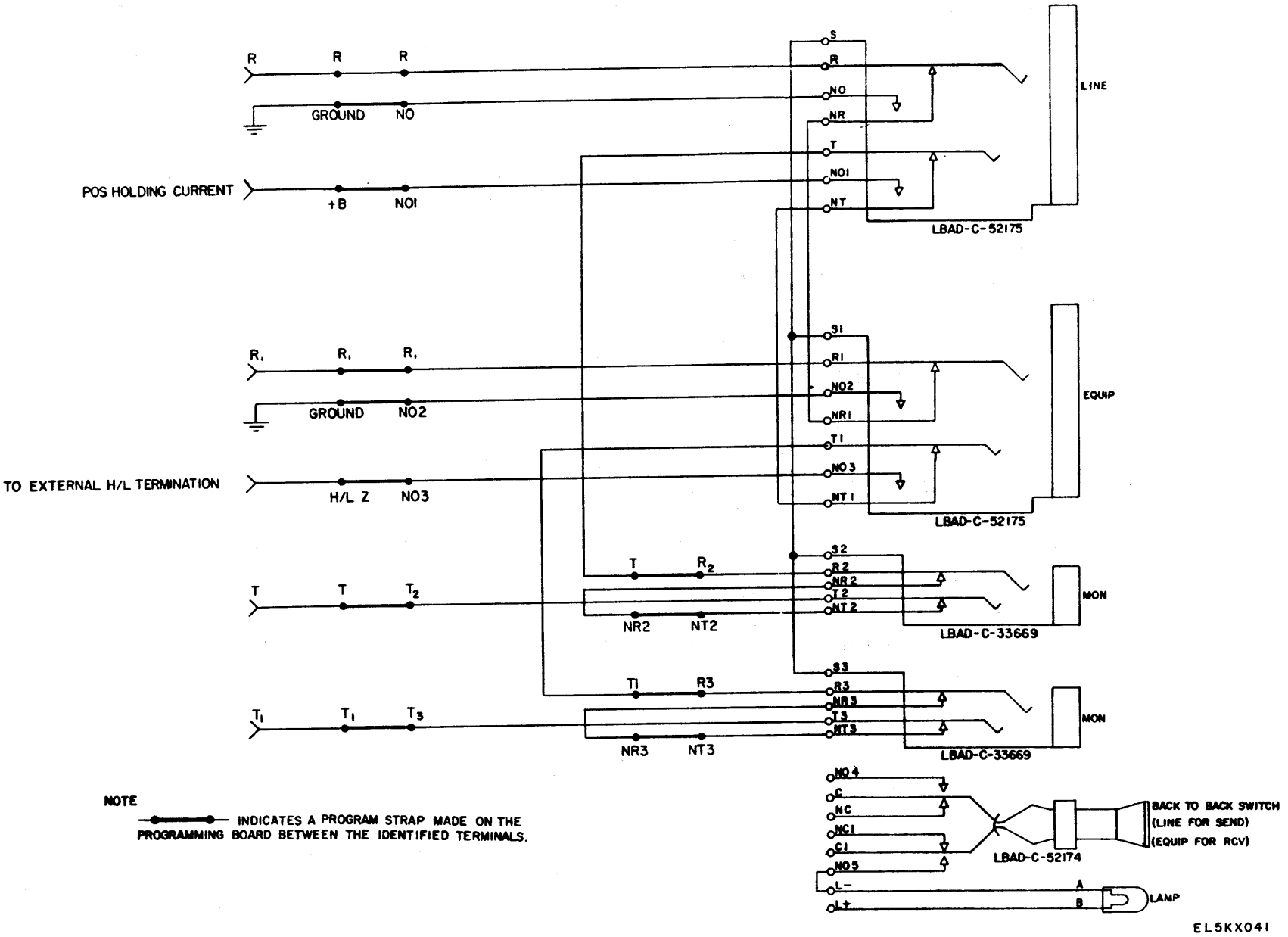


Figure 2-26. Universal Digital Patch Panel, High Level Receive Circuit, Schematic Diagram.

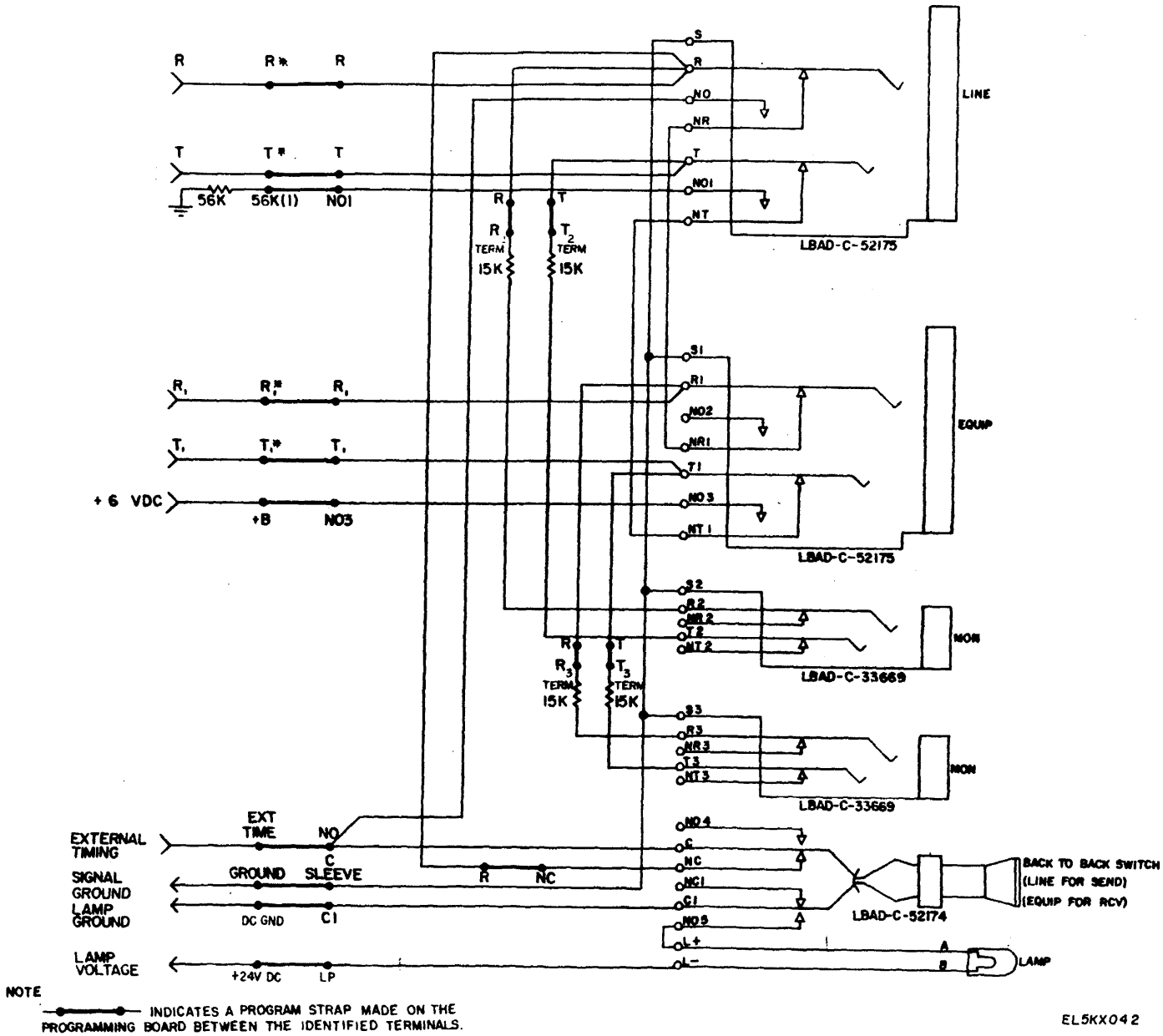


Figure 2-27. Universal Digital Patch Panel, Low Level Send Circuit (with Timing from an External Standard to Both Sender and Data Receiver), Schematic Diagram.

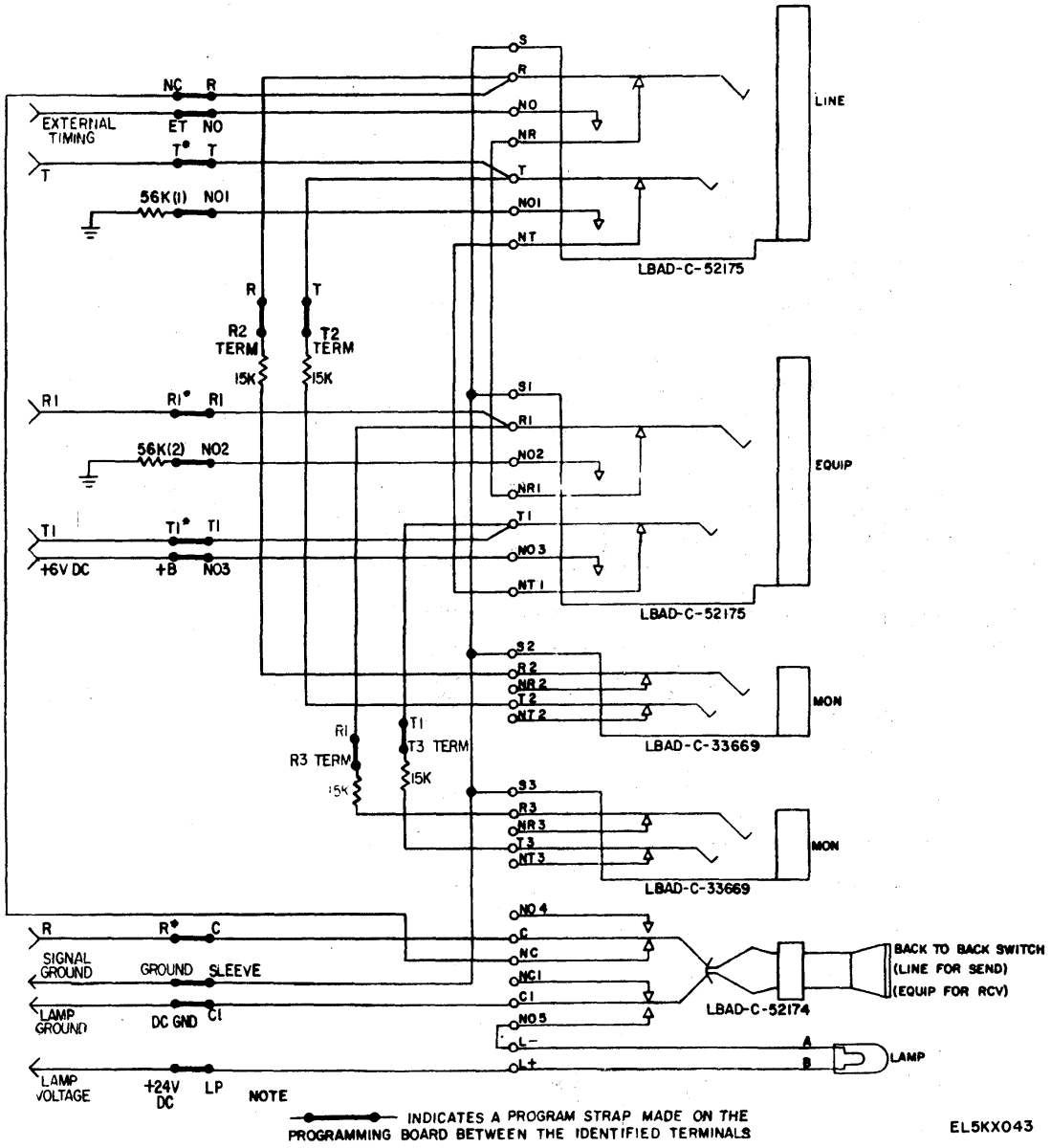


Figure 2-28. Universal Digital Patch Panel, Low Level Send Circuit (with Timing from Data Receiver to Data Sender), Schematic Diagram.

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF equipment plugged
R	To TCF equipment plugged
T1	Terminated across 56K to ground
R1	External timing

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	POS hold battery
R	Terminated across 56K to ground
T1	To line equipment plugged
R1	From line equipment plugged

k. Low Level Send Circuit (with Timing from Data Sender to Data Receiver), Program Module GP-10 (fig. 2-29).

(1) This programming module connects the following terminals:

B3 to J1
C1 to F3
B1 to J3
B2 to F1
C2 to M1
A1 to L3
A2 to H1
D1 to K1
D2 to K3

E3 to M2
D3 to E2
J2 to J3
G3 to E1
G2 to J1
H2 to F3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF plugged equipment
R	From TCF plugged equipment
T1	Terminated across 56K to ground
R1	Terminated across 56K to ground

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	POS hold battery
R	External timing
T1	To plugged line equipment
R1	To plugged line equipment

l. Low Level Receive Circuit (with Timing from Data Sender to Data Receiver), Program Module GP-11 (fig. 2-30).

(1) This Programming Module connects the following terminals:

B1 to J3
B2 to E1
B3 to J1
C1 to F3
C2 to N2
C2 to L3
D1 to H1
Al to M1
A2 to K1
D2 to K3
E3 to M2
D3 to E2
J2 to J3
G3 to E1
G2 to J1
H2 to F3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	POS hold battery
R1	External timing

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Terminated across 56K
R	Terminated across 56K
T1	From line equipment plugged
R1	From line equipment plugged

m. Low Level +6 VDC Send Circuit, Program Module GP-12 (fig. 2-31).

(1) This programming module connects the following terminals:

B1 to J3
B2 to E1
B3 to J1
C1 to F3
D2 to L3
A1 to H1
D2 to M1
D1 to K1
J2 to J3
G3 to E1
G2 to J1
H2 to F3

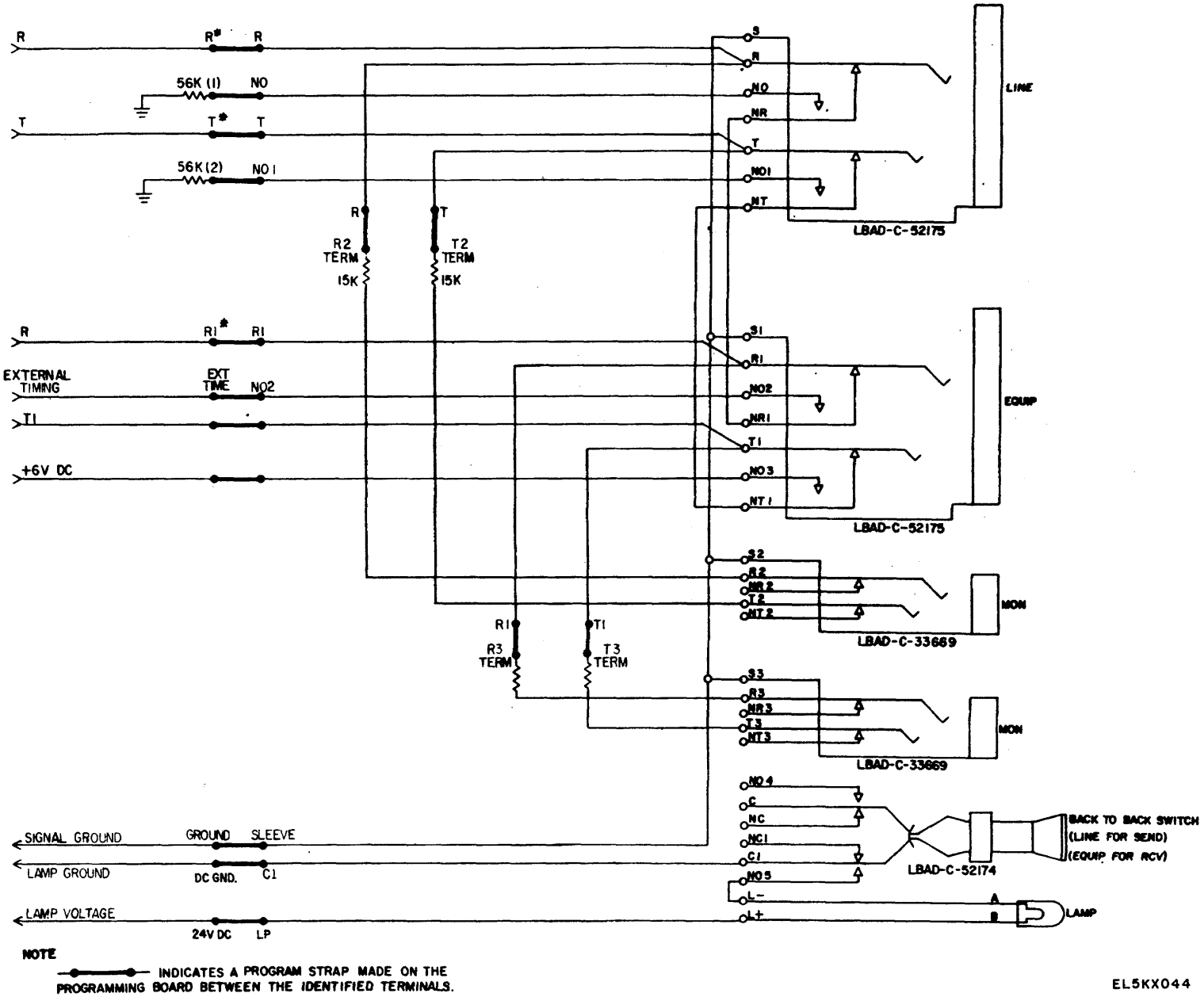


Figure 2-29. Universal Digital Patch Panel, Low Level Send Circuit (with Timing from Data Sender to Data Receiver), Schematic Diagram.

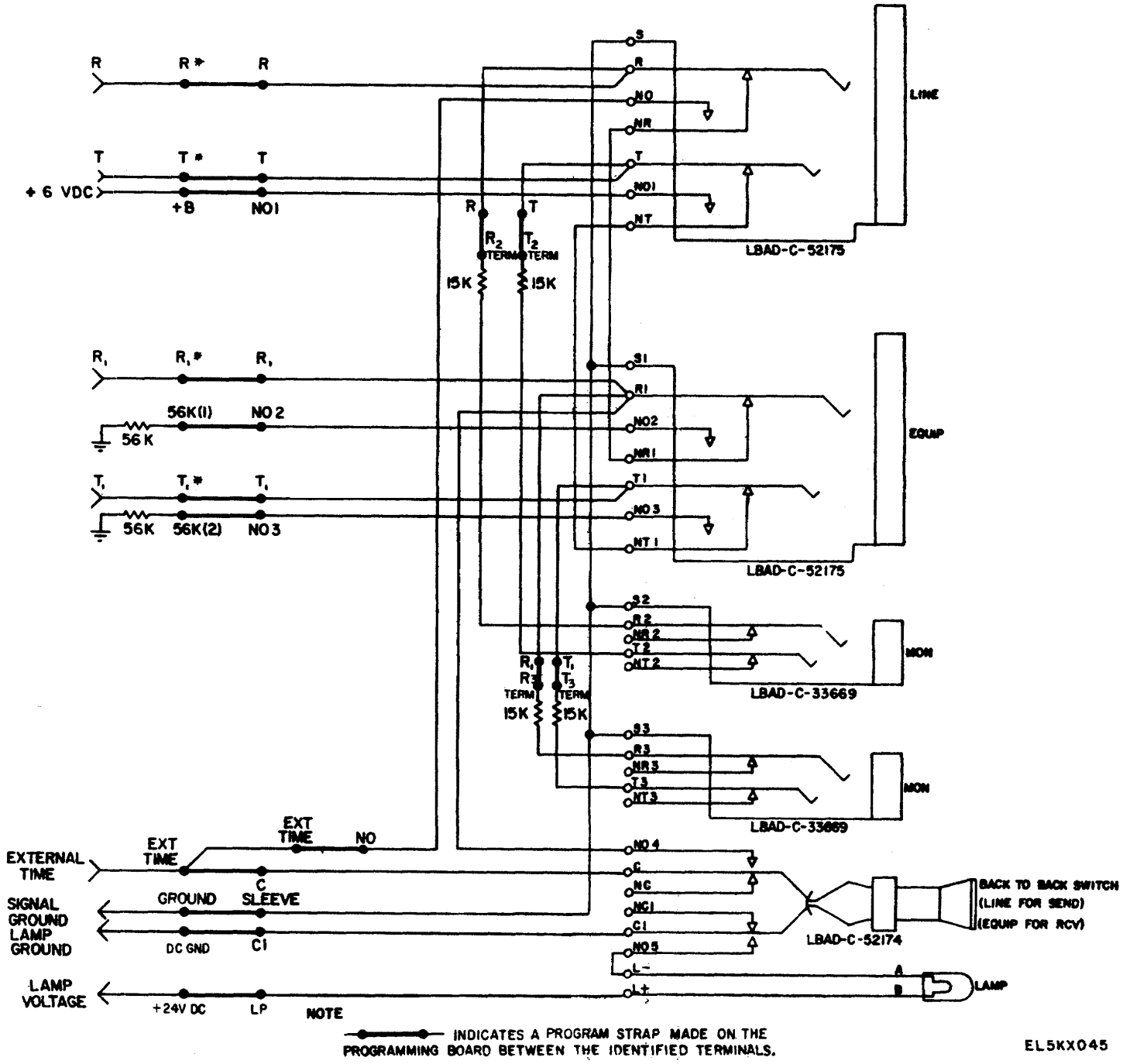


Figure 2-30. Universal Digital Patch Panel, Low Level Receive Circuit (with Timing from Data Sender to Data Receiver), Schematic Diagram

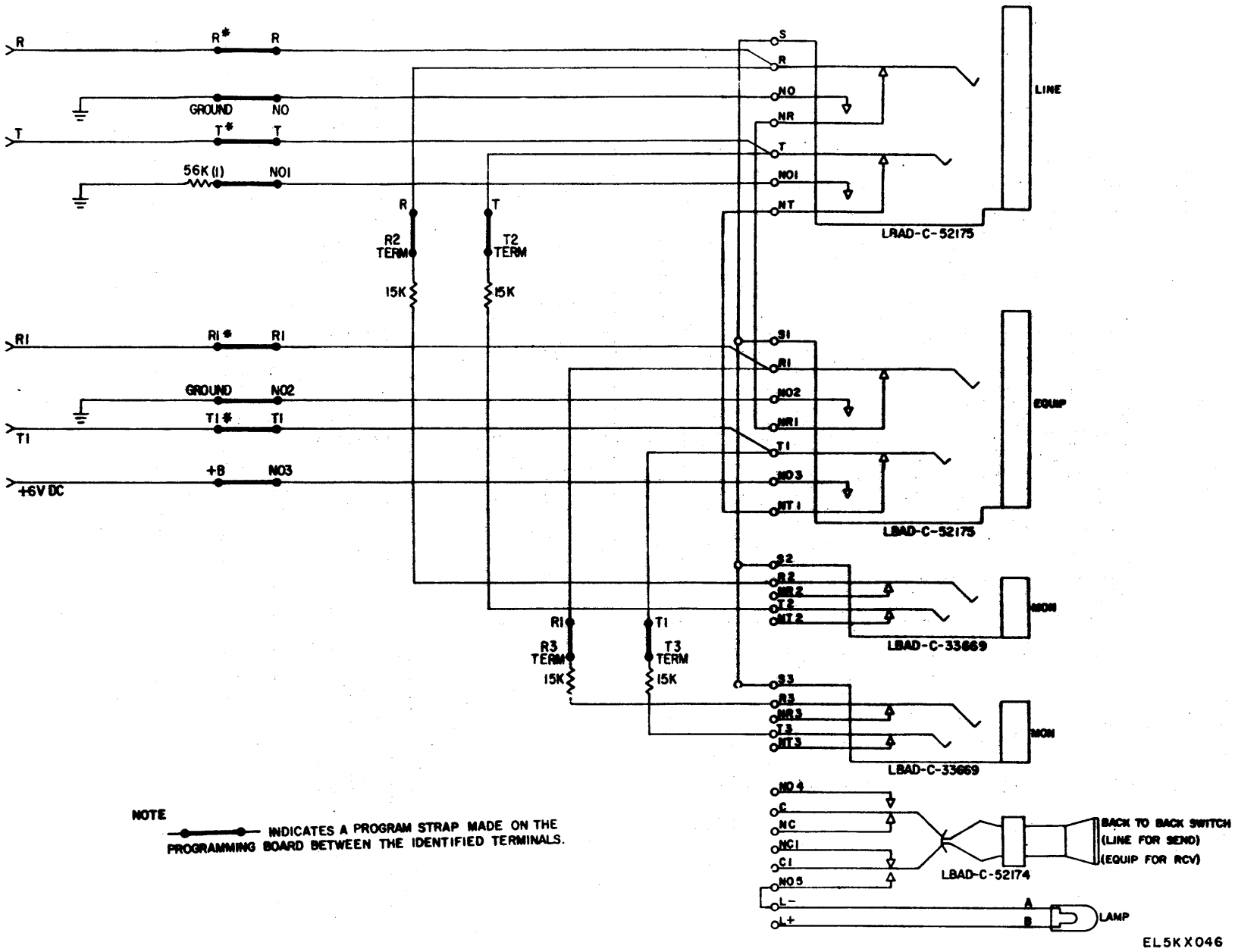


Figure 2-31. Universal Digital Patch Panel, Low Level +6VDC Send Circuit, Schematic Diagram.

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From plugged TCF equipment
R	From plugged TCF equipment
T1	Terminated across 56K
R1	Grounded

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	POS hold battery
R	Grounded
T1	To plugged line equipment
R1	To plugged line equipment

n. Low Level +6 VDC Receive Circuit, Program Module GP-13 (fig. 2-32).

(1) This programming module connects the following terminals:

B1 to J3
B2 to E1
B3 to J1
C1 to F3
D2 to L3
D1 to H1
D2 to M1
H1 to K1
J2 to J3
G3 to E1
G2 to J1
H2 to F3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	POS hold battery
R1	Grounded

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Terminated across 56K
R	Grounded
T1	From line equipment plugged
R1	From line equipment plugged

o. Low Level Balanced (+3V and- V) Send Circuit, Program Module GP-14 (fig. 2-33).

(1) This programming module connects the following terminals:

B3 to J1
C1 to F3
B1 to J3
B2 to E1
A3 to L3
A1to H1
A2 to A1
C3 to M1
D1 to K1
J2 to J3
G3 to E1
G2 to J1
H2 to F3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF equipment plugged
R	From TCF equipment plugged
T1	Terminated across 28K
R1	Terminated across 27K

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	POS hold battery
R	NEG hold battery
T1	To line equipment plugged
R1	To line equipment plugged

p. Low Level Balanced (+3V and - 3V) Receive Circuit, Program Module GP-15 (fig. 2-34).

(1) This programming module connects the following terminals:

B1 to J3
B2 to E1
B3 to J1
C1 to F3
C3 to L3
D1 to H1
A3 to M1
A1 to K1
A2 to A1
J2 to J3
G3 to E1
G2 to J1
H2 to F3

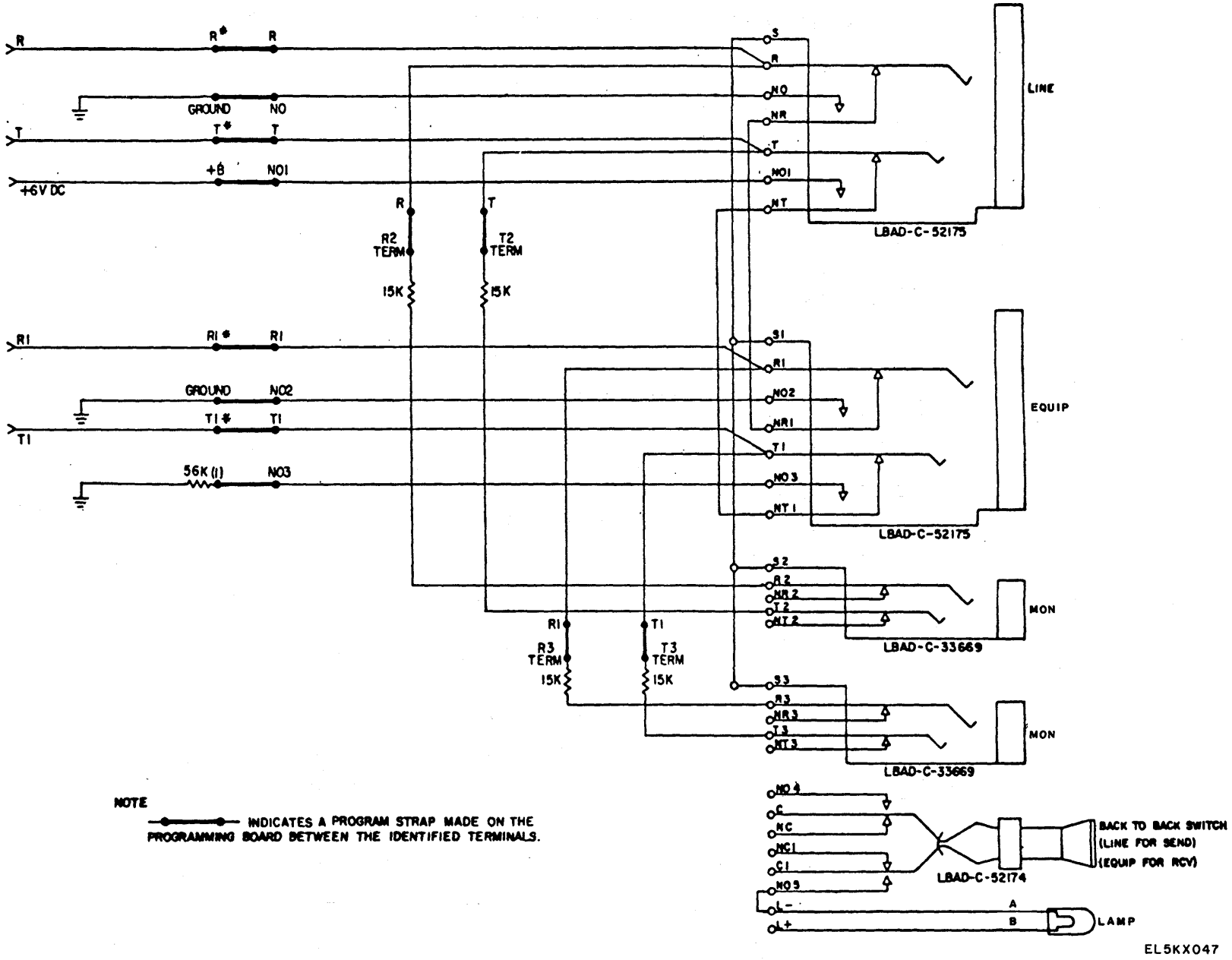


Figure 2-32. Universal Digital Patch Panel, Low Level +6VDC Receive Circuit, Schematic Diagram.

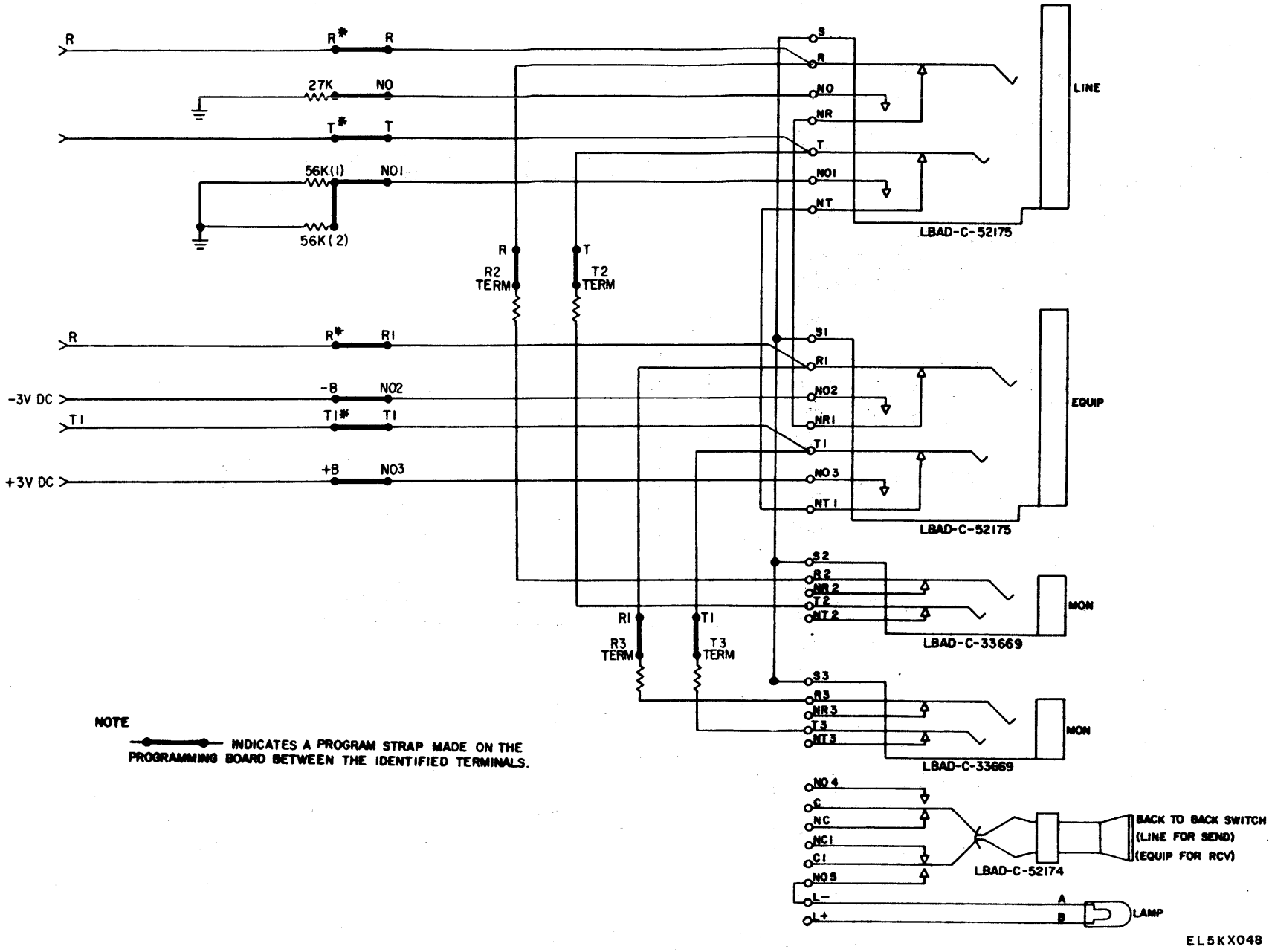


Figure 2-33. Universal Digital Patch Panel, Low Level Balanced (+3VDC and - 3VDC) Send Circuit Schematic Diagram

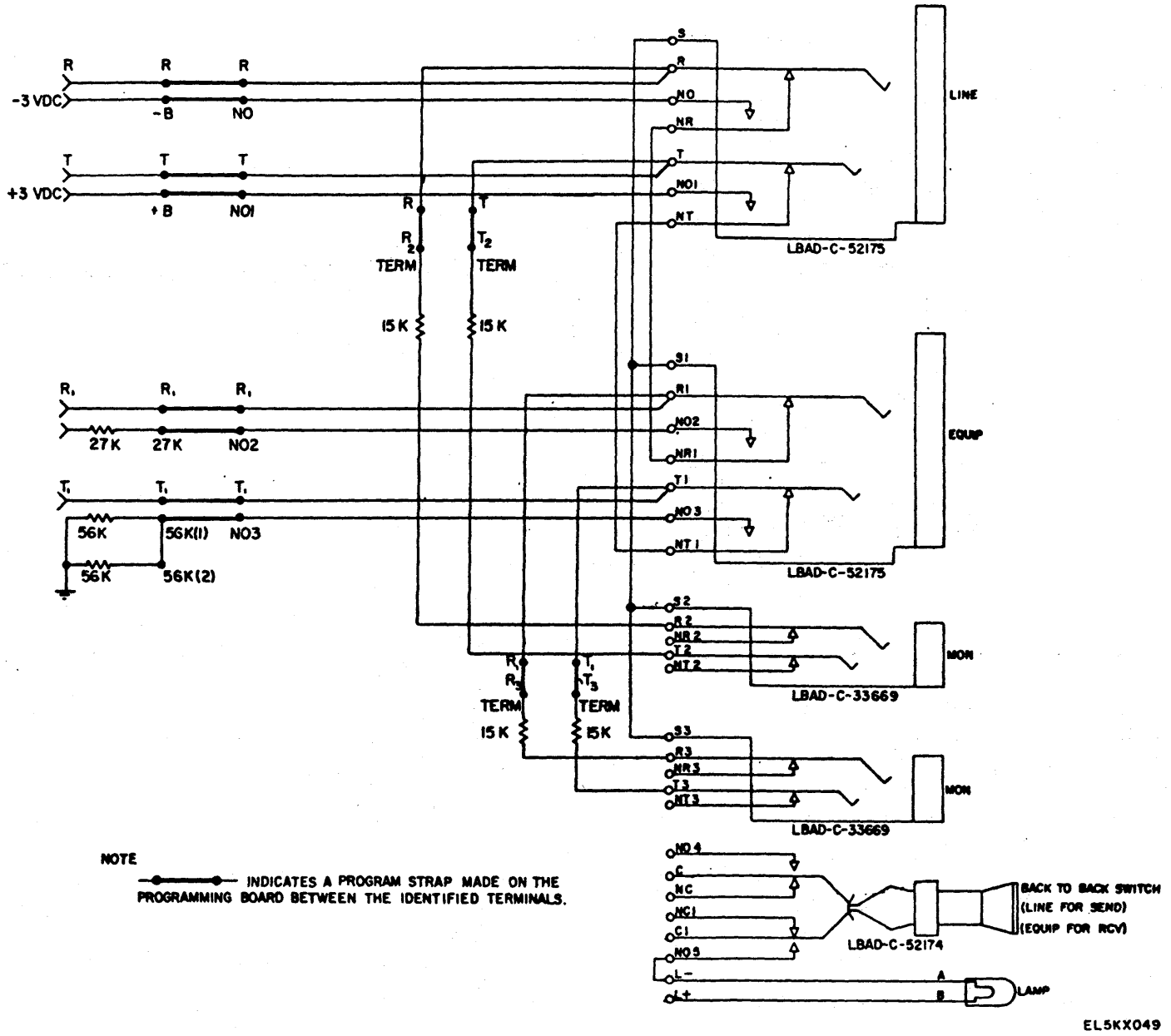


Figure 2-34. Universal Digital Patch Panel, Low Level Balanced (+3VDC and - 3 VDC) Receive Circuit, Schematic Diagram

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF equipment plugged
R	To TCF equipment plugged
T1	POS hold battery
R1	NEG hold battery

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Terminated across 28K
R	Terminated across 27K
T1	From line equipment plugged
R1	From line equipment plugged

q. Black Send Circuit (Modified Less Clock), Program Module GP-16 (fig. 2-35).

(1) This programming module connects the following terminals:

B2 to E1
B1 to J3
C1 to F3
B3 to J1
C2 to N2
D2 to K3
E3 to M2
D3 to E2
M3 to J3
H3 to E1
L1 to J1
F2 to F3
L3 to N3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	From TCF plugged equipment
R	From TCF plugged equipment
T1	Unterminated
R1	External timing

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	External timing
T1	To plugged line equipment
R1	To plugged line equipment

r. Black/Red Receive Circuit, Program Module GP-17 (fig. 2-36).

(1) This programming module connects the following terminals:

B2 to E1
B1 to J3
C1 to F3
B3 to J1
C2 to N2
C2 to L3
E3 to H1
A1 to M1
A2 to K1
D2 to K3
D2 to M2
D3 to E2
J3 to M3
E1 to H3
J1 to L1
F3 to F2
G1 to F2
C3 to D1
C3 to K3

(2) When a patch cord plug is inserted into the LINE jack, the following connections are made.

Terminal	*Termination*
T	To TCF plugged equipment
R	To TCF plugged equipment
T1	Unterminated
R1	Unterminated

(3) When a patch cord plug is inserted into the EQUIP jack, the following connections are made.

Terminal	*Termination*
T	Unterminated
R	Unterminated
T1	From plugged line equipment
R1	From plugged line equipment

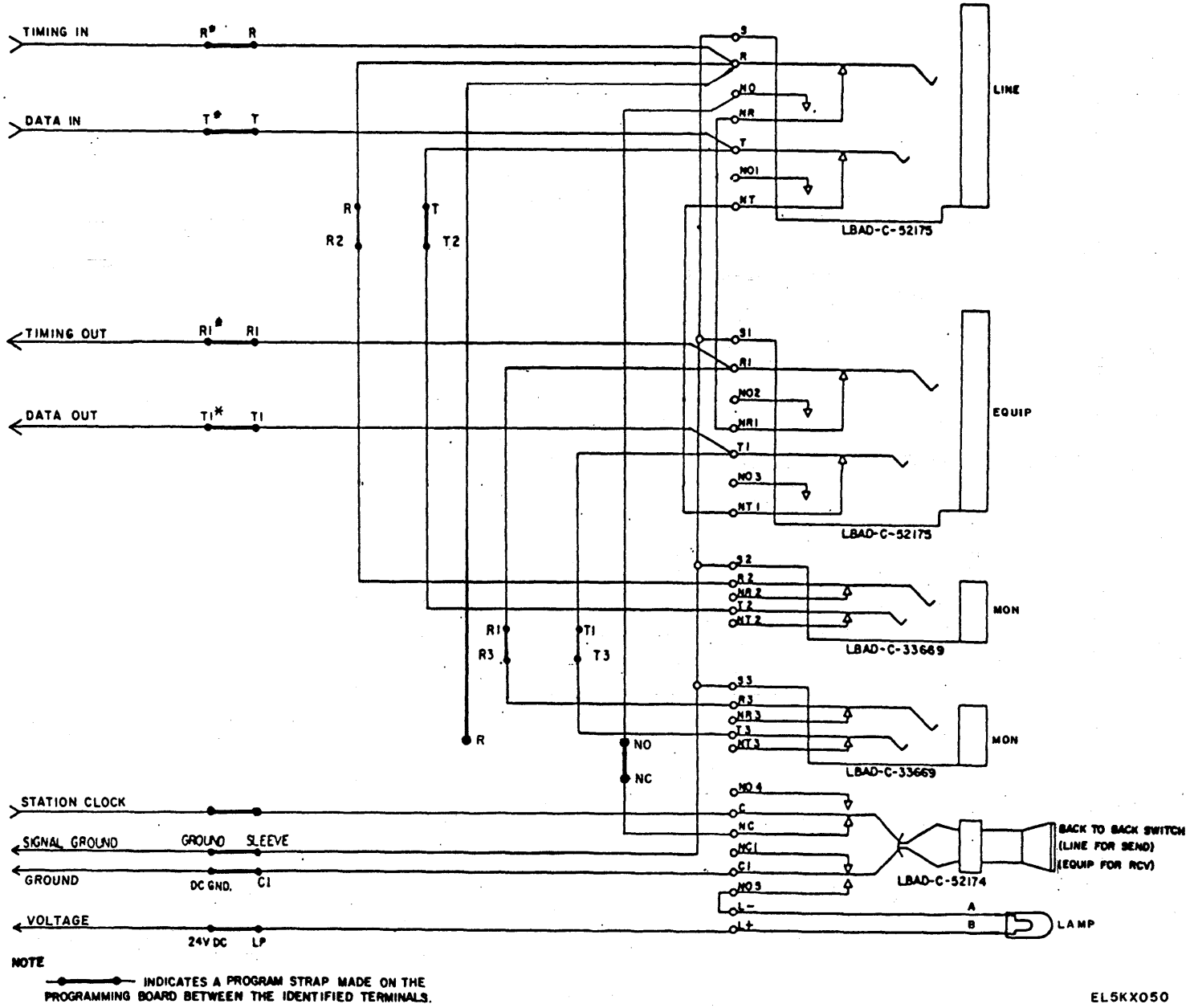


Figure 2-35. Universal Digital Patch Panel, Black Send Circuit (Modified Less Clock), Schematic Diagram

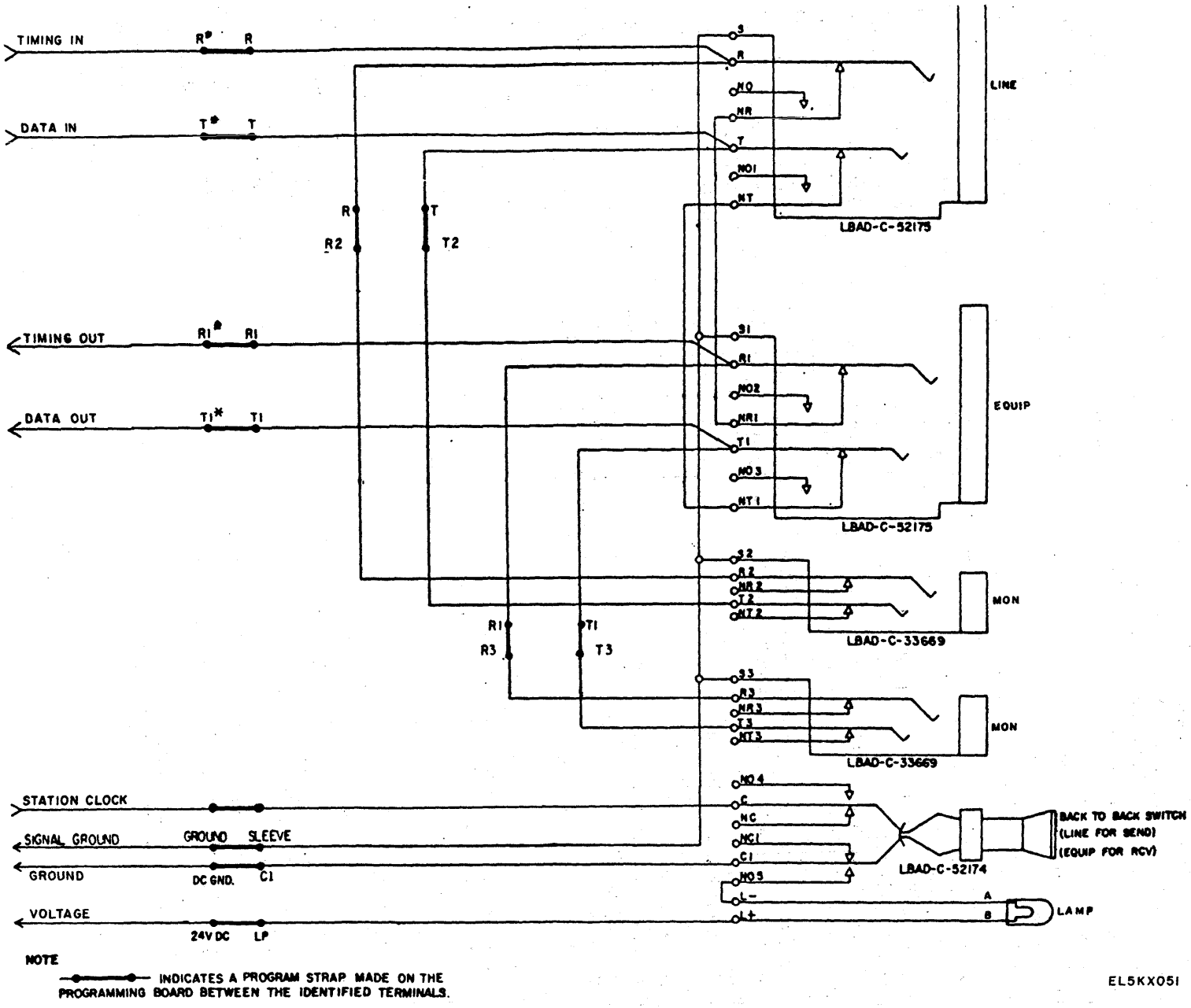


Figure 2-36. Universal Digital Patch Panel, Black/Red Receive Circuit, Schematic Diagram.

Section IV. WIDEBAND CIRCUITS AND PATCH PANEL

2-12. Wideband Circuits, General

a. There are three locations where wideband circuits may be accessed in the P&T. The black side of circuits are accessed at five patch panels in bay 1.8 (fig. 1-3). Special intelligence circuits are accessed at three patch panels in -bay 2.1 (fig. 1-8).

b. Wideband circuits may contain video signals or vf group signals. A typical wideband circuit is discussed in paragraph 2-13. The wideband patch panel is discussed in paragraph 2-14.

2-13. Typical Wideband Circuit (fig. FO-8)

a. General. The cable connecting equipment to the patch panels is 75-ohm Triax type cable. The patch panels are 75-ohm Twinax type. Therefore, Triax-to-Twinax adapters are used to connect the Triax cables to the patch panels.

b. Send Circuit. The send signals from the Pentagon user are in clear text, and connected to the LINE jack of a jack set in red patch bay 2.18. The jack set is wired normal through the LINE and EQUIP jacks of the jack set. The signals out of the jack set are from the EQUIP jack and connected to the input of a KG-24 crypto equipment. The *output signals from the KG-24 are encrypted and connected to the EQUIP jack of a jack set in black patch bay 1.8. The jack set is normal through wired. The output from the LINE jack is connected to the commercial radio send input.

c. Receive Circuit. The receive circuit is similar to the send circuit except for the following:

(1) Signals are received from the commercial radio in a secure crypto form.

