CABLE PRESSURE MONITORING SYSTEM (CPMS)

REMOTE TERMINAL (SD-7C000-01)

TROUBLE LOCATING AND ALIGNMENT PROCEDURE

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1. GENERAL

1.01 This section contains the procedures for analyzing, locating, and correcting trouble at the remote terminal of the Cable Pressure Monitoring System (CPMS). Also contained in this section are procedures for calibrating the CP5 circuit pack.

1.02 This section is being reissued for the following reasons:

- Provide expanded trouble locating procedures
- Incorporate changes necessitated by Issues 6A and 7B of SD-7C000-01
- Include a description and operation of CPMS peak detector
- Delete circuit pack test procedures that are now included in Section 201-612-313
- Change title.

1.03 This section should be used to isolate and correct troubles at the CPMS remote terminal. Calibration procedures for CP 5 are also included. If there is trouble encountered at a satellite terminal, refer to Section 201-612-311.

1.04 The first procedure will be to identify a remote terminal malfunction as one of the five trouble classifications outlined in paragraph 1.05. Then perform the appropriate trouble locating procedure.

1.05 The CPMS remote terminal malfunctions generally fall into one of the following five categories:

- CLASS 1 ALARM: Class 1 alarms generate a CENTRAL OFFICE ALARM. They may also be indicated by lighted panel lamps at the remote terminal.

- CLASS 2 ALARM: There are two types of class 2 alarms: major and minor. Class 2 alarm does not generate a central office alarm. However, they do appear as error codes at the central terminal. The alarms are then referred to the responsible maintenance organization in the form of a trouble report.

- CLASS 3 MALFUNCTION—ERRONEOUS READINGS: A class 3 malfunction is defined as an erroneous reading not accompanied by a class 1 or class 2 alarm. The transducer device, status indicator, loop resistance, and airflow indicators may have erratic or erroneous readings that are not accompanied by a class 1 or class 2 alarm. These are class 3 malfunctions. This type of malfunction is referred by the CPMS central to the responsible maintenance group.

- CLASS 4 MALFUNCTION—SATELLITE ACCESS MALFUNCTION: This type of malfunction is a failure in the satellite terminal access circuitry at the remote terminal. If the trouble is isolated to a satellite terminal, refer to Section 201-612-311.

- CLASS 5 MALFUNCTION—SUBSCRIBER TROUBLE REPORTS: This type of malfunction is a subscriber generated trouble report resulting from a CPMS malfunction. It is usually caused by a failure of the idle and ring detection circuitry to detect a BUSY condition on a subscriber loop associated with CPMS.

2. TEST EQUIPMENT

A. Test Set J1C013AD-L1

2.01 The J1C013AD-L1 test set is used in many of the test procedures in this section. A complete description is given in Section 201-612-313. This test set is designed for use in 3 separate modes as follows:

- DATA SIMULATION MODE: The test set is used in this mode as a simulator for the CPMS central terminal, DDD network, and E2A telemetry. Coded instructions are transmitted directly from the test set to the remote terminal. Output data from the remote terminal is displayed on LEDs located on the test set panel.

- DATA MONITORING MODE: In this mode the test set is used to monitor the remote terminal output leads (TD1 to TD16). Maintenance personnel can compare the remote terminal transmissions against what the central terminal displays.

- CIRCUIT PACK TEST MODE: This mode is used to test 18 of the 20 coded circuit packs used in the remote terminal.

B. CPMS Peak Detector

2.02 The CPMS peak detector is used in isolating class 4 malfunctions (satellite access malfunction). However, two versions of the CPMS peak detector are currently in the field. The first version only had two modes of operation: remote and satellite. The latest peak detector has 4 modes: 333 hz remote, 500 hz remote, test resistor, and satellite. The new version has the following features:

- Direct measurement of 333 hz signalling tones

- Direct measurement of 500 hz signalling tones

- A convenient means of placing test resistors when troubleshooting in the satellite mode.

2.03 Also needed are the following:

- SD-7C000-01

- CD-7C000-01

- ED-2P007-01

The schematic description (SD-7C000-01) contains wiring diagrams, circuit pack schematics, and trouble analysis flow charts pertaining to the CPMS remote terminal. The circuit description (CD-7C000-01) includes a summary of CPMS remote terminal functions, and expanded procedures to be used in conjunction with SD-7C000-01. The CPMS remote terminal maintenance kit (ED-2P007-01) contains spare circuit packs.

3. TROUBLE LOCATING PROCEDURES

A. Class 1 Alarms

3.01 Class 1 alarms are indicated by lamps on the power distribution panel and by a LED located on the E2A telemetry circuit pack CP4. The indicator lamps and their description are given in Table A.

3.02 The following class 1 alarms are not remote terminal malfunctions and are not covered in this section.

- E2A Telemetry—An alarm indication on the E2A that is not accompanied by one of the other class 1 alarms. This indicates the trouble is in the E2A telemetry (refer to Section 201-653-503).

- Dedicated Alarm Circuit (DAL)—A DAL alarm that is not accompanied by one of the other class 1 alarms indicates an operated contactor on one of a possible 16 dedicated alarm pairs connected to the remote terminal. Such an alarm will not affect the operation of the remote terminal. A DAL alarm is referred to the responsible outside plant maintenance organization.

3.03 A standard procedure will be used to isolate all class 1 alarms other than those listed in the preceding paragraph. First verify that the power supply and alarm circuitry are in proper working order. Then check for relay and/or circuit pack malfunction. Charts 1 and 2 provide a voltage and lamp test, respectively.

3.04 Successful completion of charts 1 and 2 indicate that the power supply and alarm circuitry are in working order. This would also indicate that all potential causes of class 1 alarms have been eliminated except for relay/circuit pack malfunctions (indicated by the FSR lamp). If any class 1 alarms other than FSR should occur after completion of Charts 1 and 2, perform the chart procedures again.

3.05 A FSR alarm that is not accompanied by any other class 1 alarm indicates a relay malfunction. This condition may be caused by defective relays or defective relay access circuitry. These relays have been known to stick occasionally resulting in intermittent FSR alarms. This problem has been corrected in the new version of these circuit packs by replacing the 327B dry reed contact relays with 345A or 326B mercury relays. If the circuit packs HY2, HY9, HY18, and CP4 are suspect, check to see if they contain the 327B dry reed contact relays. Replace any circuit pack containing the 327B dry reed contact relays with the new circuit packs which have the mercury relays on it.

TABLE A

CPMS INDICATOR LAMPS AND DESCRIPTION

LAMP	FUNCTION
PS Lamp	Lights if power supply malfunction occurs
-48F Lamp	Lights if power supply malfunction occurs or if fuse F1 operates or if central office battery fails.
FSR Lamp	Lights if power supply or relay malfunction occurs.
DAL Lamp	Lights if one of a possible 16 dedicated cable pair leads has a closure or if power supply malfunction occurs (the DAL is optional and may include from 0 to 16 cable pairs).
E2A LED	Lights if E2A telemetry fails or if power supply malfunction occurs.

3.06 Figure 1 is a sequence of steps in flowchart format for isolating, locating, and correcting FSR alarms. If the preceding procedures and flowchart fail to clear the class 1 alarm, a serious problem may exist at the remote terminal. A functional checklist flowchart is contained in SD-7C000-01, sheet D14. If the source of the class 1 alarm cannot be identified by this means, an examination of the back plane wiring and circuit pack tests will be required.

B. Class 2 Alarm

3.07 Class 2 alarms do not cause central office alarms but do appear as reported troubles at the CPMS central. They are displayed on the cathode-ray tube (CRT terminal) status display or generated on the report that is printed at the central terminal line printer. The class 2 alarm that is formatted for the CRT status display are class 2 major alarms. The class 2 alarms that are on the alarm bulletins and escalation report constitute a minor alarm. A major condition will restrict the access and measurement capability of a remote terminal for all sensors. The minor conditions indicate that a particular sensor is not being accessed and measured by the remote terminal. Major class 2 alarm conditions should be given a higher priority than minor class 2 alarms.

Major Class 2 Alarms

3.08 The major class 2 alarm codes are described in the following paragraphs. The codes appear on the CRT status display. Each code represents a different alarm condition. Major class 2 alarms should be handled before minor class 2 alarms.

Code 1: Cannot access remote terminal—This code appears on the CRT when the E2A or 202S data set have problems. This code also appears when the telephone number associated with the remote terminal is busy. Refer to the appropriate section(s) as required.

Code 2: Invalid response from interface data board—This code appears when there is trouble between the central terminal interface data board and the central computer. This code may also indicate trouble on the DDD network, E2A circuits, or the data set at the remote terminal. Refer to the appropriate section(s) as required.

Code 3: Invalid error response from remote terminal—This code appears on the CRT whenever invalid error message data is received. This would indicate a data processing malfunction at the remote terminal. A full description of troubleshooting nonvalids (NV) is contained in paragraph 3.25.

Code 4: Invalid E2A quick reply—This code appears on the CRT when either the E2A processing circuits fail to respond or when the data set fails to transmit. Refer to the appropriate section(s) as required.

