
E2 STATUS REPORTING AND CONTROL SYSTEM
MANUAL ALARM CENTRAL
TROUBLESHOOTING PROCEDURES

This section contains step-by-step procedures to be performed at E2 manual alarm central stations to determine the nature and location of a problem(s). This procedure should be started only after going through the initial trouble diagnoses, Section 201-644-501, and determining that the E2 central is suspected of being defective.

Start with Flowchart 1 and proceed as directed to the appropriate chart. Charts 2 through 5 are used independently to test and fix the **common control** logic, (the data transmission circuit and data transmission control circuit). Chart 1 is used two ways: (1) to determine if the central can alarm poll, display report, and remote switch correctly, and (2) together with Flowcharts 2 and 3 to test and repair that circuitry. If the central is equipped for remote callup (used with L5 carrier), Chart 6 and Flowchart 4 are used to test and repair that circuitry, with Chart 6 being used both alone and together with Flowchart 4.

The reference to an SD on the flowcharts represents the necessity to leave this section as the problem is not in a circuit pack. When this occurs, visually inspect the wiring, connectors, and terminal blocks for physical damage. If no damage is found, troubleshoot the central using the CDs, SDs, and appropriate test equipment as required.

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NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

CHART 1

ALARM POLLING, DISPLAY REPORTING, AND REMOTE SWITCH TEST

APPARATUS:

- KS-20937, L1, E-Telemetry Station Test Set
- KS-20937, L4, General Purpose Plug-In
- KS-20937, L5, E1/E2 Test Cable
- Spare Circuit Packs

STEP

PROCEDURE

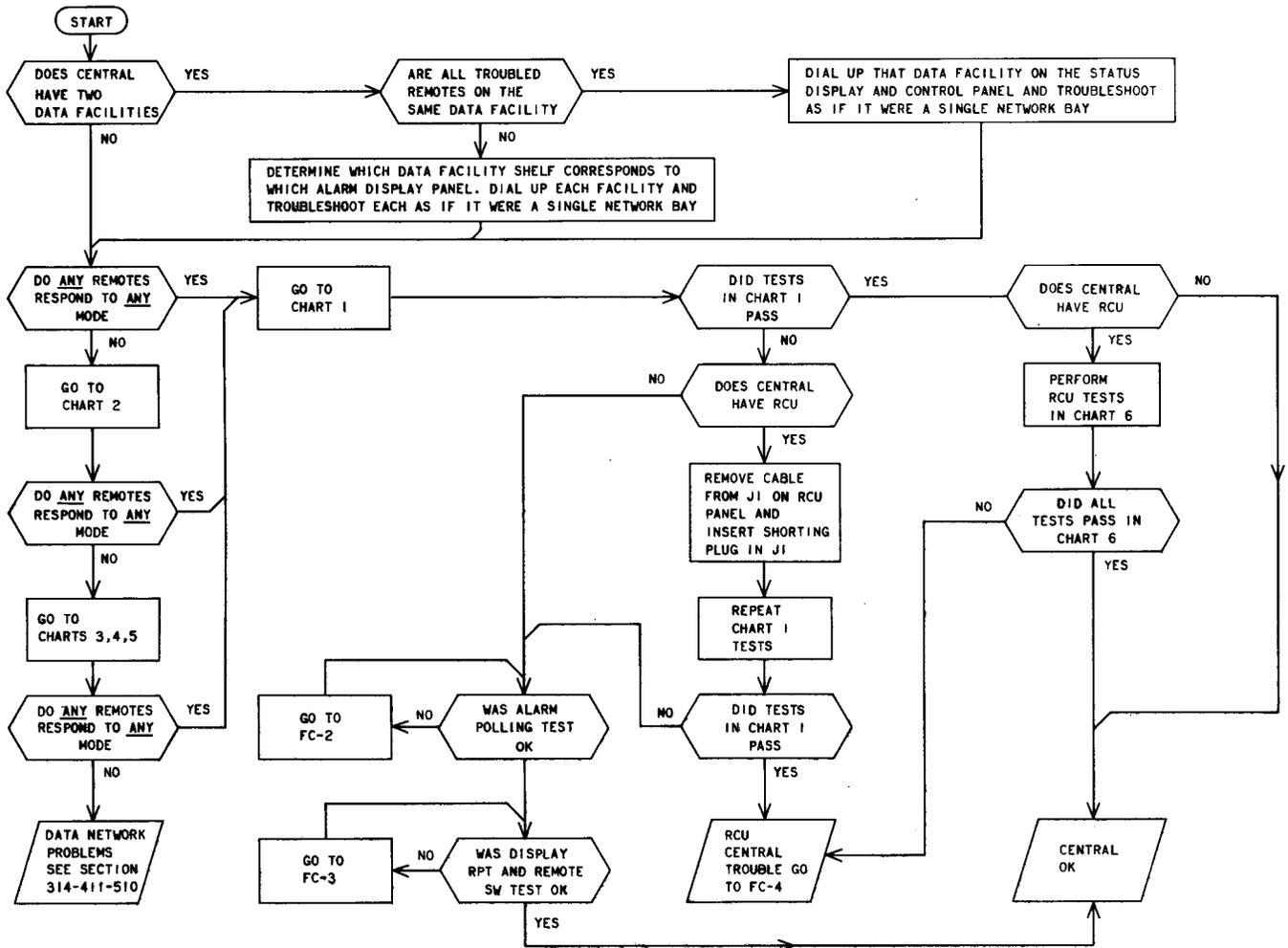
Caution: Remove power from bay before removing or replacing any circuit pack.

Initial Setup

- 1 Set the station test set switches to the following positions:

<u>SWITCH(ES)</u>	<u>POSITION</u>
SYSTEM	E1/E2
PARITY	B
BIT RATE	150 (If equipped with CP 87) 600 (If equipped with CP 88)
MODE	ONCE
ENABLE	NORMAL
DISPLAY ERROR WORD	OFF
DISPLAY WORD SELECT	1
POWER	OFF
RCU	OFF
MESSAGE LENGTH	1
WORD 1 through WORD 4	100000000000000000

CHART 1 (Contd)



Flowchart 1—Initial Central Diagnoses

CHART 1 (Contd)

STEP

PROCEDURE

2 Apply ac power to the test set.

3 Connect the E1/E2 test cable to the test set.

4 Depress the ALARM CUT OFF switch on the central bay.

5 Remove the data transmitter (in location 1-1/D) and data receiver (in location 1-1/B) circuit packs from the central bay.

6 Insert test connection cards in appropriate slots. *Do not seat cards.*

7 Set the test set POWER switch to the ON position.

8 Depress the INDICATOR TEST pushbutton.

Requirement: All RECEIVE indicator lamps will light. Failure of any or all lamps to light indicates test set problems.

9 Depress the MASTER CLEAR pushbutton.

Requirement: All RECEIVE indicator lamps will extinguish. Failure of all lamps to extinguish indicates test set problems.

CHART 1 (Contd)

STEP	PROCEDURE
10	Seat the test connector cards.
	Alarm Polling Test
11	Observe RECEIVE INFORMATION indicator lamps 4 through 7 on the station test set. Requirement: The indicator lamps will light per Table A. (This indicates if all remote stations are being polled.)
12	Depress the ALARM DISPL CLR pushbutton on the central. Requirement: The station fail indicators will flip yellow in sequence as each station is polled by the central.
13	Set the station test set MODE switch to ANSWER.
14	Depress the ALARM DISPL CLR pushbutton. Requirement: No SF (station fail) indicators will flip to yellow when the stations are polled.
15	Set WORD 1 switch number 2 to the 1 (up) position. Requirement: The top alarm indicator for each station will flip yellow sequentially.
16	Set the station test set PARITY switch to position A.
17	Depress the ALARM DISPL CLR pushbutton. Requirement: The ERROR WORD indicator lamp will light, and the SF indicators on the central will flip yellow. The top alarm indicator on the central bay will not flip yellow.
18	Set the station test set PARITY switch to position B.
19	Set WORD 1 switches 3 through 7 to the 1 position, one at a time. Requirement: Each switch (3 through 7) when placed in the 1 position will flip central alarm indicators 1 through 6, respectively, in a sequential and cyclic manner for all stations.
20	Set WORD 1 switches 2 through 7 to the 0 (down) position. Requirement: All flip indicators are cleared as each station is polled.
21	Depress the ALARM DISPLAY CLEAR pushbutton on the central.

