

INCOMING SELECTOR TEST FRAME CROSS CONNECTIONS PANEL OFFICES

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			to the test circuit connector sequence switches, three test selectors per sequence switch.
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1. GENERAL			
1.01	This section describes the method of assigning cross connections on the incoming selector test frame per SD-20042-01 and ES-239810. Information is given regarding the functions of the various connections and the method of determining the proper cross connections to be made in order to apply the tests required for each trunk group. Since the two test circuits are somewhat different, they are treated separately herein. In addition to the assignment information, the section contains a general method of procedure.		
1.02	This section is reissued to provide cross-connection information for testing trunks to No. 1 ESS.		
1.03	The test circuit obtains access to the various incoming trunk circuits appearing on the district and office multiple trunk groups by means of "test selectors" located on the various district and office frames. The test selectors are cabled		
			1.05 Test selectors are assigned on the district and office frames so that access can be had to any outgoing panel or crossbar trunk in the multiple. No attempt is made in assigning test selectors to provide means in assigning test selectors to provide means for testing all multiple wiring if that arrangement requires additional selectors.
			1.06 The test frame applies the same test to all trunks associated with a particular terminal on a directing selector. Varying conditions may exist on the different trunks within a trunk group due to different types of A or L relays, repeating incoming selectors with or without shunts around the L relay in the incoming advance position, and wide variations in conductor loop resistance due to different trunk routings. Consideration therefore

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is given to these conditions when trunks are being assigned to layers on the district of office multiple. Trunks having different requirements are normally assigned to separate layers. Where the capacity of the frame permits, different terminals on the directing selectors shall be assigned to each of these layers.

1.07 When testing through graded multiple, it is often possible to avoid retesting of common trunks by means of cross connections. Thus if the trunk group to a particular unit consists of two or more groups of ten terminals each on the district multiple, one or more of the groups may consist entirely of common trunks so that the test selector may be restored after testing the groups containing individual trunks, except for one appearance of the common trunks. This item should be given careful consideration when planning test frame cross connections since the amount of duplicate testing done has an important effect on the capacity of the test frame.

2. APPARATUS

- 2.01** Tools and materials as required for connecting and soldering cross connections.
- 2.02** C type 22-gauge switchboard wire as required.
- 2.03** 22-gauge bare tinned copper wire (P314952).

3. PREPARATION

3.01 The various data required for the preparation of the cross-connection assignments are covered in the following paragraphs. For test frame per SD-20042-01, drawing T-20042-16 may be used for preparing the assignment lists.

3.02 Obtain copies of the latest issues of the drawings covering the multiple arrangements of the district, office and A position district multiples involved.

3.03 Ascertain from the traffic schematic drawing or incoming selector test frame specification the list of incoming test selector assignments on the district, office, and A position district frames in the order of their appearance on the connector switches of the incoming selector test frame, and note the same on the multiple drawings involved.

3.04 Cross connections are not required for the L relay operate test, the L relay nonoperate test and the A relay operate test (SD-20042-01), or compensating resistance (ES-239810) when the trunk group is to be tested for continuity and polarity only.

3.05 From the outgoing trunk cross connections record prepare a list of the various incoming frame numbers in each terminating dial office on which assignments have been made.

3.06 Ascertain for each frame listed, the code of L and A relays installed for each type of selector and whether the A relay winding is connected to 24 to 48 volts, and the maximum external trunk supervisory loop as shown on the circuit drawing for each type of incoming selector. In the case of ground cutoff repeating incoming selectors, ascertain whether or not the L relay winding is shunted by 284 ohms in the incoming advance position. Also ascertain for each terminating office whether the test line circuits are of the synchronous or nonsynchronous type.

3.07 Obtain, from the cable assignment records, the cable loop resistance measurements to each terminating dial office over the actual cables involved in the trunk routings. If more than one cable routing is used for trunks within a trunk group obtain loop measurements over each routing. In addition, determine the value of any compensating resistances connected to the tip and ring sides of the loop at the incoming trunk circuit.

3.08 Using the multiple drawings and the assigned test selectors, prepare, in tabular form, the following information:

ITEM	EXAMPLE
(a) Test Selector Frame and Selector Number	D301/1
(b) Test Selector Assignment	Inc. Test Sel. 1
(c) Office Code of Trunk Group Tested	236
(d) Frames in Subgroup Tested	D301, 302, 303, 304
(e) Brush Selection	0
(f) Group Selection and Number of Layers in Group To Be Tested	0 - 4
(g) Grading of Multiple Layers Involved (Number of Individual, Convertible and Common Trunks)	25 Ind. 5 Conv. 10 Com.
(h) Code of L Relay, and Type of Incoming Circuit (2- or 3-Wire, Repeating with Shunt, Repeating without Shunt, etc)	
(i) Code and Operating Voltage of A Relay	B144-24 Volts
(j) Maximum External Trunk Supervisory Loop (from Circuit Drawing)	1920

3.09 Tabulate Items (c) to (l), inclusive for all trunk subgroups terminating in dial offices which are accessible to test selector 1 before proceeding with the data for test selector 2.

3.10 Whenever a subgroup of trunks may be tested by more than one test selector, use the test selector located on the frame farthest away electrically from the cable frame of the subgroup in order to check in so far as possible the continuity of the multiple. Do not use the other test selectors on this subgroup, as this would merely result in unnecessary duplication of testing. With test frame per ES-239810, all trunk subgroups to which any test selector has access must be tested in consecutive order by that selector before using the next test selector. It is not possible to arrange to test all subgroups of trunks to a given office using different test selectors and then reuse the test selectors to test subgroups of trunks to another office.

4. ASSIGNMENT OF CROSS CONNECTIONS FOR TEST FRAME PER SD-20042-01

4.01 Using the tabulated data prepared as outlined in Part 3, enter on the assignment sheet the various cross connections required.

4.02 Two different methods may be considered in assigning directing selector terminals:

(a) The terminals may be assigned so that all trunks to a dial office shall be tested before passing to trunks to another dial office. This method makes possible a test of all the trunks to a particular office with one setting of the frame without including trunks to other offices.

(b) The terminals may be assigned to test all of the trunks available to one test selector before passing to another test selector. This reduces the time lost while the test frame waits for test selectors, busy on service calls, to become idle and may therefore considerably reduce the time to complete a test cycle of all the trunks. In assigning directing selector control points with this method, it is advisable, if possible, to allow for spare control points on each test selector if the multiple tested by that selector contains assignments which are possible future dial office assignments or future additional individual trunk assignments that may have different types of A or L relays.

4.03 If groups of trunks to two or more dial offices appear on consecutive layers of the district or office multiple they may be assigned to a single terminal on the directing selector provided they have the same cross-connection requirements for L relay operate, L relay nonoperate, A relay operate, and type of test line.

4.04 The test frame is equipped with one or more pairs of 206-typeselectors known as directing selectors. The bank terminals of each directing selector are wired to terminal punchings for cross-connection purposes as required to direct the test connectors and the district or office test selectors and to control various test conditions. In addition, contacts of the BL and BC keys are wired to terminal punchings for cross-connection purposes as required to direct the incoming trunk under test to a test line or to a busy line. The various functions controlled by these terminals are listed below and the method of cross connection is covered in paragraphs which follow.

- (a) Directing selector control.
- (b) Test selector brush selection.
- (c) Test selector group selection.
- (d) Type of incoming trunk.
- (e) Differentiation between types of test lines and between types of connecting test selectors.
- (f) Connector control.
- (g) Overflow count (end of test group).
- (h) Compensating resistance:
 - L relay operate test
 - L relay nonoperate test
 - A relay operate test
- (i) Incoming and final selections for test line test and busy line test.

Directing Selector Control (D SWS and KYS)

4.05 Cross-connect the D SWS terminals 1 through 20 of each directing selector to the corresponding KYS terminal when the directing

selector position is used for testing a group of trunks (Fig. 1). When the directing selector position is vacant cross-connect to terminal IR. For intermediate end of cycle, if on terminals 1 through 20, inclusive, cross-connect to the corresponding KYS terminal; if on terminal 21, cross-connect to terminal IEC (terminal 21 on the KYS block).

Note: An intermediate end of cycle signal is usually provided when two test frames are installed in an office or in a multiunit building with a common district and office multiple, and is located at a point where approximately one-half the incoming trunks have been tested. In this case a cross connection is also required as covered in 4.09(g).

Test Selector Brush Selection (BR and CR)

4.06 Brush selection to direct the test selector to the bank in which the group of trunks to be tested is located is controlled by cross-connecting the BR terminals to the CR terminals as required (Fig. 2). Cross-connect the BR terminals as required to the terminals for counting relays corresponding to the bank in which the group of trunks to be tested is located. Omit cross connections on vacant positions.

Test Selector Group Selection (GR and TLS)

4.07 Group selection to direct the test selector to the bank group at which the test of the trunk group is to start is controlled by cross-connecting the GR terminals to the TLS terminals as required (Fig. 3). Cross-connect the GR terminals as required to the TLS terminals corresponding to the bank group where the particular trunk group test is to start. If the directing selector terminal is to be used for testing groups of trunks to two or more offices, the GR terminal should be cross-connected to direct the test selector to the lowest group of the combined groups. Omit cross connections on vacant positions.

Type of Incoming Trunk (TYPE and TF)

4.08 Cross-connect the TYPE terminals (Fig. 4) as follows:

- (a) Cross-connect to terminal LI for testing 3-wire local incoming selectors.

