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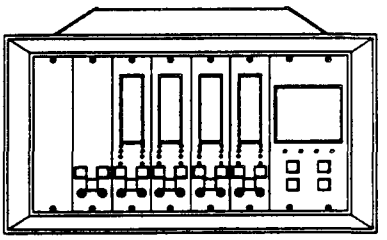
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PART NO. 84417-01

3300/48 CASE EXPANSION MONITOR

OPERATION MANUAL

BENTLY NEVADA



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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

In this document procedures are given only for channel A. Procedures for channel B are similar except for the obvious substitution of corresponding switches, terminals, and indicators.

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



FOREWORD

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

3300/48 Case Expansion Maintenance, 84418-01

Dynamic Data Manager System, 46390-01

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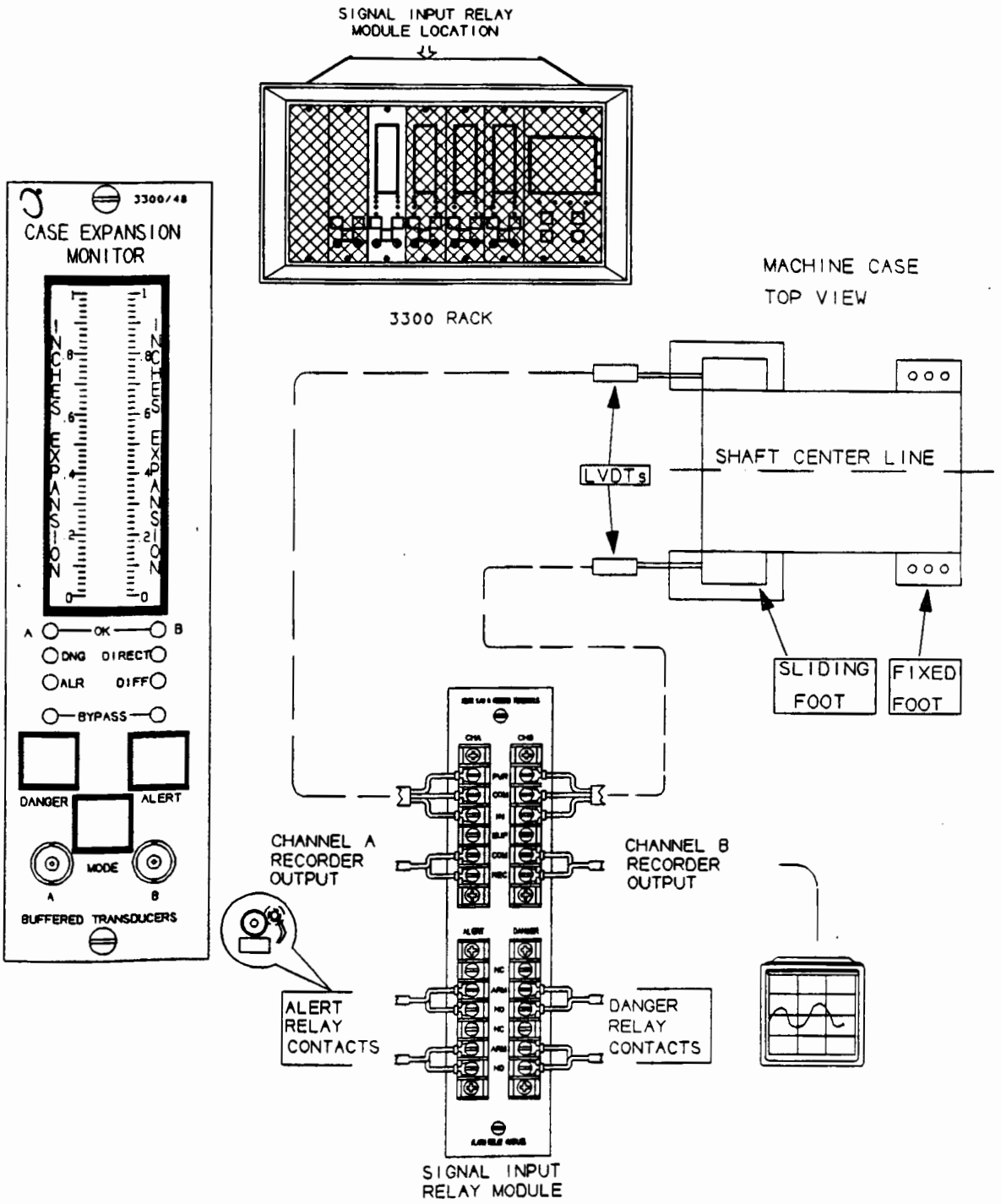
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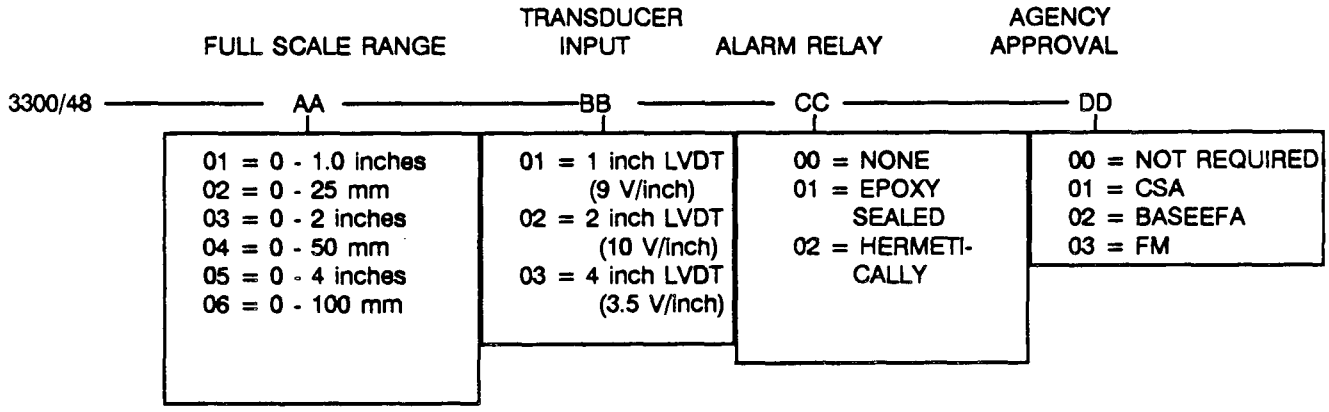
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1 CASE EXPANSION MONITOR SYSTEM



2 MONITOR OPTIONS

CASE EXPANSION
MONITOR PART NUMBER



3 PROGRAMMABLE OPTIONS

Monitor Feature	Option	Monitor Feature	Option
First Out	Enabled * Disabled	Danger Mode	Latching Non-Latching
Alarm Delays	0.1 sec 1 sec 3 sec * 6 sec	Recorder Output	+4 to +20 mA * +1 to +5 Vdc 0 to -10 Vdc
OK Mode	Latching Non-Latching *	Recorder Mode	Differential * Direct
Alert Mode	Latching * Non-Latching	Upscale Direction	Toward Transducer * Away from Transducer
Meter Response Time	Fast * Slow	Danger Bypass Switch	Enabled Disabled *
Channel B	On * Off	Timed OK Channel Defeat	Enabled Disabled *#

* As Shipped from Factory
\# Requires Non-Latching OKs

4 MONITOR FUNCTIONS

CASE EXPANSION - The Case Expansion Monitor continuously monitors the expansion of the machine case on both sides of a machine. The monitor uses signals from two linear variable differential transducers (LVDT) mounted on both sides of the machine case. LVDTs can be oriented so that the expansion of the machine case is either toward or away from the LVDT. The Case Expansion Monitor provides an alarm if the expansion of the machine case is not the same on each side.

OK - When the output voltage of the LVDTs is within its upper/lower limits, the transducer is defined as OK. The OK detection circuit controls the channel OK LED and the monitor relay drive to the OK Relay. If the monitor has the Latching Not OK option chosen, a System Reset is required to reset the OK function.

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.

DIRECT AND DIFFERENTIAL MODE - The Case Expansion Monitor can display the expansion of the machine case in two ways, direct or differential. In the direct mode, the monitor shows the amount of expansion as measured by the LVDTs on both sides of the machine. The two measurements are displayed on the bar graphs for channel A and B. In the differential mode, the monitor displays the difference between the two measured expansions. This difference is displayed on the bar graph for channel A, and the bar graph for channel B is blanked. The monitor can be toggled between direct and differential modes by pressing the MODE switch.

ALARM - Since alarms for the case expansion monitor use differential values, alarm setpoints may be read when the monitor is in the differential mode only. Pressing the Alert or Danger Switch on the front panel of the monitor causes the corresponding Alert (first-level alarm) or Danger (second-level alarm) set points to be displayed on the channel A bargraph on the front panel. Pressing alarm switches when the monitor is in direct mode gives a blank display. When the differential expansion signal exceeds the preset levels for the selected time delay, the Alert and Danger LEDs come on and the appropriate Alert and Danger alarm relay contacts activate.

FIRST OUT - Separate First Out circuits exist for Alert and Danger alarms. A monitor with First Out option selected flashes a channel alarm LED if that channel was the first channel in the rack to go into alarm since the last reset. Pressing the RESET switch acknowledges the First Out.

ALARM RELAYS - Monitor alarms can be programmed for either the latching or non-latching mode. In the non-latching mode, the alarm resets automatically when the alarm no longer exists. In the latching mode, the alarm condition must be reset manually by pressing the RESET switch on the front panel of the System Monitor or by closing external Reset contacts. The alarm will not reset if the alarm condition still exists.

DANGER BYPASS - Danger Bypass inhibits the danger relay drive. Other monitor functions continue. When Danger Bypass is on, the Bypass LEDs for both channels are on. This function can be enabled by installing a programming jumper on the monitor.

4 MONITOR FUNCTIONS [CONT]

BUFFERED OUTPUT - The Case Expansion Monitor provides the buffered output from the LVDTs at two locations: at the coaxial cable connectors on the front panel and at the terminals on the Signal Input Relay Module. These connectors can be used to connect the monitor to external equipment.

RECORDER OUTPUT - The range of recorder output can be 0 to -10Vdc, +1 to +5Vdc, or +4 to +20mA depending on which option is selected. In addition, recorder output can be in either direct or differential mode. In the direct mode, the recorder outputs are given for both channels and is proportional to the amount of expansion as measured by each transducer. In the differential mode, the recorder output is given on channel A only and is proportional to the absolute value of the difference between the expansion as measured by the two LVDTs.

SELF TEST - The monitor has three categories of self test: power-up, cyclic, and user-invoked.

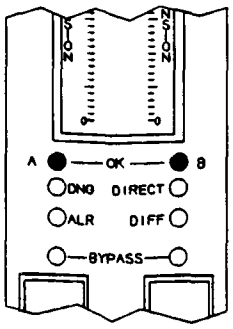
Power-up self test is performed automatically each time the monitor power is turned on. A series of basic tests and transducer OK tests are performed.

Cyclic self test is performed automatically during monitor operation. Errors encountered during cyclic tests disable the monitor, and flash an error code on the LCD bar graph. If the error is intermittent, the monitor will return to operation, and the error codes are stored. Error codes can be read by performing a user-invoked test. Stored error codes are indicated by OK LEDs flashing at 5 Hz provided that the channel is OK.

The User-Invoked test performs a power-up self test and allows error messages stored during cyclic 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 bar graph.

Timed Ok Channel Defeat - The Timed OK channel defeat function prevents faulty transducer wiring from causing false alarms. If a transducer is determined to be Not OK, the channel OK LED goes off, the Channel Bypass LED comes on, the channel alarming is disabled, and the OK relay de-energizes. If a channel's input signal returns to an OK condition, the channel's OK LED will start flashing at a 1 Hz rate to indicate that the OK state is restored, the Bypass LED will go off, and after a 10 second delay monitoring is enabled. The Reset switch on the System Monitor front panel must be pressed to stop the OK LED from flashing.

5 OK

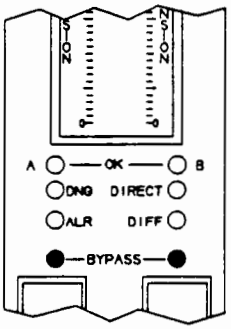


Note: Since each channel in the system controls the OK Relay, either channel can cause a Not OK Relay conditon (de-energized relay).

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. To read error messages see section 10, pages 11-15. Flashing at 1 Hz = Transducer has been Not OK since last Reset	ON

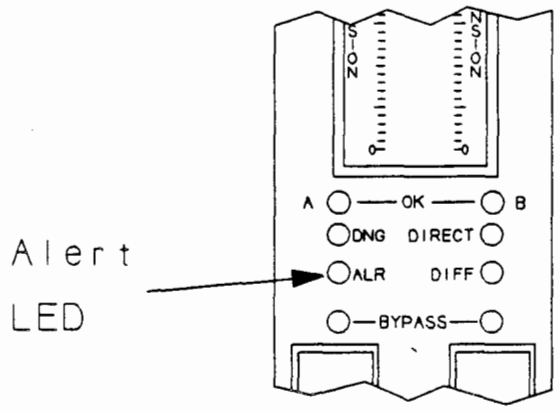
* Not OK channel can be bypassed to restore relay OK conditions

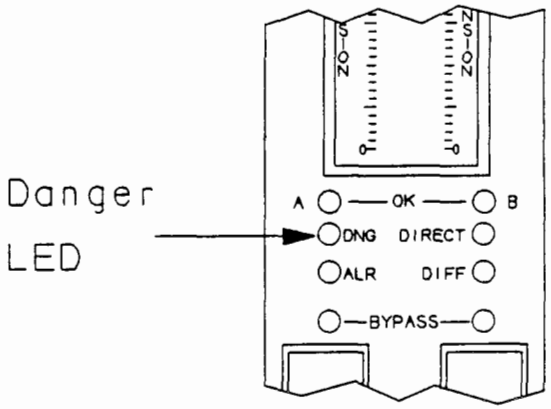
6 BYPASS



LED DISPLAY A		LED DISPLAY B	CONDITION
●	BYPASS	●	Monitor in DANGER BYPASS MODE System in POWER UP MODE User-Invoked Self Test in progress Both channels bypassed
●	BYPASS	○	Channel A or B bypassed
○	BYPASS	●	

7 ALERT AND DANGER

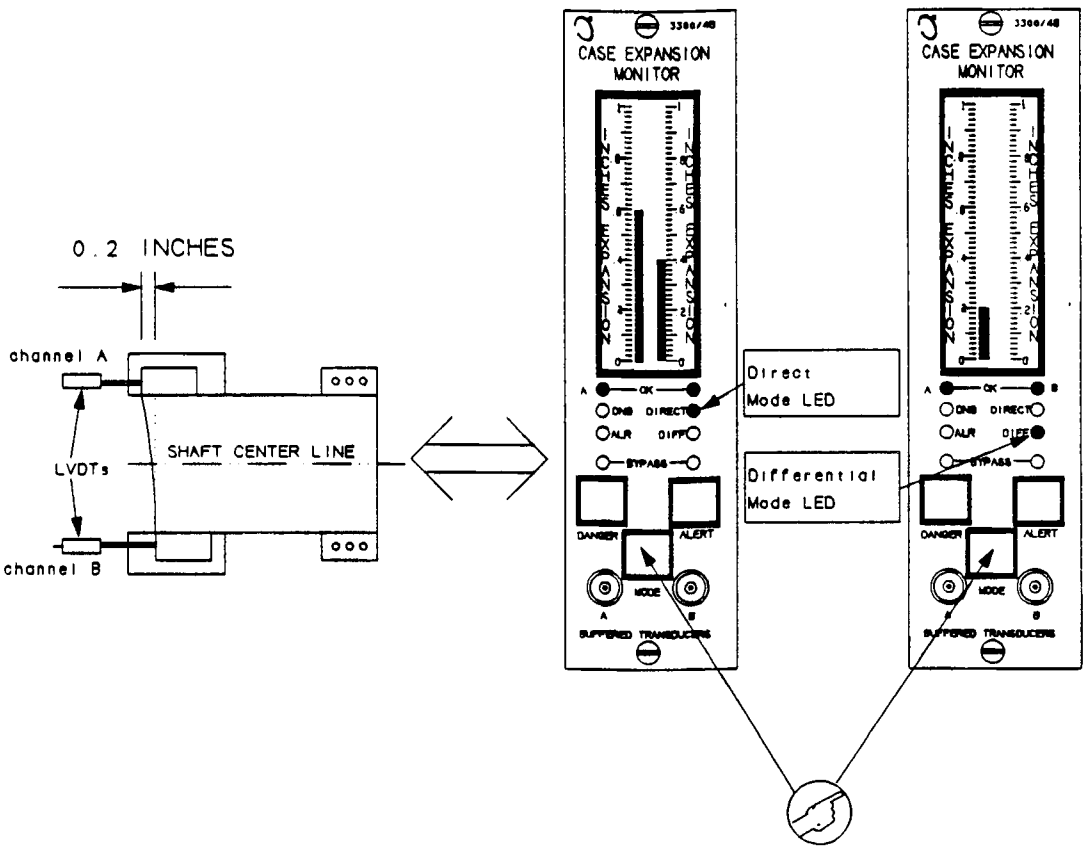




LED DISPLAY	CONDITION	ALERT RELAY DRIVE
○ ALR	The difference in case expansion as measured by channels A and B is less than the alert level.	OFF
● ALR	The difference in case expansion exceeds the alert level.	ON
◉ ALR	The difference in case expansion exceeds the alert level, and this is the first alert alarm on the rack.	ON

LED DISPLAY	CONDITION	DANGER RELAY DRIVE
○ DNG	The difference in case expansion as measured by channels A and B is less than the danger level.	OFF
● DNG	The difference in case expansion exceeds the danger level.	ON
◉ DNG	The difference in case expansion exceeds the danger level, and this is the first danger alarm on the rack.	ON

8 READ DIRECT OR DIFFERENTIAL MODE



Use the Mode Key to toggle between direct and differential mode.

The monitor in the illustration on this page indicates that the total expansion of the machine case

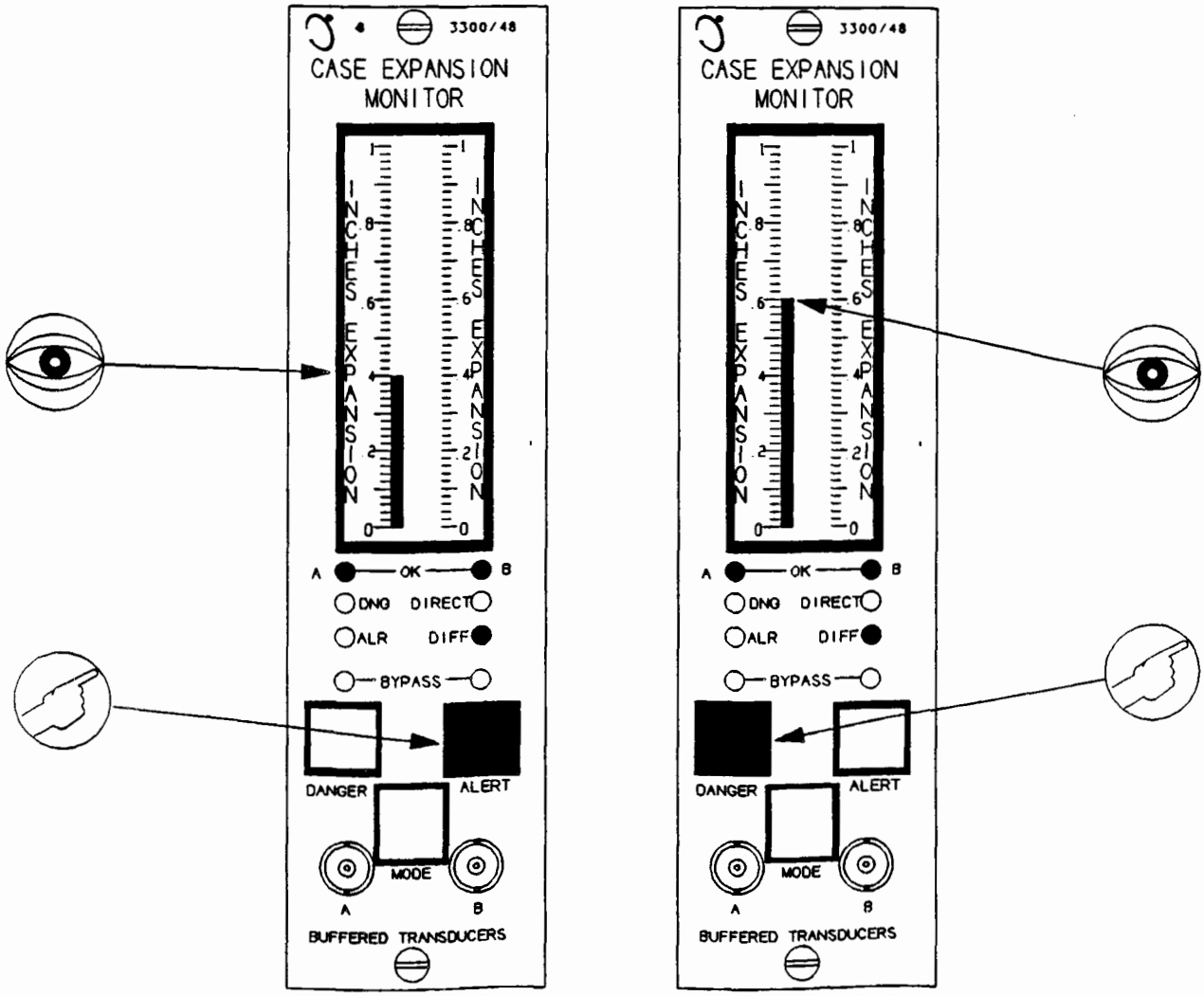
on channel A side	=	0.6 inches
on channel B side	=	0.4 inches
Difference in expansion	=	0.2 inches

9 READ SETPOINT LEVELS

Note: You can read the setpoints in Differential Mode only. If you try to read the setpoints in direct mode, the display will be blank.