CHART 1 (Contd)

TABLE A
STATION ADDRESS INDICATORS

STATION ADDRESS	TEST SET INFORMATION LAMPS			
	4	5	6	7
111	0	0	0	0
112	1	0	0	0
113	0	1	0	0
114	1	1	0	0
115	0	0	1	0
116	1	0	1	0
117	0	1	1	0
118	1	1	1	0
121	0	0	0	1
122	1	0	0	1
123	0	1	0	1
124	1	1	0	1
125	0	0	1	1
126	1	0	1	1
127	0	1	1	1
128	1	1	1	1

LEGEND:

1 - LIGHTED LAMP

0 - EXTINGUISHED LAMP

CHART 1 (Contd)

STEP	PROCEDURE
22	If all requirements in Steps 11 through 20 were met, the central alarm polls correctly. If any requirements were not met, the central does not alarm poll correctly. Note the fact that it does or does not poll correctly for decisions in Flowchart 1. Continue with the remainder of Chart 1 before returning to Flowchart 1.
	Display Report Test
23	Place a ground on pin 39 of CP 29.
	Caution: <i>Do not short ground clip to adjacent pins as damage may result.</i>
	Requirement: All SF (station fail) indicators will flip yellow.
24	Set the test set MESSAGE LENGTH switch to 4.
25	Set the STATUS GROUP thumb-wheel switches to 1A.
26	Depress, in order, the STATUS REPORT and SEND pushbuttons.
	Requirement: The TMT indicator lamp on the station test set will light, and <i>no</i> status indicators on the central will flip yellow.
27	Set all WORD 1 through WORD 4 switches to the 1 (up) position.
28	Depress, in order, the STATUS REPORT and SEND pushbuttons.
	Requirement: All status display indicators will flip yellow.
29	Set WORD 1 through WORD 4 switches 2 through 17 to the 0 (down) position.
30	Depress, in order, the STATUS REPORT and SEND pushbuttons.
	Requirement: All status display indicators will clear.
31	Set the LOOP STATION thumb-wheel switches on the central to 111.
32	Depress, in order, the STATUS REPORT and SEND pushbuttons.
	Requirement: On the station test set, RECEIVE INFORMATION indicator lamps 2 and 3 will be lighted, and 14, 15, 16, and 17 will be extinguished.
33	Advance the STATUS GROUP numeric switch from 1 to 16; depress SEND after each increment (refer to Table B).
	Requirement: The specified RECEIVE INFORMATION indicator lamps will light per Table B.

CHART 1 (Contd)

STEP	PROCEDURE
34	Set the DISPLAY WORD SELECT switch on the test set to 2.
35	Depress, in order, the STATUS REPORT and SEND pushbuttons on the central bay. Requirement: On the station test set, RECEIVE INFORMATION indicator lamps 1 and 9 will light.
36	Repeat Step 33 for each STATUS GROUP switch letter per Table C. Requirement: The specified RECEIVE INFORMATION indicator lamps will light per Table C.
Remote Switch Test	
37	Set the REMOTE SWITCH thumb-wheel switches on the central bay to 1A1.
38	Set the DISPLAY WORD SELECT switch on the station test set to 1.
39	Depress, in order, the SEND and REMOTE SWITCH pushbuttons on the central bay. Requirement: On the station test set, RECEIVE INFORMATION indicator lamps 2 and 3 will light.
40	Repeat Step 37 for each switch (left-numbered switch) position as shown in Table D. Requirement: The specified RECEIVE INFORMATION indicator lamps will light per Table D.
41	On the station test set, set the DISPLAY WORD SELECT switch to position 2.
42	Depress, in order, the SEND and REMOTE SWITCH pushbuttons on the central bay. Requirement: On the station test set, RECEIVE INFORMATION indicator lamps 1 and 12 will light.
43	Repeat Step 40 for each REMOTE SWITCH thumb-wheel (middle-lettered switch) position as shown in Table E. Requirement: The specified RECEIVE INFORMATION indicator lamps will light per Table E.
44	Set letter switch (middle switch) to position A.
45	Depress, in order, the SEND and REMOTE SWITCH pushbuttons on the central bay.

CHART 1 (Contd)

STEP	PROCEDURE
	Requirement: On the station test set, RECEIVE INFORMATION lamps 1 and 12 will light.
46	Repeat Step 42 for each REMOTE SWITCH thumb-wheel (right-numbered switch) position as shown in Table F.
	Requirement: The specified RECEIVE INFORMATION indicator lamps will light per Table F.
47	Remove the ground installed in Step 23.
48	If all requirements in Steps 22 through 44 were met, the central displays report and remote switches correctly. If any requirements were not met, the central does not display report and remote switches correctly. Note whether the central does or does not report and switch correctly for decisions in Flowchart 1.
49	Return to Flowchart 1.

CHART 2
DATA TRANSMISSION CONTROL (DTC) CIRCUIT TEST

APPARATUS:

Tektronix 453 Oscilloscope or equivalent

KS-14510, L1, Volt-Ohm-Milliammeter (VOM) or equivalent

Spare Circuit Packs

STEP	PROCEDURE
	Caution: Remove power from bay before removing or replacing any circuit pack.
1	Remove the data transmission CPs located in slots 1-1/A, 1-1/B, 1-1/C, and 1-1/D.
2	Ground pin 16 (RD lead) on CP 93.
3	Remove CP 29.

CHART 2 (Contd)

STEP	PROCEDURE
	<p>Note: E2 logic levels are as follows:</p> <p>Logic 1 = 0 to +0.35 Vdc</p> <p>Logic 0 = +5 to +24 Vdc</p>
4	Check the test points in Table G with a VOM or oscilloscope, in the order shown, for the desired logic level. Replace the defective circuit packs with spares.
5	Replace the circuit packs removed in Steps 1 and 3, and remove the ground from pin 16 on CP 93.
6	Return to Flowchart 1.

CHART 3**OPERATIONAL TEST OF THE DATA TRANSMISSION CIRCUIT****APPARATUS:**

21A Transmission Measuring Set (TMS)

KS-14510, L1, Volt-Ohm-Milliammeter (VOM) or equivalent

Tektronix 453 Oscilloscope or equivalent

Hewlett-Packard 400D Vacuum Tube Voltmeter (VTVM) or equivalent

Before any tests of the data transmission circuit are initiated, all ports of the line unit not utilized during the test must be terminated with 262B plugs to prevent transmission into the data network. If CP 119 is used, **do not** terminate those bridge ports already terminated via straps (refer to SD-1C301-01, FS1, FS3). All VF jacks must also be terminated with 262B plugs to properly terminate the data facility. It is essential that a circuit release be obtained from the network control office before any terminations are made or tests performed.

A transmission-level diagram is shown in Fig. 2 and should be referred to during the performance of any test or alignment procedure. All tests at unbalanced test points (TPs) should be made with an HP 400D VTVM or equivalent. It should be noted that the E2 data set operates at a data signal level of -13 dBm₀; that is, at any given transmission-level point (TLP), the data signal power is 13 dB less than the specified TLP value. This is an important point in that **all tests must be performed at data level and not TLP level.**

CHART 3 (Contd)

Table H summarizes the frequencies utilized in the E2 data sets and will be referred to in the following step-procedure tests.

STEP**PROCEDURE**

Caution: Remove power from bay before removing or replacing any circuit pack.

- 1 Apply a space-frequency tone (see Table H), using a 21A TMS or equivalent, at a level of -13 dBm₀ to the BR2 IN [AMP IN]* jack.

* Bracketed designations refer to jacks associated with CP 118 or CP 120.

- 2 Monitor TP 8 (RD lead) of the data receiver (CP 224, 227, 228, or 229) using either a KS-14510, L1, VOM or equivalent.

Requirement: The voltage will be greater than +12 Vdc.

- 3 Remove the space-frequency tone.

Requirement: The voltage at TP 8 will be less than +0.5 Vdc.

- 4 Reapply the space-frequency tone.

