LINE CONCENTRATOR NO. 2A REMOTE CIRCUIT ADJUSTMENTS AND OPERATION TESTS

Replaces Section 925
Dated 11-16-67 and
Section T.I. 925
Dated 6-18-71

CONTENTS

1. GENERAL

1.1 This section provides methods for circuit pack adjustments of components per Circuit Pack Schematic SD-94817-01, adjustments of Power Supply Circuit SD-81608-01 and operation tests of 2A Line Concentrator Remote Circuit SD-94816-01.

1.2 If the operating company requires load test per Section 928, tests per this section and Sections 922, 923 (Control Circuit), and 924 must be performed first.

1.3 Refer to Section 10 of this Handbook for calibration and use of tektronix model 545A or 545B oscilloscope.

1.4 Before using ED-94866-30 Card Extender, verify it for crosses between adjacent terminals and between framework and all terminals.

CAUTION: Observe precautions when testing electronic devices as written in Section 0.3 of this handbook. Never connect -24V, -48V, +130V or any test battery to a test point. Application of test battery will invariably damage the preceeding transistor logic stage. Direct ground may be applied to any test point if necessary.

2. TEST EQUIPMENT

2.1 Tests Sets

Amt	ITE	Description	Note
1	2447	High Resistance Voltmeter	A
or 1	H-P 412A	Voltmeter	T
1	4028	Attenuator	A
or 1	5A	Attenuator	T
1	4208	Handset, Telephone	A
or 1	D-81762	Handset, Telephone	T
1	4325	Timing Test Set	A
or 1	J24753A	Timing Test Set	T
1	4442	Volt-Ohmmeter	
1	4662	Tektronix Model 545A or 545B Oscilloscope or equivalent	A T,B
1	4683	Serial Data Generator and Receiver Test Set	
1	H-P 400H	AC Voltmeter	T
1	H-P 522B	Electronic Counter or equivalent	T T,B
1	ED-94866-30	Card Extender	T
1	KS-19355,62	Adjuster	

NOTES:
A - Order only if alternate set is not available from the operating company.

T - Obtain from the operating company.

B - Operating instructions are written in this section for the test set specified. If other sets are provided by the operating company consult their maintenance engineer for operating instructions and modify this section accordingly.

2.2 Cords: All cords necessary for tests of this section are included in the test sets specified.

2.3 Obtain from the operating company or locally a capacitor of approximately .01 MF value.

3. RECORDS AND REQUIREMENTS

3.1 Records: The results of tests per this section shall be recorded on forms SD-4-1313 and SD-4-1315 as described in Handbook 50, Section 3.

3.2 Requirements: The tests of this section are based on BSP AA648.000 "Performance Requirements Line Concentrator No. 2A.

4. CIRCUIT PACK ADJUSTMENTS

4.1 Power Supply

4.11 Verify that the Power Supply Circuit is plugged into it's respective jack at the frame. Verify with ITE-2447 or equivalent that +12 V DC ±0.12 V is present at the DC OUTPUT jacks. Use a screwdriver in the ADJ VOLTS potentiometer to obtain this reading.

4.12 If there is no reading at the DC OUTPUT jacks, remove the Voltmeter from these jacks and verify for presence of -48V at pin 5 and 6 of socket P1. The Power Supply Circuit must be on for approximately one hour, to allow it to stabilize, before adjustments can be accurately made.

4.2 Multivibrator CPS 6

4.21 Connect the power cords of H-P 522B Electronic Counter and H-P 400H AC Vacuum Tube Voltmeter to 115V AC appliance outlets and operate power switches to ON. The POWER and ON lamps respectively should light.

4.22 Set the controls of H-P 522B as follows:

CONTROL	POSITION
Trigger Input	COM
Trigger Slope (Start)	+
Trigger Level Volts (Start)	+5
Trigger Slope (Stop)	-
Trigger Level Volts (Stop)	+1
Time Unit	(Microsec) (100)
Function Selector	Time Interval
Display Time	Full Counter-Clockwise

4.23 Remove CPS 6 from socket A16, insert the ED-94866-30 card extender into jack A16 and insert CPS 6 into the card extender. It will be necessary to insert a capacitance of approximately .01 MF between jack START of H-P 522B and test point B34 of the remote frame under test. Use the coaxial cords supplied with H-P 522B plus whatever cords and/or connectors are needed.

4.24 Block nonoperated relays TA, OL, TM3, TM5, RT and block operated relays TM1, TM2 and TM4. In any convenient manner ground test points A55, A58 and B27. To start the test, ground test point B36. Operate switch RESET on H-P 522B. The Electronic Counter feading should be between 150 → and 160 microseconds. This is accomplished when the last digit column flashes between 5 and 6.

NOTE: Further adjustment of the trigger level controls may be necessary to get a clear reading.

4.25 Adjust potentiometer R1 on the upper part of CPS 6 to obtain the above reading if necessary. All the CPS potentiometers have 25 revolutions from one extreme to the other. Operate H-P 522B switch RESET between each adjustment.

4.26 Set the controls of H-P 522B as follows:

CONTROL	POSITION
Frequency Unit	10 CPS
Function Selector	Frequency

4.27 Remove the cord from jack START and connect it to jack INPUT. Operate Switch RESET. After ten seconds the Electronic Counter reading should be → 3200 ± 3 CPS. Adjust potentiometer R2 on the lowest part of CPS 6 to obtain this reading as necessary. Operate H-P 522B switch RESET between each adjustment. After initial adjustment, a drift of +8 CPS is permissible.

4.28 Remove the cord from test point B34 and connect it in turn to test points B11, B24, and B21. Each test point should read 200 CPS. Operate H-P 522B switch RESET before each reading.