(2) Receive jack sets are used in both the black and red patch bays.

(3) The KG-24 is used to connect the encrypted signals to clear text.

2-14. Wideband Patch Panel

a. Description (fig. 2-37). The wideband patch panel contains 20 sets of 3 associated 75-ohm Twinax jacks. Each jack set is used for one circuit (send or receive). The send circuit jack set is usually on the left of the receiver circuit jack set. The top row of jacks are LINE jacks. The second row of jacks are EQUIP jacks. The bottom row of jacks are MON jacks. An identification card holder strip is mounted across the bottom of the jack sets.

b. Circuit Function (fig. 2-38). The equipment cable is connected to the EQUIP jack. When there is no plug in the EQUIP jack, closed contacts in the EQUIP jack connect that jack in series with the LINE jack. The LINE jack is similar to the EQUIP jack and completes a through circuit to the line cable connector. When a plug is inserted into the EQUIP jack the normal through circuit to the line connector is broken. The equipment cable is connected to the plug in the EQUIP jack and the line cable is terminated across a 75-ohm resistor (the impedance of the cable). When a plug is inserted into the LINE jack, the normal through is also broken. The line cable is connected to the plug in the LINE jack. The equipment cable is terminated across the 75-ohm resistor. A MON jack. is parallel connected across the line cable connection, through two 560ohm isolation resistors and a 75-ohm termination resistor. The isolation. resistors provide a monitoring signal that is 30 dB below the line signal.

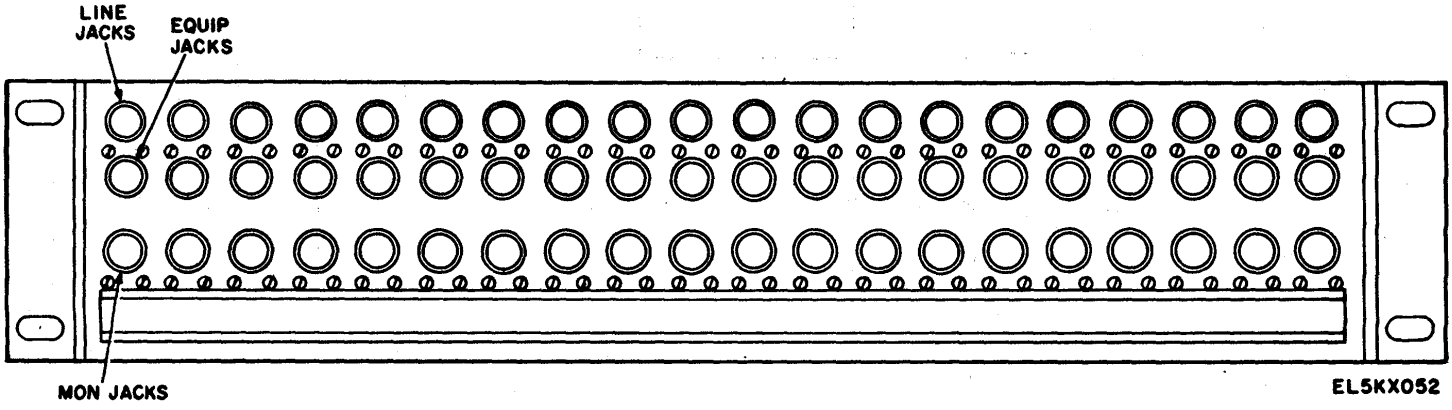


Figure 2-37. Wide Band Patch Panel, Front View.

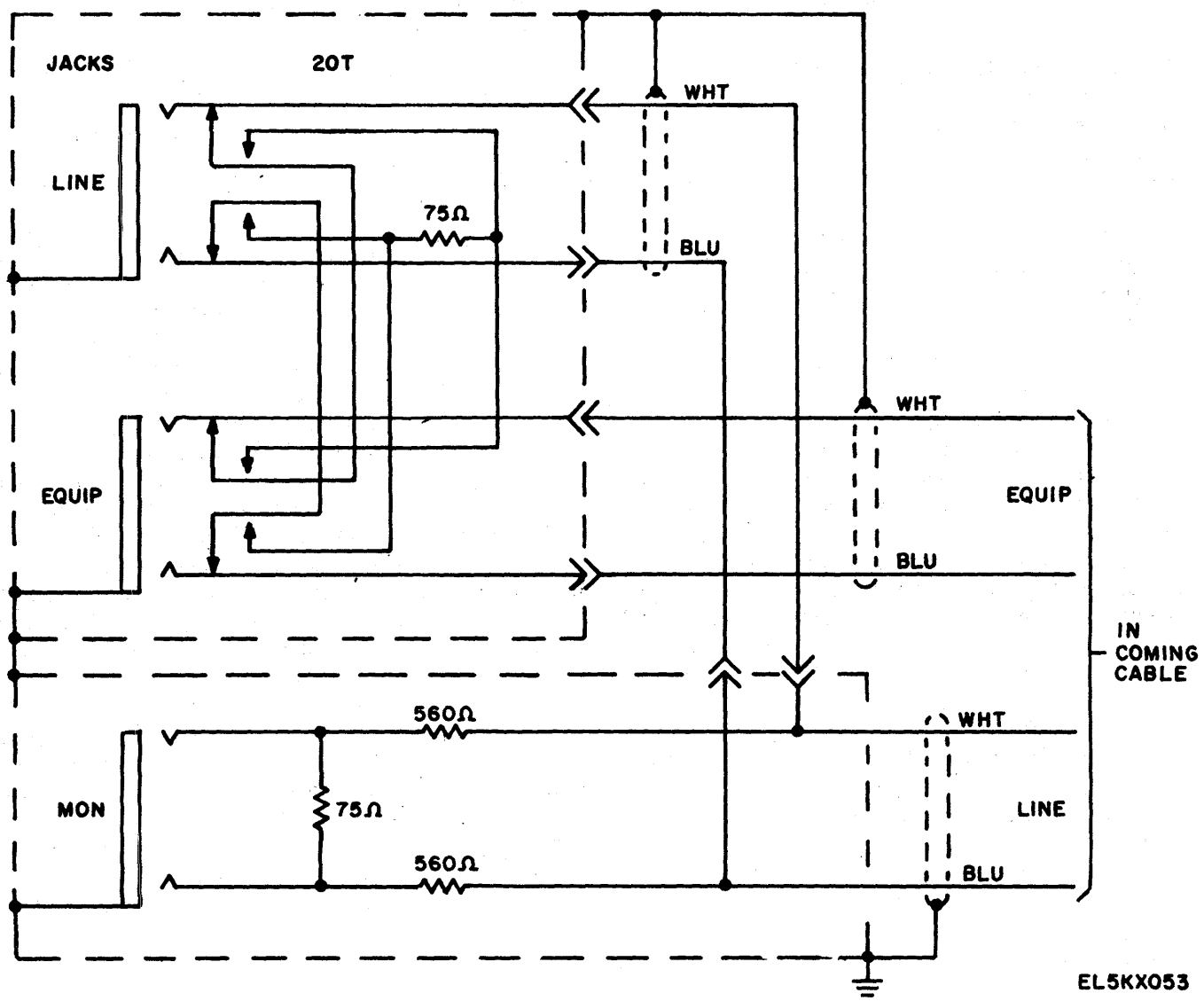


Figure 2-38. Wide Band Patch Panel, Schematic Diagram.

Section V. TEST EQUIPMENT AND MISCELLANEOUS INTERNAL SUBSYSTEMS

2-15. Scope

a. Test Equipment. A major responsibility of Technical Control personnel is that of monitoring and testing circuits passing through the station to determine circuit quality and to determine operating conditions. Additionally, they are responsible for the rapid identification and isolation of faulty equipment in order to achieve optimum operating effectiveness. Accordingly, assorted test and monitor equipment inputs are strategically located throughout the Technical Control facility to provide an efficient means for performing these operations. The functions of the P&T test equipment are given in paragraph 2-16.

b. Internal Subsystems. Many items of equipment are required to perform nontraffic missions within the station. Some of these missions include intersite coordination, coordination with other sites, fault reporting and display, administration, and power requirements. The various internal, nontraffic handling subsystems include the ac power system, dc power system, station grounding systems, alarm system, and interbay trunking system. The subsystems are discussed in paragraphs 2-16 through 2-20.

2-16. Test Equipment

a. Attenuator Panel (fig. 1-2). The attenuator panel contains two variable pads. The pad on the left has a range of 45 dB. The pad on the right has a range of 60 dB.

b. Digital Multimeter, Model 269. The 269 multimeter provides a digital readout of measurements given below. The accuracy of the multimeter is .02%.

Type measurement	*Scale range*
Dc volts	Iv to 1,000v
Ac volts	Iv to 750v (50 Hz to 20 KHz)
Dc current	100µ to 1,000ma
Ac current	100µa to 1,000ma (50 Hz to 5 KHz)
Dc resistance	0 ohm to 10 Meg ohm

c. Telegraph Carrier TestSetKS-19935. This model of the KS-19935 consists of Control Unit L5 and Electronics S Unit L1. The test set measures the level and frequency (steady-state) of the tones used in telegraph carrier and low speed data systems.

(1) AC level Meter. The Test Set allows selection and level measurement of any individual channel of a standard multiplex carrier system where a normal signal level of 0, - 10, - 17, or -26dBm (single-width) or +3, -7, -14, or -23dBm (double-width) exists per channel. Channel separation of 40dB is provided, and tone levels may be measured with an overall accuracy of ±1 dB. The level measurement is presented on a dB meter as the deviation in level, of the channel under observation, from the selected normal level stated above (-17, -26, etc.).

(2) Frequency Meter. The Mark or Space frequency error of the selected carrier channel (when in a steady Marking or Spacing condition) is measured and indicated in Hz deviation on a front-panel meter. Overall accuracy of the frequency measurement is within ±.0.5 cps.

(3) Universal Demodulator. At the same time that the level of the selected carrier channel is being measured, the tone signals (AM or FM) are demodulated and are available to drive a telegraph output circuit for monitor TTY machine printout or as a test point to provide an indication of distortion. Thus, troubles in a carrier system can be quickly and easily localized to sending or receiving terminal equipment. The output signals are standard electronic hub (+60/-30v) drive; as an option, neutral output loop keying can be provided for use in the neutral TLT testboard.

NOTE

Generally, distortion measurements made at the demodulator output will be higher, by a few percent, than the true measurements made on the circuit under observation.

d. Transmission Measuring Test Set, HP-3550AR. The Hewlett-Packard model 3550AR is used to measure transmission line and system characteristics such as attenuation, frequency response, or gain. It contains a wide range oscillator, a voltmeter, and a patch panel to match both the oscillator and the voltmeter to 135-, 600-, and 900-ohm lines.

e. Dual Speaker Panel. Speaker panels are mounted in the bottom of various patch bays in the P&T. These panels are used for oral monitoring of VF circuits carrying voice signals for the purpose of determining continuity and/or the quality of the speech traffic. The panel includes two amplifier/speaker combinations. This allows two independent inputs and outputs. Both inputs are wired to jacks in TM 11-5895-878-14&P the miscellaneous panel of a test bay. For monitoring purposes, either of these two inputs may be patched via interbay trunk jacks to the MON (Monitor) jacks in the VF circuit patch panels without degradation or interruption of circuit operation.

f. Oscilloscopes. The oscilloscopes provide dual visual displays of electrical signals and parameters. Plug-in units provide wide ranges of measurement capability.

g. Video Waveform Monitor 1485R (fig. 1-3). The Tektronix 1485R Video Waveform Monitor is a specialized oscilloscope with triggering and vertical characteristics designed for accurate measurement of the composite video signal. The monitors' vertical amplifiers have very carefully controlled responses necessary for video system signal fidelity. The waveform monitor, monitors 525/60 and 625/50 systems.

h. Electronic Counter HP-5245L. The counter provides a digital readout of the frequency of the signal being measured. The frequency range is from dc to 50 MHz.

i. Data Transmission Test Set 601 (fig. 1-5). The Frederick Electronics Corp. Model 601 Data Transmission Test Set is designed specifically for testing circuits utilizing Bell Data Transmission Sets by means of error counting techniques. The Model 601 consists of the following modules: (1) A Pattern Generator which is the source of test signals for comparison with received signals from the system under test; (2) A Synchronizer which establishes and maintains bit and pattern sychronization, recognizes pattern errors, and develops error pulses for storage and subsequent readout; (3) An Error Counter which counts the number of errors in the incoming data and registers the total count on a front panel mechanical counter. The Error Counter includes a visual and aural alarm system which warns the operator whenever the error rate exceeds the storage capacity; (4) A Power Supply which provides all operating voltages for the Model 601; (5) A second Pattern Generator which is the source of test signals for transmission to the system under test. Two Pattern Generator modules are incorporated into the Model 601 so that a single unit can be used to perform error rate tests on data subsets connected back-to-back. For this method of testing, one Pattern Generator transmits the test pattern to the system and the other Pattern Generator provides a synchronized pattern for comparison with the pattern at the output of the system.

j. Signal Distortion Analyzer Group ANIGGM-1S(V). This set provides a capability for measuring signals in DC teleprinter/data loops and for transmitting digital test messages over these loops. The Digital Distortion Analyzer Set includes three major components, that is, a signal generator, a signal distortion analyzer and an oscilloscope.

(1) Signal Generator SG-860/GGM-15(V). This unit generates data and telegraph signal outputs with controlled distortion at speeds up to 9600 baud. Various message options are available for Baudot or ASCII codes

of 80 or 128 characters.

(2) Signal Distortion Analyzer TS-28621GGM-15(V). This unit performs three major functions:

Distortion analysis, distortion monitoring, and error rate determination.

(3) Oscilloscope OS-20/GGM-15(V). This unit is used to display the signal under analysis.

k. Phase Jitter Meter, Model 48 (fig. 1-15). The model 48 phase jitter meter measures the following:

(1) Peak to peak phase jitter.

(2) Phase, amplitude, coincident hits and dropouts.

(3) Meters input/output levels and input frequency.

(4) External jitter, frequency offset, and totalizer outputs.

I. Impulse Noise Counter. The impulse noise counter is a Northeast Electronics Corporation Model TSS58AR.

The unit counts the number of impulses exceeding three different selected levels for a selected length of time. The unit provides three indications, each giving the number of times an impulse exceeds the associated adjusted level.

m. Dual-Channel Recorder, HP-7702B and 7034A. The recorders are used for simultaneous recording of two related variables when the variables are to be analyzed with respect to each other and with respect to time, and when any variable needs to be permanently recorded.

n. Digital Recorder HP-5050B. The digital recorder provides a versatile method for recording time with 0.1 second resolution along with other data measurements being recorded by a printer. In addition the recorder serves as an automatic measuring-recording system programmer by allowing printing at preselected time intervals.

o. Vector Impedance Meter, HP-4800A. The HP-4800A is used to make fast measurements of impedance to 10 megohms and phase to ±90°. The measurement can be made at a particular frequency or over a continuous range from 5Hz to 50kHz.

p. Distortion Analyzer HP-334A. The HP-334A measures total distortion down to 0.1 percent of full scale at any frequency between 5 Hz and 600 KHz. Harmonics are indicated up to 3 MHz. Noise is measured as low as 50 microvolts and voltages may be measured up to 3MH: with 300/-V to 300 full scale.

q. Wave Analyzer HP-302A. The Model 302A Wave Analyzer separates a complex input signal into individual frequency components such as harmonic, intermodulation products, and other spectral components. By tuning the 302A across the spectrum, the components can be individually measured and evaluated. Frequency is read in Hz from the dial, and amplitude is read in volts, percent or dB from the meter. The 302A is also an oscillator-tune voltmeter combination. This feature is particularly useful for measuring input-output characteristics of filters, amplifiers, and active devices. The oscillator output (BFO) and the analyzer's input tuning track together over the entire range of 20 Hz and 50 kHz and is controlled by the tuning dial. Because one control tunes both the oscillator output and the analyzer input simultaneously, on-estep response measurements are made simply, quickly and conveniently. And, since the analyzer has a very narrow bandpass, any signal distortion has negligible effect on the meter reading, making measurements highly accurate even at very low levels.

r. Multimeter HP-3490A. The HP-3490A Multimeter is a five-digit integrating digital voltmeter. The basic instrument measures dc voltages, ac voltages, and resistances. Additional measurement capability is achieved by the addition of low cost options. The HP-3490A uses a C dual slope integrating technique and is fully guarded, providing excellent noise immunity at five readings per second on all dc ranges. Ranging is automatic over all ranges on all functions. DC measurements can be made with 1µ V of ac voltage resolution. Ohms measurements can be made, utilizing the four-wire conversion technique which eliminates errors due to test lead resistances. Six ranges of ohms, including a 10,000 Kohm range, are provided. All functions and ranges include 20% overranging except the 1000 V range.

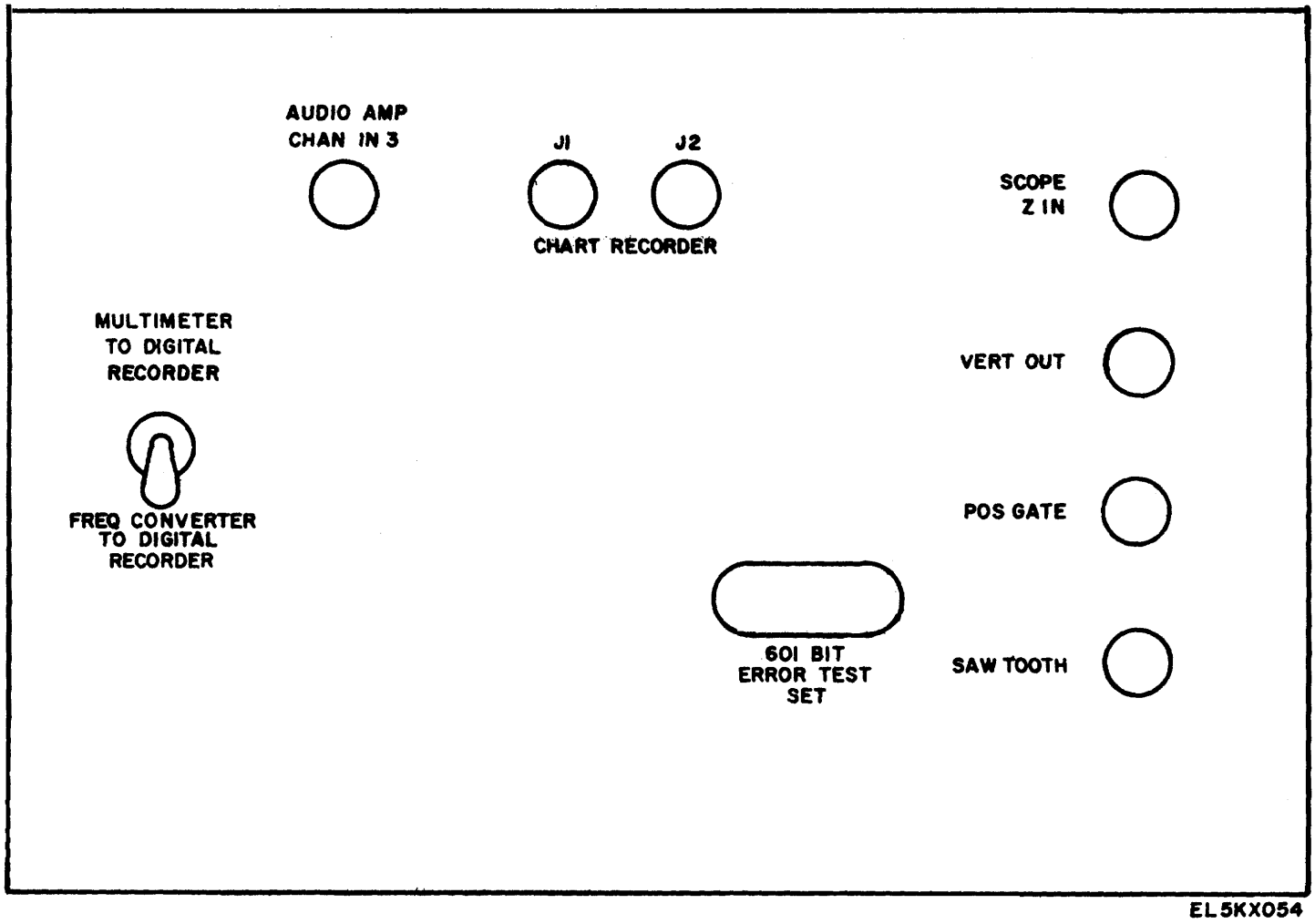


Figure 2-39. Quality Assurance Test Center, Equipment Connection Panel, Front View.

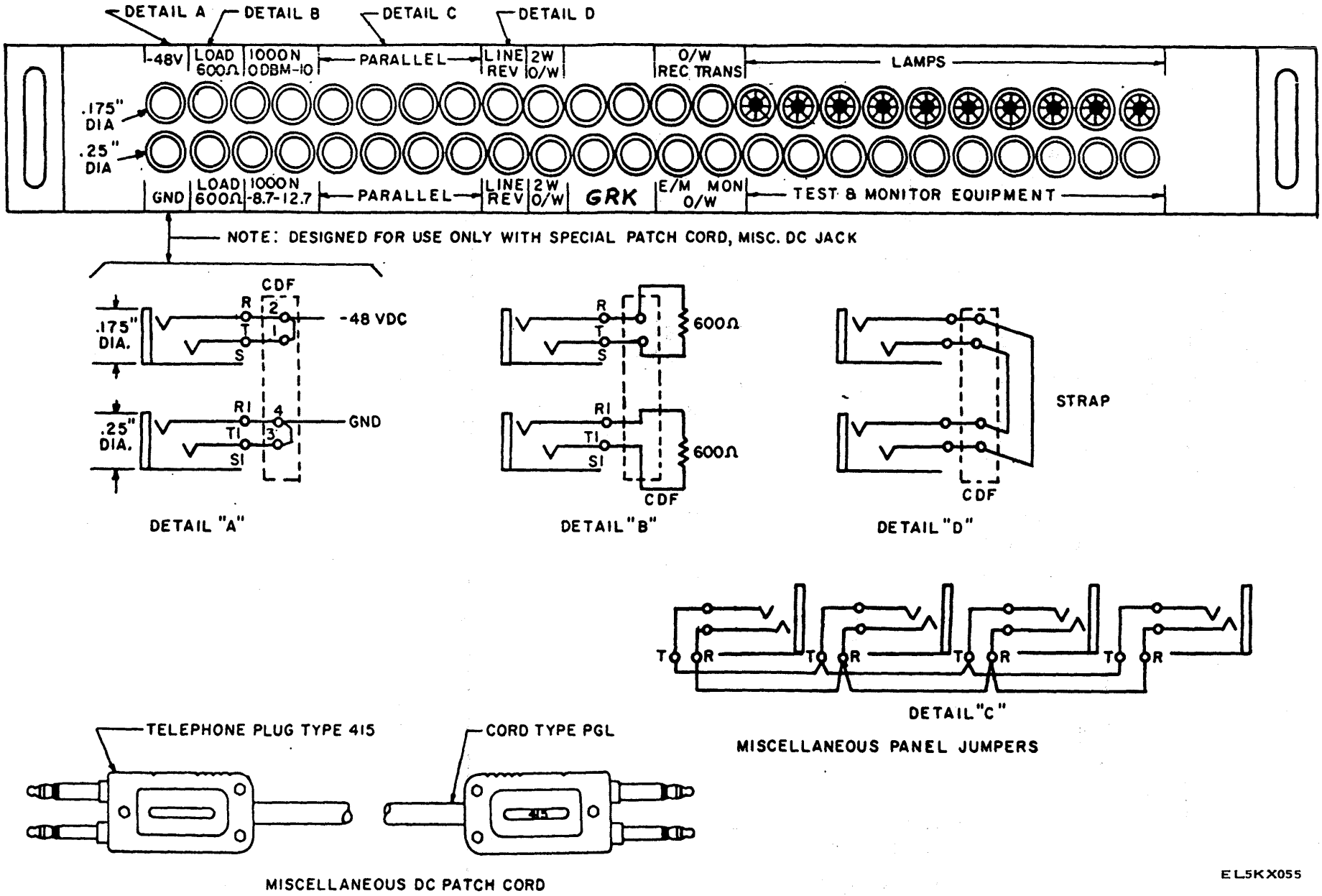


Figure 2-40. Typical Miscellaneous Patch Panel, Front View.

s. QA Test Center, Equipment Connection Panel. Bay 1 of the QA Test Center (fig. 1-15) contains an in house uilt equipment connection panel (fig. 2-39). The panel provides connection to equipments with out front panel connection. Also, a single-pole-single-through switch is provided to connect the HP-3490A multimeter to the IP-5050B digital recorder. In addition, the switch may also be set to connect the HP-5245L electronic counter (FREQ COUNTER) to the HP-5050B digital recorder. All connectors on the panel are BNC type. BNC to banana jack adapters are used on all connectors except the 601 BIT ERROR TEST SET connector. This connection requires an AMP, 25-pin type.

t. Miscellaneous Patch Panels (fig. 2-40). Miscellaneous patch panels are located in the patch and test facilities to provide the flexibility required for test and monitoring operations. The jacks are wired and cross-connected as desired by the site personnel. Figure 2-40 provides a typical function arrangement for a miscellaneous. panel with 10 lamps in a TCF. Figure 2-46 provides the panel schematic and block terminations. The panel provides such desirable jack arrangements and functions as 600 Ohms load, parallel jacks, line reversing (top-to-ring, ring-to-tip), and test equipment connections.

u. Interbay Patch Panels. Each patch and test bay contains an INT Panel. Interbay trunks are used to route circuits to other patch bays in the station. The various types of INT patch panels in the P&T are discussed in paragraph 2-17.

2-17. Interbay Trunking Systems

a. General. The P&T has five different interbay trunking systems. The systems are designed to allow sufficient trunking of circuits from one patch or test bay in a system to other bays in that system. The trunking systems are not interconnected and come together only at the intermittent test stations. The systems are listed below.

(1) Black digital (b below).
(2) Red digital.
(3) Black vf (c below).
(4) Red vf.
(5) Red QA (d below).

b. Digital Interbay Trunking Systems. The black and red systems use INT panels with 48 jacks and 48 lamps (fig. 2-41). The panel has two rows of 24 jacks and two rows of 24 in-use lamps. The first 20 sets of jacks and lamps in each row (1 through 20, and 25 through 45) are connected in a parallel configuration at the IDF. That is, all No. 1 jacks are paralleled to each other, all No. 2 jacks are paralleled to each other etc. The in-use lamps (fig. 2-42) are wired to their associated jacks so that when a patch cord plug is inserted into the jack, all the same No. lamps in that system light. This indicates which interbay trunks are in use. The last four sets of jacks and lamps in each panel (21 through 24, and 45 through 48) are provided for use as miscellaneous jacks.

c. VF Interbay Trunking Systems. The interbaying capability in the VF area is provided by the interbay patch panels which are mounted in the bottom of every VF patch and test bay. The panel has two rows of 24 jacks per row for a total of 48 interbay trunk appearances per bay. The front view of the panel resembles that shown in figure 2-40; however, there are no lamps in the panel. The schematic is that shown in figure 2-43. Terminal blocks C1 and C2 of each panel are cabled to the IDF where the panels are cross-connected to form a "series" interbay trunking system. The cross-connecting is done such that each circuit is private. That is one jack in a bay is only cross-connected to one jack in the other bay. The first three sets of jacks in bays 1.2 through 1.7 in the black system are labeled 1.1. Bay 1.1 is an IDF and does not have an INT panel. These six jacks in each bay are cross-connected to the black INT panel in bay 3 of the QA Test Center (fig. 1-15). The red vf system consists of two INT panels, bays 2.19 and 2.20 (fig. 1-14).

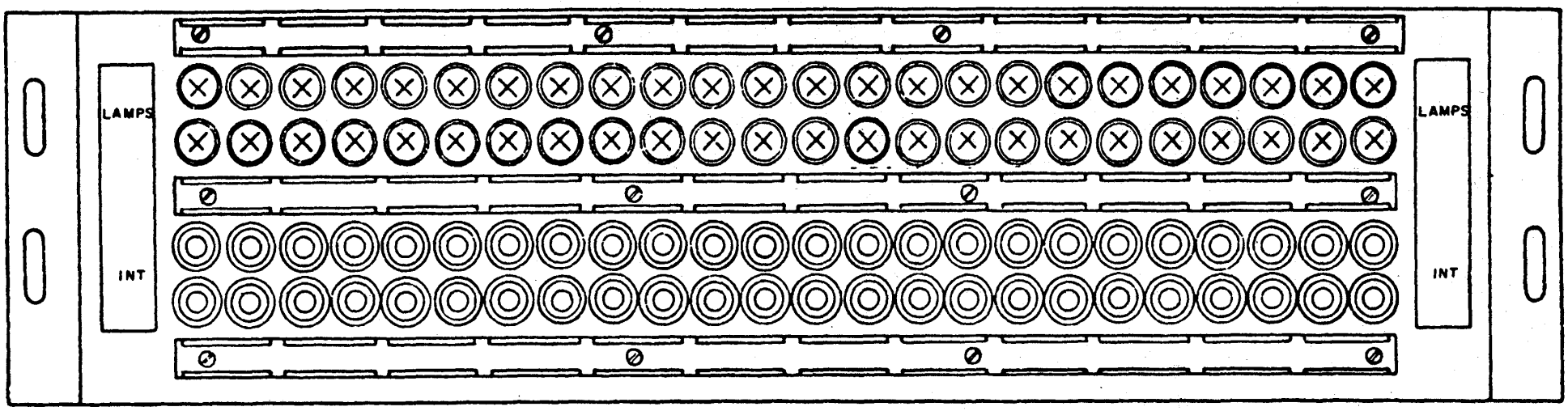


Figure 2-41. Dc Interbay Patch Panel with 48 Lamps, Front View

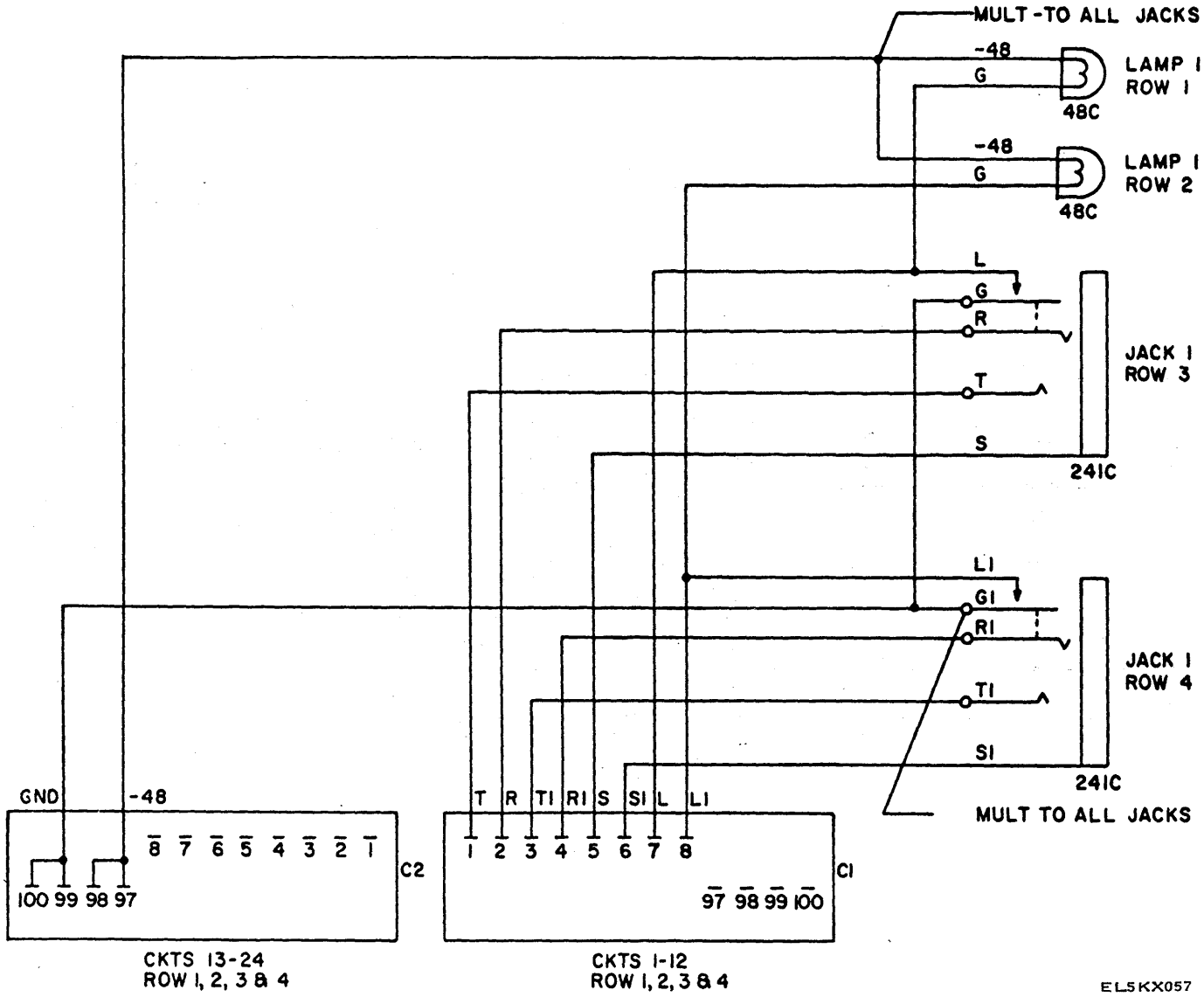


Figure 2-42. Dc Interbay Patch Panel with 48 Lamps, Schematic Diagram.

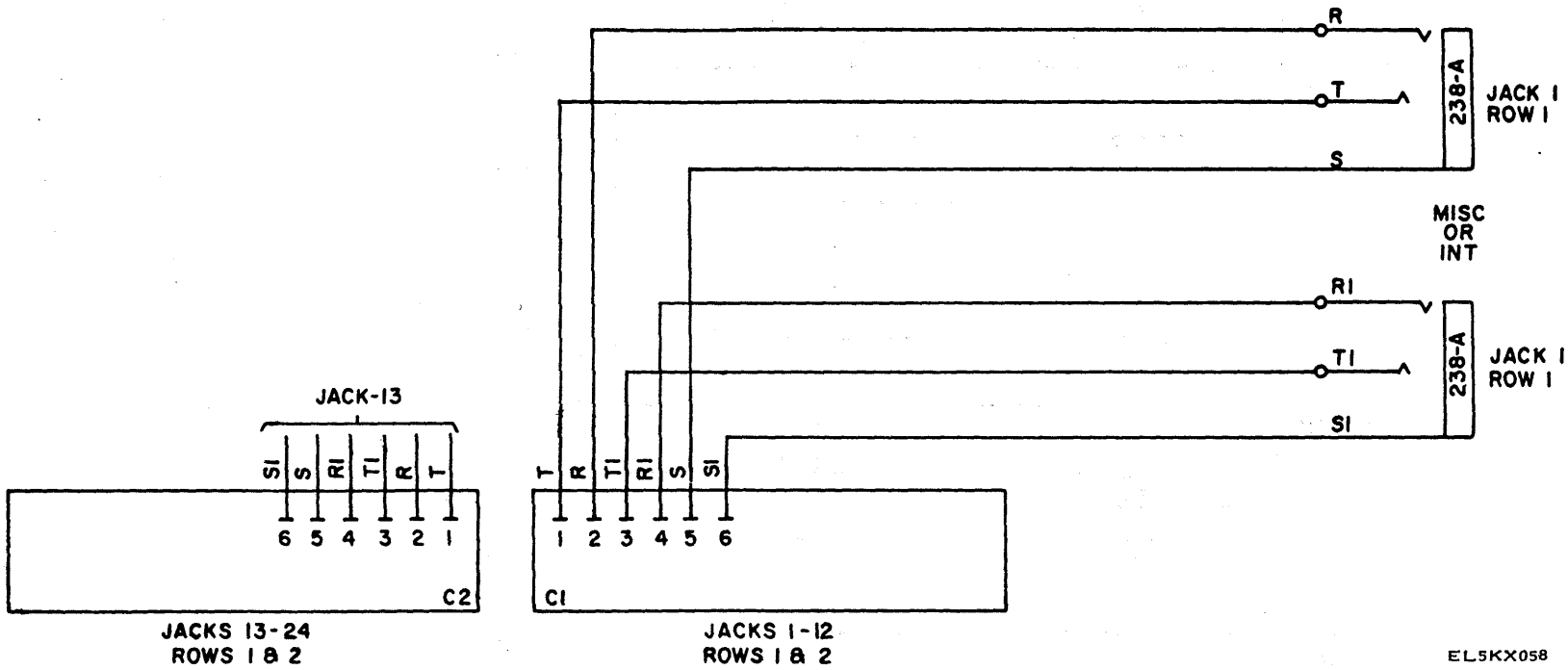


Figure 2-43. Voice Frequency Interbay Patch Panel, Schematic Diagram.

d. Red QA Interbay Trunking System. The red Quality Assurance system is made up of a TRIAX TRUNK panel in bay 2 of the QA test center. There are six TRIAX cables connected from dual banana jacks on the QA panel to six TWINAN jacks in bay 2.18 (fig. 1-13). These connections are to the first six bottom connectors on the red QA TNT panel. Above each jack is an in-use lamp. Lamps are also located on the TRIAX TRUNK panel (fig. 1-15). The lamps are powered by a 48 vdc power supply in the bottom of bay 3. The red QA panel (fig. 1-13) has two vf tie trunks to the first two lamp jacks in the MISC in bay 2.20 (fig. 1-14) for vf patching. Trunks are also provided to each odd numbered digital bay in row two for patching red digital circuits to the QA test center.

2-18. AC Power System

a. General. The PTC operates on 208/120 VAC, 3 phase, 60 Hz power. There are four 50,000 circular mil feeders feeding the PTC from one of three available power sources, A, C, & D. The critical PTC load is 154 KVA and the noncritical load is 249 KVA. Source A is the main source of power feeding the PTC. It is commercial power generated at the local power company. Source C consists of two 250 KW diesel and two 936 KVA rated gas turbine generators. Source D is an UPS power source capable of delivering 156 KVA of power to the critical load. The batteries in the UPS system consist of 163 lead calcium batteries, that are good for 15 minutes of operation when other power systems fail. Red and black P&T power distribution from their associated distribution boxes (fig. FO-1) is given in b and c below.

b. Red AC Power Distribution. All AC power to the red side of the P&T is connected with 14 AWG wire, except the two 24 vdc and the two 48 vdc power supplies. Single phase, 120 volts, 50 Hz AC power is connected with three wires to all outlets and equipment as listed below.

Ckt No.	Amperes	Phase	Equipment
1	15	X	Convenience outlets, bays 2.1, 2.3, 2.5 and 2.7.
2	15	Y	Convenience outlets, bays 2.2, 2.4, 2.6, and 2.8.
3	15	Z	Convenience outlets, bays 2.9, 2.11, 2.13 and 2.15.
4	15	X	Convenience outlets, bays 2.10, 2.12, 2.14 and 2.16.
5	15	Y	Convenience outlets, bays 2.17 and 2.19.
6	15	Z	Convenience outlets, bays 2.18 and 2.20.
7	15	X	Plug strip digital test bay 2.2.
8	15	Y	Plug strip digital test bay 2.7.
9	15	Z	Plug strip digital test bay 2.12.
10	15	X	6V power supply, plug strip, bay 2.17.
11	30	Y	48V power supply No. 1, bay 2.17.
12	30	Z	48V power supply No. 2, bay 2.17.
13	15	X	24V power supply No. 1, bay 2.17.
14	15	Y	24V power supply No. 2, bay 2.17.
15	15	Z	Plug strip VF test, bay 2.20.
16	15	X	Plug strip video monitor, bay 2.18.
17	15	Y	Plug strip, bay 2.1, 2.3, 2.5 and 2.9.
18	15	Z	Plug strip, bay 2.4, 2.6 and 2.8.
19	15	X	Plug strip, bay 2.11, 2.13, 2.15 and 2.19.
20	15	Y	Plug strip, bay 2.10, 2.14 and 2.16.
21	15	Z	Duplex receiver,. rack No. 64 and 69.
22	15	X	Wall video circuit.
23	15	Y	Philco test set.
24	15	Z	Left PTC lights.
25	30	X	Philco Receiver.
26	15	Y	Right PTC lights.
27	30	Z	Philco transmitter.
28	15		Spare.
29	20	Y	26C Modem, rack No. 62.
30-40			Spare.

c. Black AC Power Distribution. All AC power to the black side of the P&T is connected with 14 AWG wire, except the two 24 vdc and the two 48 vdc power supplies. Single phase, 120 volts, 60 Hz AC power is connected with three wires to all outlets and equipment listed below.

Ckt No.	Amperes	Phase	Equipment
1	15	X	Convenience outlets, bays 1.3, 1.7 and 1.9.
2	15	Y	Convenience outlets, bays 1.2, 1.4, 1.6 and 1.8.
3	15	Z	Convenience outlets, bays 1.11, 1.13, 1.15, 1.17 and 1.19.
4	15	X	Convenience outlets, bays 1.12, 1.14, 1.16, 1.18 and 1.20.
5	15		Spare.

Ckt No.	Amperes	Phase	Equipment
6	15		Spare.
7	15	X	Station clock plug strip, bay 1.9.
8	15	Y	Vf test plug strip, bay 1.5.
9	15	Z	Video monitor plug strip, bay 1.8.
10	15	X	6V power supply plug strip, bay 1.17.
11	30	Y	48V power supply No. 1, bay 1.11.
12	30	Z	48V power supply No. 2, bay 1.11.
13	15	X	24V power supply No. 1, bay 1.16.
14	15	Y	24V power supply No. 2, bay 1.16.
15	15	Z	Digital test plug strip, bay 1.14.
16	15	X	Digital test plug strip, bay 1.18.
17	15	Y	Plug strip, bay 1.3, 1.7, 1.11, 1.19 and 1.21.
18	15	Z	Plug strip, bay 1.2, 1.4, 1.6, 1.12, 1.16, and 1.20.
19	15	X	MOLINK Convenience outlet and plug strip, bay 1.24.
20	15	Y	MOLINK Convenience outlet and plug strip, bay 1.25.
21	15	Z	Plug strip, bay 1.13.
22	20	X	Plug strip, bay 1.15.
23	15	Y	DCL Convenience outlet and plug strip, bay 1.22.
24	20	Z	DCL Convenience outlet and plug strip, bay 1.23.
25	20	X	TAR-SAC-COM printer door lock & PTC FM tuner.
26	15	Y	8.5 corridor ac circuit.
27	15	Z	8.5 corridor ac circuit.
28	15	X	Door buzzer.
29	15	Y	Typewriter floor outlet.
30-40			Spare.

2-19. DC Power Systems

(fig. 2-44)

a. General. The P&T has six DC power systems. Three systems are in the black equipment row (No. 1), the other three systems are in the red equipment row (No. 2). The systems provide -48 vdc (b below), 24 vdc (c below) and 6 vdc (d below).

b. -48 VDC Power Systems. The items that make up the black power systems are mounted in bay 1.11 (fig. 1-4). The items in the red power system are in bay 2.17 (fig. 1-13). As shown in. figure 2-44A, there are two power supplies that are parallel connected through an alarm panel. The power supplies are powered by 120 vac (para 2-17). Each power supply's voltage output and current drain is indicated on meters that are on the front of each supply. The dc negative output of each power supply is fed through an isolation diode in the alarm panel and then to a fused distribution panel ((1) and (2) below). The alarm panel also provides a failure alarm output for each power supply to the associated (black or red) alarm system (para 2-19).

(1) -48 VDC *Black Power Distribution.* Upon installation of the P&T the black 48 vdc distribution panel (fig. 1-4) provided 17 outputs fused with two ampere fuses. The distribution is as follows:

Ckt NO.	Equipment
1	VF patch bay 1.2.
2	VF patch bay 1.3.
3	VF patch bay 1.4.
4	VF patch bay 1.5.
5	VF patch bay 1.6.
6	VF patch bay 1.7.
7	Digital patch bay 1.11.
8	Digital patch bay 1.12.
9	Digital patch bay 1.13.
10	Digital patch bay 1.14.
11	Digital patch bay 1.15
12	Digital patch bay 1.16.
13	Digital patch bay 1.17.
14	Digital patch bay 1.18.
15	Digital patch bay 1.19.
16	Digital patch bay 1.20.

(2) -48 VDC *Red Power Distribution.* Upon installation of the P&T the red 48 vdc distribution panel (fig. 1-13) provides 20 outputs fused with two ampere fuses. The distribution is as follows:

Ckt NO.	Equipment
1	S I patch bay 2.1.
2	Digital test bay 2.2.
3	Digital patch bay 2.3.
4	Digital patch bay 2.4.
5	Digital patch bay 2.5.
6	Digital patch bay 2.6.
7	Digital patch bay 2.7.
8	Digital patch bay 2.8.
9	Digital patch bay 2.9.
10	Digital patch bay 2.10.
11	Digital patch bay 2.11.
12	Digital patch bay 2.12.
13	Digital patch bay 2.13.
14	Digital patch bay 2.14.
15	Digital patch bay 2.15.
16	Digital patch bay 2.16.
17	Power bay 2.17.
18	Video monitor bay 2.18.
19	VF patch bay 2.19.
20	VF test bay 2.20.

c. 6 and 24 VDC Power Systems. The 6 and 24 vdc power systems are similar to the -48 vdc systems (b above) with the following differences: (1) The items that 'make up the black system are in bays' 1.16 and 1.17 (figs.1-5 and 1-6); (2) The power supplies do not contain their own meters, so a meter panel (fig. 2-44B) is provided. The 6 and 24 vdc output is distributed from the black and zed fuse distribution panel as given in (1) and (2) below.

(1) *6 and 24 VDC Black Power Distribution*. Upon installation of the P&T the black 24 vdc distribution panel (fig. 1-5) provided nine outputs, fused with five ampere fuses. The 6 vdc outputs are fused with 0.75 ampere fuses. The distribution is as follows:

Ckt. NO.	Equipment
1	Digital patch bay 1.11.
2	Digital patch bay 1.12.
3	Digital patch bay 1.13.
4	Digital patch bay 1.15.
5	Digital patch bay 1.16.
6	Digital patch bay 1.17.
7	Digital patch bay 1.19.
8	Digital patch bay 1.20.
9	Digital patch bay 1.21

(2) *6 and 24 VDC Red Power Distribution*. Upon installation of the P&T the red 24 vdc distribution panel (fig. 1-13) provides 13 outputs, fused with five ampere fuses. The distribution is as follows:

Ckt. NO.	Equipment
1	Digital patch bay 2.1.
2	Digital patch bay 2.3.
3	Digital patch bay 2.4.
4	Digital patch bay 2.5.
5	Digital patch bay 2.6.
6	Digital patch bay 2.8.
7	Digital patch bay 2.9.
8	Digital patch bay 2.10.
9	Digital patch bay 2.11.
10	Digital patch bay 2.13.
11	Digital patch bay 2.14.
12	Digital patch bay 2.15.
13	Digital patch bay 2.16.

