

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

Replaces Section 923
 Dated 11-16-67 and
 Section T.I. 923
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1. GENERAL

1.1 This section provides methods for circuit pack adjustments of components per Circuit Pack Schematic SD-94817-01, adjustments for Power Supply Circuit SD-81608-01 and operation tests of 2A Line Concentrator Control Circuit SD-94815-01.

1.2 If the operating company requires load test per Section 928, tests per this section and Section 922 plus Sections 924 and 925 (Remote Circuit), 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 Verify ED-94866-30 Card Extender for crosses between adjacent terminals and between framework and all terminals before using.

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 preceding transistor logic stage. Direct ground may be applied to any test point if necessary.

2. TEST EQUIPMENT

2.1 Test Sets

Amt	ITE- or Code	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	T
1	4662	Tektronix Model 545A	A
	or	or 545B Oscilloscope	
	equivalent		

2.1 Test Sets (Cont.)

Amt.	ITE- or Code	Description	Note
1	4683	Serial Data Generator and Receiver Test Set	
1	H-P 400H	AC Voltmeter	T
1	H-P 522B	Electric Counter	T
	or		
1	R-9572	Test Receiver	T, B
1	4827	Test Receiver Set	
1	ED-94866-30	Card Extender	T
1	KS-19370, L1	Trouble Recorder Card Reader	T
1	KS-19355-L2	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 a capacitor of approximately .01 MF value from the operating company or locally.

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 its respective jack at the frame. Verify with ITE-2447 or equivalent that +12 VDC $\pm 0.12V$ is present at the DC OUTPUT jacks. Use a screwdriver in potentiometer ADJ VOLTS to obtain this reading.

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

4.2 Multivibrator CPS6

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

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

<u>Control</u>	<u>Position</u>
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

4.203 Remove CPS6 from socket A24, insert ED-94866-30 card extender into jack A24 and insert CPS into the card extender. It will be necessary to insert the capacitance of approximately .01 MF value between jack START of H-P 522B and test point C13 of the control frame under test. Use the coaxial cords supplied with H-P 522B plus whatever cords and/or connectors as necessary.

4.204 In any convenient manner ground test points F46 and F56. Block nonoperated relays TA0, TA1, OLO, OLI, TM1, TM2, TM4, TM5 and TM6. Block operated relay TM3.

4.205 To start the test ground test point C52. Operate switch RESET of H-P 522B. The Electronic Counter reading 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.

4.206 Adjust potentiometer R1 on the upper part of CPS6 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.

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

<u>Control</u>	<u>Position</u>
Frequency Unit	10 CPS
Function Selector	Frequency

4.208 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 lower part of CPS6 to obtain this reading as necessary. Operate H-P 522B switch RESET after each adjustment. After initial adjustment, a drift of ± 8 CPS is permissible.

4.209 Remove the cord from test point C13 and connect it in turn to test points B14, B55 and B24. Each test point should read 200 CPS. Operate H-P 522B switch RESET before each reading.

4.210 At the conclusion of this adjustment remove the test connections, the ground from test point C52, CPS6 from the card extender, the card extender from socket A24 and reinsert CPS6 into socket A24.

4.3 Control Unit Send Circuit CPS8

4.31 Modulator (M0)

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

<u>Control</u>	<u>Position</u>
Frequency Unit	10 CPS
Function Selector	Frequency

4.312 Remove CPS8 from socket A1, insert the card extender and insert CPS8 into the card extender. Insert the 310 plug of an ITE-9639 cord into jack 50DR. At the other end of the cord connect the T connector to the H-P 522B jack INPUT and the R connector to ground.

4.313 At the back of socket A1, strap terminals 16 to 18 and 8 to 6.

4.314 In any convenient manner connect ground to test point All. Operate switch RESET of H-P 522B. The Electronic Counter should read 2025 ± 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 522B before each reading.

4.315 Remove the ground from test point All and operate switch RESET of H-P 522B. The reading should be exactly the same as obtained in Paragraph 4.313.

4.316 Apply ground to test point C45. Operate H-P 522B switch RESET. The Electronic Counter should read 2225 ± 2 CPS. If necessary, use the KS-19355 adjuster to adjust transformer T2 (2570B) to obtain this reading. Operate H-P 522B switch RESET before each reading.

4.317 Remove the ground from test point C45.

4.32 Power Amplifier (PA0)

4.321 Remove the ITE-9639 cord from H-P 522B and ground and connect the T and R connectors to the input jacks of H-P 400H with a 600 ohm termination and the R connector to the ground side. The H-P 400H should read the signal sent at -18 DBM. To obtain this reading adjust potentiometer R10 of CPS8.

4.33 At the conclusion of these adjustments remove the test connections, CPS 8 from the card extender, the card extender from socket A1 and reinsert CPS 8 into socket A1.

4.34 Modulator (M1) and Power Amplifier (PA1) (Q Wiring)

4.341 To test and adjust M1 and PA1 repeat Paragraphs 4.31 and 4.33 using jack S1DR and the CPS8 in socket A2. Use references to group 1.

4.4 Guard Interval Timer, Signal Present Detector CPS13, Limiter CPS9 and Control Unit Discriminator CPS10

4.41 Guard Interval Timer (GITO)

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

Control	Position
Trigger Input	COM
Trigger Slope (Start)	+
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 CPS13 from socket A7, insert the card extender and insert CPS13 into the card extender. Using ITE-9419 cord equipped with alligator clips connect test points A55 and B55. Using the coaxial cord supplied with H-P 522B connect jack START to test point A46 through the .01 MF capacitor. Remove CPS2 from socket A9. and in any convenient manner connect ground to T.P. A17 (group 0) or T.P. A43 (group 1).

4.413 In any convenient manner connect ground to test point C52. Operate H-P 522B switch RESET. The Electronic Counter should read 4.06 ± 0.01 milliseconds. Adjust potentiometer R5 of CPS13 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 C52 and A17 or A43. CPS13 from the card extender, the card extender from socket A7, and reinsert CPS13 into jack A7.