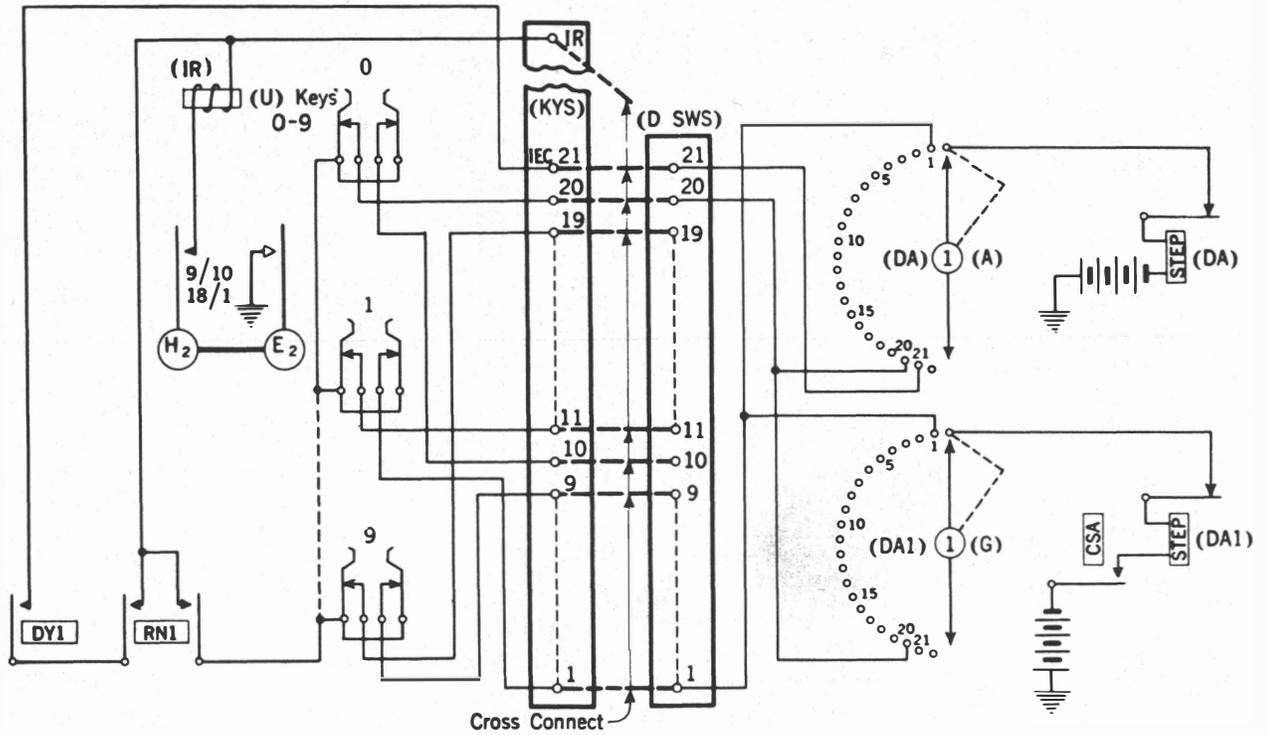


Fig. 1—Directing Selector Control—Test Frame SD-20042-01

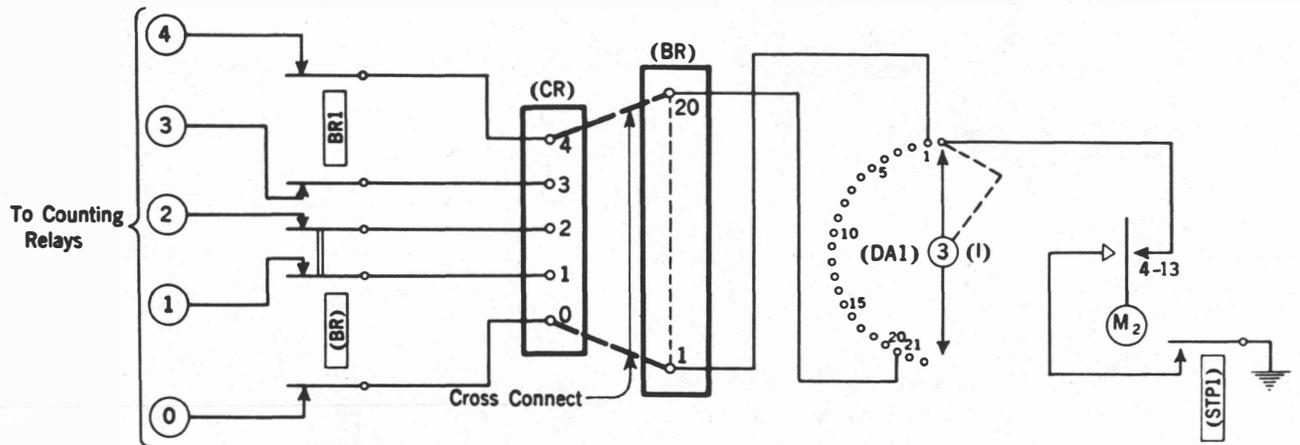


Fig. 2—Test Selector Brush Selection—Test Frame SD-20042-01

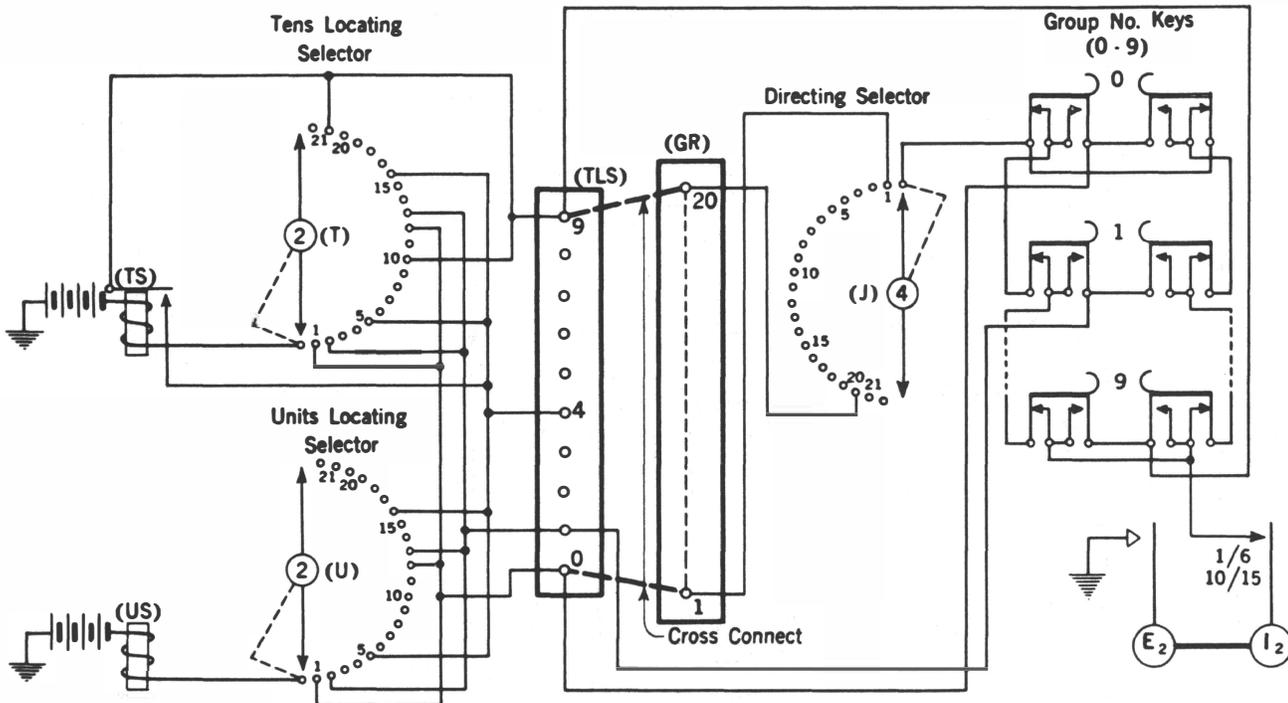


Fig. 3—Test Selector Group Selection—Test Frame SD-20042-01

- (b) Cross-connect to terminal TF for testing incoming selectors that have 24 volts on the A relay.
- (c) Cross-connect to terminal XB, if provided, for testing trunks to crossbar offices.
- (d) Cross-connect to terminal SCL, if provided, for testing repeating incoming selectors used with trunks having a loop resistance of less than 1000 ohms.
- (e) Cross-connect to terminal XBT, if provided, for testing trunks to crossbar tandem or panel sender tandem.
- (f) Omit cross connections for all other types of incoming trunks.

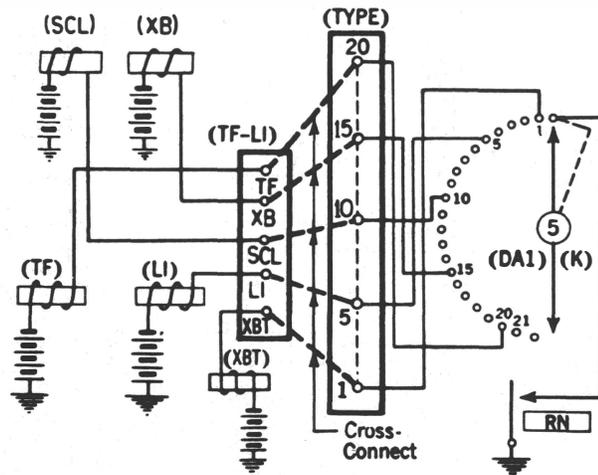


Fig. 4—Type of Incoming Trunk Test Frame SD-20042-01

Busy Ground (BUSY GRD)

4.09 The BUSY GRD terminals serve to control certain test operations depending upon the type of test line and upon the type of the connecting

test selector used in the test (Fig. 5). Cross-connect the BUSY GRD terminals as follows:

- (a) Cross-connect to terminal TL when the test selector is a subscriber district of the rotary

link type and the test lines are of the nonsynchronizing type.

