

**T1 CARRIER
SYSTEM REQUIREMENTS
AND
REPEATER BAY EQUIPMENT
EQUIPMENT DESIGN REQUIREMENTS
COMMON SYSTEMS**

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1. GENERAL

SCOPE

1.01 This specification, together with the supplementary information listed herein, covers the equipment design requirements for the engineering, manufacturing, and installation of a T1 carrier system.

1.02 This specification is reissued to:

- (a) Add torque requirements for the L and T options on the 201-type repeater.

- (b) Correct the headings in Fig. 9, and add Fig. 34A and B, Fig. 35, and Fig. 36.

- (c) Add information, under a minor heading, to the D. 206-Type Office Equipment for Repeatered Lines.

- (d) Add physical description and equipment lists for the J98710P line error detector, the J98710R quasi random signal source, and the J98710S span fault locator.

- (e) Convert this specification from the AA number to the 9-digit number (AA388..123 to 801-523-150).

DESCRIPTION

1.03 The T1 carrier system is a 24-channel, transistorized, time division, pulse code modulation (PCM) transmission system. It is applicable to short haul trunks; principally direct office trunks, tandem trunks, toll-connecting trunks, PBX trunks, and foreign exchange lines. The system is intended primarily for use in the larger metropolitan areas and should be most economical for large, fast-growing cross sections. The terminals for the T1 system are known as D1-type banks. Built-in signaling is provided, and the transmission quality of the carrier channels is adequate for signals generally expected in the switched telephone network. Interoffice transmission is on a 4-wire basis; namely, one nonloaded exchange cable pair free of bridge taps and build-out capacitors for each direction of transmission. Regenerative pulse repeaters are required, nominally spaced at 6000-foot intervals, corresponding to H load coil spacing. Line repeaters are powered from central office batteries over the carrier signal pairs.

A. D1 Channel Bank

1.04 The D1 channel bank converts the continuously changing voice and signaling information of 24 outgoing channels into a single train of PCM pulses, and at the receiving end reconverts the train of PCM pulses into a close approximation of the original signals. Since the pulses represent coded information, the signal is specified completely by the presence or absence of pulses in specific time slots. With the exception of a miscellaneous alarm and filter panel on each bay, all the circuits, including all but one of the power supplies, are packaged as plug-in units. Plug-in channel units are provided to accommodate the more common

signaling systems such as dial pulse, revertive pulsing, and E and M lead signaling. The D1 bank bays are shop-wired and accommodate three banks per 11-foot 6-inch bay and double 7-foot bay, and two banks per 9-foot bay. Complete equipment arrangements and installation requirements for the D1 bank are described in Specification J98711 (801-438-151).

B. Repeatered Lines

General

1.05 The T1 carrier system is designed to use the existing cable plant. Cable counts, main distributing frame (MDF), terminations, and splicing generally need not be changed. Pairs assigned for PCM use must be unloaded, however, and no bridge taps, build-out capacitors, or any other serious impedance discontinuities can be tolerated. Combined trunk and subscriber cable and mixed sizes and gauges should be avoided. Existing load points should be used for repeater locations, if possible. On heavy routes auxiliary manholes may be required to house repeater apparatus cases.

Cable Usage

1.06 A single-cable sheath may be employed for 2-way operation, but the number of systems that can be accommodated in this fashion depends upon the size of the cable and upon how well unit integrity has been maintained. Color groups should always be spliced to the same color groups, and bad pairs should not be made good by splicing to other color groups. Thus, while the existing cable plant may be used, it is desirable to use the most recently installed cables wherever possible, particularly for one-cable operation. Near-end crosstalk is the major limitation in how many 2-way systems may be accommodated in a cable sheath, and thus the two directions of transmission must be segregated to separate splicing groups within the cable. It is believed that 25 systems can be accommodated in nearly all cases with maximum repeater spacings, and that as many as 200 systems are possible in a new 900 pair cable using nonadjacent splicing groups.

1.07 For large installations, the two directions of transmission should be segregated to separate cable sheaths. This is called two-cable operation. Since each repeater includes two separate regenerators, two-cable operation implies that

systems are treated in pairs and each repeater services two systems or 48 channels in one direction. It is most desirable to determine at the time of the original installation whether one- or two-cable operation will best serve the long-term growth pattern of the route. It is possible, although it is not easy, to convert a route from one- to two-cable operation.

Apparatus Cases

1.08 Repeaters for manhole installation are to be housed in 466A, 466B, 466A2, or 466B2 apparatus cases (see Fig. 1A and 1B). These cases accommodate 25 repeaters and are 10 inches in diameter by 28 inches in length excluding the cable stub. The 466A and 466A2 cases have single-piece steel covers which slide off to provide access to the repeaters. The 466A has a hot-dipped galvanized underlayer and is painted black inside and out. The 466A2 has, in addition to the standard hot-dipped galvanized finish, a 0.015- to 0.018-inch coating of zinc applied by the flame-spray process for increased resistance to corrosion. The case is then painted black inside and out. This case is intended for use in manholes in which severe corrosive atmospheres are known to exist. The corrosion resistance of this case is improved by a factor of four compared to the standard hot-dipped galvanized cases. The 466B and 466B2 cases are similar to the 466A and 466A2, respectively, except that the covers are made in two pieces and are intended for use in manholes where space limitations do not allow sufficient room for the single-piece cover to be removed.

1.09 Repeaters used in systems in which protection from lightning surges is needed are to be housed in 468-type apparatus cases (see Fig. 2 and 3). The 468A, 468B, 468A2, and 468B2 accommodate 25 repeaters and are 11-1/2 inches in diameter by 28 inches in length excluding the cable stub. The larger diameter allows extra space for the necessary lightning protector blocks and the repeater secondary protection networks. The secondary protection networks were originally provided as 4037-type networks to be used in conjunction with 201-type repeaters. This network (P-42H177 or P-42H178) is now incorporated as part of the 205-type repeaters. In the first instance, the 201-type repeater is plugged into the 4037-type network and the assembly is, in turn, plugged into the apparatus case. In the second instance, the 205-type repeater includes the function of the

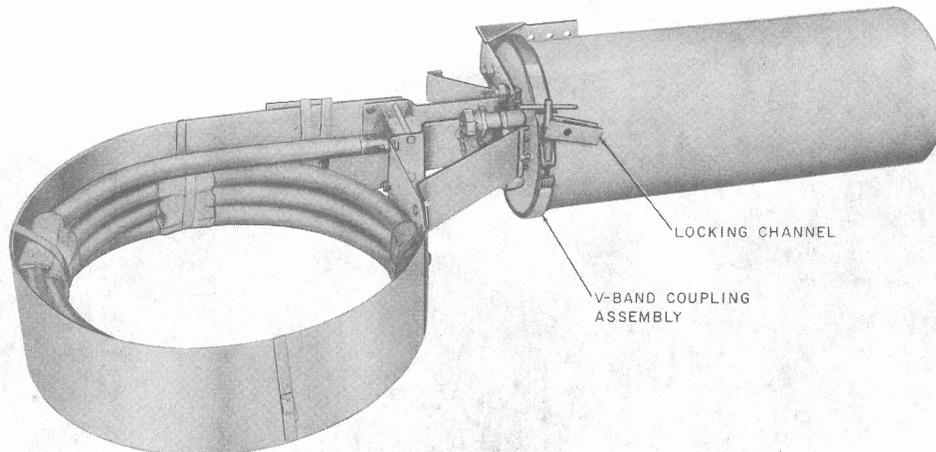


Fig. 1A—466-Type Apparatus Case

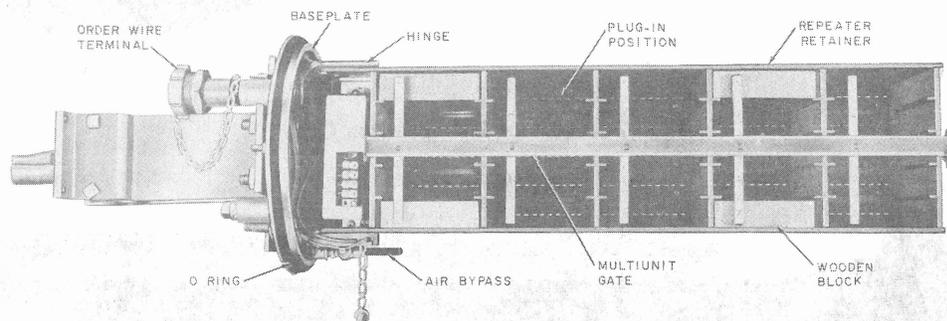


Fig. 1B—466-Type Apparatus Case (Cover Removed)

4037-type network and is plugged directly into the apparatus case. The 468A cases has a single-piece steel cover with a hot-dipped galvanized underlayer and is painted black inside and white outside. This apparatus case is intended for manhole installation as well as pole-mounted installation. The 468A2 has, in addition to the standard hot-dipped galvanized finish, a 0.015- to 0.018-inch coating of zinc applied by the flame-spray process for increased resistance to corrosion. This case has a black painted finish inside and out and is intended for use only in manholes in which severe corrosive atmospheres are known to exist. The corrosion resistance of this case is improved by a factor of four compared to the standard hot-dipped galvanized cases. The 468B and 468B2 apparatus cases are similar to the 468A and 468A2 cases, respectively, except that

the covers are made in two pieces and are intended for use in manholes where space limitations do not allow sufficient room for the single-piece cover to be removed. The 468C and 468C2 are similar to the 468A and 468A2, respectively, except that they accommodate only five repeaters and are only 9-1/2 inches in length excluding the cable stub.

Note: Only white apparatus cases may be used for pole mounting; namely, the 468A or 468C, in order to reduce the possibility of overheating repeaters inside the apparatus cases.

1.10 Since it is expected that most of the cables used for T1 repeatered lines will be pressurized, each apparatus case is provided with

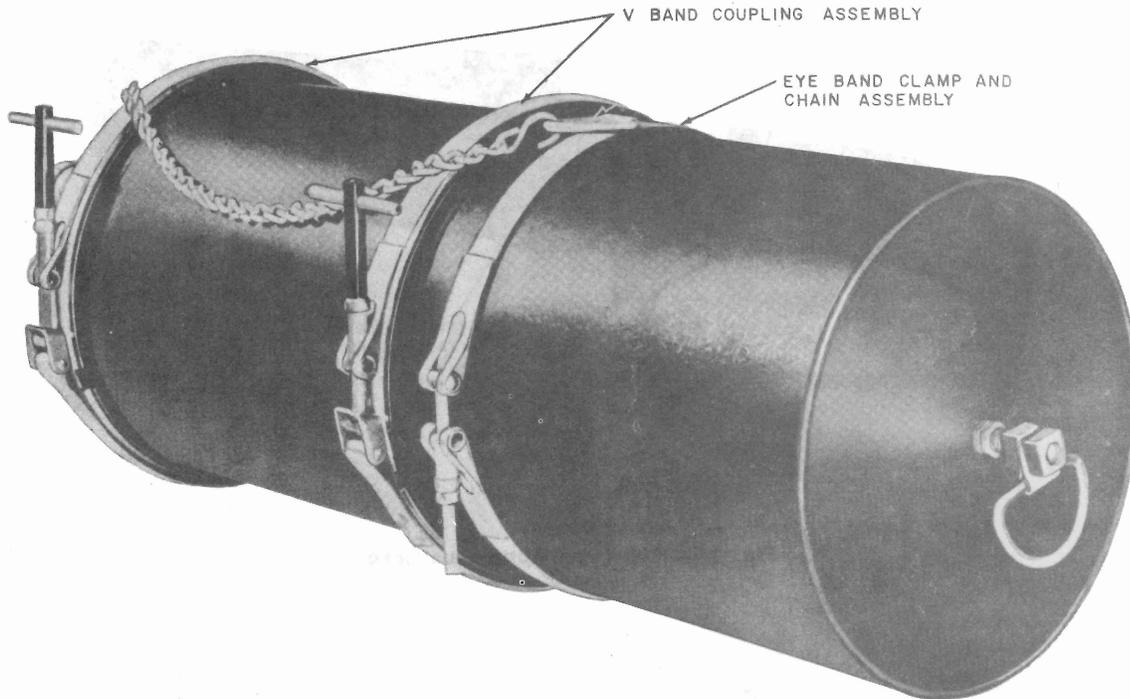


Fig. 2—468A or B Apparatus Case

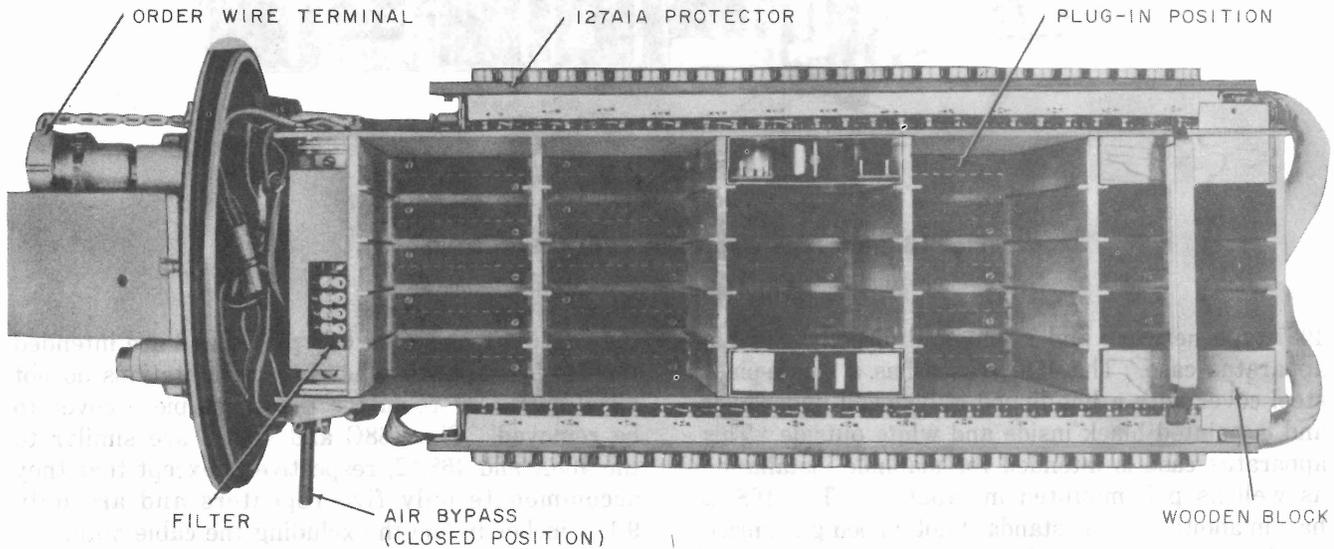


Fig. 3—468A or B Apparatus Case (Cover Removed)

the necessary gas plugs, valves, and bypasses to keep it under pressure when the case is closed and to cut off the air supply when the case is open to prevent loss of cable pressure.

1.11 All apparatus cases, except the 468C and 468C2, normally come with a 10-foot stub cable of one hundred and four 22-gauge pairs to

provide 50 pairs in and out; two pairs for order-wire use, a pair for fault location, and one spare pair. For one-cable operation, each apparatus case serves a maximum of 25 two-way systems; while for 2-cable operation, each apparatus case serves a maximum of 50 one-way systems. Units of 50 pairs should be unloaded and spliced at the time an apparatus case is installed. The 468C and

468C2 cases come with a 10-foot stub cable of fifteen 22-gauge pairs to provide five pairs in and out; two pairs for order-wire use, a pair for fault location, and two spare pairs. Where the repeater cases are located at a load point, pairs not required immediately for T1 carrier use may be made continuous for voice frequency (VF) transmission by plugging new load coil cases (180A1 coil case) or jumpers (904A connector assembly) into the repeater slots. Unused pairs need not be connected through. In addition, a 162A adapter is available to plug into the repeater slots for access to the cable pairs. The 162A adapter is shown in Fig. 4.

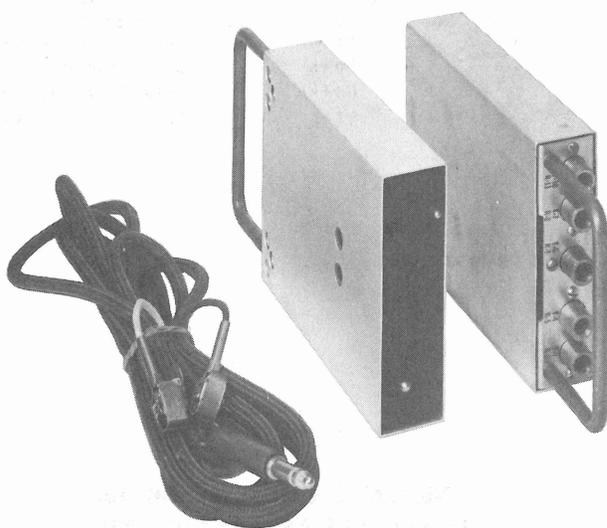


Fig. 4—162A Adapter

Repeater Spacing

1.12 The repeaters are designed for a nominal spacing of 6000 feet for 22-gauge conductors. The first repeater away from a central office must be on shorter spacing, 0 to 4500 feet out from the office. The shorter spacing is required because of the high level of impulse noise generally found in such locations. Since the repeaters are designed for nominal 6000-foot spacing for 22-gauge cable, it is necessary to build out the line where the spacings are shorter. A series of line build-out (LBO) networks, coded 836A to M, available in 2.4-dB steps, are provided for this purpose. These networks and their cable losses are shown in Table A. The networks are provided with screw terminals which engage contacting slots in the

TABLE A

LINE BUILD-OUT NETWORKS

CODE	LOSS AT 772 KHZ
	DB
836A	0
836B	2.4
836C	4.8
836D	7.2
836E	9.6
836F	12.0
836G	14.4
836H	16.8
836J	19.2
836K	21.6
836L	24.0
836M	26.4

printed wiring boards in the repeaters. This arrangement permits removal and insertion of the LBO networks with a minimum of effort. Two networks are required for each line repeater (201 type) which will be assigned on the basis of transmission measurements made immediately after the repeater apparatus cases have been installed. It is expected that systems of lengths up to more than 50 repeaters in tandem will perform satisfactorily.

