

CABLE PRESSURE TELEMETRY

CENTRAL CONTROL

TEST AND TROUBLE ANALYSIS PROCEDURES

1. GENERAL

PAGE

1.01 This section describes a method of testing cable pressure telemetry central control circuit SD-5G142-01. Also included are trouble analysis procedures.

for deterioration and fraying of the ribbon. **7**

1.02 This section is reissued to delete the precharge power supply test and to make corrections. This reissue affects the Equipment Test List.

F. Cable Check: This test checks the cable pairs for false ground, short circuits, and open circuits. . **7**

1.03 The following tests are covered.

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G. Alarm Check: This test checks that the alarm of the central control circuit will be activated when a low pressure alarm condition exists. . **8**

A. Digital Voltmeter (DVM) Adjustment: This test checks the zero adjustment of the DVM. **3**

1.04 The following trouble analysis procedures are covered.

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B. + and -24 Volt Power Supplies: This test checks the output voltages of the -24 and +24 volts power supplies. **3**

A. Central Control Does Not Measure Any Station With DVM Reading Steady: **11**

C. Constant Current Supply: This test checks the 1 milliamper and 10 milliamper currents of the constant current supply SD-81901-01 by adjusting a load resistor from 0 to 50,000 ohms. **3**

B. Measurements Obviously Wrong (DVM Display): **12**

D. Deleted

C. Measurements Obviously Wrong (Printed Numbers): **13**

E. Printer Check: This test checks the printout of the printer. **6**

D. Central Control Does Not Step Along Cable:

(a) Stops Between First and Last Station

E.1 Printer Ribbon Check and Printout Advance Check:

This test checks that the ribbon is supplying the necessary ink for the printer and that the printout paper is advanced properly. This test also checks

(b) Measures Only One Station (All Measurements on Cable Are Same)

(c) Measures Only One Station (All Cables) **14**

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E. Station Count Printout Incorrect:		
(a) Station Count Does Not Change Pressure Reading Normal		
(b) Station Count Does Not Reset to Zero at End of Cable	15	
F. Cable Counter Failure:		
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H. Digital Voltmeter Failure:		
(a) Reading All Zeros		
(b) Both Readings Greater Than 60 Volts	16	
I. Printouts Indicating Trouble:	17	

1.06 Lettered Steps: A letter a, b, c, etc, added to a step number in Part 3 or 4 of this section indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 The apparatus required for each test and trouble analysis procedure is shown in Table A. The details of each item are covered in the paragraph indicated in parentheses.

2.02 Volt-ohm-milliammeter KS-14510 (for making voltage and resistance measurements through the central control circuit).

2.03 Tektronix 453 oscilloscope equipped with P6010 voltage probe or equivalent.

2.04 Spare program patchboard in which the alarm status has been programmed to cause an alarm on the cable to be tested.

2.05 Variable resistor, 0 to 50,000 ohms, 1/2 watt minimum (for external load on constant current supply).

1.05 Trouble analysis procedures in 1.04 (A through I) should serve to locate most troubles but are not a complete trouble analysis of all circuit details.

TABLE A

APPARATUS	TESTS					TROUBLE ANALYSIS					
	B	C	E	F	G	A	B	D	E	F	H
Volt-ohm-milliammeter (2.02)	1	1		1		1	1	1	1		
Oscilloscope (2.03)						1			1	1	
Program board (2.04)					1						
Variable resistor (2.05)		1									
Testing cord (2.06)			✓					✓	✓	✓	✓
332A plug (2.07)		1									
Tools (2.08)		✓		✓			✓				

✓ As required

2.06 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools, one KS-6278 connecting clip, and one 419A connecting clip.

2.08 Blocking and insulating tools. Use and apply in accordance with Section 069-020-801.

2.07 332A plug (for gaining access to relay socket terminals).

3. METHOD

STEP	ACTION	VERIFICATION
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A. Digital Voltmeter (DVM) Adjustment

1	At DVM— Adjust for 0 indication in accordance with manufacturer manual.	
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2a	For normal operation of the 2400 DVM, check that all range buttons are out.	
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Note: If it is necessary to recalibrate the DVM, this should be done by a qualified standard laboratory or the manufacturer.