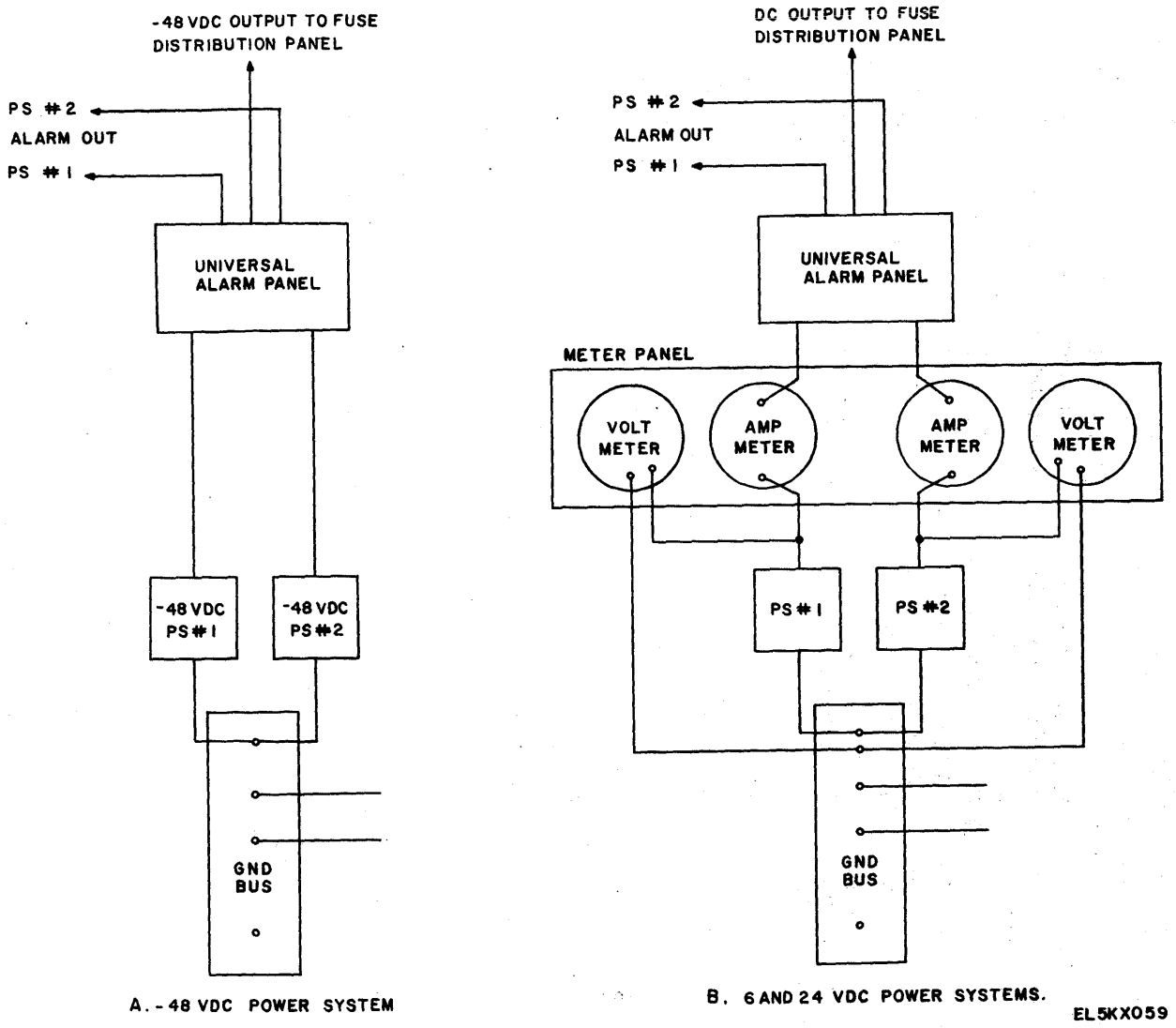


Figure 2-44. Dc Power Systems, Block Diagram.

2-20. Alarm Systems

(fig. 2-45)

Two alarm systems (red and black) are provided in the P&T (a and b below).

a. Red Alarm System. The alarm system is designed to alert the technical controller and maintenance personnel of equipment degradation and/or failures by giving both an audible and visual alarm. Equipment covered by this alarm system are DC distribution and fuse panels and DC power supplies through their associated alarm panel. The red major/minor alarm panel is in bay 2.17 (fig. 1-13). A major alarm indicates a failure or degradation which 2-60 causes the outage of two equipments performing the same function. Minor alarms include equipment alarms where on-line back-up equipment is available. Red lights on the alarm panels indicate major alarms while amber lights indicate minor alarms. The major/minor panel is capable of giving a major or minor alarm indication on a single pushbutton lamp for a single piece of equipment. The audible alarm (in the audible alarm panel) can be silenced by pressing the lighted pushbutton on the major/minor alarm panel. The various alarm circuits are normally open contacts which provide a ground to the major/minor alarm panel for a fault indication.

b. Black Alarm System. The black alarm system is similar to the red system (a above). The major/minor panel is mounted in bay 1.21 (fig. 1-7). In addition, the .AU/CCU and station clock alarms are connected into the system.

2-21. Grounding System

Grounding systems are connected separately to the red and black equipment and circuits (fig. FO-9). Each grounding system consists of three separate and isolated grounds. The shield and DC systems are tied together only at the station ground box. Each ground provides a fixed ground reference for the various equipments and systems within the building. The grounds are isolated from one another to minimize ground current loops and, therefore, reduce unequal ground potentials throughout the site. Each ground cable is tied to a separate isolated ground bar within the box. These grounds are jumpered common and extended to the building ground systems buried externally. The three grounds are the shield, DC, AC grounds.

a. AC Ground. The AC ground is extended throughout the TCF where it serves the AC ground requirements as well as bonding all the iron work within the site to common.

b. Shield Ground. The shield ground is extended to both the VF and DC IDF's, where it is commonly used to terminate the shields or armor of cables.

c. DC Ground. The DC ground runs from the ground box to the power supplies and distribution boards, where it is distributed to power boxes and alarm panels throughout the site.

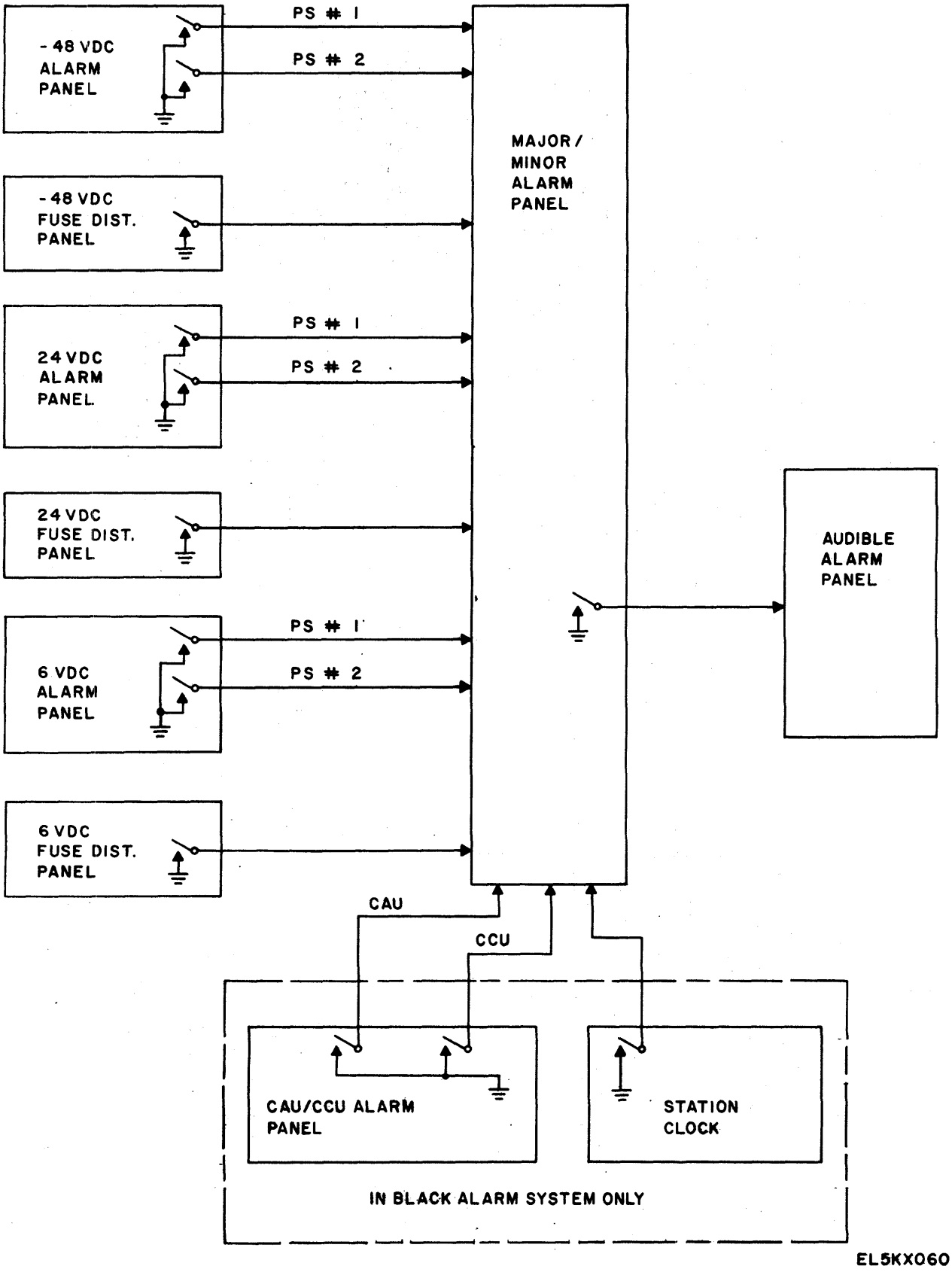


Figure 2-45. Alarm Systems, Block Diagram.

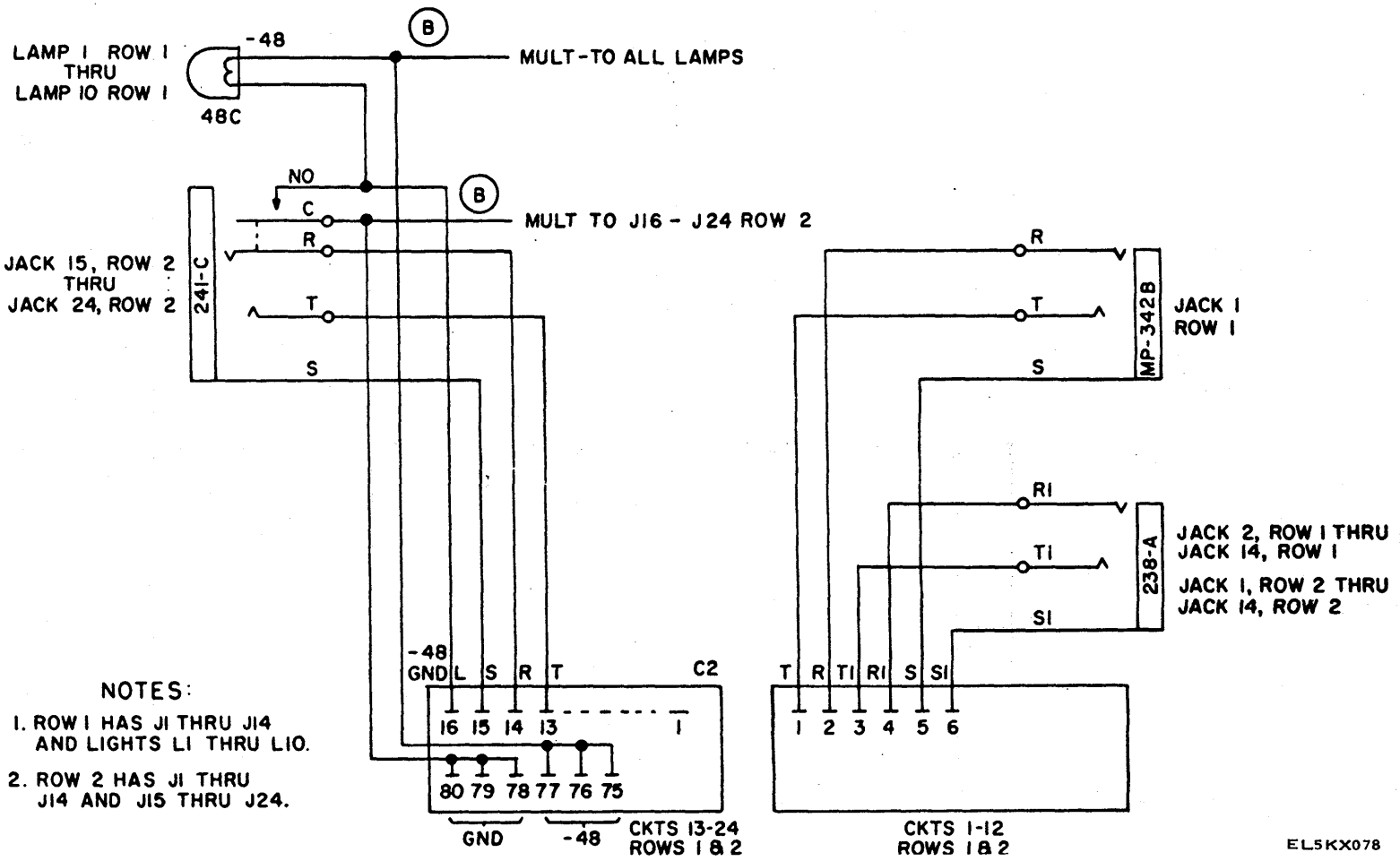


Figure 2-46. Miscellaneous Patch Panel With 10 Lamps, Schematic Diagram.

CHAPTER 3
STATION OPERATIONS

Section I. OPERATION PRACTICES AND METHODS

3-1. System Management

a. The Pentagon station is an important part of a vast, worldwide military communications network handling voice and electronic data communications. Its specific operational function in this network is to provide a wideband relay service and circuit relay service between other technical control sites, and to provide a central access point in the Washington, DC area into the communications network. This mission encompasses all of those actions necessary to maintain flexibility in traffic and circuit routing, reliability of through and terminating circuits, and peak efficiency in transmission quality. This capability can be realized only by employing approved management principles and by strict adherence to proven standard operating procedures at all stations.

b. Overall system management direction resides with the Communications Command Operations Center (CCOC) and the Defense Communications Agency (DCA). The discussions which follow are based upon the facilities provided at the site. Specific operating procedures will be published by the CCOC, and in case of conflict between information contained in this manual and the COC-DCA procedures, the latter will govern. Although the management of the system resides with the CCOC, the implementation of the operational direction, quality of service, and rapid restoration of service in the event of failure is the responsibility of each individual operator in the system. Unless there is thorough cooperation and mutual respect among the personnel manning the stations, even a perfectly designed and well managed operation will fail to provide an effective communications service. Adequate facilities are provided at all stations and a management and control structure is available. The proper use of the station's facilities and equipment will assure a station operating capability which is effective, reliable, and efficient.

3-2. Station Management Approach

The technical control subsystem has been specifically designed as the station control center and is equipped to permit effective station management. All operational orders, circuit activation and deactivation functions,: system reporting, alternate routing procedures, emergency procedures, and any other actions affecting the operation of this station will be directed to, or performed by the technical control operators. Much of the' content of this chapter is therefore addressed specifically to the station technical controllers and is intended to be used as a working guide in conjunction with station SOP's, records, and individual equipment manuals and handbooks (app A). Since the circuit configuration is subject to operational changes, a detailed study of the equipment descriptions in chapter 2 of this manual should be made to ensure familiarity with the facilities provided. Most of the day-today technical control operations require a thorough understanding of the complete station. Rapid response to CCOC directives can only be accomplished by technical controllers who have this understanding.

3-3. Station Management Facilities and Usage

Effective management and specific assignment of responsibilities are essential elements for successful operation of the station. The station design provides the tools and operational concepts necessary for effective station management. The effective assignment of responsibilities by the station manager then depends on his ability to match the capabilities of operational personnel to the station machine. A functional description of man/machine operational interfaces is provided here as an aid in this matching process. More specific operating functions of individual equipments are described in detail in the equipment technical manuals and handbooks.

a. *Patching Functions*. Patching is accomplished at two areas on site.

(1) *Video and Group Interface*. The video and group inputs and outputs are connected directly to video patch facilities. Rerouting of the multiplexed groups is readily accomplished at this point by patching.

(2) *VF and Digital Channel Interface*. Black and Red circuits are wired to the associated patch bays in the P&T area. The patching facilities in this area provide access to the circuits.

b. Monitoring and Testing Functions.

(1) *Monitor and Test Point Interface*. All VF and digital jack sets include a monitor jack appearance. These jacks are arranged to permit monitoring and testing without interrupting the circuit.

(2) *Test Bay Interface*. The test bays contain transmission measuring equipment and other test items to facilitate maintenance, fault isolation, analysis, and correction.

c. Status Reporting and Coordination Functions. Operating personnel at the station are the primary users of the supervisory subsystem which provides orderwire communications. This subsystem provides communications with other stations as required. Reporting requirements are established by the station SOP.

3-4. Duties of the Technical Controller

a. General. The principal functions of the technical controller are to monitor, test, and patch, as required, to ensure operation at peak efficiency and quality. The technical

controller has access to all circuits entering or leaving his station by means of the various jackfields in the patch and test areas. Test equipment is provided in the test bays. to permit measurement. of levels and circuit quality. In the course of his duties, the technical controller frequently has a need to coordinate with, or assist, maintenance personnel. This requirement occurs during trouble isolation, patching out equipment for maintenance, test and analysis, and other similar tasks.

b. Tasks. The technical controller has, as his responsibility, tasks which are routine, as well as priority, in nature. A task list is maintained by the technical controller. Priorities of tasks are assigned, and are accomplished. in order of priority. Precedence work tasks may develop from equipment alarms, signal alarms, fuse alarms, on-call patch, requests from distant controllers, user complaints, direction from higher authority, or return of equipment from maintenance. The tasks of the technical controller are categorized as follows:

(1) Assign priorities to work task in accordance with circuit priority and action precedence.

(2) Monitor station equipment, circuit performance and act on alarms.

(3) Evaluate circuit/equipment status.

(4) Coordinate with. users, other technical controllers, maintenance personnel, and investigate any other factors affecting service.

(5) Test and analyze equipment/circuit capability.

(6) Substitute facilities/alternate route circuits.

(7) Record status.

(8) Report status to affected parties.

(9) Restore facilities after maintenance or testing.

c. Order of Priority. The technical controller, at the start of the shift, reviews the previous shift log entries and receives from the relieved technical controller a list of tasks, arranged in order of priority, which were not completed during the preceding shift. The relieving technical controller proceeds with the accomplishment of these tasks. When a task is completed, the next highest priority task is started, or if the list is completed, routine monitoring of circuits is begun. Any alarm, or other precedence item, interrupts the routine activity of the technical controller. Precedence occurrences are as follows:

(1) Equipment alarm.

(2) Signal alarm.

(3) Request for an on-call patch.

(4) User complaint.

(5) Request for assistance from a distant technical control.

(6) Direction from a higher authority.

(7) Completion of maintenance activity.

d. Coordination. The technical controller investigates all user complaints, cooperates with other technical controllers in rectifying troubles, and in the case of problems affecting service, keeps the users informed of the status of their circuits. A considerable amount of coordination is required between the technical controller and station maintenance personnel. In-station patching during trouble isolation, release to maintenance, return from maintenance, equipment substitution, and other similar activities requires cooperation among operators and maintenance, technicians. Use of the jackfields and test instruments, located in the patch and test area, for monitoring and testing very often requires the assistance of the maintenance technician to set up the test and analyze the results. Procedures for patching operations, testing and monitoring, and some examples of each are described in the following paragraphs.

Section II. PATCHING OPERATIONS

3-5. Purpose of Patching

Patching is defined as the rearrangement of the electrical interconnections among items of station equipment by means of patchcords and jackfields.

a. Service Restoration. The various patching facilities provided in the station technical control area enable the technical controller to take positive action to restore service when a circuit failure has been localized to his station. Such restoration action consists of bypassing the defective equipments and substituting like equipments from the complement of operational spares and, similarly, substituting spare, or lower priority, channels for those degraded or inoperative. The substitution of equipment usually involves only a local patching operation, while substitution of channels requires a coordinated patching operation at the distant terminal.

b. Fault Isolation by Substitution, Substitution of station equipment and channels by patching operations is a valuable fault isolation technique. A logical procedure of successive substitutions of equipment and/or channels usually locates the fault. Often, it is possible to patch out all station equipment is one patching operation, establishing quickly whether the fault is in any of the local station's equipments. Once a channel or equipment has been patched out, test equipment is employed to evaluate circuit performance and to localize the fault.

c. Service Continuity During Maintenance. Preventive maintenance routines require periodic quality control tests (section V) and adjustments of channels and station equipment. When it is necessary to conduct such tests on assigned channels or equipments, service is maintained by a patching substitution. Troubleshooting and corrective maintenance (section III) requires that the defective equipment be disconnected from the circuit and a spare substituted. This substitution is accomplished by patching.

d. .Operational Spares. Operational spare facilities consist of spare multiplex channels and selected items of equipment cross-connected into specific spare configurations.

Whenever such spare equipment is available, spare circuits, which correspond to the DCA options in use at 'he station, may be established to permit rapid restoration X circuits by in-station patching.

3-6. Patching Precautions

a. Temporary Measure. The use of patchcords to set up rearrange circuits is intended as a temporary measure. Service restoration patches should be taken down as soon s the fault condition has been corrected. In some cases, circuit orders may be issued which specify that patchcords be used to set up or rearrange a circuit to fill an emergency or temporary requirement. Such orders may specify, for instance, that circuits be established without delay by patching, and later be cross-connected at the IDF to make a permanent configuration. The patch is to be taken down as soon as the normal circuit is arranged. The operational objective is to keep the jackfields as free of patchcords as possible. A multiplicity of patches in a jackfield frequently results in confusion as to the purpose and authority of the patches, and whether they are still required. To preclude such confusion, identification tags should be attached to any patchcord setup which is to be left in place at the end of the technical controller's duty shift. The identification tag should contain the following minimum information: Circuit number, terminal locations, using agency, mode of operation, authority, and time to be taken down.

b. Patching Technique and Sequence. When patching -operational circuits, it is essential that interruption, or service outage resulting from the actual patching procedure, e kept to an absolute minimum duration. In most patching operations, it is possible to limit the effect' on a VF circuit to a momentary click and on a digital circuit to a few garbled characters. This minimum effect can be realized, however, only when the technical controller selects and follows the correct sequence in inserting the plugs in the jacks. The order in which this is done is important. Each of the many possible patching operations must be considered individually to determine the optimum order of events in the patching procedure. Experienced technical controllers always take a moment to think out the whole patching procedure before plugging into the jacksets. In general, the spare or alternate signal path should be set up first. The plugs should then be loosely set in the proper NORMAL-THROUGH jacksets, located in the signal path of the circuit to be transferred. Finally, in a coordinated procedure, the plugs should be simultaneously pushed all the way into the NORMAL-THROUGH jacksets at two locations that constitute the end of the substitution path.

3-7. Reporting Patching Operations

Patching operations which result in reconfiguration of channels, re-routing of circuits, or cause interruption of service must generally be reported to higher headquarters. The specific reporting procedures to be followed are contained in the current station SOP.

a. Equipment Substitution. No operations reports are required for the substitution of equipment during routine maintenance operations. A failure report must be completed, however, if an equipment failure has occurred.

b. Group Patching. Except as authorized in the current SOP, group patches may not be performed at the site without prior coordination with, and approval of, the CCOC and/or DCA following completion of the group patching procedure.

c. Channel Substitution. The CCOC and/or DCA must be informed when a circuit is transferred to a spare channel, or to a channel of lower priority circuit. The notice should specify the time, circuit number, channel designator, reason, and expected duration of the rearrangement. This report is normally submitted after-the-fact, since the technical controller must take immediate action when patching is required to restore service. When it is necessary to preempt a lower priority circuit to obtain a substitution channel, the using agency must also be informed. When the circuit is restored, the using agency and higher headquarters must be notified.

3-8. Patching Operations Conducted at the VF and Digital Patching Facilities

a. General. The jackfields associated with the VF patching facilities are used to gain access to signals in the voice-frequency range (300 to 3400 Hz) and low level dc circuits for monitoring purposes, and to perform circuit rerouting, test measurements, level adjustments, and restoration of service by equipment substitution. Representative patching operations are given in b below. The patch panels and jacks used are discussed in chapter 2. The patching operations are shown in figures 3-1, 3-2, and 3-3. Install control patches in red circuits as required.

b. Representative VF Patching Operations.

Objective	Situation	Procedure	Notes
At black patch jackfield (fig. 2-16), transfer of circuit to spare channel (Fig. 3-2).	Test maintenance substitution of a. spare channel (No. 2) for online (No. 5).	a. Place two patch cord plugs loosely into channel No. 2 RECLINE and TRANS LINE jacks. b. Place plugs on other end of patch cords loosely into channel No. 5 REC EQUIP and TRANS EQUIP jacks respectively.	a. Identical procedures required at both terminals b. Procedures must be performed simultaneously.

Objective	Situation	Procedure	Notes
		c. Set all plugs into jacks simultaneously. d. Place a 600-ohm term. Plug in the channel No. 5 TRANS LINE jack.	
At red patch jackfield (fig. 2-3), transfer of active circuit to spare cable pairs (fig. 3-3).	Test maintenance substitution of spare cable circuit (No. 2) for the on-line circuit (No. 5).	a. Place two patch cord plugs loosely into channel No. 2 REC LINE and TRANS LINE jacks. b. Place plugs on other end of patch cords loosely into the channel No. 5 REC EQUIP and TRANS EQUIP jacks respectively c. Set all plugs into jacks simultaneously.	a. Cable pair change must be made at local station and second location before subscriber equipment b. Procedures must be performed simultaneously at both locations
At both black and red patch jackfields (fig. 2-16), substitution of crypto equipment strings (fig. 3-4).	Test maintenance substitution of spare crypto equipment (channel No. 2) for on-line equipment (channel No. 5).	a. At black patch bay: (1) Place two patch cord plugs loosely into channel No. 5 REC LINE and TRANS LINE jacks. (2) Place plugs on other end of patch cords loosely into channel No. 2 REC EQUIP and TRANS EQUIP jacks respectively. b. At red patch bay: (1) Place two patch cord plugs loosely into channel No. 2 REC EQUIP and TRANS EQUIP jacks. (2) Place plugs on other end of patch cords loosely into Channel No. 5 REC LINE and TRANS LINE jacks respectively. c. Set all plugs in jacks simultaneously. d. Place a 600-ohm terminal plug in the TRANS LINE jack of channel 2.	

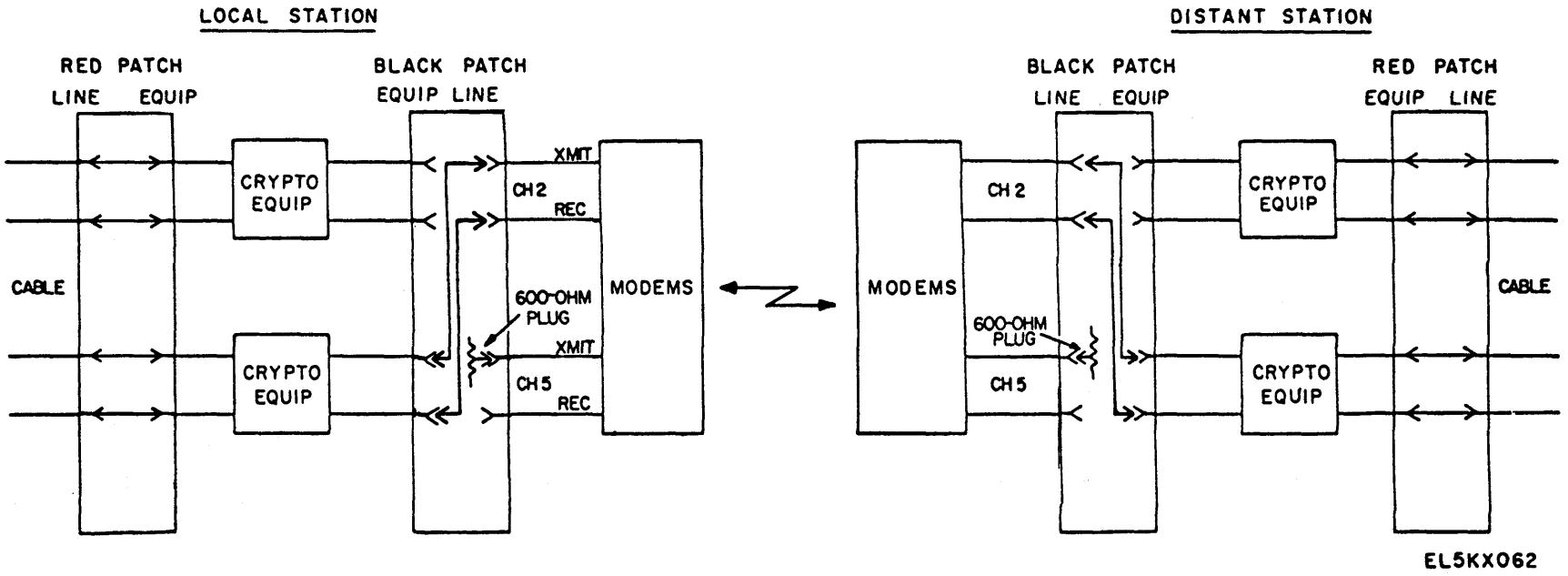


Figure 3-1. Transfer of Circuit to Spare Channel.

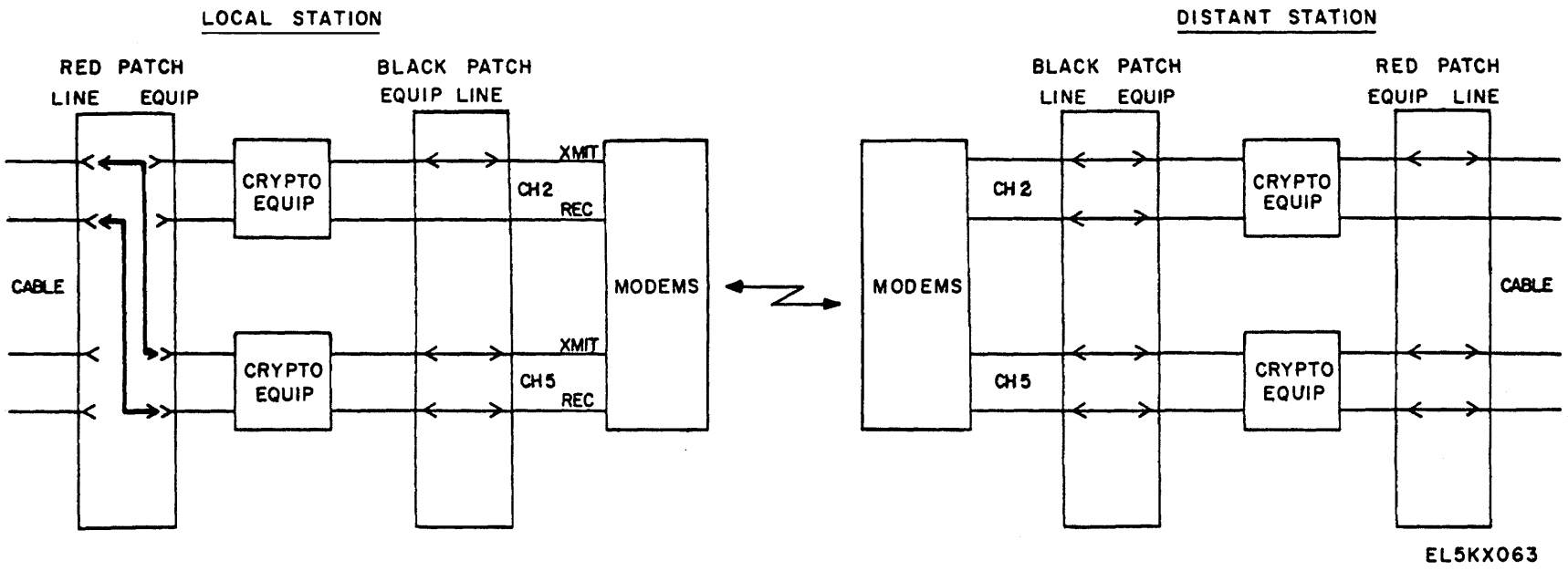


Figure 3-2. Transfer of Circuit to Spare Cable Pair.

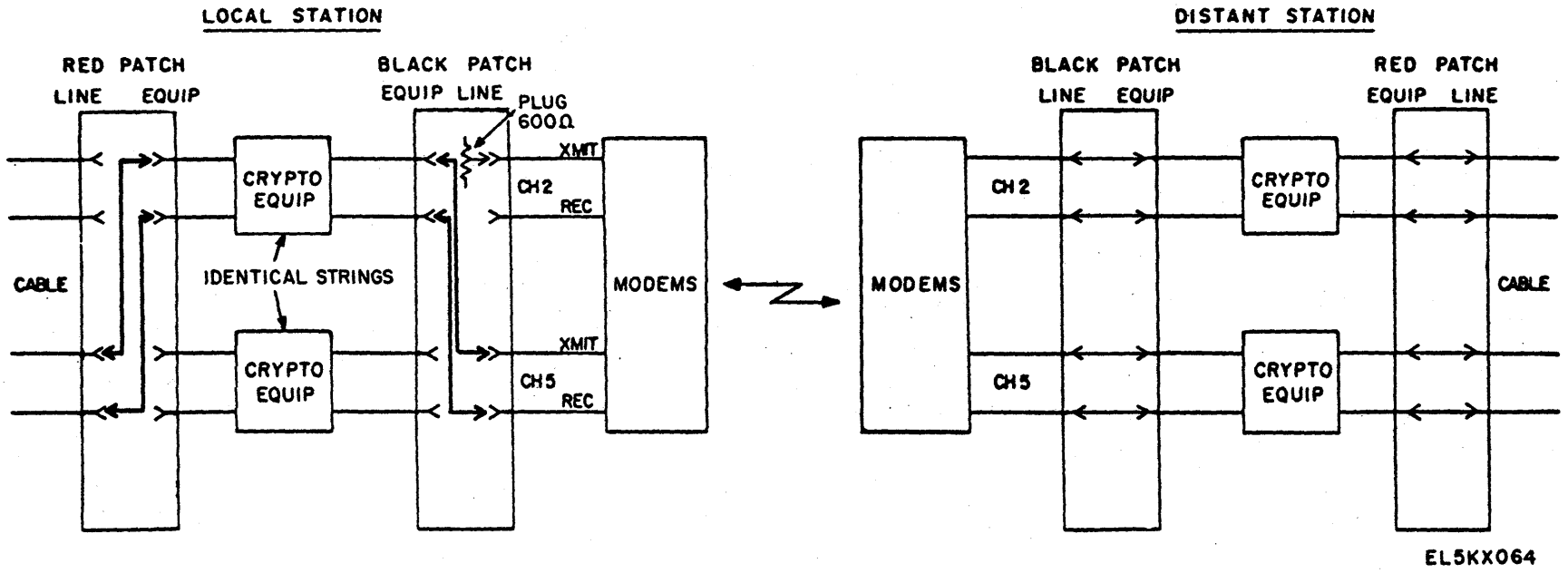


Figure 3-3. Substitution of Equipment.

Section III. TROUBLESHOOTING

3-9. Troubleshooting Responsibilities

a. Technical Controller.

(1) The technical controller at the station receiving a fault notification is responsible for determining the source of channels outages or interruptions, and for the expeditious restoration of channels to minimize the loss of effective operating time.

(2) When a degraded condition or other trouble is encountered at a given station, the technical controller of that station coordinates with distant stations, local users, and associated transmitting and receiving elements in his efforts to isolate and locate the fault. He has primary responsibility for this action, and must receive full cooperation from all other station technical controllers involved. When it is determined that the fault is located at a distant station, or in a link serving an area beyond that station, responsibility for locating and correcting the fault is transferred to, and assumed by, the station technical controller primarily concerned.

b. User. The user is responsible for notifying the responsible technical controller of all instances of service degradation evidenced by high data error rates, occasional noise bursts into the voice channels serving him, or other indications of unsatisfactory conditions. The user renders free cooperation to the technical controller in the correction of service degradation.

c. Communications Command Operations Center (CCOC).

(1) The CCOC monitors the progress of the station technical controllers in their troubleshooting efforts, but under normal circumstances, does not actively engage in the isolation of a fault. If however, the station technical controllers encounter difficulties and cannot restore service within a reasonable period of time, the CCOC is responsible for assuming the overall direction of the corrective actions, for providing a workable solution to the problem, and for keeping circuit outage time to an absolute minimum.

(2) Troubles encountered on multichannel or multilink circuits often are of an accumulative nature and present a complicated condition for resolution. To determine the cause, or causes of such a condition, special link and segment tests may be required. The CCOC is responsible for determining the requirements for such special tests on the basis of station reports. The CCOC coordinates the tests, collects and analyzes the results, and directs remedial actions as necessary.

(3) Unless there are definite indications of a major abnormality the CCOC normally does not take immediate action to inquire about circuit conditions, since continuous inquiries by the CCOC impedes the troubleshooting and fault correction actions of the station technical controller and maintenance personnel. The CCOC is responsible, however, for investigating outages which have not been cleared after a reasonable period off time, or if no explanation has been made by the remote stations or the cognizant master station, for rendering assistance in restoring service.

d. Maintenance Personnel. After faults have been located and identified, maintenance personnel are responsible for effecting necessary repairs and maintenance in accordance with appropriate technical manuals pertinent to the particular item of faulty equipment.

3-10. Troubleshooting Practices

a. Fault Notification. Technical controllers are alerted to actual, or impending circuit outages by means of alarm indicator displays, by notification from the user of circuit deterioration or failure by a distant station technical controller, and as the result of testing and monitoring.

(1) The supervisory alarm subsystem provides an alarm when failure occurs in various equipment and systems at the site, as a CAU, CCU, station clock, fuse panels, or the dc power system. When alerted to an abnormal condition by an alarm, the technical controller and maintenance personnel must perform systematic step-by-step monitoring, or testing of the system segments into, through, and out of the station, in order to isolate the fault(s) to specific areas and/or equipments. Once the trouble is defined, faulty equipment can be repaired, adjusted, or replaced, as necessary.

(2) In other instances, user service is affected by degraded circuit conditions. Such conditions do not activate the supervisory alarms, and consist of sporadic noise bursts in the circuit data error rates, or incorrect channel levels. Usually, these problems are brought to the attention of the technical controller by the user. The technical controller performs monitoring and testing routinely, as circumstances permit. However, when notified of degrading circuit conditions by the user, other technical controllers, or maintenance personnel, monitoring and testing of the degraded circuit should be initiated immediately in order to isolate and correct the cause of the trouble. For this purpose, the patch bays (test and monitor jack appearances) located in the Patch and Test areas, provide a means of sequential access to circuits and patching of the circuits to the QA test center.

b. Service Restoration. The technical controller must use every means at his disposal to restore disrupted service as expeditiously as possible. These means, when available, should be used in the following order of priority:

(1) If a spare channel is available, the technical controller should patch the user circuit or group into the spare (figs. 3-1 through 3-3) while isolating and correcting the defective equipment.

(2) If a fault is identified within an item of equipment for which a standby or spare is available, the substitute

equipment should be used to restore disrupted service while the defective equipment is being restored.

(3) During prolonged, or projected extended out-ages, the technical controller should request alternate routing instructions. Rerouting and preempting is obtained from a list in SOP.

(4) As a last resort, the technical controller should preempt lower priority circuits in order to restore service for high priority users. Every circuit, including switchboard trunks as well as allocated circuits, is assigned a priority of restoration which must be adhered to in channel restoration. Establishment of these priorities is performed on a worldwide basis by the Defense Communications Agency.

c. Records and Reports. The technical controller who first determines that a fault exists or to whom a fault is reported by a user, is responsible for coordinating the fault isolation activities with distant station controllers, and he is responsible for appropriate log entries and reports. When a fault has been isolated, an explanation of the nature of the trouble must be entered in the reporting station log, and the distant technical controller must be notified so that the entries for both stations coincide. All circuit outages must be recorded on the appropriate station logs, regardless of the duration of the outages time or the cause of the fault. Specific instructions for reporting of stations are contained in Standard Operating Procedures. Trouble reports (work orders) must be prepared for each equipment or circuit failure. This work order will notify maintenance of the faulty or substandard equipment. Only by-strict adherence to this procedure can proper records be maintained. Prompt, efficient repair of faulty equipment often depends upon the completeness and accuracy of the symptoms described on the written work order.

d. Catastrophic Failure. Normally, the technical controllers keep the CCOC and DCA informed of anticipated or existing service failures or degraded conditions which are beyond the local capability to restore within a tolerable delay or outage time period. In an exceptional case, a catastrophic failure condition may be encountered in which the alarm indicator display may depict a number of simultaneous alarms or provide an indication of a second major alarm condition within the same station before the first alarm has been cleared. In these cases, the SOC may provide alternate routing instructions, or other solutions, as applicable.

3-11. Fault Isolation Procedures

a. General. The technical controller must keep in mind that the fault isolation procedures which follow serve only as a guide for efficient technical control operations and do not represent a rigid sequence of steps which must be followed to solve a problem. The site SOP should be adhered to if not in agreement with the following. The technical controller is urged to bypass any unnecessary steps in order to achieve the most expeditious fault location and service restoration. When an equipment alarm is activated, a fault notice is received from a user, or routine checks indicate that a channel or group is not operating satisfactorily, the station technical controller proceeds in the following manner:

(1) He determines if a single channel, a group of channels, or the entire area is affected.

(2) The controller isolates the area of malfunction.

(3) He then endeavors to restore service as quickly as possible by selecting the most expeditious of the following methods: By substituting in-station spare equipment of identical configuration by patching to a spare channel between stations (figs. 3-1 through 3-3) and/or by requesting that station maintenance personnel perform the necessary testing and equipment repairs.

(4) In the event that the malfunction involves a priority channel, and service cannot be restored expeditiously by the above methods, he preempts a channel from the lowest priority user by patching.

b. Single Channel. When it is determined that a single voice channel is unserviceable, the station technical controller takes the following action:

(1) If the fault notification has been received from a connected subscriber, the controller should check the local subscriber loop to determine the serviceability of the subscriber terminal equipment and of the transmission facilities between the subscriber and the station. If it is found to be unserviceable, he should notify station maintenance personnel.

(2) If the subscriber loop is determined to be functional, he should check the serviceability of the in-station circuit path, including a check made in conjunction with microwave personnel, of the multiplex channel modem assigned to the circuit. If any component is found to be unserviceable, he should change cable pairs or request microwave personnel to restore service.

(3) If the in-station circuit path is determined to be serviceable, the controller should request that the technical controller, at the next station where the circuit appears, check the serviceability of the subscriber circuit within its station. The fault isolation mission should be continued, as necessary by coordination with other technical controllers until the fault has been isolated and corrected.

(4) If the malfunction occurred at a distant station or between station, he directs and assists the distant technical controller in the restoration of the circuit, as requested.

c. Multichannel. When it is determined that an entire group of 12 channels or supergroup of 60 channels is unserviceable, the station technical controller should take the following action:

(1) In conjunction with the station microwave personnel, he should check the serviceability of the station multiplex terminal equipment associated with the affected circuits. If any component is found to be defective, he should restore service in accordance with the service restoration guidelines (SOP). In the event that a spare group or supergroup is not available to correct the deficiency

temporarily by patching, and high priority circuits are disrupted, he should request authority from the CCOC or DCA to preempt lower priority circuits.

(2) In the event that the malfunction can be cleared only by corrective maintenance, he should request that the distant technical controller(s) involved hold traffic, pending completion of the repairs, and ensure that all users of the affected circuits are advised of the temporary disruption of traffic.

(3) If the fault occurred at a distant station, he should assist the distant technical controller in the restoration of the circuits, as required.

d. Baseband. When it has been determined that an entire baseband is unserviceable, the station technical controller should:

(1) Request that station microwave personnel check the serviceability of the radio equipment assigned to the link, and the serviceability of the associated multiplex terminal equipment.

(2) In the event that the malfunction can be cleared only by corrective maintenance, he should immediately contact the (CCOC and DCA and request rerouting instructions for any high priority circuits that may be involved.

(3) If the fault occurred at a distant station, he should assist the distant technical controller in restoration of the baseband circuits, as required.

3-12. Examples of Voice Channel Fault Isolation Procedures

There are a number of acceptable methods of isolating a faulty link in a communications channel. Two methods are explained in this paragraph. The first method (discussed in a and b below) requires the isolation procedure to begin at the point of fault recognition. Each site clears his TCF of any responsibility for the fault by working in order along the communication chain. The second method (discussed in c) allows the responsible TCF to isolate the fault over the whole communications chain by having his own signal looped back and tested at various points in succession along the chain.

a. Noise Burst on Mux Through Circuit. The local technical controller is notified by a distant technical controller that noise bursts are being encountered by one of his local subscribers. He had cleared his station and wishes the local technical controller to do the same. Since the circuit is relayed through this P&T, the local technical controller is responsible for simply checking the circuit through his site to determine if the fault source is in his station, reporting back to the distant station, and correcting the fault, if necessary. The technical controller could take the following action:

(1) At the Patch Bay electrically closer to the signal source and away from the complaining subscriber, he should patch a speaker panel into the monitor jack of the "LINE REC" appearance of the circuit. If noise is encountered, the degradation must originate at some point closer to the signal source, which includes his mux system. He should check other circuits in the same mux group to determine if the fault is confined to the circuit under test. If an entire group proves to be at fault, he should call in maintenance personnel to check multiplex group equipment, inform the responsible technical controller and prepare to coordinate with the station at the other end of the faulty link. Group patching may be required. If only the circuit under test is faulty, the responsible technical controller should be informed that this station is not the fault source and the isolation procedure should be continued at points closer to the signal source. He should also request the station maintenance personnel to check the channel modem associated with the subscriber circuit.

(2) If noise was not encountered, the fault then lies in the mux and radio link between the patch bay at this site and the distant site. This can be assumed since this distant station would have previously established that the fault was not in his TCF and the local technical controller has established that the fault is in his direction. The station responsible for the circuit should be informed, maintenance people should be requested to check the channel modem equipment, and the controller should prepare to patch around the faulty channel.

(3) He should standby for notification by maintenance of the distant technical controller that the fault has been identified.

(4) If the faulty circuit has not already been patched A out of service by stations at the distant terminals, and an extended outage is indicated, he should assist in patching to a spare mux channel.

(5) Upon notification that the equipment malfunction has been corrected, he coordinates with stations involved to restore the circuit to the normal-through configuration.

(6) He then completes station records, logs, and trouble reports.

b. Noise Burst on a Local Subscriber Circuit. The technical controller is notified by a connected (local) subscriber that frequent noise bursts are being received. The controller realizes that he is responsible for coordinating fault isolation procedures at distant stations which may be involved; however, he first determines if the fault is in his own TCF. He may decide to immediately patch to a spare channel by coordinating with the TCF which originates the signal, depending on circuit priority and space availability. He should check the circuit in his P&T area by following a procedure similar to that below:

(1) The technical controller should attempt to clear his site and subscriber loop by patching a speaker panel into the "REC MON" jack of the panel where the subscriber's circuit enters the P&T from the Mux system. If the noise is encountered, the fault is at some point closer to the signal source and away from the subscriber. It is the local technical controller's duty to coordinate further

isolation procedures at other TCF's which handle the defective circuit.

(2) If the noise is not encountered in (1) above, then the fault is in the subscriber's terminal equipment or cable. Maintenance should be notified and an alternate cable pair should be sought.

(3) If patching was necessary in some leg of the circuit, the technical controller, upon notification that the / malfunction has been corrected, coordinates with technical controllers or subscribers involved to restore the circuit to the normal-through configuration.

(4) He then completes station records, trouble reports, and log entries.

c. Fault Isolation of a VF Subscriber Circuit by the Loop-Back Method. The technical controller is notified by a local subscriber that the circuit level is not correct. The technical controller decides to patch the circuit out of service since a spare is available to the originating subscriber or switch. The technical controller clears his own station and then proceeds to isolate the fault, step by step toward the distant end (toward the end originating the signal).

The following procedure could be used:

(1) From the subscriber through the local TCF can be cleared as discussed in b above.

(2) The next TCF toward the signal source should be notified to loop back the circuit under test. That distant station patches the 0 dBm Rec to the 0 dBm Send of the same channel under test at the EL patch bay. When the local technical controller inputs a 1000 Hz test tone on the Send Circuit at a level of 0 dBm, he will receive the same test tone back on that channel's receive circuit. If the level is correct (0 dBm), that leg of the channel is cleared. If the level is wrong, the fault has been isolated between the two TCF's.

(3) If the tone looped back was received at the proper level of 0 dBm, the distant TCF should be requested to remove the loop back patch and the next TCF further toward the signal source should be requested to perform a similar patch. In this way, the trouble can be isolated between any two EL patch bays in the channel.

3-13. Examples of DC Circuit Fault Isolation Procedures

a. Open Circuit Condition. The station Technical Control activity is notified by a connected telegraph subscriber that incoming traffic has been interrupted and that the page printer has started to run open. Circuit layout record cards at the station indicate that the subscriber circuit is connected by cable to a nearby military installation. The technical controller, based on his knowledge that a break in the DC loop is the most likely reason for the condition reported, reasons that the communications failure could be caused by a failure of the loop battery, an open connection at the subscriber terminal, a defect in the cable, or an electrical failure of the receiving device.

(1) *Loop battery check*. The technical controller should check the appropriate fuse panel (or associated alarm output) to verify that no failure has occurred in the loop current distribution system serving the subscriber loop. If a blown fuse alarm is received, the line should be checked for a short circuit.

(2) *Open connection at subscriber terminals*. If no failure in the loop battery supply is detected, the station technical controller should:

(*a*) Locate the jack appearances of the subscriber circuit at the DC Patch bay and patch a voltmeter into a monitor jack appearance of the Transmit circuit (Receive circuit of Subscriber) to measure the loop voltage.

(*b*) If a zero reading is obtained, by patching a voltmeter into the subscriber circuit "REC MON" jack appearance at the DC (Low Level) patch bay, the technical controller will be checking to determine that a steady mark condition is not being received from the VFCT. Refer to maintenance.

(*c*) If a steady mark indication is obtained, he should isolate the subscriber loop from the in-station circuitry by inserting a shorting-type dummy plug-in the line transmit jack appearance at the DC Patch Bay. A + 6 vdc will be applied to the line.