Span Concept

1.13 To provide complete flexibility in engineering T1 carrier systems, the interoffice repeatered lines should be developed on a span basis as shown in Fig. 5. This arrangement requires the routing of repeatered lines through intermediate offices in order to permit proper powering of the spans. In some instances, these intermediate offices also may be terminal points. All spans terminate on a repeater bay which is also provided with cross-connecting facilities that permit flexibility in assignment of lines. Spare lines are also treated on a span basis in the same way as the regular lines. Since the spare lines terminate in the same manner, they can be patched into a failed line by using a single-patch cord at each end inserted into the jacks that are associated with each repeater. These facilities are the same in every repeater bay, whether it is located in an intermediate office or a terminal office. Span lines are powered at office

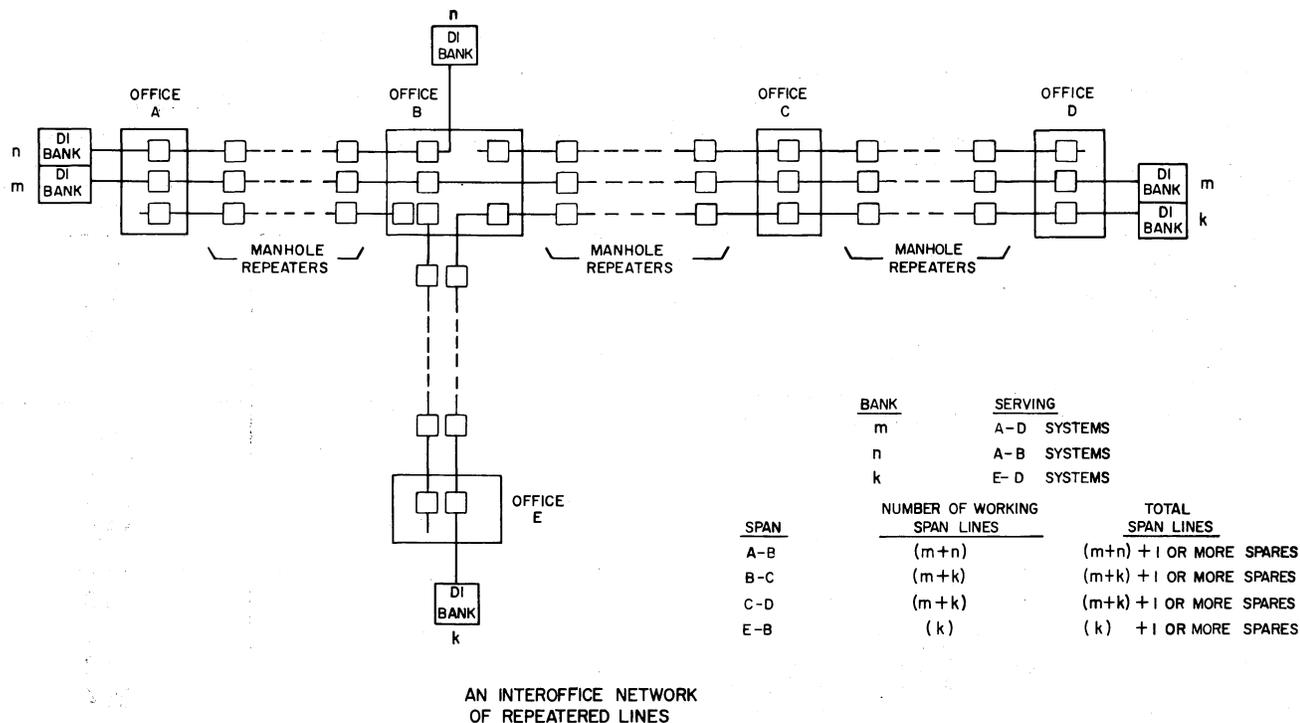


Fig. 5—Interoffice Network Layout

repeater bays from the office batteries, -48, +130, and -130 volts. The last named voltage is required only for span lines involving more than 8 or 9 repeaters. Span lines may be powered from both ends, and a line of 18 or 19 repeaters can be powered by using both +130 and -130 volts at both ends. Detailed power information is covered on application schematics SD-97080-01 and SD-97080-02.

Fault Location

1.14 Each repeater apparatus case is equipped with a 598-type filter. A series of 12 interrogation filters, coded 598A through M, have been designed to instrument the fault location plan. These filters are shown in Table B. The outputs of all 25 repeaters in an apparatus case are coupled to the input of this narrow band-pass filter (BPF). The outputs of the filters in all the apparatus cases associated with a group of systems in a given span are multiplied to a fault location line. As discussed in 1.54, a fault locating set at an office permits making measurements over the system line in conjunction with the fault location line to locate faulty repeaters at repeater locations.

TABLE B

INTERROGATION FILTERS FOR 466- AND 468-TYPE APPARATUS CASES

CODE	FREQUENCY
	HERTZ
598A	832
598B	928
598C	1048
598D	1206
598E	1340
598F	1508
598G	1722
598H	2008
598J	2193
598K	2413
598L	2680
598M	3017

Order Wire

1.15 An order-wire appearance is provided at each repeater apparatus case. This order wire is treated as a subscriber line in one of the span terminating offices. In this way, the cable splicer can dial any number from the manhole; and, in particular, he can call the test board at either span terminating office. After contact with the test board has been established, the order wire circuit can be locked up at the repeater bay, thus releasing the connection to the test board. In this manner, a private talking circuit is provided between a span-line location and the span terminating office. Where the span line is not over 10 miles long, a 1011B lineman handset should be adequate for both dialing and talking, although a 107B test set which includes a local battery, should provide improved transmission for the longer span lines. Span lines longer than 10 miles require an order wire circuit where dc continuity is broken at approximately the midpoint as illustrated in Fig. 6. In this way, talking and signaling battery can be supplied at the two ends, each serving half the span.

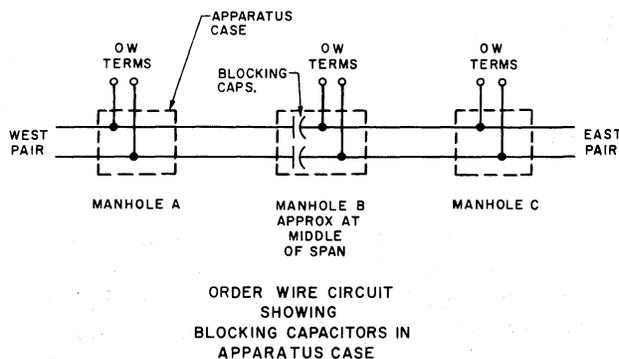


Fig. 6—Order-Wire Circuit

C. Line Repeaters and Protection

201-Type Line Repeater and Secondary Protection Network

1.16 The 201-type line repeater (see Fig. 7) is available in two basic codes. The 201D (201A Mfr Disc.) repeater is used for one-cable operation and the 201E (201B Mfr Disc.) repeater is used for two-cable operation. Either repeater includes two complete regenerators and a common power supply. To identify each half of a repeater, therefore, one half is called side 1 and the other

side 2, with the power supply being associated with side 1. A 201E repeater is identical to a 201D repeater, except that the input and output connections to side 2 are reversed internally as shown in the block schematics in Fig. 8. Reversing the transmission connections in this manner retains the same external power connections, thus simplifying the instructions for powering.

1.17 At manhole locations not subject to lightning surges, either code of the repeater may be used depending on cable requirements. They plug into the 466-type apparatus cases in this application.

1.18 At manhole locations subject to lightning surges and in aerial installations, either code of the repeater may be used depending on cable requirements. However, the 201D repeater must be installed with a 4037A network (Mfr Disc.) and the 201E repeater with a 4037B network (Mfr Disc.). These networks (see Fig. 9) are intended to provide secondary high-voltage protection for the cable pairs. The networks and repeaters plug into the 468-type apparatus cases in this application (see also 1.21).

1.19 The 210-type repeater bay installations in central offices use only the 201E or F repeaters. In this case, the repeaters are plugged into mountings associated with control units on a span terminating assembly. The 201F repeater is a bridging repeater and is discussed in 1.48(b).

205-Type Line Repeater

1.20 The 205-type line repeaters (see Fig. 10) are available in two codes. The 205D [(205A Mfr Disc.)] repeater is used for one-cable operation and the 205E (205B Mfr Disc.) repeater is used for two-cable operation. The functions of the 201D repeater and the P-42H177 protection network are included in the 205D repeater. The 201E repeater and the P-42H178 protection network functions are similarly related to the 205E repeater.

1.21 The 205-type repeaters are used where secondary high-voltage protection is required. They replace the combinations of 201-type repeaters and 4037-type networks described in 1.18. They plug into the 468-type apparatus case and are not used in the central office.

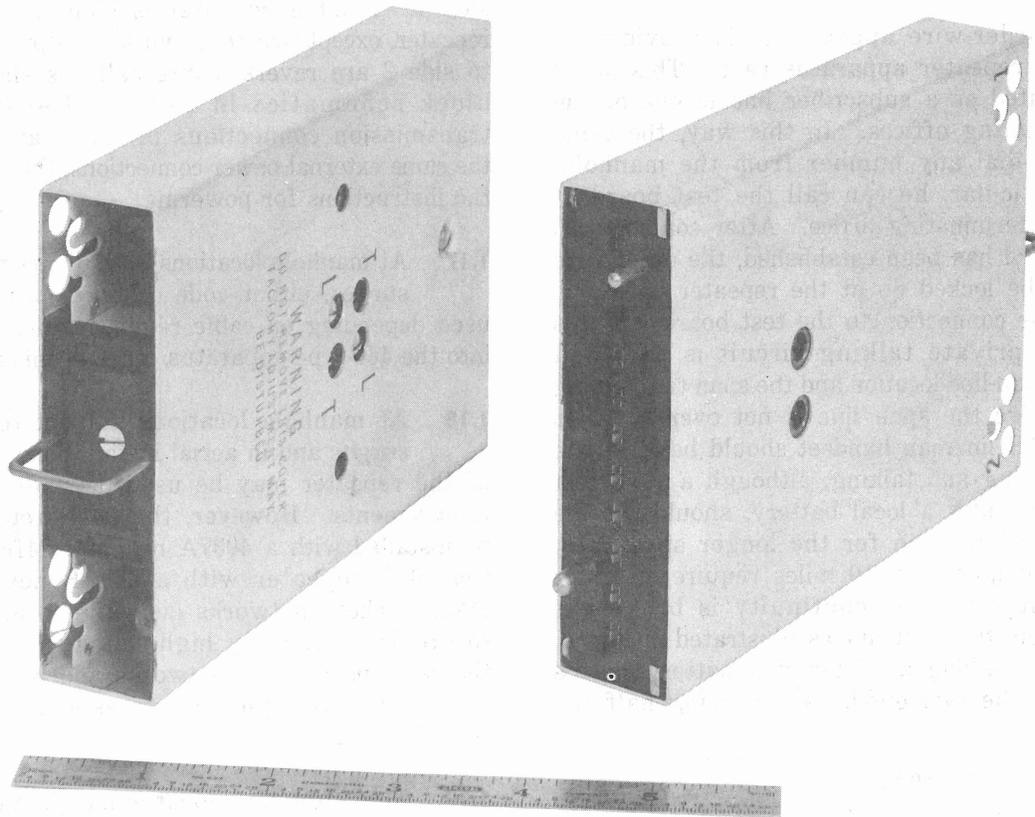


Fig. 7—201-Type Repeater

General Information

1.22 Appropriate code of the 201- and 205-type repeaters can be ordered as required to fulfill the repeatered line requirements. Since the difference between the 201D and E or 205D and E repeaters is in the internal connections, it will be advisable to carry both codes as spares in those offices where they are needed.

1.23 The 201- and 205-type repeaters are not equipped with 836-type LBO networks. These must be selected to meet the particular transmission requirements established at the time of initial tests. At that time, the power option screws are set in each repeater. In the event of failure of a repeater, no repairs should be attempted, but it should be returned to the Western Electric Company or a repair center for repair or replacement. It is proposed that the telephone companies check all 201- and 205-type repeaters using a J98710H repeater test set prior to their installation in the line.

1.24 The method of powering (loop or through) is selected by tightening either the L or T screws, as required. The screws selected should be tightened to 5 ± 1 inch-pounds at time of installation. The nominal operating current of a line repeater is 140 mA, and the nominal voltage drop is 10.6 volts. The dimensions of a 201-type repeater are 4-3/16 inches by 1-1/8 inches by 6 inches, exclusive of the guide pins. The dimensions of a 205-type repeater are 4-3/16 inches by 1-1/8 inches by 7-3/4 inches, exclusive of the guide pins. As mentioned in 1.11, the 180A1 load coil cases or 904A connectors may be substituted for repeaters in partially equipped apparatus cases. These assemblies are shown in Fig. 9.

D. 206-Type Office Equipment for Repeatered Lines

General

1.25 At intermediate and terminal offices, equipment is required to terminate span lines, interconnect span lines, provide power to the office repeaters,

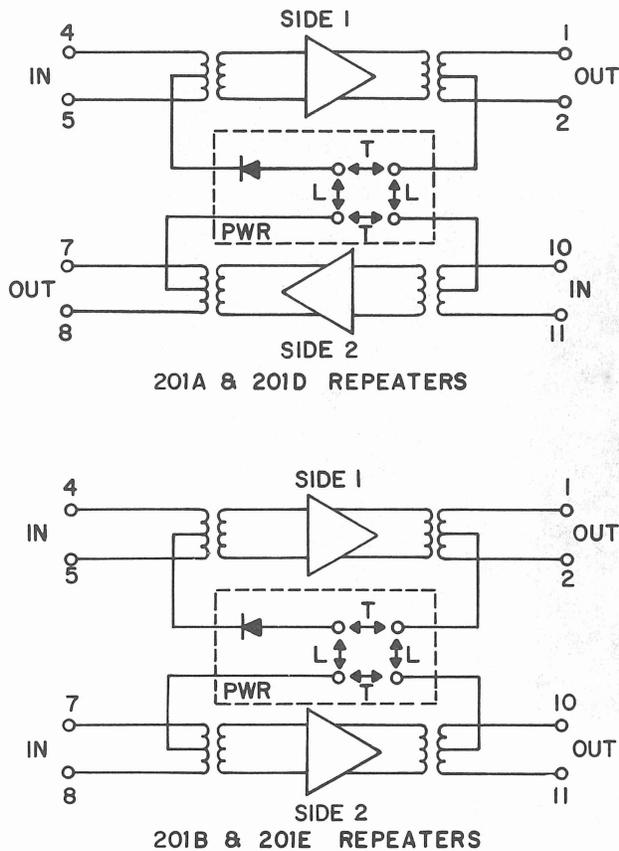


Fig. 8—Block Schematic of 201-Type Repeater

and provide cross connections to suit office requirements. Jack access points are required to accommodate maintenance and operating routines.

1.26 The new office repeater bays are available in 7-foot, 9-foot, and 11-foot 6-inch heights per J98710L, K, and J, respectively. They are equipped with shelves and common equipment and are shop wired. Both the J98710J and K bays make use of 12-inch deep, 26-3/8 inch wide unequal flange cable-duct type bay framework arranged for 1-3/4 inch mounting plates. The J98710L bay is also 12 inches deep, but is only 26 inches wide for compatibility with ESS frames. The 11-foot 6-inch bays, when fully equipped, weigh less than 600 pounds and the 7- and 9-foot bays, when fully equipped, weigh less than 500 pounds. Fig. 11 shows the three bays. The maximum range of power dissipation of a fully equipped J98710J repeater bay is from approximately 200 to 1450 watts, depending on the voltage used and the length of line powered from this source. The power dissipation for the J98710K and L bays would be two-thirds that of the J98710J bay.

1.27 The bays are equipped with die-cast aluminum shelves to hold the repeater (206 type) and 130-volt regulated power dissipation (J98710M) plug-in units. The 11-foot 6-inch bay will mount 72 working repeaters, three spare repeaters, and

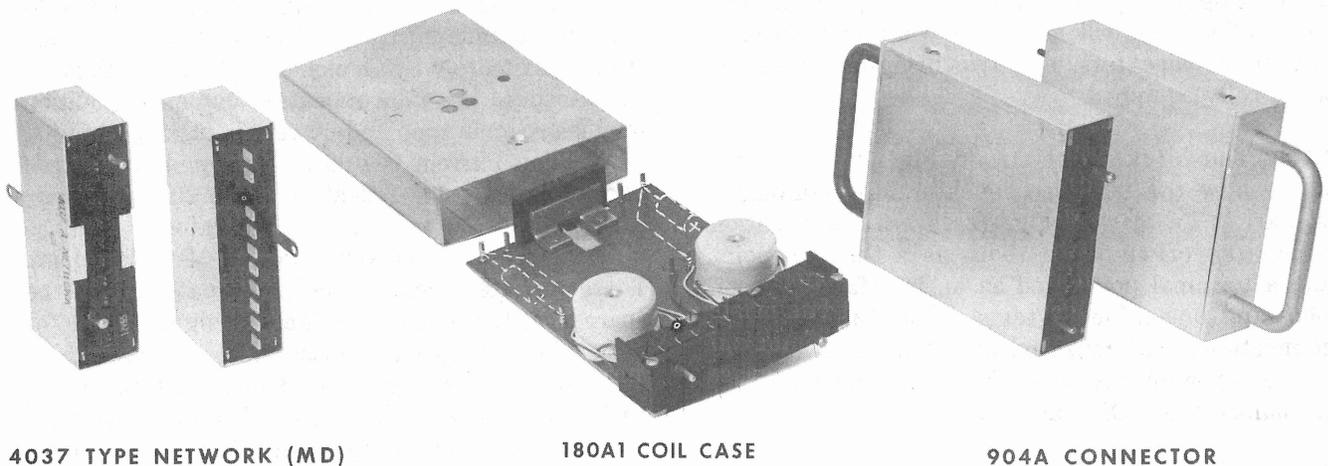


Fig. 9—904A Connector, 180A1 Coil Case, and 4037-Type Network

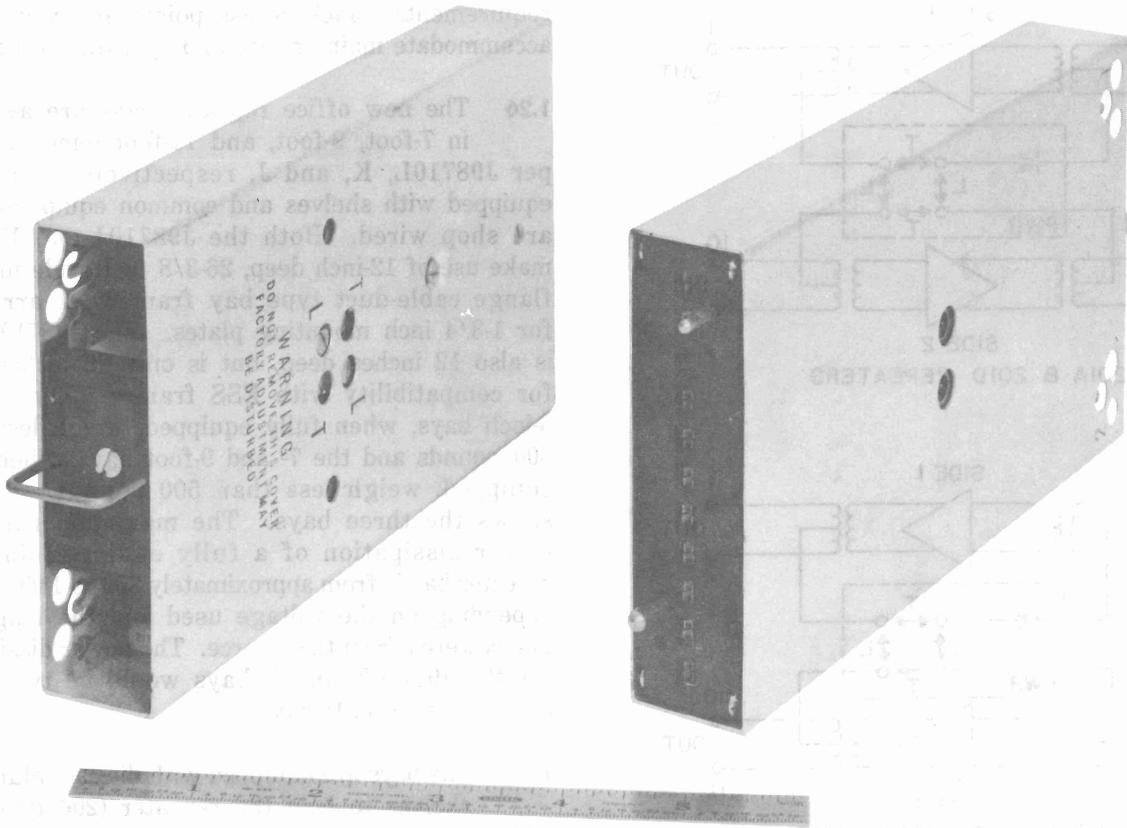


Fig. 10—205-Type Repeater

three bridging repeaters when fully equipped. The 7- or 9-foot bay will mount 48 working repeaters, two spare repeaters, and two bridging repeaters when fully equipped.

1.28 The block schematic in Fig. 12 illustrates how the 206-type repeater bay equipment is used in an office. Fig. 12 covers the situation where the office serves both as a through point and a terminal point, and as an interface between two- and one-cable systems. Fig. 13 shows the connections that must be completed between the office repeater bay and other equipment such as D1 banks, the MDF, batteries, etc.