Alert SetPoint = 0.4 inches

Danger SetPoint = 0.6 inches



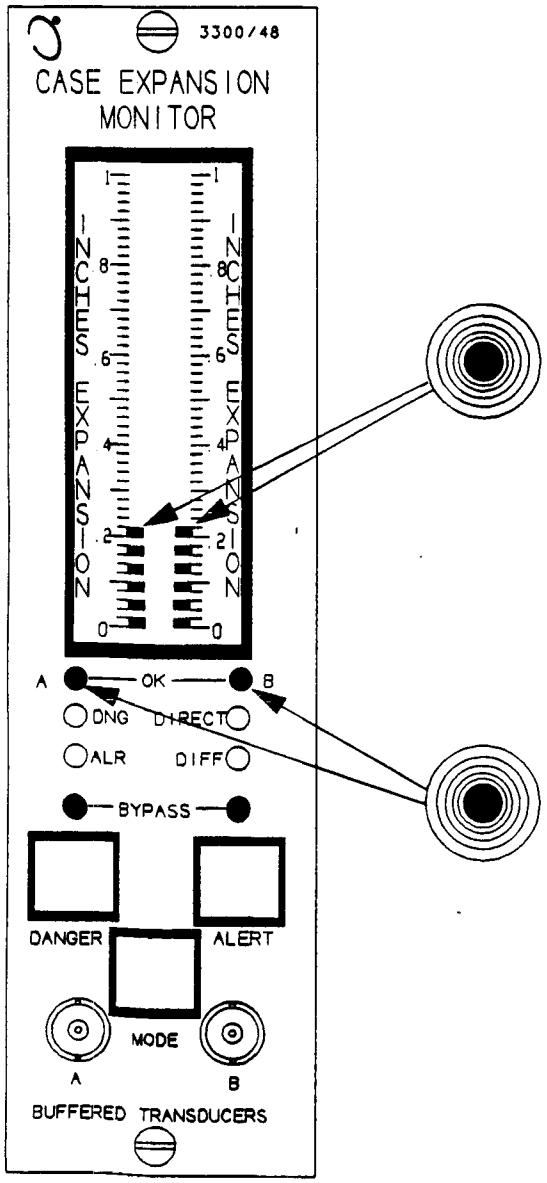
10 SELF TESTS

The three levels of self tests are

power-up - performed only when the monitor is turned on

cyclic - continuously performed by the monitor

user-invoked - performed only when initiated by the user.



The monitor on this page is giving a signal that a continuing error has been detected during a self test. When a continuing error is detected,

monitoring is stopped until the error is resolved,

the error code is flashed on the LCD bar graph and stored in memory,

the Bypass LED comes on and the OK LED flashes at 5 Hz.

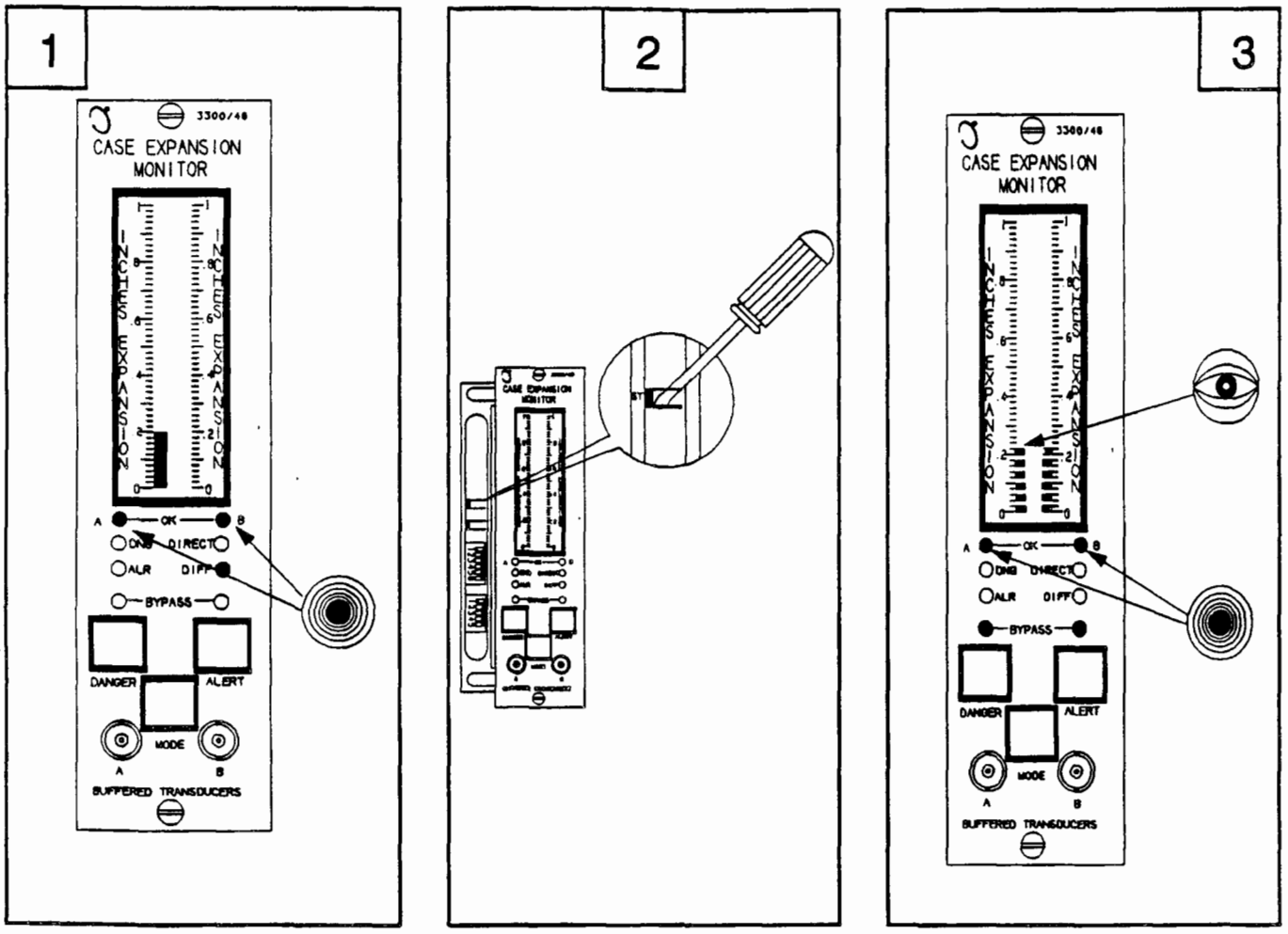
If the error goes away, monitoring is resumed and the OK LEDs flash at 5 Hz. The error code, however, remains stored in the monitor and may be read by using the user-invoked self test.

Note:

Although both columns of the bar graph flash, the error code is only the sum of the bar graph segments displayed in one column. For example the monitor on this page is displaying error code 6.

10 SELF TESTS

Follow these steps to read the error codes that have been stored in the monitor:



1

Flashing OK LEDs show that error codes are stored in the monitor.

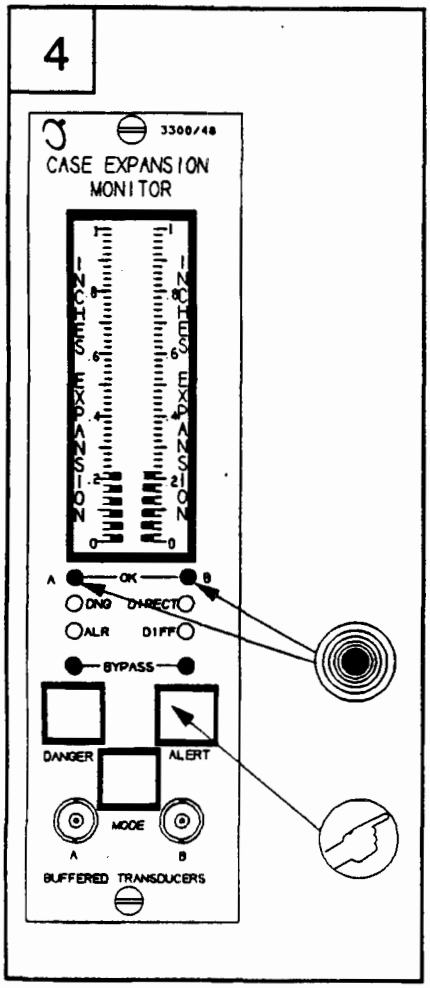
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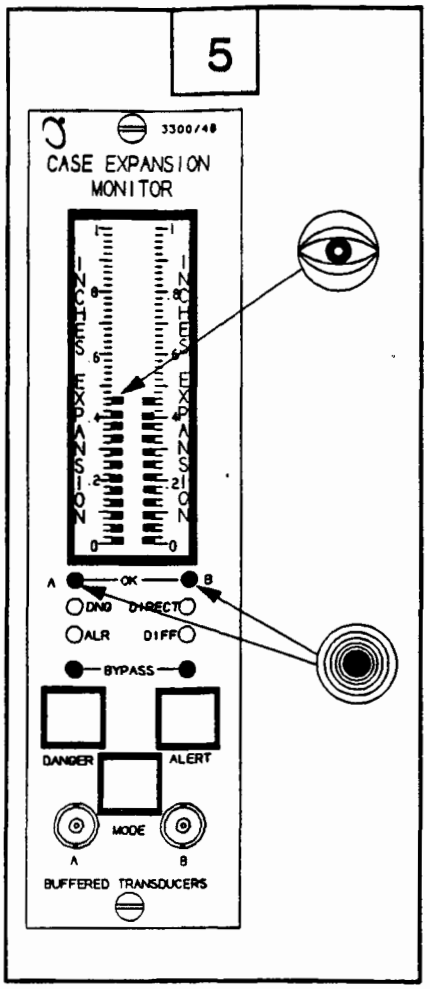
Initiate the user-invoked test by shorting across the self-test pins behind the panel. The self-test pins are labeled ST on the inner panel.

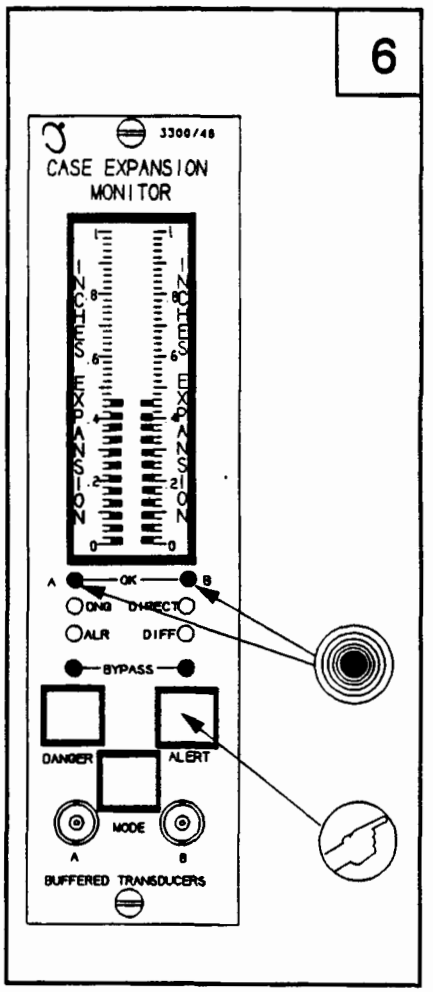
3

The first error code is displayed on the bar graph. Read the code by counting the number of bars on one side. Error code number 6 is displayed on this monitor.

10 SELF TESTS







4

Press and hold the alert switch for 1 second to toggle to the next error code.

5

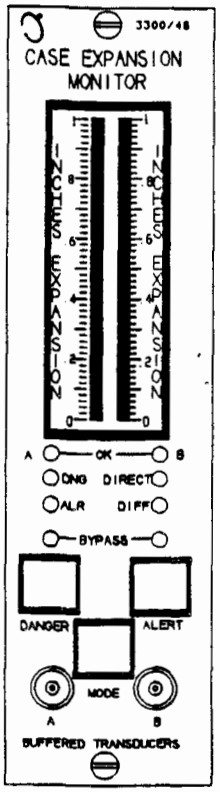
Read the second stored error code. This bar graph is displaying error code 12.

6

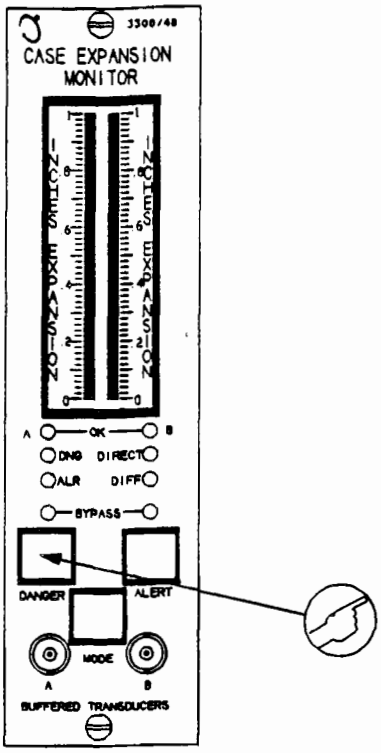
Read through all the other stored codes by pressing and holding the alert switch one second.

10 SELF TESTS

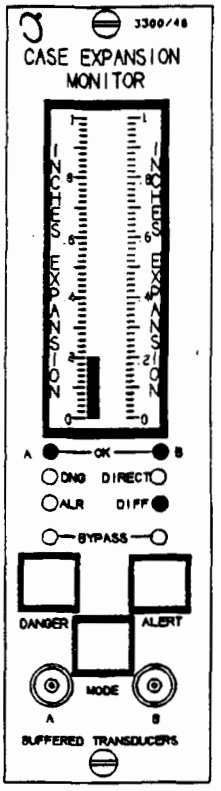
7



8



9



7

All codes have been read when the bar graph LCD comes on at full range of scale.

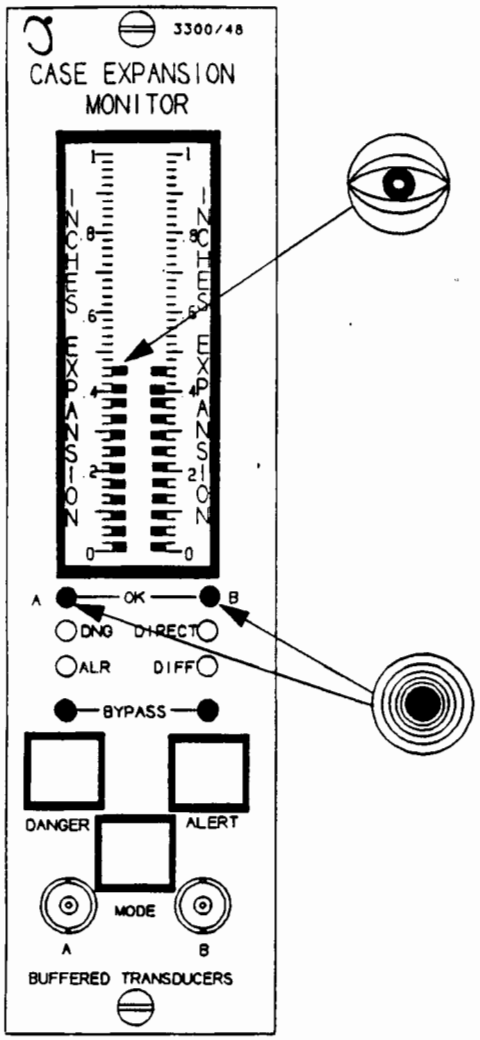
8

Press the DANGER switch to reset the monitor or Press the ALERT switch to reread the list.

9

After the monitor is reset, the error codes are removed from memory and the monitor begins operating again.

10 SELF TESTS



Error Code	Description
2	ROM CHECKSUM has failed. *
3	EEPROM failure number 1. **
4	EEPROM failure number 2. *** Adjust set points
5	+7.5V/-VT node out of tolerance. **
6	+VRH node out of tolerance. **
7	+5V node out of tolerance. **
8	MVREF node out of tolerance. **
9	+7.5V node out of tolerance. **
10	+VRL node out of tolerance. **
12	+5V/-7.5V node out of tolerance. **
14	RAM failure. *
17	COP Watchdog not configured.
18	+5V/-5V or +15V node out of tolerance. **
21	Incorrect switch or switch combination. ****
22	Incorrect jumper configuration. *

* Tested only at Power Up or User Invoked Self Test. This error is displayed on the front panel but is not stored in memory.

** Tested only at Cyclic Self Test. Errors 2, 3, and 14 are non-recoverable and errors 5 through 13 could be intermittent and recoverable.

*** Error 4 is a setpoint failure and may be corrected by adjusting all setpoints in the monitor.

**** Tested only when monitor is in calibration mode.

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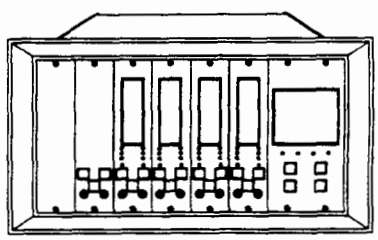
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PART NO. 84418-01

3300/48 CASE EXPANSION MONITOR

MAINTENANCE MANUAL

BENTLY NEVADA



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⚠ WARNING

High Voltage present
Could cause shock, burns or death.

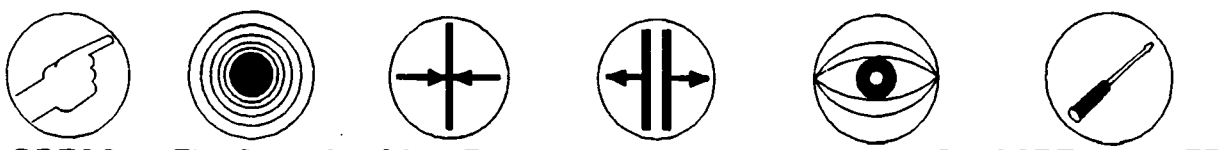
Do Not touch exposed wires or terminals.