4.29 At the conclusion of this adjustment remove the test connections, the ground from test point B36, CPS 6 from the card extender, the card extender from socket A16 and reinsert CPS 6 into socket A16.

4.3 Remote Unit Send Circuit CPS 11

4.31 On the back of socket A1 strap as follows: 3 to 15 and 2 to 4.

4.32 Modulator

4.321 Set the controls of H-P 522B as follows:

CONTROL	POSITION
Frequency Unit	10 CPS
Function Selector	Frequency

4.322 Remove CPS 11 from socket A1, insert the card extender and insert CPS 11 into the card extender. Insert the 310 plug of an ITE-9639 cord into jack SDR. At the other end of the cord connect the T connector to the H-P 522B jack INPUT. Connect the R connector to ground.

4.323 In any convenient manner connect ground to test point A-11. Operate switch RESET of H-P 522B. The → Electronic Counter should read 1070 ± 2 CPS. If necessary use the KS-19355 Adjuster to adjust the T1 transformer (2570A) to obtain this reading. Operate switch RESET of H-P before each reading.

4.324 Remove the ground from test point A-11 and operate switch RESET on H-P 522B. The reading should be exactly the same as obtained in Paragraph 4.323.

4.325 Apply ground to test point B23. Operate H-P 522B switch RESET. → The Electronic Counter should read 1270 ± 2 CPS. If necessary use the KS-19355 Adjuster to adjust transformer T2 (2570A) to obtain this reading. Operate switch RESET of H-P 522B before each reading.

4.326 Remove the ground from test point B23.

4.33 Power Amplifier

4.331 Remove the ITE-9639 cord from H-P 522B and ground and connect the T and R connectors to the input jacks of the H-P 400H with a 600 ohm termination with the R connector to the ground side. The H-P 400H should read the signal → sent at -18 DBM.

4.332 To obtain this reading adjust potentiometer R 10 of CPS 11.

4.333 At the conclusion of these adjustments, remove the test connections, CPS 11 from the card extender, the card extender from socket A1 and reinsert CPS 11 into socket A1.

4.4 Guard Interval Timer, Signal Present Detector CPS 13, Limiter CPS 9 and Remote Unit Discriminator CPS 12

4.41 Guard Interval Timer

4.411 Set the controls of H-P 522B as follows:

CONTROL	POSITION
Trigger Unit	COM
Trigger Slope	+
Trigger Level Volts (Start)	+1.5
Trigger Slope (Stop)	-
Trigger Level Volts (Stop)	+1.5
Time Unit	(Millisec.) (100)
Function Selector	Time Interval

4.412 Remove CPS 13 from socket A3, insert the card extender and insert CPS 13 into the card extender. Using ITE-9419 cord equipped with alligator clips connect test points A13 to B42. Using the coaxial cord supplied with H-P 522B connect jack START to test point A53 through .01 capacitor. Remove CPS 12 from socket A4.

4.413 In any convenient manner connect ground to test point B36. Operate switch RESET of H-P 522B. The Electronic Counter should read 4.06 ±0.01 milliseconds. Adjust potentiometer R5 of CPS 13 to obtain this reading as necessary. Operate switch RESET of H-P 522B before each reading.

4.414 At the conclusion of this test remove the test connections, the ground from test point B36, CPS 13 from card extender, remove card extender from socket A3 and reinsert CPS 13 into socket A3 Reinsert CPS 12 into A4. Remove the connection from A13 to B42.

4.42 Signal Present Detector and Limiter

4.421 Use 2 ITE-9419 cords to supply -48V test battery and ground to ITE-4683 -48V and GRD jacks. Use 2 ITE-9432 cords modified with ITE-2455 plugs to supply +12V from terminal 20 of any CPS socket (identified by red surface wire) to ITE-4683 +12 jack and ground from the "N" ground bar behind the CPS tray to ITE-4683 GRD jack. Operate switch FREQ RANGE to B and operate key RESET.

4.422 Set the controls of H-P 522B as follows:

CONTROL	POSITION
Frequency Unit	10 CPS
Function Selector	Frequency

4.423 Set the switches of ITE-4683 as follows:

SWITCH	POSITION
MODE 1	B
MODE 2	A
FREQ	B
2A-2B	2A
REM-CONT	REM
WORD	10

4.424 Connect ITE-4683 jacks AC OUT to H-P 400H jack INPUT. Connect H-P 522B jack INPUT to INPUT jack of H-P 400H. The H-P 400H reading should be approximately -14±2 DBM. Operate switch RESET of H-P 522B. The Electronic Counter should read 2025 ± 2 CPS. If this requirement is not met, remove the bottom panel from ITE-4683. Transformer T1(2570A) can be adjusted with an orange stick to meet this requirement. Operate H-P 522B switch RESET before each reading.

4.425 Operate ITE-4683 key SET. Operate switch RESET of H-P 522B. The Electronic Counter should read 2225 ± 2 CPS. In the same manner as Paragraph 4.423 adjust transformer T2(2570B) to obtain this reading if necessary.

4.426 Remove the cords between ITE-4683 jacks AC OUT and H-P 400H and H-P 522B. Using cord ITE-9723 connect ITE-4683 jacks AC OUT to ITE-4028 attenuator jacks IN. Using cord ITE-9361 connect the attenuator jacks OUT to frame jack RODR. Connect input of H-P 400H with a 1 megohm termination, to test points E34 and E44. Operate ITE-4683 key RESET. Adjust the attenuator until a reading of -38.5 ±.5 DBM is obtain on H-P 400H.

4.427 Remove CPS 9 from socket A2, insert the card extender into jack A2 and insert CPS 9 into the card extender. Remove the blocking tool from relay TA. Adjust potentiometer R2 of CPS 9 until relay TA operates. Turn potentiometer R2 in the opposite direction until relay TA releases.