Requirement: The voltage at TP 8 will return to greater than +12 Vdc.

- 5 Change the oscillator frequency to a mark tone.

Requirement: The voltage at TP 8 should shift to less than +0.5 Vdc.

- 6 If the data set fails any of the preceding tests, replace the circuit packs in the order listed, rechecking Steps 2, 3, and 4 after each substitution:

- Data Receiver (CP 224, 227, 228, or 229)
- Receiver Control (CP 218)
- Line Unit (CP 118, 119, or 120)

- 7 Connect the 21A detector input to the BR2 OUT [AMP OUT] jack and plug a monitor receiver into the 21A monitor jack.

- 8 If equipped for loopback, operate the loopback key and proceed with Step 10.

CHART 3 (Contd)

STEP	PROCEDURE
9	If not equipped for loopback, disconnect the 21A oscillator from the line unit input. Ground TP 1 on CP 93, located in the data transmission control circuit. Remove CP 94, located in the data transmission control circuit.
10	Observe the output level on the 21A TMS. Requirement: If CP 118 or CP 119 is present, the level will be approximately -29 dBm; if CP 120 is present, the level will be approximately 0 dBm.
11	If the data set fails Step 10, replace the circuit packs in the order listed, rechecking Step 10 after each substitution: <ul style="list-style-type: none"> <li data-bbox="354 821 938 848">• Data Transmitter (CP 124, 127, 128, or 129) <li data-bbox="354 884 776 911">• Line Unit (CP 118, 119, or 120)
12	If equipped for loopback, change the 21A oscillator to the space frequency. Requirement: The tone heard on the monitor receiver will be the space frequency.
13	If not equipped for loopback, reinsert CP 94. Requirement: The tone heard on the monitor receiver will periodically shift between mark and space, resulting in a chirping sound.

Note: If the operational test outlined above proves good, there is reasonable assurance that the circuit packs comprising the data set are good; however, this check is by no means comprehensive and serves only to prevent attempts to check or perform level and threshold alignment with a dead data set. Once the operational test has been made and it has been determined that the data set is not dead, proceed with the alignment test in Chart 4.

CHART 4
ALIGNMENT TEST OF THE DATA TRANSMISSION CIRCUIT

APPARATUS:

21A Transmission Measuring Set (TMS)

KS-14510, L1, Volt-Ohm-Milliammeter (VOM) or equivalent

Tektronix 453 Oscilloscope or equivalent

CHART 4 (Contd)

STEP	PROCEDURE									
	<p>Caution: Remove power from bay before removing or replacing any circuit pack.</p>									
1	<p>Using a 21A TMS or equivalent, apply a -13 dBm_0 tone to the BR2 IN [AMP IN]* jack.</p> <p>Note: If the voiceband data set is being tested, the frequency will be 1300 Hz; if a telegraph channel data set is being tested, the frequency will be the space frequency (see Table H).</p> <p>* Bracketed designations refer to jacks associated with CP 118 or CP 120.</p>									
2	<p>Observe the signal at TP 14 on CP 118, 119, or 120.</p> <p>Requirement: The signal level will be $-11 \pm 0.5 \text{ dBm}$.</p>									
3	<p>Monitor TP 3 on CP 218 with a KS-14510, L1, VOM, or an oscilloscope. If available, the oscilloscope should be used.</p> <p>Requirement: The voltage at TP 3 will be less than $+0.5 \text{ Vdc}$.</p>									
4	<p>Decrease the input signal level until TP 3 on CP 218 shifts to greater than $+12 \text{ Vdc}$. Vary the level by a small amount to determine the exact level at which the shift occurs. The level at which the shift occurs is the data set threshold and is defined as -26 dBm_0 for CP 224 and CP 229 and as -30 dBm_0 for CP 227 and CP 228.</p> <p>Requirement:</p> <table border="1" data-bbox="360 1308 1299 1449"> <thead> <tr> <th data-bbox="483 1318 597 1346"><u>LINE UNIT</u></th> <th data-bbox="813 1308 959 1360"><u>THRESHOLD CP 224, CP 229</u></th> <th data-bbox="1133 1308 1279 1360"><u>THRESHOLD CP 227, CP 228</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="440 1381 639 1409">CP 118, CP 119</td> <td data-bbox="792 1381 976 1409">$-19 \pm 0.5 \text{ dBm}$</td> <td data-bbox="1112 1381 1295 1409">$-23 \pm 0.5 \text{ dBm}$</td> </tr> <tr> <td data-bbox="500 1413 579 1440">CP 120</td> <td data-bbox="792 1413 976 1440">$-29 \pm 0.5 \text{ dBm}$</td> <td data-bbox="1112 1413 1295 1440">$-33 \pm 0.5 \text{ dBm}$</td> </tr> </tbody> </table>	<u>LINE UNIT</u>	<u>THRESHOLD CP 224, CP 229</u>	<u>THRESHOLD CP 227, CP 228</u>	CP 118, CP 119	$-19 \pm 0.5 \text{ dBm}$	$-23 \pm 0.5 \text{ dBm}$	CP 120	$-29 \pm 0.5 \text{ dBm}$	$-33 \pm 0.5 \text{ dBm}$
<u>LINE UNIT</u>	<u>THRESHOLD CP 224, CP 229</u>	<u>THRESHOLD CP 227, CP 228</u>								
CP 118, CP 119	$-19 \pm 0.5 \text{ dBm}$	$-23 \pm 0.5 \text{ dBm}$								
CP 120	$-29 \pm 0.5 \text{ dBm}$	$-33 \pm 0.5 \text{ dBm}$								
5	<p>Connect the 21A detector input to the BR2 OUT [AMP OUT] jack.</p>									
6	<p>If equipped for loopback, operate the loopback key.</p>									
7	<p>If not equipped for loopback, ground TP 1 on CP 93 located in the data transmission control circuit. Remove CP 94.</p>									
8	<p>Observe the signal level at TP 1 on CP 124, 127, or 128; or TP 6 on CP 129 of the data transmitter.</p> <p>Requirement: The signal level will be $-15 \pm 0.5 \text{ dBm}$.</p>									

CHART 4 (Contd)

STEP	PROCEDURE
9	<p>Observe the signal level at the BR2 OUT [AMP OUT] jack.</p> <p>Requirement: The level will be -29 ± 0.5 dBm for CP 118 or CP 119, or 0 ± 0.5 dBm for CP 120.</p> <p>Note: If the voltage and signal levels are within the limits outlined previously, the data set is in proper alignment. If any of the above requirements are not met, alignment of the data set must be performed as set forth in Chart 5 (Alignment Procedure for the Data Transmission Circuit).</p>

CHART 5**ALIGNMENT PROCEDURES FOR THE DATA TRANSMISSION CIRCUIT****APPARATUS:**

21A Transmission Measuring Set (TMS)

Hewlett-Packard 5233L Frequency Counter or equivalent

Hewlett-Packard 400D Vacuum Tube Voltmeter (VTVM) or equivalent

KS-14510, L1, Volt-Ohm-Milliammeter (VOM) or equivalent

Tektronix 453 Oscilloscope or equivalent

STEP	PROCEDURE
<p>Caution: Remove power from bay before removing or replacing any circuit pack.</p>	
1	Remove the data transmission control circuit fuses (F2, F7, and F18); then, remove CP 93 and REINSERT the fuses.
2	Using a 21A TMS or equivalent, apply a -13 dBm0 tone to the BR2 IN [AMP IN]* jack.
<p>Note: If the voiceband data set is being tested, the frequency will be 1300 Hz; if one of the telegraph channel data sets is being tested, the frequency will be the space frequency (see Table H).</p>	

CHART 5 (Contd)

STEP

PROCEDURE

* Bracketed designations refer to jacks associated with CP 118 or CP 120.

