PUMP INSTRUMENTATION VOLUME 6A

BCC CONTRACT NO. S.20/95/963 *Section 1 to 3*

WEIR ENGINEERING PT

A.C.N. 00

weir *Envirotech*

SCSQ

BRISBANE CITY COUNCIL DEPARTMENT OF WATER SUPPLY AND SEWAGE

PUMPWELL No 1 EAGLE FARM PUMP STATION

PUMP INSTRUMENTATION

OPERATION AND MAINTENANCE MANUAL

Volume 6

WEIR ENGINEERING PTY LTD
JOB No 15140
BCC CONTRACT No S20/95/96

REVISIONS/AMENDMENT CERTIFICATE

It is certified that the amendments promulgated in the undermentioned Amendment List have been incorporated in this copy of the Publication.

Amendment List		Topic/Set	*Amendment Effect	Amended By	Date
No.	Date of Issue	Affected			
1					
2					
3					
4					
5					
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*Note: Insert brief details of page(s) amended, inserted or cancelled.

Volume 6 Pump System Instrumentation

INDEX

Section 1 Introduction

The instrumentation supplied with this project is provided to monitor the operational state of both the 6.6kV Crompton Greaves motor and the Weir Engineering SRA 900/1000 Double Volute Vertical Sewage pumps. This volume should be read in conjunction with Volume 2 – Vertical Sewage Pump Manual and Volume 5 – Crompton Geaves Motor Manual.

The instrumentation monitors the speed, vibration and temperature of the sewage pumps and supplies control/monitoring signals directly to the BCC control system. All control actions, sequencing and data logging derived from this instrumentation is carried out by the BCC control system.

This volume includes details of the following pump instrumentation:

- Local instrumentation panel housing two Bently Nevada 3300 Monitoring System racks receiving signals for vibration, bearing temperature and machine rotation.
- Bently Nevada 330525 Velomitor XA Piezo – Velocity Sensors mounted on the pump and motor to sense machine vibration.
- RTD temperature probes mounted on the pump and motor to monitor machine temperature.
- Bently Nevada 3300/50 Tachometer to monitor pump and motor speed.
- Bently Nevada 3300/52 Reverse Rotation Monitor to detect reverse pump rotation.
- Moisture detector in the motor casing to monitor water leakage from the water cooled heat exchanger.
- Local junction boxes on the pump and motor to marshal local instrumentation.

Section 2 Description of Equipment

In this section the instrumentation is described in detail. Particular emphasis is placed on the Local Instrumentation Panel housing the Bently Nevada 3300 Monitoring System equipment; it's function and operation.

The pump instrumentation is provided to monitor the operational state of both the motor and pump. The instrumentation monitors the speed, vibration and temperature of the vertical sewage pumps and supplies control/ monitoring signals directly to the BCC control system. All control action, sequencing and data logging derived from this instrumentation is carried out by the BCC control system.

The instrument sensors are all located on both the motor and Pump. The Process and Instrumentation Drawings (P & ID) in Section 13 – No WD4357, shows the location of each sensor and how they interface with the BCC control system. The three pumps are identical apart from the tag numbers as indicated on the drawings.

The P & ID drawing should be read in conjunction with the instrumentation schedule for each. (Refer Section 13 – Drawing WD4358) The details of each instrument are summarised including:

Tag Number
Measurement parameter
Type of sensor
Location
Manufacturer
Model
Measurement Range
Alarm and trip levels

All of the pump instrumentation sensors are cabled to transducers located in the local instrument cubicle. The signals are processed and a 4-20mA analogue signal together with any alarm/trip contacts are sent back the BCC pump control system. Each pump has a local junction box to marshal the local pump signals so that they can be wired back to the local instrument cubicle via multi-triad Dekron cables. Both the vibration and proximity sensors are supplied with the manufacturers proprietary cable back the local junction box.

2.1 Local Instrumentation Panel

Local instrumentation panel is located on the Pump Drive Motor level in the Pumpwell. It houses two Bently Nevada 3300 Monitoring System racks. The Monitoring System receives signals for vibration, bearing temperature and machine rotation. The panel layout is shown in drawing WD5073. (Refer Section 13)

The requirement for rear access to the rack terminals and limited space in the pumpwell resulted in a double hinged panel design to provide access from the front to the rear terminals of the rack modules. A clear perspex-viewing panel in the front door allows observation of the local indication without opening the panel. This maintains the IP65 rating of the panel during normal pump operation.

Each rack is powered via a dedicated MCCB so that they can be individually isolated. There are 7 dedicated slots required for monitoring functions on each pump. They include a tachometer, reverse rotation monitor, 3 dual vibration monitors and a 6-channel temperature monitor. The modules for each pump are grouped together and clearly labeled for ease of identification. The module layout is shown in drawings WD5071 and WD5072. (Refer Section 13)

The control schematics for the instrumentation connected to the Local Instrumentation Panel is shown on drawings WD5074 to WD5087. (Refer Section 13) The interface point for wiring back to the BCC control system is a dedicated terminal strip for each pump located at the back of the control panel.

2.2 3300 System Overview

The following publication entitled 3300 System Overview (Part No 80171-01 Rev D) prepared by Bently Nevada provides a brief system overview of their 3300 monitoring system. A standard block diagram showing the system operation and a typical rack layout detail is provided.

The following sections are included:

2.2.1 System Overview

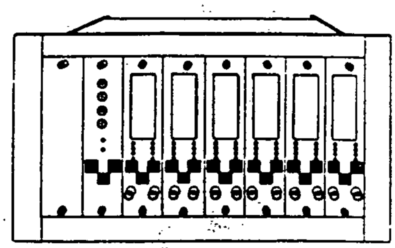
2.2.2 System Block Diagram

2.2.3 Rack

PART NO. 80171-01
REVISION D,
MARCH 1994

3300 SYSTEM OVERVIEW

BENTLY NEVADA®
MADE IN U.S.A.



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 during calibration.

Keyphasor® is a registered trademark of Bently Nevada Corporation

Proximitor® is a registered trademark of Bently Nevada Corporation

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Fax 702-782-9253

FOREWORD

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

RELATED DOCUMENTS

3300 System Installation Instructions, 80172-01

3300 System Troubleshooting, 80173-01

3300/12 AC Power Supply, 89602-01

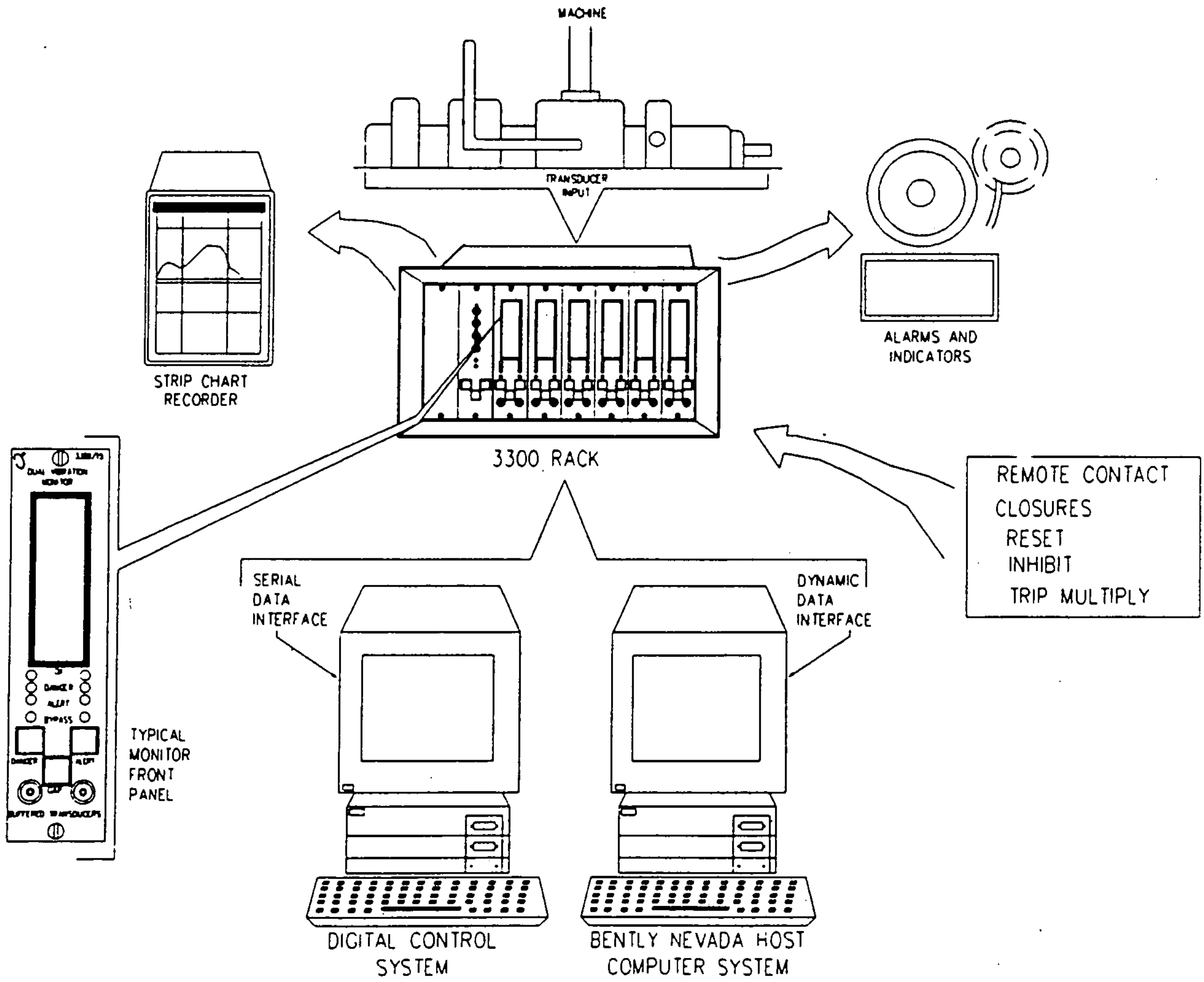
3300/03 System Monitor, 89604-01

Keyphasor ® and **Proximitor ®** are registered tradmarks of Bently Nevada Corporation

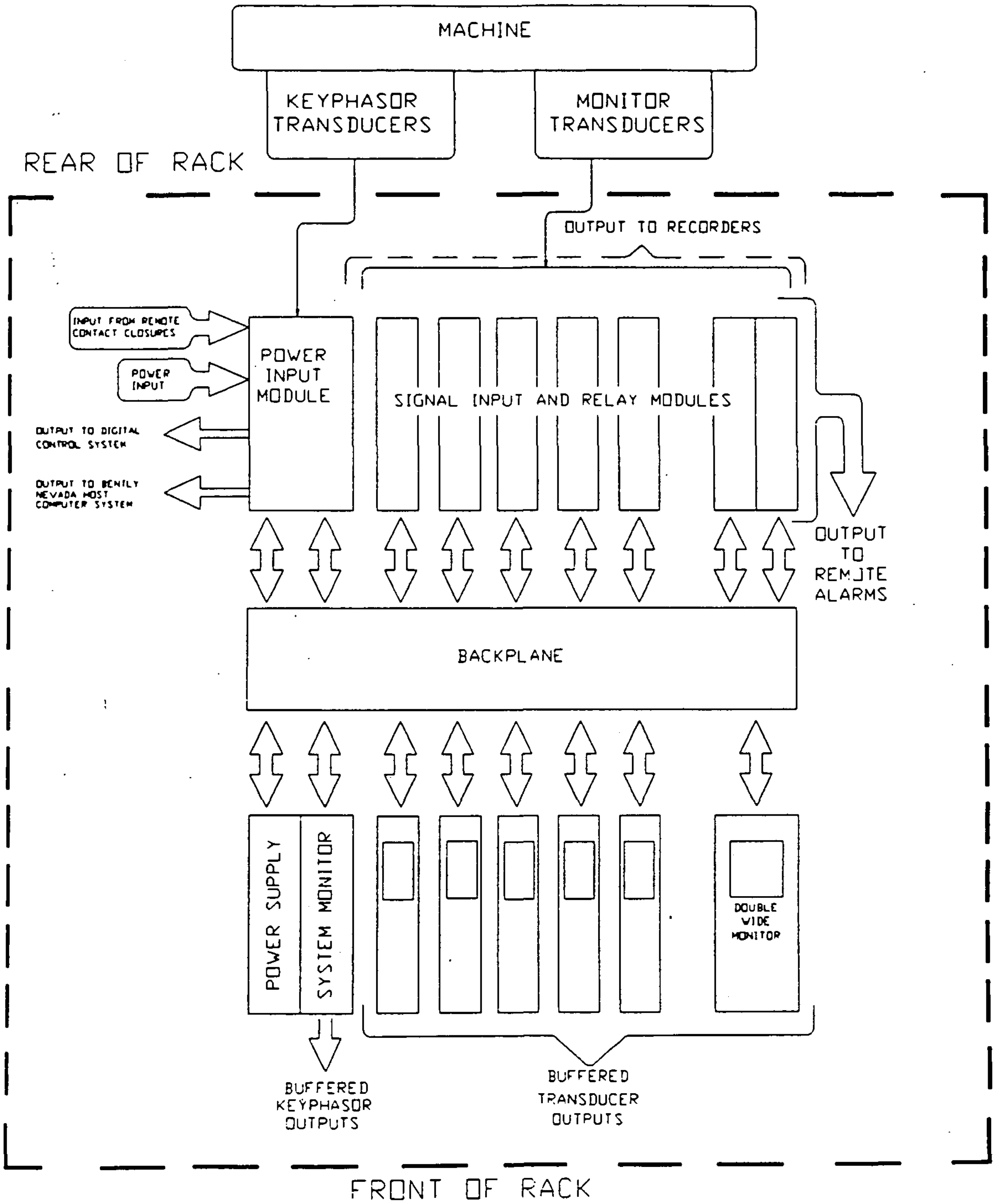
SYMBOLS
Special symbols are used in the manual to illustrate specifics in the step-by-step process. For example:

CONTENTS

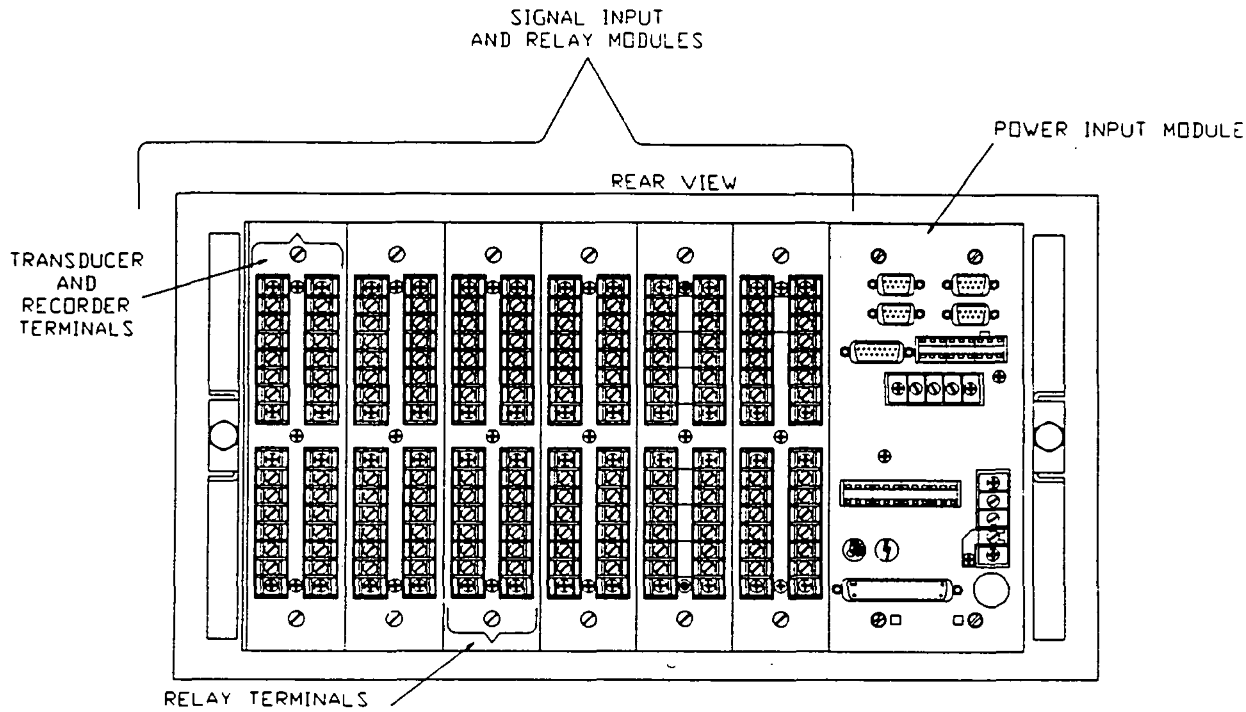
1 SYSTEM OVERVIEW

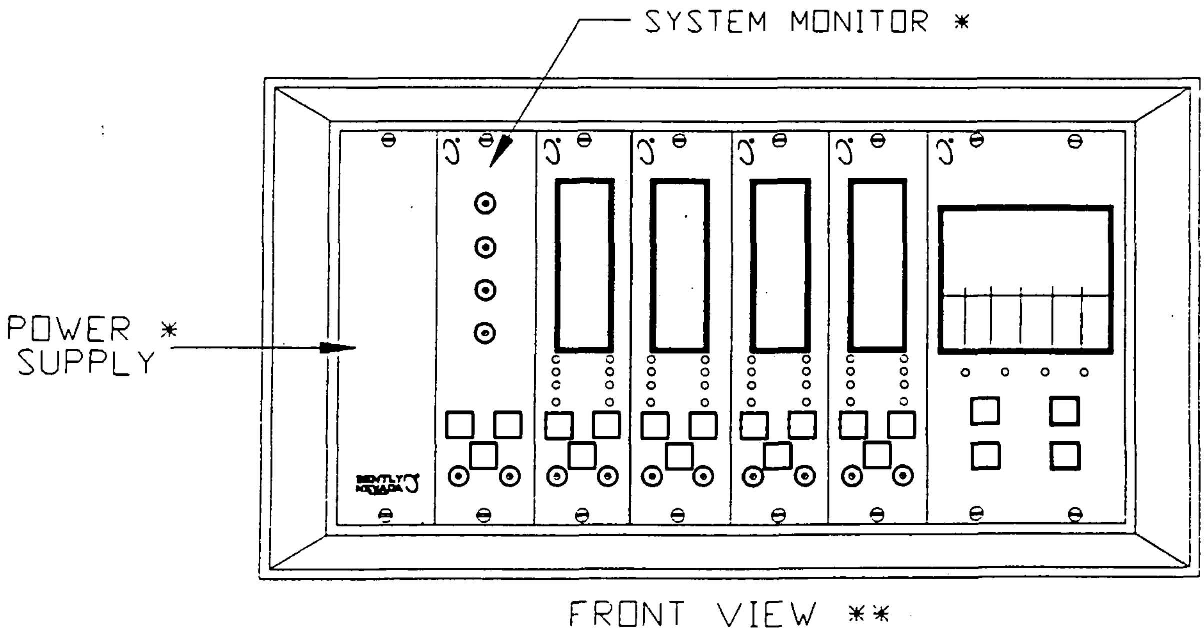


2 SYSTEM BLOCK DIAGRAM



3 RACK





* Power Supply and System Monitor positions are permanent and non-interchangeable.

** Monitor positions in rack are interchangeable and determined by customer requirements.

2.3 3300/03 System Monitor

The following publication entitled 3300/03 System Monitor (Part No 89604-01 Rev E) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of their 3300 System Monitor including details of the monitor operation, functions, disassembly procedure, programmable options, testing and a general specification.

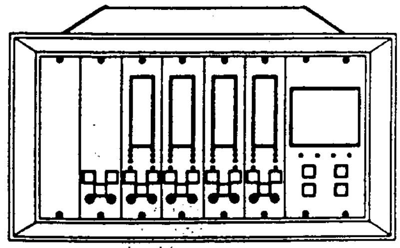
The following sections are included:

PART NO. 89604-01
REVISION E,
MARCH 1995

3300/03 SYSTEM MONITOR

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. Contact could cause shock, burns, or death.

Do not touch exposed wires or terminals.

CAUTION

Machine protection will be lost during calibration.

Keyphasor®, **Proximitor®**, **Dynamic Data Manager®** and **Transient Data Manager®** are registered trademarks of Bently Nevada Corporation.

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FOREWORD

This document is for plant personnel who operate and maintain the 3300 Monitoring System. The information includes description, disassembly instructions, performance tests, recommended spare parts, field changeable options, specifications and schematics. The procedures are presented in step-by-step graphic format.

RELATED DOCUMENTS

3300 System Overview, 80171-01

3300 System Installation Instructions, 80172-01

3300 System Troubleshooting, 80173-01

3300/12 Power Supply, 89602-01

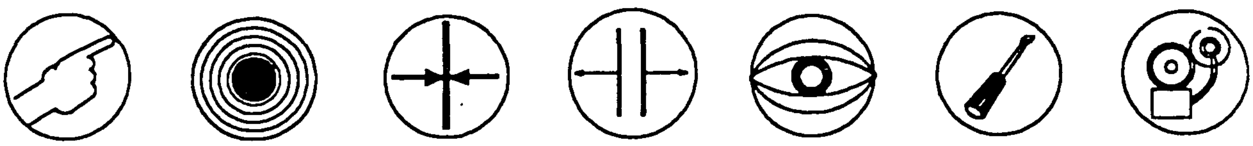
Serial Data Interface & Dynamic Data Interface, 89541-01

Dynamic Data Manager® System, 46390-01

Transient Data Manager® User Guide, 79206-01

SYMBOLS

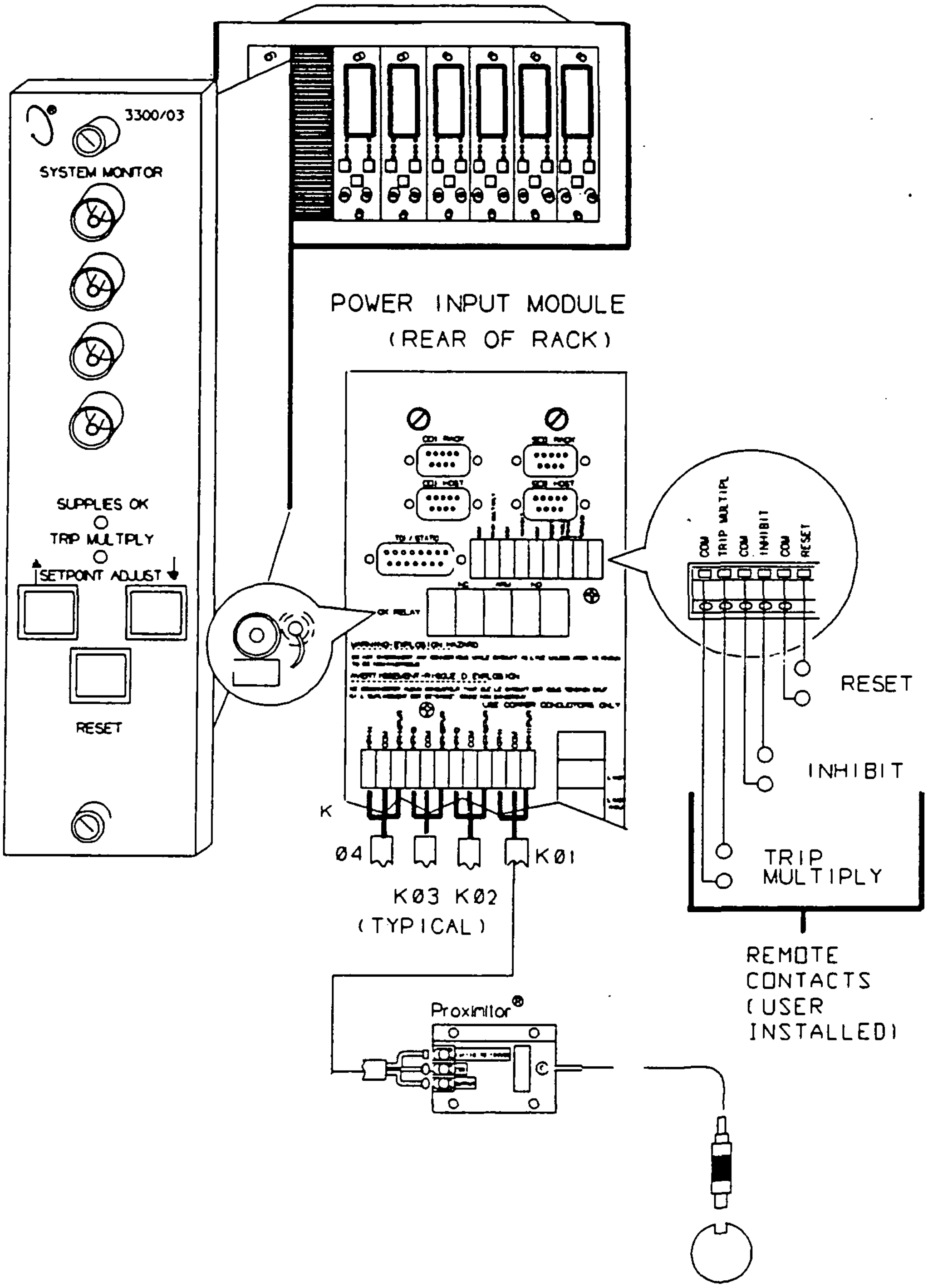
Special symbols are used in the manual to illustrate specifics in the step-by-step processes. For example:



PRESS FLASHING CONNECT DISCONNECT OBSERVE SCREWDRIVER ALARM

CONTENTS

1 SYSTEM MONITOR



2 MONITOR FUNCTIONS

SYSTEM POWER-UP INHIBIT

The System Monitor provides a Power-up Inhibit function. This function allows each monitor to inhibit its alarms during power-up or whenever a system supply voltage falls below its operating level. After power-up, the inhibit function remains active for approximately 2 seconds.

RACK INHIBIT

When activated by a external contact closure this function places all monitors in bypass, disables all alarms, zero scales all outputs, and de-energizes the system OK relay. The connections for this function are located on the power input module (PIM) at the rear of the rack.

SUPPLY VOLTAGES OK

Seven LEDs located behind the front panel of the System Monitor are ON to indicate the voltage supplies are functioning. The voltage supplies are +VRH, +VRL, +7.5V, +5V, REF, -7.5V, and -VT. There is a green LED (SUPPLIES OK) on the front panel of the System Monitor. When this LED is on all of the voltage supplies are functional.

SYSTEM RESET

The System Monitor provides the ability to cause a System Reset. Closing external contacts through terminals on the PIM or pressing the RESET switch on the front panel will cause a System Reset.

TRIP MULTIPLY

The most common use of this function is to prevent unwanted monitor alarms during certain conditions of machine operation. In the operation of some machinery, it is impossible to avoid some periods of "higher than normal" vibration. Examples include startup and coastdown, especially if the operating speed is above rotor system balance resonances ("critical speeds"), structural and other resonances, and changes in machine load or other operating conditions.

The Trip Multiply function causes the monitor alarm setpoints (both Alert and Danger) to increase by a fixed amount, either two times (2X) or three times (3X), according to the ordering option. Only those monitors ordered with this option will be affected. The Trip Multiply function is performed in the System Monitor, but is an ordering option for each monitor. It must be specified at the time of order placement and be installed at the factory.

Trip Multiply is activated by contact closure on the PIM. A red LED on the System Monitor front panel indicates that the Trip Multiply function is active.

2 MONITOR FUNCTIONS

OK RELAY

The purpose of this relay is to provide a means to annunciate a problem that is detected with any transducer system connected to the rack. The OK Relay is connected to the OK Circuit of every monitor in the rack. The OK Circuit continuously checks the condition of the transducer(s) associated with that monitor. If the circuit detects a transducer problem, the OK LED on the front of the affected monitor goes off and a relay drive signal is sent to the OK Relay in the System Monitor.
The OK Relay is located on the System Monitor PIM, is normally energized, and is a single-pole, double-throw (SPDT) relay. Since it is normally energized, the relay also can be used to annunciate when mains power to the rack is lost or interrupted. Either a system power-up inhibit signal from the System Monitor or a not OK signal from any monitor in the rack will cause the OK Relay to change state.

ALARM SETPOINT ADJUST

The System Monitor has two switches on the front panel that adjust alarm setpoint levels on each monitor. One switch is for upscale adjustments, and the other switch is for downscale adjustments.

DATA INTERFACE

The System Monitor supports the following Bently Nevada data interfaces: Dynamic Data Manager (DDM), Transient Data Manager® (TDM), Serial Data Interface (SDI), Dynamic Data Interface (DDI) and Transient Data Interface (TDI). The SDI and DDI are options of the System Monitor and reside within the System Monitor slot of the rack. DDM, TDM and TDI are external data interfaces which gain access to the rack through the PIM. There is an external version of the SDI and DDI which connects to the PIM. For more information about these products consult a Bently Nevada sales representative.

Keyphasor® TRANSDUCERS

The System Monitor receives input from four Keyphasor® transducers through terminals on the PIM. Two of the Keyphasor® transducers are available to the monitors within the rack. All four of the Keyphasor® transducers are available to the Dynamic Data Interface (DDI). Buffered Keyphasor® signals are also available from the coaxial connectors on the front panel. The System Monitor also provides short-circuit protected Keyphasor® transducer power.

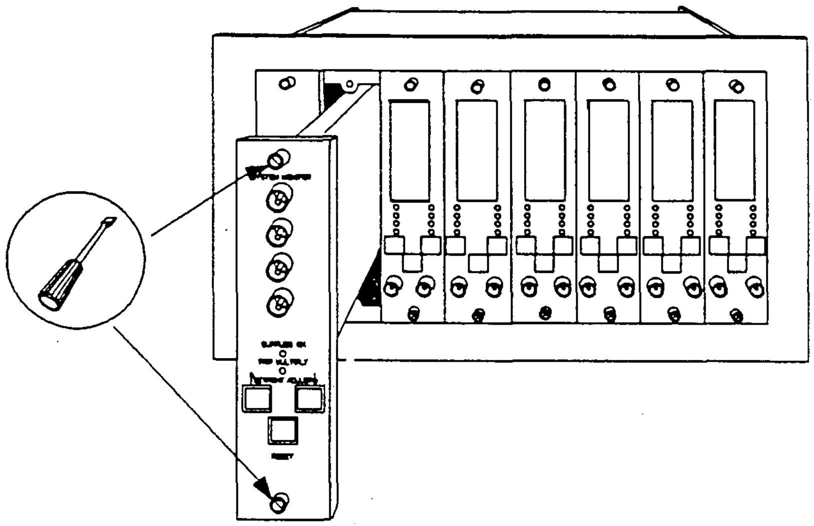
STATIC DATA BUS BUFFER

The System Monitor multiplexes signals from either the DDM or TDM to select static data from the monitors. The System Monitor buffers the static data signals sent from the monitor to the DDM or TDM.

3 ASSEMBLY & DISASSEMBLY PROCEDURE

This section explains how to disassemble the System Monitor to set jumper options on the circuit board. To install a System Monitor to a rack set the options as described in section 7 then do steps 1 through 4 in reverse order.
The only tool you need is a screwdriver.

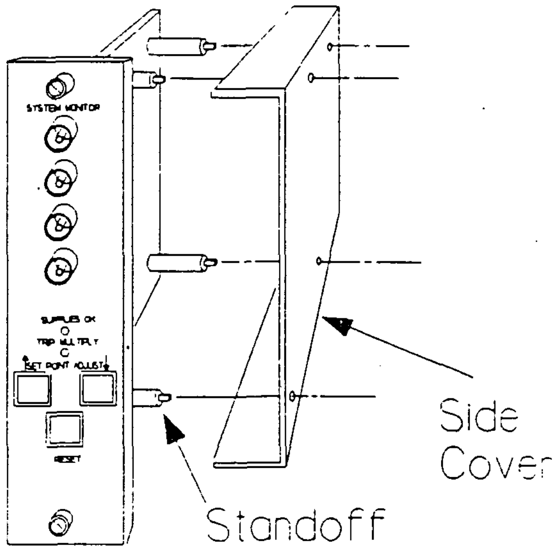
1. Loosen the screws on the front panel and pull the System Monitor out from the rack.



CAUTION

Improper rack operation may occur.
Power down rack when intalling or removing a monitor.

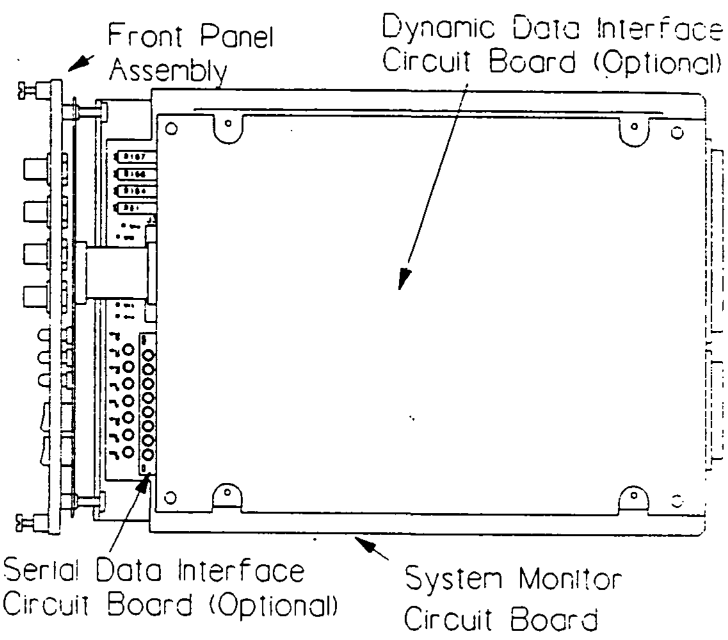
2. Remove the side cover by pinching the protruding tip on each of the 4 standoffs.



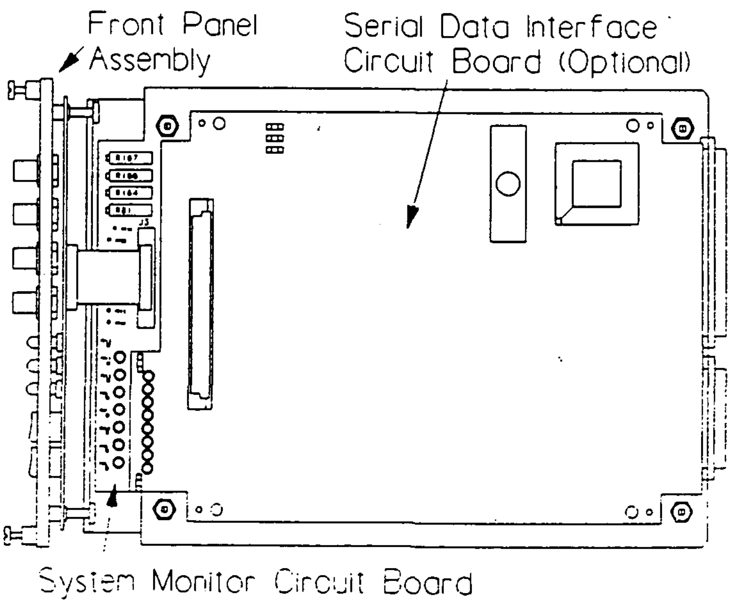
4 DATA INTERFACE REMOVAL

If the System Monitor has either the optional Dynamic Data Interface and or Serial Data Interface circuit boards installed, remove the data interface boards to access the option jumpers located on the System Monitor.

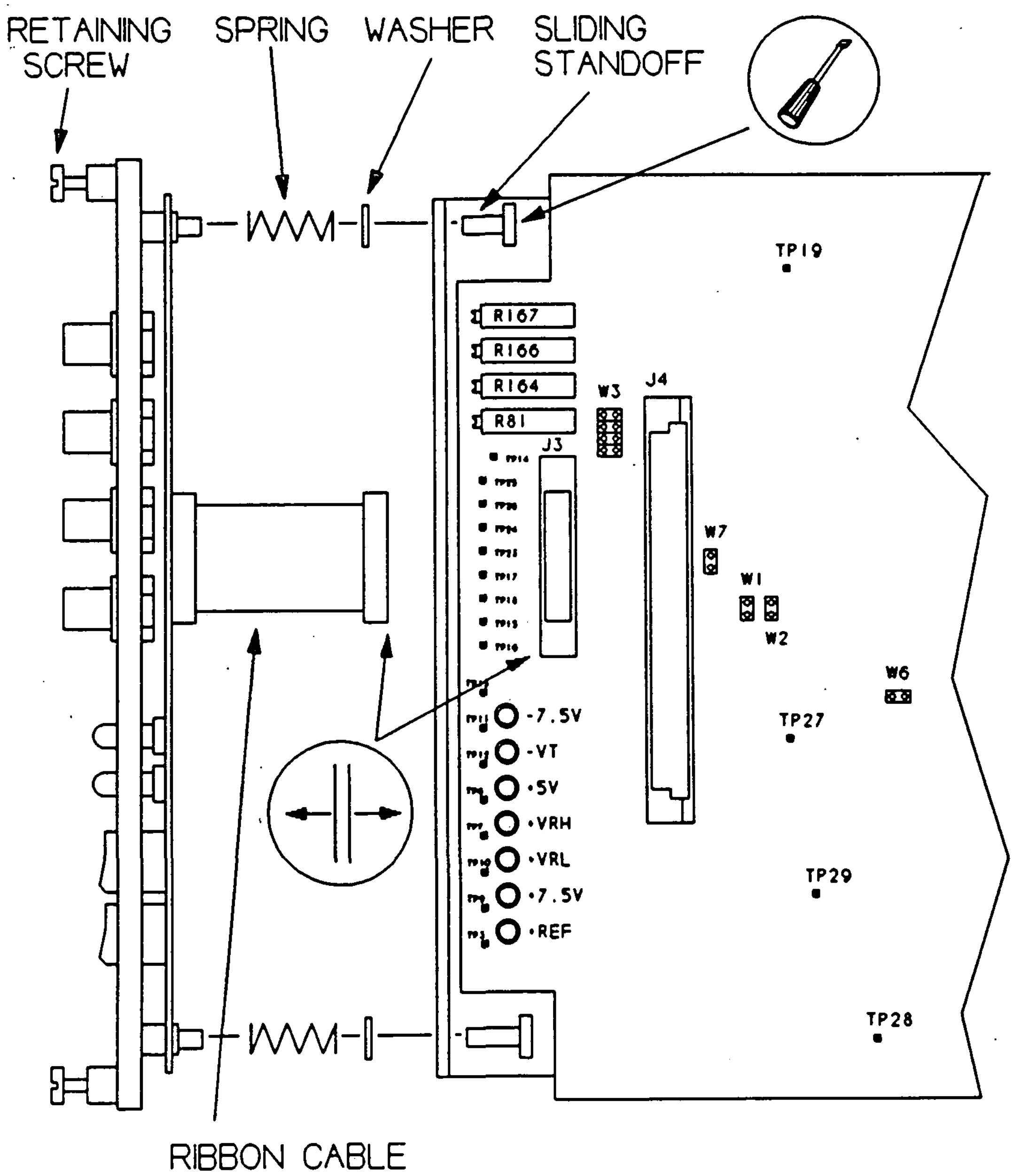
1. Remove the Dynamic Data Interface board by pinching the protruding tip on each of the 4 standoffs and gently prying the Dynamic Data Interface board away from the Serial Data Interface board.



2. Remove the Serial Data Interface board by gently prying it away from the two mating connectors and 5 standoffs on the System Monitor board.

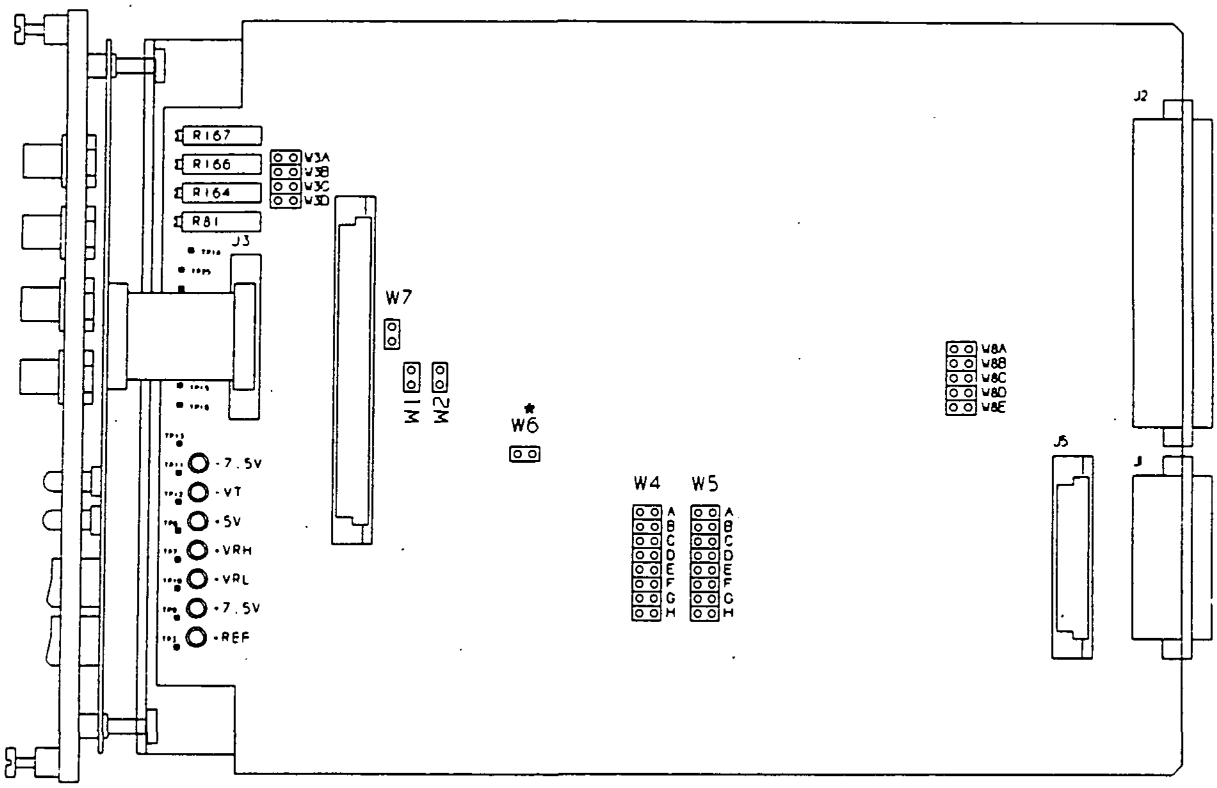


5 FRONT PANEL INSTALLATION & REMOVAL



7 PROGRAMMABLE OPTIONS

The System Monitor has jumper-programmable options for selecting the transducer voltage and the data interface. Change these options by removing and installing jumpers on the circuit board.



Jumper Locations

* W6 is reserved for future use.

6 MONITOR OPTIONS

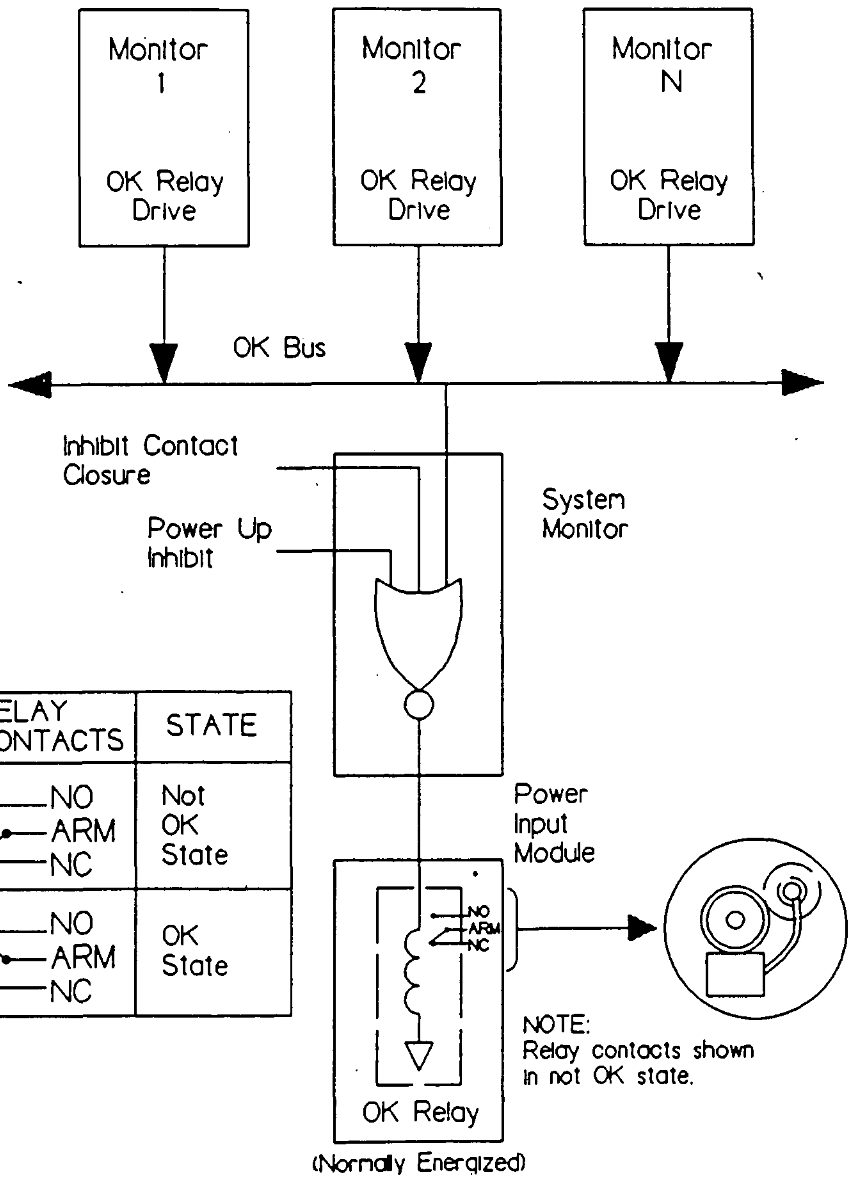
SYSTEM MONITOR PART NUMBER

3300/03 — AA — BB

DATA INTERFACE (AA)	AGENCY APPROVAL (BB)
01 = None or DDM/TDM	00 = NOT REQUIRED
02 = SDI	01 = CSA
03 = DDI	02 = BASEEFA
	03 = FM

8 OK RELAY CONFIGURATION

The following diagram shows the functional concept of the OK Relay. For more detail refer to schematics (see Section 13).



RELAY CONTACTS	STATE
NO / ARM / NC	Not OK State
NO / ARM / NC	OK State

7 PROGRAMMABLE OPTIONS

Data Manager Options

To configure the System Monitor to work with the different data interfaces remove all option jumpers from headers W3A-W3D, W4A-W4H, W5A-W5H, W7 and W8A-W8E and install jumpers as specified in Table 1.

Table 1. Data Manager Options

OPTION	INSTALL JUMPERS
Dynamic Data Manager® or Transient Data Manager® or No Data Interface	W3A,W3B,W5A,W5B,W5C,W5D,W5E,* W5F,W5G,W5H,W8D & W8E
Internal Serial Data Interface/ Dynamic Data Interface	W3C,W3D,W4A,W4B,W4C,W4D,W4E,** W4F,W4G,W4H,W7,W8D & W8E
External Serial Data Interface/ Dynamic Data Interface or Transient Data Interface	W3C,W3D,W5A,W5B,W5C,W5D,W5F, W5G,W5H,W8A,W8B & W8C

* As shipped from factory for a 3300/03 - 01 System Monitor.

** As shipped from factory for a 3300/03 - 02 or 3300/03 - 03 System Monitor.

-VT Options

To set the -VT option according to the option set on the Power Supply, remove jumpers from headers W1 and W2 and install jumpers as specified in Table 2.

Table 2. -VT Options

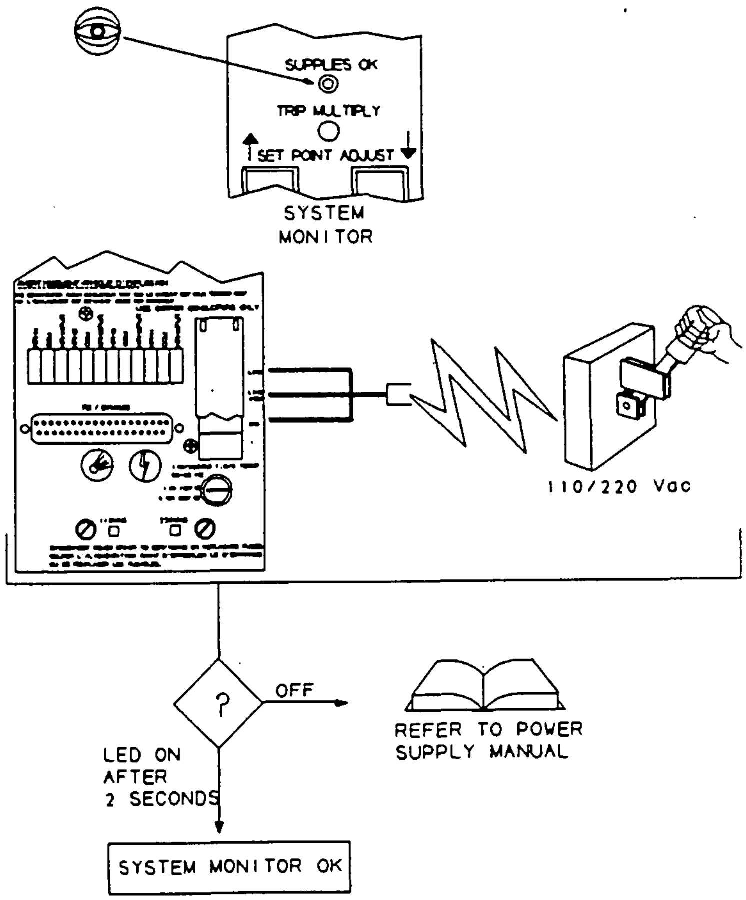
OPTION	INSTALL JUMPER	REMOVE JUMPER
-VT = -18 Volts	W2	W1
-VT = -24 Volts	W1	W2

9 OPERATIONAL TESTING

To verify that the system monitor is functional apply power at the Power Input Module. The LED indicating that the supplies are OK should turn on after 2 seconds.

CAUTION

Improper operation may occur. Set -VT Jumpers in the System Monitor and Power Supply to the same voltage (-18 VDC or -24 VDC).

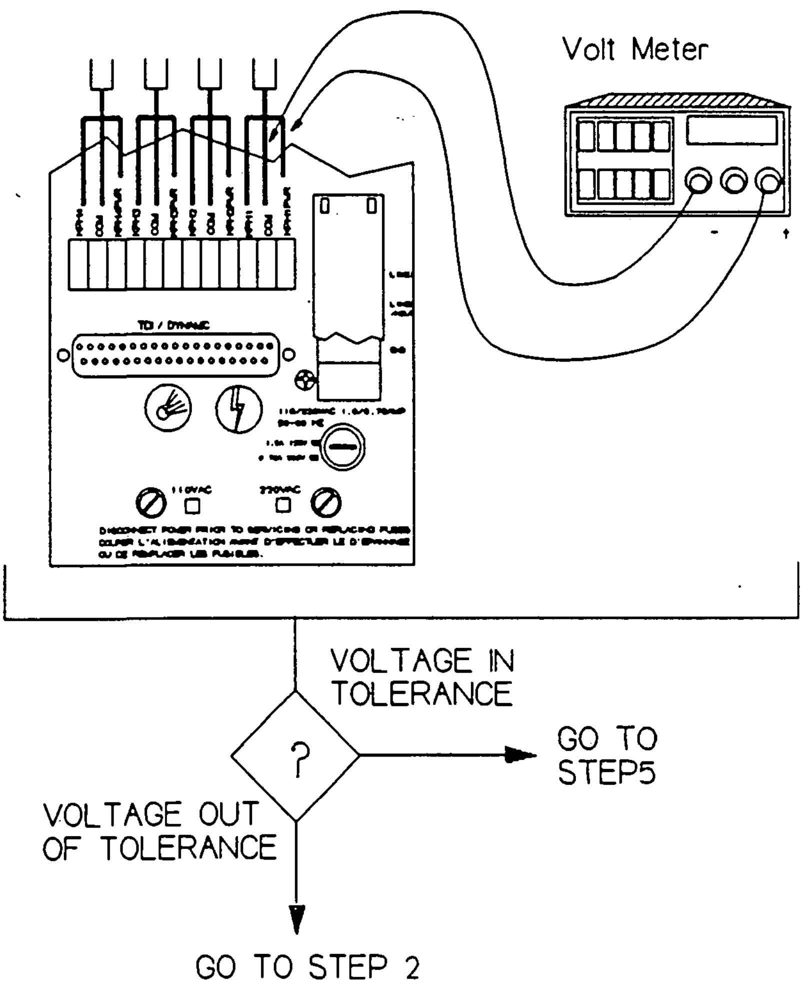


10 Keyphasor® OPERATIONAL TEST

The following test procedure for Keyphasor® transducer 1 is also applicable for testing Keyphasor® transducers 2 through 4.

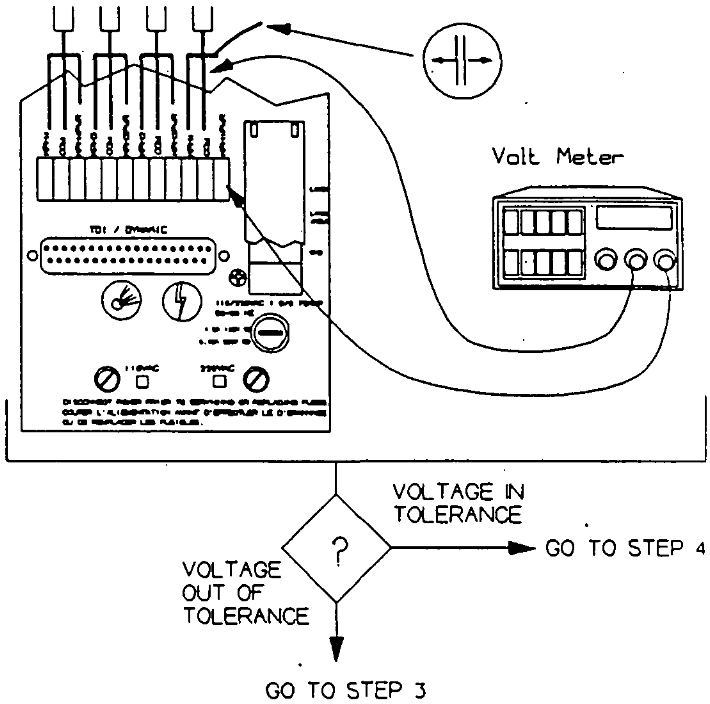
The machine associated with the Keyphasor® transducer under test should be running during this procedure. If the machine is not turning, simulate the operating machinery input at approximately the same frequency as the shaft rotating speed, with a function generator or TK3 test kit.

1. Measure Keyphasor® 1 power at the **KPH1PWR** terminal on the power input module (PIM). If -VT is -24 V, the voltage should read between -23.2 and -24.2 Vdc. If -VT is -18 V, the voltage should read between -17.40 and -18.30 Vdc.



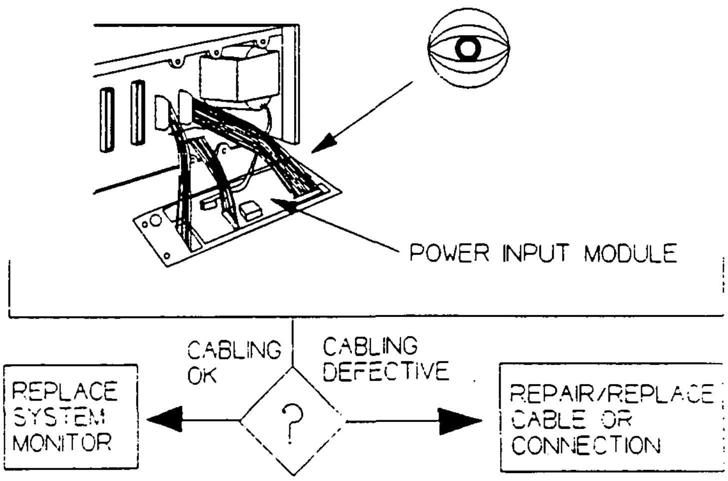
10 Keyphasor® OPERATIONAL TEST

2. Disconnect the wire from the **KPH1PWR** terminal and measure the voltage at the power terminal. The voltage should be within the tolerance specified in step 1.



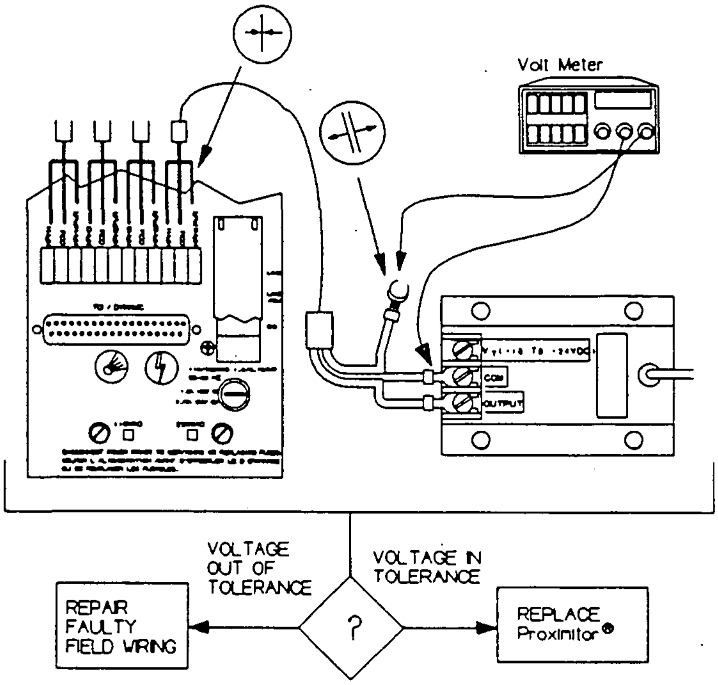
⚠ WARNING
High voltage present. Contact could cause shock, burns, or death.

3. Loosen the screws that hold the power input module to the rack and pull the power input module out from the rear of the rack. Examine the cabling and connections between the module and the rack.

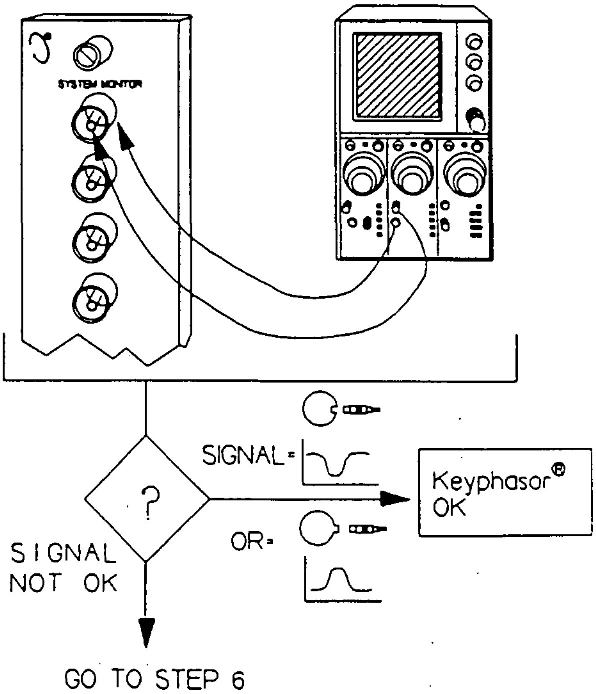


10 Keyphasor® OPERATIONAL TEST

4. Reconnect the wire to the **KPH1PWR** terminal. Disconnect the wire at the **-VT (-18 or -24 Vdc)** terminal of the Proximitor®. Measure the voltage at the wire. The voltage should be within the tolerances specified in step 1.

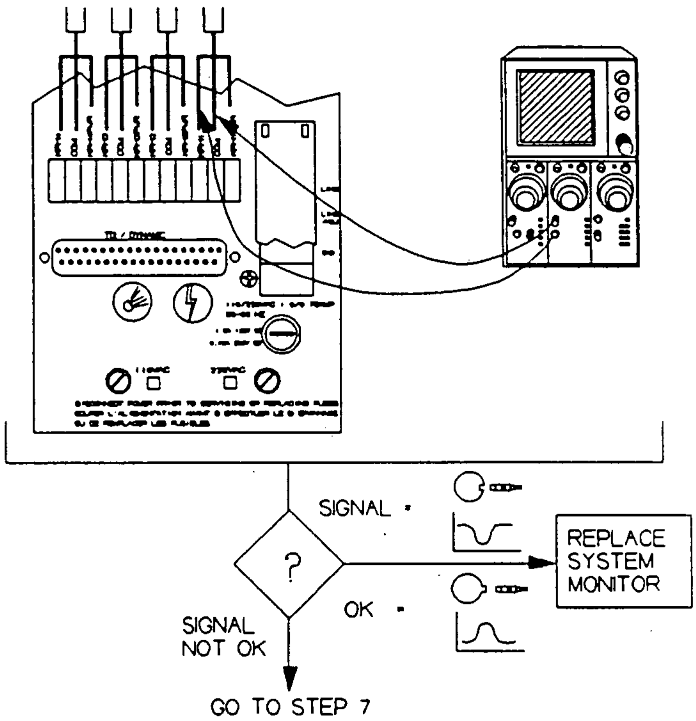


5. Check the Keyphasor® output signal at the System Monitor front panel **KØ1** coaxial connector.

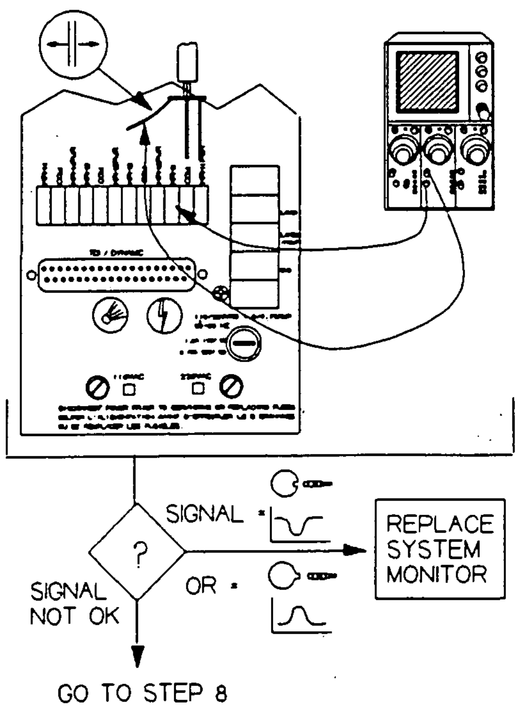


10 Keyphasor® OPERATIONAL TEST

6. Check Keyphasor® signal at the power input module **KPH1** terminal.

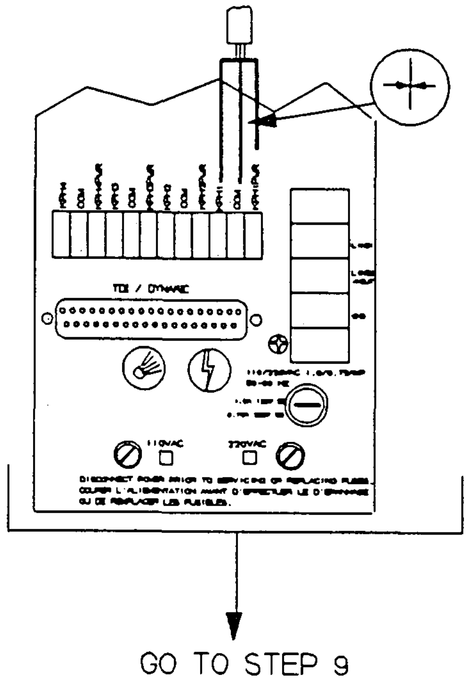


7. Disconnect wire at the power input module **KPH1** terminal and check wire for Keyphasor® signal.

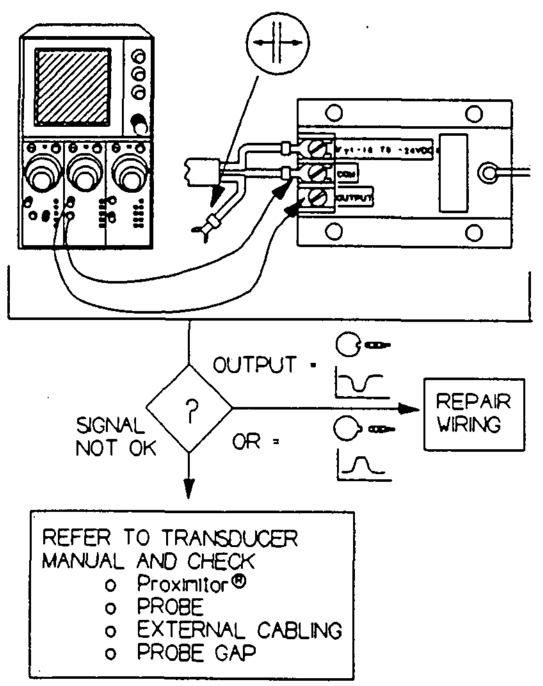


10 Keyphasor® OPERATIONAL TEST

8. Reconnect wire to the power input module **KPH1** terminal.



9. Disconnect wire at the Proximitor® output terminal and check signal at the output terminal.



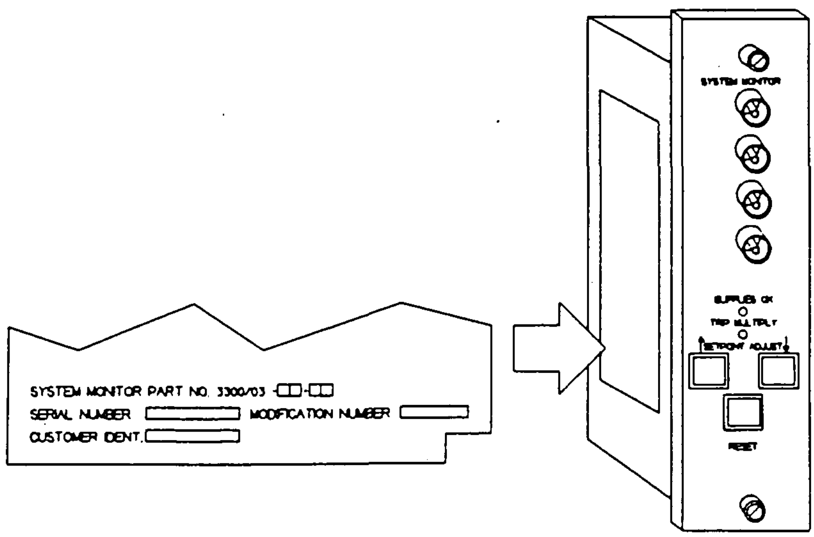
11 RECOMMENDED SPARE PARTS

Table 3. Spare Part Listing

QTY	DESCRIPTION	PART NUMBER
1	Front Panel Assembly	
	3300/03-01	87900-02*
	3300/03-02	87900-01*
	3300/03-03	87900-01*
1	Monitor Circuit Assembly	87890-01*
1	Spare Jumpers (100 pieces)	88706-01

* **TO ORDER REPLACEMENT PARTS, SPECIFY THE COMPLETE CATALOG NUMBER, 3300/03 - □□ - □□, AND THE REPLACEMENT PART NUMBER.**

If the monitor has been modified, specify the modification number on the parts order. You must set the programmable options. Section 7 lists how the options are set at the factory. If in doubt about the part number, call your Bently Nevada Corporation representative before ordering.



MONITOR IDENTIFICATION LABEL

12 SPECIFICATIONS

INPUTS

No external loads, normal operation mode, 25°C

Supply	Voltage
+VRH:	23.65 ± 6.35 Vdc
+VRL:	11.22 ± 3.09 Vdc
+7.5V:	7.5 ± 0.1 Vdc
+5V:	5.00 ± 0.05 Vdc
REF:	5.00 ± 0.009 Vdc
-7.5V:	-7.5 ± 0.1 Vdc
-VT (-24V Option):	-23.75 ± 0.45 Vdc
-VT (-18V Option):	-17.9 ± 0.4 Vdc

SYSTEM POWER-UP INHIBIT

Delay: 2.1 ± 1 seconds

CONTACT CLOSURE RATING

Contacts for System Reset, Inhibit, OK, and Trip Multiply

Active: < 100 Ω

Keyphasor®

Output Voltage

-24V Option:	-23.2 V to -24.2 V, Short-circuit Protected
-18V Option:	-17.4 V to -18.3 V, Short-circuit Protected

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.

2.4 3300/12 Power Supply

The following publication entitled 3300/12 Power Supply Manual (Part No 89602-01 Rev J) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of the Power Supply, set up options, disassembly procedure, testing, performance and trouble shooting guide.

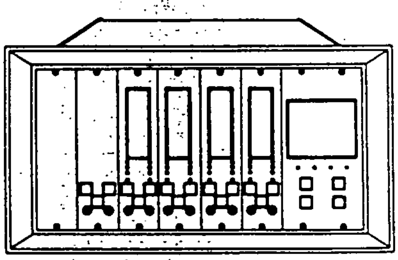
The following sections are included:

PART NO. 89602-01
REVISION J,
JANUARY 1995

3300/12 POWER SUPPLY

MANUAL

BENTLY NEVADA®



NOTICE

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. Contact could cause shock, burns, or death.

Do not touch exposed wires or terminals.

⚠ CAUTION

Machine protection will be lost.

Bently Nevada Corporation
P.O. Box 157
Minden, Nevada 89423 USA
Telephone 800-227-5514 702-782-3611
Telex 354437
Telemail 7400983 BNC UC
Fax 702-782-9253

FOREWORD

This document is intended for personnel who operate and maintain the 3300 Monitoring System. It presents information about the 3300/12 Power Supply and shows how to disassemble the power supply, set options, test performance, and troubleshoot. The procedures are presented in step-by-step graphic format.

RELATED DOCUMENTS

3300 System Overview, 80171-01

3300 System Installation Instructions, 80172-01

3300 System Troubleshooting Guide, 80173-01

The above three documents are available as part no. 80170-01.

3300/03 System Monitor, part no. 89604-01

3300/03 Serial Data Interface and Dynamic Data Interface Manual, part no. 89541-01

SYMBOLS

The manual uses the following symbols to indicate actions in the step-by-step processes.

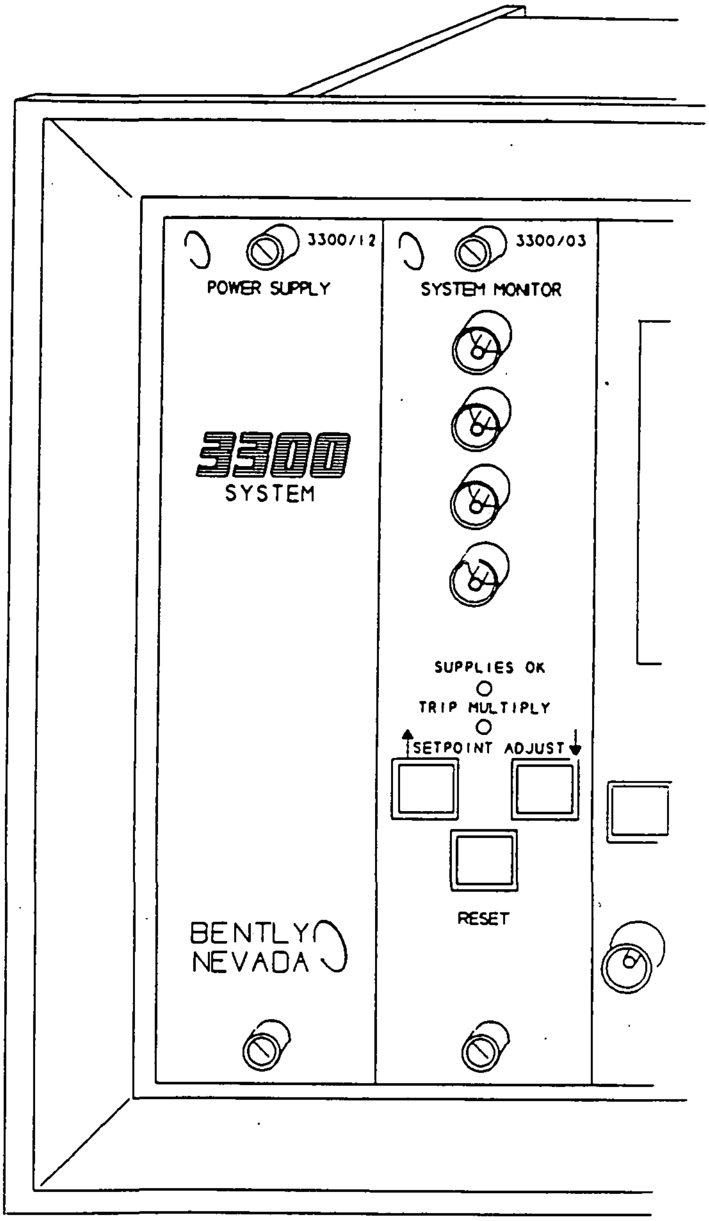
PRESS FLASHING CONNECT DISCONNECT OBSERVE SCREWDRIVER

CONTENTS

1 LOCATION OF ASSEMBLIES

This section shows the location of the Power Supply regulator board and the Power Input Module (PIM) assemblies.