CAUTION

Machine Protection
Will Be Lost

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



FORWARD

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

RELATED DOCUMENTS

3300 System Overview, 80177

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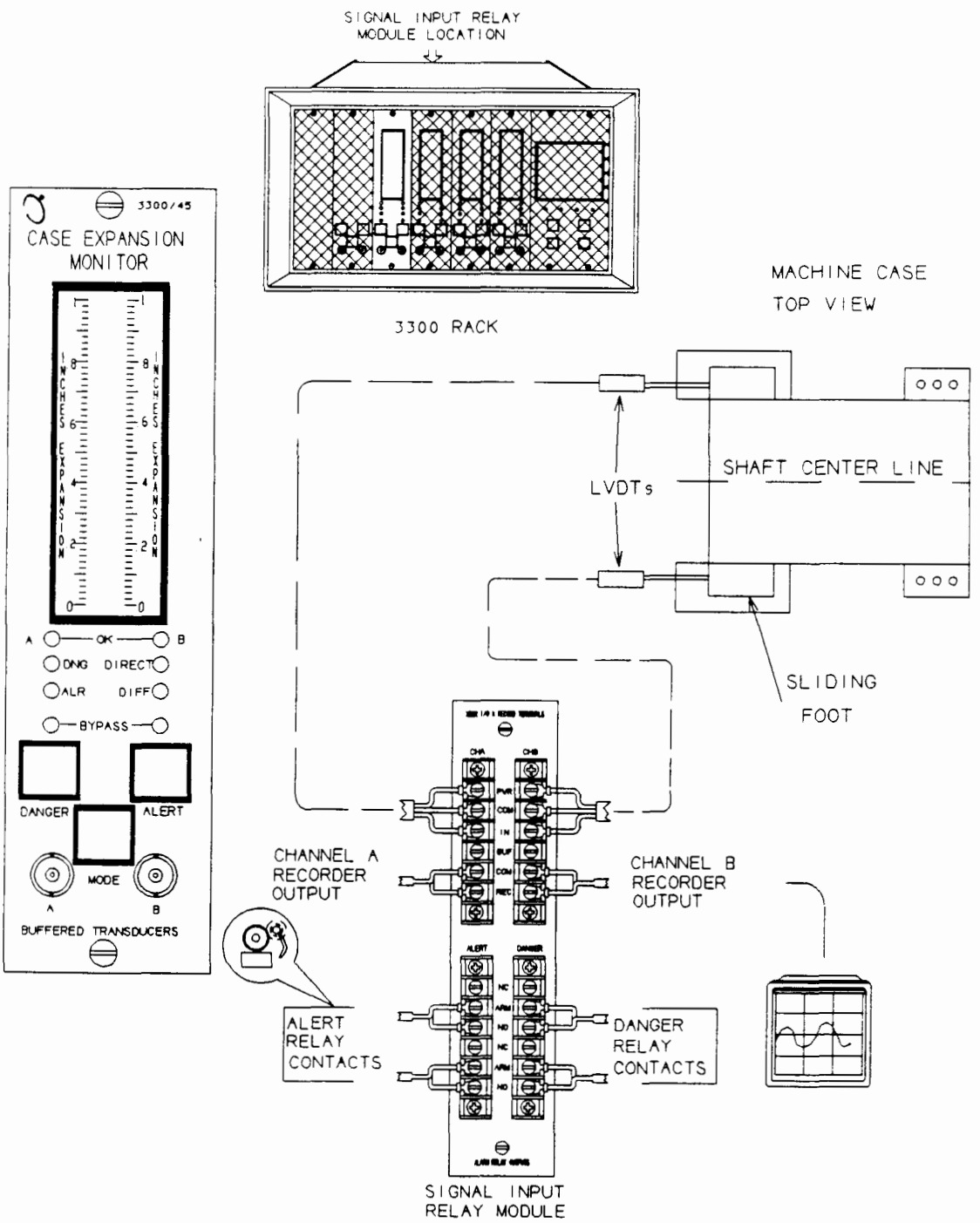
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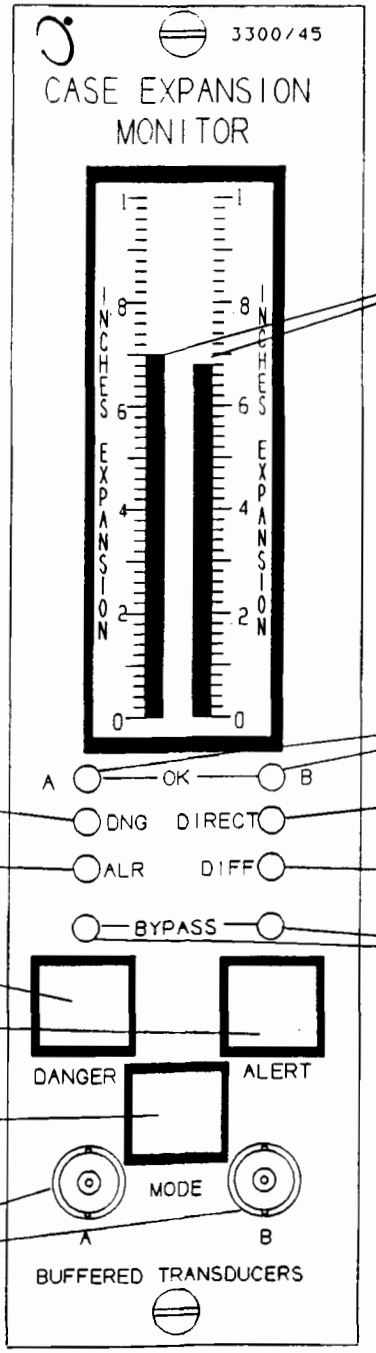
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1 Case Expansion Monitor System



2 Front Panel Features



Bargraph - Indicates Case Expansion values

Transducer OK LEDs

Danger LED

Direct Display Indicator

Alert LED

Differential Display Indicator

Read Monitor Danger Setpoints

Channel Bypass LEDs

Read Monitor Alert Setpoints

Change Monitor Display Mode

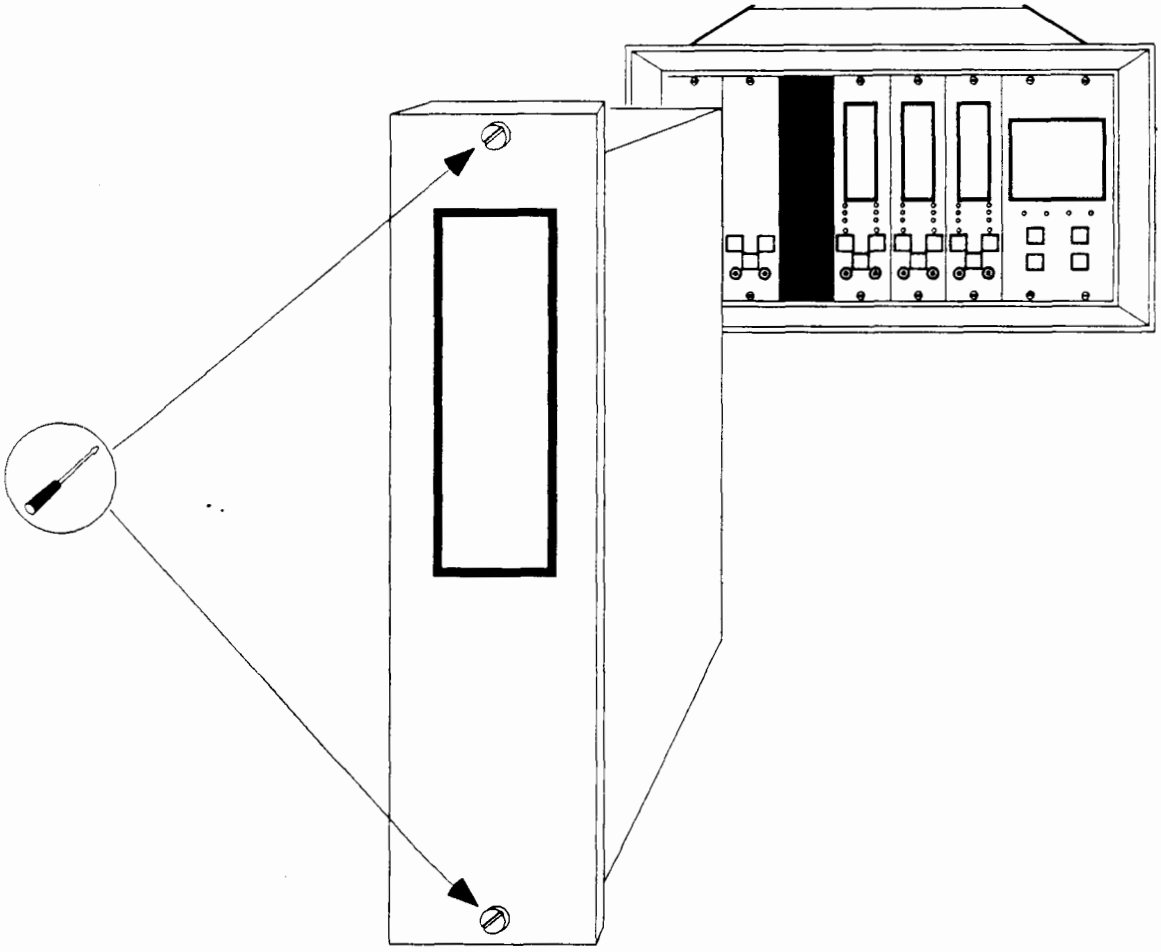
Coaxial Connectors for Buffered Transducer Outputs

3 Monitor Removal

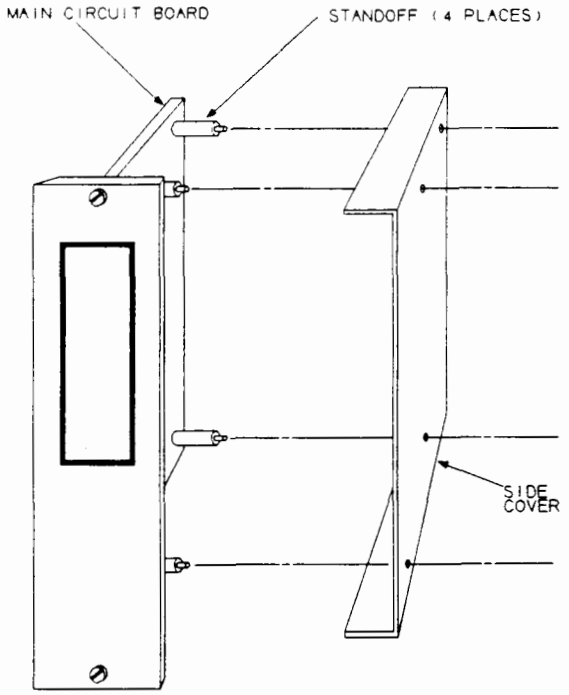
CAUTION

The machine is not protected when the monitor is removed from the rack.

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

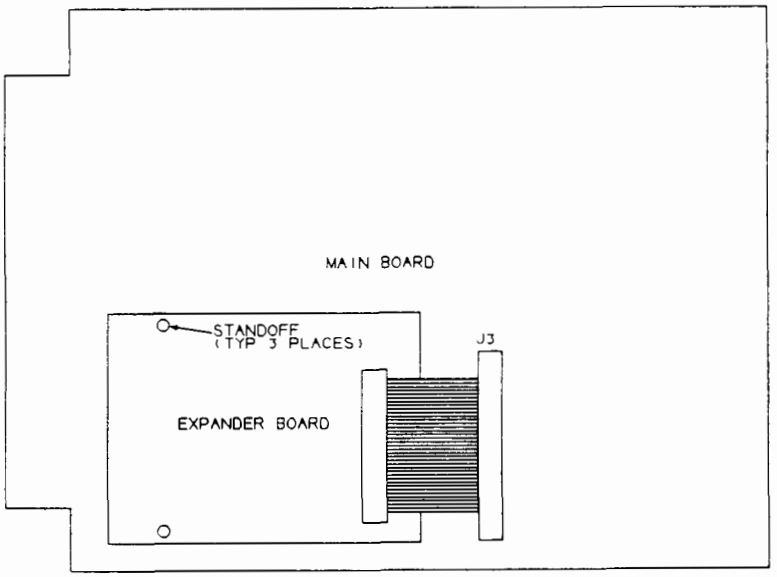


4 Monitor Disassembly



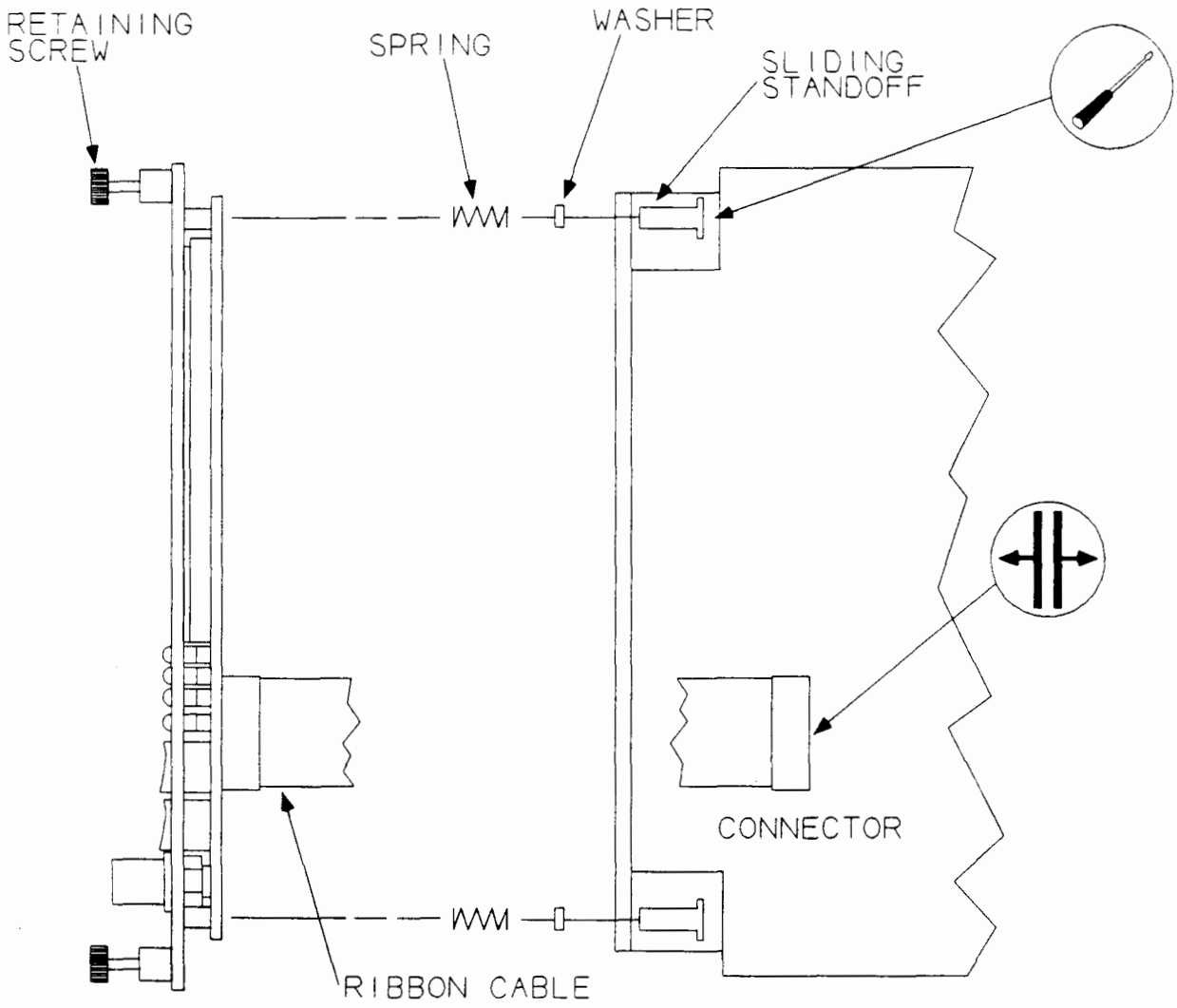
Side Cover Removal
Squeeze the retaining tips on each standoff, and remove the side cover from the monitor.

Circuit Board Removal
Squeeze the retaining tips on each standoff, and remove the expander board from the main board.



4 Monitor Disassembly [Cont]

Front Panel Removal

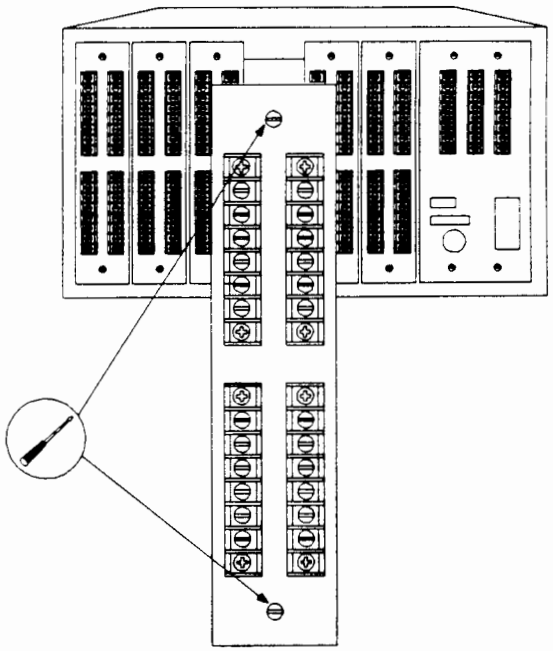


5 Signal Input Relay Module (Dual Relay)

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.



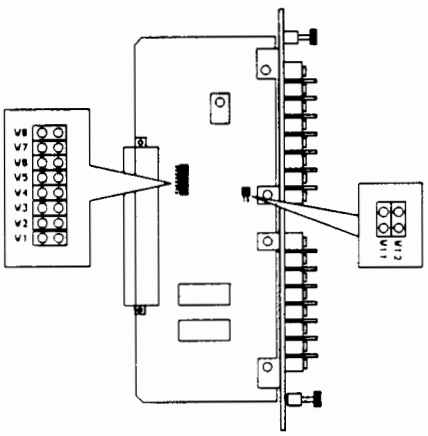
The Signal Input Relay Module is on the back of the rack. For relay configuration, see Installation Manual. For field wiring, see Section 15 (Field Wiring Diagrams).

Module Removal

Loosen two screws and remove the module.

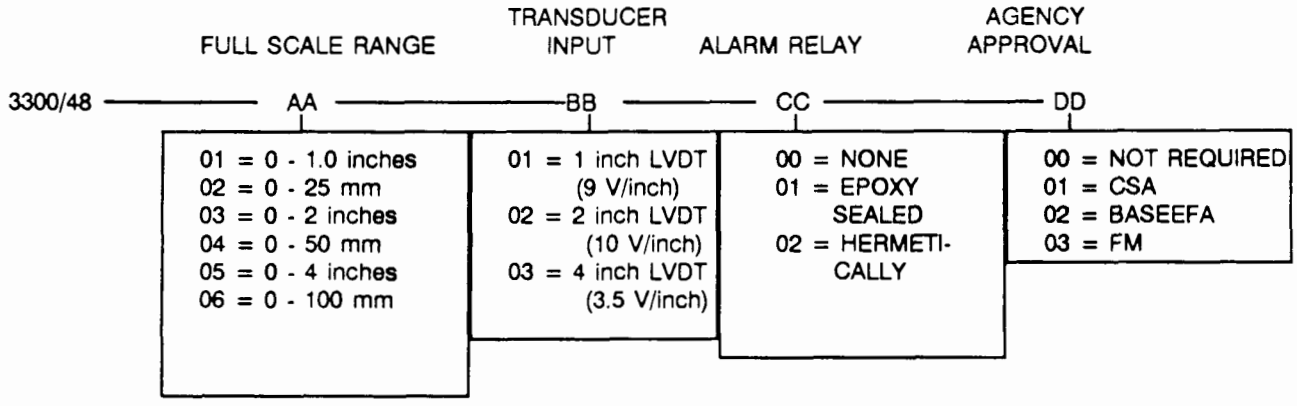
Module Options

Alert Relay	Jumper In	Jumper Out
Normally Energized	W3	W4,W11
Normally De-energized	W4,W11	W3
Danger Relay	**Jumper In**	**Jumper Out**
Normally Energized	W2	W1,W12
Normally De-energized	W1,W12	W2



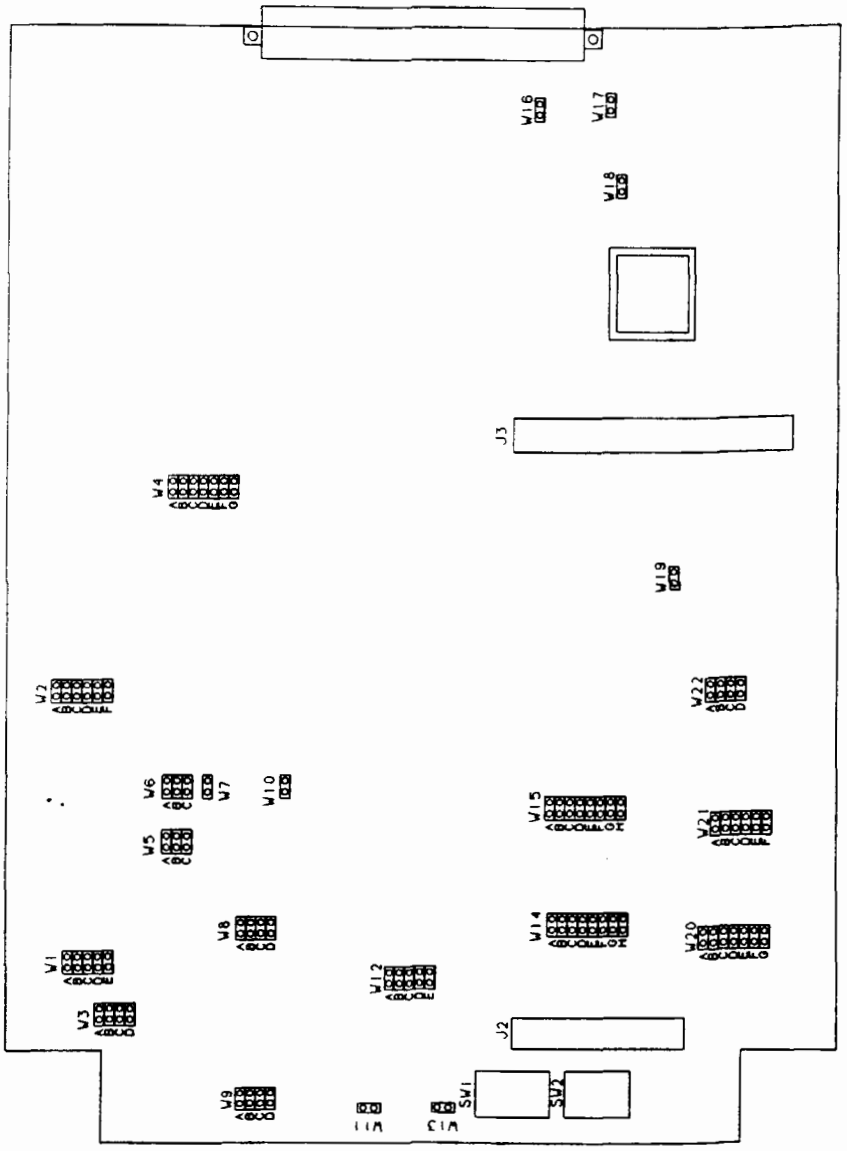
6 MONITOR OPTIONS

CASE EXPANSION
MONITOR PART NUMBER



6 Monitor Options [Cont]

The Case Expansion Monitor has several user-programmable options. The options can be changed by removing and installing jumpers on the printed circuit boards.



