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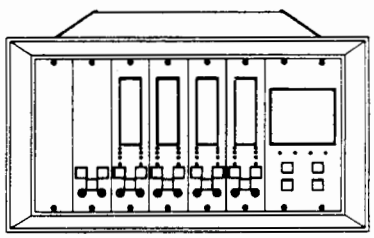
Find the *GE / Bently Nevada 3300/70-01-00* at our website: *Click HERE*

PART NO. 84607-01

3300/70 DUAL VALVE POSITION INDICATOR

OPERATION MANUAL

BENTLY NEVADA



NOTICE

READ THE FOLLOWING BEFORE INSTALLING OR OPERATING EQUIPMENT

Bently Nevada Corporation has attempted to identify areas of risk created by improper installation and/or operation of this product. These areas of information are noted as **WARNING** or **CAUTION** for your protection and for the safe and effective operation of this equipment. Read all instructions before installing or operating this product. Pay particular attention to those areas designated by the following symbols.

WARNING

HIGH VOLTAGE PRESENT
COULD CAUSE SHOCK
BURNS OR DEATH

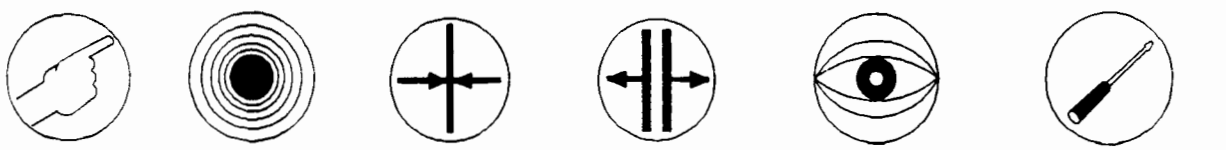
DO NOT TOUCH EXPOSED
WIRES OR TERMINALS

CAUTION

Machine Protection Will Be Lost

SYMBOLS

Special symbols are used in the manual to illustrate specifics in the step by step processes. For example:



FORWARD

This document is for control room personnel who operate the 3300 Monitoring System. The procedures are presented in step-by-step graphic format.

RELATED DOCUMENTS

3300 System Overview, 80177

3300 System Installation Instructions, 80172

3300 System Troubleshooting, 80173

3300/10 Power Supply, 80174

3300/01 System Monitor, 80175

3300/70 Dual Valve Position Indicator Maintenance Manual, 84608-01

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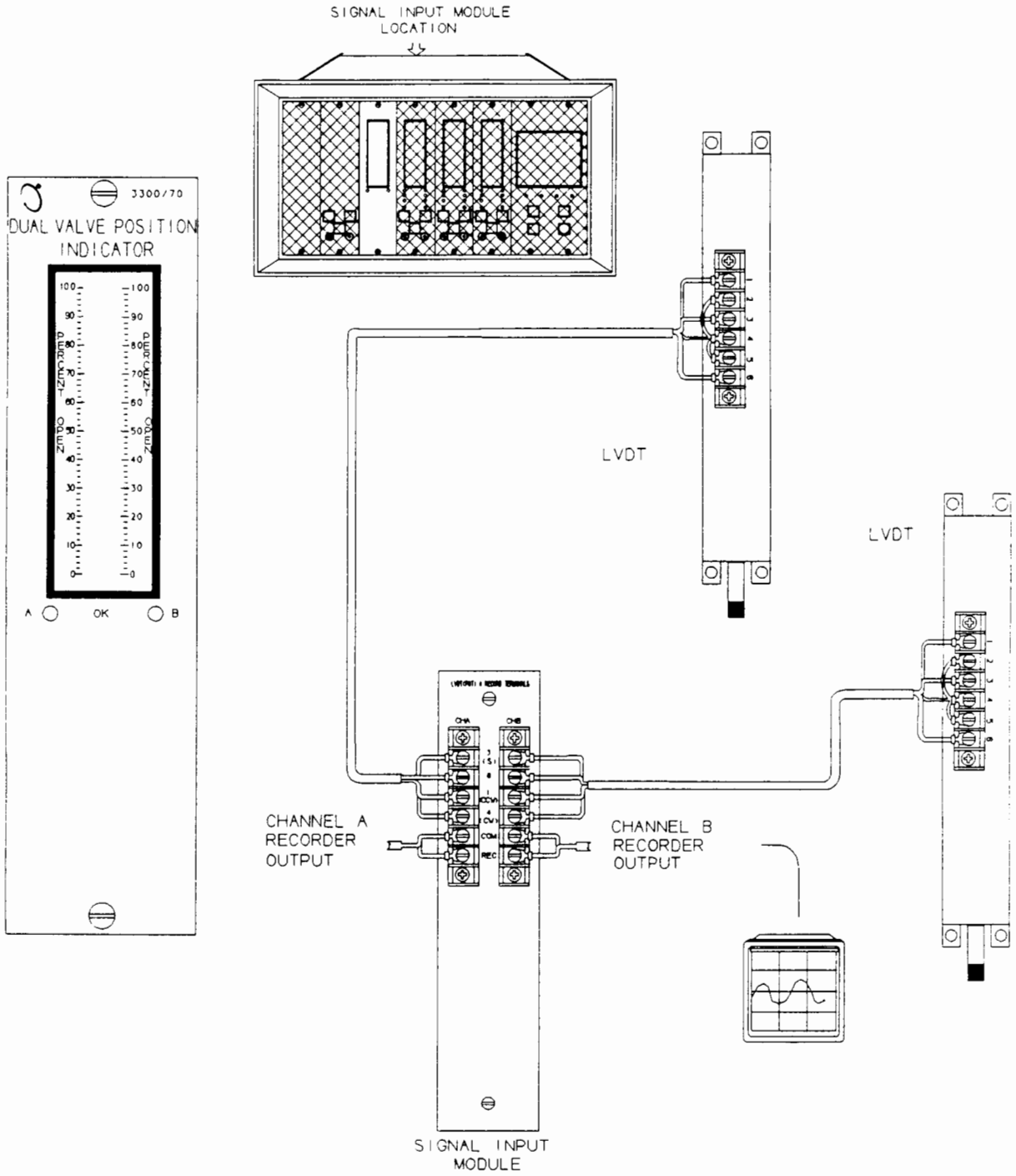
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CONTENTS

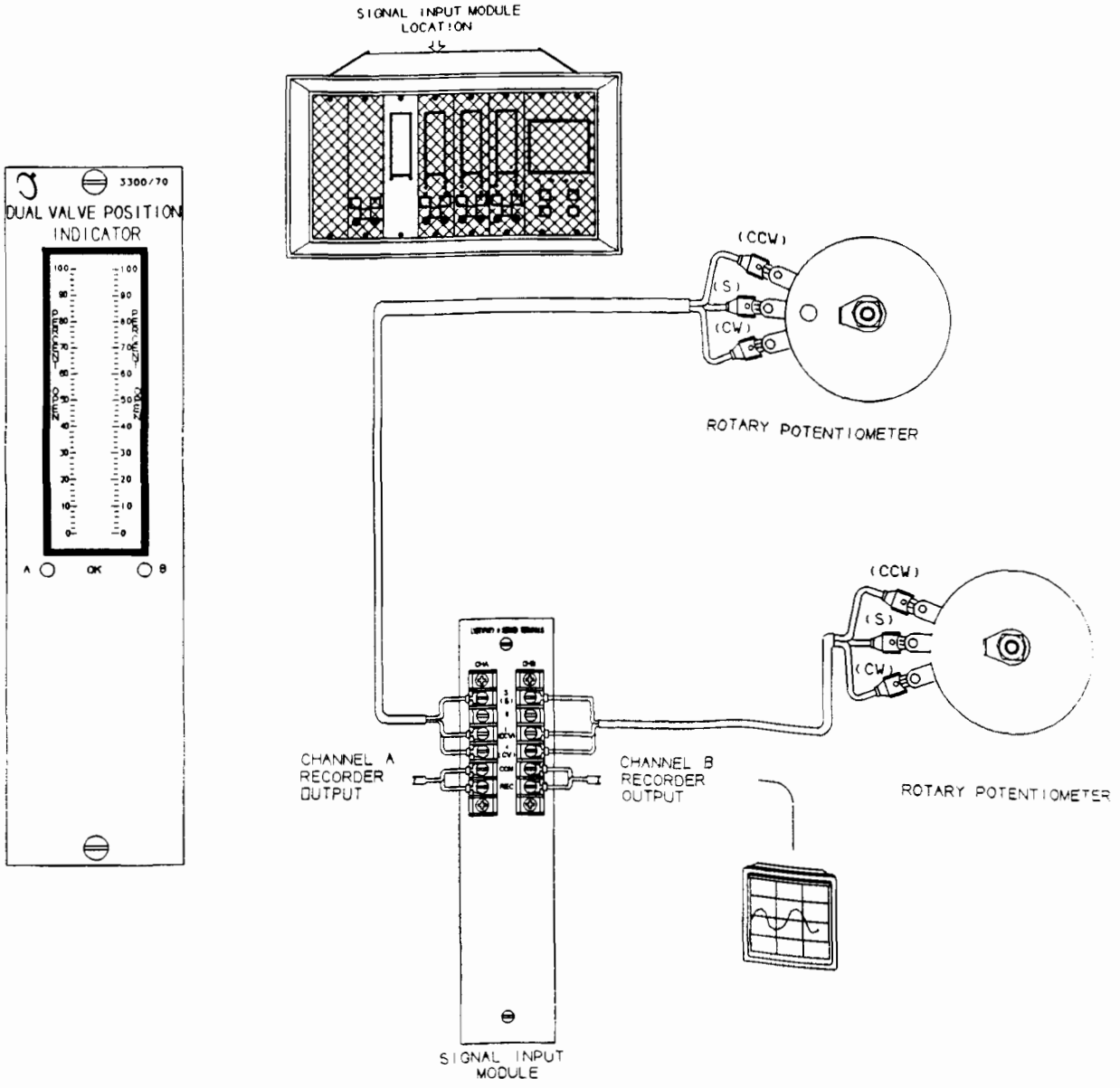
SECTION	TITLE	PAGE
1.	Dual Valve Position Indicator System	1,2
2.	Indicator Transducer Options	3
3.	Programmable Options	4
4.	Indicator Functions	5
5.	OK	6
6.	Bypass	7
7.	Read Channel Valve Position (LVDT)	8
7.	Read Channel Valve Position (POT)	9
8.	Self Test	10-12
	Index	13

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1 VALVE POSITION INDICATOR LVDT SYSTEM



1 VALVE POSITION INDICATOR POT. SYSTEM



2 INDICATOR TRANSDUCER OPTIONS

DUAL VALVE POSITION
INDICATOR PART NUMBER

TRANSDUCER TYPE

3300/70 ——— AA

01 = 5000 OHM POTENTIOMETER 90 DEGREES TO 300 DEGREES FULL SCALE ROTATION
02 = 5000 OHM POTENTIOMETER 50 DEGREES TO 90 DEGREES FULL SCALE ROTATION
03 = +/- 1.0 INCH (+/- 25mm) A.C. LVDT -> 2 INCHES (50 mm) = FULL SCALE
04 = +/- 2.0 INCH (+/- 50mm) A.C. LVDT -> 4 INCHES (100 mm) = FULL SCALE
05 = +/- 3.0 INCH (+/- 75mm) A.C. LVDT -> 6 INCHES (150 mm) = FULL SCALE
06 = +/- 5.0 INCH (+/- 125mm) A.C. LVDT -> 10 INCHES (250 mm) = FULL SCALE

3 PROGRAMMABLE OPTIONS

OK MODE	NONLATCHING LATCHING TIMED OK / CHANNEL DEFEAT
BYPASS CHANNEL A BYPASS CHANNEL B	ENABLE / DISABLE ENABLE / DISABLE
RECORDER OUTPUT OPTIONS	+1 TO +5 Vdc 0 TO -10 Vdc +4 TO +20 mAdc

4 INDICATOR FUNCTIONS

DUAL VALVE POSITION - The Dual Valve Position Indicator provides a continuous indication of relative (0 to 100 percent) valve opening on two channels (A and B). The Valve Position Indicator can be configured to operate with either one of four types of A.C. LVDTs or a Rotary Potentiometer. The same type of transducer must be used on both channels.

The **Linear Variable Differential Transformer (LVDT)** is an electromechanical transducer whose electrical output varies with the linear displacement of its movable iron core. The iron core is connected to the valve's operation linkage.

The **Rotary Five Thousand Ohm (5 Kohm) Potentiometer** is a variable resistor whose resistance changes with the rotation of its center shaft. This center shaft is connected to the cam shaft driving the valve linkage.

OK - Both the Potentiometer Transducer Option and the A.C. LVDT Transducer Options have OK circuitry. In the case of the Rotary Potentiometer, the OK circuitry checks for an open wire to the tranducer in addition to a shorted transducer. In the case of the LVDT, the OK circuitry checks for an open or shorted primary field wire and an open secondary field wire. Detection of any of the above conditions is indicated by turning OFF the appropriate channel's green LED and deenergizing the OK Relay.

If the Indicator is configured for **Nonlatching OKs**, then once the transducer error is corrected the LED is turned back on and the OK relay is energized.

If the Indicator has the **Latching OK** option, a System Reset is required to reset the OK function when the transducers return OK.

If the Indicator has **Timed OK / Channel Defeat** configured, a 30 second time out period exists after the monitor returns OK. The System Reset is then required to restore the flashing green LED to a steady ON state.

OK RELAY - The OK Relay is located on the Power Input Module. Every channel in the rack must be OK or bypassed to energize the OK Relay.

RECORDER OUTPUT - The Indicator has a recorder output for each channel. The recorder output is proportional to valve opening. Depending on the option selected, the recorder outputs are 0 to -10Vdc, +1 to +5Vdc, or +4 to +20mA.

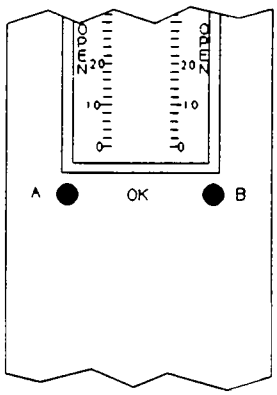
SELF TEST - The monitor has three categories of self test: Power-Up, Cyclic, and User-Invoked.

Power-up self test is performed automatically each time the monitor power is turned on. A series of basic tests and transducer OK tests are performed.

Cyclic self test is performed automatically during monitor operation. Errors encountered during cyclic tests disable the monitor, and flash an LCD bargraph error code. Should the error be intermittent, the monitor will return to operation, but the error codes are stored for retrieval during user-invoked self tests. Stored error codes are indicated by OK LEDs flashing at 5 Hz provided that the channel is OK.

User-Invoked self test performs power-up self test and allows error messages stored during Cyclic self tests to be read and cleared. Stored errors are annunciated by flashing the **OK** LEDs at **5** Hz and displaying the error codes on the front panel LCD bargraph.

5 OK



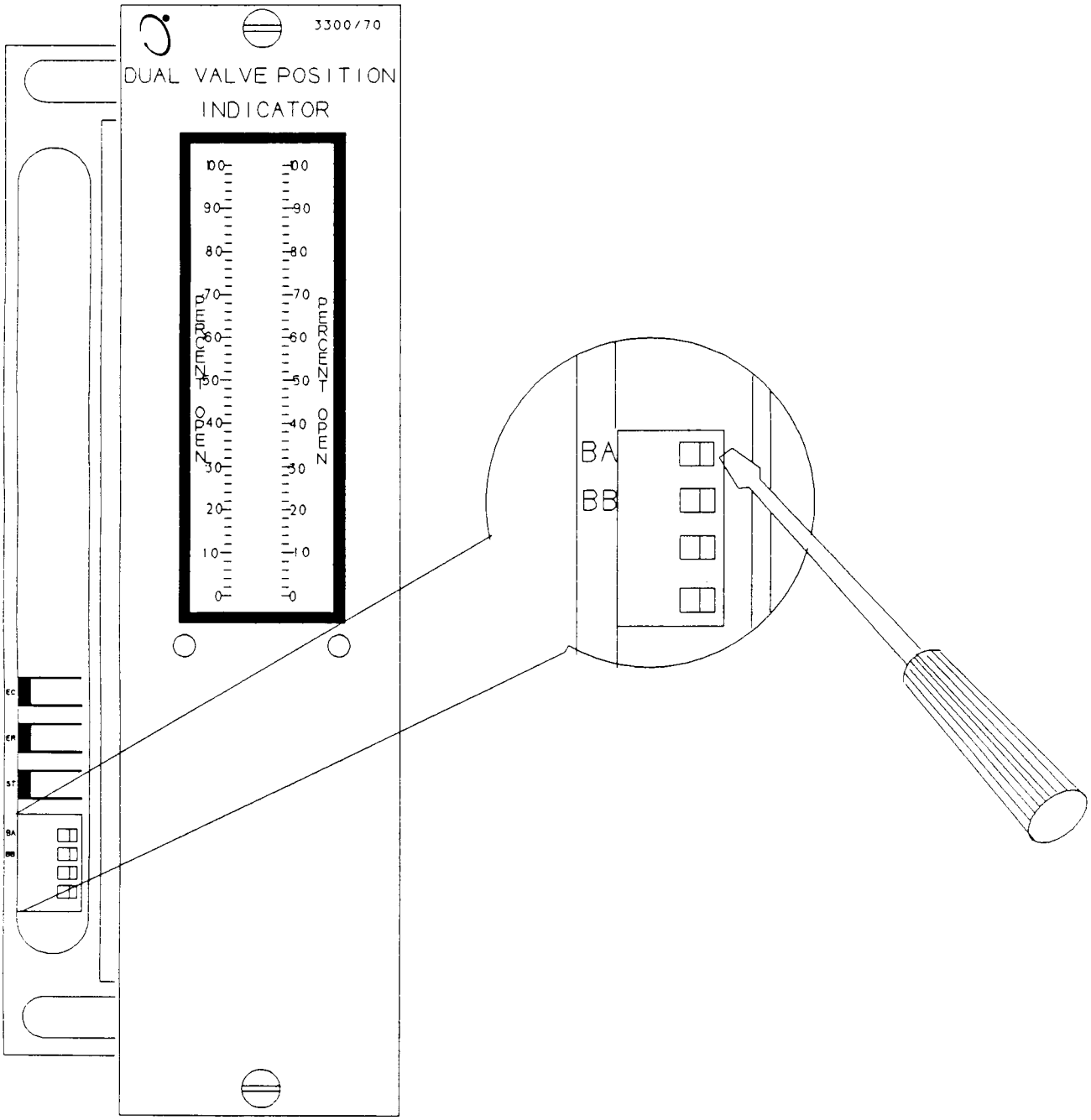
NOTE: EACH CHANNEL IN THE SYSTEM CONTROLS THE OK RELAY. THEREFORE, EITHER CHANNEL CAN CAUSE A NOT OK RELAY CONDITION (DE-ENERGIZED RELAY)

LED DISPLAY A		LED DISPLAY B	CONDITION	OK RELAY DRIVE *
●	OK	●	CHANNEL A AND B IN OPERATING RANGE	ON
●	OK	○	RESPECTIVE CHANNEL A OR B TRANSDUCER IN NOT OK CONDITION OR BYPASSED. *	OFF *
○	OK	●		
○	OK	○	MONITOR IN SELF TEST, OR BOTH TRANSDUCERS IN NOT OK CONDITION OR BYPASSED. *	OFF *
◉	OK	◉	FLASHING AT 5 Hz = ERROR ENCOUNTERED DURING CYCLIC TEST. READ ERROR MESSAGE SEE SECTION 8.	ON
◉	OK	◉	WITH TIMED OK / CHANNEL DEFEAT ENABLED, AFTER A 30 SECOND DELAY, THE OK CHANNEL'S LED WILL FLASH AT 1 HZ IF EITHER OR BOTH CHANNELS WERE NOT OK. DURING A POWER UP BOTH LEDS WILL FLASH IN THIS MODE AFTER THE 30 SEC. DELAY. SYSTEM RESET IS REQUIRED TO RESET THE FLASHING LEDS.	ON
●	OK	◉		
◉	OK	●		