4.42 Guard Interval Timer (GIT1) (Q Wiring)

4.421 To test and adjust GIT1 repeat Paragraphs 4.411 to 4.414 on CPS13 in socket A4 connecting test points A32 and B55. Test at test point A23 and connect ground to test point C52. After GIT adjustments are completed in both Groups 0 and 1 reinsert CPS2 into socket A9.

4.43 Signal Present Detector And Limiter (LO)

4.431 Use an ITE-9419 cord to supply -48V test battery to ITE-4683 -48V jack. Use two ITE-9432 cords modified with ITE-2455 plugs to supply +12V from terminal 20 of any CPS socket (identified by red surface wiring) to ITE-4683 +12 jack and ground from the "N" ground bar behind the CPS tray to ITE-4683 GRD jack.

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

Control	Position
Frequency Unit	10 CPS
Function Selector	Frequency

4.433 Set the switches of ITE-4683 as follows:

Switch	Position
FREQ	A
MODE 1	A
MODE 2	A
2A-2B	2A
REM-CONT	CONT

Momentarily operate ITE-4683 key RESET.

4.434 Connect ITE-4683 jacks AC OUT to H-P 400H jacks input with a 600 ohm termination. Connect H-P 522B jack INPUT to INPUT jack of H-P 400H. The H-P 400H reading should be approximately -18 DBM. Operate switch RESET of H-P 522B the Electronic Counter should read 1070 ± 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.

4.435 Operate ITE-4683 key SET. Operate switch RESET of H-P 522B. The Electronic Counter should read 1270 ± 2 CPS. In the same manner as Paragraph 4.434 adjust transformer T2 (2570B) to obtain this reading if necessary.

4.436 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-9631 connect attenuator jacks OUT to control circuit jack RODR. Connect input of H-P 400H with a 1 megohm termination, to test points E47 and E37. Operate ITE-4683 key RESET. Adjust the attenuator until a reading of -38.5 ± .5 DBM is obtained on H-P 400H.

4.437 Remove the blocking tool from relay TA0. Remove CPS 9 from socket A6, insert the card extender into jack A6 and insert CPS9 into the card extender. Operate key RESET on ITE-4683. Adjust potentiometer R2 to the rear of CPS9 until relay TA0 operates. Turn potentiometer R2 in the opposite direction until relay TA0 releases.

4.438 At the conclusion of this adjustment, remove the test connections to ITE-4442, remove CPS9 from

the card extender, remove the card extender from socket A6 and reinsert CPS9 into socket A6. Block relay TA0 nonoperated.

4.439 ITE-4683 will be used for discriminator adjustments of Paragraph 4.45.

4.44 Signal Present Detector and Limiter (LI) (Q Wiring)

4.441 To test and adjust LI use Paragraphs 4.431 to 4.438 to apply to control circuit jack R1DR and test points E45 and E35 per Paragraph 4.436. Repeat Paragraph 4.437 using relay TA1.

4.45 Control Unit Discriminator (DO)

4.451 Remove the cords between ITE-4028 attenuator and ITE-4683 and from frame jack RODR or R1DR. With cord ITE-9639 connect ITE-4683 jacks AC OUT to control circuit jack RODR T and R. At ITE-4683 operate switches SEND SA1, SA4, SB0, SB2, SB7, SC1, and SC4 to "1" all other switches SEND should be on "0".

4.452 Set the controls on H-P 522B as follows:

<u>Control</u>	<u>Position</u>
Trigger Input	COM
Trigger Slope (Start)	+
Trigger Slope (Stop)	-
Trigger Level (Start)	+2
Trigger Level (Stop)	+2
Time Unit	(MILLISEC) (100)
Function Selector	TIME INTERVAL

4.453 Insert card extender into socket A8 and insert CPS10 into card extender. Use the coaxial cord supplied with H-P 522B to connect H-P 522B jack start to test point B11 through the .01 MF capacitor. Operate H-P 522B switch RESET.

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

4.455 Adjust potentiometer R3 of CPS10 to obtain the above reading if necessary. Operate switches RESET of ITE-4683 and RESET of H-P 522B before each reading.

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

<u>Control</u>	<u>Position</u>	
	<u>From</u>	<u>To</u>
Trigger Slope (Start)	+	-
Trigger Slope (Stop)	-	+

4.457 Repeat Paragraph 4.454. The same results should be observed. If not repeat Paragraph 4.455. These two adjustments must be repeated until the Electronic Counter reads 5.0 ± 0.25 milliseconds for both positive and negative pulse.

4.458 At the conclusion of this adjustment, remove CPS10 from the card extender, remove the card extender from socket A8 and reinsert CPS10 into socket A8. Remove the test connections to H-P 522B but leave ITE-4683 setup for next test.

4.46 Control Unit Discriminator (D1) (Q Wiring)

4.461 To test and adjust D1 repeat Paragraphs 4.451 to 4.458 using jack R1DR, CPS10 in socket A5 and test point A38.

4.47 At this time leave relays TA0 and TA1 blocked nonoperated, but remove the blocking tools from relays TM1 to TM6. Remove grounds from test points F46 and F56.

5. TIMING TESTS

5.1 Perform timing tests per SD-94815-01, Sheet F6, using Timing Test Set ITE-4325 or J-24753A.

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 or 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 should be performed on groups 0 and 1 separately using ITE-4683 to simulate the remote frame. A series of Service Request (SR), Terminating (T) and Disconnect (D) calls are listed in Table 1. Maintenance, Test and Trouble Recording calls are listed in succeeding paragraphs. The installer must associate functional designations of relays, keys, lamps, and cross-connection terminals referred to in any paragraph with the group under test.

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

6.12 With ITE-4683 still connected per Paragraph 4.45, make additional connections with wire suitable for wire wrapping as follows: ITE-4683 terminal IN to test point A11, ITE-4683 terminal RLS to relay OLO, 10F (while testing group 0) or relay OLI, 10F (while testing group 1). Connect +12V to terminal 10M of relays OLO and OLI from terminal 20 of any CPS socket (identified by red surface wiring).

6.121 While testing group 0, temporarily install "X" wiring. This consists of a strap from 12F to 12M of relay RSF1 and ground connected to test points A14, A43 and A53. Remove the blocking tool from relay TA0. Block nonoperated relay DO.