- 3 If a telegraph channel is being tested, connect an HP 5233L frequency counter or equivalent, to TP 14 of the line unit and adjust the 21A oscillator to within 1 Hz of the space frequency. If the voiceband data set is being tested, the frequency may be read directly from the oscillator dial.
- 4 Connect an HP 400D VTVM or equivalent to TP 14 on CP 118, 119, or 120, and observe the signal level.
- Requirement:** The signal level will be -11 ± 0.5 dBm.
- 5 If the requirement in Step 4 is not met, adjust R3 on CP 119, or R2 on CP 118 or CP 120 for the required level.
- 6 Connect the HP 400D VTVM to TP 13 on CP 229, or TP 14 on CP 224, 227, or 228, and note signal level. Change the frequency of the 21A oscillator to the space frequency (CP 229), or to the mark frequency for CP 224, 227, or 228.
- Requirement:** The signal level at the mark and space frequencies will not differ by more than 2 dB. If this requirement is not met, the data receiver must be replaced and Step 6 repeated.
- 7 Adjust the 21A TMS as follows:

<u>RECEIVER</u>	<u>FREQUENCY*</u>	<u>SIGNAL LEVEL</u>	
		<u>CP 118 or 119</u>	<u>CP 120</u>
CP 229	Mark	-18 dBm	-28 dBm
CP 224	Space	-18 dBm	-28 dBm
CP 227 or 228	Space	-22 dBm	-32 dBm

* See Table H

- 8 Connect the KS-14510, L1, VOM, or an oscilloscope, to TP 3 on CP 218.
- Requirement:** The voltage will be less than +0.5 Vdc. If the voltage is +12 Vdc or more, *omit* Step 9 and proceed to Step 10.
- 9 Decrease the oscillator output level in 0.2-dB steps. When the level has been decreased 1 ± 0.4 dB, the voltage at TP 3 on CP 218 will shift to greater than +12 Vdc.
- 10 If either of the two preceding requirements are not met, set the oscillator output level 1 dB below that specified in Step 7, and adjust potentiometer R5 on CP 218 so that the voltage at TP 3 shifts low. Repeat Steps 7 through 9 to verify the adjustment.

CHART 5 (Contd)

STEP	PROCEDURE
11	If the requirements in Steps 7 through 10 cannot be met following the adjustment, replace CP 218, and repeat Steps 7 through 10.
12	Increase the output level of the 21A oscillator to -16 dBm, and adjust the frequency to the space frequency (see Table H).
13	Connect the KS-14510, L1, VOM, or an oscilloscope, to TP 8 on the data receiver, and observe the voltage at that point. Requirement: The voltage will be greater than +12 Vdc.
14	Change the oscillator frequency to the mark frequency, and observe that the voltage at TP 8 on the data receiver shifts to less than +0.5 Vdc.
15	Slowly change the oscillator frequency from the mark to the space frequency, and observe that the voltage at TP 8 on the data receiver shifts to +12 Vdc at the midband frequency ± 5 Hz. If the voiceband data set is being tested, the shift will occur at 1750 ± 20 Hz. For narrowband data sets, see Table B.
16	If the voltage shift in Step 15 does not occur at the correct frequency, adjust potentiometer R23 on CP 224, 227, or 228, or potentiometer R21 on CP 229 until the voltage shift occurs at the correct frequency. Note: This adjustment is very sensitive near threshold and requires very little movement of the potentiometer. When adjusting the voiceband data receiver, several attempts may be required before proper adjustment is attained.
17	Connect the HP 400D VTVM to TP 6 on CP 129, or TP 1 on CP 124, 127, or 128. Connect the 21A TMS detector input to the line unit output, and plug a monitor receiver into the 21A monitor jacks.
18	If the data set is equipped for loopback, perform Steps 20 through 26.
19	If the data set <i>is not</i> equipped for loopback, omit Steps 20 through 25 and perform Steps 26 through 31.
20	Operate the loopback key, and adjust the 21A TMS to the space frequency (see Table H).
21	Observe the signal level indicated on the VTVM, and note that the tone heard on the monitor is the space frequency. Requirement: The signal level read on the VTVM will be -15 ± 1 dBm.
22	If the requirement is not met, adjust potentiometer R25 on CP 129, or potentiometer R14 on CP 124, 127, or 128 so that the level is -15 dBm.

CHART 5 (Contd)

STEP	PROCEDURE
23	Change the 21A TMS oscillator to the mark frequency (see Table H). Requirement: The signal level indicated on the VTVM will be -15 ± 1.5 dBm. The tone heard on the monitor will be the mark frequency. If this requirement is not met, the data transmitter CP must be replaced.
24	Change the 21A TMS oscillator back to the space frequency, and observe the signal level indicated on the 21A TMS detector. Requirement: The signal level will be -29 ± 0.5 dBm for CP 118 or CP 119 and 0 ± 0.5 dBm for CP 120. If necessary, adjust potentiometer R6 on CP 118 or CP 120, or potentiometer R5 on CP 119 to meet this requirement.
25	Release the loopback key, and remove all test connections and terminations.
26	Remove data transmission control circuit fuses (F2, F7, and F18). Reinsert CP 93, and then reinsert the fuses.
27	Remove CP 94 and ground TP 1 on CP 93 (both CPs are located in the data transmission control circuit).
28	Observe the signal level indicated on the VTVM and that the tone heard on the monitor is the mark frequency. Requirement: The signal level will be -15 ± 1 dBm. If necessary, adjust potentiometer R25 on CP 129, or R14 on CP 124, 127, or 128 so that the level is -15 dBm.
29	Observe the signal level indicated on the 21A TMS detector. Requirement: The signal level will be -29 ± 0.5 dBm for CP 118 or CP 119, or 0 ± 0.5 dBm for CP 120. If necessary, adjust potentiometer R6 (CP 118 or CP 120) or R5 (CP 119) for the required output level.
30	Reinsert CP 94 and note that the output level oscillates near -29 dBm. The extremes will not exceed -29 ± 1 dBm. If this requirement is not met, the data transmitter CP must be replaced.
31	Remove the ground from TP 1 on CP 93 and all test connections and terminations.

CHART 6
REMOTE CALLUP TEST

APPARATUS:

- KS-20937, L1, E-Telemetry Station Test Set
- KS-20937, L4, General Purpose Plug-In
- KS-20937, L5, E1/E2 Test Cable
- Spare Circuit Packs

STEP	PROCEDURE
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Caution: Remove power from bay before removing or replacing any circuit pack.

- 1 Set the station test set switches to the following positions:

<u>SWITCH(ES)</u>	<u>POSITION</u>
SYSTEM	E1/E2
PARITY	B
BIT RATE	150 (If equipped with CP 87) 600 (If equipped with CP 88)
MODE	ONCE
ENABLE	NORMAL
DISPLAY ERROR WORD	OFF
DISPLAY WORD SELECT	1
POWER	OFF
RCU	OFF
MESSAGE LENGTH	1
WORD 1 through WORD 4	100000000000000000

- 2 Verify switch on CP 245 (RCU) is down.
- 3 Apply ac power to the station test set.
- 4 Connect the E1/E2 test cable to the station test set.

CHART 6 (Contd)

STEP**PROCEDURE**

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- 5 Place the ALARM CUT OFF switch on the central to the lighted position.
- 6 Remove the data transmitter (in location 1-1/D) and the data receiver (in location 1-1/B) circuit packs from the central bay.
- 7 Insert and seat the test circuit packs in the appropriate slots.
- 8 Set the station test set POWER switch to the ON position.
- 9 Depress the MASTER CLEAR pushbutton on the station test set.
- 10 Depress the ALARM DISPL CLR pushbutton on the central.

Requirement: The SF (station fail) indicators will flip yellow, in sequence, as each station is polled by the central.

- 11 Set the station test set MODE switch to ANSWER.

RCU Mode Test

Note: If the RCU central panel is a J92618AU unit and it fails one or more of the following tests, remove P3 from J3 and place P3 on the test circuit shorting jack.

- 12 Set switch 17 of WORD 1 to the 1 (up) position.
- 13 Connect timer two lead, pin 12 of CP 245, to ground.

Requirement: Station test set RECEIVE INFORMATION lamps 2, 14, 15, 16, and 17 will light as each station is polled. The station address is displayed on RECEIVE INFORMATION lamps 4 through 7 (refer to Table A).

Continue Test

- 14 Set the following station test set switches as indicated:

Switch 1 of WORDs 2, 3, and 4 to the 1 (up) position
 Switch 12 of WORD 2 to the 1 (up) position
 MESSAGE LENGTH switch to 1
 RCU switch to ON.