* NOT OK CHANNEL CAN BE BYPASSED TO RESTORE RELAY OK CONDITION

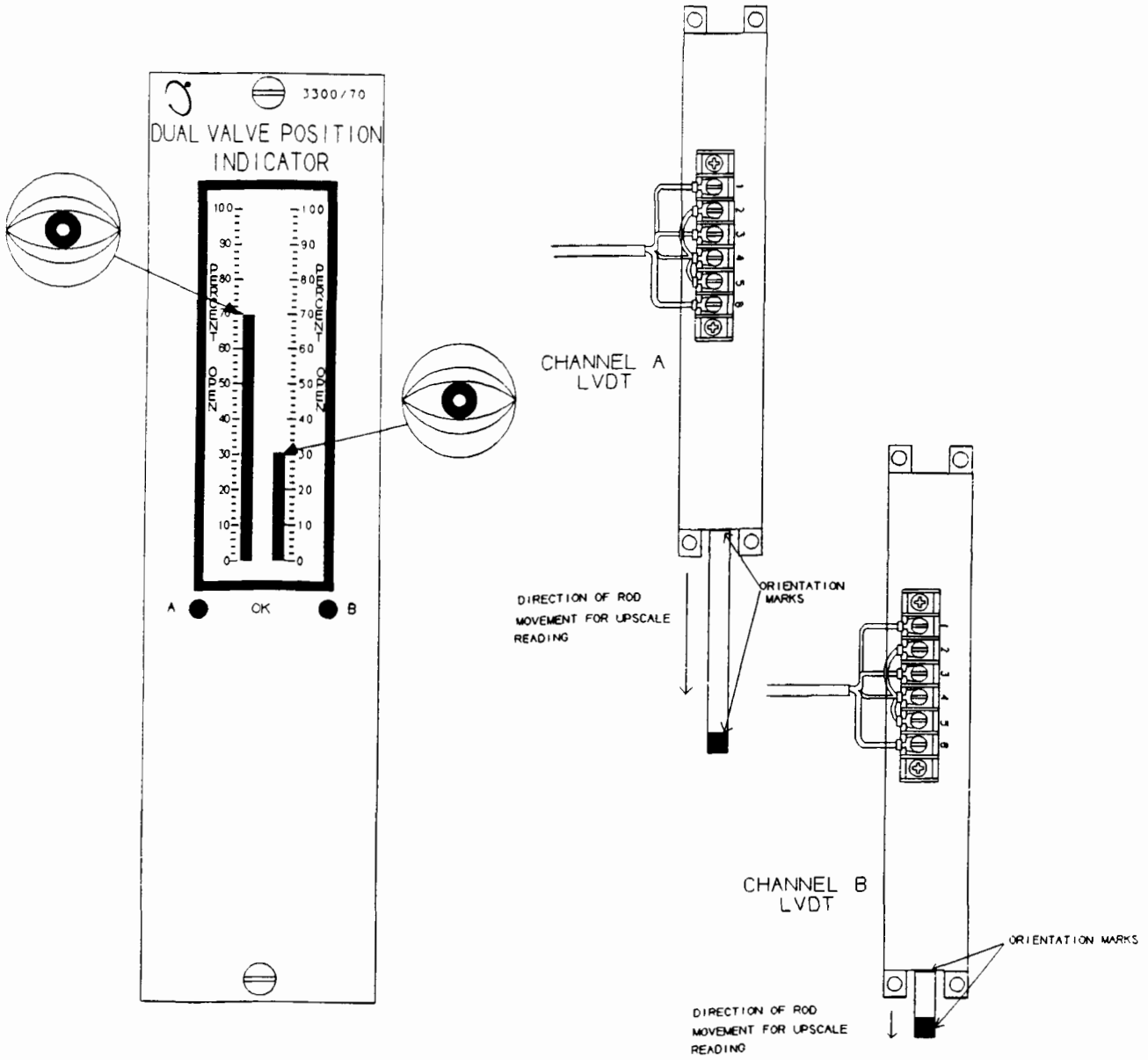
6 BYPASS

INDICATOR CHANNELS MAY BE INDIVIDUALLY BYPASSED VIA THE DIP SWITCH BEHIND THE FRONT PANEL. BYPASSING A CHANNEL THAT IS NOT OK, CLEARS THE OK RELAY. BYPASSING A CHANNEL WHICH IS OK TURNS OFF THE **OK** LED. IN EITHER CASE, BYPASSING A CHANNEL CAUSES THE BARGRAPH AND RECORDER OUTPUT FOR THAT CHANNEL TO READ ZERO.



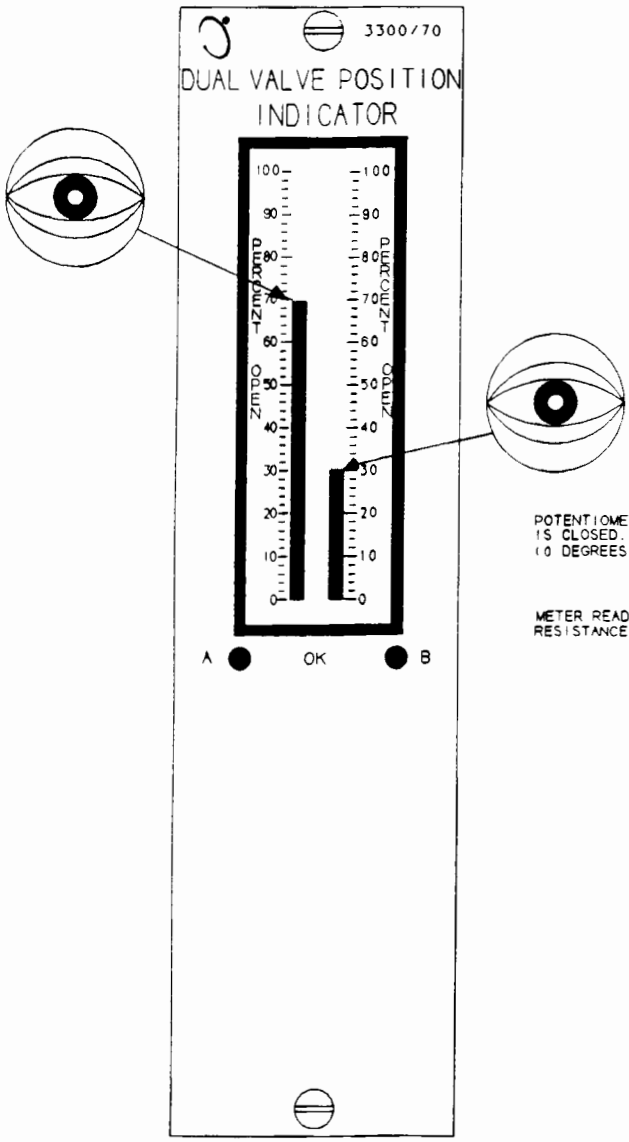
7 READ CHANNEL VALVE POSITION (POT.)

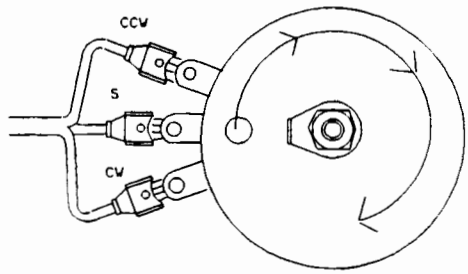
INDICATOR CONTINUOUSLY INDICATES MEASURED VALVE POSITION FOR CHANNELS A AND B.



7 READ CHANNEL VALVE POSITION (POT.)

INDICATOR CONTINOUSLY INDICATES MEASURED VALVE POSITION FOR CHANNELS A AND B.

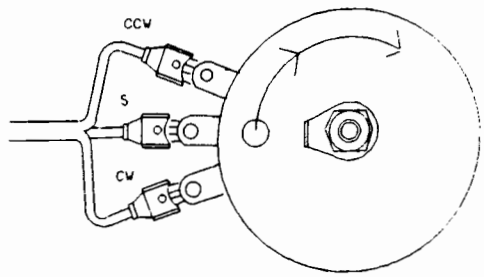




CHANNEL A POTENTIOMETER

POTENTIOMETER IS CONNECTED SO THAT WHEN THE VALVE IS CLOSED, THE POTENTIOMETER IS AT MAXIMUM RESISTANCE (0 DEGREES S REFERRED TO CW)

METER READS UPSCALE AS THE POTENTIOMETER RESISTANCE DECREASES (WITH S REFERRED TO CW)

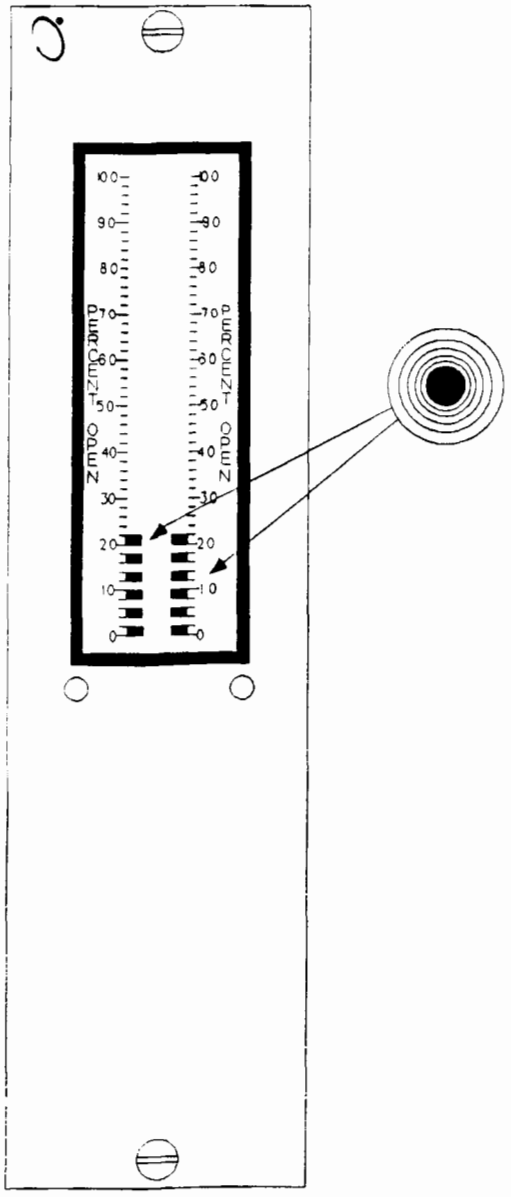


CHANNEL B POTENTIOMETER

8 SELF TEST

THE MONITOR HAS THREE LEVELS OF SELF TESTS:

POWER-UP SELF TEST: PERFORMED ONLY WHEN MONITOR IS TURNED ON.
CYCLIC SELF TEST: PERFORMED CONTINUOUSLY.
USER-INVOKED SELF TEST: PERFORMED ONLY WHEN INITIATED BY USER.



IF ERRORS ARE DETECTED DURING CYCLIC SELF TESTS:

MONITORING IS ABORTED UNTIL THE ERROR IS RESOLVED.

ERROR CODE IS STORED IN MEMORY AND FLASHED ON THE LCD BARGRAPH DISPLAY.

THE **OK** LED FLASHES AT 5 HZ.

IF ERROR IS INTERMITTENT AND GOES AWAY:

MONITORING IS RESUMED AND **OK** LED FLASHES AT 5 HZ.

ERROR CODE IS STORED. USER INVOKED TEST DISPLAYS AND CLEARS ERROR.

IF ERRORS ARE DETECTED DURING POWER-UP TEST OR USER-INVOKED SELF TEST:

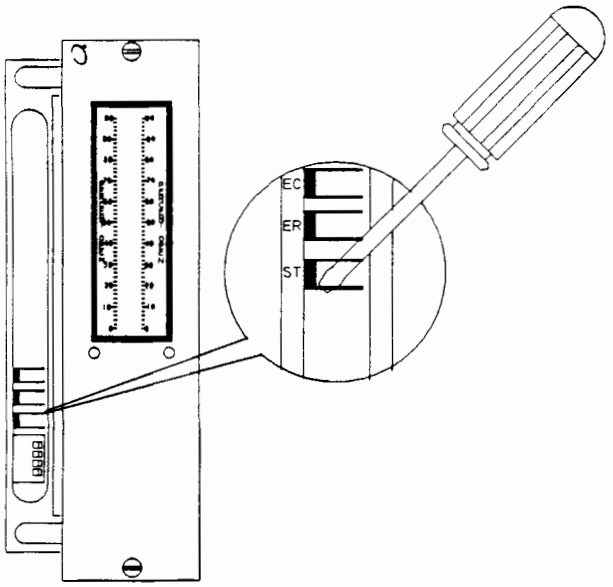
MONITORING IS ABORTED UNTIL USER ACTION RESOLVES PROBLEM.

TEST CAN BE RERUN WITH MONITOR POWER UP OR USER INVOKED TEST.

NOTE
ALTHOUGH BOTH COLUMNS ON THE BARGRAPH FLASH, THE ERROR CODE IS ONLY THE SUM OF THE BARGRAPH SEGMENTS DISPLAYED IN ONE COLUMN. EXAMPLE SHOWS ERROR CODE 6.

8 SELF TEST [CONT]

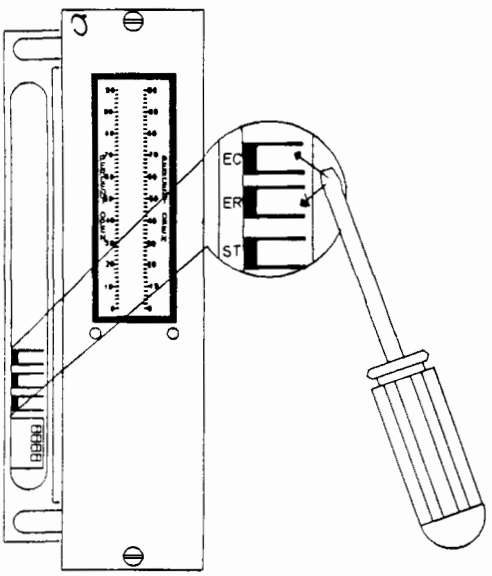
INITIATE USER-INVOKED SELF TEST BY SHORTING ACROSS TWO SELF-TEST (ST) PINS.



CAUTION

VALVE POSITION INDICATION WILL BE LOST FOR DURATION OF TEST

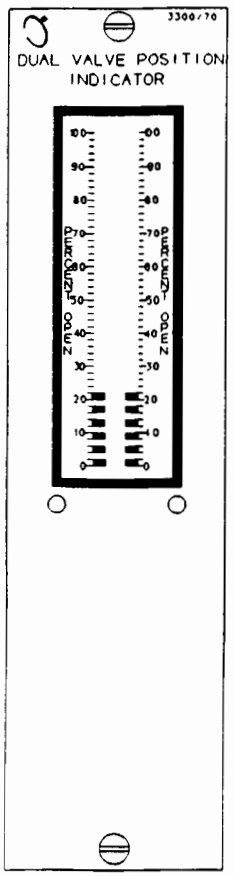
AT COMPLETION OF USER-INVOKED SELF TEST INDICATOR WILL RECALL STORED ERROR CODES, IF ANY. THESE ERROR CODES MUST BE READ AND CLEARED WITH USER INTERACTION TO ALLOW INDICATION TO CONTINUE.



READ CODES ON LIST; STEP THROUGH EACH ERROR CODE ON LIST BY SHORTING THE ERROR READ (ER) TERMINALS FOR APPROXIMATELY 1 SECOND.

AT THE END OF THE LIST, THE LCD BARGRAPH DISPLAYS ALL SEGMENTS. TO REREAD THE LIST HOLD SHORT THE ERROR READ (ER) TERMINALS. TO CLEAR THE LIST FROM MEMORY, HOLD SHORT THE ERROR CLEAR (EC) TERMINALS FOR APPROXIMATELY 1 SECOND.

8 SELF TEST [CONT]



ERROR CODE	DESCRIPTION
2	ROM CHECKSUM HAS FAILED. *
3	EEPROM FAILURE NO. 1. *
4	EEPROM FAILURE NO. 2. *
5	+7.5V&-VT NODE OUT OF TOLERANCE. **
6	+VRH NODE OUT OF TOLERANCE. **
7	+5V NODE #1 OUT OF TOLERANCE. **
8	MVREF NODE OUT OF TOLERANCE. **
9	+7.5V NODE OUT OF TOLERANCE. **
10	+VRL NODE OUT OF TOLERANCE. **
11	MVREF & -6.5V NODE OUT OF TOLERANCE. **
12	+5V&-7.5V NODE OUT OF TOLERANCE. **
13	+5V NODE #2 CHECK OUT OF TOLERANCE **
14	RAM FAILURE. *
17	COP WATCHDOG NOT CONFIGURED *

* THESE ERRORS ARE NONRECOVERABLE.

** TESTED ONLY AT CYCLIC SELF TEST. ERROR CODES 5 THROUGH 13 COULD BE INTERMITTENT AND RECOVERABLE.

INDEX

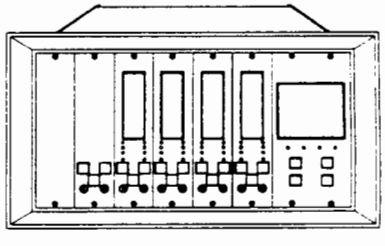
	Page
BYPASS	7
CYCLIC TEST	10
ERROR CODE	11, 12
INDICATOR	8, 9
LVDT	5
OK	5, 6
OK MODE	4
OK RELAY	5, 6
OPTIONS	3,4
PART NUMBER	3
POTENTIOMETER	5
POWER UP TEST	10
RECORDER OUTPUT	5
SELF TEST	5, 10
TRANSDUCER TYPES	3
USER INVOKED TEST	10, 11

PART NO. 84608-01

3300/70 DUAL VALVE POSITION INDICATOR

MAINTENANCE MANUAL

BENTLY NEVADA



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BURNS OR DEATH

DO NOT TOUCH EXPOSED
WIRES OR TERMINALS

CAUTION

Machine Protection
Will Be Lost

SYMBOLS

Special symbols are used in the manual to illustrate specifics in the step by step processes. For example:



FORWARD

This document is for control room personnel who maintain the 3300 Monitoring System. The procedures are presented in step-by-step graphic format.