- (b) Cross-connect to terminal TLR when the test selector is a subscriber district of the sender selector type, a tandem district selector, or a 2- or 3-wire office selector, and the test lines are of the nonsynchronizing type.
- (c) Cross-connect to terminal R when the test selector is a subscriber district of the sender selector type, a tandem district selector or a 2- or 3-wire office selector, and the test lines are of the synchronizing type.
- (d) Cross-connect to terminal AE when the test selector is a subscriber district of the panel link type and the test lines are of the synchronizing type.
- (e) Cross-connect to terminal AF when the test selector is a subscriber district of the panel link type and the test lines are of the nonsynchronizing type.
- (f) Omit cross connections where the test selectors are subscriber districts of the rotary link type and the test lines are of the synchronizing type, also omit cross connections on spare terminals.
- (g) Cross-connect terminal EC to the intermediate end of cycle point, if any. Where the intermediate end of cycle point is terminal 21 of a directing selector connect BUSY GRD terminal 21 to the EC terminal. Disconnect E wiring and connect J wiring. This wiring can be removed most conveniently at the winding of the relay associated with the directing selector.

Connector Control (CC and CONN SW)

- 4.10** Each connector switch is designed to care for three test selectors and is moved to the position of testing for a busy condition of the test selector as soon as the directing selector has been set (Fig. 6). This operation is controlled by the CC terminals.
- 4.11** Cross-connect the CC terminals of all directing selector positions which require the same test selector, to the CONN SW terminals of the connector sequence switch position associated with that test selector.

End of Test Group (END OF GRP and ULS)

- 4.12** The END OF GRP terminals serve to control the point at which the district or office test selector is to be restored to normal (Fig. 7). The test selector shall be restored to normal after the last incoming circuit in the trunk group under test has been tested. If the directing selector terminal is to be used for testing groups of trunks to two or more offices, the END OF GRP terminal shall be cross-connected to restore the test selector after testing the last incoming selector in the highest trunk group of the combined groups.
- 4.13** Cross-connect the END OF GRP terminal to ULS terminal 1 if the trunk group under test ends at the overflow terminal of bank group 0, to ULS terminal 2 if the trunk group under test ends at the end of bank group 1, etc.

L Relay Operate Test (L REL OPR and R2) See 3.04

- 4.14** The L REL OPR terminals of the directing selector serve to control the compensating resistance for the L-type relay operate test (Fig. 8).
- 4.15** The R2 terminal to which the cross connections should be made for the test of a trunk group may be determined from Table A, with the following exceptions:

All revertive pulse type trunks equipped with carrier; these are covered in 4.16.

Ground cutoff incomings modified for use in the presence of induced ac voltages; these are covered in 4.17 and 4.18.

In all other cases ascertain whether the test frame has N or M wiring and use the part of Table A that applies to the particular test frame. Determine from trunk records the maximum trunk resistance (trunk loop plus incoming trunk compensating resistance) in the trunk group. Locate the range in which the resistance falls in the Resistance of Maximum Trunk Loop column for the type of incoming selector involved. Cross-connect to the corresponding terminal.