(*d*) If the receiving device continues to run open, request that user maintenance personnel check the continuity of the subscriber loop.

(e) Upon verification by maintenance that the trouble has been located at the subscriber terminal (for example, an open connection), and has been corrected, he should ensure that the normal interface equipment has been returned to the subscriber's receive channel. Remove the dummy plug from the line jack appearance at the DC Patch bay to re-install the subscriber loop into the in-station circuitry.

(f) Complete station records, trouble reports, and log entries.

(3) *Defective cable*. The station Technical Control activity is notified by maintenance that the failure in the subscriber loop is caused by a break in the cable between the station and the subscriber location. The report indicates that the cable will be out of service for some period of time. The area circuit records have been reviewed by the station technical controller and they indicate that an alternate link is not available, or feasible, between the two locations. He has further determined that it is not practicable to copy the incoming traffic at the station for use by the subscriber. The station technical controller should:

(*a*) Contact the distant VFCT terminal and request that the technical controller stop traffic to the subscriber until the fault has been cleared.

(*b*) Insert a dummy plug in the line jack appearance of the subscriber's receive circuit ("Line Trans" Jack) at the DC Patch bay to isolate the subscriber loop from the in-station circuitry.

(*c*) Upon notification by maintenance personnel that the cable has been repaired, he should remove the dummy plug from the line jack appearance at the DC

Patch Bay.

(*d*) Notify both the subscriber and the distant VFCT technical controller that the circuit is ready for the passing of traffic.

(*e*) Complete station records, trouble reports and log entries.

(4) *Defective subscriber terminal equipment*. The station Technical Control activity is notified by maintenance personnel that an electrical failure has occurred in the page printer at the subscriber terminal. The station technical controller should:

(*a*) Insert a dummy plug in the line jack appearance of the subscriber's receive channel at the DC Patch bay to isolate the subscriber loop from the in-station circuitry.

(*b*) Upon notification by maintenance personnel that the equipment failure has been corrected, he should remove the dummy plug from the line jack appearance in the Patch bay to restore the subscriber loop to the in-station circuitry.

(*c*) Perform a Fox test as required, to ascertain that the printer is properly adjusted.

(*d*) Complete stations records, trouble reports, and log entries.

b. Defective VFCT Channel Equipment. The Technical Control activity is notified by a connected subscriber that service appears to have been interrupted on his receive circuit. The technical controller initiates his fault isolation procedures. A zero reading is shown when a voltmeter is inserted in a monitor jack of the subscriber receive channel at the DC, (low level) patch bay. The station technical controller then actuates the cut-key (if available, if not, inserts a dummy plug) of the receive channel at the DC bay to apply hold battery to the loop. To determine if a fault exists in the VFCT channel equipment, either in the station or at a distant terminal, the station technical controller should:

(1) Consult the station circuit file and identify the voice frequency (VF) and tone channel assignments of the DC subscriber circuit.

(2) Place the selector switch of the Teletype Carrier Test Set to the designated tone channel, and connect the unit to the V]F Patch bay "LINE TRANS" jack serving that channel of the VFCT terminal.

(3) Patch the DC output of the VFCT at the DC Patch bay either to the Distortion Analyzer Set, Distortion Test Set or to a Monitor Teleprinter. The jack appearances are located in. the MISC/INT jackfields of the DC test bays. If teletype signals are not received at this point, a failure in the station VFCT channel equipment is indicated. If the VFCT passes the test signal, then the fault lies in the VF area or distant terminal (refer to c below).

(4) Request that station maintenance check the VFCT channel equipment serving the subscriber loop.

(5) The technical controller should call the distant VFCT terminal and coordinate the transfer of the subscriber circuit to a spare channel (para 3-8) if required, because of anticipated circuit outage.

(6) Upon correcting of the defective channel equipment, he should coordinate with the distant VFCT terminal to return the subscriber circuit to the normal VFCT tone channel by simultaneously removing the patchcords at both stations (if a spare channel has been used).

(7) Complete station records, trouble reports, and' log entries.

c. Failure at Distant Terminal. If no signals are detected during the check in b(2) above, a failure in the VFCT system at a distant station is indicated. The station technical controller should:

(1) Contact the technical controller at the distant VFCT terminal through the orderwire and request that he continue the fault isolation procedure through his station. This procedure should be continued by all technical controllers involved until the fault has been isolated.

(2) Upon isolation of the fault at a distant station, and as requested by the responsible controller, he should coordinate efforts to restore service to the subscriber. This may involve a temporary transfer to a spare channel.

(3) Upon notification that the necessary repairs have been made, he should assist the distant technical controller(s) in the restoration of normal service to the subscriber.

(4) Complete station records, trouble reports, and log entries.

d. Channel Degradation. The Technical Control activity is notified by a connected subscriber that a teletypewriter machine has started to produce garbled page copy. The report states that the error rate is serious enough to render incoming messages largely unintelligible.

(1) *Subscriber loop check.* The station technical controller, upon receipt of this fault notification, should patch a monitor Teleprinter into a MONITOR jack appearance of the subscriber receive channel at the DC Patch bay to determine the quality of the signals passing through the subscriber loop. (As an alternative, the technical controller may patch a Distortion Analyzer into the subscriber circuit at this point to determine the type of distortion causing the signal degradation). This information is most useful in many instances in identifying the origin of a fault condition. Illustrations of normal and distorted teletype signals are contained in the instruction manual for the Distortion Analyzer.

(2) *Range setting check*. If the telegraph signals are copied without garbling during the subscriber loop check, the reported fault condition may be caused by an improper range setting of the subscriber teletype machine and this should be checked. The station technical controller should:

(*a*) Request the subscriber to stand by for a test transmission to evaluate the adjustment of his teletype machine.

(b) Patch the Pattern Generator output (EST MESSAGE jack) into the LINE jack appearance of the subscriber receive circuit at the DC patch bay, and transmit the Fox test message to the subscriber station.

The range control of the subscriber teletype machine should be adjusted by maintenance personnel to the midpoint of the range over which perfect page copy is obtained.

(c) Upon correction of the reported fault condition, he should complete station records, trouble reports, and log entries.

3-14. Orderwire Procedures

Effective operation of DCS Transmission facilities requires frequent coordination between Technical Control Facilities. The voice orderwire, the telephone and the intercom system to the various users maintenance personnel are used to rapidly disseminate unclassified information concerning circuit restoral, quality control circuit engineering and other information needed to maintain and build circuit integrity. Voice orderwire should be used for what they were intended since the maximum efficiency of the control operation is through adherence to orderwire procedures.

a. In answering the phone, you say (speaking assertively) Pentagon Technical Control, Specialist (give last name) speaking sir, may I help you (unless otherwise directed by local SOP's).

b. On voice orderwire be courteous, speak slowly and enunciate clearly. These simple practices will alleviate unnecessary and costly (both in time and money) call backs to better explain the problem or to correct misunderstandings. Always close with your initials or call sign and request the same from the party you are speaking to. This last practice might someday protect you from personal error.

Section IV. IMPLEMENTATION OF COMMUNICATIONS SERVICES REQUIREMENTS

3-15. Origination of Requirements

Communications services requirements can be originated at any command level, but must be coordinated with, and approved by the command echelon responsible for the operation of the system, or at the level exercising control over the communications facilities in a particular area. Communications requirements affecting the Pentagon station are determined by DCA, processed through ACC and are implemented under the direction and supervision of ACC.

3-16. Circuit Activation

When a request for circuit activation is initiated, all known or determinable data pertaining to the service requirement normally accompanies the request. This data will include the applicable items of circuit priority, type of service required, number and locations of subscribers or extensions involved, circuit time element (full time, part time common user, trunk tributary), and desired activation date.

a. Upon receipt of the activation order, ACC, from records on hand, determines: Any technical requirements which must be satisfied; the stations enroute; and types and amounts of equipments or materials involved. Depending upon time availability prior to the activation date, ACC processes the activation order to the appropriate station or unit concerned, either by normal administrative distribution or over the teletype orderwire facilities.

b. Each station supervisor verifies that the order is applicable to his station and schedules the work to completion. At the indicated time, station personnel install the required cross-connections at the IDF and associated equipments, and adjust appropriate patches, controls and equipments to optimum operating efficiency. As soon as the circuits are aligned and in operation, the stations complete in-station records identifying the circuitry, channels, links, jacks, IDF connections, panels and equipments used. The stations must also forward all detailed record data needed by DCA and ACC to keep the system records completely current at all times.

c. The cross-connect instructions that constitute a Circuit Order are issued directly to the stations concerned, by the agency responsible for circuit design and channel allocation. ACC, however, must receive an information or record copy and has overall responsibility for the correct implementation of the Circuit Orders. ACC furnishes technical advice to the stations, upon request, and directs the stations in testing newly established or rearranged circuits. It also maintains centralized records of equipment assignments, cable pairs, channelization, routing, and complete statistical data on the entire system operation.

3-1 7. Circuit Deactivation

At such time as requirements for a particular communications service no longer exists, the circuits, channels, equipments and facilities employed in providing that service are deactivated, and a status change of the facilities and equipments involved is entered on all applicable records. Normally, the termination of requirements is foreseen in sufficient time that the deactivation requests and orders can be scheduled for inclusion in the normal system workload. The sequence of authority for circuit deactivation is the same as for establishing new services. ACC issues the termination orders to include dates, times, and facilities or equipments involved. The station supervisor includes the work in appropriate work schedules and, on completion, all station records are updated and a detailed report forwarded to ACC. ACC records are then updated and all of the required change information which is included in the station report is forwarded

to the command headquarters, and/or high command echelons, as directed.

3-18. Circuit Rerouting

Circuit rerouting is normally accomplished on a planned (scheduled) basis on orders from DCA or ACC. System planning and growth, circuit priorities, link or equipments reliability, subscriber population density, party line or command net configurations, and system maintenance may be major system operating factors which generate circuit rerouting requirements. In addition, system or equipment failures may necessitate emergency circuit rerouting.

a. Normal Circuit Rerouting. All normal circuit rerouting requirements are determined by ACC or higher authority and are primarily based on satisfying customer demands or improving communication services in a particular area of the system. In the latter case, the determination or requirement is the result of study and analysis of system operating and service conditions. The information is taken from the daily technical control and maintenance logs and reports which are submitted by all stations to satisfy system operating statistics, and record requirements at ACC and/or higher headquarters. When a normal circuit rerouting requirements is established, ACC issues the work directive which combines the information needed for a circuit activation and a circuit deactivation. The station supervisors verify the details of the directive, check that all required equipments and/or facilities are available for use, and schedule the work for completion. As soon as the work is completed, and the circuit verified in service, the station records are updated and details promptly forwarded to ACC in order that the system master files and records can be maintained current at all times.

b. Emergency Circuit Rerouting. Any circuit rerouting necessitated by system, equipment, or facilities failure can be identified as an emergency requirement. Emergency circuit rerouting is accomplished, insofar as possible, by temporary cord, plug and jack patching arrangements at or through the Technical Control Facility using installed spare equipments or channels to bypass the failed equip ment or portion of the circuit or system. The magnitude of failure will determine the degree of emergency attached to each service interruption. A majority of the service troubles encountered can be attributed to failure of a minor item of in-station equipment; in this case, the station personnel are able to restore service expeditiously by patching in spare equipment or components. As soon as maintenance personnel repair or replace the failed items, the circuit is restored to its normal path. All troubles must be logged and reported, but the use of installed spares need not be coordinated with ACC prior to getting the circuits back in service. Any nonpatching type rerouting actions required to restore service to less than highest priority critical circuits must be first coordinated with or have the approval of DCA or ACC.

c. Catastrophic Failures. The failure of link equipment, transmitters or multichannel equipments involving critical highest priority circuitry, either by error or intent of man, or by natural forces, are considered catastrophic failures. Under these conditions, the restoration of service to critical and high priority circuits is of paramount importance. Of equal importance at this time is the need to notify ACC of the failure event, the point of failure, extent of damage, estimate of work, equipment, and time involved in correcting the failure, and what has been done or is being done to restore service. Station supervisors and station technical controllers immediately take action to reroute predetermined critical and high priority circuits to the maximum degree possible over available spares wherever alternate routing links are available. As services are restored, DCA and ACC are notified. DCA or ACC evaluates initial reports and all subsequent status reports and initiates necessary instructions to station supervisors and technical controllers detailing additional circuits to be rerouted and routes to be used. DCA or ACC also indicates which, if any, lesser priority circuits will be preempted in order to maintain a maximum service balance throughout the entire system until the failures can be completely restored to normal service.

Section V. QUALITY CONTROL TESTING

3-19. Introduction

a. In order to meet the requirements of the DCA and provide effective service, the technical control facility must be operated and maintained in peak operating condition.

b. In order to maintain the TCF in peak condition, in-service quality checks, out-of-service quality checks, and communications equipment checks should be performed on a regularly scheduled basis.

(1) *In-Service Quality Checks*. In-service checks are made on all channels within the P&T. Measurements are made on a high impedance bridging basis that will not effect user service. Only the composite signal transmission level test will be run in service. The total peak distortion test may be run in-service or out-of-service.

(2) *Out-of-Service Quality Checks.* Out-of-service checks require the release of the circuit by the user. These checks verify the technical parameters of the circuit end-to-end. The procedures used to make out of service quality checks are the same as those used when DCA circuits are activated.

(3) *Communications Equipment*. Quality control testing is require on all operational and spare communications equipment and should be conducted on a regularly

scheduled basis. These tests are located in the manufacturers' technical manuals.

c. Failing Circuits. If circuits fail to meet the required, specifications during a test, the deficiency should be located and corrected as soon as traffic conditions warrant interruption of the circuit for the required period

3-20. Testing Procedures

a. Quality Assurance tests should be made in accordance with the latest DCA QA testing schedule.

b. Patch the circuit to be tested to the QA test center via the Interbay trunking system (para 2-16).

c. Perform testing as given in DCA circulars listed in appendix A.

CHAPTER 4
MAINTENANCE

Section I. ORGANIZATION MAINTENANCE, GENERAL

4-1. Scope of Organization Maintenance

This chapter contains instructions covering organizational maintenance of the P&T. It includes the following functions:

a. Daily and weekly preventive maintenance checks and services (para 4-5).

b. Monthly preventive maintenance checks and services (para 4-6).

c. Quarterly preventive maintenance checks and services (para 4-7).

d. Cleaning (para 4-8).

e. Touchup painting (para 4-9).

f. Building and changing circuits (paras 4-10 through 4-12).

g. Troubleshooting permanently connected circuits and equipment (sec IV).

4-2. Tools, Materials, and Test Equipment Required for Organizational Maintenance

a. Tools. Tool kit, Weco # 168.

b. Materials.

(1) Lint-free cloth.

(2) Lubricating oil, general purpose, preservative (PL Special) (NSN 9150-00-185-0629).

(3) Fine sandpaper, No. 000.

(4) Tile panel lifter.

c. Test Equipment.

(1) All rack mounted test equipment listed in appendix C.

(2) Multimeter, Simpson 260.

Section II. PREVENTIVE MAINTENANCE PROCEDURES

4-3. Preventive Maintenance

Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition and assure maximum operational capability. Preventive maintenance is the responsibility of the P&T maintenance NCOIC and maintenance personnel.

a. Systematic Care. The procedures given in paragraphs 4-4, 4-5, 4-6, and 4-7 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and service charts (para 4-5 through 4-7) outline functions to be performed at specific intervals (para 4-4). These checks and services are to maintain equipment in good general (physical) condition and in good operating condition. To assist maintenance personnel in maintaining the equipment in peak condition, the charts indicate what to check, how to check, and the normal conditions. The reference column lists the paragraphs or manuals that contain detailed repair or replacement procedures. If a defect is noted that cannot be remedied by the TCF maintenance personnel, a higher category of maintenance or repair is required.

4-4. Preventive Maintenance Checks and Service Periods

Preventive maintenance checks and services of the TCF are required on a daily, weekly, monthly, and quarterly basis unless otherwise directed by the station commander.

a. Paragraph 4-5 specifies checks and services that must be accomplished weekly and under the special conditions listed below.

(1) When the equipment is initially installed.

(2) When the equipment is reinstalled after removal for any reason.

(3) At least once each month if the equipment is maintained in standby condition.

b. Paragraphs 4-6 and 4-7 specifies additional maintenance checks and services that must be performed monthly and quarterly respectively.

4-5. Daily and Weekly Preventive Maintenance Checks and Service Charts

Perform the maintenance functions indicated in the daily and weekly preventive maintenance checks and service charts below daily and weekly respectively. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions.

a. Patch and Test Facility (Daily)

Sequence No.	Item to be inspected	Procedure	References
1	Alarms and lamps.	Press test button on alarm panels.	

b. Patch and Test Facility (Weekly).

Sequence No.	Item to be inspected	Procedure	References
1	Grounding system.	Verify that the grounding system is properly installed with good electrical connections throughout.	None.
2	Cables, wires, and cords.	Remove dirt from cable insulation and connections. Tighten loose connections at all accessible connectors and jacks.	Para 4-8.
3	Lighting system.	Replace defective lamps.	None.
4	Walls, ceilings, and floors.	Report any discrepancies to Post Maintenance.	None.

c. Equipment Racks, Equipment, and Power Distribution Panel (Weekly).

Sequence No.	Item to be inspected	Procedure	References
1	Cleanliness.	Remove dirt, dust, and other foreign matter from all exposed exterior surfaces.	Para 4-8.
2	Connectors.	Check cables and connectors for secure fit.	None.
3	Mounting.	Check to be sure that the units are securely mounted.	None.
4	Operation.	During normal operation, observe that the mechanical action of each switch and control is smooth and free of binding.	None.
5	Lamps.	Check all indicating lamps. Replace defective lamps.	App A.

4-6. Monthly Preventive Maintenance Checks and Service Charts

Perform the maintenance functions indicated in the monthly preventive maintenance checks and service chart below once each month. A month is defined as approximately 30 calendar days. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions. Equipment maintained in a standby condition must have monthly preventive checks and service. Equipment in limited storage requires services before operation but not daily and weekly preventive maintenance.

a. Patch and Test Facility (Monthly).

Sequence NO.	Item to be inspected	Procedure	References
1	Grounding system.	Verify the station grounding system is adequately throughout.	None.
2	Movable parts.	Check all hinges, latches, and metal to metal sary: a. Clean and paint bare metal parts. b. Tighten loose screws, nuts, and bolts. c. Lubricate. d. Clean. all air filters.	Para 4-8 Para 4-9.
3	Cables, wires, and cords.	a. Tighten screws, clamps, and nuts that secure b. Repair insulation cuts and abrasions with tape.	a. None. b. None.
4	Electrical system conduits and	Tighten loose screws, bolts, and clips. Repair or switches, switchplates, outlets, and receptacles.	None.
5	Equipment mountings.	a. Tighten all loose bolts, nuts, screws, and clamps equipment racks, frames, shelves, braces, and ware. Replace missing hardware. b. Check to see that equipment mounting racks, braces, and clamps are not bent, broken, or out of danger equipment or personnel.	None. None.
6	Fuses.	Check fuses at fuse panel and equipment. Replace Verify that all operating fuses are of the correct fuses for proper value and quantity.	Para 2-18.

b. Equipment (Monthly). Perform periodic checks and services on each equipment in the facility (App A).

4-7. Quarterly Preventive Maintenance Checks and Service Charts

Quarterly preventive maintenance checks are required on the P&T. Periodic, daily, weekly and monthly services constitute a part of the quarterly preventive maintenance checks and services and must be performed concurrently. All deficiencies will be recorded and corrected.

a. Patch and Test Facility (Quarterly).

Sequence NO.	Item to be inspected	Procedure	References
1	Publications.	Check to see that all publications are complete. rent.	None.
2	Mounting.	Verify that all bolts, nuts, and washers are correctly properly tightened. Check for cracked, bent, or broken	None.
3	Spare parts.	Check all spare parts for general condition and method of There should be no evidence of overstock, and all on requisition.	App A.
4	Power supplies.	Remove power and dust inside.	Manufacturer's

b. Equipment.

Sequence NO.	Item to be inspected	Procedure	References
1	Completeness.	See that the equipment is complete.	App A.
2	Preservation.	Check all surfaces for evidence of fungus. Remove rust bare spots.	Para 4-8.
3	Connections.	Verify that plugs, sockets, and jacks are clean, intact, Intact, and not loose fitting.	None.
4	Pluck-out items.	Inspect clamps and seating of pluckout items. Check for Check for wrong, bent, or broken parts.	None.
5	Knobs, dials, and switches.	While making the operating checks, observe that the mechanical action of each knob, dial and switch is is smooth and free of external or internal binding.	None.

4-8. Cleaning

a. Remove dust and loose dirt from the exterior surfaces with a clean soft cloth.

WARNING

The fumes of TRICHLOROETHANE are toxic. Provide thorough ventilation whenever it is used; avoid prolonged or repeated breathing of vapor. Do not use near an open flame or hot surface; trichloroethane is nonflammable but heat converts the fumes to a highly toxic phosgene gas. The inhalation of this gas could result in serious injury or DEATH. Prolonged or repeated skin contact with trichloroethane can cause skin inflammation. When necessary, use gloves, sleeves and aprons which the solvent cannot penetrate.

b. Remove grease, fungus, and ground-in dirt from the equipment. Use a cloth dampened (not wet) with trichloroethane.

CAUTION

Do not press on the indicator face (glass) when cleaning; the indicator may be damaged.

c. Clean indicator glass; use a soft clean cloth.. If difficulty in removing dirt occurs, dampen the cloth with water. Mild soap may be used to make cleaning more effective.

d. A panel lifter furnished with the raised floor and supplied by Liskey Aluminum Inc. is used to gain access to the crawl space under the floor for cleaning and repair.

4-9. Touchup Painting Instructions

When the finish on the exterior of the equipment has been scarred or damaged, corrosion may be prevented by touching up the surfaces as follows:

a. Refer to Federal Standard No. 595a for a matching color. SB 11-573 lists painting tools and miscellaneous supplies required for painting.

b. Refer to TB 43-0118 for instructions on-painting and preserving Electronics Command equipment. When touchup painting, a perfect match with the original paint surface may not be possible, because of a change in the original pigment as a result of oxidation and differences in manufacture. The prevention of corrosion and deterioration is the. most important consideration in touchup painting; appearance is secondary. However, this does not mean that appearance of the equipment is not important Touchup painting should be accomplished neatly and competently. Inspection personnel in the field should make allowances for slight color mismatch where minor touchup has been done, but not for neglect, unskillful manner, or in cases where the need for refinishing is obvious.

c. Use No. 000 sandpaper to clean the surface down to the bare metal; obtain a bright clean finish. Sand the area back to solid paint and feather the paint edge that leads to exposed metal. Wipe the area clean.

d. Apply to the bare metal surface one coat of zinc chromate metal primer, and two thin finish coats of the matching color enamel.

Section III. BUILDING AND CHANGING CIRCUITS

4-10. Telecommunications Service Orders' (TSO's)

The basic circuit design information for all new or changed circuits is provided in DCA Telecommunications Service Orders (TSO's). The TSO is the authorization from DCA Headquarters or a DCA area to activate, change, or deactivate

circuits or trunks; to amend previously issued TSO's, and to effect administrative changes. The TSO gives the following information:

a. Issuing office.

b. The year it is issued.

c. TSO serial number.

d. Circuit identification.

e. The sequential action being taken on the circuit.

4-11. Patch and Test Facilities

a. In order to effect the very close coordination required to activate circuits in the DCS, the P&T may be assigned the responsibility for activating a circuit from end-to-end (circuit control office (CCO)) or only as an intermediate DCS station TCF with the responsibility for coordinating all action necessary to activate the circuit within the TCF.

b. The Circuit Control Office (CCO) or Special Circuit Control Office (SCCO) is designated by the DCA Circuit Engineering office on each TSO. When designed as the CCO of a circuit, the TCF has the following responsibilities:

(1) Scheduling and coordinating activation of the circuit, out-of-service quality control testing, and all other actions of the TSO for the life of the circuit.

(2) Ensure that each TCF, PTC, user terminal, and commercial agency involved is ready to provide the required service 72 hours prior to the service date.

(3) Complete overall line-up test, direct necessary adjustments, and ascertain that the circuit meets the specified technical schedule before acceptance.

(4) Advise the appropriate DCA Operations Control Complex (DC)CC) and Operation and Maintenance (O&M) element of any conditions, incomplete line-ups, or exceptions which might affect service. This would include such as operating a through circuit for terminal use only or operating with one-way transmission capability on a normal two-way circuit.

(5) Prepare and implement out-of-service quality control test schedules for routine testing in harmony with traffic conditions and user requirements.

(6) Record and file the required test summary.

(7) Initiate localization and correction of trouble that is discovered during the quality control tests.

(8) Test or coordinate testing of any circuit, end-to-end, that has been materially altered or rerouted over a new path or restored after an extended outage (e.g. 72 hours).

(9) Ensure that all TCF's on the circuit patch are advised to take down patches and cross-connects when a circuit is discontinued.

(10) Report immediately to the appropriate DOCC element all instances of negative or untimely response from patch and test facilities, TCF's, or commercial agencies during circuit activation.

c. In addition to the functional responsibilities of a CCO, the SCCO is responsible for:

(1) Coordinating the restoration of assigned circuits to include coordination with the appropriate DOCC element when rerouting of a circuit is necessary to restore j service.

(2) Directing the troubleshooting effort when necessary to clear the trouble of the disrupted segment.

(3) Reviewing the record of temporary path changes on a regular basis and taking action to have the regular path restored.

(4) Keeping the appropriate DOCC and O&M elements, subscriber, and concerned TCF's advised of the progress of restoration work or of any conditions that may effect service availability.

(5) Establishing procedures for handling and recording service interruptions.

(6) Bringing unsatisfactory conditions which are beyond the authority or capabilities of the TCF to the attention of the appropriate DOCC and O&M element.

d. As an intermediate TCF, the Pentagon P&T is responsible for:

(1) Ensuring timely completion of all actions required to activate, change, or deactivate circuits terminating in or passing through the station.

(2) Restore or reroute disrupted circuits over available facilities on the basis of the predetermined National Communications System (NCS) restoration priority. The technical control that first becomes aware of the outage is responsible for initiating the restoration and the follow through actions concerning the restoration until service is restored.

(3) Reporting to the DOCC all information required concerning an outage in accordance with reporting procedures in the appropriate DCA directive.

(4) Review the record of the temporary path changes on a regular basis, and take the necessary steps to restore the regular path. Take action to remove locally authorized circuits promptly and consult with the appropriate control concerning action on other patches.

(5) Notify the circuit control office when a circuit has been materially altered or routed over a new path or restored after a prolonged outage (e.g. 72 hours) in order that the circuit can be retested end-to-end.

(6) Respond to the technical supervision of the Facilities Control Office (FCO), SCCO, or Intermediate Control Office (ICO) in all matters concerning the fault location, rerouting, and restoration of the circuit.

(7) Activate on-call and overload circuits in accordance with established procedures.

(8) Review the facility and equipment situation periodically and make recommendations for beneficial changes. This includes any facilities and equipment that becomes available when service is discontinued.

(9) Publish and post notices as appropriate to technical controllers. These notices will contain the following information:

(*a*) Additions, deletions, or changes in circuitry.

(*b*) Special tests on circuits or equipment.

(*c*) Changes in frequency assignments.

(10) Advise the CCO, SCCO, or ICO when:

(*a*) Any circuit has been restored or rerouted over new facilities and must be tested from end-to-end.

(*b*) A service will not be able to start on date and time specified in the TSO.

4-12. Procedure for Changing and Building Circuits

a. Patch around the in-house portion of the existing circuit (fig. 3-4), or terminate the circuit legs on the line side of the patch panels with 600 ohm terminal plugs.

NOTE

Refer to site cable run drawings for IDF to equipment cabling details.

b. Change cross-connection or make new connections on the associated IDF's (paras 2-3 through 2-9) to obtain the desired jack appearances and mux, cable or VFCT assignments as necessary.

c. Record cross-connections on circuit record card.

d. Perform the necessary in-house equipment tests.

e. Remove patches or plugs installed in (*a*) above.

f. Perform the necessary QA station-to-station tests (para 3-20).

Section IV. TROUBLESHOOTING PERMANENTLY CONNECTED CIRCUITS AND EQUIPMENT

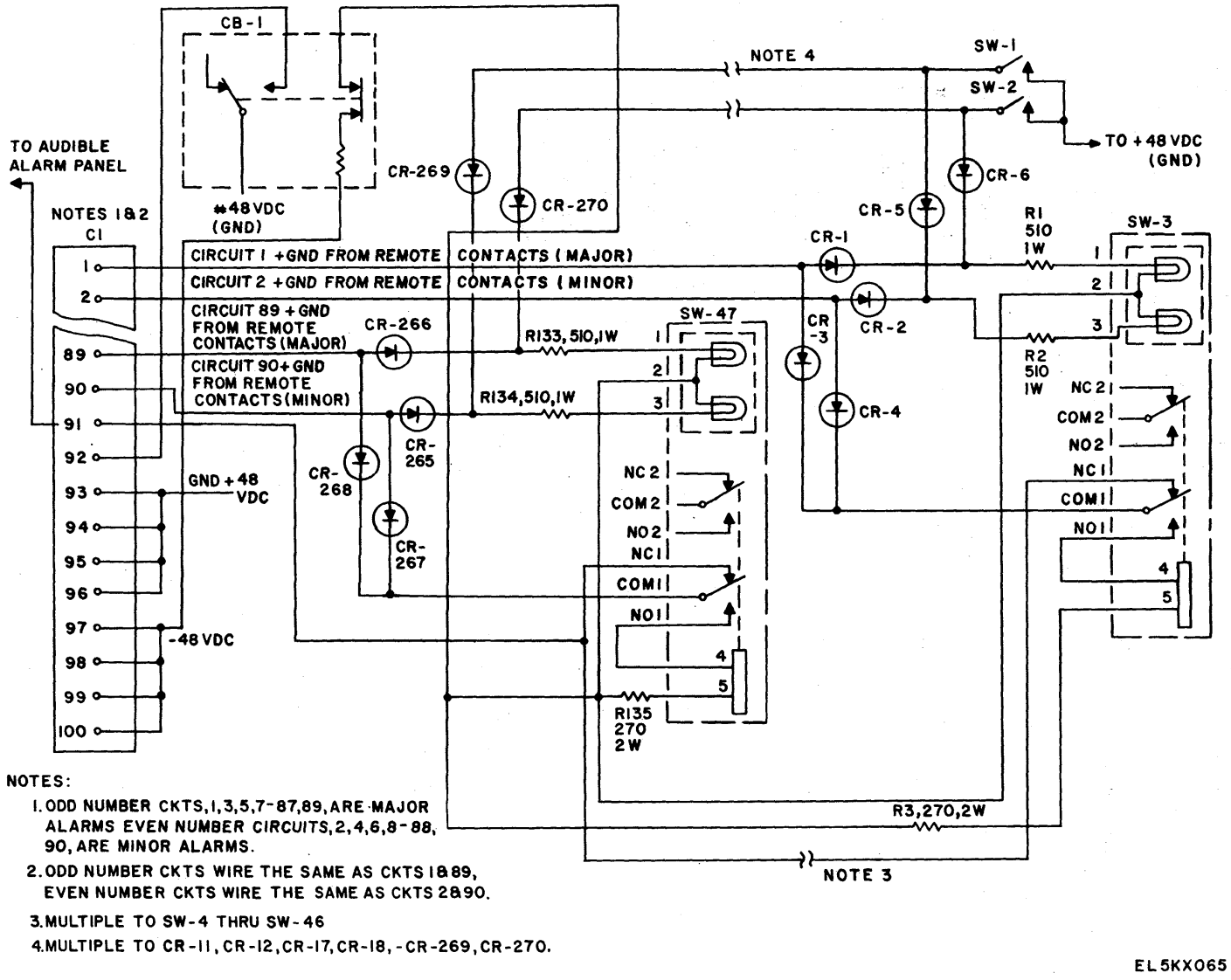
4-13. Use of Troubleshooting Charts

Troubleshooting of this facility is based upon malfunctions that may occur during normal operation of the equipment in the system. When a trouble occurs, refer to the "Trouble Symptom" column in the chart. Perform the checks and corrective measures indicated in the "Check and Corrective Maintenance" column to locate and clear the trouble.

4-14. Troubleshooting Chart, Major/Minor Alarm Panel (fig. 4-1)

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
1	No audible tone from audible alarm panel with a Tellite Illumination.	*a*. Tellite has been depressed, locking out audible tone. *b*. Gnd from alarm panel not being extended to audible alarm panel. c. Gnd not being extended through alarm panel.	*a*. Check for trouble as indicated by Tellite. *b*. Remove the appropriate cross-connect. from IDF and check for ground from alarm panel output on the IDF block. (1) If ground is found, check for -48 vdc on the audible alarm input lead. If battery is not present replace the patch and check the operation of the audible alarm panel (para 4-17). (2) If no ground is found, remove the connector from rear of alarm panel. Make a continuity check from pin 91 of the connector (cable end) to the IDF. After check is satisfactorily completed, replace the cross-connection patch cord. c. If no ground is found on pin 91 it will be necessary to remove the alarm panel from the bay to allow access to the component parts. With the top and bottom covers removed make a continuity check, using a VOM TS-352 or equal, from the pin number that corresponds to the illuminated lamp to Tellite pins NC1 and COM1. Refer to appendix D, symbol number SW3, for Tellite location. If continuity is obtained on COM1 but not NC1 this indicates a defective Tellite. **NOTE Care must be taken to ensure that the (+) lead of the VOM is connected to the corresponding pin 1-45. This will forward bias the diode in the circuit thus ensuring a valid VOM reading.**

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
			If continuity is not obtained at either NC1 or COM1, check associated diode. Refer to appendix D, symbol CR1, for parts location.
2	Audible tone from audible alarm panel without any indication on alarm panel	Defective lamp.	*a*. Depress switch SW1 and then SW2. All Tellites should glow. If any Tellite fails to illuminate, replace bulbs. *b*. If all Tellites fail, check circuit breakers (CB1) located on front panel (reset if found deactivated).
3	Equipment is known to be in an alarm condition with no alarm indication given.	Gnd not being extended from equipment to alarm panel.	Remove the appropriate patch from IDF and check for gnd on the lead coming from the defective equipment. If ground is not present, check for open circuit working toward defective equipment. If ground is found, replace the jumper and remove connector from rear of alarm panel. Check appropriate pin number (1 through 90), on the cable connector, assigned to extend ground from the defective equipment to the alarm panel. If ground is not present, make a continuity check from the connector to the IDF block. After the check is satisfactorily completed, replace the IDF patch.
4	Audible: alarm interrupted only while Tellite is depressed.	Tellite hold coil open.	In order to check the Tellite coil, it will be necessary to remove the panel from the bay to gain access to the component parts. With the top and bottom covers removed, a reading of approximately 340 ohms across pins 4. and 5 indicates a good coil while an open reading will require the replacement of the Tellite.



NOTES:

1. ODD NUMBER CKTS, 1, 3, 5, 7-87, 89, ARE MAJOR ALARMS EVEN NUMBER CIRCUITS, 2, 4, 6, 8-88, 90, ARE MINOR ALARMS.
2. ODD NUMBER CKTS WIRE THE SAME AS CKTS 1&89, EVEN NUMBER CKTS WIRE THE SAME AS CKTS 2&90.
3. MULTIPLE TO SW-4 THRU SW-46
4. MULTIPLE TO CR-11, CR-12, CR-17, CR-18, -CR-269, CR-270.

EL5KX065

Figure 4-1. Major/Minor Alarm System, Schematic Diagram.

4-15. Troubleshooting Chart, Universal Alarm Panel (fig. 4-2)

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
1	Audible tone sounding with. L1 illuminated	*a.* Power Supply No. 1 failure.	(1) Check the input terminal of CR1 for supply voltage. *a.* If voltage is not found, check the associated power supply for output voltage.

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
		b. K1 relay coil open.	*b*. If voltage is found on the CR1 terminal, check K1 relay for a possible open coil Use a multimeter set on the 1000 scale, check the coil relay of K1. An ohm reading of approximately 700 ohms is normal. It will be necessary to ensure that the voltage is removed from K1 before making this check.
2	No audible alarm when a power supply is known to be defective.	*a*. CR1 shorted.	*a*. Use a multimeter, adjusted to 10 scale, reverse bias CR1. This test should show to an open circuit. Any reading on the multimeter will indicate a defective diode.
		b. Ground not being extended through K1 contacts.	*b*. See (1) and (2) below.; (1) Check TB 1 pin 1 for signal ground. This ground is extended to the Power Supply Alarm panel from the distribution panel. (2) Check K1 relay contacts 5 and 6 for continuity by checking for ground of contacts 5 and 6. If ground is found on 5 but not 6 the contacts need to be burnished and adjusted in accordance with manufacturer's specifications.
3	Audible Alarm sounding without L1 being illuminated.	*a*. Lamp L1 burned out.	*a*. Using a lamp extractor tool (WECO 553A or equal) remove L1 from its socket and check for continuity, using a multimeter adjusted to the 10 scale.
		b. Ground not being extended through K1 relay contacts.	*b*. Remove the wire frame TB1 pin 5. Check K1 relay contact pins 8 and 9 for ground. If ground is found on pin 8 but not 9 the contacts need to be burnished and adjusted in accordance with manufacturer's specifications.
Circuit Number -two on this panel can be checked in a manner similar to 1, 2, and 3 above.			

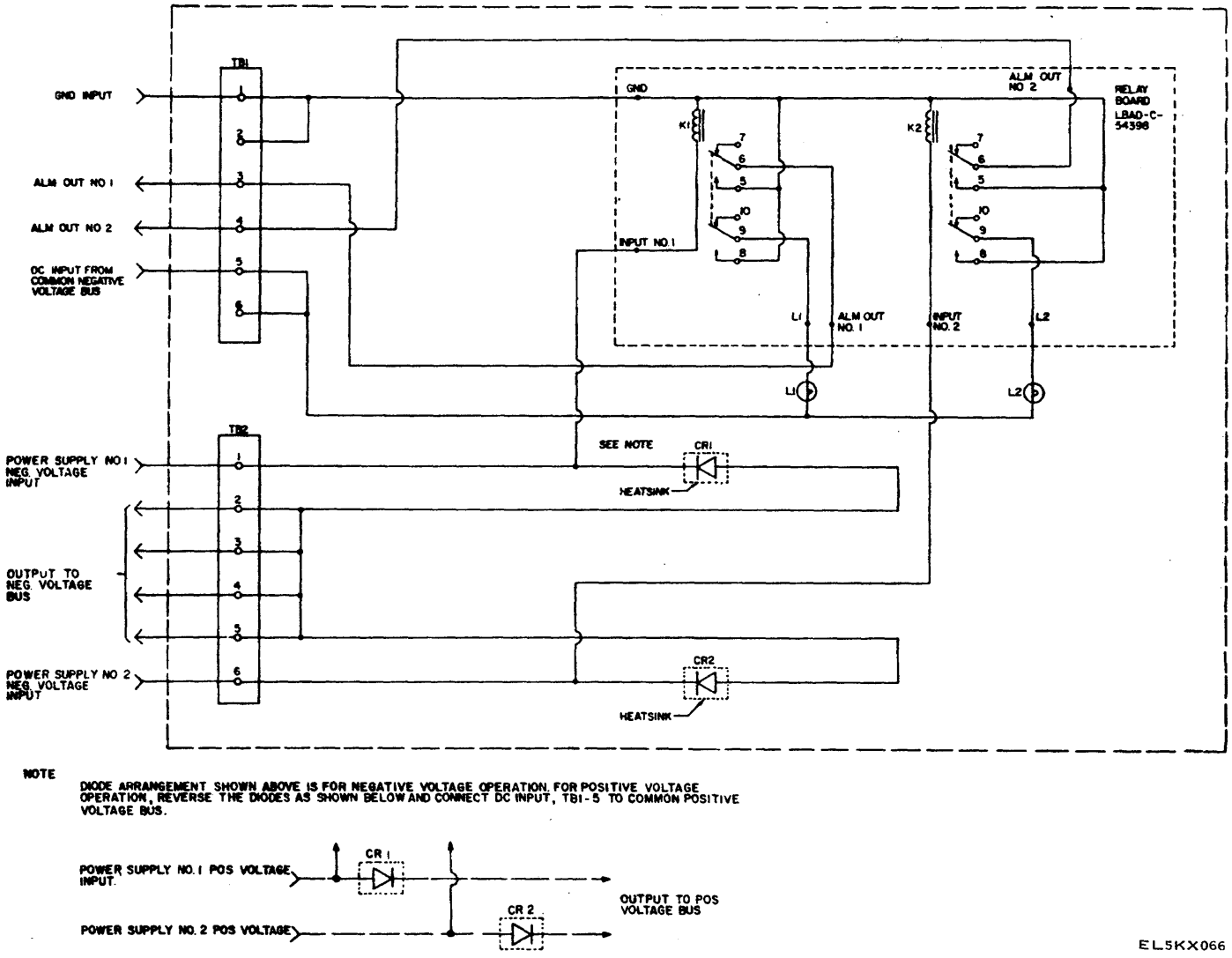


Figure 4-2. Universal Alarm Panel, Schematic Diagram

4-16. Troubleshooting Chart, CAU/CCU Alarm Panel (fig. 4-3)

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
1	No alarm (gnd) output with a known alarm signal on TB1 or TB3.	*a*. Loss of 120 VAC input power.	*a*. Check for 120 vac at TB2 terminals 3 and 4 and at the 6 vdc power supply. Apply power to unit or repair wiring as required.
		b. Ground not connected to panel.	*b*. Check for ground potential at terminal 2 of TB2. Repair wiring as required.

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
		c. Defective Major/Minor or Audible Alarm panel.	*c*. Check Alarm Panels (paras 2-14 and 2-17).
		d. Defective 6 vdc power supply.	*d*. Remove panel from rack and check for + and-6 vdc outputs from power supply. Replace defective power supply.
2	No alarm (gnd) output with known alarm signal on TB1.	*a.* Ground alarm signal not applied to Major/Minor Alarm panel.	*a*. Check for ground at CAU alarm signal output at terminal 1 of TB2. If ground is. present, check at assigned pin on Major/Minor Alarm Panel. If ground is not at Major/Minor Alarm Panel, check and repair circuit wiring.
		b. Defective Major/Minor Alarm Panel.	*b*. If ground is found on the circuit input pin, check the Major/Minor Alarm Panel circuit (para 2-14).
		c. Defective diode CB21 through CB40.	*c*. Replace defective diode.
		d. Defective relay K2.	*d*. Remove relay K2 and substitute a known good relay. Replace a defective relay.
		e. Defective resistor R4.	*e*. Disconnect power from panel and check resistance of R4. Replace and open resistor or one that has a high resistance.
		f. Defective transistor Q2.	*f.* With power disconnected, remove relay K2 from its socket. Check transistor Q2 with ohmmeter. Replace defective transistor.
3	No alarm (gnd) output with known alarm signal on TB3.	Same as item 2 above, with trouble in Q1 circuit components and exterior circuit.	Same as item 2 above. Check for ground at CCU alarm signal output at terminal 5 of TB2. Check diodes CR1 through CR20, relay K1, resistor R2 and transistor Q1.
4	A CAU or CCU alarm sounds with no alarm signal applied to TB1 or TB3.	Defective transistor Q1 or Q2.	Check for shorted transistor. Replace defective transistor.

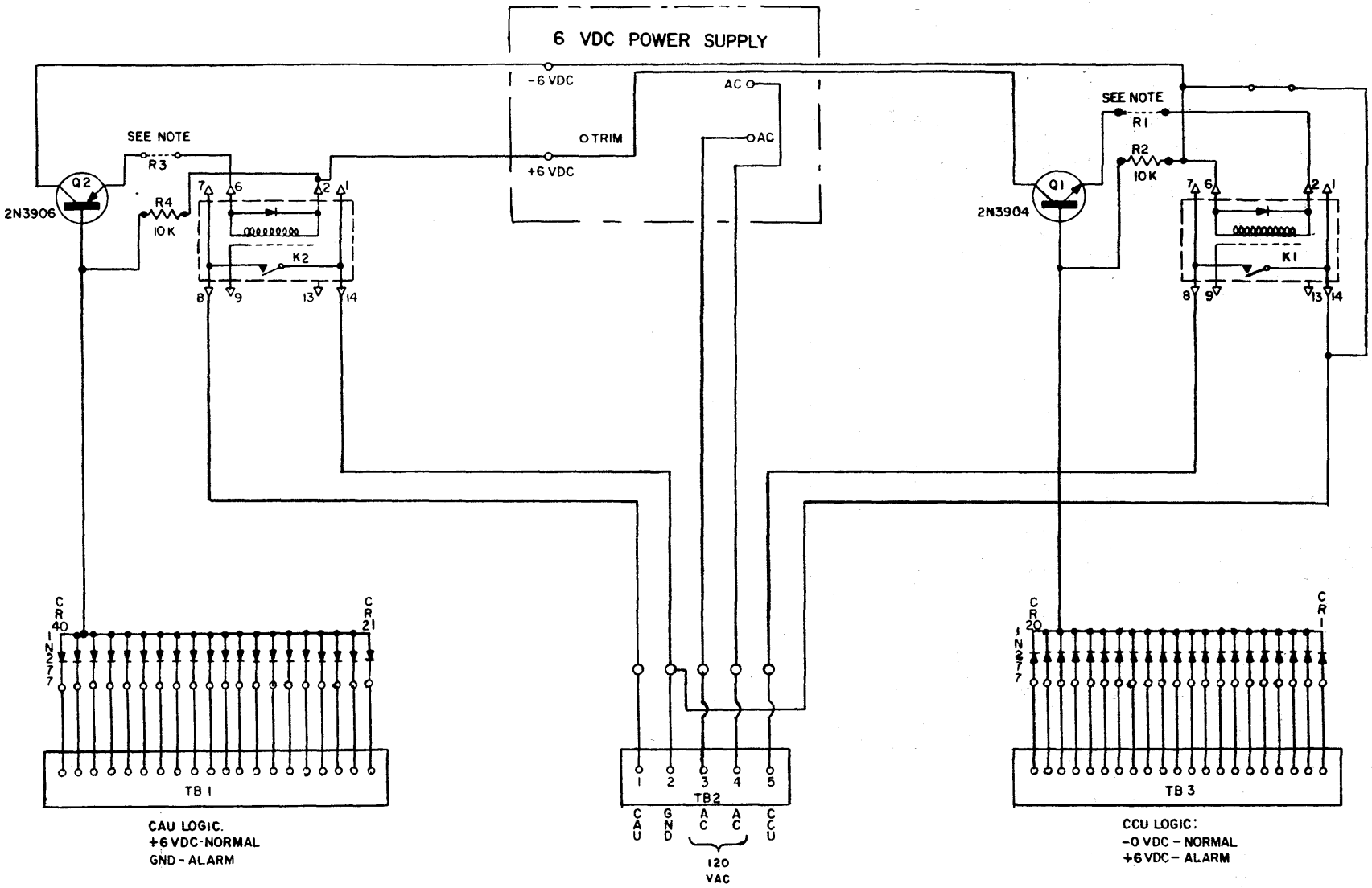


Figure 4-3. CAU/CCU Alarm Panel, Schematic Diagram.

4-17. Troubleshooting Chart, Audible Alarm Panel (fig. 4-4)

Item	Trouble Symptom	Probable trouble	Check and corrective maintenance
1	No alarm indication with ground on terminal 2 of TB1 or when test switch SW1 is depressed.	*a*. Power not applied to panel.	*a*. Check to see that -48 vdc is between terminal 1 and 2, and 1 and 3. Replace bay -48 vdc fuse or check wiring if -48 vdc is not present.
		b. Defective time delay relay.	*b*. Replace relay K1 with a known good relay.
2	Continuous audible alarm and lamp flashing with SW1 is depressed or alarm signal (ground) is applied to terminal 2 of TB1.	Defective time delay.	Replace relay K1.
3	Lamps flash but no audible alarm when SW1 is depressed alarm signal (ground) is applied to terminal 2 of TB1.	*a.* Defective resistor R1. *b.* Defective sonarlert.	*a*. Check resistor R1. Replace R1 if open. *b*. If resistor (*a* above) is good, replace sonarlert.
4	Audible sound is normal, but lamps do not flash or lamps remain on during audible sound.	*a* Defective flasher. *b.* Defective lamps DS1 and DS2.	*a*. Replace flasher. *b*. Replace lamps DS1 and DS2 if lamps remain off and new flasher (*a* above) did not help.
5	Normal operation, except lamp DS1 or DS2 does not light.	Defective lamp.	Replace lamp DS1 or DS2 as required.
6	Normal. operation with alarm signal applied, but no alarm when test button SW1 is depressed.	*a*. Ground not applied to terminal 3 on TB1. *b*. Defective test switch.	*a*. Check for ground on terminal 3 of TB1. Repair wiring if required. *b*. Replace switch SW1.