RELATED DOCUMENTS

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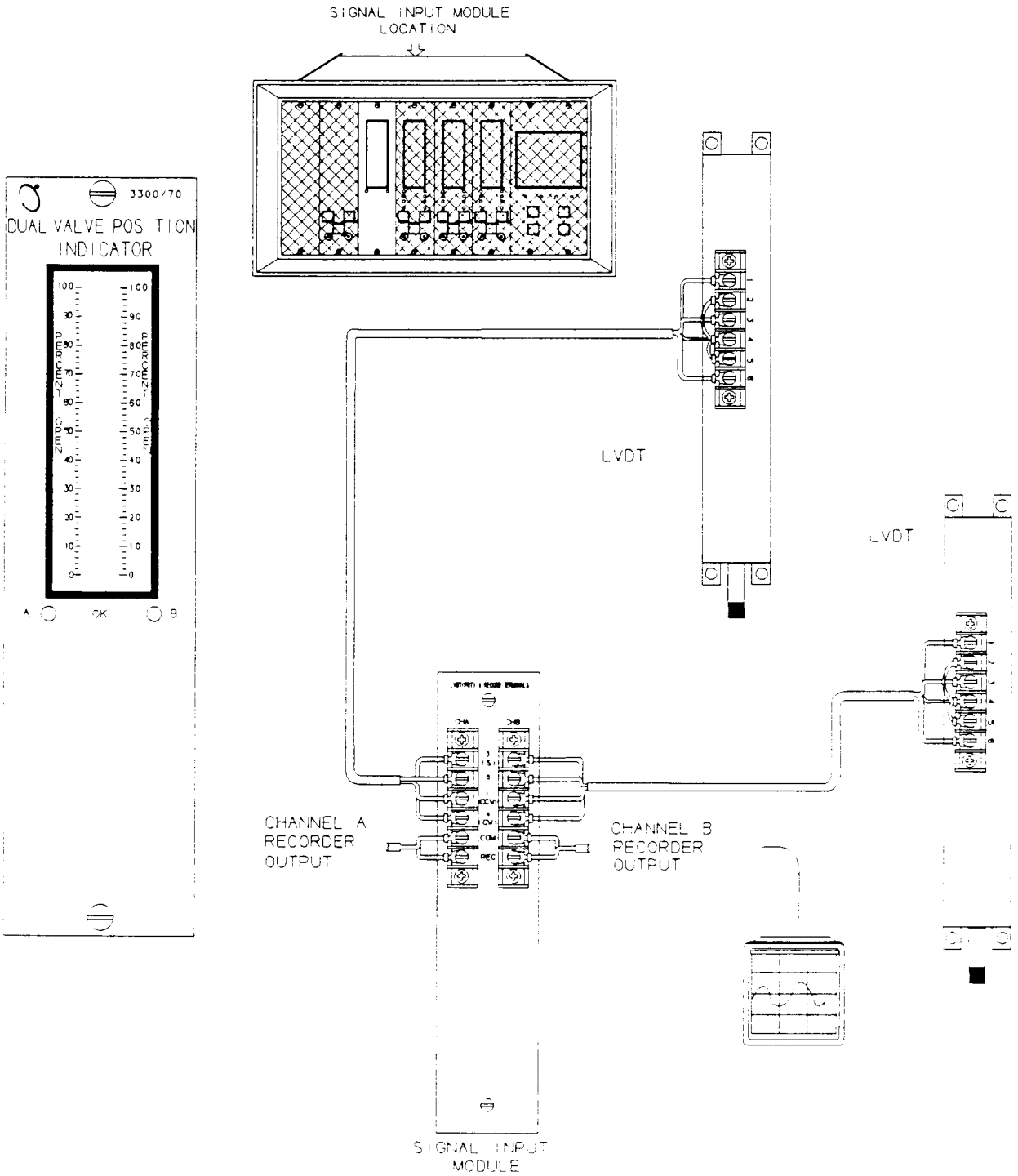
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CONTENTS

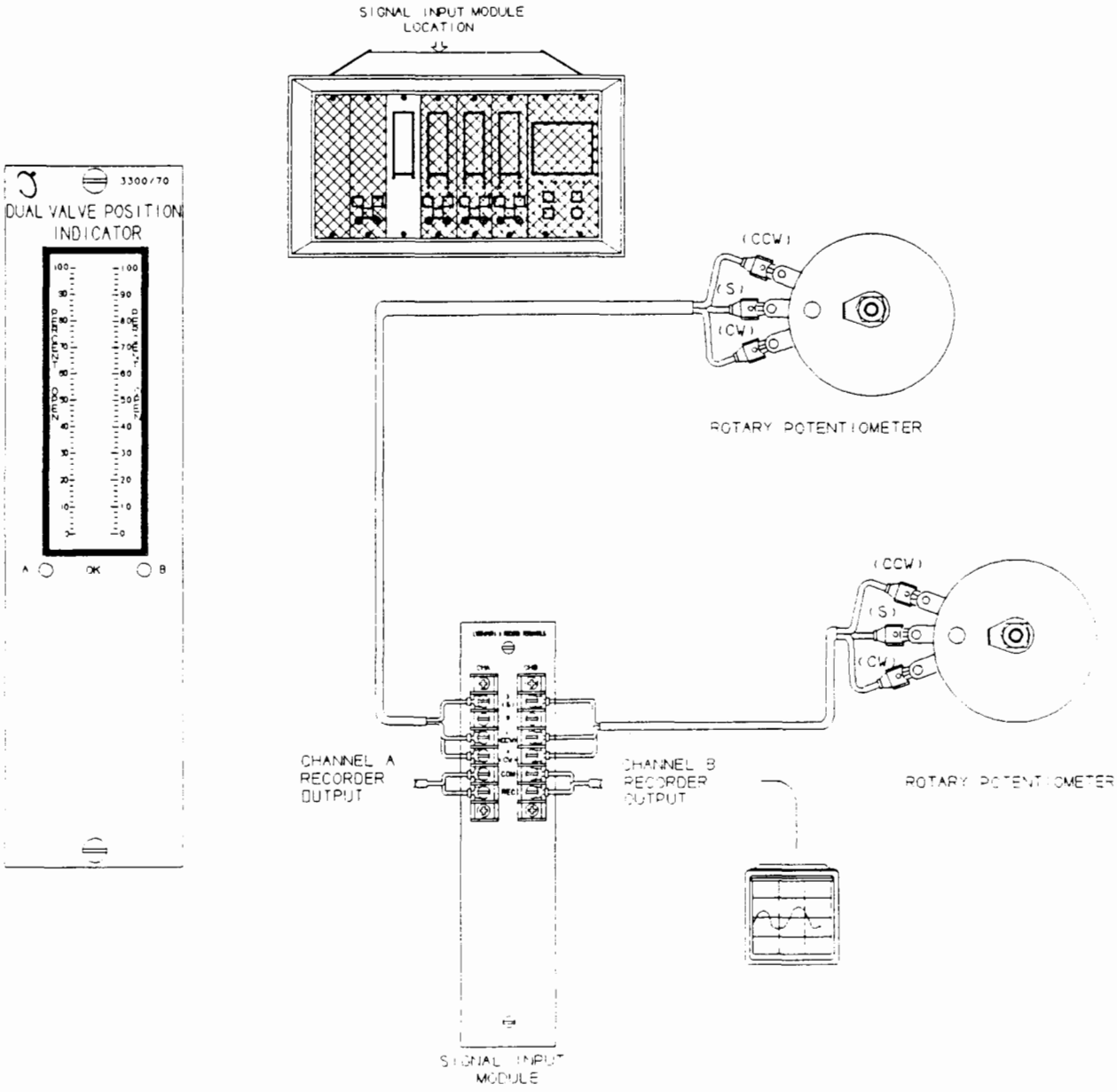
SECTION	TITLE	PAGE
1.	Dual Valve Position Indicator System	1,2
2.	Front Panel Features	3
3.	Indicator Removal	4
4.	Indicator Disassembly	5,6
5.	Signal Input Module	7
6.	Indicator Options	8-12
7.	Meter Scale Replacement	13
8.	Bypass Indicator Channel	14
9.	LVDT Primary Wiring OK Test	15,16
10.	LVDT Secondary Wiring OK Test	17
11.	Pot Open Wiring OK Test	18
12.	Pot Shorted Wiring OK Test	19
13.	Calibrate Channels (LVDT)	20-22
14.	Calibrate Channels (Pot)	23,24
15.	Self Test	25-27
16.	Field Wiring Diagrams	28,29
17.	Recommended Spare Parts	30
18.	Specifications	31
	INDEX	32
	Schematics and PWA Drawings	Appendix

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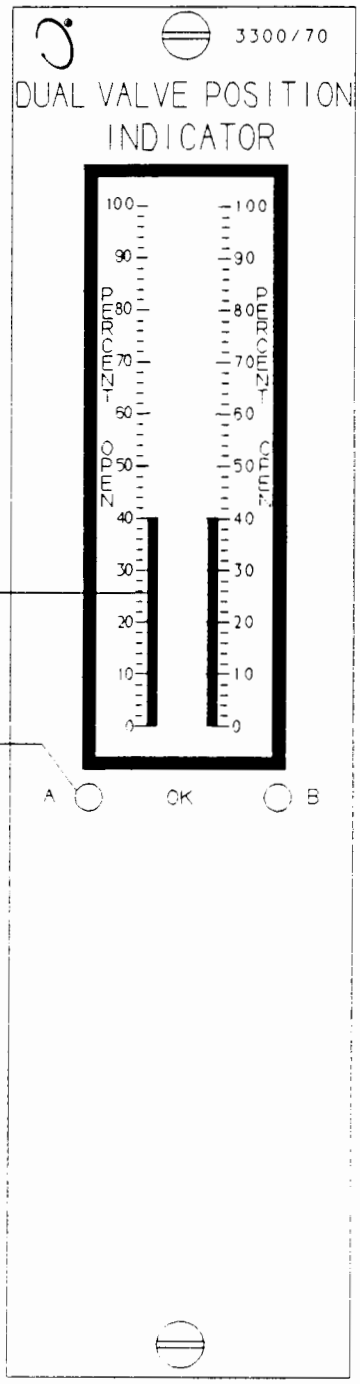
1 DUAL VALVE POSITION INDICATOR SYSTEM



1 DUAL VALVE POSITION INDICATOR SYSTEM



2 FRONT PANEL FEATURES



Bargraph - Indicates Relative Valve Position

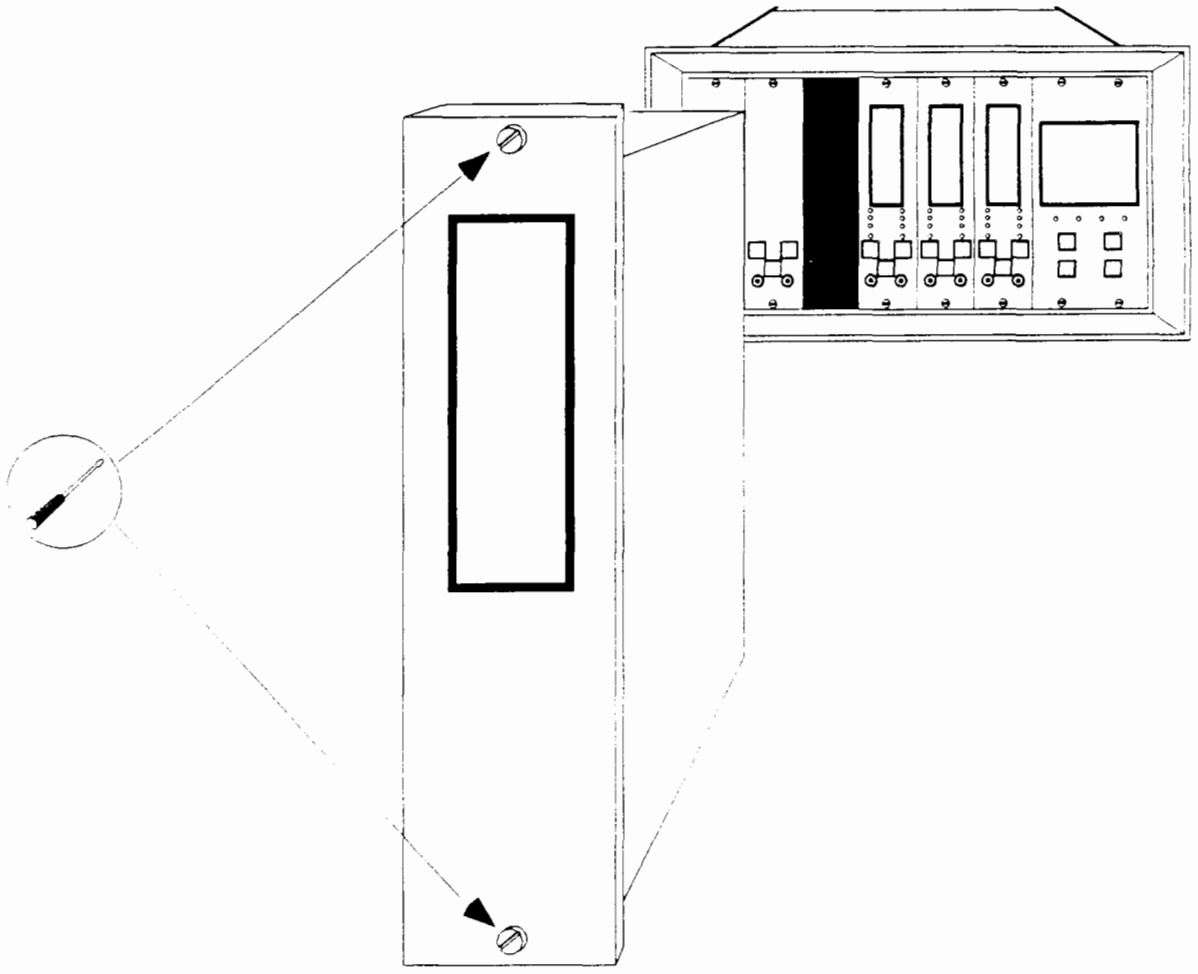
Transducer OK LED

3 INDICATOR REMOVAL

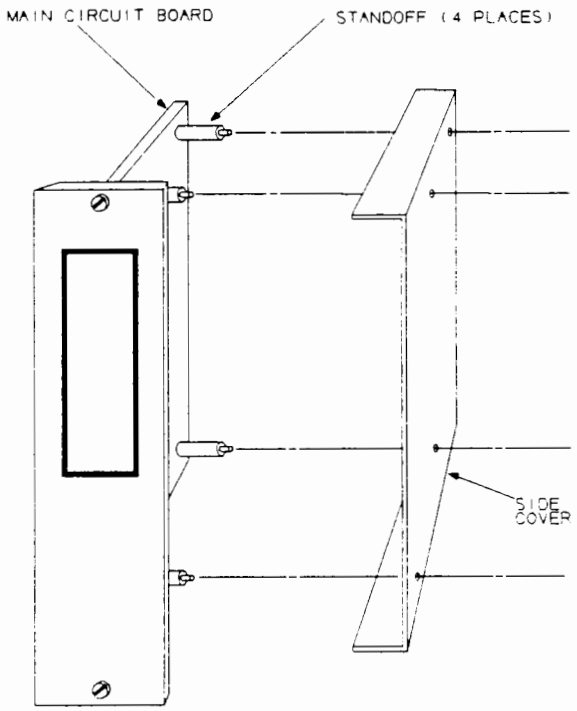
CAUTION

The valve position indication is lost when the indicator is removed from the rack.

1. Loosen two screws.
2. Pull monitor from rack.



4 INDICATOR DISASSMBLY

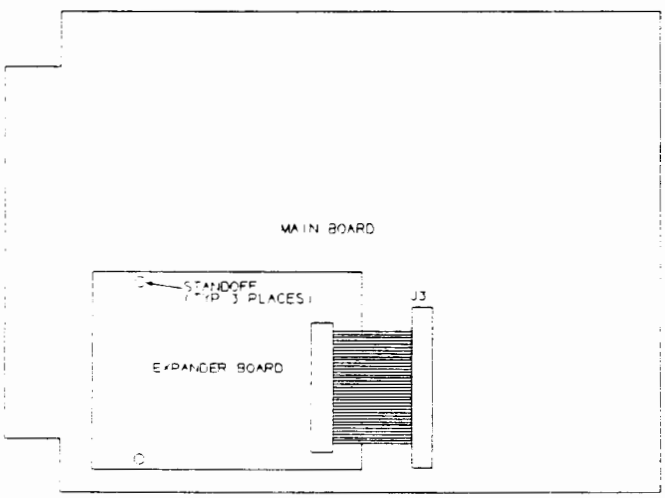


Side Cover Removal

Squeeze the retaining tips on each standoff, and remove the side cover from the indicator.

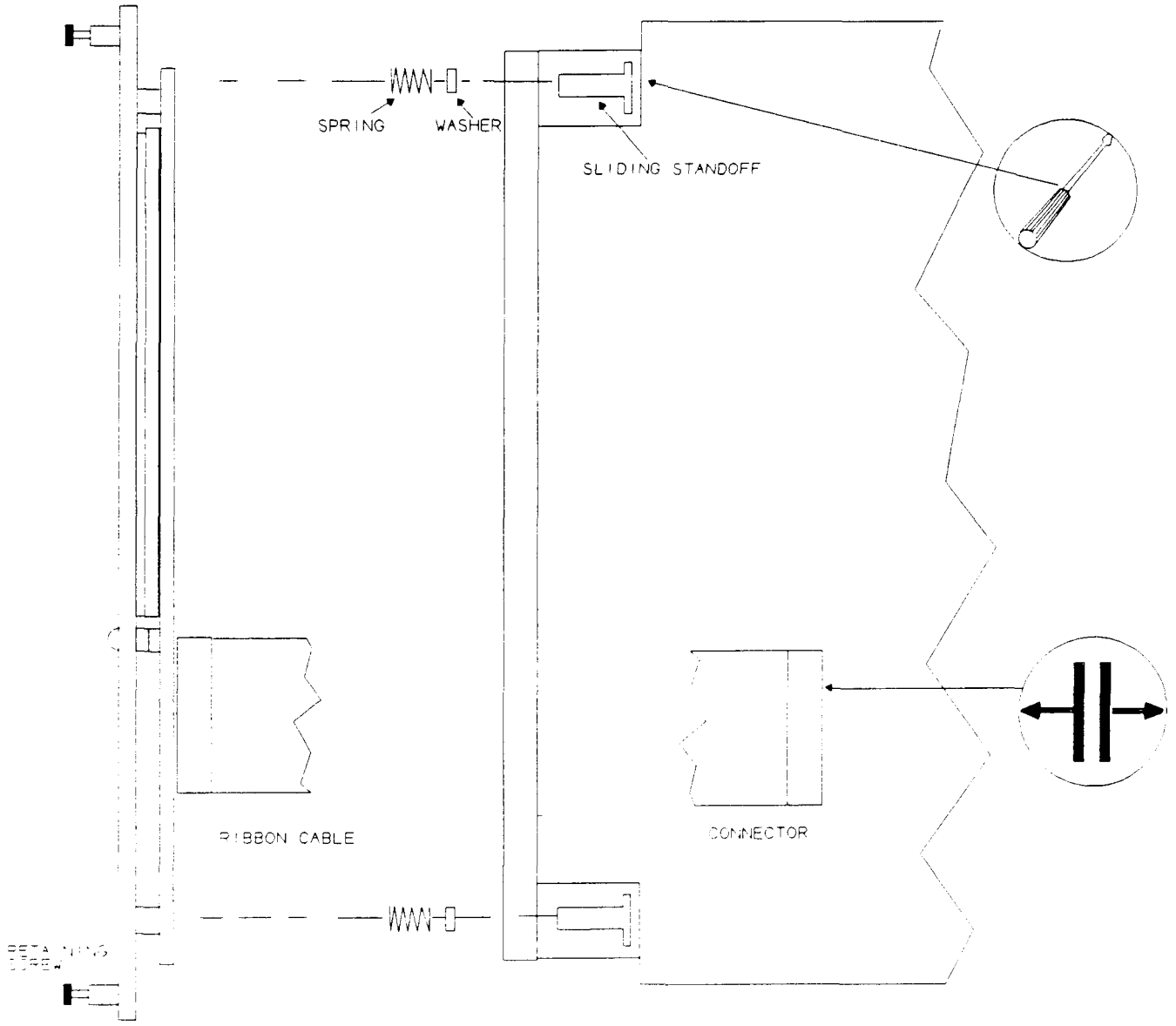
Circuit Board Removal

If this indicator has an expander board, it may be removed by squeezing the retaining tips on each standoff.



4 INDICATOR DISASSEMBLY [CONT]

Front Panel Removal



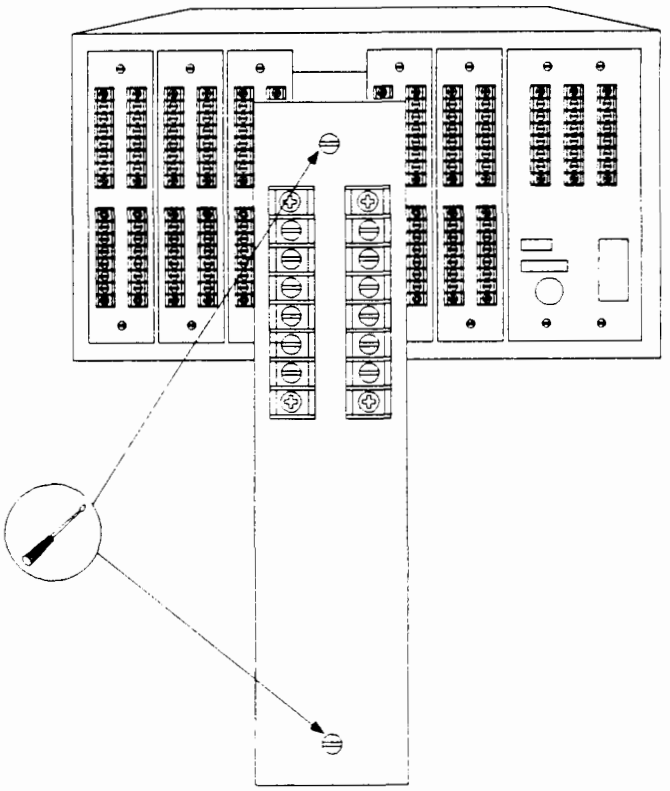
5 SIGNAL INPUT MODULE

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

The Signal Input Module is on the back of the rack. For field wiring, see Section 16 (Field Wiring Diagrams).



Module Removal

Loosen two screws and remove the module.

Module Options

The Signal Input Module of the Dual Valve Position Indicator has no options (no alarm relays).