B. + and -24 Volt Power Supplies

1	At -24 and +24 volt power supplies— During normal operation— Measure power supply output voltage.	
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VOM indicates between 23.75 and 27.0 volts.

C. Constant Current Supply

1	At -24 and +24 volt power supplies— Block operated RF1 and RF2 relays to disable power failure alarm.	
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2	Remove ac fuses.	
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3a	If equipped with 1 MA and 1.1/7.75 MA switches— At constant current supply— Operate switches to OFF.	
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4b	If equipped with 1 MA and 10 MA switches— At constant current supply— Operate switches to OFF.	
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5	At current control circuit— Replace E1 relay with 332A plug.	
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6	Connect variable resistor between pins 3 and 7 of 332A plug.	
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STEP	ACTION	VERIFICATION
	Note: A short between pins 3 and 7 of E1 relay may be used for a check.	
7	At current and cable select panel— Operate MEAS CURR/DVM NOR key to MEAS CURR and MEAS 1 MA/MEAS COMM CURR key to MEAS 1 MA.	
8	At DVM— Adjust SAMPLE RATE control to a suitable rate.	
	Note: If equipped with 2400 DVM, Step 8 is not required.	
9	Set RANGE switch to 10 volts.	
10c	For 2400 DVM, push range button to 10 volts.	
11	At constant current supply— Operate 1 MA switch to ON.	
12	At current control circuit— Adjust variable resistor connected in Step 6 from 0 to 50,000 ohms.	At DVM— Values indicate between 0.998 and 1.002 vol.
13d	If requirement for Step 12 is not within limits— At constant current supply— Adjust 1 MA FINE ADJ variable resistor to meet requirement of Step 12.	
14	At constant current supply— Operate 1 MA switch to OFF.	
15	At current control circuit— Replace 332A plug with E1 relay or remove short from pin 3 to pin 7 of E1 relay.	
16	Replace E2 relay with 332A plug or short pin 3 to pin 7 of E2 relay for a check.	
17	At current and cable select panel— Operate MEAS 1 MA/MEAS COMM CURR key to MEAS COMM CURR.	
18e	If equipped with a 1.1/7.5 MA switch— At constant current supply— Operate 1.1/7.5 MA switch to ON.	

STEP	ACTION	VERIFICATION
19f	If equipped with a 10 MA switch— At constant current supply— Operate 10 MA switch to ON.	
20	At current control circuit— Adjust variable resistor connected in Step 6 from 0 to 15,000 ohms.	At DVM— Values indicate between 9 and 11 volts.
21g	If requirements of Step 20 is not within limits— At constant current supply— Adjust 10 MA ADJ variable resistor to meet requirement of Step 20.	
22	At current control circuit— Remove variable resistor connected in Step 6 from between pins 3 and 7 of 332A plug.	
23	At constant current supply— Measure voltage at 150/200V OUTPUT jacks. <i>Note:</i> It may be necessary to remove front cover if probes are too large to enter the access holes.	If 19-gauge wire or larger is used— VOM indicates 150 volts maximum. If 22-gauge wire is used— VOM indicates 185 volts maximum.
24h	If requirement for Step 23 is not met— Adjust 150/200 VOLT ADJ variable resistor to meet requirement of Step 23.	
25	Operate 1.1/7.75 MA switch to OFF.	
26	At current control circuit— Replace 332A plug with E2 relay.	
27	At constant current supply— Operate 1 MA and 1.1/7.75 MA switches to ON.	
28	At -24 and +24 volt power supplies— Replace ac fuses.	
29	At DVM— Restore SAMPLE RATE control to HOLD and RANGE switch to RMTE. <i>Note:</i> If equipped with 2400 DVM, all range switches should be placed in the out (nonselected) position.	
30	At current and cable select panel— Operate MEAS CURR/DVM NOR key to DVM	

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STEP	ACTION	VERIFICATION
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NOR and MEAS 1 MA/MEAS COMM CURR
key to MEAS 1 MA.