4.428 At the conclusion of this adjustment remove the test connections to ITE-4442, remove CPS 9 from card extender, remove card extender from socket A2 and reinsert CPS 9 into socket A2.

4.429 ITE-4683 will be used for Discriminator adjustments of the following paragraphs.

4.43 Remote Unit Discriminator

4.431 Remove the cords between ITE-4028 attenuator and ITE-4683 and frame jack RODR. With cord ITE-9639 connect ITE-4683 jacks AC OUT to frame jack RODR T and R. At ITE-4683 operate SEND SWITCHES SA1, SA4, SB0, SB2, SB7, SC1 and SC4 to "1" all other SEND SWITCHES should be on "0".

4.432 Set the controls of H-P 522B as follows:

CONTROL	POSITION
Trigger Input	COM
Trigger Slope (Start)	+
Trigger Slope (Stop)	-
Trigger Level Volts (Start)	+2
Trigger Level Volts (Stop)	+2
Time Unit	(Millisec) (100)
Function Selector	Time Interval

4.433 Remove CPS 12 from socket A4, insert card extender into socket A4 and insert CPS 12 into card extender. Use the coaxial cord supplied with H-P 522B to connect H-P 522B jack start to test point A44. Operate H-P 522B switch RESET.

4.434 At ITE-4683 operate key TEST once. The Electronic Counter should read 5.0 ±0.25 milliseconds.

4.435 Adjust potentiometer R3 of CPS 12 to obtain the above reading if necessary. Operate switches RESET of ITE-4683 and RESET of H-P 522B before each reading.

4.436 Change the following controls of H-P 522B:

CONTROL	POSITION FROM	TO
Trigger Slope (Start)	+	-
Trigger Slope (Stop)	-	+

4.437 Repeat Paragraph 4.434. The same results should be observed. If not repeat Paragraph 4.435. These two adjustments must be repeated until the Electronic Counter reads 5.0 ±0.25 milliseconds for both positive and negative pulses.

4.438 At the conclusion of these tests remove CPS 12 from card extender, card extender from socket A4 and reinsert CPS 12 into socket A4. Remove test connections H-P 522B but leave ITE-4683 setup for next test. Remove blocking tools from relays TM1, TM2, TM3, TM4, TM5, RT and OL. Remove the grounds from test points A55, A58, and B27.

5. TIMING TESTS

5.1 Perform timing tests per SD-94816-01 sheet F5 using Timing Test Set ITE-4325 or J24753A.

5.11 When using ITE-4325 calibrate the set per TMO-4325 Paragraph 3.3.

5.12 When using J24753A, operate key MCF to NORM. With key BAT on OFF, meter should read zero; if not set needle to zero with adjusting screw on meter. Connect -48V test battery and ground to set with cord ITE-9600. Operate key BAT to ON and allow set to warm up for at least 30 seconds. Adjust meter to read zero with potentiometer ADJ-0.

6. OPERATION TESTS

6.1 These tests are made with ITE-4683 simulating the Control Frame. A series of Service Request (SR), Terminating (T), and Disconnect (D) calls will be made using Table 1. Maintenance, Test and Trouble Recording calls will also be made.

6.11 When trouble is encountered while attempting these tests refer to Paragraph 7 for trouble locating aids.

6.2 With ITE-4683 still connected per Paragraphs 4.421 and 4.431, make the following additional connections with cross connection wire or any wire suitable for wire wrapping: ITE-4683 terminal IN to test point A11, ITE-4683 terminal RLS to relay OL 11M and relay OL 11F to +12 volts (terminal 20 of any CPS socket; identified by red surface wire).

6.3 Set the switches of ITE-4683 as follows:

SWITCH	POSITION
MODE 1	B
MODE 2	A
FREQ	B
2A-2B	2A
REM-CONT	REM
WORD	10

6.4 SR Calls: Preoperate two TK- relays per Table 1. Operate the SEND and REC switches of ITE-4683 according to Table 1 which lists keys to be operated to "1", all other keys should be operated to "0". Start the test by momentarily shorting the T and R leads of the line listed. This causes the line number to be sent to ITE-4683 where it should match the REC switches operated to "1" (A=start pulse, B=line units and C=line tens). The S/R lamps associated with this number should light momentarily and if they match the operated REC switches, lamp MATCH should light. ITE-4683 then sends the trunk number as set up on the SEND switches (A=trunk level, and B=trunk steering) to the remote circuit. This should match the operated TK- relays and operate the hold magnet of the line under test. The remote circuit and ITE-4683 then exchange open line signals, reapply tone and the remote circuit should release.

6.41 Verify that the proper hold magnet is operated and repeat this procedure for each SR test of Table 1.

6.42 Control Circuit Preference Check: Block relay EP nonoperated. In any convenient manner ground test point A55. Momentarily ground test point E25. With ITE-4442 voltmeter using the 15V DC scale test for +6 to +12 volts at test point A45. Ground test point A26 momentarily. Test point A45 should read below +.3 volts. Momentarily ground test point E16. Remove the ground from test point A55 and the blocking tool from relay EP. The remote circuit should remain in a normal condition.