Code 5: Remote terminal calibration failure—This code appears on the CRT when either or both of two calibration readings are in error. This will usually occur when the analog-to-digital converter of circuit pack CP5 has drifted out of calibration. Refer to Part 4 of this section for circuit pack CP5 calibration procedures. If a code 5 cannot be corrected by calibration of circuit pack CP5, probable causes are:

- Defective circuit pack CP5 or its wiring and connector
- Defective circuit pack HY5 or its wiring and connector
- Defective circuit pack HY12 (slot 0030-03) or its wiring and connector.

If the preceding operations fail to clear the code 5 condition a serious problem may exist at the remote terminal. Verify that no other class 1 or 2 alarms have occurred. Perform the operational routine outlined in SD-7C000-01, sheet D17.

Code 6: Remote terminal fail/safe—This code may appear on the CRT whenever a class 1 alarm occurs. Refer to paragraph 3.01 in this section.

Code 7: Remote terminal relay operate error—This code appears on the CRT when one or more relays at the remote terminal operate incorrectly.

Note: Code 7 alarms are frequently accompanied by class 1 alarms. Code 7 alarms that are not accompanied by class 1 alarms are covered in the following paragraph. If a class 1 alarm occurs, refer to the trouble locating procedure for class 1 alarms.

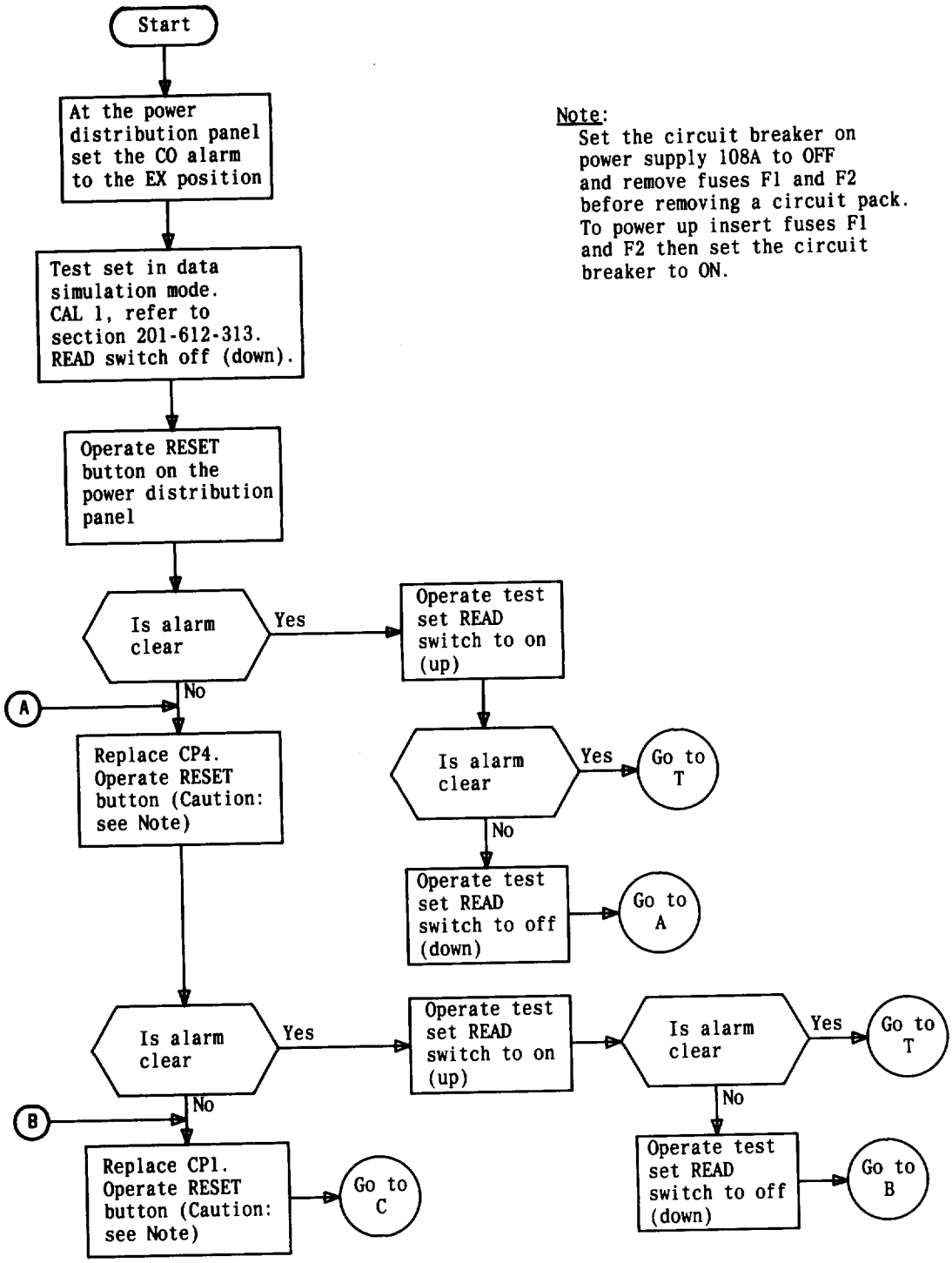


Fig. 1 — Trouble Isolation Diagram—FSR Alarm (Sheet 1 of 6)

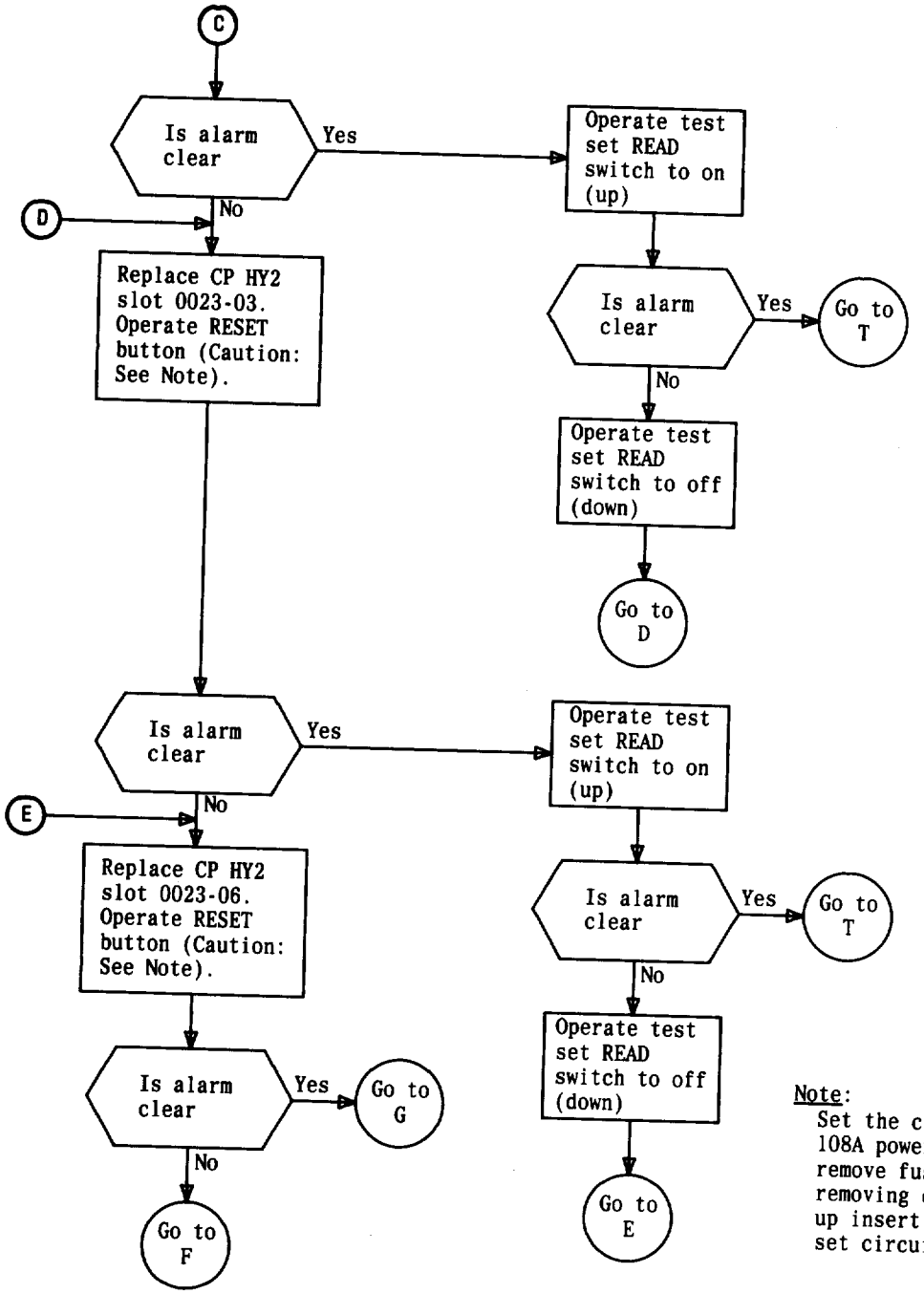


Fig. 1 — Trouble Isolation Diagram—FSR Alarm (Sheet 2 of 6)