6 INDICATOR OPTIONS

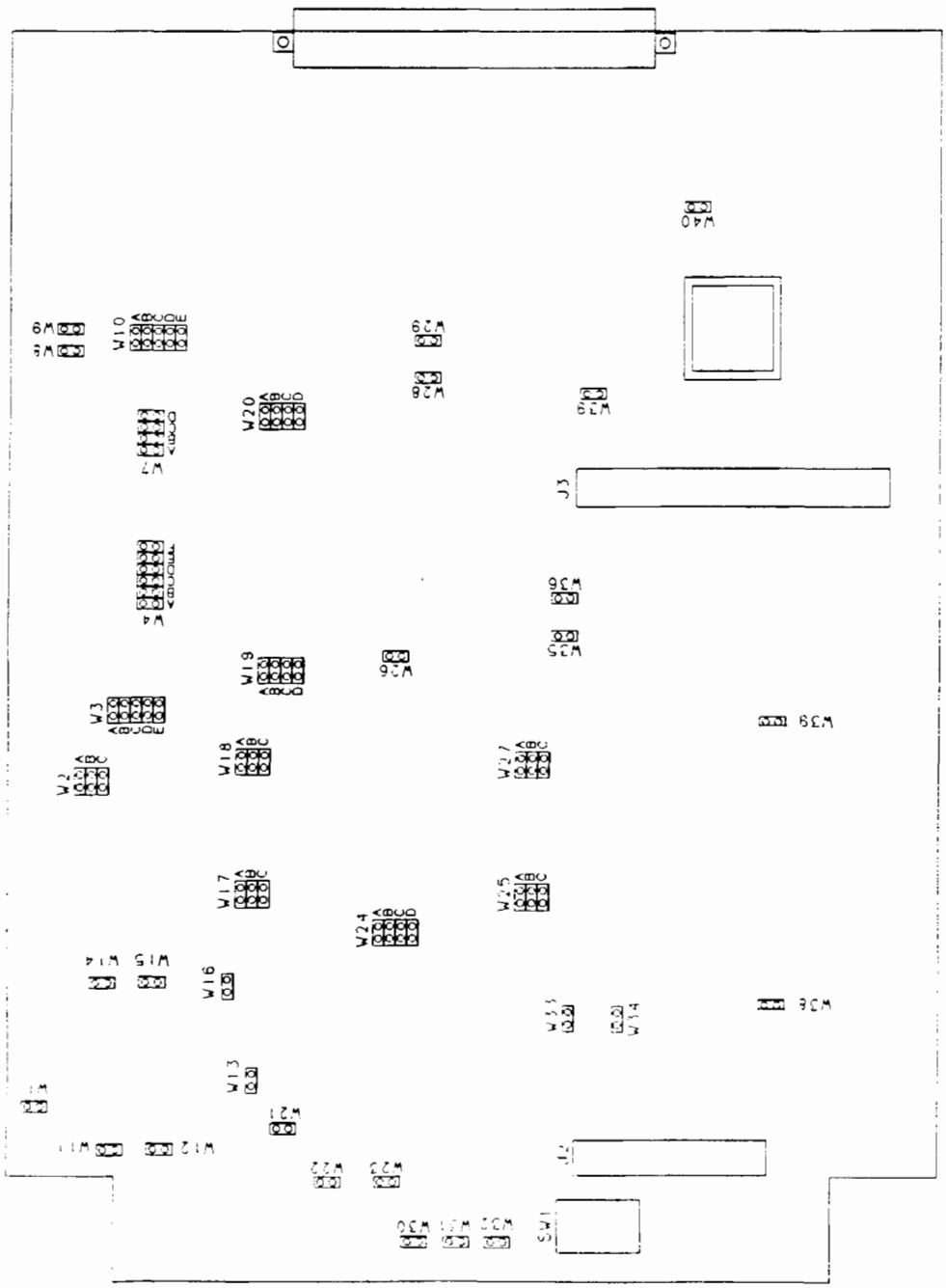
DUAL VALVE POSITION
INDICATOR PART NUMBER

	TRANSDUCER TYPE
3300/70	AA

01 = 5000 OHM POTENTIOMETER 90 DEGREES TO 300 DEGREES FULL SCALE ROTATION
02 = 5000 OHM POTENTIOMETER 50 DEGREES TO 90 DEGREES FULL SCALE ROTATION
03 = +/- 1.0 INCH (+/- 25mm) A.C. LVDT -> 2 INCHES (50 mm) = FULL SCALE
04 = +/- 2.0 INCH (+/- 50mm) A.C. LVDT -> 4 INCHES (100 mm) = FULL SCALE
05 = +/- 3.0 INCH (+/- 75mm) A.C. LVDT -> 6 INCHES (150 mm) = FULL SCALE
06 = +/- 5.0 INCH (+/-125mm) A.C. LVDT -> 10 INCHES (250 mm) = FULL SCALE

6 INDICATOR OPTIONS [CONT]

The Dual Valve Position Indicator's options are jumper programmable. The options can be changed by removing and installing these jumpers on the printed circuit board.



Jumper Locations on the Main Circuit Board

6 INDICATOR OPTIONS [CONT]

Main Board Option Settings

All Dual Valve Position Indicator option jumpers are on the Main Board. Table 1 shows these options and their jumper reference designators.

Table 1 Option Settings on Main Board

Option	Setting	Jumper	
		Install	Remove
Not OK Mode	Latching	W38,W39	
	Nonlatching *		W38
Not OK / Channel Defeat	Enabled		W38,W39
	Disabled *	W39	

* Options shipped from factory

6 INDICATOR OPTIONS [CONT]

Recorder Output Options

To set the recorder output, remove all jumpers from headers W3A-E, W4A-F, W7A-D, W8, W9, W10A-E, W19A-D, and W20A-D. Install jumpers specified in Table 2.

Table 2. Recorder Output Options

Recorder Output	+4 to +20 mA *	+1 to +5 Vdc	0 to -10 Vdc
Jumper Settings	W3B,D,E	W3A,C	W3A,C
	W4A,B,E	W4C,E	W4D,F
	W7C,D	W7B	W7A
	W9	W9	W8
	W10B,D,E	W10A,C	W10A,C
	W19D	W19B	W19A
	W20D	W20B	W20A

* Options shipped from factory

6 INDICATOR OPTIONS [CONT]

Transducer Type Options

Before reconfiguring a transducer option, remove all jumpers from the following headers: W1,W2A-C, W11-W16, W17A-C, W18A-C, W21-23, W24A-D, W25A-C, W26, W27A-C, W28, W29, W33-W36. Install jumpers specified in Table 3.

Table 3. Transducer Type Options

Transducer Type	Install Jumpers
5000 OHM ROTARY POTENTIOMETER 90 TO 300 DEGREES FULL SCALE ROTATION	W1,W2A,W13,W17A,W18B,W22,W23 W24B,W25A,W27B,W29,W34,W35
5000 OHM ROTARY POTENTIOMETER 50 TO 90 DEGREES FULL SCALE ROTATION	W1,W2A,W13,W14,W16,W17A,W18B W22,W23,W24B,W25A,W27B,W29 W34,W35
+/- 1 INCH (+/- 25 mm) A.C. LVDT 2 INCHES (50 mm) = FULL SCALE	W2B,W2C,W11,W12,W14,W15,W16,W17B W18A,W18C,W21,W24C,W24D,W25B,W27A W27C,W28,W33,W36
+/- 2 INCH (+/- 50 mm) A.C. LVDT 4 INCHES (100mm) = FULL SCALE	W2B,W2C,W11,W12,W14,W15,W16,W17B W18A,W18C,W21,W24C,W24D,W25B,W27A W27C,W28,W33,W36
+/- 3 INCH (+/- 75 mm) A.C. LVDT 6 INCHES (150 mm) = FULL SCALE	W2B,W2C,W11,W12,W14,W15,W16,W17B W17C,W18A,W18C,W21,W24A,W24C,W24D W25B,W25C,W26,W27A,W27C,W28,W33,W36
+/- 5 INCH (+/- 125 mm) A.C. LVDT 10 INCHES (250 mm) = FULL SCALE	W2B,W2C,W11,W12,W14,W15,W16,W17B W18A,W18C,W21,W24C,W24D,W25B,W27A W27C,W28,W33,W36

Indicator Full Scale Range is always 0 to 100% Open for all tranducer types.

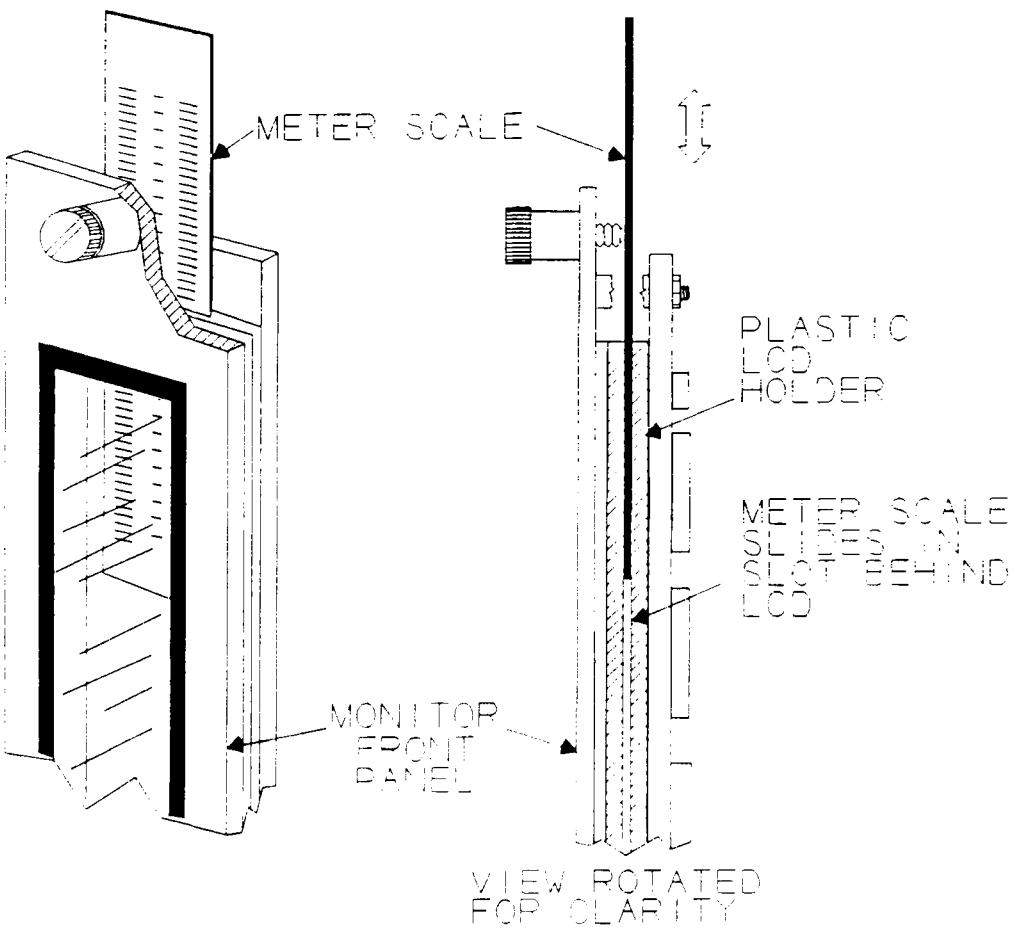
7 METER SCALE REPLACEMENT

The indicator meter scales can be replaced if required. The replacement meter scales are located in the back of this manual.

To replace a meter scale:

1. Cut the meter scale from the back of this manual. Be sure to cut along the marked outline so the meter scale will fit properly.

2. Insert the meter scale in the front panel.



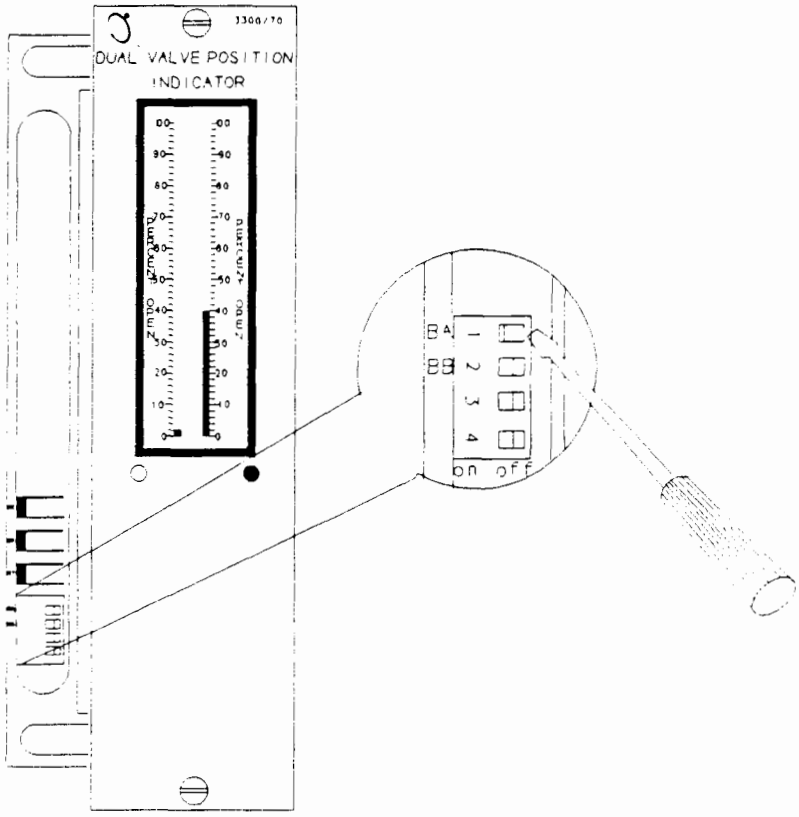
8 BYPASS INDICATOR CHANNEL

Set **BA** (Bypass channel A) or **BB** (Bypass channel B) switch to the left (ON). The corresponding **OK** LED goes OFF and the valve position reading is clamped to zero.

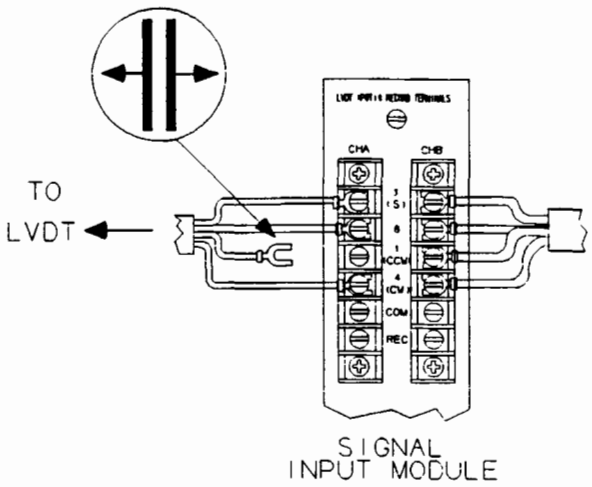
CAUTION

Valve position indication will be lost while channel Bypass switch is on.

NOTE
Bypassing a Not OK channel will clear (energize) the system OK Relay.



9 LVDT PRIMARY WIRING OK TEST



CAUTION

Tests will cause valve indication on tested channel to be invalid. Only if Timed OK / Channel Defeat is enabled will the Not OK channel's bargraph be clamped to zero.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

LVDT Open Primary OK Test

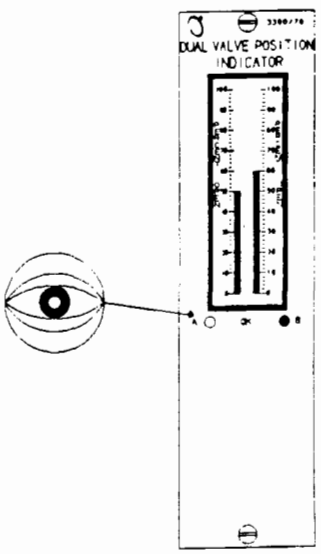
1. With both transducers connected verify the OK LEDs are ON. If only one channel is being used, Bypass the unused channel (section 8).

2. Disconnect the "1 (CCW)" wire or the "4 (CW)" wire from the Channel A terminal on the Signal Input Module or at the LVDT.

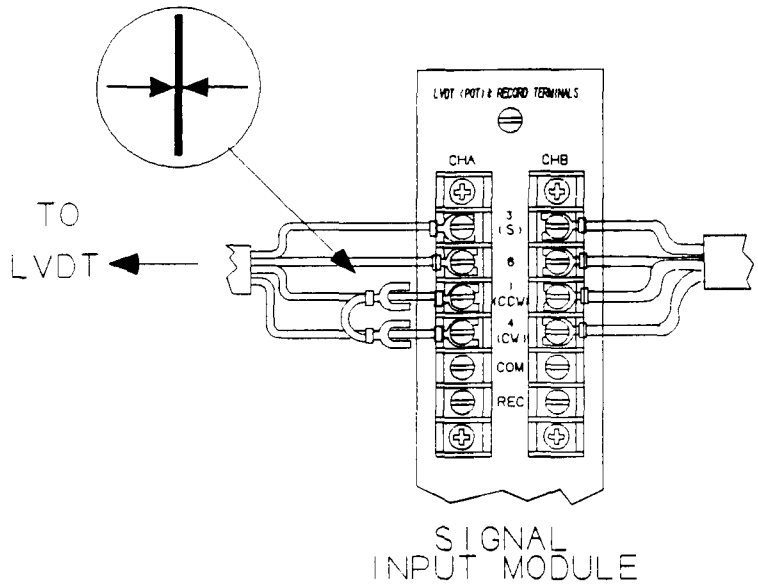
3. Verify that the OK LED for Channel A is off and that the OK Relay is de-energized. Note: All other channels in the rack must be in OK or Bypassed in order for the relay to change state.

4. Re-connect the "1 (CCW)" wire or the "4 (CW)" wire to Channel A and verify the **OK** LED comes ON and the OK Relay is energized. System reset is required if the indicator is configured for Latching OKs or Timed OK / Channel Defeat.

5. Repeat the above for Channel B.



9 LVDT PRIMARY WIRING OK TEST [CONT]



CAUTION

Tests will cause valve indication on tested channel to be invalid. Only if Timed OK / Channel Defeat is enabled will the Not OK channel's bargraph be clamped to zero.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

LVDT Shorted Primary OK Test

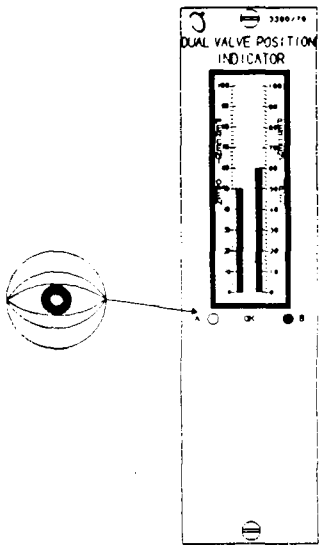
1. With both transducers connected verify the **OK** LEDs are ON. If only one channel is being used, Bypass the unused channel (section 8).

2. Short the "1 (CCW)" wire to the "4 (CW)" wire of the Channel A terminal on the Signal Input Module or at the LVDT.

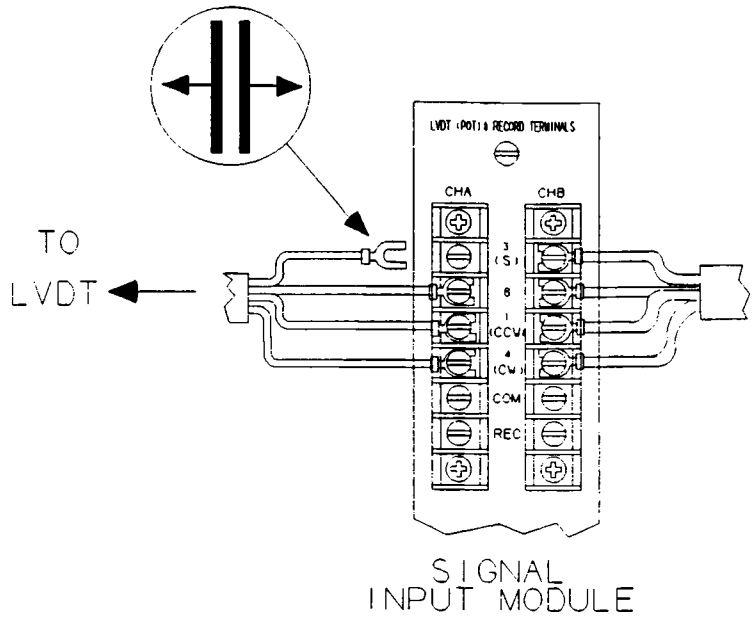
3. Verify that the OK LED for Channel A is off and that the OK Relay is de-energized. Note: All other channels in the rack must be OK or bypassed in order for the relay to change state.

4. Remove the short from between "1 (CCW)" and "4 (CW) terminals of Channel A and verify the OK LED turns ON and the "OK Relay" is energized. System Reset is required if the indicator is configured for Latching OKs or Timed OK / Channel Defeat.

5. Repeat the above for Channel B.



9 LVDT PRIMARY WIRING OK TEST [CONT]



CAUTION

Tests will cause valve indication on tested channel to be invalid. Only if Timed OK / Channel Defeat is enabled will the Not OK channel's bargraph be clamped to zero.

WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

LVDT Open Secondary OK Test

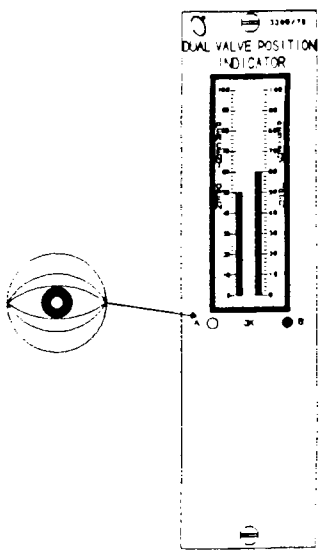
1. With both transducers connected verify the **OK** LEDs are ON. If only one channel is being used, Bypass the unused channel (section 8).

2. Disconnect the "3 (S)" or the "6" wire from the Channel A terminal on the Signal Input Module or at the LVDT.

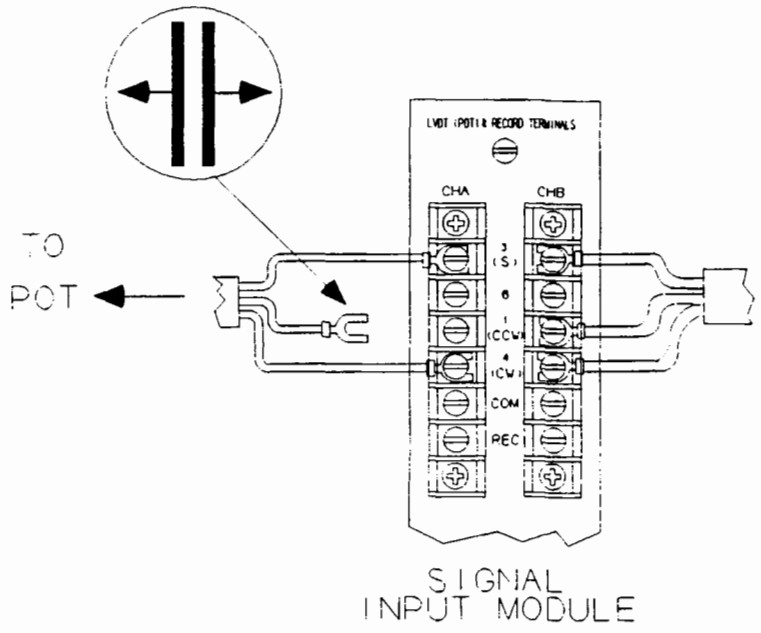
3. Verify that the **OK** LED for Channel A is off and that the OK Relay is de-energized. Note: All other channels in the rack must be OK or bypassed in order for the relay to change states.

4. Connect the "3 (S)" or "6" wire to the appropriate terminal of Channel A and verify the **OK** LED turns ON and the "OK Relay" is energized. System Reset is required if the indicator is configured for Latching OKs or Timed OK / Channel Defeat.

5. Repeat the above for Channel B.



11 POT OPEN WIRING TEST



CAUTION

Tests will cause valve indication on tested channel to be invalid. Only if Timed OK / Channel Defeat is enabled will the Not OK channel's bargraph be clamped to zero.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

Potentiometer Open Field Wiring OK Test

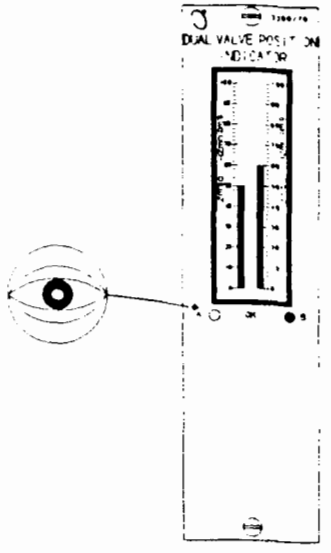
1. With both transducers connected verify the OK LEDs are ON. If only one channel is being used, Bypass the unused channel (section 8).

2. Disconnect either the "3 (S)", "1 (CCW)" or the "4 (CW)" wire from the Channel A terminal on the Signal Input Module or at the Potentiometer.

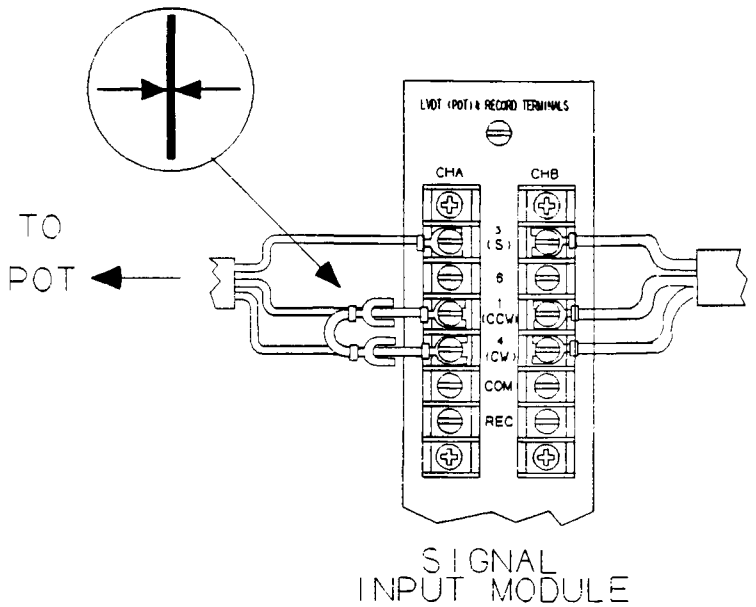
3. Verify that the **OK** LED for Channel A is off and that the OK Relay is de-energized. Note: All other channels in the rack must be OK or bypassed in order for the relay to change states.

4. Reconnect the wire(s) to the appropriate terminal of Channel A and verify the **OK** LED turns on and the OK Relay is energized. System Reset is required if the indicator is configured for Latching OKs or Timed OK / Channel Defeat.

5. Repeat the above for Channel B.



12 POT SHORTED WIRING TEST



CAUTION

Tests will cause valve indication on tested channel to be invalid. Only if Timed OK / Channel Defeat is enabled will the Not OK channel's bargraph be clamped to zero.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

Potentiometer Shorted Field Wiring OK Test

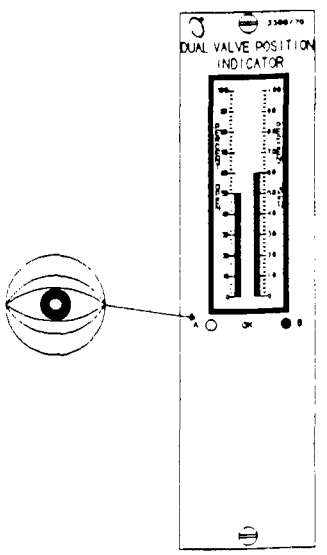
1. With both transducers connected verify the **OK** LEDs are ON. If only one channel is being used be sure to Bypass the unused channel (section 8).

2. Connect (short) the "1 (CCW)" to the "4 (CW)" wire of the Channel A terminal on the Signal Input Module. (Note this same test may be done at the Pot.)

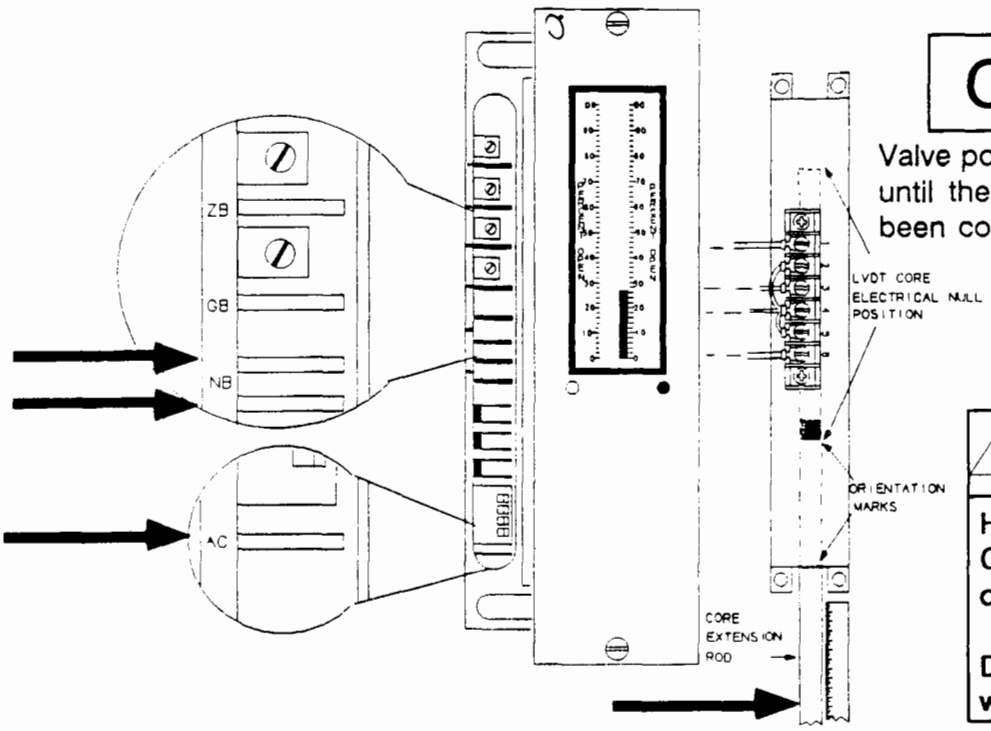
3. Verify that the **OK** LED for Channel A is off and that the OK Relay is de-energized. Note: All other channels in the rack must be in OK or bypassed in order for the relay to change states.

4. Disconnect the shorting wire between the two terminals of Channel A and verify the OK LED turns ON and the OK Relay is energized. System Reset is required if the indicator is configured for Latching OKs or Timed OK / Channel Defeat.

5. Repeat the above for Channel B.



13 CALIBRATE CHANNELS (LVDT)



CAUTION

Valve position indication is not valid until the calibration procedure has been completed.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

Calibration Procedure:

(Note: the calibration figures refer to the test points and adjust potentiometers associated with Channel B, calibration of Channel A uses the same procedure.) :

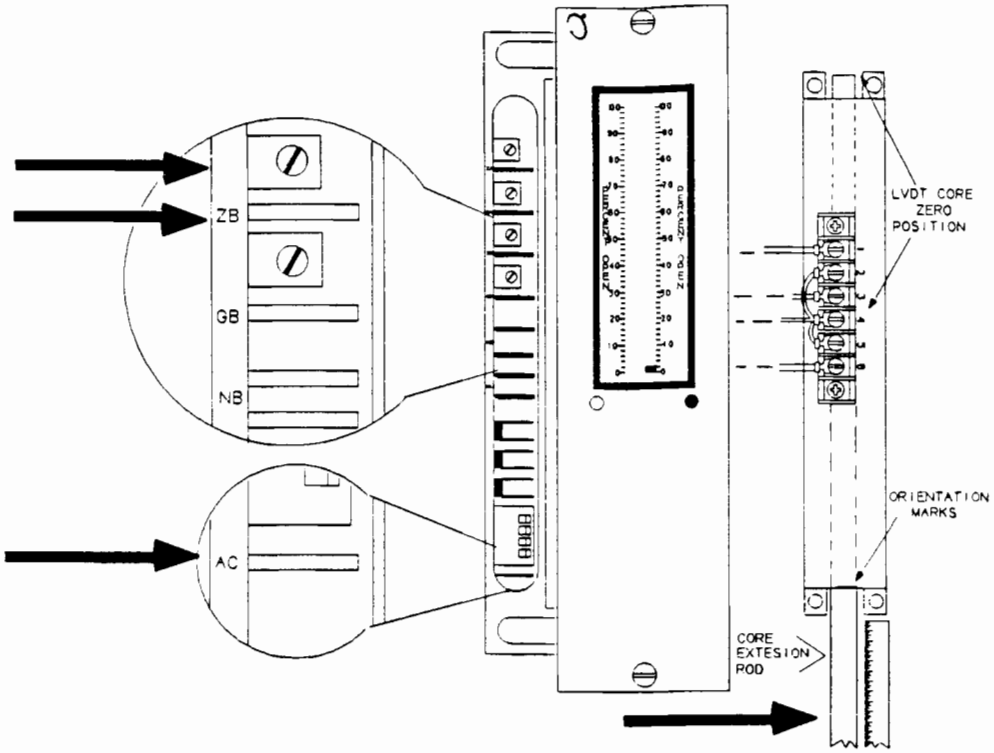
1. With the LVDT(s) connected, verify that the channel to be calibrated is OK (i.e., the **OK** LED is ON).

2. Unscrew the front panel screws and slide the front panel over to obtain access to the Calibration Test Points and Calibration Potentiometers.

3. Measure the a.c. voltage of the two Null Test Points (**NB**). (Either differentially or with an oscilloscope referenced to the Analog Common (**AC**) test point.

4. Move the LVDT's extension rod in and out until the two Null Test Points (**NB**) read the same A.C. Voltage (i.e., with a multimeter reading differentially across the two test points, the A.C. Voltage reading should be at its lowest). With a scope in the X versus Y mode, the null position corresponds to the point were minimal ripple is observed. This is the LVDT's electrical null position. Mark the core extension rod to identify this electrical null position. Once the monitor is calibrated, this null position should correspond to the Valve being 50% open.

13 CALIBRATE CHANNELS (LVDT) [CONT]

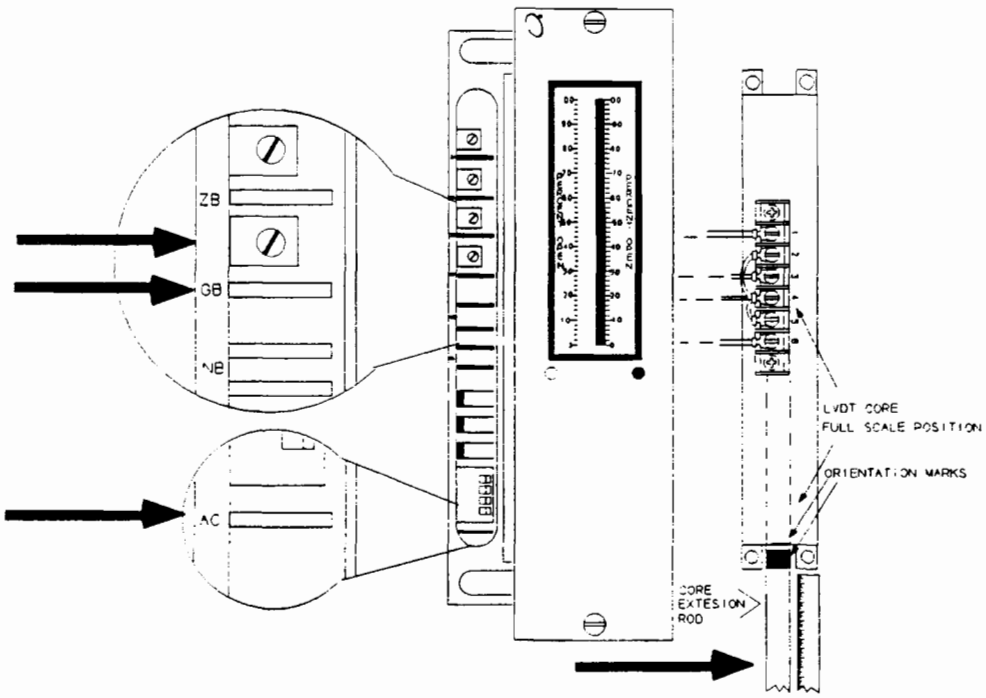


5. Measure the total movement (stroke) of the valve-to-LVDT linkage as the valve moves from 0 to 100% exclusive of any overtravel. Divide this measurement by two and place a mark on the LVDT core extension rod half the stroke away from the electrical null mark in both directions. For example, if the extension rod moves 5 inches as the valve goes from 0 to 100% open, then a mark 2.5 inches on either side of the null position mark should be made. These marks are used to position the core during calibration with linkage disconnected. They represent the core positions at the 0% and 100& valve positions. Typically the zero and gain can be calibrated for strokes down to 50% of the LVDT full scale transducer range.

6. Note: Down scale normally corresponds to the LVDT core moving such that the core orientation mark travels toward the side of the LVDT housing which does not have an orientation mark. If it is necessary to reverse this, the wires on terminals 3 & 6 of either the LVDT or Indicator (but not both) should be reversed.

7. Perform Zero Adjustment as follows: With the valve fully closed (core position at the 0% mark with the LVDT orientation marks moved away from each other) connect a voltmeter to the ZB (Zero Channel B) test point (TP20) referenced to the **AC** test point (TP19). Adjust the **ZB** potentiometer (R209) to 0.0 VDC +/- 5 mVdc.

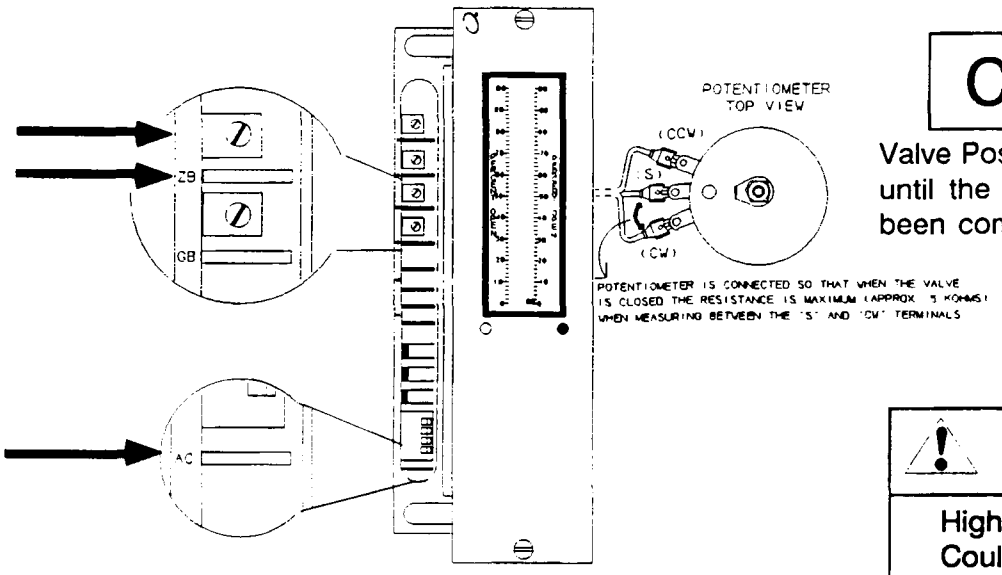
13 CALIBRATE CHANNELS (LVDT) [CONT]



8. Note: It is important that the zero has been adjusted before adjusting the gain.

9. Perform the span adjustment as follows: With the valve fully open (core positioned at the 100% mark) connect a voltmeter to **GB** (Gain Channel B) test point (TP8) referenced to the **AC** test point (TP19). Adjust the **GB** pot (R219) for +5.0 Vdc +/- 5mVdc. At this point the display should read 100% Open and the recorder output should be at full scale.

14 CALIBRATE CHANNELS (POT)



CAUTION

Valve Position Indication is not valid until the calibration procedure has been completed.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

Calibration Procedure

(Note: the calibration figures refer to the test points and pots associated with Channel B, calibration of Channel A uses the same procedure) :

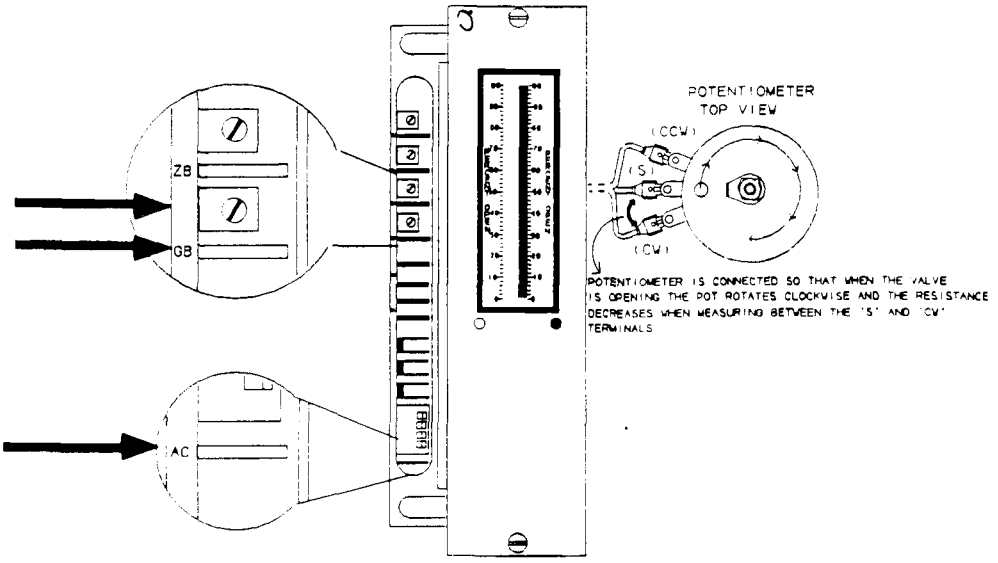
1. With the transducer connected verify that the channel to be calibrated is **OK** (i.e., the OK LED is ON).