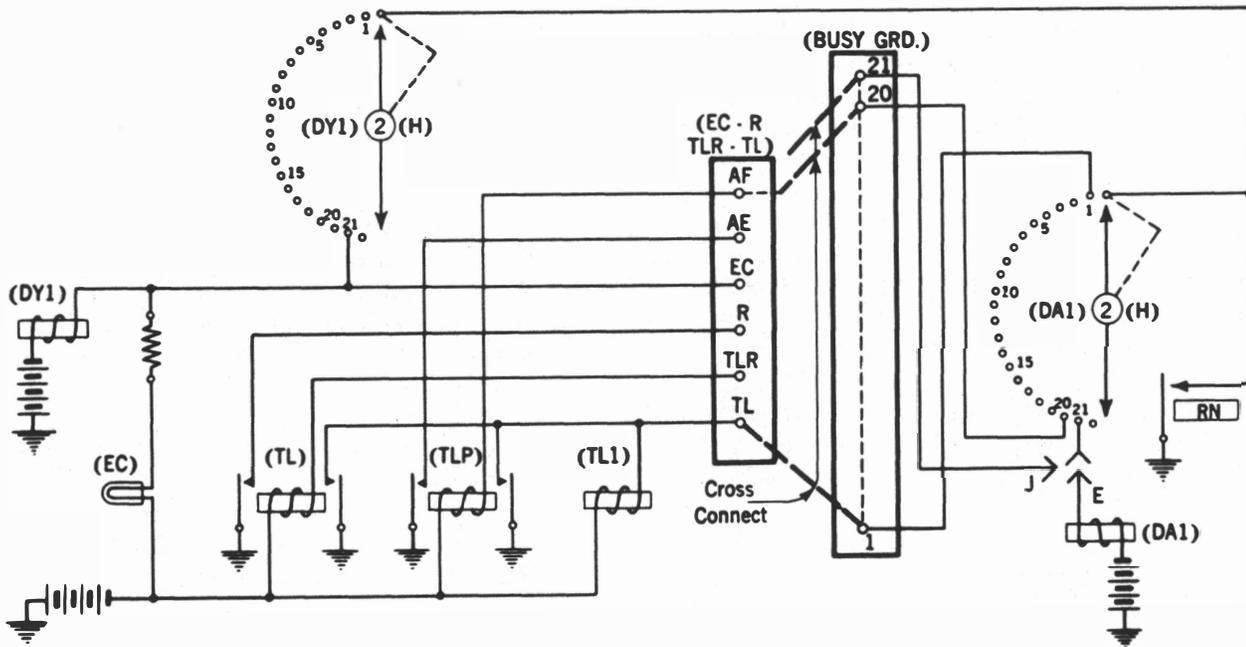


Fig. 5—Type of Test Selector and Type of Test Line—Test Frame SD-20042-01

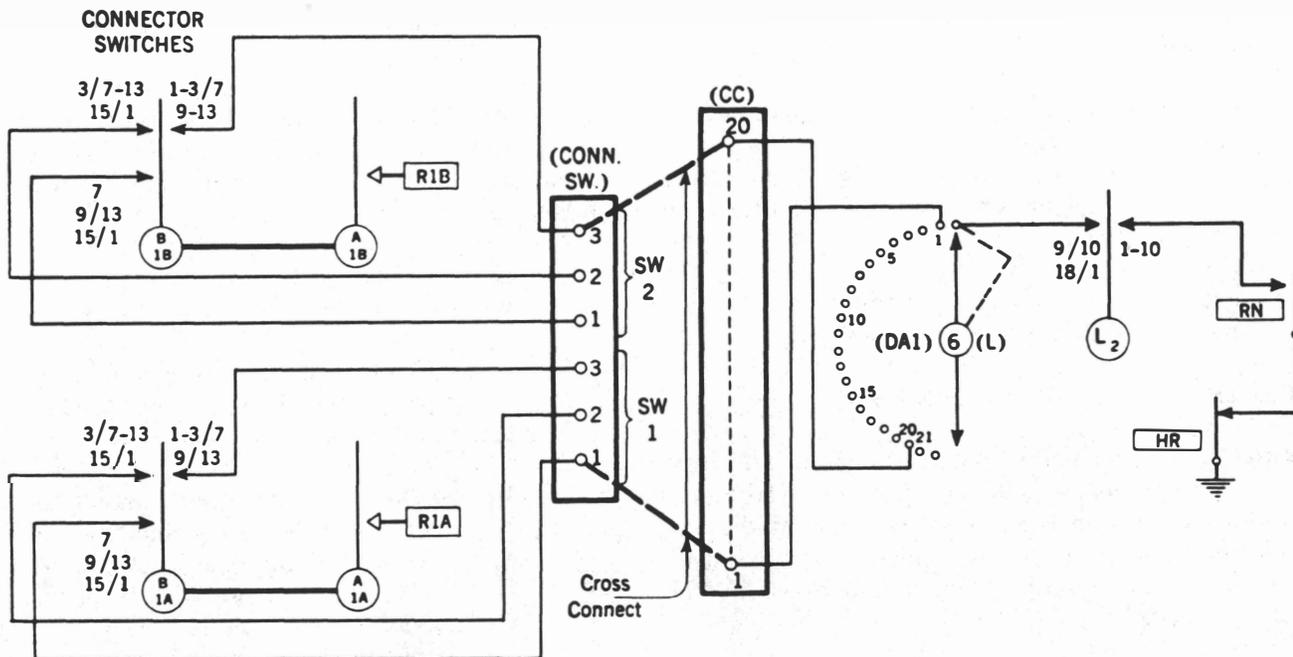


Fig. 6—Connector Control—Test Frame SD-20042-01

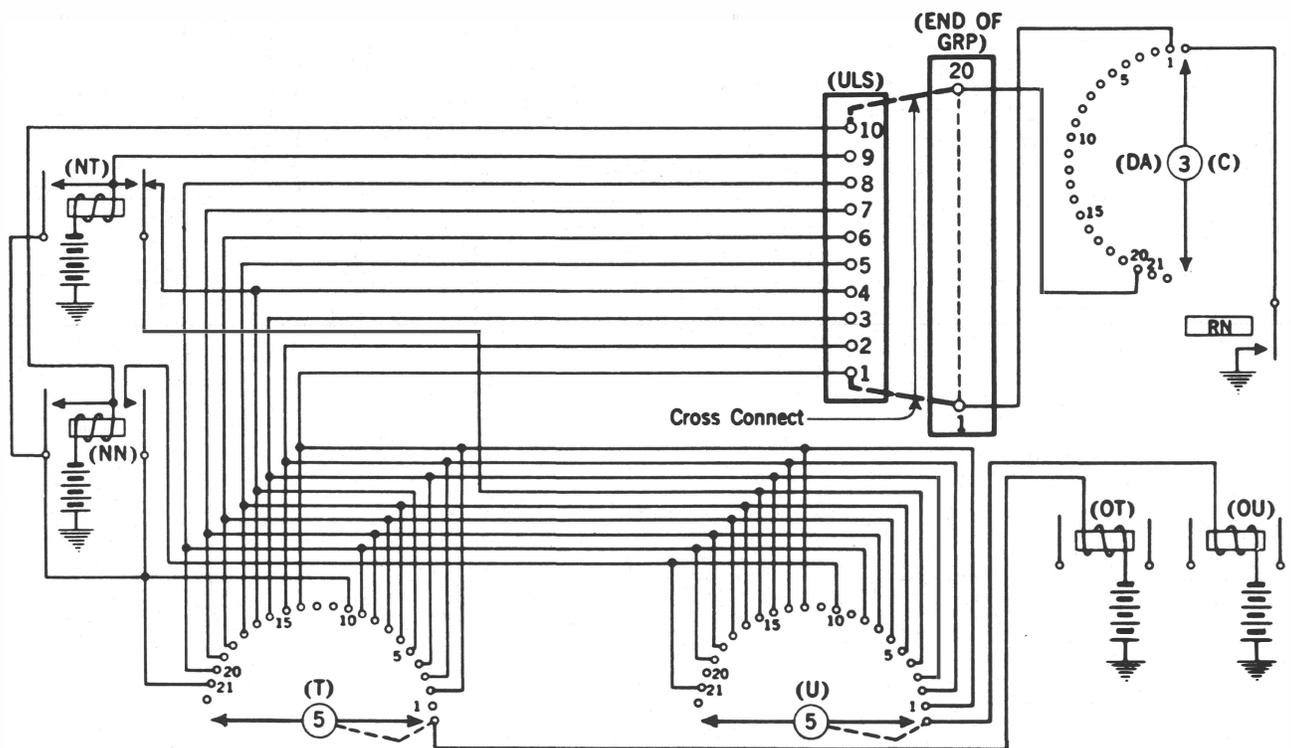


Fig. 7—End of Test Group—Test Frame SD-20042-01

4.16 When testing revertive pulse trunks equipped with carrier, cross-connect to the R2 terminal block as follows:

N wiring—terminal 0

M wiring—terminal 1

4.17 If the ground cutoff repeating incoming circuits have been modified to care for induced ac voltages on the conductors, Table A should not be used. Instead, tables shown on the circuit drawings should be consulted. These tables show Conductor Loop Resistance for different values of induced ac voltages. The particular table to be used will be determined by the type of modification in use on the incoming selectors in question. Determine from these tables the maximum conductor loop resistance allowable for the group of trunks to be tested. Subtract from this the cable resistance of the maximum trunk loop in the trunk group (including any compensating resistance used in the incoming trunk circuit).

4.18 Cross-connect the L REL OPR terminal to the terminal on the R2 block which provides

resistance ($\pm 1\%$) as near as possible to but not above the value computed in 4.17. See Table B.

L Relay Nonoperate Test (L REL NO and R1) See 3.04

4.19 The L REL NO terminals serve to control the compensating resistance for the L relay nonoperate test (Fig. 9).

4.20 When testing revertive pulse trunks equipped with carrier, cross-connect the R1 terminal block as follows:

Crossbar trunks—Follow instructions in Note 1 of Table C.

◆No. 1 ESS trunks—connect to terminal 19.◆

Panel trunks—connect to terminal 18 if provided, otherwise to terminal 15.

For all other types of trunks, follow the procedures in 4.21 through 4.23.

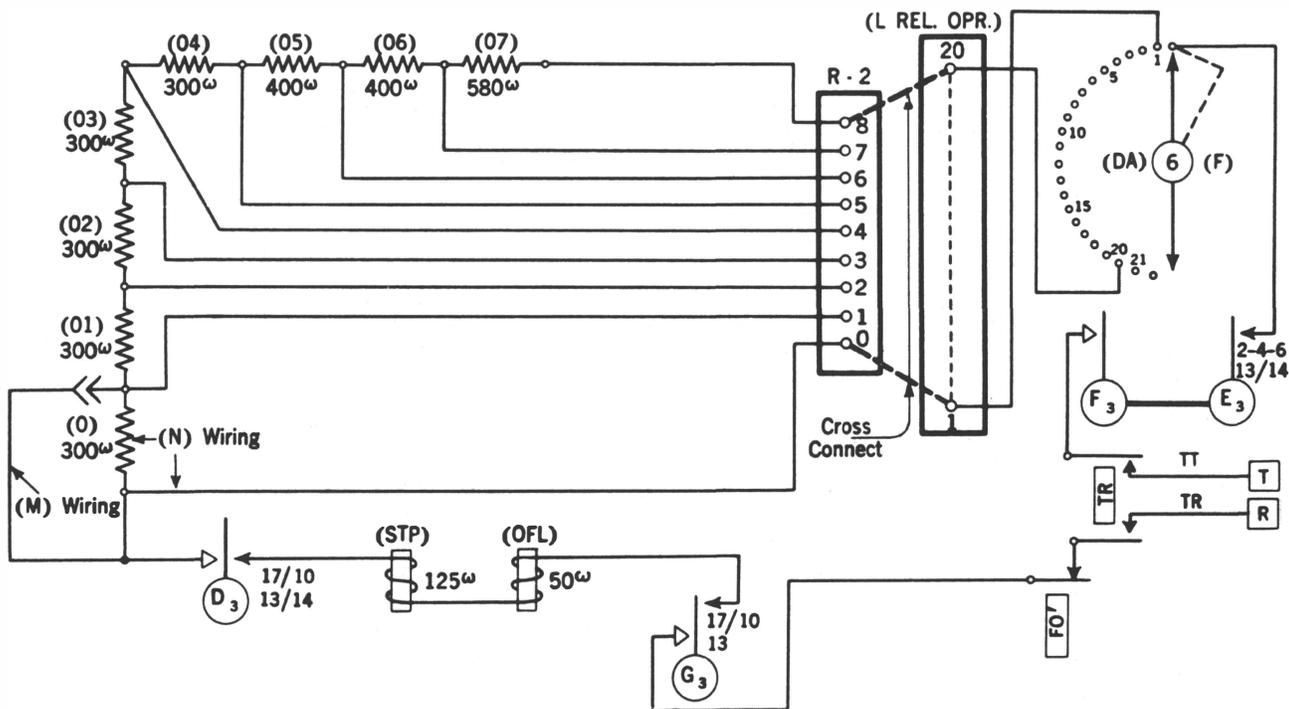


Fig. 8—L Relay Operate Test—Test Frame SD-20042-01

4.21 The R1 terminal to which the cross connection should be made for the test of a trunk group may be determined from Table C. Determine from trunk records the minimum trunk resistance in the trunk group. For trunk groups to ground cutoff panel offices and those trunk groups served by balanced incoming selectors in the battery cutoff offices this resistance should include the conductor loop resistance and the incoming selector compensating resistance; for other trunk groups to battery cutoff panel offices the conductor loop resistance only should be considered. See Notes 1, 2, and 3 in Table C.

4.22 Locate the range in which this resistance falls in the Resistance of Minimum Trunk Loop column for the type of incoming selector involved. Cross-connect to corresponding R1 terminal. Treat mixed trunk groups of long-range balanced with long-range and/or short-range selectors as if they contained only long-range balanced selectors. Treat mixed groups of long-range and short-range selectors as if they contained only long-range selectors. For trunk groups to crossbar offices see Note 1 of Table C.

4.23 When ground cutoff incoming selectors which have been modified with the 280-type relay are used, they shall be considered in Table C under the heading "Repeating with L Relay Shunt in Incoming Advance."

A Relay Operate Test (A REL OPR and R1) See 3.04

4.24 The A REL OPR terminals serve to control the compensating resistance for the A relay operate test (Fig. 10).

4.25 When testing revertive pulse trunks equipped with carrier, cross-connect to terminal 1 on R1 terminal block. For all other types of trunks follow the procedures in 4.26 through 4.29.

4.26 The resistance to be connected in the test frame for the A relay operate test for all incoming trunks, except 3-wire panel incoming selectors, should be such that when added to the resistance of the trunk loop, the total resistance will be near to, but not greater than the maximum external trunk supervisory loop as shown on the circuit drawing for the incoming trunk. For other than 3-wire panel incoming selectors the R1 terminal

TABLE A
L RELAY OPERATE
RESISTANCE OF MAXIMUM TRUNK LOOP

CONDUCTOR PLUS INCOMING SELECTOR COMPENSATING RESISTANCE						
PANEL GROUND CUTOFF		PANEL BATTERY CUTOFF (SEE NOTE)			CROSSBAR	
NONREPEATING	REPEATING (SEE 4-17 & 4-18)	SHORT RANGE (R132 L RELAY)	LONG RANGE (N3 L RELAY)	LONG RANGE BALANCED (N5 L RELAY)		R2 TER. "N" WRG.
1186-1300	1898-2010	1528-1640	2583-2700	2898-3200	901-2900	0
883-1185	1595-1897	1225-1527	2280-2582	2595-2897	603- 900	1
580- 882	1292-1594	922-1224	1977-2279	2292-2594	306- 602	2
277- 579	989-1291	619- 921	1674-1976	1989-2291	0- 305	3
0- 276	686- 988	316- 618	1371-1673	1686-1988		4
	282- 685 0- 281	0- 315	967-1370 563- 966 0- 562	1282-1685 878-1281 292- 877 0- 291		5 6 7 8
1186-1300	1898-2010	1528-1640	2583-2700	2898-3200	901-2900	"M" WRG. 1
883-1185	1595-1897	1225-1527	2280-2582	2595-2897	603- 900	2
580- 882	1292-1594	922-1224	1977-2279	2292-2594	306- 602	3
277- 579	989-1291	619- 921	1674-1976	1989-2291	0- 305	4
0- 276	585- 988	215- 618	1270-1673	1585-1988		5
	181- 584 0- 180	0- 214	866-1269 280- 865 0- 279	1181-1584 621-1180 0- 620		6 7 8
<p>Note: Treat trunk groups which are a mixture of short-range with long-range and/or long-range balanced selectors as if they contained only short-range selectors. Treat mixed groups of long-range and long-range balanced selectors as if they contained only long-range selectors.</p>						

to which the cross connection should be made may be determined as follows: Subtract the resistance of the maximum trunk loop, in the trunk group to be tested, from the circuit drawing value of the maximum external trunk supervisory loop. Determine the limits between which the result of the subtraction is located in the Computed Resistance column of