31 Unblock relays blocked in Step 1.

E. Printer Check

Reset

- | | | |
|----|---|-------------------------------|
| 1 | At printer connector
With central control in STANDBY mode—
Momentarily apply ground to terminals 10, 14,
and 15. | |
| 2 | Momentarily apply ground to terminal 3. | Printout should be all zeros. |
| 3a | If digit fails to reset—
See manufacturer manual for replacing circuits
as required. | |
| 4b | If all digits fail to reset—
Replace printer. | |

Count

Note: Terminals 4, 5, 6, and 7 at the printer connector control the four digits of the pressure printout. Terminal 8 is the station count module, and terminal 9 is the cable count input.

- | | | |
|---|--|---|
| 5 | At printer connector—
Momentarily apply ground to terminal 4. | |
| 6 | Momentarily apply ground to terminal 3. | Printout should be one on least significant pressure bit. |
| | | Note: Due to chatter on the ground, two of three counts may occur. |
| 7 | Repeat Steps 5 and 6, substituting terminals 5, 6, 7, 8, and 9 for terminal 4. | |

Note: The above test is not foolproof due to chatter, and no check is made to carry one digit to the next digit. A suspected module failure should be replaced in accordance with manufacturer manual.

STEP	ACTION	VERIFICATION
E.1 Printer Ribbon Check and Printout Advance Check		
1	Inspect printed numbers for legibility.	Numbers shall be dark enough to insure legibility.
2	Remove the printer from the case and inspect the ribbon for signs of wear.	Ribbon shall not show signs of deterioration, especially fraying. <i>Note:</i> Any sign of deterioration of the ribbon, especially fraying, is cause for replacement. This will prevent jamming of the print mechanism by the ribbon.
3	Check printout advance.	There shall be adequate separation between lines.
4a	If either requirement of Steps 1, 2, or 3 is not met— Refer to Section 201-610-311 for ribbon replacement and paper advance.	
F. Cable Check		
1	At central control circuit— With central control in STANDBY mode and H relay released— Disconnect output cable conductors T1, R2, T3, and R4. <i>Note:</i> This may be done by blocking released BA relay associated with the cable under test.	
2	Measure resistance between each conductor and ground. <i>Note:</i> Table B lists points at which measurements may be made.	VOM indicates more than 10 megohms.
3	Measure resistance between output cable conductors T1 and R2.	VOM indicates more than 1500 ohms. <i>Note:</i> This value depends upon loop resistance and the state of relays in the remote transducer; however, the above is the minimum value.
4	Measure resistance between output cable conductors T3 and R4.	If one or more B relays are operated in remote transducers— VOM indicates 4000 ohms approximately. <i>Note:</i> This resistance depends upon the polarity of the circuit and the forward resistance of a diode. In one direction, the resistance

STEP

ACTION

VERIFICATION

TABLE B

LOCATION OF CONNECTIONS TO CABLES
ON TERMINAL STRIP A OF THE CURRENT
AND CABLE SELECT PANEL - J63006B

CABLE NO.	TERMINAL NO.			
	T1	R2	T3	R4
1	51	41	31	21
2	52	42	32	22
3	53	43	33	23
4	54	44	34	24
5	55	45	35	25
6	56	46	36	26
7	57	47	37	27
8	58	48	38	28

is 50,000 ohms or more; in the opposite direction, the resistance is 4000 ohms approximately.

- 5a If the condition is found as stated in Step 4 note—
Reconnect output cable conductors T3 and R4 to central control circuit or unblock relay blocked in Step 1 note.
- 6a Manually operate H relay for 10 seconds.
- 7a Remove output cable conductors T3 and R4 or block associated BA relay released.
- 8a Measure resistance between output cable conductors T3 and R4.
- 9b If the requirement in Step 8a is not met—
Perform Test C of Part 3.
- 10 Reconnect output cable conductors T1, R2, T3, and R4 or unblock BA relay blocked in Step 7a.

VOM indicates 12,000 ohms minimum.

G. Alarm Check

- 1 With central control circuit in AUTO mode (AUTO lamp lighted)—
Operate STANDBY key.

AUTO lamp extinguished.
STANDBY lamp lighted.