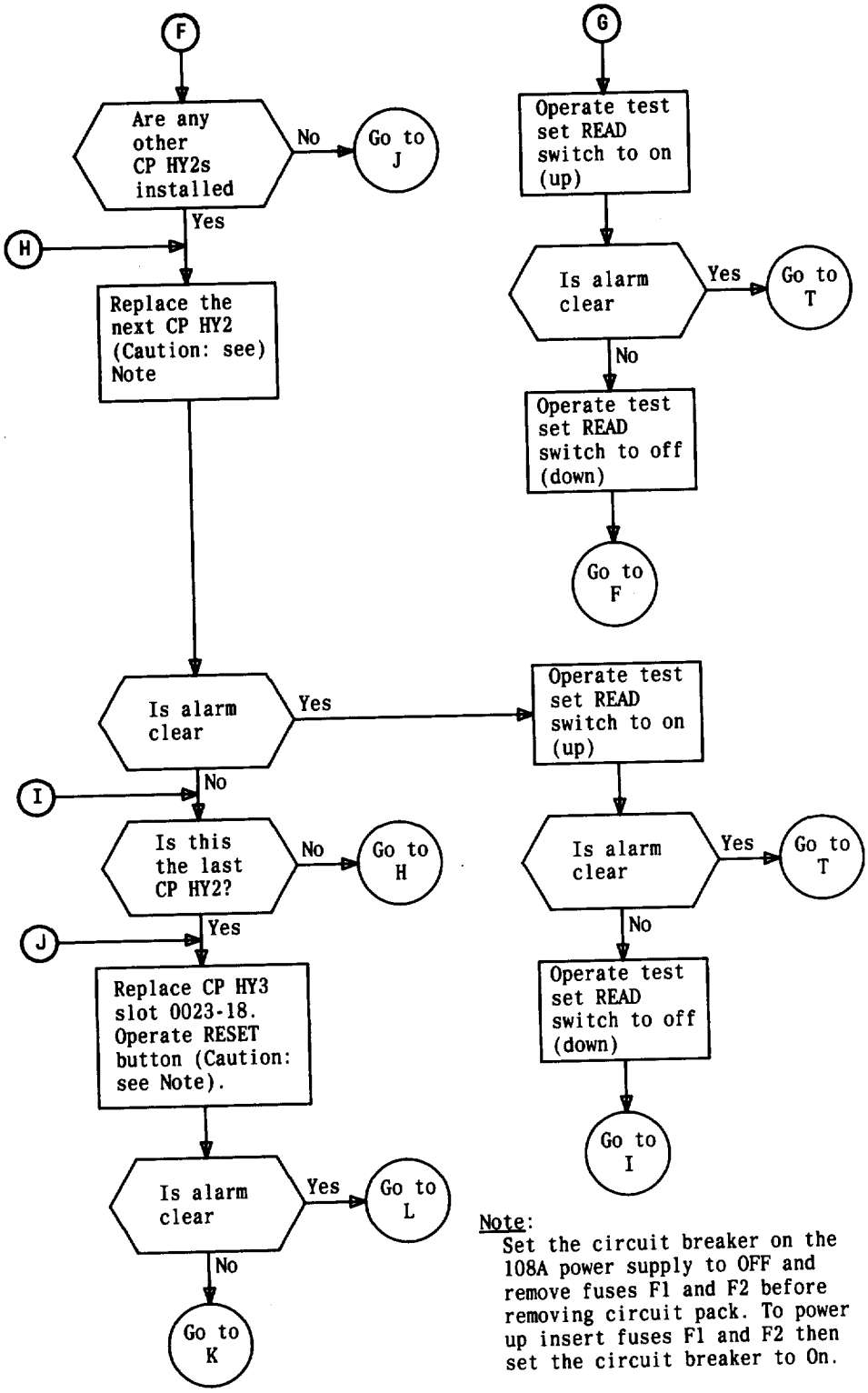


Fig. 1 — Trouble Isolation Diagram—FSR Alarm (Sheet 3 of 6)