Jumper Locations on the Main Circuit Board

6 Monitor Options [Cont]

Main Board Option Settings

All monitor option jumpers for the Case Expansion Monitor are on the Main Board. Table 1 shows these options and their jumper positions.

Table 1 Option Settings on Main Board

Option	Setting	Jumper Install	Jumper Remove
First Out	Enabled *	W14D	----------
	Disabled	----------	W14D
Not OK Mode	Latching	W15G	W21E
	Non-Latching *	----------	W15G
Alert Mode	Latching *	W14E	----------
	Non-Latching	----------	W14E
Danger Mode	Latching *	W14F	----------
	Non-Latching	----------	W14F
Danger Bypass Switch	Enabled	W12A	----------
	Disabled *	----------	W12A
Not Ok Channel Defeat	Enabled	W21E	W15G
	Disabled *	----------	W21E
Alarm Delay	0.1 Seconds	----------	W14A,B
	1 Seconds	W14B	W14A
	3 Seconds *	W14A	W14B
	6 Seconds	W14A,B	----------
Display Update	Slow	W21B	----------
	Fast *	----------	W21B
Channel B **	Off	W21F	----------
	On *	----------	W21F

* Options as shipped from factory

** When channel B is turned off, the monitor is a single channel indicator only.

6 Monitor Options [Cont]

Table 1 [continued]

Option	Setting	Jumper Install	Jumper Remove
Upscale Channel A	Toward Transducer *	W12C	----------
	Away from Transducer	----------	W12C
Upscale Channel B	Toward Probe *	W12B	----------
	Away from Probe	----------	W12B

Note : Both channels must be configured in the same direction. An error code 22 will occur if both channels are not configured the same. See section 15.

Recorder Output Options

To set the recorder output, remove all jumpers from headers W1A-E, W2A-E, W3A-D, W5A-C, W6A-C, W8A-D, W9A-D, W14G AND W14H. 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	W1B,C,E	W1A,D	W1A,D
	W2B,C,E	W2A,D	W2A,D
	W3A,D	W3A,D	W3B,C
	W5A	W5C	W5B
	W6A	W6C	W6B
	W8B,C	W8D	W8A
	W9B,C	W9D	W9A
		W14H	W14G

* Options as shipped from factory

Option	Setting	Jumper Install	Jumper Remove
Recorder Mode	Differential *	W12E	----------
	Direct	----------	W12E

6 Monitor Options [Cont]

Transducer Type Options

To set the monitor up for the correct transducer type, remove all jumpers from headers W22A-D, W21C and D, W4A-F, W16 and W17. Install jumpers specified in Table 3.

Table 3. Transducer Type Options

Transducer Type	Install Jumpers
1 Inch LVDT, 9 V/Inch	W4C,F, W22B,D, W21C,D
2 Inch LVDT, 10 V/Inch	W4C,F, W22B,C, W21C,D
4 Inch LVDT, 3.5 V/Inch	W4C,F, W22B,C,D, W21C,D

Note : Changing the transducer type option requires re-calibration of both channels. See section 13.

Full Scale Range Options

To set the monitor full scale range option, remove jumpers W15A-E. Install jumpers specified in Table 4.

Table 4. Full Scale Range Options

Full Scale Range	Install Jumpers
0 - 1.0 Inches *	W15D,E
0 - 25 mm *	W15C,E
0 - 2.0 Inches **	W15C,D,E
0 - 50mm **	W15B,E
0 - 4.0 Inches ***	W15B,D,E
0 - 100 mm ***	W15B,C,E

Note : Changing the full scale range requires re-calibration of both channels. See section 13.

* Requires 1 Inch LVDT
** Requires 2 Inch LVDT
*** Requires 4 Inch LVDT

7 Meter Scale Replacement

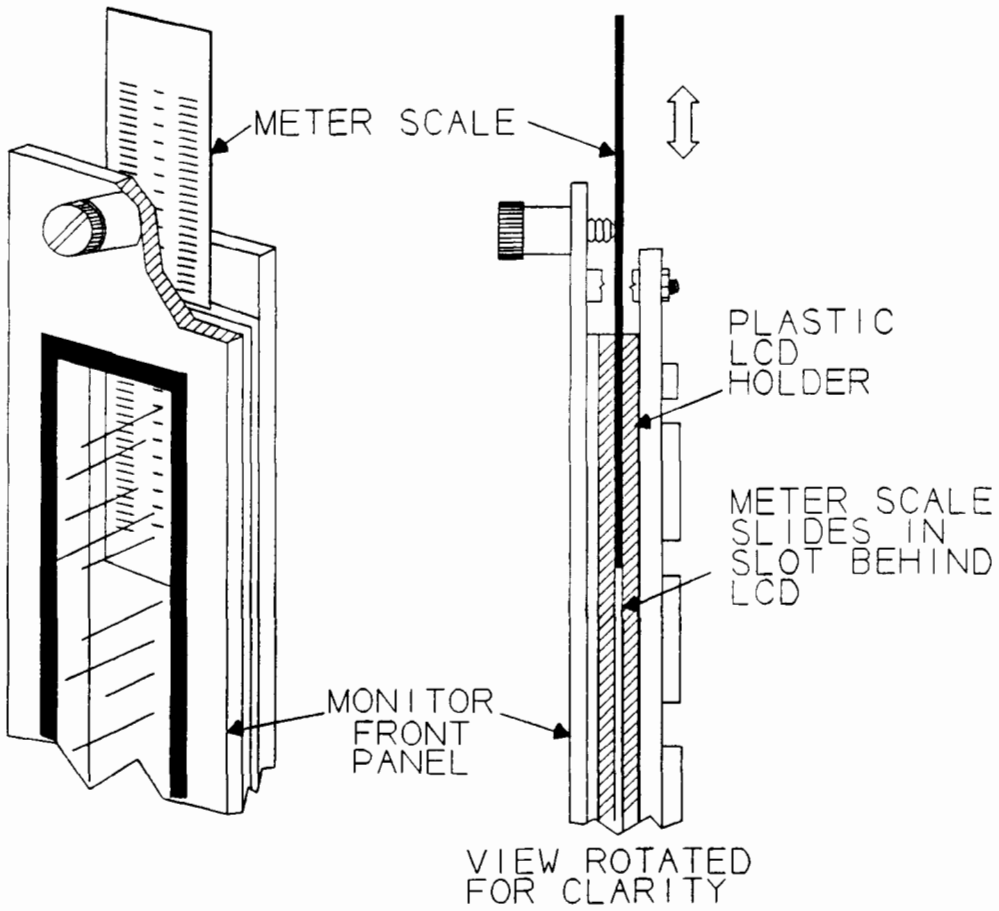
The Monitor meter scales can be replaced for operation with different full scale ranges. The replacement meter scales are located in the back of this manual.

To replace a meter scale :

1. Set the monitor full scale range. (See section 6. Monitor Options)

2. 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.

3.Insert the meter scale in the front panel.

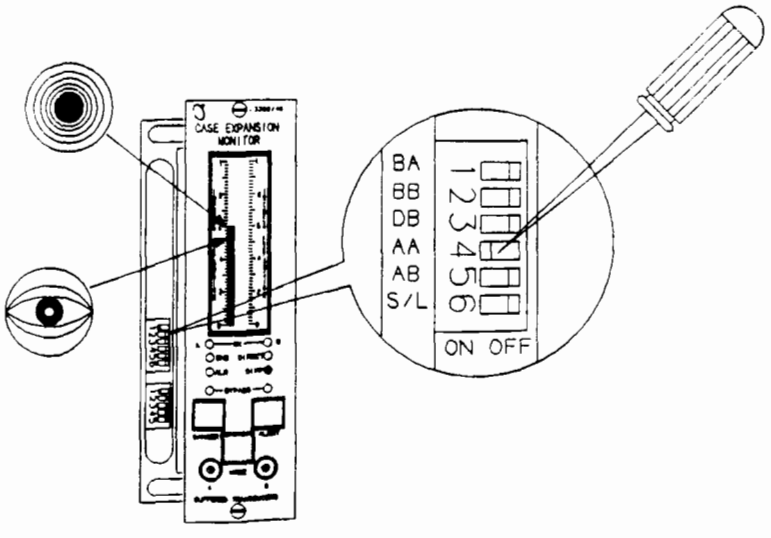


8 Alarm Setpoint Adjust

The 3300 Case Expansion Monitor has alarm setpoints for the differential values only. The alarm setpoints are adjusted on the left side of the display. To adjust the differential alarm setpoints, use the following procedure.

1. Open front panel.

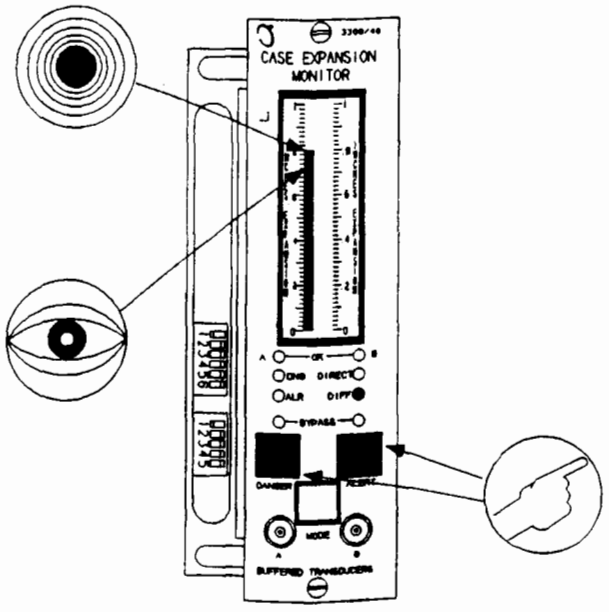
2. Set switch AA (Adjust Alarms) to the left (ON). The bar graph will start flashing.



3. To adjust ALERT or DANGER set points, press and hold ALERT or DANGER switch on the front panel.

4. Use the (↑) or (↓) switches on the System Monitor to adjust the setpoint level up or down.

5. Reset AA to the right (OFF); close front panel.



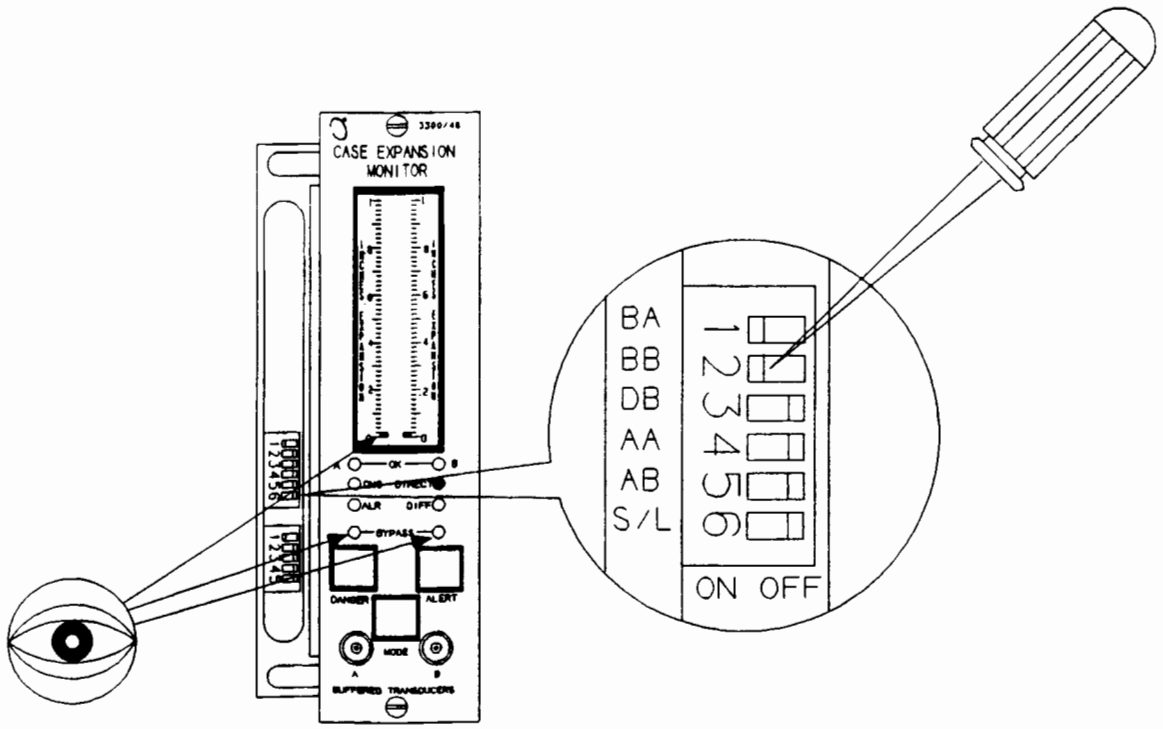
9 Bypass Monitor Channel

Set **BA** (Bypass Channel A) or **BB** (Bypass channel B) switch to the left (ON). The corresponding Bypass LED goes on, the OK LED goes off, and the Case Expansion reading is clamped to Zero. If either monitor channel is bypassed, the differential alarming is disabled. If the monitor is in the Differential mode, the display will go blank. The monitor must have two non-bypassed, OK transducers to display a differential value on the bar graph.

CAUTION

Machine Protection will be lost while Channel Bypass is on.

NOTE
When Channel Bypass is switched on, channel alarms are cleared.



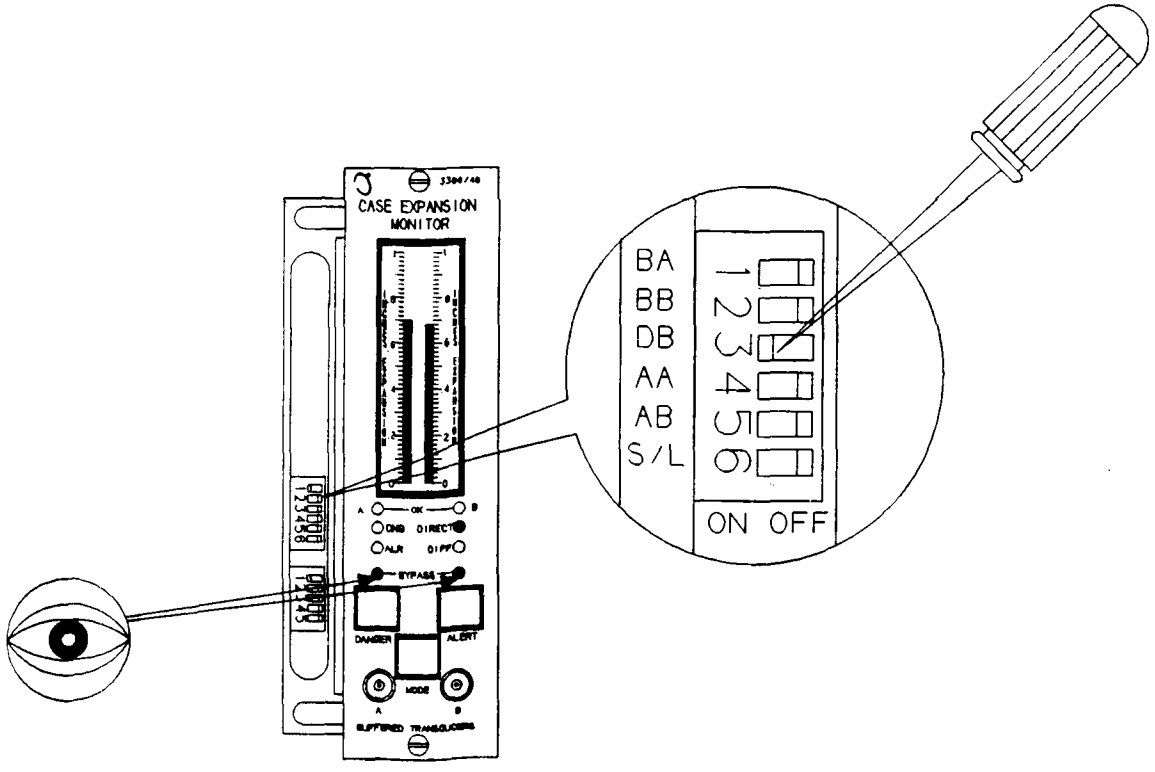
NOTE
When Channel Bypass is turned off, a ten second settling time is added to the alarm time delay.

10 Danger Bypass

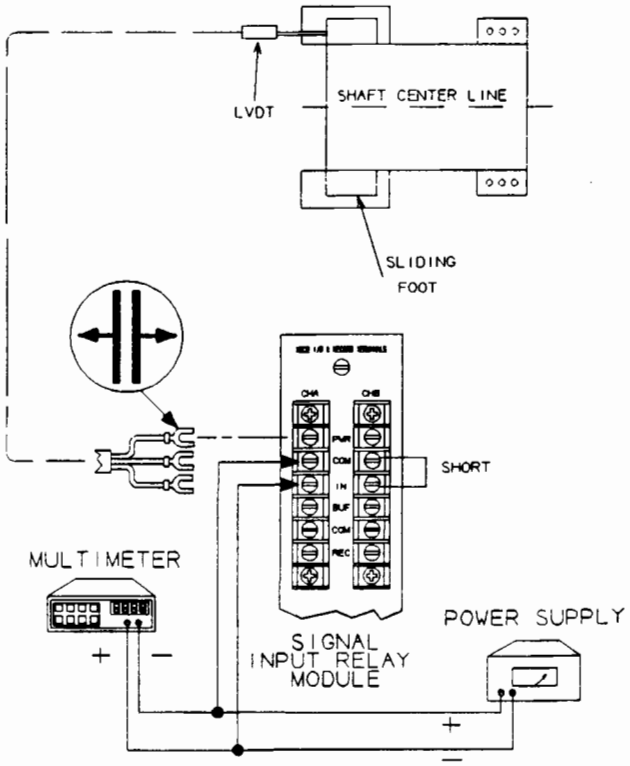
Set DB (Danger Bypass) switch to the left (ON). Both channel Bypass LEDs go on. The Danger alarm LEDs on the front panel can go on but the danger relay drive will not be activated if a Danger Setpoint is exceeded.

CAUTION

Machine Protection will be lost while Danger Bypass is on.



11 Test Channel Alarms



CAUTION

Tests will exceed alarm setpoint levels causing alarms to activate. This could result in relay contact to change state. See Danger Bypass section 10.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

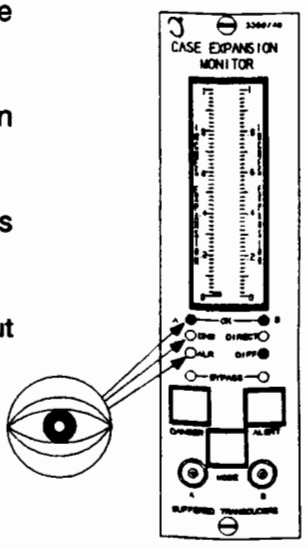
Note : The DC LVDT transducer outputs can swing both positive and negative. In order to simulate a bi-polar transducer swing it will sometimes be necessary to reverse the polarity of the power supply by swapping the test leads. Also, Alert and Danger alarms must be set below mid-scale for this test.