The Power Supply regulator board is located in the left most rack position, behind the Power Supply front panel, next to the System Monitor as viewed from the front.

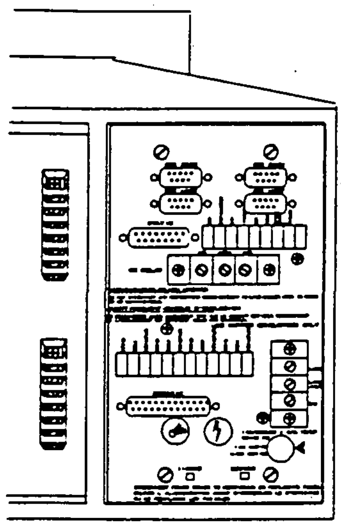


1 LOCATION OF ASSEMBLIES

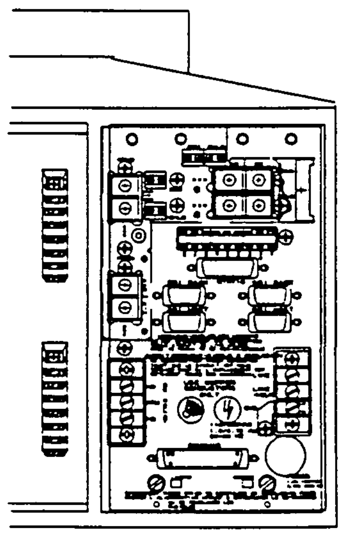
The Power Input Module (PIM) is located in the two right most rack positions as viewed from the rear, directly behind the Power Supply and System Monitor.

There are two versions of the PIM, a non-barrier version (Standard) and a barrier version. For simplicity, the remainder of the manual will often show only the Standard PIM; however, the information given applies to both versions unless otherwise noted.

The Power Input Module provides terminals for connecting the primary power, Rack Inhibit control, Trip Multiply control, Remote Alarm Reset control and Keyphasor transducers. In addition, the System OK relay and various communications ports are provided on the rear panel.



STANDARD POWER INPUT MODULE



POWER INPUT MODULE WITH BARRIERS

WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.

2 OPTIONS

This section describes the catalog and jumper-programmable options for the Power Supply.

Catalog Options

POWER SUPPLY

PART NO.	INPUT VOLTAGE	POWER INPUT MODULE	AGENCY APPROVAL
3300/12	AA	BB	CC

01 = 95 to 125 Vac 50 to 60 Hz 02 = 190 to 250 Vac 50 to 60 Hz	20 = Standard 22 = Internal Barrier	00 = None 01 = CSA 02 = BASEEFA 03 = FM 04 = City of LA

Data Communication Interface Options

Data communications can be made via the Serial Data Interface (SDI) and/or the Dynamic Data Interface (DDI). These are catalog options with the 3300/03 System Monitor. The SDI and DDI can be independently configured to use either an RS-232 or RS-422 link. Systems are shipped from the factory with both the SDI and DDI links optioned for RS-232 operation. Section 7 shows how to change these options.

Transducer Voltage Option

The transducer voltage (-VT) can be set to -24 Vdc or -18 Vdc. Systems are shipped from the factory with this option set for -24 Vdc. Section 8 shows how to change this option.

3 DISASSEMBLY PROCEDURE

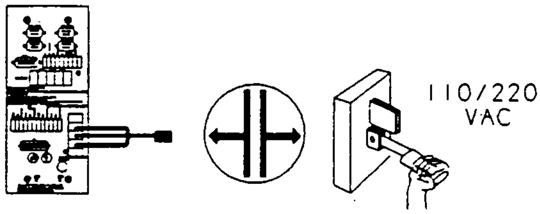
This section shows how to access the Power Supply regulator board, Power Input Module, connecting cables, and transformer assembly.

CAUTION

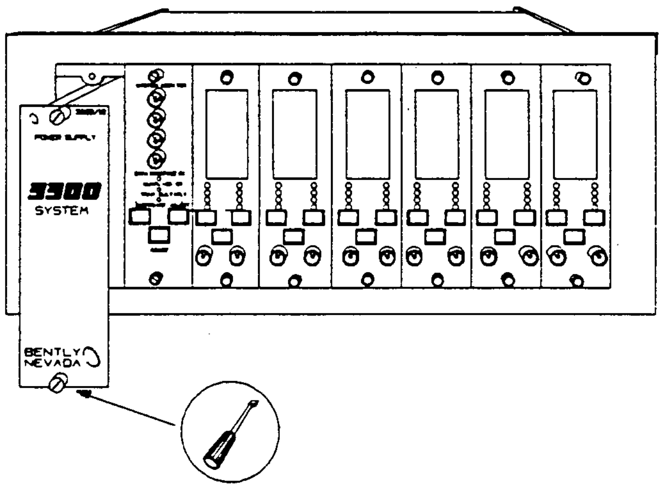
Removing the Power Supply from the rack or disconnecting the primary power source will result in loss of machine protection and may trigger false alarms.

Regulator Board

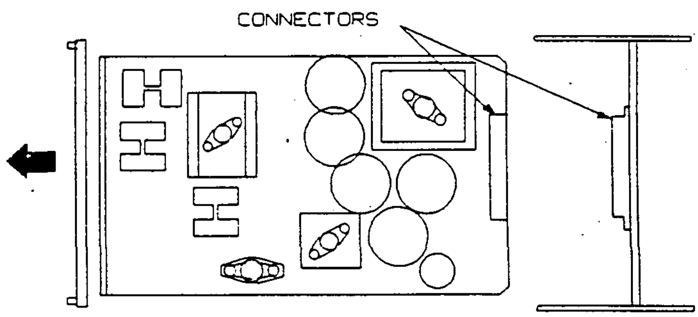
1. Disconnect the primary power source from the Power Input Module.



2. Loosen the screws on the Power Supply front panel.



3. Pull the assembly out of the rack.

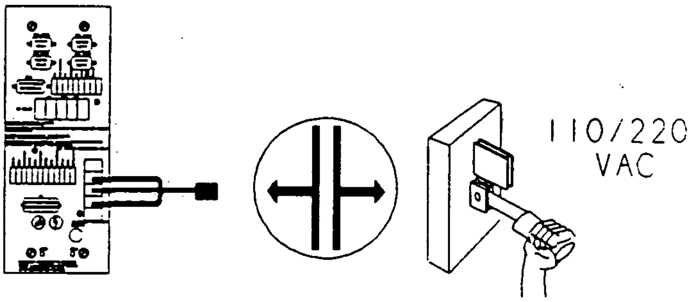


3 DISASSEMBLY PROCEDURE

WARNING

High voltage present. Contact could cause shock, burns or death.

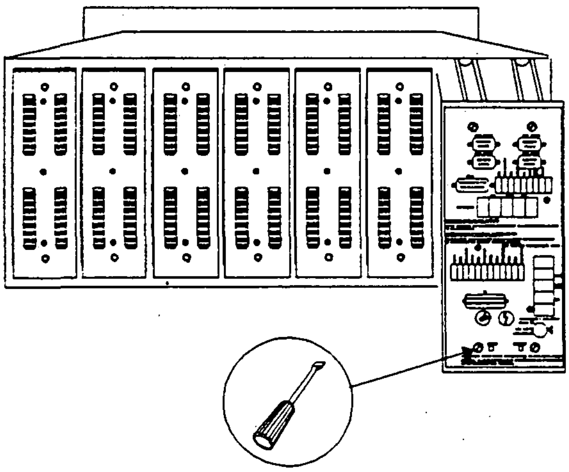
Do not touch exposed wires or terminals.



Power Input Module

4. Disconnect the primary power source from the Power Input Module (unless already done in Step 1).

5. Loosen the screws on the Power Input Module rear panel.

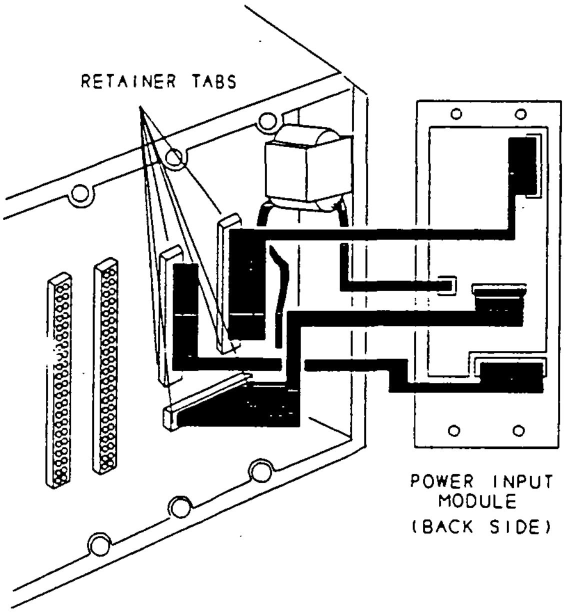


6. Carefully pull the assembly out of the rack, being sure not to stress the connecting cables.

3 DISASSEMBLY PROCEDURE

Connecting Cables

7. Release the retainer tabs on the ends of the cable connectors as required to remove the Power Input Module from the rack. Be sure all of the cables are properly secured when reconnecting the Power Input Module to the rack.



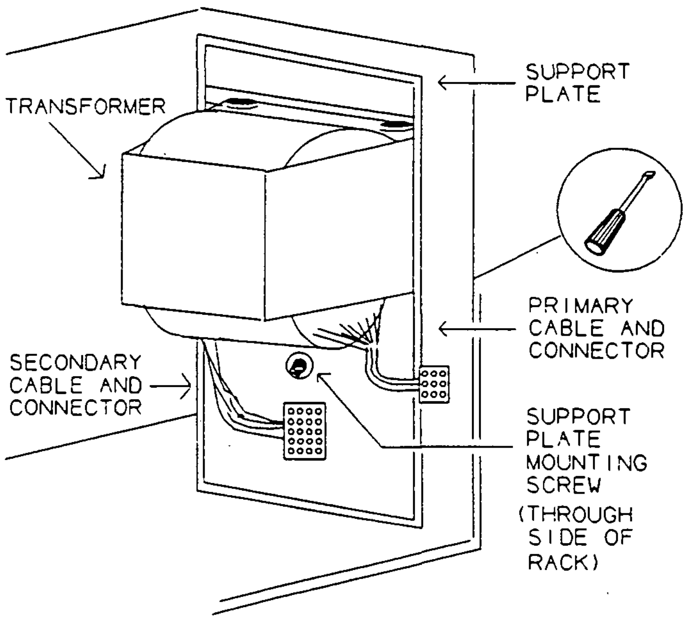
Transformer Assembly

The transformer is secured to a support plate with two bolts. The support plate slides into the rack behind the Power Input Module.

8. Remove the screw that mounts the support plate to the rack side panel.

9. Disconnect the primary and secondary connector plugs from the Power Input Module and backplane.

10. Slide the transformer and support plate assembly out of the rack.



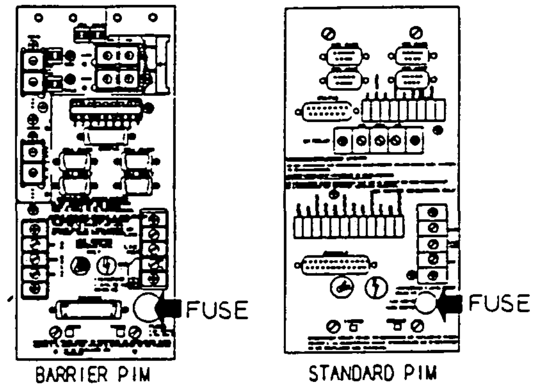
4 FUSES

This section shows where fuses are located and how to replace them.

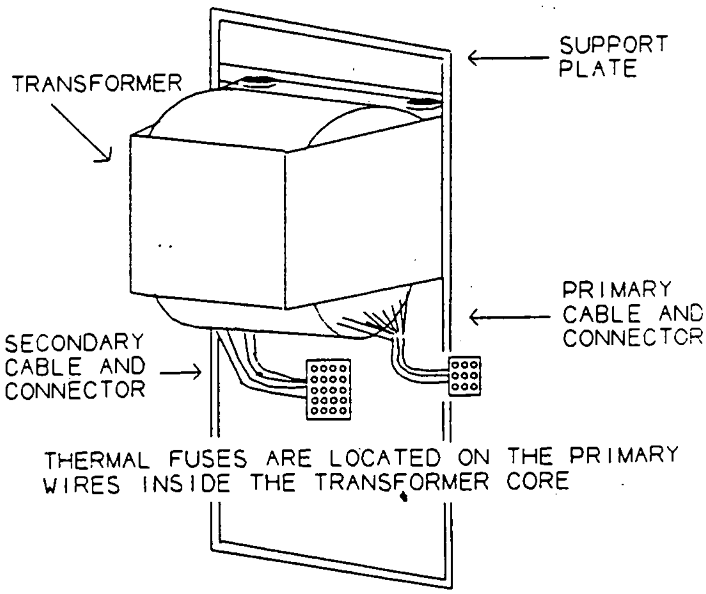
WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.



The primary power fuse is located on the Power Input Module as shown. First disconnect the primary power source from the Power Input Module, then unscrew the retainer cap to check or replace the fuse. See Section 9 for information on ordering replacement fuses.



The power transformer has built-in thermal fuses that cannot be serviced. If they open, the transformer must be replaced. See Section 3 for information on accessing the transformer assembly. See Section 9 for information on ordering a replacement transformer.

5 INPUT VOLTAGE OPTION

The Power Supply has two input voltage options, either 95 to 125 Vac or 190 to 250 Vac. In order to change the input voltage option, follow the steps below to configure the Power Input Module and change the primary power fuse.

WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.

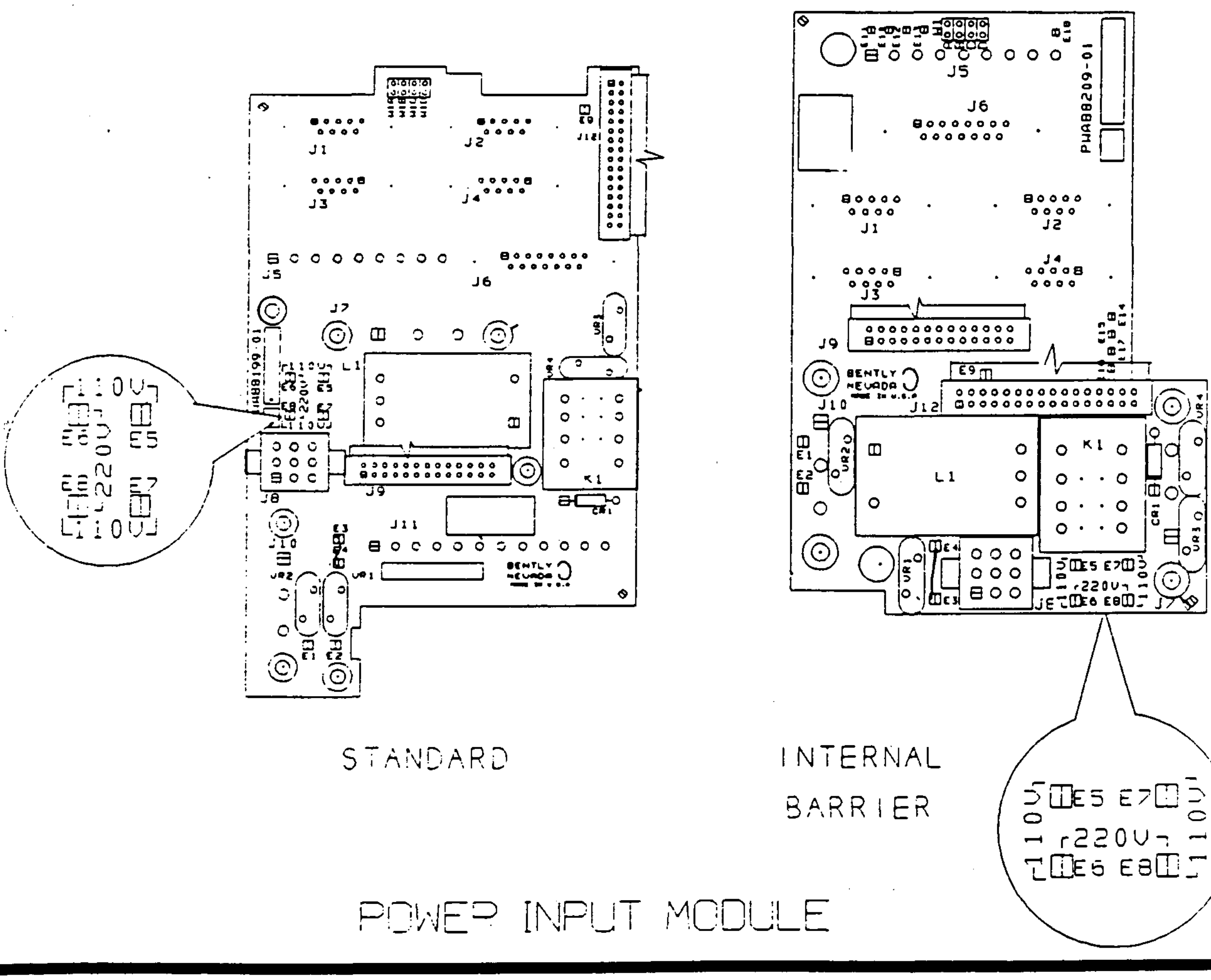
1. Disconnect the primary power source from the Power Input Module.
2. Remove the connections to the primary power input terminals.
3. Remove power and the connections to the OK Relay terminals.
4. Remove the Power Input Module from the rack and disconnect the attached cables (see Section 3, Disassembly Procedure).
5. Remove the primary power fuse (see Section 4, Fuses). Using the table below, select and install the appropriate fuse for the desired input voltage option. Note that systems with BASEEFA approvals require a different fuse.

Desired input voltage option	None, CSA, FM, or City of LA approval (Catalog option CC=00, 01, 03, or 04, see Section 2)	BASEEFA approval (Catalog option CC=02, see Section 2)
95 - 125 Vac	01701500	01710512
190 - 250 Vac	01703118	01720007

5 INPUT VOLTAGE OPTION

6. Use the table below to configure jumpers E5-E8 on the Power Input Module for the desired input voltage option. Note that this requires soldering and desoldering the jumper connections. The drawing at the bottom of the page shows where the jumpers are located on a standard and an internal barrier Power Input Module.

Desired input voltage option	Break these connections on Power Input Module:	Make these connections on Power Input Module:
95 - 125 Vac	E6 to E8	E5 to E6 E7 to E8
190 - 250 Vac	E5 to E6 E7 to E8	E6 to E8



POWER INPUT MODULE

5 INPUT VOLTAGE OPTION

7. Reconnect the cables that were disconnected in step four and re-install the Power Input Module to the rack. Connect the wires to the OK Relay and the primary power input terminals. Apply the OK Relay power and the primary power. Do not apply power to the rack until the Power Input Module is completely installed.

6 TESTING AND TROUBLESHOOTING

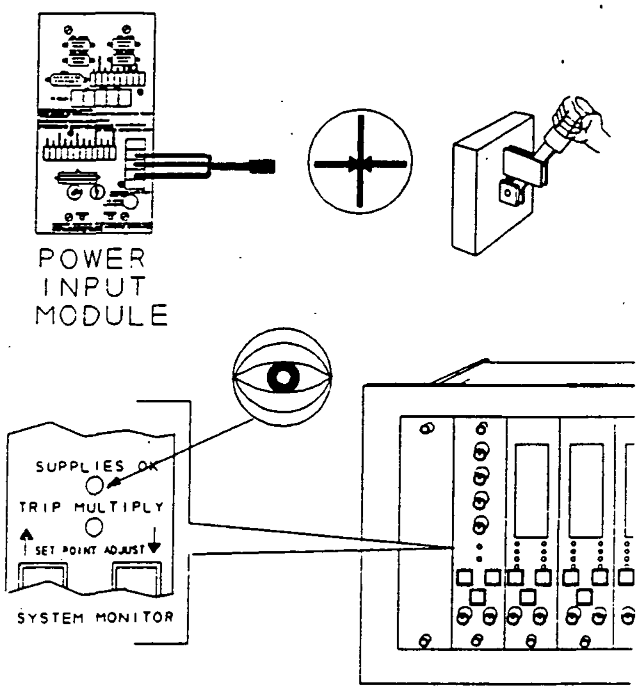
This section shows how to verify that the Power Supply is operating properly and explains what to do if it is not.

WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.

1. Apply power to the rack and observe the **SUPPLIES OK** LED on the System Monitor front panel.



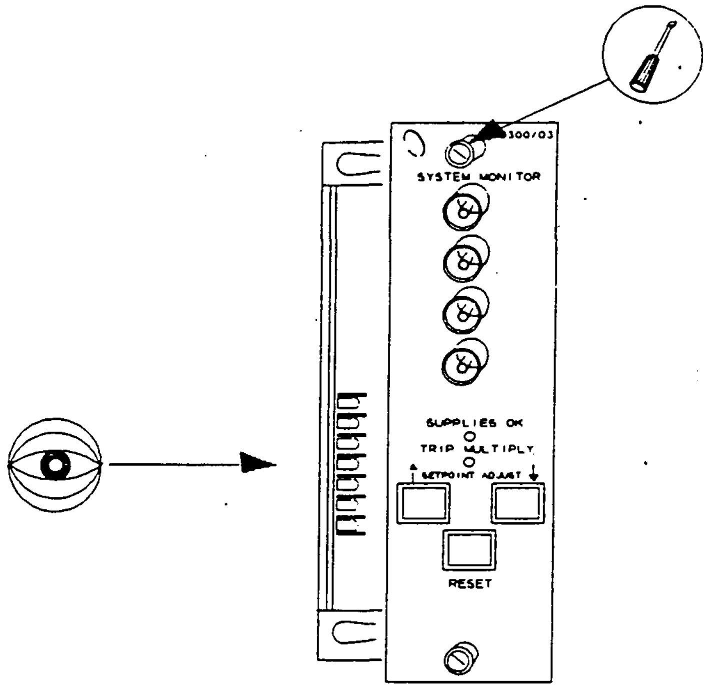
IS "SUPPLIES OK" LED ON?

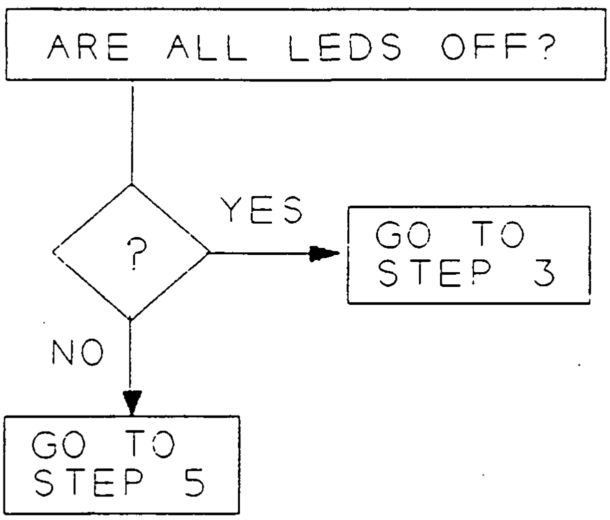
? YES → SUPPLIES OK END OF TEST

NO → GO TO STEP 2

6 TESTING AND TROUBLESHOOTING

2. Loosen the System Monitor front panel screws and move the panel to the right. Observe the seven LEDs on the System Monitor circuit board.



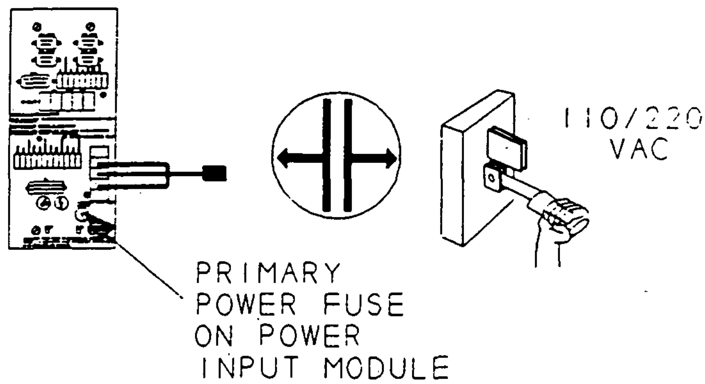


6 TESTING AND TROUBLESHOOTING

⚠ WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.



3. Disconnect the primary input power source from the rack. Check the primary input power source and the primary power fuse.

ARE PRIMARY INPUT POWER SOURCE AND PRIMARY POWER FUSE IN WORKING ORDER?

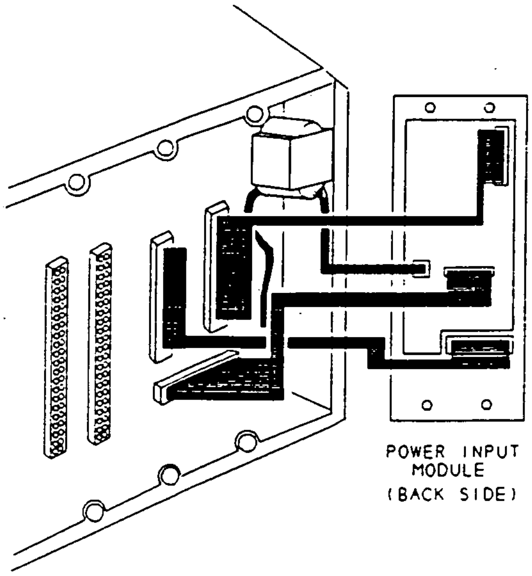
?

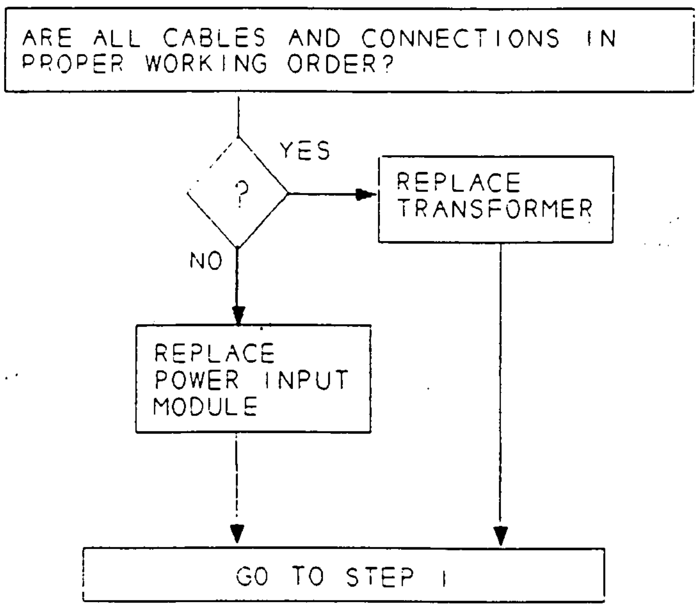
YES → GO TO STEP 4

NO → REPAIR PRIMARY INPUT POWER SOURCE AND/OR REPLACE FUSE → GO TO STEP 1

6 TESTING AND TROUBLESHOOTING

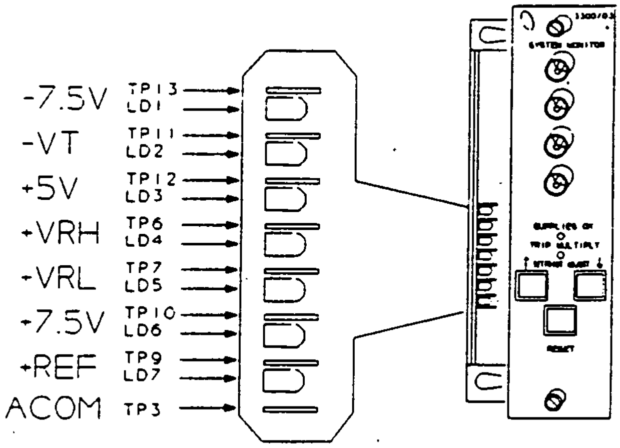
4. Leaving the rack disconnected from the primary input power source, loosen the Power Input Module screws and carefully pull the module away from the rack as far as the connecting cables will allow. Check that the cabling and connections between the Power Input Module, power transformer, and backplane is correct and connected tightly. When this step is complete, repeat the test starting with Step 1. Do not apply power to the rack until the Power Input Module is completely installed.





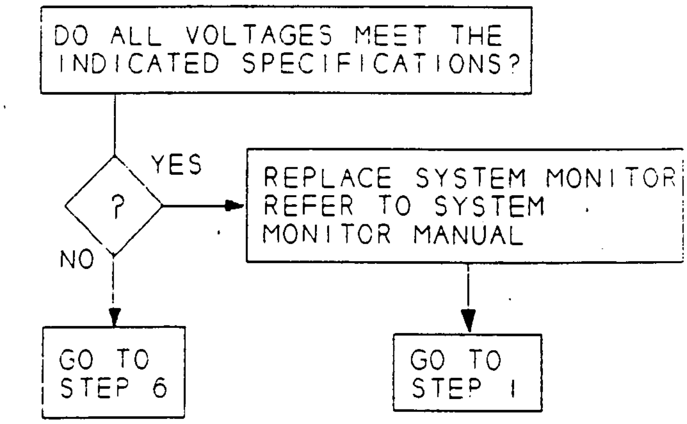
6 TESTING AND TROUBLESHOOTING

5. Measure the dc voltages at the test points indicated (referenced to ACOM TP3) on the System Monitor as shown. All voltages should meet the specifications given in the table at right.



VOLTAGE	TEST PT	TOLERANCE (VDC)
-7.5V	TP13	-7.40 TO -7.60
-VT (-24V)	TP11	-23.30 TO -24.20
-VT (-18V)	TP11	-17.50 TO -18.30
+5V	TP12	+4.95 TO +5.05
+VRH	TP6	+17.30 TO +30.00
+VRL	TP7	+8.00 TO +15.70
+7.5V	TP10	+7.40 TO +7.60
+REF	TP9	+4.991 TO +5.009

VOLTAGES REFERENCED TO ACOM (TP3)

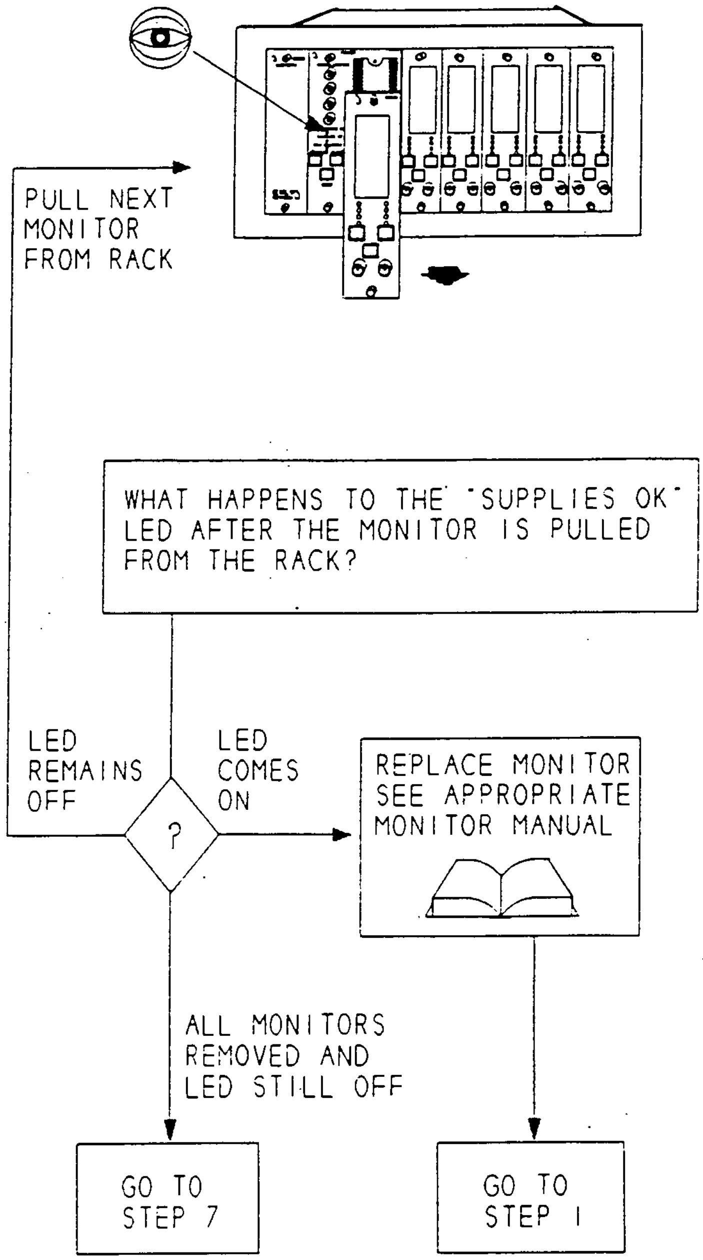


6 TESTING AND TROUBLESHOOTING

CAUTION

Machine protection will be lost.

6. Leaving the Power Supply and System Monitor in the rack, take one monitor at a time out of the system. Loosen the front panel screws on a monitor and disengage the monitor from the rack by pulling it forward out of the front of the rack, approximately two inches. Observe the System Monitor **SUPPLIES OK** LED after the monitor is pulled from the rack. Continue disengaging monitors from the rack until the **SUPPLIES OK** LED comes on, or until all monitors are disengaged from the rack.



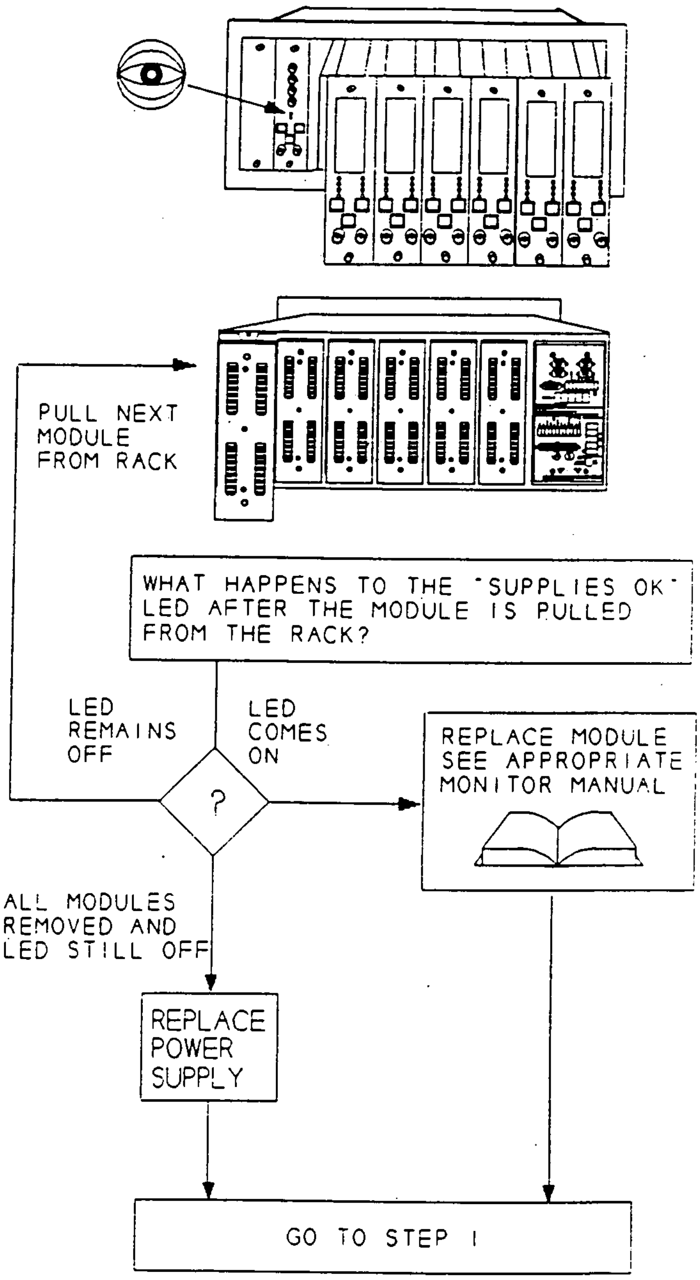
6 TESTING AND TROUBLESHOOTING

WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.

7. Leaving the monitors disengaged from the rack, take one Signal Input Module at a time out of the system. Loosen the retainer screws on a module and disengage the module from the backplane by pulling it forward, away from the back of the rack, about two inches. Observe the System Monitor **SUPPLIES OK** LED after the module is pulled from the rack. Continue disengaging modules from the rack until the **SUPPLIES OK** LED comes on, or until all modules are disengaged from the rack. If all the modules are disengaged from the rack and the **SUPPLIES OK** LED still does not come on, replace the Power Supply and repeat the test starting with Step 1.



7 DATA COMMUNICATION INTERFACE OPTIONS

The Power Input Module can be configured to use an RS-232 or RS-422 interface with the Serial Data Interface (SDI) and/or the Dynamic Data Interface (DDI). Systems are shipped from the factory with both the SDI and DDI links optioned for RS-232 operation. Use this procedure to select RS-232, RS-422 or "unused" for the SDI and DDI communication interface links. The 3300/03 Serial Data Interface and Dynamic Data Interface manual provides details about these options.

WARNING

High voltage present. Contact could cause shock, burns or death.

Do not touch exposed wires or terminals.

CAUTION

Machine protection will be lost.

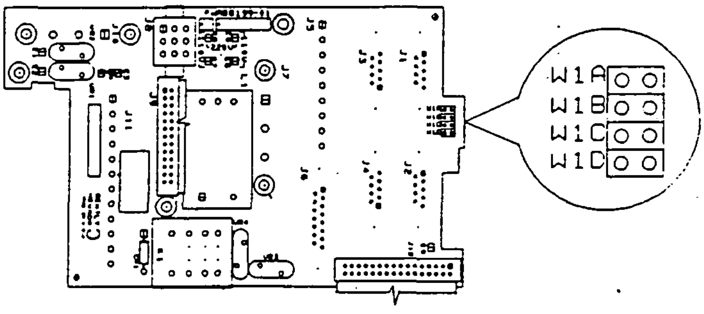
1. Disconnect the primary power source from the Power Input Module (Sec. 3, Step 1).

2. Remove the Power Input Module from the rack (Sec. 3, Steps 5-7).

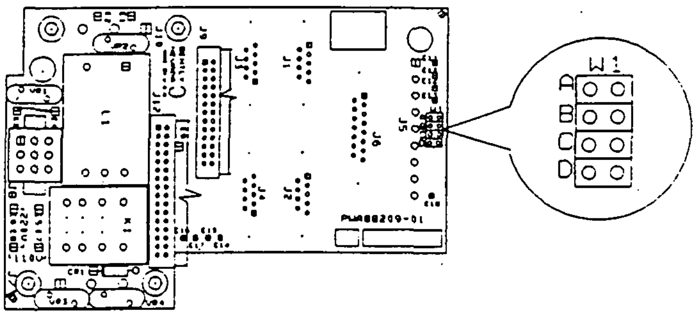
3. Change the jumper options on the Power Input Module circuit board as shown in the table at right.

4. Reinstall the Power Input Module to the rack.

5. Reconnect the primary power source to the Power Input Module.



STANDARD POWER INPUT MODULE



POWER INPUT MODULE WITH BARRIERS

COMM LINK	DDI HOST INSTALL	DDI HOST REMOVE	SDI HOST INSTALL	SDI HOST REMOVE
RS-422	W1D	W1C	W1B	W1A
RS-232	W1C	W1D	W1A	W1B
UNUSED	W1C	W1D	W1A	W1B

8 TRANSDUCER VOLTAGE OPTION

This section shows how to set the transducer voltage to -24 Vdc or -18 Vdc.

CAUTION

Machine protection will be lost.

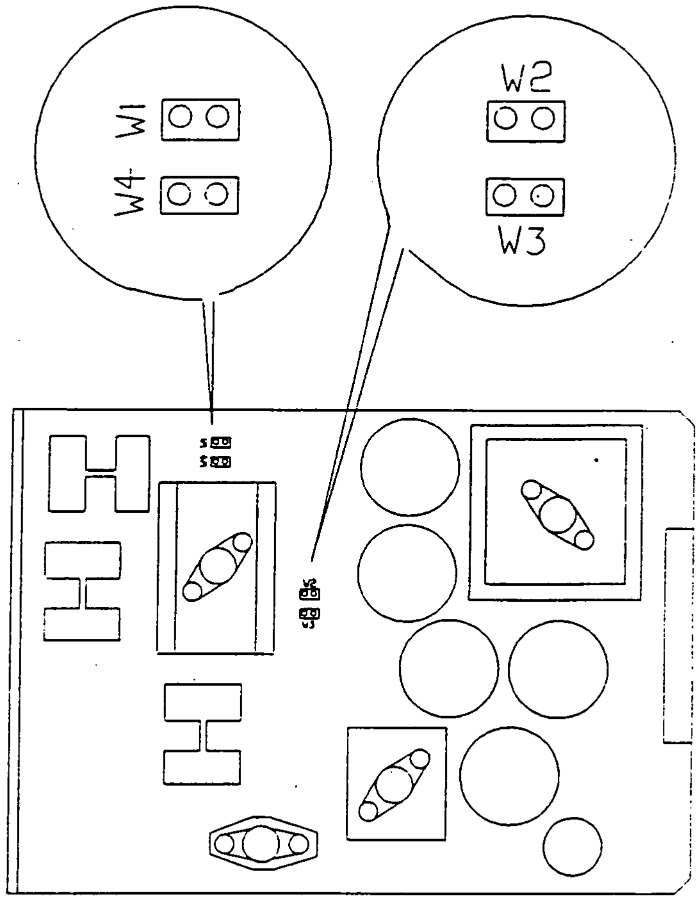
1. Remove the Power Supply from the rack (Sec. 3, Steps 1-3).

2. Change the jumper options on the Power Supply regulator board as shown in the table at right.

3. Reinstall the Power Supply to the rack.

CAUTION

Make sure the transducer voltage option on the System Monitor circuit board is set to the same voltage option as the Power Supply (see System Monitor manual). If the voltage options are different, the System Monitor will indicate a transducer voltage (-VT) tolerance error.

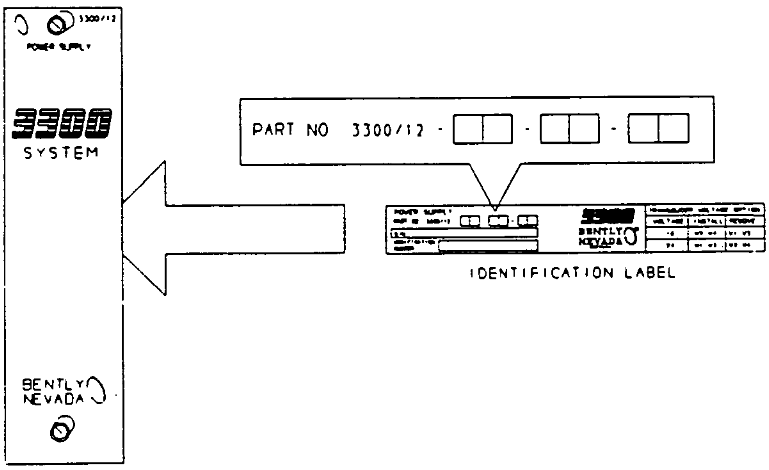


TRANSDUCER VOLTAGE (-VT)	REMOVE	INSTALL
-24 VDC	W2 W4	W1 W3
-18 VDC	W1 W3	W2 W4

9 RECOMMENDED SPARE PARTS

To order replacement parts, specify the complete catalog number as indicated on the identification label on the back side of the front panel. Also include the replacement part number(s) given in the following table. If the Power Supply has been modified (also shown on identification label), include the modification number on the parts order. If you are in doubt as to the proper part numbers to request, contact your Bently Nevada Corporation representative for assistance.

QTY	DESCRIPTION	PART NUMBER
1	Primary Power Fuse (See AA and CC Catalog Options) AA=01, CC=00/01/03/04 : 250V/1.50A, Time Lag AA=02, CC=00/01/03/04 : 250V/0.75A, Time Lag AA=01, CC=02 (BASEEFA): 250V/2.50A, Time Lag AA=02, CC=02 (BASEEFA): 250V/1.25A, Time Lag	 01701500 01703118 01710512 01720007
1	Regulator Board	88219-01
1	Power Input Module (See BB Catalog Option) Standard (BB=20) Internal Barrier (BB=22)	 88199-01 88209-01
1	Power Transformer	00270143
1	Spare Jumpers (100 pieces)	88706-01



10 SPECIFICATIONS

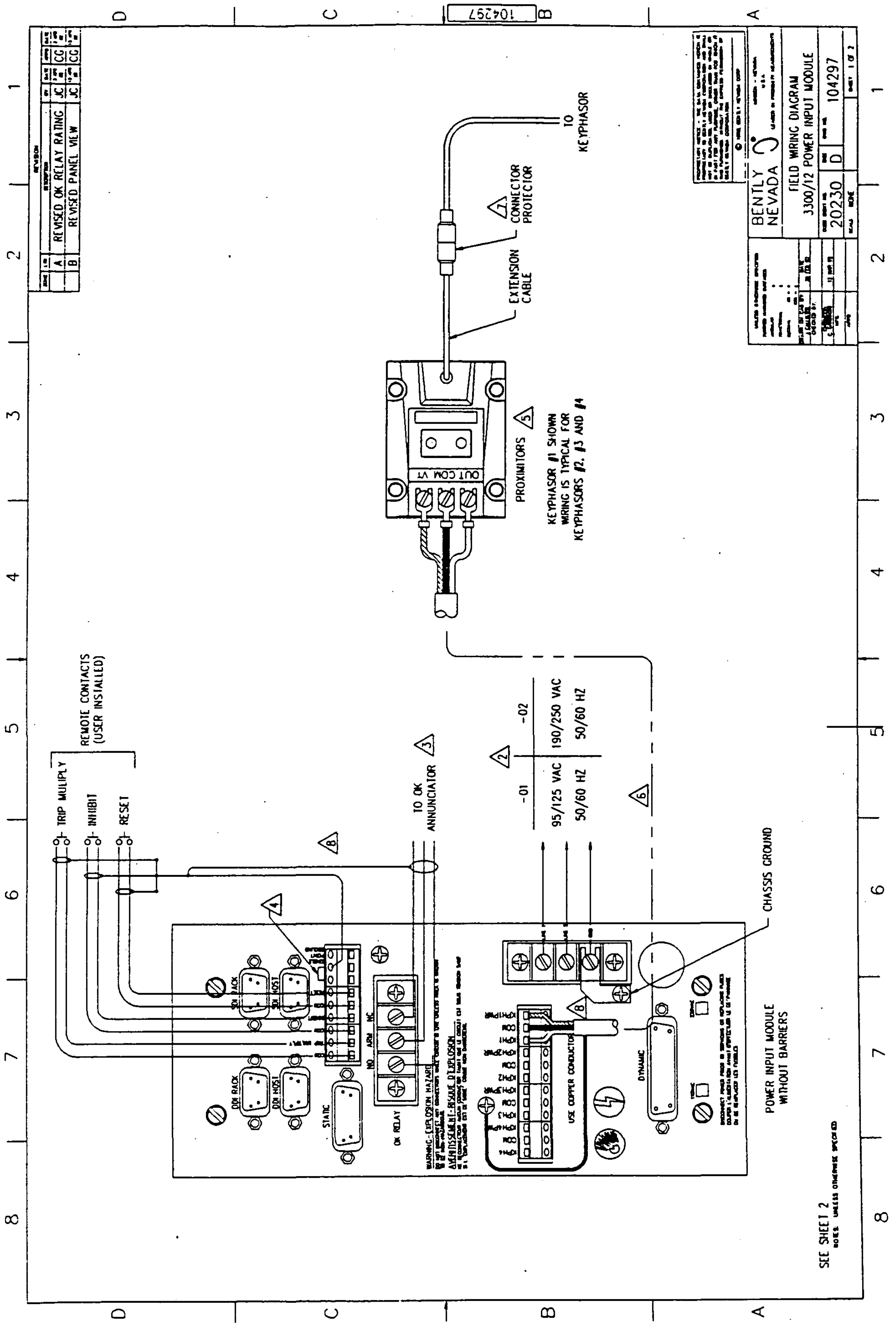
POWER INPUT

110 Vac Option:	95 to 125 Vac, Single Phase, 50 to 60 Hz, 0.6 A maximum.
220 Vac Option:	190 to 250 Vac, Single Phase, 50 to 60 Hz, 0.3 A maximum.
Start Up Surge:	20 A peak (7 A rms) for one cycle.
Surge Suppression:	Clamp Voltage 285 to 300 V rms. Peak Surge Current 100 A for 6 msec maximum.
Power Dissipation:	60 W average.

ENVIRONMENTAL

Operating Temperature:	+32•F to +149•F (0•C to +65•C)
Storage Temperature:	-40•F to +185•F (-40•C to +85•C)
Relative Humidity:	0 to 95%, noncondensing

11 FIELD WIRING DRAWINGS


104297
REVISION
A REVISED OK RELAY RATING JC CG
B REVISED PANEL VIEW JC CG
TO KEYPHASOR
CONNECTOR PROTECTOR
EXTENSION CABLE
OUT COM VT
PROXIMITORS
KEYPHASOR #1 SHOWN WIRING IS TYPICAL FOR KEYPHASORS #2, #3 AND #4
REMOTE CONTACTS (USER INSTALLED)
TRIP MULIPLY
INHIBIT
RESET
TO OK ANNUNCIATOR
-01
95/125 VAC
50/60 HZ
-02
190/250 VAC
50/60 HZ
CHASSIS GROUND
SDI RACK
SDI HOST
DDI RACK
DDI HOST
STATIC
NO ARM NC
OK RELAY
WARNING-EXPLOSION HAZARD
AVERTISSEMENT-RISQUE D'EXPLOSION
USE COPPER CONDUCTORS
DYNAMIC
POWER INPUT MODULE WITHOUT BARRIERS
SEE SHEET 2
BENTLY NEVADA
FIELD WIRING DIAGRAM
3300/12 POWER INPUT MODULE
20230
D
104297

ZONE	LTR	REVISION DESCRIPTION	BY	DATE	APPD	DATE
	B	SEE SHEET 1				

NON-BARRIER SYSTEM FIELD WIRING NOTES

1. WIRING RECOMMENDATIONS:
   POWER INPUT MODULE TO PROXIMITORS: 18AWG TO 22AWG STRANDED 3 WIRE SHIELDED WITH INSULATING SHEATH.
   POWER INPUT MODULE TO REMOTE CONTACTS: 18AWG TO 22AWG STRANDED 2 WIRE WITH INSULATING SHEATH.

2. WIRE GAUGE AND TYPE SELECTED PER LOCAL CODE REQUIREMENTS. POWER REQUIREMENTS ARE: 95-125 VAC, 50/60 HZ, SINGLE PHASE, 1.0 A MAXIMUM, OR 190-250 VAC, 50/60 HZ, SINGLE PHASE, 0.5 A MAXIMUM.
   POWER SURGE AT START-UP: 20 A PK FOR ONE CYCLE.

3. OK RELAY CONTACT RATING: 5 A @ 28 VDC, OR 5 A @ 120 VAC, 50/60 HZ, OR 3 A @ 220 VAC, 50/60 HZ, RESISTIVE MAXIMUM.

4. TO MINIMIZE GROUND LOOP NOISE PROBLEMS, A SINGLE POINT EARTH GROUND (GND) TO SYSTEM COMMON (COM) CONNECTION IS RECOMMENDED.

5. THE 3000 AND 7200 PROXIMITOR CASES MUST BE ELECTRICALLY ISOLATED FROM EARTH GROUND. ELECTRICAL ISOLATION: 500 VAC (RMS) MINIMUM. ISOLATION KIT P/N 19094-01 MAY BE USED TO SATISFY ISOLATION REQUIREMENTS. WIRING FOR THE 7200 AND 3000 PROXIMITORS IS THE SAME AS SHOWN FOR THE 3300 PROXIMITOR.

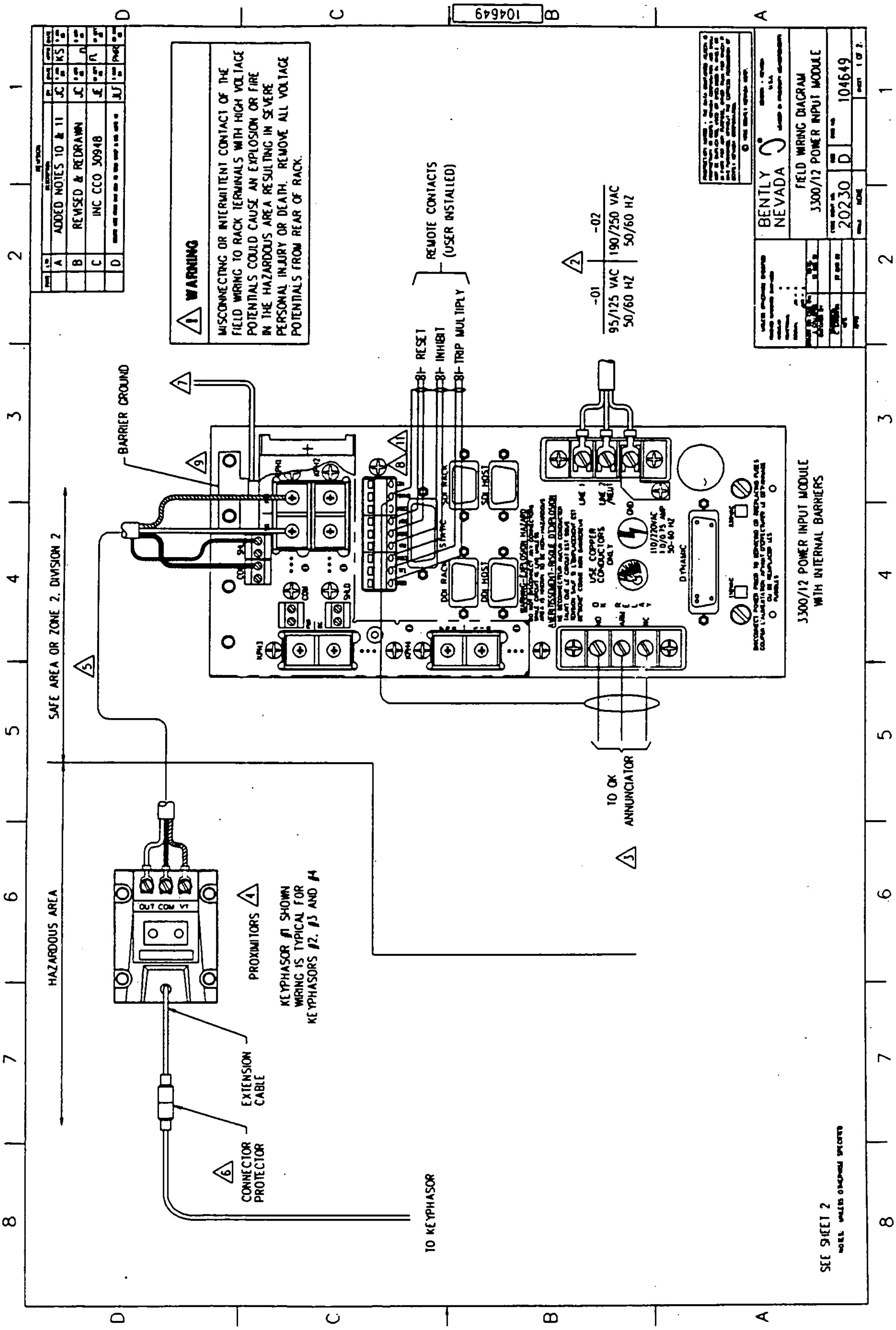
6. MAXIMUM CABLE LENGTH BETWEEN POWER INPUT MODULE AND PROXIMITORS SHOULD NOT EXCEED 1000 FEET (305 METRES).

7. TO ELECTRICALLY ISOLATE AND PROTECT COAXIAL CONNECTIONS, USE CONNECTOR PROTECTOR KIT 40113-02.

8. SHIELDS ARE SPLICED INTO A SINGLE WIRE, THEN GROUNDED AS SHOWN, TERMINATING AT THE CHASSIS IN TWO PLACES. SHIELDS SHOULD BE INSULATED.

NOTES: UNLESS OTHERWISE SPECIFIED

CODE IDENT NO	SIZE	DWG NO.
20230	D	104297
SCALE NONE		SHEET 2 OF 2


104649
WARNING
MISCONNECTING OR INTERMITTENT CONTACT OF THE FIELD WIRING TO RACK TERMINALS WITH HIGH VOLTAGE POTENTIALS COULD CAUSE AN EXPLOSION OR FIRE IN THE HAZARDOUS AREA RESULTING IN SEVERE PERSONAL INJURY OR DEATH. REMOVE ALL VOLTAGE POTENTIALS FROM REAR OF RACK.
A ADDED NOTES 10 & 11 JC KS
B REVISED & REDRAWN JC
C INC CCO 30948 JE
D JLF PHR
REMOTE CONTACTS (USER INSTALLED)
RESET
INHIBIT
TRIP MULTIPLY
BARRIER GROUND
-01 95/125 VAC 50/60 HZ
-02 190/250 VAC 50/60 HZ
SAFE AREA OR ZONE 2, DIVISION 2
HAZARDOUS AREA
3300/12 POWER INPUT MODULE WITH INTERNAL BARRIERS
USE COPPER CONDUCTORS ONLY
110/220VAC
DYNAMIC
TO OK ANNUNCIATOR
PROXIMITORS
OUT COM VT
KEYPHASOR #1 SHOWN WIRING IS TYPICAL FOR KEYPHASORS #2, #3 AND #4
EXTENSION CABLE
CONNECTOR PROTECTOR
TO KEYPHASOR
SEE SHEET 2
BENTLY NEVADA
FIELD WIRING DIAGRAM 3300/12 POWER INPUT MODULE
20230 D 104649
A B C D
1 2 3 4 5 6 7 8

REV	DESCRIPTION
D	SEE SHEET 1

INTERNAL BARRIER SYSTEM FIELD WIRING NOTES

1. WIRING RECOMMENDATIONS:
   POWER INPUT MODULE TO PROXIMITORS: 14AWG TO 18AWG STRANDED
   3 WIRE, SHIELDED WITH INSULATING SHEATH.
   POWER INPUT MODULE TO REMOTE CONTACTS: 18AWG TO 22AWG STRANDED
   2 WIRE WITH INSULATING SHEATH.

2. WIRE GAUGE AND TYPE SELECTED PER LOCAL CODE REQUIREMENTS. POWER REQUIREMENTS
   95-125 VAC, 50-60 HZ, SINGLE PHASE, 1.0 AMP MAX. OR
   190-250 VAC, 50-60 HZ, SINGLE PHASE, 0.5 AMP MAX.
   POWER SURGE AT START-UP: 20 AMP PEAK FOR ONE CYCLE.

3. OK RELAY CONTACT RATING: 5A @ 28VDC, OR 5A @ 120VAC, 50/60 HZ, OR 3A @ 220VAC, 50/60 HZ. RESISTIVE, MAXIMUM.

4. THE 7200 PROXIMITOR CASES MUST BE ELECTRICALLY ISOLATED FROM EARTH GROUND. ELECTRICAL ISOLATION: 500 VAC (RMS) MINIMUM. ISOLATION KIT P/N 19094-01 MAY BE USED TO SATISFY ISOLATION REQUIREMENTS. WIRING FOR THE 3000 AND 7200 PROXIMITORS IS THE SAME AS SHOWN FOR THE 3300 PROXIMITOR.

5. MAXIMUM CABLE LENGTH BETWEEN POWER INPUT MODULE AND PROXIMITORS SHOULD NOT EXCEED 1000 FEET (305 METRES).

6. TO ELECTRICALLY ISOLATE AND PROTECT COAXIAL CONNECTIONS, USE CONNECTOR PROTECTOR KIT 40113-02.

7. REDUNDANT CONNECTIONS TO THE MAIN EARTH BUS. IF EXTERNAL BARRIERS ARE ALSO USED WITH THIS RACK, THESE CONNECTIONS MUST BE MADE TO THE EXTERNAL BARRIER RAIL. TOTAL EARTH LOOP IMPEDANCE (INCLUDING BARRIER RAIL) MUST NOT EXCEED 1 OHM.

8. SHIELDS ARE SPLICED INTO A SINGLE WIRE, THEN GROUNDED AS SHOWN, TERMINATING AT THE CHASSIS. SHIELDS SHOULD BE INSULATED.

9. AT BARRIER GROUND, SCREWS MUST BE TIGHT TO MAINTAIN PROPER GROUNDING.

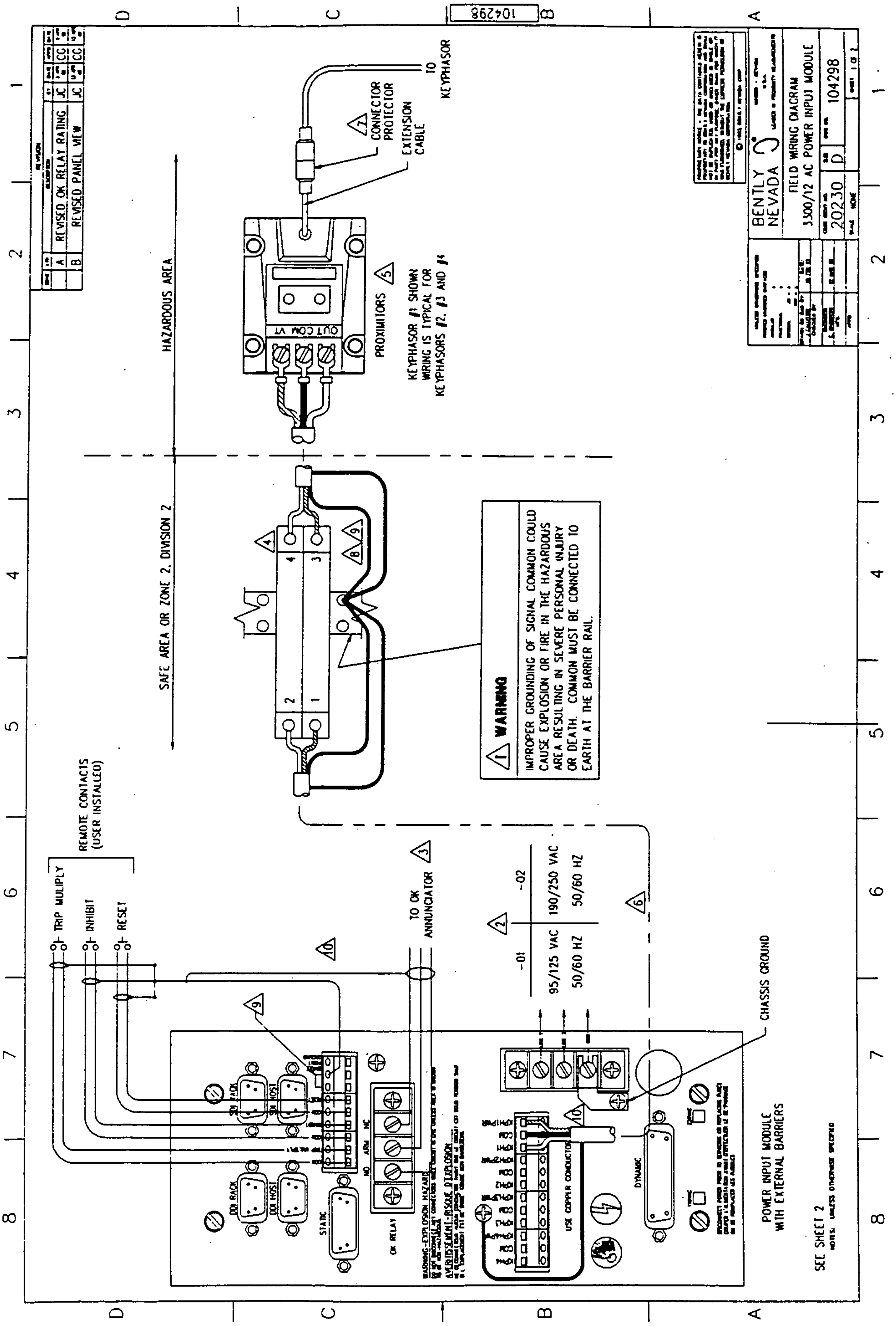
10. DELETED

11. DO NOT CONNECT SYSTEM COMMON TO CHASSIS GROUND WHEN BARRIERS ARE BEING USED.

NOTES: UNLESS OTHERWISE SPECIFIED

CODE IDENT NO	SIZE	DWG NO
20230	D	104649
SCALE NONE		SHEET 2 OF 2

104649


104298
REVISED OK RELAY RATING
REVISED PANEL VIEW
HAZARDOUS AREA
SAFE AREA OR ZONE 2, DIVISION 2
TO KEYPHASOR
CONNECTOR PROTECTOR
EXTENSION CABLE
PROXIMITORS
KEYPHASOR #1 SHOWN WIRING IS TYPICAL FOR KEYPHASORS #2, #3 AND #4
OUT COM VT
WARNING
IMPROPER GROUNDING OF SIGNAL COMMON COULD CAUSE EXPLOSION OR FIRE IN THE HAZARDOUS AREA RESULTING IN SEVERE PERSONAL INJURY OR DEATH. COMMON MUST BE CONNECTED TO EARTH AT THE BARRIER RAIL.
REMOTE CONTACTS (USER INSTALLED)
TRIP MULIPLY
INHIBIT
RESET
TO OK ANNUNCIATOR
-01
-02
95/125 VAC
50/60 HZ
190/250 VAC
50/60 HZ
CHASSIS GROUND
OK RELAY
USE COPPER CONDUCTOR
DYNAMIC
POWER INPUT MODULE WITH EXTERNAL BARRIERS
SEE SHEET 2
BENTLY NEVADA
FIELD WIRING DIAGRAM
3300/12 AC POWER INPUT MODULE
20230
D
104298

REVISION						
ZONE	LTR	DESCRIPTION	BY	DATE	APPD	DATE
	B	SEE SHEET 1				

EXTERNAL BARRIER SYSTEM FIELD WIRING NOTES

1. WIRING RECOMMENDATIONS:
   POWER INPUT MODULE TO BARRIERS – BARRIERS TO PROXIMITORS: 14AWG TO 18AWG STRANDED 3 WIRE, SHIELDED WITH INSULATING SHEATH.
   POWER INPUT MODULE TO REMOTE CONTACTS: 18AWG TO 22AWG STRANDED 2 WIRE WITH INSULATING SHEATH.

2. WIRE GAUGE AND TYPE SELECTED PER LOCAL CODE REQUIREMENTS. POWER REQUIREMENTS ARE: 95-125 VAC, 50/60 HZ, SINGLE PHASE, 1.0 A MAXIMUM OR 190-250 VAC, 50/60 HZ, SINGLE PHASE, 0.5 A MAXIMUM.
   POWER SURGE AT START-UP: 20 A PK FOR ONE CYCLE.

3. OK RELAY CONTACT RATING: 5 A @ 28 VDC, OR 5 A @ 120 VAC, 50/60HZ, OR 3 A @ 220 VAC, 50/60 HZ, RESISTIVE MAXIMUM.

4. USE MTL BARRIER PER DRAWING BA22000, NOTE 14.

5. THE 7200 PROXIMITOR CASES MUST BE ELECTRICALLY ISOLATED FROM EARTH GROUND. ELECTRICAL ISOLATION: 500 VAC (RMS) MINIMUM. ISOLATION KIT P/N 19094-01 MAY BE USED TO SATISFY ISOLATION REQUIREMENTS. WIRING FOR THE 3000 AND 7200 PROXIMITOR IS THE SAME AS SHOWN FOR THE 3300 PROXIMITOR.

6. MAXIMUM CABLE LENGTH BETWEEN POWER INPUT MODULE AND PROXIMITORS SHOULD NOT EXCEED 1000 FEET (305 METRES).

7. TO ELECTRICALLY ISOLATE AND PROTECT COAXIAL CONNECTIONS, USE CONNECTOR PROTECTOR KIT 40113-02.

8. TRANSDUCER SHIELDS ARE JOINED AS SHOWN TERMINATING AT BARRIER GROUND. SHIELDS SHOULD BE INSULATED.

9. BARRIERS ARE MOUNTED TO BARRIER RAIL WHICH IS THE POTENTIAL EQUALIZATION BUS BETWEEN SYSTEM GROUND AND EARTH GROUND. TO MINIMIZE GROUND LOOP PROBLEMS, A SINGLE POINT EARTH GROUND (GND) TO SYSTEM COMMON (COM) CONNECTION IS RECOMMENDED AT THE BARRIER RAIL. TOTAL EARTH LOOP IMPEDANCE MUST NOT EXCEED 1 OHM. REMOVE SINGLE POINT EARTH GROUND CONNECTION ON THE 3300 POWER INPUT MODULE.

10. SHIELDS ARE SPLICED INTO A SINGLE WIRE, THEN GROUNDED AS SHOWN, TERMINATING AT THE CHASSIS IN TWO PLACES. SHIELDS SHOULD BE INSULATED.

NOTES: UNLESS OTHERWISE SPECIFIED

CODE IDENT NO.	SIZE	DWG NO.
20230	D	104298
SCALE NONE		SHEET 2 OF 2

104298

2.5 3300 Six Channel Temperature Monitor

The following publication entitled 3300 Six Channel Temperature Monitor Operation Manual (Part No 80182-01 Rev F) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of the Temperature Monitor, details of the operation, functions, alarm setup, programmable options, testing and error codes.

The following sections are included:

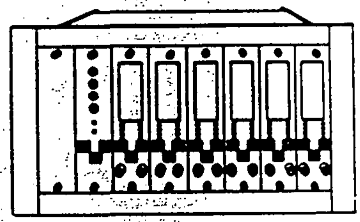
PART NO. 80182-01
REVISION F,
NOVEMBER 1993

3300 SIX CHANNEL TEMPERATURE MONITOR

3300/30 - THERMOCOUPLE
3300/35 - RTD

OPERATION MANUAL

BENTLY NEVADA®
MADE IN U.S.A.



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. Contact Could cause shock, burns or death. **Do not touch exposed wires or terminals.**

⚠ CAUTION
Machine protection will be lost during calibration.