6.122 While testing group 1, temporarily install "W" wiring. This consists of a strap between 5F and 5M of relay RSF0 and ground connected to test points A37, A17 and A27. Remove the blocking tool from relay TA1. Block nonoperated relay D1.

6.13 Cord ITE-9639 will be used to connect ITE-4683 jacks AC OUT to jacks RODR and R1DR to test groups 0 and 1 respectively.

6.2 SR Calls: Preoperate relay TK- per Table I. 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 line number to be sent from ITE-4683 to the control circuit as set up on the send switches (A = line tens, B = line units). The control circuit should receive, interpret this information and operate the line hold magnet. The control circuit should then send a trunk check signal to ITE-4683 where it should match the REC switches operated to "1" (A = start, B = trunk level and C = trunk steering). Lamps S/R should light corresponding to the message received and if they match the REC switches, lamp MATCH should light. ITE-4683 and the control circuit then exchange open line signals, reapply tone and the control circuit should release.

6.21 Verify that the proper hold magnet is operated. Momentarily operate ITE-4683 key RESET before attempting another test. Repeat the above procedure for each SR test of Table 1.

6.3 T Calls: Preoperate relay TK- per Table I. 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 applying ground to terminal S of the line under test at T.S. S (beneath electronic tray). The control circuit should function to operate the line hold magnet and send a class of call and line number to ITE-4683 where it should match the REC switches operated to "1" (A = class of call, B = line units, and C = line tens). Lamp S/R will light corresponding to the message sent and if they match the 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 control circuit. This should match the operated TK- relay. The control circuit and ITE-4683 then exchange open line signals, reapply tone and the control circuit should release.

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

6.4 D Calls: Ascertain that no TK- relays are operated and that relays Z 0/1 and TPR 01/11 are operated. Relays W 0/1 and TPR 02/12 to 05/15 should be released. 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 removing the blocking tool from relay D 0/1 which should operate. The control circuit should function to operate relay TK-, release the line hold magnet latched to this trunk and send a class of call and trunk number to ITE-4683 where it should match the REC switches operated to "1" (A = class of call, B = trunk level and C = trunk steering). Lamps S/R will light corresponding to the message sent and if they match the REC switches, lamp MATCH will light. ITE-4683 then sends the trunk number as set upon the SEND switches (A = trunk level, and B = trunk steering) to the control circuit. This should match the operated TK- relay. The control circuit and ITE-4683 then exchange open line signals, reapply tone and the control circuit should release.

6.41 Verify that the proper hold magnet has released and that the proper TK- relay has operated. Also verify that the trunk preference control has advanced properly (refer to SC22). Block operated relay D 0/1 and manually release the operated relay TK- before attempting another test. Repeat the above procedure for each D call of Table 1 except do not release relay TK15 and do not block relay D 0/1 nonoperated after test 32. The frame is now in a condition to proceed with the following maintenance calls.

TABLE 1

TEST NO.	TYPE CALL	LINE	TRUNK	PREOPERATE RELAYS TK	ITE-4683					RELAY TK OPERATED	RELEASE RELAY TK	
					SEND SWITCHES		REC SWITCHES		WORD SWITCH			
					A	B	A	B				C
1	SR	09	00	00	2,7	4,7	7	4,7	4,7	10		
2	SR	18	01	01	1,7	0,1	7	4,7	0,1	10		
3	SR	27	02	02	0,7	0,2	7	0,1	4,7	10		
4	SR	36	03	03	2,4	1,2	7	0,1	0,1	10		
5	SR	45	04	04	1,4	0,4	7	0,2	4,7	10		
6	SR	54	05	05	0,4	1,4	7	0,2	0,1	10		
7	SR	63	06	06	1,2	2,4	7	1,2	4,7	10		
8	SR	72	07	07	0,2	0,7	7	1,2	0,1	10		
9	T	71	08	08	0,4	4,7	4,7	0,1	0,7	15		
10	T	60	09	09	0,4	0,1	4,7	4,7	2,4	15		

TABLE 1 (Cont.)

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

6.5 Maintenance Calls

6.51 Service Denial

6.511 Operate ITE-4683 switch WORD to 15. Operate switches SEND and REC to "1", all other switches to "0" as follows:

Group	Switch
REC A	1,2 (service denial class)
REC B	2,7 (line units)
REC C	4,7 (line tens)
SEND A	4,7 } special code for
SEND B	2,7 } service denial

6.512 At the control frame, in the group under test, install a temporary cross-connection between terminals SD 0/1 and S09 0/1. Relay TK15 should still be operated from test 32 of Table 1.

6.513 Momentarily operate ITE-4683 key RESET. Start the test by operating key SD 0/1. The call should proceed similar to a T call except lamp CC should light at completion; release key SD 0/1. Hold magnet 09 should operate, but no select finger should be engaged. Relay TK15 should still be operated.

6.52 Release Service Denial

6.521 Operate ITE-4683 switch WORD to 15. Operate switches SEND and REC to "1", all other switches to "0" as follows:

Group	Switch
REC A	0,4 (release service denial class)
REC B	2,7 (line units)
REC C	4,7 (line tens)
SEND A	4,7 } special code for
SEND B	2,7 } service denial

6.522 At the control frame, move the cross-connection installed per Paragraph 6.512 from terminal SD to terminal RSD 0/1.

6.523 Momentarily operate ITE-4683 key RESET. Start the test by operating key RSD 0/1. The call should proceed similar to a T call except lamp CC should light at completion; release key RSD 0/1. Hold magnet 09 should release and relay TK15 should still be operated. Remove the cross-connection from terminals RSD 0/1 and S09 0/1.

6.53 Permanent Signal Denial

6.531 The control circuit function on this type call is to first disconnect the line from the trunk and then recycle into a Service Denial Call. In order to test with ITE-4683, the installer must test each half separately.

6.532 In the group under test, block nonoperated relay D 0/1, manually release relay TK15 and originate an SR call per test 1 of Table 1 (relay TK00 operated). Afterwards manually operate relay TK01 and remove the blocking tool from relay D 0/1. Set switch TST 0/1 to 00 and block relay TM 5 nonoperated.