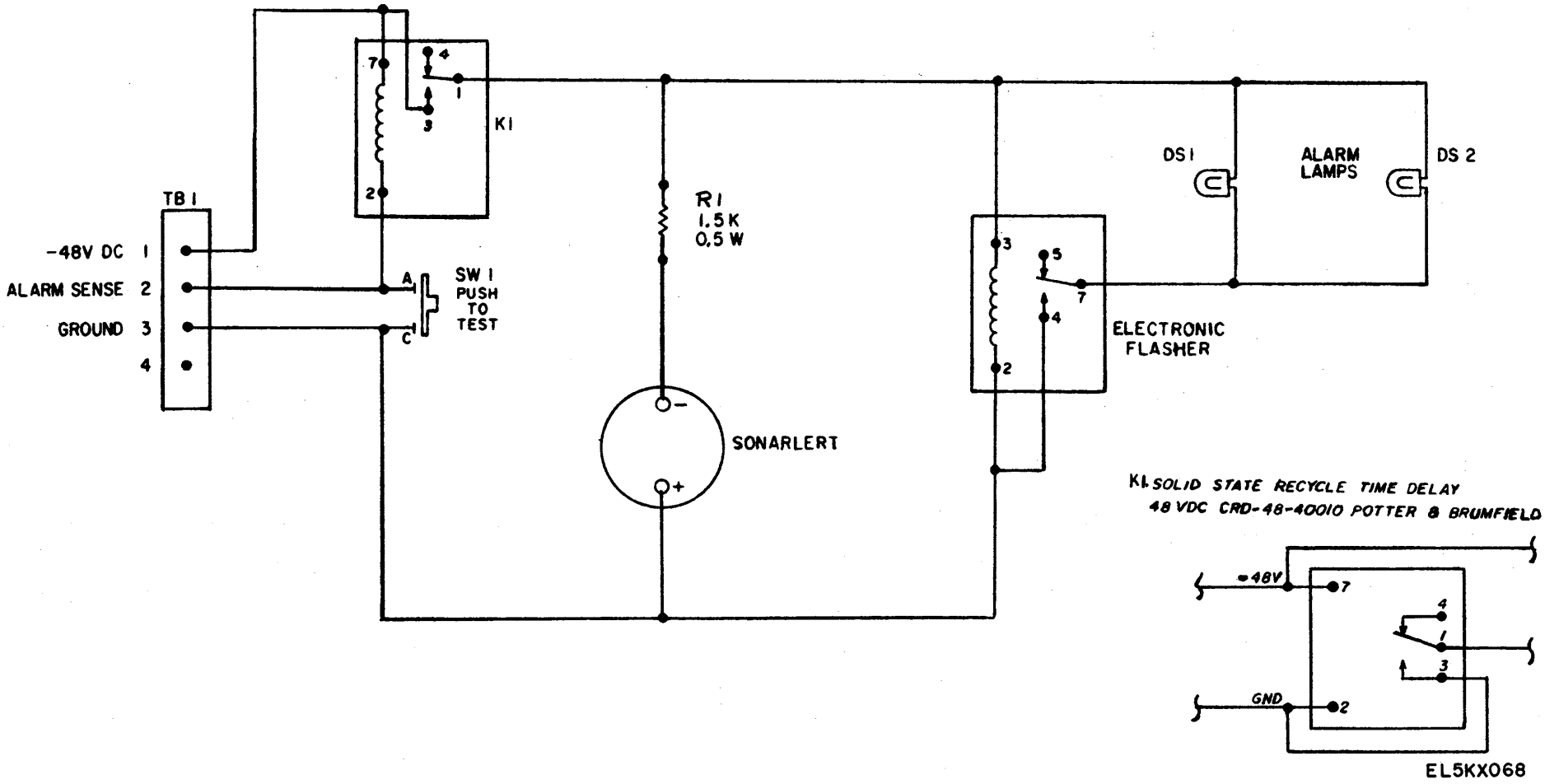


Figure 4-4. Audible Alarm Panel, Schematic Diagram

CHAPTER 5
FUNCTIONING OF ALARM EQUIPMENT

5-1. Scope

This chapter describes the major/minor alarm panel, the universal alarm panel, CAU/CCU alarm panel, and the audible alarm panel. This chapter is made available to aid in the operation and repair of the equipment. The equipment is LBAD fabricated; therefore, no manufacturer's literature is available. The alarm system is discussed in paragraph 2-19. Parts location and identification for the assemblies discussed are given in appendix D.

5-2. Major/Minor Alarm Panel, Functional Description (fig. 4-1)

a. Major Alarm Circuit. A remote contact gives a major alarm by presenting a ground at one of the odd numbered pins on the panel connector (odd pins for major alarms and even pins for minor alarms). This places a ground, through the diode, on terminal 1 of one of the Tellites. Since -48 VDC is supplied to Pin 2, the red Tellite lights. The ground is also extended to the COM1 terminal of the same Tellite. The relay contacts in the Tellite are normally closed; therefore, this ground appears at the NC1 pin of the Tellite and pin 91 of the panel connector. The ground on pin 91 causes an audible alarm at the audible alarm panel (para 5-5).

b. Minor Alarm Circuit. In a similar fashion, a remote contact gives a minor alarm by presenting a ground at one of the even numbered pins on the panel connector. The operation is the same as a major alarm except the amber light is lit by placing the ground on pin 3 of the Tellite.

c. Acknowledge Circuit. The alarm, whether major or minor, is acknowledged by pressing the Tellite. This action manually operates the relay contact thus removing the ground from NC1 and puts it on the NO1 of the Tellite. This removes the ground from Pin 91; therefore, the audible alarm is silenced. Due to the jumper from NO1 to Pin 4, the ground is placed on a locking coil within the Tellite. Since -48 VDC is wired to pin 5, this coil is energized, locking the Tellite relay in its present state, once the Tellite is no longer depressed. Once the fault is cleared and the ground is removed from the Tellite, the light goes out and the relay unlocks.

d. Test Buttons. All major alarms may be tested by depressing the red button on the front of the alarm panel. The minor alarms may be tested by depressing the black button. These buttons place a ground on the appropriate pins on all the Tellites, thus causing the lights to energize. The diodes located between the Tellites and the connector prevent the ground from being placed on COM1 and Pin 91; therefore, the audible alarm is not enabled during the test.

e. Panel Circuit Breaker. The panel circuit breaker is located on the left side of the assembly with the reset button appearing on the front panel. Power is brought into the panel through connector pins 97 through 100. The breaker, if tripped, will give a ground-out alarm through pin 92.

5-3. Universal Alarm Panel, Functional Description

The universal alarm panel is designed to connect two redundant power supplies in parallel while providing the necessary isolation between power supplies. The unit also senses the loss of power from one or both power supplies and gives an alarm indication. The schematic of the panel is shown in figure 5-2. The redundant power supplies are isolated from one another by CR1 and CR2. if voltage is lost from PS # 1, the power supply side of diode CR1 goes to ground potential, relay K1 goes to a de-energized state, and an alarm indication is given through TB1, pin 3 or 4. If voltage is lost from PS # 1, CR2 and K2 operate similarly to CR1 and K1.

5-4. CAU/CCU Alarm Panel, Functional Description (fig. 4-3)

a. The CAU/CCU Alarm Panel provides a common alarm signal (ground) for as many as 20 Crypto Ancillary Units and 20 Common Control Units. A separate alarm connection is provided for each type of equipment.

b. The panel is powered by 120 vac, which is connected through terminals 3 and 4 of TB2 to a 6 vdc power supply. The + and -6 volt output of the power supply is used to power two transistor circuits (Q1 and Q2) and operate two relays (K1 and K2).

c. Up to 20 CCU alarm outputs may be connected to TB3. Each input is isolated from other equipment alarm circuits by diodes CR1 through CR20. When 0 vdc is applied to all inputs (on TB3) transistor Q1 is held cut off. When + 6 vdc is applied through an isolation diode to the base of Q1, the transistor conducts current through the coil of relay K1, closes its contacts, placing ground on the panels CCU alarm output (terminal 5 of TB2).

d. The panel also provides connections for up to 20 CAU alarm inputs. Due to the difference in the alarm logic, the isolation diodes are connected in the opposite direction as they are for CCU operation. The circuit operates similarly to the CCU circuit, except for the following: (1) The transistor (Q2) is a PNP in place of a NPN; (2) An alarm from a CAU is +6 vdc; (3) Relay K2 contacts provide ground at the CAU panel alarm output (terminal 1 of TB2).

5-5. Audible Alarm Panel, Functional Description (fig. 4-4)

a. There are two audible alarm panels, one connected to the black: Major/Minor Alarm Panel, the other connected to the red Major/Minor Alarm Panel. The panel is powered by the - 48 vac power system of the associated side of the P&T.

b. The -48 vdc power is connected through terminal 1 of TB1 to pin 7 of series solid state recycle time relay K1. When an alarm is sensed, ground (+48 vdc) is applied through terminal 2 of TB1 to pin 2 of relay K1. The relay is activated, and its time delay action begins closing and opening contacts 1 and 3. (The contact close and open times are adjustable from 0.1 to 10 seconds.) When the contacts are closed -48 vdc is applied through a 1.5 Kohm dropping resistor to a sonarlert, the electronics flasher, and alarm lamps DS1 and DS2.

c. The solaralert provides an audible sound. The electronic flasher operates, opening and closing contacts 4 and 7. When contacts 4 and 7 are closed, alarm lamp DS1 and DS2 light.

d. When relay K1 contacts open the -48 vdc is removed, and the audible sound along with the flashing lights stop. The panel may be tested by depressing switch SW1. The switch is connected to the panel ground (+48 vdc) through terminal 3 of TB1.

APPENDIX A
REFERENCES

The following publications are available to the maintenance personnel of the Pentagon Patch and Test Technical Control Facility:

DA Pam 310-4	Index of Technical Publications Technical Manuals, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
DCAC 310-70-1	Volume I, DCS Technical Control Policy and Facilities; Volume II, DCS Technical Control Procedures; Volume IV, DCS Technical Control Glossary.
DECEO H500-12-64	DCS Technical Control Engineering Criteria.
MIL-STD-188-310	Subsystems Design and Engineering Standards for Technical Control Facilities.
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
TB 11-6625-602-35	Calibration Procedure for Telephone Test Set AN/USM-181A (NSN 6625-00-740-0344) and AN/USM-181B (NSN 6625-00-740-0344).
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.
TM 11-5815-306-12	Operator's and Organizational Maintenance Manual (Including Repair Parts and Special Tools Lists): Teletypewriter Set AN/FGC-80.
TM 11-5815-306-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools): Teletypewriter Set AN/FGC-80 (NSN 5815-00-941-0068).
TM 11-5815-306-35	Direct Support, General Support, and Depot Maintenance Manual: Teletypewriter Set AN/FGC-80.
TM 11-6625-602-12	Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools Lists: Test Set, Telephone AN/USM-181 and Hewlett-Packard Model 3550B.
M 11-6625-602-12-1	Operator's and Organizational Maintenance Manual: Test Set, Telephone AN/USM-181B.
TM 11-6625-602-20P	Organizational Maintenance Repair Parts and Special Tools Lists for Test Sets, Telephone AN/USM-181 and AN/USM-181A (NSN 6625-00-740-0344).
TM 11-6625-602-20P-1	Organizational Maintenance Repair Parts and Special Tool Lists for Test Sets, Telephone AN/USM-181B and AN/USM-181C (NSN 6625-00-740-0344).
TM 11-6625-602-40-1	General Support Maintenance Manual: Test Set, Telephone AN/USM-181B.
TM 11-6625-602-40P	GS Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Test Sets Telephone AN/USM-181 and AN/USM-181A (NSN 6625-00-740-0344).
TM 11-6625-602-40P-1	General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Test Set, Telephone AN/USM-181B and AN/USM-181C (NSN 6625-00-740-0344).
TM 11-6625-602-45	General Support and Depot Maintenance Manual Including Repair Parts List: Test Set, Telephone AN/USM-181 and Hewlett-Packard Model 3550B.
TM 11-6625-1548-15	Organizational, DS, GS, and Depot Maintenance Manual: Counter, Electronic, Digital CP-772 Hewlett-Packard Model 5245L.
TM 11-6625-1668-12	Operator and Organizational Maintenance Manual (Including Repair Parts and Special Tools Lists): Test Sets, Telegraph AN/GGM-15(V)1 (NSN 6625-00-424-1702) and AN/GGM-15(V)2 (NSN 6625-00-442-6131).
TM 11-6625-1668-45-1	General Support and Depot Maintenance Manual (Including Repair Parts and Special Tools List): Test Sets, Telegraph AN/GGM-15(V)1 and AN/GGM-15(V)2; Generator, Signal SG-860/GGM-15(V) and Dolly Test Equipment V-434/GGM-15 (V).
TM 11-6625-1668-45-2	General Support and Depot Maintenance Manual (Including Repair Parts and Special Tools List): Test Sets, Telegraph AN/GGM-15(V)1 and AN/GGM-15(V)2; Analyzer, Signal Distortion TS-2862/GGM-15(V).
TM 11-6625-1668-45-3	General Support and Depot Maintenance Manual Including Repair Parts and Special

	Tools List: Test Sets, Telegraph AN/GGM-15(V) 1 (NSN 6625-00-464-1702) and AN/GGM-15(V)2 (NSN 6625-00-442-6131); Oscilloscope OS-206/GGM-15(V).
TM 11-66725-1794-15	Operator's, Organizational, Direct Support and Depot Maintenance Manual: Impulse Noise Counter, Northeast Electronics Model TTS-58A.
TM 38-750	The Army Maintenance Management System (TAMMS).

COMMERCIAL LITERATURE

Instruction Manual	Distortion Analyzer Hewlett-Packard Model 334A.
Instruction Manual	Multimeter Hewlett-Packard Model 4390A.
Instruction Manual	DC Power Supply, Sorenson (-48 VDC supply), DCR-60-30B.
Instruction Manual	DC Power Supply, Solar Electric. (24 VDC), 282127-1.
Instruction Manual	DC Power Supply, Tele-Signal Corp. # 676D (+6 VDC).
Instruction Manual	Model 601 Data Transmission Test Set (Frederick Electronics Corp).
Instruction Manual	Measuring Set, Envelope Delay, Acton 490.
Instruction Manual	Electronics Counter, Hewlett-Packard Model 5245L.
Instruction Manual	Oscilloscope, Storage, Tektronix Model R7623.
Instruction Manual	Oscilloscope Hewlett-Packard 183BR.
Instruction Manual	Tektronix Model RM-527.
Instruction Manual	Vector Impedance Meter, Hewlett-Packard Model 4800A.
Instruction Manual	Video Waveform Monitor, Tektronix Model 1485R.
Instruction Manual	Wave Analyzer Hewlett-Packard Model 302A.
Instruction Manual	X Y Recorder Hewlett-Packard Model 7034A.
Instruction Manual	X Y Recorder Hewlett-Packard Model 7702B.
Instruction Manual	Phase Jitter Meter, Hekimian 48.
Instruction Manual	Multimeter, Digitech Model 269.
Technical Manual	Dual Speaker Panel (Engineering Devices).
Technical Manual	CTM-2021 Iss. 4 Telegraph Carrier Test Set KS-19935 (Stelma Inc.).

APPENDIX B
ABBREVIATIONS

The following is a listing of abbreviations used throughout this technical manual:

Abbreviation	*Definition*
AC	Alternating current
ACC	Army Communications Command
ALM	Alarm
AMP	Ampere
AMPL	Amplifier
AQRMS	Automatic Quality Reporting, Monitoring System
AUTO	Automatic
AUTOVON	Automatic Voice Network
BATT	Battery
CAU	Crypto Ancillary Unit
CCO	Circuit Control Office
CCOC	Communications Command Operations Center
CCU	Common Control Unit
CH	Channel
CKT	Circuit
COM	Common
CR	Diode
dB	Decibel
dBm	decibel (referenced to 1 mw across 600 ohms)
dBmO	dBm referenced and measured from any relative . transmission level
dBrn	decibels above the standard reference noise level of -90 dbm
dBrnc	decibels above the reference noise level when the noise is weighted with a standard "C message" filter
dBrncO	dBrnc referenced and measured from any relative noise level
DC	Direct current
DCS	Defense Communication System
DEMOD	Demodulator
DL	Drawing list
DOCC	DCA Operations Control Complex
EL	Equal level
EQ	Equipment
Equip	Equipment
FREQ	Frequency
GND	Ground
GP	Group
HF	High frequency
HP	Hewlett-Packard
Hz	Hertz
ICO	Intermediate Control Office
IDF	Intermediate Distribution Frame
INT	Interbay
INT P&T	Intermediate Patch and Test Bay
KV	Kilovolts
KVA	Kilovolt-amperes

Abbreviation	*Definition*
LBAD	Lexington-Blue Grass Army Depot
MAJ	Major
MIN	Minor
MISC	Miscellaneous
MOB	Mobile
MOD	Modulator
MODEM	Modulator-Demodulator
MON	Monitor
Mux	Multiplex
MWO	Modification Work Order
NC	Normally closed
NCS	National Communication System
NO	Normally open
NT	Normally through; no transition
OL	Open loop
O&M	Operation and Maintenance
OSC	Oscillator
O/W	Orderwires
PBX	Private Branch Exchange
PC	Printed circuit
PS	Power supply
P&T	Patch and test facility
Q	Integrated circuit or transistor
QA	Quality assurance
QC	Quality control
R	Resistor, a ring lead
REC	Receive
RX	Receiver
RMS	Root mean square
SCCO	Special Circuit Control Office
SG	Signal ground
SOP	Standard Operating Procedures
T	Tip lead, or transformer
TCF	Technical Control Facility
TMS	Transmission measuring set
TRANS	Transmit
TSO	Telecommunications Service Order
TTY	Teletypewriter
TX	Transmit
VAC	Volts alternating current
VDC	Volts direct current
VF	Voice frequency
VFCT	Voice frequency carrier telegraph
VFTC	Voice frequency telegraph circuit
VM	Voltmeter
VTVM	Vacuum tube voltmeter
XMIT	Transmit

APPENDIX D
ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS

Section I. INTRODUCTION

D-1. Scope
This appendix lists spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE), and other special support equipment required for performance of organizational, direct support, and general support maintenance on Technical Control, Patch and Test Facility. It authorizes the requisitioning and issue of spares and repair parts as indicated by the source and maintenance codes.

D-2. General
This Repair Parts and Special Tools List is divided into the following sections:

a. Section II Repair Parts List. A list of spares and repair parts authorized for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in numeric sequence, with the parts in each group listed in figure and item number sequence.

b. Section III. *Special Tools List*. Not applicable.

c. Section IV. National Stock Number and Part Number Index. A list, in National item identification number (NIIN) sequence, of all National stock numbers (NSN) appearing in the listings, followed by a list, in alphameric sequence, of all part numbers appearing in the listings. National stock numbers and part numbers are cross-referenced to each illustration figure and item number appearance.

D-3. Explanation of Columns
a. Illustration. This column is divided as follows:

(1) *Figure number*. Indicates the figure number of the illustration on which the item is shown.

(2) *Item number*. The number used to identify item called out in the illustration.

b. Source, Maintenance, and Recoverability (SMR) Codes.

(1) *Source code.* Source codes indicate the manner of acquiring support items for maintenance; repair, or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

Code	*Definition*
PA	-Item procured and stocked for anticipated or known usage.
MD	-Item to be manufactured or fabricated at the depot maintenance level.
XD	-A support item that is not stocked. When required, item will be procured through normal supply channels.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above except those coded XA and aircraft support items as restricted by AR 700-42.

(2) *Maintenance code*. Maintenance codes are assigned to indicate the levels of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(*a*) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the third position will indicate one of the following levels of maintenance:

Code	*Application/Explanation*
O	-Support item is removed, replaced, used at the organizational level.
F	-Support item is removed, replaced, used at the direct support level.
H	-Support item is removed, replaced, used at the general support level.

(*b*) The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies the lowest maintenance level with the capability to perform complete repair (i.e., all authorized maintenance functions). This position will contain one of the following maintenance codes:

Code	*Application/Explanation*
F	-The lowest maintenance level capable of complete repair of the support item is the direct support level.
H	-The lowest maintenance level capable of complete repair of the support item is the general support level.
D	-The lowest maintenance level capable of complete repair of the support item is the depot level.
Z	-Nonreparable. No repair is authorized.

(3) *Recoverability code*. Recoverability codes are assigned to support items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

Recoverability codes	*Definition*
Z	-Nonreparable item. When unserviceable, condemn and dispose at the level indicated in position 3.
F	-Reparable item. When uneconomically reparable, condemn and dispose at the direct support level.
H	-Reparable item. When uneconomically

Recoverability codes *Definition*

reparable, condemn and dispose at the general support level.

D -Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal not authorized below depot level.

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

d. 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.

NOTE

When a stock numbered item is requisitioned, the repair part received may have a different part number than the part being replaced.

e. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

g. Unit of Measure (U/M). Indicates the standard of the 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, etc). 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.

h. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column in lieu of a quantity indicates that no specific quantity is applicable (e.g., shims, spacers, etc).

D-4. Special Information

National stock numbers (NSN's) that are missing from P source coded items have been applied for and will be added to this TM by future change/revision when they are entered in the Army Master Data File (AMDF). Until the NSN's are established and published, submit exception requisitions to: Commander, U S Army Communications and Electronics Materiel Readiness-Command, ATTN: DRSEL-MM, Fort Monmouth, NJ 07703 for the part required to support your equipment.

D-5. How to Locate Repair Parts

a. When National stock number or part number is unknown.

(1) *First.* Using the table of contents, determine the functional group within which the item belongs. This is necessary since illustrations are prepared for functional groups and listings are divided into the same groups.

(2) *Second*. Find the illustration covering the functional group to which the item belongs.

(3) *Third.* Identify the item on the illustration and note the illustration figure and item number of the item.

(4) *Fourth*. Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. When National stock number or part number is known.

(1) *First*. Using the Index of National Stock Numbers and Part Numbers, find the pertinent National stock number or part number. This index is in NIIN sequence followed by a list of part numbers in alphameric sequence, cross-referenced to the illustration figure number and item number.

(2) *Second.* After finding the figure and item number, locate the figure and item number in the repair parts list.

D-6. Abbreviations

Not applicable.

(Next printed page is D-4)

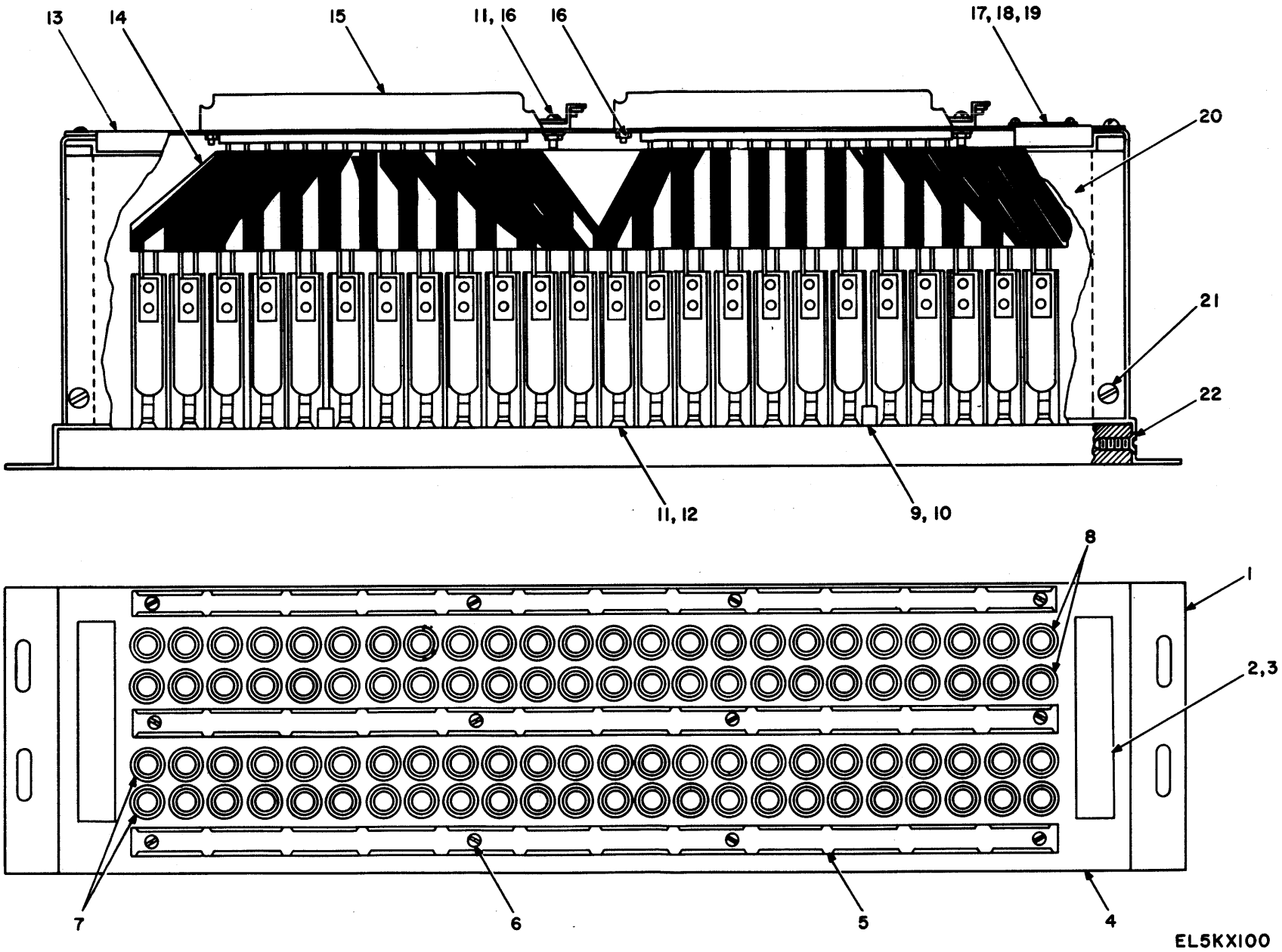


Figure D-1. Patch Panel Assembly, 2/Wire Audio, Parts Location.

SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 01 PATCH PANEL, ASSEMBLY, 2/WIRE AUDIO LBAD-D-33674, 21617		
D-1	I	MDFZZ		LBAD-D-33656	21617	SIDE FRAME	EA	2
D-1	2	MDFZZ		LBAD-D-28580-52	21617	IDENTIFICATION PLATE	EA	2
D-1	3	PAFZZ	5305-00-253-5607	MS21318-8	96906	SCREW, DRIVE #0 X 3/16 LG	EA	8
D-1	4	MDFZZ		LBAD-D-28579	21617	PANEL, PATCHBOARD	EA	1
D-1	5	XDFZZ		90A	64959	STRIP, IDENTIFICATION	EA	3
D-1	6	PAFZZ	5305-00-958-5483	MS35190-221	96906	SCREW, FLAT HEAD #4-40 X 1/4 LG	EA	12
D-1	7	MDFZZ		LBAD-D-33668	21617	JACK, TELEPHONE	EA	48
D-1	8	MDFZZ		LBAD-D-33666	21617	JACK, TELEPHONE	EA	48
D-1	9	PAFZZ	5365-00-954-9301	2335	83330	SPACER, SLEEVE	EA	4
D-1	10	PAFZZ	5305-00-889-2999	MS35206-217	96906	SCREW, P.H.M.S. #4-40 X 1/2 LG	EA	4
D-1	11	PAFZZ	5305-00-984-4988	MS35206-228	96906	SCREW, P.H.M.S. #6-32 X 3/8 LG	EA	104
D-1	12	PAFZZ	5330-00-209-0788	MS35335-30	96906	WASHER, LOCK (EXTERNAL TEETH) #6	EA	96
D-1	13	MDFZZ		LBAD-D-33659	21617	PANEL, CONNECTOR 4-3/8-2 X 80	EA	1
D-1	14	MDFZZ		LBAD-D-33675	21617	PRINTED CIRCUIT, FLEXIBLE	EA	1
D-1	15	MDFZZ		LBAD-D-33665-2	21617	CONNECTOR, 80 PIN	EA	2
D-1	16	PAFZZ	5310-00-081-8087	MS21044-N06	96906	NUT, ELASTIC STOP #6-32	EA	14
D-1	17	MDFZZ		LBAD-D-33672-1	21617	PLATE, IDENTIFICATION	EA	1
D-1	18	PAFZZ	5305-00-889-3116	MS35206-213	96906	SCREW, P.H.M.S. #4-40 X 1/4 LG	EA	2
D-1	19	PAFZZ	5310-00-088-0551	MS21044-N04	96906	NUT, SELF LOCKING #4-40 NC	EA	2
D-1	20	MDFZZ		LBAD-D-33658	21617	COVER (TOP AND BOTTOM)	EA	2
D-1	21	PAFZZ	5305-00-995-6653	MS35190-222	96906	SCREW, FLAT HEAD #4-40 NC X 5/16 LG	EA	4
D-1	22	PAFZZ	5305-00-984-7361	MS35191-270	96906	SCREW, FLAT HEAD #10-32 NF X 3/8 LG	EA	6

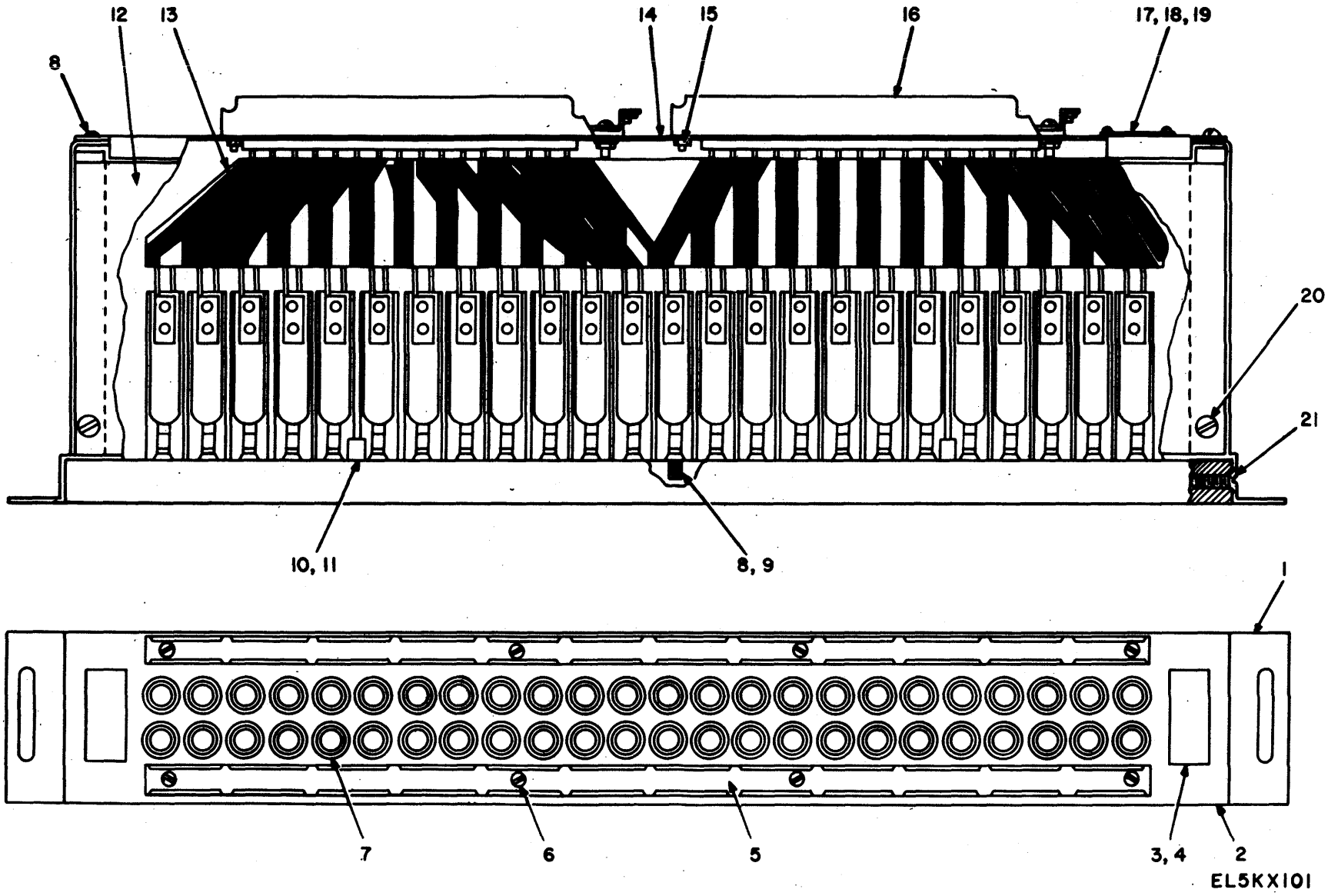


Figure D-2. Patch Panel Assembly, Interbay, Parts Location.

SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION / USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 02 PATCH PANEL ASSEMBLY, INTERBAY LBAD-D-33679, 21617		
D-2	1	MDFZZ		LBAD-D-33655	21617	SIDE FRAME	EA	2
D-2	2	MDFZZ		LBAD-D-12377	21617	PANEL, PATCHBOARD	EA	1
D-2	3	MDFZZ		LBAD-D-28580-1	21617	PLATE, IDENTIFICATION	EA	2
D-2	4	PAFZZ	5305-00-253-5607	MS21318-8	96906	SCREW, DRIVE #0-3/16 LG	EA	8
D-2	5	XDFZZ		90A	64959	STRIP, IDENTIFICATION	EA	2
D-2	6	PAFZZ	5305-00-958-5483	MS35190-221	96906	SCREW, F.H.M.S. #4-40 X 1/4 LG	EA	8
D-2	7	MDFZZ		LBAD-D-33670	64959	JACK, TELEPHONE	EA	48
D-2	8	PAFZZ	5305-00-984-4988	MS35206-228	96906	SCREW, P.H.M.S. #6-32 X 3/8 LG	EA	56
D-2	9	PAFZZ	5310-00-209-0788	MS35335-30	96906	WASHER, LOCK (EXTERNAL TEETH) #6	EA	48
D-2	10	PAFZZ	5365-00-954-9301	2335-	83330	SPACER, SLEEVE	EA	4
D-2	11	PAFZZ	5305-00-889-2999	MS35206-217	96906	SCREW, P.H.M.S. #4-40 X 1/2 LG	EA	4
D-2	12	MDFZZ		LBAD-D-33658	21617	COVER (TOP AND BOTTOM)	EA	2
D-2	13	MDFZZ		LBAD-D-33681	21617	PRINTED CIRCUIT, FLEXIBLE	EA	1
D-2	14	MDFZZ		LBAD-D-33660	21617	PANEL, CONNECTOR	EA	1
D-2	15	PAFZZ	5310-00-081-8087	MS21044-N06	96906	STOP NUT, ELASTIC #6-32 NC	EA	4
D-2	16	MDFZZ		LBAD-D-33665-2	21617	CONNECTOR	EA	2
D-2	17	MDFZZ		LBAD-D-33672-2	21617	PLATE, IDENTIFICATION	EA	1
D-2	18	PAFZZ	5305-00-889-3116	MS35206-213	96906	SCREW,, P.H.M.S. #4-40 X 1/4 LG	EA	2
D-2	19	PAFZZ	5310-00-088-0551	MS21044-N04	96906	NUT, SELF LOCKING #4-40 NC	EA	2
D-2	20	PAFZZ	5305-00-995-6653	MS35190-222	96906	SCREW, F.H.M.S. #4-40 NC X 5/16 LG	EA	4
D-2	21	PAFZZ	5305-00-984-7361	MS35191-270	96906	SCREW F.H.M.S. #10-32 NF X 3/8 LG	EA	4

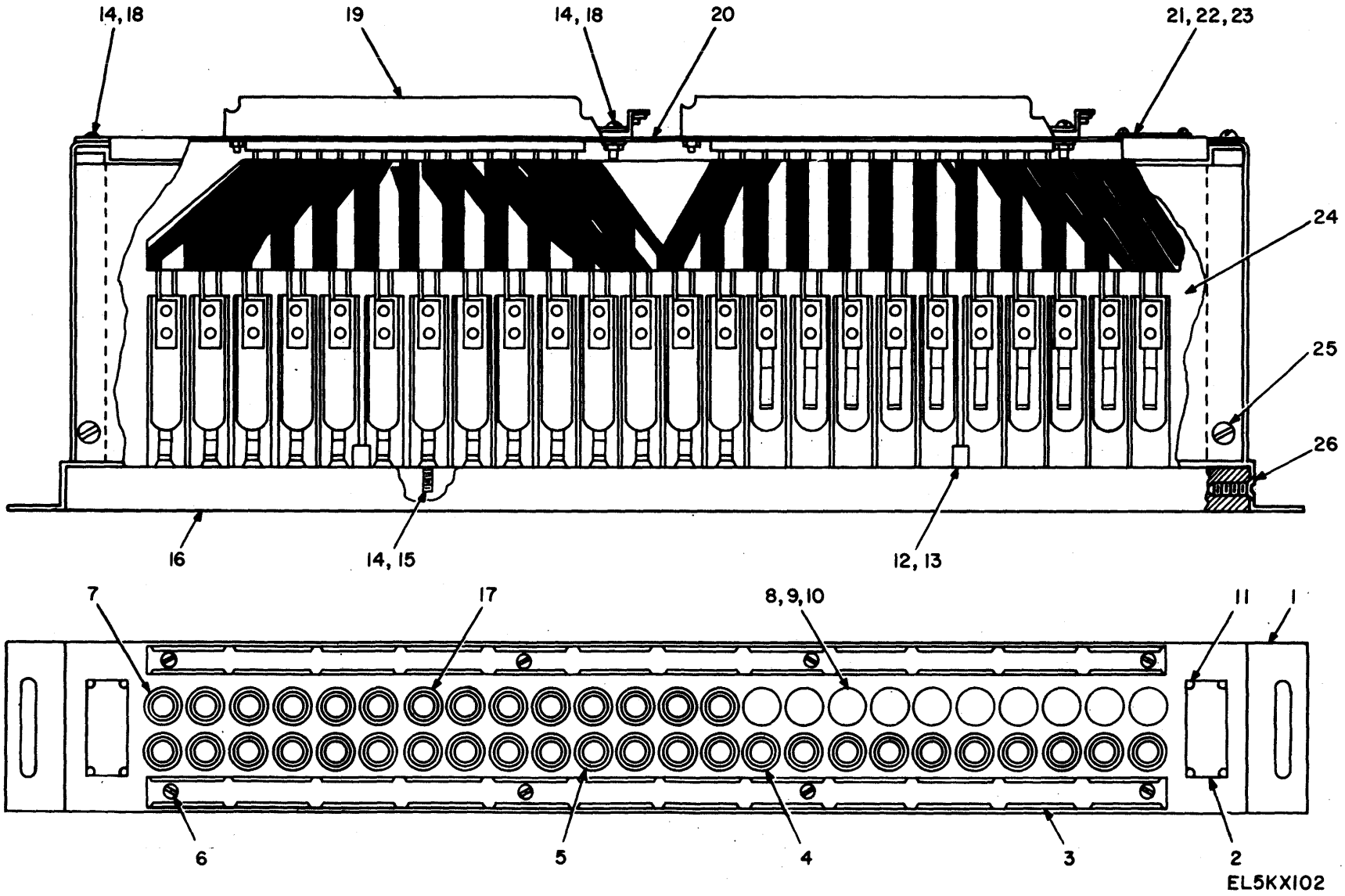


Figure D-3. Patch Panel Assembly, Misc, 10 Lamp GP3, Parts Location.

SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION / USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 03 PATCH PANEL, MISC, 10 LAMP GP 3 LBAD-D33684-3, 21617		
D-3	1	MDFZZ		LBAD-D-33655	21617	SIDE FRAME	EA	2
D-3	2	MDFZZ		LBAD-D-28580-5	21617	PLATE IDENTIFICATION	EA	2
D-3	3	XDFZZ		90A	64959	STRIP, IDENTIFICATION	EA	2
D-3	4	MDFZZ		LBAD-D-33667	21617	JACK	EA	10
D-3	5	MDFZZ		LBAD-D-33670	21617	JACK	EA	15
D-3	6	PAFZZ	5305-00-958-5483	MS35190-221	96906	SCREW, FLATHEAD #4-40 X 1/4 LG	EA	8
D-3	7	MDFZZ		LBAD-D-33369	21617	JACK	EA	12
D-3	8	MDFZZ		LBAD-D-33699	21617	JACK, LAMP	EA	10
D-3	9	XDFZZ		PJ-152	70674	CAP, LAMP	EA	10
D-3	10	XDFZZ		48C-T2	58854	BULB, LIGHT	EA	10
D-3	11	XDFZZ		MS21318-18	96906	SCREW, DRIVE #0 X 3/16 LG	EA	8
D-3	12	PAFZZ	5365-00-954-9301	2335	83330	SPACER, SLEEVE	EA	4
D-3	13	PAFZZ	5305-00-889-2999	MS35206-217	96906	SCREW, P.H.M.S. #4-40 X 1/2 LG	EA	4
D-3	14	PAFZZ	5305-00-984-4988	MS35206-228	96906	SCREW, P.H.M.S. #6-32 X 3/8 LG	EA	46
D-3	15	PAFZZ	5310-00-209-0788	MS35335-30	96906	WASHER, LOCK #6 (EXTERNAL TEETH)	EA	46
D-3	16	MDFZZ		LBAD-D-12377	21617	PANEL, PATCHBOARD	EA	1
D-3	17	MDFZZ		LBAD-D-33671	21617	JACK	EA	1
D-3	18	PAFZZ	5310-00-081-8087	MS21044-N06	96906	NUT, ELASTIC STOP #6	EA	8
D-3	19	MDFZZ		LBAD-D-33665-2	21617	CONNECTOR	EA	8
D-3	20	MDFZZ		LBAD-D-33660	21617	PANEL, CONNECTOR	EA	2
D-3	21	MDFZZ		LBAD-D-33672-8	21617	PLATE, IDENTIFICATION	EA	1
D-3	22	PAFZZ	5305-00-889-3116	MS35206-213	96906	SCREW, P.H.M.S. #4-40 X 1/4 LG	EA	2
D-3	23	PAFZZ	53100-0-088-0551	MS21044-N04	96906	NUT, SELF LOCKING #4 40 NC	EA	2
D-3	24	MDFZZ		LBAD-D-33686	21617	PRINTED CIRCUIT, FLEXIBLE	EA	1
D-3	25	PAFZZ	5305-00-995-6653	MS35190-222	96906	SCREW, F.H.M.S. #4-40 X 5/16 LG	EA	4
D-3	26	PAFZZ	5305-00-984-7361	MS35191-270	96906	SCREW, F.H.M.S. #10-32 X 3/8 LG	EA	4

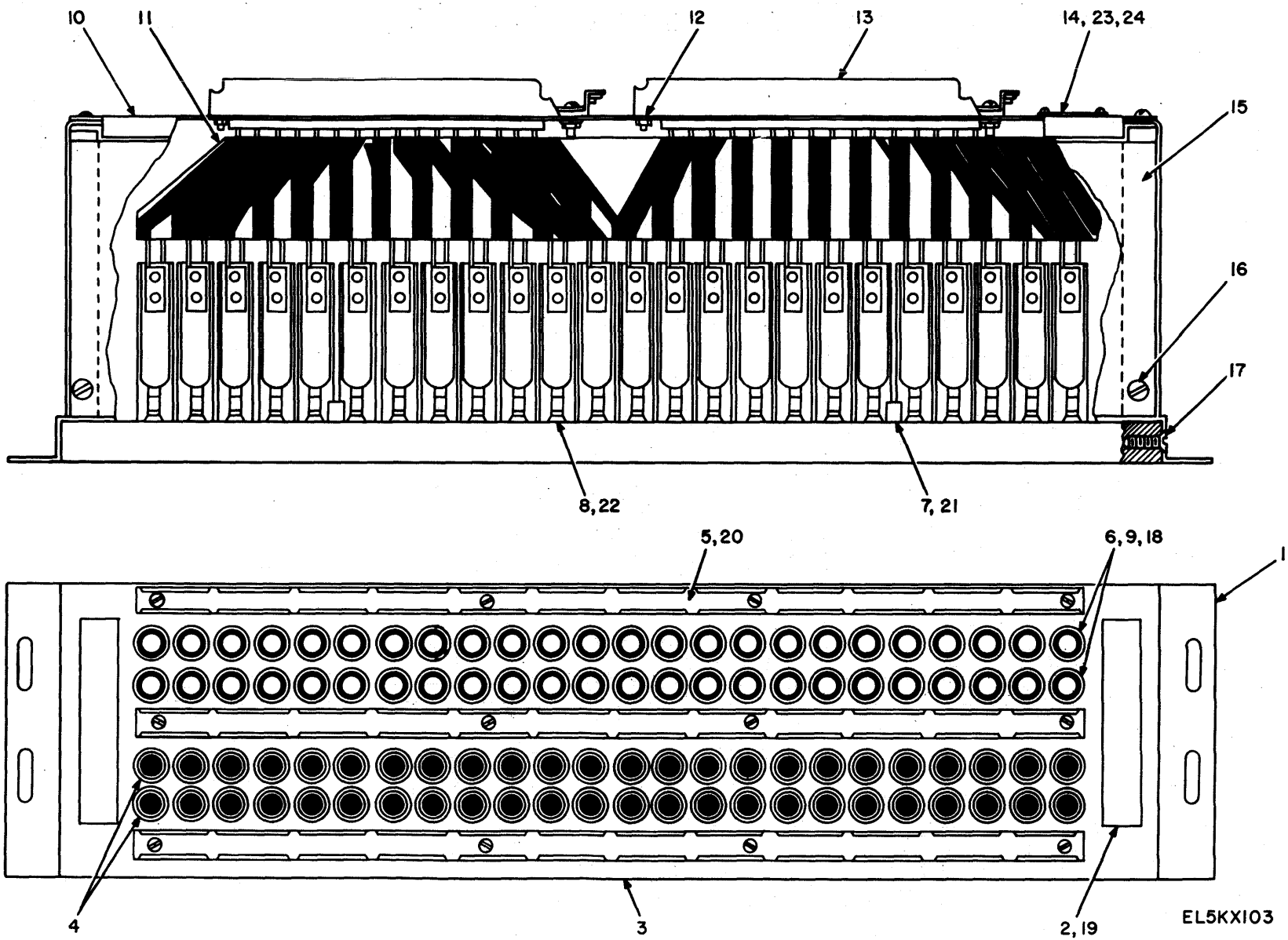


Figure D-4. Patch Panel Assembly, Interbay, 48 Lines W/48 Lamps, Parts Location.

SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION / USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 04 PATCH PANEL ASSEMBLY, INTERBAY, 48 LINES W/48 LAMPS, LBAD-D-33700		
D-4	1	MDFZZ		LBAD-D-33656	21617	SIDE FRAME	EA	2
D-4	2	MDFZZ		LBAD-D-28580-51	21617	PLATE, IDENTIFICATION	EA	2
D-4	3	XDFZZ		LBAD-D-28579	21617	PANEL, PATCHBOARD	EA	1
D-4	4	XDFZZ		LBAD-D-33668	21617	JACK, JJ074 (MOD)	EA	48
D-4	5	XDFZZ		90A	64959	STRIP, IDENTIFICATION STRIP	EA	3
D-4	6	MDFZZ		LBAD-D-33699	21617	JACK, LAMP	EA	48
D-4	7	PAFZZ	5365-00-954-9301	2335	83330	SPACER, SLEEVE	EA	4
D-4	8	PAFZZ	5305-00-984-4988	MS35206-228	96906	SCREW, P.H.M.S. #6-32 X 3/8 LG	EA	104
D-4	9	PAFZZ		PJ-152	70674	CAP, LAMP	EA	48
D-4	10	MDFZZ		LBAD-D-33664	21617	PANEL, CONNECTOR	EA	1
D-4	11	MDFZZ		LBAD-D-33702	21617	CIRCUIT, PRINTED, FLEXIBLE	EA	1
D-4	12	PAFZZ	5310-00-081-8087	MS21044-N06	96906	NUT, ELASTIC STOP 6-32 NC	EA	4
D-4	13	XDFZZ		LBAD-D-33665-3	44038	CONNECTOR, 100 PIN #513938 (MOD)	EA	2
D-4	14	MDFZZ		LBAD-D-33672-6	21617	PLATE, IDENTIFICATION	EA	1
D-4	15	MDFZZ		LBAD-D-33658	21617	COVER (TOP AND BOTTOM)	EA	2
D-4	16	PAFZZ	5305-00-995-6653	MS35190-222	96906	SCREW, FLAT HEAD #4-40 NC X 5/16 LG	EA	4
D-4	17	PAFZZ	5305-00-984-7361	MS35191-270	96906	SCREW, FLAT HEAD #10-32 NF X 3/8 LG	EA	6
D-4	18	PAOZZ		48C-T2	58854	BULB, LIGHT	EA	48
D-4	19	PAFZZ	5305-00-253-5607	MS21318-8	96906	SCREW, DRIVE 0 X 3/16 LG	EA	8
D-4	20	PAFZZ	5305-00-958-5483	MS35190-221	96906	SCREW, FLAT HEAD 4-49 X 1/4 LG	EA	12
D-4	21	PAFZZ	5305-00-889-2999	MS35206-217	96906	SCREW, P.H.M.S. 4-40 X 1/2 LG	EA	4
D-4	22	PAFZZ	5310-00-209-0788	MS35335-30	96906	WASHER, LOCK #6 (EXTERNAL TEETH)	EA	96
D-4	23	PAFZZ	5305-00-889-3116	MS35206-213	96906	SCREW, P.H.M.S. 4-40 X 1/4 LG	EA	2
D-4	24	PAFZZ	5310-00-088-0551	MS21044-N04	96906	NUT, SELF LOCKING #4-40 NC	EA	2

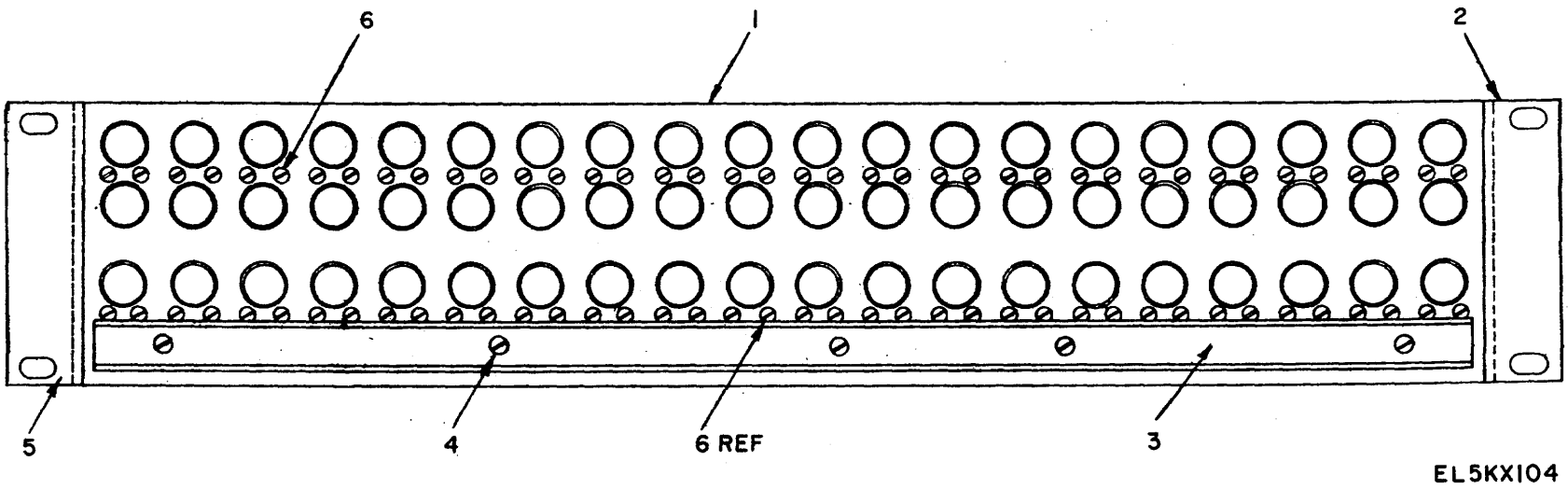


Figure D-5. Twinax Wideband Patch Panel Assembly, Parts Location (Sheet 1 of 2).

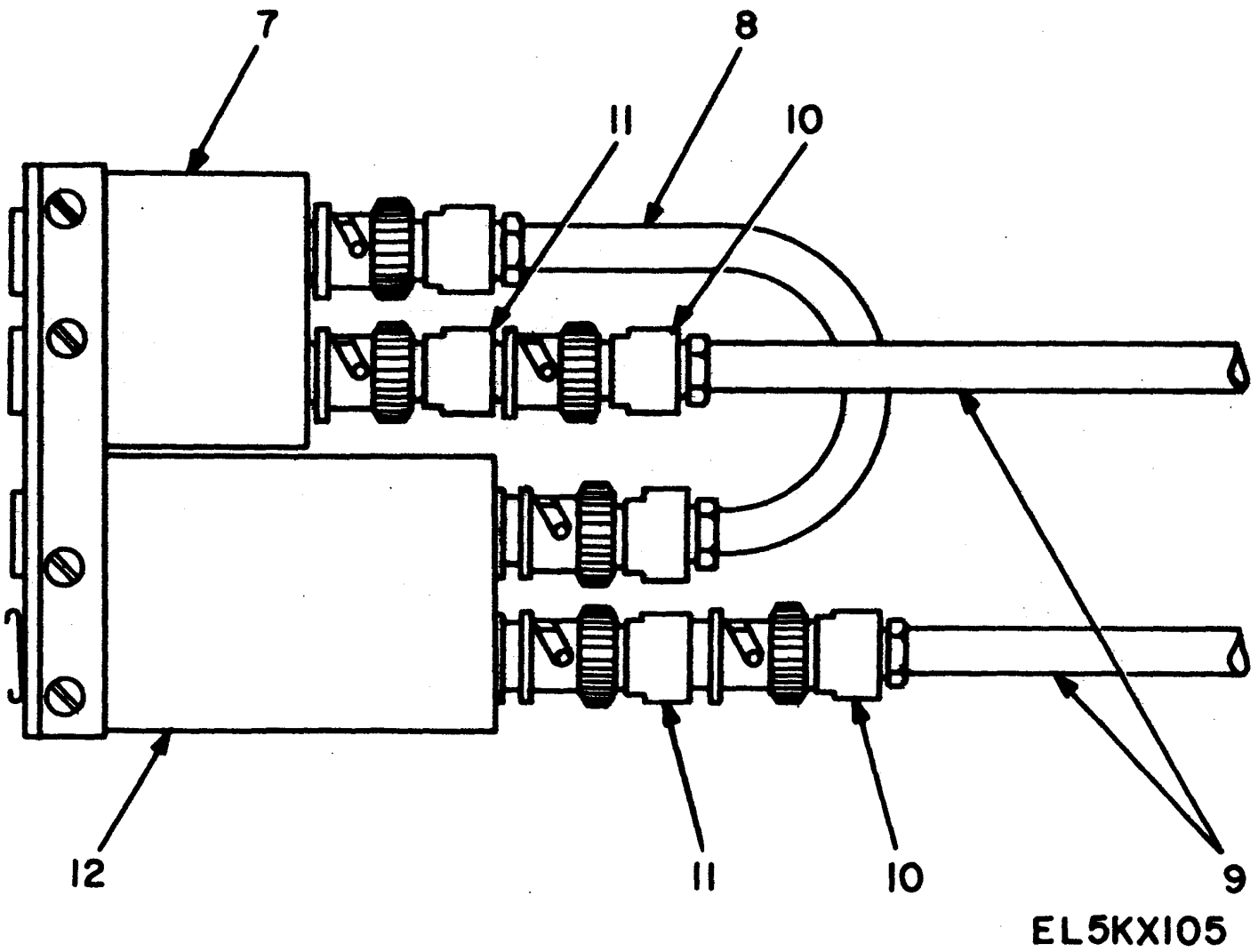


Figure D-5. Twinax Wideband Patch Panel Assembly, Parts Location (Sheet 2 of 2).

SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION / USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 05 TWINAX WIDEBAND PATCH PANEL ASSEMBLY, LBAD-D-33440-3, 21617		
D-5	1	MDFZZ		LBAD-D-33441	21617	PANEL	EA	1
D-5	2	MDFZZ		LBAD-D-33443-1	21617	BRACKET	EA	1
D-5	3	MDFZZ		LBAD-D-33444	21617	STRIP DESIGNATION	EA	1
D-5	4	PAFZZ	5305-00-151-1321	MS35198-12	96906	SCREW, F.H.M.S. #4-40 X 1/4 LG	EA	13
D-5	5	MDFZZ		LBAD-D-33443-2	21617	BRACKET	EA	1
D-5	6	XDFZZ		MS35198-17	96906	SCREW, F.H.M.S. #4-40 X 5/8 LG	EA	80
D-5	7	XDFHH		LBAD-C-33442	21617	JACK, TWINTERM 207T (75)	EA	20
D-5	8	MDFFF		LBAD-D-33445-3	21617	ASSEMBLY, CABLE (75)	EA	20
D-5	9	XDFZZ		TRC-75-2	14949	CABLE, TRIAX	FT	V
D-5	10	XDFZZ		PL-76	14949	PLUG, CABLE	EA	40
D-5	11	MDFZZ		LBAD-D-54465	21617	ASSEMBLY, TRIAX TO WINAX ADAPTER	EA	40
D-5	12	XDFHH		LBAD-C-33442	21617	JACK, TWINTERM 20M (75)	EA	40

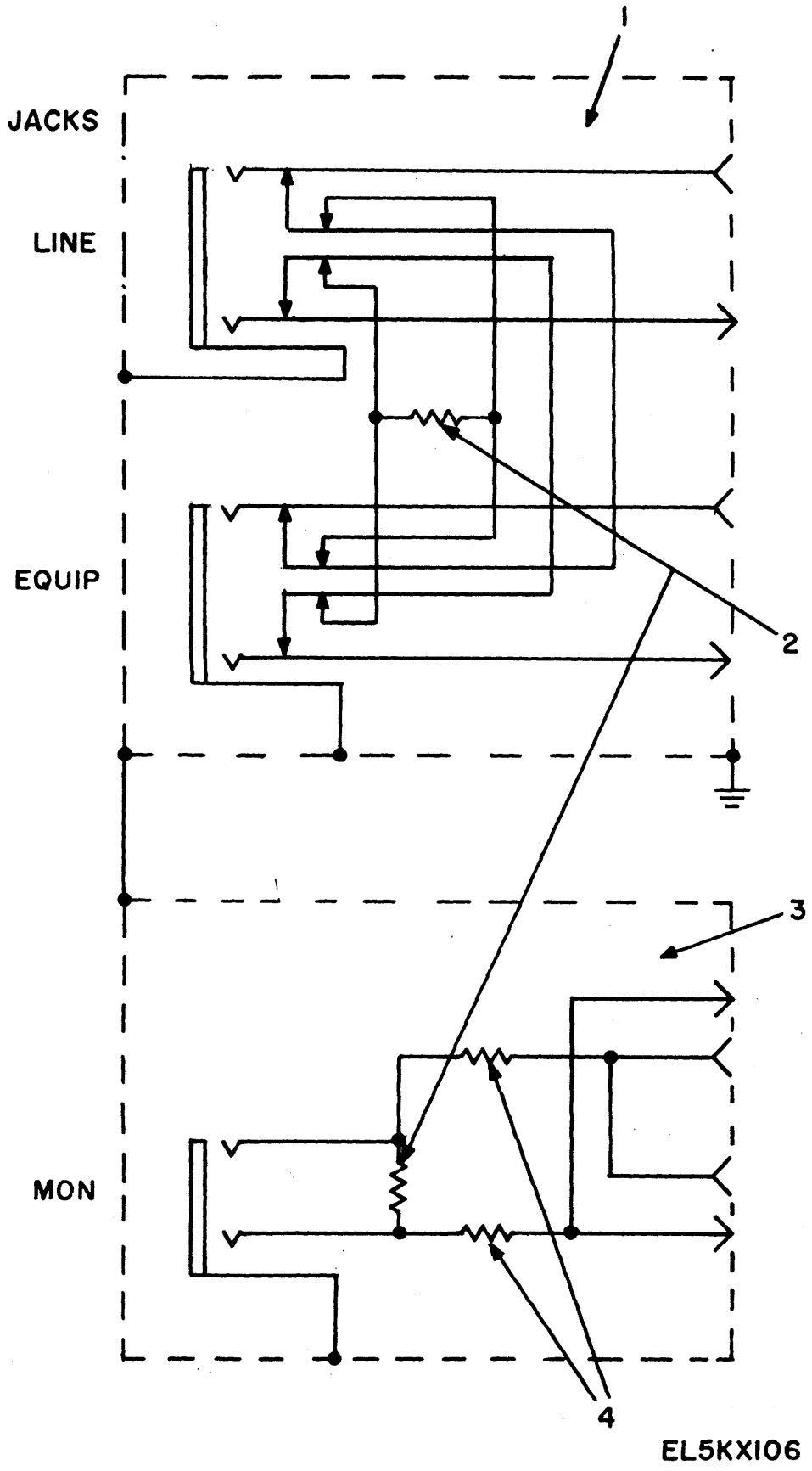


Figure D-6. Assembly, Jack Twinterm 20T and 20M, Parts Location.

SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 0501 ASSEMBLY, JACK TWINTERM 20T AND 20M, LBAD-C-33442, 21617		
D-6	1	PAFHH	5935-01-049-0049	20T	02002	JACK.....	EA	1
D-6	2	PAFZZ	5905-00-116-8567	RCR20G750JS	81349	RESISTOR, COMPOSITION: 750 OHM, 1/2W, PORM 5...	EA	2
D-6	3	XDFHH		20M	02002	JACK.....	EA	1
D-6	4	PAFZZ	5905-00-105-7768	RCR07G561JS	81349	RESISTOR, COMPOSITION: 560 OHM, 1/4W, PORM 5%	EA	2

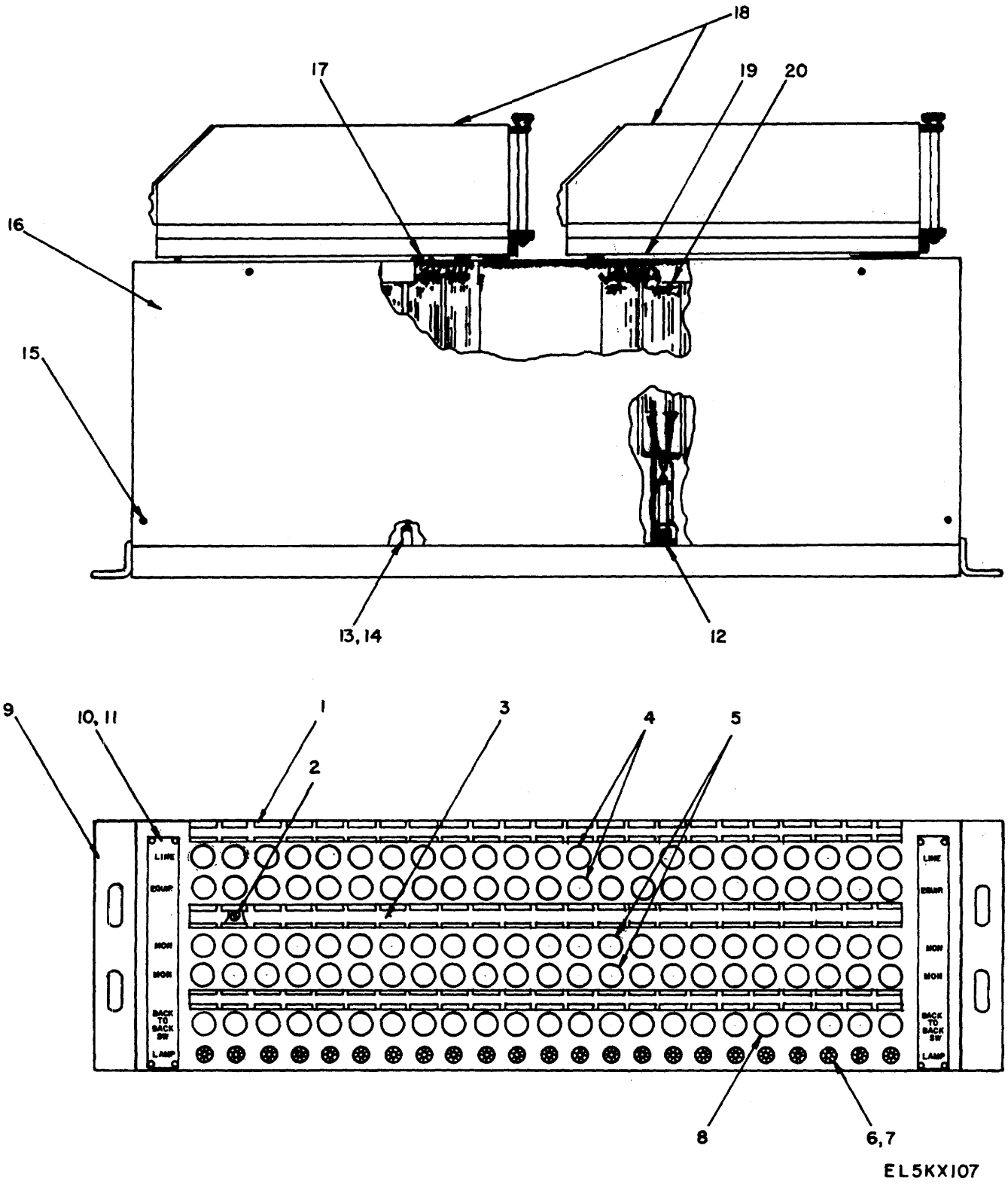


Figure D-7. Universal DC Patch Panel Assembly, Parts Location (Sheet 1 of 3).

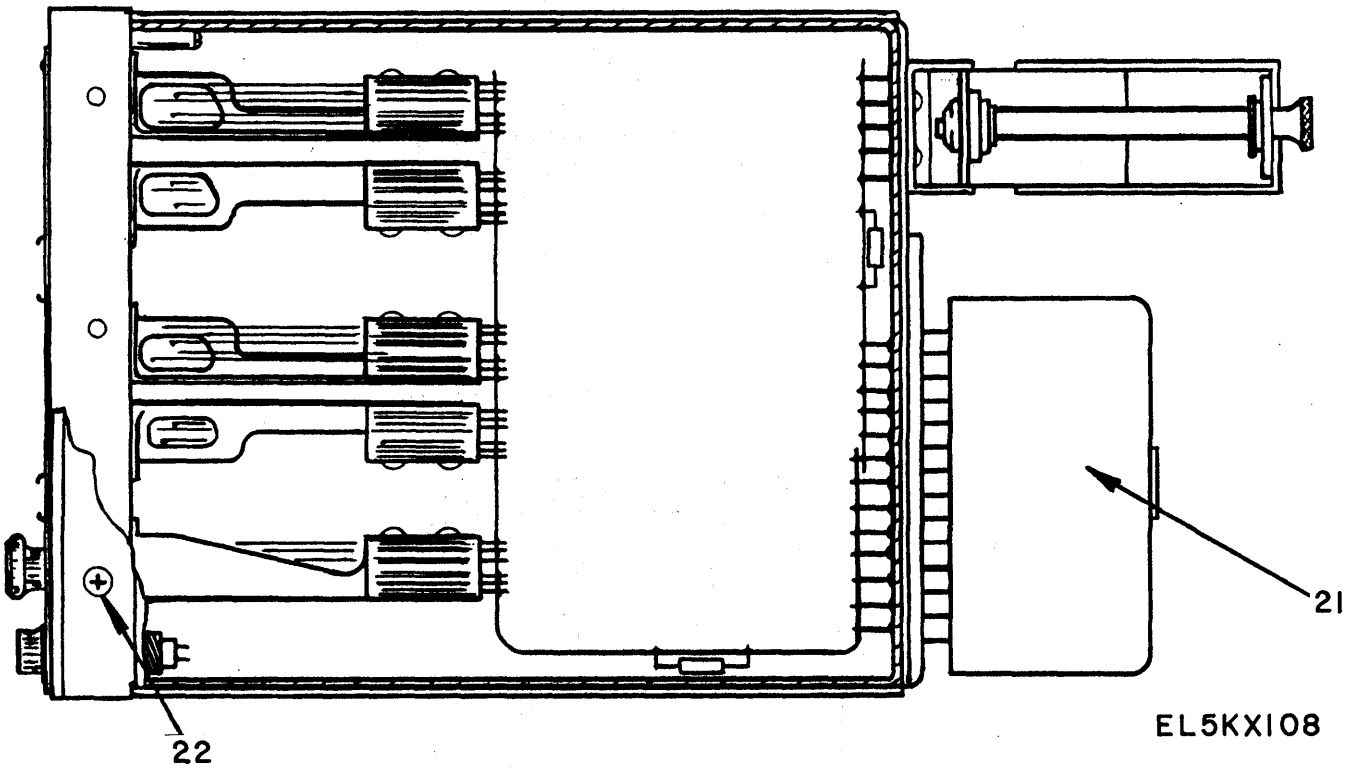


Figure D-7. Universal DC Patch Panel Assembly, Parts Location (Sheet 2 of 3).

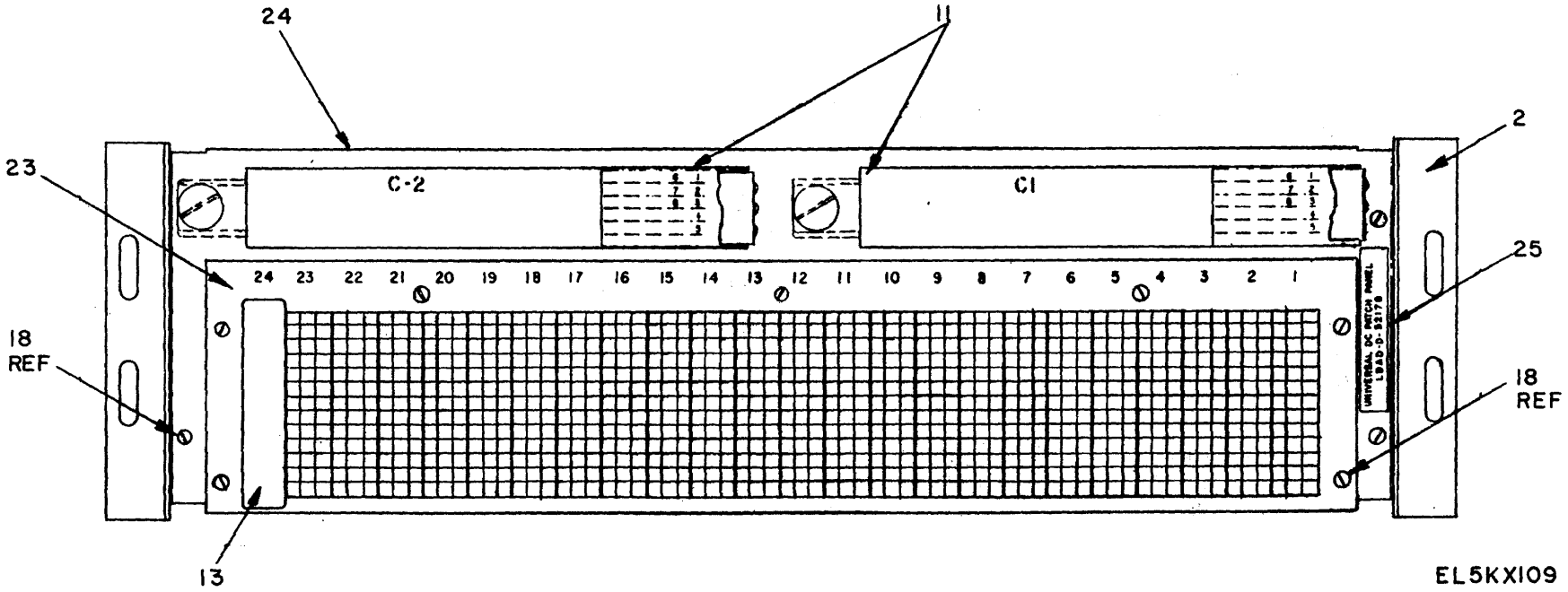


Figure D-7. Universal DC Patch Panel Assembly, Parts Location (Sheet 3 of 3).

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 06 UNIVERSAL D.C. PATCH PANEL ASSEMBLY, LBAD-D-52178, 21617		
D-7	1	MDFZZ		LBAD-D-52180	21617	PANEL	EA	1
D-7	2	PAFZZ	5305-00-958-5483	MS35190-221	96906	SCREW, F.H.M.S. 4-40 X 1/4	EA	12
D-7	3	XDFZZ		90A	64959	STRIP, IDENTIFICATION	EA	3
D-7	4	MDFZZ		LBAD-C-52175	21617	JACK, TELEPHONE	EA	48
D-7	5	MDFZZ		LBAD-C-33669	21617	JACK, TELEPHONE	EA	48
D-7	6	XDFZZ		CL-24V40-L2R	95146	LAMP	EA	24
D-7	7	PAFZZ	6210-00-485-9843	250-7538-14-504	72619	HOLDER, LAMP	EA	24
D-7	8	MDFZZ		LBAD-C-52174	21617	JACK, PUSH BUTTON	EA	24
D-7	9	MDFZZ		LBAD-D-52182	21617	PANEL, SIDE	EA	2
D-7	10	MDFZZ		LBAD-D-52727	21617	PLATE, IDENTIFICATION	EA	2
D-7	11	XDFZZ		MS21318-18	96906	SCREW, DRIVE #0 X 3/16 LG	EA	12
D-7	12	PAFZZ	5305-00-984-4988	MS35206-228	96906	SCREW, P.H.M.S. #6-32 X 3/8 LG	EA	4
D-7	13	PAFZZ	5305-00-889-2999	MS35206-217	96906	SCREW, P.H.M.S. #4-40 X 1/2 LG	EA	4
D-7	14	PAFZZ	5365-00-954-9301	2335	83330	SPACER, FIBER	EA	4
D-7	15	PAFZZ	5305-00-889-2997	MS35206-215	96906	SCREW, P.H.M.S; #4-40 X 3/8 LG	EA	8
D-7	16	MDFZZ		LBAD-D-52729	21617	COVER (TOP AND BOTTOM)	EA	2
D-7	17	MDFZZ		LBAD-D-52183	21617	CIRCUIT BOARD ASSEMBLY, FLEXIBLE	EA	1
D-7	18	MDFZZ		LBAD-D-54338	21617	CONNECTOR ASSEMBLY (100 PIN MODIFIED)	EA	1
D-7	19	MDFZZ		LBAD-D-52190	21617	CIRCUIT BOARD ASSEMBLY, FLEXIBLE	EA	1
D-7	20	MDFZZ		LBAD-D-52734	21617	CIRCUIT BOARD ASSEMBLY, FLEXIBLE	EA	24
D-7	21	MDFZZ		LBAD-C-54324	21617	PROGRAM MODULE ASSEMBLY	EA	24
D-7	22	PAFZZ	5305-00-957-6266	MS35190-252	96906	SCREW, F.H.M.S. #8-32 X 7/16 LG	EA	6
D-7	23	XDFZZ		230-1863	29587	PROGRAM BOARD	EA	1
D-7	24	NDFZZ		LBAD-D-52181	21617	PANEL, REAR	EA	1
D-7	25	MDFZZ		LBAD-D-52728	21617	PLATE, IDENTIFICATION	EA	1

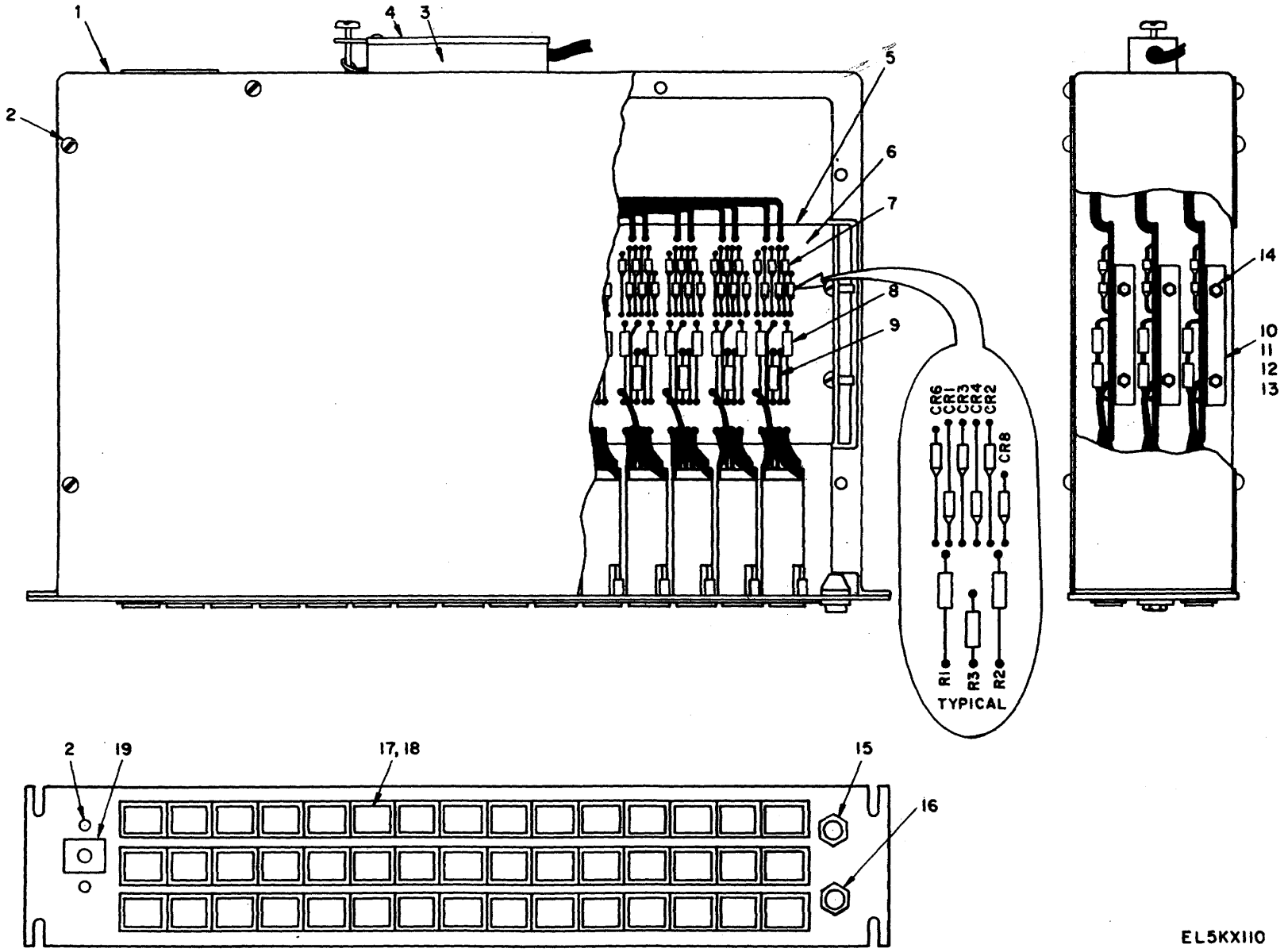


Figure D-8. Panel Alarm, Major/Minor, Parts Location

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 07 PANEL, ALARM - MAJOR/MINOR		
						LBAD-D-33161-1 (-48VDC), 21617		
D-8	1	XDFZZ		LBAD-D-33167	21617	ALARM COVER PANEL	EA	1
D-8	2	PAFZZ	5305-00-889-3000	MS35206-230	96906	SCREW, (PHMS) STEEL CAD PLTD 6-32 X 1/2 LG	EA	31
D-8	3	PAFZZ	5935-00-847-7840	513938	44038	CONNECTOR, SERIES MTC TYPE "D"	EA	1
D-8	4	PAFZZ	5935-00-799-2442	513936	44038	CONNECTOR, 100 PIN	EA	1
D-8	5	XDFHD		LBAD-D-33172-GP1	21617	CIRCUIT BOARD ASSY (-48V)	EA	3
D-8	6	XDHZZ		LBAD-D-33171	21617	PCB ASSY (MAJOR-MINOR)	EA	3
D-8	7	XDHZZ		5A4	81483	SEMICONDUCTOR DEVICE, DIODE	EA	270
D-8	8	PAHZZ	5905-00-279-2656	RC32GF511J	81349	RESISTOR, CARBON COMP 510 OHMS, 5% 1W	EA	90
D-8	9	PAHZZ	5905-00-279-1922	RC42GF271J	81349	RESISTOR, CARBON COMP 270 OHMS, 5% 2W	EA	45
D-8	10	XDHZZ		LBAD-C-12684	21617	BRACKET, CIRCUIT BOARD	EA	6
D-8	11	XDFZZ		MS35237-37	96906	SCREW, (FHMS) CAD PLTD 6-32 X 1/2 LG	EA	12
D-8	12	PAFZZ	5310-00-983-8483	MS27183-5	96906	WASHER, FLAT, ROUND STEEL CAD PLTD #6	EA	12
D-8	13	PAFZZ	5310-00-045-4007	MS35338-41	96906	WASHER, LOCK, CAD PLATED #6	EA	15
D-8	14	PAFZZ	5310-00-088-0553	MS21044-5	96906	NUT, HEX, 6-32	EA	15
D-8	15	PAFZZ	5930-00-268-0309	138187E	96182	SWITCH, PUSH BUTTON	EA	1
D-8	16	XDFZZ		138187G	96182	SWITCH, PUSH BUTTON	EA	1
D-8	17	XDFZZ		90E A2C2 F3J4 (RA) L4-N1	96182	SWITCH, TELLITE	EA	45
D-8	18	PAOZZ	6240-00-155-7836	MS25237-327	81344	LAMP, INCANDESCENT (2 EA IN SWITCH)	EA	90
D-8	19	PAFZZ	5925-01-031-5935	117-210-101	79405	CIRCUIT BREAKER	EA	1

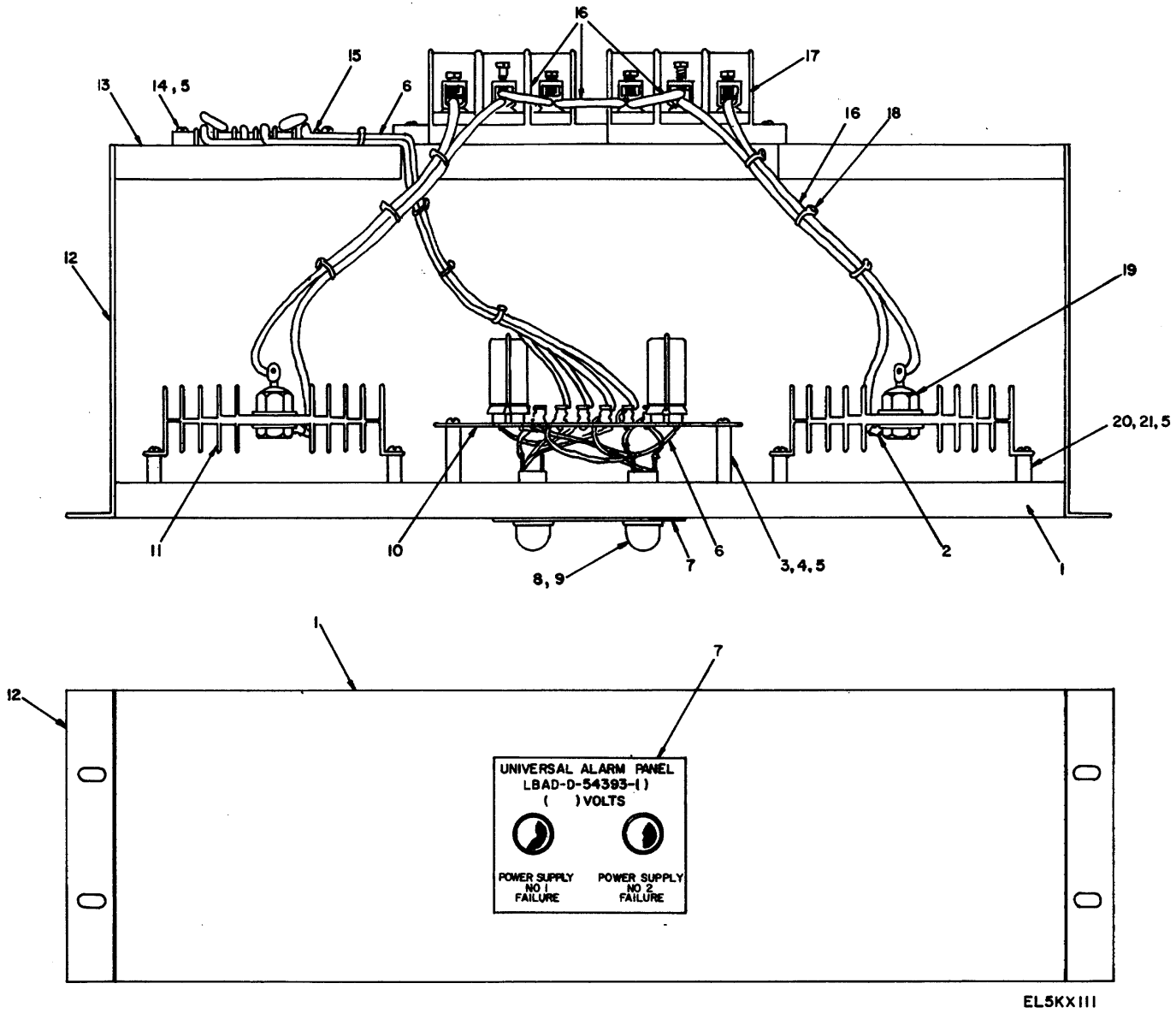


Figure D-9. Assembly, Universal Alarm Panel, Parts Location (Sheet 1 of 2).

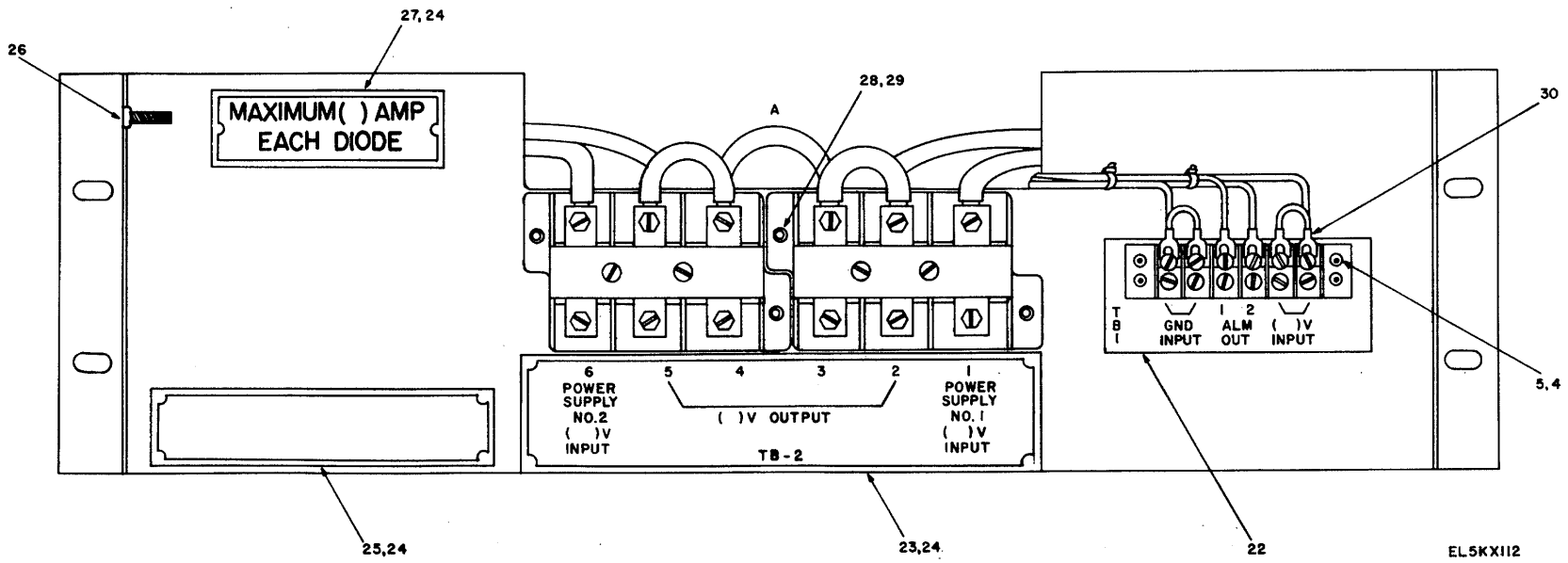


Figure D-9. Assembly, Universal Alarm Panel Parts Location (Sheet 2 of 2).

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 08 ASSEMBLY, UNIVERSAL ALARM PANEL, LBAD-D-54393-2, 21617		
D-9	1	MDFZZ		LBAD-D-54394	21617	PANEL, FRONT	EA	1
D-9	2	XDFZZ		E6-14	59730	TERMINAL, RING-TONGUE	EA	2
D-9	3	PAFZZ	5365-01-051-0884	9418	73734	SPACER, 7/32 O.D. X 1 LG	EA	4
D-9	4	PAFZZ	5305-00-984-6223	MS35206-236	96906	SCREW, P.H.M.S. #6-32 X 1-1/2	EA	4
D-9	5	PAFZZ	5310-00-983-8483	MS27183-5	96906	WASHER, FLAT #6	EA	16
D-9	6	XDFZZ				WIRE, #18 AWG, COPPER	FT	V
D-9	7	MDFZZ		LBAD-D-54402-2	21617	NAMEPLATE, FRONT PANEL	EA	1
D-9	8	XDFZZ		48P-SB	04655	LAMP, 48V TYPE T-2	EA	2
D-9	9	PAFZZ	6210-00-300-8825	95-1059-3171-102	72619	LAMPHOLDER, RED	EA	2
B-9	10	MDFHD		LBAD-D-54398-2	21617	ASSEMBLY, RELAY BOARD	EA	1
D-9	11	XDFZZ		NC403K	05820	HEATSINK	EA	2
D-9	12	MDFZZ		LBAD-D-54396	21617	SIDEFRAME	EA	2
D-9	13	MDFZZ		LBAD-D-54395	21617	PANEL, REAR	EA	1
D-9	14	PAFZZ	5305-00-889-3001	MS35206-231	96906	SCREW, P.H.M.S. #6-32 X 5/8	EA	4
D-9	15	XDFZZ		6-164	71785	BLACK, TERMINAL	EA	1
D-9	16	XDFZZ			00645	WIRE, #6 AWG, COPPER THW	FT	V
D-9	17	XDFZZ		U-32	90211	BLOCK, TERMINAL	EA	2
D-9	18	PAFZZ	5975-00-727-5153	MS3367-4-9	96906	TIES, CABLE, 0-3/4 X 4" LG	EA	V
D-9	19	XDFZZ		1N2130A	81483	DIODE, 60 AMP	EA	2
D-9	20	PAFZZ	5340-00-737-6389	8503	83330	SPACER, 1/4 O.D. X 1/2 LG	EA	8
D-9	21	PAFZZ	5305-00-984-4993	MS35206-233	96906	SCREW, P.H.M.S. #6-32 X 7/8	EA	8
D-9	22	MDFZZ		LBAD-D-54399-1	21617	NAMEPLATE, TERMINAL BLOCK (TB-1)	EA	1
D-9	23	MDFZZ		LBAD-D-54401-1	21617	NAMEPLATE, TERMINAL BLOCK (TB-2)	EA	1
D-9	24	PAFZZ	5305-00-253-5608	MS21318-9	96906	SCREW, DRIVE #0-3/16 LG	EA	10
D-9	25	MDFZZ		LBADC-54406-2	21617	NAMEPLATE, FABRICATION	EA	1
D-9	26	XDFZZ		MS34191-272	96906	SCREW, F.H.M.S. 10-32 X 1/2	EA	12
D-9	27	MDFZZ		LBAD-D-54400-2	21617	NAMEPLATE, DIODE	EA	1
D-9	28	PAFZZ	5305-00-984-6196	MS35206-248	96906	SCREW, P.H.M.S. #8-32 X 7/8	EA	4
D-9	29	PAFZZ	5310-00-809-8544	MS27183-7	96906	WASHER, FLAT #8	EA	4
D-9	30	PAFZZ	5940-00-864-9563	RA18-6F	59730	TERMINAL, FORK TONGUE #6	EA	8

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 09 ASSEMBLY, UNIVERSAL ALARM PANEL, LBAD-D-54393-3, 21617		
D-9	1	MDFZZ		LBAD-D-54394	21617	PANEL, FRONT	EA	1
D-9	2	XDFZZ		E6-14	59730	TERMINAL, RING-TONGUE	EA	2
D-9	3	PAFZZ	5365-01-051-0884	9418	73734	SPACER, 7/32 O.D. X 1 LG	EA	4
D-9	4	PAFZZ	5305-00-984-6223	MS35206-236	96906	SCREW, P.H.M.S. #6-32 X 1-1/2	EA	4
D-9	5	PAFZZ	5310-00-983-8483	MS27183-5	96906	WASHER, FLAT, #6	EA	16
D-9	6	XDFZZ				WIRE, #18 AWG, COPPER	FT	V
D-9	7	MDFZZ		LBAD-D-54402-3	21617	NAMEPLATE, FRONT PANEL	EA	1
D-9	8	XDFZZ		24P-SB	04655	LAMP, 24V TYPE T-2	EA	2
D-9	9	PAFZZ	6210-00-300-8825	95-1059-3171-102	72619	LAMPHOLDER, RED	EA	2
D-9	10	MDFHD		LBAD-D-54398-1	21617	ASSEMBLY, RELAY BOARD	EA	1
D-9	11	XDFZZ		NC403K	05820	HEATSINK	EA	2
D-9	12	MDFZZ		LBAD-D-54396	21617	SIDEFRAME	EA	2
D-9	13	MDFZZ		LBAD-D-54395	21617	PANEL, REAR	EA	1
D-9	14	PAFZZ	5305-00-889-3001	MS35206-231	96906	SCREW, P.H.M.S. #6-32 X 5/8	EA	4
D-9	15	XDFZZ		6-164	71785	BLACK, TERMINAL	EA	1
D-9	16	XDFZZ			00645	WIRE, #8 AWG, COPPER, THW	FT	V
D-9	17	XDFZZ		U-32	90211	BLOCK, TERMINAL	EA	2
D-9	18	PAFZZ	5975-00-727-5153	MS3367-4-9	96906	TIES, CABLE, 0-3/4 X 4" LG	EA	V
D-9	19	XDFZZ		1N1183	81483	DIODE, 40 AMP	EA	2
D-9	20	PAFZZ	5340-00-737-6389	8503	83330	SPACER, 1/4 O.D. X 1/2 LG	EA	8
D-9	21	PAFZZ	5305-00-984-4993	MS35206-233	96906	SCREW, P.H.M.S. #6-32 X 7.8	EA	8
D-9	22	MDFZZ		LBAD-D-54399-2	21617	NAMEPLATE, TERMINAL BLOCK (TB-1)	EA	1
D-9	23	MDFZZ		LBAD-D-54401-2	21617	NAMEPLATE, TERMINAL BLOCK (TB-2)	EA	1
D-9	24	PAFZZ	5305-00-253-5608	MS21318-9	96906	SCREW, DRIVE #0-3/16 LG	EA	10
D-9	25	MDFZZ		LBAD-C-54406-3	21617	NAMEPLATE, FABRICATION	EA	1
D-9	26	XDFZZ		MS34191-272	96906	SCREW, F.H.M.S. 10-32 X 1/2	EA	12
D-9	27	MDFZZ		LBAD-D-54400-3	21617	NAMEPLATE, DIODE	EA	1
D-9	28	PAFZZ	5305-00-984-6196	MS35206-248	96906	SCREW, P.H.M.S. #8-32 X 7/8	EA	4
D-9	29	PAFZZ	5310-00-809-8544	MS27183-7	96906	WASHER, FLAT #8	EA	4
D-9	30	PAFZZ	5940-00-864-9563	RA18-6F	59730	TERMINAL, FORK TONGUE #6	EA	8