First Printing: March 1989

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Telex 7400983 BNC UC
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FOREWORD

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

RELATED DOCUMENTS

3300 System Overview, 80171-01

3300 System Installation Instructions, 80172-01

3300 System Troubleshooting, 80173-01

3300/12 AC Power Supply, 89602-01

3300/14 DC Power Supply, 101256-01

3300/03 System Monitor, 89604-01

3300/30 and 3300/35 Six Channel Temperature Monitors Maintenance, 80183-01

3300 Internal Barrier Installation, 88837-01

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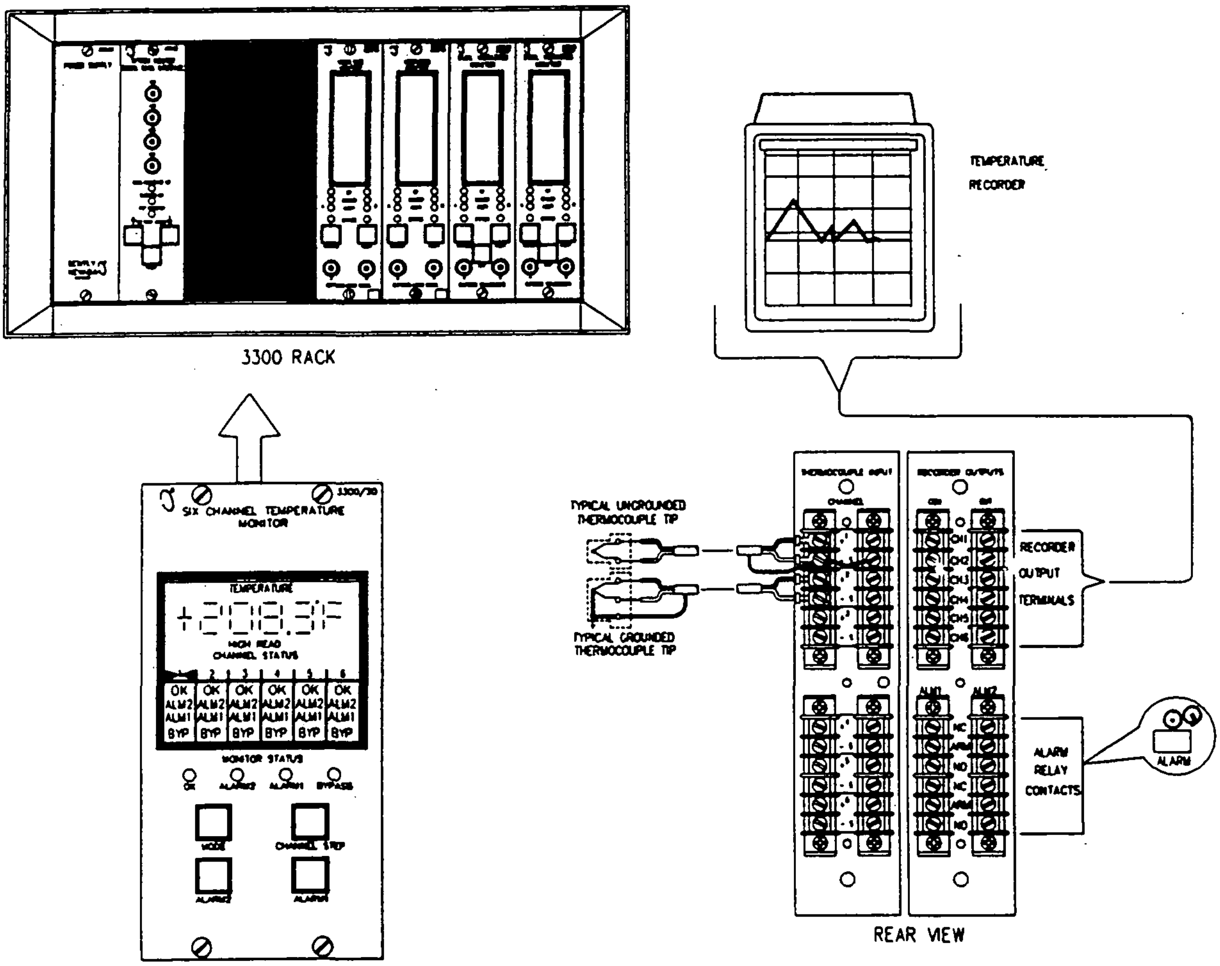
SYMBOLS

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

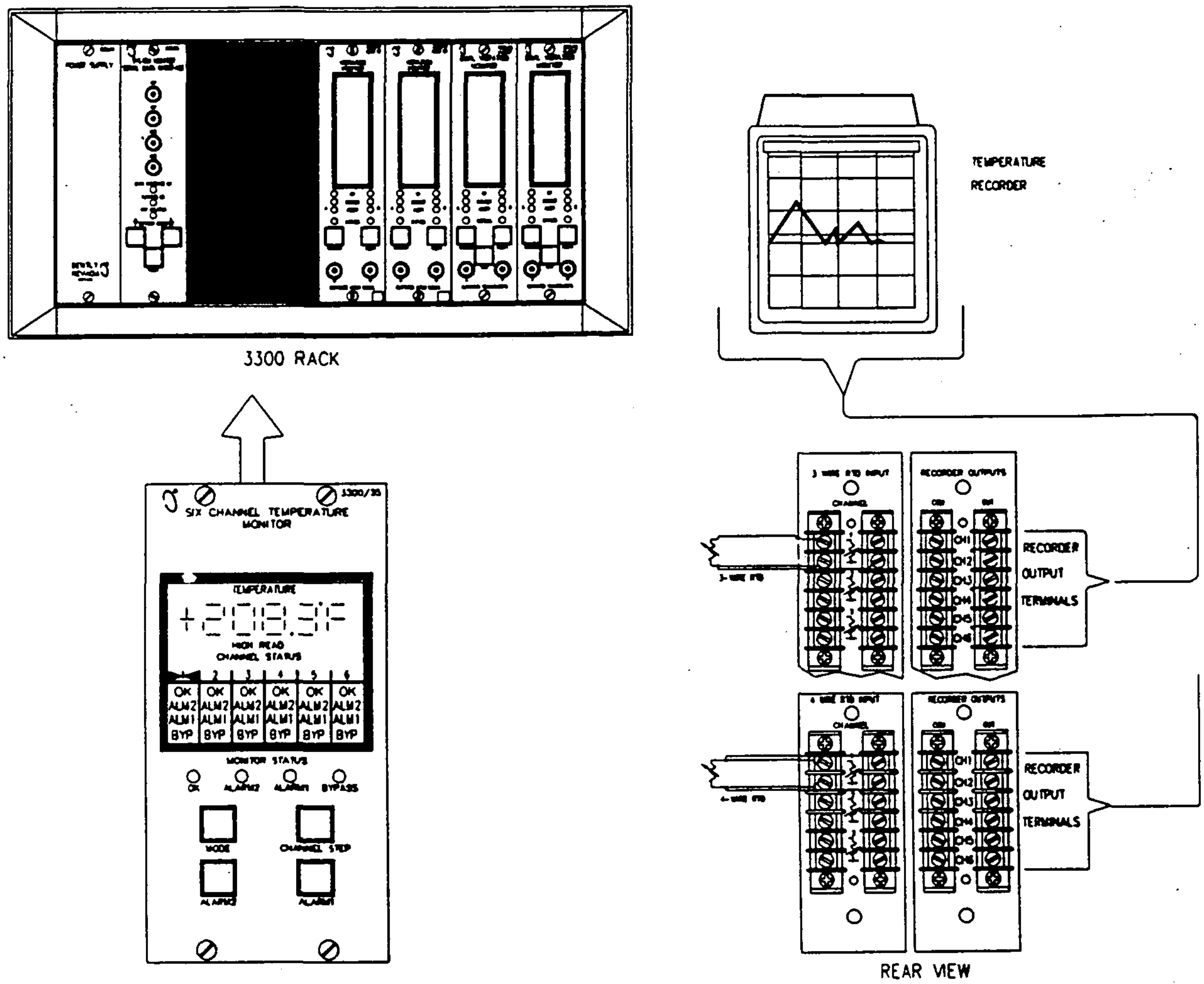
CONTENTS

1 SIX CHANNEL TEMPERATURE MONITOR SYSTEM



THERMOCOUPLE MONITOR SYSTEM
(SEE PAGE 2 FOR THE RTD MONITOR SYSTEM)

1 SIX CHANNEL TEMPERATURE MONITOR SYSTEM



RTD MONITOR SYSTEM
(SEE PAGE 1 FOR THERMOCOUPLE MONITOR SYSTEM)

2 MONITOR FUNCTIONS

SIX CHANNEL TEMPERATURE MEASUREMENTS - Temperature measurements can be obtained from various machine components and are important for the quality of the process involved. The 3300/30 Six Channel Temperature Monitor provides six independent channels of on-line thermocouple (TC) temperature monitoring. The monitor accepts input from up to six TC transducers with either grounded or ungrounded tips. The 3300/35 Six Channel Temperature Monitor provides six independent channels of on-line resistance temperature detection (RTD) temperature monitoring. The monitor accepts input from up to six 3-wire or six 4-wire RTD transducers.

OK - When the TC output voltage or RTD resistance is within its upper and lower limits, the transducer is defined as OK. The OK detection circuit controls the channel OK, the monitor OK, and the monitor relay drive to the OK Relay. If the monitor has the latching OK option enabled, 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.

ALARM - Pressing the **ALARM1** and **ALARM2** switches on the front panel of the monitor causes the corresponding first-level alarm or second-level alarm setpoints on each channel to be displayed on the front panel LCD. ALM1 and ALM2 indications are displayed when the transducer signal level exceeds preset levels for the selected time delay, and appropriate Alarm 1 and Alarm 2 relay contacts are activated. Alarm 2 setpoint levels can be optionally set for over or under alarm conditions. Alarm 1 setpoint levels can be set only for an over alarm. AND and OR voting logic options per pair of channels (channels 1 and 2, 3 and 4, 5 and 6) determine when the Alarm 2 relay contacts are activated.

RACK FIRST OUT - The first channel in the rack to have an alarm **ALM1** or **ALM2** (called ALERT or DANGER in many monitors) since the last reset or power-up will flash its **ALM1** or **ALM2** LCD (**ALERT** or **DANGER** LED on other monitors) indicator if the First Out option is enabled.

MONITOR FIRST OUT - When enabled, Monitor First Out ignores all other alarms in the rack and indicates First Out only for the six channels in the monitor. Both **ALM1** and **ALM2** have separate First Out circuitry.

ALARM RELAYS - Monitor alarms can be programmed for either latching or nonlatching mode. In the nonlatching mode, the alarm resets automatically when the alarm condition no longer exists. In the latching mode, the alarm 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.

RECORDER OUTPUT - A recorder output is provided for each channel. Depending on the option selected, the recorder output levels, proportional to recorder full scale, are either 0 to -10 Vdc, +1 to +5 Vdc, or +4 to +20 mA.

2 MONITOR FUNCTIONS

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

- Cyclic Self Test is performed automatically during monitor operation. Any error encountered during a cyclic test disables the monitor and flashes an LCD error code. Should the error be intermittent, the monitor will return to operation, but the error code is stored for retrieval during user-invoked self-tests. Stored error codes are annunciated by the **OK** LED and the **OK** LCD flashing at 5 Hz provided that the channel is OK.

- 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.

- User-invoked Self Test performs power-up self test and allows error messages stored during cyclic tests to be read and cleared. Stored errors are annunciated by the **OK** LED and the **OK** LCD flashing at 5 Hz and the error codes displayed on the front panel LCD.

3 MONITOR OPTIONS

SIX CHANNEL TEMPERATURE TC MONITOR

PART NUMBER	FULL-SCALE RANGE	TRANSDUCER INPUT	ALARM RELAY	AGENCY APPROVAL	BARRIERS USED
3300/30	AA	BB	CC	DD	EE
	01=0-200°F 02=0-300°F 03=0-400°F 04=0-500°F 05=0-1000°F 11=0-100°C 12=0-150°C 13=0-200°C 14=0-250°C 15=0-500°C	01=TYPE J 02=TYPE K 03=TYPE T* 04=TYPE E*	00=NONE 01=5A EPOXY SEALED 02=5A HERMETI-CALLY SEALED	00=NONE 01=CSA 02=BASEEFA 03=FM 04=CITY OF LA	00=NO 01=EXTERNAL 02=INTERNAL

* TRANSDUCER INPUT USED ONLY WITH FULL-SCALE RANGE OPTIONS (AA) -01, -02, -03, -04, -11, -12, -13, AND -14.

SIX CHANNEL TEMPERATURE RTD MONITOR

PART NUMBER	FULL-SCALE RANGE	TRANSDUCER INPUT	ALARM RELAY	AGENCY APPROVAL	BARRIERS USED
3300/35	AA	BB	CC	DD	EE
	01=0-200°F 02=0-300°F 03=0-400°F 04=0-500°F 05=0-1000°F 11=0-100°C 12=0-150°C 13=0-200°C 14=0-250°C 15=0-500°C	3-WIRE: 01=100 OHMS PLATINUM (1.392) 02=100 OHMS PLATINUM (1.385) 03=120 OHMS NICKEL 04=10 OHMS COPPER 4-WIRE: 05=100 OHMS PLATINUM (1.392) 06=100 OHMS PLATINUM (1.385) 07=120 OHMS NICKEL 08=10 OHMS COPPER	00=NONE 01=5A EPOXY SEALED 02=5A HERMETI-CALLY SEALED	00=NONE 01=CSA 02=BASEEFA 03=FM 04=CITY OF LA	00=NO 01=EXTERNAL 02=INTERNAL

* FOR COPPER, USE ONLY FULL-SCALE RANGE OPTIONS (AA) -01 AND -11.

4 PROGRAMMABLE OPTIONS

PROGRAMMABLE OPTIONS

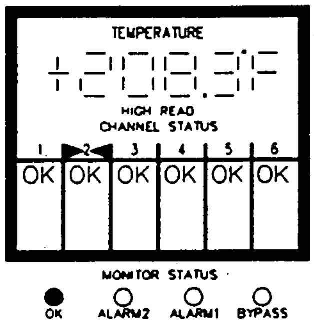
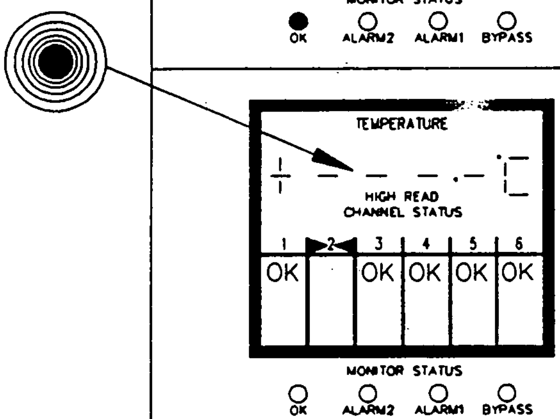
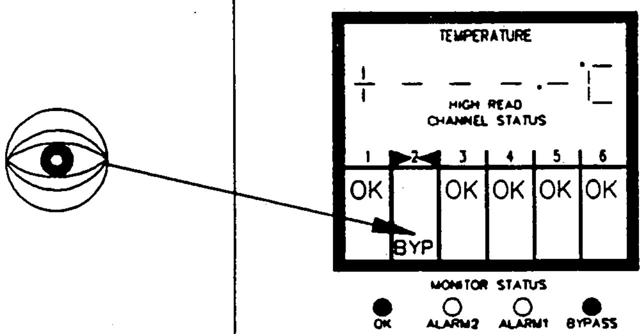
RACK FIRST OUT	• ENABLED • DISABLED *
MONITOR FIRST OUT	• ENABLED * • DISABLED
ALARM DELAYS	• 1 SECOND • 3 SECONDS* • 6 SECONDS
ALARM1 MODE	• LATCHING * • NONLATCHING
ALARM2 MODE	• LATCHING * • NONLATCHING • OVER ALARM* • UNDER ALARM

* STANDARD CONFIGURATION

RECORDER OUTPUTS	• +4 TO +20 mA* • +1 TO +5 Vdc • 0 TO -10 Vdc
ALARM2 VOTING	• OR VOTING FOR RELAY DRIVE * • AND VOTING FOR RELAY DRIVE
OK MODE	• NONLATCHING * • LATCHING
TEMPERATURE NOT-OK	• UPSCALE • DOWNSCALE*
TENTH (0.1) DIGIT	• ENABLED • DISABLED*
ALARM2 RELAY BYPASS	• ENABLED • DISABLED*

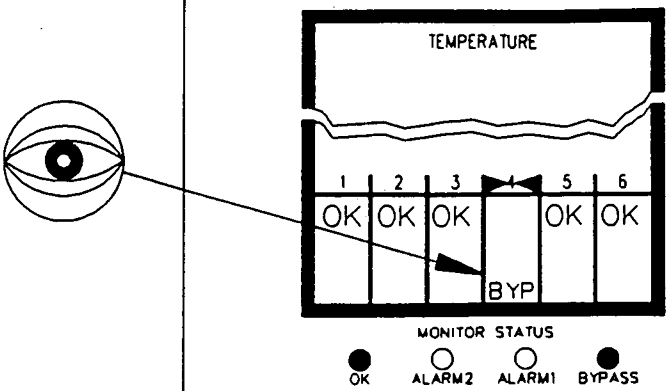
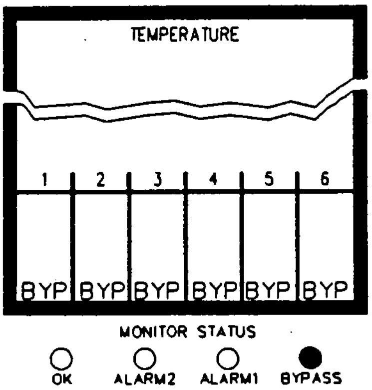
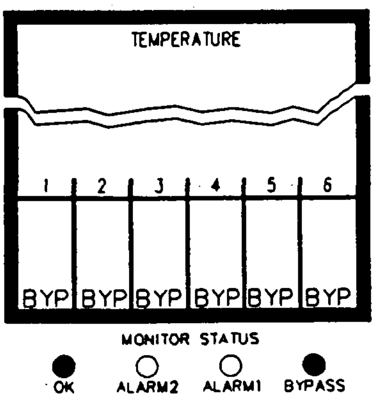
5 OK

NOTE
Each channel in the system controls the OK Relay. Any channel can cause a not OK Relay condition (de-energized Relay).

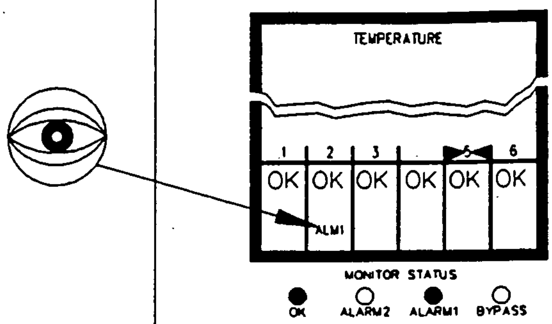
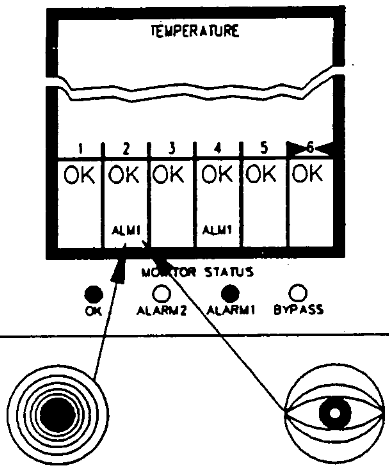
DISPLAY	CONDITION	OK RELAY DRIVE
	ALL SIX CHANNELS OK	ON
	CHANNEL 2 NOT OK	OFF*
	CHANNEL 2 BYPASSED	ON

*** Not OK channel can be bypassed to restore Relay-OK condition.**

6 BYPASS

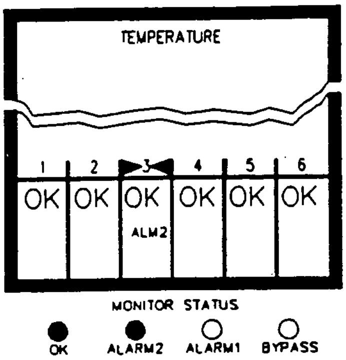
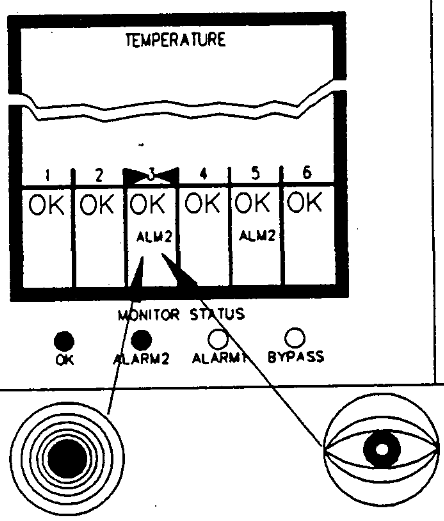
DISPLAY	CONDITION
	CHANNEL 4 BYPASSED
	1. MONITOR IN ALARM2 BYPASS 2. ALL CHANNELS BYPASSED
	1. SYSTEM IN POWER-UP MODE 2. USER-INVOKED SELF TEST

7 ALARM 1

DISPLAY	CONDITION	ALARM 1 RELAY DRIVE
	CHANNEL 2 HAS EXCEEDED ALARM 1 LEVEL.	ON
	CHANNELS 2 AND 4 HAVE EXCEEDED ALARM 1 LEVEL. FIRST OUT CONDITION FOR CHANNEL 2.	ON

If two alarms occur within 50 milliseconds, both LEDs could flash.

8 ALARM 2

DISPLAY	CONDITION	ALARM 2 RELAY DRIVE	
		OR VOTING*	AND VOTING**
	CHANNEL 3 HAS EXCEEDED ALARM 2 LEVEL.	ON	OFF
	FIRST OUT CONDITION FOR CHANNELS 3 OR 5 THAT HAVE EXCEEDED ALARM LEVEL. TWO (OR MORE) CHANNELS MAY INDICATE FIRST OUT FOLLOWING SELF TEST. ***	ON	OFF

* Any channel that exceeds alarm level will activate Alarm 2 relay drive.

** AND voting is accomplished between channels in the following pairs: Channels 1 and 2, Channels 3 and 4, Channels 5 and 6.
The output of these three channel pairs is an OR function.
If either channel in a pair is bypassed, an alarm relay is activated when the nonbypassed channel is in alarm.

*** If two alarms occur within 50 milliseconds, both LEDs could flash.

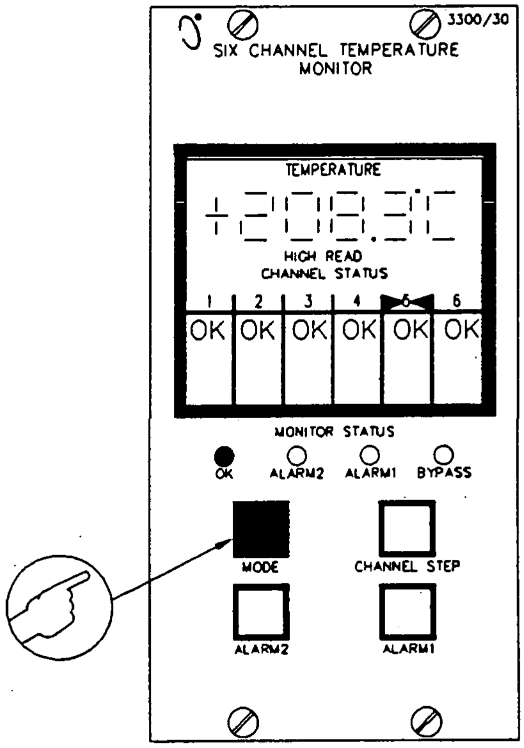
9 READ CHANNEL TEMPERATURE

The Six Channel Temperature Monitor has two operating modes selected by the **MODE** switch:

- HIGH-READ MODE
- AUTO-STEP MODE

Select a mode by pressing **MODE** switch.

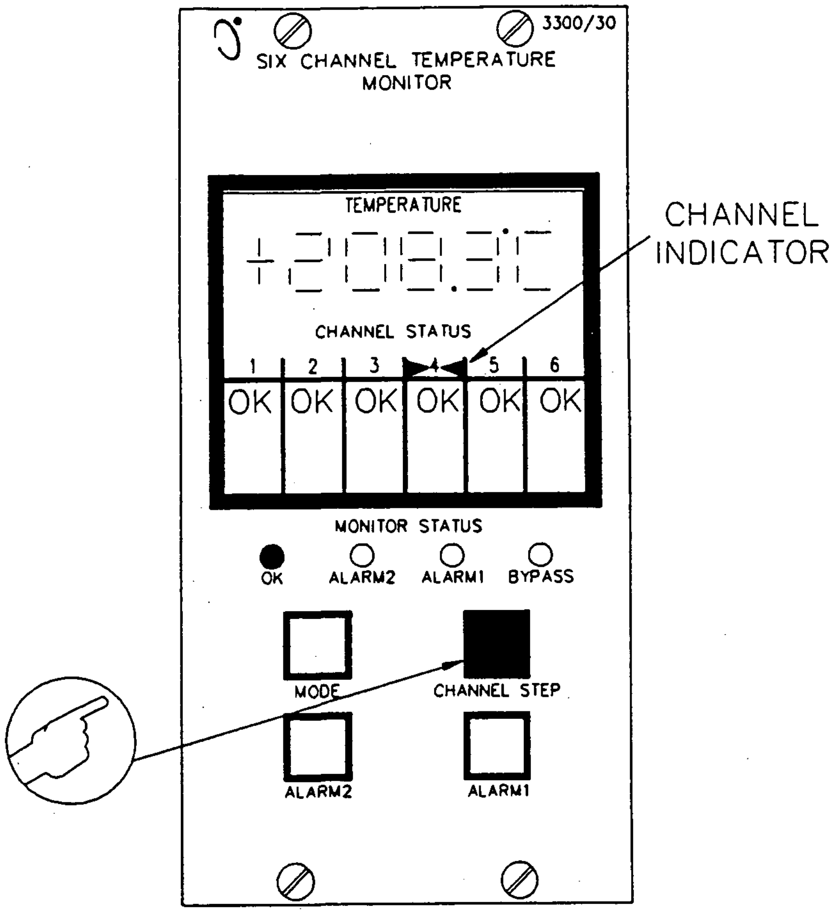
HIGH-READ MODE
High-read mode occurs automatically during power up or by pressing MODE switch. In high-read mode, the monitor displays the highest temperature reading measured on any of the six channels.



AUTO-STEP MODE
In auto-step mode, the monitor cycles through channels 1 through 6 in sequence, pausing approximately 5 seconds for each channel.

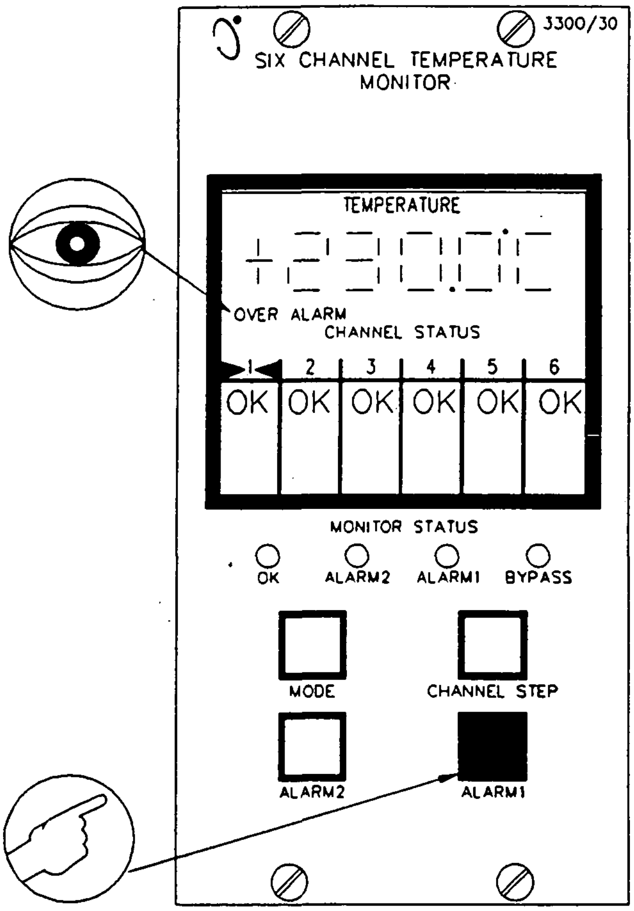
9 READ CHANNEL TEMPERATURE

CHANNEL-SELECT MODE
Press CHANNEL STEP to cycle through channels 1 through 6 in sequence.



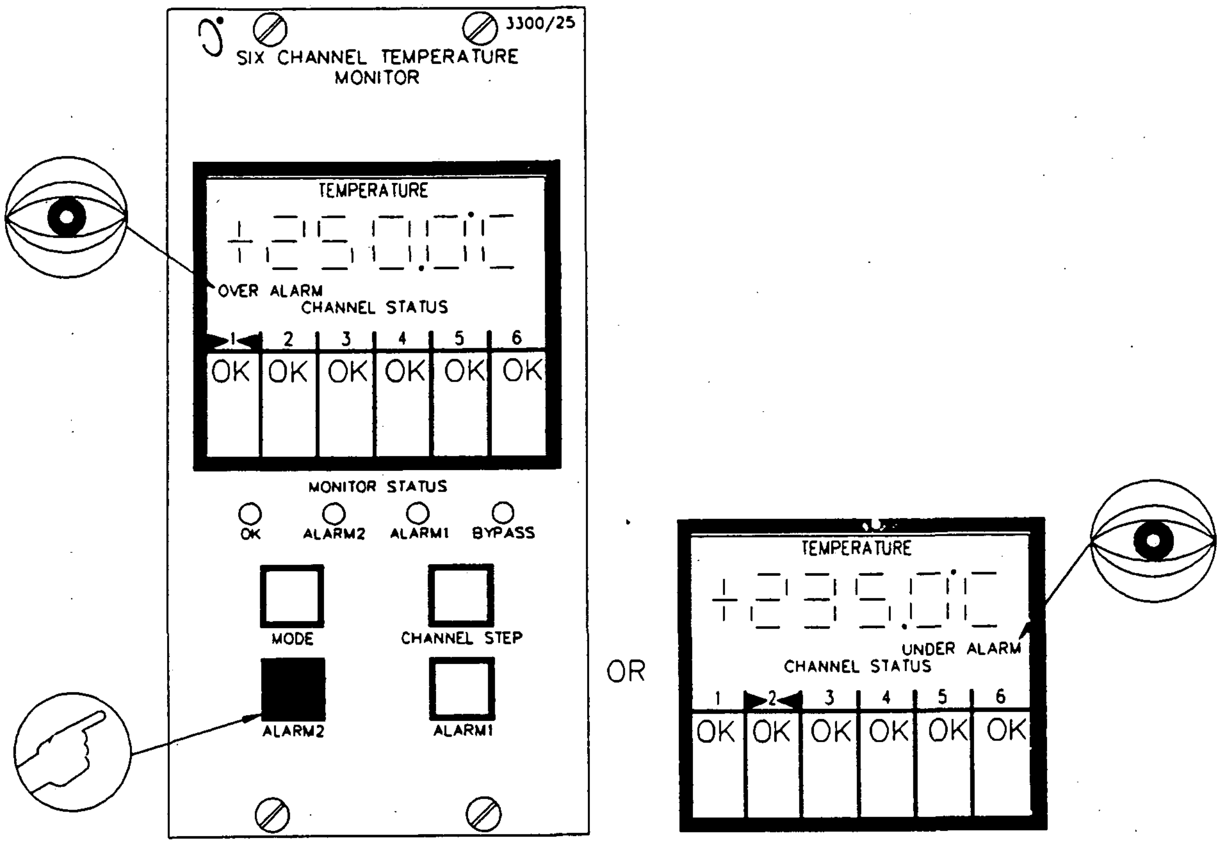
10 READ ALARM 1 SETPOINT LEVELS

Press CHANNEL STEP switch to select channel, and press ALARM1 switch to read alarm 1 setpoints. Repeat process for each succeeding channel.

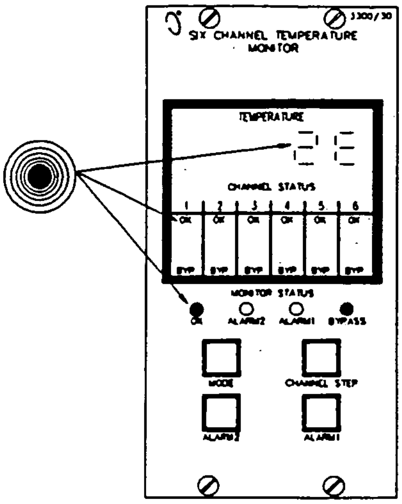


11 READ ALARM 2 SETPOINT LEVELS

Press **CHANNEL STEP** switch to select channel, and press **ALARM2** switch to read alarm 2 setpoints. Repeat process for each succeeding channel.



12 SELF TEST



Active Error Indication

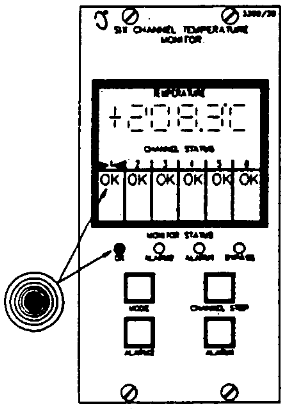
The monitor has three levels of self test:

SELF TEST	PERFORMED
Power-up	When the monitor is turned on.
Cyclic	Continuous during monitoring operations.
User-invoked	When you initiate the self test by temporarily shorting the self test pins.

When the monitor detects an error, it displays an error condition in one of two ways depending on whether the error is active or stored. An active error is an error that currently exists. A stored error indicates that a storable error has occurred since the last time errors were cleared but that this error is no longer active.

If the monitor detects an active error, the following events occur:

- Monitoring stops until the problem is resolved
- The error code is stored in memory and flashes on the LCD temperature display followed by an "E"
- The **OK** LED flashes at 5 Hz and all channel **OK** LCDs flash at 5 Hz
- The **BYPASS** LED comes on and all channel **BYPASS** LCDs come on



Stored Error Indication

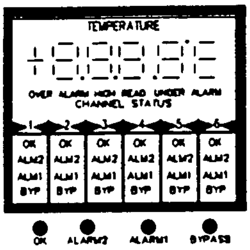
If the monitor no longer detects an active error and a stored error exists, the following events occur:

- Monitoring resumes
- If the **OK** LED would otherwise be on, the **OK** LED and all channel **OK** LCDs flash at 5 Hz to indicate that an error code has been stored

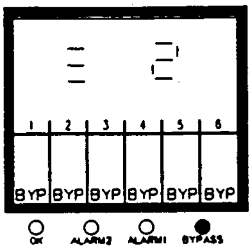
12 SELF TEST

The display sequence during the Power-up self test is as follows:

1. ALL INDICATORS ON

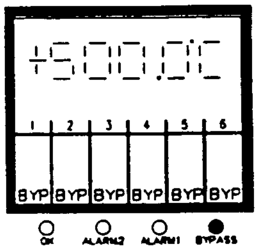


2. TRANSDUCER TYPE DISPLAYED

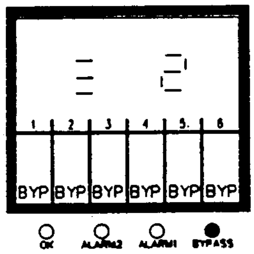


THERMOCOUPLE	RTD
1 = TYPE J	PLATINUM (1.392)
2 = TYPE K	PLATINUM (1.385)
3 = TYPE T	NICKEL
4 = TYPE E	COPPER

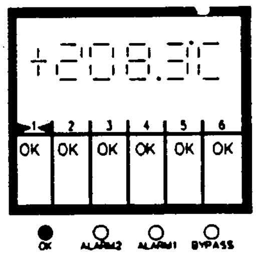
3. FULL SCALE RECORDER OUTPUT DISPLAYED



4. FIRMWARE REVISION



5. MONITORING BEGINS



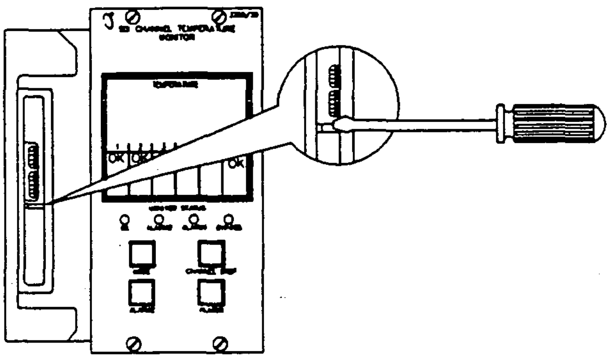
12 SELF TEST

Recall stored error codes by using the User-invoked self test. Use the following steps to run the User-invoked self test, read error codes, and clear stored error codes:

> **CAUTION**
>
> Machine protection provided by this monitor will be lost for the duration of the self test.

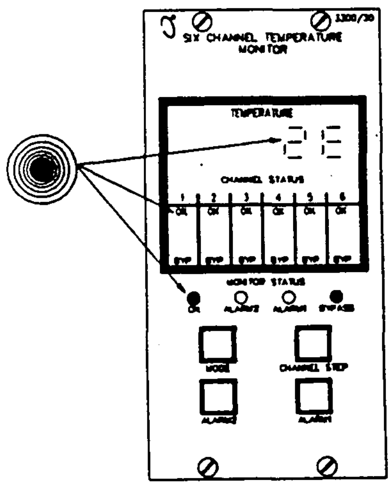
NOTE: User-invoked self test cannot be initiated if any error is active. Refer to the Error Codes section for more information on the error codes.

1. Initiate the User-invoked self test by shorting the two self test pins (ST) with a screwdriver. All the LEDs and LCD elements will come on for 5 seconds.



If an active or stored error is present, the **BYPASS** LED and all channel **BYPASS** LCDs remain on, the **OK** LED and all channel **OK** LCDs flash at 5 Hz, and the first error code flashes on the LCD temperature display at 2 Hz. The error code is followed by an "E".

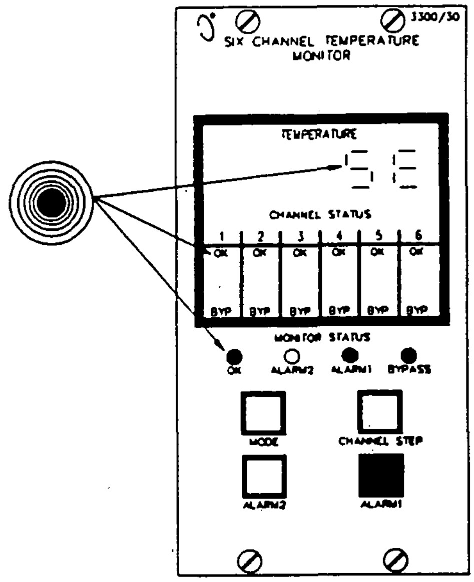
For example, the monitor to the right is indicating error code number 2.



12 SELF TEST

2. Read any other stored error codes by pressing and holding the **ALARM1** switch for approximately one second.

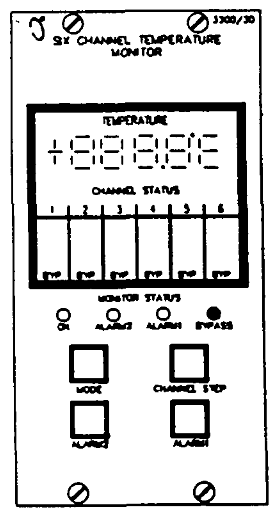
   For example, the monitor to the right contains a second stored error code - number 5.



   When you reach the end of the error code list, the LCD temperature display will show "8888E" and the **OK** LED and all channel **OK** LCDs go off.

   You may read through the list again by continuing to press the **ALARM1** switch.

3. When you have reached the end of the error code list (as described above), clear error codes from memory by pressing and holding the **ALARM2** switch for approximately one second. The monitor will go through the power up display sequence, beginning with display number two (transducer type), before it resumes monitoring.



13 ERROR CODES

Refer to the Self Test section for information about displaying and clearing stored error codes.

ERROR CODE	DESCRIPTION	EXPLANATION/RECOVERY
2	ROM checksum failed.	Test at Power-up and User-invoked self test. This error is displayed on the front panel, but not stored in memory. Install your spare monitor or call your local Bently Nevada office for service.
3	Nonrecoverable EEPROM failure.	Tested only at Cyclic self test. Install your spare monitor or contact your local Bently Nevada office for service.
4	EEPROM failure	May be corrected by adjusting alarm setpoints in the monitor (see Maintenance Manual). If setpoint adjustment fails to correct this error, install your spare monitor or contact your local Bently Nevada office for service.
5	+7.5 V/-VT node out of tolerance.	Tested cyclically. If it is a stored error, recall and clear the error codes as described in the Self Test section. If it is an active error, replace the monitor with a spare or contact your local Bently Nevada Office for service.
6	+VRH node out of tolerance.	
7	+5V node out of tolerance.	
8	MVREF node out of tolerance.	
9	+7.5 V node out of tolerance.	
10	+VRL node out of tolerance.	
12	+5 V/-7.5V node out of tolerance.	
14	RAM failure.	Tested only at Power-up or User-invoked self test. These errors are displayed on the front panel but not stored in memory. For error 16, correct the jumper configuration of the full scale option or the transducer type option (see Maintenance Manual - note that only one full scale option and one transducer type option may be selected). For errors 14 and 17, install your spare monitor or contact your local Bently Nevada office for service.
16	Invalid jumper configuration.	
17	COP watchdog not configured.	

NOTE: If the monitor experiences recurring stored errors contact your local Bently Nevada office for service.

2.6 3300/50 Tachometer

The following publication entitled 3300/50 Tachometer Operation Manual (Part No 83870-01 Rev D) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of the Tachometer module, details of the operation, functions, alarm setup, programmable options, probe gap adjustment, and testing.

The following sections are included:

2.6.18 Read Peak Hold

2.6.19 Reset Peak Hold

2.6.20 Enable (Zero Speed Tachometer)

2.6.21 Self Test

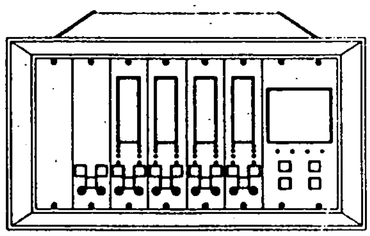
2.6.22 Index

PART NO. 83670-01
REVISION D,
FEBRUARY 1994

3300/50 TACHOMETER

INCLUDES DUAL SETPOINT, ZERO SPEED, AND ROTOR ACCELERATION TACHOMETERS.

OPERATION MANUAL



BENTLY NEVADA®
MADE IN U.S.A.

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 during calibration.

Keyphasor® is a registered trademark of Bently Nevada Corporation

Proximitor® is a registered trademark of Bently Nevada Corporation

First Printing: March 1989

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Fax 702-782-9253

NOTICE

WARNING !

Bently Nevada Tachometers are not designed for use independently as, or a component of, a speed control or overspeed protection system.

Bently Nevada Tachometers do not provide protective redundancy and the response speed needed for reliable operation as a speed control or overspeed protection system.

Where provided, the analog proportional output is suitable for data logging or chart recording purposes only. Also, where provided, speed Alert setpoints are suitable for annunciation purposes only.

Failure to take the above warnings into account constitutes a misuse of the product and may result in property damage and/or bodily injury.

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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, [illegible]71-01

3300 System Installation Instructions, 80172-01

3300 System Troubleshooting, 80173-01

3300/12 AC Power Supply, 89602-01

3300/14 DC Power Supply, 101256-01

3300/03 System Monitor, 89604-01

3300/50 Tachometer Maintenance, 83871-01

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

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CONTENTS

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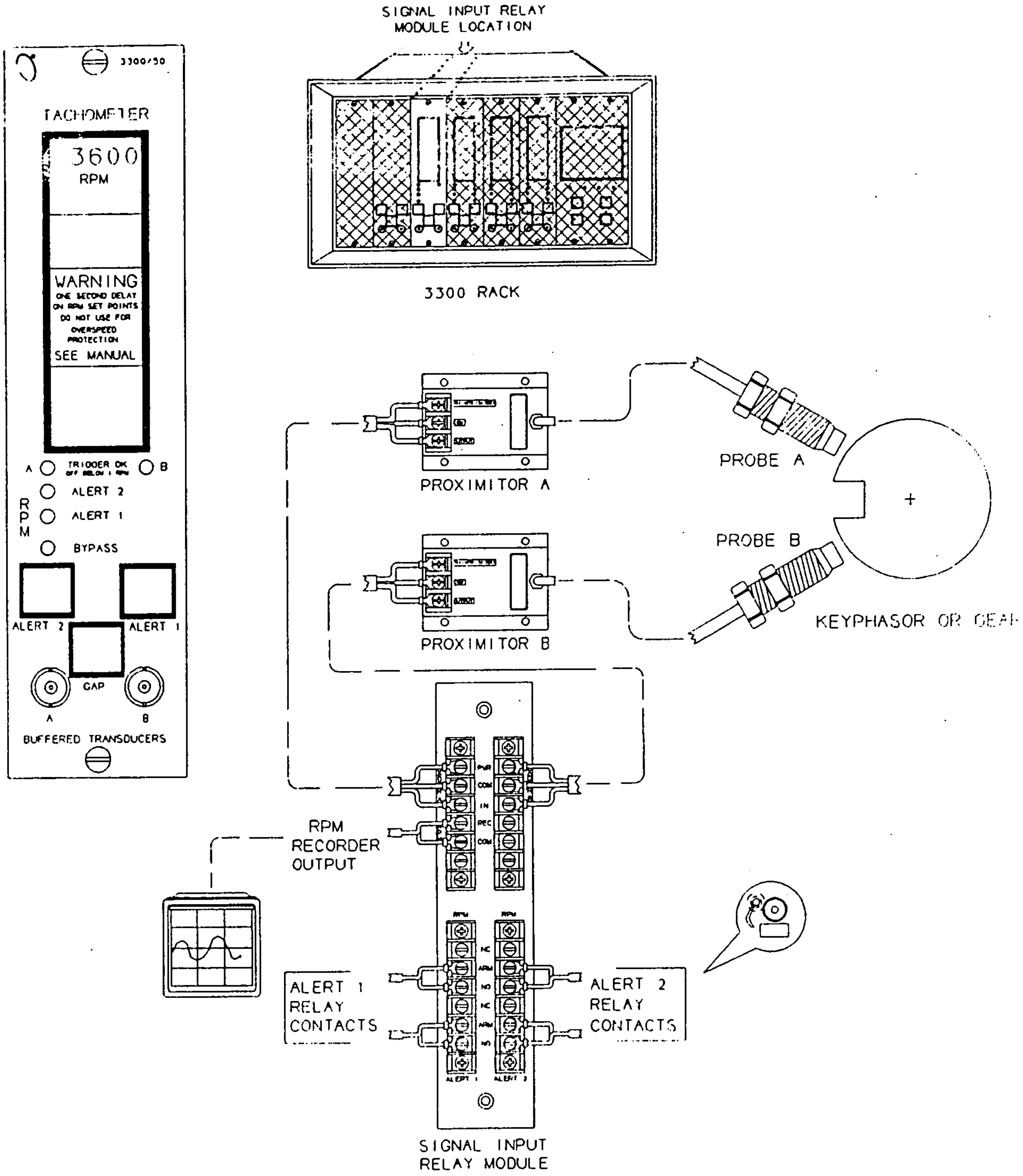
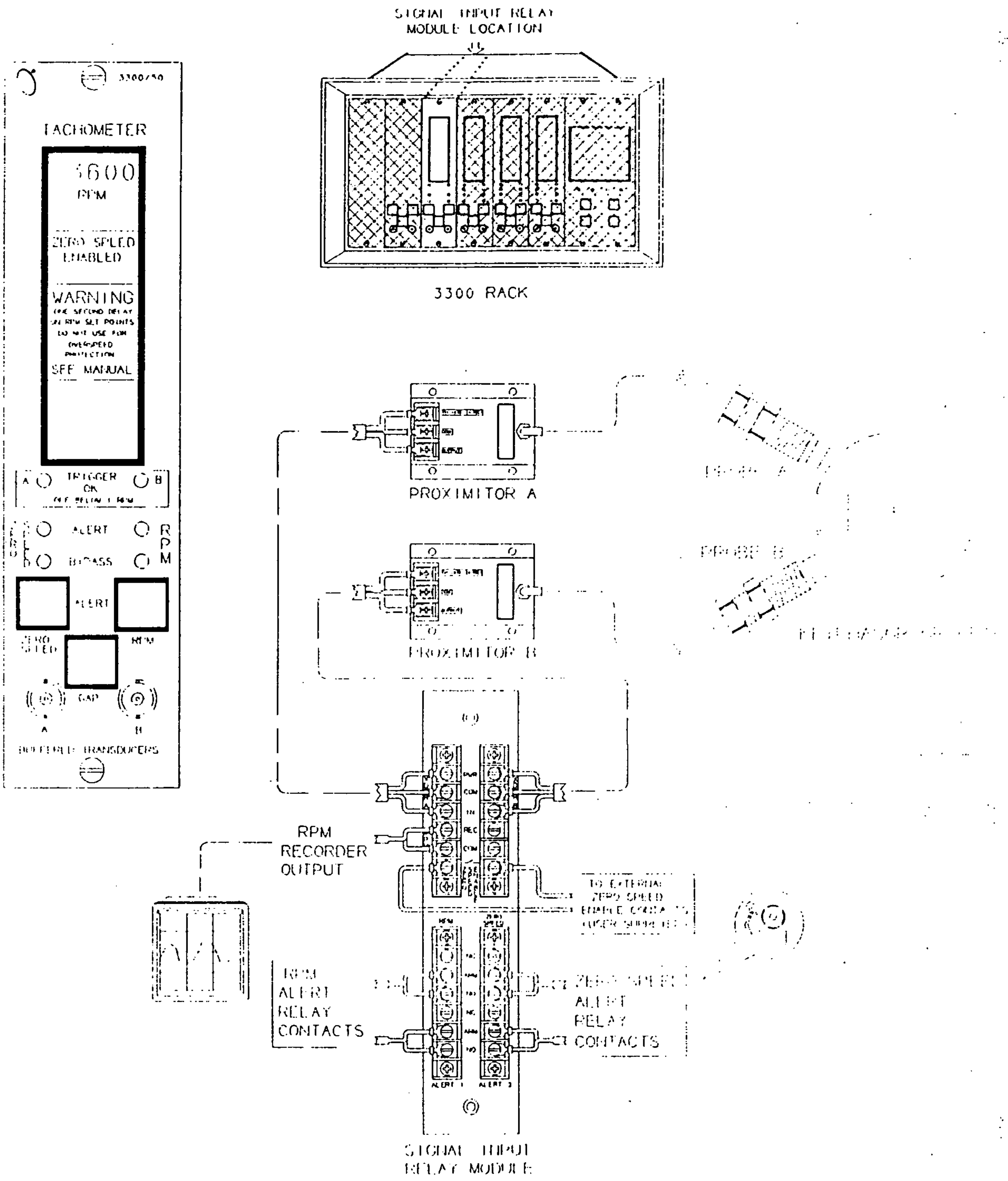
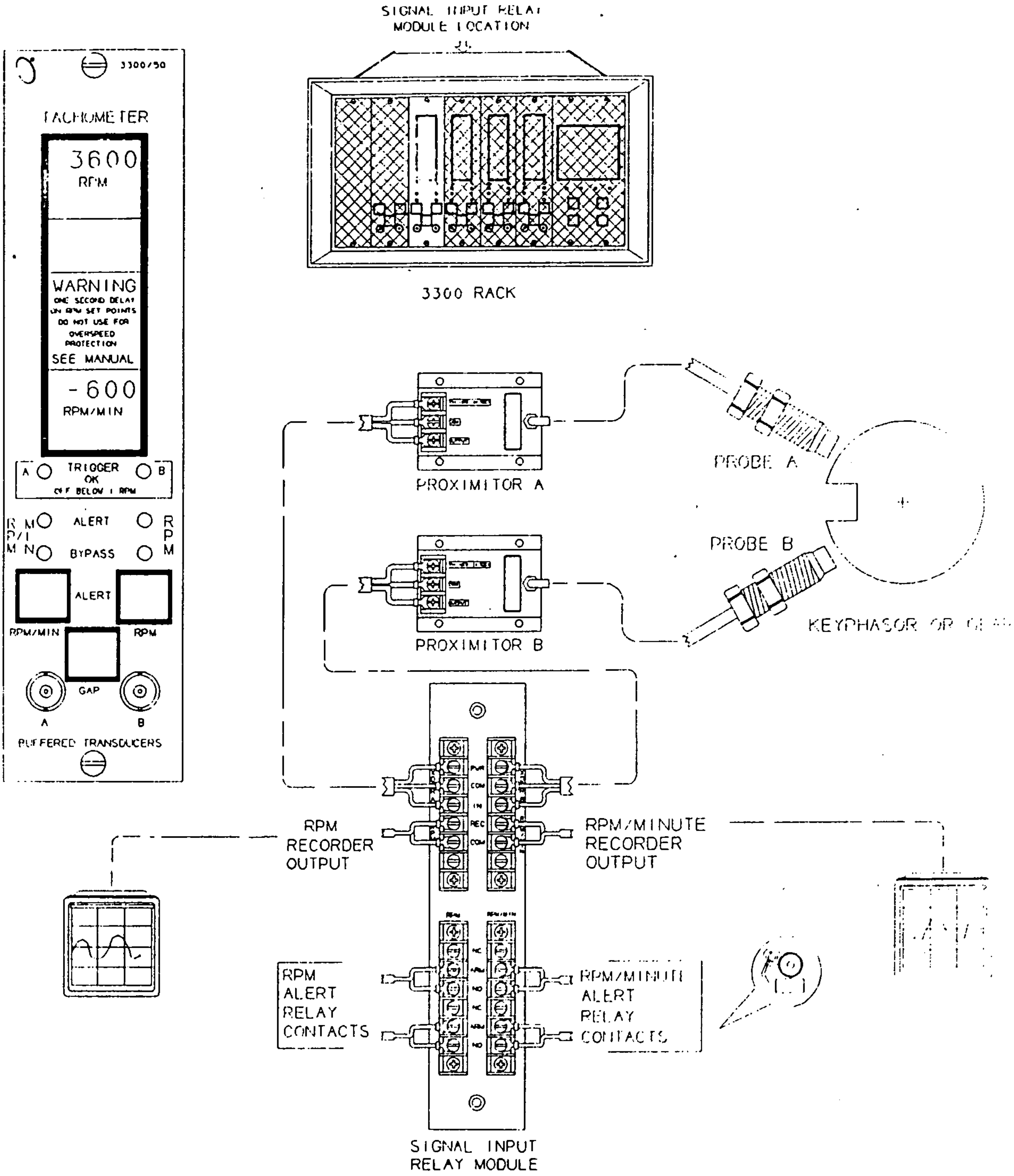
1 DUAL SETPOINT TACHOMETER SYSTEM



2 ZERO SPEED TACHOMETER SYSTEM



3 ROTOR ACCELERATION TACHOMETER SYSTEM



4 MONITOR OPTIONS

TACHOMETER
PART NUMBER

TACHOMETER TYPE	ALERT RELAYS	AGENCY APPROVAL	BARRIERS
3300/50 —— AA	BB	CC	DD
01 = DUAL SETPOINT TACHOMETER	00 = NONE	00 = NOT REQ'D	00 = NO BARRIERS
02 = ZERO SPEED TACHOMETER	01 = 5 AMP EPOXY SEALED	01 = CSA	01 = EXTERNAL BARRIERS
03 = ROTOR ACCELERATION TACHOMETER	02 = 5 AMP HERMETI-CALLY SEALED	02 = BASEEFA	02 = INTERNAL BARRIERS
		03 = FACTORY MUTUAL	

5 PROGRAMMABLE OPTIONS

TRANSDUCER INPUT (NOTE 1)	SYSTEM KEYPHASORS * 7200/3000 PROXIMITOR MAGNETIC PICKUP	TRANSDUCER THRESHOLD MODE (NOTE 3)	MANUAL * AUTOMATIC
TRANSDUCER CONDITIONING HYSTERESIS	0.2 VOLTS * 0.5 VOLTS 1.0 VOLTS 2.0 VOLTS	ALERT MODES	* OVER ALERT UNDER ALERT * LATCHING NON-LATCHING
FIRST OUT ALERT (NOTE 2)	* ENABLED DISABLED	ALERT BYPASS	ENABLED * DISABLED
RECORDER OUTPUTS	* +4 TO +20 mA +1 TO +5 Vdc 0 TO -10 Vdc		

* OPTIONS SHIPPED FROM BENTLY NEVADA

NOTE 1: MAGNETIC PICKUPS ARE NOT ALLOWED FOR ZERO SPEED APPLICATIONS.

NOTE 2: ALL VERSIONS OF THE TACHOMETER DRIVE ONLY THE RACK FIRST OUT ALERT BUS. THIS MONITOR DOES NOT DRIVE THE RACK FIRST OUT DANGER BUS.

NOTE 3: THE ZERO SPEED TACHOMETER IS SHIPPED IN THE MANUAL THRESHOLD MODE. AUTO THRESHOLD IS NOT ALLOWED IN THE ZERO SPEED MONITOR. AUTO THRESHOLD WILL NOT WORK BELOW 5 Hz (300 RPM AT ONE EVENT PER REVOLUTION).

6 MONITOR FUNCTIONS

ROTOR SPEED MONITORING - The Tachometer function provides continuous monitoring of shaft rotative speed. The Tachometer accepts input from either a proximity probe or magnetic pickup (not recommended). The Tachometer measures the time between Keyphasor pulses and calculates the rotor speed in revolutions per minute (RPM). The monitor displays the rotor speed on the front panel and provides a proportional voltage or current recorder output. The Tachometer also outputs Alert status via rear panel relay contacts for external annunciation.

ZERO SPEED - The 3300 Tachometer provides, as a factory installed option, a Zero Speed function. Zero Speed measurements are generally taken on turbines, generators and other rotating machinery with large rotors.

Zero Speed is a preselected shaft rotative speed that allows for proper engagement of the turning gear. Continuous shaft rotation during machine shutdown is imperative to prevent shaft bow that could lead to possible machine damage during startup.

The Zero Speed function requires inputs from two transducers. Voting logic between the two transducers minimizes false Zero Speed indication in the event of a transducer failure. When the Zero Speed function is enabled, and the preselected Zero Speed is reached, an Alert LED indicates the condition. Alert relay contacts are also provided for use with an external indicator such as an annunciator panel.

ROTOR ACCELERATION - The 3300 Tachometer provides, as a factory installed option, a Rotor Acceleration indicator. The Rotor Acceleration function provides an indication of a machine's rotative acceleration. The acceleration/deceleration information is displayed on the front panel. A recorder output, as well as Alert relay outputs are provided.

Rotor Acceleration is used with machinery during startup or shutdown. The original machine manufacturer's recommended ramp up or ramp down rate must be maintained to minimize possible damage.

PROBE GAP VOLTAGE - Probe gap is measured in negative DC voltage and is directly proportional to the gap between the face of a proximity probe and the surface being monitored. Probe gap voltage for each transducer is displayed on the front panel by pressing the GAP switch.

TRIGGER OK - The TRIGGER OK LEDs indicate the status of the transducer input signal, and the monitor. The TRIGGER OK LEDs remain on as long as the Tachometer is receiving valid input signals and the monitor is OK. The LEDs will extinguish when the input is less than 1 RPM or greater than 99,999 RPM. An invalid trigger will not cause the system OK relay to go NOT OK.

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

6 MONITOR FUNCTIONS (CONT)

ALERT - Pressing one of the Alert switches on the front panel of the monitor causes the corresponding Alert setpoint to be displayed on the front panel. When the particular Alert setpoint conditions have been met, the Alert LEDs will illuminate and the Alert relay contacts are activated.

FIRST OUT ALERT - A monitor with the First Out option selected flashes an Alert LED if that Alert was the first in the rack. Pressing the RESET switch acknowledges the First Out.

ALERT RELAYS - Monitor Alerts can be programmed for either latching or nonlatching modes. In the nonlatching mode, the alert resets automatically when the Alert no longer exists. In the latching mode, the Alert condition must be reset manually by pressing the RESET switch on the front panel of the System Monitor (or by closing the external reset contacts). The Alert will not reset if the Alert condition still exists.

ALERT BYPASS - An Alert can be bypassed using a switch located behind the front panel. When bypassed, an Alert condition no longer causes the Alert LEDs to illuminate or the relay to actuate. Alert bypass can be during maintenance. Alert Bypass is indicated by the front panel BYPASS LED. Other front panel functions are not affected by Alert Bypass. This function can be disabled using a programmable jumper within the monitor.

MONITOR BYPASS - The monitor can be completely bypassed using the Monitor Bypass switch located behind the front panel. When bypassed, the monitor is completely nonfunctional, and can be removed from the system monitoring loop. After this function is activated, the normal system OK operation (OK Relay) will be restored for the remaining active monitors in the rack.

PEAK HOLD - The PEAK HOLD function allows recall of the maximum RPM value obtained since the last PEAK HOLD reset. The PEAK HOLD value is read by pressing both Alert buttons simultaneously. The Tachometer retains the PEAK HOLD value even after loss of monitor power. PEAK HOLD is cleared by shorting two adjacent testpoints located behind the front panel.

BUFFERED OUTPUTS - The BUFFERED TRANSDUCER A and B coaxial cable connectors on the front panel of the monitor provide buffered signals both redundant transducers. These connectors can be used to connect external equipment to the monitor.

RECORDER OUTPUT - Depending on the option selected, the recorder output levels proportional to RPM (and RPM/MIN with the Rotor Accel. Tach.) are either 0 to -10Vdc, +1 to +5Vdc, or +4 to +20mA.

6 MONITOR FUNCTIONS (CONT)

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

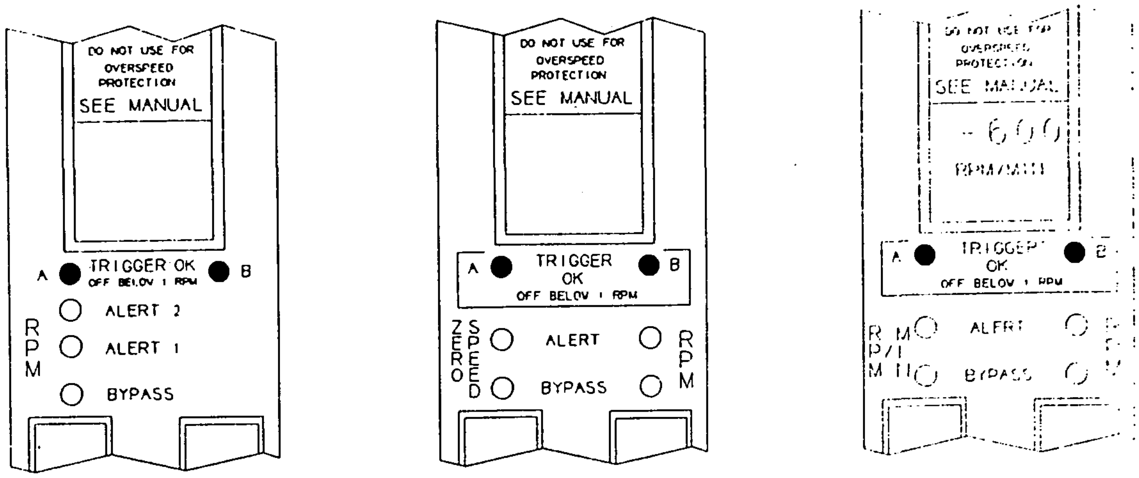
A power-up self test, consisting of a series of basic monitor OK tests, is performed automatically each time the monitor is turned on.

A cyclic self test is performed automatically while the monitor is operating. Errors encountered during cyclic tests disable the monitor and flash an error code on the front panel display. If the error is intermittent, the monitor will begin operating again, and the error codes will be stored for retrieval during user-invoked self tests. Stored error codes are indicated by the TRIGGER OK LEDs flashing at 5 Hz (5 times per second) provided that the monitor (or trigger) is OK.

A 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 TRIGGER OK LEDs at 5 Hz and displaying the error codes on the front panel LCD display.

MONITOR OK - A MONITOR NOT OK condition resulting from failing self test will drive the system OK relay into its NOT OK state and extinguish the front panel TRIGGER OK LEDs.

7 OK



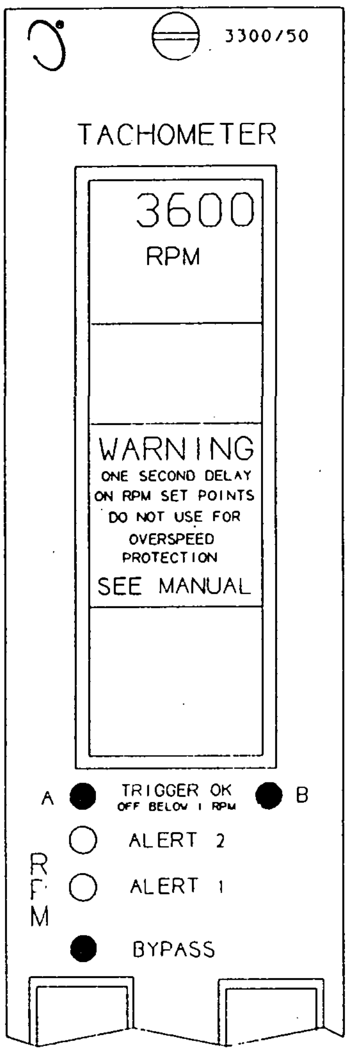
NOTE: EACH MONITOR IN THE SYSTEM CONTROLS THE OK RELAY. THE TACHOMETER CAN CAUSE A NOT OK RELAY CONDITION (DE-ENERGIZED RELAY) ONLY WITH A MONITOR NOT OK. A TRIGGER NOT OK WILL NOT AFFECT THE SYSTEM OK RELAY.

LED DISPLAY A / B	CONDITION	OK RELAY DRIVE **
● TRIGGER OK * ●	MONITOR OK AND TRIGGER A AND B OK *	ON
● TRIGGER OK ○ ○ TRIGGER OK ●	RESPECTIVE TRIGGER A OR B NOT OK, AND MONITOR OK	ON
○ TRIGGER OK ○	BOTH TRIGGER A AND B NOT OK, AND/OR MONITOR NOT OK	OFF **
◉ TRIGGER OK ◉	FLASHING AT 5 Hz = ERROR ENCOUNTERED DURING CYCLIC TEST. READ ERROR MESSAGE SEE SECTION ON ERROR CODES	ON

* "TRIGGER OK" MEANS THE RPM VALUE IS BETWEEN 1 AND 100,000 RPM AND THAT THE RPM VALUE HAS NOT CHANGED MORE THAN 50% BETWEEN TWO INPUT TRIGGERS.

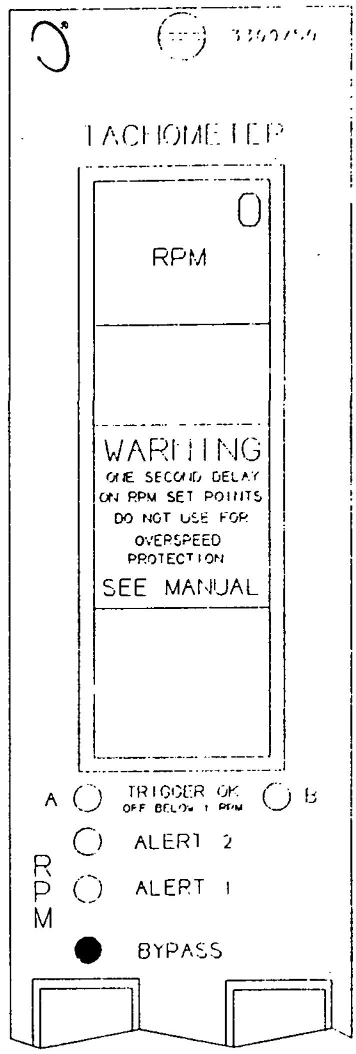
** A NOT OK MONITOR CAN BE BYPASSED TO RESTORE RELAY OK CONDITIONS. IF THE MONITOR IS OK, BUT THE TRIGGERS ARE NOT, THE OK RELAY WILL BE ON (OK).

8 BYPASS (DUAL SETPOINT TACHOMETER)



ALERT 2 RELAY BYPASSED

MONITOR ON LINE
ALERT 1 RELAY FUNCTIONAL

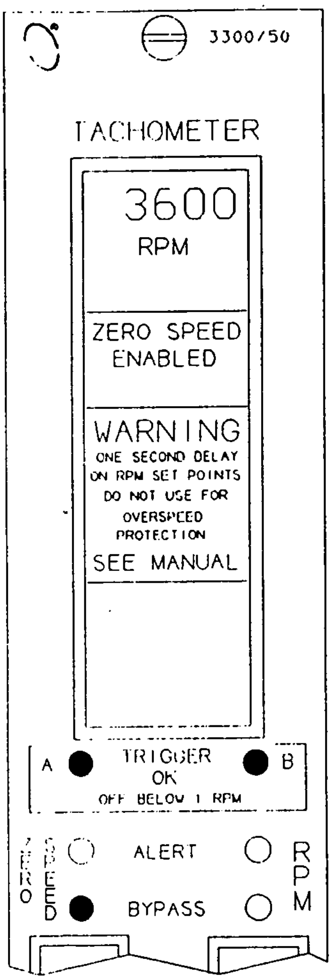


MONITOR BYPASSED

MONITOR OFF LINE
DISPLAY AT ZERO

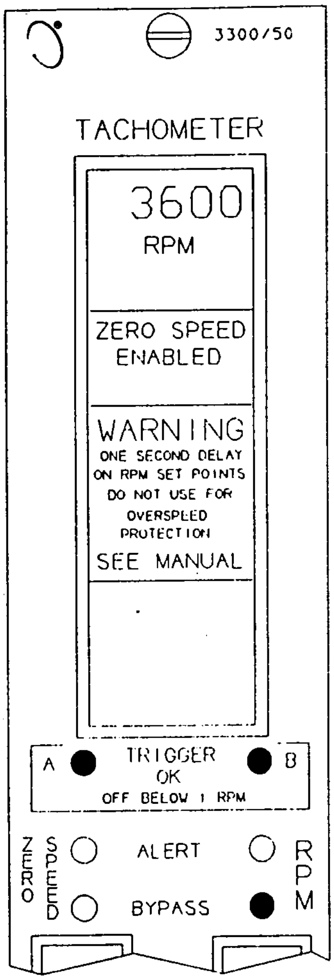
NOTE: THE ALERT 1 RELAY CANNOT BE BYPASSED IN THE DUAL SETPOINT TACHOMETER.

9 BYPASS (ZERO SPEED TACHOMETER)



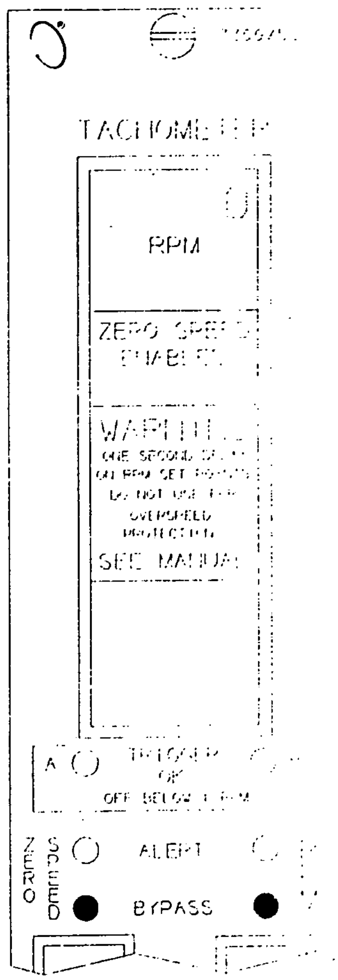
ZERO SPEED ALERT
RELAY BYPASSED

MONITOR ON LINE
RPM ALERT RELAY
FUNCTIONAL



RPM ALERT RELAY
BYPASSED

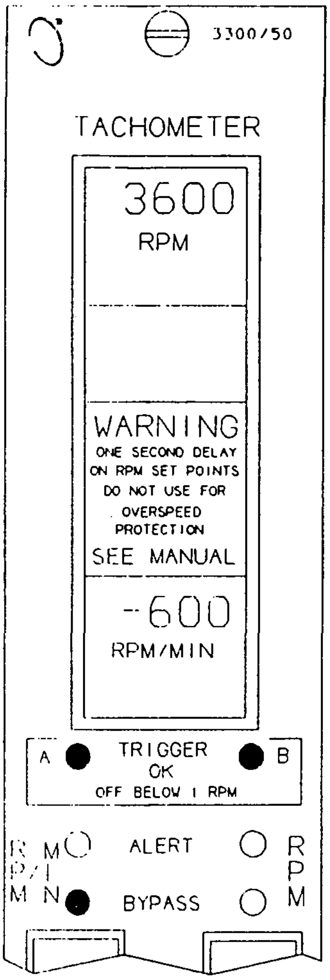
MONITOR ON LINE
ZERO SPEED ALERT
RELAY FUNCTIONAL



MONITOR BYPASSED

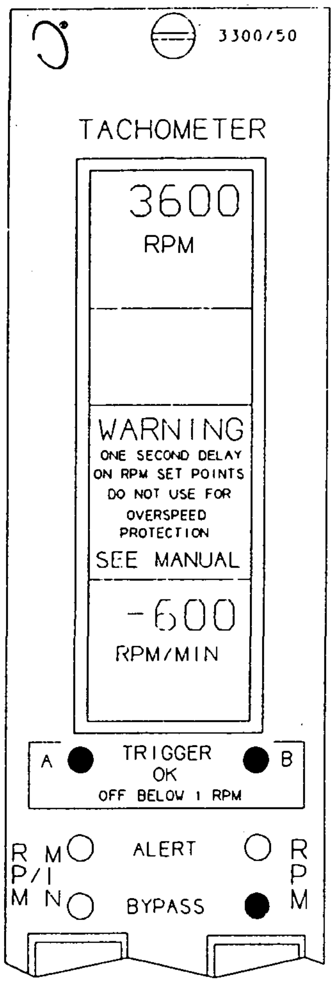
MONITOR OFF LINE
RPM DISPLAY AT ZERO

10 BYPASS (ROTOR ACCEL. TACHOMETER)



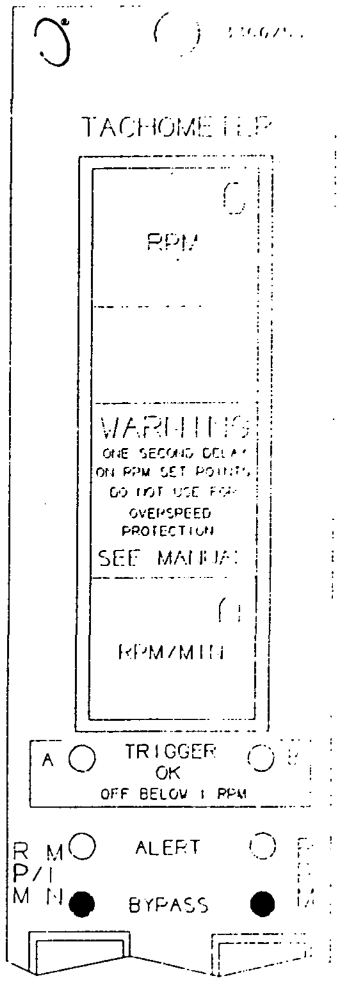
ROTOR ACCEL ALERT RELAY BYPASSED

MONITOR ON LINE RPM ALERT RELAY FUNCTIONAL



RPM ALERT RELAY BYPASSED

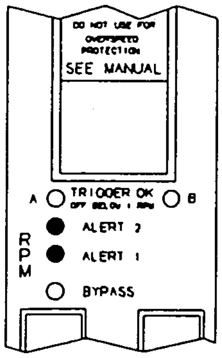
MONITOR ON LINE ROTOR ACCEL. ALERT RELAY FUNCTIONAL



MONITOR BYPASSED

MONITOR OFF LINE DISPLAYS AT ZERO

11 ALERT (DUAL SETPOINT TACHOMETER)

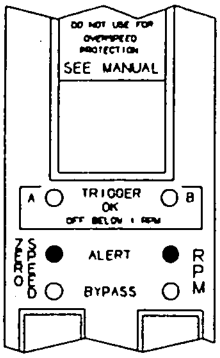


LED DISPLAY	CONDITION	RELAY DRIVE ALERT 1	RELAY DRIVE ALERT 2
● ALERT 1 ○ ALERT 2	THE ALERT 1 SETPOINT HAS BEEN EXCEEDED. *	ON	OFF
○ ALERT 1 ● ALERT 2	THE ALERT 2 SETPOINT HAS BEEN EXCEEDED. *	OFF	ON
● ALERT 1 ● ALERT 2	BOTH ALERT SETPOINTS HAVE BEEN EXCEEDED. *	ON	ON
◎ ALERT 1 ○ ALERT 2	THE ALERT 1 SETPOINT HAS BEEN EXCEEDED. ALERT 1 IS THE FIRST OUT ALERT. **	ON	OFF
○ ALERT 1 ◎ ALERT 2	THE ALERT 2 SETPOINT HAS BEEN EXCEEDED. ALERT 2 IS THE FIRST OUT ALERT. **	OFF	ON

* AN RPM ALERT REQUIRES AT LEAST ONE TRANSDUCER TO OBSERVE THE ROTOR SPEED (RPM) RISE ABOVE AN OVER SPEED SETPOINT OR BOTH TO FALL BELOW AN UNDER SPEED SETPOINT FOR AT LEAST ONE SECOND.