TABLE 1

TEST NO	TYPE CALL	LINE	TRUNK	PREOPERATE RELAYS TK	ITE-4683 SEND SWITCHES A	SEND SWITCHES B	SEND SWITCHES C	RECEIVE SWITCHES A	RECEIVE SWITCHES B	RECEIVE SWITCHES C	RELAYS OPERATED TK	RELEASE RELAYS TK
1	SR	09	00	0,8	4,7	4,7		7	2,7	4,7		
2	SR	18	01	0,9	4,7	0,1		7	1,7	0,1		
3	SR	27	02	1,8	0,1	4,7		7	0,7	0,2		
4	SR	36	03	1,9	0,1	0,1		7	2,4	1,2		
5	SR	45	04	2,8	0,2	4,7		7	1,4	0,4		
6	SR	54	05	2,9	0,2	0,1		7	0,4	1,4		
7	SR	63	06	3,8	1,2	4,7		7	1,2	2,4		
8	SR	72	07	3,9	1,2	0,1		7	0,2	0,7		
9	T	71	08	4,8	4,7	0,1	0,7	7	0,4	4,7		
10	T	60	09	4,9	4,7	4,7	2,4	7	0,4	0,1		
11	T	58	10	5,8	4,7	1,7	1,4	7	1,4	4,7		
12	T	46	11	5,9	4,7	2,4	0,4	7	1,4	0,1		
13	T	34	12	6,8	4,7	0,4	1,2	7	2,4	4,7		
14	T	22	13	6,9	4,7	0,2	0,2	7	2,4	0,1		
15	T	17	14	7,8	4,7	0,7	0,1	7	0,7	4,7		
16	T	05	15	7,9	4,7	1,4	4,7	7	0,7	0,1		
17	D	09	00		0,1	4,7	4,7	7	4,7	4,7	0,8	X
18	D	18	01		0,1	4,7	0,1	7	4,7	0,1	0,9	X
19	D	27	02		0,1	0,1	4,7	7	0,1	4,7	1,8	X
20	D	36	03		0,1	0,1	0,1	7	0,1	0,1	1,9	X
21	D	45	04		0,1	0,2	4,7	7	0,2	4,7	2,8	X
22	D	54	05		0,1	0,2	0,1	7	0,2	0,1	2,9	X
23	D	63	06		0,1	1,2	4,7	7	1,2	4,7	3,8	X
24	D	72	07		0,1	1,2	0,1	7	1,2	0,1	3,9	X
25	D	71	08		0,1	0,4	4,7	7	0,4	4,7	4,8	X
26	D	60	09		0,1	0,4	0,1	7	0,4	0,1	4,9	X
27	D	58	10		0,1	1,4	4,7	7	1,4	4,7	5,8	X
28	D	46	11		0,1	1,4	0,1	7	1,4	0,1	5,9	X
29	D	34	12		0,1	2,4	4,7	7	2,4	4,7	6,8	X
30	D	22	13		0,1	2,4	0,1	7	2,4	0,1	6,9	X
31	D	17	14		0,1	0,7	4,7	7	0,7	4,7	7,8	X
32	D	05	15		0,1	0,7	0,1	7	0,7	0,1	7,9	X

6.5 T Calls: Preoperate two TK- relays per Table 1. Operate the SEND and REC switches of ITE-4683 according to Table 1 which lists keys to be operated to "1"; all other keys should be operated to "0". Start the test by momentarily operating key TEST (Be very careful in operating this key to get the fastest and most minimal operation and release). This causes a class of call and line number to be sent from ITE-4683 to the remote circuit as set up on SEND switches (A=terminating class, B=line units, and C=line tens). The remote circuit should receive, interpret this information and operate the line hold magnet. The remote circuit should then send a trunk check signal to ITE-4683 where it should match the REC switches operated to "1" (A=start pulse, B=trunk level, C=trunk steering). The S/R lamps will light corresponding to the message received and if they match the REC switches operated, the MATCH lamp should light. ITE-4683 and the remote circuit then exchange open line signals, reapply tone and the remote circuit should release.

6.51 Verify that the proper hold magnet is operated. Momentarily operate ITE-4683 key RESET before attempting another test. Repeat the above procedure for each T test of Table 3.

6.6 D Calls: No TK- relays should be operated before a D call is started. Operate the SEND and REC switches of ITE-4683 according to Table 1 which lists keys to be operated to "1", all other keys should be operated to "0". Start the test by momentarily operating key TEST (Be very careful in operating this key to get the fastest and most minimal operation and release). This causes a class of call and trunk number to be sent from ITE-4683 to the remote circuit as set up on SEND switches (A=disconnect class, B=trunk level and C=trunk steering). The remote circuit should receive, interpret this information and release the hold magnet of the line that has been latched to this trunk. The two TK- relays should operate and lock corresponding to this trunk. The remote circuit should then send a trunk check signal to ITE-4683 where it should match the REC switches operated to "1" (A=start pulse, B=trunk level and C=trunk steering). The S/R lamps will light corresponding to the message received and if they match the REC switches operated, the MATCH lamp should light. ITE-4683 and the remote circuit then exchange open line signals, reapply tone and the frame should release.

6.61 Verify that the proper hold magnet has released and that the proper relays TK- are operated. Manually release

these relays TK- and momentarily operate ITE-4683 key RESET before attempting another test. Repeat the above procedure for each D test of Table 1.

6.7 Maintenance Calls

6.71 Permanent Signal Denial

6.711 Originate a SR call to ITE-4683 per test 1 of Table 1. Manually operate relays TK1 and TK9 which should lock.

6.712 Operate ITE-4683 SEND and REC switches to "1" as follows, all other switches to "0".

GROUP	SWITCH
SEND A	0,2 (special disconnect class)
SEND B	4,7 (trunk level 0)
SEND C	4,7 (trunk steering 0)
REC A	7 (start)
REC B	4,7 (trunk level 0)
REC C	4,7 (trunk steering 0)

6.713 Momentarily operate ITE-4683 key RESET. Start the call by momentarily operating ITE-4683 key TEST. The call should proceed as a disconnect call. Verify that HM 09 is released and that relays TK0, TK8 and TST are operated. Manually operate any relay L-- to verify that a SR call cannot be started. Momentarily operate ITE-4683 key RESET. Test set and remote circuit are now ready for next test.