Plug-in Units

1.29 Two types of plug-in units are used in the new 206-type repeater bay. They are the 206-type office repeater and the J98710M 130-volt regulated power dissipation unit (see Fig. 14 and 15). The 206A, B, C, and D repeaters consist of apparatus components, mounted on two printed

wiring boards which, in turn, are assembled onto a die-cast aluminum frame. The overall dimensions are approximately 8-3/4 inches by 10-1/4 inches by 1-5/8 inches. The 206A repeater contains, in addition to pulse regeneration and power simplexing circuits, a -48 volt current regulator to provide regulated current for the line repeaters. The 206B repeater contains a +130 volt current regulator as well as the pulse regeneration and power simplexing circuits. These repeaters contain jacks for patching in the spare line, for monitoring the line signals, and for measuring the regulator output current and voltage. The regulators are also fused in each repeater as part of the line circuit. The 206C repeater contains a pulse regeneration circuit and is used to enable spare line patching as well as to place a signal on the idle line. The 206D repeater is similar to the 206A and B but contains no current regulator and is used only when power is supplied to the line from the other end of the span.

1.30 *The J98710M 130-volt regulated power dissipation units* consist of resistors fastened

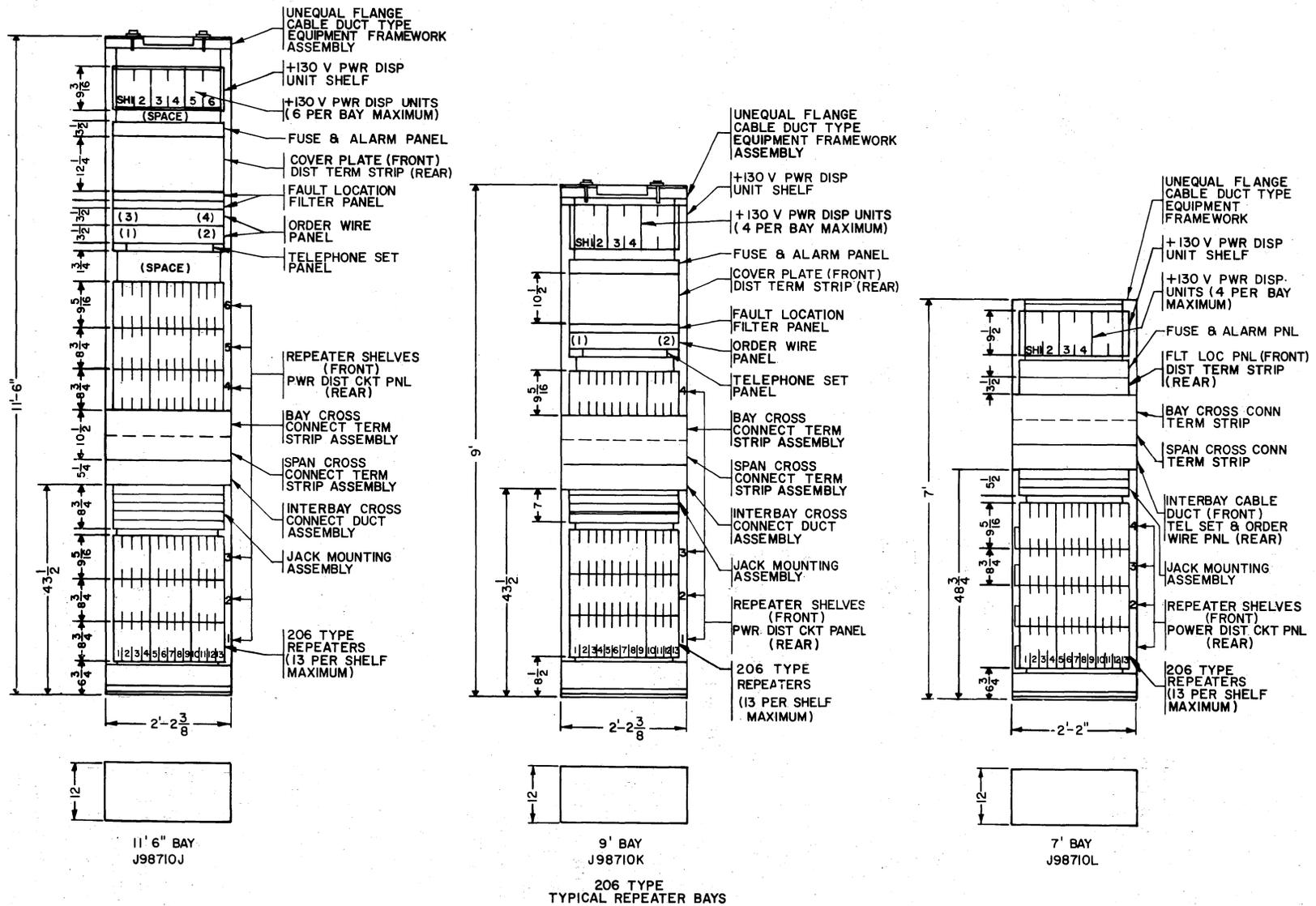


Fig. 11—New 7-Foot, 9-Foot, and 11-Foot 6-Inch Office Repeater Bays for the New 206-Type Office Repeater

to a metal mounting plate which, in turn, is assembled onto a die-cast aluminum frame. A perforated metal cover completes the assembly and provides protection against the hot surface temperature of the resistors, as well as ventilation for them. This unit provides power dissipation resistors for a shelf of thirteen 206B repeaters operating with 130-volt current regulation. It is not required when 206A or D repeaters are used.

Common Equipment

1.31 The common equipment panels fall into two categories, those which are provided with the shop-wired bay and those which are ordered and installed by the field as required. The following paragraphs describe this equipment and specify to which category it relates.

1.32 *The ED-97443-30 fuse and alarm panel* mounts fuses for the ± 130 and -48 volts possibly required for repeatered line power, as well as -48 volts required for the office repeaters (see Fig. 16). Each repeater shelf is fused for each voltage. Strap options on this panel enable the assignment of proper voltage combinations to the repeater shelves. In addition, the -48 volt miscellaneous power is fused on this panel. This voltage is associated with the order-wire panel, the telephone set panel, and is also used for test purposes. Alarm relays and fuse alarm lamps make up the remainder of the panel. This panel is part of the shop-wired bay.

1.33 The distributing terminal strip, a 234D terminal strip, is arranged to terminate the transmission pairs and fault locating pairs from the distributing frame. The terminal strip will terminate up to 75 systems and 12 fault locating pairs. It is part of the shop-wired bay.

1.34 The fault locating filter panel is part of the shop-wired bay but is not equipped with 598-type fault locating interrogation filters. The filters are ordered and installed as required. The 11-foot 6-inch bay has two panels with a capacity of six 598-type filters. The 7- and 9-foot bays have a single panel with a capacity of three filters. The bay wiring from the fault locating jacks and the distributing terminal strip is dead ended at the fault locating panel with appropriate lugs for the installer or telephone company to terminate when the filters are mounted.

1.35 Framework to mount order-wire panels and associated capacitor panels is provided on the shop-wired bay. The order-wire panels and/or capacitor panels per J98710E are ordered and installed as required (see Fig. 17). A maximum of four order-wire panels can be mounted on the 11-foot 6-inch bay and a maximum of two can be mounted on the 7- or the 9-foot bay. Bay wiring from the order wire lamp and jack circuits is dead ended at the order-wire panel positions for the installer to terminate when the panels are mounted.

1.36 A telephone set panel per J68769AJ is provided as part of the shop-wired bay for use with the order circuits (see Fig. 18). Power is supplied from the fuse and alarm panel.

1.37 A span cross-connection terminal strip per ED-97442-50, Group 1, is mounted on the shop-wired bay (see Fig. 19). Bay cabling from the dry side of the office repeaters is terminated on this terminal strip. Intrabay span cross connections are made at this block, as are interbay span cross connections from contiguous repeater bays, via the interbay cable-duct assembly provided as part of the bay per ED-97230-50, Group 2, or P-43L117 and P-43L180.

1.38 When the office repeater bay in a terminal office is to be cabled to noncontiguous repeater bays, or is to be cabled to a central cross-connect field, or a D1-type terminal, a bay cross-connecting terminal strip (ED-97442-50, Group 2) is required (see Fig. 20). This terminal strip must be ordered and installed as required. Cabling from the remote bay is terminated on this terminal strip and cross connections are made between the bay and the span cross-connecting terminal strips. However, when a central cross-connect field is used, the bay and span cross-connecting terminal strips should be wired together and all further cross-connections made at the central cross-connect cabinet.

1.39 A jack field per ED-3C119-30 is mounted on the shop-wired bay and is equipped with test set power and fault locating jacks, order wire lamp and jack circuits, plus the telephone set circuit jack appearances.

1.40 Power distribution circuit panels per ED-3C009-30 are provided on a one per repeater shelf basis on the shop-wired bay (see Fig. 21). These panels mount resistors to drop

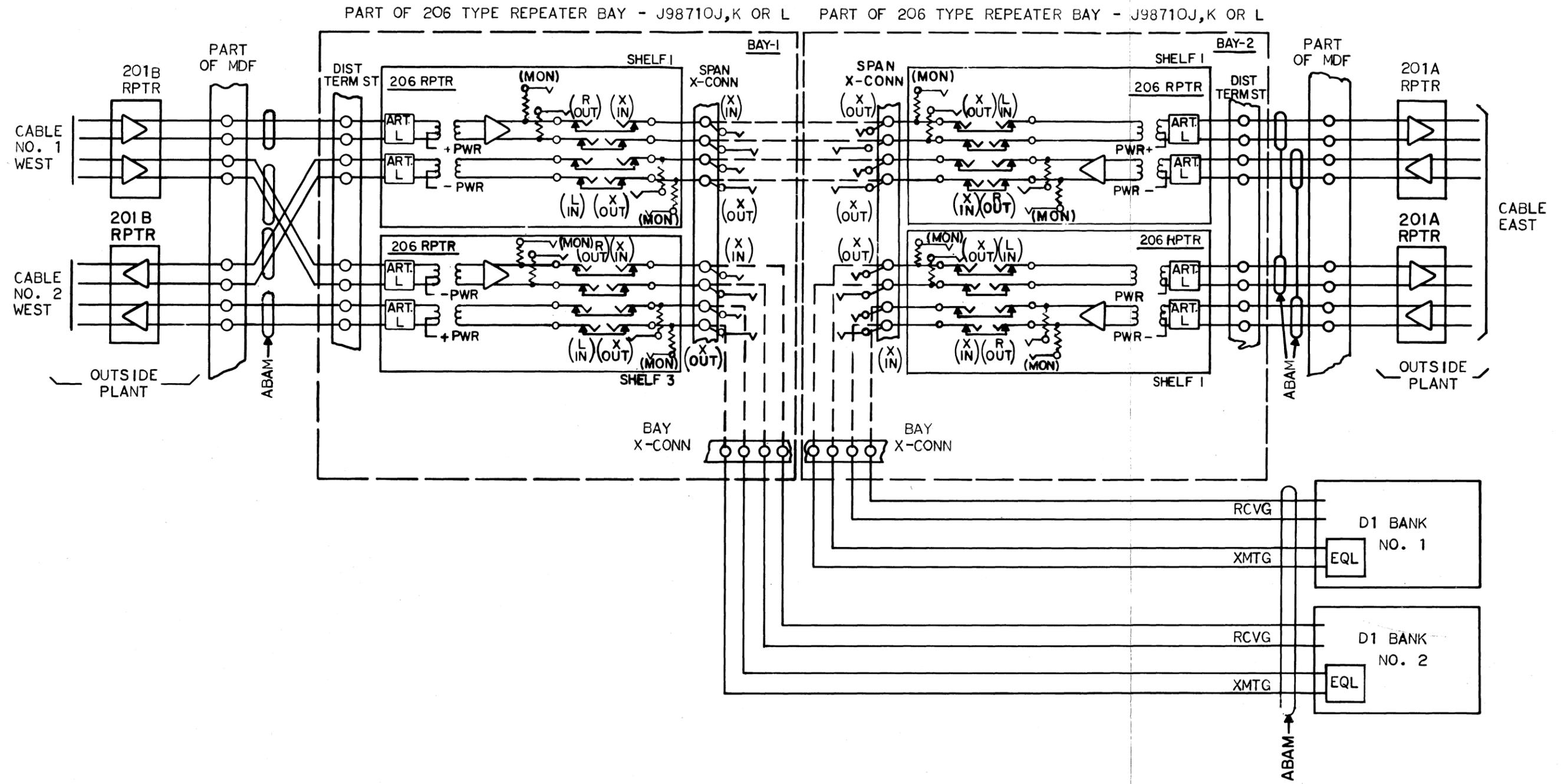


Fig. 12—Block Schematic of Combination of Two- and One-Cable Systems—New 206-Type Repeater Bay Configuration

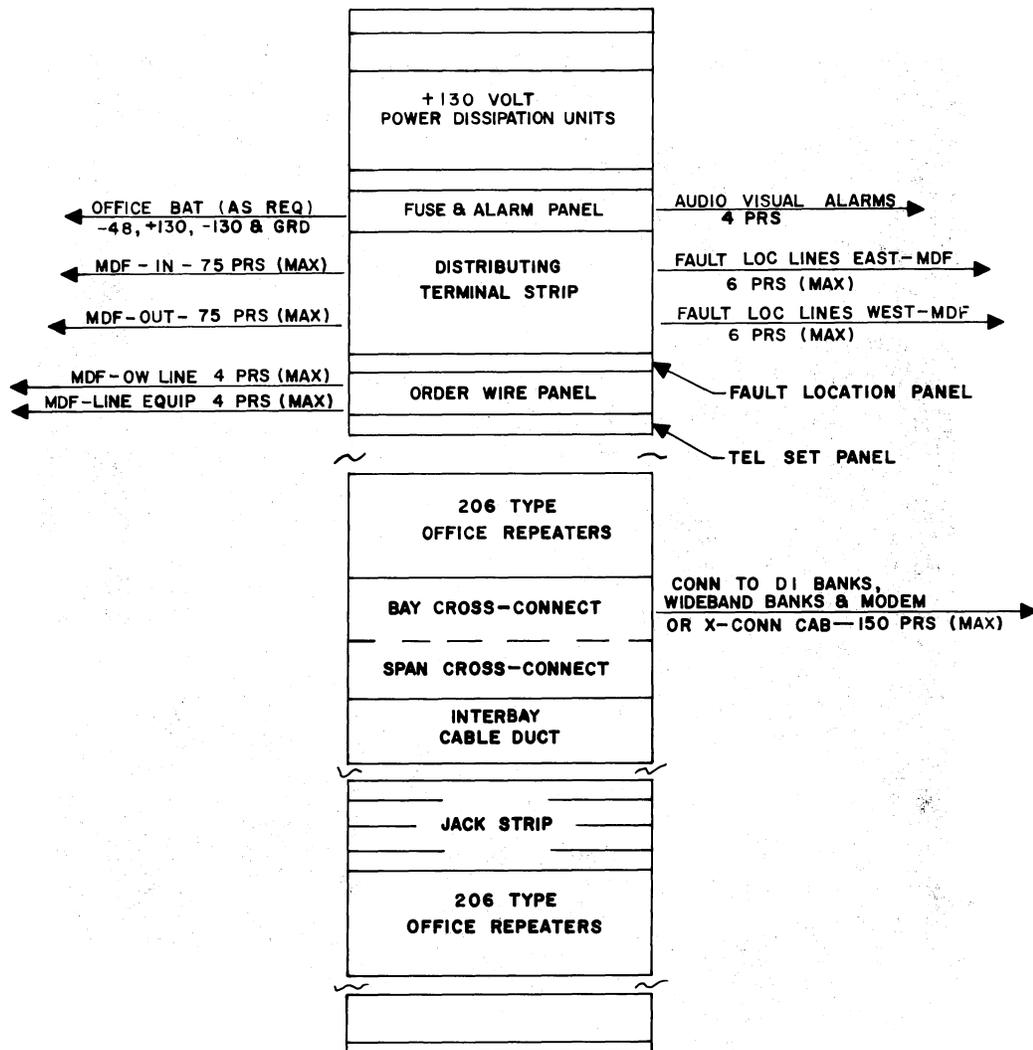


Fig. 13—New 206-Type Repeater Bay External Connections

the -48 volt office battery to the proper voltage level for the operation of the office repeaters. In addition, other resistors are mounted on the panels for use when -130 volts is required for repeatered-line powering. They are normally furnished strapped out of the circuit. The power distribution circuit panels are located on the rear of the bay to keep the heat generated away from the office repeaters.

Line Powering

1.41 The line receives power via the 206-type repeater as a function of power loop resistance. It is recommended that whenever possible, the 206-type repeater be powered in series with the

line, as this will reduce the power to be dissipated by the bay by approximately 400 watts.

E. 201-Type Office Equipment for Repeatered Lines (A&M Only)

General

1.41 The equipment arrangements described in this section have been replaced by those previously described. There are, however, partially equipped office repeater bays of this vintage in the field. The following is a description of the earlier office repeater bay arrangements and associated equipment.

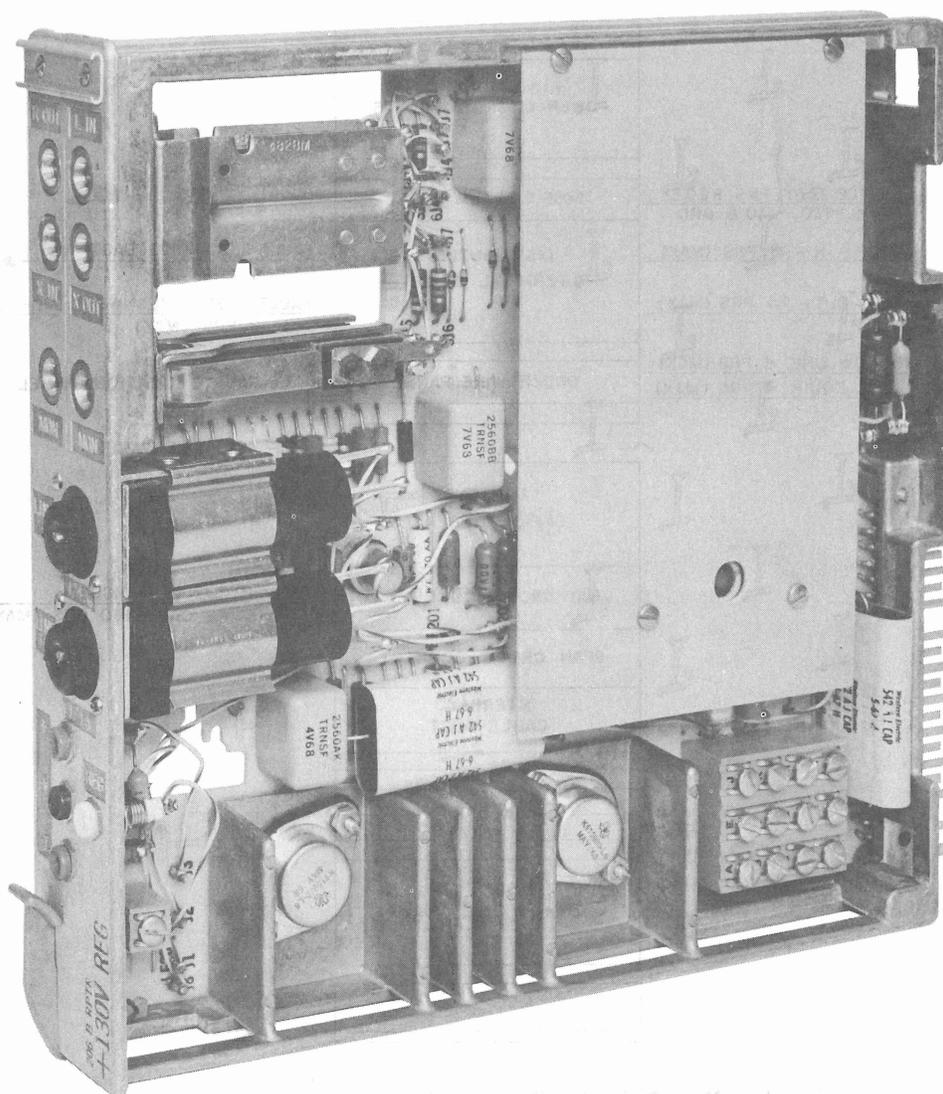


Fig. 14—206-Type Repeater

1.42 Repeater bay equipment arrangements are shown on ED-97076-11 (9-foot and 11-foot 6-inch bays) and on ED-97076-11 make use of 24-5/8 inch bulb-angle framework, while those covered on ED-97224-30 use 26-3/8 inch unequal flange cable-duct type framework. These bays are not shop-wired and are designed to be equipped and cabled by the installation forces. Fig. 22 shows typical bay arrangements.