** FIRST OUT RESOLUTION IS BETTER THAN 50 MILLISECONDS. IF TWO ALERTS OCCUR WITHIN 50 MILLISECONDS OR LESS, BOTH LEDS COULD FLASH. BOTH ALERTS MAY FLASH TO INDICATE FIRST OUT FOLLOWING SELF TEST.

12 ALERT (ZERO SPEED TACHOMETER)



LED DISPLAY ALERT ZERO SPEED	RPM	CONDITION	RELAY DRIVE ALERT ZERO SPEED	RPM
●	○	THE ZERO SPEED ALERT CONDITIONS HAVE BEEN MET. *	ON	OFF
○	●	THE RPM ALERT CONDITIONS HAVE BEEN MET. **	OFF	ON
●	●	BOTH THE ZERO SPEED AND RPM ALERT CONDITIONS HAVE BEEN MET. * **	ON	ON
◉	○	THE ZERO SPEED ALERT CONDITIONS HAVE BEEN MET. ZERO SPEED IS THE FIRST OUT ALERT. ***	ON	OFF
○	◉	THE RPM ALERT CONDITIONS HAVE BEEN MET. THE RPM ALERT IS THE FIRST OUT ALERT. ***	OFF	ON

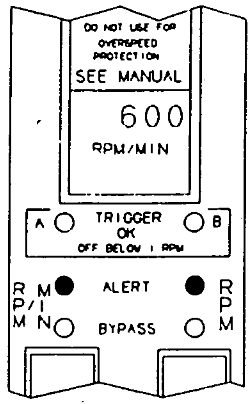
* THE ZERO SPEED ALERT CONDITIONS ARE AS FOLLOWS:

1. THE TRIGGER OK CONDITIONS (SECTION 7) MUST BE MET FOR BOTH TRANSDUCERS BELOW 500 RPM.
2. BOTH TRANSDUCERS MUST OBSERVE THE ROTOR SPEED (RPM) FALL BELOW THE ZERO SPEED ALERT SETPOINT FOR AT LEAST ONE SECOND.

** AN RPM ALERT REQUIRES AT LEAST ONE TRANSDUCER TO OBSERVE THE ROTOR SPEED (RPM) RISE ABOVE AN OVER SPEED SETPOINT OR BOTH TO FALL BELOW AN UNDER SPEED SETPOINT FOR AT LEAST ONE SECOND.

*** FIRST OUT RESOLUTION IS BETTER THAN 50 MILLISECONDS. IF TWO ALERTS OCCUR WITHIN 50 MILLISECONDS OR LESS, BOTH LEDS COULD FLASH. BOTH ALERTS MAY FLASH TO INDICATE FIRST OUT FOLLOWING SELF TEST.

13 ALERT (ROTOR ACCEL. TACHOMETER)



LED DISPLAY ALERT RPM/MIN	LED DISPLAY ALERT RPM	CONDITION	RELAY DRIVE ALERT RPM/MIN	RELAY DRIVE ALERT RPM
●	○	THE RPM/MINUTE ALERT CONDITIONS HAVE BEEN MET. *	ON	OFF
○	●	THE RPM ALERT CONDITIONS HAVE BEEN MET. **	OFF	ON
●	●	BOTH THE RPM/MINUTE AND RPM ALERT CONDITIONS HAVE BEEN MET. * **	ON	ON
◎	○	THE RPM/MINUTE ALERT CONDITIONS HAVE BEEN MET. RPM/MINUTE IS THE FIRST OUT ALERT. ***	ON	OFF
○	◎	THE RPM ALERT CONDITIONS HAVE BEEN MET. THE RPM ALERT IS THE FIRST OUT ALERT. ***	OFF	ON

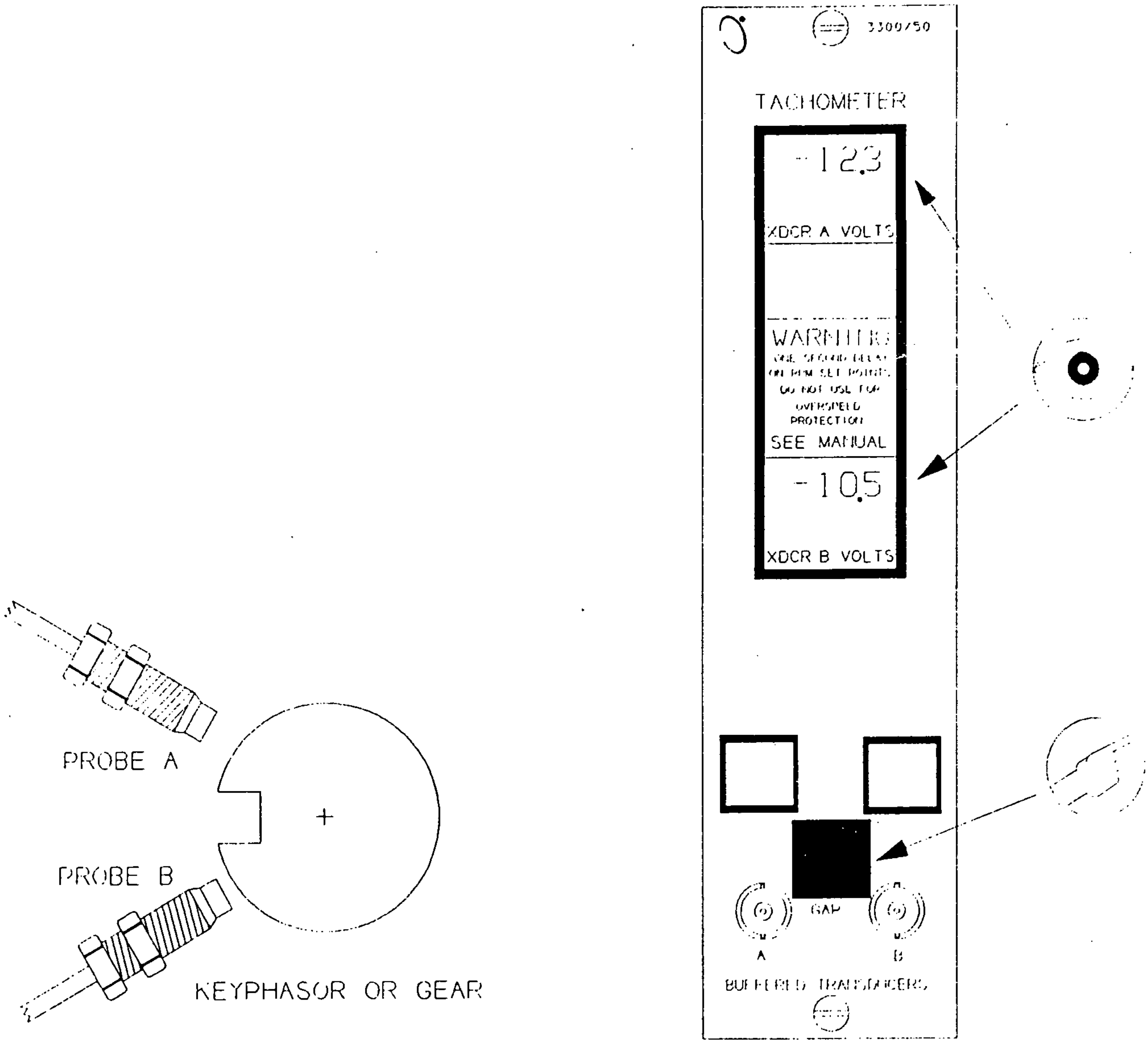
* AN RPM/MIN ALERT REQUIRES AT LEAST ONE TRANSDUCER TO OBSERVE THE ROTOR ACCELERATION (RPM/MIN) VALUE EXCEED THE RPM/MIN SETPOINT FOR AT LEAST ONE SECOND.

** AN RPM ALERT REQUIRES AT LEAST ONE TRANSDUCER TO OBSERVE THE ROTOR SPEED (RPM) RISE ABOVE AN OVER SPEED SETPOINT OR BOTH TO FALL BELOW AN UNDER SPEED SETPOINT FOR AT LEAST ONE SECOND.

*** FIRST OUT RESOLUTION IS BETTER THAN 50 MILLISECONDS. IF TWO ALERTS OCCUR WITHIN 50 MILLISECONDS OR LESS, BOTH LEDS COULD FLASH. BOTH ALERTS MAY FLASH TO INDICATE FIRST OUT FOLLOWING SELF TEST.

14 READ GAP VOLTAGE

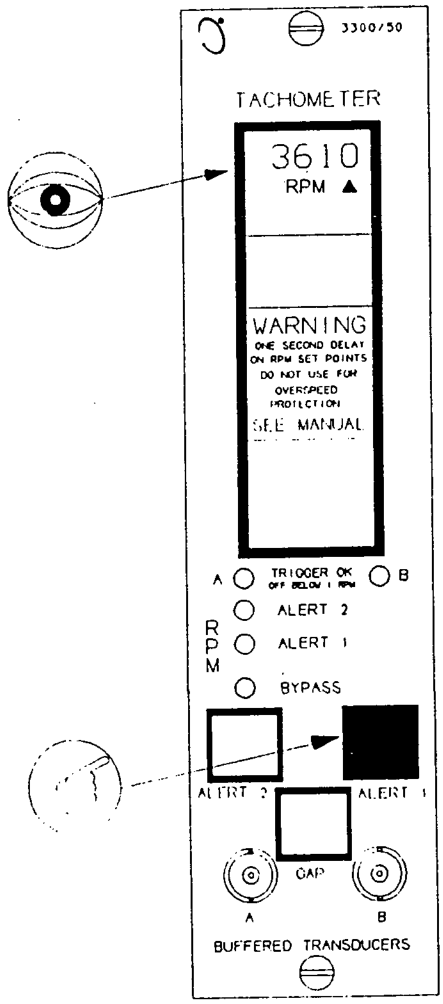
PRESS GAP SWITCH AND READ GAP VOLTAGE FOR BOTH TRANSDUCER A AND TRANSDUCER B.



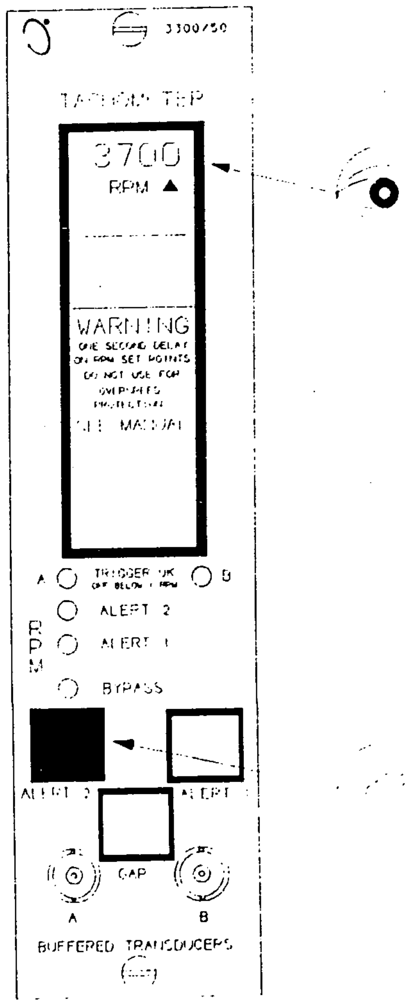
NOTE: THE GAP VOLTAGE IS INTENDED TO BE USED FOR THE INSTALLATION OF PROBES. WHILE A MACHINE IS RUNNING, THE DISPLAYED GAP VOLTAGE MAY VARY SIGNIFICANTLY.

15 READ SETPOINTS (DUAL SETPOINT TACH.)

PRESS THE ALERT 1 SWITCH AND READ THE ALERT 1 SETPOINT ON THE FRONT PANEL DISPLAY. UP ARROW INDICATES OVER SPEED SETPOINT. DOWN ARROW INDICATES UNDER SPEED SETPOINT



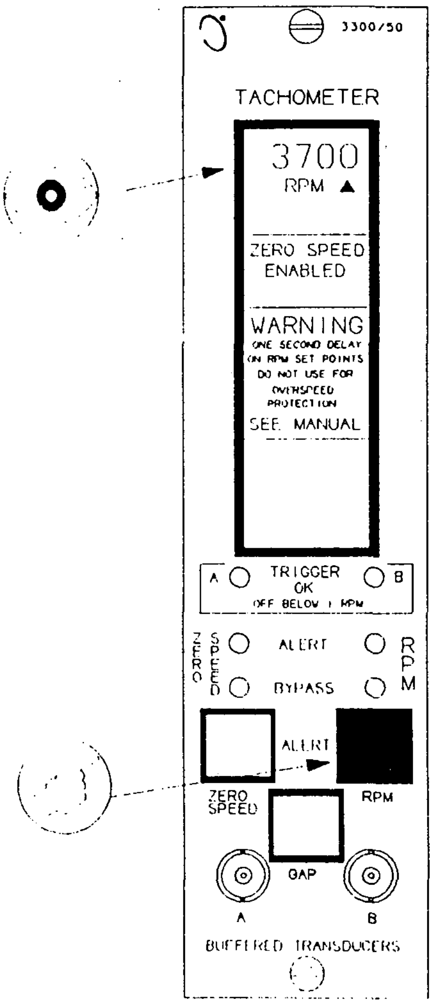
PRESS THE ALERT 2 SWITCH AND READ THE ALERT 2 SETPOINT ON THE FRONT PANEL DISPLAY. UP ARROW INDICATES OVER SPEED SETPOINT. DOWN ARROW INDICATES UNDER SPEED SETPOINT.

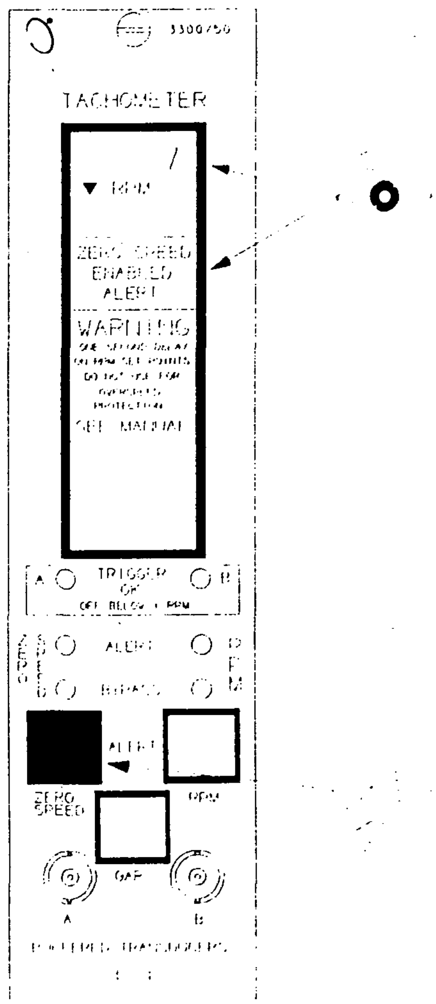


16 READ SETPOINTS (ZERO SPEED TACH.)

PRESS THE RPM ALERT SWITCH AND READ THE RPM ALERT SETPOINT ON THE FRONT PANEL DISPLAY. UP ARROW INDICATES OVER SPEED SETPOINT. DOWN ARROW INDICATES UNDER SPEED SETPOINT.

PRESS THE ZERO SPEED ALERT SWITCH AND READ THE ZERO SPEED ALERT SETPOINT ON THE FRONT PANEL DISPLAY. DOWN ARROW INDICATES UNDER SETPOINT. (ZERO SPEED IS ALWAYS AN UNDER SETPOINT.)

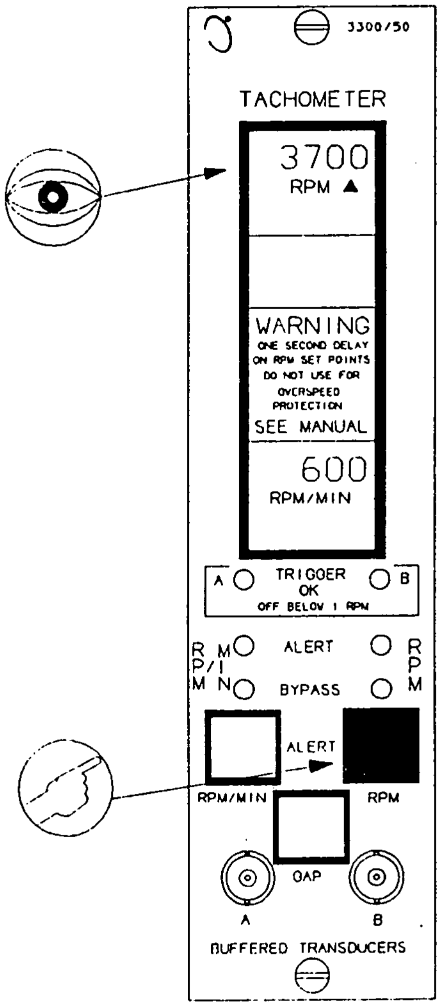


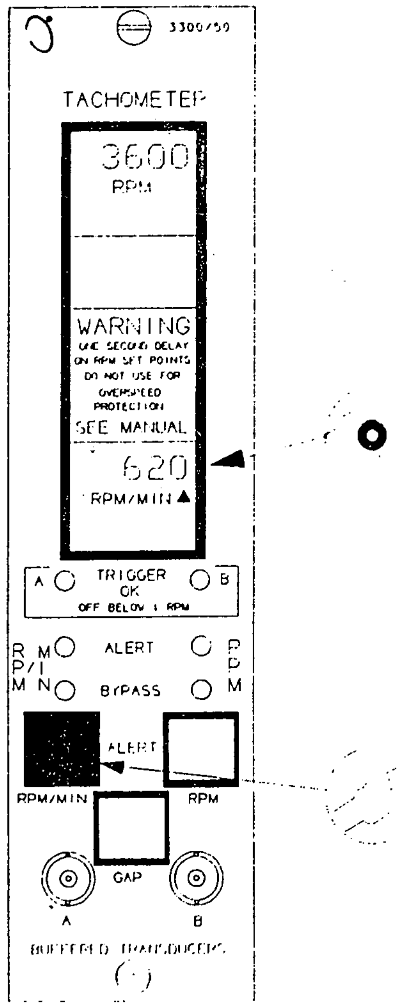


17 READ SETPOINTS (ROTOR ACCEL. TACH.)

PRESS THE RPM ALERT SWITCH AND READ THE RPM ALERT SETPOINT ON THE FRONT PANEL DISPLAY. UP ARROW INDICATES OVER SPEED SETPOINT. DOWN ARROW INDICATES UNDER SPEED SETPOINT.

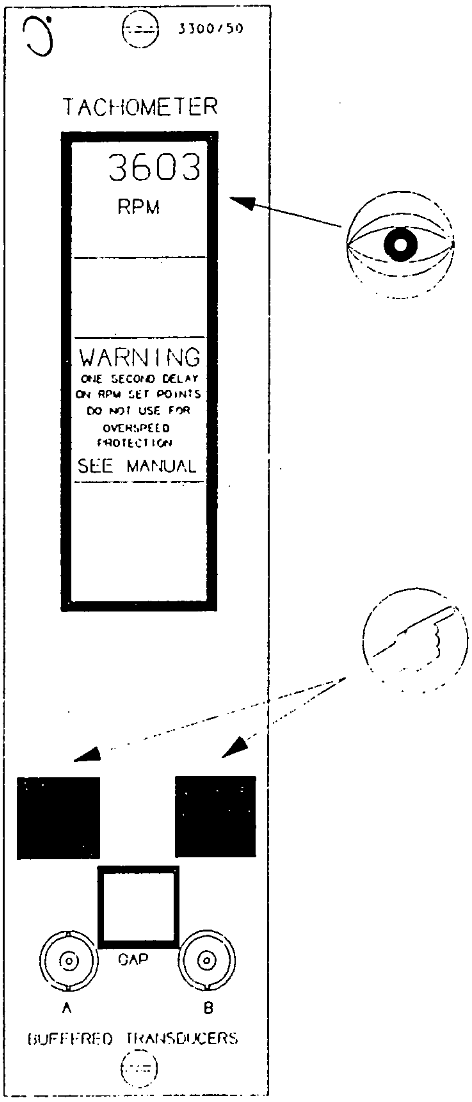
PRESS THE RPM/MIN ALERT SWITCH AND READ THE RPM/MIN ALERT SETPOINT ON THE FRONT PANEL DISPLAY. UP ARROW INDICATES OVER SETPOINT. (ROTOR ACCEL IS ALWAYS AN OVER SETPOINT.)





18 READ PEAK HOLD

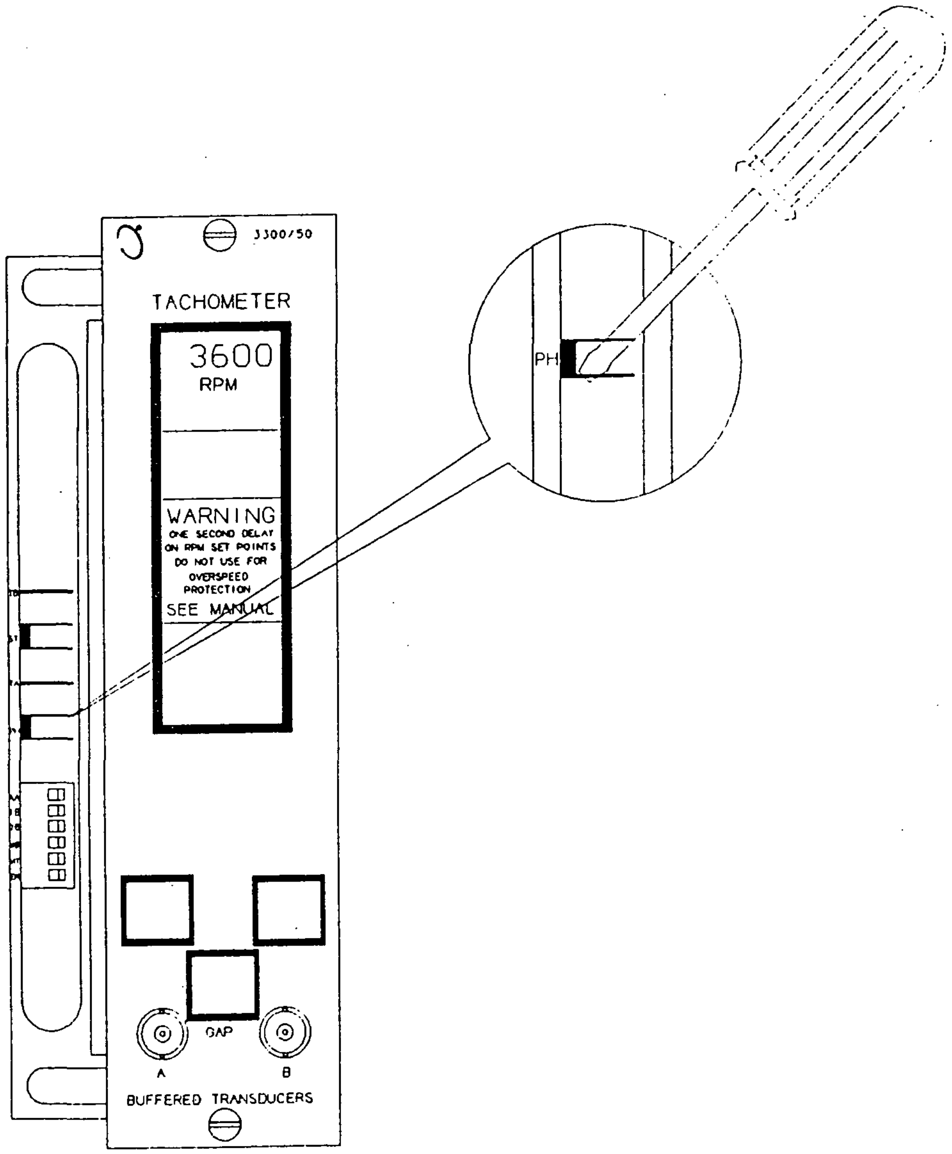
PRESS BOTH ALERT SWITCHES SIMULTANEOUSLY AND READ THE **PEAK HOLD** VALUE.



PEAK HOLD IS THE MAXIMUM RPM VALUE OBTAINED SINCE THE LAST **PEAK HOLD** RESET.

19 RESET PEAK HOLD

RESET THE VALUE STORED IN **PEAK HOLD** MEMORY BY SHORTING ACROSS **PEAK HOLD** (PH) PINS.

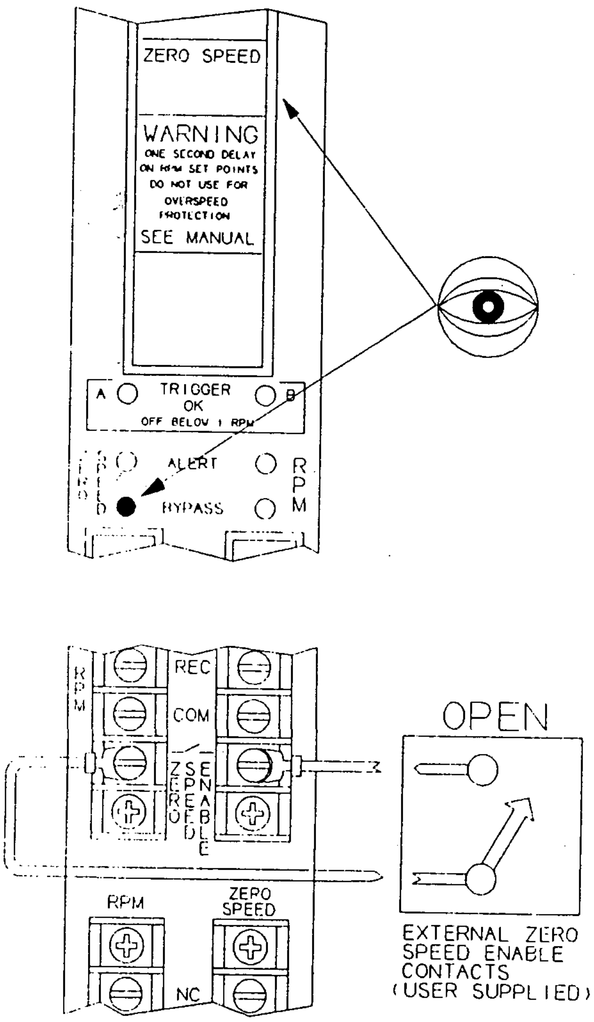


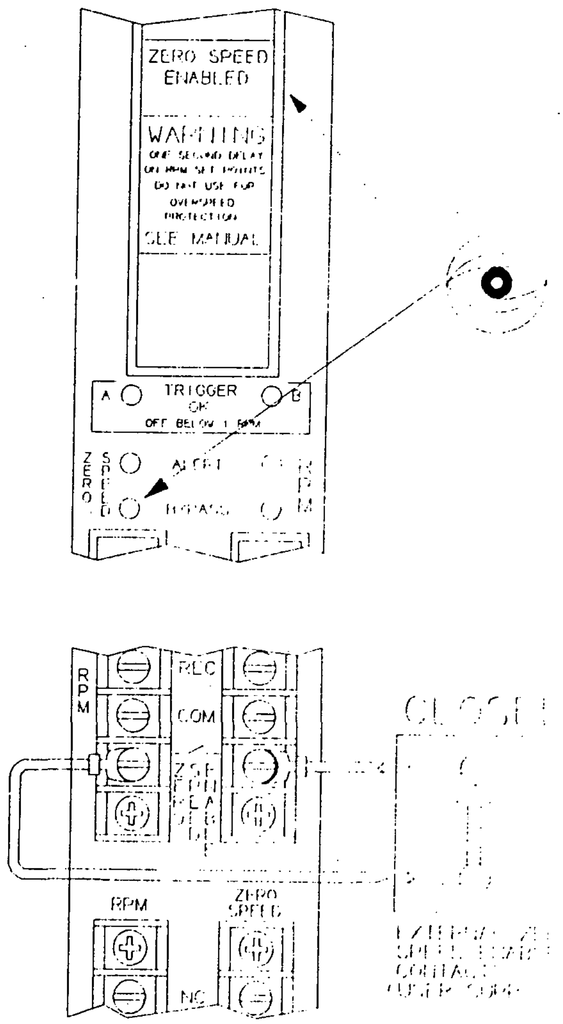
READ PEAK HOLD TO VERIFY THAT IT HAS BEEN CLEARED (SEE PREVIOUS PAGE).

20 ENABLE (ZERO SPEED TACHOMETER)

WHEN THE EXTERNAL ZERO SPEED ENABLE CONTACTS ARE OPEN, THE **ENABLE** INDICATOR WILL EXTINGUISH AND THE ZERO SPEED **BYPASS** LED WILL LIGHT. WHILE THESE CONTACTS ARE OPEN, A ZERO SPEED ALERT CANNOT OCCUR.

WHEN THE EXTERNAL ZERO SPEED ENABLE CONTACTS ARE CLOSED, THE **ENABLE** INDICATOR WILL SHOW AND THE **BYPASS** LED WILL EXTINGUISH (IF THE ZERO SPEED FUNCTION HAS NOT BEEN MANUALLY BYPASSED).

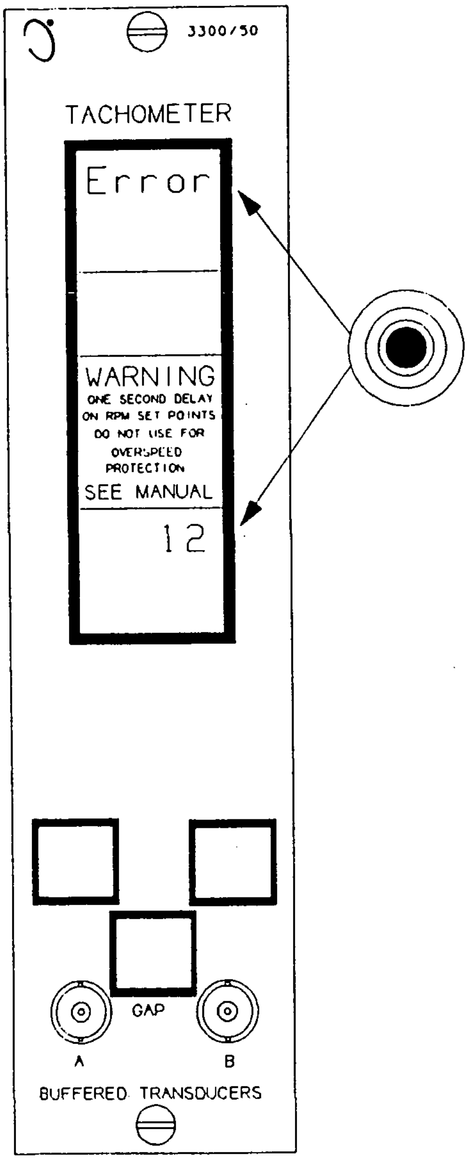




21 SELF TEST

THE MONITOR HAS THREE LEVELS OF SELF TESTS:

POWER-UP TEST: PERFORMED ONLY WHEN THE MONITOR IS TURNED ON.
CYCLIC TEST: PERFORMED CONTINUOUSLY.
USER-INVOKED 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 DISPLAY.

BYPASS LED GOES ON AND **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.

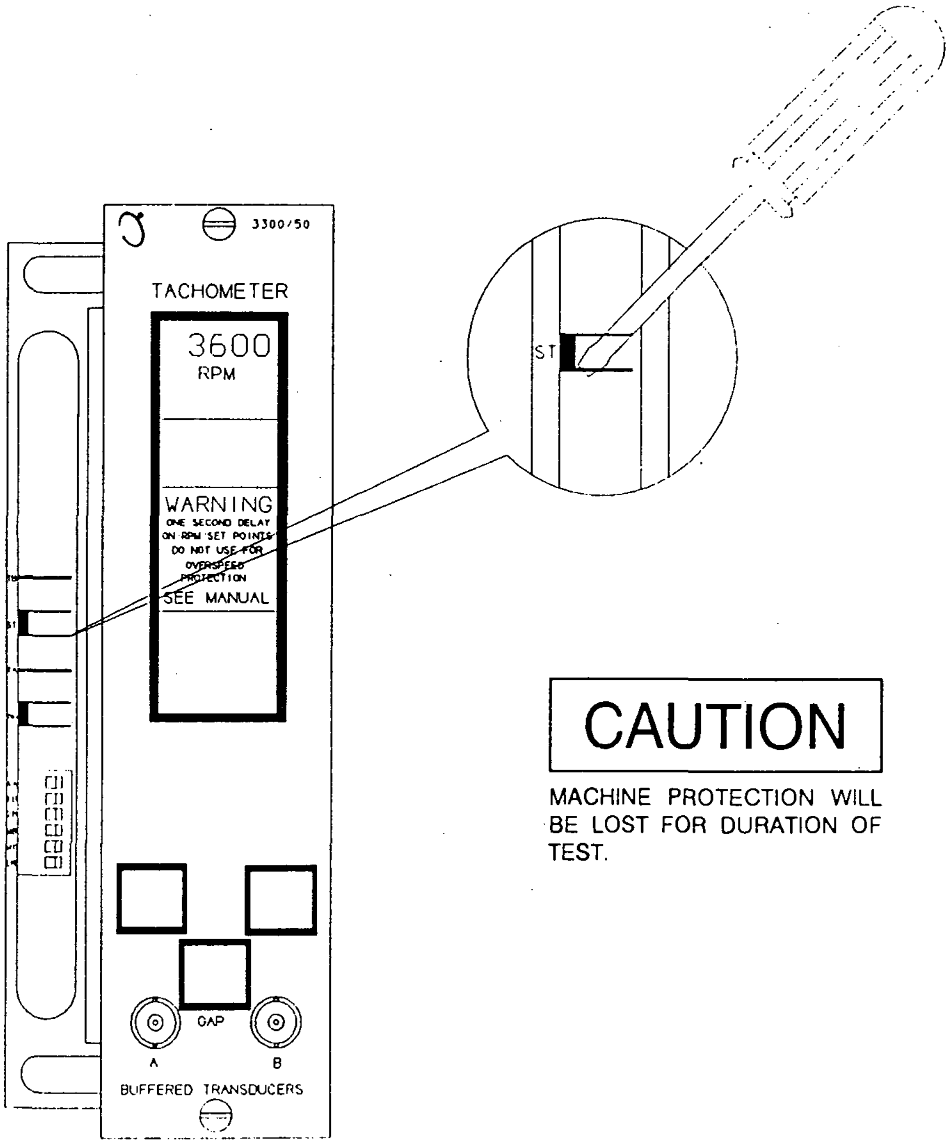
IF ERRORS ARE DETECTED DURING POWER-UP TEST OR USER-INVOKED SELF TEST:

MONITORING IS ABORTED UNTIL USER ACTION RESOLVES PROBLEM.

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

21 SELF TEST (CONT)

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

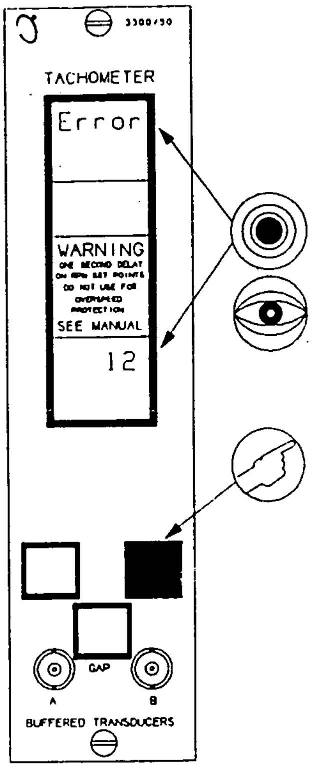


CAUTION

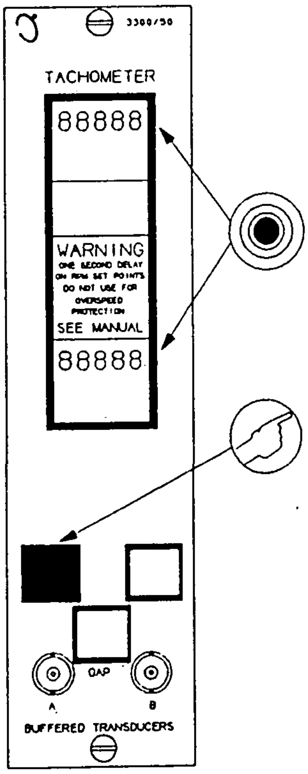
MACHINE PROTECTION WILL BE LOST FOR DURATION OF TEST.

21 SELF TEST (CONT)

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

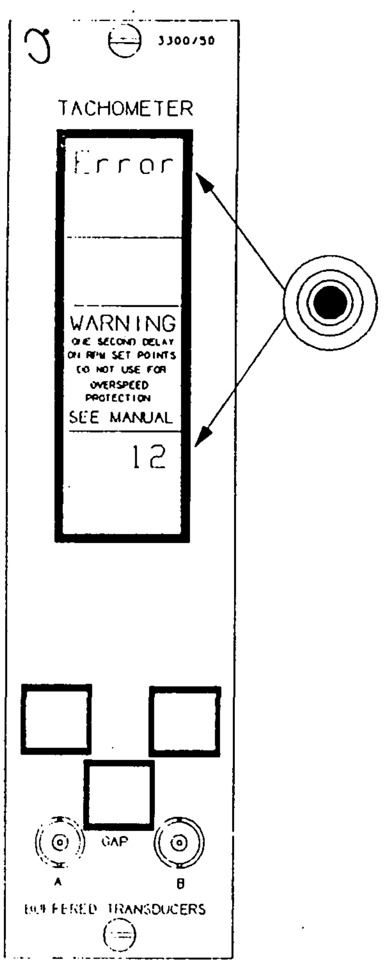


READ CODES ON LIST; STEP THROUGH EACH ERROR CODE ON LIST BY PRESSING AND HOLDING THE RIGHT ALERT SWITCH FOR APPROXIMATELY ONE SECOND.



AT THE END OF THE LIST, THE LCD WILL DISPLAY ALL EIGHTS. TO REREAD THE LIST, PRESS THE RIGHT ALERT SWITCH. TO CLEAR THE LIST FROM MEMORY, PRESS AND HOLD THE LEFT ALERT SWITCH FOR APPROXIMATELY ONE SECOND.

21 SELF TEST (CONT)



ERROR CODE	DESCRIPTION
2	ROM CHECKSUM HAS FAILED. *
3	EEPROM FAILURE NO. 1. **
4	EEPROM FAILURE NO. 2. *** ADJUST SETPOINTS
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. *
21	INCORRECT SWITCH OR SWITCH COMBINATION. ****
32	AUTO THRESHOLD OR MAGNETIC PICKUP NOT ALLOWED WITH A ZERO SPEED TACHOMETER.
33	THE PROCESSOR HAS NOT BEEN PROGRAMMED FOR THE TACHOMETER TYPE. *
34	THE INPUT FREQUENCY TO THE TACHOMETER IS TOO HIGH FOR PROPER OPERATION.

* 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 NONRECOVERABLE AND ERRORS 5 THROUGH 12 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 SETUP MODE.

22 INDEX

2.7.17 Alert Hysteresis

2.7.18 Adjust Alert Setpoints

2.7.19 Bypass Alert Relays

2.7.20 Bypass Monitor

2.7.21 Adjust Threshold and Hysteresis

2.7.22 Adjust Full Scale Range

2.7.23 Test Trigger OK LED's

2.7.24 Test Alerts

2.7.25 Self Test

2.7.26 Error Codes

2.7.27 Recommended Spare Parts List

2.7.28 Specifications

2.7.29 Index

2.7.30 Field Wiring Diagram

2.7 3300/52 Reverse Rotation Monitor

The following publication entitled 3300/52 Reverse Rotation Operation / Maintenance Manual (Part No 101211-01 Rev E) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of the Reverse Rotation module, details of the operation, functions, alarm setup, programmable options, probe gap adjustment, testing, recommended spare parts and a general specification.

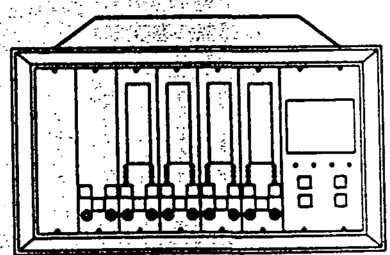
The following sections are included:

PART NO. 101211-01
REVISION E,
JANUARY 1995

3300/52 REVERSE ROTATION MONITOR

OPERATION / MAINTENANCE MANUAL

BENTLY NEVADA®



NOTICE

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. Contact could cause shocks, burns, or death. Do not touch exposed wires or terminals.

⚠ CAUTION
Machine protection provided by this monitor will be lost while the monitor is removed from the rack.

Keyphasor® and **Proximitor**® are registered trademarks of Bently Nevada Corporation.

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NOTICE

WARNING !

Bently Nevada Reverse Rotation Monitors are not designed for use independently as, or a component of, a speed control or overspeed protection system.

Bently Nevada Reverse Rotation Monitors do not provide protective redundancy and the response speed needed for reliable operation as a speed control or overspeed protection system.

Where provided, the analog proportional output is suitable for data logging or chart recording purposes only. Also, where provided, speed Alert setpoints are suitable for annunciation purposes only.

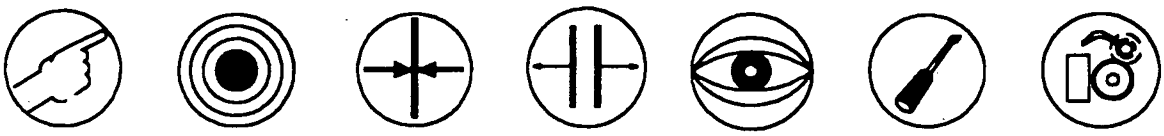
Failure to take the above warnings into account constitutes a misuse of the product and may result in property damage and/or bodily injury.

FOREWORD

Related Documents

DOCUMENT	BENTLY NEVADA PART NUMBER
3300 System Overview, Installation Instructions and Troubleshooting 3300/12 AC Power Supply 3300/14 DC Power Supply 3300/03 System Monitor 3300 Internal Barrier Manual	80170-01 89602-01 101256-01 89604-01 88837-01

This manual uses these symbols to indicate actions in the step-by-step procedures.

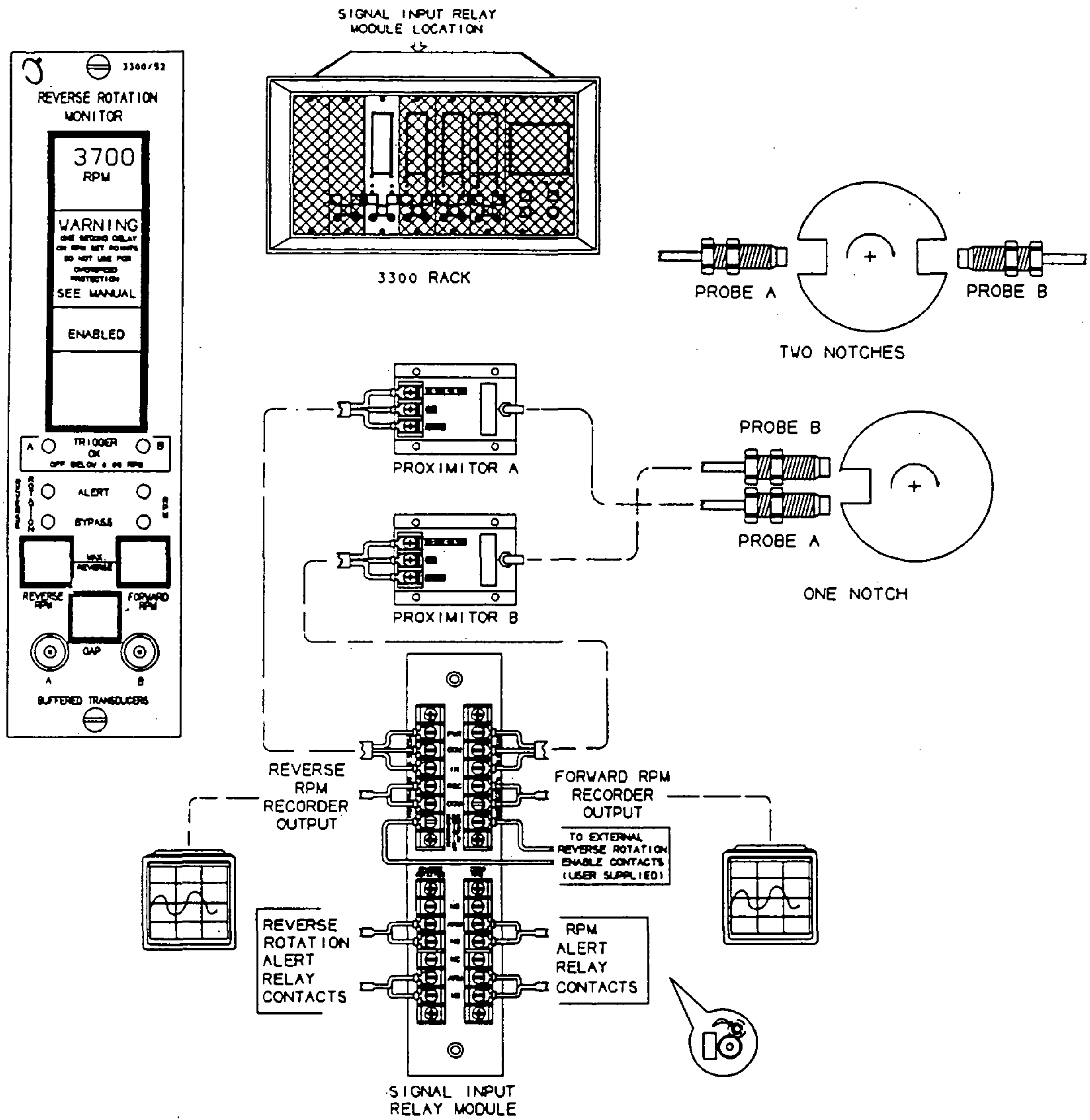


PRESS FLASHING CONNECT DISCONNECT OBSERVE SCREWDRIVER ALARM

CONTENTS

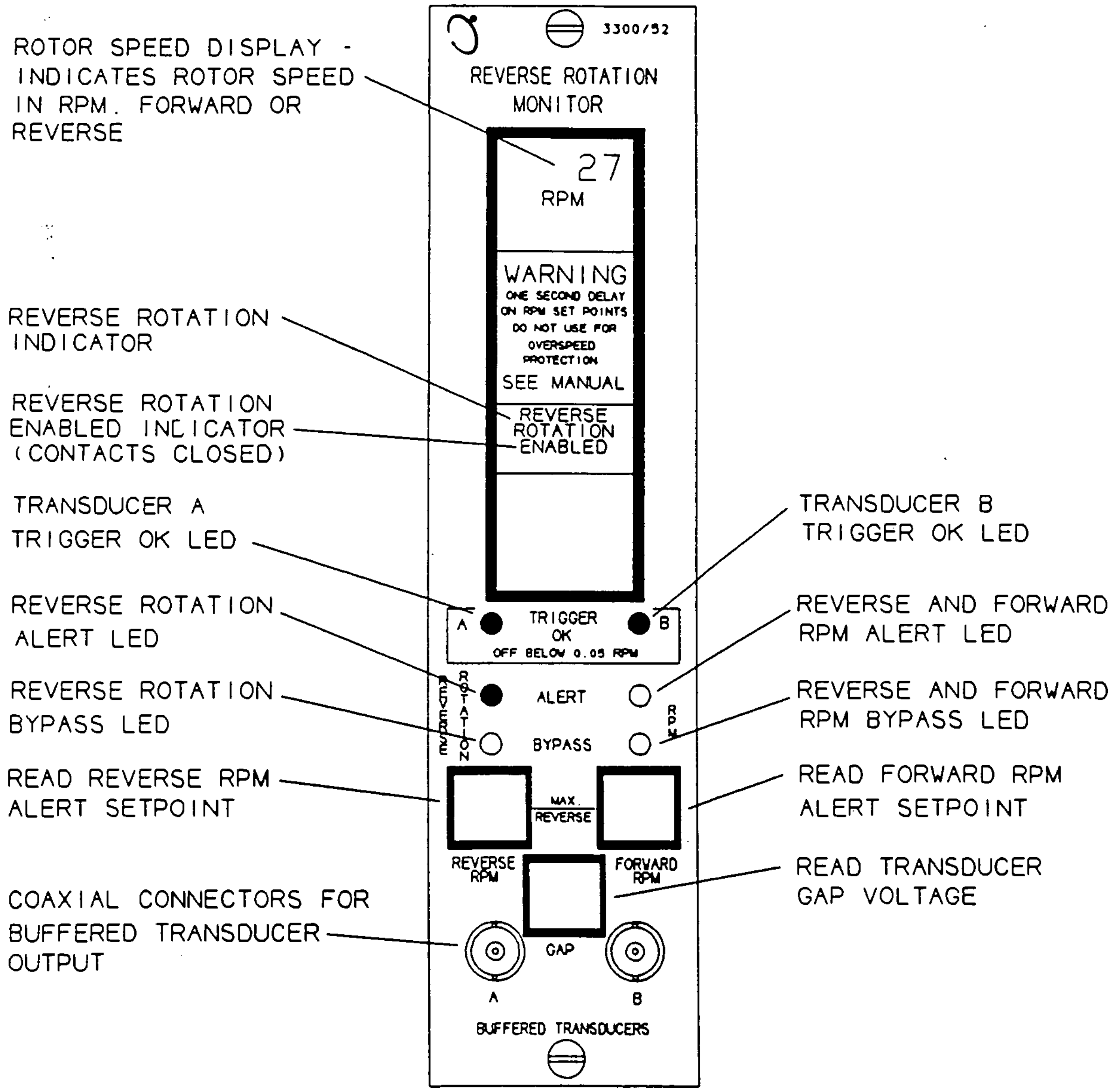
CONTENTS

1 REVERSE ROTATION MONITOR SYSTEM



2 FRONT PANEL FEATURES

The LCD on the Reverse Rotation monitor is used to display a variety of messages. The figure on this page shows what the LCD displays in typical operating mode. Refer to sections 11 to 13 in this manual to see how the monitor uses the LCD to display other information.



3 MONITOR FUNCTIONS

The Reverse Rotation Monitor continuously monitors the speed and direction of shaft rotation. It receives signals from two Keyphasor proximity probes, measures the time between Keyphasor pulses, calculates the speed and determines the direction of rotation. The monitor is designed for applications where reverse rotation would cause damage such as on a machine with dry gas seals or a process that involves flow in two directions such as hydroelectric pumped storage applications.

Alarms

This monitor has one level of alarm, alert, and has two types of alert alarms, reverse rotation and RPM (in both reverse and forward direction). The reverse RPM alert has an over alert setpoint only. The forward RPM alert has either an over or an under alert setpoint.

REVERSE ROTATION ALERT -- When the monitor detects reverse rotation, the **REVERSE ROTATION ALERT** LED comes on and the Reverse Rotation Alert relay activates.

RPM ALERT -- When the speed of the shaft equals or exceeds the setpoint levels in either the reverse or forward direction, the **RPM ALERT** LED comes on and the RPM Alert relay activates.

FIRST OUT ALERT -- A monitor with the First Out option selected flashes an **ALERT** LED if that alert was the first in the rack since the last reset or rack power-up. Pressing the **RESET** switch on the System Monitor acknowledges the First Out and stops the **ALERT** LED from flashing.

OK Functions

The OK functions check that the components of the monitor are functioning properly. The OK functions of the Reverse Rotation Monitor include Trigger OK and Monitor OK.

TRIGGER OK -- Trigger OK checks the validity of the Keyphasor pulses. The **TRIGGER OK** LEDs will go off if:

1. The Keyphasor pulses are less than 0.05 RPM or greater than 20,000 RPM if the shaft has one notch or projection or 10,000 RPM if the shaft has two notches or projections.
2. The monitor detects missing or extra keyphasor pulses.
3. The monitor detects a transducer gap reading of zero volts.

MONITOR OK -- Monitor OK uses the self tests to check the integrity of the monitor. If a self test fails, the OK Relay changes state (goes not OK) and the **TRIGGER OK** LEDs flashes at 5 Hz.

3 MONITOR FUNCTIONS (CONT)

Relays

ALERT RELAYS -- There are two alert relays: Reverse Rotation Alert Relay and RPM Alert Relay. The alerts can be programmed individually for either latching or nonlatching mode. In the nonlatching mode, the alert resets automatically when the alert no longer exists. In the latching mode, the alert condition must be reset manually by pressing the **RESET** switch on the front panel of the System Monitor or by closing the external reset contacts on the Power Input Module. The alert will not reset if the alert condition still exists.

REVERSE ROTATION ALERT RELAY -- This alert relay changes state whenever reverse rotation is detected. This relay can be bypassed by setting a DIP switch.

RPM ALERT RELAY -- This alert relay changes state when either the Reverse RPM setpoint is exceeded or the Forward RPM setpoint is exceeded. The Reverse RPM alert is always an over alert setpoint, while the Forward RPM alert can be jumper-programmed for either an over or an under alert setpoint. This relay can be bypassed by setting a DIP switch.

OK RELAY -- The OK Relay is a feature of the 3300 system and is located on the Power Input Module. Every monitor in the rack must be OK or bypassed to drive the OK Relay OK.

Bypass

The bypass functions let you disable alert alarms or the entire monitor. Bypass functions are useful to avoid alarms when you configure or test the monitor.

REVERSE ROTATION ALERT RELAY BYPASS -- Use Reverse Rotation Alert Relay Bypass to disable the Reverse Rotation relay. When an alarm is bypassed, the alert relay for that alarm is disabled. The monitor continues to indicate speed, direction, and alarm status on the front panel even when Reverse Rotation Alert Relay Bypass is on.

RPM ALERT RELAY BYPASS -- Use RPM Alert Relay Bypass to disable the RPM relay. When an alarm is bypassed, the alert relay for that alarm is disabled. The monitor continues to indicate speed, direction, and alarm status on the front panel even when RPM Alert Relay Bypass is on.

MONITOR BYPASS -- Use Monitor Bypass to disable the entire monitor. The monitor disables any monitoring, displays 0 (zero) RPM forward on the front panel, and drives the OK relay OK.

3 MONITOR FUNCTIONS (CONT)

Switches on the Front Panel

REVERSE RPM – Press this switch to display the Reverse RPM setpoint. The up arrow will be on, indicating an over alert setpoint, and the "REVERSE ROTATION ALERT" label will be displayed on the front panel.

FORWARD RPM – Press this switch to display the Forward RPM setpoint. The up arrow will be on if the monitor is jumper-programmed to have an over Forward RPM setpoint, and the down arrow will be on if the monitor is jumper-programmed to have an under Forward RPM setpoint.

PROBE GAP VOLTAGE – Display the probe gap voltage for each transducer by pressing the **GAP** switch. Probe gap is measured in negative DC voltage and is directly proportional to the gap between the face of the proximity probe and the surface being monitored.

MAX REVERSE/PEAK HOLD – The monitor stores values for maximum speed in the reverse direction and the number of rotations in the reverse direction. You can read these values by pressing the **REVERSE RPM** and **FORWARD RPM** switches simultaneously. The monitor retains these values even after loss of monitor power.

Input and Output

The monitor can receive input from two sources: system Keyphasor signals from the Power Input Module or separate Keyphasor signals from the Signal Input Relay Module. The monitor provides outputs from the coaxial connectors on the front panel and from the Reverse RPM and Forward RPM recorder outputs at the rear of the rack.

KEYPHASOR SIGNALS – The monitor can use System Keyphasor signals that enter the rack through the Power Input Module and are available to all the monitors in the rack. The monitor can also use separate Keyphasor signals from the Monitor's Signal Input Module.

BUFFERED OUTPUTS – The **BUFFERED TRANSDUCER A** and **B** coaxial cable connectors on the front panel of the monitor provide buffered signals from the transducers. Use these connectors to connect external equipment to the monitor.

RECORDER OUTPUT – Depending on the option selected, the recorder output levels proportional to reverse RPM and forward RPM are 0 to -10 Vdc, +1 to +5 Vdc, or +4 to +20 mA. There are two recorders, one for reverse RPM and another for forward RPM. For reverse rotation, the reverse RPM recorder is driven to the proportional output level, and the forward RPM recorder is driven downscale. For forward rotation, the forward RPM recorder is driven to the proportional output level, and the reverse RPM recorder is driven downscale.

3 MONITOR FUNCTIONS (CONT)

Self Tests

The monitor has three categories of self test: Power-up, Cyclic, and User-invoked.

POWER UP – A Power-up self test, consisting of a series of basic monitor OK tests, is performed automatically each time the monitor is turned on.

CYCLIC – A Cyclic self test is performed automatically while the monitor is operating. Any error encountered during cyclic tests disables the monitor and flashes an error code on the front panel display. If the error is intermittent, the monitor will begin operating again, and the error code will be stored for retrieval during user-invoked self tests. Stored error codes are indicated by the **TRIGGER OK** LEDs flashing at 5 Hz (5 times per second) provided that the monitor and the triggers are OK.

USER INVOKED – A User-invoked self 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 **TRIGGER OK** LEDs at 5 Hz and displaying the error codes on the front panel LCD display.

4 MONITOR REMOVAL

CAUTION

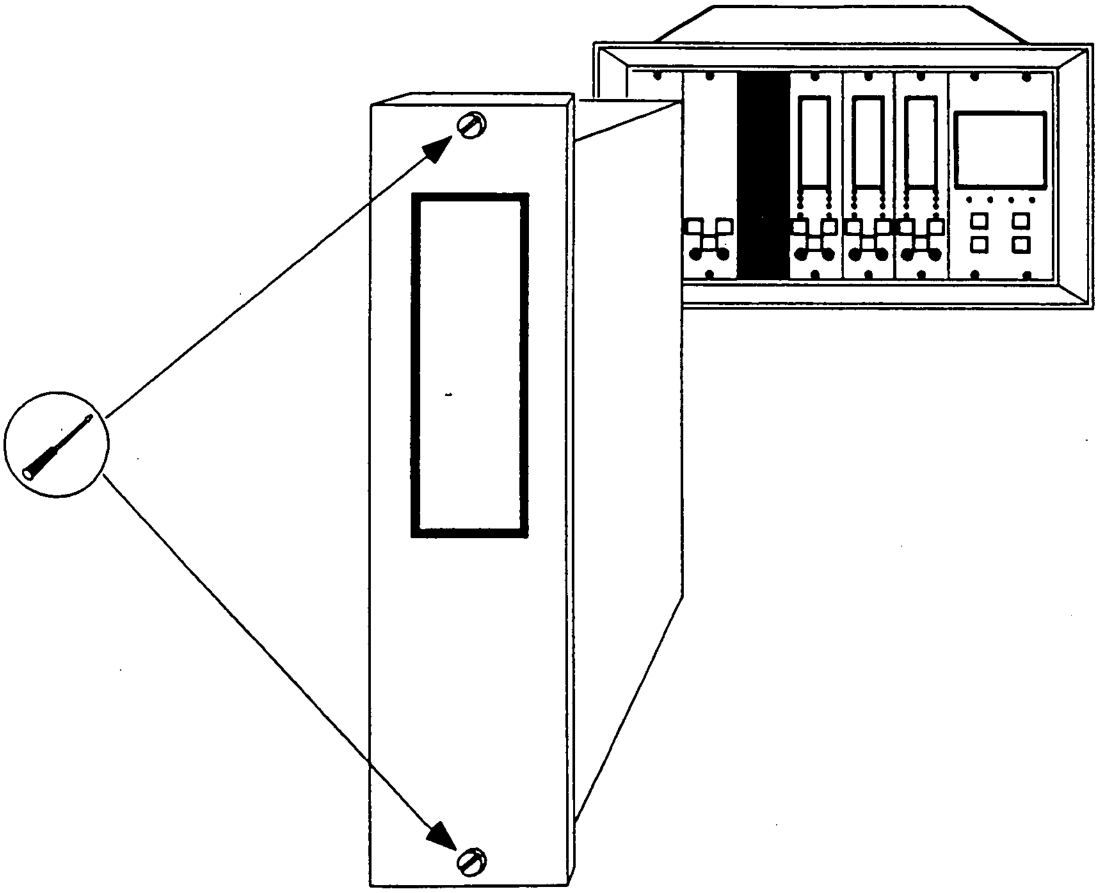
Machine protection provided by this monitor will be lost while the monitor is removed from the rack.

CAUTION

Components on the circuit boards can be damaged by electrostatic discharge (ESD).

Use a grounding strap when handling circuit boards and use antistatic bags to store or transport boards.

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

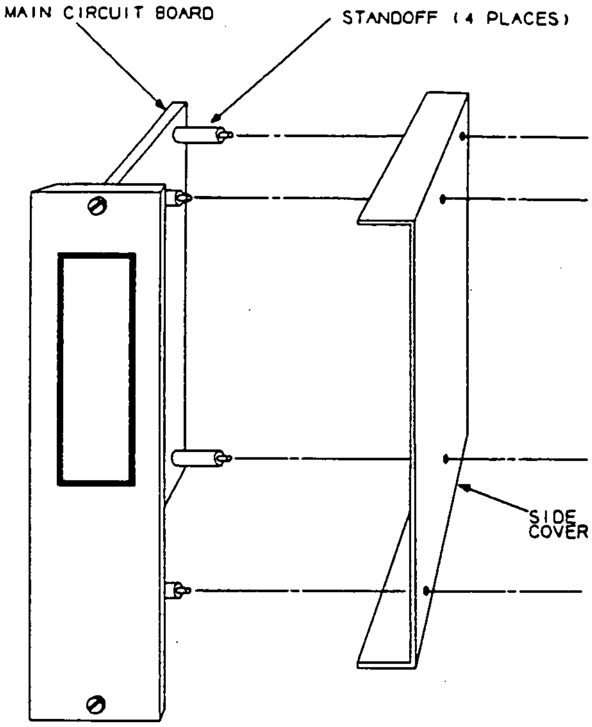


5 MONITOR DISASSEMBLY

CAUTION

Components on the circuit boards can be damaged by electrostatic discharge (ESD).

Use a grounding strap when handling circuit boards and use antistatic bags to store or transport boards.

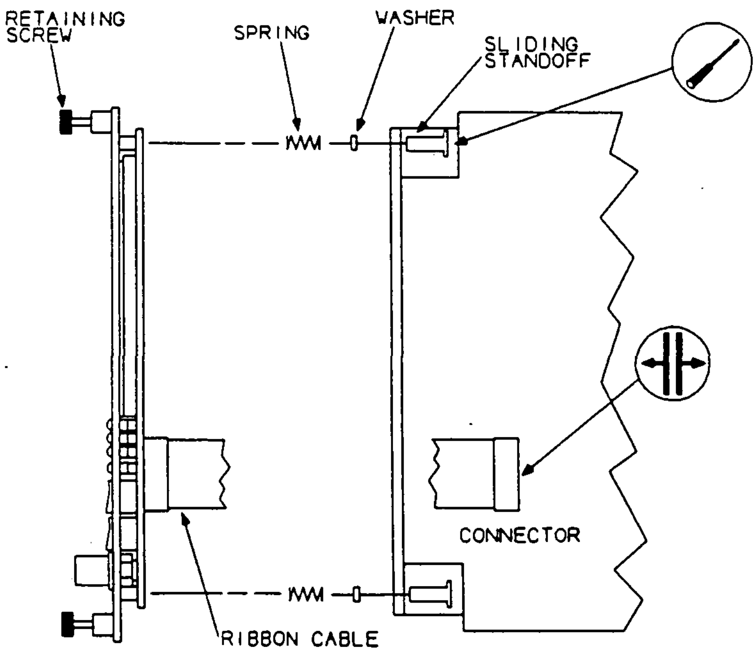


Side Cover Removal

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

Front Panel Assembly Removal

1. Disconnect J2 by pressing the connector latches outward.
2. Unscrew the two sliding standoffs.



5 MONITOR DISASSEMBLY (CONT)

Recorder Board Removal

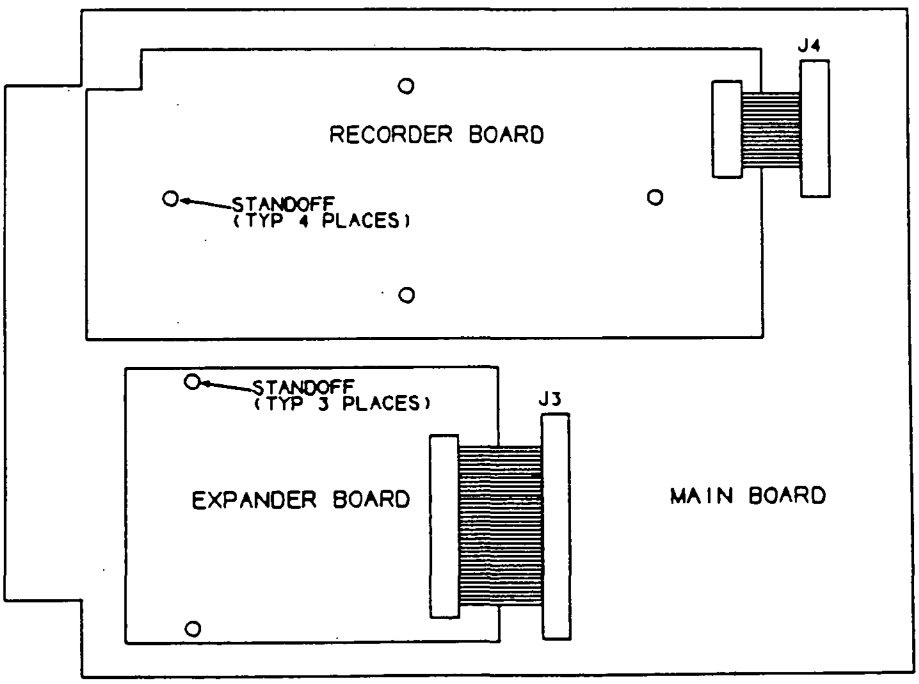
1. Disconnect J4 by pressing the connector latches outward.
2. Release all four plastic standoffs by squeezing the retaining clip while gently pulling the recorder board away from the main board.
3. Remove the recorder board.

Expander Board Removal

1. Diconnect J3 by pressing the connector latches outward.
2. Release all three platic standoff by squeezing the retaining clip while gently pulling the expander board slightly away from the main board.

NOTE: The third standoff is under the ribbon cable to the right of the expander board.

3. Remove the expander board.



6 SIGNAL INPUT RELAY MODULE

WARNING

High voltage present. Contact could cause shocks, burns, or death.

Do not touch exposed wires or terminals.

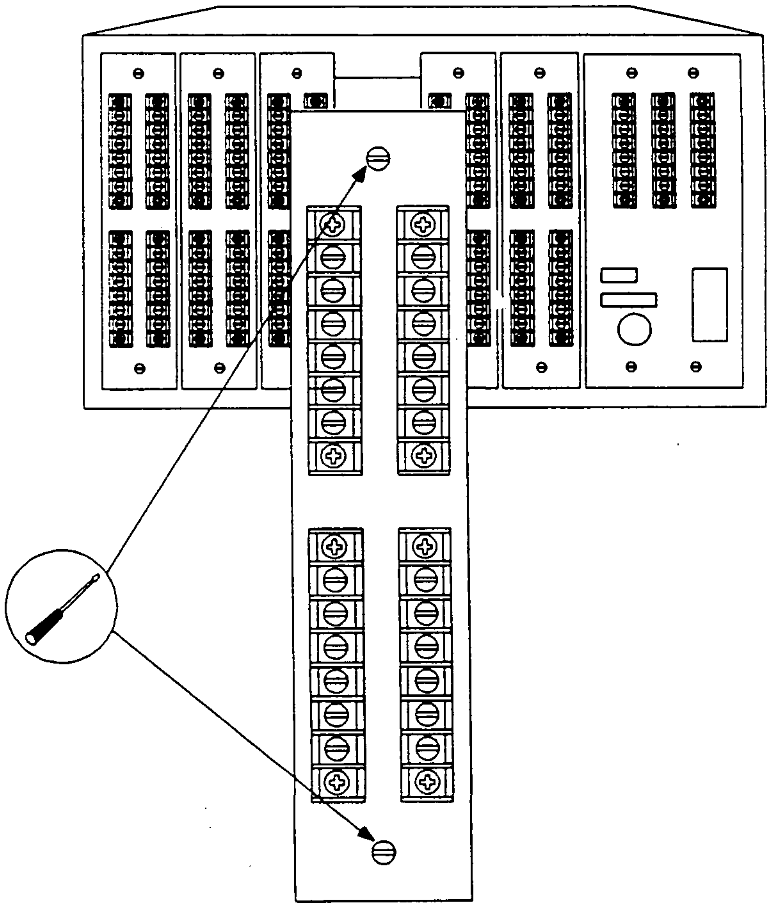
CAUTION

Machine protection provided by this monitor will be lost while the monitor is removed from the rack.

The Signal Input Relay Module is on the back of the rack. For information on relay configuration, refer to the 3300 System Installation Manual. For field wiring diagrams, refer to the last section of this manual.

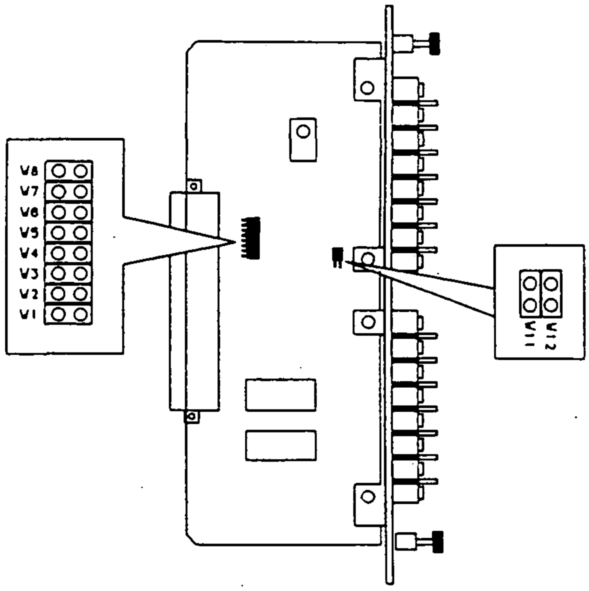
Module Removal

Loosen two screws and remove the module.