STEP	ACTION	VERIFICATION
2a	If constant current supply is equipped with 1 MA and 1.1/7.75 MA switches— Deactivate -24 and +24 volt power supplies and 1 MA and 1.1/7.75 MA switches.	
3b	If constant current supply is equipped with 1 MA and 10 MA switches— Deactivate -24 and +24 volt power supplies and 1 MA and 10 MA switches.	
4	Remove program patchboard of cable to be tested.	
5	Insert spare program patchboard.	
	Note: The spare program patchboard (alarm board) is to be programmed as follows.	
5	If only one alarm level exists on the cable being tested— Program spare program patchboard to alarm on second or greater transducer. If more than one alarm level exists on the cable being tested— Program spare program patchboard to alarm on second or greater alarm level. See associated SD for programming of patchboard.	
6a	If constant current supply is equipped with 1 MA and 1.1/7.75 MA switches— Activate -24 and +24 volt power supplies and 1 MA and 1.1/7.75 MA switches.	
7b	If constant current supply is equipped with 1 MA and 10 MA switches— Activate -24 and +24 volt power supplies and 1 MA and 10 MA switches.	
8	Operate CLEAR key.	CLEAR lamp momentarily lighted. STANDBY lamp lighted. Central control unit now prepared to start measuring station 1 of cable 1.
9	Operate MANUAL key.	At completion of operation in progress (10 seconds or less)— MANUAL READY lamp lighted.
10	Operate CABLE ADVANCE key to cable to be tested.	
11	When advanced to cable to be tested and MANUAL READY lamp is lighted—	When only one alarm level exists on cable being tested—

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STEP	ACTION	VERIFICATION
	Operate READ NEXT STATION key.	On second or greater transducer— Red ALARM lamp lighted. Office alarm sounded. When more than one alarm level exists on cable being tested— On second or greater alarm level— Red ALARM lamp lighted. Office alarm sounded.
12	Operate ACO (alarm cutoff) key.	Audible alarm silenced. Associated ACO lamp lighted. Associated ALARM lamp extinguished.
13	Release ACO key.	
14	Operate CLEAR key.	CLEAR lamp momentarily lighted.
15a	If constant current supply is equipped with 1 MA and 1.1/7.75 MA switches— Deactivate -24 and +24 volt power supplies and 1 MA and 1.1/7.75 MA switches.	
16b	If constant current supply is equipped with 1 MA and 10 MA switches— Deactivate -24 and +24 volt power supplies and 1 MA and 10 MA switches.	
17	Remove program patchboard (alarm board).	
18	Replace original program patchboard of cable tested.	
19a	If constant current supply is equipped with 1 MA and 1.1/7.75 MA switches— Activate -24 and +24 volt power supplies and 1 MA and 1.1/7.75 MA switches.	
20b	If constant current supply is equipped with 1 MA and 10 MA switches— Activate -24 and +24 volt power supplies and 1 MA and 10 MA switches.	
21	Operate CLEAR key.	CLEAR lamp momentarily lighted. Central control unit now prepared to start measuring station 1 of cable 1.
22	Operate AUTO key.	AUTO lamp lighted.
23c	If other cables are to be tested— Repeat Steps 1 through 22 for remaining cables to be tested.	

4. TROUBLE ANALYSIS PROCEDURES

STEP	ACTION	VERIFICATION
A. Central Control Does Not Measure Any Station With DVM Reading Steady		
1	At -24 and +24 volt power supplies— Measure 24-volt outputs of power supplies.	◆ Voltages should be between 23.75 and 27 volts.◆
2	At clock and clock control circuit— Measure voltage at pin B9 of CP14 or CP19 for presence of clock pulses.	Voltage should vary between 0 volts and +6 volts at a 5-second rate regardless of position of operating switches.
3a	If requirements of Step 2 are not met— Replace clock and clock control circuit CP14 or CP19.	
4	At control panel— Place central control in AUTO mode.	
5	At clock and clock control circuit— Check voltages at pins B29 and B16 of CP14 or CP19.	Pin B29 should be 0 volts, and pin B16 should change between 0 and +6 volts at a 5-second rate.
6b	If pin B29 is not 0 volts— At central control— Check AUTO relay, ◆STBY◆ relay, and CP15.	◆AUTO relay should be energized and STBY relay should be deenergized.◆
7c	If pin B29 is 0 volts and no clock pulses appear at pin B16— At central control— Replace clock and clock control circuit CP14 or CP19.	
8	At station readout control circuit CP4— With central control in AUTO mode— Measure voltage at TP6 jack to check sample pulse to DVM.	VOM indicates +6 volts for 3 seconds, 0 volts for 2 seconds, and then repeats the indications.
9d	If no pulse appears in Step 8— At control panel— Operate CLEAR pushbutton and then AUTO pushbutton.	
10d	At station readout control circuit CP4— Measure voltage at pins B27 and B28.	+6 volts appears at both pins.
11e	If requirements for Step 10d are not met— At central control— Replace general control circuit CP13 or CP20.	