1.43 The 11-foot 6-inch bay arrangement per ED-97076-11, when fully equipped, will service 36 through, or 72 terminating, systems. It will mount up to six bank terminating assemblies (J98710C) and six span terminating assemblies

(J98710A). A fully equipped bay having six span terminating assemblies (STAs) and six bank terminating assemblies (BTAs) and associated equipment weighs less than 500 pounds.

1.44 The 9-foot bay arrangement per ED-97076-11, when fully equipped, will service 24 through, or 48 terminating, systems. It will mount up to four BTAs and four STAs. A fully-equipped bay having a full complement of BTAs and STAs and associated equipment weighs less than 450 pounds.

1.45 The 7-foot bay arrangement per ED-97224-30, when fully equipped, will service 18 through, or 36 terminating, systems. It will mount up to

three BTAs and three STAs and associated equipment and weighs less than 450 pounds.

1.46 The size and arrangement of office repeater bays will depend on route requirements. Combinations of STAs and BTAs can be used in a bay. With this flexibility, an office can grow from a simple terminal or intermediate office to one serving a large number of through or terminating systems. In addition, the units and assemblies may also be adapted to mount on other types of frameworks that may be used in an office.

1.47 The block schematic in Fig. 23 illustrates how the repeater bay equipment is used in an office. Fig. 23 covers the situation where the office serves both as a through point and a terminal point, and as an interface between one- and two-cable systems. Fig. 24 illustrates the connections that must be completed between the several panels and assemblies of the office repeater equipment and other equipment such as D1 banks, the MDF, batteries, etc.

Plug-in Units

1.48 The plug-in units which make up an office repeater bay of this vintage are as follows.

- (a) **201B or E Repeater, Fig. 7:** This unit has been described in 1.16 through 1.19.
- (b) **201C or F Repeater, Fig. 7:** This unit is a bridging repeater which plugs into the STA and contains two pulse regenerator circuits. It is used to enable in-service span line patching as well as to place a signal on the idle line. Jacks are provided for access to the input and

output of each regenerator. The input and output connections to the 201C bridging repeater may be internally connected to normal through jacks so patch cords will not be necessary to supply a signal to the spare line.

- (c) **J98710B Control Unit (A&M Only), Fig. 25:** This unit plugs into the STA. Its principal function is to power four span lines. Typical

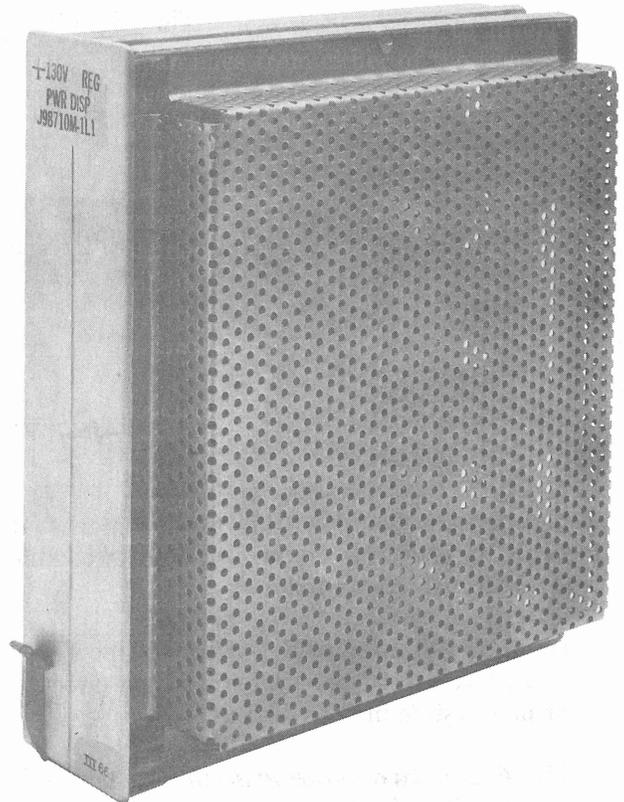


Fig. 15—J98710M 130-Volt Regulated Power Dissipation Unit

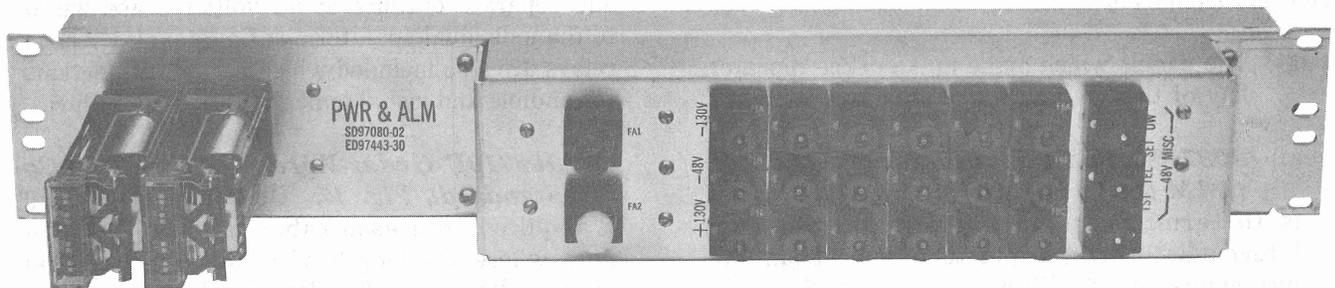


Fig. 16—ED-97443-() Fuse and Alarm Panel

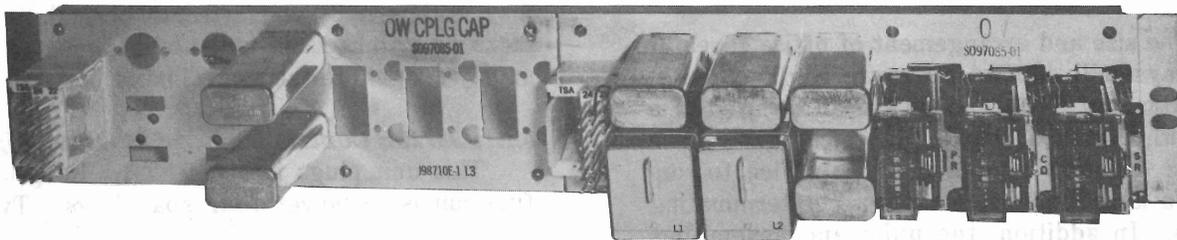


Fig. 17—J98710E Order-Wire Panels

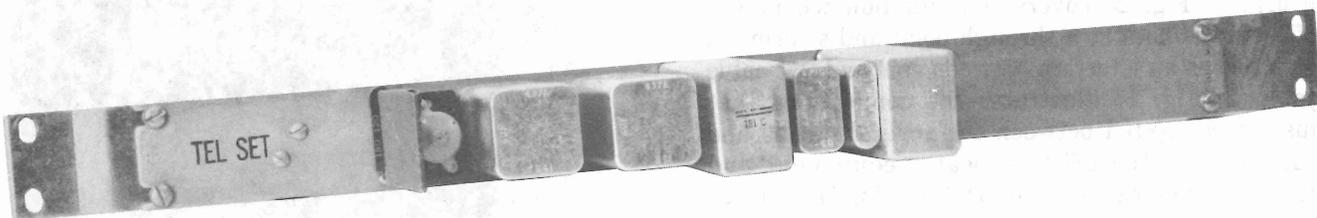


Fig. 18—J68769AJ Telephone Set Panel

examples are the powering requirements at intermediate offices for a one- and two-cable system. These are as follows.

- (1) **For a one-cable system**, the power is provided for two systems in one direction or one system in both directions.
- (2) **For a two-cable system**, the power is provided for two systems in one direction. (For this arrangement two control units are required for two systems in both directions.)

Common Equipment

1.49 The panels which make up an office repeater bay of this vintage are as follows.

- (a) **J98710A Span Terminating Assembly (A&M Only), Fig. 26:** Its principal function is to terminate span lines at terminal or intermediate offices and to provide span-line interconnecting facilities. It mounts 201B, C, D, or E repeaters, and accommodates six through systems at an intermediate point, or as many as 12 systems at a terminal point.
- (b) **J98710C Bank Terminating Assembly (A&M Only), Fig. 27:** This unit serves as an interface between D1 banks and the span terminating assemblies. It provides connections to 12 D1 banks, and originally provided interconnecting facilities and pads or equalizers for equalizing the lines (now provided on D1 terminal bays) between the repeater bays and the terminal bays.
- (c) **J98710D Fuse and Alarm Panel (A&M Only), Fig. 28:** This is the power distribution panel for the office repeater bay. Battery leads from the power board are connected to this panel and separate outputs of all voltages are wired to the individual span terminating panels. Alarm relays are also included which permit connections for audible and visual indications of fuse failures.
- (d) **J98710E Order-Wire Panel (AT&TCO Standard), Fig. 17:** One order-wire panel is required with each cable or group of span lines where the length of cable to the central office is less than 10 miles. If the span length is longer than 10 miles, an order-wire panel is provided at each end. In this case, blocking capacitors are located in the approximate center

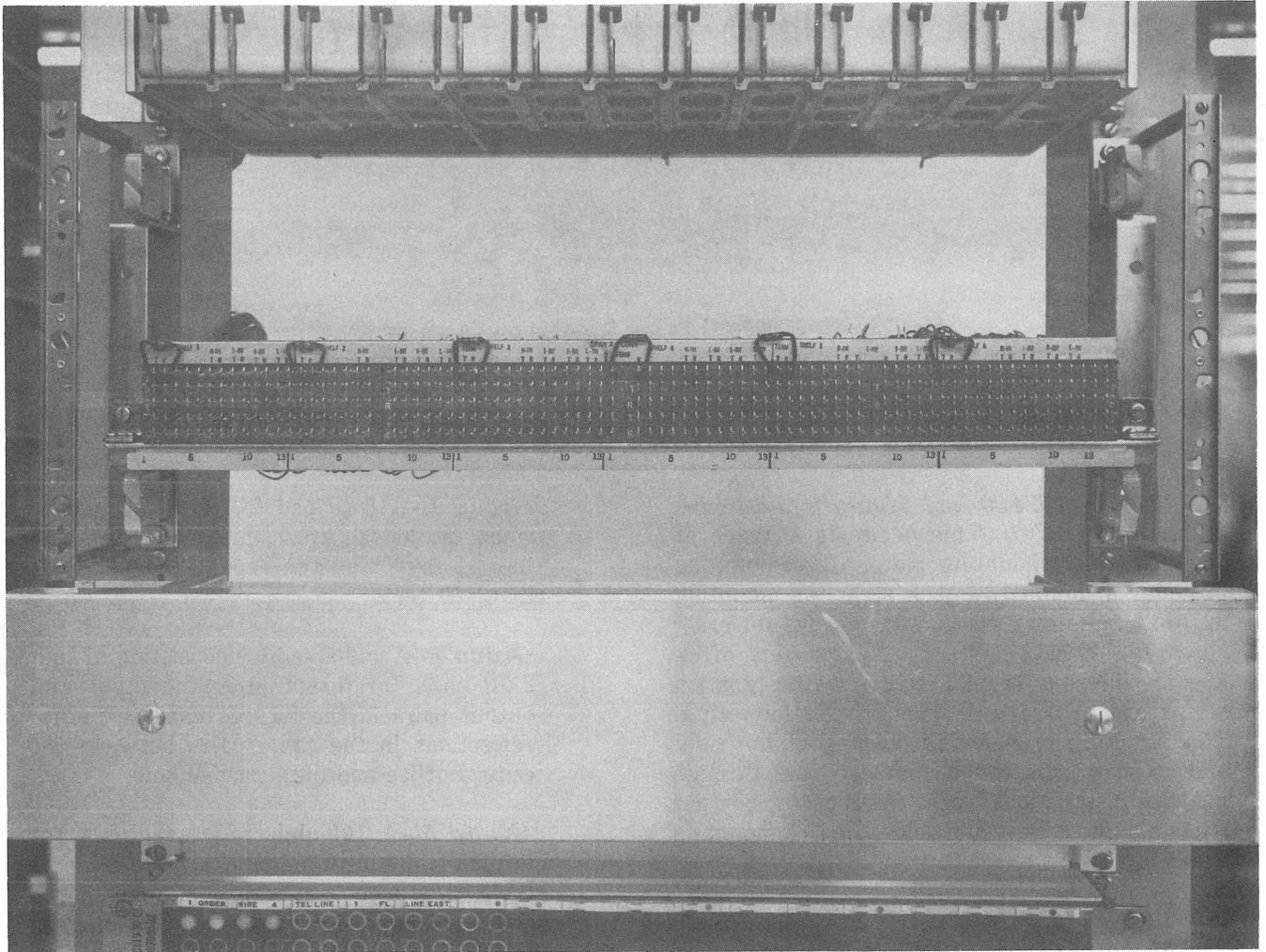


Fig. 19—ED-97442-(), G1 Span Cross-Connecting Terminal Strip



Fig. 20—ED-97442-(), G2 Bay Cross-Connecting Terminal Strip

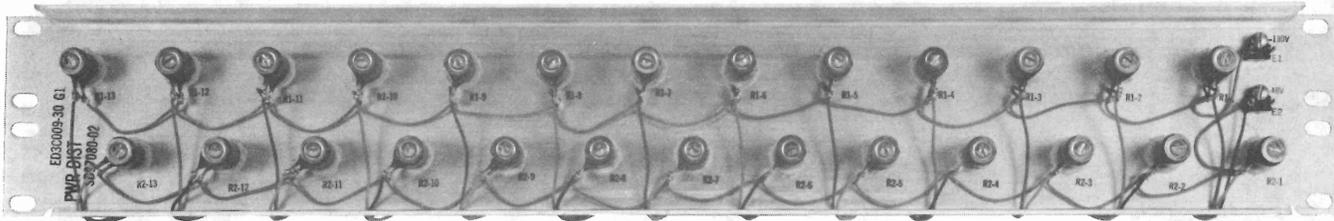


Fig. 21—ED-3C009-() Power Distribution Circuit Panel

of the span so that either end can be called from the outside line locations.

(e) **The ED-97074-30 Jack Mounting Assembly (A&M Only):** This occupies a space of one 1-3/4 inch mounting plate. This mounting provides a double-row jack strip for mounting up to 20 pairs of jacks, lamps, or keys for order wires, fault location filters, telephone sets, office alarms, interbay trunks, etc. Two designation strips are provided as part of the mounting. The structure provides an opening at the right end so that cross connections can pass through in those installations where the repeater bay has STAs mounted above and below the jack mounting assembly.

(f) **The P-43L654 Fault Location Filter Mounting Plate (AT&TCo Standard):** This is 1-3/4 inches wide and will mount three 598-type filters for use in fault location tests. Jacks for terminating the filters are located on the repeater bay jack mounting.

(g) **An ED-97078-50 Shelf Assembly (A&M Only):** This is intended for mounting on the bulb-angle relay rack for supporting a J98710F-() fault locating set. When used for this purpose, a space of six 1-3/4 inch mounting plates is required with the shelf located in the lowest position in this space. This shelf is only used in partially-equipped repeater bays and should be specified when requested by the customer.

(h) **ED-97079-30 Pad Assemblies (A&M Only):** These are required with the repeater equipment to provide suitable loss for the proper functioning of the circuits. The following are

the pads and their application to the various units.

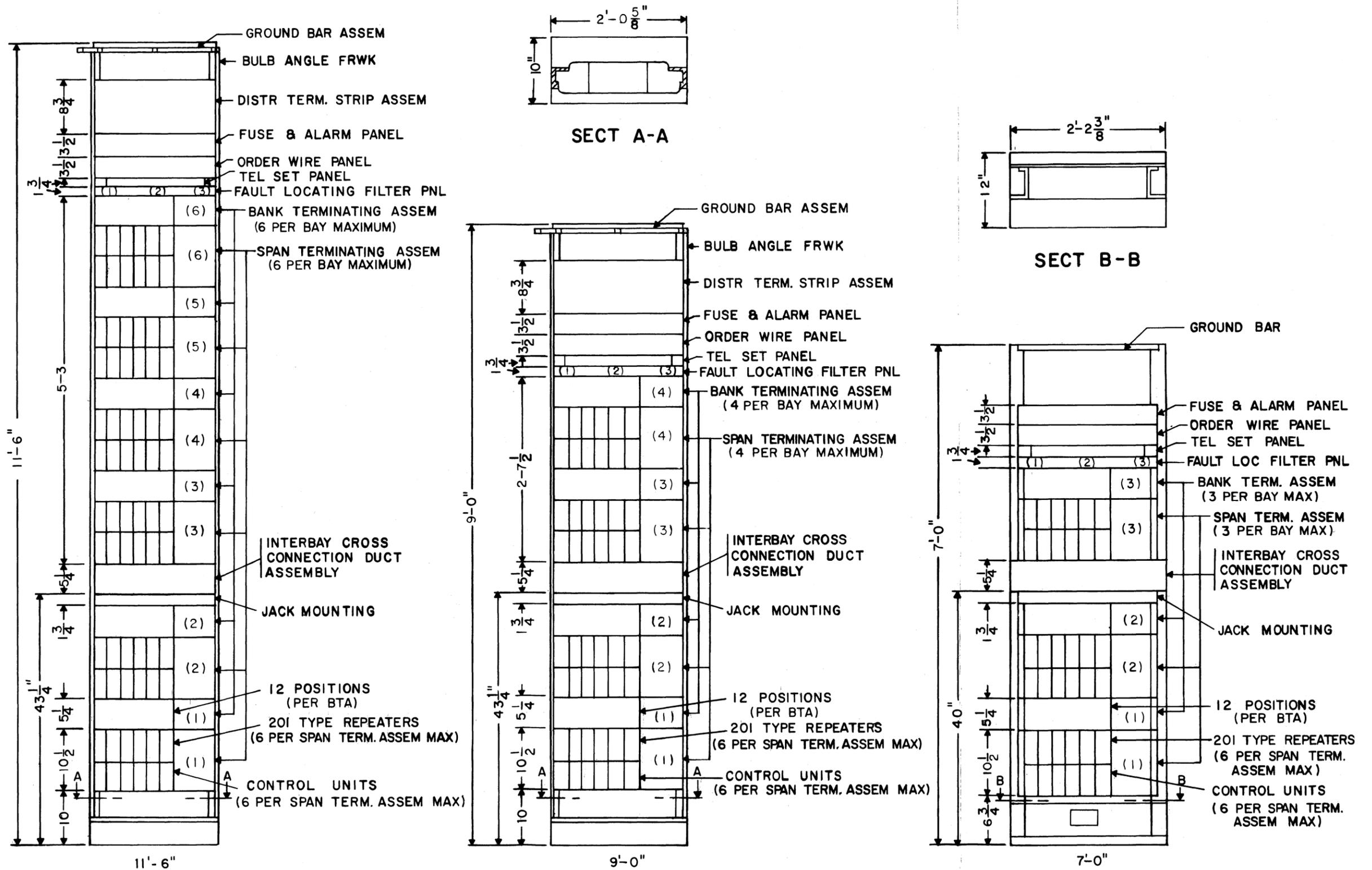
Group 1—A 6-dB pad for the BTA is used when the length of shielded cable between the D1 bank and the repeater bay is less than 150 feet.