6 SIGNAL INPUT RELAY MODULE (CONT)

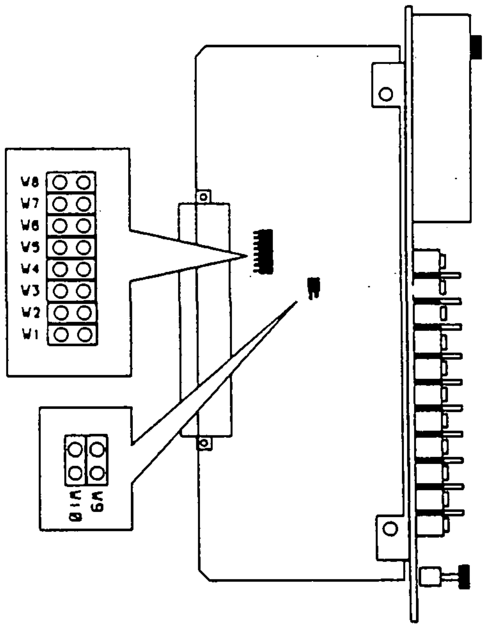
Signal Input Relay Module without internal barriers:



Module Options

Reverse Rotation Alert Relay	Jumper In	Jumper Out
Normally Energized Normally De-energized	W3 W4,W11	W4,W11 W3
RPM Alert Relay	Jumper In	Jumper Out
Normally Energized Normally De-energized	W2 W1,W12	W1,W12 W2

Signal Input Relay Module with internal barriers:



Module Options

Reverse Rotation Alert Relay	Jumper In	Jumper Out
Normally Energized Normally De-energized	W3 W4,W9	W4,W9 W3
RPM Alert Relay	Jumper In	Jumper Out
Normally Energized Normally De-energized	W2 W1,W10	W1,W10 W2

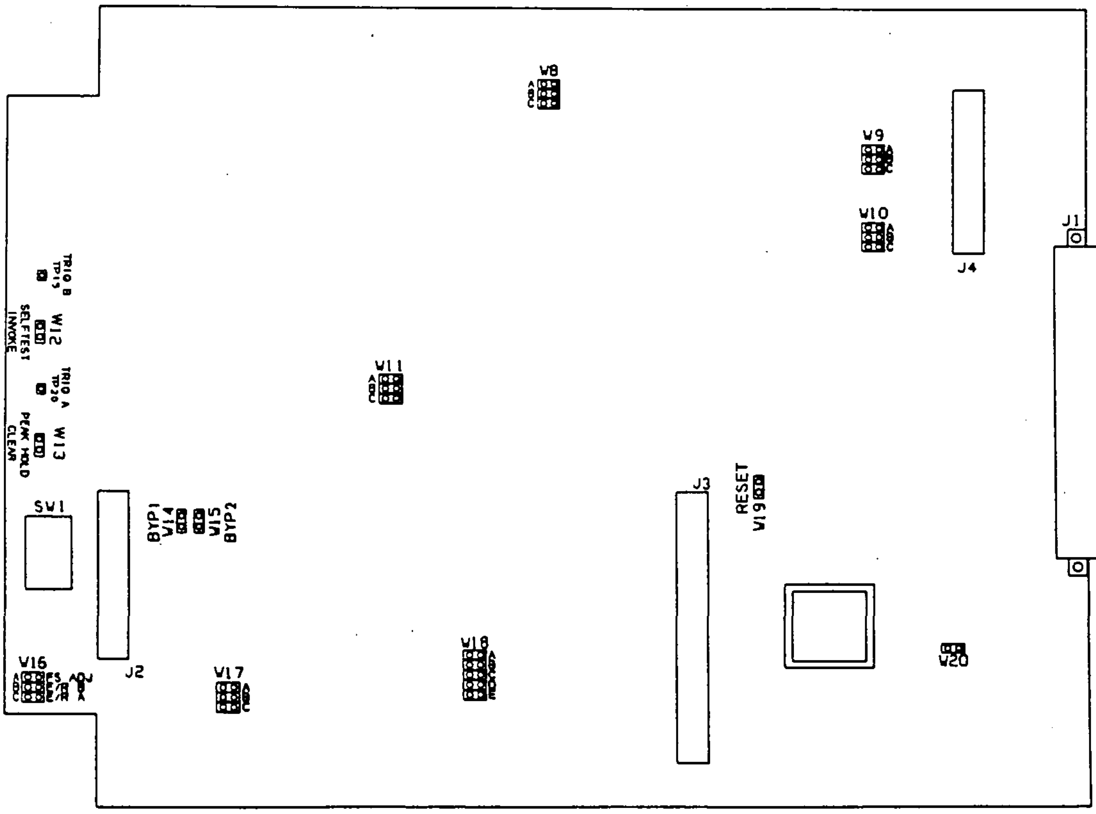
For relay configuration, see Internal Safety Barrier Installation Manual, 88837-01. For field wiring, see the the last section of this manual (Schematics and Drawings).

7 MONITOR OPTIONS

REVERSE ROTATION MONITOR
PART NUMBER

	ALERT RELAYS		AGENCY APPROVAL		BARRIERS
3300/52 —	AA	—	BB	—	CC
	00 = NONE		00 = NOT REQ'D		00 = NONE
	01 = 5 AMP EPOXY SEALED		01 = CSA, DIV. 2, CLASS 1		01 = EXTERNAL BARRIERS
	02 = 5 AMP HERMETICALLY SEALED		02 = BASEEFA, ZONE 2		02 = INTERNAL BARRIERS
			03 = FACTORY MUTUAL, DIV. 2, CLASS 1		
			04 = CITY OF LOS ANGELES, DIV. 2, CLASS 1		

The Reverse Rotation Monitor has several user-programmable options. The options can be changed by removing and installing jumpers. Contact your nearest Bently Nevada representative for agency approval availability (option BB).



Jumper Locations on the Main Circuit Board

7 MONITOR OPTIONS (CONT)

Main Board Options

Jumpers for all options except for recorder options are on the main circuit board. Use this table and the circuit board diagram on the previous page to set options.

OPTION	SETTING	TRANSDUCER A		TRANSDUCER B	
		INSTALL	REMOVE	INSTALL	REMOVE
Transducer Input	Internal Keyphasors	W10C	W10A,B	W9C	W9A,B
	External Signals (7200, 3000, or 3300 Proximitor)*	W10A	W10B,C	W9A	W9B,C
Transducer Hysteresis Conditioning	0.2 V	W11B	W11A,C	W8B	W8A,C
	0.5 V*	W11C	W11A,B	W8C	W8A,B
	1.0 V	W11A	W11B,C	W8A	W8B,C
	2.0 V	—	W11A,B,C	—	W8A,B,C

* Option settings as normally shipped from the factory

NOTE : Do not install W20. It is for special test mode only.

7 MONITOR OPTIONS (CONT)

Main Board Options (continued)

OPTION	SETTING	INSTALL	REMOVE
Reverse Rotation Alert	Latching* Nonlatching	— W18C	W18C —
RPM Alert	Over* ** Under ** Latching* Nonlatching	— W18D — W18E	W18D — W18E —
First Out***	Enabled* Disabled	W17A —	— W17A
Reverse Rotation Alert Bypass Switch	Enabled Disabled*	W14 —	— W14
RPM Alert Bypass Switch	Enabled Disabled*	W15 —	— W15
RPM Alert Hysteresis Band****	0 RPM 1 RPM 5 RPM 10 RPM*	— W17C W17B W17B,17C	W17B,17C W17B W17C —
Events per Revolution	One* Two*****	— W18A	W18A —

* Option settings as shipped from the factory.

** Over or under alert is only valid for forward RPM setpoint. The reverse RPM setpoint is always an over alert.

*** All alerts in this monitor drive the rack **FIRST OUT ALERT** Bus. The Reverse Rotation Monitor does not drive the rack **FIRST OUT DANGER** Bus.

**** Refer to section 17 for more information about the RPM Alert Hysteresis Band.

***** Two events per revolution is only valid for external signals transducer inputs.

7 MONITOR OPTIONS (CONT)

Recorder Board Options

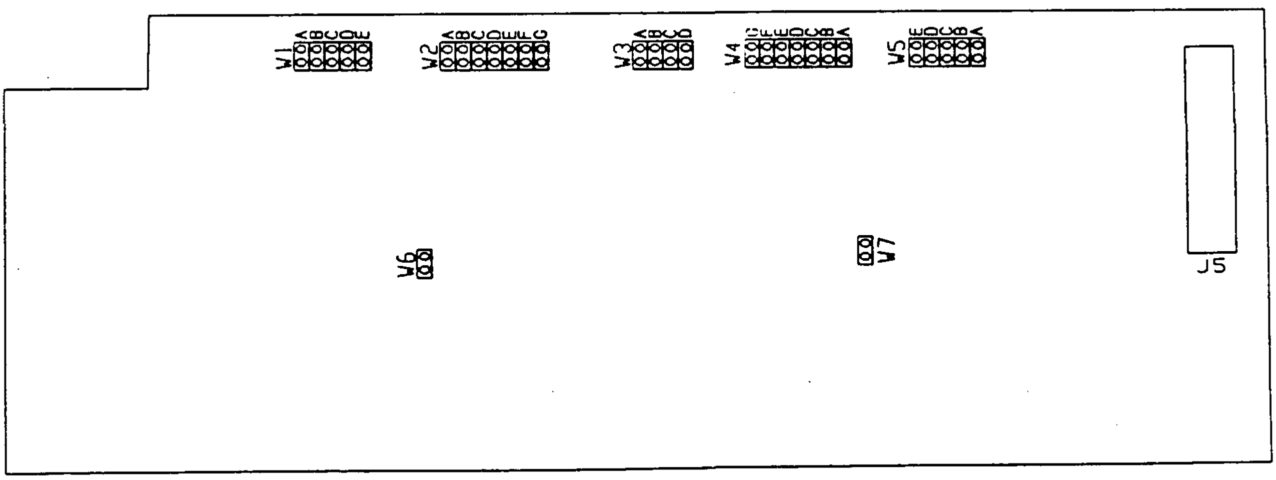
RECORDER OUTPUT		
To program Recorder Output Options, remove ALL jumpers in W1, W2, W3, W4, W5, W6, and W7 on the recorder board. Then install jumpers:		
+4 to +20 mA*	0 to -10 Vdc	+1 to +5 Vdc
W1B,C,D W2B,D,E W3A,C W4B,D,E W5B,C,D	W1A,E W2A,G W3B,D W4A,G W5A,E	W1A,E W2C,F W3A,C W4C,F W5A,E

OPTION	SETTING	INSTALL	REMOVE
2 mA Clamp**	Enabled Disabled*	W6 W7 —	— W6 W7

* Option settings as shipped from the factory.

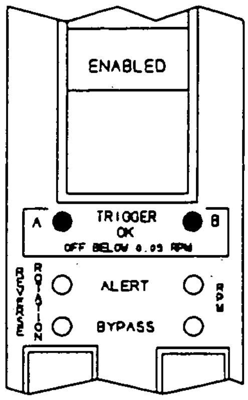
** 2 mA clamp means that when the OK relay goes not OK the recorder output is driven to 2 mA (it is only valid for the +4 to +20 mA recorder option).

NOTE: The jumpers for the recorder options are on the recorder board.



Jumper Locations on the Recorder Board

8 OK



NOTE: Each monitor in the system controls the OK Relay. The Reverse Rotation Monitor can cause a not OK relay condition (de-energized relay) with a monitor not OK.

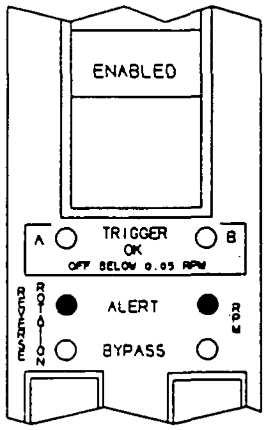
LED DISPLAY A		B	CONDITION	OK RELAY DRIVE **
●	TRIGGER OK	●	Monitor OK and trigger A and B OK.*	on
●	TRIGGER OK	○	Respective transducer A or B reads zero gap volt and monitor OK.	on
○	TRIGGER OK	●		
○	TRIGGER OK	○	Either trigger A or B not OK, and/or monitor not OK.	off **
◎	TRIGGER OK	◎	Flashing at 5 Hz means that an error was found during a cyclic test. See section 25 on how to read stored error codes.	off ***

* "TRIGGER OK" means that the RPM value is between 0.05 and 20,000 RPM for one event per revolution or between 0.05 and 10,000 RPM for two events per revolution, that the signal contains no missing or extra pulses, and that the transducer gap readings are not zero volts.

** A not OK monitor can be bypassed to restore OK Relay conditions.
If the monitor is OK, but the triggers are not, the OK Relay will be on (OK).

*** If there is no current error but there are stored errors in EEPROM the OK Relay will be on.

9 ALERT



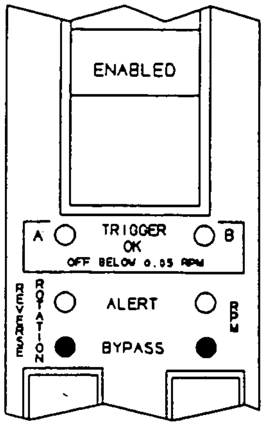
LED DISPLAY ALERT REVERSE ROTATION	RPM	CONDITION	RELAY DRIVE ALERT REVERSE ROTATION	RPM
●	○	The reverse rotation alert conditions have been met. *	on	off
○	●	The forward RPM alert conditions have been met. **	off	on
●	●	Both the reverse rotation and reverse RPM alert conditions have been met. * **	on	on
◎	○	The reverse rotation alert conditions have been met. Reverse rotation is the First Out alert. ***	on	off
○	◎	The RPM alert conditions have been met. The RPM alert is the First Out alert. ***	off	on

* The reverse rotation alert requires that reverse rotation is observed for at least two valid input triggers and 330 milliseconds. Two valid input triggers is two revolutions for one event per revolution, or one revolution for two events per revolution.

** An RPM alert requires that both transducers observe the rotor speed (RPM) rise above an over speed setpoint or fall below an under speed setpoint for at least one second and three valid speed readings.

*** First out resolution is 164 milliseconds. If two alerts occur within 164 milliseconds or less, both LEDs could flash. Both **ALERT** LEDs may flash to indicate first out following self test.

10 BYPASS



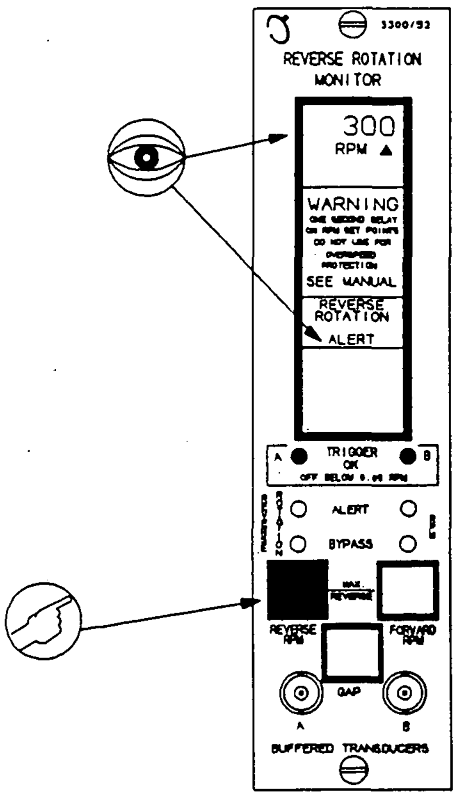
LED DISPLAY BYPASS REVERSE ROTATION	 RPM	CONDITION
●	○	The Reverse Rotation Enable contacts are open,* or the Reverse Rotation Alert Relay is bypassed.
○	●	The RPM Alert Relay is bypassed.
●	●	One or more of these conditions exist: Monitor is bypassed. The monitor detects extra / missing pulses. The monitor reads zero volts for transducer gap readings. The input frequency of the signal is exceeded. The inhibit contacts are closed. Within 10 seconds after power-up / self test.

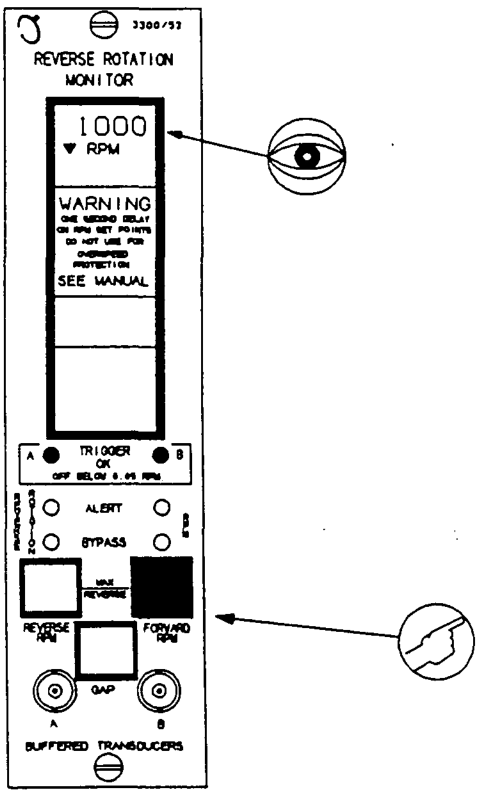
* When the Reverse Rotation Enable contacts are open, Reverse Rotation and Reverse RPM alerts cannot occur. Forward RPM alert is functional.

11 READ SETPOINTS

Press the **REVERSE RPM** switch and read the Reverse RPM Alert setpoint on the front panel display. An up arrow indicates an over speed setpoint. (The reverse RPM alert has no under setpoint.) This monitor is displaying a Reverse RPM setpoint of 300 RPM.

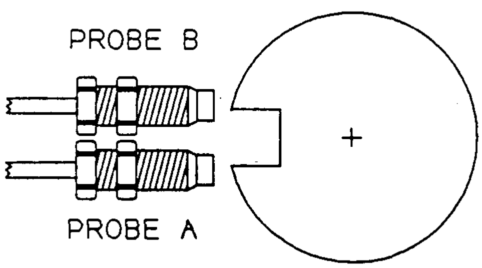
Press the **FORWARD RPM** switch and read the Forward RPM Alert setpoint on the front panel display. An up arrow indicates an over speed setpoint and a down arrow indicates an under speed setpoint. This monitor is displaying a forward RPM Under Speed setpoint of 1000 RPM.

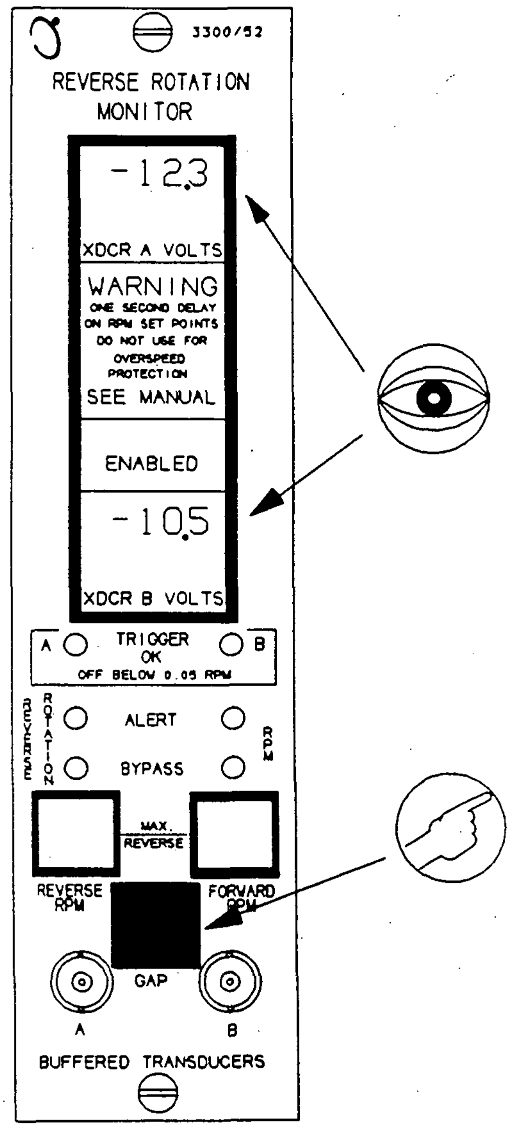




12 READ GAP VOLTAGE

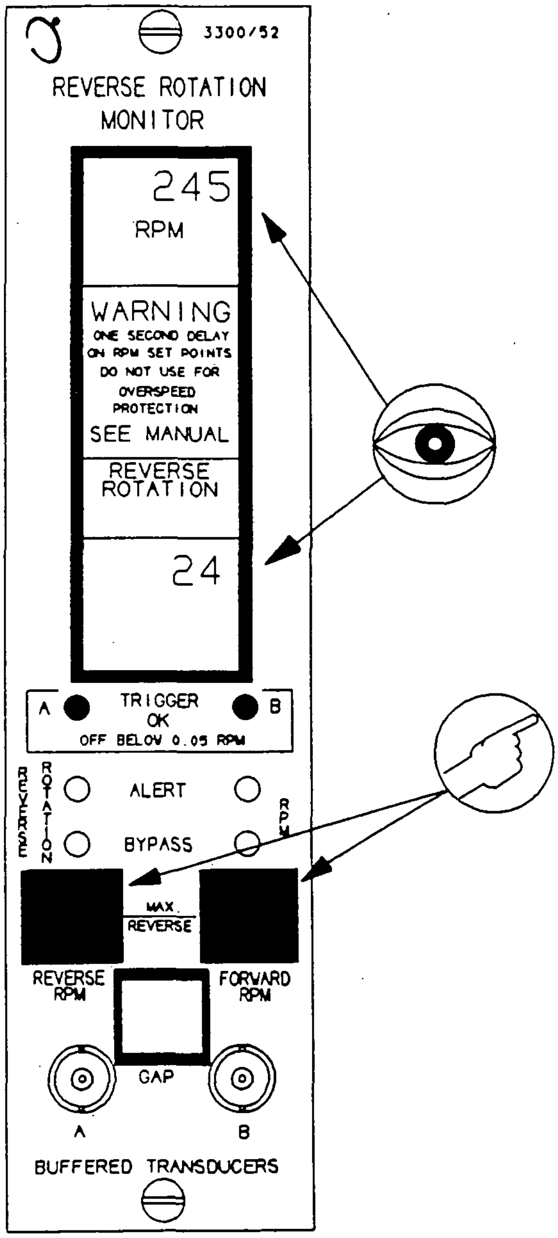
Press the GAP switch and read the voltage for both transducer A and transducer B.





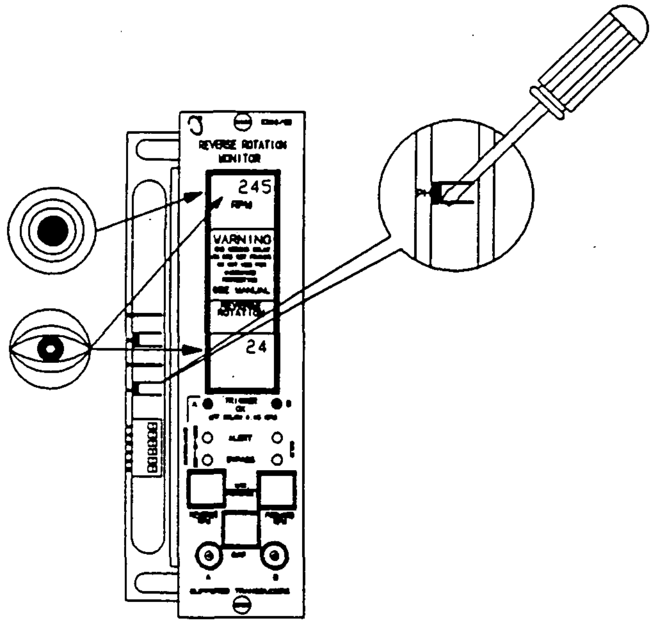
13 READ MAX. REVERSE/ PEAK HOLD

Press the **REVERSE RPM** and **FORWARD RPM** switches simultaneously to read the maximum reverse RPM and the number of reverse rotations since the last peak hold reset. This monitor is displaying a maximum reverse RPM of 245 and 24 reverse rotations.

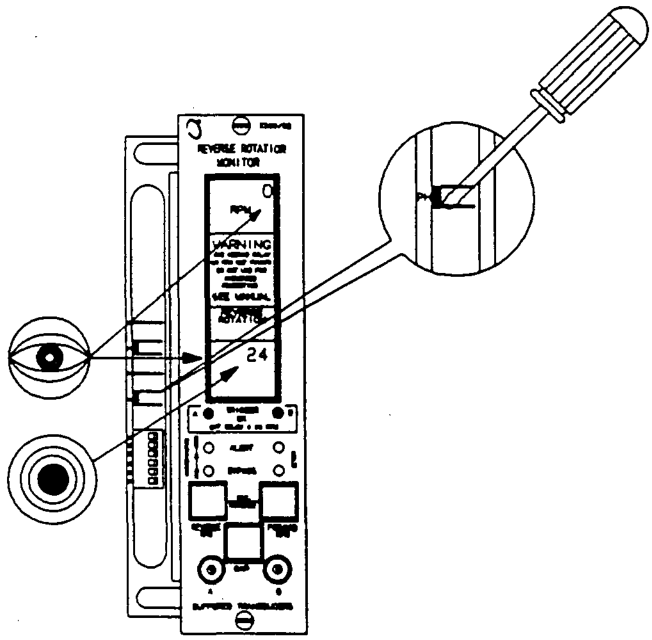


14 RESET MAX. REVERSE/ PEAK HOLD

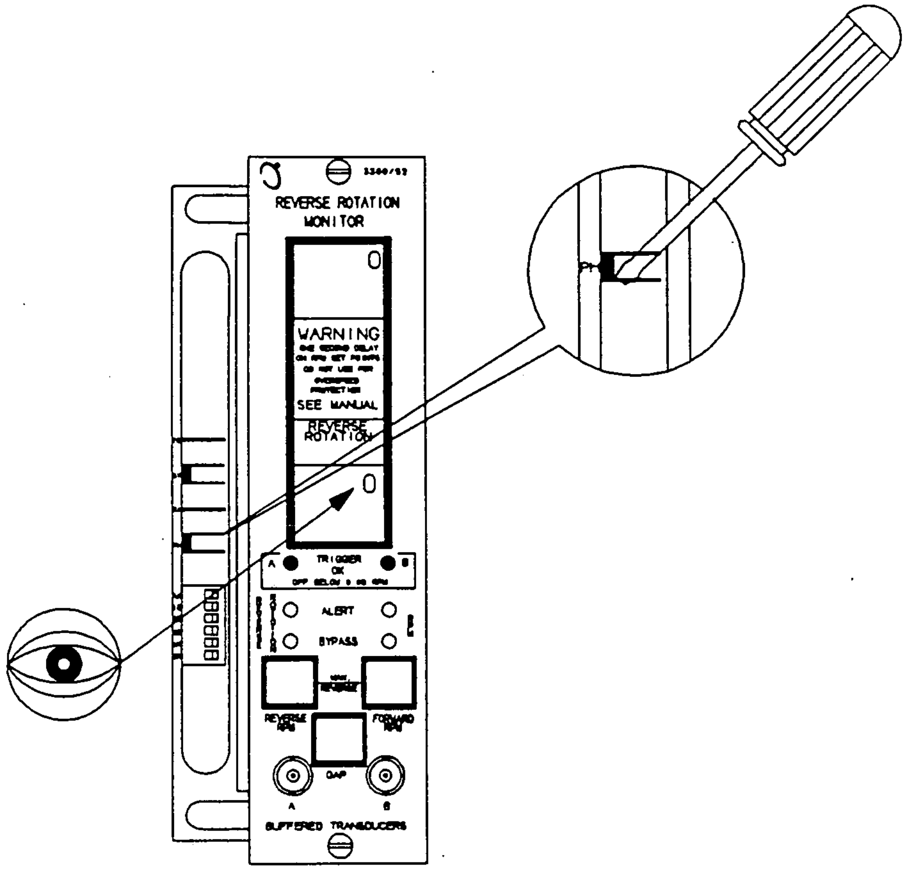
Reset the values stored in Peak Hold memory by shorting across Peak Hold Clear (**PH**) pins for 10 seconds. The Peak Hold values will be displayed. The maximum reverse RPM value will be flashing.



After shorting the pins for 5 seconds, the maximum reverse RPM will be reset to zero, and the number of reverse rotations will be flashing.



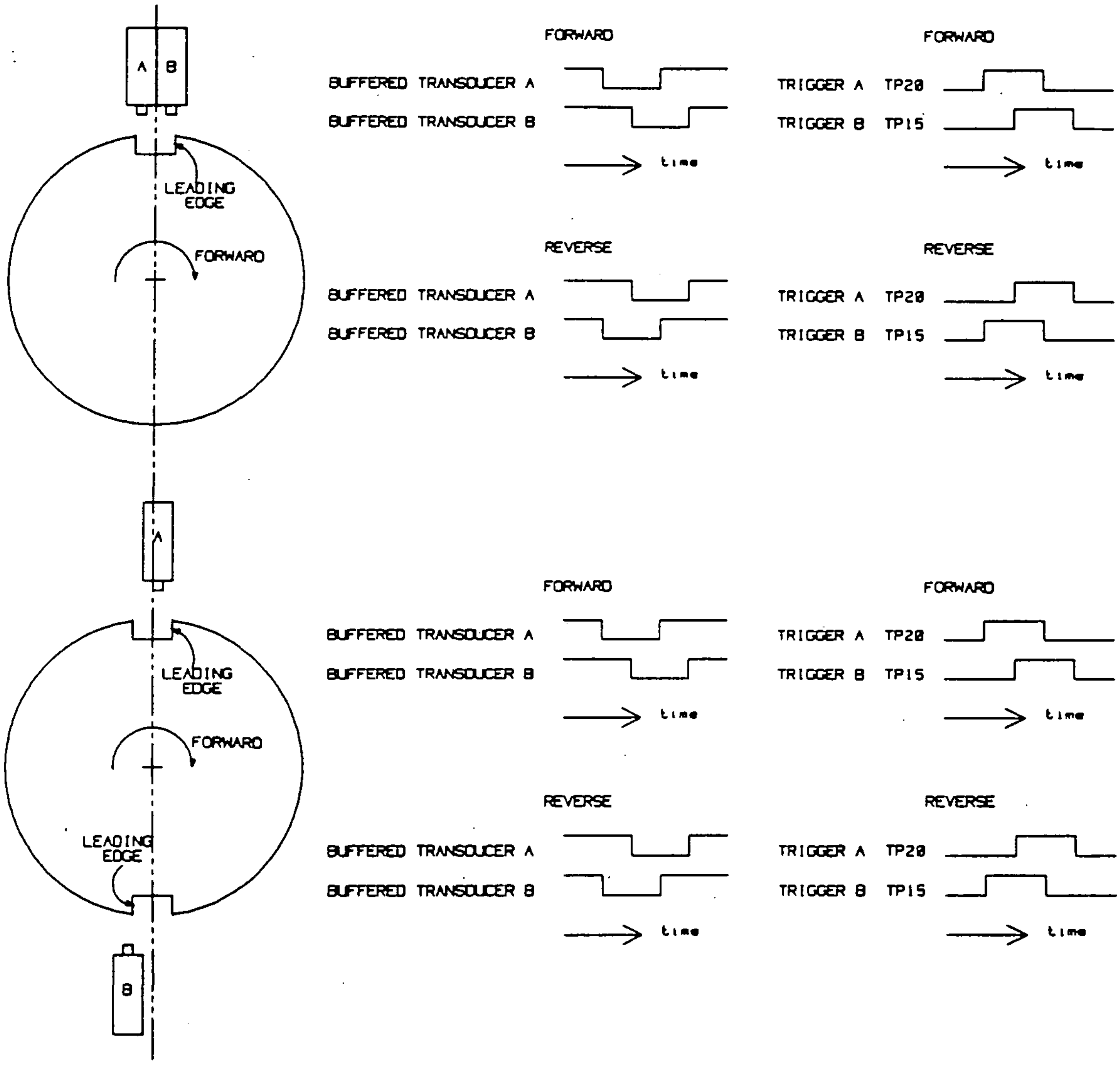
14 RESET MAX. REVERSE/ PEAK HOLD (CONT)



After shorting the pins for 10 seconds, the number of reverse rotations will be reset to zero.

15 PROBE INSTALLATION

This section shows how to position the two probes that provide input signals to the Reverse Rotation monitor so that the monitor works correctly. Position the probes so that when one probe is at the center of a notch or a projection, the other probe is at the leading edge of a notch or projection. The result of this positioning is that the pulses from the two probes overlap as shown in the figure below. The Buffered Transducers are on the front panel while the Trigger Points are just behind the front panel.



NOTE : If a projection is observed, the polarity of the pulses will be reversed from those shown.

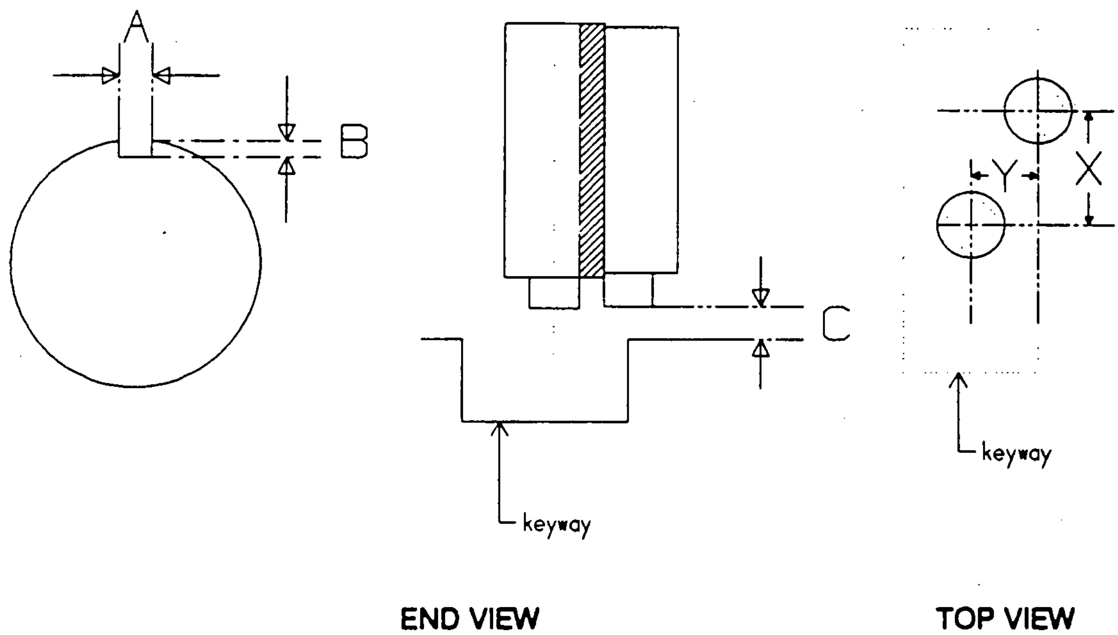
15 PROBE INSTALLATION (CONT)

The two alternate configurations that you can use are to have two probes observe one notch or one projection or to have two probes observe two notches or two projections. In either case, gap the probe to the surface of the shaft for a notch or to the projection for a projection.

Positioning Probes that Observe One Notch or Projection

If you position your probes to observe one notch or projection, be sure to separate the probes enough so that they do not interfere with each other. Use this figure and table to be sure that the two probes are separated adequately.

Installation Dimensions for Two Probes Observing One Notch



A = minimum keyway (notch) width / projection width.

B = minimum keyway (notch) depth / projection height.

C = recommended probe gap.

D = minimum required keyway length.

X = minimum axial separation.

Y = minimum radial separation.

15 PROBE INSTALLATION (CONT)

Probe	A (inches) minimum	B (inches) minimum	C (inches) recommended	X (inches) minimum	Y (inches) minimum
300	0.600	0.060	0.050	1.000	0.150
190	0.380	0.100	0.050	1.000	0.095
5 mm	0.400	0.060	0.050	1.500	0.100
8 mm	0.400	0.060	0.050	1.500	0.100
11 mm	0.870	0.120	0.120	1.500	0.220
14 mm	0.870	0.120	0.100	1.500	0.220

For more information, refer to:

Application Note on Proximity Probes and Related Accessories, AN028.
Performance and Test Specification of your particular transducer.

Required Keyway Length:

Probe	Minimum Required Keyway Length – D (inches)	
	Two probes in one keyway	One probe per keyway
300	0.900 + X	0.900
190	0.570 + X	0.570
5 mm	0.600 + X	0.600
8 mm	1.300 + X	0.600
11 mm	1.300 + X	1.300
14 mm	1.300 + X	1.300

Positioning Probes that Observe Two Notches or Projections

For probes that observe two notches or projections, be sure that the notches or projections are 180 degrees apart (+/-0.05 of a notch width) and the probes are 180 degrees plus half a notch width apart. The observed pulses coming in are subject to the same constraints as the one notch / projection installation. Any error in the notch / projection separation will be reflected in the speed reading.

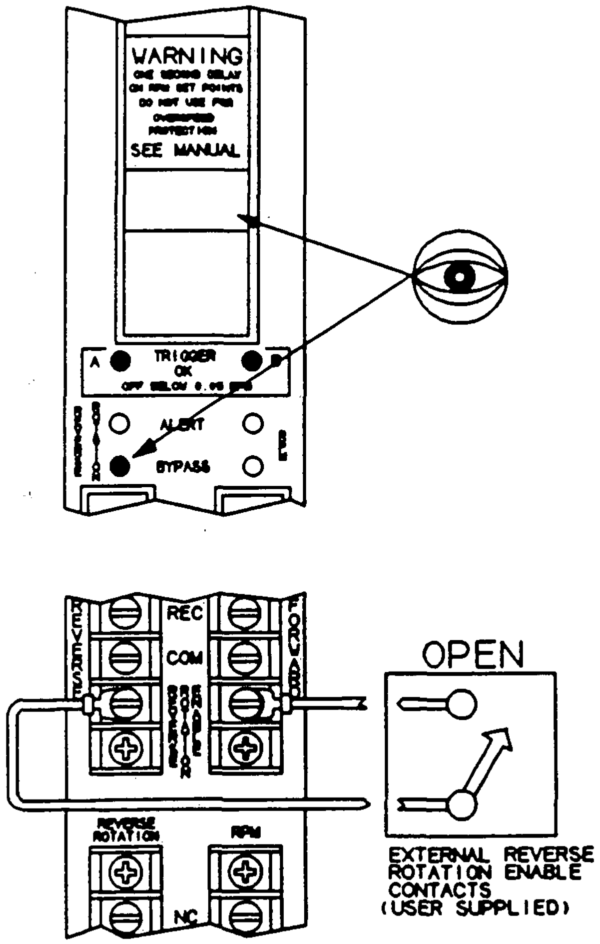
16 REVERSE ROTATION ENABLED

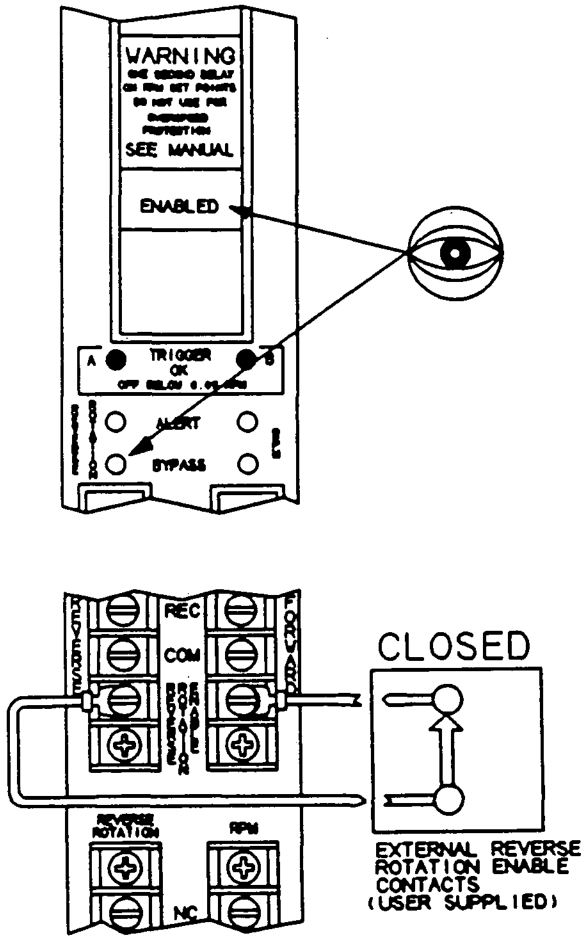
The external **REVERSE ROTATION ENABLE** contacts are used to enable/ disable the Reverse Rotation alert and the Reverse RPM alert.

While these contacts are open, Reverse Rotation and Reverse RPM Alerts cannot occur.

When the external **REVERSE ROTATION ENABLE** contacts are open, the "ENABLED" indicator will go off and the Reverse Rotation **BYPASS** LED will come on.

When the external **REVERSE ROTATION ENABLE** contacts are closed, the "ENABLED" indicator will come on and the **BYPASS** LED will go off (if the Reverse Rotation function has not been manually bypassed).





17 ALERT HYSTERESIS

Definition of Alert Hysteresis

Each alert setpoint in the 3300 Reverse Rotation Monitor has a hysteresis band associated with it. For over alerts, the hysteresis band is a region below the setpoint where an alert remains annunciated. For under alerts, the hysteresis band is a region above the setpoint where an alert remains annunciated if the alert is optioned to be nonlatching and has not been reset.

You can set the amount of alert hysteresis for both forward and reverse RPM to 0, 1, 5, or 10 RPM. Section 7, Monitor Options, describes how to select the RPM Alert hysteresis.

Examples

Example 1: Reverse RPM Over Alert Hysteresis:

PARAMETER	SETTING (RPM)
Reverse RPM Alert setpoint	100
RPM Alert Hysteresis	1
Initial machine speed (reverse direction)	100

DISPLAYED SPEED (reverse direction)	RPM ALERT LED
100	on
99	on
98	off

Example 2: Forward RPM Over Alert Hysteresis:

PARAMETER	SETTING (RPM)
Forward RPM Over Alert setpoint	3600
RPM Alert Hysteresis	10
Initial machine speed (forward direction)	3600

DISPLAYED SPEED (forward direction)	RPM ALERT LED
3600	on
3590	on
3589	off

17 ALERT HYSTERESIS (CONT)

Example 3: Forward RPM Under Alert Hysteresis:

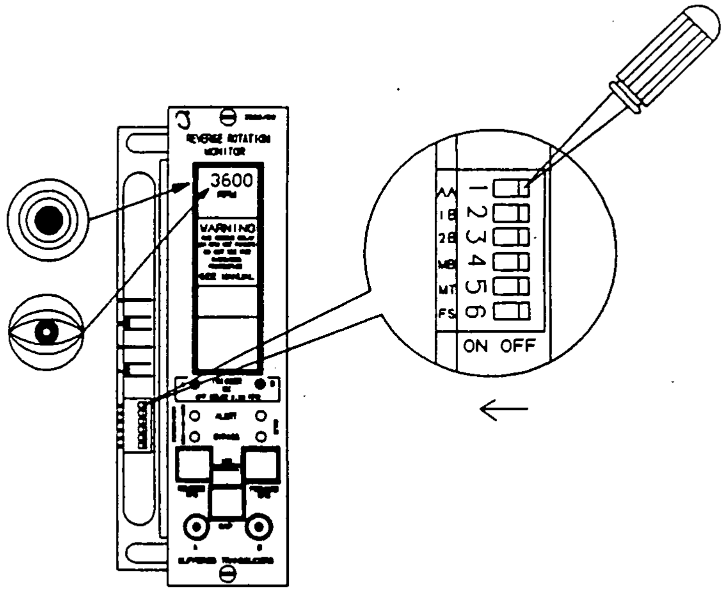
PARAMETER	SETTING (RPM)
Forward RPM Under Alert setpoint	1000
RPM Alert Hysteresis	10
Initial machine speed (forward direction)	1000

DISPLAYED SPEED (forward direction)	RPM ALERT LED
1000	on
1010	on
1011	off

18 ADJUST ALERT SETPOINTS

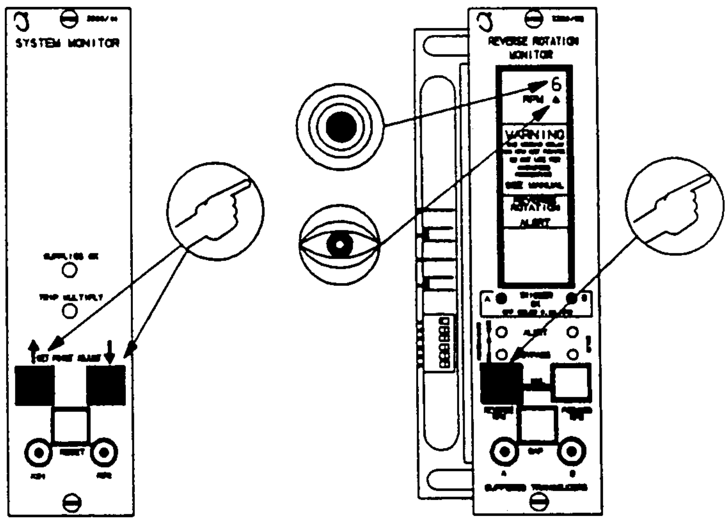
1. Open the front panel and slide it to the right.

2. Set Switch 1, Alert Adjust (**AA**), to ON. The RPM display flashes to indicate Alert Adjust mode.



3. Press and hold the **REVERSE RPM** switch. The current Reverse RPM Alert setpoint now flashes on the display. The upward pointing arrow indicates an Over Alert setpoint (Reverse RPM is always an Over setpoint).

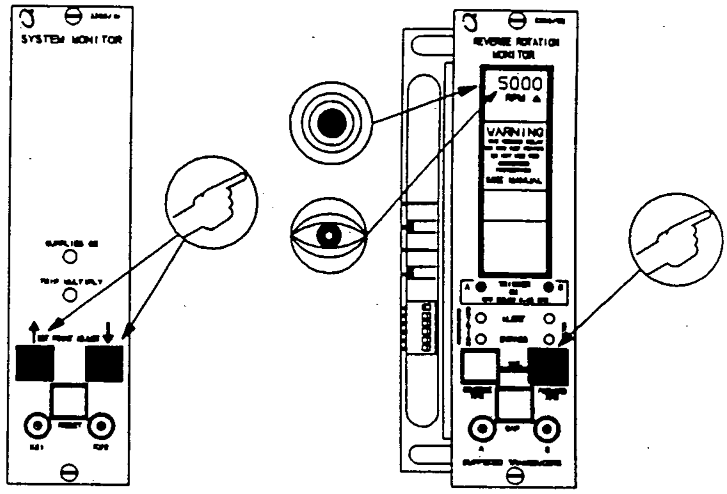
4. Use the (↑) or (↓) switches on the System Monitor to adjust the Reverse RPM Alert setpoint.



18 ADJUST ALERT SETPOINTS (CONT)

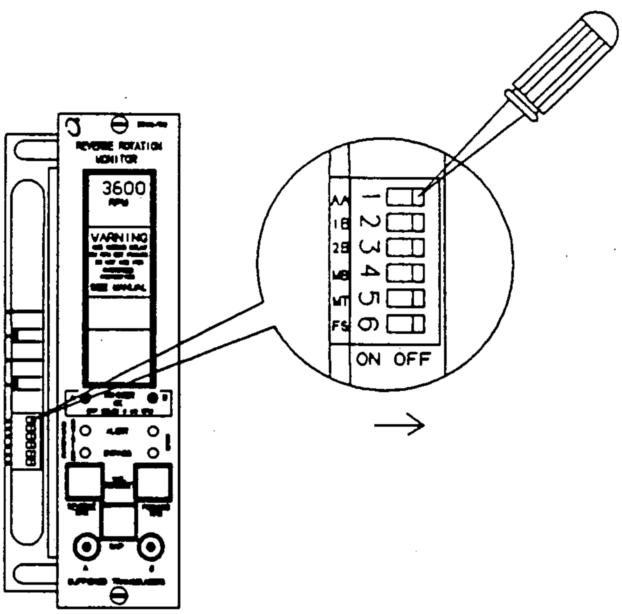
5. Press and hold the **FORWARD RPM** switch. The current Forward RPM Alert setpoint now flashes on the display. The upward pointing arrow indicates an Over Alert setpoint. (A downward pointing arrow would indicate an Under Alert setpoint).

6. Use the (↑) or (↓) switches on the System Monitor to adjust the Forward RPM Alert setpoint.



7. Save the Alert setpoints in permanent memory by setting Switch 1, Alert Adjust (AA), to OFF.

8. Close the monitor front panel.

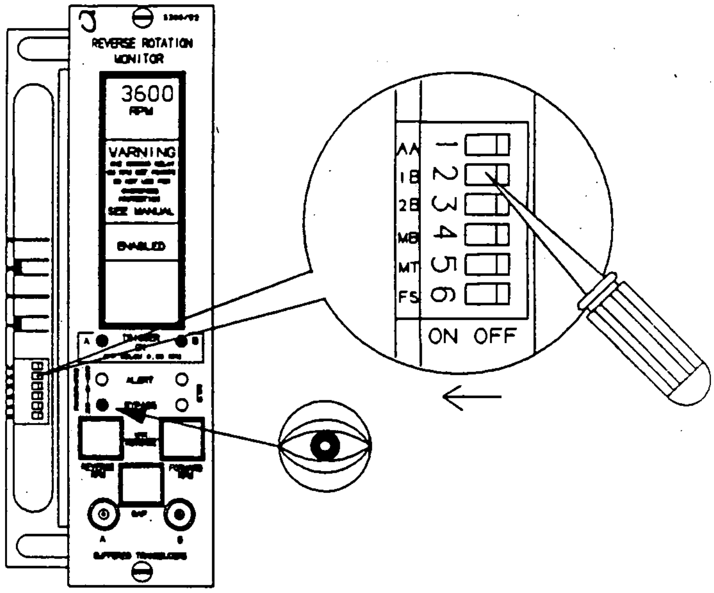


19 BYPASS ALERT RELAYS

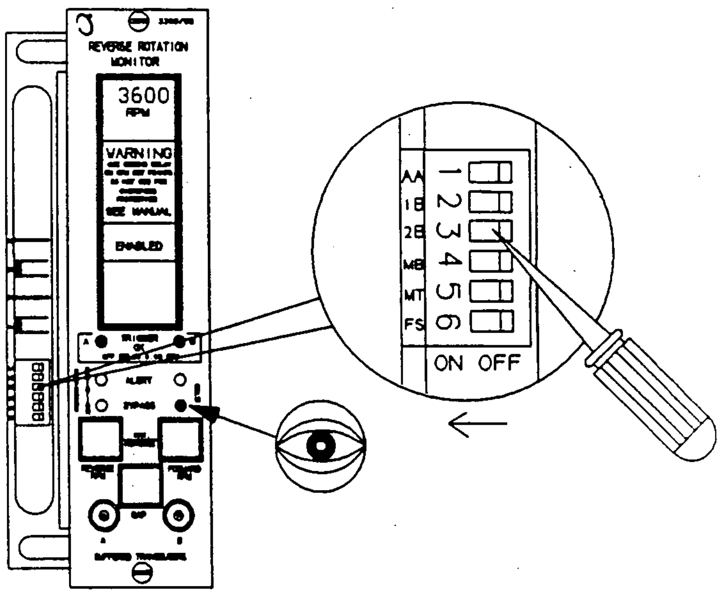
CAUTION

Machine protection provided by this monitor will be lost while Alert Relay Bypass is on.

Set the Bypass Reverse Rotation Alert Relay (**1B**) switch to the ON position to bypass the Reverse Rotation Alert relay. The **REVERSE ROTATION BYPASS** LED will come on. The monitor will otherwise function normally.



Set the Bypass RPM Alert Relay (**2B**) switch to the ON position to bypass the RPM Alert relay. The **RPM BYPASS** LED will come on. The monitor will otherwise function normally.

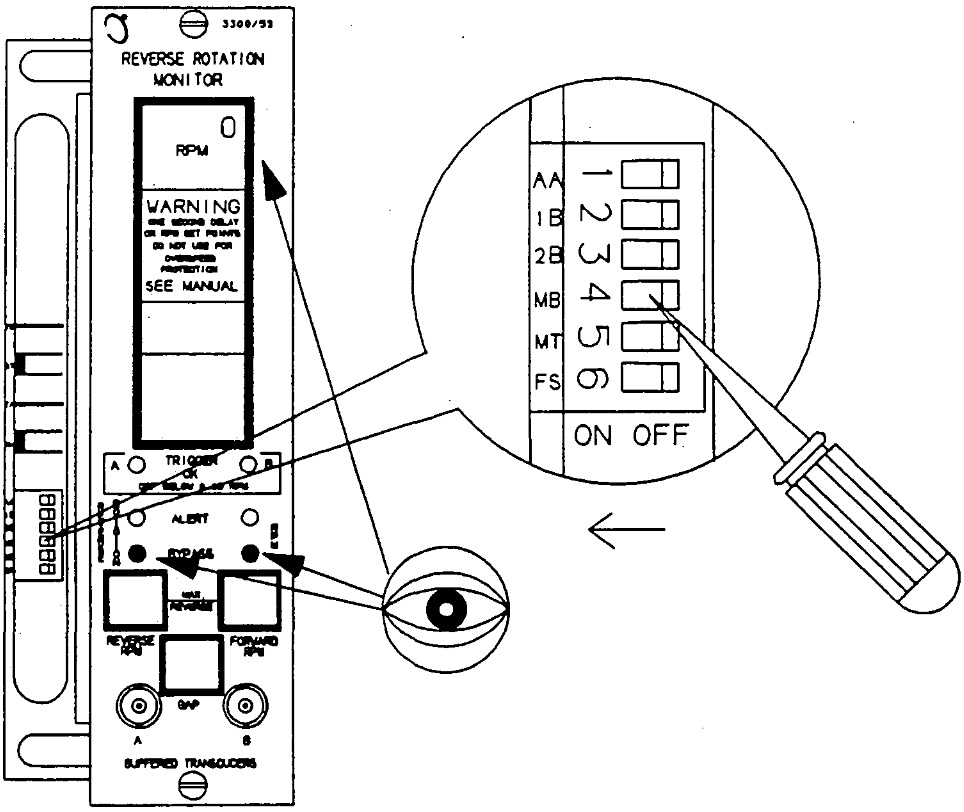


20 BYPASS MONITOR

CAUTION

Machine protection provided by this monitor will be lost while Monitor Bypass is on.

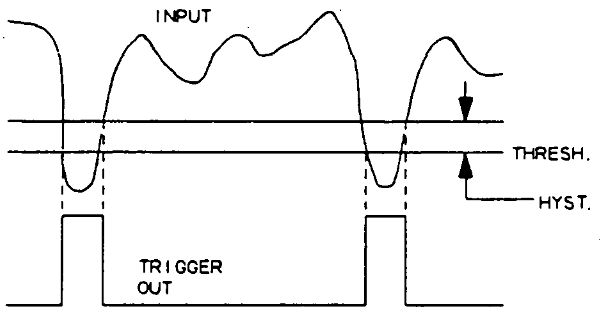
Set the Monitor Bypass (**MB**) Switch to the ON position. The **BYPASS** LEDs will come on, the **TRIGGER OK** LEDs will go off, and the RPM display will go to zero.



21 ADJUST THRESHOLD AND HYSTERESIS

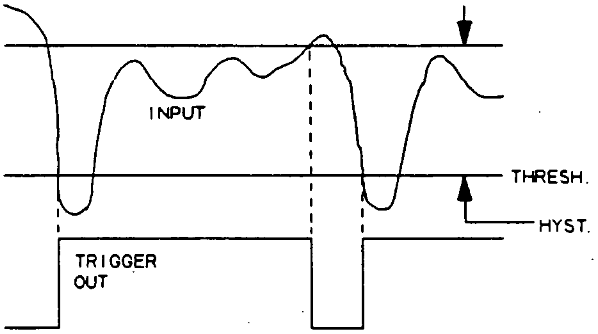
This procedure shows how to adjust the threshold and hysteresis so that the trigger out signal contains one pulse for each Keyphasor event in the input signal. Threshold is the voltage level in the input signal where the trigger out pulse is turned on. Hysteresis is the difference between the level where the trigger out pulse turns on and the level where it turns off.

The objective of the procedure is to set the threshold and hysteresis so that the trigger out signal contains one pulse for each Keyphasor event as shown in figure 1. Figures 2 and 3 show the effect of incorrect adjustments.



THRESHOLD PROPERLY ADJUSTED

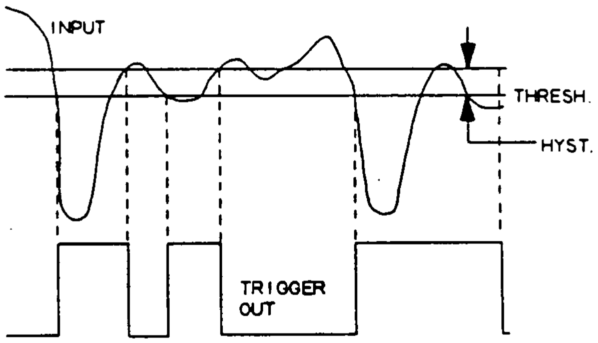
FIGURE 1



HYSTERESIS TOO HIGH BUT OPERATIONAL

FIGURE 2

The Reverse Rotation Monitor is normally shipped from the factory with the hysteresis set at 0.5 V. Since this setting should work well in most installations, we recommend that you leave the hysteresis setting at 0.5 V and use the following procedure to adjust the threshold. If you cannot obtain an acceptable trigger out signal with this procedure, use section 7 (Monitor Options) to change the hysteresis setting and readjust the threshold.



THRESHOLD AND HYSTERESIS IMPROPERLY ADJUSTED

FIGURE 3

Before you begin this procedure, you will need an oscilloscope and you will need to check that the Keyphasor transducers are properly installed and that the machine is running. See section 15 on Probe Installation.

21 ADJUST THRESHOLD AND HYSTERESIS (CONT)

CAUTION

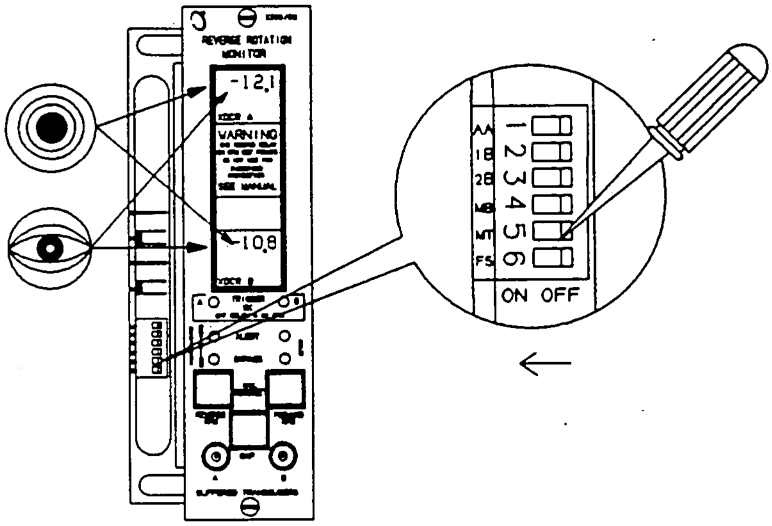
Machine Protection provided by this monitor will be lost during the Manual Threshold Adjust Procedure.

CAUTION

Test might activate Alerts. This could result in relay contact state change. See section 19, Bypass Alert Relays.

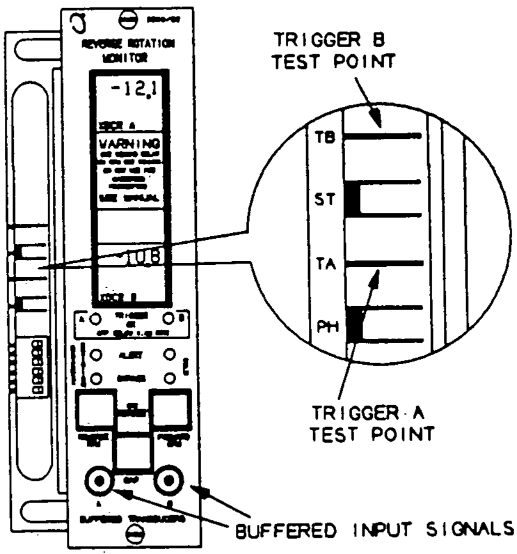
Threshold Adjust Procedure:

1. Open the front panel of the monitor and slide it to the right.
2. Set Switch 5, Manual Threshold (MT), to the ON position. The front panel display flashes the threshold voltages for transducers A and B.



3. Connect an oscilloscope to the TRIGGER A Test Point (TA) located behind the front panel.

NOTE: To observe the buffered transducer input signals, connect the oscilloscope to the coaxial connectors on the front panel.

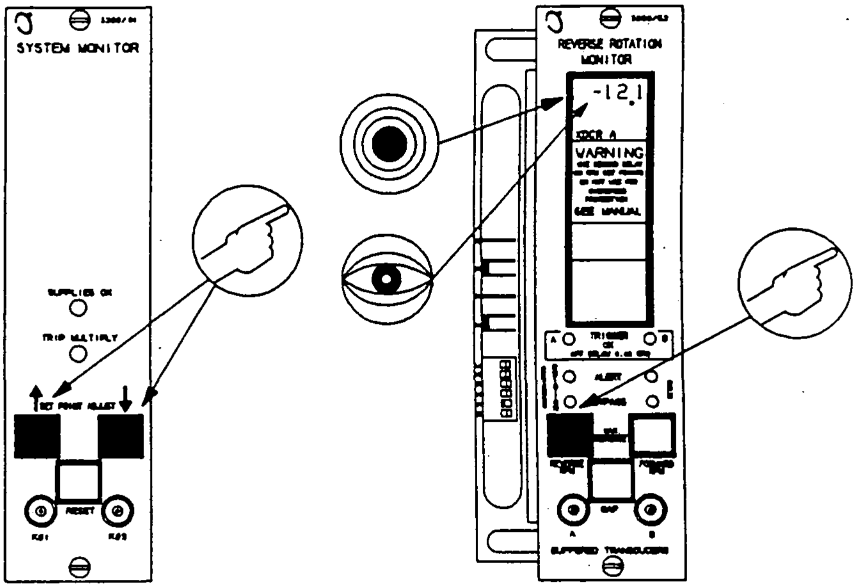


21 ADJUST THRESHOLD AND HYSTERESIS (CONT)

4. Press and hold the **REVERSE RPM** alert switch on the front panel. The threshold A value remains flashing.

5. Adjust threshold A by pressing the (↑) or (↓) switches on the System Monitor.

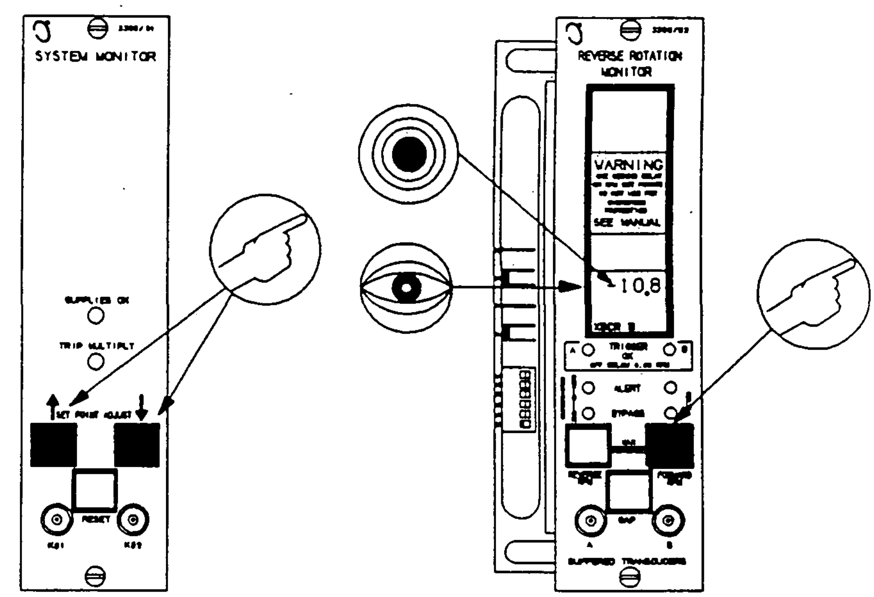
6. Adjust threshold A up or down until the oscilloscope displays the trigger A rectangular wave (approximately 0 to 5 volts).



7. Continue adjusting threshold A up or down until the oscilloscope shows no rectangular wave. Note the threshold A value at which this occurs

8. Adjust threshold A to a value midway between the values obtained in steps 6 and 7 above.

21 ADJUST THRESHOLD AND HYSTERESIS (CONT)



9. Connect the oscilloscope to the TRIGGER B Test Point (TB).

10. Press and hold the **FORWARD RPM** switch on the front panel. The threshold B value remains flashing.

11. Adjust threshold B by pressing the (↑) or (↓) switches on the System Monitor.

12. Adjust threshold B up or down until the oscilloscope displays the trigger B rectangular wave (approximately 0 to 5 volts).

13. Continue adjusting threshold B up or down until the oscilloscope shows no rectangular wave. Note the threshold B value at which this occurs.

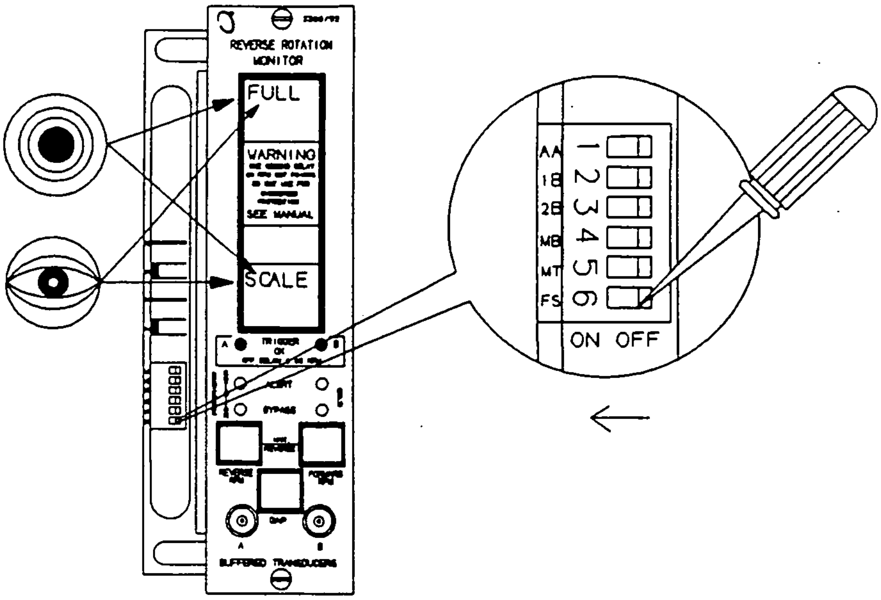
14. Adjust threshold B to a value midway between the values obtained in steps 12 and 13 above.

15. Save the threshold values in permanent memory by setting switch 5 (**MT**) to OFF. If the transducers' voltage hysteresis and thresholds are properly adjusted both **TRIGGER OK** LEDs will be on. See section 15, Probe Installation, to verify.

16. Close the monitor front panel.

22 ADJUST FULL SCALE RANGE

The Full Scale settings are used for the full scale of the recorder outputs.

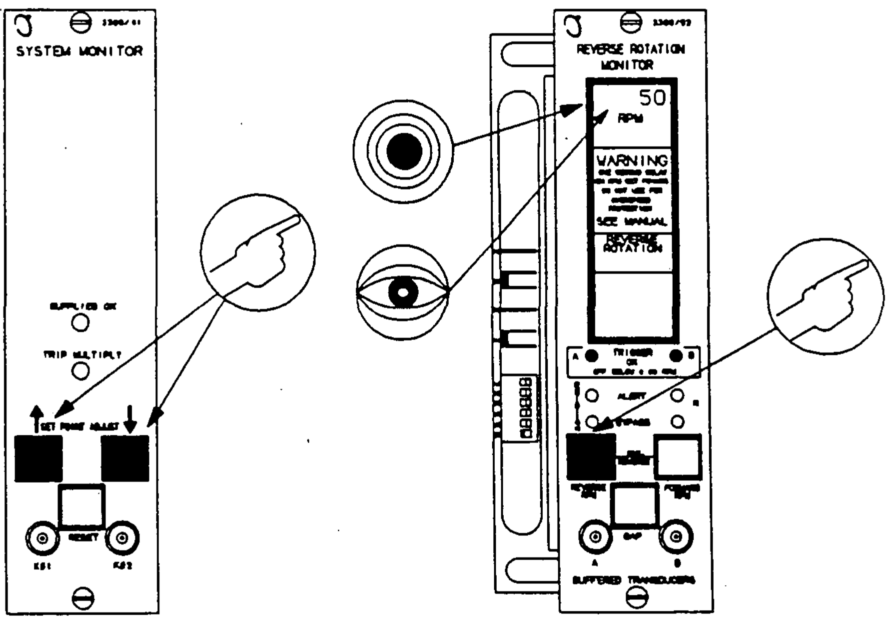


1. Set Switch 6 (**FS**) to the ON position. "FULL SCALE" will flash.

2. Press and hold the **REVERSE RPM** switch on the front panel. The Reverse RPM Full Scale Range will begin flashing.

3. Adjust the setting for Reverse RPM by pressing the (↑) or (↓) switches on the System Monitor.

4. Release the **REVERSE RPM** switch. "FULL SCALE" will begin flashing again.

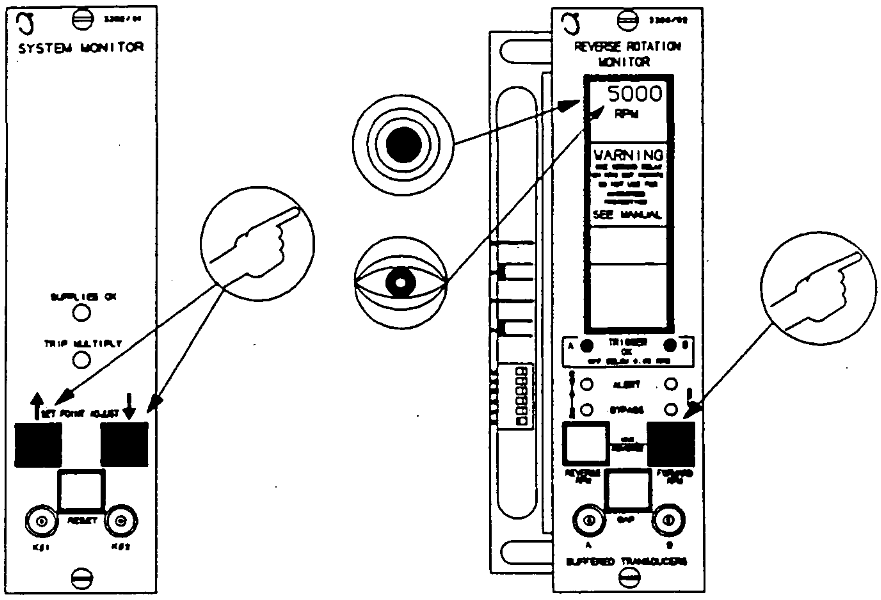


22 ADJUST FULL SCALE RANGE (CONT)

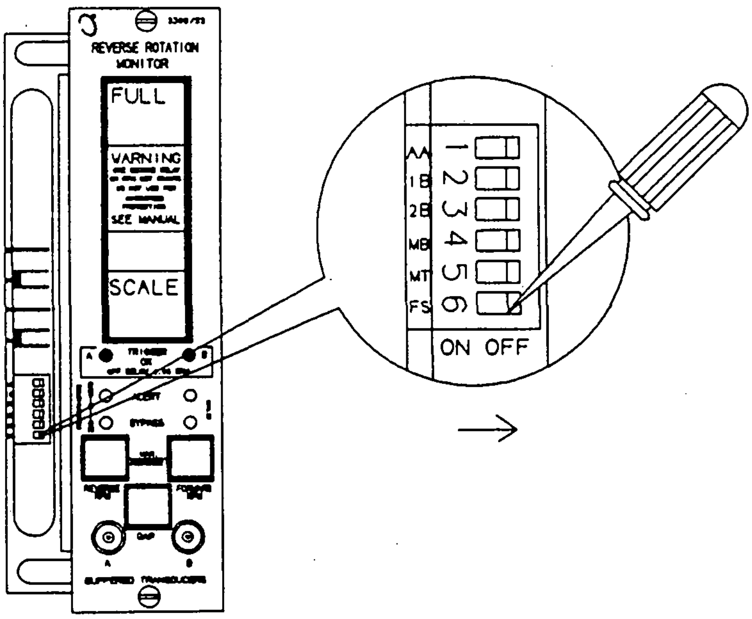
5. Press and hold the **FORWARD RPM** switch on the front panel. The Forward RPM Full Scale Range will begin flashing.