Requirement:

- The TMT lamp and WORD 1 through WORD 4 indicator lamps will blink.
- The TMT lamp and WORD 2 through WORD 4 indicator lamps will blink.

CHART 6 (Contd)

STEP	PROCEDURE
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- The TMT-RCU sequence will continue for approximately 30 seconds.
- The RECEIVE INFORMATION indicator lamps 4 through 7 will display 0000 (all off) after approximately 30 seconds.

Data Display Test

15 Set the following station test set switches as indicated:

<u>SWITCH(ES)</u>	<u>POSITION</u>
RCU	OFF
WORD 2 through WORD 4	1111111111111111

16 Set switch on CP 245 to the up position.

17 Set the station test set RCU switch to the ON position.

Requirement: The central status display indicators 1 through 48 will flip yellow.

Immediate Reply Test

18 Set the station test set RCU switch to the OFF position.

19 Ground pin 39 of CP 29.

20 Set the following station test set switches as indicated:

<u>SWITCH(ES)</u>	<u>POSITION</u>
MESSAGE LENGTH	1
RCU	ON
MODE	ONCE
WORD 1	1000000000000001

21 Depress the MASTER CLEAR pushbutton.

22 Depress the START pushbutton.

Requirement: RECEIVE INFORMATION indicator lamps 2, 14, 15, 16, and 17 will light. Note which address lamps (4 through 7) are lighted.

CHART 6 (Contd)

STEP	PROCEDURE
23	Set WORD 2 through WORD 4 switches to 1000000000000000.
24	Add 1 to the address noted in Step 13 and set switches 4 through 7 in WORD 2 to the new address. Refer to Table A for switch positions.
25	Set switches 12, 13, and 14 in WORD 2 to the 1 (up) position.
26	Set the MODE switch to ANSWER.
27	Depress the MASTER CLEAR pushbutton.
28	Depress the STATUS DISPLAY CLEAR pushbutton on the central.
29	Depress the START pushbutton.
	Requirement:
	<ul style="list-style-type: none"> ● RECEIVE INFORMATION indicator lamps 2, 14, 15, 16, and 17 will light. ● The RECEIVE INFORMATION indicator lamps corresponding to the address in Step 21 will light. ● The status display indicators on the control status display panel will flip yellow corresponding to WORD 2 switches, on the test set, that are in the 1 (up) position. ● The test set will transmit and receive continuously for more than 30 seconds.
30	After verification of the requirements in Step 26, set switch 13 of WORD 2 to the 0 (down) position.
	Requirement: The test set will stop transmitting (TMT lamp stops blinking).
31	Depress the MASTER CLEAR pushbutton.
32	Remove ground lead from pin 39 of CP 29.
	Interrupt Test
33	Depress the START pushbutton.
	Requirement: The test set will go into a TMT-RCU mode.
34	Set the STATUS GROUP thumb-wheel switches to position 1A.
35	Depress, in order, the STATUS REPORT and SEND pushbuttons on the central bay.

CHART 6 (Contd)

STEP	PROCEDURE
	<p>Requirement: The test set stops transmitting (TMT lamp stops blinking) and RECEIVE INFORMATION indicator lamps 2 and 3 will light.</p> <p>Note: The ERROR lamp on the central will light because the RCU switch is in the ON position. When it is in this position, the test set will not answer a display command; therefore, when it receives a display command, the central ERROR lamp will light.</p>
36	Depress the MASTER CLEAR pushbutton.
37	Depress the ALARM DISPL CLR and STATUS DISPL CLR pushbutton switches on the central.
38	Set switch 13 of WORD 2 to the 1 (up) position.
39	Depress the START pushbutton.
	<p>Requirement: The test set will go into a TMT-RCU mode.</p>
40	Set the STATUS GROUP thumb-wheel switches to position 1A.
41	Depress, in order, the STATUS REPORT and SEND pushbuttons on the central bay.
	<p>Requirement: The RCU mode is not interrupted, and the SEND lamp on the central remains lighted.</p>
42	Set switch 13 of WORD 2 to the 0 (down) position.
	<p>Requirement: The RCU mode is interrupted, RECEIVE INFORMATION indicator lamps 2 and 3 will light, and the central ERROR lamp will light. This information will be displayed each time the SEND switch is depressed.</p>
43	Remove timer two lead ground from pin 12 of CP 245.
44	Set the switch on CP 245 to the down position.
45	If the RCU central panel is a J92618AH unit, return to Flowchart 1. If the RCU central panel is a J92618AU unit and has passed all tests with P3 connected to J3, continue with Step 46. If P3 was placed on the test circuit shorting jack, go back to the point where it was placed on the shorting jack, repeat the test from that point on, and then proceed to Step 46.

CHART 6 (Contd)

STEP	PROCEDURE
------	-----------

46 Set the station test set switches to the following positions:

SWITCH(ES)	POSITION
RCU	OFF
MODE	ONCE
DISPLAY WORD SELECT	1
WORD 1	100000000000000000

47 On the J92618AU RCU central panel, set the STATION ADDRESS switches to 13, and set the IR-TR switch to IR.

48 While observing the station test set INFORMATION indicators, depress and release the START TEST button on the RCU central panel.

Requirement: The RECEIVE INFORMATION indicator lamps (bits 4 through 7) on the station test set, will light in the order shown in Table A. This indicates that the central is polling each remote station reporting to it.

Note: Only the address of the remotes normally connected to the central will be displayed.

49 While observing the station test set RECEIVE INFORMATION indicator lamps, depress the START button.

Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display:

RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	0	1	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1
and then shall change to	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1

To reinitiate the sequence, depress the START TEST button on the RCU central panel, and then depress the START button on the station test set.

50 On the station test set, set the DISPLAY WORD SELECT switch to 2.

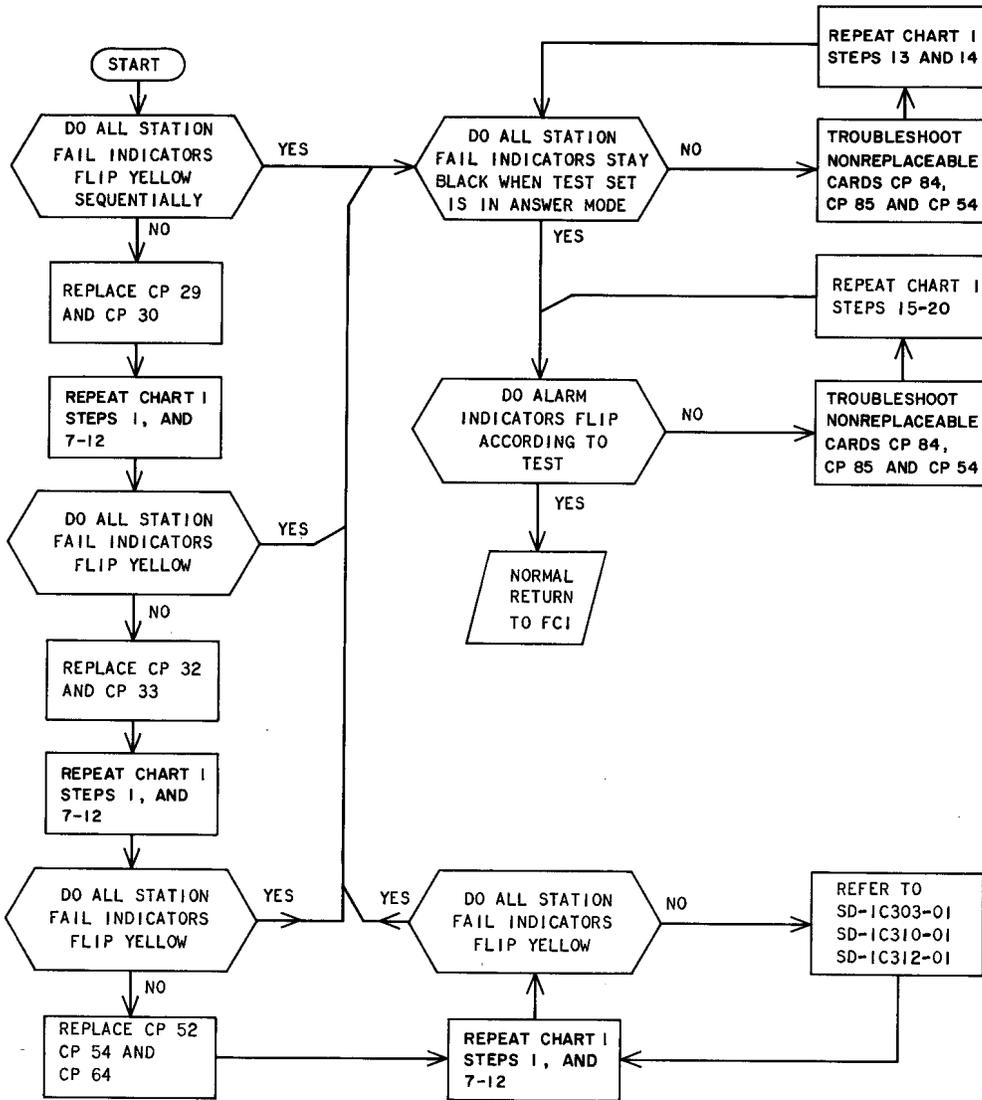
Note: Polling commands will be displayed only when the DISPLAY WORD SELECT switch is in position 1. When it is in position 2 or 3 and the E2 central returns to the polling mode, all RECEIVE INFORMATION indicator lamps will be off and the ERROR WORD lamp will light.