6.533 Operate ITE-4683 switch WORD to 15. Operate switches SEND and REC to "1", all other switches to "0" as follows:

Group	Switch
REC A	0,2 (special disconnect class)
REC B	4,7 (trunk level)
REC C	4,7 (trunk steering)
SEND A	4,7 (trunk level)
SEND B	4,7 (trunk steering)

Momentarily operate ITE-4683 key RESET.

6.534 Start the disconnect portion of the test by blocking operated first key PSD 0/1 and then key TST 0/1 (block these keys by means of orange sticks or toothpicks). The call should proceed similar to a D call. Relay TK01 should release, hold magnet 09 should release and relay TK00 should operate. Block nonoperated relay SL09 0/1 and install a temporary cross-connection between terminals SD 0/1 and S09 0/1.

6.535 Change ITE-4683 switches SEND and REC operated to "1" as follows:

Group	Switch
REC A	1,2 (service denial class)
REC B	2,7 (line units)
REC C	4,7 (line tens)
SEND A	4,7 } special code for
SEND B	2,7 } service denial

Momentarily operate ITE-4683 key RESET.

6.536 Start the Service Denial portion of the test by removing the blocking tool from relay SL09. It should operate and the call should proceed similar to T call. Lamp CC should light. Remove the blocking tools from keys TST and PSD. Hold magnet 09 should be operated, but no select should be engaged, relay TK00 should still be operated and lamp CC should be extinguished.

6.537 Repeat Paragraph 6.52 to release line 09 from a Service Denial Condition. Relay TK00 should still be operated. Remove the temporary cross-connection from terminals RSD 0/1 and S09 0/1 and set switch TST 0/1 to OFF.

6.6 Test Calls

6.61 Remote Circuit Request A Terminating Test Call

6.611 The control circuit function on this type call is to receive a request to operate relay SL79 as the start of a terminating Test Call. In order to test with ITE-4683, the installer must divide the test into two parts.

6.612 At the control frame block non-operated relays LT 07/17 and LU 09/19.

6.613 Operate ITE-4683 switch WORD to 10. Operate switches SEND to "1", all other switches SEND and REC to "0" as follows:

Group	Switch
SEND A	2,7 (line units)
SEND B	0,7 (line tens)

6.614 Momentarily operate ITE-4683 key RESET. Start the first half of the test by momentarily operating ITE-4683 key TEST. In the group under test relay SL79 should operate and lamp TTC 00/10 should light. Connect a test receiver across terminals T and R of trunk 00 (T.S.A).

6.615 At ITE-4683 operate switch WORD to 15 and momentarily operate key RESET. Operate switches SEND and REC to "1", all other switches to "0" as follows:

Group	Switch
REC A	4,7 (terminating class)
REC B	2,7 (line units)
REC C	0,7 (line terms)
SEND A	4,7 (trunk level)
SEND B	4,7 (trunk steering)

6.616 In the group under test, block nonoperated relay D 0/1. Start the second half of the test by removing the blocking tools from relays LU 09/19 and LT 07/17. The call should proceed as a T call. Verify that 1000 CPS tone is heard in the test receiver. Remove the test receiver and lamp TTC 00/10 should be extinguished.

6.617 Manually release hold magnet 79

6.62 Terminating Test Call

6.621 The control circuit function on this type call is to first disconnect the line connected to the trunk selected on switch TST and then recycle into a T call connecting the line under test or line 79 to the trunk selected. In order to test with ITE-4683 the installer must test each half separately.

6.622 Terminating Test Call On A Subscribers Line

6.6221 In the group under test, originate an SR call per test 2 of Table 1 (relay TK01 operated). Afterwards, manually operate relay TK02, remove the blocking tool from relay D 0/1, block relay SL27 nonoperated and set switch TST 0/1 to 01. Install a temporary cross-connection between terminals TC 0/1 and S27 0/1.

6.6222 Operate ITE-4683 switch WORD to 15. Operate switches SEND and REC to "1", operate all other switches to "0" as follows:

Group	Switch
REC A	0,2 (special disconnect class)
REC B	4,7 (trunk level)
REC C	0,1 (trunk steering)
SEND A	4,7 (trunk level)
SEND B	0,1 (trunk steering)

Momentarily operate ITE-4683 key RESET.

6.6223 Start the disconnect portion of the test by blocking operated first key TC 0/1 and then key TST 0/1 (block these keys by means of orange sticks or toothpicks). The call should proceed similar to a D call. Relay TK02 should release, hold magnet 18 should release and relay TK01 should operate.

6.6224 Change ITE-4683 switches SEND and REC operated to "1" as follows:

Group	Switch
REC A	4,7 (terminating class)
REC B	0,7 (line units)
REC C	0,2 (line tens)
SEND A	4,7 (trunk level)
SEND B	0,1 (trunk steering)

Momentarily operate ITE-4683 key RESET.

6.6225 Block relay D 0/1 nonoperated. Start the T portion of the call by removing the blocking tool from relay SL27 which should operate. Lamp CC should light. Remove the blocking tools from keys TC and TST. Hold magnet 27 should be latched to trunk 01 and lamp CC should be extinguished.

6.6226 Remove the cross-connection between terminals TC 0/1 and S27 0/1.

6.623 Terminating Test Call To Line 79

6.6231 In the group under test, originate an SR call per test 4 of Table 1 (relay TK03 operated). Afterwards, manually operate relay TK04, block nonoperated relay SL79, remove the blocking tool from relay D 0/1 and set switch TST 0/1 to 03.

6.6232 Operate ITE-4683 switch word to 15 and switches SEND and REC to "1". all other switches to "0" as follows:

Group	Switch
REC A	0,2 (special disconnect class)
REC B	0,1 (trunk level)
REC C	0,1 (trunk steering)
SEND A	0,1 (trunk level)
SEND B	0,1 (trunk steering)

Momentarily operate ITE-4683 key RESET.

6.6233 Start the disconnect portion of the test by blocking operated key TST. The call should proceed similar to a D call. Relay TK04 should release, hold magnet 36 should release, relay TK03 should operate and lamp TTC 01/11 should light.