6.72 Service Denial

6.721 Operate ITE-4683 SEND and REC switches to "1", as follows, all other switches to "0".

GROUP	SWITCH
SEND A	1,2 (service denial class)
SEND B	2,7 (line units number)
SEND C	4,7 (line tens number)
REC A	7 (start)
REC B	4,7 } special code for service
REC C	2,7 } denial

6.722 Momentarily operate ITE-4683 key TEST. The call should proceed similar to a T call. Hold magnet 09 should be operated, but no select finger should be engaged. Verify that relay TST is released. Momentarily operate ITE-4683 key RESET. Test set and frame are now ready for next test.

6.73 Service Denial Release

6.731 Operate ITE-4683 SEND and REC switches to "1" as follows, all other switches to "0".

GROUP	SWITCH
SEND A	0,4 (service denial release class)
SEND B	2,7 (line units number)
SEND C	4,7 (line tens number)
REC A	7 (start)
REC B	4,7 } special code for service
REC C	2,7 } denial

6.732 Momentarily operate ITE-4683 key TEST. The call should proceed similar to a T call. Hold magnet 09 should be released. Momentarily operate ITE-4683 key RESET.

6.8 Test Calls

6.81 Terminating Test Call Started at Remote Circuit

6.811 Manually operate relays TK0 and TK9 which should lock. Ascertain that no other TK- relays are operated.

6.812 Block relay RT nonoperated and connect ground to test point A13. Operate ITE-4683 REC switches to "1" as follows, all other REC switches and all SEND switches to "0".

GROUP	SWITCH
REC A	7 (Start)
REC B	2,7 (Line Units)
REC C	0,7 (Line Tens)

6.813 Insert the plug of ITE-4208 handset into jack 79 with key TLK operated. Operate and hold the frame key TER until lamp TCR lights; release key TER. ITE-4683 lamp MATCH should be lighted. Momentarily operate ITE-4683 switch RESET.

6.814 Operate and hold frame key TER. ITE-4683 lamp MATCH and frame lamp TCR should light. Relay TLD should operate.

6.815 Operate relay TA manually; relay OL should operate and the remote circuit should release normally. Release relay TA, remove the ground from test point A13 and release key TER. Lamp TCR should be extinguished.

6.816 Momentarily operate ITE-4683 key RESET, remove the handset from jack 79 and remove the blocking tool from relay RT.

6.82 Terminating Test Call Started At Control

6.821 Manually operate relays TK0 and TK8. Operate ITE-4683 SEND and REC switches to "1" as follows, all other switches to "0".

GROUP	SWITCH
SEND A	4,7 (terminating class)
SEND B	2,7 (line units)
SEND C	0,7 (line tens)
REC A	7 (start)
REC B	4,7 (trunk select)
REC C	4,7 (trunk steering)

6.822 Momentarily operate ITE-4683 key TEST. The call should proceed as a T call to line 79. Verify that 1000 CPS tone is present at T and R leads of trunk 00. Relay TLB should be operated and lamp TLB lighted. Manually release relay TLB which should extinguish lamp TLB. Momentarily operate ITE-4683 key RESET.

6.83 Service Request Call Started At Control

6.831 Manually operate relays TK0 and TK9 which should lock. Block relay L78 nonoperated.

6.832 Operate ITE-4683 SEND switches to "1" as follows, all other SEND switches and all REC switches to "0".

GROUP	SWITCH
SEND A	4,7 (terminating class)
SEND B	1,7 (line units)
SEND C	0,7 (line tens)

6.833 Operate ITE-4683 key TEST. Lamp MATCH should light. Verify that lamp TLA is lighted. Momentarily operate ITE-4683 key RESET.

6.834 Operate ITE-4683 SEND and REC switches to "1" as follows, all other switches to "0."

GROUP	SWITCH
REC A	7 (start)
REC B	1,7 (line units)
REC C	0,7 (line tens)
SEND A	4,7 (trunk level)
SEND B	0,1 (trunk steering)

6.835 Start the call by allowing relay L78 to operate. The call should proceed as a SR call. Verify that 1000 CPS tone is present at trunk 01 T and R terminals (T.S. FR). Lamp TLA should be lighted. Momentarily operate ITE-4683 key RESET.

6.84 Loop Around Test

6.841 Line 79 should be latched to trunk 00 because of tests per Paragraph 6.82.

6.842 Line 78 should be latched to trunk 01 because of tests per Paragraph 6.83.

6.843 Manually operate relay TLB which should lock lighting lamp TLB. Verify that trunks 00 and 01 are connected to each other T to R and R to T.

6.844 Release relays TLA and TLB and hold magnets 78 and 79.

6.9 Alarms and Trouble Recording

6.91 Failure to Seize; SR Call (TM1)

6.911 Manually operate relay LTO. Relay TM1 should release operating relay AL to light lamp AL and activate the office alarms. Release relay LTO and relay TM1 should reoperate. Verify that relays LT1 to LT7 release relay TM1 when operated.

6.912 Momentarily operate key AR to release relay AL, extinguish lamp AL and retire the alarms.

6.92 Recycle Timing (RT)

6.921 SR Call (240-295 MSEC)

6.9211 Block nonoperated relays TA, TM5, SQ2 and RC2. Manually operate relays TK0 and TK8. Originate an SR call per test 1 of Table 1. Because relay SQ2 cannot operate, the 240-295 MSEC function of timer RT should be activated and the call should not complete. Relay RC1 should operate (SC2 and SC4). Momentarily operate ITE-4683 key RESET.