2. Unscrew the front panel screws and slide the front panel over to obtain access to the Calibration Test Points and Calibration Potentiometers.

3. Note: Down scale corresponds to rotating the potentiometer (as viewed from the top) in a counter clockwise direction such that the resistance measured between the "S" and "CW" terminals increases. For both potentiometer full scale options, zero (valve fully closed) corresponds to the resistance between the "S" and "CW" terminals being maximum (approximately 5 kohms).

4. Perform Zero Adjustment as follows: With the valve fully closed (maximum resistance between the "S" and "CW" terminals) connect a voltmeter to the **ZB** test point (TP20) referenced to the **AC** test point (TP19). Adjust the **ZB** (Zero Channel B) potentiometer (R209) to 0.0 VDC +/- 5 mVdc.

14 CALIBRATE CHANNELS (POT) [CONT]



5. The Valve Position Indicator has two Rotary Potentiometer (Pot) Full Scale options. Option 01 is used if the valve opening causes the Pot's full scale rotation to be between 90 and 300 degrees from the zero position. Option 02 is used if the valve opening causes the Pot's full scale rotation to be between 50 and 90 Degrees from the zero position. It is important that the indicator has been optioned correctly prior to calibration. Note: The minimum rotation necessary to successfully calibrate the 01 Option (90 to 300 degrees) is typically 75 degrees from zero. The minimum rotation necessary to successfully calibrate the 02 Option (50 to 90 degrees) is typically 40 Degrees from zero.

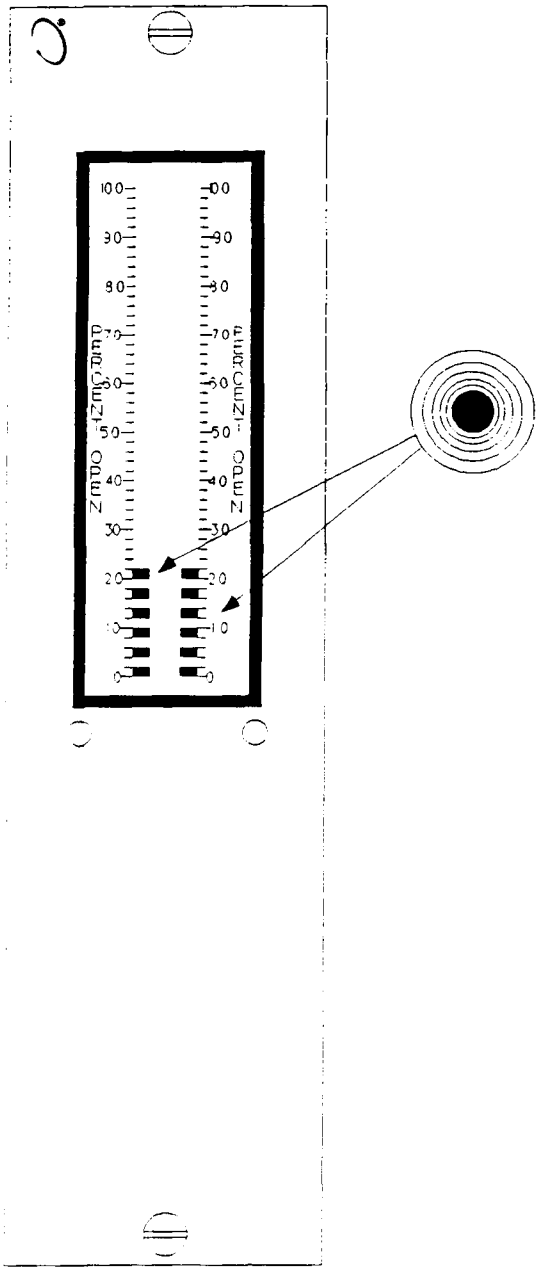
6. Note: It is important that the Zero has been adjusted before adjusting the Gain.

7. Perform the gain (span) adjustment as follows: With the valve fully open, connect a voltmeter to the **GB** test point (TP8) referenced to the **AC** test point (TP19). Adjust the **GB** potentiometer (R219) for +5.0 Vdc +/- 5mVdc. At this point the display should read 100% open and the recorder should be at full scale.

15 SELF TEST

THE MONITOR HAS THREE LEVELS OF SELF TESTS:

POWER-UP SELF TEST: PERFORMED ONLY WHEN MONITOR IS TURNED ON.
CYCLIC SELF TEST: PERFORMED CONTINUOUSLY.
USER-INVOKED SELF TEST: PERFORMED ONLY WHEN INITIATED BY USER.



IF ERRORS ARE DETECTED DURING CYCLIC SELF TESTS:

MONITORING IS ABORTED UNTIL THE ERROR IS RESOLVED.

ERROR CODE IS STORED IN MEMORY AND FLASHED ON THE LCD BARGRAPH DISPLAY.

THE **OK** LED FLASHES AT 5 HZ.

IF ERROR IS INTERMITTENT AND GOES AWAY:
MONITORING IS RESUMED AND **OK** LED FLASHES AT 5 HZ.

ERROR CODE IS STORED. USER INVOKED TEST DISPLAYS AND CLEARS ERROR.

IF ERRORS ARE DETECTED DURING POWER-UP TEST OR USER-INVOKED SELF TEST:

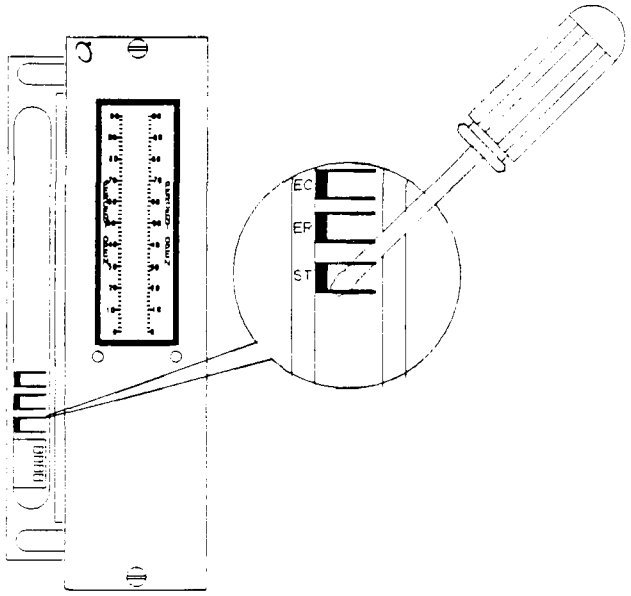
MONITORING IS ABORTED UNTIL USER ACTION RESOLVES PROBLEM.

TEST CAN BE RERUN WITH MONITOR POWER UP OR USER INVOKED TEST.

NOTE
ALTHOUGH BOTH COLUMNS ON THE BARGRAPH FLASH, THE ERROR CODE IS ONLY THE SUM OF THE BARGRAPH SEGMENTS DISPLAYED IN ONE COLUMN. EXAMPLE SHOWS ERROR CODE 6.

15 SELF TEST [CONT]

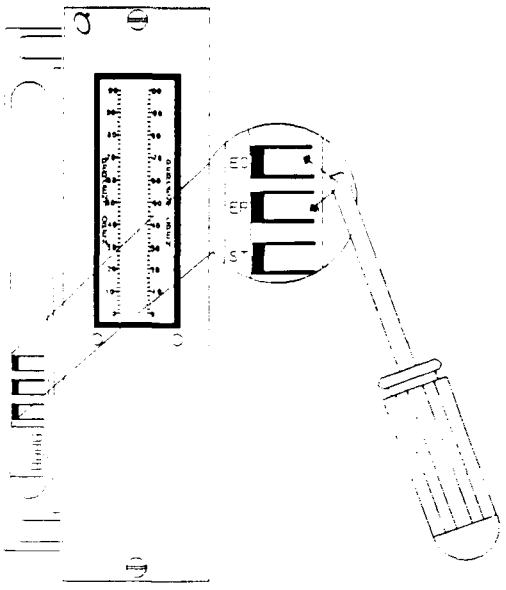
INITIATE USER-INVOKED SELF TEST BY SHORTING ACROSS TWO SELF-TEST (ST) PINS.



CAUTION

VALVE POSITION INDICATION WILL BE LOST FOR DURATION OF TEST

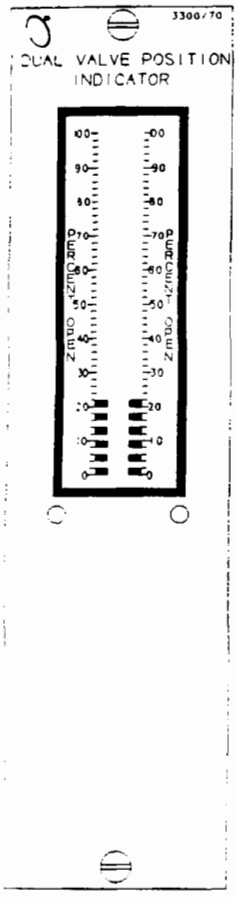
AT COMPLETION OF USER-INVOKED SELF TEST, MONITOR WILL RECALL STORED ERROR CODES, IF ANY. THESE ERROR CODES MUST BE READ AND CLEARED WITH USER INTERACTION TO ALLOW INDICATION TO CONTINUE.



READ CODES ON LIST; STEP THROUGH EACH ERROR CODE ON LIST BY SHORTING THE ERROR READ (ER) TERMINALS FOR APPROXIMATELY 1 SECOND.

AT THE END OF THE LIST, THE LCD BARGRAPH DISPLAYS ALL SEGMENTS. TO REREAD THE LIST HOLD SHORT ERROR READ (ER) TERMINALS. TO CLEAR THE LIST FROM MEMORY, HOLD SHORT THE ERROR CLEAR (EC) SWITCH FOR APPROXIMATELY 1 SECOND.

15 SELF TEST [CONT]



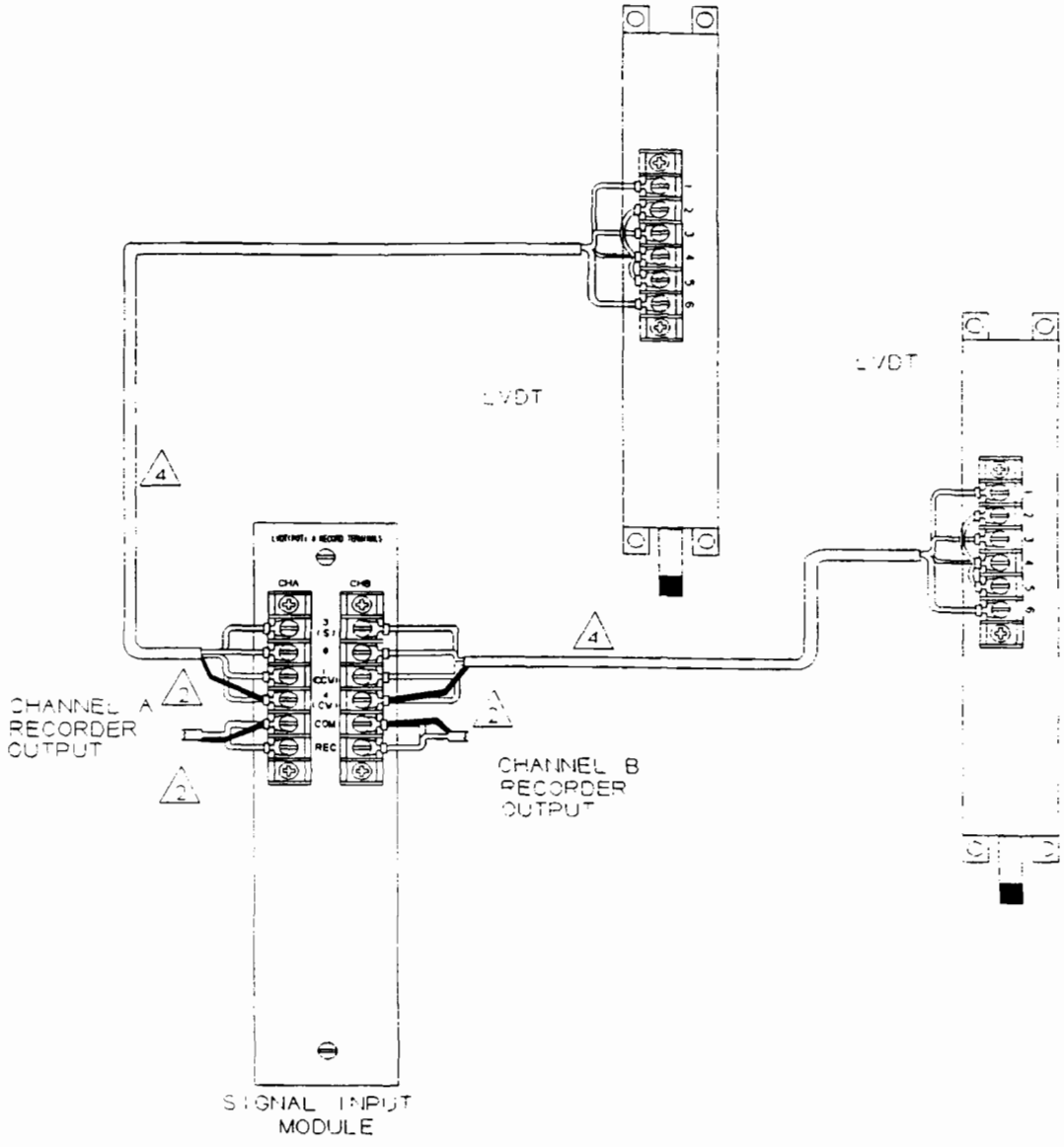
ERROR CODE	DESCRIPTION
2	ROM CHECKSUM HAS FAILED *
3	EEPROM FAILURE NO. 1 *
4	EEPROM FAILURE NO. 2 *
5	+7.5V/-VT NODE OUT OF TOLERANCE **
6	+VRH NODE OUT OF TOLERANCE **
7	+5V NODE #1 OUT OF TOLERANCE **
8	MVREF NODE OUT OF TOLERANCE **
9	+7.5V NODE OUT OF TOLERANCE **
10	+VRL NODE OUT OF TOLERANCE **
11	MVREF & -6.5V NODE OUT OF TOLERANCE **
12	+5V/-7.5V NODE OUT OF TOLERANCE **
13	+5V NODE #2 CHECK OUT OF TOLERANCE **
14	RAM FAILURE *
17	COP WATCHDOG NOT CONFIGURED *

* THESE ERRORS ARE NONRECOVERABLE.

** TESTED ONLY AT CYCLIC SELF TEST. ERRORS 5 THROUGH 13 COULD BE INTERMITTENT AND ARE RECOVERABLE.

16 FIELD WIRING DIAGRAM

3300/70 FIELD WIRING (LVDT)

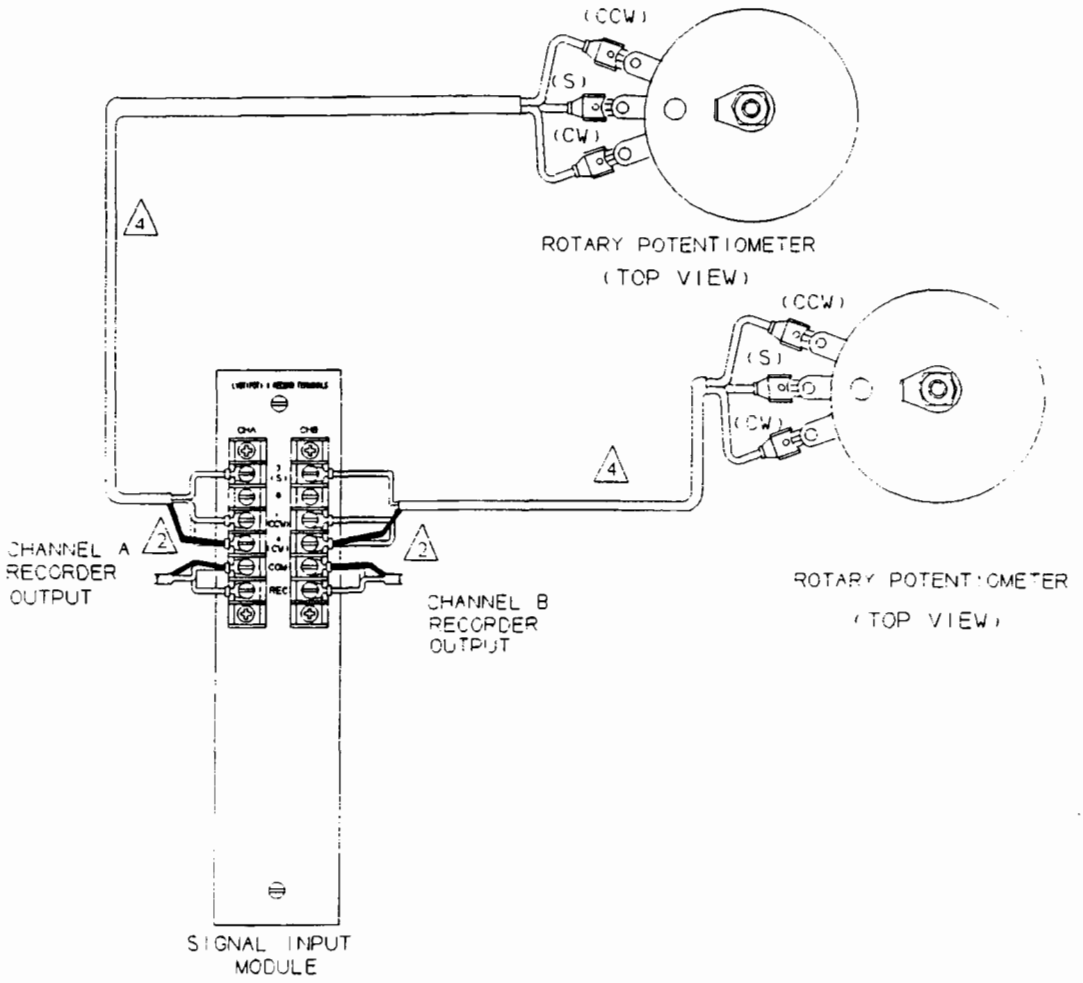


1. Wiring Recommendations:
   a. Signal Module to LVDT, 16 to 18 AWG solid or stranded 4-wire shielded with insulating sheath. 1000 feet (305 metres) maximum.

   b. Signal Module to Recorder, 18 to 22 AWG solid or stranded 2-wire shielded with insulating sheath.

16 FIELD WIRING DIAGRAM [CONT]

3300/70 FIELD WIRING (POT)



2. Shields terminated to Signal Module Common. The transducer ends of the shield should remain disconnected.

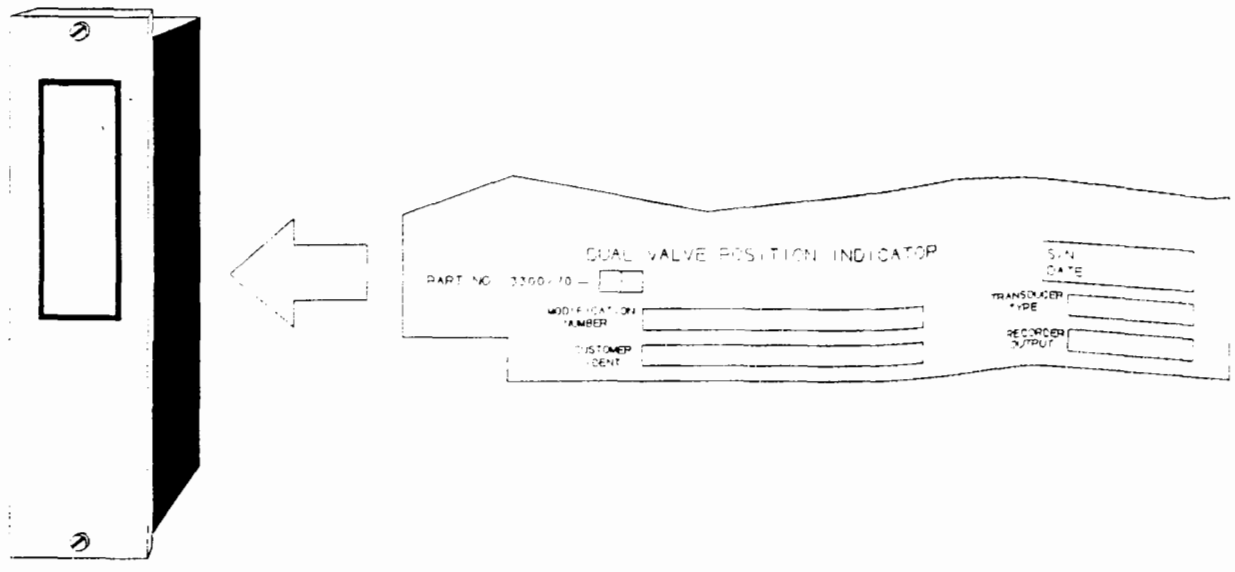
3. To minimize ground loop noise problems, a single point earth ground (GND) to system common (COM) connection is recommended.