1. Disconnect COM and IN wiring from the channel A terminals on the Signal Input Relay Module.

2. Connect the multimeter and the power supply to channel A as shown.

3. Adjust the voltage for Zero (0.0) Vdc. Use the mode switch to put the monitor in the DIFF mode.

4. Press the RESET switch and verify the OK LEDs are on, and the ALERT and DANGER LEDs are off.

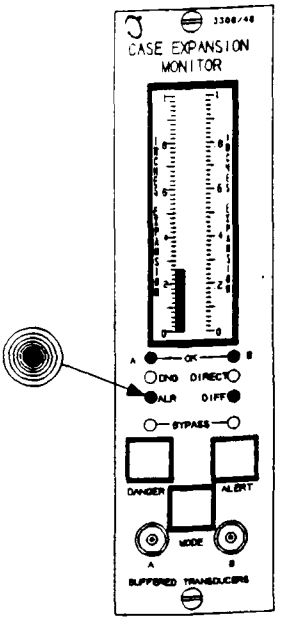


11 Test Channel Alarms

5. Adjust the power supply voltage past the alert setpoint level and verify that the ALERT LED goes on (Flashing if the first out option is selected). It may be necessary to switch the polarity at the power supply to exceed the setpoint.

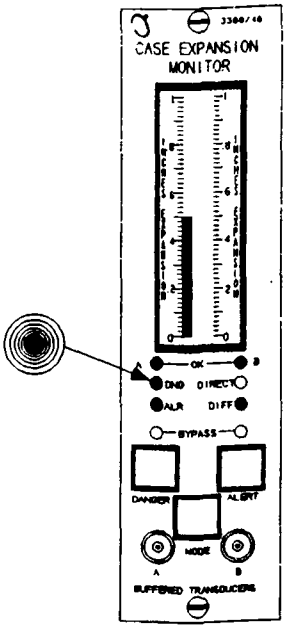
6. Verify that the ALERT RELAY changed state.

7. Press the RESET switch on the system monitor and verify that the ALERT LED remains on steady.



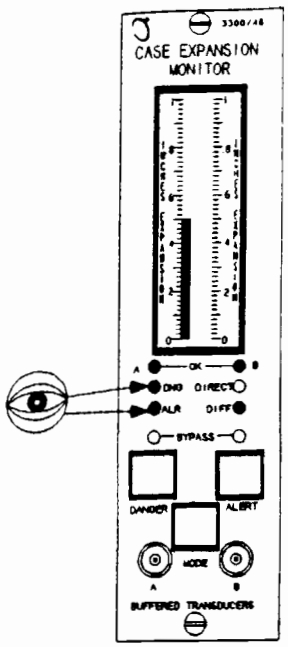
8. Adjust the power supply voltage past the DANGER setpoint level and verify that the DANGER LED goes on (Flashing if first out option is selected).

9. Verify that the DANGER Relay changed state. If DANGER "AND" voting logic is selected, the relay will not change states until both channels exceed their DANGER setpoints. "AND" voting is not active if either channel is bypassed; Also, the Relay will not change states if the Danger Bypass is on.



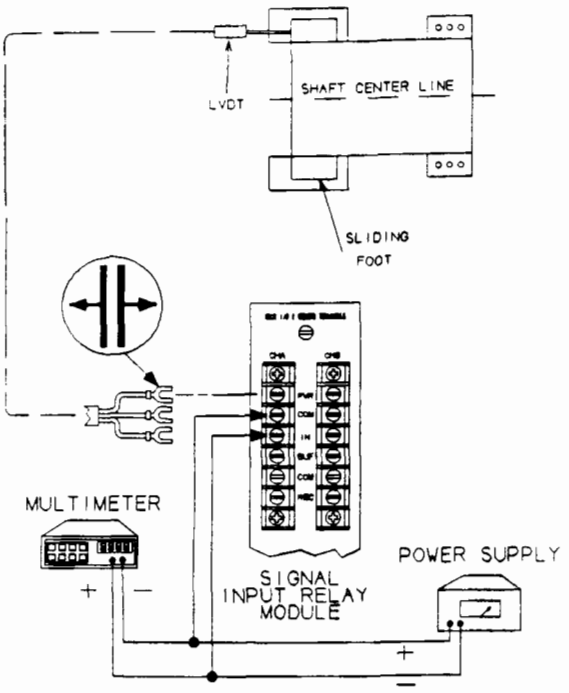
11 Test Channel Alarms [Cont]

10. Press RESET switch on system monitor. Verify that ALERT and DANGER LEDs remain on and steady.



11. Reduce the power supply voltage to below the alarm set points and observe that the ALERT and DANGER LEDs go off (if non-latching alarm jumper is installed). Press RESET switch on system monitor to reset latching alarms.

12 Test OK Limits



CAUTION

Tests will exceed alarm set point levels causing alarms to activate. This could result in relay contact to change state. See Danger Bypass section 10.

⚠ WARNING

High Voltage present Could cause shock, burns or death.

Do Not touch exposed wires or terminals.

1. Disconnect COM and IN wiring from the channel A terminals on the Signal Input Relay Module.

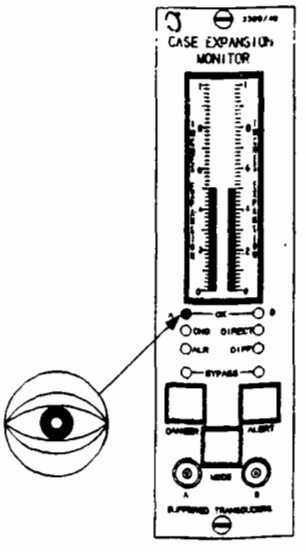
2. Connect the multimeter and the power supply.

3. Adjust the power supply voltage for Zero Vdc.

4. Verify that the Channel A OK LED is on.

5. Increase the power supply voltage in the negative direction until the OK LED goes off (upper limit). Verify that the upper OK limit is within the limits specified in Table 5.

6. Verify that the OK relay changes state (de-energized). Note : all other channels in the rack must be OK or bypassed in order for the relay to change states.



12 Test OK Limits [Cont]

7. Adjust the power supply to Zero Vdc. Verify that the OK LED comes back on and the OK relay energizes (if non-latching OK mode is selected). Press RESET switch on the system monitor to reset latching OKs.

8. Reverse the polarity of the power supply by switching the leads. Gradually increase the power supply voltage until the OK LED turns off (Lower Limit). Verify that the Lower OK Limit is within the limits specified in table 5.

9. Verify that the OK relay de-energizes.

10. When finished, disconnect the power supply and multimeter and reconnect **COM** and **IN** wiring to the channel A terminals on the Signal Input Relay Module. Verify that the OK LED comes on and the OK relay energizes (if non-latching OK mode is selected). Press RESET switch on the system monitor to reset latching OKs.

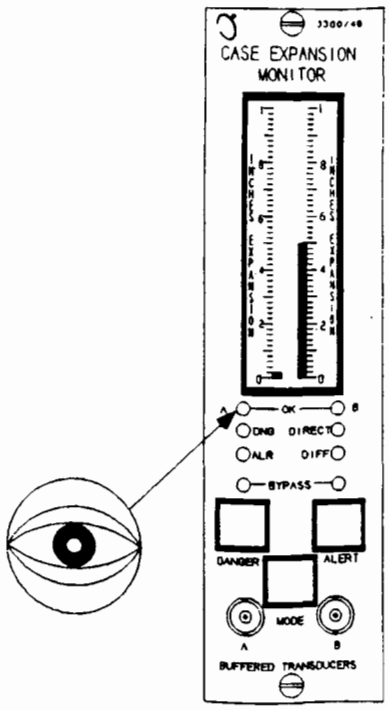
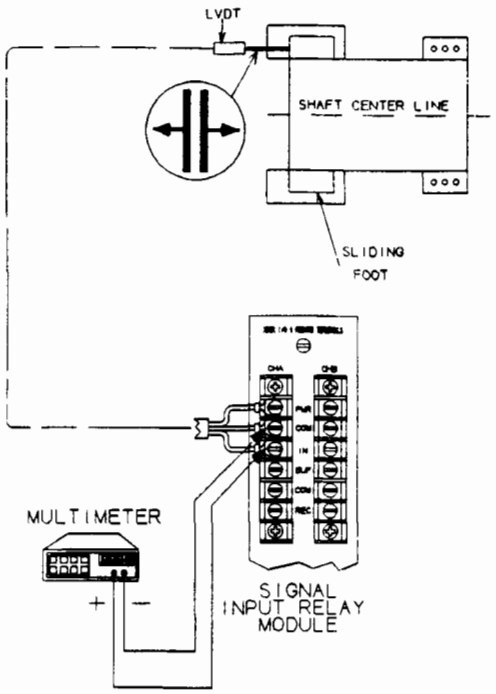


Table 5

Transducer	Lower OK Limit	Upper OK Limit
1 Inch LVDT	-5.65 to -6.05 Vdc	+5.65 to +6.05 Vdc
2 Inch LVDT	-12.80 to -13.20 Vdc	+12.80 to +13.20 Vdc
4 Inch LVDT	-8.90 to -9.30 Vdc	+8.90 to +9.30 Vdc

13 Calibrate Channels

Figure 1



CAUTION

Both channels will be bypassed automatically during calibration. Machine Protection will be lost during calibration. See Danger Bypass section 10.

⚠WARNING

High Voltage present Could cause shock, burns or death.

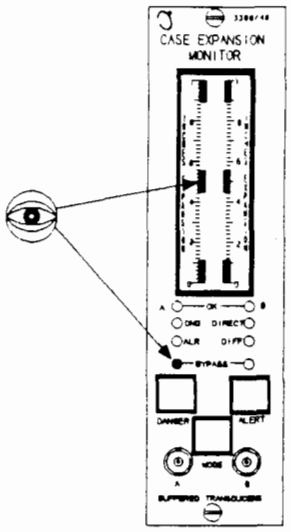
Do Not touch exposed wires or terminals.

Since the transducer sensitivity can vary as much as ± 20%, It is necessary to perform the channel calibration with the actual transducer to be used with that channel. The user may construct a gauging tool, if desired, to aid in accurately adjusting the LVDT core position during calibration.

1. Loosen and adjust the LVDT or core mounting components such that the core position can be adjusted manually throughout the entire indicator expansion measurement range.
2. Connect a multimeter to **COM** and **IN** with polarity as shown in Figure 1.
3. Open front panel.

13 Calibrate Channels [Cont]

4. Short calibration terminals (CA) using a clip lead (a jumper may be used if the monitor is on an extender card). A test pattern will appear on the display when the Calibration terminals are shorted and no Calibration switches are set. Both Bypass lights will come on.

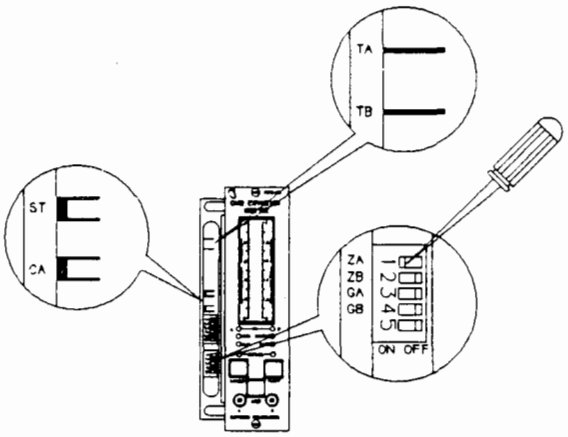


5. Manually adjust the core position until the Digital Multimeter displays 0.00 Vdc.

6. Move the core of the LVDT as follows:
   If the full scale expansion is toward the transducer, then move the core away from the transducer exactly half the full scale meter range. The transducer output voltage should be within the Zero range specified in Table 6 on page 24.

   If the full scale expansion is away from the transducer, then move the core toward the transducer exactly half the full scale meter range. The transducer output voltage should be within the Zero range specified in Table 6 on page 24.

7. Activate the channel A zero adjust dipswitch (ZA) by moving it to the left.Measure the voltage at Test Point channel A (TA) using the multimeter. Press the MODE switch and use the (↑) and (↓) switches on the system card to adjust the voltage at TA to get
   0.00 ± 0.03Vdc. Note the bypass light will indicate an under-range adjustment by flashing at a 5 Hz rate. If this happens back off the adjustment until the correct voltage is achieved and the bypass light is on steady.

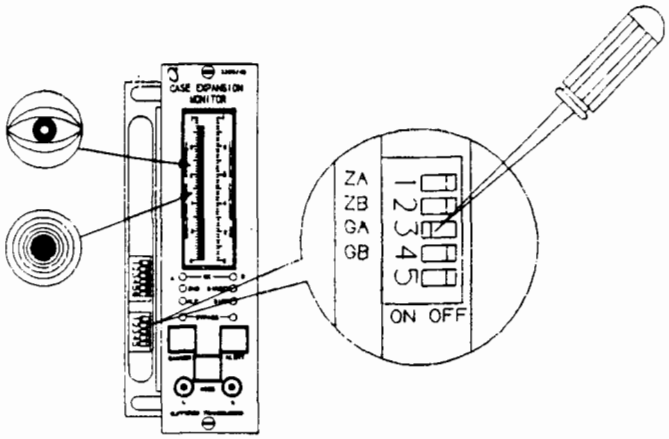


8. De-activate the channel A zero adjust dipswitch (ZA) by moving it to the right. If the short is removed from the Calibration terminals before the dipswitch is deactivated, the adjustment will not be stored.

13 Calibrate Channels [Cont]

9. Move the core exactly the total linear distance of the full scale meter range in the upscale direction (opposite of direction of movement in step 6). The transducer output should be within the range indicated if Table 6 on page 24.

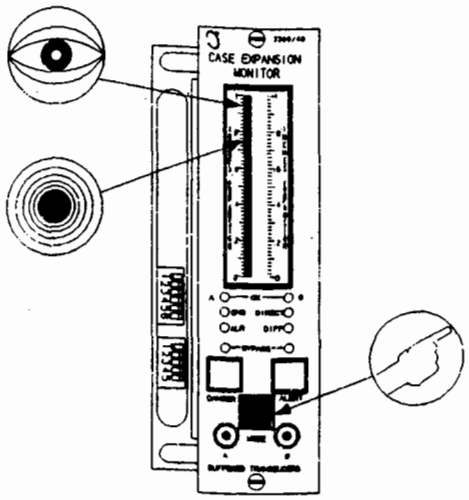
10. Activate the channel A gain adjust dipswitch (GA) by moving it to the left. The channel A bar graph will begin to flash. Measure the voltage at Test point channel A (TA) using the multimeter.



11. Press the MODE switch and use the system monitor (↑) and (↓) to adjust the gain until the Test point channel A (TA) is at +5.0 ±0.05 Vdc and the bypass LED is on steady (not flashing). The flashing bypass LED indicates an over-range condition. If this occurs, reduce the gain using the system monitor (↓) switch.

12. De-activate the channel A gain adjust switch (GA) by moving it to the right. If the short is removed from the Calibration terminals (CA) before the dipswitch is de-activated, the adjustment will not be stored.

13. Remove the clip lead (or jumper) from the Calibration terminals (CA).



14. After the monitor channel is calibrated, the case expansion transducer must be reinstalled and adjusted to indicate zero expansion when the machine case is cold.

13 Calibrate Channels [Cont]

Table 6

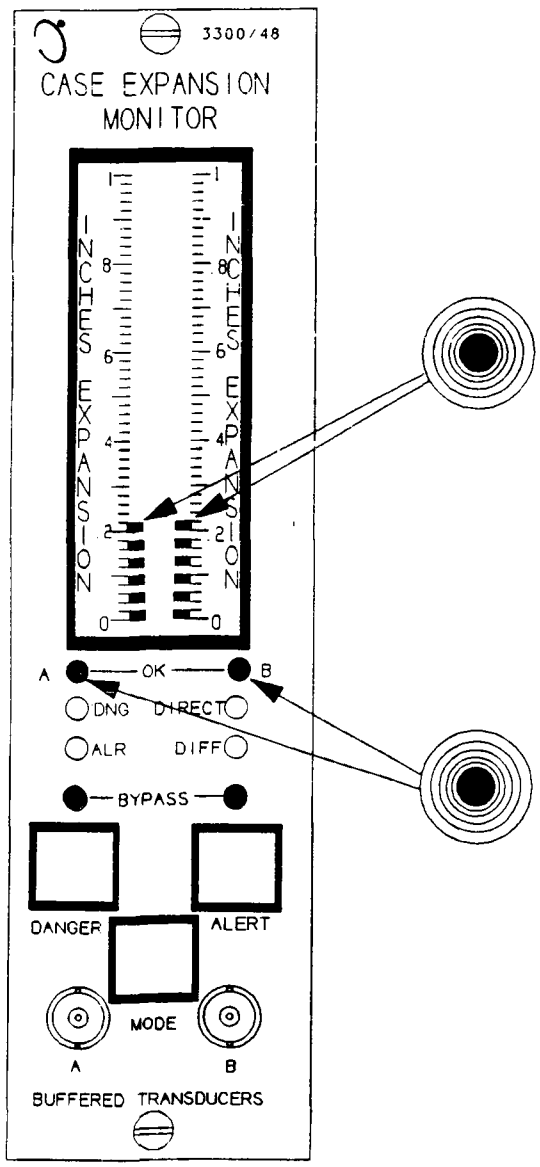
Transducer	Zero Voltage		Full Scale Voltage	
	Toward Transducer	Away from Transducer	Toward Transducer	Away from Transducer
1 Inch LVDT	-3.6 to -5.4 Vdc	+3.6 to +5.4 Vdc	+3.6 to +5.4 Vdc	-3.6 to -5.4 Vdc
2 Inch LVDT	-4.0 to -6.0 Vdc	+4.0 to +6.0 Vdc	+4.0 to +6.0 Vdc	-4.0 to -6.0 Vdc
4 Inch LVDT	-2.8 to -4.2 Vdc	+2.8 to +4.2 Vdc	+2.8 to +4.2 Vdc	-2.8 to -4.2 Vdc

Note : If upscale direction selected is toward transducer, use the zero and full scale values under the "Toward Transducer" columns.

If upscale direction selected is away from transducer, use the zero and full scale values under the "Away from Transducer" columns.

14 Self Test

The three levels of self tests are
- power-up - performed only when the monitor is turned on
- cyclic - continuously performed by the monitor
- user-invoked - performed only when initiated by the user.