Table E. The cross connection should be made to the corresponding terminal in the terminal on R1 block column. For example, consider a group of trunks to a battery cutoff dial office. The circuit drawing, SD-21115-01, gives the maximum external trunk supervisory loop as 7200 ohms, trunk records give the maximum trunk loop resistance in the

TABLE C
L RELAY NONOPERATE
RESISTANCE OF MINIMUM TRUNK LOOP

CONDUCTOR RESISTANCE PLUS ANY INCOMING COMPENSATING RESISTANCE							R1 TERMINAL NOTE 5
GROUND CUTOFF SELECTORS				BATTERY CUTOFF SELECTORS (BALANCED)	BATTERY CUTOFF SELECTORS (OTHER)		
NONREPEATING WITH R638 L RELAY NOTE 2	NONREPEATING WITH E526 OR E375 L RELAY NOTE 2	REPEATING WITH L RELAY SHUNT IN INCOMING ADVANCE NOTES 3 & 4	REPEATING WITHOUT L RELAY SHUNT IN INCOMING ADVANCE NOTES 3 & 4	LONG RANGE BALANCED WITH N5 L RELAY	SHORT RANGE WITH R132 L RELAY	LONG RANGE WITH N3 L RELAY	
	981-1300 486- 980			2836-3200	1241-1640	2521-2700 2026-2520 1531-2025	1 2 3 4 5
1025-1300 530-1024 35- 529	0- 485	1939-2010 1444-1938 949-1443		2341-2835 1846-2340 1351-1845 856-1350 361- 855	746-1240 251- 745 0- 250	1036-1530 541-1035 46- 540 0- 45	6 7 8 9 10
0- 34		454- 948 0- 453		0- 360			11 12 13 14 15 (See Note 1)
			0-2010				16 17 18 (See Note 1)
NO. 1 ESS TRUNKS							19

Note 1: For trunks to crossbar offices where the XB terminal has been cross-connected at the TYPE terminal strip, omit the R1 cross connection. Where the XB terminal is not provided use terminal 18, if provided, otherwise use terminal 15.

Note 2: If R638 and E526 or E375 L relays are used in the same trunk group, use values for the R638 relay.

Note 3: If a trunk group includes ground cutoff incoming selectors with a shunt around the L relay and others without a shunt around the L relay, use values for those without a shunt.

Note 4: Where repeating incoming selectors with a trunk loop of less than 1000 ohms are to be tested see 4.08(d).

Note 5: For trunks to crossbar tandem or panel sender tandem offices where the XBT terminal has been cross-connected on the TYPE terminal strip, omit the R1 cross connection.

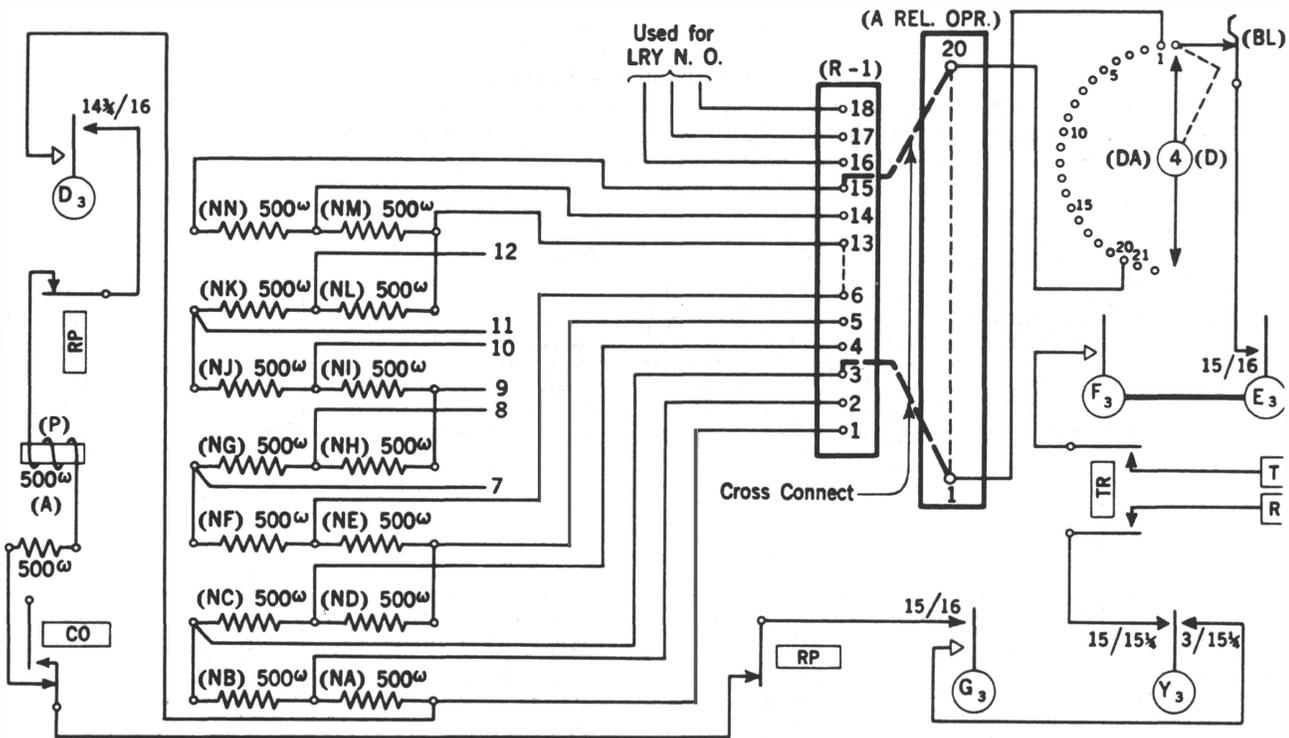


Fig. 10—A Relay Operate Test—Test Frame SD-20042-01

should be obtained from the circuit drawings of the incoming trunks included in the trunk group.

Note: If more than one type of A relay is used in the same trunk group use the one with the lowest maximum external supervisory loop for determining the resistance to be connected in the test frame.

4.29 Cross-connect the A REL OPR terminals to the terminals on the R1 block to provide resistance ($\pm 1\%$) as required by computations in 4.26 according to Table E.

Test Line Cross-Connections

4.30 To direct the test call to the first test line circuit, connect the BC terminals (IB, IG, FB, FT, FU) to the proper counting relay CR terminals (SO and 1 to 9) Fig. 11.

4.31 To direct the test call to the permanently busy test line, connect the BL terminals (IB-1, IG-1, FB-1, FT-1, FU-1) to the proper counting relay CR terminals (SO and 1 to 9) Fig. 11.

TABLE D

TYPE OF RELAY	VOLTAGE	MAX. EXTERNAL SUPERVISORY LOOP (FROM CKT. DWG.)	TYPE OF OFFICE
B71	24	1920	Ground Cutoff
B144	48	7540	Ground Cutoff
B144	48	6350	Ground Cutoff
B144	48	6080	Ground Cutoff
B144	48	5340	Ground Cutoff
B144	24	2380*	Ground Cutoff
B144	24	1920*	Ground Cutoff
B144	24	1875*	Ground Cutoff
B392	48	7540	Ground Cutoff
B403	48	7540	Ground Cutoff
B415	48	7540	Ground Cutoff
B415	48	6350	Ground Cutoff
B415	24	2380*	Ground Cutoff
B567	48	7200	Battery Cutoff
B608	48	6760	Crossbar
S523	48	7500	Crossbar
UA84	48	6200 #	Crossbar
AJ8	48	6200 #	Crossbar
	48	9200	No. 1 ESS

* Subtract 500 ohms before using for A relay operate computations.

For A relay operate computations subtract 500 ohms. In addition, for trunk groups to offices such as No. 5 crossbar, where the central office battery may drop momentarily to 47.5 volts or less subtract an additional 500 ohms.

TABLE E

COMPUTED RESISTANCE (SEE 4.21)

TERM. ON R1 BLOCK

0- 504	1
505-1009	2
1010-1514	3
1515-2019	4
2020-2524	5
2525-3029	6
3030-3534	7
3535-4039	8
4040-4544	9
4545-5049	10
5050-5554	11
5555-6059	12
6060-6564	13
6565-7069	14
7070 & Higher	15

Note: For 3-wire incomings connect to R1 terminal 3 (1000 ohms)

Capacity (CAP-C)