4. Maximum cable length between Signal Input Module and Transducer (LVDT or Pot) should not exceed 1000 feet (305 metres).

17 RECOMMENDED SPARE PARTS

Qty	Description	Part Number
	DUAL VALVE POSITION INDICATOR	3300/70 - [ ]
1	Front Panel Assembly	84136-01
1	Monitor Circuit Assembly	83980-01
1	Signal Input Module	84157-01

To order replacement parts, specify the complete part number according to this table as indicated on the identification decal. If the monitor has been modified, specify the modification number on the parts order. User must set programmable options (Reference section 6 of this manual). If in doubt about the part number, call your local sales representative before ordering.



18 SPECIFICATIONS

INPUTS

Signal Inputs: Two channels A.C. LVDT or Pot input. (Both channels must use the same transducer type.)

SIGNAL CONDITIONING

Monitor Range: Full scale meter range always set at 0 to 100% Open.

Accuracy: ± 0.33% of full scale error typical at 77°F (25°C).
± 1% of full scale error maximum at 77°F (25°C).

DISPLAYS

Meter: LCD bargraph, dual scale with outside scales marked as "0 to 100% Open" full scale range. Bargraph resolution is 1.6% of full scale range.

LEDs: Green LEDs annunciate transducer OK condition.

CONTROLS

Internal: Switches on circuit board for Channel Bypass. Shorting Terminals on the circuit board for Self Test Invoke, Error Code Reads and Error Code Clear.

External: External remote controls: Reset and Inhibit.

OUTPUT

Recorder: Output proportional to full scale monitor range and protected against continuous short circuit to ground:
+4 mA to +20 mA, +12 Vdc compliance.
+1 Vdc to +5 Vdc, 100 Ohm output impedance.
0 Vdc to -10 Vdc, 100 Ohm output impedance.

Transducer Drive Signal: 1.5 Vrms @ 2.5 kHz for A.C. LVDT, -5.4Vdc for Pot. Output is short circuit protected.

OK: Relay drives system OK Relay.

ENVIRONMENTAL

Temperature: Operating +32°F to +149°F (0°C to +65°C).
Storage -40°F to +185°F (-40°C to +85°C).

Humidity: 0 to 95%, noncondensing.

INDEX

PAGE

CALIBRATION WITH LVDT 20-22
CALIBRATION WITH POT 23, 24
CHANNEL BYPASS 14
CYCLIC TEST 25
ERROR CODE 25-27
FIELD WIRING (LVDT) 28
FIELD WIRING (POT) 29
FRONT PANEL FEATURES 3
FRONT PANEL REMOVAL 6
INDICATOR PART NUMBER 8
JUMPER LOCATIONS 9
JUMPER OPTIONS 10
METER SCALE REPLACEMENT 13
MODULE REMOVAL 7
MONITOR DISASSEMBLY 5
MONITOR REMOVAL 4
OK TEST 15-19
PART NUMBER 8
POWER UP TEST 25
RECORDER OPTIONS 11
SELF TEST 25
SPARE PARTS 30
SPECIFICATIONS 31
SYSTEM DIAGRAM WITH LVDTs 1
SYSTEM DIAGRAM WITH POTS 2
TRANSDUCER OPTIONS 12
USER-INVOKED TEST 25, 26

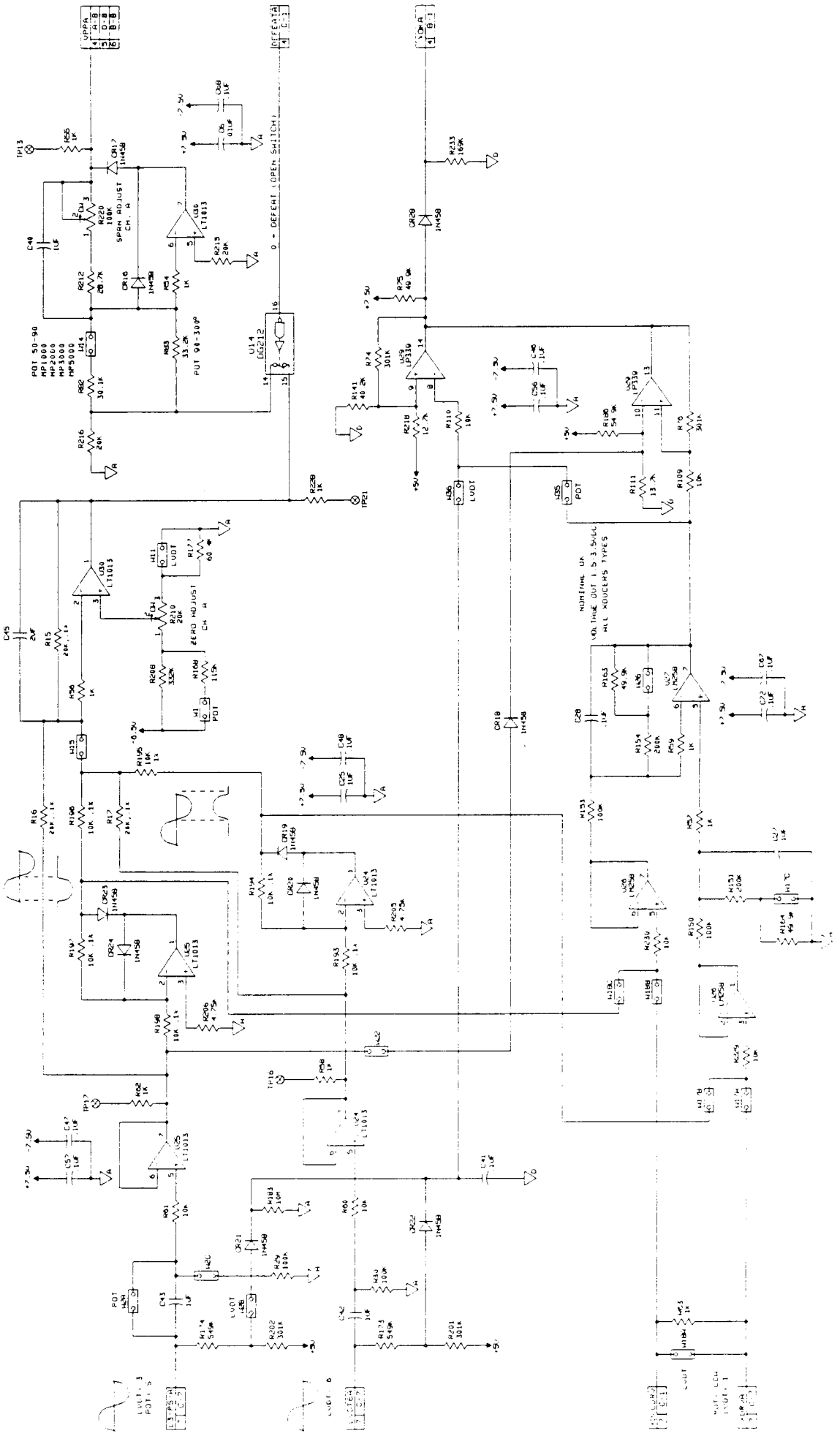
APPENDIX

SCHEMATICS AND PWA DRAWINGS

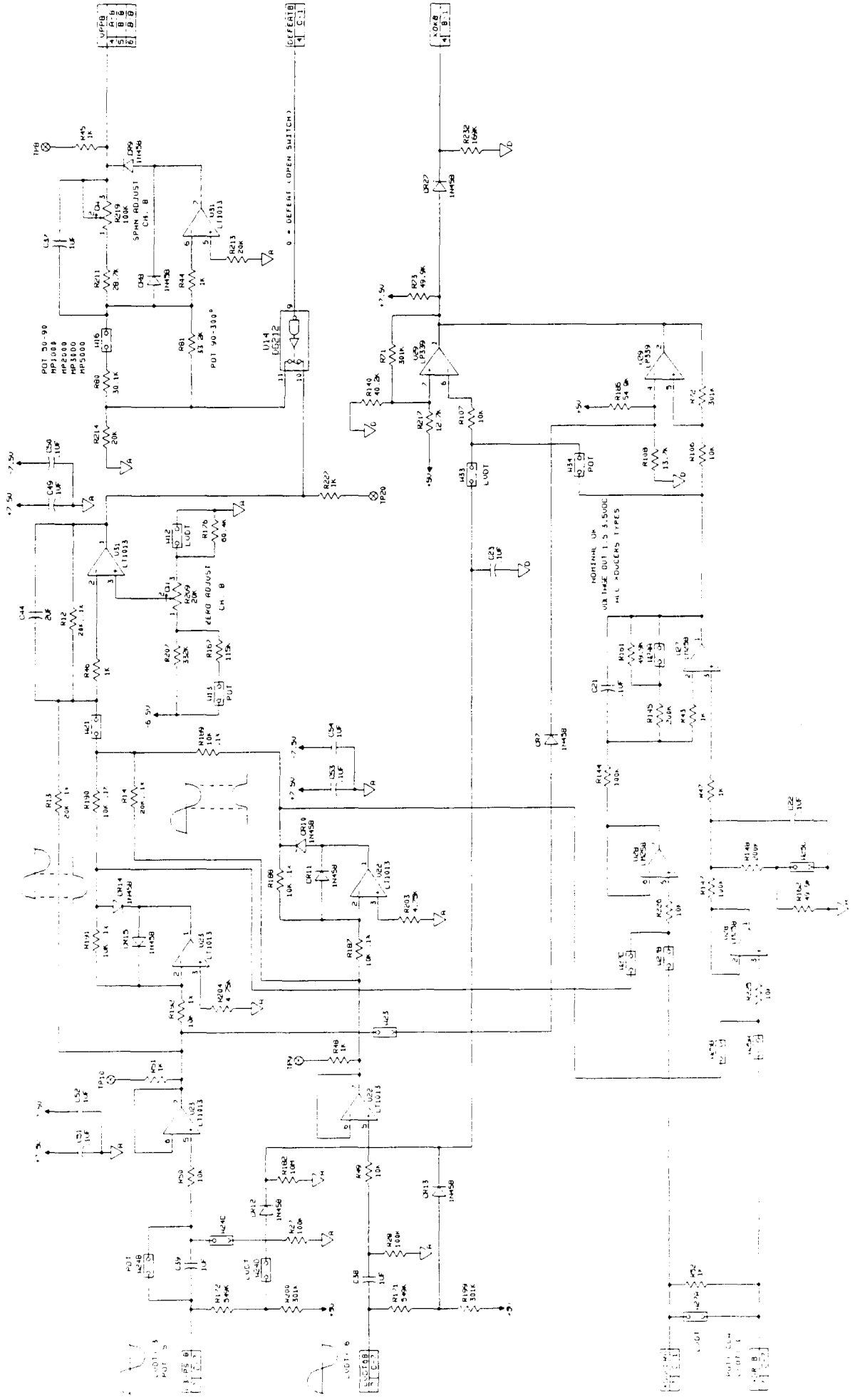
SCHEMATIC (1 OF 10)
330070 DUAL VALVE POSITION INDICATOR

VOLTAGE CHART		
REF DESIG	PIN NO.	TO
U1,3,4,12,18,19,20	16	+5V
	8	DCOM
U2,9,10	14	+5V
	7	DCOM
U5,6,7,22,23,24,25, 26,27,28,30,31,32	8	+7.5V
	4	-7.5V
U11	8	+7.5V
	4	DCOM
U13	8	+VOP
	4	-VOP
U14	12	+5V
	13	+7.5V
	5	DCOM
	4	-7.5V
U15,16	16	+5V
	8	DCOM
	7	-7.5V
U21	28	+5V
	1	DCOM
U29	3	+7.5V
	12	-7.5V

REFERENCE DESIGNATORS	
LAST USED	NOT USED
C72	C24,29,55,
CR30	64
J3	CR6
Q2	R26,35-42,
R233	93-95,97
RP6	146,149,
S1	152,155
TP21	W5,6
U32	
W40	
Y1	