6.6234 Change ITE-4683 switches SEND and REC operated to "1" as follows:

Group	Switch
REC A	4,7 (terminating class)
REC B	2,7 (line units)
REC C	0,7 (line tens)
SEND A	0,1 (trunk level)
SEND B	0,1 (trunk steering)

Momentarily operate ITE-4683 key RESET.

6.6235 Block relay D 0/1 nonoperated. Start the T portion of the call by removing the blocking tool from relay SL79 which should operate. Lamp CC should light. Remove the blocking tool from key TST. Hold magnet 79 should be latched to trunk 03 and lamps CC and TTC 01/11 should be extinguished.

6.63 Control Unit Requests A Service Request Test Call

6.631 Manually operate relay TK04 and remove the blocking tool from relay D 0/1. Set switch TST 0/1 to OFF.

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

Group	Switch
REC A	4,7 (terminating class)
REC B	1,7 (line units)
REC C	0,7 (line tens)

Momentarily operate ITE-4683 key RESET.

6.633 Start the test by operating and holding key SRT 0/1. The call should proceed as a T call. Lamp SRC 0/1 should light followed by lamp SRT 0/1. Release key SRT 0/1. Verify that ITE-4683 lamp MATCH is lighted and that relay TK04 is still operated.

6.634 Manually release hold magnets 27 and 79.

6.7 Alarms and Trouble Recording

NOTE: For these tests the trouble recorder should not be made busy. Relay TK designations, line and/or hold magnet numbers refer to both groups 0 and 1. Unless noted otherwise, disregard ITE-4683 lamps.

6.71 Recycle Timing TMI

6.711 SR Call (100-150 MSEC)

6.7111 Block nonoperated relays TM5, ABK and D0/1. Manually operate relay TK02. Originate an SR call per test 3 of Table 1. Because relay ABK cannot operate, the 100-150 MSEC function of timer TMI should be activated and the call should not complete. Relay RC2 should operate and the control circuit should function per SC2.

6.7112 Remove the blocking tool from relay ABK and momentarily operate ITE-4683 key RESET. Restart the test by momentarily operating ITE-4683 key TEST. The call should complete normally operating the hold magnet to latch line 27 to trunk 02 and releasing relay RC2.

6.7113 Block nonoperated relay ABK and manually operate relay TK03. Originate another SR call per test 4 of Table 1. Again the call should not complete and relay RC2 should operate.

6.7114 At ITE-4683 again momentarily operate keys RESET and then TEST. A trouble release should occur (SC13 and SC19). Lamps RLT and TRT should be lighted, the major alarm should be activated and a trouble recorder card should be perforated. Momentarily operate key AR to retire the alarms and extinguish the lamps. The hold magnet for line 36 and relay TK03 should be released.

6.7115 With the KS-19370 Trouble Recorder Card Reader, verify that designations WC, LT1 and LT2 (line tens 3), LU2 and LU4 (line units 6), T10 and T11 (trunk steering 1), TU0 and

TU1 (trunk level 1), CP1, CP2 and CP8 (clock phase 11) and SR are perforated. Also verify that designations FT 0/1, FU 2/5 and GRP 0/1 are perforated to agree with the frame and unit under test.

6.712 SR Call (500-600 MSEC)

6.7121 Remove the blocking tool from relay ABK and block non-operated relays RL1 and RC2. Manually operate relay TK04 and originate an SR call per test 5 of Table 1. Because relay RL1 cannot operate, the 500-600 MSEC function of timer TM1 should be activated and the call should not complete (SC6). Relay RC1 should be operated.

6.7122 Remove the blocking tools from relays RL1 first, then RC2. Relay RC2 should operate in turn operating relay SS. The call should complete normally operating the hold magnet to latch line 45 to trunk 04.

6.7123 Block nonoperated relay RL1 and manually operate relay TK05. Originate another SR call per test 6 of Table 1. Relay TM1 should operate twice and a trouble release should occur (SC6 and SC19). Lamps RLT, TRT and DL should be lighted, the major alarm should be activated and a trouble record should be perforated. Remove the blocking tool from relay RL1. The control circuit should release. Momentarily operate keys AR and DL to retire the alarms and extinguish the lamps.

6.7124 Verify that the trouble recorder perforations are correct (CP should be 22). Relay TK05 should be operated and the hold magnet for line 54 should be released.

6.713 D Call (500-600 MSEC)

6.7131 Block nonoperated relay RC2 and in any convenient manner connect ground to T.P. B33. Manually release relay TK05. Reset the trunk preference by manually operating relays TPR 01/11, 02/12 and Z 0/1 and releasing relays TPR 03/13, 04/14, 05/15 and W 0/1. Originate a D call per test 19 of Table 1. Because relay EP will not release the 500-600 msec function of timer TM1 should be activated and the call should not complete (SC13). The hold magnet for line 27 should release and relays TK 02, RC1 and RC3 should be operated.

6.7132 Momentarily operate ITE-4683 key RESET and remove the ground from T.P. B33. Restart the test by removing the blocking tool from relay RC2 which should operate releasing relays RC1 and RC3. The call should complete normally releasing relay RC2.

6.7133 Connect ground to T.P. B33. Block nonoperated relays RC2 and D 0/1 and manually release relay TK 02. Preset the trunk preference by manually operating relays TPR 01/11, 02/12, 03/13 and Z 0/1 and releasing relays TPR 04/14, 05/15 and W 0/1. Originate a D call per test 21 of Table 1. Timer TM1 should again function as in paragraph 6.7131 to operate relays RC1 and RC3. Relay TK 04 should be operated.

6.7134 At ITE-4683 set switches SEND A4, A7, B1 and B7 to "1" with all other switches SEND set to "0". Momentarily operate ITE-4683 key RESET. Remove the ground from T.P. B33 and insulate contact 3B of relay RL1. Restart the test by removing the blocking tool from relay RC2. Relay RF should operate and a trouble release should occur. Lamp TRT should be lighted, the major alarm should be activated and a trouble recorder card should be perforated. Momentarily operate key AR to retire the alarm and extinguish lamp TLT. No TK- relays should be operated. Block nonoperated relay D 0/1 and remove the insulation from relay RL1.