Group 4—A pad assembly consisting of four 3-dB pads for insertion in the input and output pairs in the STA is used to reduce reflections in the cable pairs between the central office and the first manhole.

Group 5—A 100-ohm LBO assembly for insertion in the input and output pairs in the STA is used to provide additional shaped loss for extremely short end sections, as well as to reduce reflections in the end section cables.

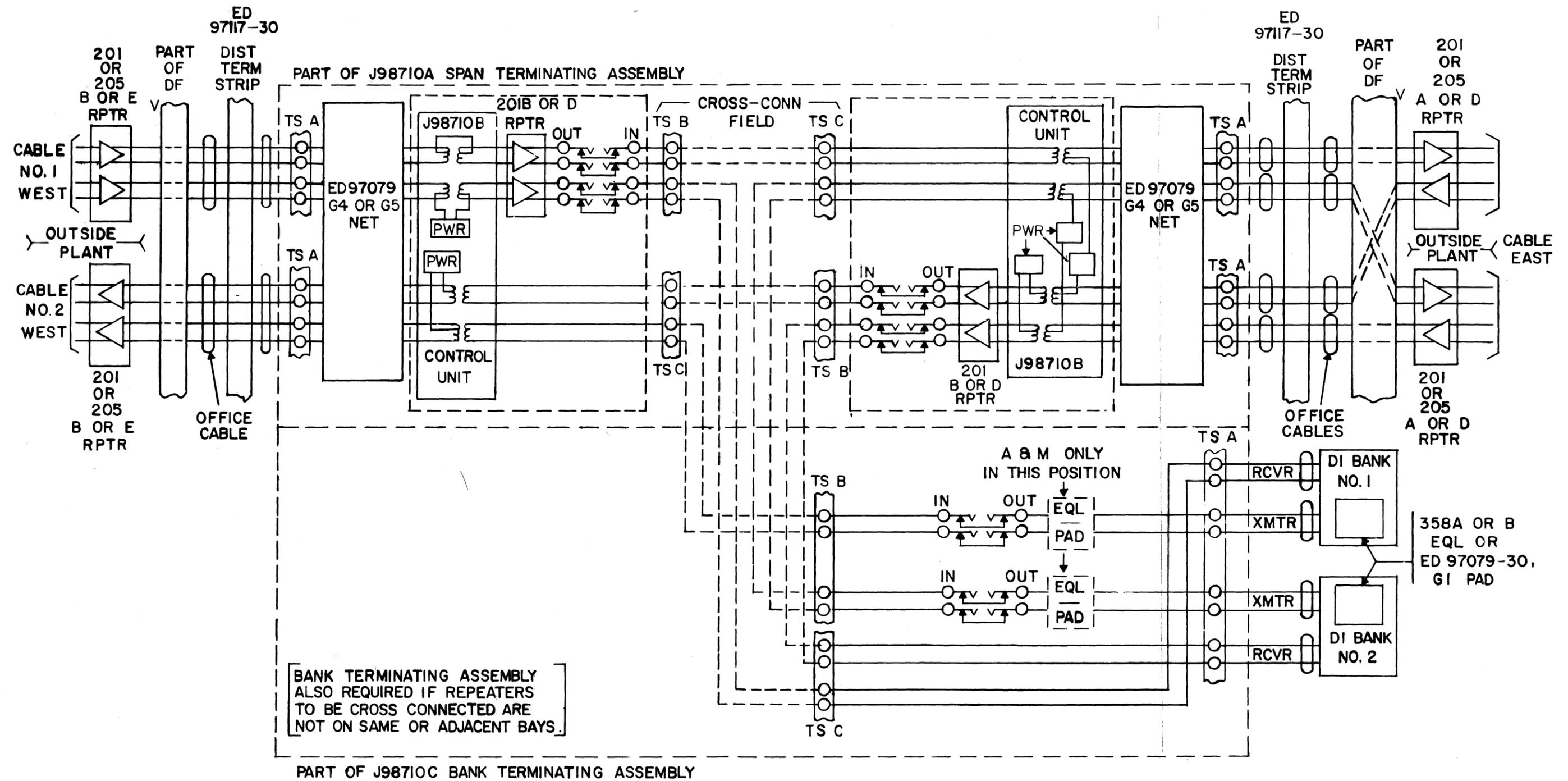
(i) **An ED-97185-50 Interbay Cross-Connect Duct Assembly (A&M Only):** This is intended to enable cross connection between contiguous repeater bays. It is made for mounting on 23-inch bulb-angle framework and is three 1-3/4 inch mounting plates high.

(j) **An ED-97117-30 Distributing Terminal Strip Assembly (A&M Only):** This is used in offices that use ABAM-type cables from the MDF to the repeater bay. This terminal strip assembly will permit connecting a total of six STAs to the MDF. It provides a means of terminating separate input and output common sheath cables on the rear side and the 753A input and output cables from the STAs on the front side. Suitable grounding facilities for both the aluminum sheath of the ABAM set is shown in Fig. 29. Fault locating sets are required at



TYPICAL 201 TYPE OFFICE REPEATER BAYS (A&M)

Fig. 22—Typical Old Repeater Bay Equipment Arrangements



CONNECTIONS REQUIRED FOR A 201 TYPE OFFICE REPEATER BAY FOR ONE THROUGH SYSTEM AND TWO TERMINATING SYSTEMS FOR TWO-CABLE OPERATION TO THE WEST, ONE-CABLE OPERATION TO THE EAST.

Fig. 23—Block Schematic of Combination of Two- and One-Cable Systems—Old Repeater Bay Configuration

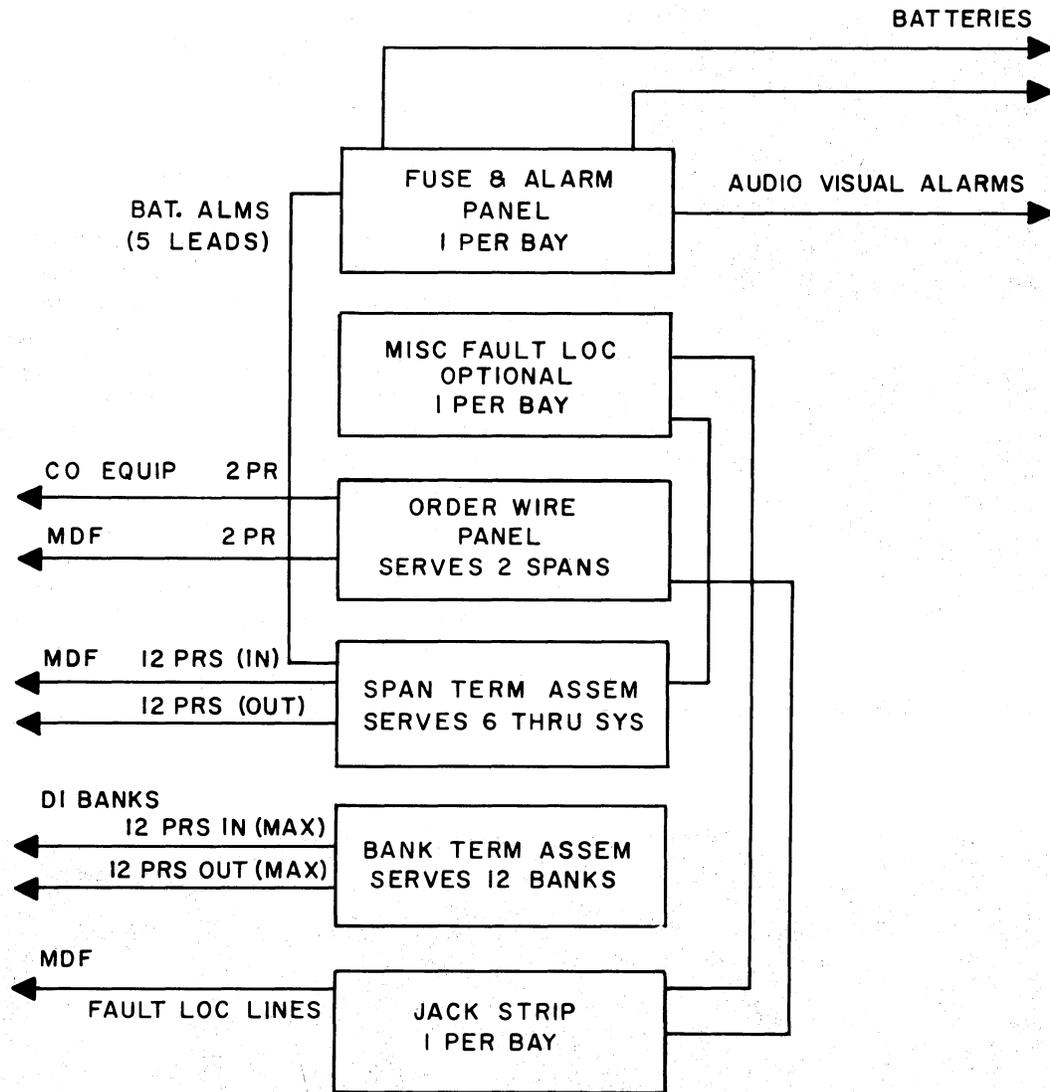


Fig. 24—Old Repeater Bay External Connections

terminal offices, at intermediate offices involving long span lines, and at intermediate offices that operate as branching points.

F. Test Equipment for Repeatered Lines

Function

1.51 The J98710G error detecting set can be used to evaluate the performance of a system on an in-service basis. The method depends upon the bipolar nature of the PCM signal; that is, successive pulses, in whatever time slots, should be of opposite polarity. Violations of this rule are

recognized as errors which are recorded as flashes of a panel lamp. Each office should have an error detecting set. The set is shown in Fig. 30.

1.52 The J98710H repeater test set is used in central offices in conjunction with a fault locating set and an error detecting set to check out repeaters prior to their installation. The set is designed to make a gross performance test of the repeater rather than a detailed quality check. The set is shown in Fig. 31.

1.53 The 113A and B test sets are used to measure the transmission loss of the exchange area

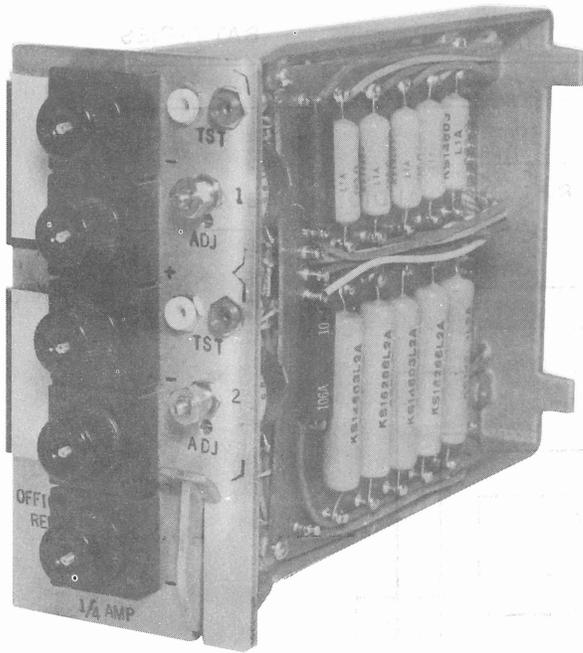


Fig. 25—J98710B Control Unit

cable between repeater apparatus cases. These measurements are used to determine the correct code of the 836-type LBO networks to install in the line and office repeaters. The 113A and B test sets are shown in Fig. 32.

Description of Test Equipment

1.54 *The J98710F Fault Locating Set (AT&TCo Standard):*

This is a portable test set in a standard aluminum box, 10 inches wide by 17 inches long and 9 inches high, containing a digit generator and 12 filters for locating marginal or faulty repeaters between central offices. The major equipment is mounted on plug-in printed wiring boards within the box, and the associated control potentiometers, switches, and jacks are mounted on the front panel. The printed wiring boards are shown in Table C. The 48 volts required for operation of this equipment is obtained from a test jack mounted in the jack field of the repeater bay. A 3W9A plug, which is an integral part of this set, is used for this purpose. In a fault locating arrangement at an attended intermediate or terminal

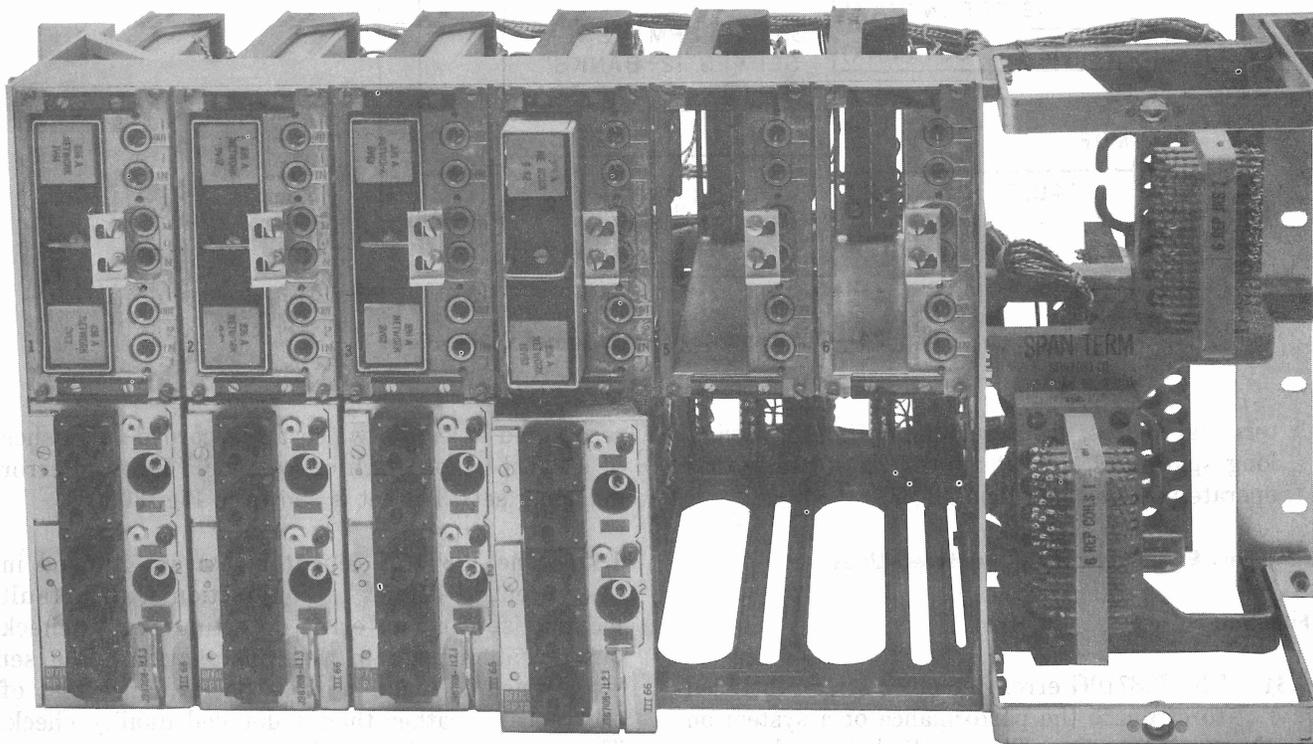


Fig. 26—J98710A Span Terminating Assembly

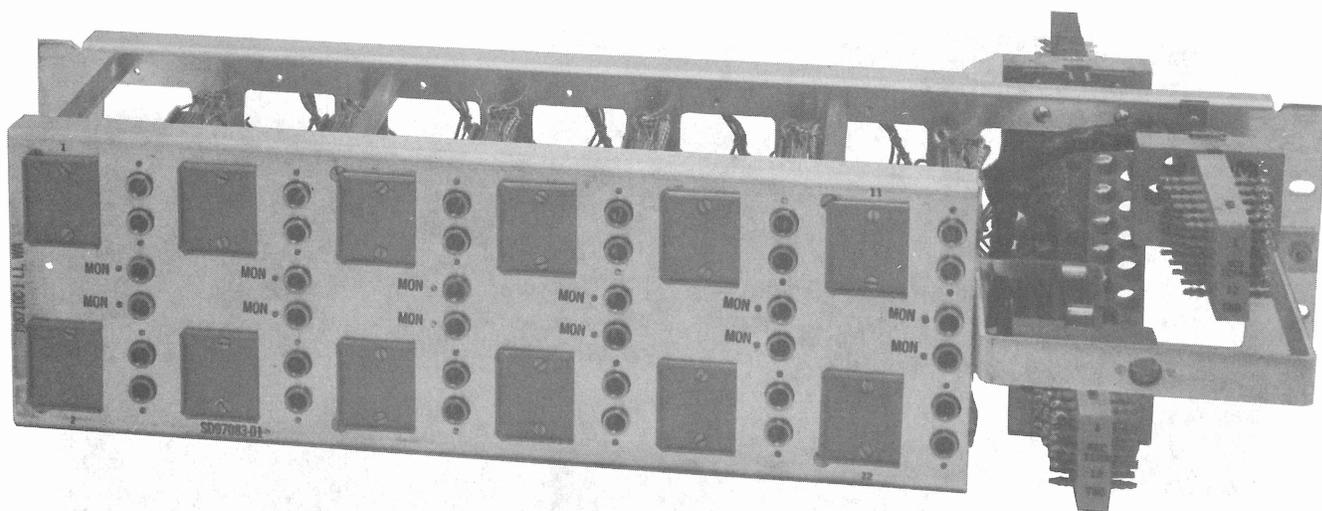


Fig. 27—J98710C Bank Terminating Assembly

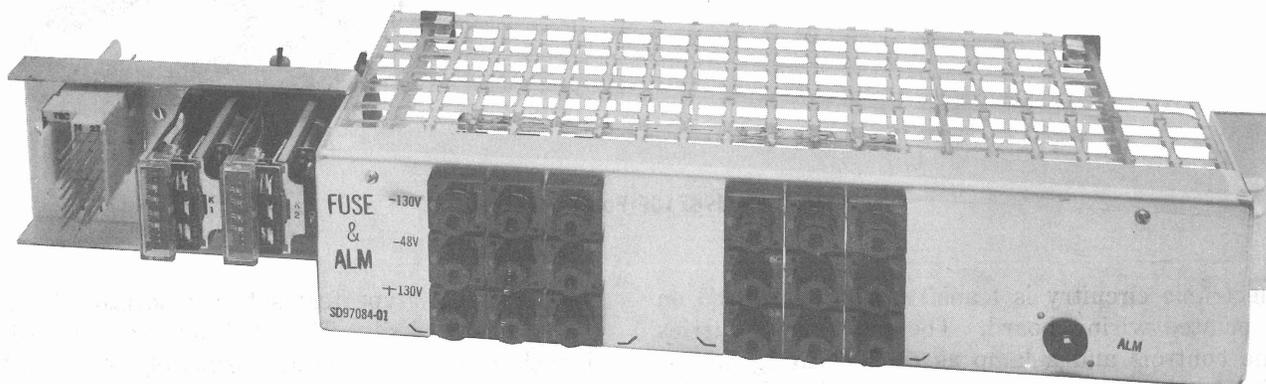


Fig. 28—J98710D Fuse and Alarm Panel

office, it is necessary to provide a jack termination for the fault location line at the repeater bay jack field. At an unattended intermediate office, however, the repeater bay is provided with a fault location filter in addition to through connected jacks in the lines from both directions. This filter connects to the fault locating windings of all the repeaters in the span terminating assemblies associated with the particular cables. The fault location line, therefore, passes through this office and is treated as another repeater point, like a manhole location. In performing fault tests, use is made of the fault locating set, the fault locating jacks in the jack field, and the span jacks on the STAs, to determine where the fault has developed. The fault locating

set contains 12 BPFs corresponding to 12 filters in the fault locating setup so that frequency responses can be checked to determine the location of the failure. The fault locating set can also be used as a source of bipolar signals for additional tests. One of the switches on the front panel provides a means of switching from unipolar to bipolar functions for this purpose.