4.32 Unless specified locally, cross connections for capacity test are omitted.

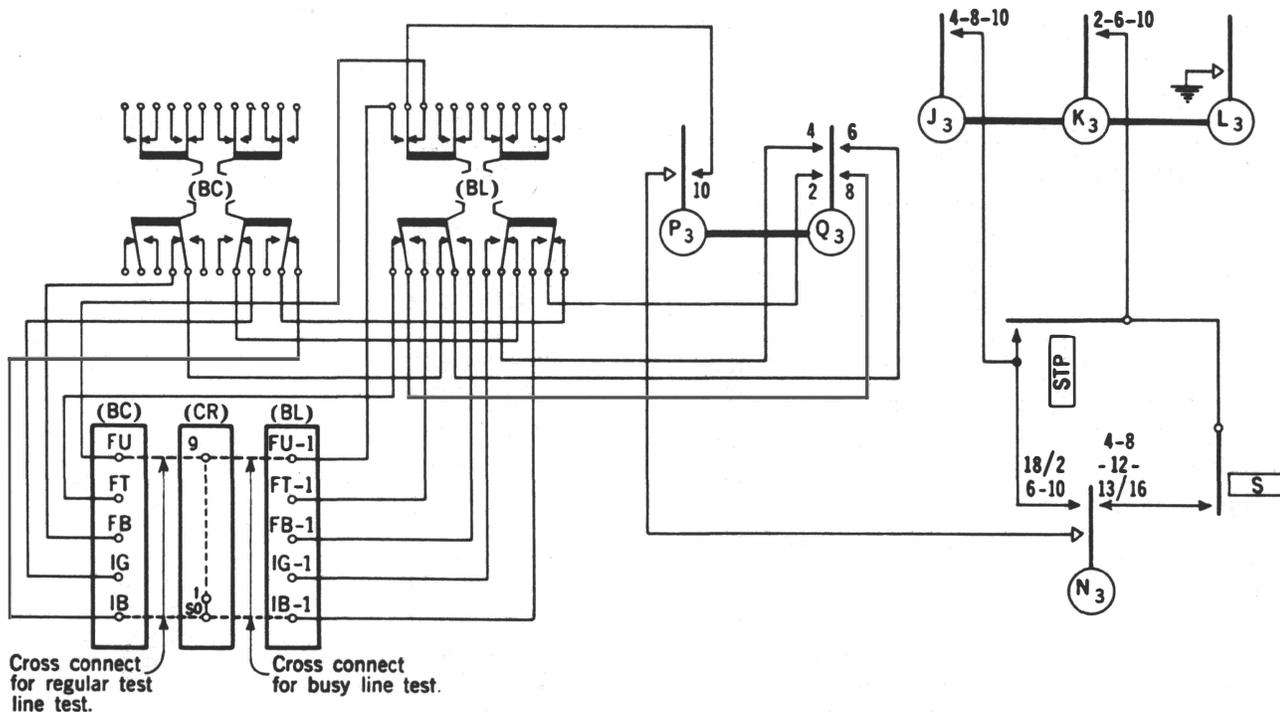


Fig. 11—Incoming and Final Selections Control—Test Frame SD-20042-01

5. ASSIGNMENT OF CROSS CONNECTIONS FOR BROAD-RANGE TESTS FOR TEST FRAME SD-20042-01

5.01 Where the number of trunk groups, assigned in accordance with 4.03, exceeds the number of available directing selector terminals the broad-range tests may be used to increase the number of trunk groups that may be combined. These tests are not as severe, in all cases, as the tests made when cross connections are made in accordance with Part 4 of this section. They will, however, be more severe than any actual service condition.

Note: Directing selector terminals associated with groups of trunks to repeating incoming selectors modified to care for induced ac voltages on the conductors should not be cross-connected for broad-range tests. See 4.17 and 4.18.

5.02 The cross connections for the L relay operate, L relay nonoperate, and A relay operate tests may be determined from Tables F and G (these cross connections are not required when

the trunk group is to be tested for continuity and polarity only). these tables list trunk loop resistance ranges for the various types of trunks and the terminals to which cross connections should be made for each of the tests. For example, assume a group of trunks to be tested that terminate at ground cutoff repeating incoming selectors with a shunt around the L relay in incoming advance, and the resistance of the trunk loop plus the incoming selector compensating resistance is 1327 ohms. Ascertain whether the test frame has M or N wiring and use Table F or G, respectively. Assume for this example that the frame has N wiring, the trunk group will be in the range 1292 to 1594 ohms, for which the cross connections are shown to be L OPR to terminal 2 on the R2 block, L NON OPR to terminal 9 on the R1 block, and A OPR to terminal 9 on the R1 block.

6. ASSIGNMENT OF CROSS CONNECTIONS FOR TEST FRAME PER ES-239810

6.01 Using the tabulated data prepared as outlined in Part 3, enter on the assignment sheet the various cross connections required.

TABLE F
For Test Frames with "M" Wiring

TYPE OF TRUNK	TRUNK RESISTANCE (CONDUCTOR LOOP & SELECTOR COMPENSATING)	L OPR TO R2	L NON OPR TO R1	A OPR TO R1
Ground Cutoff Nonrepeating 24V A Relay	0- 276	5	11	3
	277- 579	4	10	2
	580- 882	3	9	1
	883-1185	2	9	1
	1186-1300	1	8	1
Ground Cutoff Nonrepeating 48V A Relay	0- 276	5	11	11
	277- 579	4	10	10
	580- 882	3	9	9
	883-1185	2	9	9
	1186-1300	1	8	9
# Ground Cutoff Repeating With Shunt Around L Relay in Incoming Advance and Those Modified for 280-type L Relay	0- 180	7	12	12
	181- 584	6	11	11
	585- 988	5	11	11
	989-1291	4	10	10
	1292-1594	3	9	9
	1595-1897	2	9	9
# Ground Cutoff Repeating Without Shunt Around L Relay in Incoming Advance	0- 180	7	16	12
	181- 584	6	16	11
	585- 988	5	16	11
	989-1291	4	16	10
	1292-1594	3	16	9
	1595-1897	2	16	9
Battery Cutoff Short Range (R132 L Relay)	0- 214	6	10	14
	215- 618	5	9	14
	619- 921	4	9	13
	922-1224	3	8	12
	1225-1527	2	7	12
	1528-1640	1	7	12
Battery Cutoff Long Range (N3 L Relay)	0- 279	8	11	14
	280- 865	7	10	13
	866-1269	6	9	12
	1270-1673	5	8	11
	1674-1976	4	7	11
	1977-2279	3	7	10
	2280-2582	2	6	10
	2583-2700	1	5	9
Battery Cutoff Long Range (N5 L Relay)	0- 620	8	11	14
	621-1180	7	10	13
	1181-1584	6	9	12
	1585-1988	5	8	11
	1989-2291	4	7	10
	2292-2594	3	7	10
	2595-2897	2	6	9
	2898-3200	1	5	8
Crossbar	0- 900	4	18*	11
	901-2900	1	18*	7
No. 1 ESS	0-900	4	19	11
	901-2900	1	19	7

* If terminal 18 is not provided use terminal 15.

If ground cutoff repeating selectors with shunt around the L relay in incoming advance are combined in the same trunk group with ground cutoff repeating selectors without shunt around the L relay in incoming advance, use values for repeating incomings without shunt.

TABLE G

For Test Frames with "N" Wiring

TYPE OF TRUNK	TRUNK RESISTANCE (CONDUCTOR LOOP & SELECTOR COMPENSATING)	L OPR TO R2	L NON OPR TO R1	A OPR TO R1
Ground Cutoff Nonrepeating 24V A Relay	0- 276	4	11	3
	277- 579	3	10	2
	580- 882	2	9	1
	883-1185	1	9	1
	1186-1300	0	8	1
Ground Cutoff Nonrepeating 48V A Relay	0- 276	4	11	11
	277- 579	3	10	10
	580- 882	2	9	9
	883-1185	1	9	9
	1186-1300	0	8	9
# Ground Cutoff Repeating With Shunt Around L Relay in Incoming Advance and Those Modified for 280-type L Relay	0- 281	6	12	12
	282- 685	5	11	11
	686- 988	4	10	11
	989-1291	3	10	10
	1292-1594	2	9	9
	1595-1897	1	9	9
	1898-2010	0	8	9
# Ground Cutoff Repeating Without Shunt Around L Relay in Incoming Advance	0- 281	6	16	12
	282- 685	5	16	11
	686- 988	4	16	11
	989-1291	3	16	10
	1292-1594	2	16	9
	1595-1897	1	16	9
	1898-2010	0	16	9
Battery Cutoff Short Range (R132 L Relay)	0- 315	5	10	14
	316- 618	4	9	14
	619- 921	3	9	13
	922-1224	2	8	12
	1225-1527	1	7	12
	1528-1640	0	7	12
Battery Cutoff Long Range (N3 L Relay)	0- 562	7	11	13
	563- 966	6	9	13
	967-1370	5	9	12
	1371-1673	4	8	11
	1674-1976	3	7	11
	1977-2279	2	7	10
	2280-2582	1	6	10
	2583-2700	0	5	9
Battery Cutoff Long Range (N5 L Relay)	0-291	8	11	14
	292- 877	7	11	13
	878-1281	6	9	12
	1282-1685	5	9	11
	1686-1988	4	8	11
	1989-2291	3	7	10
	2292-2594	2	7	10
	2595-2897	1	6	9
2898-3200	0	5	8	
Crossbar	0- 900	3	18*	11
	901-2900	0	18*	7
No. 1 ESS	0-900	3	19	11
	901-2900	0	19	7

* If terminal 18 is not provided use terminal 15.

If ground cutoff repeating selectors with shunt around the L relay in incoming advance are combined in the same trunk group with ground cutoff repeating selectors without shunt around the L relay in incoming advance, use values for repeating incomings without shunt.

6.02 The terminals should be assigned so that all trunks to dial offices to which a test selector has access will be tested before passing to another test selector. In assigning directing selector terminals it is advisable, if possible, to allow for spare control points on each test selector if the multiple tested by that selector contains assignments which are possible future dial office assignments, or possible future additional individual trunk assignments that may have different cross-connection requirements.

6.03 The test frame is equipped with one or more 206-type selectors known as directing selectors. The bank terminals of each directing selector are wired to terminal punchings for cross-connection purposes as required to direct the test connectors and the district or office test selectors and to control certain test conditions. In addition, contacts of the BC and BL keys are wired to terminal punchings for cross-connection purposes as required to direct the incoming trunk to a test line or to a busy line. These functions are listed below and the method of cross connection is covered in subsequent paragraphs.

- (a) Directing selector control.
- (b) Test selector brush selection.
- (c) Test selector group selection.
- (d) Overflow count (end of test group).
- (e) Connector control.
- (f) Compensating resistance.
- (g) Incoming and final selection for test line test and busy line test.

Directing Selector Control (D SW—KEYS)

6.04 The directing selectors are moved from terminal to terminal automatically during a cycle of tests but may be started from any particular terminal by use of the tens, units, and D keys. Cross-connection arrangements are shown in Fig. 12.

6.05 Cross-connect the D SW terminals as follows:

- (a) ***Crossbar Trunk Group Where XBP Terminals Are Provided:*** If trunk group is to be passed by on brush continuity only,

cross-connect the D SW terminal to the odd-numbered XBP terminal and the associated even-numbered XBP terminal to the KEYS terminal.

- (b) ***Panel Sender Tandem or Crossbar Tandem Trunk Group Where TCP Terminals Are Provided:***

If trunk group is to be tested for continuity and polarity only, cross-connect the D SW terminal to the odd-numbered TCP terminal and the associated even-numbered TCP terminal to the KEYS terminal.