6.7135 Verify that the trouble recorder perforations are correct (CP should be 27).

6.714 D Call (100-150 MSEC)

6.7141 Manually operate relay TK 06 and originate an SR call per test 7 of Table 1. Manually operate relay TK 07 and originate another SR call per test 8 of Table 1.

6.7142 Block nonoperated relays ABK, TM2 and TM6 and block operated relay TM3. Insulate contact 10M of relay OL 0/1. Preset the trunk preference by manually operating relays TPR 01/11, 02/12, 03/13, 04/14, and Z 0/1 and releasing relays TPR 05/15 and W 0/1. Originate a D call per test 23 of Table 1. Because relay ABK cannot operate the 100-150 msec function of timer TM1 should be activated and the call should not complete (SC14). The hold magnet for line 63 should be released and relays TK 06, RC2 and RC4 should be operated.

6.7143 At ITE-4683, momentarily operate key RESET and set all switches REC to "0". Remove the blocking tool from relay ABK and remove the insulation from relay OL 0/1. Restart the test by momentarily operating ITE-4683 key TEST. The call should complete normally releasing relay RC2.

6.7144 Block relay D 0/1 nonoperated and manually release relay TK06.

6.7145 Block relay ABK nonoperated and insulate contact 10M of relay OL 0/1. Preset the trunk preference by manually operating relays TPR 01/11, 02/12, 03/13, 04/14 and W 0/1 and releasing relays TPR 05/15 and Z 0/1. Originate a D call per test 24 of Table 1. The TM1 timer should again function as in paragraph 6.7142 to release the hold magnet for line 72 and operate relays TK07, RC1 and RC4.

6.7146 Momentarily operate ITE-4683 key RESET and restart the test by momentarily operating ITE-4683 key TEST. A trouble release should occur. Lamp TRT should be lighted, the major alarm should be activated and a trouble recorder card should be perforated. ITE-4683 should display some lamps S/R lighted, particularly C 0-7. This results from the solid "high" sent by the control circuit as a trouble release signal. Operate ITE-4683 switches REC to match the lighted S/R lamps. Lamp

MATCH should light. Insulate contact 3B of relay RL1. Remove the insulation from relay OL 0/1. The control circuit should release. Momentarily operate key AR to retire the alarms and extinguish lamp TRT. Block non-operated relay D 0/1 and remove the insulation from relay RL1. Line 72 should again be latched to trunk 07.

6.7147 Verify that the trouble recorder perforations are correct (CP should be 27). Remove the blocking tools from relays ABK, TM2, TM3 and TM6.

6.72 Timing The Release Of Relay RL1 (TM2): Insulate contact 11M of relay RL1 and manually operate relay TK00. Originate an SR call per test 1 of Table 1. The call should complete, but lamp RLT should light and the major alarm should be activated (SC6). Momentarily operate key AR to retire the alarm and extinguish lamp RLT. Remove the insulation from relay RL1.

6.73 Timing The Release of Relays RL2 Or RLS and TR2 (TM3): Block non-operated relay NK and manually operate relay TK01. Originate an SR call per test 2 of Table 1. The call should complete but lamp RLT should light and the major alarm should be activated (SC6). Momentarily operate key AR to retire the alarm and extinguish lamp RLT. Remove the blocking tool from relay NK.

6.74 Trouble Recorder Timer (TM4) and Overall Timer (TM5)

6.741 Block nonoperated relays RLS and TM1. Preset the trunk preference by manually operating relays TPR 01/11 and Z 0/1 and releasing relays TPR 02/12, 03/13, 04/14, 05/15 and W 0/1. At ITE-4683 set switches SEND A4, A7, B1 and B7 to "1" with all other switches SEND set to "0" and set switches REC A0, A1, B4, B7, C4 and C7 to "1" with all other switches REC set to "0". Set switch WORD to 15 and momentarily operate key RESET. Start a D call by removing the blocking tool from relay D. Lamps TRT and DL should light, the major alarm should be activated and a trouble recorder card should be perforated.

6.742 Insulate contact 3B of relay RL1. Remove the blocking tool from relay TM5. When relay TM5 operates, lamp TM5 should be lighted. Remove the blocking tool from relay RLS; lamp RLT should light. Momentarily operate key AR and DL to retire the alarms and extinguish the lamps. Block nonoperated relay D 0/1 and remove the insulation from relay RL1.

6.743 Line 09 should again be latched to trunk 00 and no TK- relay should be operated. Verify that the trouble recorder perforations are correct (CP should be 27).

6.744 Block nonoperated relays TM6 and TA0. Preset the trunk preference as in paragraph 6.741. Originate a D call per test 17 of Table 1. When the timing interval of relay TM5 has lapsed operating relay TM5, lamps TRT and TM5 should light, the major alarm should be activated and a trouble recorder card should be perforated. Momentarily operate key AR to retire the alarms and extinguish the lamps.

6.745 Relay TK00 should be operated and the hold magnet for line 09 should be released. Verify that the trouble recorder perforations are correct with designation TM5 perforated (CP should be 27). Remove the blocking tools from relays TM6 and TA0. Block nonoperated relay D 0/1 and manually release relay TK00.

6.75 Remote Signal Failure (TM6)

6.751 Block nonoperated relay TM5. RLS and TA1 (while testing group 0) or TA0 (while testing group 1). Preset the trunk preference by manually operating relays TPR 01/11 and W 0/1 and releasing relays TPR 02/12, 03/13, 04/14, 05/15 and Z 0/1. Originate a D call per test 18 of Table 1. Lamps TRT, DL and RSFO should light, the major alarm should be activated and a trouble recorder card should be perforated.

6.752 Insulate contact 3B of relay RL1 and remove the blocking tool from relay TM5. When relay TM5 operates lamps RLT, RSF1 and TM5 should light and lamps DL and RSFO should be extinguished. Remove the blocking tool from relay RLS and the control circuit should release. Momentarily operate keys AR and DL to retire the alarms and extinguish the lamps.