The monitor on this page is giving a signal that a continuing error has been detected during a self test. When a continuing error is detected,

monitoring is stopped until the error is resolved,

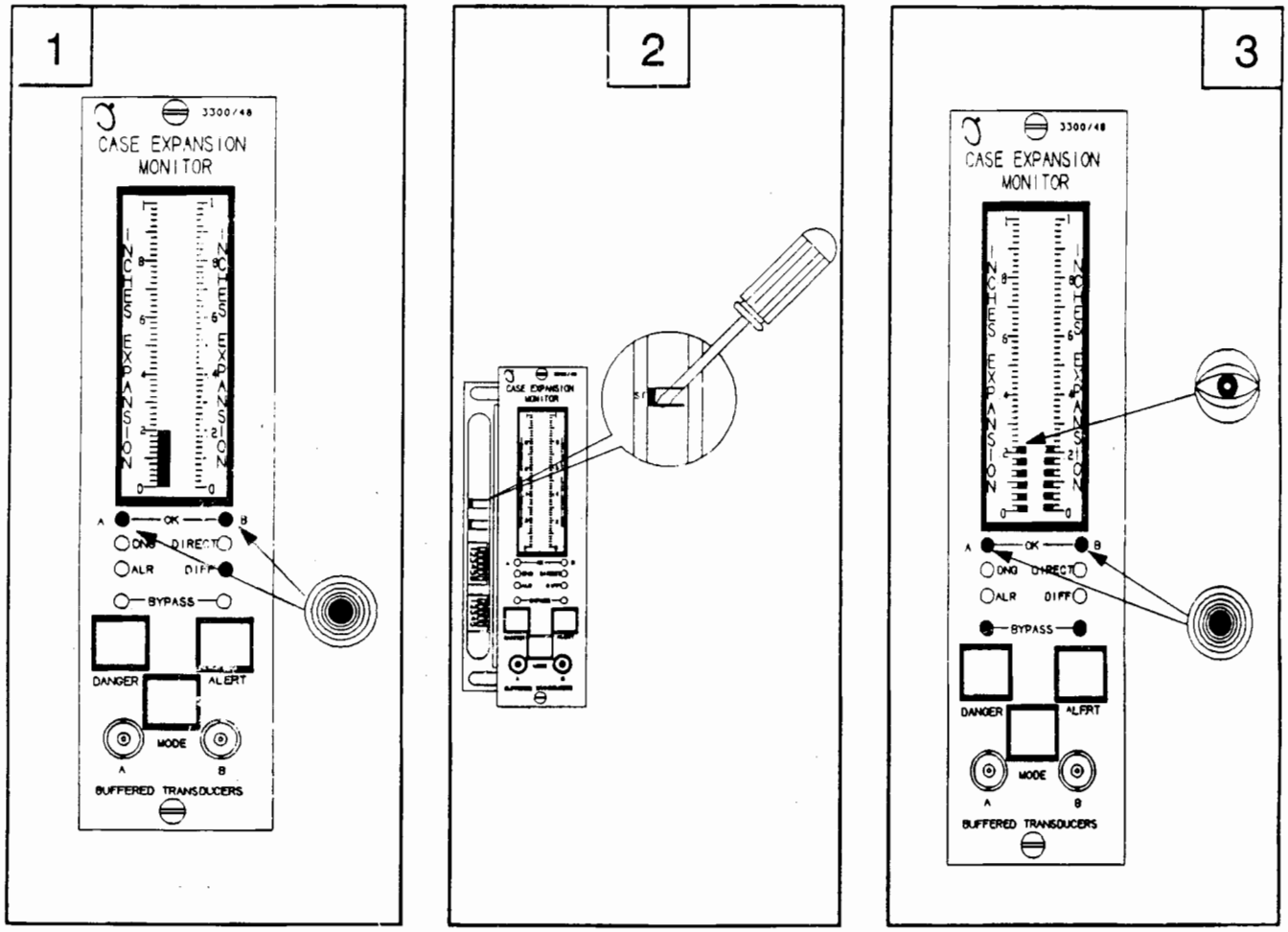
the error code is flashed on the LCD bar graph and stored in memory,

the Bypass LED comes on and the OK LED flashes at 5 Hz.

If the error goes away, monitoring is resumed and the OK LEDs flash at 5 Hz. The error code, however, remains stored in the monitor and may be read by using the user-invoked self test.

14 Self Test [Cont]

Follow these steps to read the error codes that have been stored in the monitor:



1

Flashing OK LEDs show that error codes are stored in the monitor.

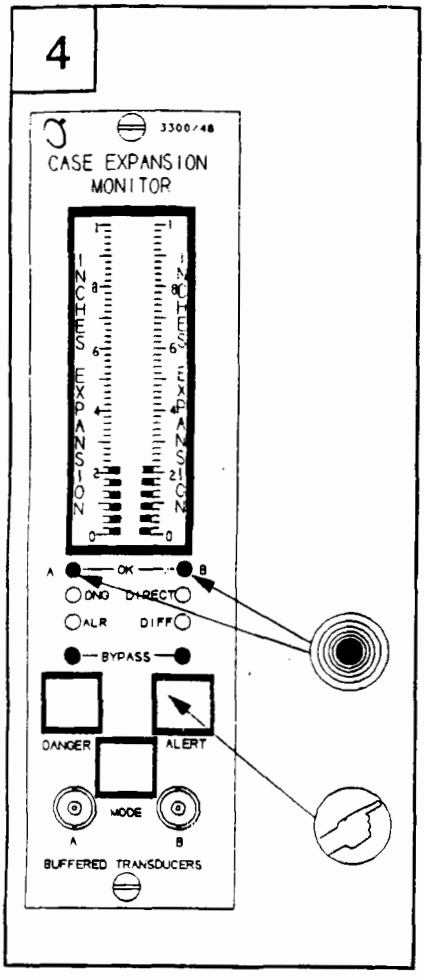
2

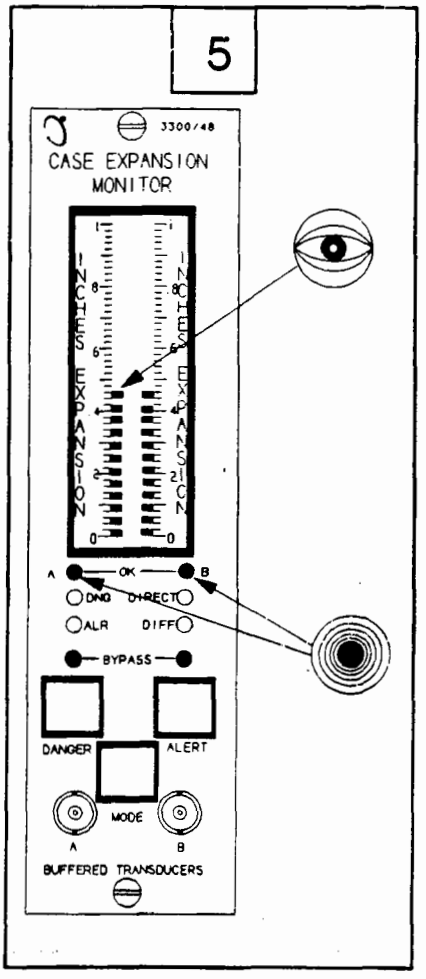
Initiate the user-invoked test by shorting across the self-test pins behind the panel. The self-test pins are labeled ST on the inner panel.

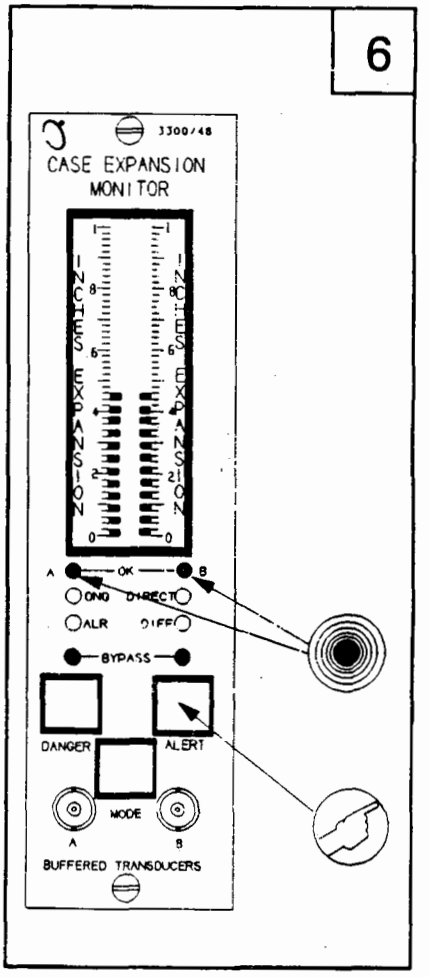
3

The first error code is displayed on the bar graph. Read the code by counting the number of bars on one side. Error code number 6 is displayed on this monitor.

14 Self Test [Cont]







4

Press and hold the ALERT switch for 1 second to toggle to the next error code.

5

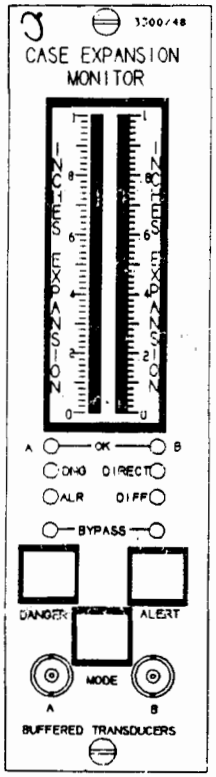
Read the second stored error code. This bar graph is displaying error code 12.

6

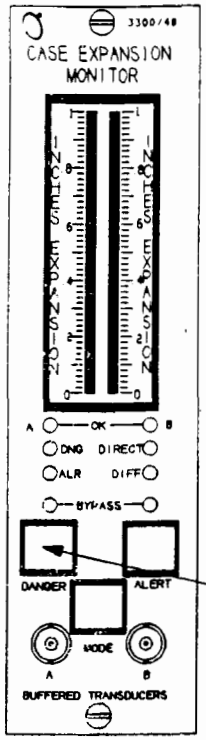
Read through all the other stored codes by pressing and holding the ALERT switch one second.

14 Self Test [Cont]

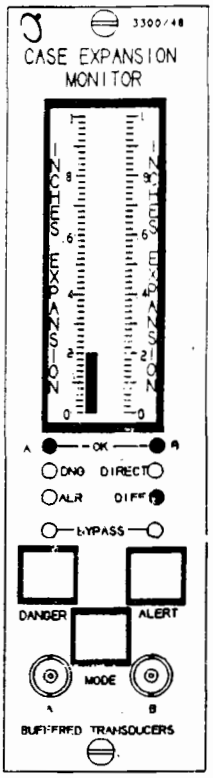
7



8



9



7

All codes have been read when the bar graph LCD comes on at full range of scale.

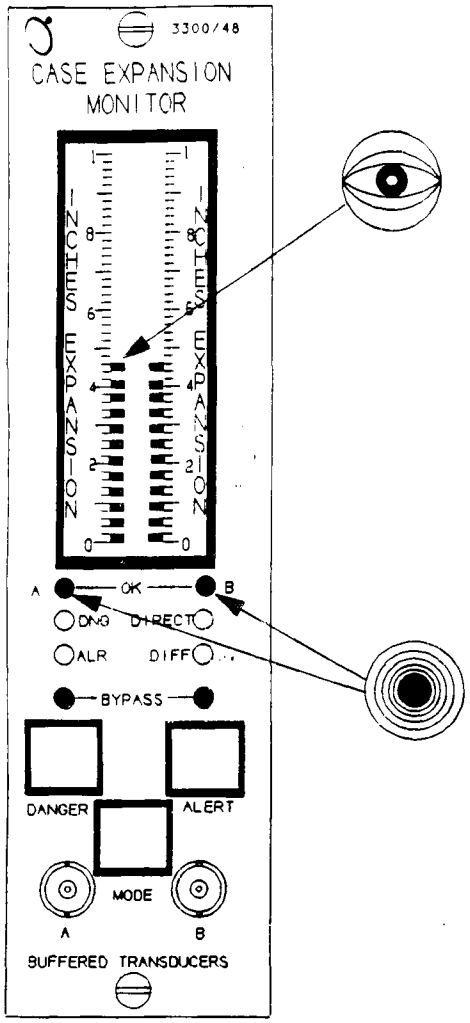
8

Press the DANGER switch to reset the monitor or Press the ALERT switch to reread the list.

9

After the monitor is reset, the error codes are removed from memory and the monitor begins operating again.

14 Self Test [Cont]



Error Code	Description
2	ROM CHECKSUM has failed. *
3	EEPROM failure number 1. **
4	EEPROM failure number 2. *** Adjust set points
5	+7.5V/-VT node out of tolerance. **
6	+VRH node out of tolerance. **
7	+5V node out of tolerance. **
8	MVREF node out of tolerance. **
9	+7.5V node out of tolerance. **
10	+VRL node out of tolerance. **
12	+5V/-7.5V node out of tolerance. **
14	RAM failure. *
17	COP Watchdog not configured.
18	+5V/-5V or +15V node out of tolerance. **
21	Incorrect switch or switch combination. ****
22	Incorrect jumper configuration. *

* Tested only at Power Up or User Invoked Self Test. This error is displayed on the front panel but is not stored in memory.

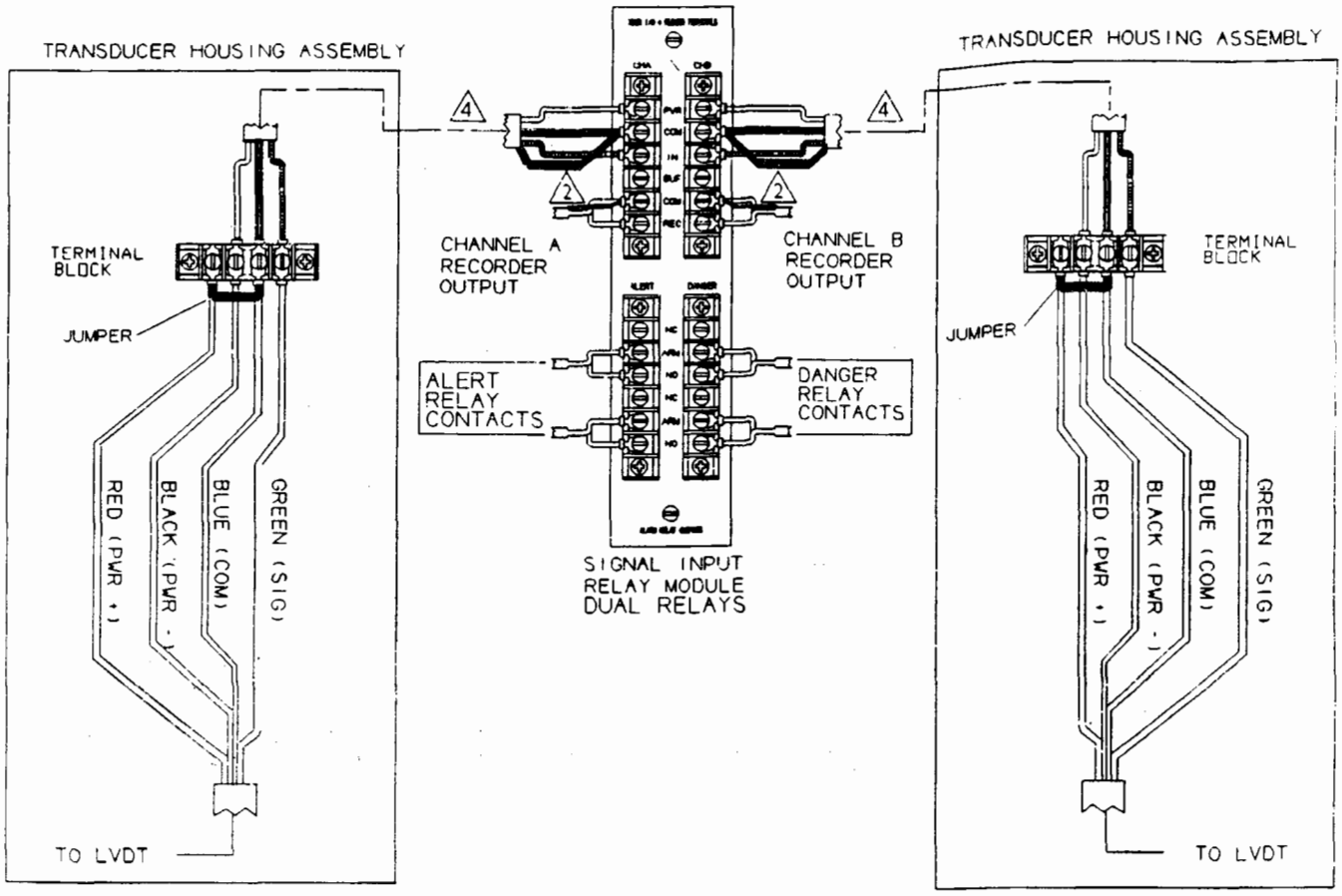
** Tested only at Cyclic Self Test. Errors 2, 3, and 14 are non-recoverable and errors 5 through 13 could be intermittent and recoverable.

*** Error 4 is a setpoint failure and may be corrected by adjusting all setpoints in the monitor.

**** Tested only when monitor is in calibration mode.

15 Field Wiring Diagram

3300/45 FIELD WIRING



1. Wiring Recommendations:

   a. Signal Module to LVDT, 18 to 22 AWG solid or stranded 3 - 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.

△2. Shields terminated to Signal Module Common.

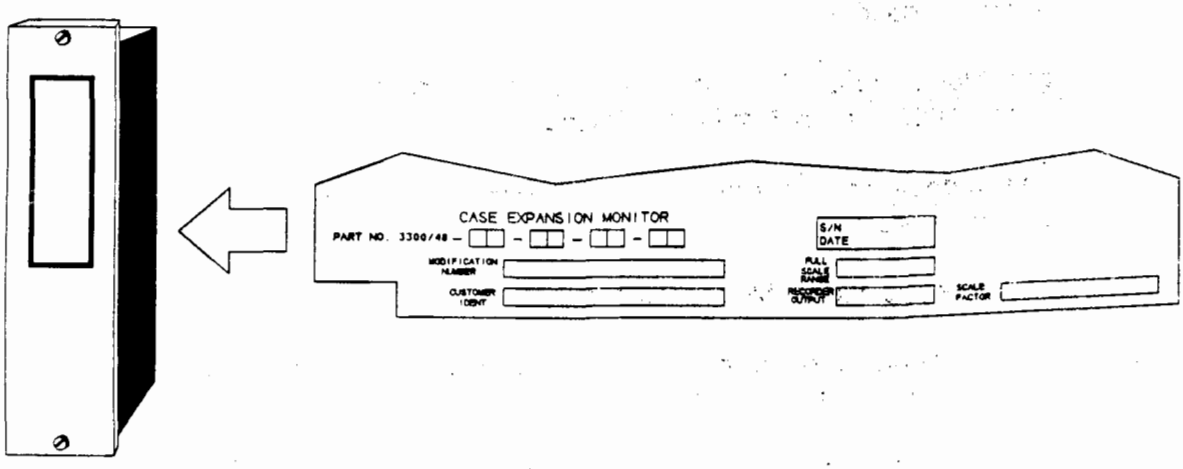
3. To minimize ground loop noise problems, a single point earth ground (GND) to system common (COM) connection is recommended.

△4. Maximum cable length between Signal Input Relay Module and LVDT must not exceed 1000 feet (305 metres).

16 Recommended Spare Parts

Qty	Description	Part Number
	Case Expansion Monitor	3300/48 - ☐☐ - ☐☐ - ☐☐ - ☐☐
1	Front Panel PWA Assembly	84132-01
1	Monitor Circuit Assembly	82803-01
1	Expander Board PWA	81410-01
1	Signal Input Relay Module	
	No Relays	81544-01 ☐0☐0
	Epoxy Sealed Relays	81545-01 ☐0☐1
	Hermetically Sealed Relays	81546-01 ☐0☐2

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 7 of this manual). If in doubt about the part number, call your Bently Nevada Corporation representative before ordering.



17 Specifications

INPUTS

Signal Inputs:	Two channels LVDT input, 230K Ohm input impedance.
Signal Scale Factors:	9V/inch (0.35V/mm) - 1 Inch LVDT 10V/inch (0.39V/mm) - 2 Inch LVDT 3.5V/inch (0.14V/mm) - 4 Inch LVDT

SIGNAL CONDITIONING

Monitor Range:	Full scale meter range selected per Option Table.
Accuracy:	± 0.33% of full scale error typical at +77°F (+25°C). ± 1% of full scale error maximum at +77°F (+25°C).

ALARMS

Alarm Set Points:	Alert/Danger alarm levels (adjustable from 0 to 100% of full scale).
Alarm Delay:	Alarm delay times are user-programmable per options.

DISPLAYS

Meter:	LCD bar graph, dual scale with outside scales marked per monitor full scale range. Bargraph resolution is 1.6% of full scale.
LEDs:	Green LEDs annunciate transducer OK condition and monitor mode, red LEDs annunciate DANGER alarm, ALERT alarm, and BYPASS conditions.

CONTROLS

Front Panel:	Front panel switches (3) for reading ALERT and DANGER setpoint levels, and MODE for changing between direct and differential modes.
Internal:	Switches on circuit board for setpoint adjustment, Danger Bypass, Channel Bypass, and Calibration functions.
External:	External remote controls: Reset, Inhibit, and SetPoint and Calibration Adjust (↑ and ↓).

OUTPUT

Recorder:	Output proportional to selected 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 Power:	-24 Vdc or -18 Vdc per option selected in power supply. Output is short circuit protected.
Alarms and OK:	Relay drives for ALERT, DANGER, and system OK.

17 Specifications [Cont]

RELAY CONTACT RATINGS

Dual Relays:	5 A @ 120 Vac 50/60 Hz. 5 A @ 28 Vdc.

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%, non-condensing.