CHART 6 (Contd)

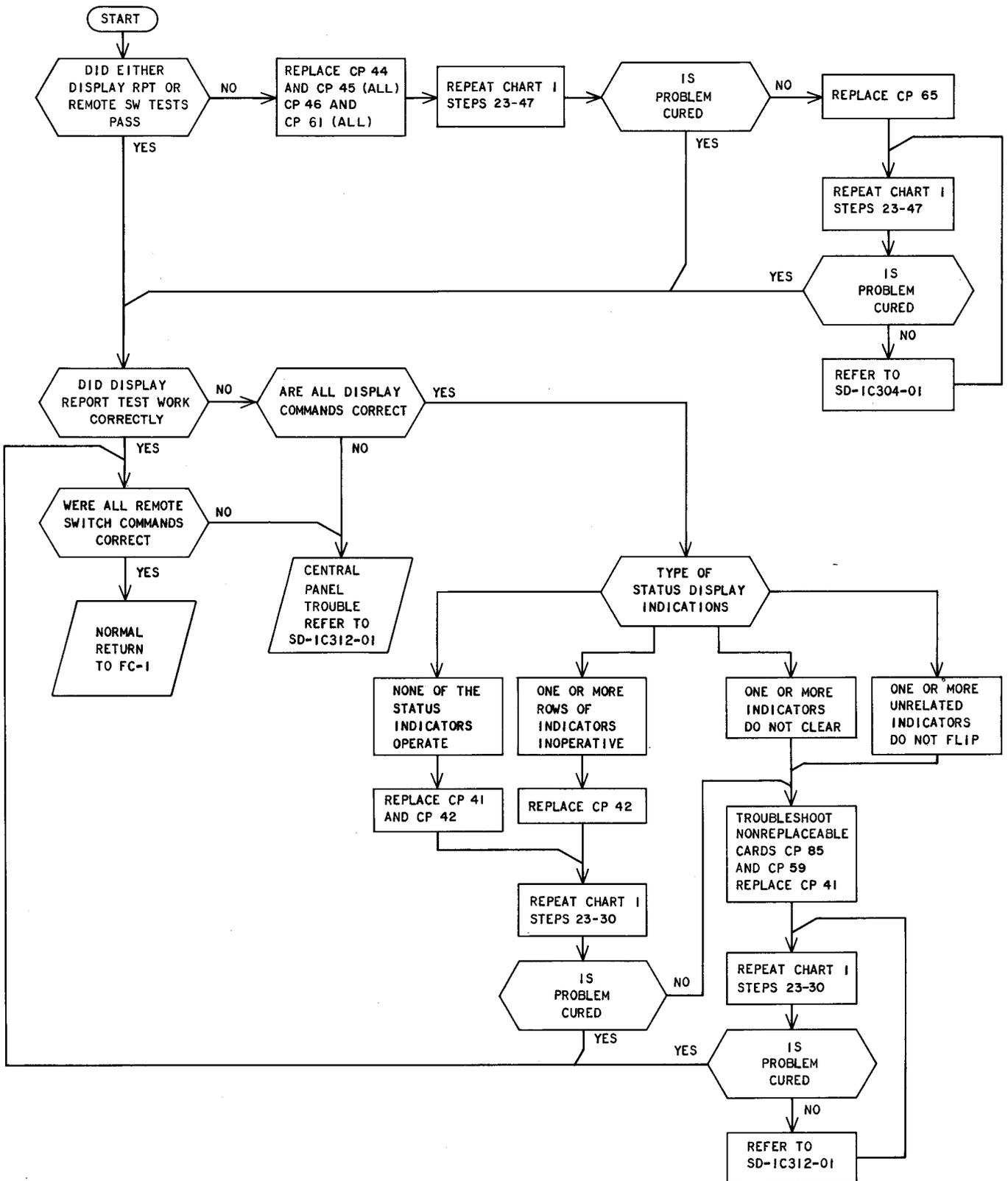
STEP	PROCEDURE																																				
51	On the RCU central panel, depress and release the START TEST button.																																				
52	While observing the station test set RECEIVE INFORMATION indicator lamps, depress the START button. Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display:																																				
	<table border="1"> <thead> <tr> <th>RECEIVE-INFORMATION Lamp</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>13</th> <th>14</th> <th>15</th> <th>16</th> <th>17</th> </tr> </thead> <tbody> <tr> <td></td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table>	RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																				
	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0																				
53	On the station test set, set the DISPLAY WORD SELECT switch to 1. Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display polling commands. See the requirement for Step 48.																																				
54	On the station test set, set the DISPLAY WORD SELECT switch to 2.																																				
55	On the RCU central panel, set the IR-TR switch to TR, the TEST A/TEST B switch to TEST B, and depress and release the RCU START TEST button.																																				
56	While observing the RECEIVE INFORMATION indicator lamps on the station test set, depress the START button. Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display:																																				
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RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																				
	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0																				
57	On the station test set, set the DISPLAY WORD SELECT switch to 1. Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display polling commands. See the requirement for Step 48.																																				
58	On the station test set, set the DISPLAY WORD SELECT switch to 3.																																				
59	On the RCU central panel, address and release the START TEST button.																																				

CHART 6 (Contd)