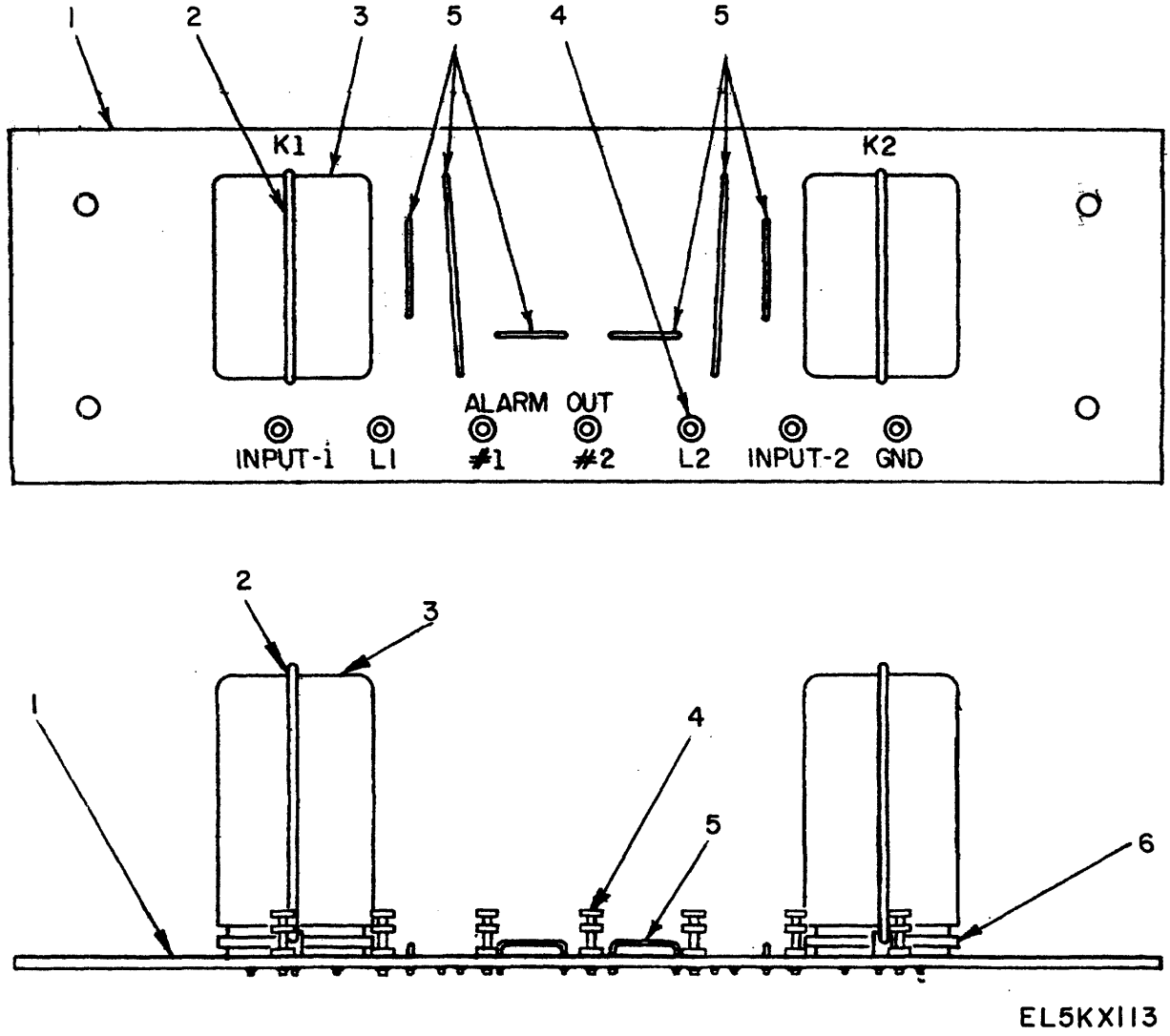


Figure D-10. Relay Board Assembly, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 10 RELAY BOARD ASSEMBLY, LBAD-D-54398-2, 21617		
D-10	1	MDFZZ		MP54403	21617	BOARD, PRINTED CIRCUIT	EA	1
D-10	2	PAFZZ	5945-00-758-1335	30040-1	70309	RETAINER, RELAY	EA	1
D-10	3	XDFZZ		T154-2C-48VDC	70309	RELAY, DPDT	EA	2
D-10	4	XDFZZ		125220	73734	TERMINAL TURRENT	EA	7
D-10	5	XDFZZ		22AWG	23172	WIRE, JUMPER: BARE	FT	V
D-10	6	XDFZZ		30055-5	70309	SOCKET, RELAY	EA	2
						GROUP: 11 RELAY BOARD ASSEMBLY, LBAD-D-54398-1, 21617		
D-10	1	MDFZZ		MP54403	21617	BOARD, PRINTED CIRCUIT	EA	1
D-10	2	PAFZZ	5945-00-758-1335	30040-1	70309	RETAINER, RELAY	EA	1
D-10	3	XDFZZ		T154-2C-24VDC	70309	RELAY, DPDT	EA	2
D-10	4	XDFZZ		125220	73734	TERMINAL TURRENT	EA	7
D-10	5	XDFZZ		22AWG	23172	WIRE, JUMPER: BARE	FT	V
D-10	6	XDFZZ		30055-5	70309	SOCKET, RELAY	EA	2

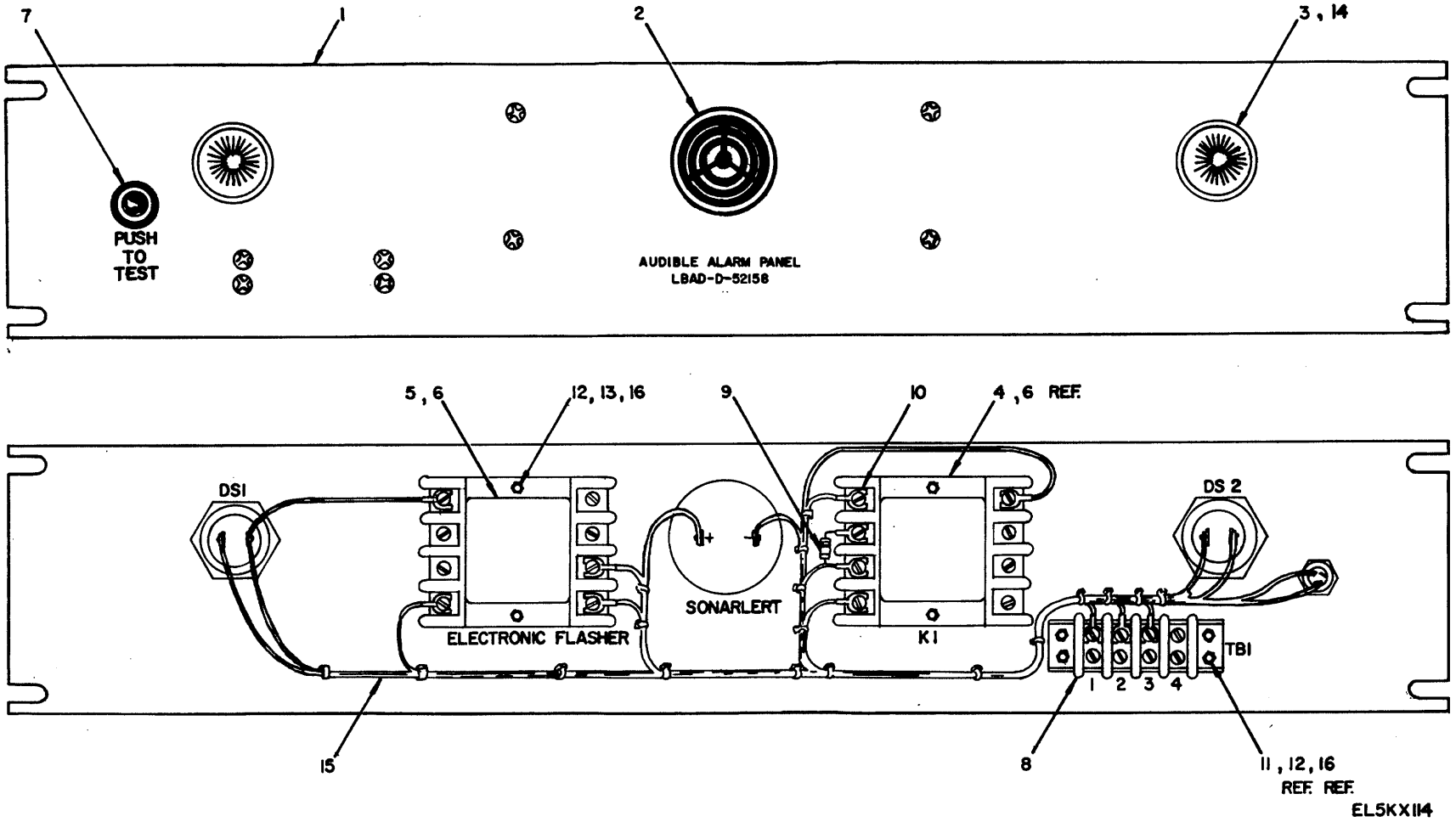


Figure D-11. Assembly, Audible Alarm Panel, Parts Location

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 12 ASSEMBLY, AUDIBLE ALARM PANEL, LBAD-D-52158, 21617		
D-11	1	MDFZZ		LBAD-D-52159	21617	PANEL, AUDIBLE ALARM	EA	1
D-11	2	PAFZZ	6350-00-071-2492	SC628P	06124	ALARM, SONARLERT	EA	1
D-11	3	XDFZZ		51-0901-0131-301	72619	LIGHT, PANEL	EA	2
D-11	4	XDFZZ		CRD48-40010	93929	RELAY, 48 VDC	EA	1
D-11	5	XDFZZ		902098-64	93929	FLASHER, ELECTRONIC, 48 VDC	EA	1
D-11	6	PAFZZ	5935-00-302-6343	146-103	02660	SOCKET, RELAY	EA	2
D-11	7	PAFZZ	5930-00-823-0018	903	82389	SWITCH	EA	1
D-11	8	XDFZZ		4-140	71785	BLOCK, TERMINAL	EA	1
D-11	9	PAFZZ	5905-00-279-1757	RC20GF152J	81349	RESISTOR, COMPOSITION, 1.5K OHM, 1/2W, PORM 5%	EA	1
D-11	10	PAFZZ	5940-00-864-9563	RA18-6F	59730	TERMINAL, FORK TONGUE	EA	20
D-11	11	PAFZZ	5305-00-958-5457	MS35190-226	96906	SCREW, F.H.M.S. #4-40 X 5/8 LG	EA	4
D-11	12	PAFZZ	5310-00-934-9739	MS35649-242	96906	NUT, HEX, #4-40	EA	8
D-11	13	PAFZZ	5305-00-958-5456	MS35190-230	96906	SCREW, F.H.M.S. #4-40 X 1-1/4 LG	EA	4
D-11	14	XDFZZ		6S6-50VDC	71744	LAMP, CANDLELABRA	EA	2
D-11	15	PAFZZ	6145-00-652-1441	8507	70903	WIRE, 20 AWG	FT	20
D-11	16	PAFZZ	5310-00-950-1310	MS27183-4	96906	WASHER, FLAT #4	EA	8

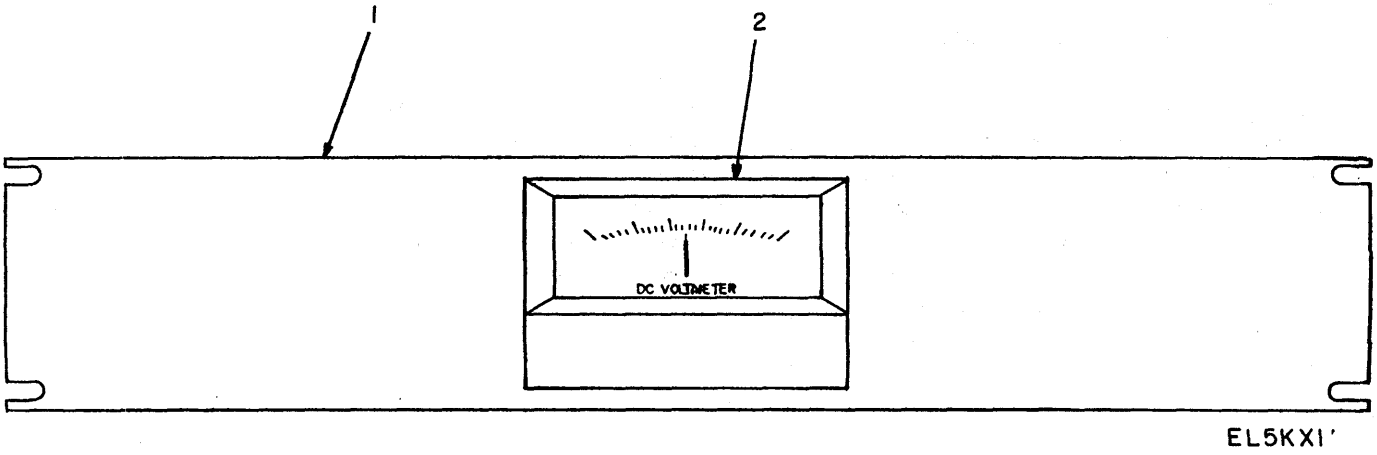


Figure D-12. Meter Panel Assembly, 0 ± 15VDC, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 13 METER PANEL ASSEMBLY 0 ±15VDC, LBAD-D-52721, 21617		
D-12	1	MDFZZ		LBAD-D-52722	21617	PANEL	EA	1
D-12	2	XDFHD		524	16902	METER, VOLT, 0 PORM L5 VDC, 4-1/2"	EA	1

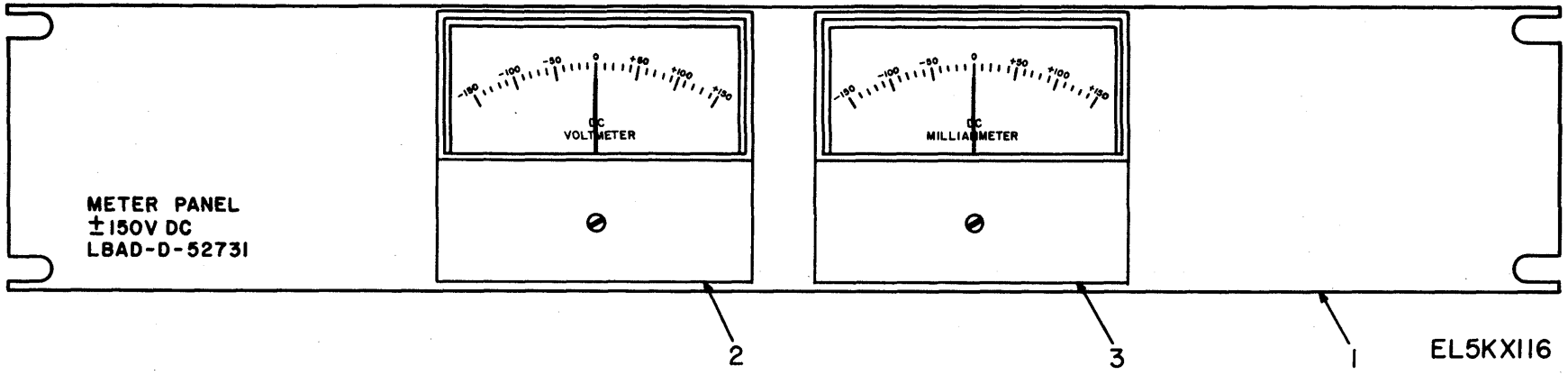


Figure D-13. Meter Panel Assembly, ±150 VDC, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 14 METER PANEL ASSEMBLY ±150VDC, LBAD-D-52731, 21617		
D-13	1	MDFZZ		LBAD-D-52732	21617	PANEL	EA	1
D-13	2	XDFHD		50-251-321-PZPZ	29834	METER, VOLT	EA	1
D-13	3	XDFHD		50-251-301-JXJX	29834	METER, MILLIAMMETER	EA	1

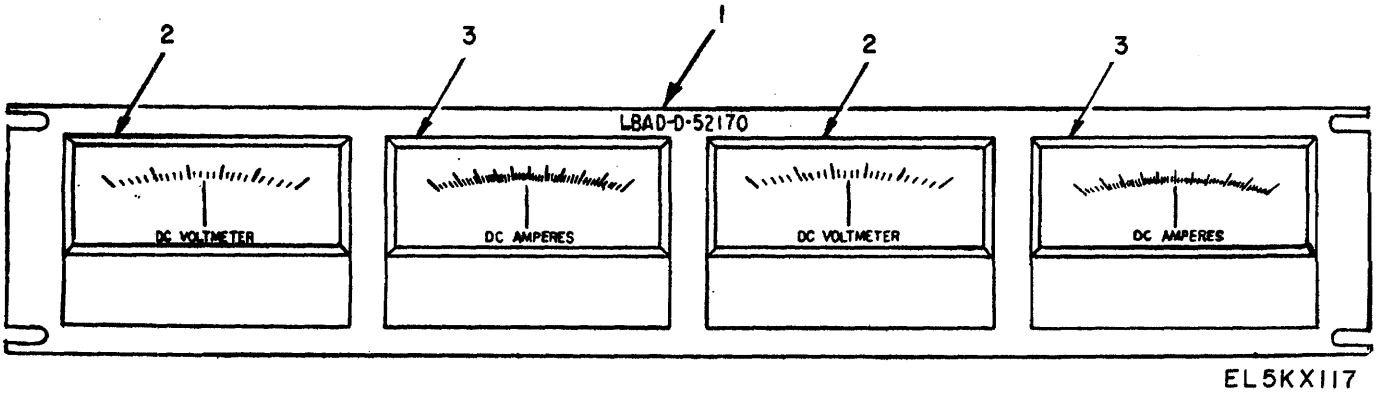


Figure D-14. Meter Panel Assembly, 24VDC, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 15 METER PANEL ASSEMBLY, 24VDC LBAD-D-52170-5, 21617		
D-14	1	MDFZZ		LBAD-D-52171	21617	PANEL, FRONT	EA	1
D-14	2	XDFHD		MODEL52331/2"	55026	VOLTMETER, 0 PORM 50 VDC, ZERO CENTER	EA	2
D-14	3	XDFHD		MODEL52331/2"	55026	AMMETER, 0-50 AMPS., ZERO LEFT	EA	2
						GROUP: 16 METER PANEL ASSEMBLY ±6VDC, LBAD-D-52170-1, 21617		
D-14	1	MDFZZ		LBAD-D-52171	21617	PANEL, FRONT	EA	1
D-14	2	XDFHD		MODEL52331/2"	55026	VOLTMETER, 0 PORM 7.5 VDC	EA	2
D-14	3	XDFHD		MODEL52331/2"	55026	AMMETER, 0 PORM 2.5 A	EA	2

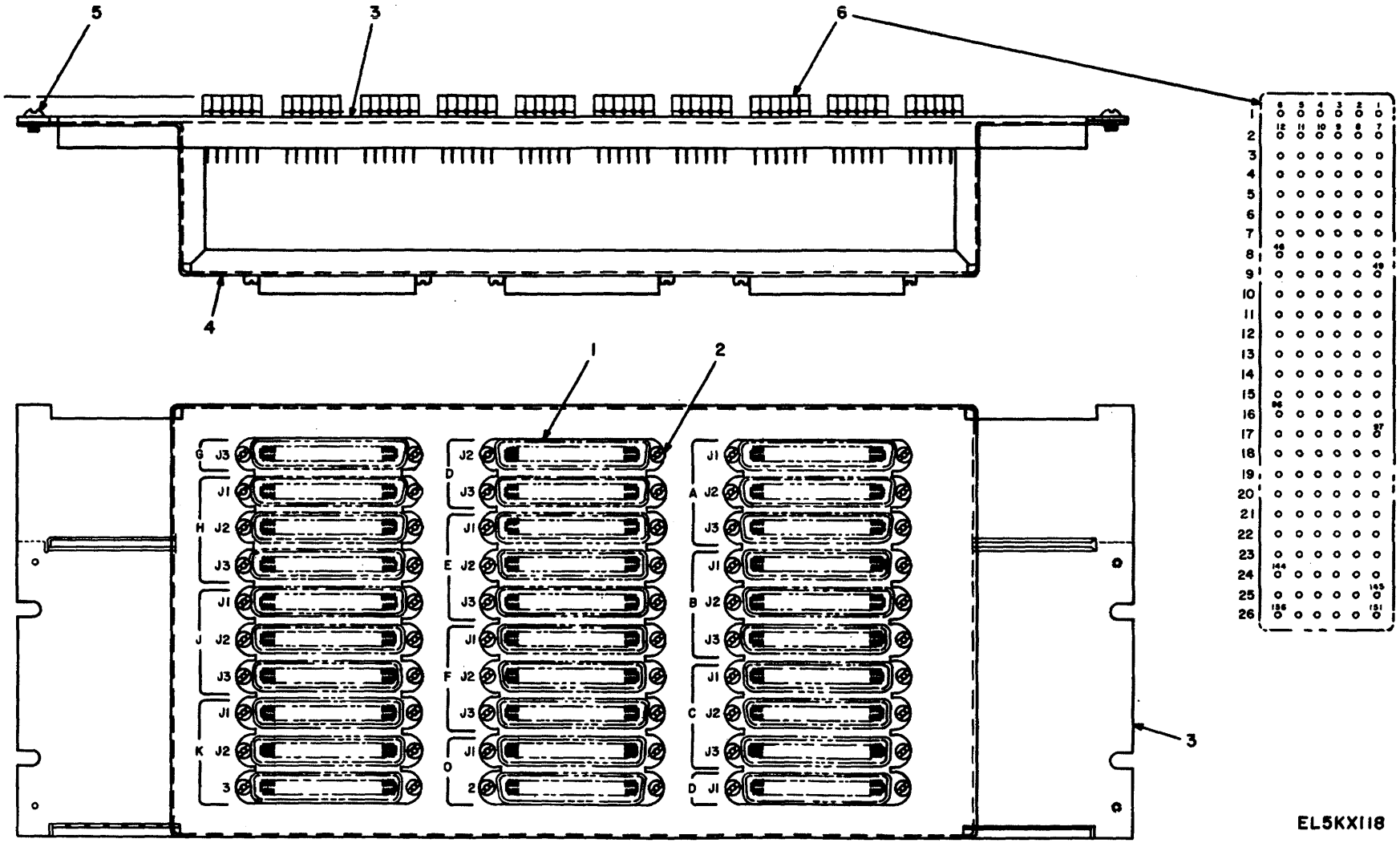


Figure D-15. Connectorized Circuit Concentration Panel Assembly, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 17 CONNECTORIZED CIRCUIT CONCENTRATION PANEL ASSEMBLY		
D-15	1	XDFZZ		57-10640-11	29587	CONNECTOR, PLUG	EA	30
D-15	2	XDFZZ		230-10143	29587	SCREW #10-24 NC	EA	60
D-15	3	XDFZZ		230-10158-A01	29587	PANEL, FRONT	EA	1
D-15	4	XDFZZ		230-94618-07	29587	PANEL, BACK	EA	1
D-15	5	XDFZZ		34-1229	29587	SCREW, P.H.M.S. 10-16	EA	4
D-15	6	XDFZZ		230-843-33-203	29587	CONNECTOR - SNAP - WRAP	EA	10

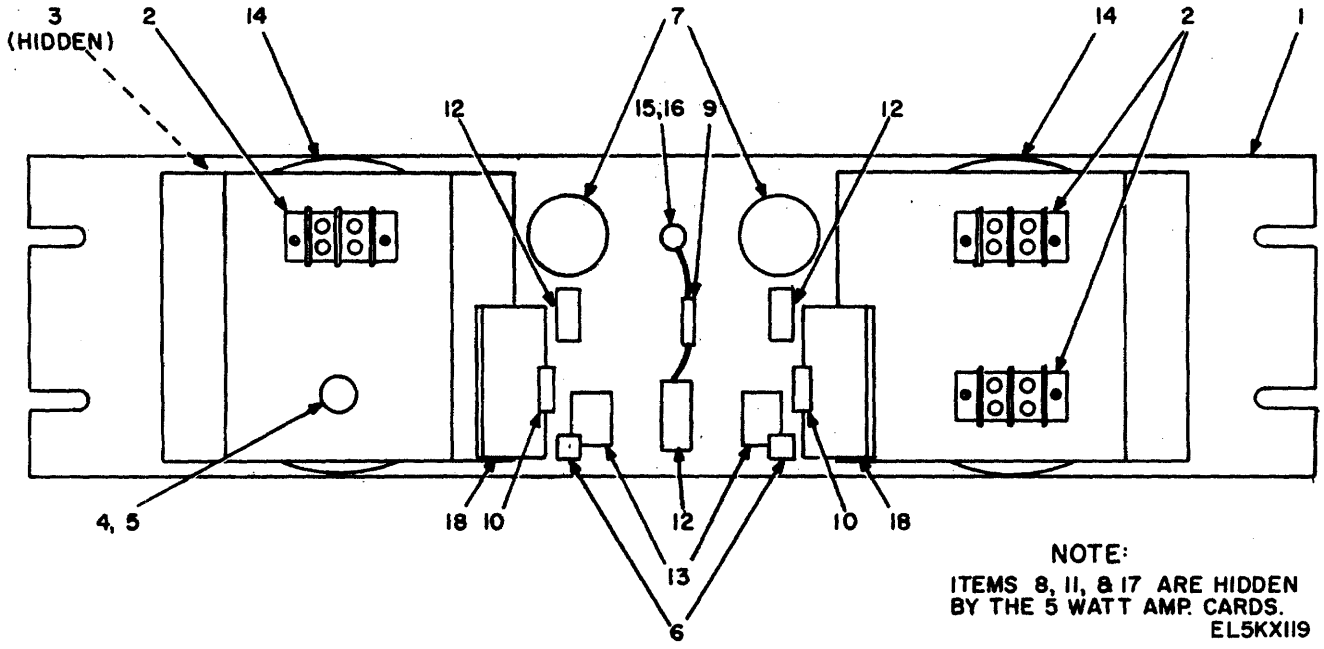


Figure D-16. Panel Dual Speaker, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 18 PANEL DUAL SPEAKER, ENGINEERING DEVICES CO., LEXINGTON, KY.		
D-16	1	XDFZZ		DSP-102-DSP-105		CHASSIS	EA	1
D-16	2	XDOZZ		2-140Y	71785	BARRIER STRIP	EA	3
D-16	3	PAOZZ	5910-00-079-7044	39D	56289	CAPACITOR, 500MF, 5OVDC	EA	1
D-16	4	XDOZZ		MDL	71400	FUSE 0.4A	EA	1
D-16	5	XDOZZ		HKP	71400	FUSEHOLDER	EA	1
D-16	6	XDOZZ		WMT-334B	82389	JACK	EA	2
D-16	7	XDOZZ		TYPE J	01121	RESISTOR, VARIABLE	EA	2
D-16	8	PAOZZ	5905-00-195-6502	RC20GF332K	81349	RESISTOR, FIXED, COMPOSITION, 3300 OHM, 1/2W, 10%	EA	2
D-16	9	XDOZZ		RC32GF332K	81349	RESISTOR, FIXED, COMPOSITION, 3300 OHM, 1W, 10%	EA	1
D-16	10	PAOZZ	5905-00-279-1761	RC20GF62IJ	81349	RESISTOR, FIXED, COMPOSITION 620 OHM 1/2W, 5%	EA	1
D-16	11	PAOZZ	5961-00-914-6005	1N4004	04713	SEMICONDUCTOR DEVICE	EA	1
D-16	12	XDOZZ		7501KI3	27191	SWITCH, SPST	EA	3
D-16	13	XDOZZ		VM15-FPB	00348	TRANSFORMER	EA	2
D-16	14	XDOZZ		S-4682-1		SPEAKER, 5"t 45 OHM	EA	2
D-16	15	PAOZZ	5961-00-274-2702	FLV-102	13715	DIODE, LIGHT EMITTING	EA	1
D-16	16	XDOZZ		FLS-001	13715	HOLDER	EA	1
D-16	17	XDOZZ		SMS	05487	CONNECTOR	EA	2
D-16	18	XDFDD		6912		AMPLIFIER, 5 WATT, MFR ENGINEERING DEVICE CO. LEXINGTON, KY.	EA	2

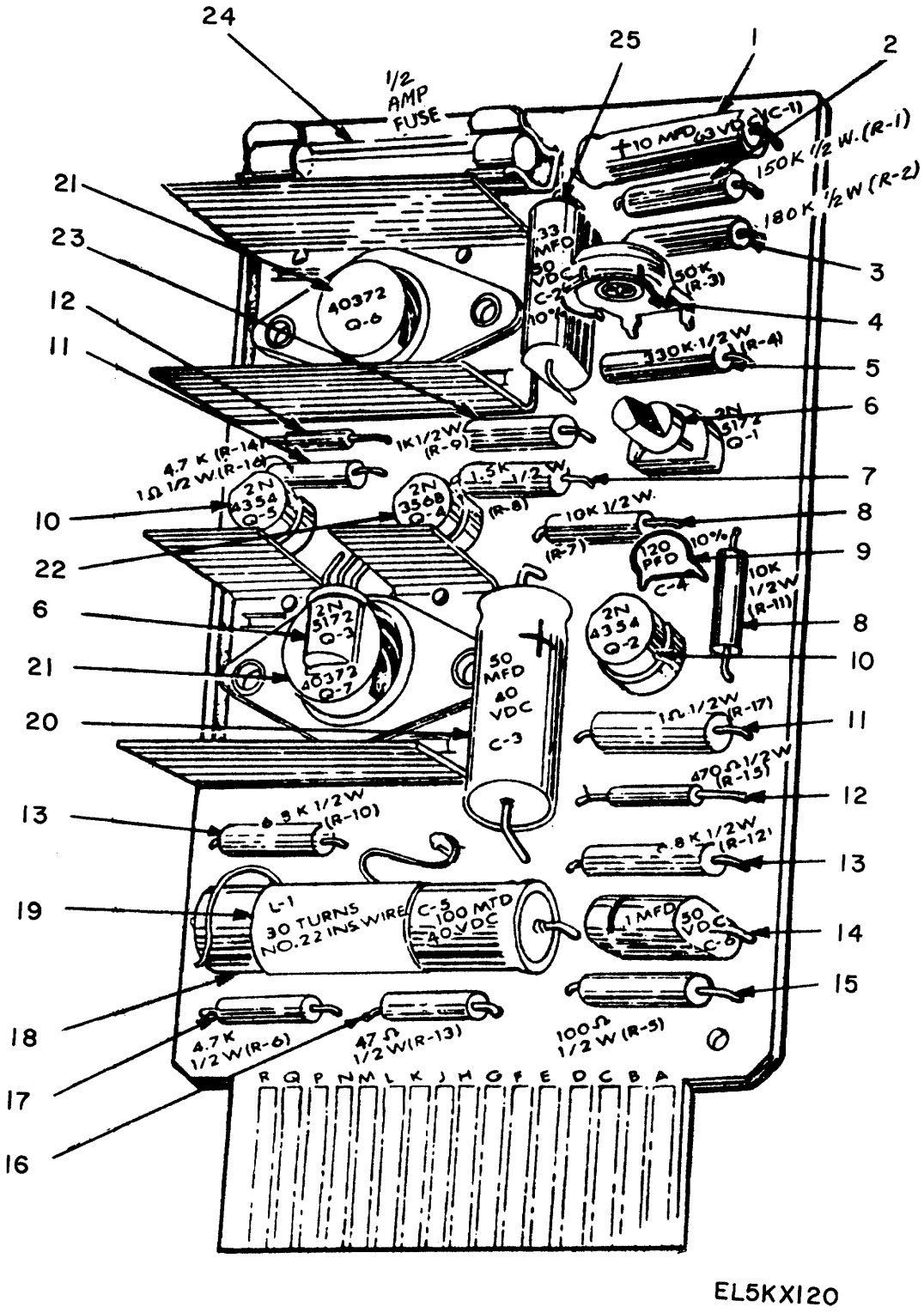


Figure D-17. Amplifier, 5 Watt, Parts Location.

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 1801 AMPLIFIER, 5 WATT #6912		
D-17	1	XDFZZ			56289	CAPACITOR, ELECTROLYTIC: 10 MFD, 63 VDC	EA	1
D-17	2	PAFZZ	5905-00-192-9260	RC20GF154K	81349	RESISTOR, FIXED COMPOSITION:150000 OHM 1/2W, ±10%	EA	1
D-17	3	PAFZZ	5905-00-192-0662	RC20GF184K	81349	RESISTOR, FIXED COMPOSITION2180000 OHM 1/2W, ±10%	EA	1
D-17	4	XDFZZ		TYPE J	01121	POTENTIOMETER: 50000 OHM	EA	1
D-17	5	XDFZZ		RC20GF333K	81349	RESISTOR, FIXED COMPOSITION: 33000 OHM 1/2W, +10%	EA	1
D-17	6	PAFZZ	5961-00-145-5991	2N5172	03508	TRANSISTOR	EA	2
D-17	7	PAFZZ	5905-00-195-5514	RC20GF152K	81349	RESISTOR, FIXED COMPOSITION:1500 OHM, 1/2W, ±10%	EA	1
D-17	8	PAFZZ	5905-00-185-8518	RC20GF103K	81349	RESISTOR, FIXED COMPOSITION:10000 OHM, 1/2W, ±10%	EA	2
D-17	9	XDFZZ			56289	CAPACITOR, FIXED: 330 PF 1KV	EA	1
D-17	10	PAFZZ	5961-00-146-3979	2N5354	81349	TRANSISTOR	EA	2
D-17	11	XDFZZ		RC20GFIROK	81349	RESISTOR, FIXED COMPOSITION: 1 OHM, 1/2W, ±10%	EA	2
D-17	12	PAFZZ	5905-00-171-2005	RC20GF471K	81349	RESISTOR, FIXED COMPOSITION:470 OHM 1/2W, ±.10%	EA	2
D-17	13	PAFZZ	5905-00-245-0023	RC20GF682K	81349	RESISTOR, FIXED COMPOSITION:6900 OHM, 1/2W, ±10%	EA	2
D-17	14	XDFZZ			56289	CAPACITOR, ELECTROLYTIC: .047 MFD 10OOVDC	EA	1
D-17	15	PAFZZ	5905-00-186-3008	RC20GF101K	81349	RESISTOR, FIXED COMPOSITION:100 OHM 1/2W, ±.10%	EA	1
D-17	16	XDFZZ		RC20GF470K	81349	RESISTOR, FIXED COMPOSITION:47 OHM, 1/2W, ±10%	EA	1
D-17	17	PAFZZ	5905-00-195-6451	RC20GF472K	81349	RESISTOR, FIXED COMPOSITION:4700 OHM 1/2W, ±10%	EA	1
D-17	18	XDFZZ			56289	CAPACITOR, ELECTROLYTIC: 100 MFD, 40 VDC	EA	1
D-17	19	XDFZZ				*COIL	EA	1
D-17	20	XDFZZ			56289	CAPACITOR, ELECTROLYTIC: 50 MFD, 40 VDC	EA	1
D-17	21	PAFZZ	5961-00-497-9132	40372	59303	TRANSISTOR	EA	2
D-17	22	XDFZZ		2N2568	04713	TRANSISTOR	EA	1
D-17	23	XDFZZ		RC20GF102K	81349	RESISTOR, FIXED COMPOSITION: 1000 OHM, 1/2W, ±10%	EA	1
D-17	24	XDFZZ		3AG	75915	FUSE 1/2 A	EA	1
D-17	25	XDFZZ		Q5P33	01304	CAPACITOR: 33 MFD, 50 VDC	EA	1
						*COIL L-1: 30 TURNS #22 INS. WIRE WOUND ON ITEM 19		

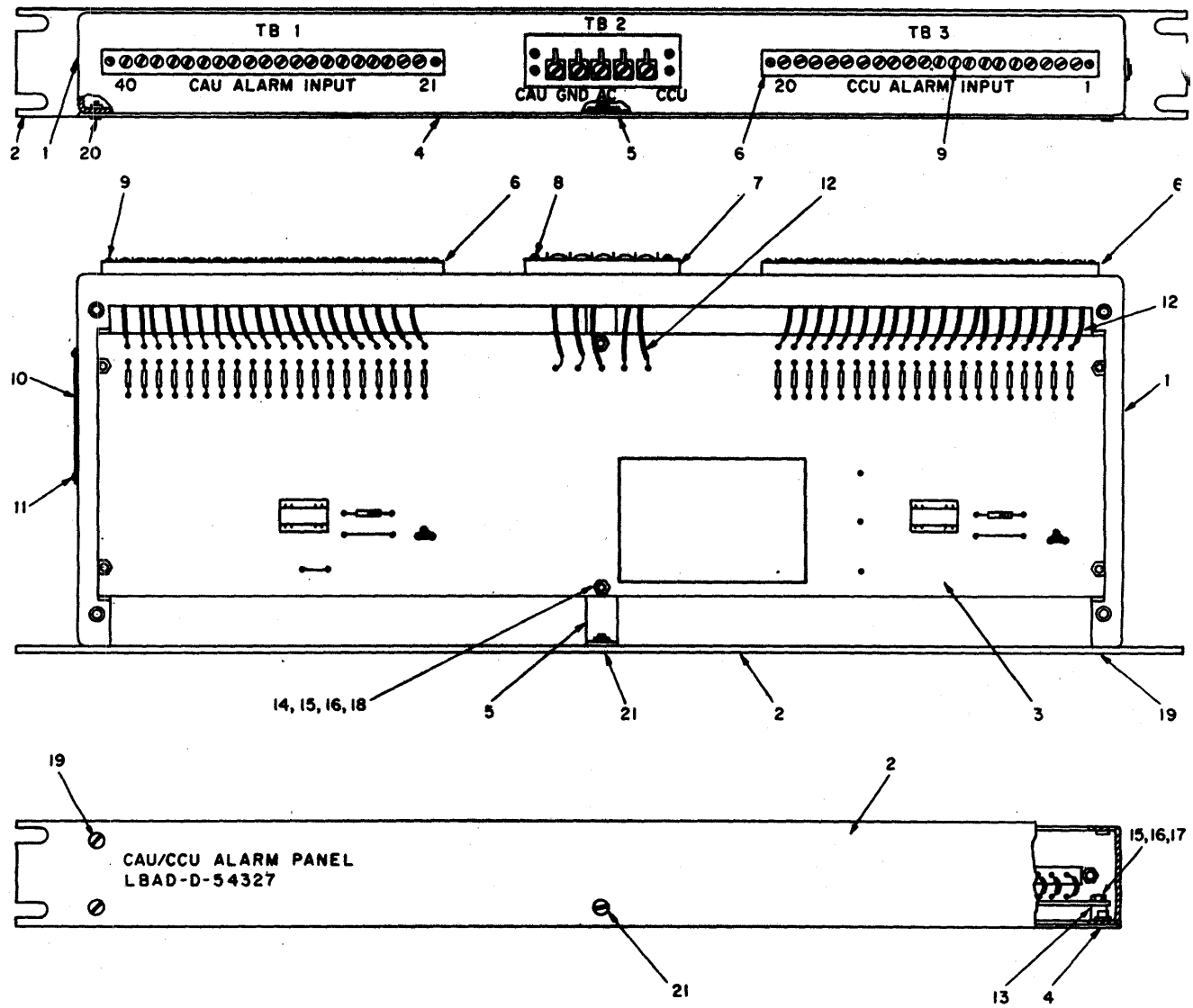


Figure D-18. Alarm Panel Assembly, CAU/CCU Parts location.

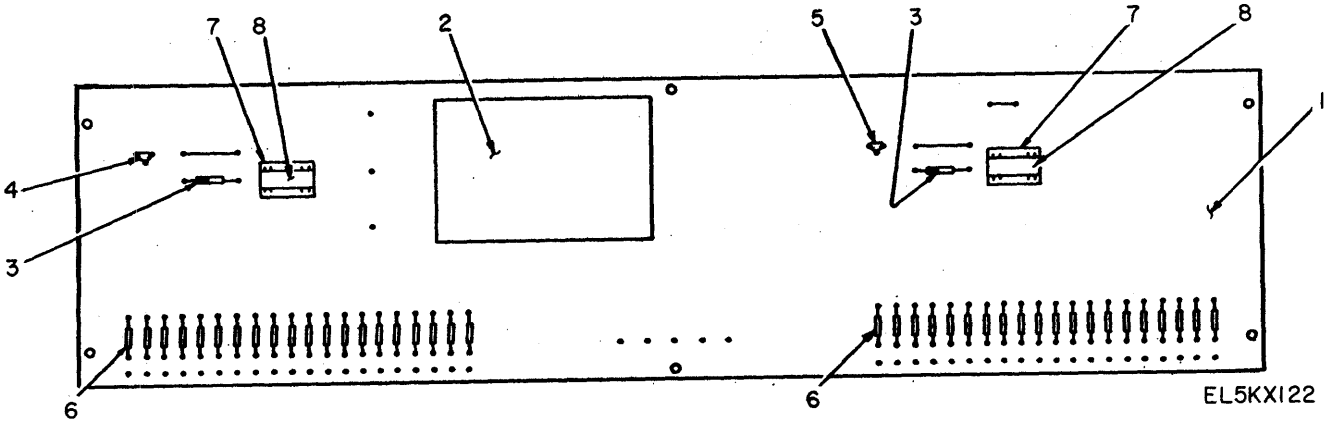


Figure D-19. Alarm Panel P.C.B. Assembly, Parts Location

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP: 19 ALARM PANEL ASSEMBLY, CAU/CCU: LBAD-D-54327, 21617		
D-18	1	MDFZZ		LBAD-D-54409	21617	FRAME, ALARM PANEL	EA	1
D-18	2	MDFZZ		LBAD-D-54408	21617	PANEL, FRONT	EA	1
D-18	3	MDFHD		LBAD-D-54413	21617	PC BOARD ASSEMBLY	EA	1
D-18	4	MDFZZ		LBAD-D-54411	21617	PANEL, BOTTOM COVER	EA	1
D-18	5	MDFZZ		LBADLD-54410	21617	STIFFENER	EA	1
D-18	6	XDFZZ		411	75382	BLOCK, TERMINALI 20 TERMINALS	EA	2
D-18	7	XDFZZ		5-104-Y	27361	BLOCK, TERMINALI 5 TERMINALS	EA	1
D-18	8	PAFZZ	5305-00-889-3000	M535206-230	96906	SCREW, P.H.MS.S #6-32 X 1/2 LG	EA	4
D-18	9	PAFZZ	5305-00-889-2999	MS535206-217	96906	SCREW, P.H.M.S. #4-40 X 1/2 LG	EA	4
D-18	10	MDFZZ		LBAD-C-54443	21617	NAMEPLATE	EA	1
D-18	11	XDHZZ		MS21318-8	96906	SCREW, #0 X 3/16 LG	EA	2
D-18	12	XDFZZ		8502	70903	WIRE #20 AWG, COPPER, BLACK	IN	96
D-18	13	PAFZZ	5365-00-954-9301	2335	83330	SPACER, SLEEVE	EA	4
D-18	14	XDFZZ		8883	83330	SPACER, FIBER	EA	2
D-18	15	PAFZZ	5310-00-934-9739	MS35649-242	96906	NUT, HEX, #4-40	EA	6
D-18	16	PAFZZ	5310-00-782-1349	M515795-804	96906	WASHER, FLAT #4	EA	6
D-18	17	PAFZZ	5305-00-957-6264	M535190-225	96906	SCREW, F.H.M.S. #4-40 X 1/2 LG	EA	4
D-18	18	PAFZZ	5305-00-958-6230	M535190-224	96906	SCREW, F.H.M.S. #4-40 X 7/8 LG	EA	2
D-18	19	PAFZZ	5305-00-958-5453	MS35190-236	96906	SCREW, F.H.M.S. #6-32 X 3/8 LG	EA	4
D-18	20	PAFZZ	5305-00-059-4550	MS35190-235	96906	SCREW, F.H.M.S. #6-32 X 5/16 LG	EA	4
D-18	21	PAFZZ	5305-00-957-6636	MS35190-223	96906	SCREW, F.H.M.S. #4-40 X 3/8 LG	EA	1

(1) ILLUSTRATION (a) FIG NO.	(1) ILLUSTRATION (b) ITEM NO.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP 1901 ALARM PANEL P.C.B. ASSEMBLY LBAD-D-54413, 21617		
D-19	1	MDFZZ		MP54414	21617	P.C. BOARD ALARM PANEL	EA	1
D-19	2	XDFHD		TW 6-200	98853	POWER SUPPLY, 6 VDC	EA	1
D-19	3	PAFZZ	5905-00-185-8510	RC20GF103J	81349	RESISTOR, COMPOSITION; 10K OHMS, 1/2W, PROM 5%	EA	2
D-19	4	PAFZZ	5961-00-931-0372	2N3906	04713	TRANSISTOR	EA	1
D-19	5	PAFZZ	5961-00-892-8706	2N3904	04713	TRANSISTOR	EA	1
D-19	6	PAFZZ	5961-00-669-6884	1N277	81349	SEMICONDUCTOR	EA	40
D-19	7	XDFZZ			80266	SOCKET, I.C. 14 PIN, P.C.B. MTG.	EA	2
D-19	8	XDFZZ		W171D1P7	94696	RELAY, 3.8 VDC, SPST-NO	EA	2

SECTION IV NATIONAL STOCK NUMBER AND PART NUMBER INDEX

STOCK NUMBER	FIGURE NO.	ITEM NO.
5310-00-045-4007	D-8	13
5305-00-059-4550	D-18	20
5910-00-079-7044	D-16	3
5310-00-081-8087	D-1	16
5310-00-081-8087	D-2	15
5310-00-081-8087	D-3	18
5310-00-081-8087	D-4	12
5310-00-088-0551	D-1	19
5310-00-088-0551	D-2	19
5310-00-088-0551	D-3	23
5310-00-088-0553	D-8	14
5905-00-105-7768	D-6	4
5905-00-116-8567	D-6	2
5961-00-145-5991	D-17	6
5961-00-146-3979	D-17	10
5305-00-151-1321	D-5	4
6240-00-155-7836	D-8	18
5905-00-171-2005	D-17	12
5905-00-185-8510	D-19	3
5905-00-185-8518	D-17	8
5905-00-186-3008	D-17	15
5905-00-192-0662	D-17	3
5905-00-192-9260	D-17	2
5905-00-195-5514	D-17	7
5905-00-195-6451	D-17	17
5905-00-195-6502	D-16	8
5310-00-209-0788	D-1	12
5310-00-209-0788	D-2	9
5310-00-209-0788	D-3	15
5310-00-209-0788	D-4	22
5905-00-245-0023	D-17	13
5305-00-253-5607	D-1	3
5305-00-253-5607	D-2	4
5305-00-253-5607	D-4	19
5305-00-253-5608	D-9	24
5305-00-253-5608	D-9	24
5930-00-268-0309	D-8	15
5961-00-274-2702	D-16	15
5905-00-2'79-1757	D-11	9
5905-00-2'79-1761	D-16	10
5905-00-2'79-1922	D-8	9
5905-00-2'79-2656	D-8	8
6210-00-300-8825	D-9	9
6210-00-300-8825	D-9	9
5935-00-302-6343	D-11	6
6210-00-485-9843	D-7	7
5961-00-497-9132	D-17	21
6145-00-652-1441	D-11	15
5961-00-669-6884	D-19	6
5975-00-727-5153	D-9	18
5975-00-727-5153	D-9	18
5340-00-737-6389	D-9	20
5340-00-737-6389	D-9	20
5945-00-758-1335	D-10	2
5945-00-758-1335	D-10	2
5310-00-782-1349	D-18	16
5935-00-799-2442	D-8	4
5310-00-809-8544	D-9	29
5310-00-809-8544	D-9	29
5930-00-823-0018	D-11	7
5935-00-847-7840	D-8	3
5940-00-864-9563	D-9	30
5940-00-864-9563	D-9	30
5940-00-864-9563	D-11	10
5305-00-889-2997	D-7	15
5305-00-889-2999	D-1	10
5305-00-889-2999	D-2	11
5305-00-889-2999	D-3	13
5305-00-889-2999	D-4	21
5305-00-889-2999	D-7	13
5305-00-889-2999	D-18	9
5305-00-889-3000	D-8	2
5305-00-889-3000	D-18	8
5305-00-889-3001	D-9	14
5305-00-889-3001	D-9	14
5305-00-889-3116	D-1	18
5305-00-889-3116	D-2	18
5305-00-889-3116	D-3	22
5305-00-889-3116	D-4	23
5961-00-892-8706	D-19	5
5961-00-914-6005	D-16	11
5961-00-931-0372	D-19	4
5310-00-934-9739	D-11	12
5310-00-934-9739	D-18	15
5310-00-950-1310	D-11	16
5365-00-954-9301	D-1	9
5365-00-954-9301	D-2	10
5365-00-954-9301	D-3	12
5365-00-954-9301	D-4	7
5365-00-954-9301	D-7	14
5365-00-954-9301	D-18	13
5305-00-957-6264	D-18	17
5305-00-957-6266	D-7	22
5305-00-957-6636	D-18	21
5305-00-958-5453	D-18	19
5305-00-958-5456	D-11	13
5305-00-958-5457	D-11	11
5305-00-958-5483	D-1	6
5305-00-958-5483	D-2	6
5305-00-958-5483	D-3	6
5305-00-958-5483	D-4	20
5305-00-958-5483	D-7	2

SECTION IV NATIONAL STOCK NUMBER AND PART NUMBER INDEX (CONTINUED)

STOCK NUMBER	FIGURE NO.	ITEM NO.
5305-00-958-6230	D-18	18
5310-00-983-8483	D-8	12
5310-00-983-8483	D-9	5
5310-00-983-8483	D-9	5
5305-00-984-4988	D-1	11
5305-00-984-4988	D-2	8
5305-00-984-4988	D-3	14
5305-00-984-4988	D-4	8
5305-00-984-4988	D-7	12
5305-00-984-4993	D-9	21
5305-00-984-4993	D-9	21
5305-00-984-6196	D-9	28
5305-00-984-6196	D-9	28
5305-00-984-6223	D-9	4
5305-00-984-6223	D-9	4
5305-00-984-7361	D-1	22
5305-00-984-7361	D-2	21
5305-00-984-7361	D-3	26
5305-00-984-7361	D-4	17
5305-00-995-6653	D-1	21
5305-00-995-6653	D-2	20
5305-00-995-6653	D-3	25
5305-00-995-6653	D-4	16
5925-01-031-5935	D-8	19
5935-01-049-0049	D-6	1
5365-01-051-0884	D-9	3
5365-01-051-0884	D-9	3