6.9212 Remove the blocking tools from relays TA and SQ2. Restart the test by removing the blocking tool from relay RC2. The call should complete normally operating the hold magnet to latch line 09 to trunk 00. Momentarily operate ITE-4683 key RESET.

6.9213 Block nonoperated relays TA, SQ2 and RC2. Manually operate relays TK0 and TK9. Originate an SR call per test 2 of Table 1. Timer RT should again function to operate relay RC1. Momentarily operate ITE-4683 key RESET and restart the test by removing the blocking tool from relay RC2. A trouble release should occur. Relay SF1 should operate, lamps AL, SF, SR, T0, T1, U1, U7, C4, C2, C16, TK0 and TK9 should be lighted and the office alarms should be activated. Remove the blocking tool from relay TA which should operate and the remote circuit should release.

6.9214 Momentarily operate key AR to retire the alarms. Verify that the proper lamps are lighted and that relays TK0, TK8 and the hold magnet for Line 18 are released. Momentarily operate key RR to extinguish the lamps and momentarily operate ITE-4683 key RESET.

6.922 SR Call (55-75 MSEC)

6.9221 Remove the blocking tool from relay SQ2 and block nonoperated relays TA, ABK and TCF. Manually operate relays TK1 and TK9. Originate an SR call per Test 4 of Table 1. Because relay ABK cannot operate, the 55-75 MSEC function of timer RT should be activated and the call should not complete. Relay RC2 should operate (SC5). Momentarily operate ITE-4683 key RESET.

6.9222 Remove the blocking tool from relays TA and ABK. Restart the test by momentarily operating ITE-4683 key TEST. The call should complete operating the hold magnet to latch line 36 to trunk 03. Manually operate relay TA momentarily and the remote circuit should release. Momentarily operate ITE-4683 key RESET.

6.9223 Block nonoperated relays TA and ABK. Manually operate relays TK1 and TK8. Originate an SR call per Test 3 of Table 1. Timer RT should again function to operate relay RC2. Momentarily operate ITE-4683 key RESET and restart the test by momentarily operating ITE-4683 key TEST. A trouble release should occur. Relay SF2 should operate, lamps AL, SF, SR, T0, T2, U0, U7, C2, C4, C16, TK1 and TK8 should be lighted and the office alarms should be activated. Remove the blocking tool from relay TA and manually operate it momentarily. The remote circuit should release and ITE-4683 should display lamps S/R A7, B0-B7 and some C0-C7 lighted.

6.9224 Momentarily operate key AR to retire the alarms. Verify that the proper lamps are lighted and that relays TK1, TK8 and the hold magnet for Line 27 are released. Momentarily operate key RR to extinguish the lamps and momentarily operate ITE-4683 key RESET. Remove the blocking tool from relays ABK and TCF.

6.93 Hold Magnet Timer (TM3)

6.931 SR Call

6.9311 Block nonoperated relays TA, RT and XPK1. Manually operate relays TK2 and TK9. Originate an SR call per Test 6 of Table 1. Because relay SQ1 cannot operate, timer TM3 should function to operate relay TM3 and start a trouble release. Lamps AL, TM3, SR, T1, T4, UO, U4, C2. C4, C16, TK2 and TK9 should be lighted and the office alarms should be activated. Remove the blocking tool from relay TA which should operate and the remote circuit should release. ITE-4683 should display lamps S/R A7, BO-B7 and some CO-C7 lighted.

6.9312 Momentarily operate key AR to retire the alarms. Verify that the proper lamps are lighted and that relays TK2, TK9 and the hold magnet for Line 54 are released. Momentarily operate key RR to extinguish the lamps and momentarily operate ITE-4683 key RESET. Remove the blocking tool from relay XPK1.

6.932 D Call

6.9321 Block nonoperated relay TA and insulate contact 6M of relay SO2. Originate a D call per Test 17 of Table 1. Because relay SQ2 cannot operate, timer TM3 should function to operate relay TM3 and start a trouble release. Lamps AL, TM3, D, T4. T7, U2, U7, C16, TKO and TK8 should be lighted and the office alarms should be activated. ITE-4683 lamps S/R A7, B4, B7, C1 and C7 should be lighted. Operate switches REC to "1" to match the lighted lamps S/R with all other keys REC operated to "0." ITE-4683 lamp MATCH should light. Remove the blocking tool from relay TA which should operate and the remote circuit should release.

6.9322 Momentarily operate key AR to retire the alarms. Verify that the proper lamps are lighted, that relays TKO and TK8 are released and that the hold magnet for Line 09 is again operated to latch Line 09 to trunk 00. Momentarily operate key RR to extinguish the lamps and momentarily operate ITE-4683 key RESET. Remove the insulation from relay SO2.

6.94 Trunk Check Failure (TCF)

6.941 Block nonoperated relays TA and TNK. Manually operate relays TK3 and TK8. Originate an SR call per Test 7 of Table 1. Because relay TNK cannot operate, relay TCF should operate to start a trouble release. Lamps AL, TCF, SR, T2, T4, U1, U2, C2, C4, C16, TK3 and TK8 should be lighted and the office alarms should be activated. Remove the blocking tool from relay TA which should operate and the remote circuit should release. ITE-4683 lamps S/R A7, BO-B7 and some CO-C7 should be lighted.

6.942 Momentarily operate key AR to retire the alarms. Verify that the proper lamps are lighted and that relays TK3, TK8 and the hold magnet for Line 63 are released. Momentarily operate key RR to extinguish the lamps and momentarily operate ITE-4683 key RESET. Remove the blocking tool from relay TNK.

6.95 Release Timer (TM2)

6.951 In any convenient manner connect ground to contact 12M of relay RL2. Originate a D call per Test 20 of Table 1. Because relay RL2 cannot release, relay TM2 should release to operate relay AL, to light lamp AL and activate the office alarms. Momentarily operate key AR to retire the alarms and extinguish lamp AL.