6.753 Block nonoperated relay D 0/1 and remove the insulation from relay RL1. No TK- relay should be operated and line 18 should again be latched to trunk 01. Verify that the trouble recorder perforations are correct (CP should be 27). Remove the blocking tool from relay TA 1/0.

6.76 Trunk Check Failure

6.761 Block nonoperated relays TM5. RLS and TCK. Preset the trunk preference by manually operated relays TPR 01/11, and W 0/1 and releasing relays TPR 02/12, 03/13, 04/14, 05/15 and Z 0/1. Originate a D call per test 18 of Table 1. Verify that relays TCF and ALM1 have operated. Lamps TRT and DL should light, the major alarm should be activated and a trouble recorder card should be perforated. Insulate contact 3B of relay RL1. Remove the blocking tool from relay TM5. When relay TM5 operates lamp TM5 should light. Remove the blocking tool from relays RLS and lamp RLT should light. Momentarily operate keys AR and DL to retire the alarms and extinguish the lamps.

6.762 Block relay D 0/1 nonoperated and remove the insulation from relay RL1. No TK- relay should be operated and line 18 should again be latched to trunk 01. Verify that the trouble recorder perforations are correct (CP should be 27). Remove the blocking tool from relay TCK.

6.77 Hold Magnet Failure - D Call

6.771 Block nonoperated relays TM5, HMK and RLS. Preset the trunk preference by manually operating relays TPR 01/11 and W 0/1 and releasing relays TPR 02/12, 03/13, 04/14, 05/15 and Z 0/1. Originate a D call per test 18 of Table 1. Verify that relays HMF1 and ALM1 have operated. Lamps TRT and DL should light, the major alarm should be activated and a

trouble recorder card should be perforated. Insulate contact 3B of relay RL1. Remove the blocking tool from relay TM5. When relay TM5 operates lamp TM5 should light and lamp DL should be extinguished. Remove the blocking tool from relay RLS and lamp RLT should light. Momentarily operate key AR to retire the alarms and extinguish the lamps.

6.772 Block relay D 0/1 nonoperated and remove the insulation from relay RL1. No TK- relay should be operated and line 18 should again be latched to trunk 01. Verify that the trouble recorder perforations are correct (CP should be 27). Remove the blocking tool from relay HMK.

6.78 Hold Magnet Failure - SR Call

6.781 Block nonoperated relay TM5 and the hold magnet for line 27. Manually operate relay TK02. Originate an SR call per test 2 of Table 1. Verify that relays HMF2 and ALM1 have operated. Momentarily operate ITE-4683 key RESET, set all switches SEND to "0" and momentarily operate ITE-4683 key TEST. Relay TBL should operate and a trouble release should occur. Lamps RLT and TRT should be lighted, the major alarm should be activated and a trouble recorder card should be perforated. Momentarily operate key AR to retire the alarms and extinguish the lamps. Verify that the trouble recorder perforations are correct (CP should be 22). Remove the blocking tools from relays TM1, TM5 and HM 27.

6.79 T, Service Denial and Release Service Denial Calls

6.791 Block nonoperated relays ATC 00/10 and ATC 01/11. Block operated relay TER 00/10. Operate relay TR1 momentarily. A trouble record should be perforated. Remove the blocking tool from relay TER 00/10. Operate relay TR2 momentarily. Lamps RLT and TRT should light and the major alarm should be activated. Momentarily operate key AR to retire the alarm and extinguish the lamps. Verify that designation T is perforated on the trouble recorder card.

6.792 Block operated relay SD 0/1. Operate relay TR1 momentarily. A trouble record should be perforated. Remove the blocking tool from relay SD 0/1. Operate relay TR2 momentarily. Lamps RLT and TRT should light and the major alarm should be activated. Momentarily operate key AR to retire the alarm and extinguish the lamps. Verify that designation SD is perforated on the trouble recorder card.

6.793 Operate and hold key RSD 0/1. Operate relay TR1 momentarily. A trouble record should be perforated. Release key RSD 0/1. Operate relay TR2 momentarily. Lamps RLT and TLT should light and the major alarm should be activated. Momentarily operate key AR to retire the alarm and extinguish the lamps. Manually release relay D 0/1. Remove the blocking tools from relays ATC 00/10 and ATC 01/11. Verify that designation RSD is perforated on the trouble recorder card.

6.8 Call Preference Check: In any convenient manner, connect ground to T.P. A17 and A43 first, then T.P. A38 and B11. With ITE-4442 voltmeter, using the 15V DC scale, test for +3V to 12V at T.P. A32 and A55. Connect ground to T.P. E38. T.P. A32 and A55 should read below +.3V. Remove the grounds from T.P. E38, B11, A38, A43 and A17.

6.9 At the conclusion of testing with ITE-4683, remove the "X" or "W" wiring installed in paragraph 6.1. Block relays TA0 and/or TA1 nonoperated, manually operate relays TK00 in both groups 0 and 1 and preset the trunk preference by manually operating relays TPR 01/11 and releasing relays TPR 02/12, 03/13, 04/14, 05/15. W 0/1 and Z 0/1. Remove the blocking tools from relays D 0/1 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. It is not detailed for the functions of the solid state logic section of the control 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 control 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 should 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 Basically the timing functions are:

- (a) TM1 (normally released) recycle timer; operates on failure to receive a message after sending one or a check failure of an incoming message.
- (b) TM2 (normally released) operates on failure of relay RL1 to release.
- (c) TM3 (normally operated) releases on failure of relays RL2 or RLS and TR2 to release.
- (d) TM4 (normally released) operates on failure of relay TR1 to release.
- (e) TM5 (normally released) operates on failure of entire call to complete within 12 to 14 seconds.
- (f) TM6 (normally released) operates on failure of relay TA 0/1 to operate in group not being served.
- (g) HMF1 and HMF2 (normally released) operates on failure of relay HMK to operate.
- (h) TCF (normally released) operates on failure of relay TCK to operate.