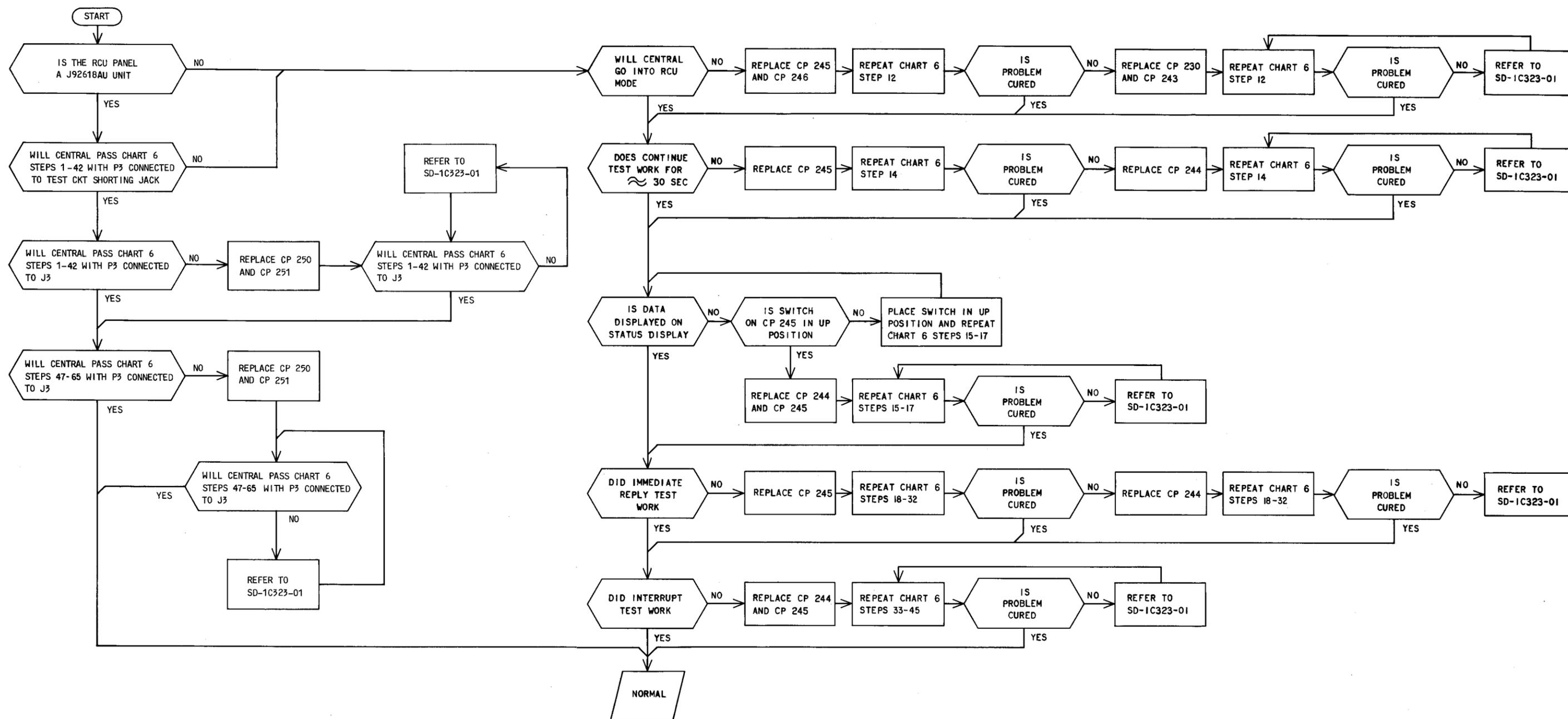
STEP	PROCEDURE																																				
60	<p>While observing the RECEIVE INFORMATION indicator lamps on the station test set, depress the START button.</p> <p>Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display:</p> <table border="1"> <thead> <tr> <th>RECEIVE-INFORMATION Lamp</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>13</th> <th>14</th> <th>15</th> <th>16</th> <th>17</th> </tr> </thead> <tbody> <tr> <td></td> <td>1</td> <td>0</td> <td>1</td> </tr> </tbody> </table>	RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																				
	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1																				
61	<p>On the station test set, set the DISPLAY WORD SELECT switch to 1.</p> <p>Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display polling commands. See the requirement for Step 48.</p>																																				
62	<p>On the station test set, set the DISPLAY WORD SELECT switch to 3.</p>																																				
63	<p>On the RCU central panel, set the RCU TEST A/TEST B switch to TEST A, and then depress and release the START TEST button.</p>																																				
64	<p>While observing the RECEIVE INFORMATION indicator lamps on the station test set, depress the START button.</p> <p>Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display:</p> <table border="1"> <thead> <tr> <th>RECEIVE-INFORMATION Lamp</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>13</th> <th>14</th> <th>15</th> <th>16</th> <th>17</th> </tr> </thead> <tbody> <tr> <td></td> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
RECEIVE-INFORMATION Lamp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17																				
	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0																				
65	<p>On the station test set, set the DISPLAY WORD SELECT switch to 1.</p> <p>Requirement: The RECEIVE INFORMATION indicator lamps on the station test set will display polling commands. See the requirement for Step 48.</p>																																				
66	<p>Return to Flowchart 1.</p>																																				



Flowchart 2—Alarm Polling Mode



Flowchart 3—Command Mode



Flowchart 4—Remote Callup Mode

TABLE B
DISPLAY COMMAND INDICATORS

SWITCH NUMBER	TEST SET - INFORMATION LAMPS - WORD 1					
	2	3	14	15	16	17
1	1	1	0	0	0	0
2	1	1	0	0	0	1
3	1	1	0	0	1	0
4	1	1	0	0	1	1
5	1	1	0	1	0	0
6	1	1	0	1	0	1
7	1	1	0	1	1	0
8	1	1	0	1	1	1
9	1	1	1	0	0	0
10	1	1	1	0	0	1
11	1	1	1	0	1	0
12	1	1	1	0	1	1
13	1	1	1	1	0	0
14	1	1	1	1	0	1
15	1	1	1	1	1	0
16	1	1	1	1	1	1

TABLE C
DISPLAY COMMAND INDICATORS

SWITCH LETTER	TEST SET - INFORMATION LAMPS - WORD 2			
	1	9	13	14
A	1	1	0	0
B	1	1	1	0
C	1	1	0	1
D	1	1	1	1

LEGEND:

- 1 - LIGHTED LAMP
- 0 - EXTINGUISHED LAMP

NOTE:

Information lamps not in table are all 0s.

TABLE D

REMOTE SWITCH INDICATORS

SWITCH NUMBER	TEST SET – INFORMATION LAMPS – WORD 1					
	2	3	14	15	16	17
1	1	1	0	0	0	0
2	1	1	0	0	0	1
3	1	1	0	0	1	0
4	1	1	0	0	1	1
5	1	1	0	1	0	0
6	1	1	0	1	0	1
7	1	1	0	1	1	0
8	1	1	0	1	1	1
9	1	1	1	0	0	0
10	1	1	1	0	0	1
11	1	1	1	0	1	0
12	1	1	1	0	1	1
13	1	1	1	1	0	0
14	1	1	1	1	0	1
15	1	1	1	1	1	0
16	1	1	1	1	1	1

TABLE E

REMOTE SWITCH INDICATORS

SWITCH LETTER	TEST SET – INFORMATION LAMPS – WORD 2					
	1	6	7	12	13	14
A	1	0	0	1	0	0
B	1	1	0	1	0	0
C	1	0	1	1	0	0
D	1	1	1	1	0	0
E	1	0	0	1	1	0
F	1	1	0	1	1	0
G	1	0	1	1	1	0
H	1	1	1	1	1	0
J	1	0	0	1	0	1
K	1	1	0	1	0	1
L	1	0	1	1	0	1
M	1	1	1	1	0	1
N	1	0	0	1	1	1
P	1	1	0	1	1	1
R	1	0	1	1	1	1
S	1	1	1	1	1	1

LEGEND:

- 1 – LIGHTED LAMP
- 0 – EXTINGUISHED LAMP

NOTE:

Information lamps not in table are all 0s.

TABLE F
REMOTE SWITCH INDICATORS

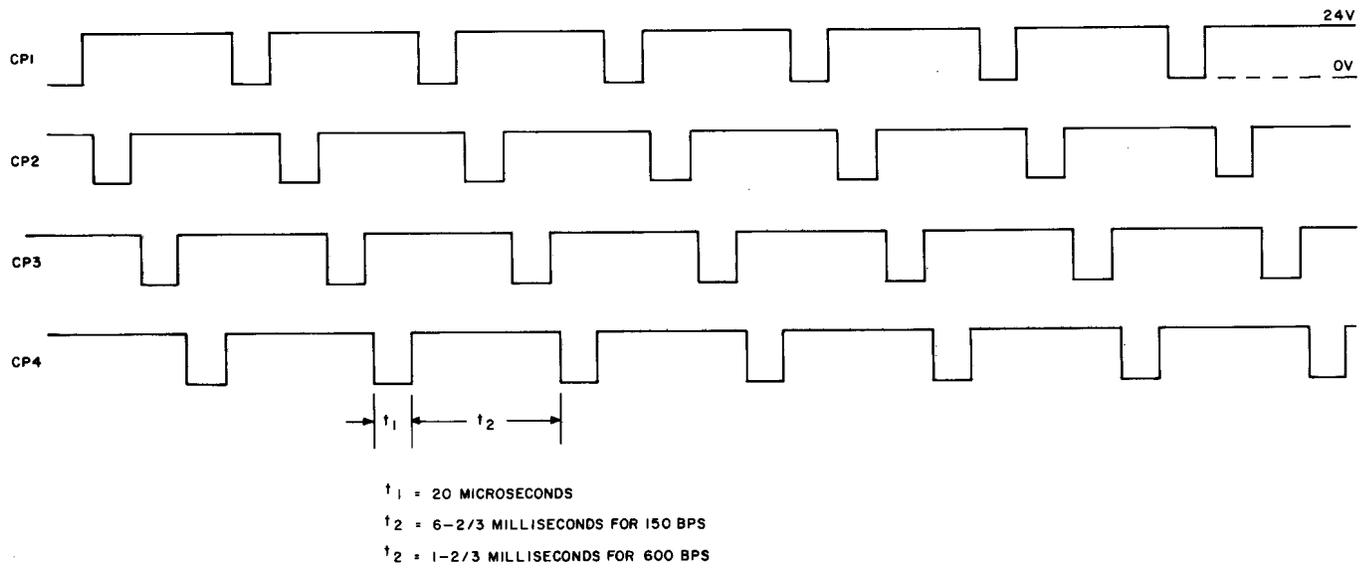
SWITCH NUMBER	TEST SET – INFORMATION LAMPS – WORD 2					
	1	2	3	4	5	12
1	1	0	0	0	0	1
2	1	1	0	0	0	1
3	1	0	1	0	0	1
4	1	1	1	0	0	1
5	1	0	0	1	0	1
6	1	1	0	1	0	1
7	1	0	1	1	0	1
8	1	1	1	1	0	1
9	1	0	0	0	1	1
10	1	1	0	0	1	1
11	1	0	1	0	1	1
12	1	1	1	0	1	1
13	1	0	0	1	1	1
14	1	1	0	1	1	1
15	1	0	1	1	1	1
16	1	1	1	1	1	1