1.55 The J98710C Error Detecting Set (AT&Co Standard): This is a portable test set in a small aluminum box, 6 inches wide by 8 inches long and 6 inches high, containing comparator and memory circuits for checking the presence of the bipolar pulse violations on the T1 carrier line. The

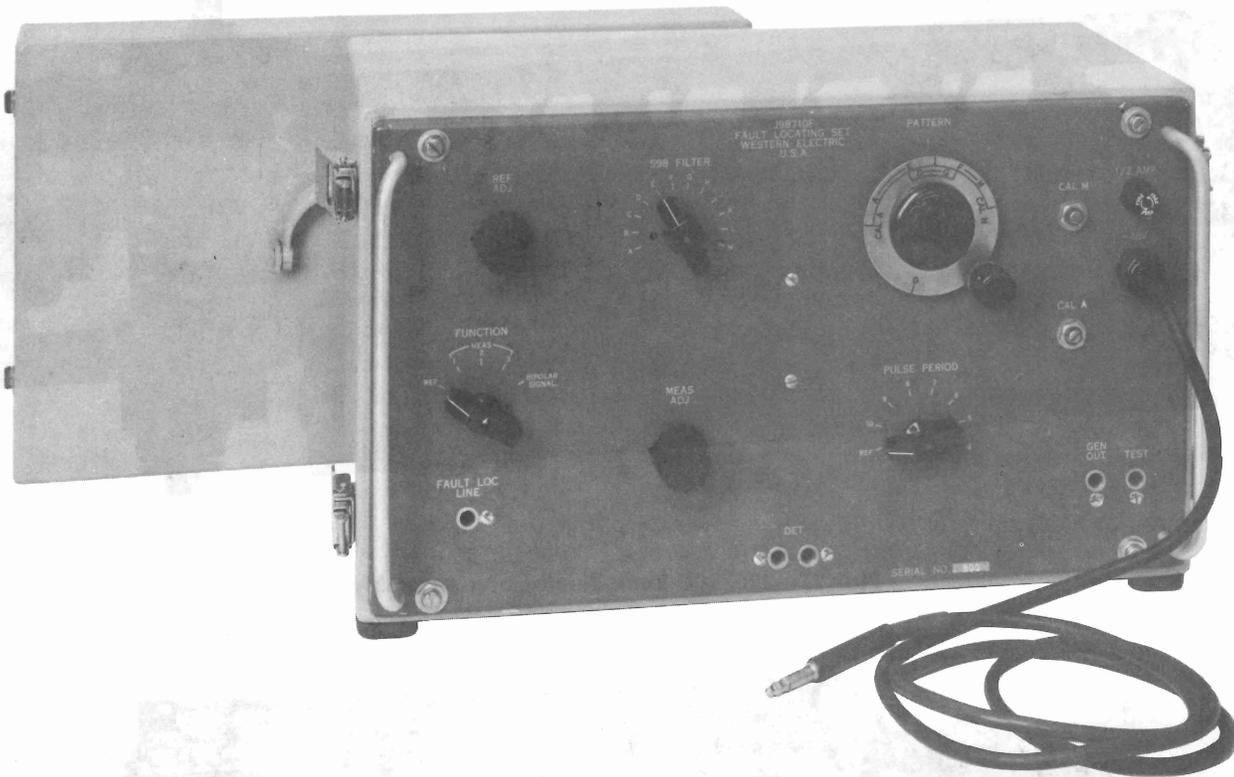


Fig. 29—J98710F Fault Locating Set

electronic circuitry is transistorized and wired on a printed wiring board. The front panel carries the controls and a lamp as the indicating device. The test set is powered by means of a plug-ended cord from a -48 volt dc source.

1.56 *The J98710H Repeater Test Set (AT&TCo Standard):* This is a portable test set in an aluminum box, 9 inches wide by 13 inches long and 9 inches high, containing the necessary equipment for field testing the 201- or 205-type repeaters prior to installation. It must be used in conjunction with the J98710F fault locating set and the J98710G error detecting set. It will be used primarily to check the performance and transmission continuity of the repeater, to measure the repeater power supply voltage, and to check breakdown of the circuit to the can cover. It can be set to check the repeater with any of the 12 LBO networks. The test set will be used in a central office where the other two test sets are available. It requires 110 volts ac for operation.

1.57 The 113-type test set is a portable battery operated set. The 113A test set (Mfr Disc.) is enclosed in a steel case approximately 7-5/16 inches wide by 9-15/16 inches long by 9-7/8 inches high. The 113B test set, which replaces the 113A, is enclosed in an aluminum case approximately 7-1/4 inches wide by 11-13/16 inches long by 8-13/16 inches high. Both test sets (see Fig. 32) are used in the central office and at the line-repeater points for the determination of proper repeater LBO networks and, hence, standard span losses. The 113-type test set is powered from two 10-volt mercury batteries. When used with a 206-type repeater bay, a 175A adapter must also be available. (The 175A adapter is shown in Fig. 33.)

1.58 *The J98710P T1 Line Error Detector (AT&TCo Standard):* This is a portable test set which operates similar to the J98710G error detecting set. The difference is that the line error detector is designed to monitor bipolar violations along a T1 span at each repeater position. The unit also provides a 100-ohm termination for the

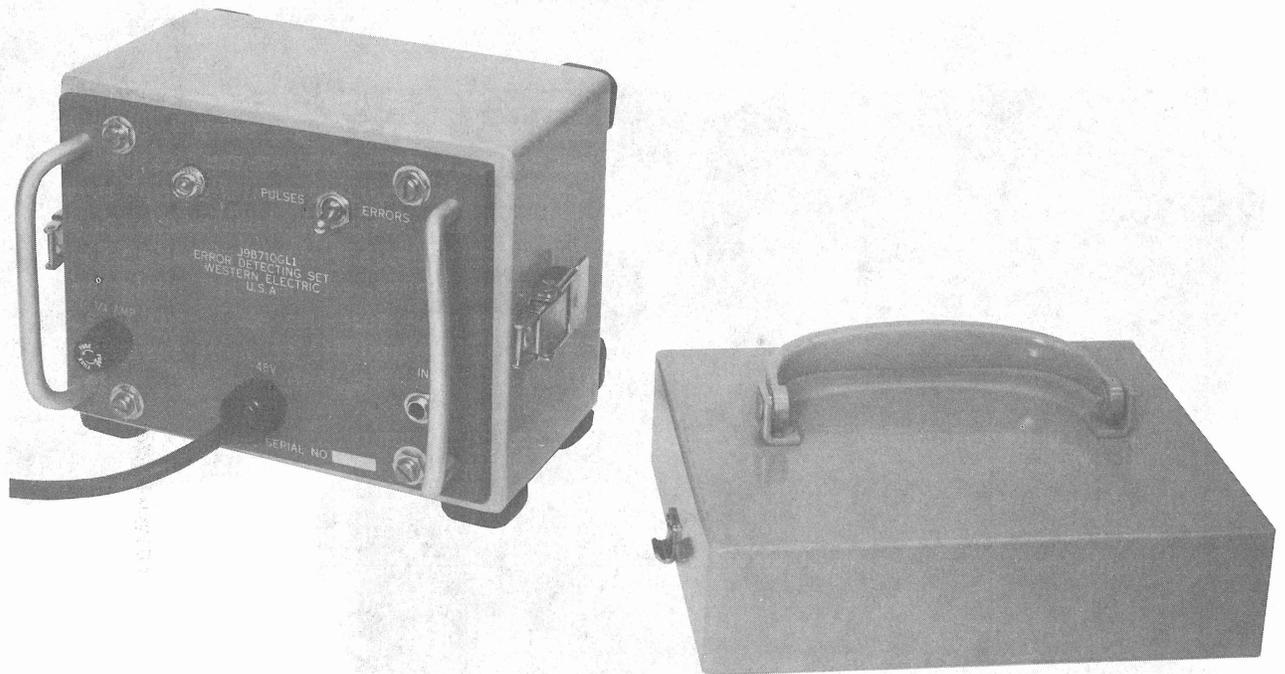


Fig. 30—J98710G Error Detecting Set

T1 span so that if the span checks out the repeater can be tested. The line error detector is powered by 4 penlight cell batteries (AA size) located in a hinged door as shown in Fig. 34A. The line error detector may be used in testing a one- or two-cable system by setting the switch located within adapter portion (see Fig. 34B) of the error detector in the desired position.

1.59 The J98710R Quasi Random Signal Source (AT&TCo Standard): The T1 quasi random signal source shown in Fig. 35 occupies one 1-3/4 inch mounting plate position when mounted in a 23-inch wide bay. The signal source is designed to work from -48 volt office battery and is equipped with complete office alarm facilities. The T1 quasi random signal source provides 25 outputs which simulate a D1 channel bank output for checking the performance of a T1 line. The output of a signal source supplies a pulse pattern approximating a random signal which will produce errors over a T1 line which may not produce errors with other available test signals.

1.60 The J98710S Span Fault Locator (AT&TCo Standard): The span fault locator shown

in Fig. 36 will allow a craftsman to interrogate individual span lines from either of the two terminal offices to remotely locate a faulty span. The span fault locator allows a craftsman to interrogate a long T1 carrier system having many spans in a matter of a few minutes. It is especially useful when interrogating spans having unattended offices or even manned offices when a craftsman is not readily available.

G. Central Cross-Connect Field

1.61 The central cross-connect field is intended to provide complete flexibility of cross-connections between repeatered lines, or between repeatered lines and terminals, in offices where repeater bays are not contiguous and partial flexibility is not adequate. Complete flexibility is already available where repeater bays are adjoining in the same lineup and partial flexibility where they are separated.

1.62 The central cross-connect field facilitates the reassignment of span lines and D1 banks. The reassignment procedure consists of making simple cross connections with twisted pairs of

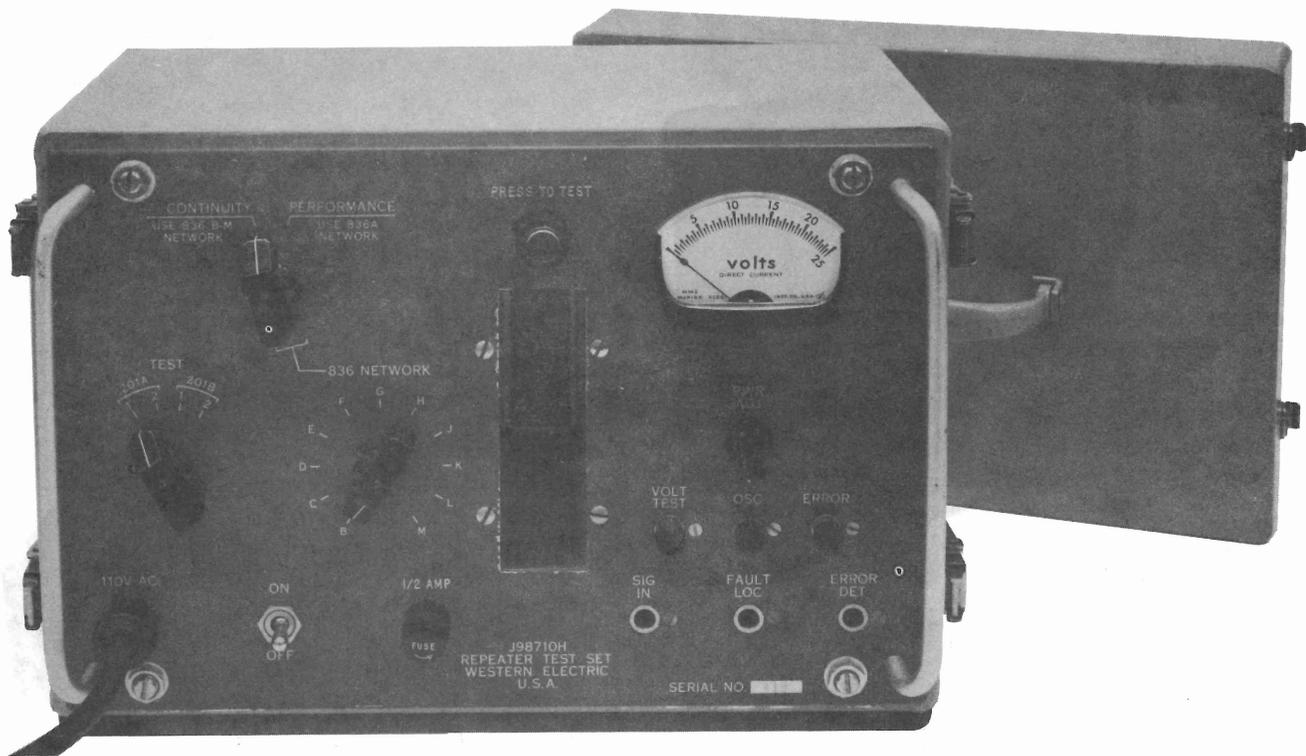


Fig. 31—J98710H Repeater Test Set

switchboard-type wire, solderless gun wrapped to terminals. Terminal strips are provided with the terminal spacing arranged to minimize the possibility of errors. Two terminal strips with a wiring trough are available as a shelf per ED-97446-30. Each shelf is capable of serving up to 75 through systems, 75 terminating systems, or any combination of through and terminating systems totaling 75, as required.

1.63 The central cross-connect field frame assembly is covered on ED-97446-50. It consists of a cabinet-type structure assembled to a bay framework. The frame assembly is available in 7-foot, 9-foot, and 11-foot 6-inch heights to accommodate the variety of ceiling heights present in central offices. The 9-foot and 11-foot 6-inch bays are 12 inches deep by 52-7/8 inches wide and should be mounted on 53-inch centers. The 7-foot bay is 12 inches deep by 52 inches wide and should be mounted on 52-1/8 inch centers. The cross-connect field, however, is contained in approximately the lower 7 feet of the bay framework regardless of bay height. This arrangement has evolved because of the cable congestion which would take place in the overhead

cable racks if more than 450 system cross-connections were attempted in a single cross-connect field. These frames are very similar to the group distributing frames used in L-multiplex systems.

1.64 The ED-97446-50 central cross-connect field frame assembly can be equipped with up to six of the ED-97446-30 shelves. These shelves, however, are not furnished as part of the frame assembly and must be ordered separately as required. Provisions are available for the central cross-connect field to be ordered less the front and/or rear doors. Finally, provisions are also available for the addition of contiguous central cross-connect field frames to allow for office growth.

Wiring and Cabling

1.65 The standard wire size and insulation shall be as specified in Section 800-610-152.

1.66 The cabling for either vintage of repeater bay shall be selected to meet office growth requirements. In general, the input and output leads (753A or ABAM) should be run in separate

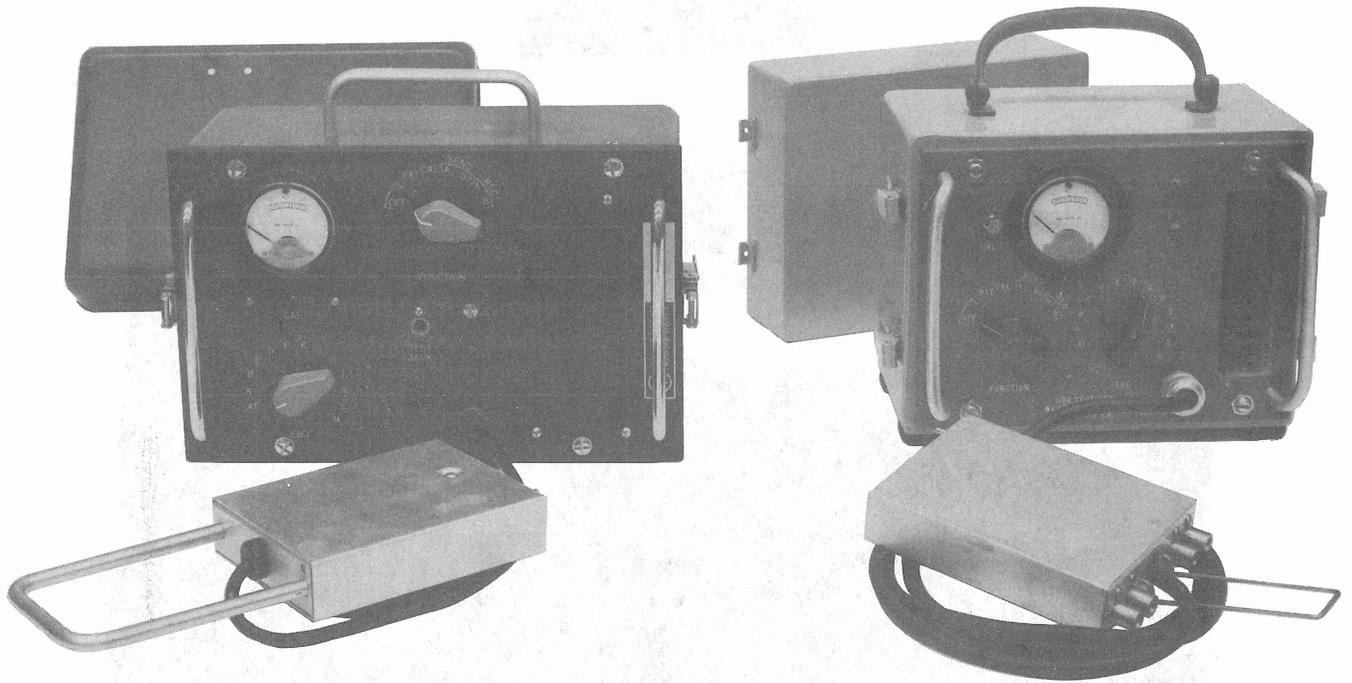


Fig. 32—113-Type Test Sets

TABLE C

PLUG-IN PRINTED WIRING BOARDS FOR
FAULT LOCATING SET

CODE	DESCRIPTION
4068A Network	Circuitry for unipolar flip-flop, clock, and power supply for digit generator
4068B Network	Circuitry for digit oscillators
4068C Network	Circuitry for audio flip-flop, gating, and blocking oscillator
639A Filter	Filters for 832, 928, 1045, and 1206 hertz
639B Filter	Filters for 1340, 1508, 1722, and 2008 hertz
639C Filter	Filters for 2193, 2413, 2680, and 3017 hertz