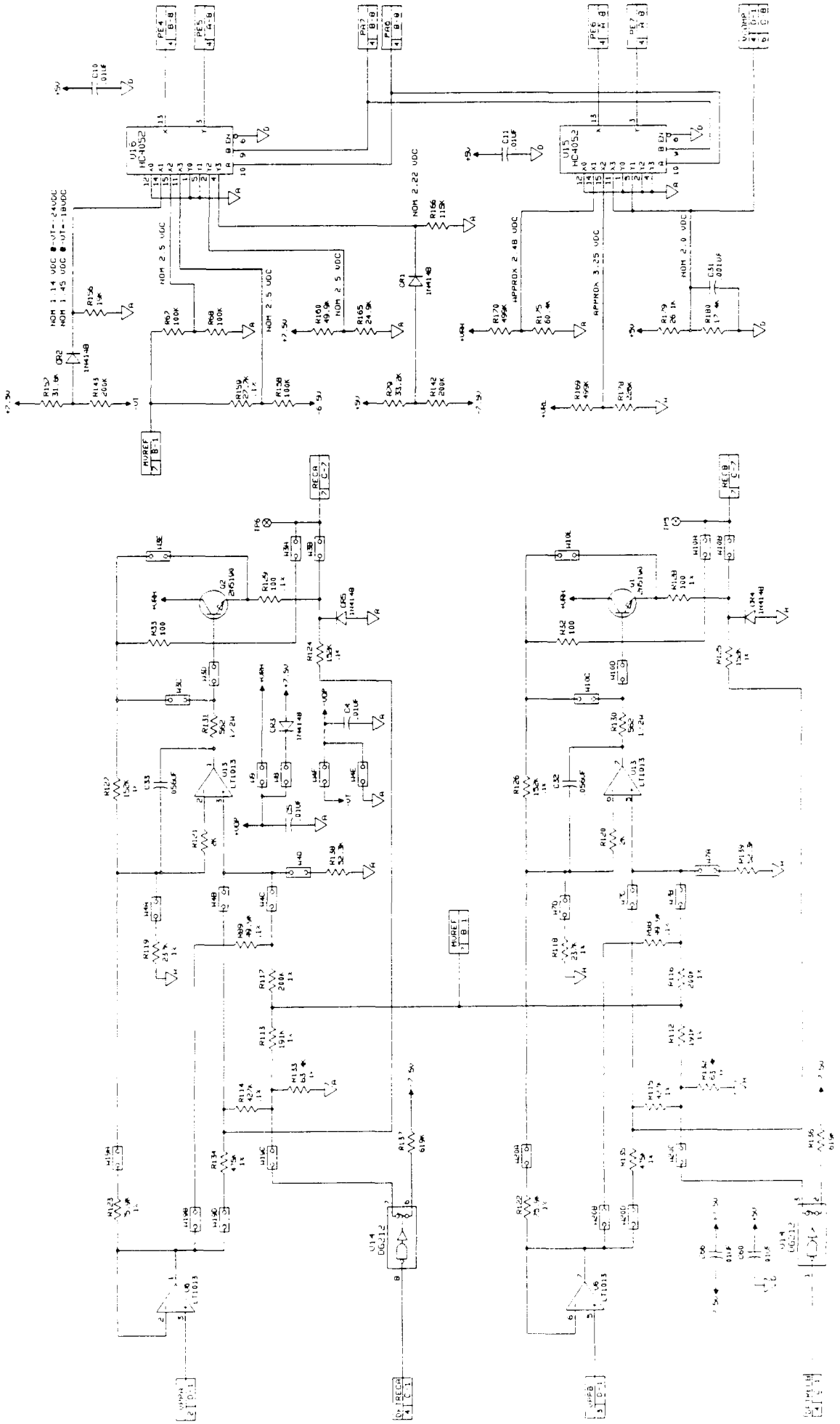


SCHEMATIC (2 OF 10)
330070 DUAL VALVE POSITION INDICATOR

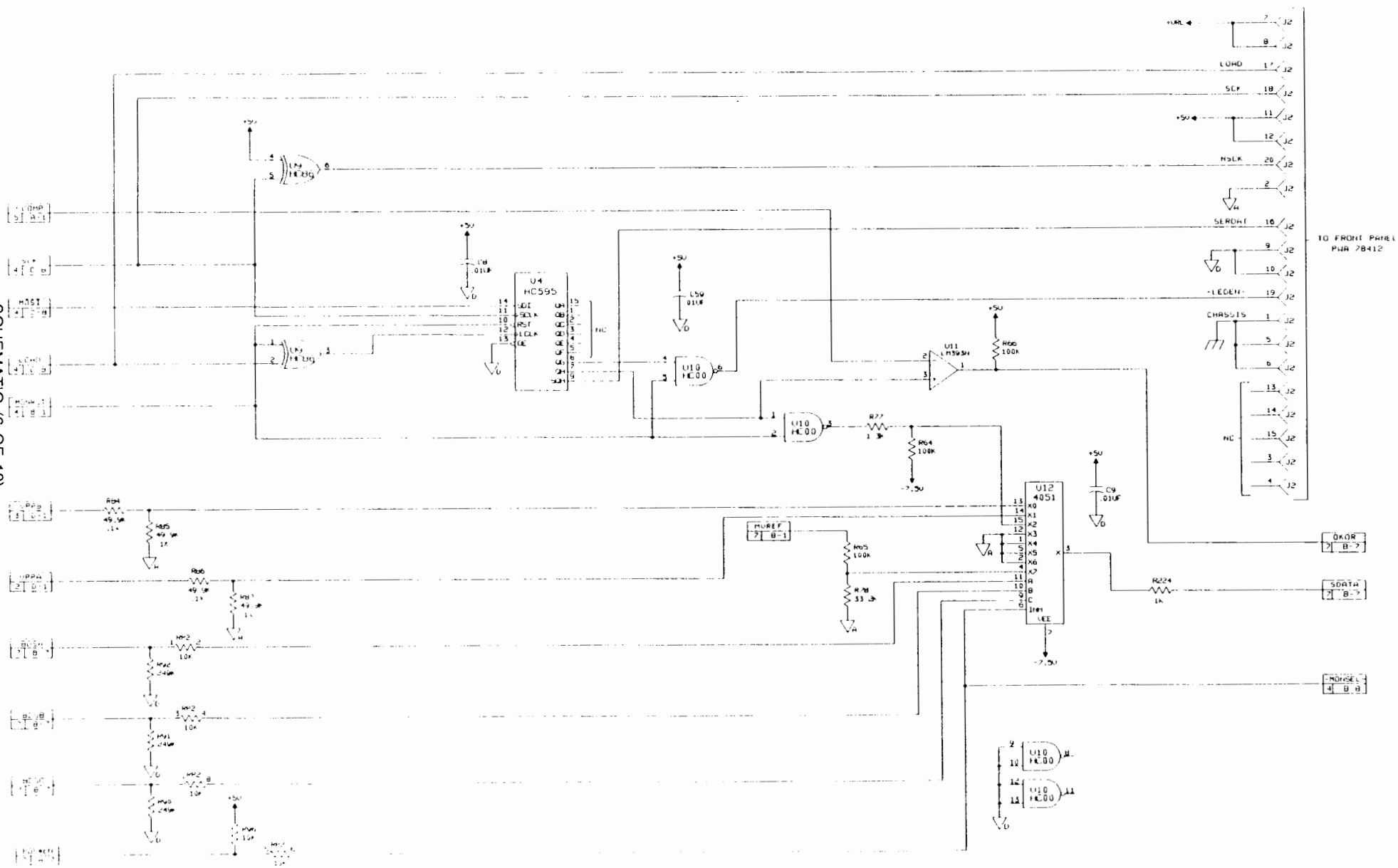


SCHEMATIC (3 OF 10)
330070 DUAL VALVE POSITION INDICATOR

SCHEMATIC (4 OF 10)
330070 DUAL VALVE POSITION INDICATOR

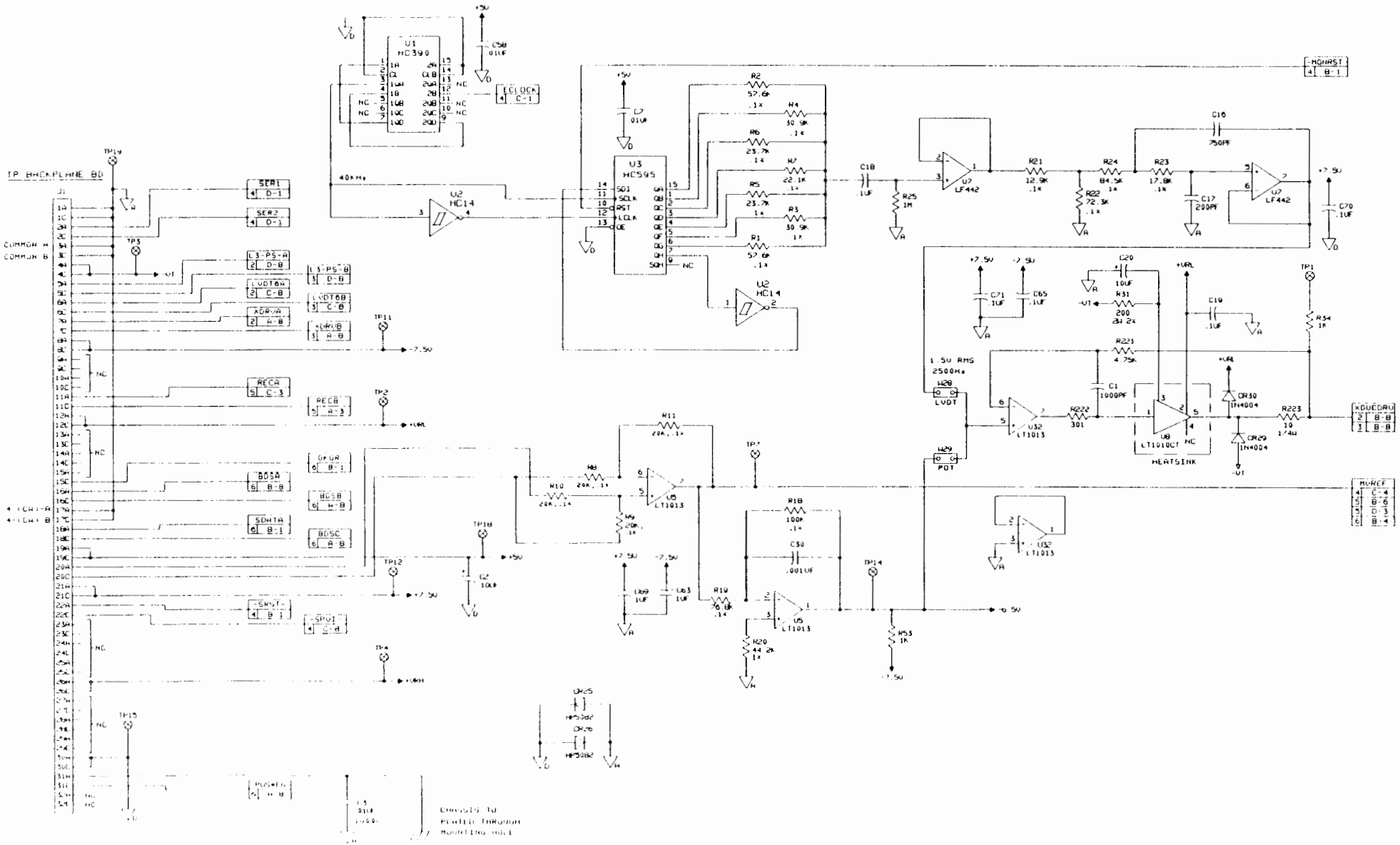


SCHEMATIC (5 OF 10)
330070 DUAL VALVE POSITION INDICATOR



330070 DUAL VALVE POSITION INDICATOR

SCHEMATIC (6 OF 10)


SCHEMATIC (7 OF 10)
330070 DUAL VALVE POSITION INDICATOR
TP BACKPLANE BD
U1 HC390
U2 HC14
U3 HC595
U5 LT1013
U7 LF442
U8 LT1010CT
HEATSINK
LVDT
POT
SER1
SER2
L3-PS-A
L3-PS-B
LVDT6A
LVDT6B
XDRVA
XDRVB
RECA
RECB
DRVA
BDSA
BDSB
SDHTA
BDSC
-SHUT
-SPDT
MONRST
MUREF
XDUCDRV
COMMON A
COMMON B
4 (CH1-A
4-(CH1-B
40kHz
1.5V RMS
2500Hz
+5V
-5V
+7.5V
-7.5V
+VR
-VT
+VRL
+VRH
+6.5V
ECLOCK
Chassis To
Printed Through
Mounting Hole

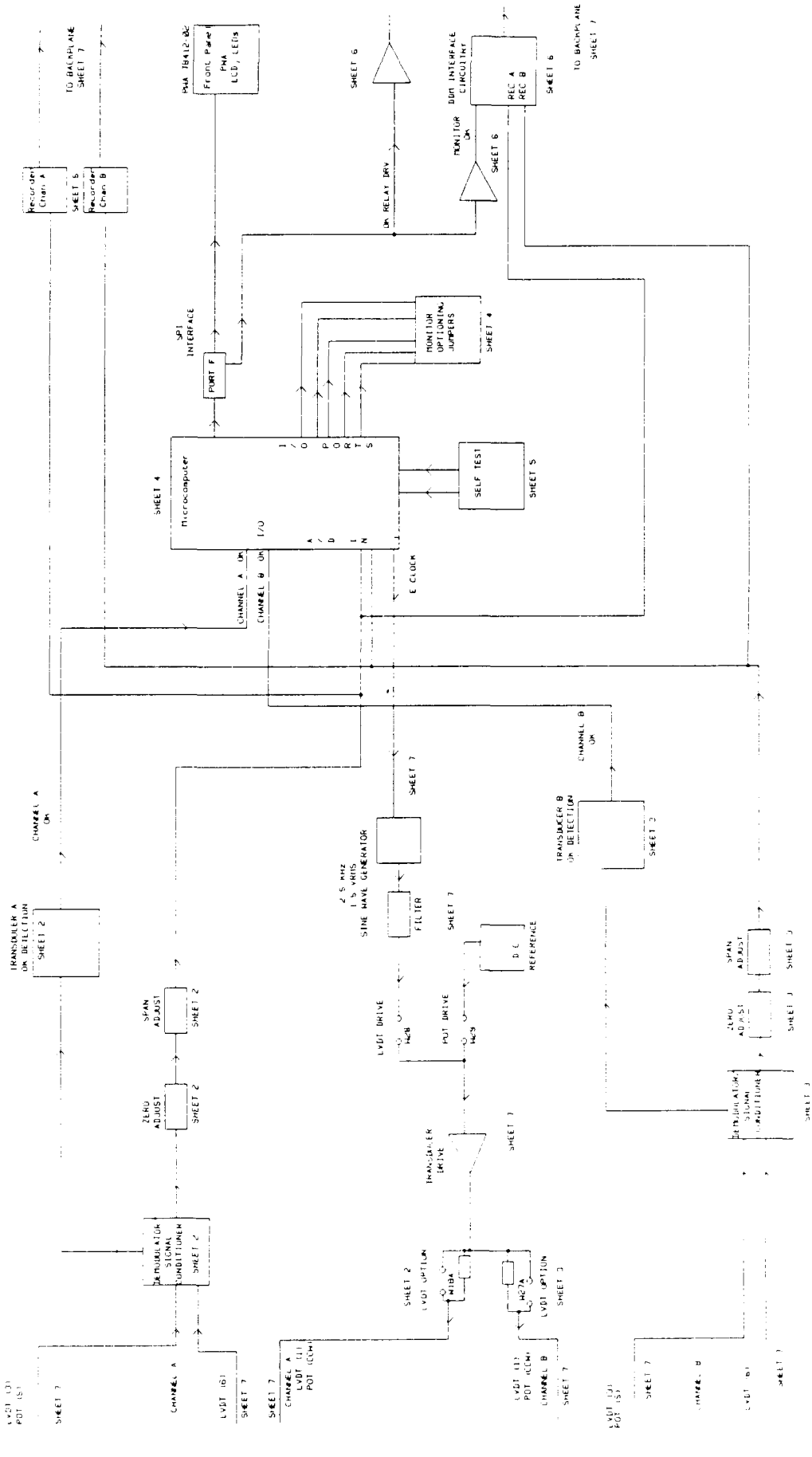
SCHEMATIC (8 OF 10)

330070 DUAL VALVE POSITION INDICATOR

LIST OF TERMINOLOGY

ACOM	ANALOG COMMON
DCOM	DIGITAL COMMON
+5V	+5 VOLT SUPPLY VOLTAGE
+7.5V	+7.5 VOLT SUPPLY VOLTAGE
-7.5V	-7.5V SUPPLY VOLTAGE
-VT	TRANSDUCER/ANALOG SUPPLY -24 VOLTS OR -18 VOLTS
+VRL	LOW ROUGH SUPPLY VOLTAGE
+VRH	HIGH ROUGH SUPPLY VOLTAGE
LVPS-A	LVDT PIN 3 OR POT SLIDER SIGNAL FOR CHANNEL A
LVDT6A	LVDT PIN 6 SIGNAL CHANNEL A
*DRVCOM	TRANSDUCER DRIVE SIGNAL COMMON SOURCE
*DRVA	TRANSDUCER DRIVE SIGNAL CHANNEL A
VPPA	CHANNEL A PROPORTIONAL VOLTAGE OUT
DEFEATA	DEFEAT SIGNAL FOR CHANNEL A
XDRA	CHANNEL A TRANSDUCER OK SIGNAL
LVPS-B	LVDT PIN 3 OR POT SLIDER SIGNAL FOR CHANNEL B
LVDT6B	LVDT PIN 6 SIGNAL CHANNEL B
*DRVB	TRANSDUCER DRIVE SIGNAL CHANNEL B
VPPB	CHANNEL B PROPORTIONAL VOLTAGE OUT
XDRB	CHANNEL B TRANSDUCER OK SIGNAL
-SPUI-	SYSTEM POWER UP INHIBIT SIGNAL
SCK	SERIAL PERIPHERAL INTERFACE (SPI) CLOCK SIGNAL
MOSI	MASTER OUT SLAVE IN SPI DATA SIGNAL
LOAD	SHIFT REGISTER LOAD & WATCH DOG UPDATE SIGNAL
PA6	PORT A6 SIGNAL
PA7	PORT A7 SIGNAL
PE4	PORT E4 SIGNAL
PE5	PORT E5 SIGNAL
PE6	PORT E6 SIGNAL
PE7	PORT E7 SIGNAL
-MONSEL-	MONITOR SELECT SIGNAL
VCOMP	COMPARATOR VOLTAGE AND +5 SELF TEST VOLTAGE
SER1	SERIAL DATA SIGNAL 1
SER2	SERIAL DATA SIGNAL 2
DFTRECA	DEFEAT RECORDER A SIGNAL
DFTRECB	DEFEAT RECORDER B SIGNAL
ECLOCK	PROCESSOR CLOCK SIGNAL
-SRST-	SYSTEM RESET LINE
-MONRST-	MONITOR RESET LINE
RECA	RECORDER CHANNEL A
RECB	RECORDER CHANNEL B
BDSA	BUFFERED DATA SELECT A
BDSB	BUFFERED DATA SELECT B
BDSC	BUFFERED DATA SELECT C
POSWEN	POSITION ENABLE
SDATA	STATIC DATA
-MONSEL-	MONITOR SELECT
NSCK	INVERTED SPI CLOCK SIGNAL
SERDAT	SERIAL DATA
CHASSIS	CHASSIS
OKOR	OK RELAY DRIVE
MVREF	MONITOR +5 VOLTAGE REFERENCE
-6.5V	-6.5 VOLTAGE REFERENCE

- SIGNAL NAME- DENOTES ACTIVE LOW
- [illegible] REPRESENT [illegible]
- [illegible]



SCHEMATIC (9 OF 10)
330070 DUAL VALVE POSITION INDICATOR

330070 DUAL VALVE POSITION INDICATOR

SCHEMATIC (10 OF 10)

330070 [A] [A]

OPT	TRANSDUCER TYPE	JUMPERS INSTALLED
Ø1	5000 OHM ROTARY POTENTIOMETER 90 TO 300 DEGREES FULL SCALE ROTATION	W1,W2A,W13,W17A,W18B,W22 W23,W24B,W25A,W27B,W29 W34,W35
Ø2	5000 OHM ROTARY POTENTIOMETER 60 TO 90 DEGREES FULL SCALE ROTATION	W1,W2A,W13,W14,W16,W17A W18B,W22,W23,W24B,W25A W27B,W29,W34,W35
Ø3	+/- 1 Ø INCH (+/- 25mm) A.C. LVDT 2 INCHES (50mm) = FULL SCALE	W28,W2C,W11,W12,W14,W15,W16,W17B W18A,W18C,W21,W24C,W24D W25B,W27A,W27C,W28,W33,W36
Ø4	+/- 2 Ø INCHES (+/- 50mm) A.C. LVDT 4 INCHES (100mm) = FULL SCALE	W28,W2C,W11,W12,W14,W15,W16,W17B W18A,W18C,W23,W24C,W24D W25B,W27A,W27C,W28,W33,W36
Ø5	+/- 3 Ø INCHES (+/- 75mm) A.C. LVDT 6 INCHES (150mm) = FULL SCALE	W28,W2C,W11,W12,W14,W15,W16,W17B W17C,W18A,W18C,W21,W24A,W24C W24D,W25B,W26C,W26,W27A W27C,W28,W33,W36
Ø6	+/- 5 Ø INCHES (+/- 125mm) A.C. LVDT 10 INCHES (250mm) = FULL SCALE	W28,W2C,W11,W12,W14,W15,W16,W17B W18A,W18C,W21,W24C,W24D W25B,W27A,W27C,W28,W33,W36

BEFORE CONFIGURING A TRANSDUCER OPTION, REMOVE THE FOLLOWING JUMPERS:

W1,W2A-W2C,W11,W12,W13,W14,W15,W16,W17A-C,W18A-C

W21,W22,W23,W24A-D,W25A-C,W26,W27A-C,W28,W29,W33,W34,W35,W36

INDICATOR OPTIONS	
LATCHING "NOT OK"	INSTALL W38,W39
* NON-LATCHING "NOT OK"	REMOVE W38 INSTALL W39
TIMED OK CHANNEL DEFEAT ENABLED	REMOVE W38,W39
TIMED OK CHANNEL DEFEAT DISABLE	INSTALL W39
SELF TEST INVOKE	MOMENTARILY SHORT W32
SELF TEST ERROR CODE READ	MOMENTARILY SHORT W31 WHILE IN THE SELF TEST MODE
SELF TEST ERROR CODE CLEAR	MOMENTARILY SHORT W38 WHILE IN THE ERROR CODE READ MODE
PROCESSOR RESET	MOMENTARILY SHORT W37

INDICATOR RECORDER OPTIONS		
* +4 TO +20 mA	INSTALL	W3B,W3D,W3E,W4A,W4B,W4E,W7C,W7D,W9 W10B,W10D,W10E,W19D,W20D
	REMOVE	W3A,W3C,W4C,W4D,W4F,W7A,W7B,W8 W10A,W10C,W19A,W19B,W20A,W20B
+1 TO +5 V	INSTALL	W3A,W3C,W4C,W4E,W7B,W9 W10A,W10C,W19B,W20B
	REMOVE	W3B,W3D,W3E,W4A,W4B,W4D,W4F,W7A,W7C W7D,W8,W10B,W10D,W10E,W19A,W19D W20A,W20D
Ø TO -10 V	INSTALL	W3A,W3C,W4D,W4F,W7A,W8,W10A,W10C W19A,W20A
	REMOVE	W3B,W3D,W3E,W4A,W4B,W4C,W4E,W7B W7C,W7D,W9,W10B,W10D,W10E,W19B W19D,W20B,W20D

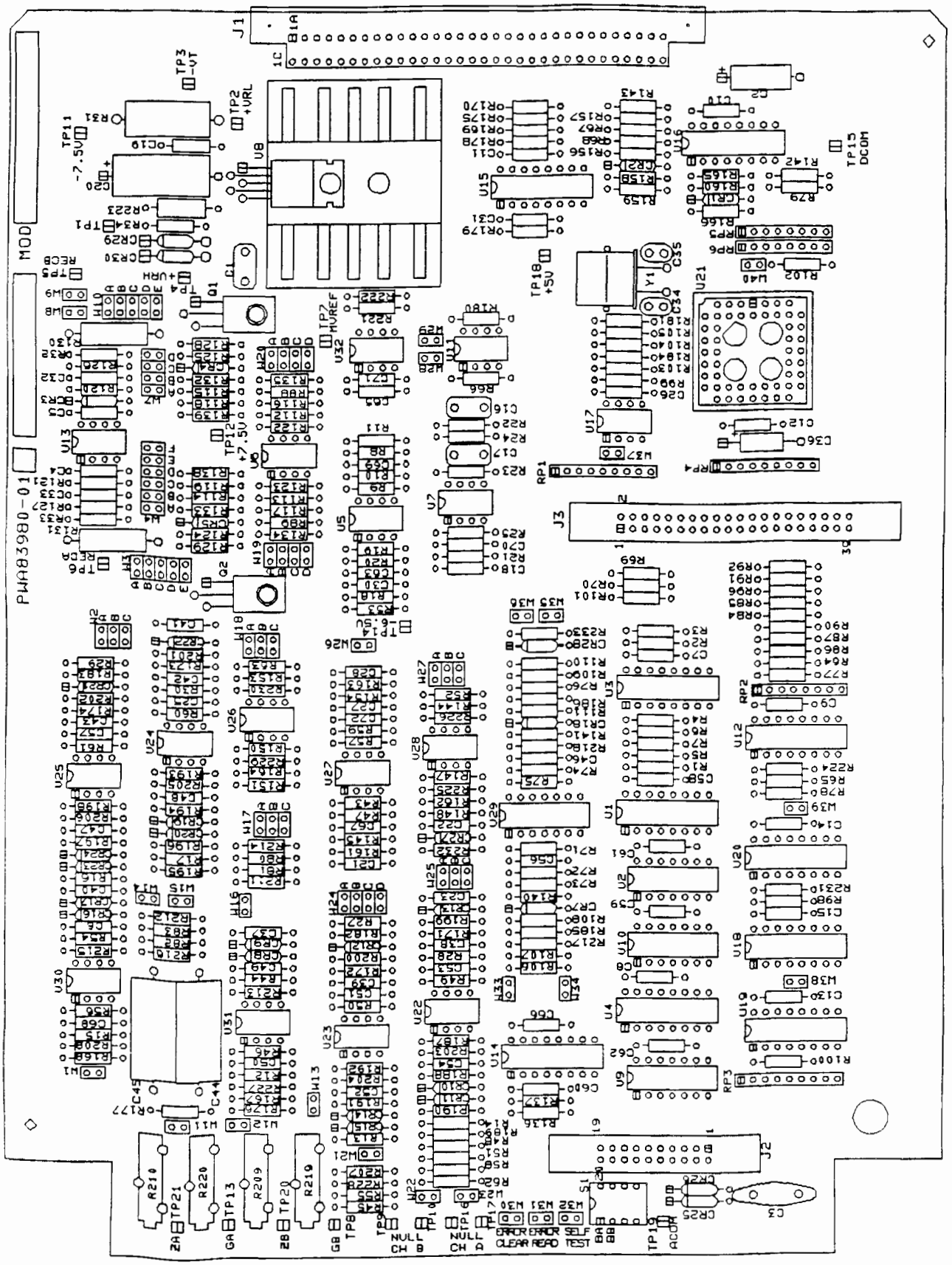
* SPECIAL OPTION - +4 TO +20 mA RECORDER 2mA CLAMP DURING A DEFEAT	
ENABLE	CH. A INSTALL W19C, CH. B INSTALL W20C
DISABLE	CH. A REMOVE W19C, CH. B REMOVE W20C

* NOTE IF IT IS DESIRED TO HAVE THE 2 MA CLAMP OCCUR DURING A "NOT OK" CONDITION THEN TIMED OK CHANNEL DEFEAT MUST BE ENABLED (I.E., REMOVE W38,W39)

2 [ ] = SHIPPED AS OPTION

1 THIS SCHEMATIC REPRESENTS PWA 83308 01

NOTES: UNLESS OTHERWISE SPECIFIED



PRINTED WIRE ASSEMBLY (PWA) DRAWING (1 OF 1)
330070 DUAL VALVE POSITION INDICATOR

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