TABLE G
DTC LOGIC LEVELS

CIRCUIT PACK	DESIG	LOGIC LEVEL	TEST POINTS	REPLACED IN ORDER LISTED IF LOGIC LEVELS ARE INCORRECT				
				1	2	3	4	5
93	Clock Pulse 1,2,3,4	As Indicated In Fig. 1	Punchings* 1,3,5,7	87 OR 88	93			
92	C0,C1,C2 C3,C4	0	10,7,4 6,14	92	93			
93	RCV	0	14	93	96			
93	\overline{RC}	1	13	93				
93	WR	0	12	93				
93	TMT	0	1	93	96	81 OR †147	8,15, OR †131	21 OR †146
90	IS	0	5	96				
94	TD	1	3	94	93			
96	CK	0	8	96				
96	ADV	0	3	96				
96	\overline{INH}	1	12	96				
96	$\overline{C31}$	1	5	96				
96	SCL	0	2	96				
95	P7,P6,P5 P4,P3,P2 P1	0	1,2,3,4 5,6,13	95	96			
2	\overline{ME}	1	1	2	93			
2	$\overline{NOT ME}$	1	9	2	93			
2	LF2	0	13	2	93			

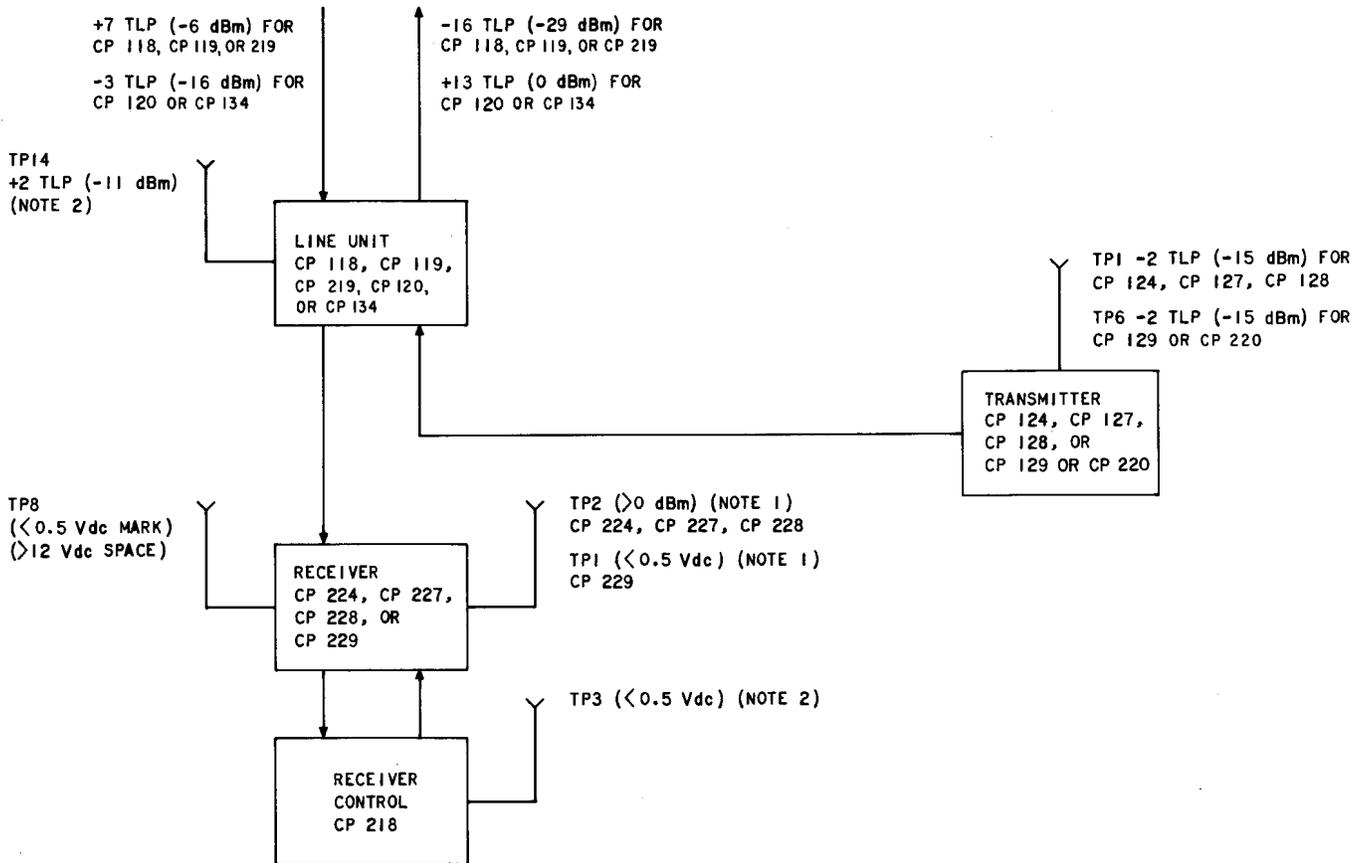
* On 908C Card Connector

† As Equipped



CAUTION: WHEN MAKING ABOVE TEST, BE CAREFUL NOT TO SHORT CIRCUIT PUNCHINGS.

Fig. 1—Clock Waveforms



NOTES:

1. NUMBERS SHOWN IN BRACKETS ARE DATA LEVELS AT THE POINT INDICATED. THOSE NUMBERS NOT ASSOCIATED WITH TPs ARE SHOWN FOR REFERENCE ONLY. ACTUAL VALUES MAY BE CONSIDERABLY HIGHER THAN THE MINIMUM VALUES SHOWN. THE ACTUAL VALUE IS DEPENDENT ON THE COMBINATION OF CIRCUIT PACKS USED IN A PARTICULAR INSTALLATION.
2. TP3 ON CP 218 IS AT A VOLTAGE OF LESS THAN 0.5 Vdc WHEN THE SIGNAL LEVEL AT THE INPUT OF CP 218 IS ABOVE THE THRESHOLD LEVEL OF -29 dBm. WHEN THE SIGNAL IS BELOW THE THRESHOLD VALUE, TP3 SHALL BE GREATER THAN +12 Vdc.

Fig. 2—Data Transmission Circuit—Level Diagram

TABLE H
DATA SET FREQUENCIES

DATA SET		TRANS/RCV CP NO.	MARK FREQ	MIDBAND FREQ	SPACE FREQ
TLG 150 bps	CH 4	124/224	1770	1700	1630
	CH 7	127/227	2790	2720	2650
	CH 8	128/228	3130	3060	2990
VB 600 bps		129/229	1300	1700	2100