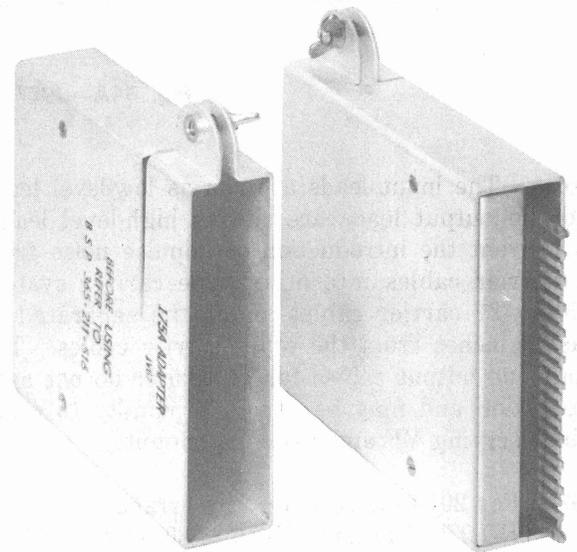


Fig. 33—175A Adapter

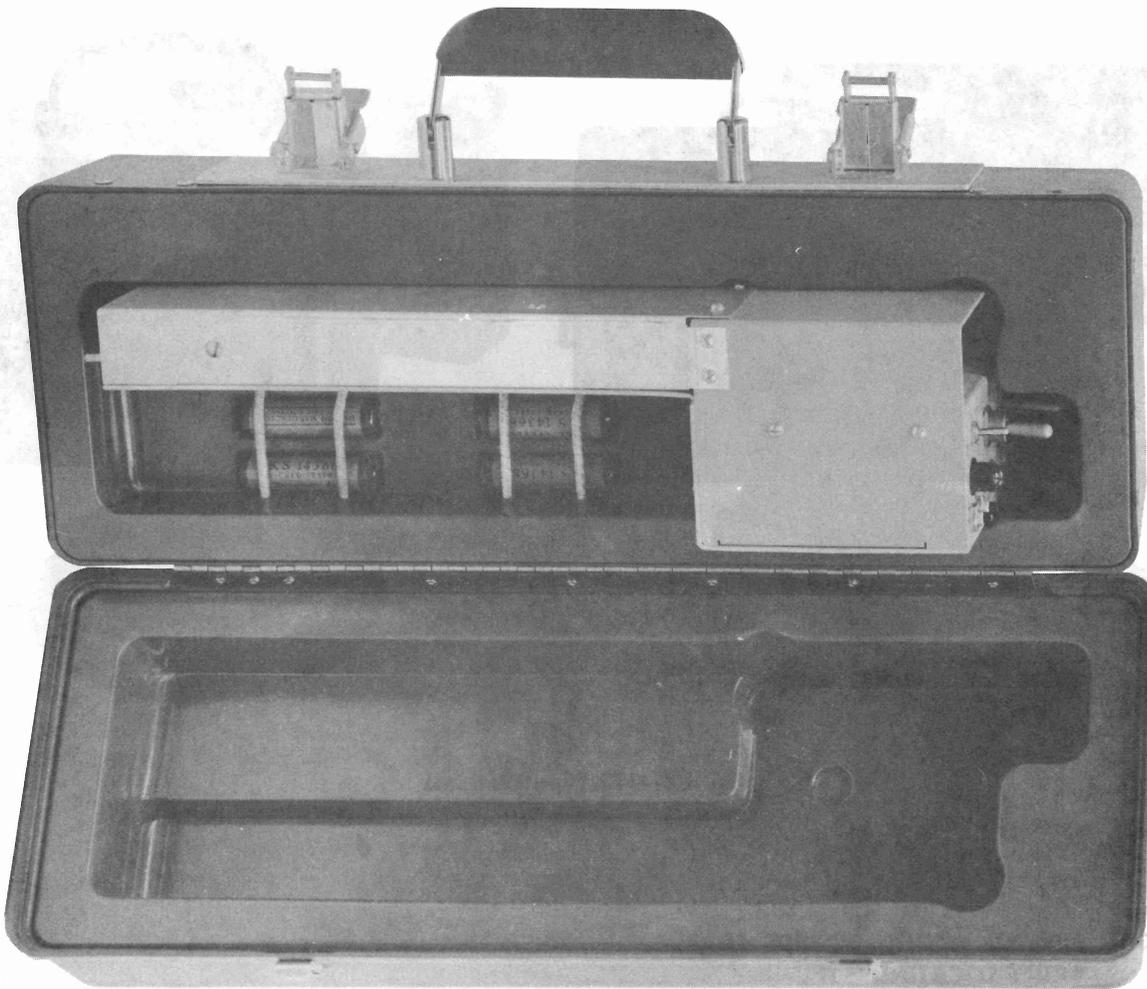


Fig. 34A—J98710P T1 Line Error Detector

cables. The input leads are run as low-level leads and the output leads are run as high-level leads. To prevent the introduction of impulse noise from T1 carrier cables into other type carrier system cables, T1 carrier cables should be separated at least 3 inches from the other carrier cables. The input and output cables for T1 carrier do not need separation and may be run in proximity to other cables serving VF and switching circuits.

1.67 For 201-type repeater bay arrangements per ED-97076-11 and ED-97224-30, when 750-type cables or ABAM are run from the MDF to the repeater bay, the inputs are connected to terminals on the left side of the distributing terminal strip, and the outputs to the right side, facing the front of the bay. The input and output connections are

then made from the distributing terminal strip to the STAs with separate 753A cables. In small installations, the 753A cables may be run directly from the STAs on the repeater bay to the MDF. In all installations, however, the cables from the repeater bay to the terminal bay may be run in either 750- or ABAM-type cable. For a terminal bay having three D1 banks, the cable shall be either 752A (six shielded pairs) or six pair ABAM; for a terminal bay having two D1 banks, the cables shall be either 758A (four shielded pairs) or six pair ABAM. These cables contain high-level leads and can be grouped together on the cable rack. Typical cabling plans for the repeater bays are shown on ED-97077-11 and ED-97225-10. Standard methods of grounding shielded pairs shall be followed. Until such time as a standard method of grounding

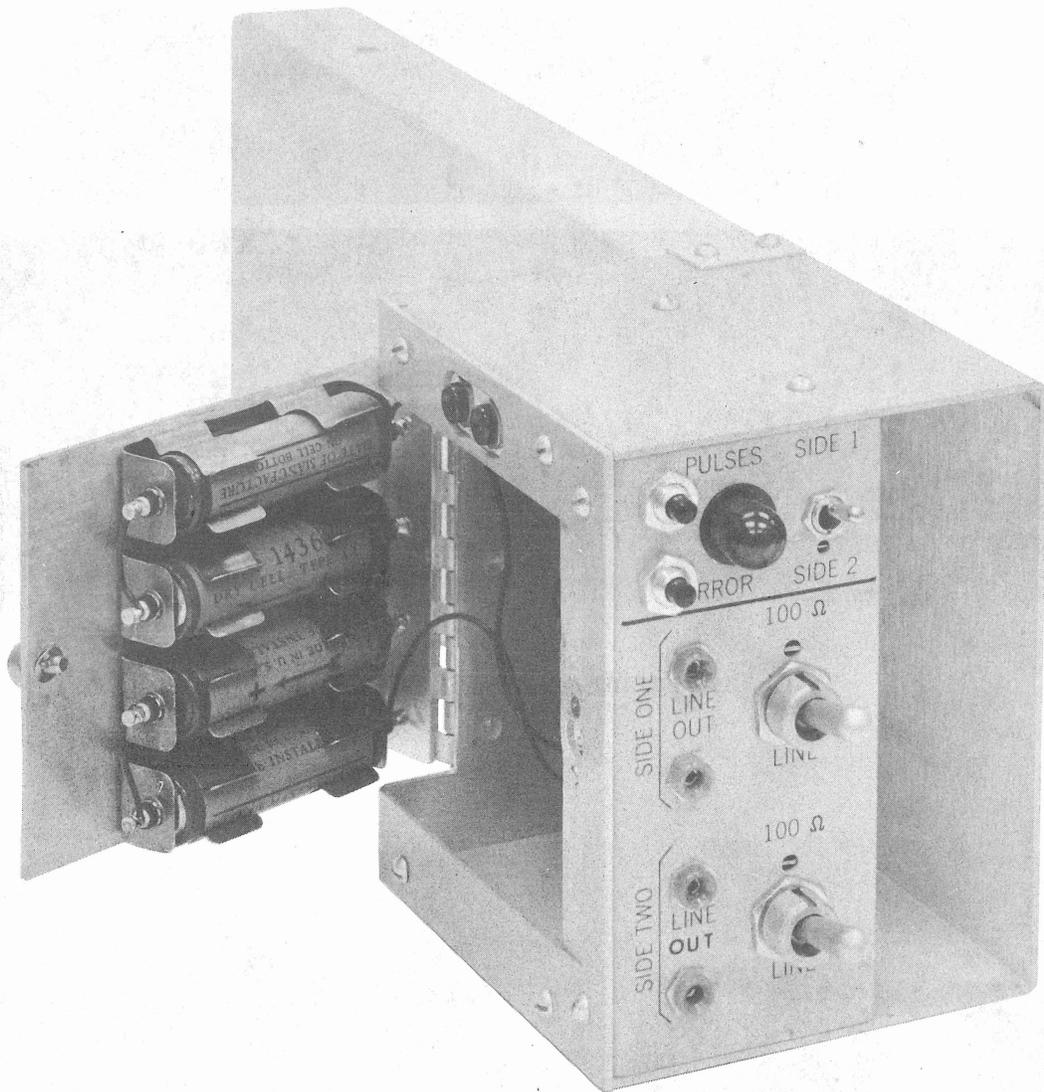


Fig. 34B—J98710P T1 Line Error Detector (Adapter Portion)

common sheath cable is established, the methods illustrated on the typical cabling plan drawings shall be followed for grounding at the repeater bay. Adequate grounding facilities are provided for this purpose.

1.68 For 206-type repeater bay arrangement per J98710J, K, and L when 16- or 26-pair type ABAM cable is run from the MDF to the repeater bay, the inputs are connected to terminals on the left side of the distributing terminal strip and the

outputs to the right side, facing the front of the bay. The 26-pair type ABAM cable is recommended for cases where two repeater shelves are dedicated to a span. However, where only one shelf is dedicated to a span, 16-pair type ABAM cable may be used for each direction of transmission. In any case, only systems of the same span may be run in the same cable. In all installations, however, the leads from the repeater bay to the terminal bay shall be run in 6-pair type ABAM cable, regardless of the number of D1 banks in the

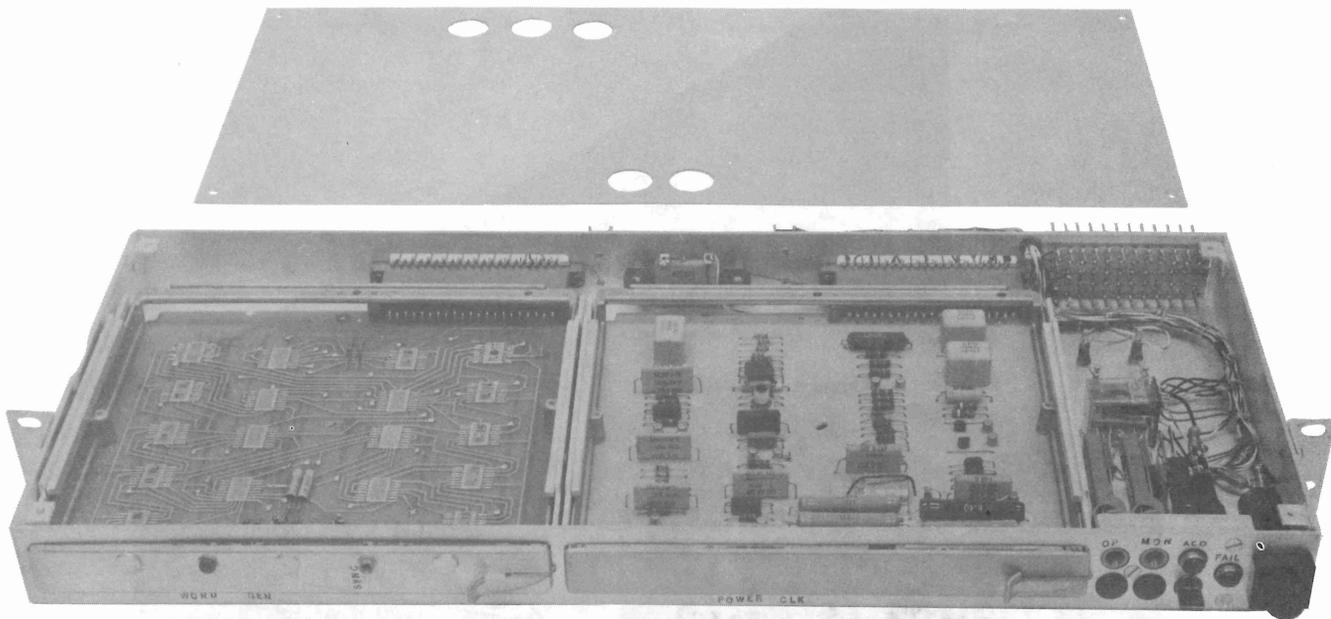


Fig. 35—J98710R Quasi Random Signal Source



Fig. 36—J98710S Span Fault Locator

terminal bay. These cables contain high-level leads and can be grouped together on the cable rack. The cabling plan for these repeater bays is shown on ED-97077-12 and ED-97077-14. Standard methods of grounding shielded pairs shall be followed. Until

such time as a standard method of grounding common sheath cable is established, the methods illustrated on the cabling plan drawing shall be followed for grounding at the repeater bay. Adequate grounding facilities are provided for this purpose.

SUBDIVISIONS OF EQUIPMENT AND DETAILED INDEX

WECO J drawings should be ordered by referring to the prefix and base number and requesting the current dash (—) number.

EQUIPMENT CODE	RATING	TITLE	EQUIPMENT DRAWING	CIRCUIT DRAWING	WEIGHT OF UNIT IN POUNDS	1-3/4 INCH MTG PLTS PER UNIT
ED-97074-30	A&M Only	Jack Mounting Assembly for Use With 201-Type Office Repeater Bay	ED-97075-30			
ED-97078-50	A&M Only	Shelf Assembly for Use With 201-Type Office Repeater Bay	ED-97078-50			
ED-97117-30	A&M Only	Distributing Terminal Strip Assembly for Use With 201-Type Office Repeater Bay	ED-97117-30			
ED-97185-50	A&M Only	Interbay Cross-Connect Duct Assembly for Use With 201-Type Office Repeater Bay	ED-97185-50			
ED-97446-30	AT&TCo Std	Shelf Assembly for Use With Central Cross-Connect Field	ED-97446-30			
ED-97446-50	AT&TCo Std	Central Cross-Connect Field Frame Assembly	ED-97446-50			
J98710A	A&M Only	Span Terminating Assembly for Use With 201-Type Office Repeater Bay	J98710A-()	SD-97081-01	18	6
J98710B	A&M Only	Control Unit Assembly for Use With 201-Type Office Repeater Bay	J98710B-()	SD-97082-01	1-1/2	—
J98710C	A&M Only	Bank Terminating Assembly for Use With 201-Type Office Repeater Bay	J98710C-()	SD-97083-01	10	3
J98710D	A&M Only	Fuse and Alarm Panel for Use With 201-Type Office Repeater Bay	J98710D-()	SD-97084-01	6	2
J98710E	AT&TCo Std	Order-Wire Panel	J98710E-()	SD-97085-01	5	2
J98710F	AT&TCo Std	Fault Locating Set	J98710F-()	SD-97078-02	25	—
J98710G	AT&TCo Std	Error Detecting Set	J98710G-()	SD-97086-01	5	—
J98710H	AT&TCo Std	Repeater Test Set	J98710H-()	SD-97092-01	15	—
J98710J	AT&TCo Std	11-Foot 6-Inch 206-Type Office Repeater Bay	J98710J-()	SD-97080-02	600	—

EQUIPMENT CODE	RATING	TITLE	EQUIPMENT DRAWING	CIRCUIT DRAWING	WEIGHT OF UNIT IN POUNDS	1-3/4 INCH MTG PLTS PER UNIT
J98710K	AT&TCo Std	9-Foot 206-Type Office Repeater Bay	J98710K-()	SD-97080-02	500	-
J98710L	AT&TCo Std	7 Foot 201-Type Office Repeater Bay	J98710L-()	SD-97080-02	500	-
J98710M	AT&TCo Std	130-Volt Regulated Power Dissipation Unit for Use With 206-Type Office Repeater Bay	J98710M-()	SD-97080-02	3	-
J98710P	AT&TCo Std	T1 Line Error Detector	J98710P-()	SD-3C092-01	5	-
J98710R	AT&TCo Std	T1 Quasi Random Signal Source	J98710R-()	SD-3C097-01	15	-
J98710S	AT&TCo Std	Span Fault Locator	J98710S-()	SD-3C096-01	20	-

CIRCUIT SCHEMATIC INDEX

CIRCUIT DRAWING	J98710 EQUIPMENT CODE	
SD-97078-02	F	J97038 — 801-015-151 — Relay Rack Unequal Flange Cable-Duct Type
SD-97080-02	J, K, L, M	J98711 — 801-438-151 — 24 Channel PCM Bank, Type D1
SD-97081-01	A	J98713 — 801-438-152 — Wideband Data Banks and Modems
SD-97082-01	B	X-17079 — Manufacturing Testing Requirements — 4027A and 4068A Networks
SD-97083-01	C	X-17080 — Manufacturing Testing Requirements — 4027B and 4068B Networks
SD-97084-01	D	X-17105 — Manufacturing Testing Requirements — 4027C and 4068C Networks
SD-97085-01	E	X-17132 — Manufacturing Testing Requirements — 201 and 205 Repeaters
SD-97086-01	G	X-17417 — Manufacturing Testing Requirements — 206 Repeaters
SD-97092-01	H	X-67985 — Manufacturing Testing Requirements — Fault Locating Set
SD-3C092-01	P	X-77030 — Manufacturing Testing Requirements — Error Detecting Set
SD-3C096-01	S	X-77033 — Manufacturing Testing Requirements — Repeater Test Set
SD-3C097-01	R	Floor Plan Data — Section 3.3, Sheet 41 (Bays per ED-97162-51)
		Floor Plan Data — Section 3.3, Sheet 94 (Bays per ED-97170-50 and ED-97162-50)
		Floor Plan Data — Section 7.1, Sheet 62 (Bays per ED-97076-30 and ED-97076-31)
2. SUPPLEMENTARY INFORMATION		
AA128.002 — Checking List — Equipment Design Requirements Sections		
AA128.006 — Checking List — General Equipment Requirements Sections		
AA610.003 — Gauge and Insulation of Wire		
AA612.020 — Grounding, Splicing, and Terminating Shielded Wiring and Coaxial and Twin-Conductor Shielded Office Cable		
J68769 — 804-627-156 — Miscellaneous Maintenance and Testing Equipment		
J97025 — 801-006-155 — Relay Rack — Bulb-Angle Type		

3. DRAWINGS

For additional drawings forming a part of this specification, see listings under Subdivisions of Equipment and Detailed Index.

CIRCUIT

- A-220474 — 205-Type Repeater Circuit Schematic
- A-576144 — 201-Type Repeater Circuit Schematic
- SD-3C017-01 — Application Schematic — T1WB-3 Wideband Bank
- SD-56073-01 — Telephone Set Circuit
- SD-97060-01 — Application Schematic — 24 Channel PCM Bank — Type D1
- SD-97080-01 — Application Schematic — 201-Type Office Repeater Bay
- SD-97248-01 — Application Schematic — T1WM-1 Wideband Modem
- SD-97300-01 — Application Schematic — T1WB-1 and T1WB-2 Wideband Bank

FRAMEWORK

- ED-91183-30 — Relay Rack Assembly — Bulb-Angle Type
- ED-91205-50 — Cable Brackets
- ED-91210-51 — Ground Bar Assembly for Bulb-Angle Type Framework
- ED-97162-50 — Relay Rack Assembly — Unequal Flange Cable-Duct Type
- ED-97162-51 — Relay Rack Assembly — Unequal Flange Cable-Duct Type
- ED-97170-50 — Relay Rack Assembly — Unequal Flange Cable-Duct Type

EQUIPMENT

- ED-3C009-30 — Power Distribution Circuit Panel for Use With 206-Type Repeater Bay
- ED-3C119-30 — Jack Mounting Assembly for Use With 206-Type Repeater Bay
- ED-97076-11 — Typical 201-Type Office Repeater Bay
- ED-97076-30 — Ordering Specification for 11-Foot 6-Inch 201-Type Repeater Bay
- ED-97076-31 — Ordering Specification for 9-Foot 201-Type Repeater Bay
- ED-97079-30 — Pad Assemblies for Use With 201-Type Repeater Bay
- ED-97088-30 — Transformer Board Assembly for Use With 201-Type Repeater Bay

- ED-97090-30 — Click Reducer Assembly for Use With 201-Type Repeater Bay
- ED-97224-30 — Ordering Specification for 7-Foot 201-Type Repeater Bay
- ED-97230-50 — Interbay Cross-Connection Trough for Use With 206-Type Repeater Bay
- ED-97442-50 G1 — Span Cross-Connect Field Assembly for Use With 206-Type Repeater Bay
- ED-97442-50 G2 — Bay Cross-Connect Field Assembly for Use With 206-Type Repeater Bay
- ED-97443-30 — Fuse and Alarm Panel for Use With 206-Type Repeater Bay
- ED-97446-11 — Typical Central Cross-Connect Field Bay Arrangement for Use With 206-Type Repeater Bay
- J68769AJ — Telephone Set Panel

CABLING

- ED-3C014-51 — Method of Grounding Unequal Flange Cable-Duct Type Framework
- ED-97077-11 — Typical 201-Type Office Repeater Bay Cabling Plan for 9-Foot and 11-Foot 6-Inch Bays per ED-97076-11
- ED-97077-12 — 206-Type Office Repeater Bay Cabling Plan for 9-Foot and 11-Foot 6-Inch Bays per J98710J and K
- ED-97077-14 — 206-Type Office Repeater Bay Cabling Plan for 7-Foot Bay per J98710L
- ED-97225-10 — Typical 201-Type Office Repeater Bay Cabling Plan for 7-Foot Bay per ED-97224-30
- ED-97446-10 — Typical Central Cross-Connect Bay Cabling Plan for all Bays per ED-97446-11

4. EQUIPMENT

- ED-97074-30 — A&M Only — Jack Mounting Assembly for Use With 201-Type Office Repeater Bay*

Group 1 — Assembly and equipment required for one jack mounting for office repeater bay.