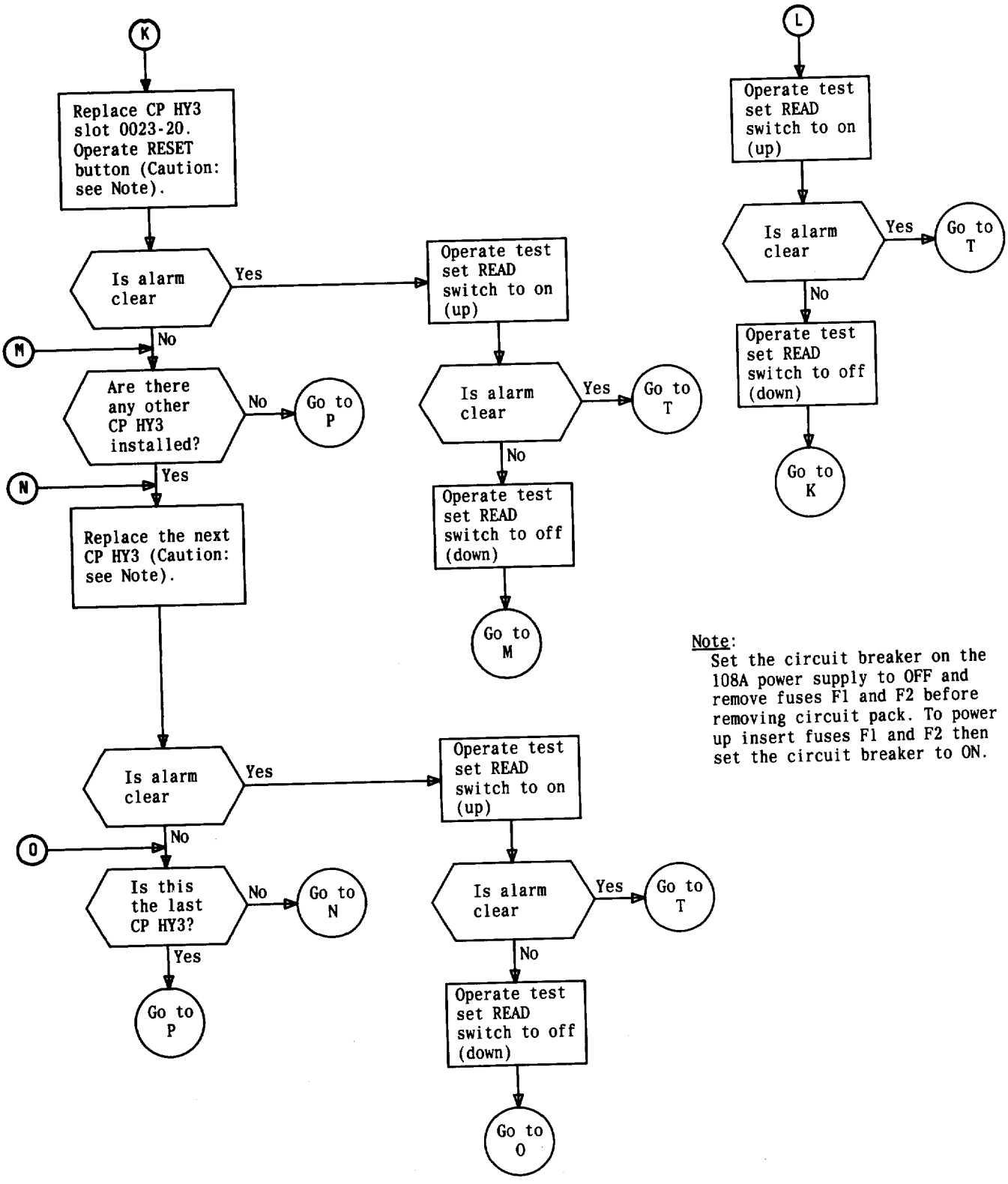
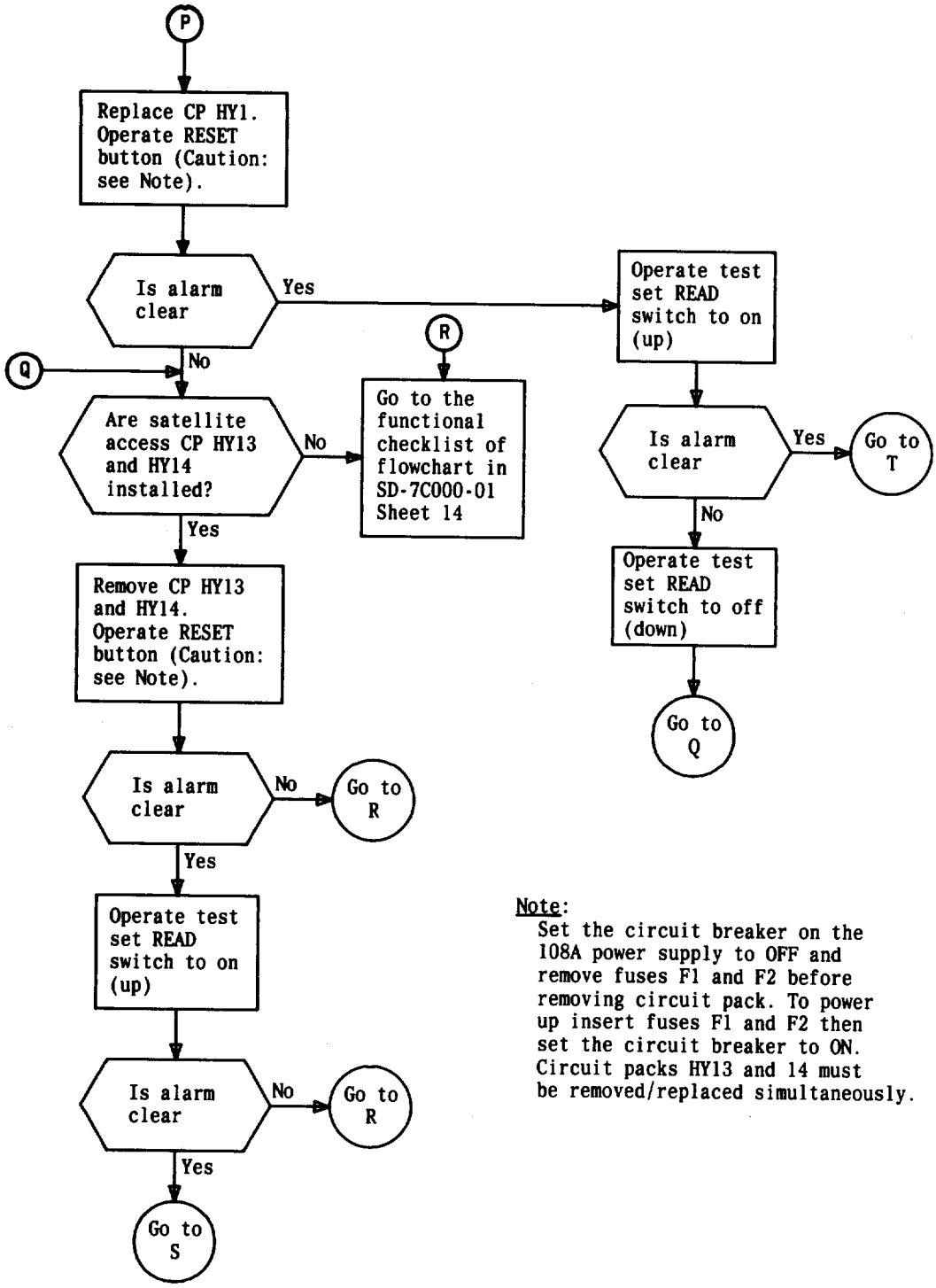
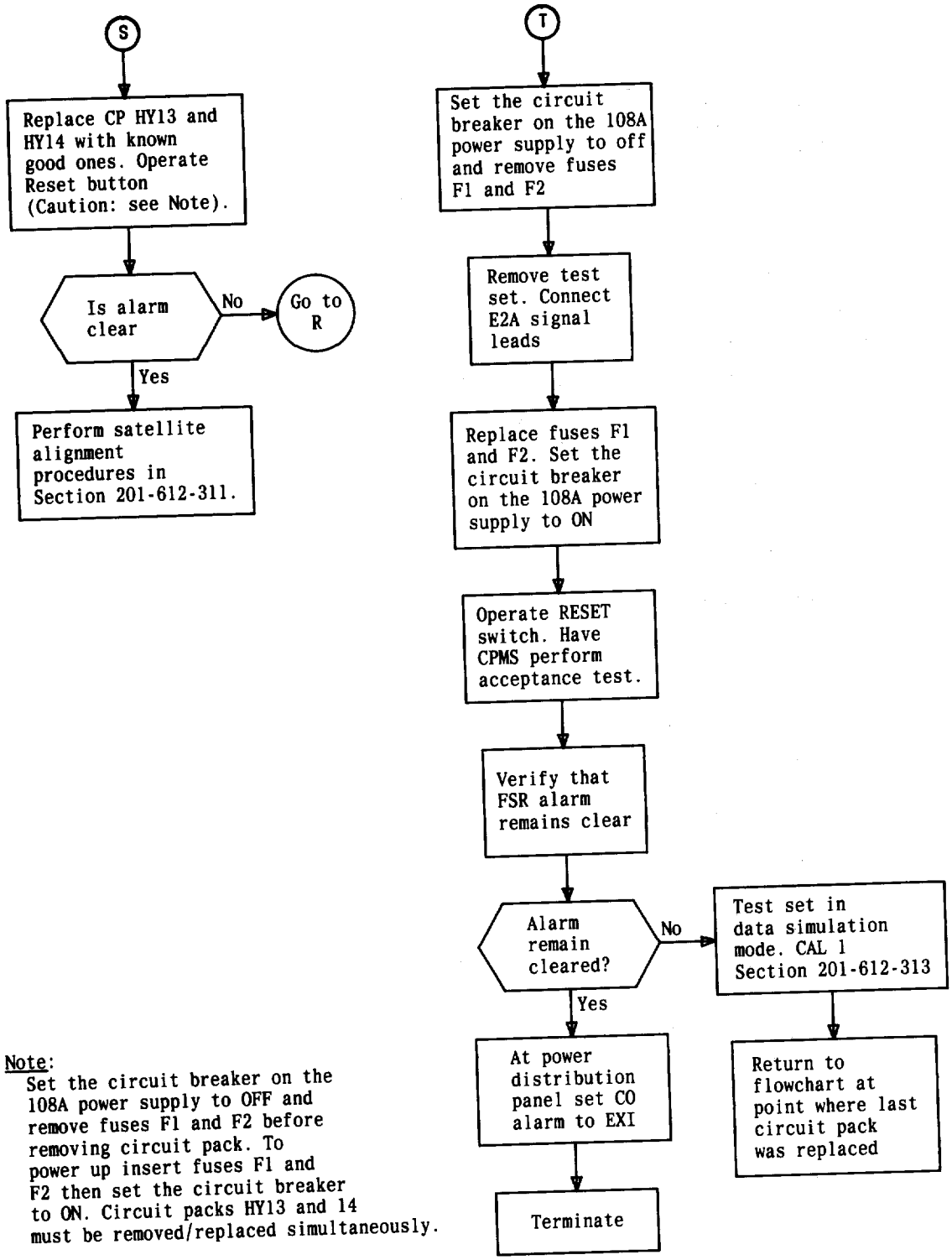


Fig. 1 — Trouble Isolation Diagram—FSR Alarm (Sheet 4 of 6)



Note:
Set the circuit breaker on the 108A power supply to OFF and remove fuses F1 and F2 before removing circuit pack. To power up insert fuses F1 and F2 then set the circuit breaker to ON. Circuit packs HY13 and 14 must be removed/replaced simultaneously.

Fig. 1 — Trouble Isolation Diagram—FSR Alarm (Sheet 5 of 6)



Note:
Set the circuit breaker on the 108A power supply to OFF and remove fuses F1 and F2 before removing circuit pack. To power up insert fuses F1 and F2 then set the circuit breaker to ON. Circuit packs HY13 and 14 must be removed/replaced simultaneously.

Fig. 1 — Trouble Isolation Diagram—FSR Alarm (Sheet 6 of 6)

3.09 Code 7 alarms can occur when one or more relays at the remote terminal operate incorrectly. Code 7 alarms can also occur during the calibration mode or when the remote terminal is accessing a transducer device, status indicator, or satellite terminal. If a code 7 alarm occurs during the calibration mode (CAL 1 or CAL 2), monitoring is terminated and no alarm bulletin is generated for that wire center. If a remote terminal has generated a code 7 alarm for several monitoring periods and no data has been generated on the alarm bulletin, a relay operate condition has probably taken place during CAL 1 or CAL 2. Chart 4 of this section should isolate the trouble.

3.10 If a code 7 alarm occurs during transducer device monitoring, one or more RO error codes should appear on the alarm bulletin. If the condition is singular (only occurs for one transducer device) the probable cause is a defective circuit pack HY12 or the wiring connector associated with the alarmed transducer device. If multiple RO error codes appear on the alarm bulletin, check all circuit packs HY2 and HY3. The circuit packs in chart 4 of this section should also be checked until the trouble is located.

3.11 A code 7 alarm that is accompained by valid pressure readings on the alarm bulletin and is not accompanied by RO error codes indicates possible trouble in the status indicator or satellite terminal access circuitry. Chart 5 of this section should isolate this type of trouble.

Code 8: CPMS parity check, central to remote terminal—This code appears on the CRT when an input command word has odd parity instead of even parity. The parity bits are a check on the interface circuits between the remote terminal and the E2A equipment. If the problem is not in the central terminal the trouble could be:

- Defective E2A equipment
- Defective circuit pack HY 1 or its wiring and connector.

Code 9: CPMS parity check remote terminal to central—This code appears on the CRT whenever a response from the remote terminal contains even parity instead of odd.

3.12 The parity bit (TD16) is generated by the output processor on circuit pack HY7. Input to circuit pack HY7 is delivered from circuit pack HY1 and HY13 (if equipped). To clear the parity problem, perform the procedures in Chart 3 (parity check).