- (c) ***Other Trunk Groups:*** Cross-connect the D SW terminal to the corresponding KEYS terminal.

- (d) ***Vacant Terminal on Directing Selector:*** Cross-connect D SW terminal to PASS BY or G terminal.

6.06 If the D SW and KEYS terminal strips are not provided, the directing selector terminals are wired directly to the keys. To pass by vacant terminals it will be necessary to remove the wire at the vacant terminal on the selector and connect ground directly to the terminal.

Test Selector Brush Selection (BR-CR)

6.07 Arc C of the directing selector serves to control the brush selection of the district or office test selector (Fig. 13). Cross-connect the BR terminals as required to the CR terminals for counting relays corresponding to the bank in which the group of trunks to be tested is located. Omit cross connections on vacant positions.

Test Selector Group Selection (GR-CR)

6.08 Arc D of the directing selector serves to control the group selection of the district or office test selector (Fig. 14). Cross-connect the GR terminals as required to the CR terminals for counting relays corresponding to the bank group where the test is to start. If the directing selector terminal is to be used for testing groups of trunks to two or more offices the GR terminal should be cross-connected to direct the test selector to the lowest group of the combined group. Omit cross connections on vacant positions.

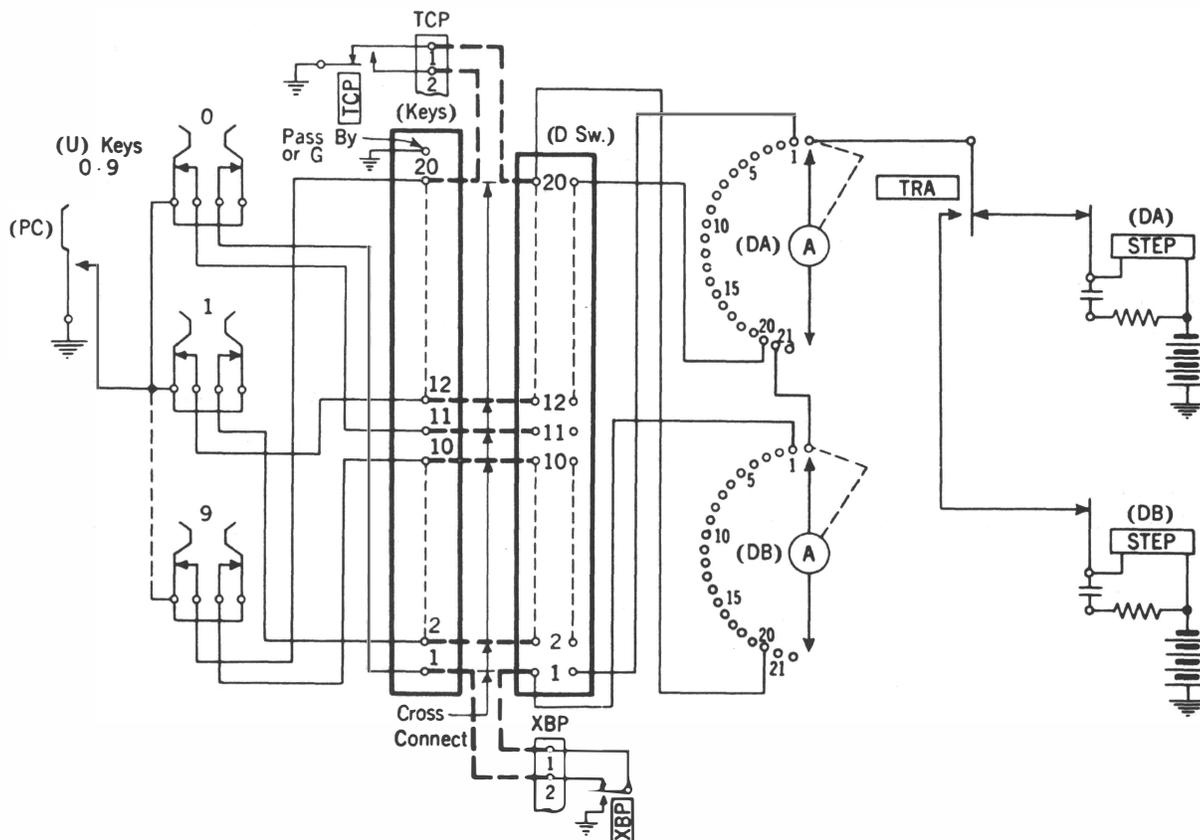


Fig. 12—Directing Selector Control—Test Frame ES-239810

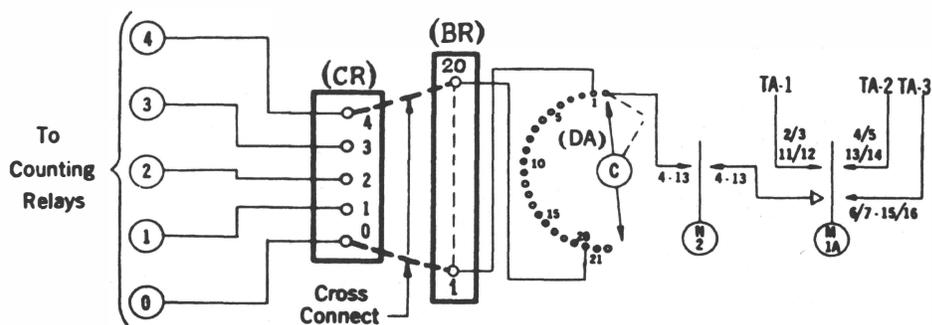


Fig. 13—Test Selector Brush Selection—Test Frame ES-239810

Overflow Count—End of Test Group (GN-OC)

6.09 Cross-connect the GN terminals of the directing selector to the OC terminals 1 to 10 (terminals of the DC, district control switch) in accordance with the number of groups of terminals to be

tested before the test selector is restored to normal (Fig. 15). If the trunk group includes any 3-wire incoming selectors see 6.10. If the directing selector terminal is to be used for testing groups of trunks to two or more offices, all of the groups in the combined group should be considered.

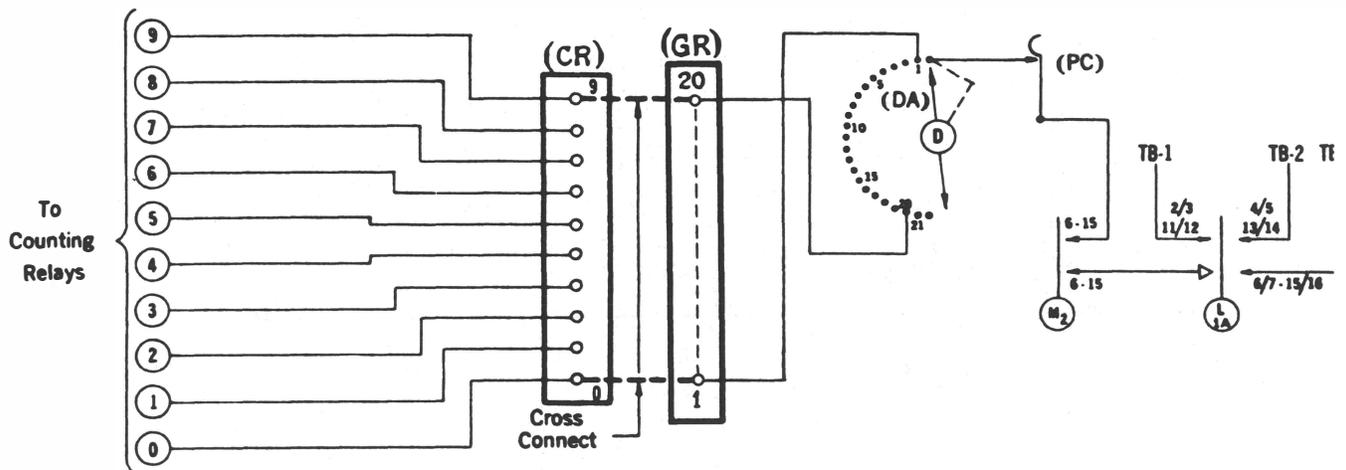


Fig. 14—Test Selector Group Selection—Test Frame ES-239810

TABLE H

TEST SELECTOR NUMBER	CONNECTOR SWITCH	CONN SW TERMINALS
1	-	BW1
2	1	B2
3	1	B3
4	1	W1
5	2	B2
6	2	B3
7	2	W1
etc	-	-
etc	-	-
etc	-	-
22	7	W1
23	8	B2
24	8	B3

6.10 For testing 3-wire incoming selectors or combination 2- and 3-wire incoming selectors cross-connect GN terminal to the LI terminal. Cross-connect the associated C terminal to the proper OC terminal. Ordinarily an LI relay with its associated wiring and terminals will be required for each group of 3-wire trunks.

Connector Control (CC-CONN SW)

6.11 Each connector switch is designed to control three test selectors and is moved to the

position of testing for a busy condition of the test selector as soon as the directing selector has been set. This operation is controlled by the CC and CONN SW terminals (Fig. 16).

6.12 Cross-connect the CC terminals to the connector switch terminals as indicated in Table H.

Compensating Resistance (CM-CMR or R1)

Test Frame With Fig. 3 (Compensating Resistance and Capacity) See 3.04.

6.13 An artificial cable network (resistance and capacity) is provided in the test frame to simulate standard 19-gauge cable. The resistance portion of this network consists of two steps of 150 ohms each and five steps of 300 ohms each and is controlled by relays which are cross-connected as required at the directing selector switch. The capacity is also arranged in steps and the amount used in the test depends upon the cross connection for the compensating resistance.

6.14 These cable network relays have two windings and the particular winding to be cross-connected depends upon the type of incoming trunk to be tested. When the primary winding is cross-connected the artificial cable capacity is inserted during incoming and final selections. When the secondary winding is cross-connected, the capacity is inserted only during incoming selections. The primary winding is used for testing repeating type and battery cutoff incoming selectors because it is

during final selections that the operation of these selectors is most critical. The secondary winding is used for testing 3-wire local, 2-wire nonrepeating ground cutoff and crossbar type incoming trunks.