7.14 When any timing relay functions a major alarm should be activated. In addition when relays TM1 with TR2, TM5, TM6 with TA 0/1 (group being served) HMF1 and HMF2, or TCF function, a trouble record should be perforated; when relays TM1 with TR2, HMF1 and HMF2, or TCF function, lamp TRT should be lighted; when relays TM2 or TM3 function, lamp RLT should be lighted; when relay TM4 functions, lamps TRT and DL should be lighted; when relay TM5 functions, lamp TM5 should be lighted; when relay TM6 functions, lamp RSF 0/1 should be lighted for the group not being served, or with relay TA0/1 operated, lamp RSF 0/1 should be lighted for the group being served.

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 a trouble recorder card and/or 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 relays ALM1 and ALM2 nonoperated. Associate the observed condition with the proper sequence chart and repeat the test again. The control 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 control circuit may be released by manually operating relay RL2 between tests.

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

SR Call - A keys, B relays - line units
B keys, A relays - line tens

T or D Call - A keys, B relays - trunk level
B keys, A relays - trunk steering

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 control circuit. The start of a message should trigger a single trace which should display the entire message on the oscilloscope screen.

→ Arrowed lines indicate new or changed information.

7.32 When using ITE-4662 (Tektronix model 545 A 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 CCW
TIME/CM	10 MILLISEC

C-A CHANNEL A

VARIABLE	Full CCW
VOLTS/CM	5
POLARITY	(+)
AC-DC	DC
MODE	A ONLY

★Set TRIGGER SLOPE on AUTO to position the trace to start at the left center of the screen grid with the HORIZONTAL and VERTICAL POSITION controls.

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

<u>TIME BASE</u> <u>TRIGGER INPUT</u>	<u>C-A</u> <u>CHANNEL A</u>
--	--------------------------------

SR outgoing T.P. F54	T.P. A11
T and D outgoing T.P. E38	T.P. A11
SR, T and D incoming T.P. A37	T.P. A55

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

7.34 Adjust the TRIGGER LEVEL control until a trace appears only when test points F54, E38 or A37 are grounded momentarily.

7.35 Figure A illustrates a trace pattern of incoming message from ITE-4683 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.

Manager, Crossbar Product Engineering
Control Center

ATTACHMENT

Figure A on Page 13.

Reason for Reissue:

To make tolerance corrections and remove references to manual release of hold magnets.

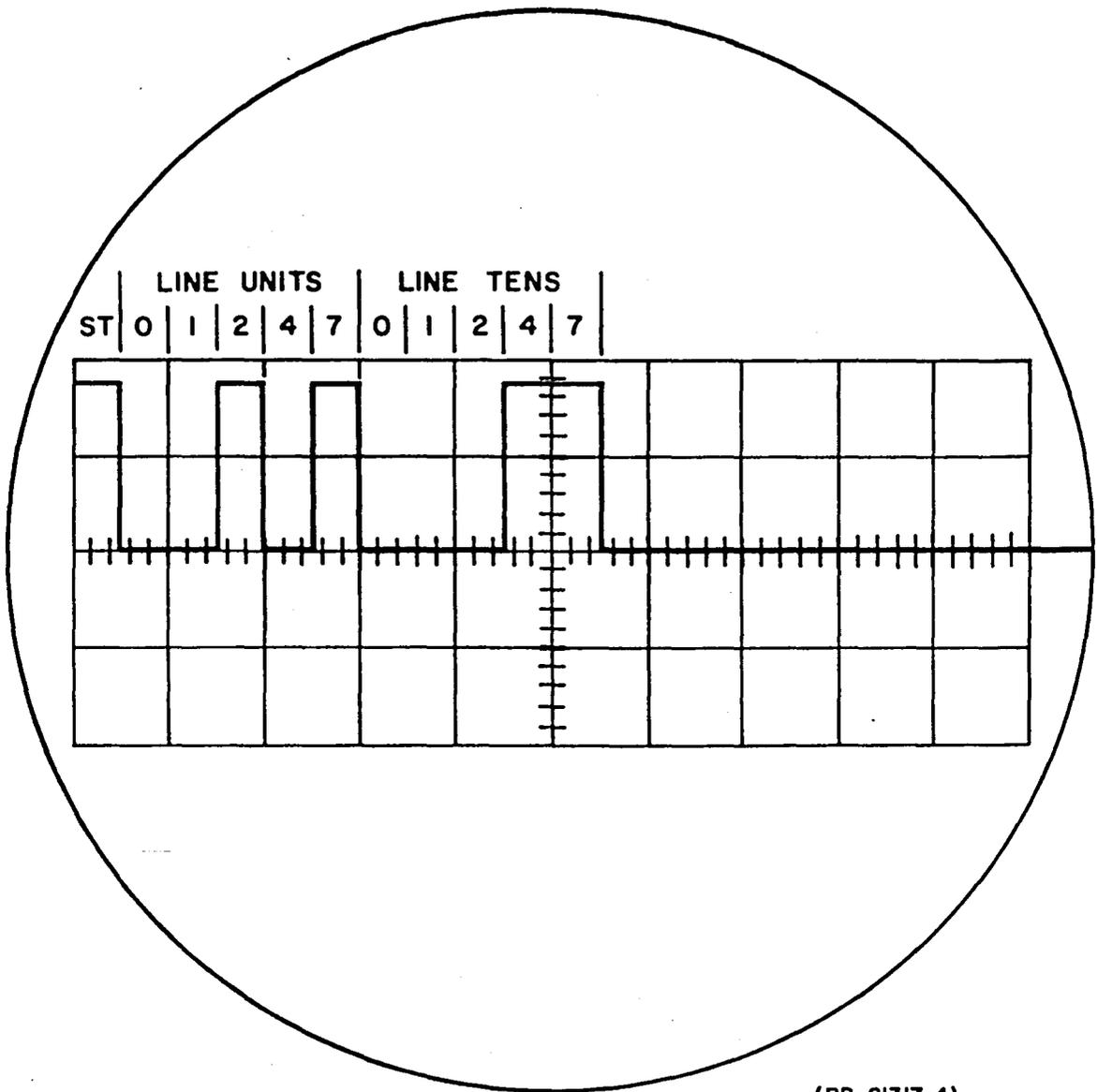


FIGURE A