ED-97078-50 — A&M Only — Shelf Assembly for Use With 201-Type Office Repeater Bay

Group 1 — Framework required for one shelf for office repeater bay.

ED-97117-30 — A&M Only — Distributing Terminal Strip Assembly for Use With 201-Type Office Repeater Bay

Group 1 — Framework, assembly, and equipment required for one distributing terminal strip.

ED-97185-50 — A&M Only — Interbay Cross-Connect Duct Assembly for Use With 201-Type Office Repeater Bay

Group 1 — Framework required for one interbay cross-connection duct assembly.

ED-97446-30 — AT&T Co Standard — Shelf Assembly for Use With Central Cross-Connect Field

Group 1 — Framework, assembly, and equipment required for one cross-connect block shelf assembly. (Maximum of six shelf assemblies per central cross-connect field.)

ED-97446-50 — AT&T Co Standard — Central Cross-Connect Field Frame Assembly

Group 1 — Framework and assembly required for one 7-foot by 52-inch originating basic bay.

Group 2 — Framework and assembly required for one 9-foot by 52-7/8 inch originating basic bay.

Group 3 — Framework and assembly required for one 11-foot 6-inch 52-7/8 inch originating basic bay.

Group 4 — Cabinet enclosure doors, panels, and associated equipment required for one side of a 7-foot basic bay.

Group 5 — Cabinet enclosure doors, panels, and associated equipment required for one side of a 9-foot basic bay.

Group 6 — Cabinet enclosure doors, panels, and associated equipment required for one side of an 11-foot 6-inch basic bay.

Group 7 — One frame junction upright required for one 7-foot supplementary basic bay (one side only).

Group 8 — One frame junction upright required for one 9-foot supplementary basic bay (one side only).

Group 9 — One frame junction upright required for one 11-foot 6-inch supplementary basic bay (one side only).

Group 10 — Framework and assembly required for one 7-foot by 52-inch supplementary basic bay.

Group 11 — Framework and assembly required for one 9-foot by 52-7/8 inch supplementary basic bay.

Group 12 — Framework and assembly required for one 11-foot 6-inch by 52-7/8 inch supplementary basic bay.

J98710A — A&M Only — Span Terminating Assembly for Use With 201-Type Office Repeater Bay (See Note 5.04)

Equipment — J98710A-()

List 1 — Assembly, wiring, and common equipment required for a span terminating assembly to be mounted on bulb-angle framework.

WIRE EQUIP NOTES

Framework Assembly ED-97072-50, G1		1	
Repeater and Jack Mounting Assembly ED-97073-30, G1	6	6	C
Pad Assembly ED-97079-30, G4		6	
Span Terminating Ckt, SD-97081-01, Fig. 1 and A	6	6	A

List 4 — Assembly, wiring, and common equipment required for a span terminating assembly to be mounted on duct-type framework.

WIRE EQUIP NOTES

Framework Assembly ED-97072-50, G1		1	
Repeater and Jack Mounting Assembly ED-97073-30, G1	6	6	C

	WIRE	EQUIP	NOTES
Pad Assembly ED-97079-30, G4		6	
Span Terminating Ckt, SD-97081-01, Fig. 1 and A	6	6	A

List 5 — Assembly, wiring, and common equipment required for a span terminating assembly to be mounted on bulb-angle framework.

	WIRE	EQUIP	NOTES
Framework Assembly ED-97072-50, G1		1	
Repeater and Jack Mounting Assembly ED-97073-30, G1	6	6	C
100-ohm LBO Assembly ED-97079-30		6	
Span Terminating Ckt, SD-97081-01, Fig. 1 and B	6	6	B

Lits 6 — Assembly, wiring, and common equipment required for a span terminating assembly to be mounted on cable-duct type framework.

	WIRE	EQUIP	NOTES
Framework Assembly ED-97072-50, G1		1	
Repeater and Jack Mounting Assembly ED-97073-30, G1	6	6	C
100-ohm LBO Assembly ED-97079-30, G5		6	
Span Terminating Ckt, SD-97081-01, Fig. 1 and B	6	6	B

Notes:

- A. Lists 1 and 4 are equipped with the ED-97079-30, Group 4 pad assemblies for use with repeatered line and sections having cable losses of 6 dB or greater at 772 kHz (1500 to 4500 feet for 22-gauge cable).
- B. Lists 5 and 6 are equipped with the ED-97079-30, Group 5 100-ohm LBO assemblies for use with repeatered line end sections having cable losses less than 6 dB at 772 kHz (0 to 1800 feet for 22-gauge cable).
- C. The repeater and jack mounting assemblies shall be prewired before mounting them in the span-terminating framework.

J98710B — A&M Only — Control Unit Assembly for Use With 201-Type Office Repeater Bay

Equipment — J98710B-()

List 1 — Assembly, wiring, and equipment required for a one-cable control unit per SD-97082-01, Fig. 1 and A.

	WIRE	EQUIP	NOTES
Transformer Board Assembly ED-97088-30, G1	1	1	

List 2 — Assembly, wiring, and equipment required for a 2-cable control unit per SD-97082-01, Fig. 1 and B.

	WIRE	EQUIP	NOTES
Transformer Board Assembly ED-97088-30, G1	1	1	

List 3 — Assembly, wiring, and equipment required in addition to list 1 or 2 for click reducers and surge capacitors per SD-97082-01, Fig. 1, X option.

	WIRE	EQUIP	NOTES
Click Reducer Assembly ED-97090-30, G1	1	1	
Click Reducer Assembly ED-97090-30, G2	1	1	

J98710C — A&M Only — Bank Terminating Assembly for Use With 201-Type Office Repeater Bay (See Note 5.02)

Equipment — J98710C-()

List 1 — Assembly, wiring, and equipment required for a bank terminating assembly for use on bulb-angle type framework.

	WIRE	EQUIP	NOTES
Bank Terminating Ckt, SD-97083-01, Fig. 1	12	12	

List 2 — Equipment required in addition to list 1 or 6 to provide one equalizer for equalizing cable from 150 to 450 feet.

	WIRE	EQUIP	NOTES
Bank Terminating Ckt, SD-97083-01, Fig. A	1	1	A

List 3 — Equipment required in addition to list 1 or 6 to provide one equalizer for equalizing cable over 450 feet.

	WIRE	EQUIP	NOTES
Bank Terminating Ckt, SD-97083-01, Fig. B	1	1	A

List 4 — Equipment required in addition to list 1 or 6 to provide a 6-dB pad for cables up to 150 feet per SD-97083-01, Fig. C.

	WIRE	EQUIP	NOTES
Pad Assembly ED-97079-30, G1	1	1	A

List 6 — Assembly, wiring, and equipment required for a bank terminating assembly for use on duct-type framework.

	WIRE	EQUIP	NOTES
Bank Terminating Ckt, SD-97083-01, Fig. 1	12	12	

Note

A. Equalizers or pads shall be specified by the telephone company to meet office requirements.

J98710D — A&M Only — Fuse and Alarm Panel for Use With 201-Type Office Repeater Bay

Equipment — J98710D-()

List 1 — Assembly, wiring, and equipment required for one fuse and alarm panel per SD-97084-01, Fig. 2 and 3 (six circuits maximum). (See Note A.)

Note

A. Fuses F1A through F3A, F6A through F8A, F1B through F3B, F6B through F8B, F1C through F3C, and F6C through F8C, all inclusive, shall be furnished with 72A dummy fuses.

J98710E — AT&TCo Standard — Order-Wire Panel

Equipment — J98710E-()

List 1 — Framework required for order-wire panels (two maximum).

List 3 — Assembly, wiring, and equipment required for a pair of coupling capacitors per SD-97085-01, Fig. 4.

List 4 — Assembly, wiring, and equipment required for a pair of bridging capacitors and a pair of coupling capacitors per SD-97085-01, Fig. 5.

List 6 — Assembly, wiring, and equipment required for one order-wire panel per SD-97085-01, Fig. 4 and 7.

J98710F — AT&TCo Standard — Fault Locating Set

Equipment — J98710F-()

List 2 — Assembly, wiring, and equipment required for one fault locating set per SD-97078-02, Fig. 1 (see Note A).

Note

A. Coded plug-in networks and filters required with each fault locating set are provided with list 2 as follows:

4068A Network per SD-97078-02, Fig. 2

4068B Network per SD-97078-02, Fig. 3

4068C Network per SD-97078-02, Fig. 4

639A Filter — BPF for 832, 928, 1048, and 1206 hertz

639B Filter — BPF for 1340, 1508, 1722, and 2008 hertz

639C Filter — BPF for 2193, 2413, 2680 and 3017 hertz

J98710G — AT&TCo Standard — Error Detecting Set

Equipment — J98710G-()

List 2 — Assembly, wiring, and equipment required for one error detecting set per SD-97086-02, Fig. 1.

J98710H — AT&TCo Standard — Repeater Test Set

Equipment — J98710H-()

List 1 — Assembly, wiring, and equipment required for one repeater test set per SD-97092-01, Fig. 1 and 2.

J98710J — AT&TCo Standard — 11-Foot 6-Inch 206-Type Office Repeater Bay (See Notes 5.03 and 5.04)

Equipment — J98710J-()

List 1 — Framework, wiring, and equipment required for one shop-wired office repeater bay using 11-foot 6-inch by 26-3/8 inch unequal flange cable-duct type framework, and arranged to accommodate up to seventy-eight 206-type office repeaters and associated circuits per SD-97080-02.

	WIRE	EQUIP	NOTES
Order-Wire Plate J98710E-(), L1		1	
Fault Locating Panel P-43L654		2	
Fault Locating Jack Ckt, SD-97080-02, Fig. 12	6	6	
Power Distributing Ckt Panel ED-3C009-30, G1 and Connected per SD-97080-02, Fig. 8	6	6	
Jack Mounting Panel ED-3C119-30, G1		1	
Repeater Shelf Equipped With Jacks and Wiring for 13 Positions per SD-97080-02, Fig. 1	6	6	
Span Cross-Connect Field ED-97442-50, G1 and Connected per SD-97080-02, Fig. 1	1	1	
130-Volt Regulated Power Dissipation Shelf Equipped With Jacks and Wiring per SD-97080-02, Fig. 7	6	6	
Fuse and Alarm Panel ED-97443-30, G1 and Connected per SD-97080-02, Fig. 10	1	1	
Test Set Power Jack Ckt, SD-97080-02, Fig. 11	1	1	

	WIRE	EQUIP	NOTES
Order Wire Lamp and Jack Ckt, SD-97080-02, Fig. 14	4	4	
Telephone Set Panel J68769AJ-(), L1 Plus P-35B612 Adapters per SD-97080-02, Fig. 16	1	1	
Unequal Flange Cable-Duct Type Framework ED-97170-50, G3, G17, and G25 (11 feet 6 inches by 26-3/8 inches with 1-3/4 inch mounting plate centers)		1	
Interbay Cable Duct ED-97230-50, G2		1	

List 2 — Assembly, wiring, and equipment required in addition to list 1 to provide one quasi random signal source per SD-97080-02, Fig. 23, 24, 25, and 107.

J98710K — AT&TCo Standard — 9-Foot 206-Type Office Repeater Bay (See Notes 5.03 and 5.04)

Equipment — J98710K-()

List 1 — Framework, wiring, and equipment required for one shop-wired office repeater bay using 9-foot by 26-3/8 inch unequal flange cable-duct type framework, and arranged to accommodate up to fifty-two 206-type office repeaters and associated circuits per SD-97080-02.

	WIRE	EQUIP	NOTES
Interbay Cable Duct ED-97230-50, G2		1	
Order-Wire Plate J98710E-(), L1		1	
Fault Locating Panel P-43L654		1	
130-volt Regulating Power Dissipation Shelf Equipped With Jacks and Wiring per SD-97080-02, Fig. 7	4	4	
Power Distributing Ckt Panel ED-3C009-30, G1 and Connected per SD-97080-02, Fig. 8	4	4	
Test Set Power Jack Ckt, SD-97080-02, Fig. 11	1	1	

	WIRE	EQUIP	NOTES
Fault Locating Jack Ckt, SD-97080-02, Fig. 12	3	3	
Order Wire Lamp and Jack Ckt, SD-97080-02, Fig. 14	2	2	
Telephone Set Panel J68769AJ-(), L1 Plus P-35B612 Adapters per SD-97080-02, Fig. 16	1	1	
Unequal Flange Cable-Duct Type Framework, SD-97170-50, G4, G17, and G25 (9 feet by 26-3/8 inches with 1-3/4 inch mounting plate centers)		1	
Jack Mounting Panel ED-3C119-30, G2		1	

List 2 — Assembly, wiring, and equipment required in addition to list 1 to provide one quasi random signal source per SD-97080-02, Fig. 23, 24, 25, and 107.

J98710L — *AT&TCo Standard* — 7-Foot 201-Type Office Repeater Bay (See Notes 5.03 and 5.04)

Equipment — J98710L-()

List 1 — Framework, wiring, and equipment required for one shop-wired office repeater bay using 7-foot by 26-inch unequal flange cable-duct framework, and arranged to accommodate up to fifty-two 206-type office repeaters and associated circuits per SD-97080-02.

	WIRE	EQUIP	NOTES
Jack Mounting Panel ED-3C119-30, G2		1	
Unequal Flange Cable-Duct Type Framework ED-97162-51, G2 (7 feet by 26 inches with 1-3/4 inch mounting plate centers). (Front and rear guard- rail covers must be ordered separately. See ED-97162-51, G7 and G9 for electronic switch- ing system, G10 and G13 for all others.)		1	
Interbay Cable Duct P-43L177 and P-43L180		1	
Fault Locating Panel P-43L654		1	

	WIRE	EQUIP	NOTES
Fault Locating Jack Ckt, SD-97080-02, Fig. 12	3	3	
Repeater Shelf Equipped With Jacks and Wiring for 13 Posi- tions per SD-97080-02, Fig. 1	4	4	
Span Cross-Connect Field ED-97442-50, G1 and Connected per SD-97080-02, Fig. 1	1	1	
130-Volt Regulating Power Dissipation Shelf Equipped With Jacks and Wiring per SD-97080-02, Fig. 7	4	4	
Power Distributing Ckt Panel ED-3C009-30, G1 and Connected per SD-97080-02, Fig. 8	4	4	
Fuse and Alarm Panel ED-97443-30, G2 and Connected per SD-97080-02, Fig. 10	1	1	
Test Set Power Jack Ckt, SD-97080-02, Fig. 11	1	1	
Order Wire Lamp and Jack Ckt, SD-97080-02, Fig. 14	2	2	
Telephone Set Panel J68769AJ-(), L1 Plus P-35B612 Adapters per SD-97080-02, Fig. 16	1	1	

J98710M — *AT&TCo Standard* — 130-Volt Regulated Power Dissipation Unit for Use With 206-Type Office Repeater Bay

Equipment — J98710M-()

List 1 — Assembly, wiring, and equipment required for one 130-volt regulated power dissipation unit per SD-97080-02, Fig. 7 (see Note A).

Note

A. This plug-in unit should be ordered as required (see Note 5.03).

J98710N —

J98710P — *AT&TCo Standard* — T1 Line Error Detector

Equipment — J98710P-()

List 1 — Assembly, wiring, and equipment required for a T1 line error detector per SD-3C092-01 (see Note A).

Note

A. The T1 line error detector is powered by 4 penlight batteries which should be ordered separately. They are Eveready type penlight batteries, or equivalent.

J98710R — AT&TCo Standard — T1 Quasi Random Signal Source

Equipment — J98710R-()

List 1 — Assembly, wiring, and equipment required for T1 quasi random signal source per SD-3C097-01.

	WIRE	EQUIP	NOTES
ED-3C342-() Word Generator Plug-in Unit		1	
ED-3C343-() Power and Clock Plug-in Unit		1	

J98710S — AT&TCo Standard — Span Fault Locator

Equipment — J98710S-()

List 1 — Assembly, wiring, and equipment required for one span fault locator per SD-3C096-01.

5. GENERAL NOTES

5.01 The information for powering repeater spans is shown on the T1 carrier application schematics SD-97080-01 and SD-97080-02. Based upon this information, the telephone company will provide the installation department with the proper strapping procedures.

5.02 Information on the equalization of cables between the repeater bay and the D1 bank bays is covered in Specification J98711 (801-438-151).

5.03 Table D lists the associated apparatus and equipment which must be ordered separately as required for the 206-type office repeater bays.

**TABLE D
APPARATUS AND EQUIPMENT FOR 206-TYPE OFFICE REPEATER BAYS**

MAXIMUM QUANTITY FOR J98710		DESCRIPTION
J	K OR L	
4	2	order-wire and/or capacitor panels per J98710E-(), List 3, 4, or 6 and connected per SD-97080-02, Fig. 15
1	1	bay cross-connect field per ED-97442-50, Group 2
6	3	598-type filter connected per SD-97080-02, Fig. 13
75	50	206A, B, or D repeaters, or combinations per SD-97095-01, Fig. 1 plus 2, 3, or 5
3	2	206C repeaters per SD-97095-01, Fig. 4
75	50	836-type LBO networks for use in 206A, B or D repeaters (one per repeater)
6	4	130-volt regulated power dissipation units per J98710M-(), List 1 and connected per SD-97080-02, Fig. 7
*	*	175A adapter

* A minimum of one per office is recommended.

5.04 The protective covers which were initially ordered separately have been included in the standard offerings for the D1 bank bays and the new repeater bays. If older bays have been ordered without separately ordered protective covers, or if covers are not available for existing bays, they should be ordered per ED-3C111-50. When ordering the following bays, or later-coded bays, the covers need *not* be ordered separately.

J98710J-1, List 1B
 J98710K-1, List 1B
 J98710L-1, List 1B
 J98711A-2, List 9
 J98711B-2, List 9
 J98711C-1, List 9

LIST OF A&M ONLY AND MFR DISC. EQUIPMENT

The following equipment has been replaced as indicated. Where A&M Only items appear,

the issue numbers shown are those in which the rating was first applied.

EQUIPMENT	RATING	DETAILS LAST SHOWN IN ISSUE	REPLACING EQUIPMENT
ED-97074-30	A&M Only	2	—
ED-97078-50	A&M Only	2	—
ED-97117-30	A&M Only	2	—
ED-97185-50	A&M Only	2	—
J98710A	A&M Only	2	—
L2 and L3	Mfr Disc.	1	—
J98710B	A&M Only	2	—
J98710C	A&M Only	2	—
L5	Mfr Disc.	1	—
J98710D	A&M Only	2	—
J98710E, L2	Mfr Disc.	1	J98710E, L6
L5	Mfr Disc.	2	—
J98710F, L1	Mfr Disc.	1	J98710F, L2
J98710G, L1	Mfr Disc.	2	J98710G, L2

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