SECTION IV NATIONAL STOCK NUMBER AND PART NUMBER INDEX (CONTINUED)

PART NUMBER	FSCM	FIG. NO.	ITEM NO.
CL-24V40-L2R	95146	D-7	6
CRD48-40010	93929	D-11	4
DSP-102-DSP-105		D-16	1
E6-14	59730	D-9	2
E6-14	59730	D-9	2
FLS-001	13715	D-16	16
FLV-102	13715	D-16	15
HKP	71400	D-16	5
LBAD-C-12684	21617	D-8	10
LBAD-C-33442	21617	D-5	7
LBAD-C-33442	21617	D-5	12
LBAD-C-33669	21617	D-7	5
LBAD-C-52174	21617	D-7	8
LBAD-C-52175	21617	D-7	4
LBAD-C-54324	21617	D-7	21
LBAD-C-54406-2	21617	D-9	25
LBAD-C-54406-3	21617	D-9	25
LBAD-D-12377	21617	D-2	2
LBAD-D-12377	21617	D-3	16
LBAD-D-28579	21617	D-1	4
LBAD-D-28579	21617	D-4	3
LBAD-D-28580-1	21617	D-2	3
LBAD-D-28580-51	21617	D-4	2
LBAD-D-28580-52	21617	D-1	2
LBAD-D-28580-5	21617	D-3	2
LBAD-D-33167	21617	D-8	1
LBAD-D-33171	21617	D-8	6
LBAD-D-33172-GP1	21617	D-8	5
LBAD-D-33369	21617	D-3	7
LBAD-D-33441	21617	D-5	1
LBAD-D-33443-1	21617	D-5	2
LBAD-D-33443-2	21617	D-5	5
LBAD-D-33444	21617	D-5	3
LBAD-D-33445-3	21617	D-5	8
LBAD-D-33655	21617	D-2	1
LBAD-D-33655	21617	D-3	1
LBAD-D-33656	21617	D-1	1
LBAD-D-33556	21617	D-4	1
LBAD-D-33658	21617	D-1	20
LBAD-D-33658	21617	D-2	12
LBAD-D-33658	21617	D-4	15
LBAD-D-33659	21617	D-1	13
LBAD-D-33660	21617	D-2	14
LBAD-D-33660	21617	D-3	20
LBAD-D-33664	21617	D-4	10
LBAD-D-33665-2	21617	D-1	15
LBAD-D-33665-2	21617	D-2	16
LBAD-D-33665-2	21617	D-3	19
LBAD-D-33665-3	44038	D-4	13
LBAD-D-33666	21617	D-1	8
LBAD-D-33667	21617	D-3	4
LBAD-D-33668	21617	D-1	7
LBAD-D-33668	21617	D-4	4
LBAD-D-33670	64959	D-2	7
LBAD-D-33670	21617	D-3	5
LBAD-D-33671	21617	D-3	17
LBAD-D-33672-1	21617	D-1	17
LBAD-D-33672-2	21617	D-2	17
LBAD-D-33672-6	21617	D-4	14
LBAD-D-33672-8	21617	D-3	21
LBAD-D-33675	21617	D-1	14
LBAD-D-33681	21617	D-2	13
LBAD-D-33686	21617	D-3	24
LBAD-D-33699	21617	D-3	8
LBAD-D-33699	21617	D-4	6
LBAD-D-33702	21617	D-4	11
LBAD-D-52159	21617	D-11	1
LBAD-D-52171	21617	D-14	1
LBAD-D-52171	21617	D-14	1
LBAD-D-52180	21617	D-7	1
LBAD-D-52181	21617	D-7	24
LBAD-D-52182	21617	D-7	9
LBAD-D-52183	21617	D-7	17
LBAD-D-52190	21617	D-7	19
LBAD-D-52722	21617	D-12	1
LBAD-D-52727	21617	D-7	10
LBAD-D-52728	21617	D-7	25
LBAD-D-52729	21617	D-7	16
LBAD-D-52732	21617	D-13	1
LBAD-D-52734	21617	D-7	20
LBAD-D-54338	21617	D-7	18
LBAD-D-54394	21617	D-9	1
LBAD-D-54394	21617	D-9	1
LBAD-D-54395	21617	D-9	13
LBAD-D-54395	21617	D-9	13
LBAD-D-54396	21617	D-9	12
LBAD-D-54396	21617	D-9	12
LBAD-D-54398-1	21617	D-9	10
LBAD-D-54398-2	21617	D-9	10
LBAD-D-54399-1	21617	D-9	22
LBAD-D-54399-2	21617	D-9	22
LBAD-D-54400-2	21617	D-9	27
LBAD-D-54400-3	21617	D-9	27
LBAD-D-54401-1	21617	D-9	23
LBAD-D-54401-2	21617	D-9	23
LBAD-D-54402-2	21617	D-9	7
LBAD-D-54402-3	21617	D-9	7
LBAD-D-54408	21617	D-18	2
LBAD-D-54409	21617	D-18	1
LBAD-D-54410	21617	D-18	5
LBAD-D-54411	21617	D-18	4
LBAD-D-54413	21617	D-18	3
LBAD-C-54443	21617	D-18	10
LBAD-D-54465	21617	D-5	11
MDL	71400	D-16	4
MODEL523 3 1/2"	55026	D-14	2
MODEL523 3 1/2"	55026	D-14	2
MODEL523 3 1/2"	55026	D-14	3
MODEL523 3 1/2"	55026	D-14	3
MP54403	21617	D-10	1
MP54403	21617	D-10	1
MP54414	21617	D-19	1
MS15795-804	96906	D-18	16
MS21044-N04	96906	D-1	19

SECTION IV NATIONAL STOCK NUMBER AND PART NUMBER INDEX (CONTINUED)

PART NUMBER	FSCM	FIG. NO.	ITEM NO.
MS21044-N04	96906	D-2	19
MS21044-N04	96906	D-3	23
MS21044-N04	96906	D-4	24
MS21044-N06	96906	D-1	16
MS21044-N06	96906	D-2	15
MS21044-N06	96906	D-3	18
MS21044-N06	96906	D-4	12
MS21044-5	96906	D-8	14
MS21318-18	96906	D-3	11
MS21318-18	96906	D-7	11
MS21318-8	96906	D-1	3
MS21318-8	96906	D-2	4
MS21318-8	96906	D-4	19
MS21318-8	96906	D-18	11
MS21318-9	96906	D-9	24
MS21318-9	96906	D-9	24
MS25237-327	81344	D-8	18
MS27183-4	96906	D-11	16
MS27183-5	96906	D-8	12
MS27183-5	96906	D-9	5
MS27183-5	96906	D-9	5
MS27183-7	96906	D-9	29
MS27183-7	96906	D-9	29
MS3367-4-9	96906	D-9	18
MS3367-4-9	96906	D-9	18
MS34191-272	96906	D-9	26
MS34191-272	96906	D-9	26
MS35190-221	96906	D-1	6
MS35190-221	96906	D-2	6
MS35190-221	96906	D-3	6
MS35190-221	96906	D-4	20
NS35190-221	96906	D-7	2
MS35190-222	96906	D-1	21
MS35190-222	96906	D-2	20
MS35190-222	96906	D-3	25
MS35190-222	96906	D-4	16
MS35190-223	96906	D-18	21
MS35190-224	96906	D-18	18
MS35190-225	96906	D-18	17
MS35190-226	96906	D-11	11
MS35190-230	96906	D-11	13
MS35190-235	96906	D-18	20
MS35190-236	96906	D-18	19
MS35190-252	96906	D-7	22
MS35191-270	96906	D-1	22
MS35191-270	96906	D-2	21
MS35191-270	96906	D-3	26
MS35191-270	96906	D-4	17
MS35198-12	96906	D-5	4
MS35198-17	96906	D-5	6
MS35206-213	96906	D-1	18
MS35206-213	96906	D-2	18
MS35206-213	96906	D-3	22
MS35206-213	96906	D-4	23
MS35206-215	96906	D-7	15
MS35206-217	96906	D-1	10
MS35206-217	96906	D-2	11
MS35206-217	96906	D-3	13
MS35206-217	96906	D-4	21
MS35206-217	96906	D-7	13
MS35206-217	96906	D-18	9
MS35206-228	96906	D-1	11
MS35206-228	96906	D-2	8
MS35206-228	96906	D-3	14
MS35206-228	96906	D-4	8
MS35206-228	96906	D-7	12
MS35206-230	96906	D-8	2
MS35206-230	96906	D-18	8
MS35206-231	96906	D-9	14
MS35206-231	96906	D-9	14
MS35206-233	96906	D-9	21
MS35206-233	96906	D-9	21
MS35206-236	96906	D-4	4
MS35206-236	96906	D-9	4
MS35206-248	96906	D-9	28
MS35206-248	96906	D-9	28
MS35237-37	96906	D-8	11
MS35335-30	96906	D-1	12
MS35335-30	96906	D-2	9
MS35335-30	96906	D-3	15
MS35335-30	96906	D-4	22
MS35338-41	96906	D-8	13
MS35649-242	96906	D-11	12
MS35649-242	96906	D-18	15
NC403K	05820	D-9	11
NC403K	05820	D-9	11
PJ-152	70674	D-3	9
PJ-152	70674	D-4	9
PL-76	14949	D-5	10
RA18-6F	59730	D-9	30
RA18-6F	59730	D-9	30
RA18-6F	59730	D-11	10
RCR07G561JS	81349	D-6	4
RCR20G750JS	81349	D-6	2
RC20GF1R0K	81349	D-17	11
RC20GF101K	81349	D-17	15
RC20GF102K	81349	D-17	23
RC20GF103J	81349	D-19	3
RC20GF103K	81349	D-17	8
RC20GF152J	81349	D-11	9
RC20GF152K	81349	D-17	7
RC20GF154K	81349	D-17	2
RC20GF184K	81349	D-17	3
RC20GF332K	81349	D-16	8
RC20GF333K	81349	D-17	5
RC20GF470K	81349	D-17	16
RC20GF471K	81349	D-17	12
RC20GF472K	81349	D-17	17
RC20GF621J	81349	D-16	10
RC20GF682K	81349	D-17	13
RC32GF332K	81349	D-16	9
RC32GF511J	81349	D-8	8
RC42GF271J	81349	D-8	9
SC628P	06124	D-11	2

SECTION IV NATIONAL STOCK NUMBER AND PART NUMBER INDEX (CONTINUED)

PART NUMBER	FSCM	FIG. NO.	ITEM NO.
SMS	05487	D-16	17
S-4682-1		D-16	14
TRC-75-2	14949	D-5	9
TW6-200	98853	D-19	2
TYPE J	01121	D-16	7
TYPE J	01121	D-17	4
T154-2C-24VDC	70309	D-10	3
U-32	90211	D)-9	17
U-32	90211	D-9	17
VM15-FPB	00348	D-16	13
WMT-334B	82389	D-16	6
W171D1P7	94696	D-19	8
05P33	01304	D-17	25
117-210-101	79405	D-8	19
125220	73734	D-10	4
125220	73734	D-10	4
138187E	96182	D-8	15
138187G	96182	D-8	16
146-103	02660	D-11	6
1N1183	81483	D-9	19
1N2130A	81483	D-9	19
1N277	81349	D-19	6
1N4004	04713	D-16	11
20M	02002	D-6	3
20T	02002	D-6	1
2-140Y	71785	D-16	2
22AWG	23172	D-10 5	90A
22AWG	23172	D-10	5
230-10143	29587	D-15	2
230-10158-A01	29587	D-15	3
230-1863	29587	D-7	23
230-843-33-203	29587	D-15	6
230-94618-07	29587	D-15	4
2335	83330	D-1	9
2335	83330	D-2	10
2335	83330	D-3	12
2335	83330	D-4	7
2335	83330	D-7	14
2335	83330	D-18	13
24P-SB	04655	D-9	8
250-7538-14-504	72619	D-7	7
2N3904	04713	D-19	5
2N3906	04713	D-19	4
2N4354	81349	D-17	10
2N2568	04713	D-17	22
2N5172	03508	D-17	6
30040-1	70309	D-10	2
30040-1	70309	D-10	2
30055-5	70309	D-10	6
30055-5	70309	D-10	6
34-1229	29587	D-15	5
39D	56289	D-16	3
3AG	75915	D-17	24
40372	59303	D-17	21
411	75382	D-18	6
4-140	71785	D-11	8
48C-72	58854	D-3	10
48C-T2	58854	D-4	18
48P-SB	04655	D-9	8
50-251-301-JXJX	29834	D-13	3
50-251-321-PZPZ	29834	D-13	2
5-104-Y	27361	D-18	7
51-0901-0131-301	72619	D-11	3
513936	44038	D-8	4
513938	44038	D-8	3
524	16902	D-12	2
57-10640-11	29587	D-15	1
5A4	81483	D-8	7
6-164	71785	D-9	15
6-164	71785	D-9	15
6912		D-16	18
6S6-50VDC	71744	D-11	14
7501K13	27191	D-16	12
8502	70903	D-18	12
8503	83330	D-9	20
8503	83330	D-9	20
8507	70903	D-11	15
8883	83330	D-18	14
902098-64	93929	D-11	5
903	82389	D-11	7
90A	64959	D-1	5
90A	64959	D-2	5
90A	64959	D-3	3
64959		D-4	5
90A	64959	D-7	3
90EA2C2F3J4(RA)			
L4-N1	96182	D-8	17
9418	73734	D-9	3
9418	73734	D-9	3
95-1059-3171-102	72619	D-9	9
95-1059-3171-102	72619	D-9	9

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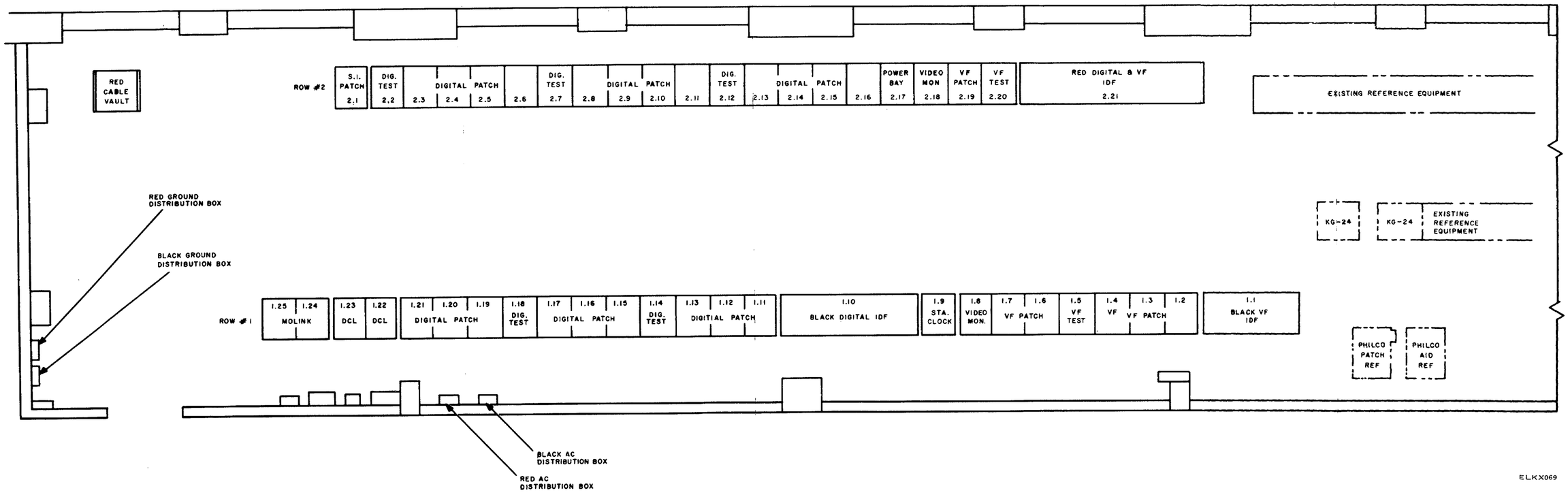

Figure FO-1. Patch and Test Section of the Technical Control Facility, Floor Plan.

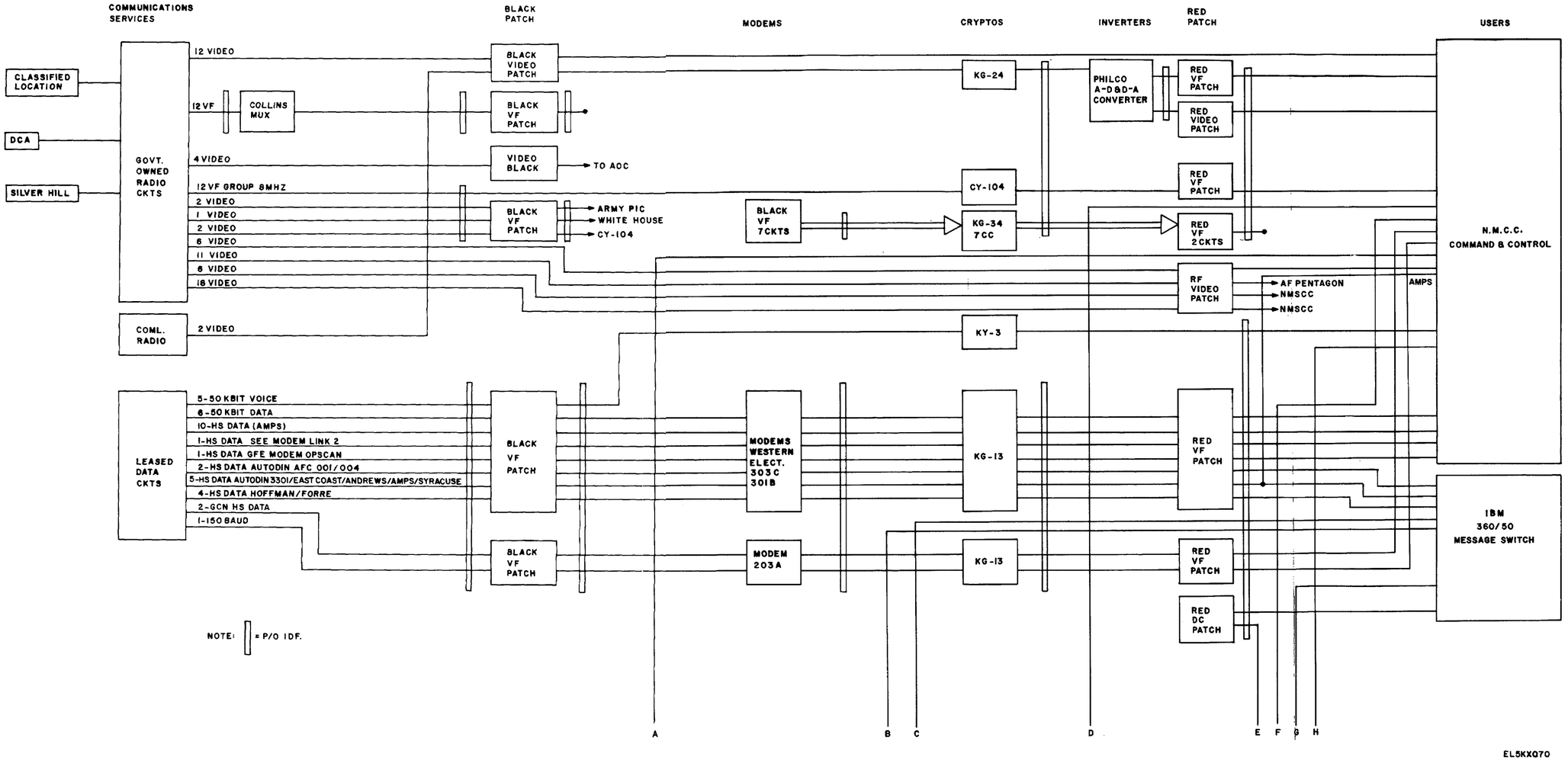

Figure FO-2(1). PTC Circuit Routing Diagram (part 1 of 2).

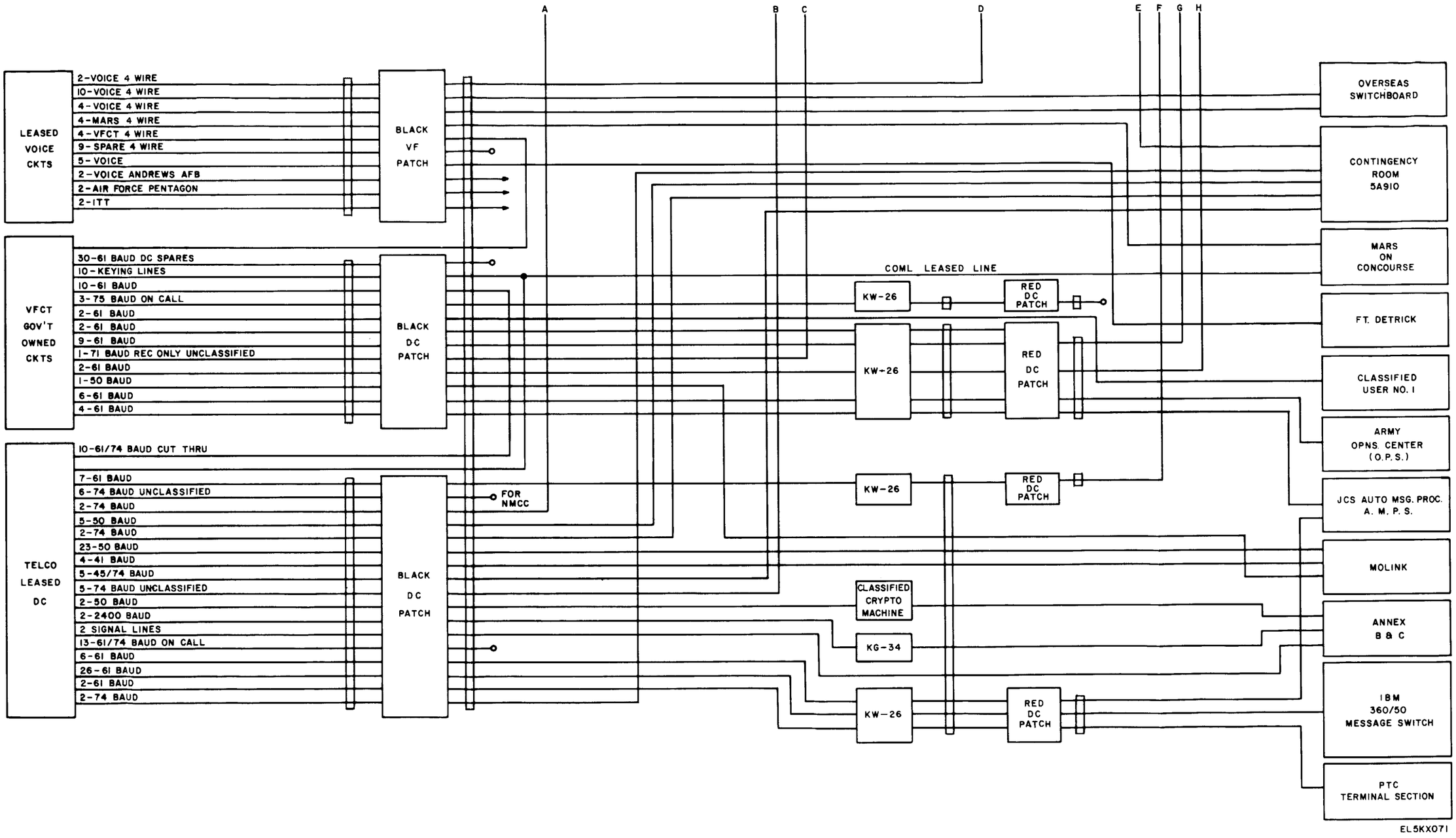

Figure FO-2(2). PTC Circuit Routing Diagram (part 2 of 2).

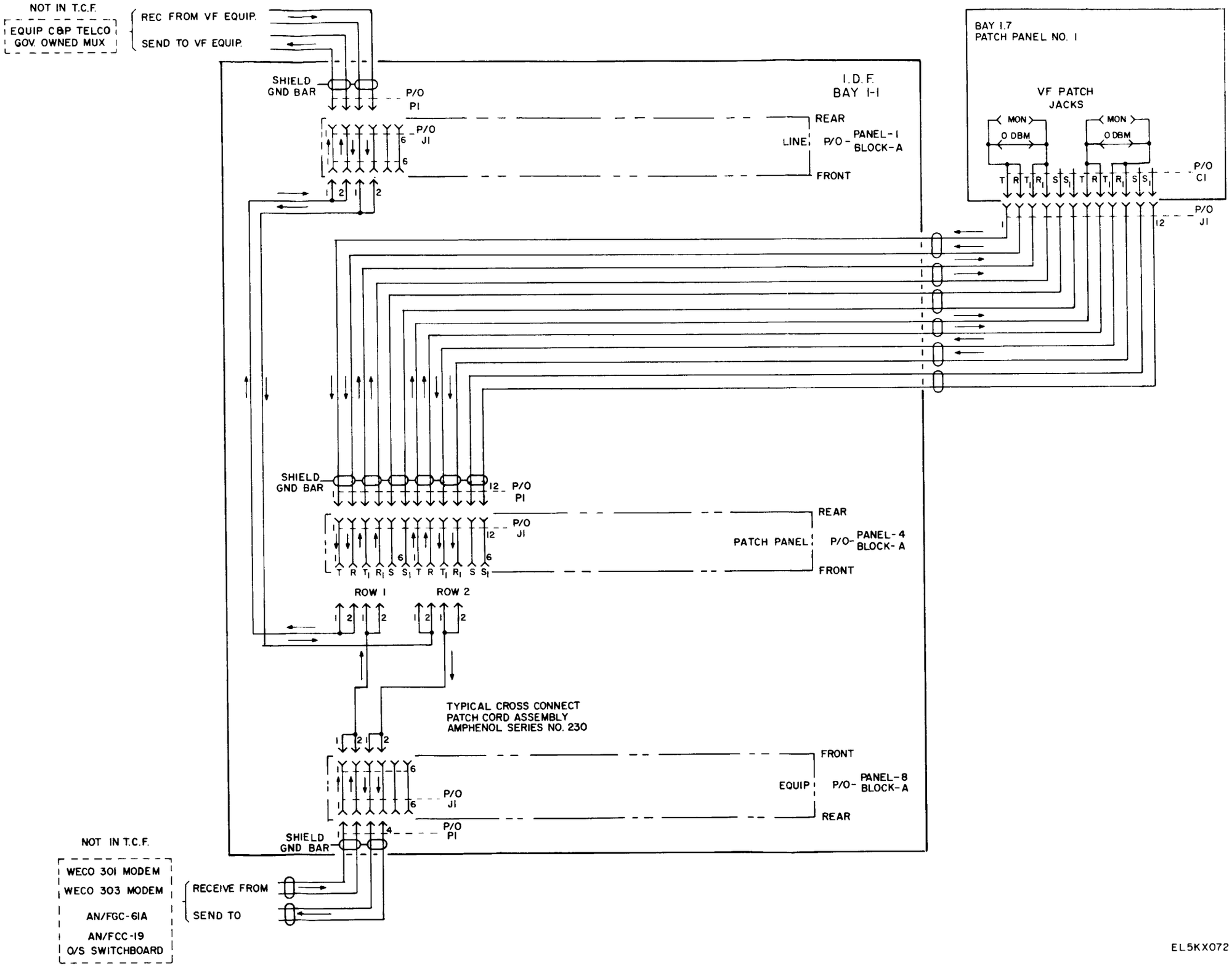

Figure FO-3. Typical Voice Frequency Circuit Diagram.

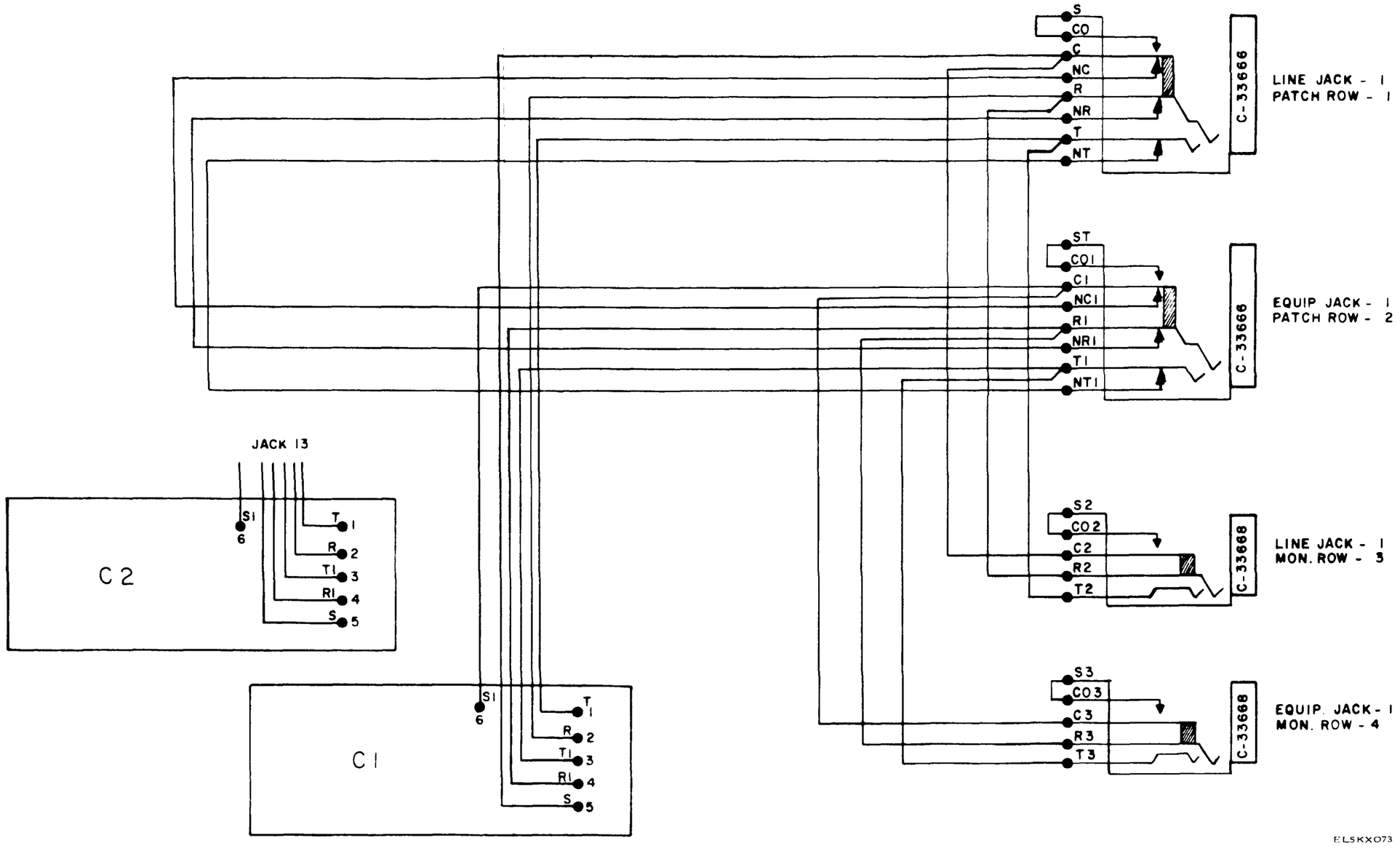

Figure FO-4. Voice Frequency Patch Panel, Schematic Diagram.

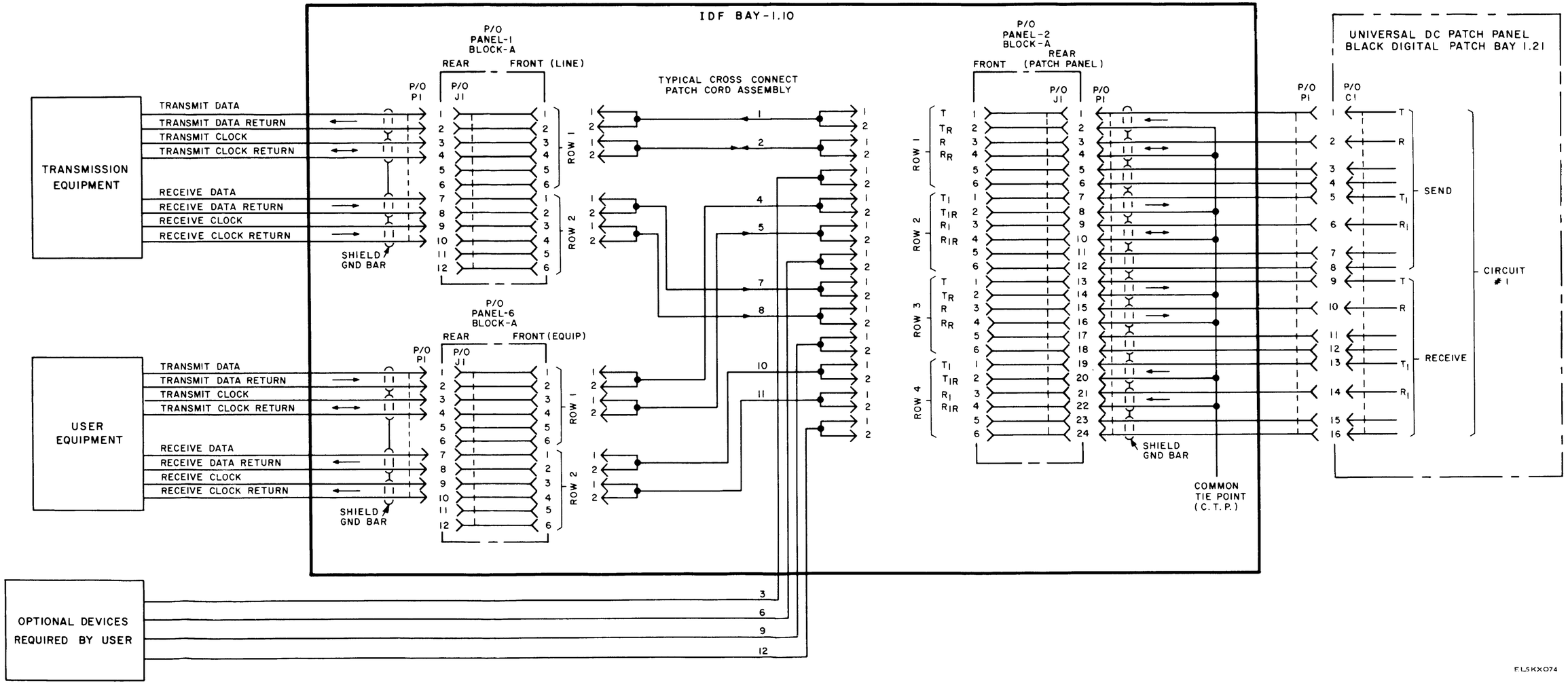

Figure FO-5. Typical Black Digital Circuit IDF Connection Diagram.

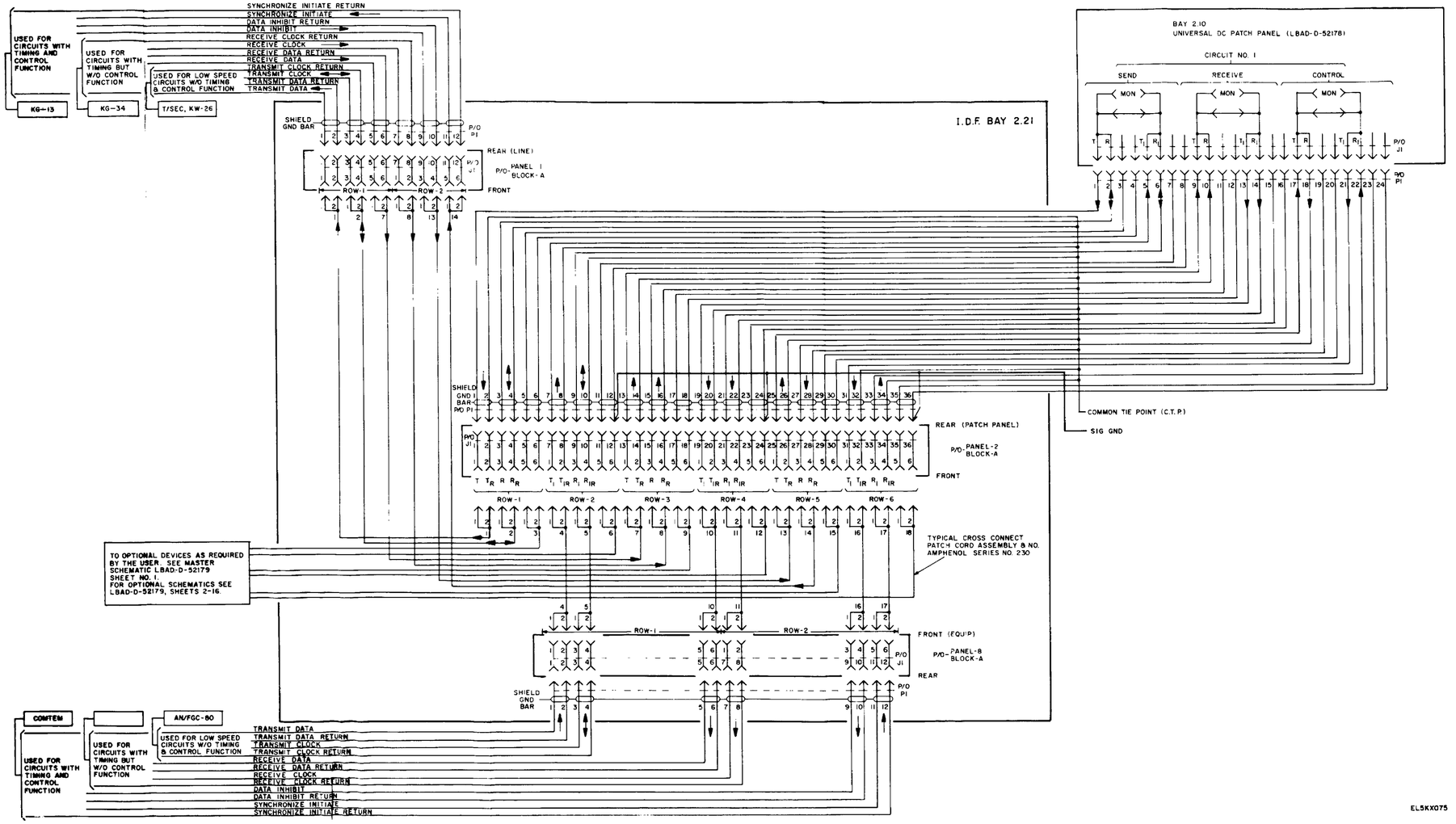

Figure FO-6. Typical Red Digital Circuit Diagram.

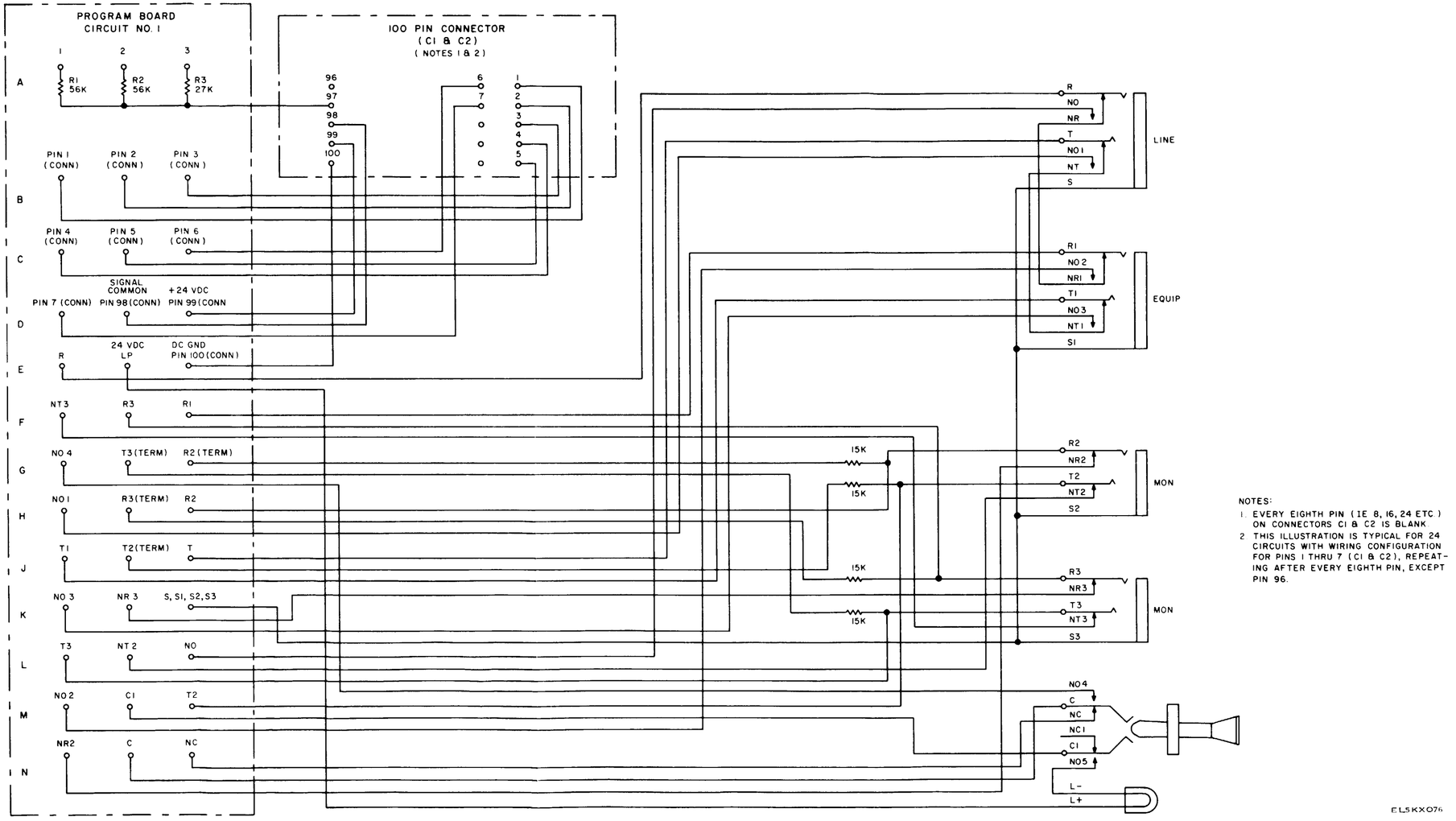

Figure FO-7. Universal Digital Patch Panel, Schematic Diagram.

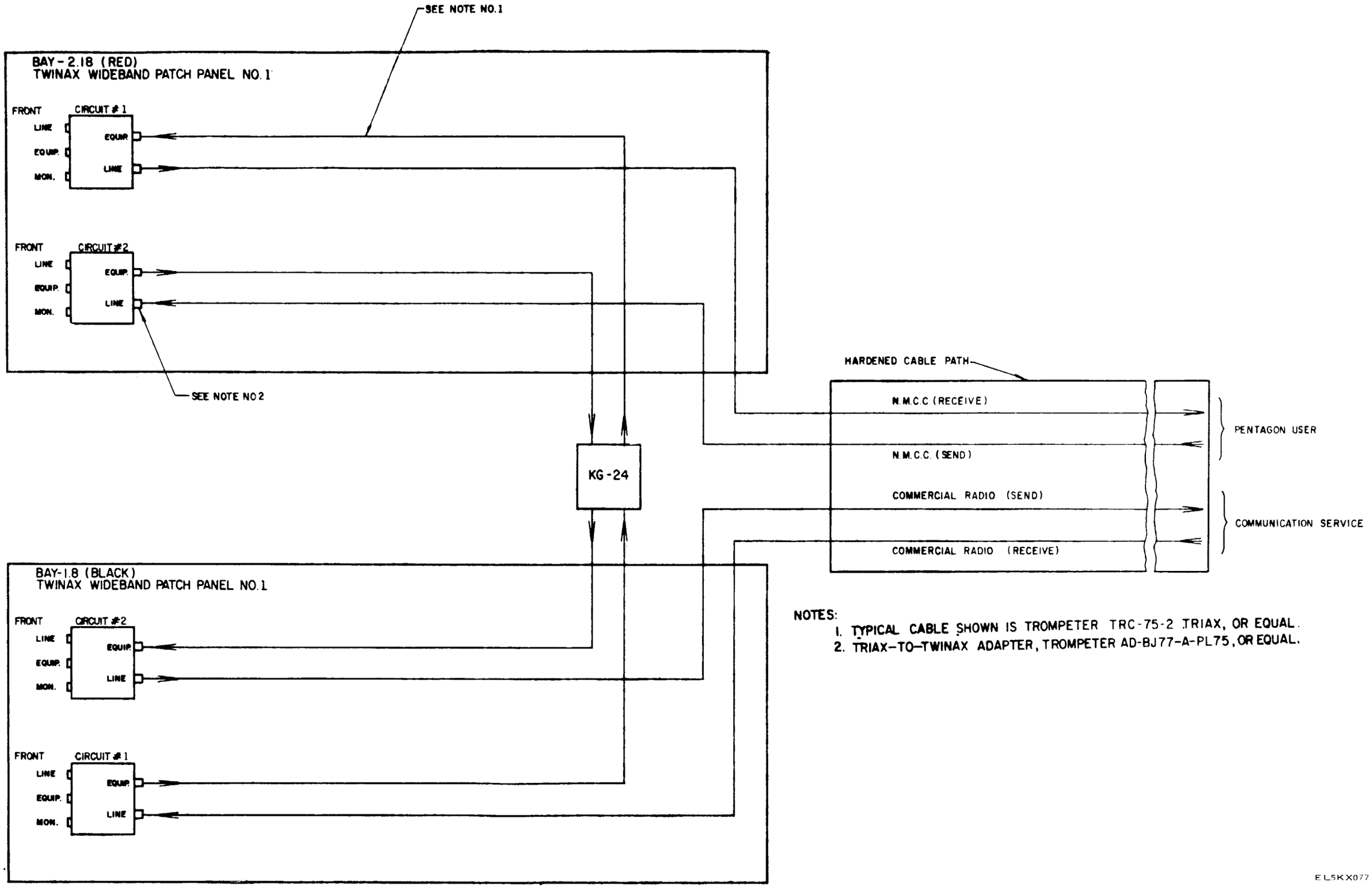

Figure FO-8. Typical Wide Band Circuit Diagram.

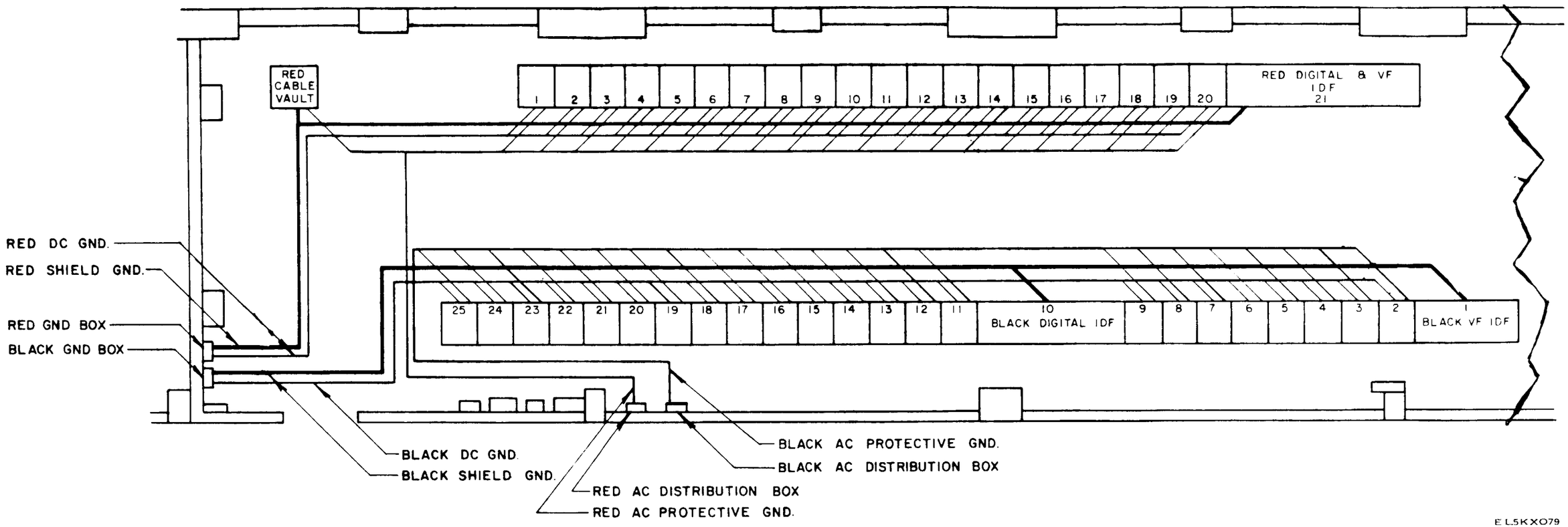

Figure FO-9. PTC Grounding System Diagram.

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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

PIN: 040634-000