Minor Class 2 Alarms

3.13 The following paragraphs are troubleshooting procedures for minor class 2 alarms. They should only be used if a class 1 alarm or a major class 2 alarm does not exist. The minor class 2 alarms are given in Table B.

OC

3.14 The open circuit (OC) alarm appears in the alarm bulletin whenever the response from a transducer assigned to a line access relay indicates that the circuit is open. This problem is associated with the line access relay panel (LARP), main distribution frame (MDF), or outside plant. When an OC occurs on a single transducer device the most probable causes are:

- Resistance leakage from tip to ground or ring to ground on a cable pair
- Open cable pair
- Missing or open pressure transducer
- Missing or open heat coils
- Craft activity in cable which contains cable pair connected to transducer device in alarm
- MDF cross-connections improperly terminated
- Bad circuit pack HY12 or its wiring or connector
- Open WE installed cabling to auxiliary MDF terminal strip.

IR

3.15 The insulation resistance code appears on the alarm bulletins for transducer devices when one of the following occurs:

- The remote terminal measures a tip-to-ring resistance between 33K ohms and 95K ohms on a transducer device associated with a cable pair.
- A foreign voltage is present on the cable pair.

The IR codes are usually the result of faulty cable pairs. Have the cable pair tested per local procedure.

TABLE B

MINOR CLASS 2 ALARMS

ALARM	ACRONYM
Open circuit	OC
Insulation resistance	IR
Airflow equals zero	AFO
Excessive busy	BY
Nonvalid data response	NV
Relay operate error	RO
Tone decode	TD

AFØ

3.16 If an active airflow meter registers Ø for one full day, a bulletin is generated at the CPMS central. Since it is highly unlikely that airflow will be Ø over 24 hours in a normally pressurized pipe, defective airflow circuitry is indicated. Airflow counters are located on circuit pack HY11 at the remote terminal. There are 4 counters per board and a maximum of 12 circuit pack HY11s at a remote terminal (48 counters maximum).

3.17 If the AFØ condition exists for only one airflow counter, the probable causes are:

- Defective circuit pack HY11 or its wiring or connector
- Open or grounded MDF cross-connections
- Open or grounded WE installed cabling
- Defective airflow meter (airflow meters are maintained by the plant organization responsible for pressurization and are not part of CPMS).

3.18 If the AFØ condition exists for multiple airflow counters, the probable causes are:

Caution: Set circuit breaker on 108A power supply to the OFF position and remove fuses F1 and F2 before replacing CPs.

- Defective circuit pack HY6 or its wiring or connector. Replace all circuit pack HY6s checking wiring and connectors as necessary until trouble is cleared.
- Defective circuit pack HY1 or its wiring or connector.

Airflow Did Not Reset

3.19 If the airflow counters fail to reset to either a 1 or 0 cubic foot reading following a monitoring cycle, an **AIRFLOW DID NOT RESET** message will appear on the alarm bulletin. The central terminal operator will identify the failed airflow counter.

3.20 If a single airflow counter or a group of airflow counters on a single circuit pack HY11 fails to reset, the probable cause is a defective circuit pack HY11 or its wiring or connector. Refer to SD-7C000-01, sheets B23 and B24 to determine the location of the failed circuit pack.

3.21 If the airflow counters on multiple circuit fail to reset, perform procedures in Chart 6.

BY

3.22 This report appears on the escalation report at the central terminal whenever a cable pair with a transducer is busy an excessive number of times. Excessive busies can be characterized in two ways:

- Excessive busies on a single transducer device
- Excessive busies on multiple transducer devices.

3.23 If excessive busies appear on a single transducer device, the probable causes are:

- Excessive traffic on a subscriber loop. If this is the problem the transducer device should be transferred to a less active cable pair.
- A defective cable pair. If the tip-to-ring resistance on the cable pair is less than 33K ohms, or there is a foreign voltage present, CPMS may read a false busy. Have the cable pair tested per local procedures.
- The transducer device is mounted on a spare cable pair with no central office termination. If a transducer is mounted on a spare cable pair or service is denied on a subscriber loop associated with CPMS, a false busy may occur. This problem has been corrected in Issue 3 of Section 201-612-302 (Remote Terminal Cross-Connections). Section 201-612-302 provides placement of grounded terminations at

the central office when a CPMS transducer is assigned to a spare cable pair. Examine the auxiliary MDF to determine if those terminations are in place.

- A reversal in MDF cross-connections or WE installed cabling. If the connections for the central office line equipment to the line access relay panel (LARP) is reversed (battery on tip instead of ring) CPMS will read a busy on that line at all times. Frequently the source of the reversal is in the WE installed cabling between the LARP and the auxiliary MDF. When this happens frame personnel must intentionally reverse the cross-connection wire between the auxiliary MDF and the central office line equipment (HMDF). Frame personnel must also reverse the corresponding cross-connections between the auxiliary MDF and the vertical MDF (VMDF). This will prevent trouble reports from subscribers equipped with TOUCH-TONE® service. If a reversal is suspected, refer to SD-7C000-01, sheets B10 through B20. These pages will help determine the location of the HY12 relay and its horizontal tip and ring pin terminations for the transducer device in alarm. With a volt ohm meter (VOM), determine which side has −48 volts and which side is grounded. If the −48 volts appears on the tip, the MDF cross-connections must be reversed.

- A horizontal/vertical transposition in MDF cross-connections or WE installed cabling. The CPMS will read a busy on a transducer device relay at all times if the central office battery and ground are connected to the vertical tip and ring connector pin terminations for its HY12 relay. To correct this problem frame personnel must swap the horizontal and vertical cross-connection wires associated with the alarmed transducer device at the auxiliary MDF.

3.24 Excessive busies on multiple transducer devices indicates trouble in the idle and ring detection circuitry. The probable causes are defective circuit pack HY4, circuit pack HY5, or their associated wiring and connectors.

NV

3.25 The nonvalid (NV) data response code appears in the alarm bulletin whenever invalid data is received. A NV can be recognized in two ways:

- NVs on a single transducer device
- NVs on multiple transducer devices.

3.26 When a NV data response appears repeatedly on a single transducer device, probable causes are:

- A defective or out-of-calibration circuit pack CP5 (see Part 4)
- The CPMS central has incorrectly coded an underground transducer device as aerial and the cable pressure is in excess of 8.5 lbs.
- Foreign positive voltage on the cable pair
- The cable pair has an excessive amount of capacitance as would occur for several subscriber extension ringers.

3.27 When a NV appears on multiple transducer devices a serious problem exists at the remote terminal. Check for the occurrence of a class 1 or class 2 major alarm. If there are not any present, perform the operational routine outlined in SD-7C000-01, sheet D17.

RO

3.28 The relay operate (RO) error code appears in the alarm bulletin whenever a relay operate condition occurs while accessing a transducer device. It is always accompanied by a class 2 major alarm code 7. Refer to paragraph 3.09 in this section for corrective procedures.

TD

3.29 This condition exists whenever a signal decoding error occurs at a satellite terminal. Refer to Section 201-612-313

C. Class 3 Malfunctions

3.30 Class 3 malfunctions are failures that do not produce a class 1 or class 2 alarm. They include the following:

- Erratic or erroneous pressure readings
- Erratic airflow indications
- Inaccurate loop resistance measurements
- Erroneous status indicator readings.

Malfunctions that are not accompanied by a class 1 or class 2 alarm are rare and usually the result of defects in outside plant. Before attempting to isolate a class 3 malfunction, verify that a class 1 or class 2 alarm has not occurred. If while attempting to isolate a class 3 malfunction, a class 1 or class 2 alarm is received, refer immediately to the paragraph(s) in this section pertaining to the alarm.

3.31 The erratic or erroneous pressure reading (transducer mode) may be differentiated into two classes:

- Erratic or erroneous readings on a single transducer device
- Erratic or erroneous readings on multiple transducer devices.

3.32 When erratic or erroneous readings appear on a single transducer device the probable causes are:

- A defective cable pair. Have the CPMS central operator run an acceptance test in the trouble diagnostic mode (Section 637-600-401) and access the relay. Observe output data for at least one minute. If the pressure reading fluctuates more than 0.5 lbs. in either direction, the subscriber loop is suspect. Have the subscriber loop tested per local procedure.

  Note: If the central terminal operator is unavailable, this test may be performed using the CPMS test set in the data simulation mode.

- A defective circuit pack HY12—Worn or pitted relay contacts in the circuit pack HY12 can cause erroneous readings. Replace circuit pack HY12 and check its wiring and connectors. If this fails to clear the trouble, perform the preceding procedure.

3.33 If erratic or erroneous readings appear on multiple transducer devices, a major problem may exist at the remote terminal. Perform the following:

- Check the wiring and connectors for circuit pack HY13 and HY14 (if equipped). Remove both circuit packs and have the CPMS central access the remote terminal to determine if the error condition still exists. The operator may choose an appropriate mode for this purpose. If the trouble is cleared, either the wiring or one of the circuit packs was defective.

  Caution: Circuit packs HY13 and HY14 must be installed or removed together. Failure to do this will result in a remote terminal malfunction.

- If the preceding procedure fails to correct the problem reinsert circuit packs HY13 and HY14. After replacing the circuit packs, have the CPMS central access the remote terminal to determine if the error condition still exists.