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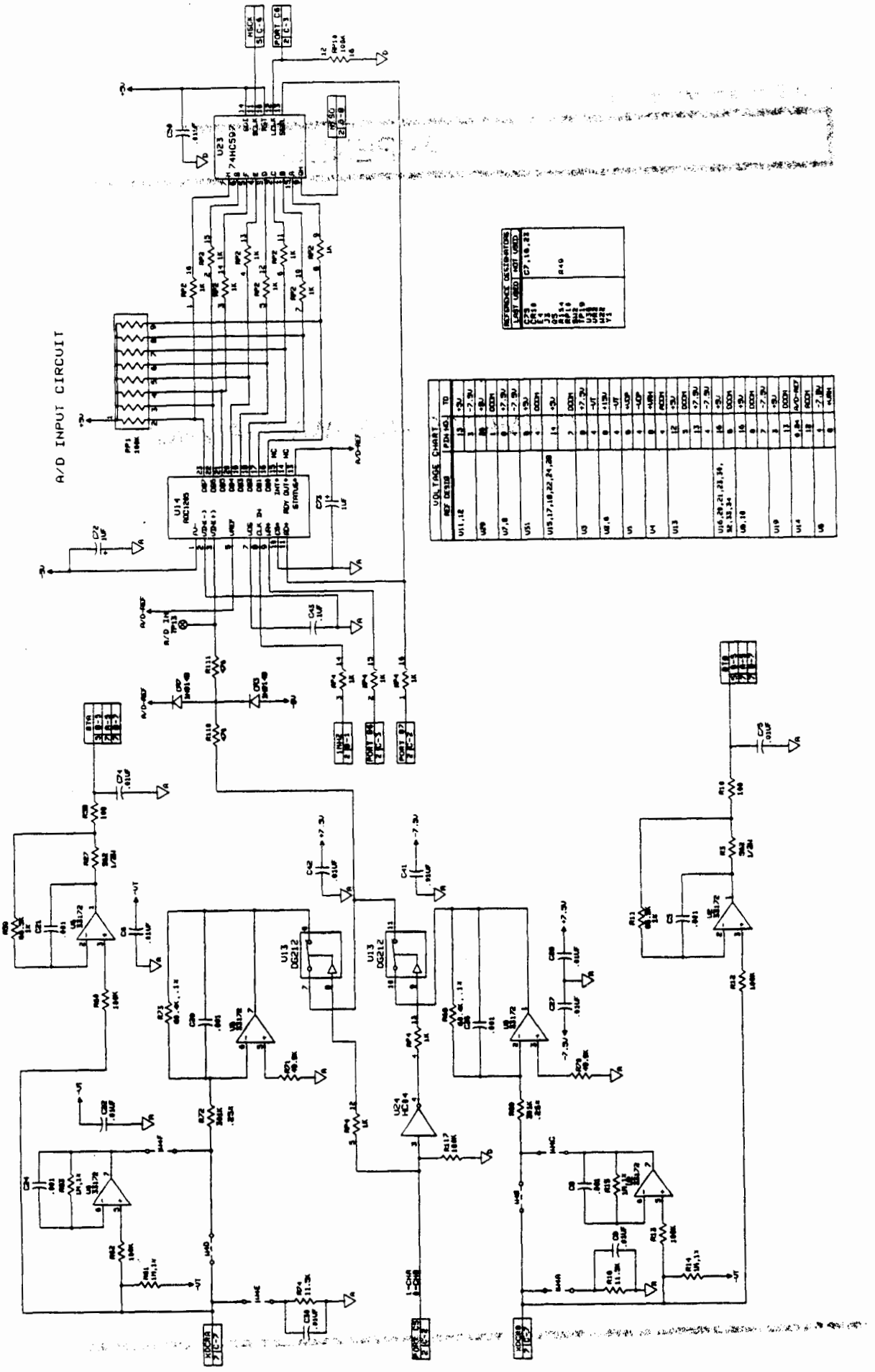
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Alarm Delay 10
Alert 2
Alert Alarm 2
Alert Mode 10
Alert Relay 6,7
Alert Setpoints 2
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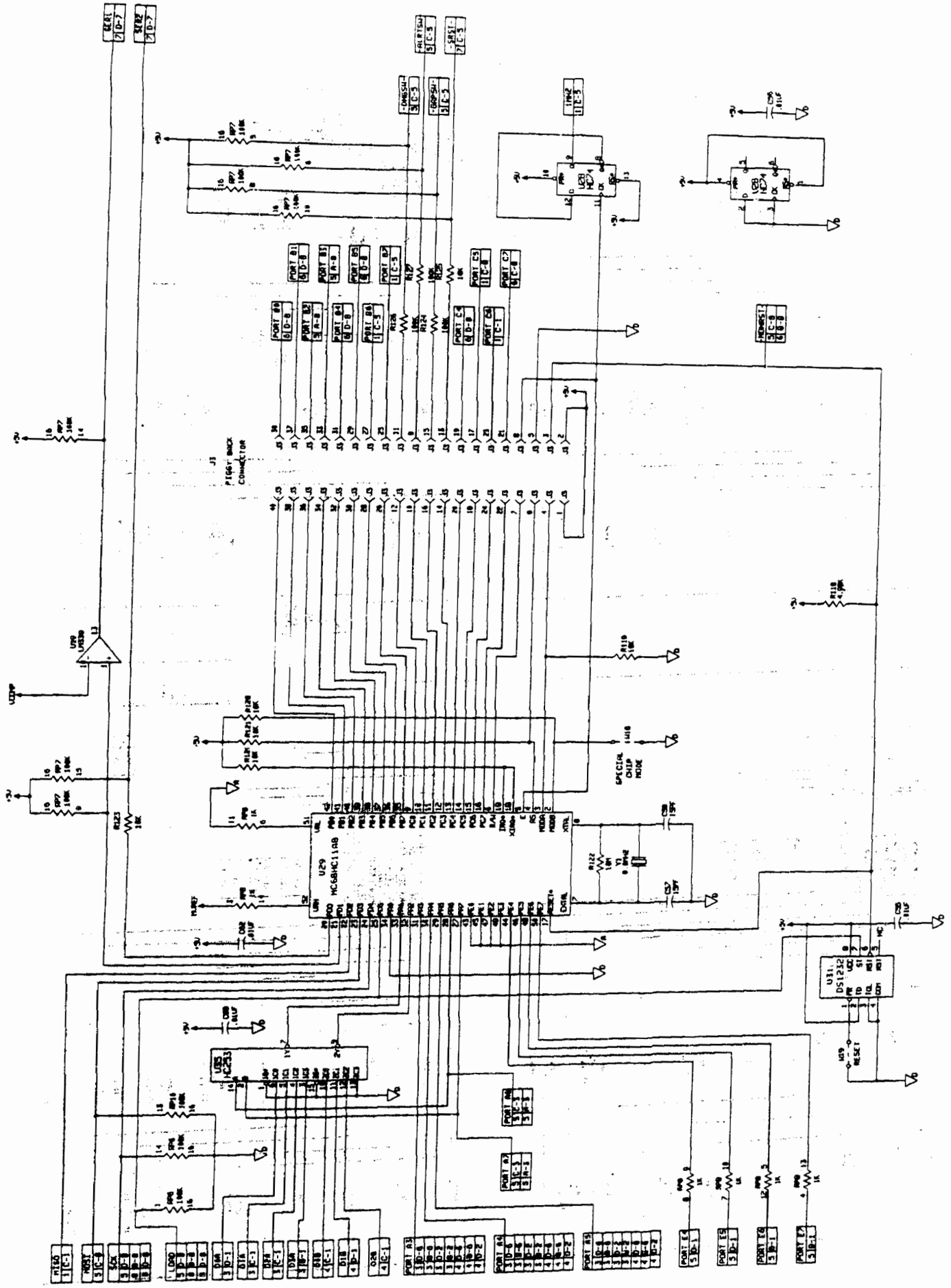
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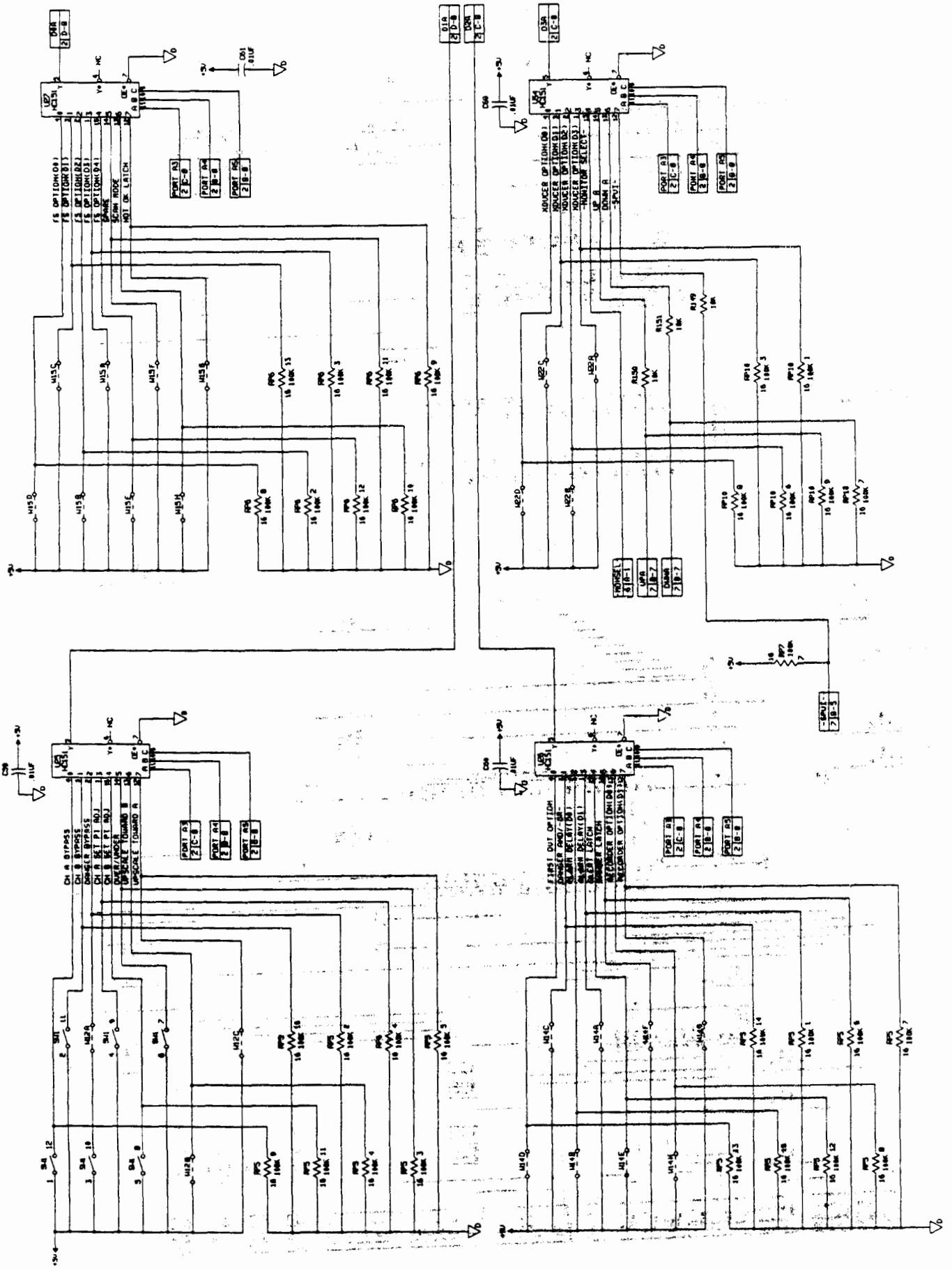
SCHEMATICS AND PWA DRAWINGS



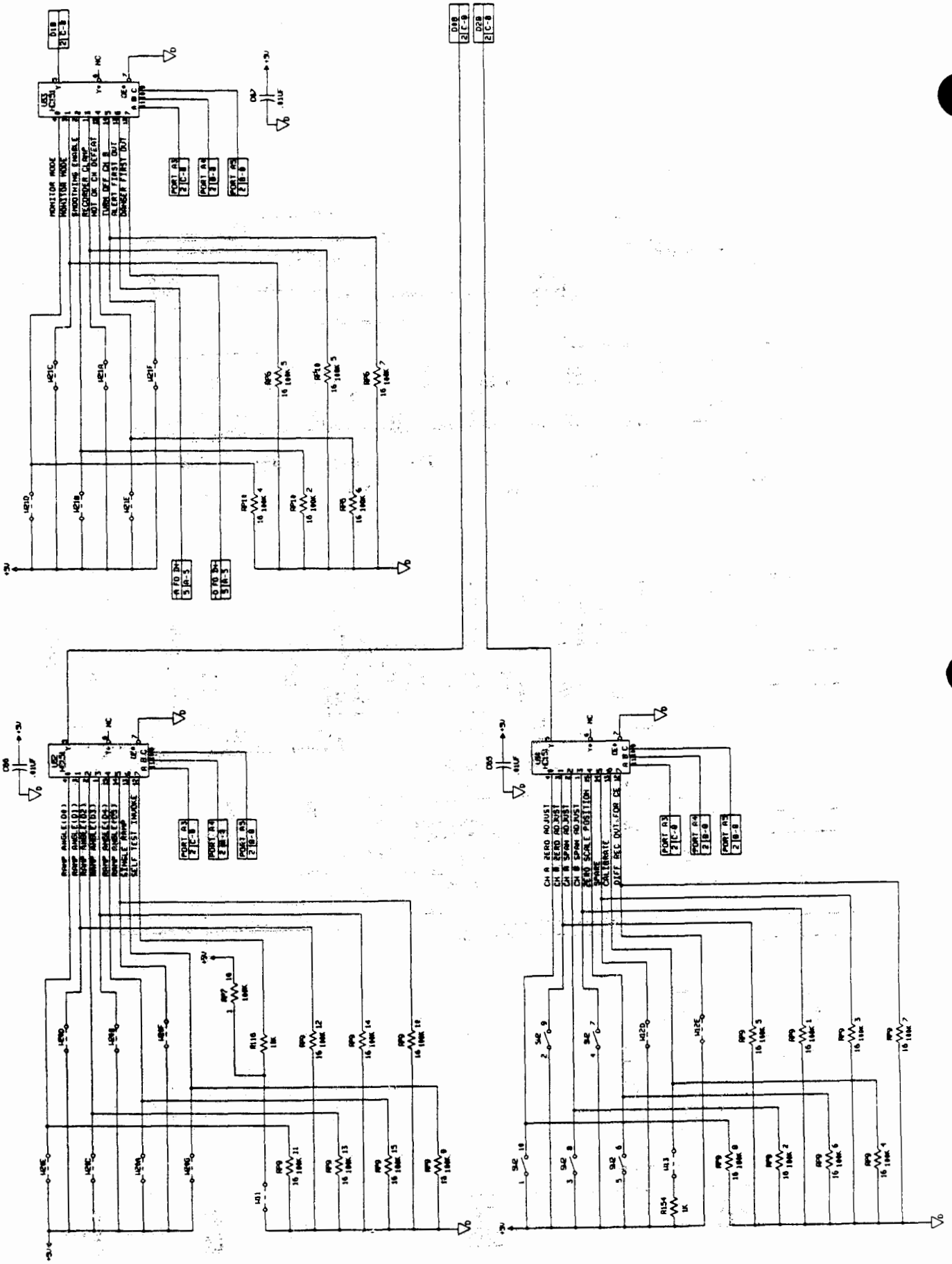
Case Expansion Monitor Schematic
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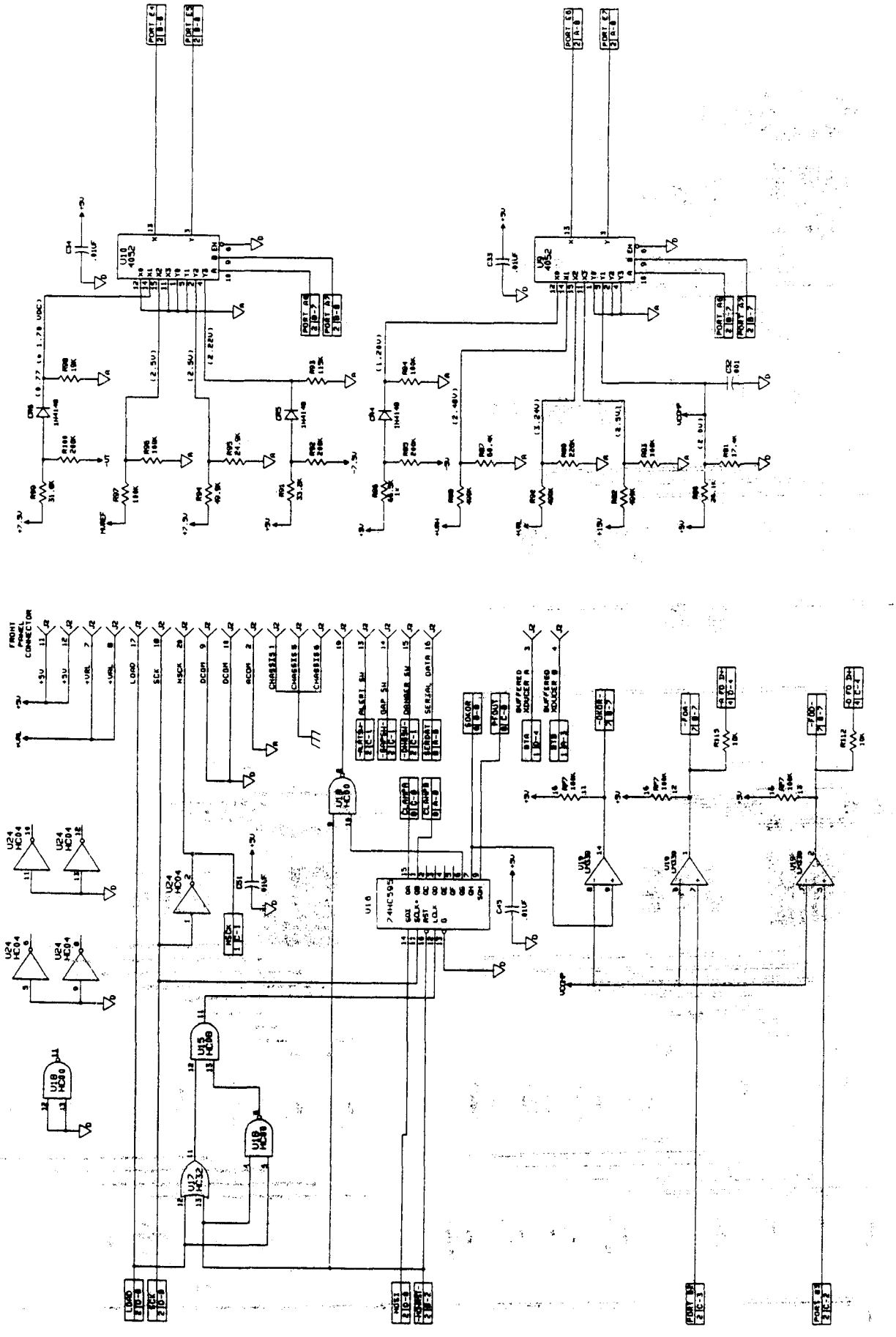
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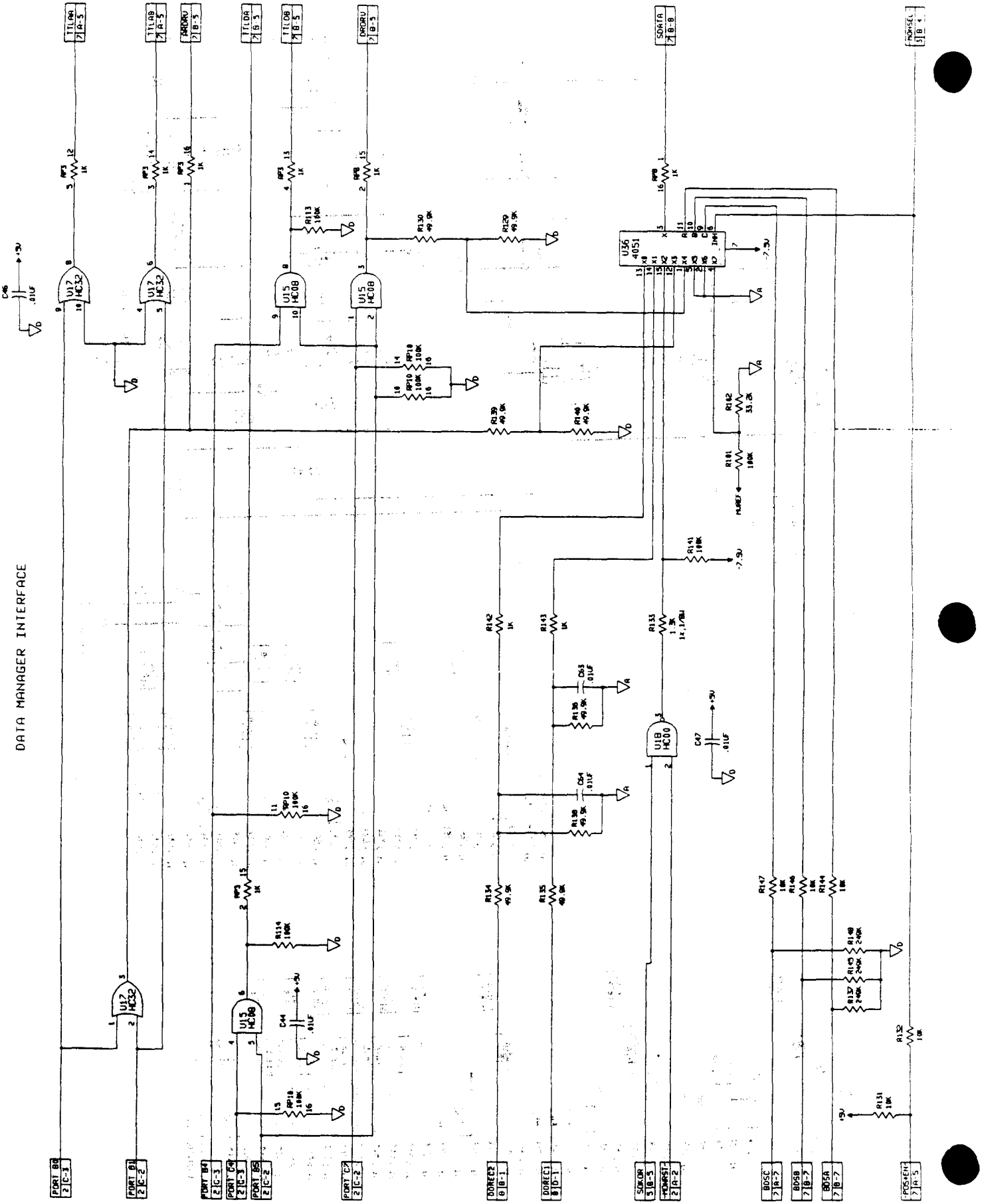
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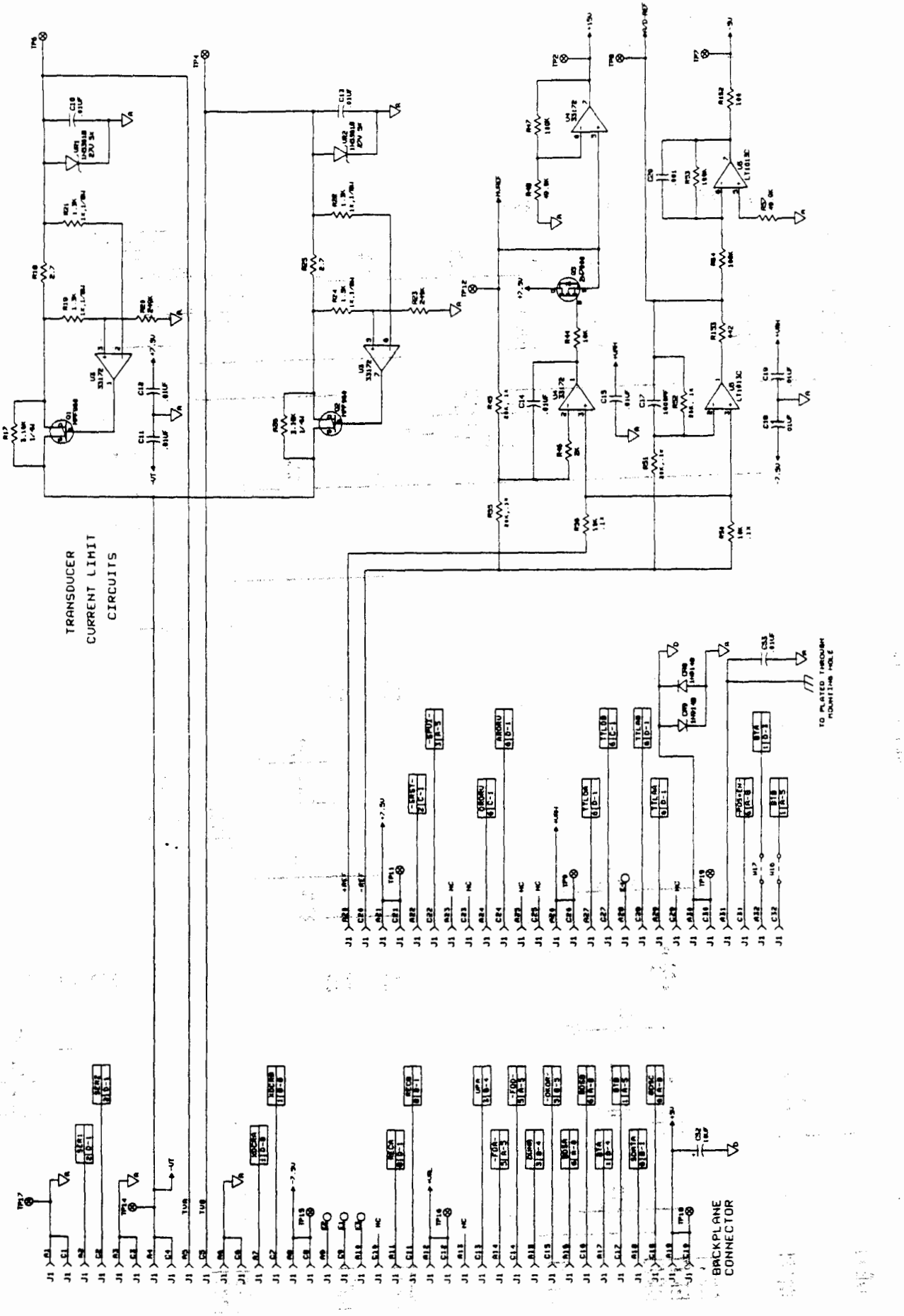
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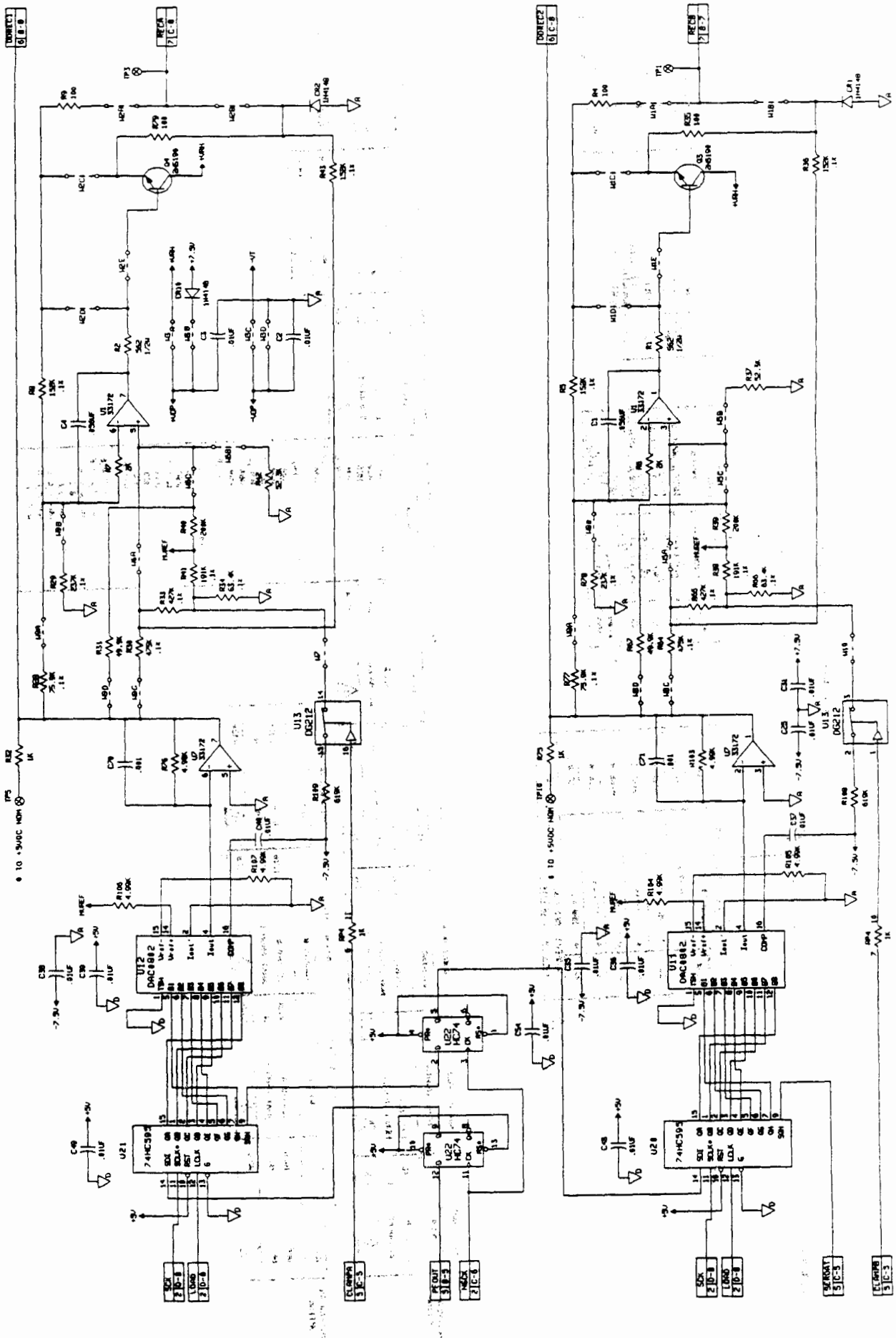
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Case Expansion Monitor Schematic
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Case Expansion Monitor Schematic
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Case Expansion Monitor Schematic
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Case Expansion Monitor Schematic
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CASE EXPANSION MONITOR