6. Adjust the setting for Forward RPM by pressing the (↑) or (↓) switches on the System Monitor.

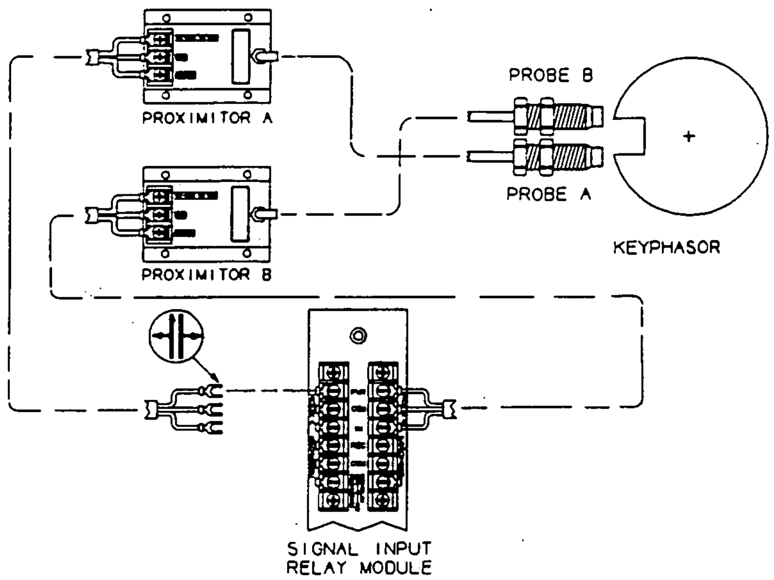
7. Release the **FORWARD RPM** switch. "FULL SCALE" will begin flashing again.



8. Save the settings for full scale range into permanent memory by setting switch 6 (**FS**) to OFF.



23 TEST TRIGGER OK LEDS



WARNING

High voltage present. Contact could cause shock, burns, or death.

Do not touch exposed wires or terminals.

CAUTION

Machine protection provided by this monitor will be lost during Test Trigger OK LEDs procedure.

1. Verify that both **TRIGGER OK** LEDs are on. The monitor must receive an input signal from a machine that is turning, or from a signal generator. If **TRIGGER OK** LEDs are not on, see section 15 on Probe Installation and section 21 on Adjust Threshold and Hysteresis.

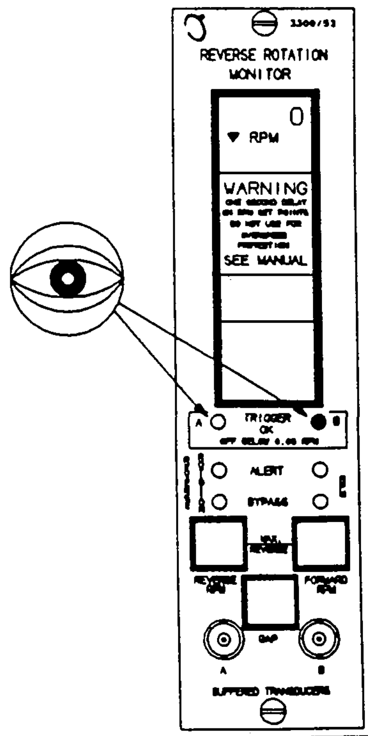
2. Disconnect the **COM** and **IN** wiring from the Transducer A terminals on the Signal Input Module.

3. Verify that the **TRIGGER OK A** LED goes off.

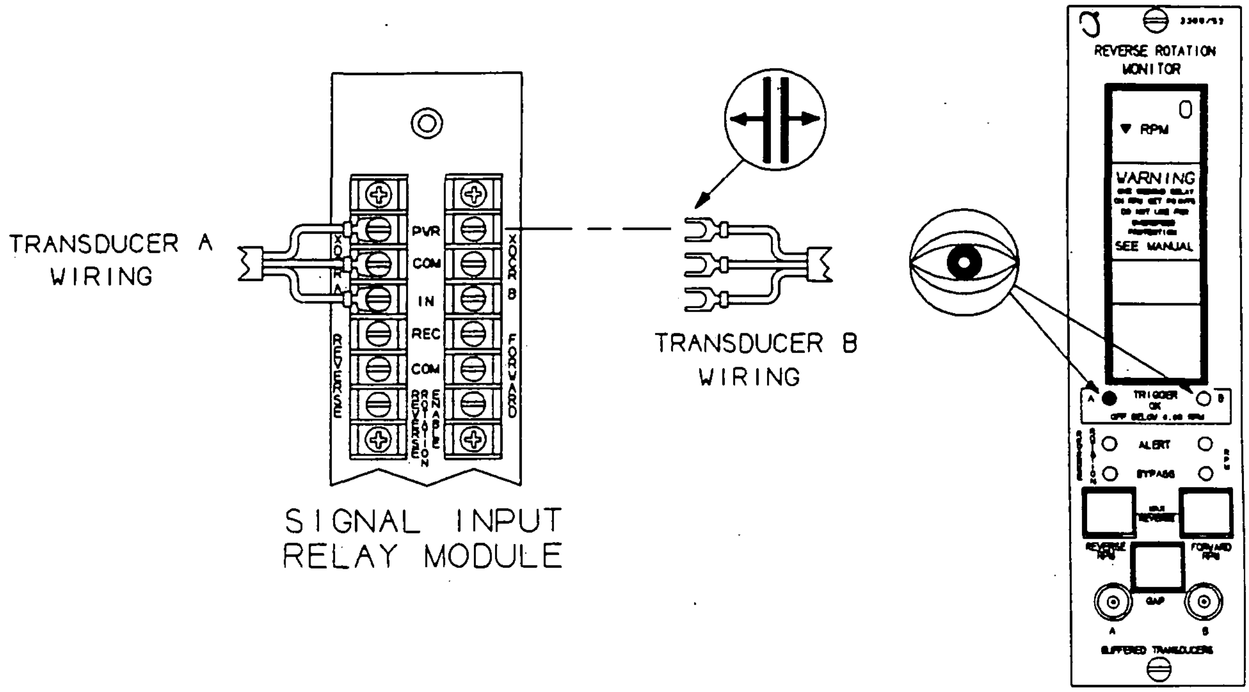
NOTE: If the frequency of the input signal is below 0.05 RPM, it may take up to 40 minutes for the **TRIGGER OK A** LED to go off, worst case. Both **TRIGGER OK** LEDs will turn off if missing or extra pulses are detected before transducer gap reading of zero volts is detected.

4. Reconnect the **COM** and **IN** wiring from the Transducer A terminals on the Signal Input Module.

5. Verify that the **TRIGGER OK A** LED comes back on.



23 TEST TRIGGER OK LEDS (CONT)



6. Disconnect the **COM** and **IN** wiring from the Transducer B terminals on the Signal Input Module.

7. Verify that the **TRIGGER OK B** LED goes off.

NOTE: If the frequency of the input signal is below 0.05 RPM, it may take up to 40 minutes for the **TRIGGER OK B** LED to go off, worst case. Both **TRIGGER OK** LEDs will turn off if missing or extra pulses are detected before transducer gap reading of zero volts is detected.

8. Reconnect the **COM** and **IN** wiring from the Transducer B terminals on the Signal Input Module.

9. Verify that the **TRIGGER OK B** LED comes back on.

24 TEST ALERTS

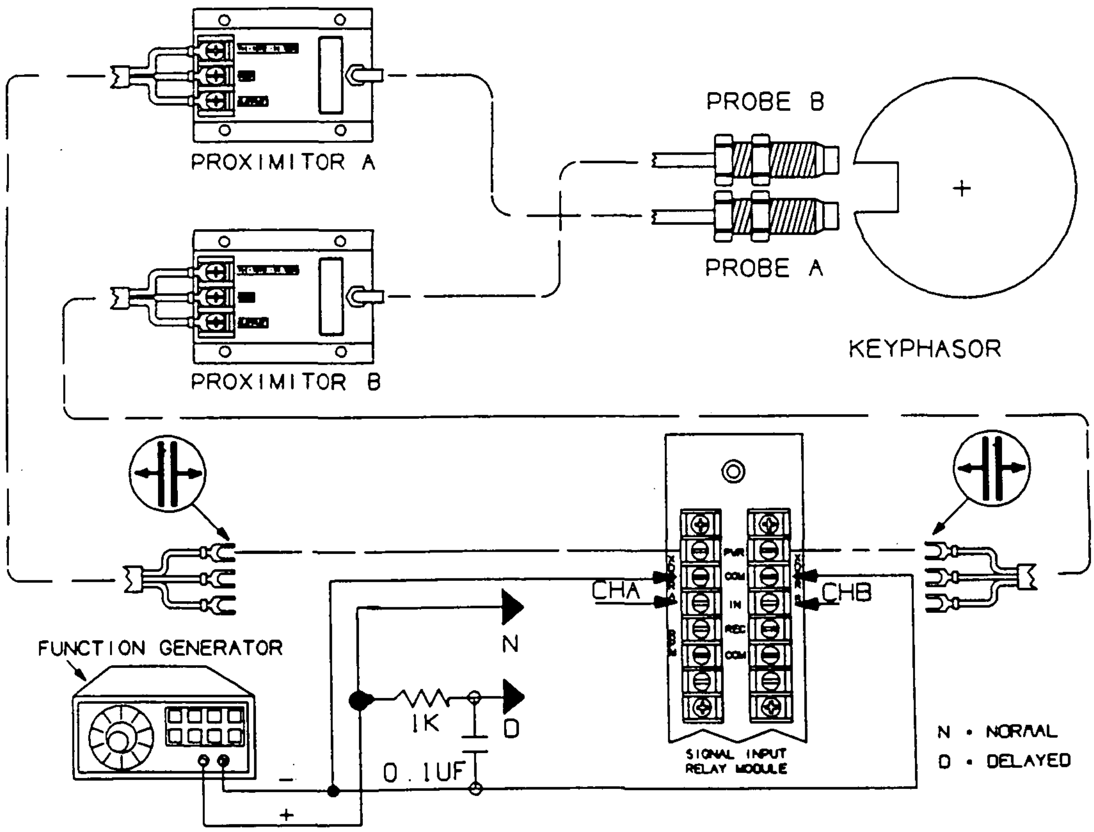
WARNING

High voltage present. Contact could cause shock, burns, or death.

Do not touch exposed wires or terminals.

CAUTION

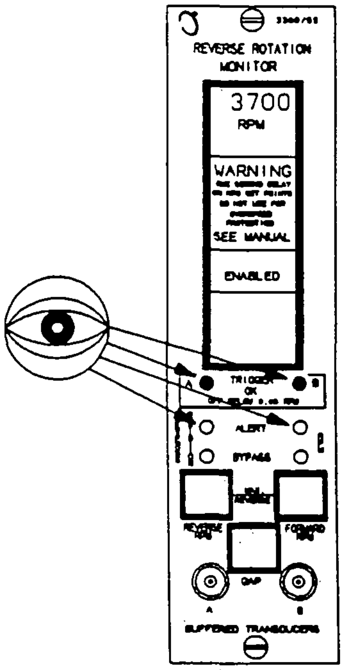
Test will exceed Alert setpoint levels causing Alerts to activate. This could result in relay contact state change. See section 19, Bypass Alert Relays.



24 TEST ALERTS (CONT)

Before starting this test procedure, set the transducer inputs option for external signals. Among jumpers W9A,B,C and W10A,B,C, only W9A and W10A should be installed.

1. Short the Reverse Rotation Enable contacts on the Signal Input Module if not shorted already.
2. Set the Manual Threshold (**MT**) switch to ON, note the Keyphasor Threshold values, and reset the Manual Threshold (**MT**) switch to OFF. You might need to adjust the Keyphasor Threshold settings for this test if the function generator cannot simulate the true voltage values of the transducers.
3. Disconnect the COM and IN wiring from the Transducer A and B terminals on the Signal Input Module.
4. Connect the function generator and the resistor - capacitor circuit shown in the figure above.
5. Setup the function generator for a rectangular wave output (for example a rectangular wave that goes from -2.5 V to -7.5 V, with the KPH threshold set at -5.0V for both transducer A and transducer B).
6. Connect Normal (N) signal to Transducer A terminal and Delayed (D) signal to Transducer B terminal on the Signal Input Module. Since this test setup simulates forward rotation, the "REVERSE ROTATION" label should be off.
7. Adjust the function generator frequency until the Reverse Rotation Monitor displays a speed reading below the Forward RPM Over setpoint or above the Forward RPM under setpoint.
8. Press the **RESET** switch on the System Monitor and verify that the **TRIGGER OK** LEDs are on and that the **REVERSE ROTATION ALERT** LED and the **RPM ALERT** LED are off.

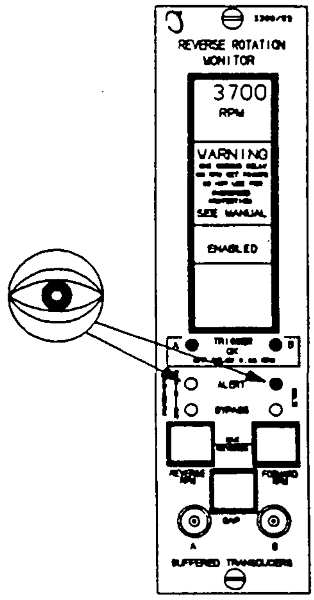


24 TEST ALERTS (CONT)

9. Adjust the function generator frequency until the Reverse Rotation Monitor displays a speed reading above the Forward RPM Over setpoint or below the Forward RPM Under setpoint.

10. Verify that the **RPM ALERT** LED comes on (flashes if First Out option is selected) and that the RPM alert relay changes state (the relay will not change state if the RPM relay has been bypassed, see section 19).

11. Press the **RESET** switch on the System Monitor and verify that the **RPM ALERT** LED remains on steadily and the **REVERSE ROTATION ALERT** LED is off.



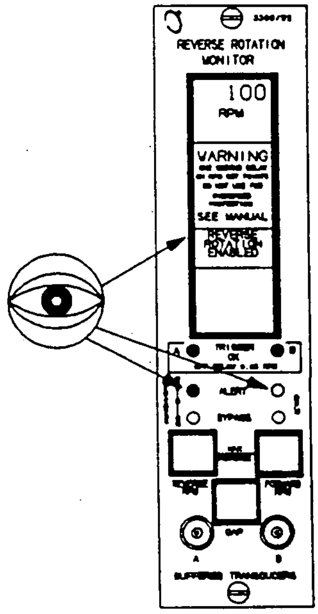
12. Disconnect the Normal and Delayed Signal inputs from Transducer A and Transducer B terminals on the Signal Input Module.

13. Connect Normal (D) to Transducer B terminal and Delayed (D) to Transducer A terminal on the Signal Input Module. Since this test setup simulates reverse rotation, the "REVERSE ROTATION" label should come on.

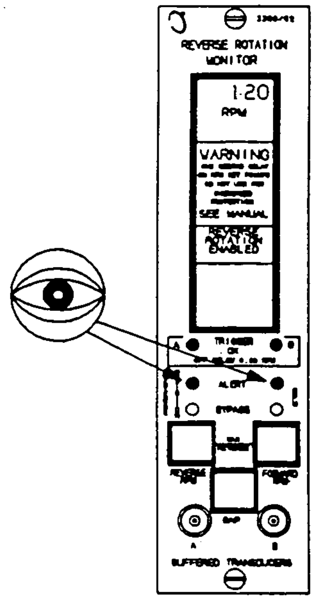
14. Adjust the function generator frequency so that the speed displayed is below the Reverse RPM setpoint.

15. Verify that the **REVERSE ROTATION ALERT** LED comes on (flashes if First Out option is selected) and the Reverse Rotation relay changes state (unless the Reverse Rotation relay has been bypassed, see section 19).

16. Press the **RESET** switch on the System Monitor and verify that the **REVERSE ROTATION ALERT** LED remains on steadily. The **RPM ALERT** LED should be off and the **TRIGGER OK** LEDs should be on.



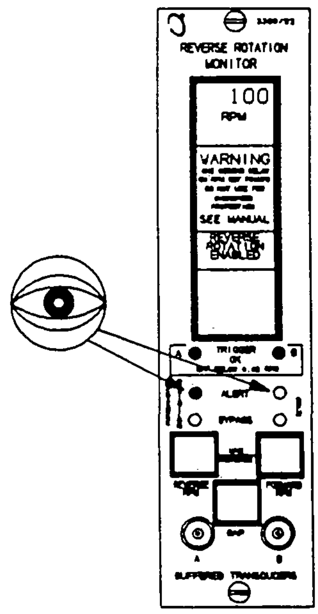
24 TEST ALERTS (CONT)



17. Adjust the function generator frequency until the Reverse Rotation Monitor displays an RPM reading above the Reverse RPM setpoint.

18. Verify that the **RPM ALERT** LED comes on (flashes if First Out option is selected) and the RPM relay changes state (unless the RPM relay has been bypassed, see section 19).

19. Press the **RESET** switch on the System Monitor and verify that both the **REVERSE ROTATION ALERT** LED and the **RPM ALERT** LED are on steadily. The **TRIGGER OK** LEDs should be on.



20. Adjust the function generator frequency until the RPM displayed is below the Reverse RPM setpoint.

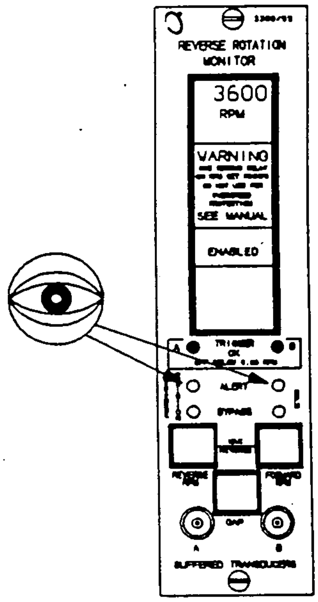
21. Press the **RESET** switch on the System Monitor and verify that the **RPM ALERT** LED goes off.

24 TEST ALERTS (CONT)

22. Disconnect the Normal and Delayed signals from Transducer A and Transducer B terminals.

23. Press the **RESET** switch on the System Monitor and verify that both **ALERT** LEDs go off.

24. Reconnect all field wiring and restore jumpers, switches, and Keyphasor threshold values to the pre-test settings.

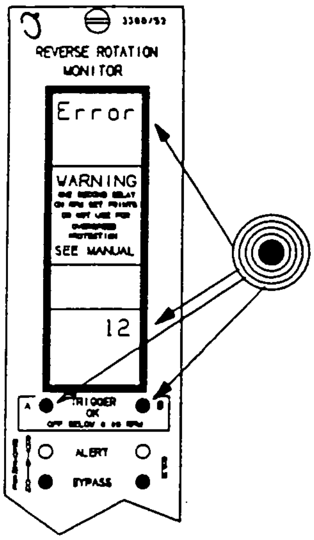


25 SELF TEST

The monitor has three levels of self tests:

SELF TEST	PERFORMED
Power-up	When the monitor is turned on.
Cyclic	Continuously during monitoring operations.
User-invoked	When you initiate the self test by temporarily shorting the self test pins.

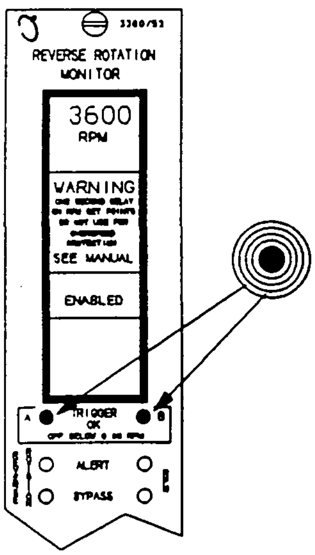
When the monitor detects an error, it displays an error condition in two ways depending on whether the error is active or stored. An active error is an error that currently exists. A stored error condition results from a storable error momentarily occurring after the last time all errors were cleared.



Active error indication.

If the monitor detects an active error, the following events occur:

- Monitoring stops until the problem is resolved
- The error code is stored in memory and flashes on the LCD display
- The **BYPASS** LEDs come on
- The **TRIGGER OK** LEDs flash at 5 Hz



Stored error indication.

If the monitor no longer detects an active error and a stored error exists, the following events occur:

- Monitoring resumes
- If the **TRIGGER OK** LED would otherwise be on, the **TRIGGER OK** LEDs flash at 5 Hz to indicate that an error code has been stored

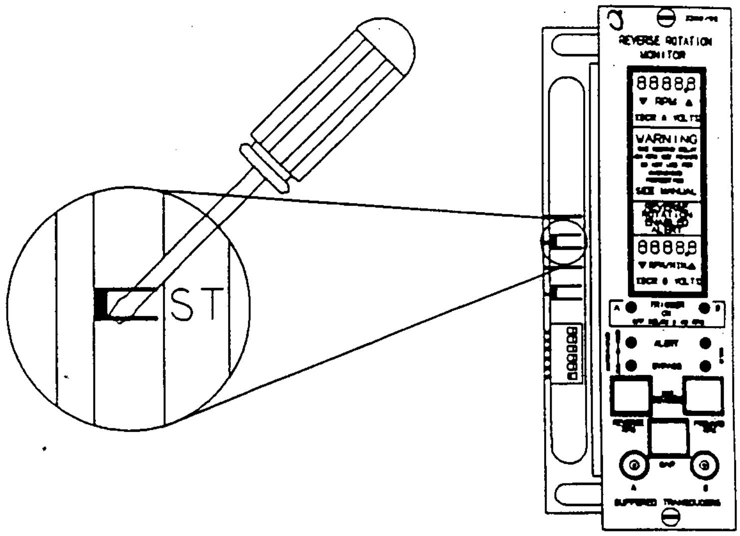
25 SELF TEST (CONT)

Recall stored error codes by using the User-invoked self test. Use the following steps to run the User-invoked self test, read error codes, and clear stored error codes:

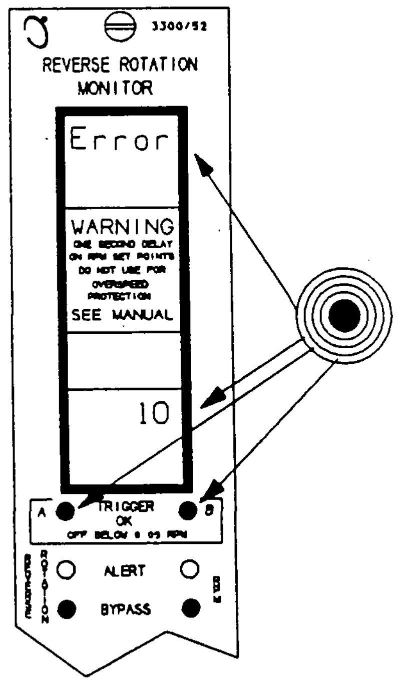
CAUTION

Machine protection provided by this monitor will be lost for the duration of the self test.

1. Initiate the User-invoked self test by shorting the two self test pins (**ST**) with a screwdriver. All the LEDs and LCD elements will come on for 5 seconds.



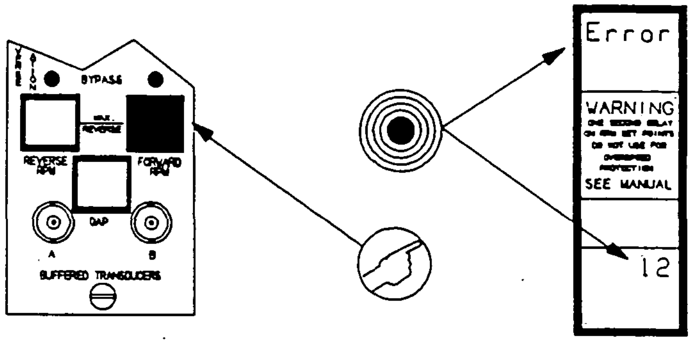
The error code is given by the flashing "ERROR" indicator and flashing error code number. For example, the monitor to the right is indicating error code number 10.



25 SELF TEST (CONT)

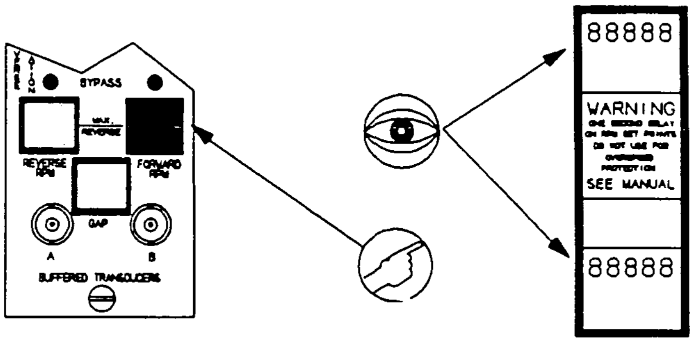
2. Read any other stored error codes by pressing and holding the **FORWARD RPM** switch for one second.

For example, the display to the far right contains a second stored error code — number 12.



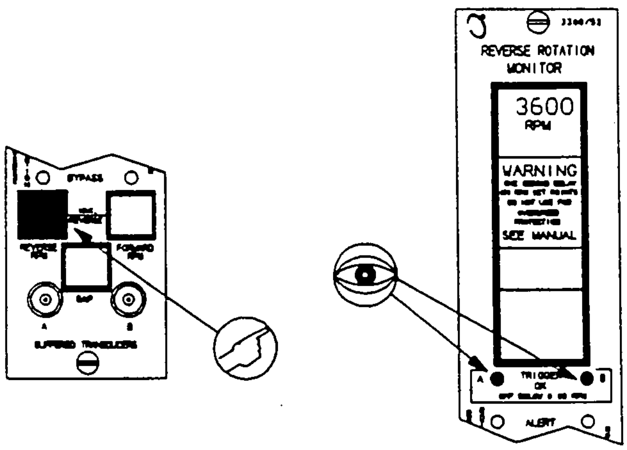
When you reach the end of the error code list, the LCD displays all eights.

You may read through the list again by continuing to press the **FORWARD RPM** switch.



3. When the LCD displays all eights, clear error codes from memory by pressing and holding the **REVERSE RPM** switch for one second.

The monitor will return to normal operation if no active or stored errors are present. If an active or stored error is present at the end of the self test, the **BYPASS** LED remains on, the **TRIGGER OK** LEDs flash at 5 Hz, and the first error code flashes at 2 Hz on the LCD display.



26 ERROR CODES

Refer to Monitor Function and Self Test sections for more information about displaying error codes. Refer to the Self Test section for information about clearing stored errors.

ERROR CODE	DESCRIPTION	RECOVERY
2	ROM checksum error	Install your spare monitor and contact your local Bently Nevada office for service.
3	Nonrecoverable EEPROM error	Install your spare monitor and contact your local Bently Nevada office for service.
4	Recoverable EEPROM error	Readjust setpoints, KPH Threshold and Full Scales. Recall and clear the error as described in the Self Test section. If the error is persistent, install your spare monitor and contact your local Bently Nevada office for service.
  5 6 7 8 9 10 12	Error 5 through 12 are node voltage out of tolerance error : +7.5V & -VT +VRH +5V MVREF +7.5V +VRL +5V & -7.5V	Recall and clear the error codes as described in the Self Test section. If the error is persistent, install your spare monitor and contact your local Bently Nevada office for service.
14	RAM error	Install your spare monitor and contact your local Bently Nevada office for service.
17	CONFIG register error	Install your spare monitor and contact your local Bently Nevada office for service.

26 ERROR CODES

ERROR CODE	DESCRIPTION	RECOVERY
21	Incorrect dip switch combination	Check that only one of the dip switches AA, MT, and FS is on. Turn off the unneeded dip switch. If the error is not recoverable, install your spare monitor and contact your local Bently Nevada office for service.
34	Input frequency is too high for proper operation (exceeding 500 Hz). The maximum input frequency for the Reverse Rotation Monitor is 10,000 RPM (166.7 Hz) for 2 (two) events per revolution or 20,000 RPM (333.3 Hz) for 1 (one) event per revolution.	Check that the speed of the machine observed does not exceed the operating range for the monitor.
80	Nonvolatile RAM error for Maximum Reverse RPM. The Maximum Reverse RPM might be reset to zero automatically.	Clear the error code. If the error is persistent, the nonvolatile RAM is probably defective. Install your spare monitor and contact your local Bently Nevada Office for service.
81	Nonvolatile RAM error for Number of Reverse Rotations. The Number of Reverse Rotations might be reset to zero automatically.	Clear the error code. If the error is persistent, the nonvolatile RAM is probably defective. Install your spare monitor and contact your local Bently Nevada Office for service.

NOTE: If the monitor experiences recurring stored errors, contact your local Bently Nevada office for service.

27 RECOMMENDED SPARE PARTS

The monitor comes with programmable options set as described in section 7, Monitor Options.

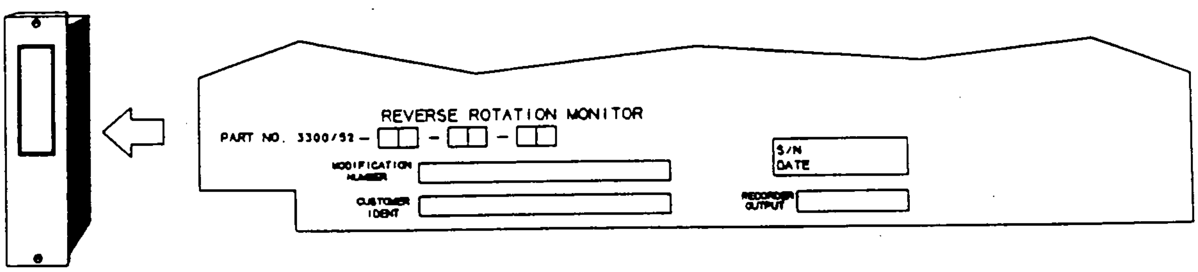
QTY	DESCRIPTION	PART NUMBER	ORDERED OPTION**	
	REVERSE ROTATION MONITOR	3300/52	AA	CC
1	FRONT PANEL ASSEMBLY	101708-01*		
1	MONITOR MAIN CIRCUIT BOARD ASSEMBLY	101402-01*		
1	EXPANDER BOARD 32K PWA	89511-01*		
1	SIGNAL INPUT RELAY MODULE			
	without Internal Barriers			
	NO RELAY	101709-01*	00	00 or 01
	EPOXY SEALED RELAY	101710-01*	01	00 or 01
	HERMETICALLY SEALED RELAY	101711-01*	02	00 or 01
	with Internal Barriers			
	NO RELAY	103475-01*	00	02
	EPOXY SEALED RELAY	103474-01*	01	02
	HERMETICALLY SEALED RELAY	103473-01*	02	02
1	SPARE JUMPERS (100 PIECES)	88706-01*		

NOTES:

* To order replacement parts, specify the complete part number according to this table, as indicated on the identification decal. If you have a monitor that has been modified, specify the modification number on the parts order. The modification number (if any) will be shown on the identification decal.

** Use the option letter in the Reverse Rotation Monitor part number to choose the appropriate spare part for your monitor.

If in doubt about the part number, call your Bently Nevada Corporation representative before ordering the part.



28 SPECIFICATIONS

INPUTS

Signal Inputs:	Any two of the following: Proximity Probes, 0 to -24 or 0 to -18 Volts. 3300 System (rack) Keyphasors.
Input Impedance:	System Keyphasor Transducer: 130 kΩ External Transducer: 10 kΩ
Input Frequency:	333.33 Hz (20,000 RPM) maximum (1 event per revolution) 166.67 Hz (10,000 RPM) maximum (2 events per revolution)

SIGNAL CONDITIONING

Hysteresis:	Jumper programmable: 0.2, 0.5, 1.0 or 2.0 Volts.
Events per Revolution:	1 or 2

REVERSE ROTATION ALERT

Requirements:	Two valid input triggers indicating reverse rotation.
Alert Delay:	Two valid input triggers indicating reverse rotation or 330 milliseconds, whichever is greatest.

REVERSE RPM ALERT

Setpoint:	Adjustable from 1 to 20,000 RPM
Requirements:	Three valid RPM readings above an over speed setpoint.
Alert Delay:	One second or three valid RPM readings, whichever is greatest.

FORWARD RPM ALERT

Setpoint:	Adjustable from 1 to 20,000 RPM
Requirements:	Three valid RPM readings above an over speed setpoint or below an under speed setpoint.
Alert Delay:	One second or three valid RPM readings, whichever is greatest.

28 SPECIFICATIONS (CONT)

RPM ALERT HYSTERESIS

Reverse RPM and Forward RPM:	Jumper programmable: 0, 1, 5, or 10 RPM

RPM DISPLAY

Range:	1 to 20,000 RPM
Resolution:	±1 RPM @ 25•C.
Accuracy:	± (1 RPM + 0.02% of input RPM).
Over/Under Indicators:	One of two arrows indicates whether an RPM setpoint is an over or under Alert. The over arrow flashes to indicate an over range condition, and the under arrow flashes to indicate an under range condition.

REVERSE ROTATION DISPLAY

"REVERSE ROTATION":	Indicates when the monitor detects reverse rotation, or when the monitor displays the Reverse RPM setpoint, full scale range, or number of reverse rotations.
"ENABLED":	Indicates when the Reverse Rotation Enable contacts (user-supplied) have been closed.
"ALERT":	Indicates when a Reverse RPM Alert setpoint is being read or adjusted.

LEDs

Green:	Annunciates the TRIGGER OK condition or monitor OK condition.
Red:	Annunciates ALERTS and BYPASS conditions.

CONTROLS

Front Panel:	Three front panel switches for reading the RPM ALERT setpoints, MAX. REVERSE/PEAK HOLD values, and probe gap voltage.
Internal:	Switches on circuit board for setpoint adjustment, Reverse Rotation Relay Bypass, RPM Relay Bypass, Monitor Bypass, Keyphasor Threshold adjustment, and Full Scale Range adjustment.
External:	External remote controls: Reset, Inhibit, adjustment (↑ and ↓).

28 SPECIFICATIONS (CONT)

OUTPUT

Recorder: Output proportional to selected full scale RPM ranges. Output is protected against continuous short circuit to ground:
- +4 mA to +20 mA, +12 Vdc compliance.
- +1 Vdc to +5 Vdc, 100 Ω minimum output impedance.
- 0 Vdc to -10 Vdc, 100 Ω minimum output impedance.

Transducer Power: -24 Vdc or -18 Vdc per option selected in Power Supply. Output is short circuit protected.

Alerts and OK: Relay drives for Alerts and monitor (system) OK.

Accuracy: from the display to the digital byte:
for all recorders: ±1 RPM or ±0.4% of displayed speed, whichever is greatest.

from the digital byte to the recorder output:

+4 to +20 mA recorder:	±0.09 mA offset,	±1.8% of signal @ 25°C.
	±0.15 mA offset,	±2.3% of signal, 0 to 65°C.
+1 to +5 V recorder:	±10 mV offset,	±2.2% of signal @ 25°C.
	±14 mV offset,	±2.6% of signal, 0 to 65°C.
0 to -10 V recorder:	±14.5 mV offset,	±2.1% of signal @ 25°C.
	±16.1 mV offset,	±2.4% of signal, 0 to 65°C.

RELAY CONTACT RATINGS

Relays 5 Amps @ 120 Vac 50/60 Hz resistive load.
5 Amps @ 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%, noncondensing.

NOTE: Operation outside the specified limits will result in false readings or loss of machine protection.

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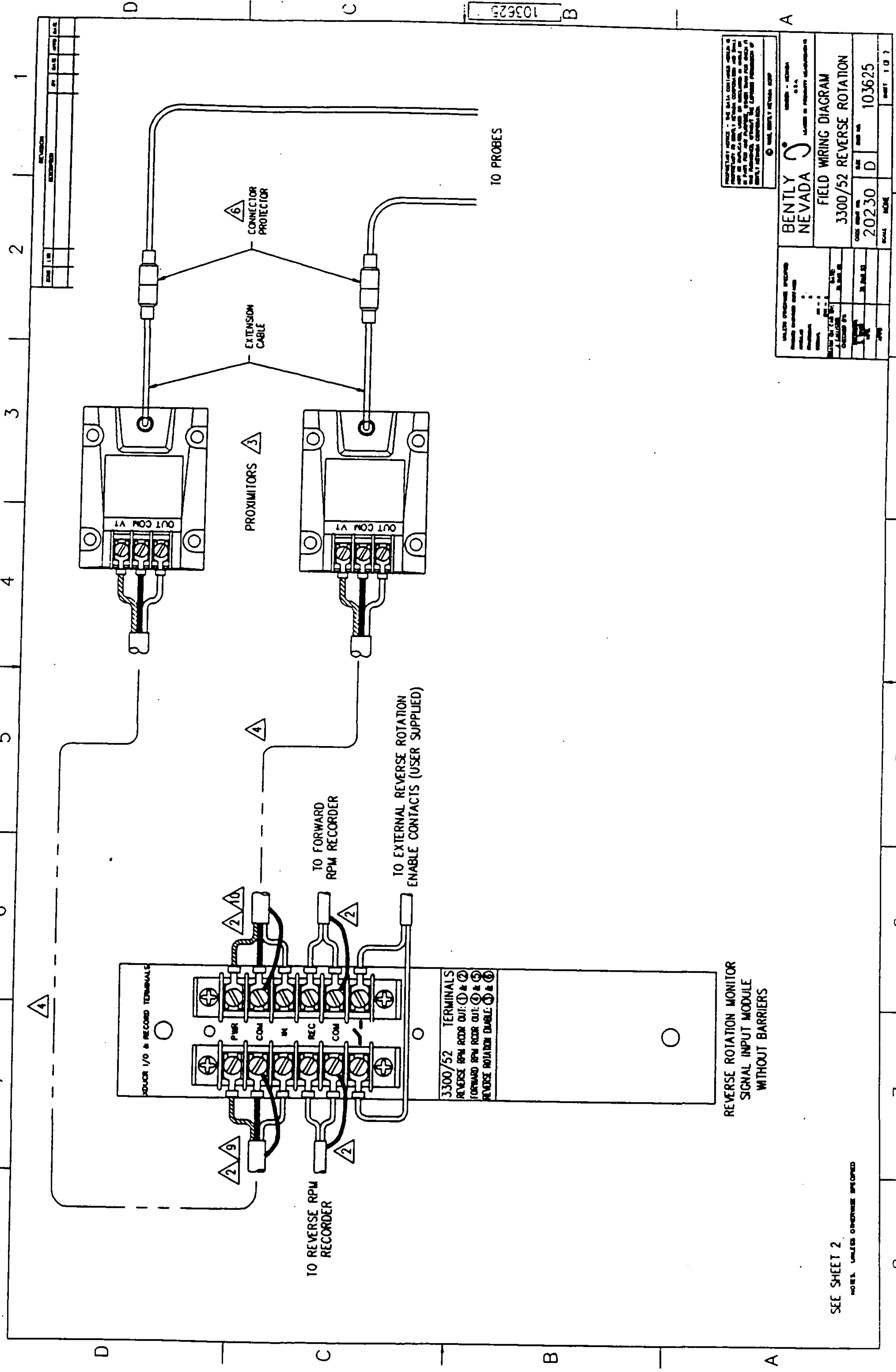
FIELD WIRING DIAGRAMS

DRAWING TITLE	DRAWING NO.	NO. OF SHEETS
Field Wiring Diagram Without Barriers	103625	2
Field Wiring Diagram With External Barriers	103626	2
Field Wiring Diagram With Internal Barriers	104147	2


TO PROBES
CONNECTOR PROTECTOR
EXTENSION CABLE
PROXIMITORS
OUT COM VT
TO FORWARD RPM RECORDER
TO EXTERNAL REVERSE ROTATION ENABLE CONTACTS (USER SUPPLIED)
TO REVERSE RPM RECORDER
3300/52 TERMINALS
REVERSE ROTATION MONITOR SIGNAL INPUT MODULE WITHOUT BARRIERS
SEE SHEET 2
BENTLY NEVADA
FIELD WIRING DIAGRAM
3300/52 REVERSE ROTATION
20230
D
103625

SYSTEM FIELD WIRING NOTES

1. WIRING RECOMMENDATIONS:
   SIGNAL MODULE TO PROXIMITORS: 18AWG TO 22AWG STRANDED
   3-WIRE SHIELDED WITH INSULATING SHEATH.
   SIGNAL MODULE TO RECORDERS: 18AWG TO 22AWG STRANDED
   2-WIRE SHIELDED WITH INSULATING SHEATH.

2. TRANSDUCER AND RECORDER SHIELDS ARE JOINED AS SHOWN TERMINATING AT THE SIGNAL MODULE COMMON. SHIELDS SHOULD BE INSULATED.

3. 7200 PROXIMITOR CASES MUST BE ELECTRICALLY ISOLATED FROM THE EARTH GROUND. ELECTRICAL ISOLATION: 500 VAC (RMS) MINIMUM. ISOLATION KIT P/N 19094-01 MAY BE USED TO SATISFY THE ISOLATION REQUIREMENT. WIRING FOR THE 7200 PROXIMITORS IS THE SAME AS SHOWN FOR THE 3300 PROXIMITOR.

4. MAXIMUM CABLE LENGTH BETWEEN SIGNAL INPUT RELAY MODULE AND PROXIMITOR SHOULD NOT EXCEED 1000 FEET (305 METRES).

5. TO MINIMIZE GROUND LOOP NOISE PROBLEMS, A SINGLE POINT EARTH GROUND (GND) TO SYSTEM COMMON (COM) CONNECTION RECOMMENDED.

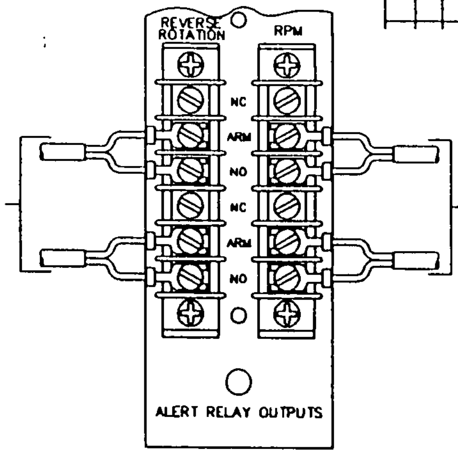
6. TO ELECTRICALLY ISOLATE AND PROTECT COAXIAL CONNECTIONS, USE CONNECTOR KIT P/N 40113-02.

7. CONNECTIONS SHOWN FOR DUAL RELAY MODULE OPTION. THIS OPTION HAS TWO DPDT RELAYS, ONE FOR REVERSE ROTATION, ONE FOR REVERSE AND FORWARD RPM.

8. IF RELAYS HAVE BEEN CONFIGURED NORMALLY DE-ENERGIZED, "NC" IS CLOSED AND "NO" IS OPEN IN A NON-ALARM STATE. IF RELAYS HAVE BEEN CONFIGURED NORMALLY ENERGIZED, "NC" IS OPEN AND "NC" IS CLOSED IN A NON-ALARM STATE.

9. IF THE MONITOR IS OPTIONED TO USE SYSTEM KEYPHASOR 1 FOR TRANSDUCER A, THEN NO CONNECTION AT THE TRANSDUCER A INPUT OF THE SIGNAL INPUT MODULE IS REQUIRED.

10. IF SYSTEM KEYPHASOR 2 IS OPTIONED FOR TRANSDUCER B, THEN NO CONNECTION AT THE TRANSDUCER B INPUT OF THE SIGNAL INPUT MODULE IS REQUIRED.

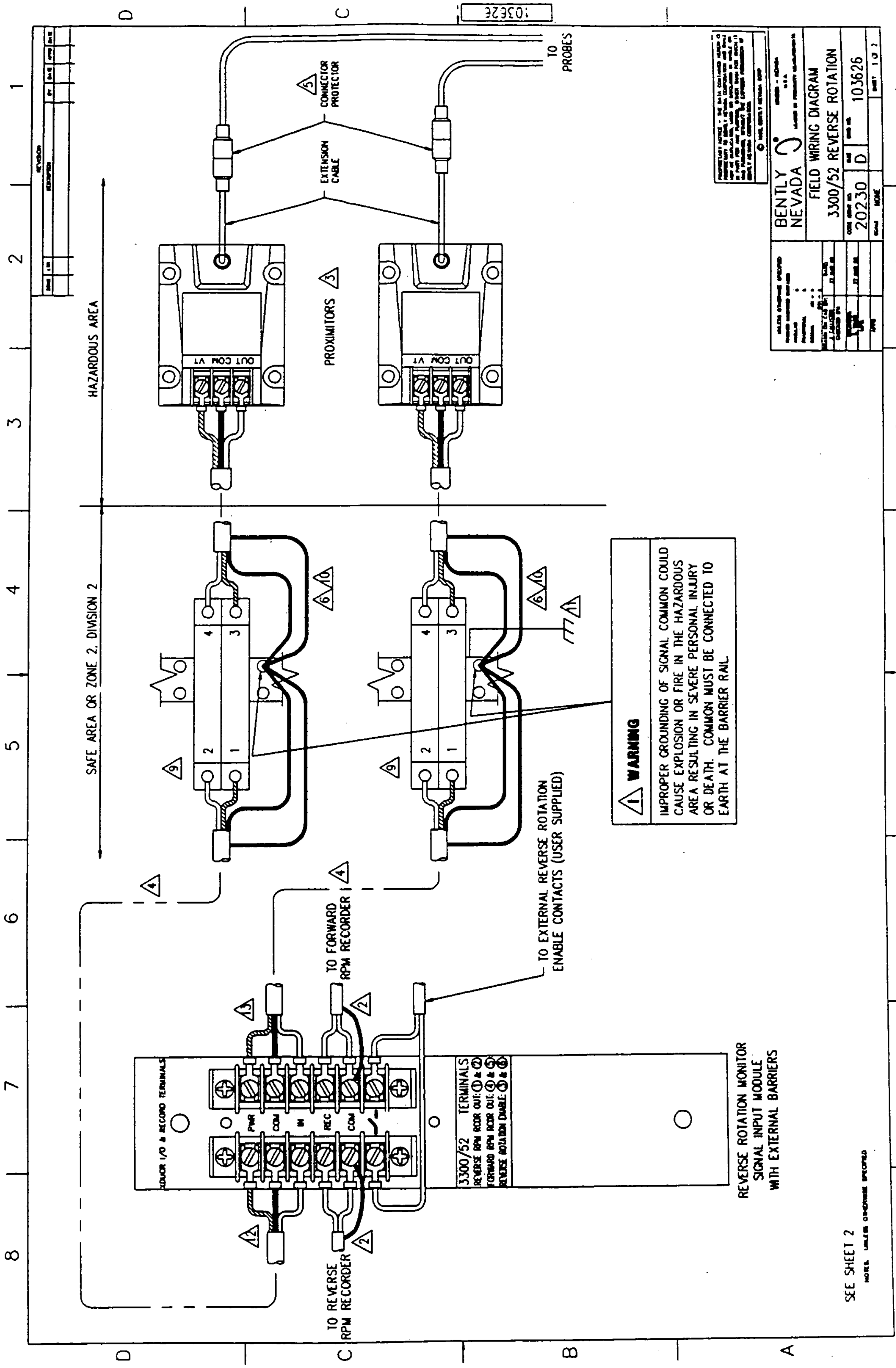


REVERSE ROTATION MONITOR SIGNAL INPUT RELAY MODULE WITH DUAL RELAYS

NOTES: UNLESS OTHERWISE SPECIFIED

CODE IDENT NO	SIZE	DWG NO
20230	D	103625
SCALE NONE		SHEET 2 OF 2

103625


TO PROBES
CONNECTOR PROTECTOR
EXTENSION CABLE
PROXIMITORS
OUT COM VT
HAZARDOUS AREA
SAFE AREA OR ZONE 2, DIVISION 2
WARNING
IMPROPER GROUNDING OF SIGNAL COMMON COULD CAUSE EXPLOSION OR FIRE IN THE HAZARDOUS AREA RESULTING IN SEVERE PERSONAL INJURY OR DEATH. COMMON MUST BE CONNECTED TO EARTH AT THE BARRIER RAIL.
TO EXTERNAL REVERSE ROTATION ENABLE CONTACTS (USER SUPPLIED)
TO FORWARD RPM RECORDER
TO REVERSE RPM RECORDER
PWR COM IN REC COM
3300/52 TERMINALS
REVERSE ROTATION MONITOR SIGNAL INPUT MODULE WITH EXTERNAL BARRIERS
SEE SHEET 2
BENTLY NEVADA
FIELD WIRING DIAGRAM
3300/52 REVERSE ROTATION
20230
D
103626

EXTERNAL BARRIER SYSTEM FIELD WIRING NOTES

1. WIRING RECOMMENDATIONS:
   SIGNAL MODULE TO BARRIERS - BARRIERS TO PROXIMITORS: 16AWG TO 18AWG STRANDED 3-WIRE SHIELDED WITH INSULATING SHEATH.
   SIGNAL MODULE TO RECORDERS: 18AWG TO 22AWG STRANDED 2-WIRE SHIELDED WITH INSULATING SHEATH.

2. RECORDER SHIELDS ARE JOINED AS SHOWN TERMINATING AT THE SIGNAL MODULE COMMON. SHIELDS SHOULD BE INSULATED.

3. 7200 PROXIMITOR CASES MUST BE ELECTRICALLY ISOLATED FROM THE EARTH GROUND. ELECTRICAL ISOLATION: 500 VAC (RMS) MINIMUM. ISOLATION KIT P/N 19094-01 MAY BE USED TO SATISFY THE ISOLATION REQUIREMENT. WIRING FOR THE 7200 PROXIMITOR IS THE SAME AS SHOWN FOR THE 3300 PROXIMITOR.

4. MAXIMUM CABLE LENGTH BETWEEN BARRIER AND PROXIMITOR SHOULD NOT EXCEED 1000 FEET (305 METRES).

5. TO ELECTRICALLY ISOLATE AND PROTECT COAXIAL CONNECTIONS, USE CONNECTOR KIT P/N 40113-02.

6. TRANSDUCER SHIELDS ARE JOINED AS SHOWN TERMINATING AT BARRIER GROUND, ONLY. SHIELDS SHOULD BE INSULATED.

7. CONNECTIONS SHOWN FOR DUAL RELAY MODULE OPTION. THIS OPTION HAS TWO DPDT RELAYS, ONE FOR REVERSE ROTATION, ONE FOR REVERSE AND FORWARD RPM.

8. IF RELAYS HAVE BEEN CONFIGURED NORMALLY DE-ENERGIZED, "NC" IS CLOSED AND "NO" IS OPEN IN A NON-ALARM STATE. IF RELAYS HAVE BEEN CONFIGURED NORMALLY ENERGIZED, "NC" IS OPEN AND "NO" IS CLOSED IN A NON-ALARM STATE.

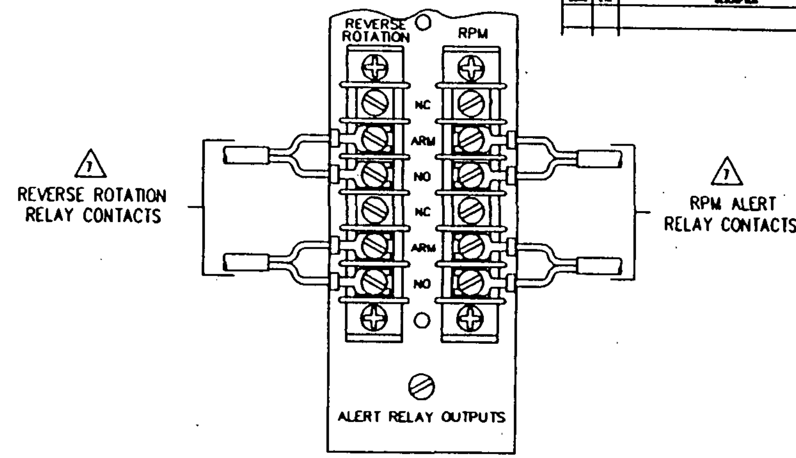
9. TYPICAL CONNECTION IS SHOWN. SEE APPROVAL DRAWING BA22000 OR CA 22000.

10. BARRIERS ARE MOUNTED TO BARRIER RAIL WHICH IS THE POTENTIAL EQUALIZATION BUS BETWEEN SYSTEM GROUND AND EARTH GROUND. TO MINIMIZE GROUND LOOP PROBLEMS, A SINGLE POINT EARTH GROUND (GND) TO SYSTEM COMMON (COM) CONNECTION IS REQUIRED AT THE BARRIER RAIL. TOTAL EARTH LOOP IMPEDANCE MUST NOT EXCEED 1 OHM. REMOVE SINGLE POINT EARTH GROUND CONNECTION AT CHASSIS GROUND ON THE 3300 POWER INPUT MODULE.

11. INDEPENDENT CONNECTION TO SYSTEM EARTH.

12. IF THE MONITOR IS OPTIONED TO USE SYSTEM KEYPHASOR 1 FOR TRANSDUCER A, THEN NO CONNECTION AT THE TRANSDUCER A INPUT OF THE SIGNAL INPUT MODULE IS REQUIRED.

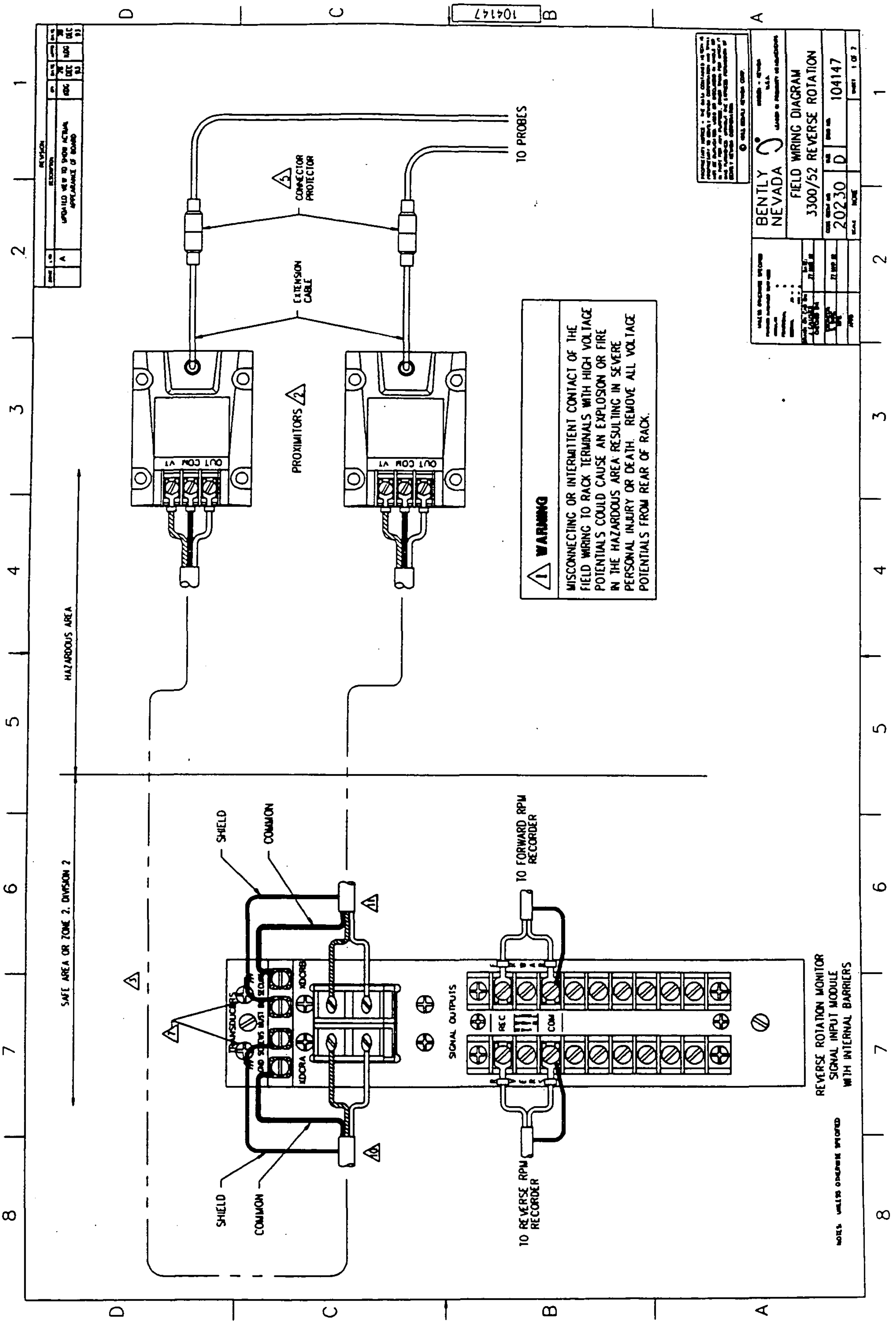
13. IF SYSTEM KEYPHASOR 2 IS OPTIONED FOR TRANSDUCER B, THEN NO CONNECTION AT THE TRANSDUCER B INPUT OF THE SIGNAL INPUT MODULE IS REQUIRED.



REVERSE ROTATION MONITOR SIGNAL INPUT RELAY MODULE WITH DUAL RELAYS

NOTES: UNLESS OTHERWISE SPECIFIED

CODE IDENT NO.	SIZE	DWG NO.
20230	D	103626
SCALE NONE		SHEET 2 OF 2


TO PROBES
CONNECTOR PROTECTOR
EXTENSION CABLE
PROXIMITORS
OUT COM VT
WARNING
MISCONNECTING OR INTERMITTENT CONTACT OF THE FIELD WIRING TO RACK TERMINALS WITH HIGH VOLTAGE POTENTIALS COULD CAUSE AN EXPLOSION OR FIRE IN THE HAZARDOUS AREA RESULTING IN SEVERE PERSONAL INJURY OR DEATH. REMOVE ALL VOLTAGE POTENTIALS FROM REAR OF RACK.
HAZARDOUS AREA
SAFE AREA OR ZONE 2, DIVISION 2
SHIELD
COMMON
TO FORWARD RPM RECORDER
TO REVERSE RPM RECORDER
SIGNAL OUTPUTS
REC
COM
TRANSDUCERS
REVERSE ROTATION MONITOR SIGNAL INPUT MODULE WITH INTERNAL BARRIERS
BENTLY NEVADA
FIELD WIRING DIAGRAM
3300/52 REVERSE ROTATION
20230
D
104147
NONE
104147

REVISION
DESCRIPTION
SEE SHEET 1

INTERNAL BARRIER SYSTEM FIELD WIRING NOTES

1. WIRING RECOMMENDATIONS:
   SIGNAL MODULE TO PROXIMITORS: 16AWG TO 18AWG STRANDED 3-WIRE SHIELDED WITH INSULATING SHEATH.
   SIGNAL MODULE TO RECORDER/READOUT: 18AWG TO 22AWG STRANDED 2-WIRE SHIELDED WITH INSULATING SHEATH.

2. 7200 PROXIMITOR CASES MUST BE ELECTRICALLY ISOLATED FROM THE EARTH GROUND. ELECTRICAL ISOLATION: 500 VAC (RMS) MINIMUM. ISOLATION KIT P/N 19094-01 MAY BE USED TO SATISFY THE ISOLATION REQUIREMENT. WIRING FOR THE 7200 PROXIMITOR IS THE SAME AS SHOWN FOR THE 3300 PROXIMITOR.

3. MAXIMUM CABLE LENGTH BETWEEN MONITOR AND PROXIMITORS MUST NOT EXCEED 1000 FEET (305 METRES).

4. TO MINIMIZE GROUND LOOP NOISE PROBLEMS, A SINGLE POINT EARTH GROUND (GND) TO SYSTEM COMMON (COM) CONNECTION IS RECOMMENDED.

5. TO ELECTRICALLY ISOLATE AND PROTECT COAXIAL CONNECTIONS, USE CONNECTOR KIT P/N 40113-02.

6. CONNECTIONS SHOWN FOR DUAL RELAY MODULE OPTION. THIS OPTION HAS TWO DPDT RELAYS, ONE FOR REVERSE ROTATION, ONE FOR REVERSE AND FORWARD RPM.

7. SCREWS MUST BE SECURELY FASTENED FOR PROPER GROUND. BARRIERS ARE CONNECTED TO THE INTERNAL BARRIER GROUND RAIL AT THIS POINT. SEE POWER SUPPLY MANUAL FOR PROPER SINGLE POINT GROUND CONNECTION BETWEEN BARRIER GROUND AND EARTH GROUND AT THE POWER INPUT MODULE.

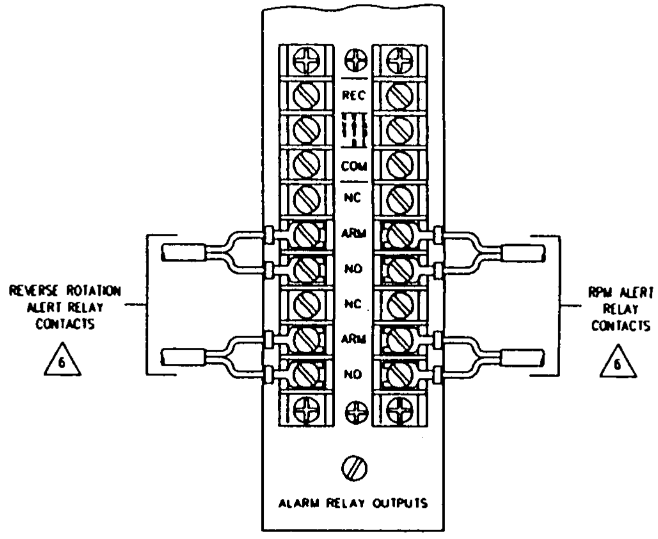
8. IF RELAYS HAVE BEEN CONFIGURED NORMALLY DE-ENERGIZED, "NC" IS CLOSED AND "NO" IS OPEN IN A NON-ALARM STATE. IF RELAYS HAVE BEEN CONFIGURED NORMALLY ENERGIZED, "NC" IS OPEN AND "NO" IS CLOSED IN A NON-ALARM STATE.

9. TERMINATE THE RECORDER SHIELDS AT THE SIGNAL MODULE COMMON AS SHOWN. SHIELDS SHOULD BE INSULATED.

10. IF THE MONITOR IS OPTIONED TO USE SYSTEM KEYPHASOR 1 FOR TRANSDUCER A, THEN NO CONNECTION AT THE TRANSDUCER A INPUT OF THE SIGNAL INPUT MODULE IS REQUIRED

11. IF SYSTEM KEYPHASOR 2 IS OPTIONED FOR TRANSDUCER B, THEN NO CONNECTION AT THE TRANSDUCER B INPUT OF THE SIGNAL INPUT MODULE IS REQUIRED.

12. SEE APPROVAL DRAWING BA22000 OR CA22000.



REVERSE ROTATION MONITOR SIGNAL INPUT RELAY MODULE WITH DUAL RELAYS

NOTES: UNLESS OTHERWISE SPECIFIED

20230	D	104147
SCALE NONE		SHEET 2 OF 2

104147

2.8 330525 Velometer XA Piezo Velocity Sensor

The following publication entitled 330525 Velometer XA Piezo Velocity Sensor Operation Manual (Part No 107316-01 Rev B) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of the Velometer, application notes, installation details, maintenance procedures, and a guide to field-testing.

The following sections are included:

2.8.1 Operating Information

2.8.2 Installation

2.8.3 Maintenance

2.8.4 Field Testing and Trouble Shooting

2.8.5 Specifications

Contents

Foreword

This manual describes the Bently Nevada 330525 Velomitor XA, a piezo-velocity sensor, and contains instructions for its installation and maintenance. If you need additional assistance contact the nearest Bently Nevada Corporation office.

This manual is intended for use by those experienced in the use of electronic instrumentation and machinery monitoring equipment.

Section 1 describes the 330525 Velomitor XA, tells how it works, and lists applications and optional accessories. This section also includes information on the Bently Nevada machinery monitoring systems that are compatible with the 330525 Velomitor XA.

Section 2 gives instructions for receiving and inspecting the 330525 Velomitor XA, choosing the proper monitoring points, and mounting the device. This section also shows how to install connecting cables.

Section 3 tells how to maintain the 330525 Velomitor XA by describing the test procedures and equipment needed to verify that the device is operating properly.

Section 4 contains instructions for field testing and troubleshooting problems with the 330525 Velomitor XA and compatible Bently Nevada monitoring systems.

The Appendix provides detailed specifications and sensitivity curves representing typical 330525 Velomitor XA operation. It also provides instructions for installing Velomitor XA to meet CE requirements.

RELATED DOCUMENTS

3300/55 Dual Velocity Monitor Maintenance Manual, 83965-01

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.

CAUTION

A piezoelectric velocity transducer subjected to a sudden mechanical impulse may generate a low frequency signal that does not represent actual machinery vibration. This signal may change the state of alarm and/or danger relays.

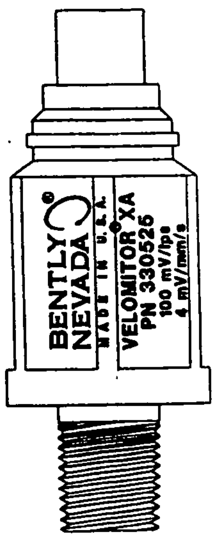
Bently Nevada Corporation
P.O. Box 157
Minden, Nevada 89423 USA
Telephone 800-227-5514 702-782-3611
Telex 354437
Telemail 7400983 BNC UC
Fax 702-782-9253

PART NO. 107316-01
Revision B
19 Dec. 95

330525 VELOMITOR® XA PIEZO - VELOCITY SENSOR

OPERATION MANUAL

BENTLY NEVADA®



Install the sensor on the bearing housing or machine casing carefully. Improper installation may decrease the amplitude and frequency response of the velocity sensor and/or generate false signals which do not represent actual vibration. Section 2 shows how to install the sensor.

Principle of Operation

The 330525 Velomitor XA is a piezo-velocity sensor. The sensing element of the device is a piezoelectric ceramic compressed, by means of a screw, between a metal base and a seismic mass. When subjected to machinery vibration, this mass spring system exerts a force on the piezoelectric ceramic which generates a signal proportional to that force. This signal is amplified and integrated within the sensor to produce a low-noise output signal proportional to velocity.

CAUTION

A piezoelectric velocity sensor subjected to a sudden mechanical impulse may generate a low frequency signal that does not represent actual machinery vibration. The result may be a change in the state of alarm and/or danger relays.

The 330525 Velomitor XA is designed to monitor vibration in frequencies ranging from 4.5 Hz to 2 kHz. It has a calibrated sensitivity of 4 mV/mm/s (100 mV/in/s) and can measure velocities up to 1270 mm/s pk (50 in/sec pk). Its stainless steel casing protects it in highly corrosive environments. The integral 1/4-18 NPT stud at the base and weather resistant cable assembly eliminates the need for large housings. The operating temperature range is from -55° to 121° C (-67° to 250° F).

Traditional velocity sensors are composed of either a moving wire coil surrounding a fixed magnet or a fixed wire coil surrounding a moving magnet. Because the 330525 Velomitor XA contains no moving parts, it is more reliable and less sensitive to transverse motion than traditional devices.

Section 1 - Operating Information

The 330525 Velomitor XA is a velocity sensor designed for applications where a transducer housing is either unecessary or not desired. This section helps you plan how to install your sensor by discussing typical applications and principles of operation and by listing accessories including compatible monitoring systems.

Application

Velocity sensors measure machinery casing vibration and are used on machines where using eddy current proximity transducers is not practical. Typical applications include machines with roller element bearings (e.g. pumps, overhung compressors, and centrifuges), gear boxes, turbine generators, electric motors, and fans.

CAUTION

Casing measurements may not be appropriate for some machinery protection applications.

If you protect a machine by measuring casing velocity, evaluate the usefulness of the measurement for each application. Most common machine malfunctions, such as unbalance or misalignment, occur on the rotor and originate as an increase (or at least a change) in rotor vibration. In order for any casing measurement alone to be effective for overall machine protection, a significant amount of rotor vibration must be faithfully transmitted to the machine casing or mounting location of the sensor.

Its piezoelectric sensing element and solid state circuitry let the 330525 Velomitor XA withstand years of continuous use.

The 330525 Velomitor XA is a two wire device which requires an external power supply. The power supply must provide -22 to -30 Vdc. A constant current diode is used to limit the current to the sensor to 2.5 to 6 mA. A simple block diagram of the 330525 Velomitor XA system appears in Figure 1-1.

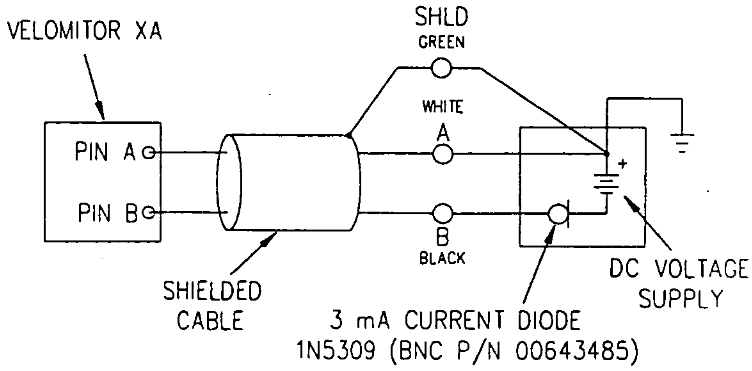


Figure 1-1 330525 Velomitor XA Block Diagram

The 330525 Velomitor XA internal circuitry automatically sets the DC output bias when a constant current is supplied. The DC bias and AC signal appears between pins "A" and "B".

> **CAUTION**
>
> **An input current greater than 6 mA may damage the sensor or cause inaccurate operation. Use a current diode or other current limiting circuitry to limit the current to the 330525 Velomitor XA.**

Compatible Bently Nevada monitoring systems can power the 330525 Velomitor XA without additional external circuitry.

Ordering Options and Accessories

330525 Velomitor XA Options

When ordering a Velomitor XA, you may choose from the following list of options.

Part Number: 330525 - A ☐☐

A ☐☐ Approvals

- **0 0** None Required
- **0 1** Pending CSA Approval
- **0 2** Pending CENELEC Approval
- **0 3** Pending FM Approval

Agency approvals are currently pending. Consult with your local Bently Nevada sales representative for information regarding approvals status.

Compatible Monitoring Systems

The 330525 Velomitor XA is compatible with the Bently Nevada 3300/55 Dual Velocity Monitor. This system continuously monitors machinery vibration on two channels and can accept inputs from one or two velocity sensors. The 3300/55 Monitor with the 330525 Velomitor XA option may be used in any 3300 System Rack that provides a -24 volt DC transducer output voltage.