6.15 Cross connections between CM and CMR terminals serve to control the compensating resistance and associated capacity for the test of a trunk group (Fig. 17).

6.16 When testing revertive pulse trunks equipped with carrier, cross-connect the CM terminal to CMR 1 terminal. For all other types of trunks follow the procedures in 6.17.

6.17 The CMR terminal to which the cross connection should be made for the test of a trunk group may be determined from Table I. Determine from trunk records the maximum trunk resistance (trunk loop plus incoming selector compensating resistance if any) in the trunk group. Locate the range in which the resistance falls in the Resistance of Maximum Trunk Loop column for the type of incoming selector involved. The corresponding number in the Test Frame (CMR) Terminal column is the terminal to which the cross connection should be made. Where a shortage of directing selector terminals makes it desirable, adjacent groups of nonrepeating, 3-wire local and crossbar trunks or adjacent groups of repeating, short-range and long-range trunks may be connected to one directing selector terminal using the CMR terminal for the group having the maximum loop resistance. In such cases the test loop resistance of the minimum resistance group of trunks shall

not be lower than the service loop resistance of the trunk group with the lowest resistance.

6.18 In order to simulate both maximum and minimum loop conditions, a NO-CAP (No capacity) key is provided. The circuit is so arranged that when this key is operated, the capacity of the artificial cable network is not applied and the resistance only is used and in addition a part of the compensating resistance is removed from the circuit. The two 150-ohm steps, the first 300-ohm step of resistance, and an additional resistance of 200 ohms, intended to increase the severity of the operate test of the incoming L relay, are removed from the circuit when testing repeating incoming selectors or selectors in battery cutoff relay offices with this key operated. When testing nonrepeating type, 3-wire local or crossbar incoming trunks with this key operated, the 200-ohm resistance is removed from the circuit.

Compensating Resistance (CM-CMR or R1)

Test Frame without Fig. 3 (Compensating Resistance Only) See 3.04.

6.19 The CM terminals of the directing selector serve to control the compensating resistance for the test of a trunk group.

6.20 When testing revertive pulse trunks equipped with carrier, cross-connect the CM terminal to CMR 1 terminal. For all other types of trunks, follow the procedures in 6.21.

6.21 The CMR terminal to which the cross connection should be made for the test of a

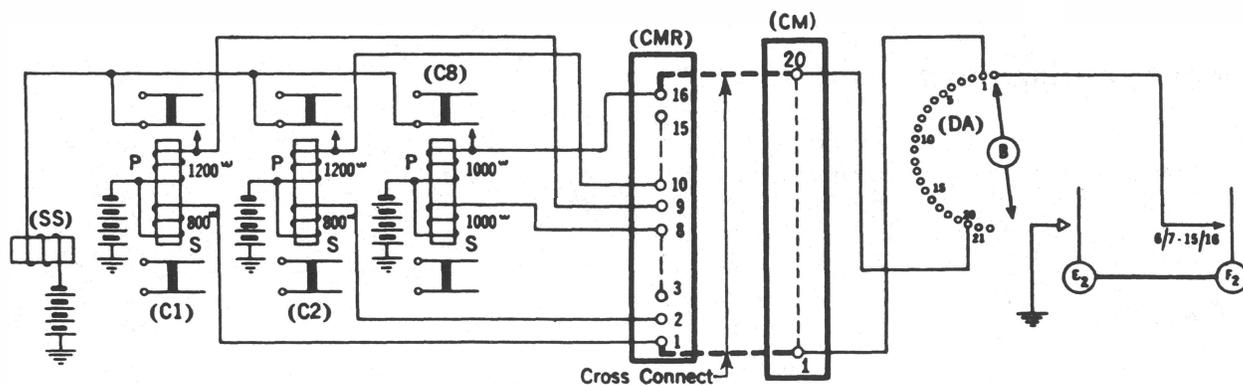


Fig. 17—Compensating Resistance—Test Frame ES-239810

trunk group may be determined from Table J. Determine from trunk records the maximum trunk resistance (trunk loop plus incoming selector compensating resistance) in the trunk group. Locate the range in which this resistance falls in the Resistance of Maximum Trunk Loop column for the type of incoming selector involved. The corresponding number in the Test Frame (CMR) Terminal column is the terminal to which the cross connection should be made. Where a shortage of directing selector terminals makes it desirable, adjacent groups of trunks may be connected to one directing selector terminal using the CMR terminal for the group having the maximum loop resistance. In such cases the test loop resistance of the minimum resistance group of trunks shall not be lower than the service loop resistance of the trunk group with the lowest resistance.

Incoming and final Selections Control (BL-CR-BC)

6.22 BL and BC terminals are provided for cross connection to counting relay CR terminals (SO and 1 to 9) to direct calls to a busy test line or to a regular test line. A BC terminal is also provided for cross connection to a counting relay for final brush selection when an incoming brush continuity test is being made.

6.23 An N terminal is sometimes provided for cross connection to a counting relay to determine the number of pulses to be received for an OK supervisory relay test.

6.24 Since these terminals vary according to local requirements and seldom require changes after installation, they are not covered in detail in this section. If changes are necessary, consult local job information.

7. METHOD OF CROSS CONNECTION

7.01 When cross connections are necessitated by the addition of new trunk groups and the

test frame per SD-20042-01 is used, the required cross connections may be placed at any time before the initial test. The cross connection to the assigned directing selector terminal from the IR terminal should not be removed until the trunk group is ready for test.

7.02 When cross connections are necessitated by the addition of new trunk groups and the test frame ES-239810 is used, the required cross connections to the assigned terminal may be placed at any time before the initial test. The cross connection from the assigned directing selector terminal to the PASS BY or G terminal should not be removed until the trunk group is ready for test. If spare terminals are not available, as described in 6.02, it will be necessary to rearrange trunk groups to provide a terminal.

7.03 When making cross connections applicable to existing trunk groups, the cross connections on either frame may be changed at the time of the trunk change or as soon as necessary before testing.

7.04 There are three general classes of cross connections required on the test frames:

- (a) Connections between adjacent terminals of the same group of terminals—use bare strap wire.
- (b) Connections between nonadjacent terminals of the same group of terminals—use switchboard wire.
- (c) Connections between terminals of one group and terminals of another group—use switchboard wire.

7.05 For general methods and precautions regarding cross-connection work and soldering, see Sections 069-120-801 and 069-140-811.

TABLE I

RESISTANCE OF MAXIMUM TRUNK LOOP							
CONDUCTOR PLUS INCOMING SELECTOR COMPENSATING RESISTANCE						CONDUCTOR RESISTANCE	TEST FRAME (CMR) TERMINAL
PANEL GROUND CUTOFF			PANEL BATTERY CUTOFF (SEE NOTE)			CROSSBAR	
NON-REPEATING	REPEATING	3-WIRE LOCAL (INCLUDE ONLY RING SIDE INCOMING COMP.)	R132 L RELAY SHORT RANGE	N3 L RELAY LONG RANGE	N5 L RELAY BALANCED LONG RANGE		
1338-1488		950-1100				901-2900	CMR 1
1186-1337		798- 949				751- 900	CMR 2
883-1185		495- 797				603- 750	CMR 3
580- 882		192- 494				306- 602	CMR 4
277- 579		0- 191				0- 305	CMR 5
0- 276							CMR 6
	2050-2200		1680-1830	2735-2885	2951-3200		CMR 7
	1898-2049		1528-1679	2583-2734	2701-2950		CMR 8(R1-1)
	1595-1897		1225-1527	2280-2582	2401-2700		CMR 9(R1-2)
	1292-1594		922-1224	1977-2279	2101-2400		CMR 10(R1-3)
	989-1291		619- 921	1674-1976	1801-2100		CMR 11(R1-4)
	686- 988		216- 618	1371-1673	1501-1800		CMR 12(R1-5)
	383- 685		0- 215	1068-1370	1201-1500		CMR 13(R1-6)
	0- 382			0-1067	0-1200		CMR 14(R1-7)
							CMR 15(R1-8)
							CMR 16(R1-9)

Note: Treat trunk groups which are a mixture of short-range with long-range and/or long-range balanced selectors as if they contained only short-range selectors. Treat mixed groups of long-range and long-range balanced selectors as if they contained only long-range selectors.

TABLE J

RESISTANCE OF MAXIMUM TRUNK LOOP							
CONDUCTOR PLUS INCOMING SELECTOR COMPENSATING RESISTANCE						CONDUCTOR RESISTANCE	TEST FRAME (CMR) TERMINAL
PANEL GROUND CUTOFF			PANEL BATTERY CUTOFF (SEE NOTE)			CROSSBAR	
NON-REPEATING	REPEATING	3-WIRE LOCAL (INCLUDE ONLY RING SIDE INCOMING COMP.)	R132 L RELAY SHORT RANGE	N3 L RELAY LONG RANGE	N5 L RELAY BALANCED LONG RANGE		
1186-1300	1898-2200	798-1100	1528-1640	2583-2700	2901-3200	901-2900	1
883-1185	1595-1897	495- 797	1225-1527	2280-2582	2601-2900	603- 900	2
580- 882	1292-1594	192- 494	922-1224	1977-2279	2301-2600	306- 602	3
277- 579	989-1291	0- 191	619- 921	1674-1976	2001-2300	0- 305	4
0- 276	585- 988		215- 618	1270-1673	1601-2000		5
	181- 584		0- 214	866-1269	1201-1600		6*
	0- 180			0- 865	0-1200		7*

* If terminals 6 and 7 are not provided, connect to terminal 5.

Note: Treat trunk groups which are a mixture of short-range with long-range and/or long-range balanced selectors as if they contained only short-range selectors. Treat mixed groups of long-range and long-range balanced selectors as if they contained only long-range selectors.