- If the problem still exists replace circuit pack HY9 then HY18 checking the wiring and connectors of each circuit pack. After each replacement have the CPMS central access the remote terminal to determine if the error condition still exists.

- If the problem is still present refer to SD-7C000-01, sheet D17 and perform the operational routine.

3.34 Erratic Airflow: A remote terminal may malfunction in that there may be an unrealistic airflow reading or an airflow device may have an unusually high alarm rate. The procedure for troubleshooting this condition will be the same as for the class 2 minor alarm for a zero airflow indication (refer to paragraphs 3.16 through 3.21).

3.35 Inaccurate loop resistance measurements: An inaccurate loop resistance measurement that is not accompanied by a CAL 2 failure or a failure in the status indicator mode is caused by a defective cable pair. Have the cable pair tested (per local procedures) for the following:

- Resistance to ground
- Tip-to-ring resistance
- Foreign voltages.

If the pair tests show a good cable pair refer to the following paragraph.

3.36 Erroneous Status Indicator Reading: A status indicator is a two state device (open or closed) that is bridged across a dedicated cable pair in pressurized cable sections. When the pressure in the cable section falls below a specified threshold the device will operate (close) and a report will be generated on an alarm bulletin at the CPMS central. False status indications may be characterized in two ways:

- Alarm bulletins generated on a status indicator that has not operated
- Operated status indicators that fail to generate an alarm.

3.37 If an alarm bulletin is generated on a status indicator that has not operated and the trouble is only one status indicator, the probable causes are:

- A defective cable pair. If tip-to-ring resistance or ring to ground resistance on the cable pair is less than 6.375 K ohms, a status indicator alarm bulletin will be generated. Have the cable pair tested per local procedures.
- Improperly terminated cross-connection on MDF. If the MDF cross-connection or WE installed cabling is terminated so that ring to ground resistance is less than 6.375 K ohms an alarm bulletin will be generated. Check per local procedure.
- Wiring problems of the remote terminal. Refer to SD-7C000-01 to determine the location of the circuit pack HY 10 relay that corresponds to the alarmed status indicator. Check wiring and connector.

3.38 If an alarm bulletin is generated for multiple status indicators that are not operated, the probable causes are:

- Defective circuit pack HY 9 or its wiring and connector
- Defective circuit pack HY 6 or its wiring and connector
- Defective circuit pack HY 1 or its wiring and connector.

3.39 If an operated status indicator fails to generate a report on the alarm bulletin and only one status indicator is involved, the probable causes are:

- Defective circuit pack HY 10 or its wiring or connector, refer to SD-7C000-01 for location of circuit pack HY 10 that corresponds to the alarmed status indicator
- Open cable pair
- Open or missing heat coils
- Open MDF cross-connection or WE installed cabling
- Defective circuit pack HY 9 or its wiring or connector
- Defective circuit pack HY 1 or its wiring or connector
- Defective circuit pack HY 6 or its wiring or connector
- Improperly terminated pressure connector.

3.40 If multiple operated status indicators fail to generate a report on the alarm bulletin while the cable pairs, cross-connections, and cabling are not the problem, probable causes are:

- Defective circuit pack HY 9 or its wiring and connector
- Defective circuit pack HY 1 or its wiring and connector
- Defective circuit pack HY 6 or its wiring and connector
- Defective circuit pack HY 10 or its wiring and connector.

D. Class 4 Malfunction

3.41 The following procedures should be used whenever a satellite terminal malfunction has been isolated to a remote terminal as outlined in Section 201-612-311. Before attempting to isolate a class 4 malfunction verify that a class 1 or 2 alarm has not occurred. If while attempting to isolate a class 4 malfunction, a class 1 or 2 alarm is encountered; refer immediately to the paragraph(s) in this section pertaining to the alarm observed.

3.42 Satellite terminals are connected to remote terminals by dedicated trunk cable pairs. A single remote terminal may serve up to 20 satellite terminals. To access a satellite terminal the remote terminal generates an audio frequency signal on the dedicated trunk pair to which the desired satellite terminal is connected. There are 32 different signal combinations generated from 10 basic frequencies. The 32 signal combinations correspond to the maximum of 32 transducer devices that can be accessed by a satellite terminal. The operational sequence is as follows:

- The remote terminal connects the desired trunk pair to the signal generator
- A short signal burst (about 50 milliseconds) is generated and a transducer at the satellite terminal is accessed
- The remote terminal disengages the signal generator
- While the satellite terminal and its transducer are still engaged, the remote terminal connects the circuit that measures resistance.
- After the measurement is taken the remote terminal generates a dropoff pulse which disengages the satellite terminal and its transducer.

The preceding sequence takes between 1.5 and 2 seconds to complete. This sequence is repeated for each transducer connected to the satellite terminal.

3.43 The procedure for testing the satellite terminal is given in Chart 7. These maintenance procedures are for:

- Verifying that the signalling tones are of a sufficient amplitude to activate the decoding circuitry of a satellite terminal.
- Checking the resistance measurement circuitry of the remote terminal for proper operation.

E. Class 5 Malfunction

3.44 A remote terminal malfunction that affects service on a CPMS associated subscriber loop is a class 5 malfunction. Typical trouble reports caused by a class 5 malfunction are:

- Noise on the line when the remote accesses a busy subscriber loop
- Disconnection when the remote accesses a busy subscriber loop.

Class 5 malfunctions are classified in two ways:

- Class 5 malfunctions that occur on a single subscriber loop
- Class 5 malfunctions that occur on multiple subscriber loops.

3.45 Before attempting to isolate a class 5 malfunction, verify that a class 1 or class 2 alarm has not occurred. If, while attempting to isolate a class 5 malfunction, a class 1 or class 2 alarm is encountered, refer immediately to the paragraph(s) in this section pertaining to the alarm observed.

3.46 If a class 5 malfunction occurs on multiple loops the probable causes are:

- Defective circuit pack HY 4 or its associated wiring and connector
- Defective circuit pack HY 5 or its associated wiring and connector.

3.47 If a class 5 malfunction occurs on a single subscriber loop, check the following:

- Circuit pack HY12 and its wiring and connector
- MDF cross connections and WE installed cabling.

Procedures to check the subscriber loop are in Chart 8.

4. REMOTE TERMINAL CALIBRATION PROCEDURES

4.01 Circuit pack CP5 contains the circuitry used in measuring transducer devices, satellite terminals, and loop resistances. Tests are performed on this circuitry to determine its accuracy before scheduled monitoring. These tests are known as CAL 1 and CAL 2.

4.02 The CAL 1 test is used to determine the accuracy of the resistance measurement circuit for the transducer device mode and satellite terminal mode. The CAL 2 test is used to determine the accuracy of the resistance measurement circuit in the loop resistance operational mode.

4.03 In each test a known fixed resistance is accessed in place of an active device. If the response does not match that of the fixed resistance, a class 2 major alarm code 5 is generated at the CPMS central terminal. The scheduled monitoring cycle is aborted. Chart 9 contains the calibration procedures for circuit pack CP5.

5. REFERENCES

5.01 The following sections are referred to and pertain to CPMS:

SECTION	TITLE
201-612-101	Remote Terminal SD-7C000-01—Cross-Connections—Cable Pressure Monitoring System (CPMS)
201-612-302	Remote and Satellite Terminals (SD-7C000-01, SD-2P035-01) Description—Cable Pressure Monitoring System
201-612-311	Satellite Terminal SD-2P035-01—Trouble Locating Procedures—Cable Pressure Monitoring System
201-612-312	Satellite Terminal SD-2P035-01—Cross-Connections—Cable Pressure Monitoring System (CPMS)
201-612-313	CPMS Remote Terminal Test Set (J1C013AD, L1) Operations and Description Cable Pressure Monitoring System
637-600-011	Expanded—General
637-600-051	Expanded—Description and Operation
637-600-075	Administrative Guidelines
637-600-101	Expanded—Central Computer Operations
637-600-150	Central Terminal Records
637-600-200	Transducer Assignment Procedures
637-600-251	Expanded—Developing and Maintaining Data Base
637-600-301	Expanded—Reports and Bulletins—Description and Utilization
637-600-350	Management Reports—Description and Utilization
637-600-351	Expanded—Management Reports—Description and Utilization
637-600-400	System Maintenance
637-600-401	Expanded—System Maintenance
637-600-450	Data Acquisition Procedures From Maintenance Centers
637-600-451	Expanded—Data Acquisition Procedures From Maintenance Centers
637-600-500	Central Terminal Installation
637-600-501	Expanded—Central Terminal Installation

CHART 1

VOLTAGE TEST

APPARATUS:

Volt-ohmmeter—KS-20538-L1 or Equivalent

STEP	PROCEDURE
1	Set the central office alarm switch (on the power distribution panel) to the EX position. ***Requirement:*** The central office alarm is disabled.
2	Verify that the circuit breaker on the 108A power supply (on the front panel) is in the ON position.
3	Check the alarm lamps. ***Requirement:*** Lamps should be off. ***Note:*** If all lamps are lighted, then 60 Hz power is not present, check per local procedure.
4	With a VOM check the voltage to ground of jack −48V SIG. ***Requirement:*** −48V should be present. ***Note:*** If this voltage is not present the central office battery is not being supplied to the system. Check per local procedure.
5	With a VOM check the voltage to ground of jack −48V(F). ***Requirement:*** −48V should be present. ***Note:*** If voltage in Step 4 is present and −48V(F) is not present, replace 1 amp fuse F1 (on the power distribution panel). If trouble is not cleared a wiring problem is indicated.
6	With a VOM check the voltage to ground of jack +24V and −24V. ***Requirement:*** +24V and −24V should be present. ***Note:*** If either or both of these voltages are not present, replace the 2 amp fuse F2 (on the power distribution panel). If there is still no voltage present, the 24V power supply may be defective.
7	With a VOM check the +5V and −5V pins. ***Requirement:*** The +5V and −5V should be present.