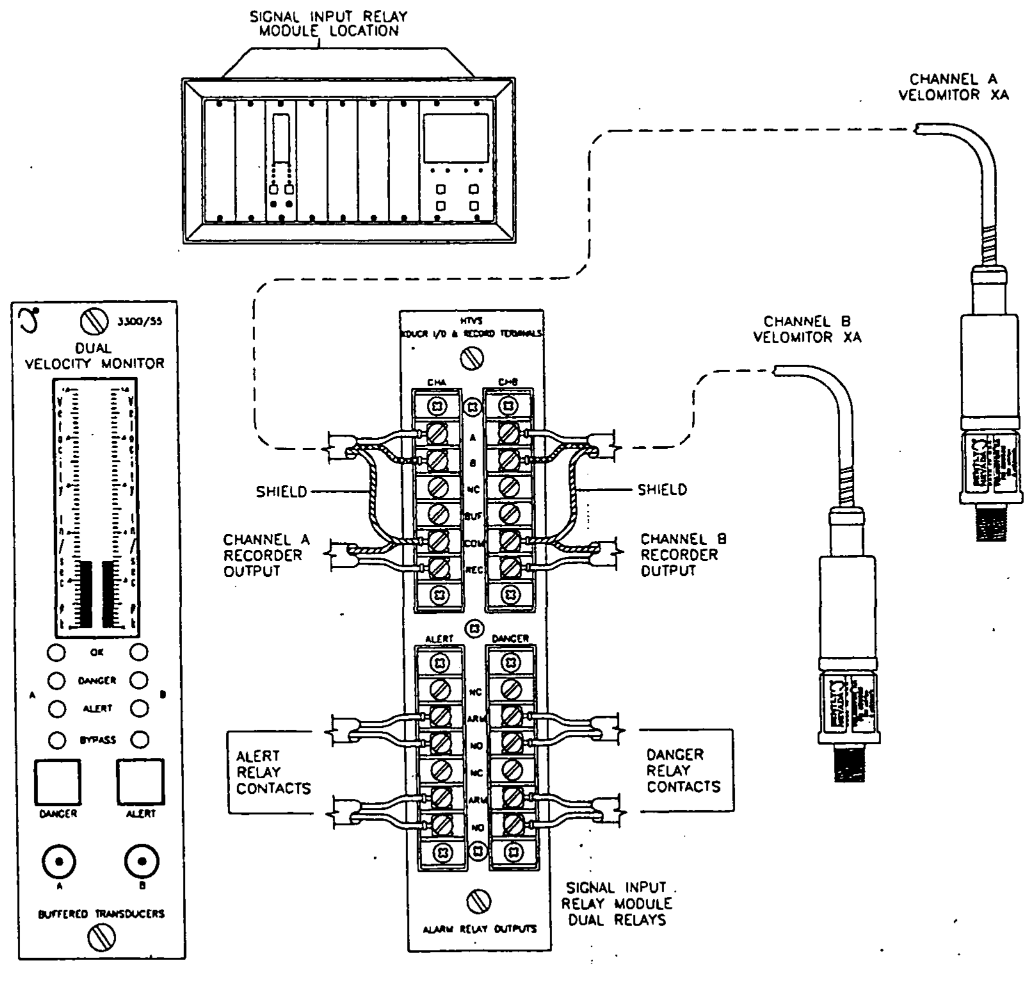


Figure 1-2 Dual Velocity Monitor System 3300/55 with Velomitor XA

The flexibility of the 3300/55 Dual Velocity Monitor makes it ideally suited for use with piezoelectric velocity sensors. For example, you can adjust the setpoints and filtering to isolate, eliminate, or emphasize specific vibration frequencies. One channel of the monitor can be configured to integrate the other channel to provide velocity and displacement. Also, both channels of the monitor can be integrated in order to provide output in terms of displacement. OK circuitry continuously monitors field wiring and detects open circuits and sensor malfunctions.

The monitor is ready for computer interfacing. No additional hardware is required to enhance the system for computerized data access using Bently Nevada standard on-line computerized monitoring hardware and software.

CAUTION

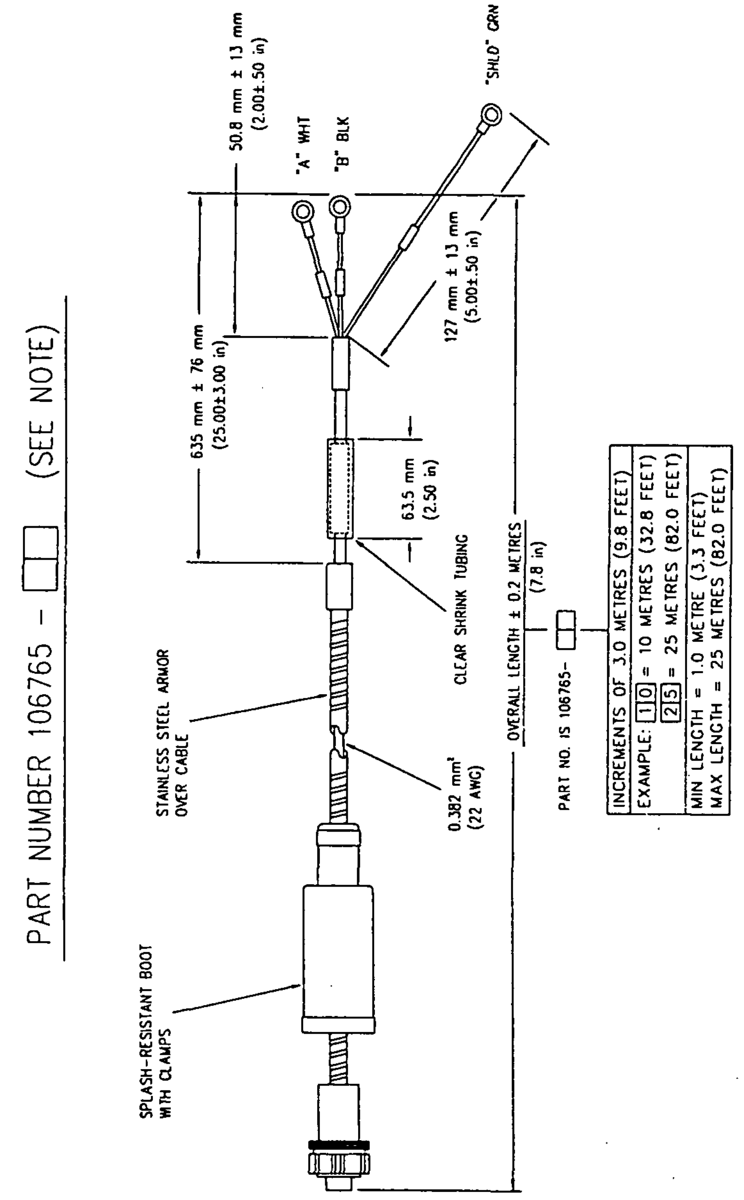
Using Radio Frequency Transmitters near the Velomitor XA may result in the generation of false signals.
Avoid using Radio Frequency Transmitters within 3 metres (10 feet) of the Velomitor XA when the transducer output signal is to be integrated.

Interconnect Cable

The 330525 Velomitor XA requires the Bently Nevada splash resistant cable assembly (part number 106765-XX, sold seperately). The assembly is available in three metre increments from one metre to twenty-five metres. The cable conductors are shielded to minimize noise interference. A splash resistant boot protects the connector from moisture and the armor protects the cable.

Connecting Cable and Accessories
Table 1-2

Appplication	Part Number	Cable Description
Standard Temperature Armored Cable	106765 - AA	Flexible stainless steel armored cable.
Bulk Cable	02173007	Two conductor shielded bulk cable. 0.382mm^2 (22 AWG). Specify number of metres.
Spare Boot	03839144	Flourosilicone elastomer boot
Spare Boot Clamps	03839142 03839143	Bottom clamp Top clamp



(See Data Sheet or your Local Bently Nevada Sales Representative for details)

Section 2 - Installation

This section shows how to mount the sensor on a machine and install the field wiring. Secton 1 contains additional information about how to order cables and other installation accessories.

Receiving Inspection

Inspect the components of the order as soon as you receive them to see if there was any damage during shipping. Keep all shipping forms and invoices. If any shipping damage is apparent, file a claim with the carrier ar.d submit a copy to Bently Nevada Corporation. Include all model numbers and serial numbers with the claim. We will either repair or replace damaged parts according to the terms and conditions of the sale.

The velocity sensor is shipped in a foam filled package and an anti-static bag. The 330525 Velomitor XA is a sensitive instrument and these precautions help to prevent damage during shipping.

Installing the Transducer

This procedure covers the positioning and the mounting of the transducer. Proper placement and mounting of the transducer ensures optimum performance. Consider the steps outlined below when installing the transducer on the machine.

Positioning the Sensor

For optimum performance and accurate measurements, place the Velomitor XA at a position on the machine casing that is most responsive to vibration. Proper placement often depends on the application. Bently Nevada offers Machinery Diagnostic Services which can help determine the best place to mount the sensor for your application.

Mounting

Follow these steps to install the 330535 Velomitor XA:

Step 1— Check that the ambient temperature and the temperature of the installation surface is within the temperature rating of the transducer.

Step 2— Check that the mounting site will be suitable for drilling and tapping a hole for a 1/4 - 18 NPT thread. Consider the hole depth and casing thickness when selecting a mounting site for the transducer.

Step 3— Drill and tap the mounting hole to the dimensions required by the 1/4 - 18 NPT stud. Standard drill size and depth is 7/16 inch and 0.90 inch, respectively. Drill the hole so that the sensitive axis of the transducer will be perpendicular to a tangential plane on the machine casing. For the best results the perpendicularity of the hole should be no more than ± 30 minutes. When handtight, the mounting stud of the transducer will have 2 or 3 threads exposed.

Step 4— Using a crescent or socket wrench, tighten the 330525 Velomitor XA to the mounting site 1/4 to 1/2 turns after handtight engagement. This corresponds to a mounting torque of approximately 400 in-lb.

Installing Connecting Cable

Installing and Routing Cable

Bently Nevada Corporation supplies connecting cables with military-type circular connectors. The cable connector must be compatible with the 330525 Velomitor XA connector. The 106765-AA cable assembly includes a quick connect/disconnect connector and clamps to secure and seal the splash-resistant boot.

The cable assembly comes with the top clamp secured in position and the bottom clamp is looped around the boot. Open the clamps with a small screw driver by prying the teeth of the clamps apart. Slide the boot back to reveal the connector. The cable assembly can now be easily installed on the transducer. Once the connector is engaged, slide the boot down over the connector asssembly and top of the transducer. The groove on the inside bottom of the boot should fit neatly over the lip above the hex flats. The grooves on the outside of the boot at the top and bottom indicate the placement of the clamps. Secure the clamps with pliers. The final assembly is shown below.

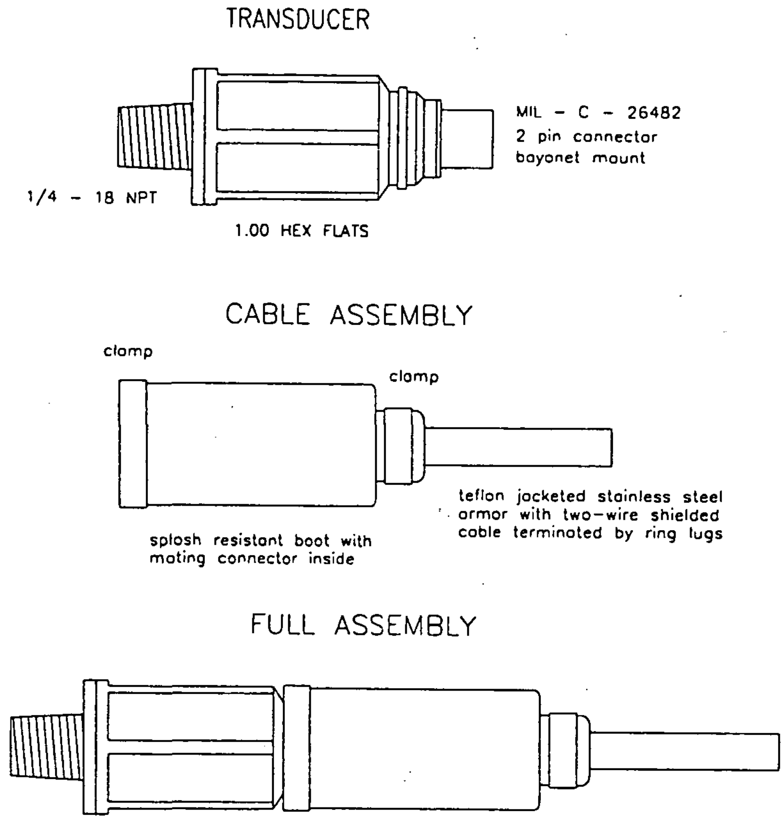


Figure 2-1 Final Assembly of Velomitor XA and Interconnect Cable

Route the cable through protected areas to reduce the chance of damage. Connect one end of the armor directly to the enclosure or other structure in which the monitor is mounted. Connect the other end of the armor rigidly to a structure near the 330525 Velomitor XA. The recommended minimum bend radius for armored cable is 38.1 mm (1.5 in).

Power and Signal Connections

Connect the "A" and "B" terminals of the 330525 Velomitor XA through the terminal connector of the extension cable. At the monitor end of the cable, connect the cable "A" lead to the "A" terminal on the monitor and the "B" lead to the "B" terminal. Connect the green shield wire to the "COM" terminal. The terminal connections for the 3300/55 Dual Velocity Monitor appear in Figure 2-2. Refer to the 3300/55 Dual Velocity Monitor Maintenance Manual (part number 83965-01) for further information.

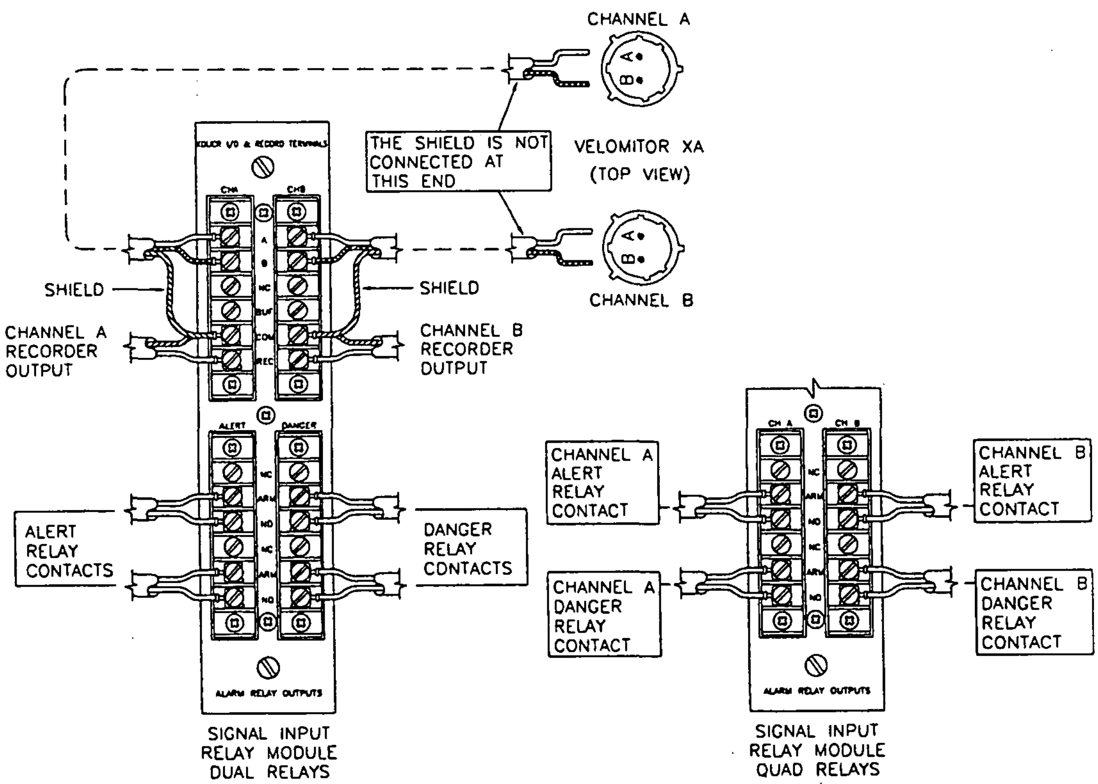


Figure 2-2 3300 / 55 Field Wiring Diagram

Section 3 - Maintenance

This section shows how to check the performance of the 330525 Velomitor XA. Table 3-1 lists the recommended maintenance equipment . If the equipment is not available, contact the nearest Bently Nevada Corporation field office, or return the transducer to the factory or a testing laboratory for testing.

Table 3-1
Recommended Maintenance Equipment

Recommended Equipment	Specification
MB Dynamics Model PM50 Exciter Shake Table	
MB Dynamics, Model 2250 Power Amplifier	
Krohn-Hite Model 1200A Function Generator (Bently Nevada Corp. part number 02280852)	
Tektronix 2235 Oscilloscope, Bently Nevada Corp. part number 02280741	
Bently Nevada Corporation Model 330100-50-00 Proximitor® Model 330101-00-08-10-02-00 Probe Model 330130-040-00-00 Extension Cable	
Power Supply, Bently Nevada TK15	-24.0 Vdc with minimum output current of 20 mA and less than 5 mV pp noise
AISI 4140 Steel Target Material	0.762 mm inch (0.030) thick, 21.6 mm (0.85 inch) diameter, 0.41 µm rms (16 µin rms)
3 mA (Motorola part number 1N5309) current diode Bently Nevada Corp. part number 00643485	

Test Setup

Step 1— Connect test equipment as shown in Figure 3-1.

Step 2— Mount the 4140 steel target to the shake table so that it is rigidly attached to the moving armature as shown in Figure 3-2.

Step 3— Mount a 3300 8mm, 1 metre probe (part number 330101) such that it is isolated from the motion of the shake table.

Step 4— Connect the probe to a four metre extension cable (part number 330130-040-00-00) and Proximitor® (part number 330100-50-00).

Step 5— Apply -24 Vdc power to the Proximitor® and monitor the output with a voltmeter or oscilloscope.

Note

The accuracy of the system can be improved by mounting the probe and target on the same axis as the sensitive axis of the 330525 Velomitor XA and by verifying that there are no mechanical resonances in the probe or target fixture at the frequency of calibration (100 Hz).

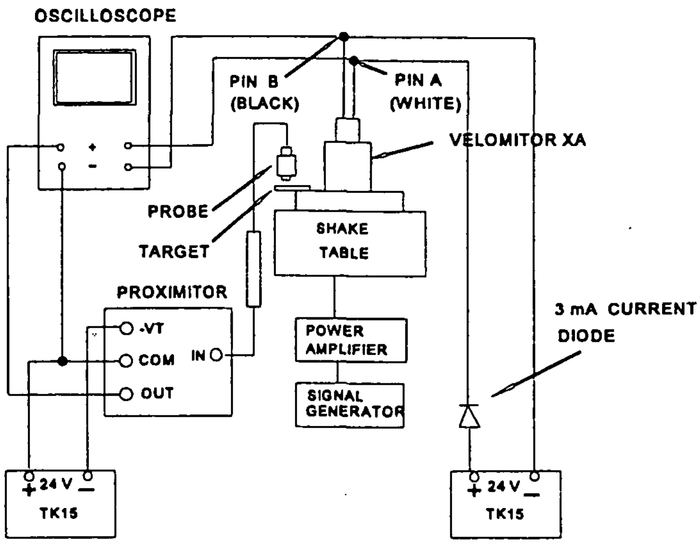


Figure 3-1 Velocity Transducer Test Equipment Setup

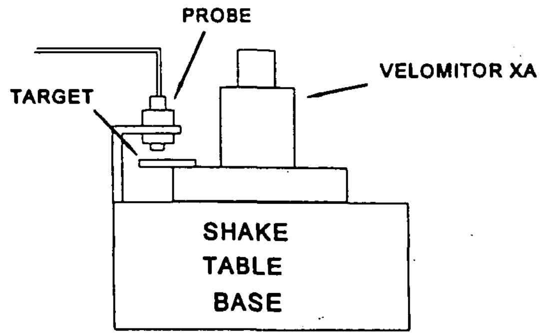


Figure 3-2 Probe and Target Position

Step 6— Mount the Velomitor XA to be checked in a 1/4 - 18 NPT to 1/4 - 28 UNF adapter and then onto the shake table and tighten by hand.

Step 7— Adjust the probe-to-target gap so that the Proximitor® output is at midrange, -10.0 ± 0.5 Vdc.

Step 8— Connect the Velomitor XA to the Oscilloscope or voltmeter as shown in Figure 3 -1.

Performance Test Procedure

Step 1— Set the signal generator to 100 Hz and adjust the power amplifier gain so that the Proximitor output is 0.318 V pp (0.112 V rms). This signal corresponds to a peak-to-peak displacement of 0.0404 mm (0.00159 in) and a peak velocity of 12.7 mm/s (0.5 in/s).

Step 2— Verify that the output of the velocity sensor is between 0.095 and 0.105 V pp (0.0336 to 0.0371 V rms). If the output is not in this range, return the unit to the factory.

Polarity Test Procedure

Use this test to verify the proper phase response. Any out of phase response will adversely affect machinery diagnostics.

Step 1— Connect the cable as shown in the setup in Figure 3-1.

Step 2— Set the time base on the oscilloscopeto 20 milliseconds/division.

Step 3— Hold the velocity sensor in hand and tap the bottom. Observe that the wave-form on the oscilloscope first

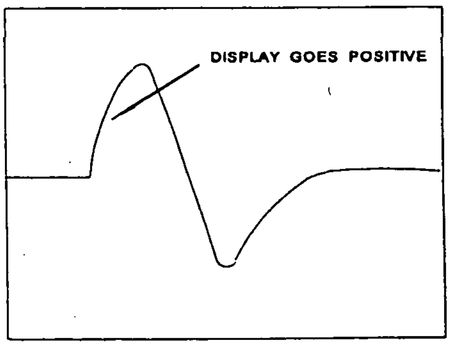


Figure 3-3 Polarity Check Oscilloscope Display

goes positive as shown in Figure 3-3. If it goes negative first, return the unit to the factory for replacement.

Section 4 - Field Testing and Troubleshooting

Use the following procedure to test an installed Velomitor XA and isolate a suspected malfunction. The Velomitor XA is a hermetically sealed unit with no adjustments or field repairable components. If you determine that the Velomitor XA is not functioning properly, contact the nearest Bently Nevada office for assistance.

When the Velomitor XA is used with a Bently Nevada monitoring system, a sensor fault is indicated when the monitor's OK LED goes OFF. A fault may be due to a sensor malfunction or a malfunction in the field wiring. Before troubleshooting a suspected problem, check that the sensor has been correctly installed and that all connections are secured and in the proper locations. If the sensor is properly installed, use the following steps to help identify the problem.

Fault Indication #1 Cause/Solution

Bently Nevada Monitor OK LED is off

Monitor Power is off.
Check that the monitor power supply is plugged in and power is on.

Interconnect cable is disconnected, connected loosely, or connected to the wrong monitor.
Verify that the sensor is connected to the correct monitor and to the correct monitor terminals. Check that the screws are tight.

Interconnect cable is not connected or connection is loose at the Sensor.
Verify that the sensor is connected either visually or by disconnecting the interconnect cable from the monitor and measuring the resistance between the two conductors of the interconnect cable. If the resistance is not between 400 kΩ and 600 kΩ, the cable or sensor may be damaged.

Sensor open or shorted
Disconnect the interconnect cable from the sensor and measure the resistance across sensor terminals "A" and "B". If it is less than 400 kΩ or greater than 600 kΩ, replace the sensor.

Interconnect Cable is Damaged: Shorted
Visually inspect the interconnect cable for apparent damage. Disconnect the interconnect cable at both ends and measure the resistance between the two conductors, "A" to "B". If intermittent or shorted, replace the cable.

Interconnect Cable is Damaged: Open
Disconnect the interconnect cable at both ends. Then short the two conductors together at one end and measure the resistance of the cable at the other end. If open circuited, replace the cable.

Fault Indication #2 Cause/Solution

Unusually low vibration with nonmachine-related low-level, broad band noise.

Sensor signal is not isolated, is shorted to the case, or has noise coupled to the signal.
Measure the resistance between the "A" terminal and case and "B" terminal and case of the transducer. If the resistance is not 1 MΩ or greater, replace the sensor.

Appendix Specifications

330525 Velomitor XA

Parameters are specified at 25° C (77° F) unless otherwise indicated

Electrical

Sensitivity	4 mV/mm/s (100 mV/in/s) ± 5% at 100 Hz
Frequency Response	±0.9 dB 6.0 Hz to 1 kHz ±3.0 dB 4.5 Hz to 2 kHz
Velocity Range	1.27 m/s pk (50 in/s pk)
Transverse Sensitivity	less than 5% of axial
Amplitude linearity	± 2% to 150 mm/s (6.0 in/s pk)
Power Requirement - DC Voltage - Bias Current	-22 to -30 Vdc 2.5 to 6 mA
Output Bias Voltage	-12.0 Vdc (nominal)
Dynamic Output Impedance	less than 1500 Ω
Broadband Noise Floor	4.06 μm/s (160 μin/s)
Grounding	Case isolated

Environmental

Operating Temperature Range	-55° to 121° C (-67° F to 250° F)
Shock Limit	2500 g minimum
Humidity Limit	100% Relative nonsubmerged, case is hermetically sealed

Mechanical

Weight	150 grams (5.3 oz) Typical
Diameter	28 mm (1.1 in)
Height	71 mm (2.8 in)
Case Material	316L Stainless Steel
Connector	2 pin Mil-C-26482 hermetically sealed, 304 stainless steel shell
Mounting Torque	45.3 N•m (400 in•lb)
Polarity	Pin A goes positive with respect to pin B when the transducer case motion is toward the connector.

Note: Operation outside the specified limits will result in false readings or loss of machine monitoring.

Mechanical Drawing

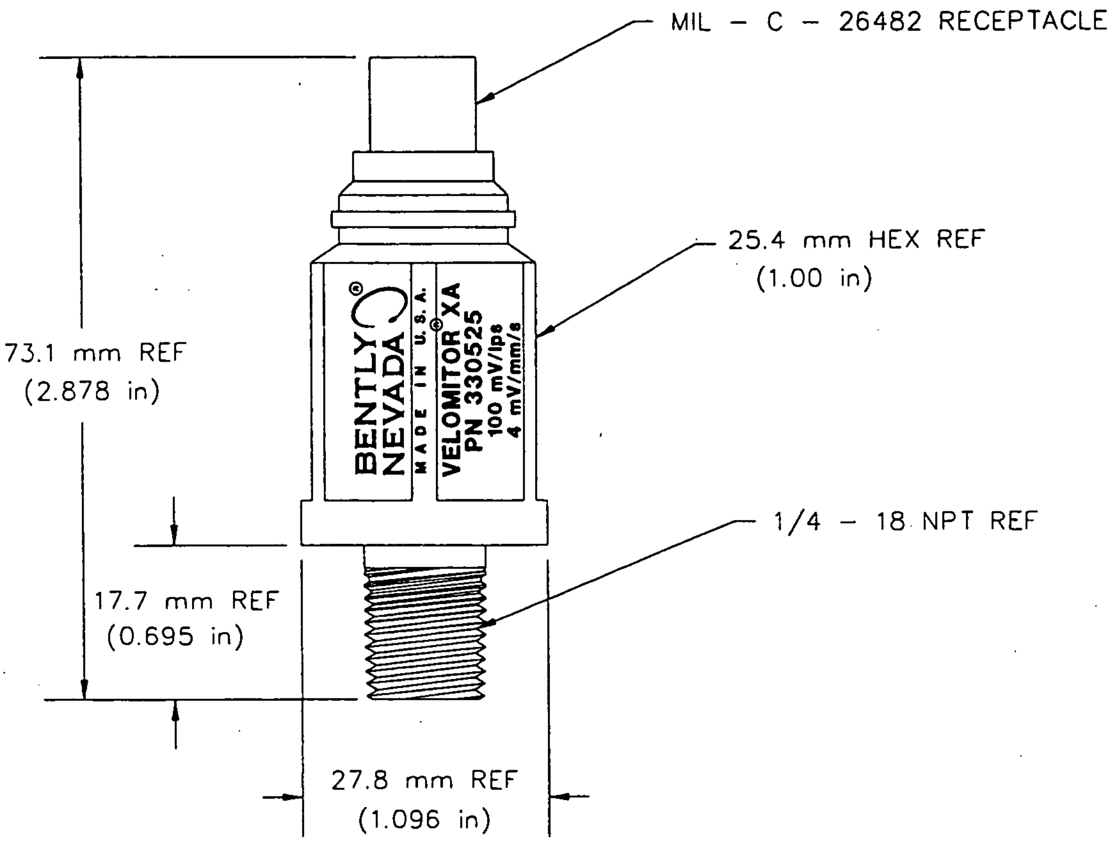


Figure A—1 330525 Velomitor XA Mechanical Drawing

330525 Velomitor XA Frequency Response

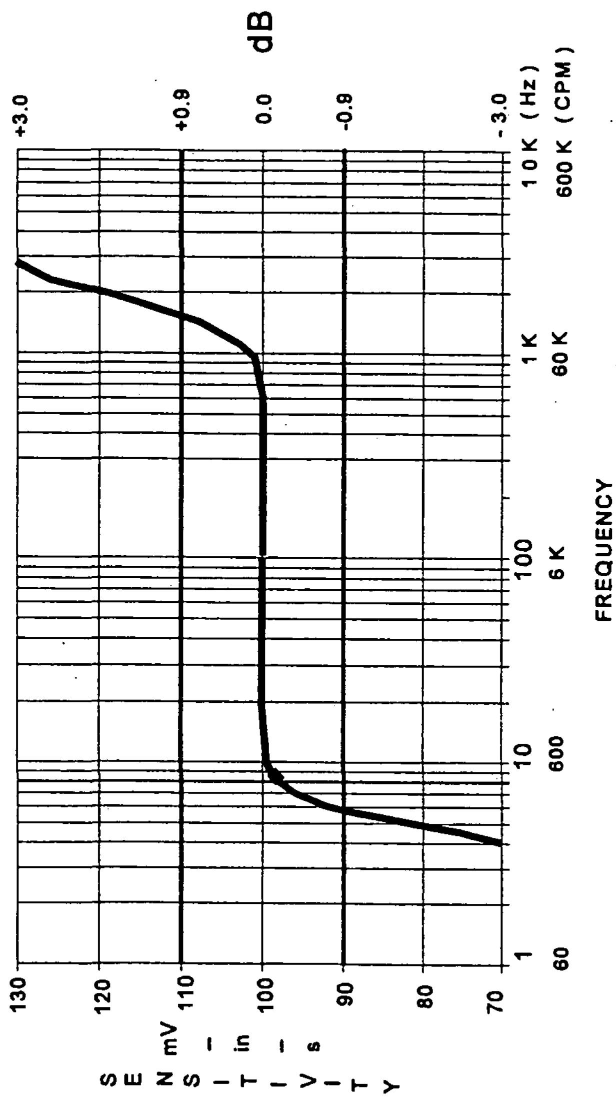


Figure A—2. Typical Velomitor XA Frequency Response

330525 Velomitor XA Phase Response

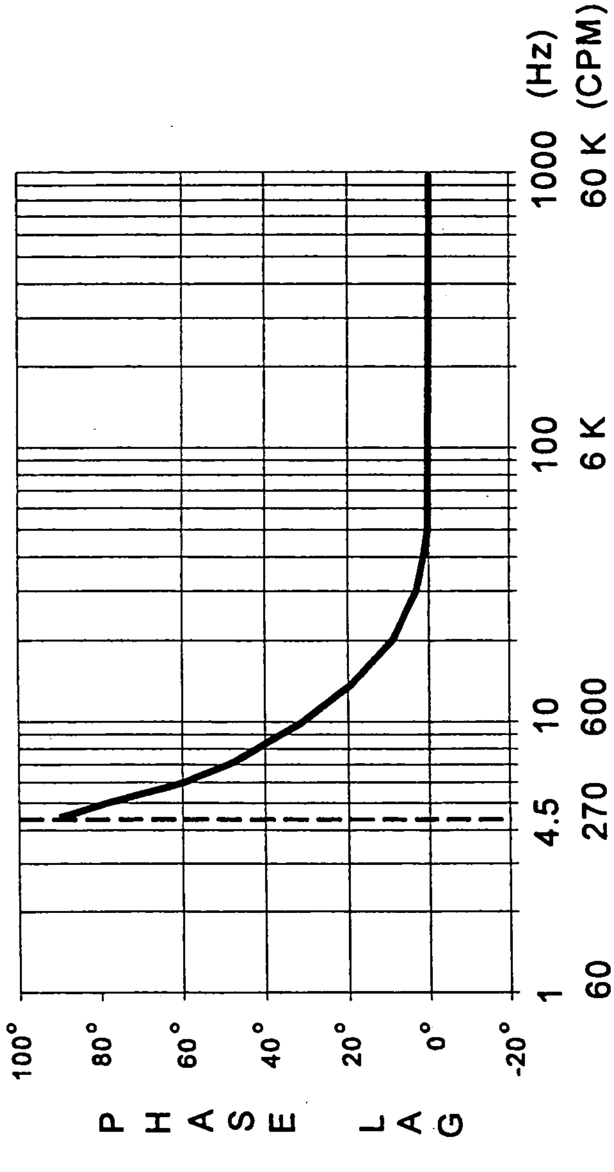


Figure A—3. Typical Phase Lag Between Output and Case Velocity

Interconnect Cable

Size	0.382 mm² (22 AWG)
Materials	
Conductor	Silver Plated Copper
Insulation	TFE 0.254 mm (0.010 in) Nominal Wall
Shield	Braided Silver Plated Copper
Jacket	Extruded FEP - White
Voltage Rating	600 V
Bend Radius-Armored	38.1 mm (1.50 in)
Tensile Strength	
Cable	44.5 N (10 lb_f)
Connector to Cable	44.5 N (10 lb_f)
Terminal to Cable	44.5 N (10 lb_f)
Connector to Armor	222.5 N (50 lb_f)
Operating Temperature Range	-29° to 121° C (-20° to 250° F)
Nominal O.D.	3.63 mm (0.143 in)
Stranding	19/34
Capacitance	150 pF/m (45 pF/ft) grounded 82 pF/m (25 pF/ft) mutual

CE INSTALLATION NOTES

The Velomitor XA was tested at a recognized facility and found to be compliant with european electromagnetic compatibilty directive 89/336/EEC (EMC Directive). The applicable norms are: EN55022, EN50081-2, PrEN50082-2, ENV50140.

Testing and Test Levels

Test	Specification	Requirement
Electrostatic Discharge	IEC 801-2 (1991) EN50082-2 (1993)	8KV contact 8KV air
Radiated Susceptibility	IEC 801-3 (1984) EN50082-2 (1993)	27-1000 MHz 10 V / m
Radiated Susceptibility	ENV50140 (1993) EN50082-2 (1993)	900 MHz 10 V / m
Conducted Susceptibility	ENV50141 (1993)	150 Khz-80 MHz 12 V criteria A
Electrical Fast Transient	IEC 801-4 (1988) ENG1000-4-4 Level 4	2 KV criteria B

CE Installation Instruction

These instruction are in addition to those contained elsewhere in this manual.

Sensor - The Piezo-Velocity Sensor should be mounted to a machine in such a manner that it makes good electrical contact with the machine which itself should be thoroughly grounded.

Cable - The cable shield on the monitoring side, should be grounded to the shield of the receiving system (metal enclosure of monitoring system or junction box if applicable). This will provide a path to the ground for electromagnetic interference (EMI) energy.

2.9 3300 - 8 mm Proximity Transducer System

The following publication entitled 3300 8mm Proximity Transducer Manual (Part No 86130-01 Rev R) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides a detailed description of the Proximity Transducer, application notes, installation details, maintenance procedures, and a guide to field-testing.

The following sections are included:

2.9.1 Operating Information

2.9.2 Installation

2.9.3 Maintenance and Trouble Shooting

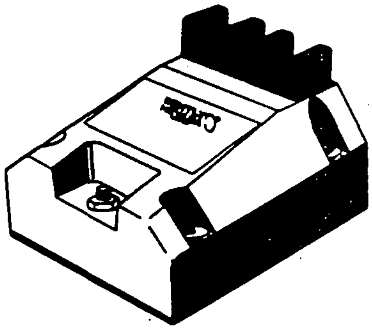
2.9.4 Specifications

Part No. 86130-01
Revision R, Dec 1995

3300
8 mm PROXIMITY TRANSDUCER SYSTEM

MANUAL

BENTLY NEVADA®



Bently Nevada Technical Publication

The 3300 REBAM® Proximity Transducer System, due to its inherent sensitivity, is susceptible to EMI at levels EN50082-2. Special EMC (Electromagnetic Compatibility) protection measures may be necessary to achieve reliable measurements. Each unique installation must be considered.

Proximity Probes All probes must be mounted in an EMI shielded environment (i.e.typically a machine casing⑥). All probe cables ② and extension cables, running from the point exiting the machine to the EMI shielded enclosure, must be inside metal conduit ⑤ (or equivalent) with the conduit grounded at the machine and the enclosure.

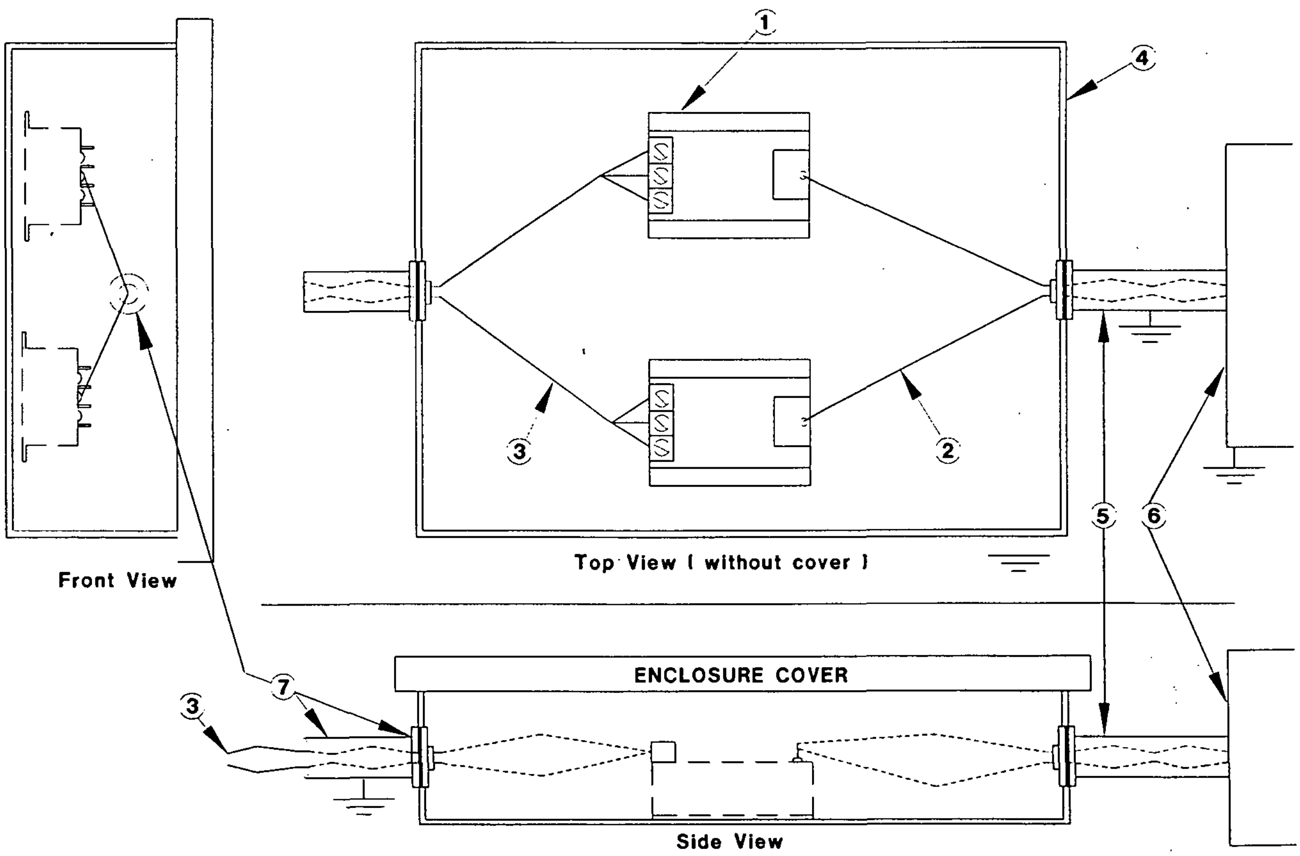
Field Wiring All field wiring ③, from the Proximitor® Sensor enclosure ④ to a receiving unit (i.e. monitor), must be shielded from EMI energy. Acceptable EMI shielding includes solid metal conduit or multi-conductor cable with both a foil and braid shield.

EMI Shielded Enclosures and EMI Shield Grounding Enclosures made of metal typically provide EMI shielding. Covers should be electrically connected to the enclosure or have overlap with the sides of the enclosure, both is preferable. BNC Proximitor® Sensor Housings and Probe Housings, which are made of metal, provide adequate EMI shielding.

Grounding EMI shields ⑦ at the point of entrance to the Proximitor® sensor enclosure④ and any subsequent junction enclosure is required. The shield must be maintained around the wiring as it is grounded to the enclosure.

Exposure of the systems when the EMI shielding is removed (i.e. enclosure cover) will increase EMI susceptibility.

Figure 1



Contents

Related Documents

The following documents contain additional information that you may find helpful when you install the transducer. This manual refers to these documents by number.

Note: Bently Nevada application notes and document numbers are listed in ( ).

Installing the Transducer

1 Proximitor Probes and Related Accessories (AN028)

2 Guidelines for Grounding Bently Rotating Machinery Information Systems (AN013)

3 Instaltion of Electrical Equipment in Hazardous Ares (AN015)

Transducer Installation Accessories

4 3100/3200 Proximity Probe Housing Manual (124200-01)

Electrical and Mechanical Runout

5 "Glitch": Definition of and Methods for Correction, including Shaft Burnishing to Remove Electrical Runout. (AN002)

C API 670, third edition, Section 4.1.2: Machine Shaft Requirements for Electrical and Mechanical runout. Available from the American Petroleum Institute, Publications and Distribution, 1220 L Street N.W., Washington D.C., 20005. Phone: (202) 682-8375.

Reference

7 Performance Specifications for the 3300 8 mm Transducer System (155687).

8 Bently Nevada Glossary (L1014).

9 European CE mark of Bently Nevada Proximity Transducer System (AN072)

System Description

The 3300 Series 8mm Proximity Transducer System measures machine vibration and the position of a shaft or other part of a machine in relation to the location of the probe tip. The system consists of a probe, an extension cable, and a Proximitor®.

The components of the 3300 8mm Transducer System are designed to work as a single unit and are calibrated for a target material that is AISI 4140 steel. The system measures displacement by using the eddy current principle and provides a negative voltage proportional to the distance between the target and the probe tip. This voltage signal may be applied to a monitor, portable instrumentation, or diagnostic equipment.

Application Notice

The 3300 8mm Proximity transducer is designed for measuring position or vibration within a frequency range from 0 to 10 kHz. Typical applications of the system include radial vibration and position, axial position, and Keyphasor® measurements.

CAUTION

Although the terminals and connector on the Proximitor have protection against electrostatic discharge, take reasonable precautions to avoid electrostatic discharge when handling the Proximitor.

Receiving, Inspecting, and Handling the System

The probe, extension cable, and Proximitor are shipped as separate units and must be interconnected at the installation site by the user. Carefully remove all equipment from the shipping containers and inspect the equipment for shipping damage. If shipping damage is apparent, file a claim with the carrier and submit a copy to the nearest Bently Nevada office. Include part numbers and serial numbers on all correspondence. If no damage is apparent and the equipment is not going to be used immediately, return the equipment to the shipping containers and reseal until ready for use.

Store the equipment in an environment free from potentially damaging conditions such as high temperature or a corrosive atmosphere. See Specifications, pages 19, 20, and 21, for environmental specifications.

Customer Service

Bently Nevada provides product service throughout the world. If you cannot contact your local product service representative, call the Bently Nevada corporate headquarters:

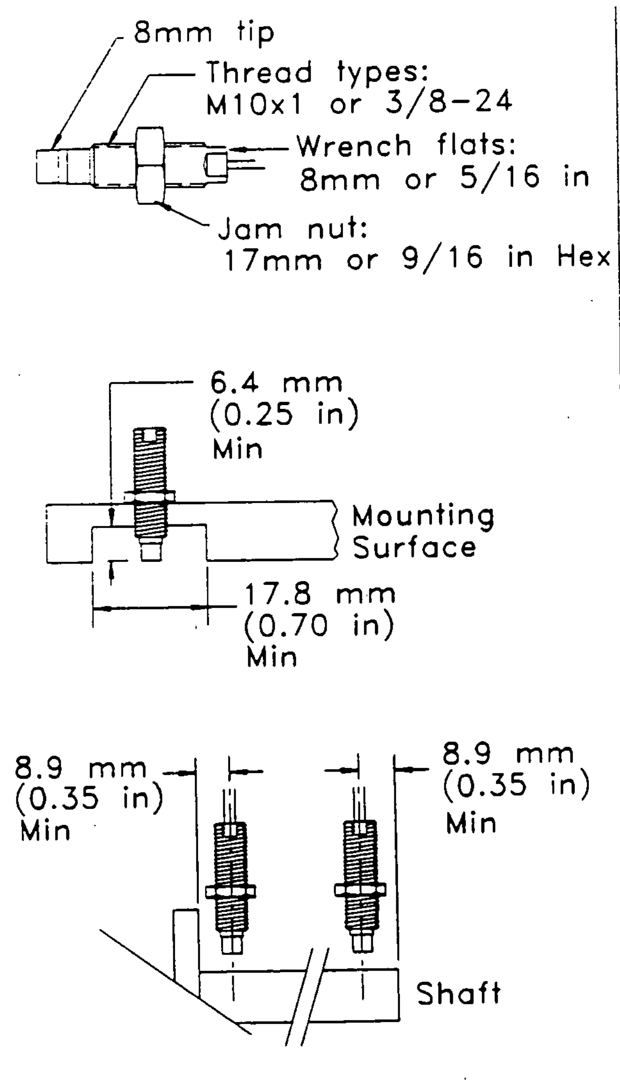
800-227-5514 Monday through Friday, 8:00 a.m. to 5:00 p.m. Pacific time
702-782-3611 Any time

Installation

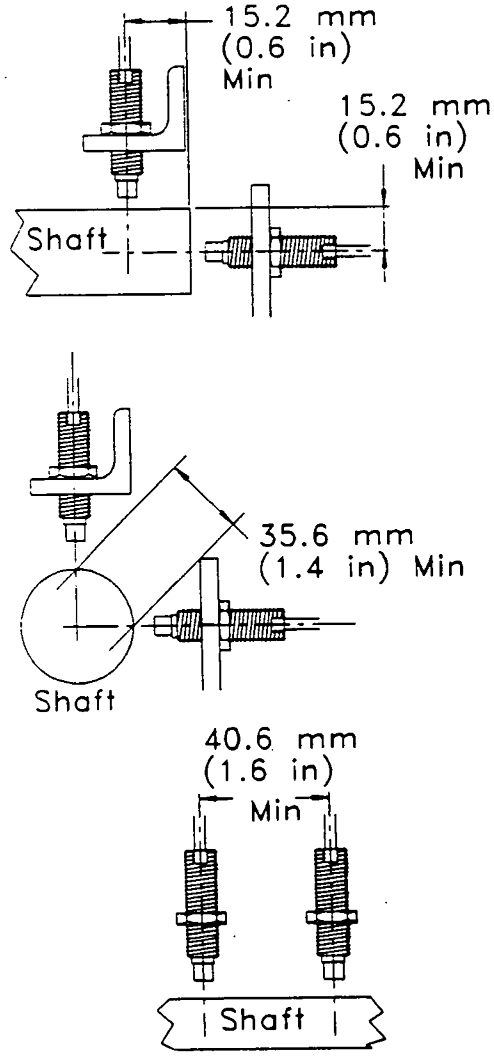
This section contains a checklist of items that you must consider when you install a 3300 8mm Transducer system. For detailed information about designing installations for specific applications refer to document 1.

Installing the Probe

The following figures show the dimensions of the probe and the minumum values for probe separation, side clearance, and target configuration. Refer to Specifications, page 20, for proper torque and the dimensions of the thread.

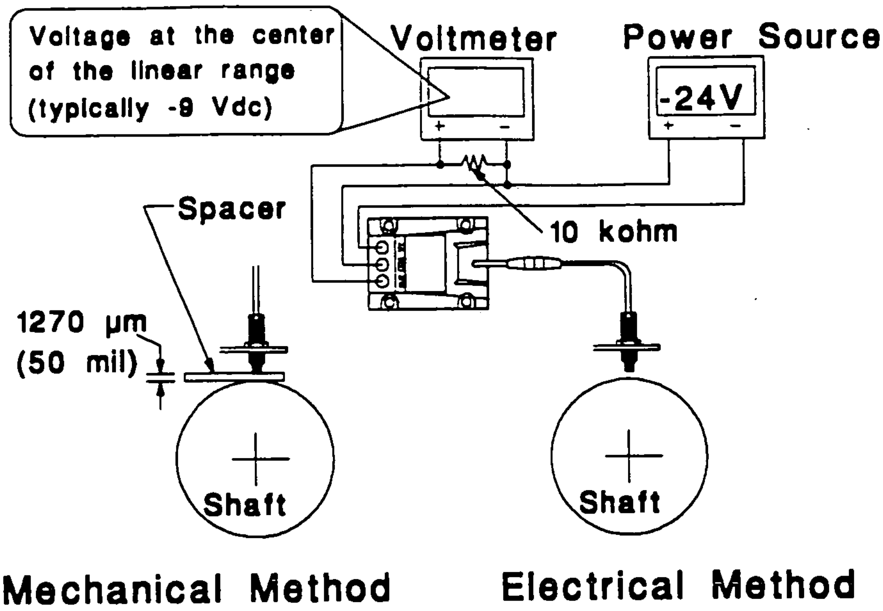


Probe Mounting Dimensions



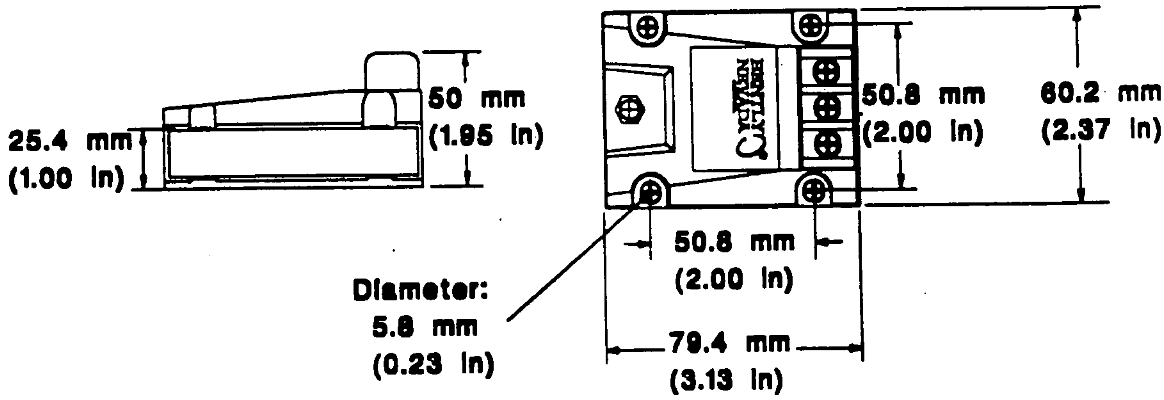
Probe to Probe Separation Due to Crosstalk

Adjust the distance between the probe tip and the shaft using one of the methods shown in the following figure. (Refer to document 1.)



Mounting the Proximitor

Mount the Proximitor in a location that is compatible with the environmental specifications of the Proximitor (page 19). Consider the local electrical codes and the amount of hazardous or explosive gas at the installation site. (Refer to document 3.)



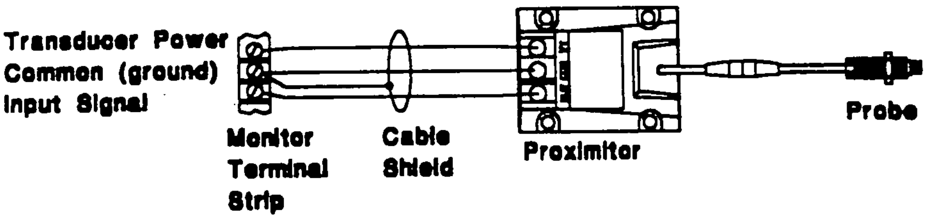
Routing the Extension Cable and Field Wiring

Route the extension cable using the following guidelines. (Refer to document 1).

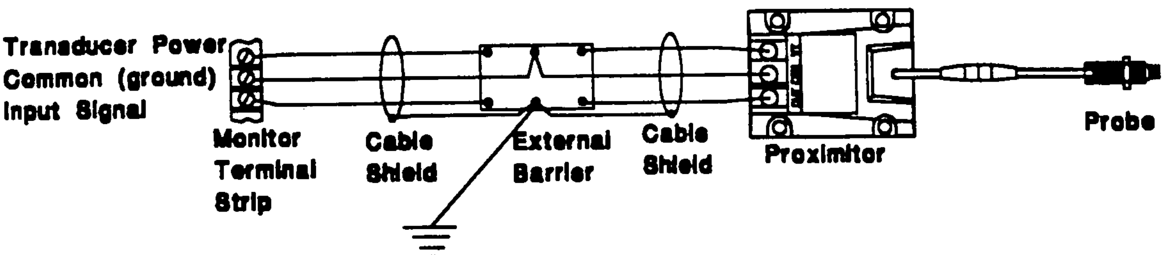
- Check that the Proximitor, extension cable, and probe belong to the same system. (For example, a 9 metre Proximitor will not work with a 4 metre extension cable and a 1 metre probe.)
- Secure the extension cable to supporting surfaces by using mounting clips or similar devices.
- Identify both ends of the extension cable by inserting labels under the clear Teflon sleeves and applying heat to shrink the tubing.
- Insulate the connection between the probe lead and the extension cable.
- If the probe is in a part of the machine that is under pressure or vacuum, seal the hole where the extension cable leaves the machine by using appropriate cable seals and terminal boxes.
- Join the coax connectors between Proximitor, extension cable, and probe lead. Tighten to finger tight plus 1/8 turn. Reference torque specification on pages 20 and 21.

Use the following wiring diagrams to connect the field wiring between the Proximitor and the monitoring instruments. (Refer to documents 2 and 3.)

No Barriers



External Barriers



Maintenance and Troubleshooting

This section shows how to verify that the system is operating properly, adjust the system, and identify parts of the system that are not working properly.

The transducer system does not require verification at regular intervals. You should, however, verify operation by using the scale factor verification on page 2 if any of the following conditions occur:

- components of the system are replaced or disturbed
- the performance of the system changes or becomes erratic
- you suspect that the transducer is not calibrated correctly

The adjustment procedure on pages 3 and 4 is included for your information. For target materials other than AISI 4140 steel and for other special applications, contact your local Bently Nevada office .

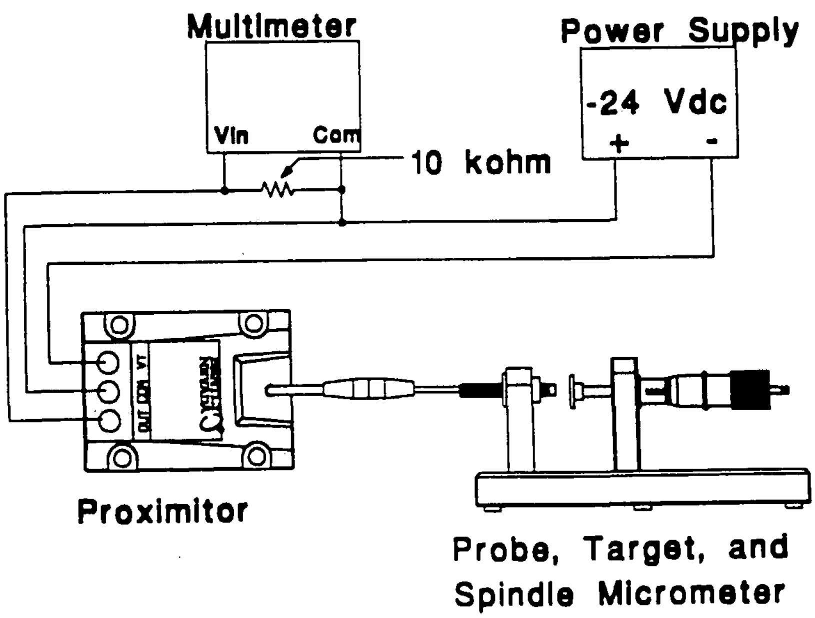
The scale factor verification and the adjustment procedure require the following instruments:

digital multimeter	spindle micrometer	fixed resistor, 10 kΩ
soldering iron and suppiles	power supply	

The adjustment procedure also requires the following items:

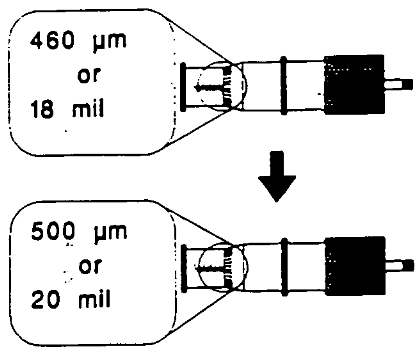
variable resistor, 0 to 100 kΩ
vulcanizing compound (for example Dow 3110 RTV)

The scale factor verification and the adjustment procedure both use the test setup as shown in the following figure:



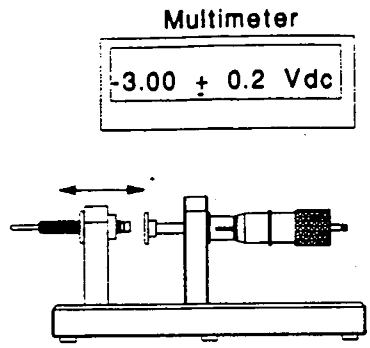
Scale Factor Verification

1



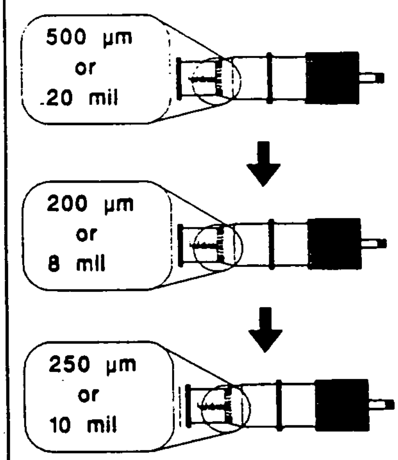
Compensate for mechanical backlash and adjust the spindle micrometer for electrical zero.

2



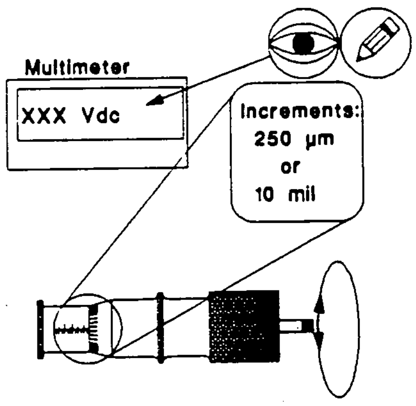
Adjust gap to electrical zero by moving the probe.

3



Compensate for mechanical backlash. Adjust to the first setting for recording voltages.

4



n	Adjust Micrometer to.. µm	or mil	Record Voltages $mVdc_n$	Calculate Scale Factor: ISF_n (Incremental Scale Factor)	ASF (Average Scale Factor)
1	250	10	___		
2	500	20	___	___	
3	750	30	___	___	
4	1000	40	___	___	
5	1250	50	___	___	
6	1500	60	___	___	
7	1750	70	___	___	
8	2000	80	___	___	
9	2250	90	___	___	___

$$ISF_n = \frac{Vdc_n - Vdc_{n-1}}{250\ \mu m} \qquad ASF = \frac{Vdc_{250\ \mu m} - Vdc_{2250\ \mu m}}{2000\ \mu m}$$

$$ISF_n = \frac{Vdc_n - Vdc_{n-1}}{10\ mil} \qquad ASF = \frac{Vdc_{10\ mil} - Vdc_{90\ mil}}{80\ mil}$$

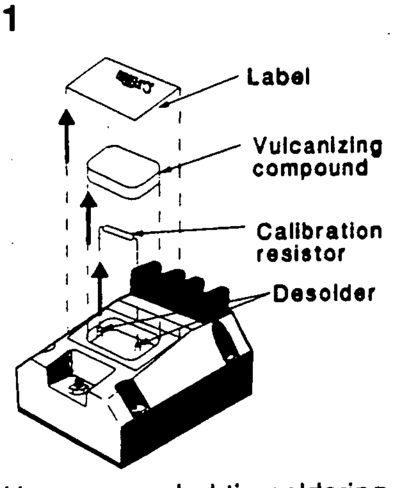
If the incremental scale factor (ISF) or the average scale factor (ASF) of the system is out of tolerance (refer to page 18), contact Bently Nevada Corporation for further information on possible calibration problems or perform the following adjustment.

Adjustment Procedure

CAUTION

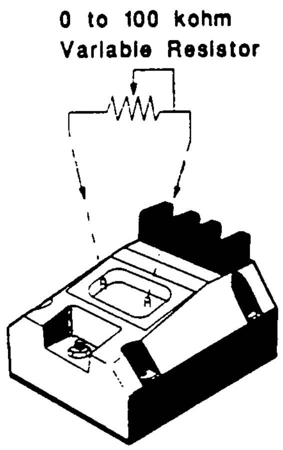
Electrostatic discharge on the exposed calibration resistor terminals can cause the accuracy of the system to go out of specification or cause the system to fail. Use a grounding strap or equivalent precaution during this procedure.

1

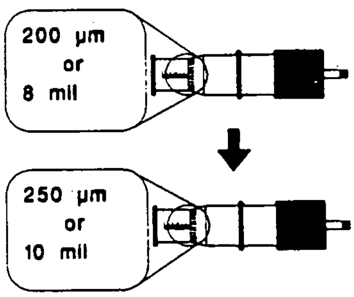


Use a grounded tip soldering iron with less than a 60 watt rating. Leave the iron in contact with the Proximitor terminal for less than 10 seconds.

2

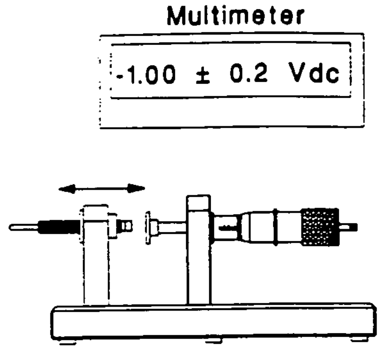


3



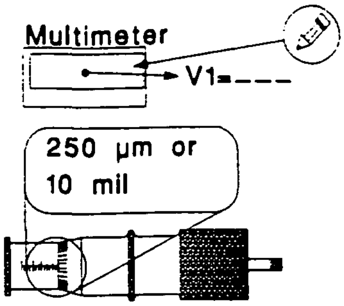
Compensate for mechanical backlash and adjust to start of the linear range.

4

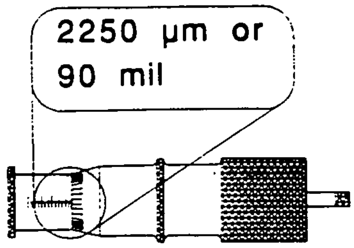


Adjust gap by moving the probe for an output of −1.00±0.20 Vdc.

5

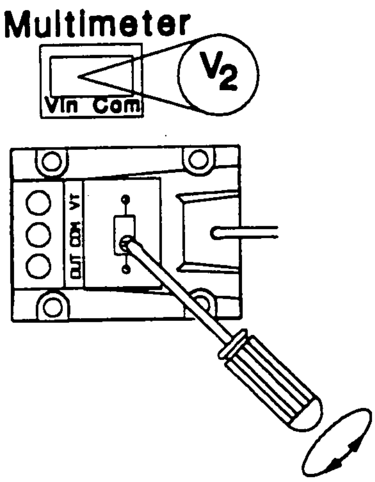


6



Set micrometer to end of the linear range.

7

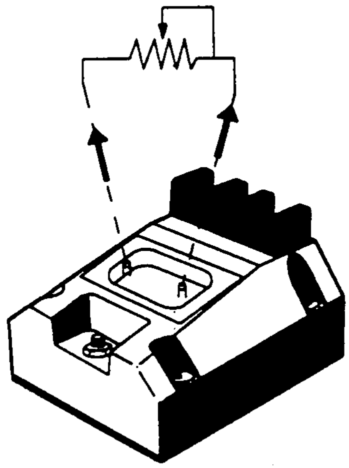


Adjust the variable resistor until the measured voltage (V_2) equals $(-|V_1| - 16\ \text{Vdc}) \pm 0.16$ Vdc

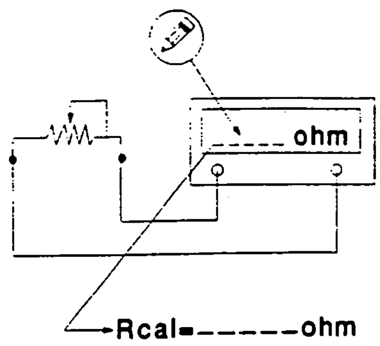
8

Repeat steps 3 through 7 until the variable resistor is not changed.

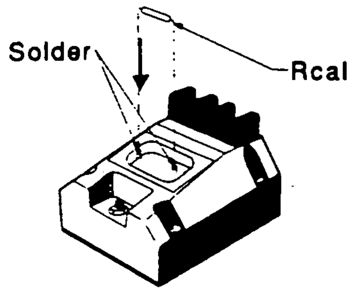
9



10

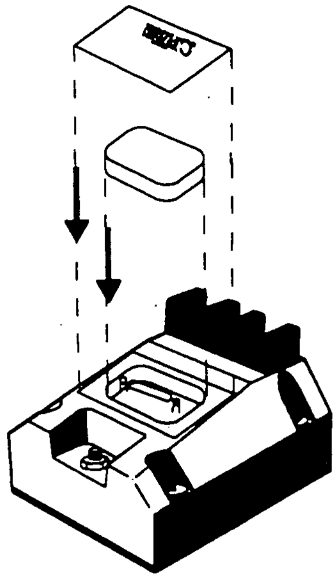


11



The calibration resistor (R_{cal}) must have a tolerance of 1% or better.

12

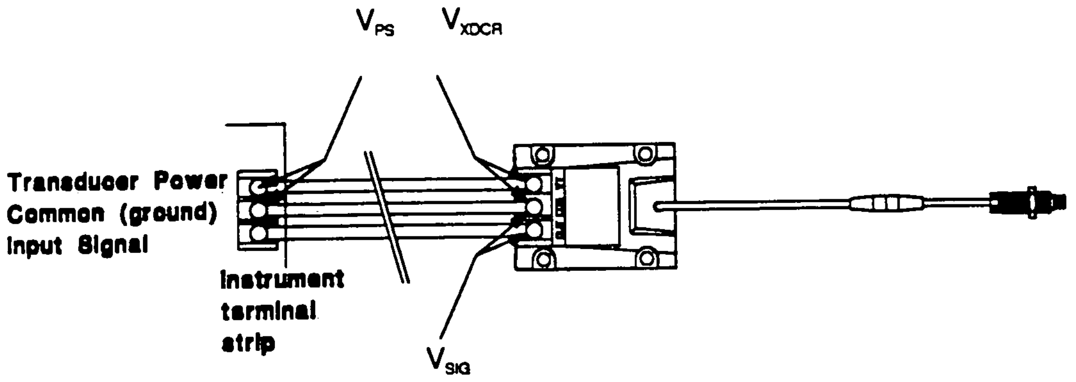


Troubleshooting

This section shows how to interpret a fault indication and isolate faults in an installed transducer system. Before beginning this procedure, be sure the system has been installed correctly and all connectors have been secured properly in the correct locations.

When a malfunction occurs, locate the appropriate fault, check the probable causes for the fault indication, and follow the procedure to isolate and correct the fault. Use a digital multimeter to measure voltage and resistance. If you find faulty transducers, contact your local Bently Nevada Corporation office for assistance.

The troubleshooting procedures use measured voltages as shown in the following figure and table:



Symbols for Measured Voltages

Symbol	Meaning	Voltage measured between...
V_{XDCR}	Transducer input voltage	V_T and COM
V_{SIG}	Signal voltage from the transducer	OUT and COM
V_{PS}	Power supply voltage	Power Source and Common

Note: V_{XDCR}, V_{SIG}, and V_{PS} are all negative voltage values.

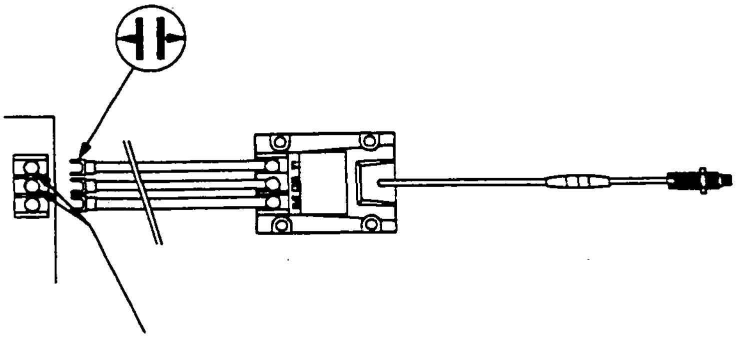
Definitions

Symbol	Definition
A > B	"A" value is more positive than "B"
A < B	"A" value is more negative than "B"
A = B	"A" same value (or very close) to "B"

Fault Type 1: V_{XDCR} > -17.5 Vdc or V_{XDCR} < -26 Vdc

Possible Causes:

- Faulty power source
- Faulty field wiring
- Faulty Proximitor



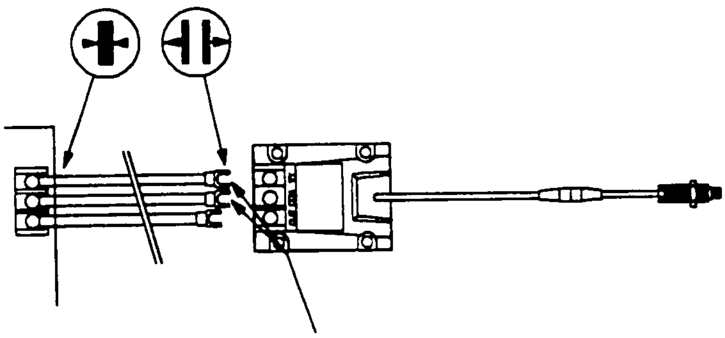
V_{PS}

Measure V_{PS}:

V_{PS} > -17.5 Vdc or V_{PS} < -26 Vdc

Yes → Faulty Power Source

No ↓



V_{XDCR}

Measure V_{XDCR}:

V_{XDCR} > -17.5 Vdc or V_{XDCR} < -26 Vdc

Yes → Faulty Field Wiring

No ↓

Faulty Proximitor

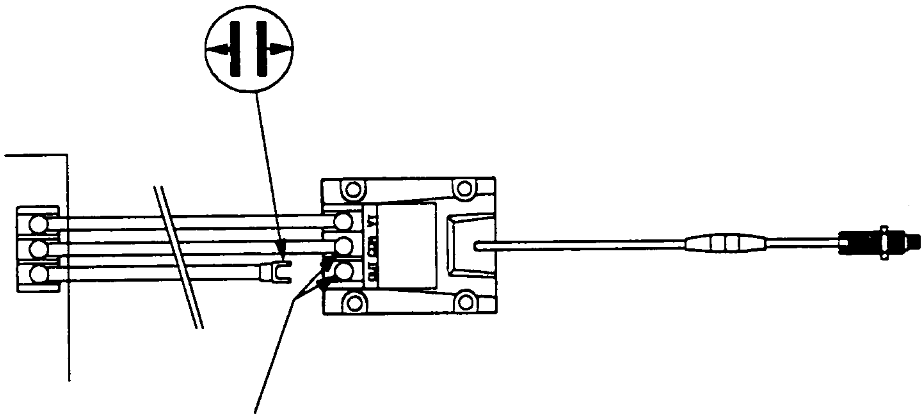
Fault Type 2: V_{SIG} = 0 Vdc

Possible Causes:

- Incorrect power source voltage
- Short circuit in field wiring
- Short circuit at Proximitor terminal connection
- Faulty Proximitor

Fault condition type 1

↓ No



V_{SIG}

Measure V_{SIG}:

V_{SIG} = 0 Vdc

No → Short in Field Wiring or Short at Proximitor Terminal Connection

↓ Yes

Faulty Proximitor

Fault Type 3: -1 Vdc < V_{SIG} < 0 Vdc

Possible Causes:

- Probe is incorrectly gapped (too close to target)
- Incorrect power source voltage
- Faulty Proximitor
- Probe is detecting other material than target (ie: counterbore or machine case)
- Short or open circuit in a connector (ie: dirty)
- Short or open circuit in the probe
- Short or open circuit in the extension cable

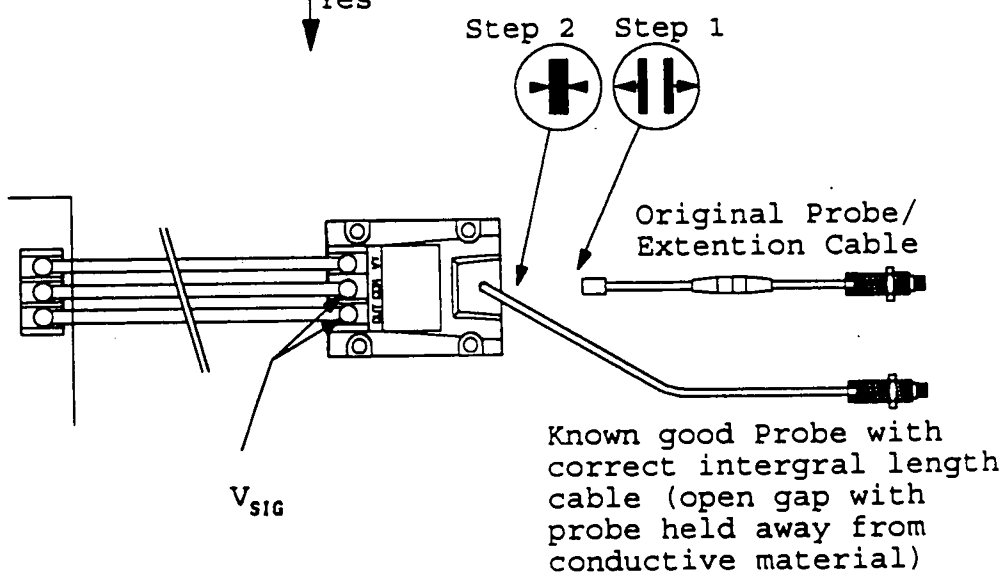
Fault condition type 1

↓ No

Is the probe gapped correctly? Are counterbore dimensions correct?