6.952 Verify that relays TK1 and TK9 are operated and that the hold magnet for Line 36 is released. Momentarily operate ITE-4683 key RESET and remove the ground from relay RL2.

6.96 Control Circuit Failure

6.961 With relays TK1 and TK9 still operated from Paragraph 6.952, set ITE-4683 switches REC for an SR call per Test 4 of Table 1. Operate switches SEND A4, A7, B1 and B7 to "1" with all other switches SEND operated to "0." Start the SR call in the normal manner. A trouble release should occur. Lamps AL, CF, SR, T1, T2, U2, U4, TK1 and TK9 should be lighted and the office alarms should be activated. The remote circuit should release.

6.962 Momentarily operate key AR to retire the alarms. Verify that the proper lamps are lighted, that relays TK1, TK9 and the hold magnet for Line 36 are released. Momentarily operate key RR to extinguish the lamps and momentarily operate ITE-4683 key RESET. Remove the blocking tool from relay TM5.

6.97 Overall Timer (TM5)

6.971 Block relay TM2 operated and remove relay RLS from its socket. Originate a D call per Test 17 of Table 1. Within 14 to 17 seconds, timer TM5 should function to operate relay AL, to light lamp AL and activate the office alarms. The remote circuit should release. Momentarily operate key AR to retire the alarms and extinguish lamp AL.

6.972 Verify that relays TKO and TK8 are operated and that the hold magnet for Line 09 is released. Momentarily operate ITE-4683 key RESET, remove the blocking tool from relays RT and TM2 and replace relay RLS in its socket.

6.98 Control Circuit Preference (TM4): Block operated relay RL2; relay TM4 should release. Manually operate, in turn, relays L00, L11, L22, L33, L44, L55 L66 and L77. No other relays should operate. Remove the blocking tool from relay RL2; within 80 to 100 MSEC relay TM4 should operate.

6.99 Display Lost: Manually operate relay RR; it should lock. Manually operate relay TM3 momentarily; relay DL should operate lighting lamp DL. Momentarily operate key RR; relays RR and DL should release; lamp DL should be extinguished.

6.991 At the conclusion of testing with ITE-4683, block relay TA nonoperated, manually operate relays TKO and TK8 and release all operated hold magnets.

7. TROUBLE LOCATING

7.1 General

7.11 This paragraph is presented as a general guide to follow in locating troubles. They are not detailed for the functions of the solid state logic section of the remote circuit but will aid the installer to follow a line of analyzation.

7.12 Paragraph 7.3 illustrates the use of an oscilloscope to monitor a serial data message to or from the remote circuit. The triggering test points selected should suffice for all manner of troubles associated with that particular message. If the oscilloscope fails to trigger, that in itself could indicate the cause of the trouble. The CHANNEL A input lead may be moved to any other test point to test a particular logic state function.

7.13 Generally the timing relay functions are:

- TM1 (normally operated) release on failure to seize circuit (SR calls).
- TM2 (normally operated) release on failure of release function (all calls).
- TM3 (normally released) operate on failure of HM to operate or release (all calls).
- TM5 (normally released) times entire call for 14 to 17 seconds (all calls).
- RT (normally released) operates on failure to receive a message after sending one (all calls), or operates on failures of check on incoming message (all calls).
- TM4 (normally operated) releases upon successful release of the circuit to inhibit the start of another SR call for 80 to 100 MSEC.

7.14 Relays TM1, TM2 and TM5 should cause relay AL only to operate lighting lamp AL and activating the office alarms. Relay TM3 should cause relays AL (with alarms as above), RS1, RS2 and RR to operate in turn operating the reed relays that light lamps TK (2/10), T(2/5), U(2/5), C-- (clock phase), TM3, and a class of call lamps. Relay RT should cause a display similar to a TM3 failure with lamp SF lighted. When the circuit failure causes relay RT to operate, the portion of the call in trouble will be repeated once and the alarm will occur on the second failure.

7.2 Analysis and Locating

7.21 When a test fails, one of the timing circuits will function to start a trouble record by means of lamps. Release the test and repeat to attempt to determine which timer is functioning. Release the test again, momentarily operate keys AR and DL to extinguish the lamps and retire the alarms. Block all timing relays normal (operated or released) per Paragraph 7.13 and block relay AL nonoperated. Associate the observed condition with the proper sequence chart and repeat the test again. The remote circuit should lock at the point of failure facilitating analyzation.

7.22 If a serial data message is suspect, connect the oscilloscope per Paragraph 7.3 and repeat the test as often as necessary. The remote circuit may be released by manually operating relay RL2 between tests.

7.23 The relationship between ITE-4683 keys SEND operated to "1" and A, B or C relays of the remote circuit are as follows:

SR Call - A keys, B relays = trunk level
B keys, A relays = steering level
T or D Call - A keys, C relays = Class of call (T=4,7; D=0,1)
T Call - B keys, B relays = line units
C keys, A relays = trunk level
C keys, A relays = steering level

7.24 After a trouble has been cleared, remove the blocking tools from the timing relays before proceeding with the subsequent tests.

7.3 Use of Oscilloscope For Trouble Locating

7.31 Generally the Oscilloscope will be used to monitor outgoing or incoming messages from or to the remote circuit. The start of a message should trigger a single trace which should display the entire message on the oscilloscope screen.