CHART 1 (Contd)

STEP	PROCEDURE
	Note: If both voltages are not present replace fuse F2 and repeat Step 7. If replacing F2 does not restore those voltages, the 108A power pack may be defective. If one voltage is present and the other is not, the 108A power supply may be defective.
8	With a VOM check the +12V and −12V pins. ***Requirement:*** The +12V and −12V should be present. ***Note:*** If either or both of these voltages are not present it indicates a defective CP4 or its wiring or connector.
9	With a VOM check the −40V pin. ***Requirement:*** This voltage must be −40V ±0.5V. ***Note:*** If this voltage is not within limits, adjust R64 on CP5 until requirement is met. If adjustment of R64 potentiometer cannot meet the requirement, a defective CP5 and wiring or connector is indicated. If R64 on CP5 is adjusted or CP5 is replaced, see Chart 4 for recalibration.

CHART 2

LAMP TEST

APPARATUS:

None

STEP	PROCEDURE
1	Set the circuit breaker of the 108A power supply to the OFF position. ***Requirement:*** All alarm lamps (including E2A) should light.
2	Replace any lamps that do not light.
3	If the E2A LED fails to light, remove fuse F2 and replace CP4 on the E2A panel. ***Note:*** Both the E2A and remote terminal contain circuit packs designated CP4. These are not interchangeable. Care should be taken not to confuse one with the other.
4	If the lamps fail to light after performing Steps 2 and 3, remove fuses F1 and F2 from their receptacles and replace CP4 (in the remote terminal) with a good circuit pack.
5	If failures persist, wiring problems are indicated. Refer to SD-7C000-01.
6	Place fuses F1 and F2 in their receptacles on the power distribution panel.
7	Set the circuit breaker of the 108A power supply (on power distribution panel) to the ON position.

CHART 3

PARITY CHECK

APPARATUS:

CPMS Test Set—J1C013AD-L1

STEP	PROCEDURE
1	Set the circuit breaker of the 108A power supply on the power distribution panel to the OFF position.
2	Remove fuses F1 and F2 from their receptacles (on the power distribution panel).
3	Replace circuit pack HY7 checking its wiring and connectors.
4	Replace fuses F1 and F2 in their receptacles.
5	Set the circuit breaker of the 108A power supply to the ON position.
6	Check with the CPMS central, verify that parity error has cleared.
7	If parity error still exists, repeat Steps 1 through 6 replacing first circuit pack HY1, and if error condition still exists replace HY13 (if equipped).
8	If the procedures in Steps 1 through 7 fail to correct the parity problem, connect the CPMS test set in the data monitoring mode to the central data link (see Chart 7 in Section 201-612-313).
9	Have the CPMS central access a transducer device.
10	Observe parity on the output data word on the test set. ***Requirement:*** Parity should be odd. If parity is even, repeat Steps 1 through 7.
11	If parity is odd, check 202S data set to verify correct option settings.
12	If option settings are correct, the problem is either in the E2A telemetry or the central terminal.

CHART 4

TROUBLESHOOTING PROCEDURES FOR A CODE 7 ALARM OCCURRING DURING CALIBRATION MODE

APPARATUS:

None

STEP	PROCEDURE
1	Set the circuit breaker of the 108A power supply (on the power distribution panel) to the OFF position.
2	Remove fuses F1 and F2 from their receptacles on the power distribution panel.
3	Replace circuit pack HY2 slot 0023-03 checking its wiring and connectors
4	Place fuses F1 and F2 in their receptacles.
5	Set the circuit breaker of the 108A power supply to the ON position.
6	Check with the CPMS central, verify that the code 7 class 2 alarm has cleared.
7	If the code 7 class 2 alarm still exists, repeat Steps 1 through 6 for the following circuit packs, checking one at a time after each replacement if the code 7 class 2 alarm to clear: • HY 2 slot 0023-06 • HY 9 • HY 10 slot 0012-04 • HY 12 slot 0030-03 • HY 3 slot 0023-18 • HY 3 slot 0023-20 • HY 1 • CP 1 • HY 13 (if equipped) • CP 3 • HY6 slot 0023-48 • HY 7.

CHART 5

TROUBLESHOOTING PROCEDURES FOR A CODE 7 ALARM OCCURRING DURING TRANSDUCER DEVICE MONITORING

APPARATUS:

None

STEP	PROCEDURE
1	Set the circuit breaker of the 108A power supply (on the power distribution panel) to the OFF position.
2	Remove fuses F1 and F2 from their receptacles on the power distribution panel.
3	Replace circuit pack HY9 checking its wiring and connectors.
4	Place fuses F1 and F2 in their receptacles.
5	Set the circuit breaker of the 108A power supply to the ON position.
6	Check with the CPMS central, verify that the class 2 code 7 alarm has cleared.
7	If the class 2 code 7 alarm still exists, repeat Steps 1 through 6 for the following circuit packs, checking one at a time after each replacement if the class 2 code 7 alarm is clear: • HY 2 Slot 0023-03 • HY 18 • All HY 10s • HY3 Slots 0023-18 and 0023-20 • HY 1 • CP 1 • HY 13 (if equipped) • CP 3 • HY 6 • HY 7

CHART 6

AIRFLOW COUNTER TROUBLESHOOTING

APPARATUS:

None

STEP	PROCEDURE
1	Set the circuit breaker on the 108A power supply (on the power distribution panel) to the OFF position.
2	Remove fuses F1 and F2 from their receptacles (power distribution panel).
3	Replace circuit pack CP4 on the remote terminal checking its wiring and connectors.
4	Replace fuses F1 and F2 in their receptacles.
5	Set the circuit breaker on the 108A power supply to the ON position.
6	Check with the CPMS central, verify that the AIRFLOW DID NOT RESET alarm has cleared.
7	If the AIRFLOW DID NOT RESET still exists, repeat Steps 1 through 6 for the following circuit packs, checking one at a time after each replacement that the alarm has cleared: • All HY 6s • HY 1

CHART 7

SATELLITE TERMINAL ACCESS CIRCUITRY TROUBLESHOOTING

APPARATUS:

CPMS Test Set (J1C013AD-L1)

Volt-Ohmmeter (KS020538-L1 or equivalent)

CPMS Peak Detector

STEP	PROCEDURE
1	Verify that the power supply and alarm circuity are in working order. Review paragraph 3.02.
	OLD VERSION OF CPMS PEAK DETECTOR (if using new version see Step 25).
2	Connect the CPMS peak detector as follows: • Connect in order, ground, +12V, and −12V leads to the appropriate jacks on the remote terminal power distribution panel. • Connect a VOM to the output jacks on the peak detector.
	Note: Digital VOMs cannot be used with either version of the CPMS peak detector.
3	Set VOM to 12V scale (or the next highest setting).
4	Have frame personnel remove the heat coils on the dedicated trunk pair associated with the failed satellite terminal.
5	Set the peak detector to the REMOTE mode.
6	Connect the tip and ring leads of the peak detector to the pin terminations on the L5 terminal strip that corresponds to the failed satellite terminal. (Refer to Table C for pin locations.)
7	A surge will be observed on the VOM. When the needle drifts below 3V, set the VOM to the 3V scale (or next highest setting if VOM does not have 3V scale).
8	Have the CPMS central run an acceptance test in the trouble diagnostic mode (TDM), and access relay OOB for the failed satellite terminal (if the central terminal operator is unavailable, perform test using the test set in data simulation mode Section 201-612-313).
9	Observe the relays on circuit pack HY 10 (slot 0012-09). Only one of these relays should operate periodically in cycles of approximately two seconds. The relay should close approximately 1.5 seconds then open for approximately 0.5 seconds.
	Note: If the relay does not operate or operates erratically, refer to chart 5.