3300/40 — A A — B B — C C — D D

FULL SCALE OPTION		
OPTION CODE	DESCRIPTION	JUMPERS
01	0 - 1.0 INCHES	M15B,E
02	0 - 25 mm	M15E,C
03	0 - 2 INCHES	M15E,C,B
04	0 - 50 mm	M15E,B
05	0 - 4 INCHES	M15E,D,B
06	0 - 100 mm	M15E,D,C
⚠1 JUMPERS USED FOR FULL SCALE OPTIONS		M15A,B,C,D,E

TRANSDUCER OPTION		
OPTION CODE	DESCRIPTION	JUMPERS
01	1 INCH LVDT 9 V/inch	M22B,B M21C,B M4C,E
02	2 INCH LVDT 10 V/inch	M22B,C M21C,B M4C,E
03	4 INCH LVDT 3.5 V/inch	M22B,C,B M21C,B M4C,E
⚠1 JUMPERS USED FOR TRANSDUCER OPTIONS		M22B,C,B M4A,B,C,D,E,F M18,M17,M21C,B

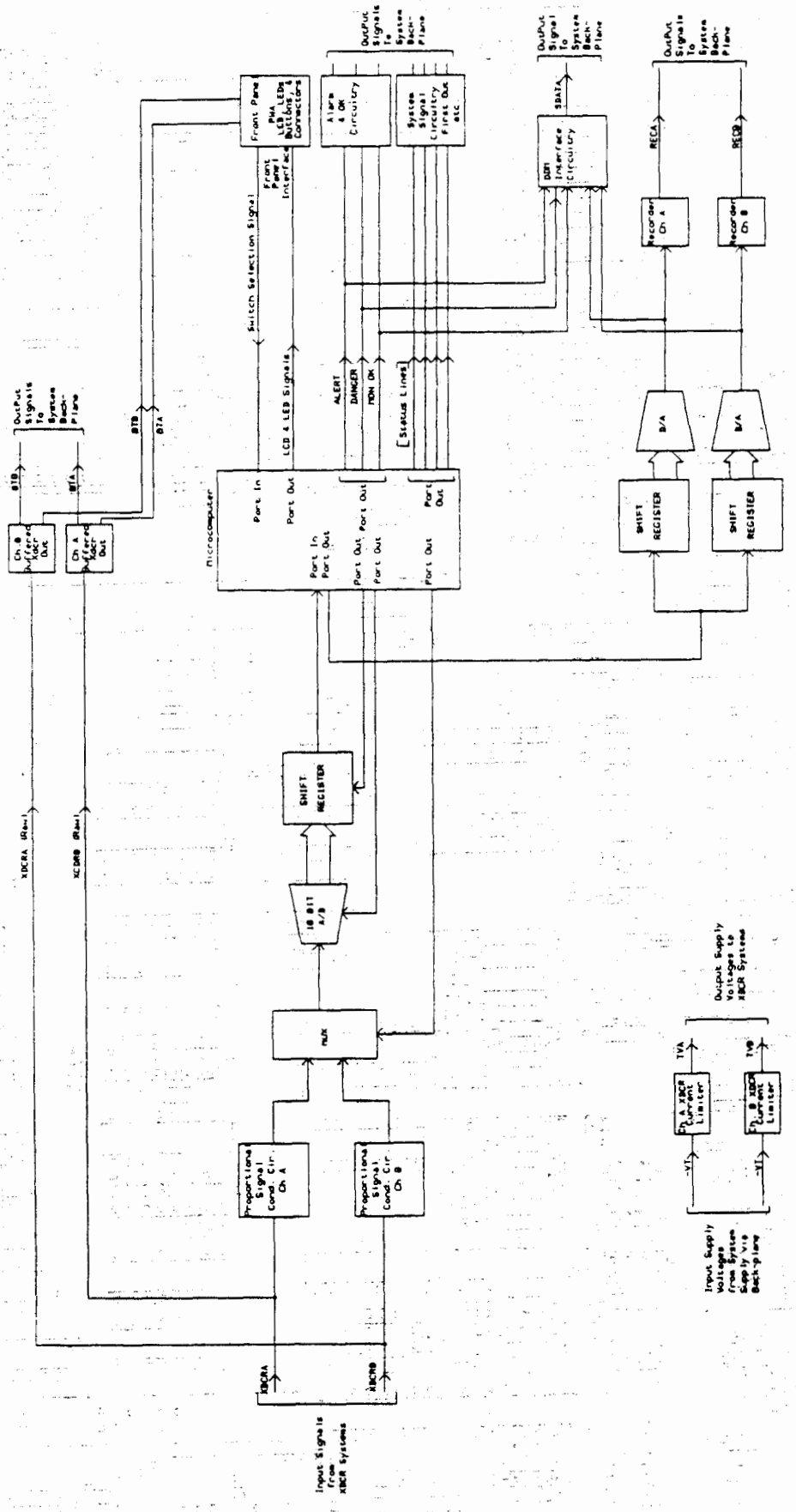
ALARM RELAY OPTION	
OPTION CODE	DESCRIPTION
00	NONE
01	EPOXY SEALED RELAY
02	HERMETIC SEALED RELAY

APPROVALS OPTION	
OPTION CODE	DESCRIPTION
00	NOT REQUIRED
01	CSA
02	BASEEFA
03	FACTORY MUTUAL

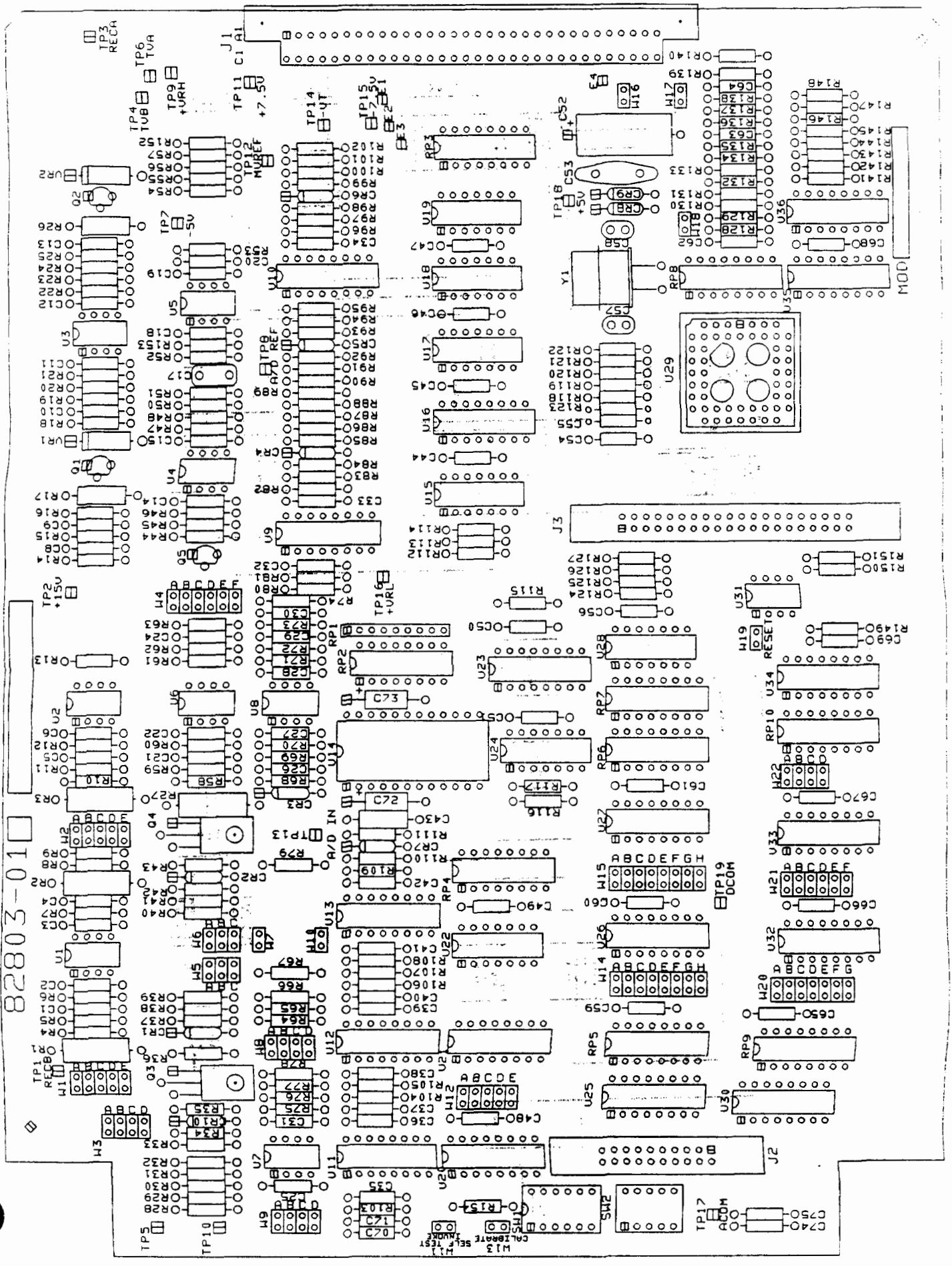
	FIRST OUT		MDR OR MODE		ALERT MODE		BANDER MODE		BANDER BYPASS		RECORDER OUTPUTS		NOT OK CHANNEL DEFEAT		ALARM DELAY		DISPLAY	
SHIPPED AS OPTION	ENABLED		NON-LATCHING		LATCHING		LATCHING		DISABLED		+4 TO +20 mA		DISABLED		3 SEC.		FAST	
	ENABLED	M14B	LATCHING	M15C	LATCHING	M14E	LATCHING	M14F	ENABLED	M12A	+4 TO +20 mA	M6B,C M2B,C,E M6A M3A,B M6B,C M1B,C,E M6A	ENABLED	M21E	0.1 SEC.	NJ	SLOW	M21B
	DISABLED	NJ	NON-LATCHING	NJ	NON-LATCHING	NJ	NON-LATCHING	NJ	DISABLED	NJ			DISABLED	NJ	1 SEC.	M14B	FAST	NJ
	⚠1	M14B	⚠1	M15C	⚠1	M14E	⚠1	M14F	⚠1	M12A			⚠1	M21E	3 SEC.	M14A	⚠1	M21B
															6 SEC.	M14A,B		
															⚠1	M14A,B		

	CHANNEL B		UPSCALE CH A		UPSCALE CH B		RECORDER OUTPUT	
SHIPPED AS OPTION	ON		TOWARD A		TOWARD B		DIFF.	
	OFF	M21F	TOWARD A	M12C	TOWARD B	M12B	DIFF.	M12E
	ON	NJ	AWAY FROM A	NJ	AWAY FROM B	NJ	DIRECT	NJ
	⚠1	M21F	⚠1	M12C	⚠1	M12B	⚠1	M12E

-8 TO -10 Vdc	M14G	M6A M6B M2A,B M3B,C M6A M6B M1A,B
+1 TO +8 Vdc	M14H	M6B M6C M2A,B M3A,B M6B M6C M1A,B
⚠1		M1A,B,C,D,E M2A,B,C,D,E M3A,B,C,D M6A,B,C M6A,B,C M6A,B,C,D M6A,B,C,D M14G,H



Case Expansion Monitor Block Diagram
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Case Expansion Monitor PWA Drawing
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