7.32 When using ITE-4662 (Tektronix model 545A or B) oscilloscope install the ITE-4664 (type C-A) plug in unit and set the controls as follows:

545 Chassis TIME BASE A	
STABILITY (RED)	FULL CCW
TRIGGERING LEVEL	(SEE PARAGRAPH 7.34)
TRIGGERING MODE (RED)	DC
TRIGGER SLOPE	EXT-
VARIABLE (RED)	FULL CW
TIME/CM	10 MILLISEC
C-A CHANNEL A	
VARIABLE (RED)	FULL CW
VOLTS/CM	5
POLARITY	(+)
AC-DC	DC
MODE	A ONLY

7.33 Interconnect the oscilloscope and remote circuit with 2 ITE-9419 cords to monitor outgoing and incoming messages as follows:

TIME BASE TRIGGER INPUT	C-A CHANNEL A
SR outgoing T.P. E25	T.P. A11
T and D outgoing T.P. E35	T.P. A11
SR, T and D incoming T.P. A54	T.P. B32

NOTE: Do not use attenuated probes supplied with ITE-4662.

7.34 Adjust the TRIGGERING LEVEL control until a repetitive trace shows on the oscilloscope screen. Adjust the VERTICAL POSITION and HORIZONTAL POSITION controls to start the trace at the left center border of the screen grid. Readjust TRIGGERING LEVEL so that a trace appears only when test point E25, E35 or A54 is grounded momentarily.

7.35 Figure A illustrates a trace pattern of the outgoing message from the remote circuit that should result when attempting an SR call per test 1 of Table 1. The spacing and magnitude of the "highs" is approximate. The "highs" represent "mark" or "1" pulses while the base line or "lows" represent "space" or "0" pulses.

7.36 Variations of the foregoing setup may be used to monitor different portions of the electronic circuitry as required. Refer to the manual included with ITE-4662 for specific uses.

➔ Arrowed lines indicate new or changed information.

Manager, Crossbar Product Engineering
Control Center

ATTACHMENT
Figure A on Page 11.

Reason for Reissue:
To make tolerance corrections and remove references to manual release of hold magnets.

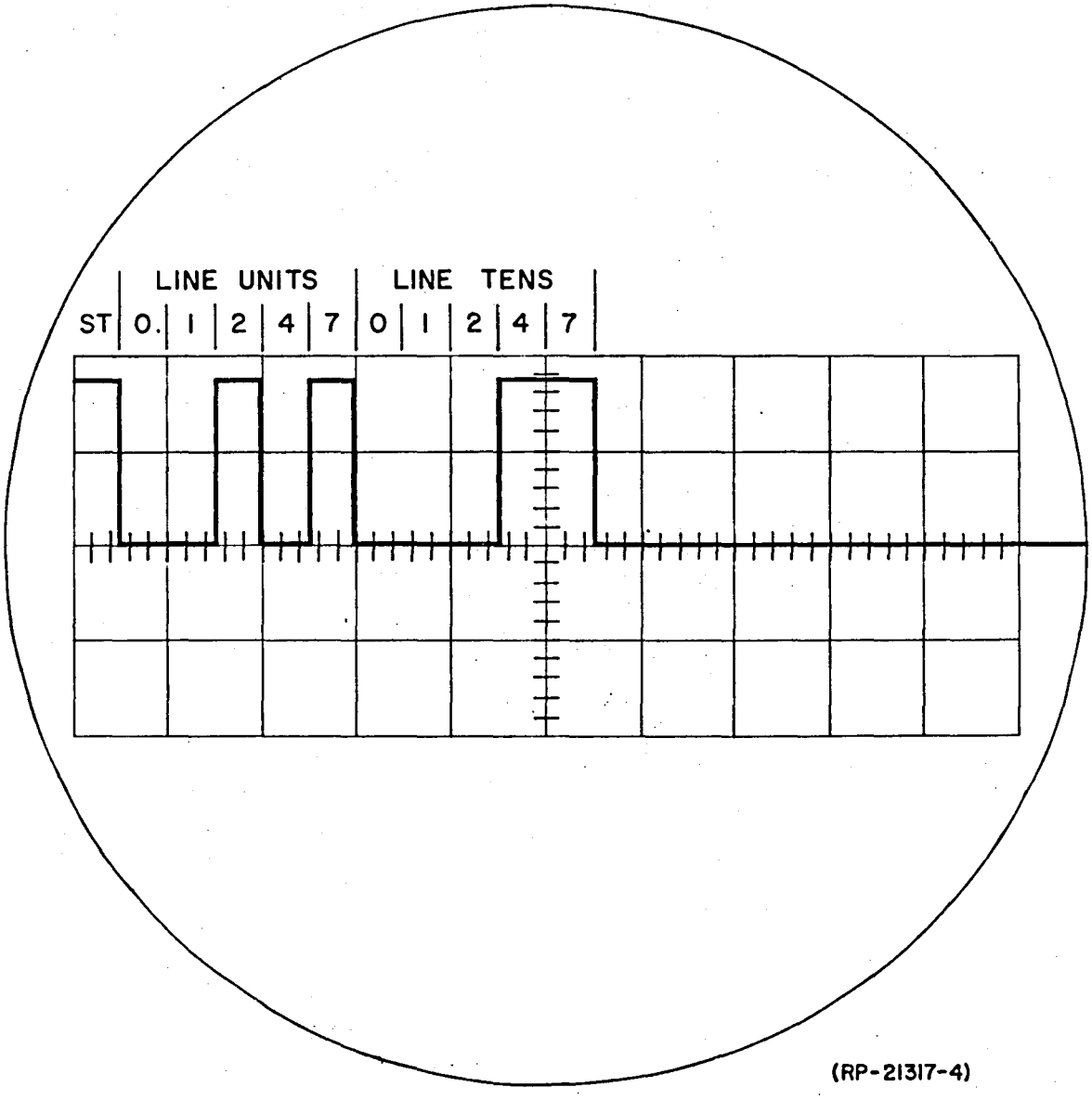

FIGURE A