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STEP	ACTION	VERIFICATION
12f	If pulse appears OK in Step 8— At DVM buffer CP17— Measure voltage at pin A11.	VOM indicates +24 volts for 3 seconds and 0 volts for 2 seconds.
13g	If pulse appears OK in Step 12f— At DVM— Check to see if it blinks every 5 seconds. Note: If DVM fails to blink, connections to DVM or DVM itself is defective.	
14	At DVM buffer CP17— Connect an oscilloscope to pin A9 to check for presence of encode complete pulse from DVM.	A positive pulse of 12-volt and 200-millisecond duration occurs every 5 seconds at pin A9.
15h	If pulse is not present in Step 14— At DVM— Check DVM and its connections.	
16i	If pulse is present in Step 14— At DVM buffer CP17— Check output voltage at pin A8 using an oscilloscope. Note: These checks should result in a system which is making measurements in the AUTO mode as indicated by DVM readings that change or blink every 5 seconds. If additional problems are present, see the appropriate procedure in Part 4.	Pin A8 should be normally +6 volts with a negative going pulse of 200-millisecond duration occurring every 5 seconds.

B. Measurements Obviously Wrong (DVM Display)

- 1 At control panel—
Place central control in STANDBY mode.
 - 2 At DVM—
Set DVM RANGE switch to 10 volts.
 - 3a For 2400 DVM, push range button to 10 volts.
 - 4 Adjust SAMPLE RATE control to a suitable rate.

Note: If equipped with 2400 DVM, Step 4 is not required.
 - 5 At front panel—
Connect a source of voltage less than 10 volts to jacks HI and LO on front panel.
- At DVM—
Value indicates applied voltage.

STEP	ACTION	VERIFICATION
6b	If DVM is defective— See manufacturer's manual.	
7c	If DVM is not defective— Check 1 MA and command current in Test C of Part 3.	
8	At station readout control circuit CP4— Replace station readout control circuit.	
9	Perform current flow test of C1, C2, E1, E2, D1, and D2 relays.	
10d	If all preceding checks are OK and display numbers are wrong— At current and cable select panel— Place a short across pins 41 and 51 of terminal strip A.	
10d	Block BA0 relay released.	
12e	At control panel— Place central control in AUTO mode to measure first cable.	At DVM— Display is approximately 9.24 volts for the first reading and 0.24 volts for the second reading. The difference between the two readings should be 9.00 ± 0.1 volts.
13f	If requirements of Step 12e are incorrect— Check cable, transducers, or connections thereto, and see appropriate procedure in Part 4.	
14	At cable and current select panel— Remove short of Step 10d from terminal strip A.	
15	Unblock BA0 relay blocked in Step 11d.	

C. Measurements Obviously Wrong (Printed Numbers)

1	At DVM— Observe visual display and compare against printed numbers; subtract smaller number (second reading) from larger number (first reading).	Difference of two visual display numbers is larger by one in last place than printed number.
2a	If Step 1 is correct, transfer of information from the DVM to the printer is correct, and printer operation is correct— See Test B of Part 4.	

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STEP	ACTION	VERIFICATION
3b	If Step 1 is incorrect and bay meets requirements in Test B of Part 4— At central control— Replace following circuit packs one at a time: Readout sequencer circuit CP3 Selection gate circuit CP2 Readout counter circuit CP1 Interface printer circuit CP6 DVM buffer circuit CP17.	
4	Check printer in Test E of Part 3.	

D. Central Control Does Not Step Along Cable

Stops Between First and Last Station

- 1 At central control circuit—
Perform Test C of Part 3.
- 2 Replace transducer measured or the one following it.