CHART 7 (Contd)

STEP	PROCEDURE
10	The instant the relay on circuit pack HY10 operates the needle on the VOM should deflect sharply to the right then drift back toward the left until the relay closes again (about 2 seconds) at which point the needle should again deflect to the right. The maximum value displayed by the needle deflection is the peak voltage level of the signal being transmitted to the satellite terminal. This peak value should be 1.6V. If it is not, adjust the potentiometer on circuit pack HY 14.
11	If the peak voltage in Step 10 cannot be obtained by adjusting the potentiometer, replace circuit pack HY 14 and repeat Step 10.
12	If trouble is not clear go to Step 32.
13	If the peak voltage in Step 10 is satisfactory, have the CPMS central access relays 00A through 03B. (This test may also be made using the CPMS test set in the data simulation mode. See Section 201-612-313, Tables H and I.)
14	Observe peak voltage as each relay is accessed. ***Requirement:*** Verify that peak voltage falls within a range of from 1.5V to 2.0V. Adjust the potentiometer as necessary to bring all observed peaks within this range.
15	If the requirements in Step 14 cannot be met, replace circuit pack HY 14 and repeat Steps 10 through 14.
16	If satisfactory results are still not met go to Step 34.
17	If requirements are met in Step 14, have the CPMS central access relays 04A and 08A. Observe peak voltages for each relay. ***Requirement:*** Peak levels should be 2.5V to 3.0V. (The reason for increased amplitude is the fact that two signalling tones are transmitted simultaneously.) ***Note:*** If the peak level for either relay is substantially below 2.5V, the amplitude for one or both of the signalling tones is insufficient. Replace circuit pack HY14 and repeat Steps 10 through 17.
18	If satisfactory results are still not met go to Step 34.
19	Disconnect the peak detector.
20	Have the CPMS central access one or more relays with the heat coils for the dedicated trunk pair removed. Have the CPMS central terminal operator observe the responses on the CRT.

CHART 7 (Contd)

STEP	PROCEDURE

Requirement: For all relays the response should be:

1240000	(retransmit code)
0000020	(response) (20 is open circuit)
1240000	-
0000020	-
1240000	-
0000020	-

21 Any interruption of the requirement sequence in Step 20 means that the relays in Step 9 are not operating properly. Go to Step 9.

22 If relay operation is normal, and the response code is something other than 0000020 for the requirement in Step 20, the probable causes are:

- Frame personnel removed the heat coil from the wrong cable pair
- The A/D converter on circuit pack CP5 is out of alignment
- MDF cross-connection or WE installed cabling is improperly terminated.

23 If satisfactory results are still not met go to Step 34.

Note: Satisfactory completion of these procedures indicate that the remote terminal is functioning normally in the satellite terminal mode. If problems persist, the cause may be a satellite terminal malfunction or a defective dedicated trunk cable pair. Refer to Section 201-612-311.

24 Have frame personnel replace the heat coils on the dedicated trunk cable pair.

NEW VERSION OF THE CPMS PEAK DETECTOR

25 Connect the CPMS peak detector as follows:

- Connect in order, ground, +12V, and −48V leads to the appropriate jacks on the power distribution panel
- Connect a VOM to the output jacks on the peak detector

26 Set the VOM to the 3V scale (or next highest if not equipped).

27 Set the new version of the CPMS peak detector to remote (667-2133) mode.

CHART 7 (Contd)

STEP	PROCEDURE
28	Perform Step 6 through 10, but while using the new peak detector the voltage level in Step 10 should be 1.1V instead of 1.6V. The surge described in Step 7 can be eliminated on the new version of the peak detector by operating the DISCHARGE BUTTON.
29	Perform Steps 11 through 16, except the voltage range described in Step 14 should be 1.0V to 1.5V.
30	Set peak detector to remote (333-500) mode.
31	Have the CPMS central access relays 04A and 08A. Observe the peak voltages for each relay. ***Requirement:*** Levels should fall in the range of 1.0V to 1.5V. ***Note:*** If the levels are not correct, adjust the potentiometer on circuit pack HY 14. If adjustment is required on potentiometer (HY14) set peak detector to remote (667-2133) mode and repeat Step 29.
32	If Steps 25 through 32 do not produce satisfactory results, replace circuit pack HY 14 and repeat Steps 27 through 32.
33	If satisfactory results are still not met, go to Step 34.
34	The following circuit packs are to be replaced in order and their associated wiring and connectors will be checked until the trouble is cleared. After each circuit pack is replaced an appropriate test will be made by the CPMS central to determine if the trouble is cleared. Replace circuit packs: • HY 13 • CP 1 • CP 2 • CP 3 • HY 18 • HY 9 • HY 10 slot 0012-09 • CP4 • HY 1 • CP5 (alignment will be required) • HY 2 slot 0023-03

TABLE C

REMOTE TERMINAL SATELLITE ACCESS NUMBER

REMOTE TERMINAL SATELLITE ACCESS NUMBER	LS TERMINAL STRIP PAIR IDENTIFICATION	
	TIP	RING
40	11-1	16-1
41	12-1	17-1
42	13-1	18-1
43	14-1	19-1
44	15-1	20-1
50	11-3	16-3
51	12-3	17-3
52	13-3	18-3
53	14-3	19-3
54	15-3	20-3
60	11-5	16-5
61	12-5	17-5
62	13-5	18-5
63	14-5	19-5
64	15-5	20-5
70	11-7	16-7
71	12-7	17-7
72	13-7	18-7
73	14-7	19-7
74	15-7	20-7

CHART 8

SUBSCRIBER LOOP CHECK

APPARATUS:

1013A Handset With 2W37A Cord Assembly

STEP	PROCEDURE
1	Using a 1013A handset, bridge into the vertical side of the subscriber loop on which the class 5 malfunction was reported.
2	If the line is idle, dial up the central office quiet battery per local procedure.
3	Have the CPMS central run an acceptance test in the TDM and access the relay.
4	Listen for noise on the handset and verify that the connection is not interrupted.
5	Have the central terminal operator verify a constant busy indication on the CRT.
6	Remove the 1013A handset and verify that the central terminal operator observes a pressure reading. ***Caution: Set circuit breaker on 108A power supply to the OFF position and remove fuses F1 and F2 before replacing any circuit pack.***
7	If noise is still present check for the following defective circuit packs: • HY4 • HY5.
8	Upon successful completion of the preceding procedures, call the subscriber while the CPMS central accesses the relay. ***Requirement:*** A busy indication should be observed if the relay is accessed during the application of ringing voltage. At all other times a valid pressure reading should be observed by the central terminal operator. When the subscriber picks up, a constant busy should be observed and no noise should be on the line.

CHART 9

CALIBRATION PROCEDURES FOR CP5

APPARATUS:

Volt-ohmmeter—KS-20538-L1 or Equivalent

STEP	PROCEDURE
1	Prior to calibration, verify that all power supply voltages are of their proper levels per chart 1.
2	Before performing any calibrations verify that power has been supplied at least 15 minutes. If not, allow system to warmup for at least 15 minutes.
3	CP 5 contains six potentiometers. They are arranged vertically and face forward when the circuit pack is installed. Three of these (−40V, CAL 1, and CAL 2) are adjusted during calibration. The remaining 3 are preset by the factory and should not be adjusted. Figure 2 shows the layout of the potentiometers on CP 5.
4	Adjust the −40V potentiometer to −40V keeping within ±0.5V tolerances.
5	There is some interdependency between the CAL 1 and CAL 2 adjustments. To ensure accurate calibration, CAL 1 should always be done first, followed by CAL 2.
6	In each calibration mode the correct response will be observed over a range of approximately two turns of the potentiometer. The object will be to set the potentiometer at midrange for the correct response.
7	If calibration is performed with the assistance of the CPMS central, the procedure is found in Section 637-600-401 (see Chart 3).
8	If calibration is performed with the CPMS test set, the procedures are found in Section 201-612-313 (see Charts 1 and 2).

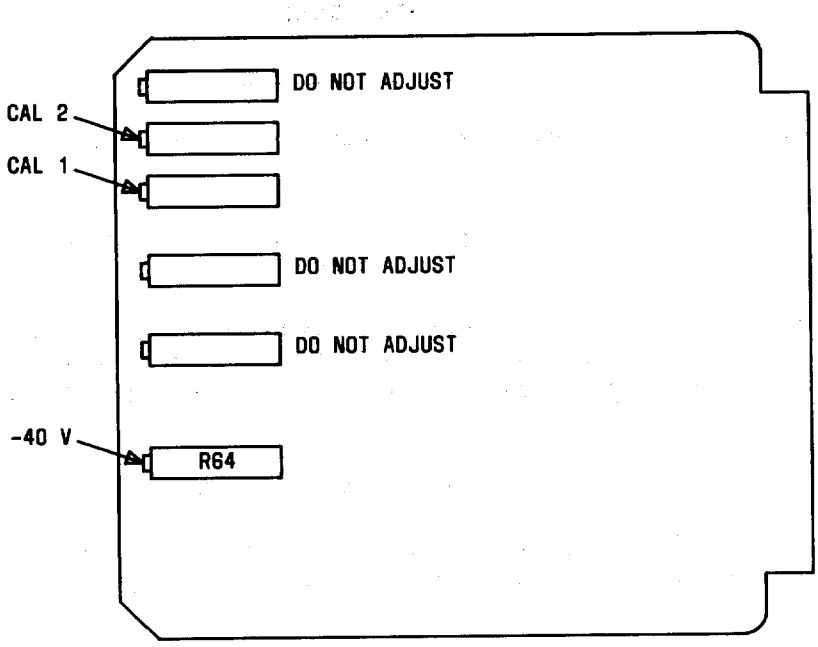


Fig. 2—CP5 Potentiometer Layout