Measures Only One Station (All Measurements on Cable Are Same)

- 3 Perform Test F of Part 3.

Measures Only One Station (All Cables)

- | | | |
|----|--|--|
| 4 | At station readout control circuit CP4—
Measure voltage at TP3 jack. | VOM indicates 0 for 2 seconds in each 10-second clock period and +24 volts at other times. |
| 5a | If requirements for Step 4 are not met—
Replace station readout control circuit CP4. | |
| 6 | Measure voltage at RH2G lead for pin A37. | VOM indicates +6 volts. |
| 7b | If VOM does not indicate +6 volts in Step 6—
At manual control circuit CP15—
Replace manual control circuit. | |
| 8b | At station readout control circuit CP4—
Repeat Step 6. | VOM indicates +6 volts. |

STEP	ACTION	VERIFICATION
E. Station Count Printout Incorrect		
Station Count Does Not Change Pressure Reading Normal		
1	At interface printer circuit CP6— Connect an oscilloscope to pin 40.	Oscilloscope shows a positive output pulse of +24 volts and 17-millisecond duration every 10 seconds.
2a	If requirement in Step 1 is not met— At station readout control circuit CP4— Replace station readout control.	
3	At interface printer circuit CP6— Measure voltage at TP4 jack.	When pin B40 is grounded— VOM indicates 0. When pin B40 is +6 volts— VOM indicates -24 volts.
Note: Do not ground pin B40 for more than 2 minutes to avoid overheating print module.		
4b	If requirement in Step 3 is not met— Replace interface printer circuit CP6.	
5	Check printer in Test E of Part 3.	
Station Count Does Not Reset to Zero at End of Cable		
Note: See Test F of Part 3 if cable count is not working correctly.		
6	At general control circuit— Ground TP5 on CP13 (option ZC) or CP20 (option ZD).	G relay operated momentarily once every 10 seconds.
7c	If G relay does not operate— Replace CP13 or CP20.	
8d	If G relay operates and station count does not reset— At printer— Check for defective printer or wiring.	
F. Cable Counter Failure		
Cable Counter Does Not Advance in AUTO Mode		
1	At central control— Remove translator CP10.	
2	At general control circuit— Check output at TP6 on CP13 or CP20 using	G relay operated momentarily and H relay operated for 10 seconds. Every 10 seconds a

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STEP	ACTION	VERIFICATION
	an oscilloscope.	+6 volt pulse appears at TP6 with a duration of 0.9 seconds. G relay operates every time +6 volt pulse appears.
3a	If Step 2 fails— Replace CP13 or CP20. <i>Note:</i> Cards CP13 and CP20 are interchangeable.	
4b	If Step 2 is OK and cable counter advances every 10 seconds with CP10 removed— At central control— Check or replace CP7 and CP10.	
5c	If Step 2 is OK and cable counter does not advance with CP10 removed— At central control— Check or replace CP9 or CP18 (depending on option provided).	

Cable Counter Printout Incorrect

- 6 Perform Test E in Part 3.

G. Manual Control Failure

- 1 At manual control circuit CP15—
Replace manual control circuit.
- 2 At readout counter circuit CP1—
Replace readout counter circuit.

H. Digital Voltmeter Failure

Reading All Zeros

- 1 At -24 and +24 volt power supplies—
Remove ac fuses.
- 2 At DVM—
Disconnect inputs to rear of meter.
- 3 Connect a dc voltage of less than 90 volts to front terminals. DVM indicates voltage used for test.
- 4 Disconnect dc voltage from front terminals.
- 5 Reconnect input disconnected in Step 2.
- 6 Perform Test C in Part 3.

STEP	ACTION	VERIFICATION
7	Adjust DVM in accordance with Test A in Part 3.	
8	At -24 and +24 volt power supplies— Replace ac fuses.	
Both Readings Greater Than 60 Volts		
9	Perform Test F in Part 3.	
I. Printouts Indicating Trouble		
1	At printer— 8.90 to 9.10 indicates a short circuit between cable pair T1 and R2.	
2	0.00X or 9.99X indicates an open circuit between cable pair T1 and R2.	
3	Perform Test F in Part 3.	