→ No: Re-gap the Probe or Check Counterbore Retest System

↓ Yes



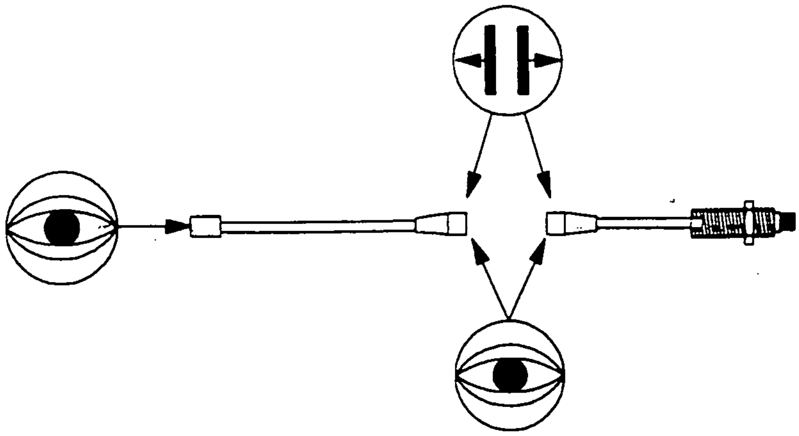
Measure V_{SIG}:

V_{SIG} < V_{XDCR}+1 Vdc

→ No: Faulty Proximitor

↓ Yes

Continues next page

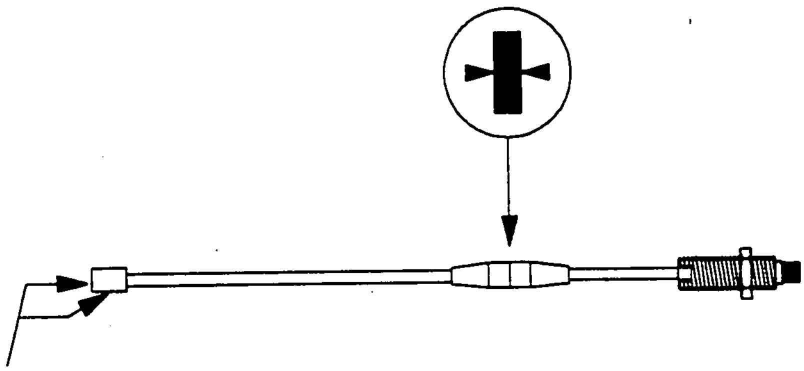


Inspect for clean connection

Dirty, rusty, poor connection?

Yes → Clean connector, reassemble, and retest the original system

No ↓



R_{TOTAL}

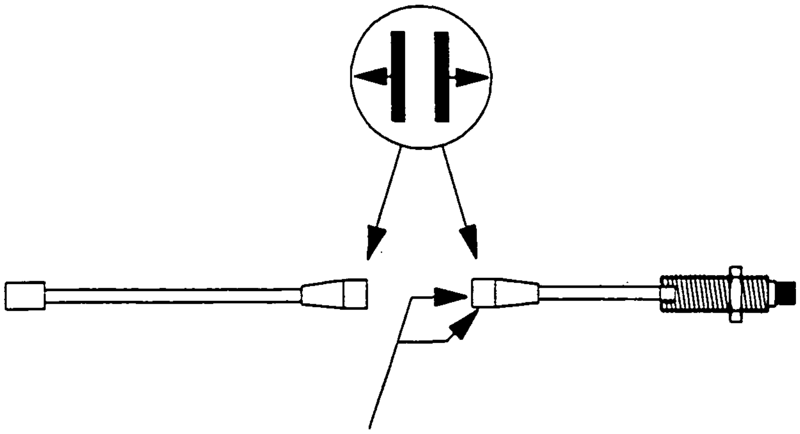
Measure resistance, R_{TOTAL}:

Within specifications?
5 m system: 8.75±0.70 Ω
9 m system: 9.87±0.90 Ω

Yes → Retest original system

No ↓

Continues next page



R_{PROBE}

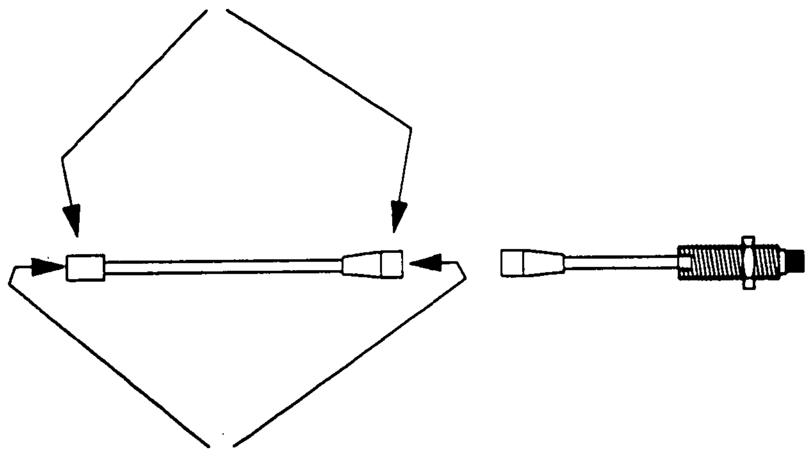
Measure resistance, R_{PROBE}:

Within specifications?
(See probe resistance, page 20)

No → Faulty Probe

Yes ↓

R_{JACKET}



R_{CORE}

Measure Resistances, R_{JACKET} and R_{CORE}:
Within specifications?
(See cable resistance, page 21)

No → Faulty Extension Cable

Yes ↓

Retest original system

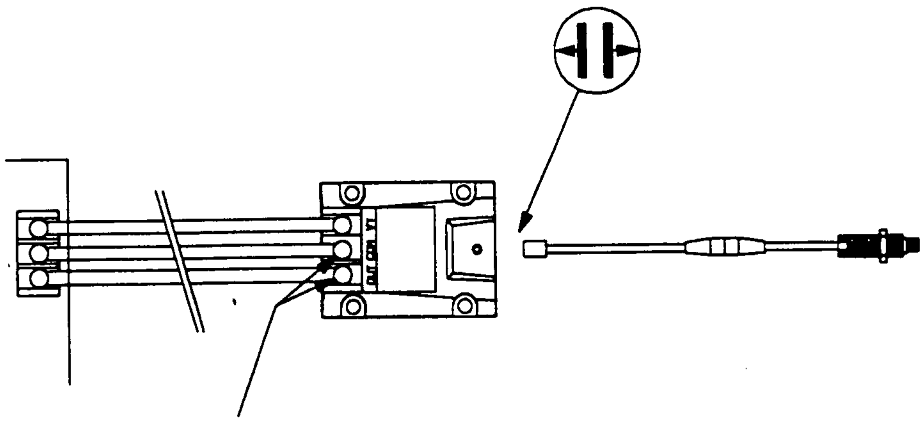
Fault Type 4: $V_{XDCR} < V_{SIG} < V_{XDCR}+2.5$ Vdc

Possible Causes:

- Faulty Proximitor
- Probe is incorrectly gapped (too far from target)

Fault condition type 1

↓ No



V_{SIG}

↓

Measure V_{SIG}:

-1.2 Vdc < V_{SIG} < -0.3 Vdc

No → Faulty Proximitor

↓ Yes

Re-connect System
Re-gap the Probe
Retest System

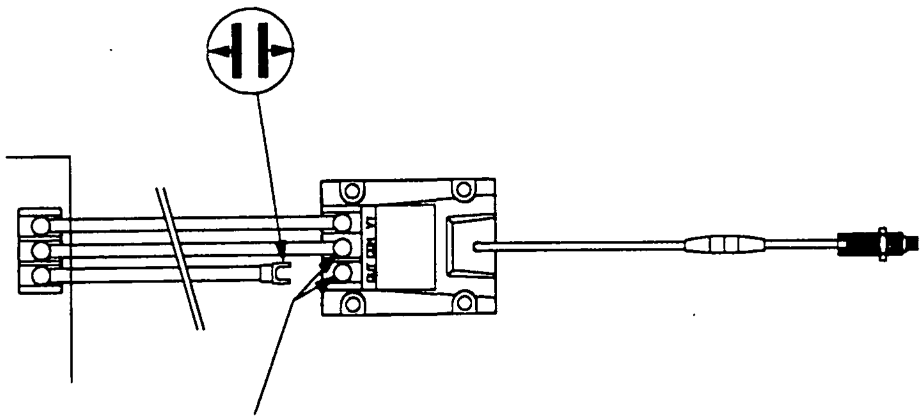
Fault Type 5: $V_{SIG} = V_{XDCR}$

Possible Causes:

- Incorrect power source voltage
- Faulty Proximitor
- Faulty field wiring (between Out and V_T)

Fault condition type 1

No



V_{SIG}

Measure V_{SIG}

$V_{sig} = V_{XDCR}$

Yes → Faulty Proximitor

No

Faulty Field Wiring (between OUT and COM)

Specifications

The following specifications apply at 22°C (72°F) with AISI 4140 steel target. Typical is defined as 90% of the devices built meeting the specification, and worst case is defined as 99.7% of the Devices built meeting the specification. The calibration range is 250 µm (10 mil) to 2250 µm (90 mil).

Note
Operation outside the specified limits will result in false readings and/or loss of machine monitoring.

System

Average Scale Factor (ASF)

Typical	7.87 ± 0.21 mV/µm (200.0 ± 5.4 mV/mil)
Worst Case	7.87 ± 0.39 mV/µm (200.0 ± 10.0 mV/mil)
Bench Calibration	Can be adjusted with the Proximitor calibration resistor for exactly 7.87 mV/µm (200.0 mV/mil).

Incremental scale factor (ISF)

Typical	7.87 ± 0.51 mV/µm (200 ± 13 mV/mil)
Worst Case	7.87 ± 0.75 mV/µm (200 ± 19 mV/mil)
Bench Calibration (Worst Case)	7.87 ± 0.31 mV/µm (200 ± 8 mV/mil)

Deviation from a Straight Line

This specification covers a range starting at the beginning of the calibration range 250 µm (10 mil) and ending at 2500 µm (100 mils). Error is referenced to the straight line which is centered to yield minimum error and which has a 7.87 mV/µm (200 mV/mil) slope over the calibration range.

Typical	Less than ± 38 µm (1.5 mil)
Worst Case	Less than ± 58 µm (2.3 mil)
Bench Calibration (Worst Case)	Less than ± 20 µm (0.8 mil)

Proximitor

Interchangeability Error

Average scale factor (ASF) change

Typical:	Less than 0.09 mV/µm (2.3 mV/mil)
Worst Case:	Less than 0.33 mV/µm (8.4 mV/mil)

Apparent Gap Change

At 1270 µm (50 mils) gap:
180 µm (7.1 mils) (maximum)

At 250 µm (10 mils) gap:
130 µm (5.3 mils) (maximum)

Supply Sensitivity

Less than 2 mV change in output voltage per volt change in input voltage.

Supply Voltage Range

-17.5 Vdc to -26 Vdc

Current Draw

12 mA maximum with 10 kΩ load.

Output Resistance

50 Ω

Output Load

Calibrated into a 10 kΩ load.

Weight

255 g (9.0 oz)

Temperature

Storage	-51°C to +105°C (-60°F to +221°F)
Operating	-51°C to +100°C (-60°F to +212°F)

Relative Humidity

100% condensing nonsubmerged from 2°C to 100°C (35°F to 212°F) when connectors are protected.

Probe

Interchangeability Error

Average scale factor (ASF) change

Typical:	Less than 0.25 mV/µm (6.3 mV/mil)
Worst Case:	Less than 0.42 mV/µm (10.8 mV/mil)

Voltage Difference at Same Physical Gap (maximum)

At 1270 µm (50 mils) gap
4.6 Vdc

At 250 µm (10 mils) gap
3.6 Vdc

DC Resistance (Nominal) (R_{PROBE})

7.3 Ω +0.28 Ω/m (7.3 Ω + 0.087 Ω/ft)

Connector Torque Requirement

0.565 N·m (5 in lb) (minimum)

Case Types and Torque Limits

M10x1 or 3/8 - 24 Cases	33.9 N·m (300 in lb) (maximum)
M10x1or 3/8 - 24 Cases (first three threads)	22.6 N·m (200 in lb) (maximum)
3/8 - 24 Reverse Mount Case	22.6 N·m (200 in lb)

Recommended minimum bend radius

25.4 mm (1.00 in)

Weight

20 g (0.7 oz)

Temperature

Storage	-34°C to +177°C (-30°F to +350°F).
Operating	-34°C to +177°C (-30°F to +350°F).

NOTE: Maximum temp. for sealed ETFE armor is 149°C (300°F).

Relative Humidity

100% condensing nonsubmerged from 2°C to 100°C (35°F to 212°F) when connectors are protected.

Cable

Interchangeability Error

Average scale factor (ASF) change

Typical	Less than 0.09 mV/µm (2.2 mV/mil)
Worst Case	Less than 0.19 mV/µm (4.9 mV/mil)

Apparent gap change

At 1270 µm (50 mil) gap	145 µm (5.8 mils) (maximum)
At 250 µm (10 mil) gap	100 µm (4.0 mils) (maximum)

DC resistance, nominal

Center conductor (R_{CORE})	0.220 Ω/m (0.067 Ω/ft)
Shield (R_{JACKET})	0.066 Ω/m (0.020 Ω/ft)

Capacitance

69.9 pF/m (21.3 pF/ft) (typical)

Minimum bend radius

25.4 mm (1.0 inch)

Connector Torque Requirement

0.565 N·m (5 in lb) (minimum)

Weight

45 g/m (0.5 oz/ft)

Temperature

Storage	-51°C to +177°C (-60°F to +350°F)
Operating	-51°C to +177°C (-60°F to +350°F)

Relative Humidity

100% condensing nonsubmerged from 2°C to 100°C (35°F to 212°F) when connectors are protected.

BENTLY NEVADA®
1617 WATER STREET • MINDEN, NEVADA 89423 • (702) 782-3611 • FAX: (702) 782-9253

European CE mark for
Bently Nevada Proximity Transducer Systems

CE

In this Document is a list of the proximity transducer systems that have the CE mark, applicable standards used for certification, and installation instructions required for compliance.

Proximity Transducer Systems are electronic devices typically used in industrial applications. These systems have been certified using one Technical Construction File (TCF) and declaration of conformity because they are similar in design and application. A Proximity Transducer System consists of a Proximitor® sensor (or transmitter), proximity probe, and extension cable (except for the 25 mm DE transducer which is a single unit).

TCF through TÜV Rheinland of North America A Technical Construction File has been prepared through TÜV Rheinland of North America (TÜV Rheinland File Number: P9472350.01). The certificate of compliance is for Directive 89/336/EEC (EMC Directive). The applicable Generic Norms are: EN50081-2 and EN50082-2.

Installation Instructions
(reference Figure 1) These instructions are an addition to the product manuals.

All Proximitor® Sensors ① and Transmitters ① must be mounted inside an EMI (Electromagnetic Interference) shielded enclosure ④ with a cover.

Compliant Systems and Component Part Numbers

#	Model Names	Model Numbers
1	3300 8 mm	330100, 330101, 330102, 330103, 330104, 330105, 330106, 330130, 330255**
2	3300 RAM	330900, 330901, 330902, 330903, 330904, 330905, 330906, 330930**
3	7200 14 mm	81305, 81723, 81724, 81725, 83936**
4	35 mm Extended Range	76679, 76680, 76681, 76682, 76683, 76684**
5	50 mm Extended Range	24582, 24583, 24710, 28480**
6	25 mm Differential Expansion	102241, 102242, 102243, 102244**
7	990 Vibration Transmitter	990 (uses RAM probe and cable components)**
8	991 Thrust Transmitter	991 (uses RAM probe and cable components)**
9	3300 REBAM®	330600, 330601, 330602, 330603, 330604, 330630**

includes all options and all approval versions of the base model numbers listed
**--any proximity transducer, proximity probe, or extension cable which works correctly with the listed modules.

Testing and Test Levels

Title	EN55022 Emission	EN 61000-4-2 (IEC 801-2) ESD	ENV50140 (IEC 801-3) Rad. RFI	ENV50140 Rad. RFI	EN 61000-4-4 (IEC 801-4) EFT	IEC 801-5 Surge	ENV50141 (IEC 801-6) Cond. RFI	EN 61000-4-8 (IEC 1000-4-8) Mag. Fields
Testing Levels	Emission Class A	8kV; 15kV①	10V/m②	10V/m③	1kV④	0.5kV④	10V⑤	30A/m, 50Hz
Criteria	n/a	A	A	A	B	A	B	A

These notes listed below apply only to the table "Testing and Test Levels"
① discharge method: Contact; Air
② 27-1000 MHz sweep with 80% 1 kHz sine wave amplitude modulation
③ 900 MHz dwell with 100% 200 Hz square wave modulation
④ lines tested: I/O
⑤ 150 kHz-80 MHz sweep with 80% 1 kHz sine wave amplitude modulation

Bently Nevada Technical Publication

The 3300 REBAM® Proximity Transducer System, due to its inherent sensitivity, is susceptible to EMI at levels EN50082-2. Special EMC (Electromagnetic Compatibility) protection measures may be necessary to achieve reliable measurements. Each unique installation must be considered.

Proximity Probes All probes must be mounted in an EMI shielded environment (i.e.typically a machine casing⑥). All probe cables ② and extension cables, running from the point exiting the machine to the EMI shielded enclosure, must be inside metal conduit ⑤ (or equivalent) with the conduit grounded at the machine and the enclosure.

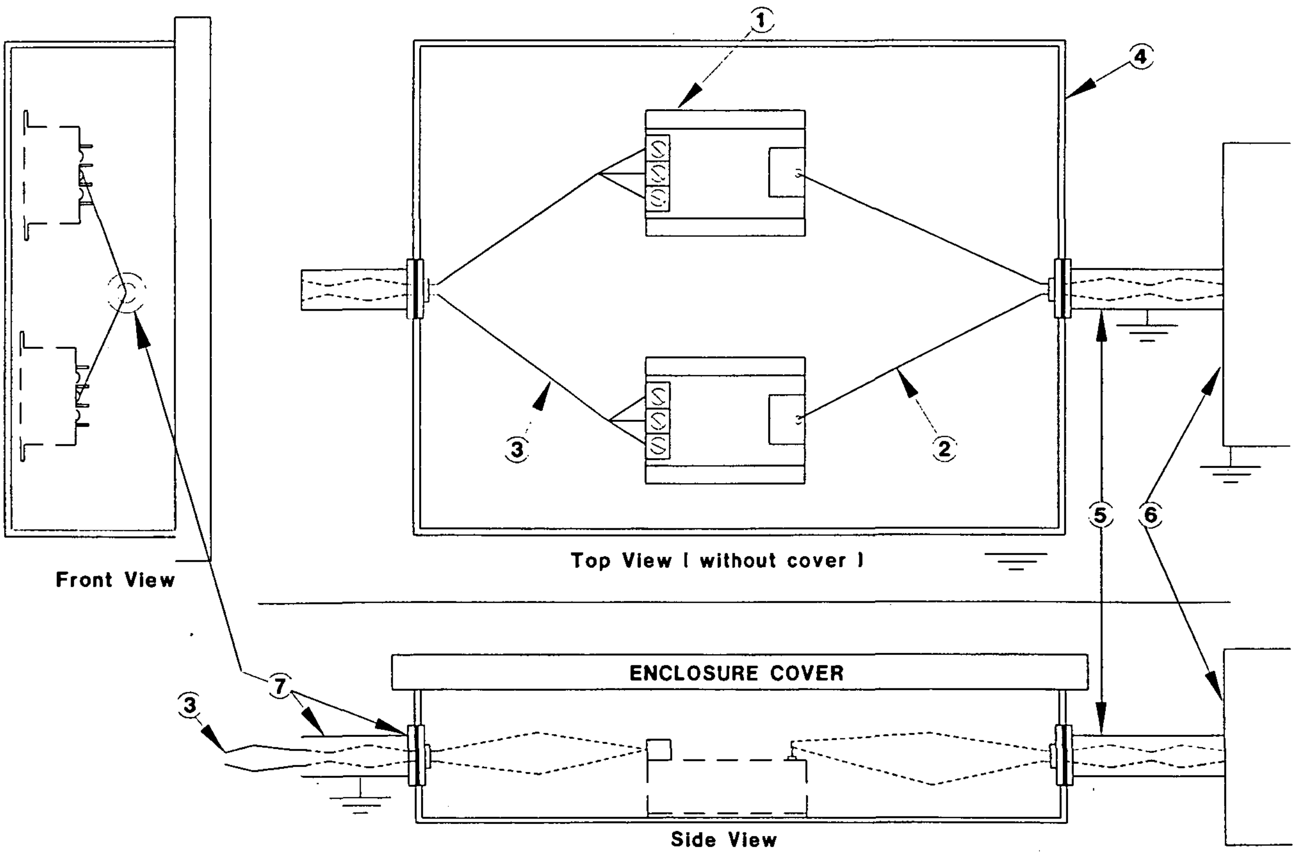
Field Wiring All field wiring ③, from the Proximitor® Sensor enclosure ④ to a receiving unit (i.e. monitor), must be shielded from EMI energy. Acceptable EMI shielding includes solid metal conduit or multi-conductor cable with both a foil and braid shield.

EMI Shielded Enclosures and EMI Shield Grounding Enclosures made of metal typically provide EMI shielding. Covers should be electrically connected to the enclosure or have overlap with the sides of the enclosure, both is preferable. BNC Proximitor® Sensor Housings and Probe Housings, which are made of metal, provide adequate EMI shielding.

Grounding EMI shields ⑦ at the point of entrance to the Proximitor® sensor enclosure④ and any subsequent junction enclosure is required. The shield must be maintained around the wiring as it is grounded to the enclosure.

Exposure of the systems when the EMI shielding is removed (i.e. enclosure cover) will increase EMI susceptibility.

Figure 1



2.10 RTD Temperature Sensing Elements

The RTD temperature sensing probes used on this project are all Class A, 3 wire with a standard PT 100 characteristic as shown in the attached Reference Table for Platinum Resistance Elements. They are manufactured by Temperature Controls Pty Ltd located at 55 Henry Street, Leichhardt, NSW, 2040.

The sensing elements are mounted on the pump and motor to monitor machine bearing temperature and also the motor cooling air temperature. The bearing temperature elements are provided with a spring loaded tip to ensure a positive contact with the bearing surface.

Attached are the following details of the equipment supplied:

Drawing No 3015 Small Terminal Head, Sprung Loaded - Class A RTD

Drawing No 3015A Pipe Extension for 3015

Drawing No 3016 Small Terminal Head, Sprung Loaded - Class A RTD

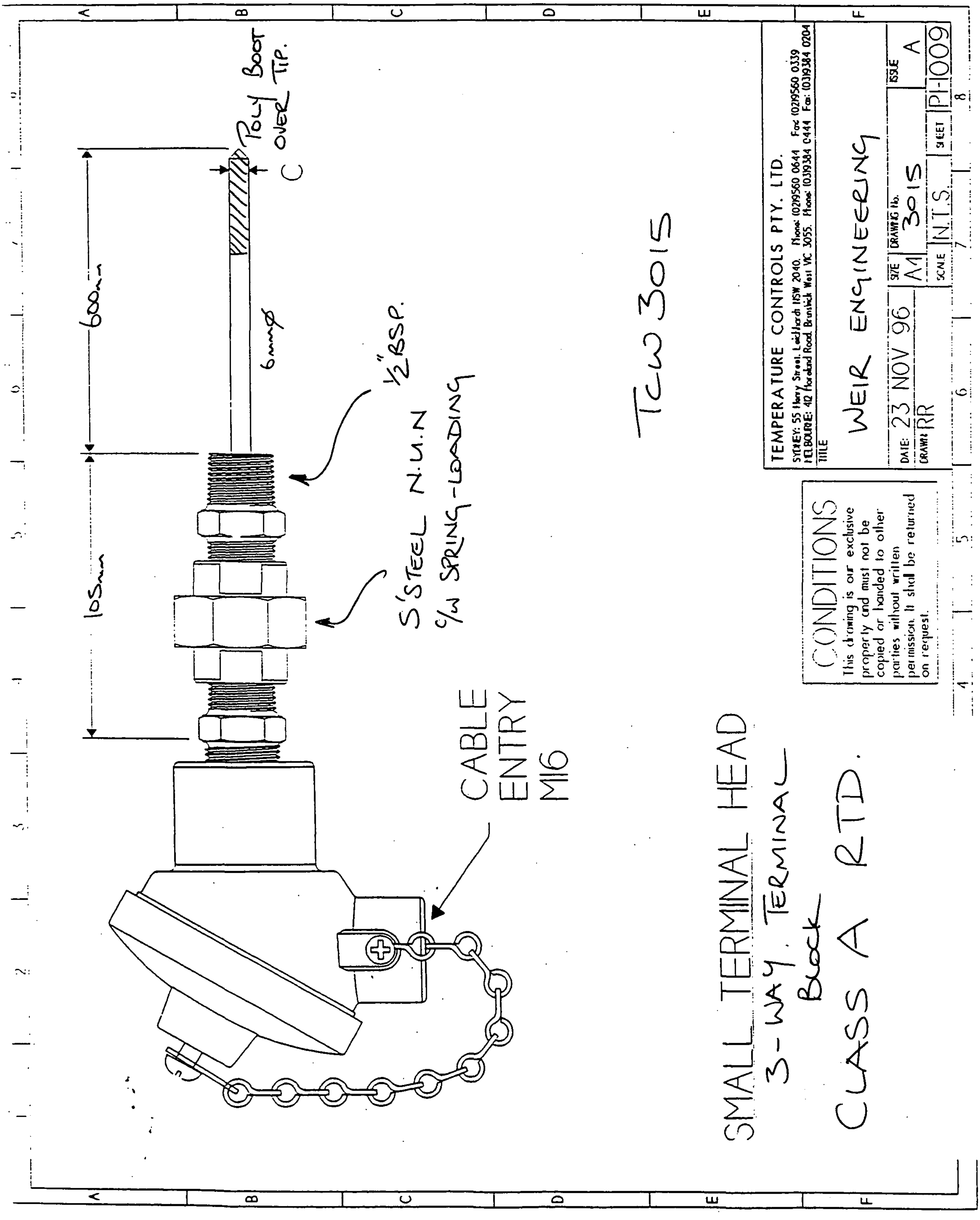
Drawing No 3017 Small Terminal Head, Sliding Compression Process Connection Assembly - Class A RTD

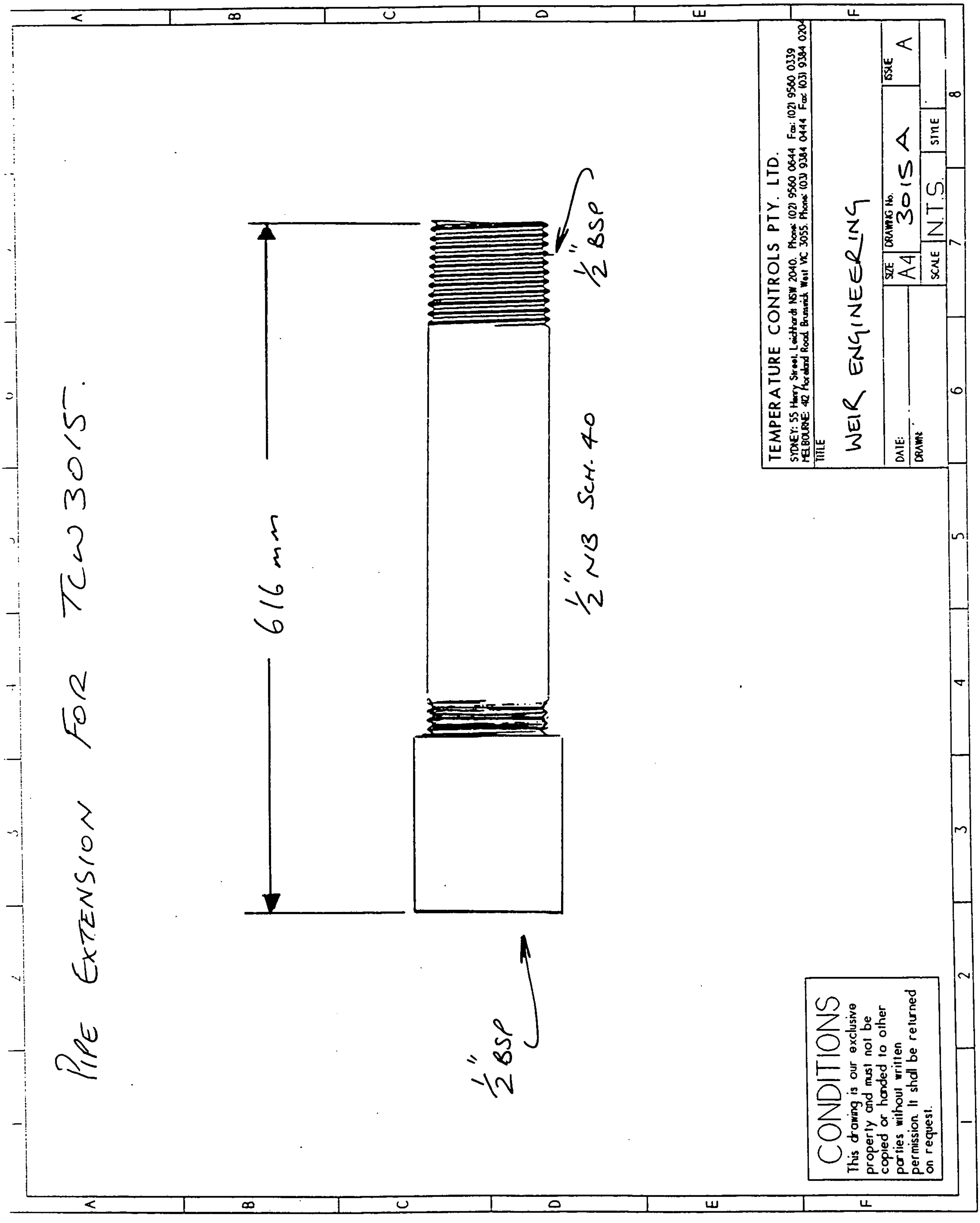
Drawing No 3018 Small Terminal Head, Sprung Loaded - Class A RTD

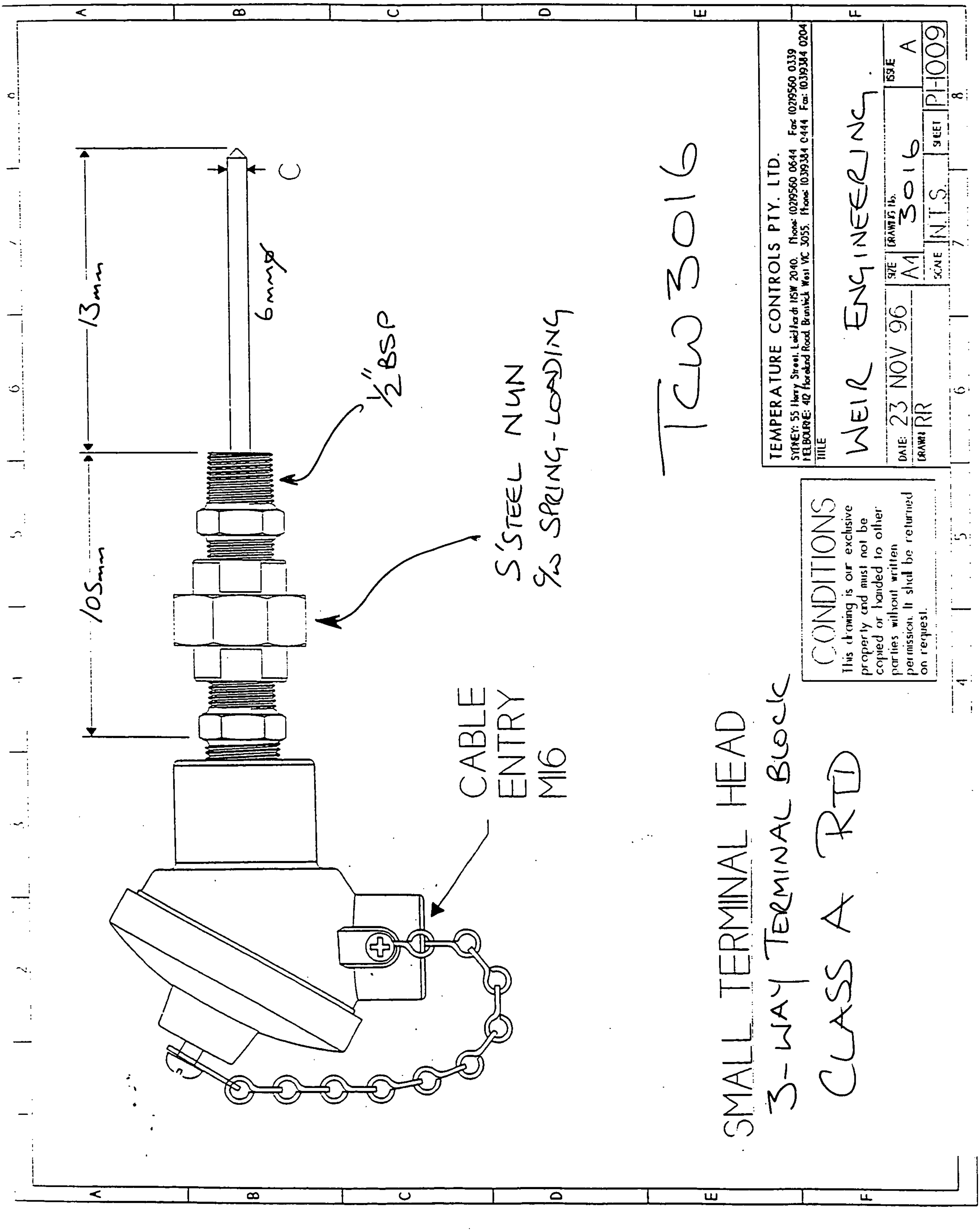
Reference Table for Platinum Resistance Elements

Certificate of Compliance for PT 100 Platinum Resistance Temperature Detectors Type 1/100-30-25 Class A

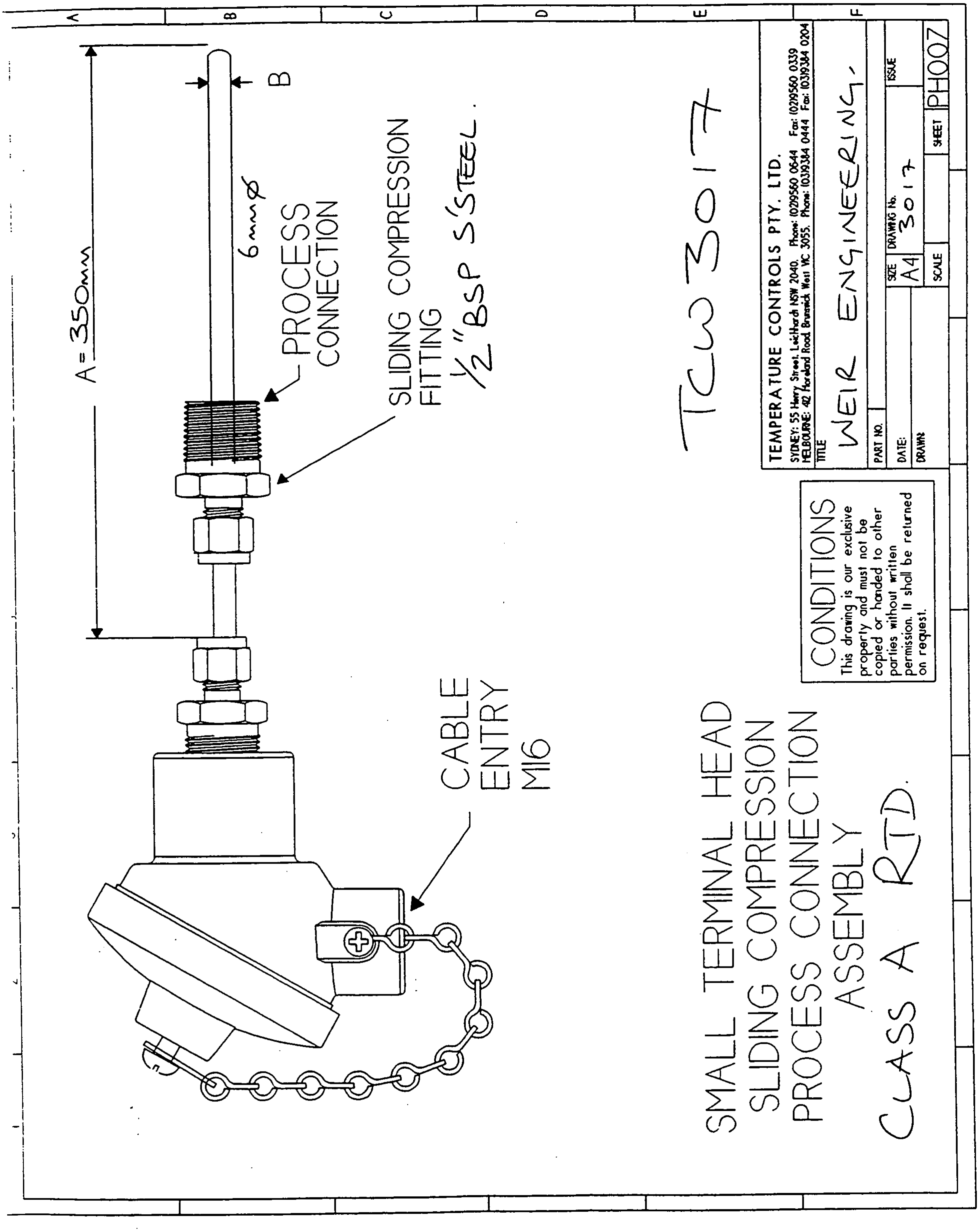
COPY


POLY BOOT OVER TIP.
C
600mm
6mmØ
1/2" BSP.
105mm
S'STEEL N.U.N
C/W SPRING-LOADING
TCW 3015
CABLE ENTRY M16
SMALL TERMINAL HEAD
3-WAY TERMINAL BLOCK
CLASS A RTD.
TEMPERATURE CONTROLS PTY. LTD.
SYDNEY: 55 Harry Street, Leichhardt NSW 2040. Phone (02)9560 0644 Fax (02)9560 0339
MELBOURNE: 412 Moreland Road Brunswick West VIC 3055. Phone (03)9384 0444 Fax (03)9384 0204
TITLE
WEIR ENGINEERING
DATE: 23 NOV 96
DRAWN: RR
SIZE A1
DRAWING No. 3015
ISSUE A
SCALE N.T.S.
SHEET PI-1009
CONDITIONS
This drawing is our exclusive property and must not be copied or handed to other parties without written permission. It shall be returned on request.

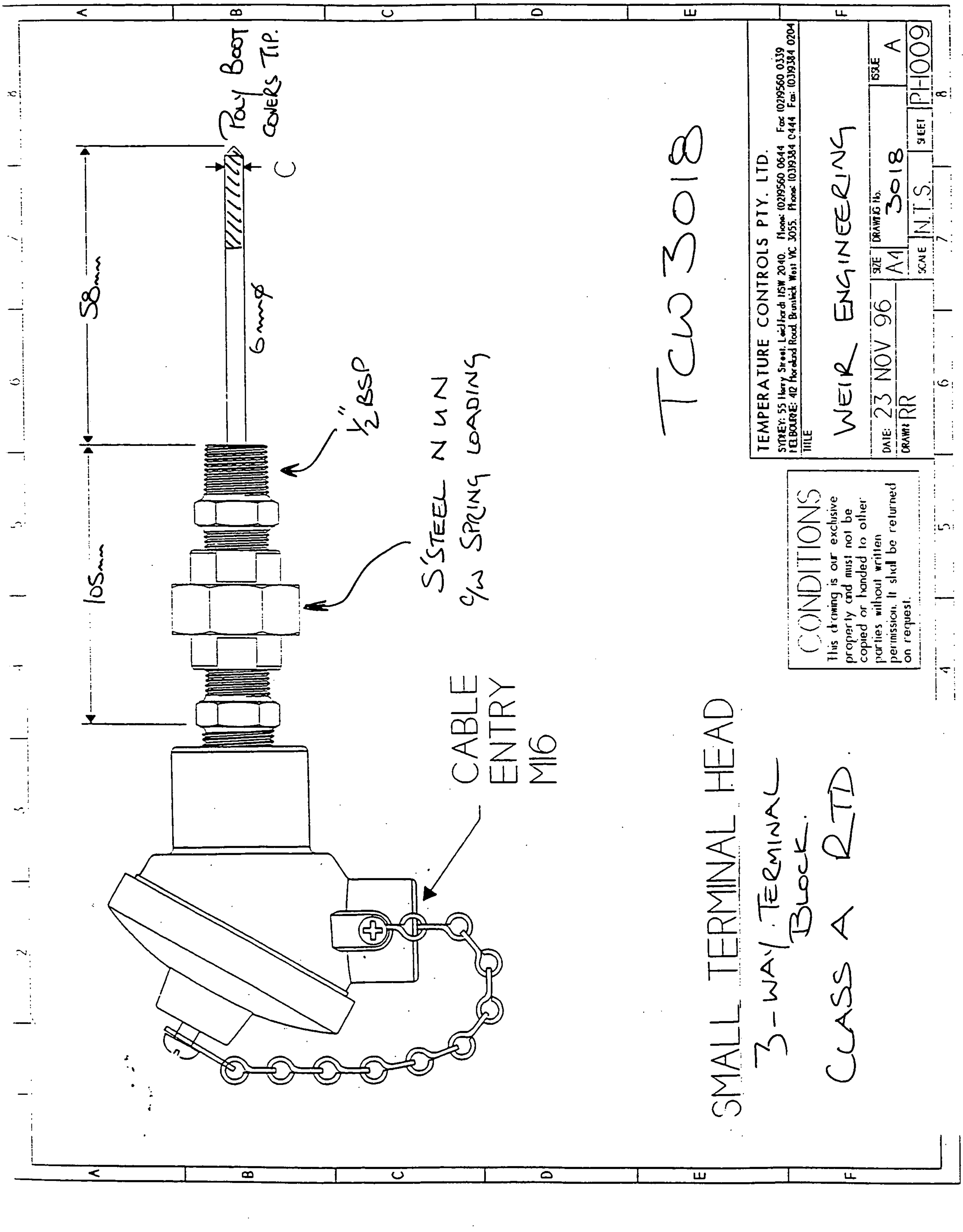

PIPE EXTENSION FOR TCW 3015.
616 mm
1/2" BSP
1/2" NB SCH. 40
1/2" BSP
TEMPERATURE CONTROLS PTY. LTD.
SYDNEY: 55 Harry Street, Leichhardt NSW 2040. Phone: (02) 9560 0644 Fax: (02) 9560 0339
MELBOURNE: 42 Moreland Road, Brunswick West VIC 3055. Phone: (03) 9384 0444 Fax: (03) 9384 020
TITLE
WEIR ENGINEERING
DATE:
DRAWN:
SIZE
A4
DRAWING No.
3015A
ISSUE
A
SCALE
N.T.S.
STYLE
CONDITIONS
This drawing is our exclusive property and must not be copied or handed to other parties without written permission. It shall be returned on request.



TCW 3016
13mm
105mm
6mm ⌀
1/2" BSP
S'STEEL NUN
c/w SPRING-LOADING
CABLE ENTRY M16
SMALL TERMINAL HEAD
3-WAY TERMINAL BLOCK
CLASS A RTD
TEMPERATURE CONTROLS PTY. LTD.
TITLE
WEIR ENGINEERING
DATE: 23 NOV 96
DRAWN RR
SIZE A1
DRAWING No. 3016
ISSUE A
SCALE N.T.S.
SHEET PI-1009
CONDITIONS
This drawing is our exclusive property and must not be copied or handed to other parties without written permission. It shall be returned on request.


A = 350mm
B
6mm ø
PROCESS CONNECTION
SLIDING COMPRESSION FITTING
½" BSP S'STEEL.
CABLE ENTRY M16
TCW 3017
SMALL TERMINAL HEAD
SLIDING COMPRESSION
PROCESS CONNECTION
ASSEMBLY
CLASS A RTD.
CONDITIONS
This drawing is our exclusive property and must not be copied or handed to other parties without written permission. It shall be returned on request.
TEMPERATURE CONTROLS PTY. LTD.
SYDNEY: 55 Harry Street, Leichhardt NSW 2040. Phone: (02)9560 0644 Fax: (02)9560 0339
MELBOURNE: 42 Moreland Road Brunswick West VIC 3055. Phone: (03)9384 0444 Fax: (03)9384 0204
TITLE
WEIR ENGINEERING.
PART NO.
DATE:
DRAWN:
SIZE
A4
DRAWING No.
3017
ISSUE
SCALE
SHEET
PH007

COPY


POLY BOOT COVERS TIP.
58mm
6mm ø
1/2" BSP
S'STEEL NUN c/w SPRING LOADING
105mm
CABLE ENTRY M16
TCW 3018
SMALL TERMINAL HEAD
3-WAY TERMINAL BLOCK.
CLASS A RTD
CONDITIONS
This drawing is our exclusive property and must not be copied or handed to other parties without written permission. It shall be returned on request.
TEMPERATURE CONTROLS PTY. LTD.
SYDNEY: 55 Harry Street, Leichhardt NSW 2040. Phone: (02)9560 0644 Fax: (02)9560 0339
MELBOURNE: 412 Moreland Road, Brunswick West VIC 3055. Phone: (03)9384 0444 Fax: (03)9384 0204
TITLE
WEIR ENGINEERING
DATE: 23 NOV 96
DRAWN: RR
SIZE A4
DRAWING No. 3018
ISSUE A
SCALE N.T.S.
SHEET PH009

TEMPERATURE CONTROLS PTY LTD

A.C.N. 003 512 294

SYDNEY
Phone **(02) 560 0644** Fax (02) 560 0339

MELBOURNE
Phone **(03) 364 0677** Fax (03) 364 1461

THERMOCOUPLES • RTD SENSORS • THERMOWELLS • EXTENSION CABLES

Reference table for platinum resistance elements

Resistance values in Ohm from 0°C to +400°C

°C	0	1	2	3	4	5	6	7	8	9
0	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.28
30	111.67	112.06	112.45	112.83	113.22	113.61	113.99	114.38	114.77	115.15
40	115.54	115.93	116.31	116.70	117.08	117.47	117.85	118.24	118.62	119.01
50	119.40	119.78	120.16	120.55	120.93	121.32	121.70	122.09	122.47	122.86
60	123.24	123.62	124.01	124.39	124.77	125.16	125.54	125.92	126.31	126.69
70	127.07	127.45	127.84	128.22	128.60	128.98	129.37	129.75	130.13	130.51
80	130.89	131.27	131.66	132.04	132.42	132.80	133.18	133.56	133.94	134.32
90	134.70	135.08	135.46	135.84	136.22	136.60	136.98	137.36	137.74	138.12
100	138.50	138.88	139.26	139.64	140.02	140.39	140.77	141.15	141.53	141.91
110	142.29	142.66	143.04	143.42	143.80	144.17	144.55	14'.93	145.31	145.68
120	146.06	146.44	146.81	147.19	147.57	147.94	148.32	148.70	149.07	149.45
130	149.82	150.20	150.57	150.95	151.33	151.70	152.08	152.45	152.83	153.20
140	153.58	153.95	154.32	154.70	155.07	155.45	155.82	156.19	156.57	156.94
150	157.31	157.69	158.06	158.43	158.81	159.18	159.55	159.93	160.30	160.67
160	161.04	161.42	161.79	162.16	162.53	162.90	163.27	163.65	164.02	164.39
170	164.76	165.13	165.50	165.87	166.24	166.61	166.98	167.35	167.72	168.09
180	168.46	168.83	169.20	169.57	169.94	170.31	170.68	171.05	171.42	171.79
190	172.16	172.53	172.90	173.26	173.63	174.00	174.37	174.74	175.10	175.47
200	175.84	176.21	176.57	176.94	177.31	177.68	178.04	178.41	178.78	179.14
210	179.51	179.88	180.24	180.61	180.97	181.34	181.71	182.07	182.44	182.80
220	183.17	183.53	183.90	184.26	184.63	184.99	185.36	185.72	186.09	186.45
230	186.82	187.18	187.54	187.91	188.27	188.63	189.00	189.36	189.72	190.09
240	190.45	190.81	191.18	191.54	191.90	192.26	192.63	192.99	193.35	193.71
250	194.07	194.44	194.80	195.16	195.52	195.88	196.24	196.60	196.96	197.33
260	197.69	198.05	198.41	198.77	199.13	199.49	199.85	200.21	200.57	200.93
270	201.29	201.65	202.01	202.36	202.72	203.08	203.44	203.80	204.16	204.52
280	204.88	205.23	205.59	205.95	206.31	206.67	207.02	207.38	207.74	208.10
290	208.45	208.81	209.17	209.52	209.88	210.24	210.59	210.95	211.31	211.66
300	212.02	212.37	212.73	213.09	213.44	213.80	214.15	214.51	214.86	215.22
310	215.57	215.93	216.28	216.64	216.99	217.35	217.70	218.05	218.41	218.76
320	219.12	219.47	219.82	220.18	220.53	220.88	221.24	221.59	221.94	222.29
330	222.65	223.00	223.35	223.70	224.06	224.41	224.76	225.11	225.46	225.81
340	226.17	226.52	226.87	227.22	227.57	227.92	228.27	228.62	228.97	229.32
350	229.67	230.02	230.37	230.72	231.07	231.42	231.77	232.12	232.47	232.82
360	233.17	233.52	233.87	234.22	234.56	234.91	235.26	235.61	235.96	236.31
370	236.65	237.00	237.35	237.70	238.04	238.39	238.74	239.09	239.43	239.78
380	240.13	240.47	240.82	241.17	241.51	241.86	242.20	242.55	242.90	243.24
390	243.59	243.93	244.28	244.62	244.97	245.31	245.66	246.00	246.35	246.69
400	247.04									

PROUDLY MANUFACTURING IN AUSTRALIA

:F: AG24

ENGELHARD-CLAL

CERTIFICATE OF COMPLIANCE

REFERENCE Lot number 0879

GENTLEMEN We hereby certify that the Platinum Resistance Temperature Detectors Type 1/100-30-25 Class A comply in all respects with the specifications stated.

Conforming to IEC 751

SPECIFICATION Type A 0.5 DIN $\pm$ 0.06 OHM at 0°C.

YOURS

On behalf of

Platinum Sensors

JEWELRY - SILVER INDUSTRIAL PRODUCTS - PLATINUM INDUSTRIAL PRODUCTS - PLATING - REFINING - SPECIAL WIRES
ENGELHARD-CLAL AUSTRALIA PTY. LTD. A.C.N. 007 082 448. 10 PROSPECT STREET, BOX HILL, VICTORIA 3128, AUSTRALIA
TELEPHONE: 61-3 9899 6330 FACSIMILE: 61-3 9899 6360

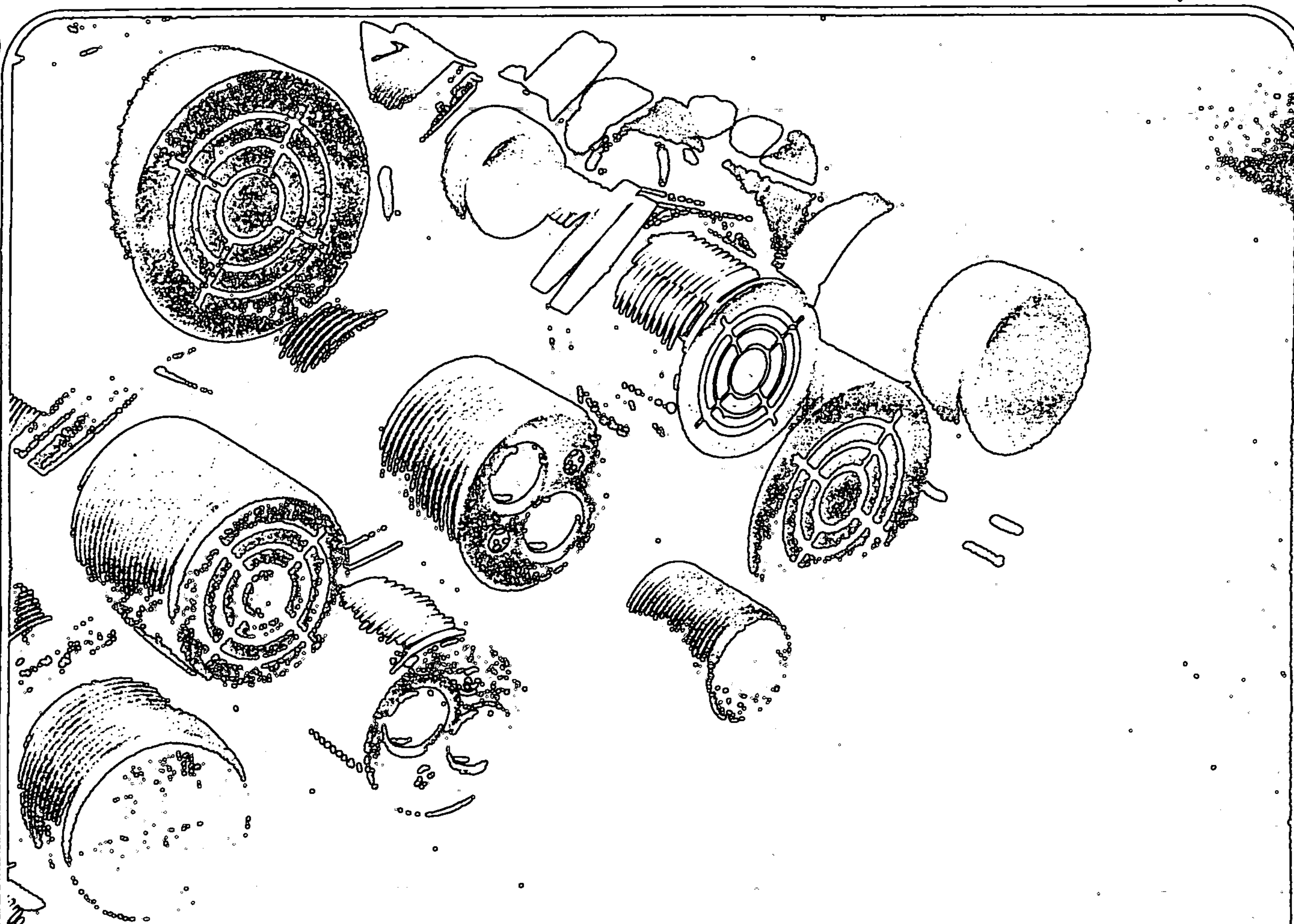
2.11 Motor Moisture Detector

Moisture detectors are located in the motor to detect water leakage from the heat exchanger. There is one in the bottom of the motor housing and one in each heat exchanger, located close to the bottom of the chamber. A Schmersal type IFC 15-30-10yTPD Capacitive Proximity switch has been used to sense the moisture. They are available from NHP Electrical Engineering Products Pty Ltd.

Attached is a brochure on this unit prepared by Schmersal describing the principle of operation, installation and maintenance of these switches.

BULLETIN
I
NOVEMBER 1987

SCHMERSAL
Proximity Switches



NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

Proximity Switches, Inductive, Capacitive, and Optical

Proximity Switches, General

The proximity switch is an electronic signal transmitter. Basically it differs from a mechanical limit switch in that it switches when it is in proximity, that is to say without contact and operates electronically, that is to say in contactless fashion.

As there are no wearing mechanical parts such as actuating elements and contacts, the service life is practically unlimited. Contact burning and contact contamination brought about by ambient influences cannot occur. The electronic proximity switch operates silently, without chatter and non-reactively. It is insensitive to vibration. There is no uncertain contact as can occur with mechanical switching elements as a result of excessively slow actuation, insufficient switching current etc. Contact migration when switching D.C. is eliminated.

Proximity switches should be given preference over electro-mechanical limit switches if:
- Contact difficulties as a result of ambient influences, insufficient switching current etc., are expected
- No actuating force is available
- High switching frequency is needed
- Long service life is necessary
- Considerable dirt must be expected
- Severe vibration and oscillation occur
- An electronic control system is connected
- When switching D.C. it is necessary to prevent contact migration
- No counter force may be exerted by the switch (restoring force in the case of electro-mechanical limit switches, magnetic force in the case of magnetic switches).

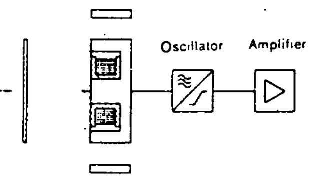
Of course not even proximity switches are entirely free from problems.
When selecting the type and location please note the following:
- There is a difference as to whether the proximity switch has to switch A.C. or D.C.
- The sensors need direct or indirect supply voltage
- The actuating distance differs with actuating vanes of different materials
- The actuating distance is to a slight standard dependent on the ambient temperature
- It is important to consider whether flush or non-flush mounting will be involved
- The minimum distance necessary between two proximity switches must be taken into account
- Especially in the case of high actuating frequencies the length of the actuating vane and the distance from the next vane are important
- Inductive proximity switches react only to metals
- With capacitive sensors the actuating distance is dependent to a greater or lesser standard on the air humidity according to actuating material
- In type selection of capacitive sensors it should be taken into account whether they come in direct contact with liquid
- For optical proximity switches, a changing of the sensing range may occur in the case of dust environment.

These points will be dealt with in greater detail in the description that follows.

IFL Inductive Proximity Switches

The oscillator of the inductive proximity switch generates with the aid of the coil located in the open pot core a high frequency alternating electro-magnetic field which emerges at the active face. If an electrically conductive material (for example metal) is moved into this field an induced eddy voltage occurs. The eddy current flowing extracts energy from the LC resonant circuit (coil-capacitor). The load of the oscillator resonant circuit produces a reduction in the oscillation amplitude. The oscillator is damped. (Fig. 1)

Fig. 1



The reduction in the amplitude is converted by the following electronic circuitry into a clear electrical signal. The switching state of the proximity switch is altered thereby.

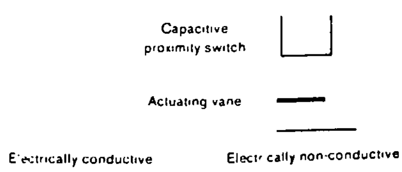
When the electrically conductive material is removed from the alternating field the oscillation amplitude increases again and the original switching state of the sensor is restored via the electronic circuitry. The oscillator is undamped.

IFC Capacitive Proximity Switches

The capacitive sensor operates with an RC resonant circuit (resistor-capacitor) where the capacitance is affected. To achieve this, the electrodes of the capacitor are separated. One electrode is located in the proximity switch on the active face. The second electrode is either the actuating medium with earth or ground as return line or ground itself whereby the actuating medium causes a change in the dielectric (Fig. 2).

When this medium aproaches the active surface and thus the capacitor electrode in the sensor, the capacitance increases to the extent where the value for tuning with the resistor in the resonant circuit is reached and the oscillator starts to oscillate.

Fig. 2



When actuating target is removed oscillation ceases again.
The commencement and ceasing of oscillation, evaluated by the connected electronic circuitry, produces a change in the switching state of the proximity switch. A built-in potentiometer permits subsequent fine adjustment of the actuating distance. The sensor responds to all solid and liquid media such as water, glass, wood, paper, metal, plastic, foodstuffs etc.

As air forms the dielectric of the capacitor, it should be taken into account that a pronounced change in air humidity will cause a change in the actuating distance which can lead to unwanted switching in the case of delicately adjusted proximity switches.

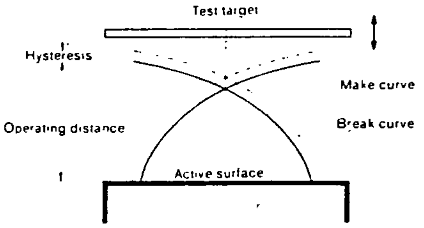
The model "D" capacitive sensors given in the catalogue are particularly suitable for dielectrics such as for example plastics, ceramic, glass, wood, foodstuffs etc. The active surface may not, however, remain wetted with a liquid as otherwise the sensor remains actuated.

For such cases the model "L" sensor should be chosen which is specially suitable (for electrically conductive solid and) for liquid media as it is deactuated as soon as the wetting film breaks down.

Operating Distance "s"

The rated operating distance is the design characteristic of the proximity switch given in the part number (see type code).
The effective operating distance s, may when measured at room temperature and design voltage deviate from the rated operating distance by ± 10%. It is set during production with the aid of a 1 mm thick St 37 (mild steel) test target (by axial approach to the active surface) (Fig. 4). The size of the target can be taken from the technical data.

Fig. 4



$$s_r = s_n \pm 10\%$$

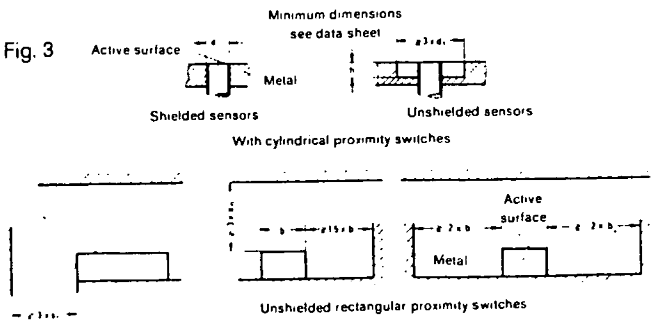
Mounting

(Flush and non-flush)

The alternating field does not only emerge from the active surface vertically. It also fringes slightly to the sides and can be influenced here. A proximity switch of this type (unshielded) is only suitable for non-flush mounting. When being mounted it should be taken care that no material is in the vicinity of the sensor head which can influence the sensor. The minimum dimensions of the free zones shown in Fig. 3 and stated in the technical data must be taken into consideration. If these dimensions are reduced the actuating distance will alter up to the point of undesirable damping.

In the case of embeddable-in-metal proximity switches (shielded types) precaution has been taken against laterally emerging lines of force. Thus for example with inductive proximity switches there is a metal shielding ring around the coil. The proximity switch can no longer be influenced laterally in such cases. It is, however, partially damped and has, therefore, a shorter actuating distance than an unshielded sensor.

Fig. 3



Proximity switches can mutually influence one another, if they are too close to each other. It is therefore necessary to ensure sufficient clearance.

As the operating distance of the proximity switch, as already mentioned, is temperature dependent, in order to obtain the ultimate operating distance s a tolerance of ± 10% is allowed over the complete temperature and voltage limits stated in the technical data.

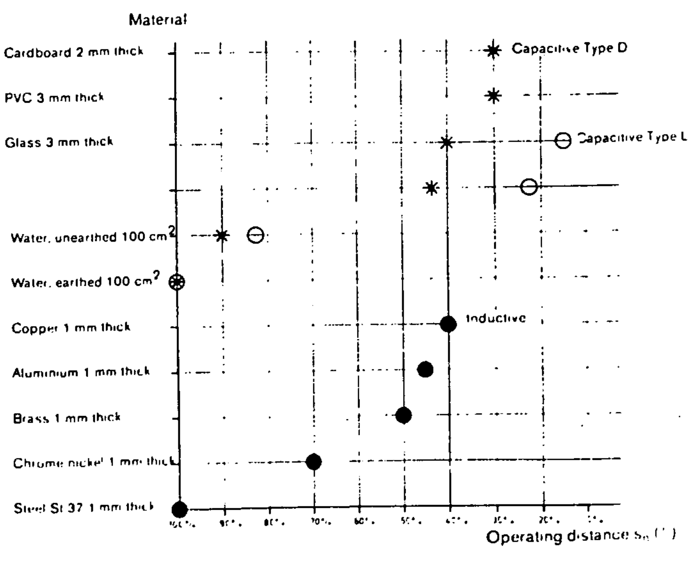
$$s = s_r \pm 10\%$$

To permit satisfactory switching the sensor, in exactly the same way as an electro-mechanical limit switch with snap-action operation, must have differential travel. This differential travel, or hysteresis "H", is dependent on the effective operating distance and is given in the technical data.

All operating distances stated refer to a 1 mm thick steel St 37 (mild steel) test target. Other materials have different distances; typical values are given in the graph below.

Change in operating distance with different materials

Fig. 3



With the capacitive types the data refer to earthed metal targets

Optical Proximity Switches IFO

Not all applications of proximity switches can be handled by inductive or capacitive types. Inductive proximity switches only react to metal material up to an operating distance of approx. 50 mm. Capacitive proximity switches can also detect non-metallic materials, but only in relatively small operating distances. For this reason, we have added to our programme of proximity switches a third kind, the optical proximity switch series IFO. With this series it is possible to widen the range of applications considerably. They were designed by us with the objective to be equal to inductive and capacitive proximity switches of our programme as far as dimensions as well as electrical input and output data are concerned.

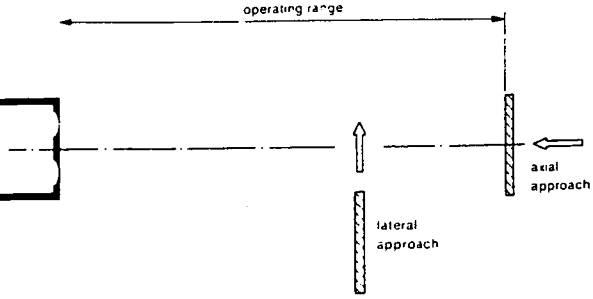
The optical proximity switch IFO is a switch that operates without physical contact, it is suitable for use as specular sensor (without reflector) or as retroreflective sensor (with reflector). Light emitter, receiver and output circuitry for AC or DC are all in one common housing (self-contained type). No additional power supply or switching units or switching amplifiers are necessary. The operating principle is based on modulated infrared light, which is emitted through a lens in the front surface directly on the object to be detected, or on a reflector. The reflected light is received by a second front lens and the receiver, and is processed electronically, causing a change of the output condition of the proximity switch. Removal of the object from the detection barrier causes return to the original switching condition. By synchronization of emitter and receiver circuitry, the optical proximity switch has little sensitivity against interference and also external light.

Optical proximity switches can only detect object surfaces that reflect sufficient ligh' The operating distance, therefore, depends very much on the surface condition (ability for reflection) of the object. A smooth white surface gives a much larger operating distance than a mat-black one. The optimum operating distance of each application can be set by a built-in potentiometer. Unwanted background reflections can thus be elimininated. When setting the sensing distance, the function indicator LED indicates the switching condition and thus helps adjusting the switch. It is further possible to choose between light-operation (ON with reflection, corresponding to NO contact) and dark-operation (OFF with reflection, corresponding to NC contact) by repositioning a small jumper in the connection compartment.

Applications for optical proximity switches IFO
Basically, the optical proximity switch can be used in two different ways:
- as specular-type sensor (proximity switch)
- as retroreflective-type sensor (with reflector)

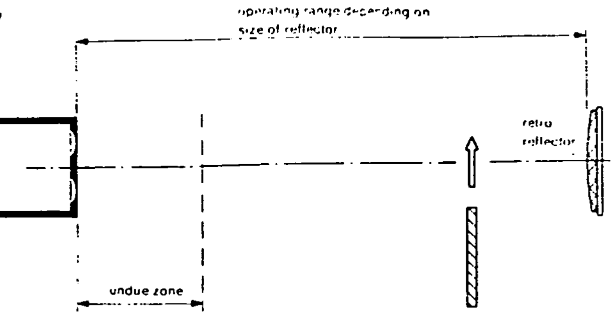
When operating as **specular-type sensor**, the emitted infrared light undergoes a diffused reflection from the object to be detected. Part of this reflection enters the receiving lens of the sensor and causes a switching function.

Fig. 6



When operating as **retroreflective-type sensor**, the emitted infrared light is reflected back to the receiver by a reflector (e. g. retroreflector RC 110). An interruption of this light beam by an object will cause a switching function.

Fig. 7



Operation as **specular-type sensor** is preferred when

- objects shall be detected in small distances
- the objects reflect sufficient light
- objects in the background do not cause interference or if the interference can be eliminated by setting the potentiometer to a reduced sensitivity
- physical conditions do not allow mounting of a reflector.

Operation as **retroreflective-type sensor** is preferred when

- long sensing ranges are required
- there are no interfering objects in the close range, which could reflect the emitted light directly to the receiver
- the sensing distance must be absolutely independent from the distance object / IFO.

Mounting of the optical proximity switch IFO
All optical proximity switches can be flush-mounted. For a reliable function, the following conditions have to be considered:

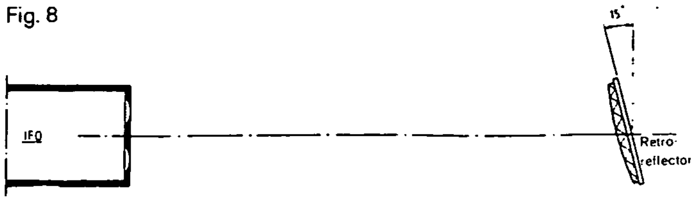
Specular-type sensor
With this kind of utilization, background reflections can interfere, they can be eliminated by a suitable setting of the potentiometer in most cases. To do this, the object is brought into the active range of the sensor, and the sensitivity is slowly lowered at the potentiometer (turning with screwdriver counterclockwise), until the LED-indicator changes (potentiometer setting "object"). Now the object is removed from the active range completely and the sensitivity is slowly increased (turning clockwise), until the LED indicator changes again (potentiometer setting "background"). The final setting of sensitivity is now adjusted in the middle between these two extremes (half number of turns between "object" and "background"). In order to obtain a stable function, there should be a minimum of 6 turns between the two settings "object" and "background" (i. e. optimum setting 3 turns in either direction). If there are less than 6 turns between these settings or if the LED does not change, when removing the object, one should try to remove parts with strong reflection from the active sensing area or to cover them with mat-black surfaces.

Due to the emitting and receiving angles of the light at the double-lens system, it is not possible to detect objects in a very close range, the minimum distance is 30–35 mm. From there all objects are detected up to the maximum sensing range. A special filter, which can be applied to the front of the IFO reduces the sensing range and also allows detection in the very short range from 0 to 150 mm (VF 30).

Retroreflective-type sensor
With this kind of utilization, the adjustment is not quite as simple as with barriers that operate with visible light, because the light spot cannot be seen (infrared). For easy adjustment and mounting, retroreflectors should be used, which allow for adjustment without problems, whereas normal plane mirrors have to be adjusted precisely. We suggest for adjustment of the retro-reflector to follow the beam with the reflector in one hand. The reception of the reflected signal is indicated by the LED indicator.

The triple-reflector allows for an angular misalignment of approx. ± 15°.

Fig. 8

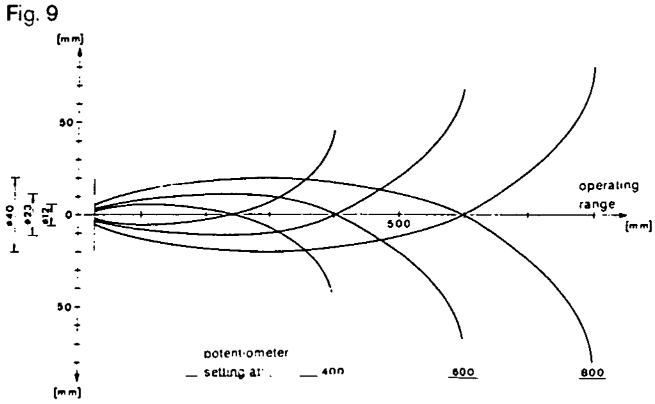


For the standard version, no objects shall be in the close sensing range, roughly up to the specular-type sensor operating range, which depends on the sensitivity set at the potentiometer and on the surface conditions of the object – otherwise direct reflection from this object can cause interference. A unit avoiding this disadvantage is Spez. 1404.

Operating distance of the optical proximity switch IFO As specular-type sensor, the IFO has an operating range which depends upon the surface condition (reflection properties) of the object, as well as its size and the degree of air pollution.

The graph in figure 9 shows the direction of motion of the object versus operating range, with different settings of the potentiometer. The object was of white mat paper with 90% reflection, size 200 x 200 mm and clean air.

Fig. 9



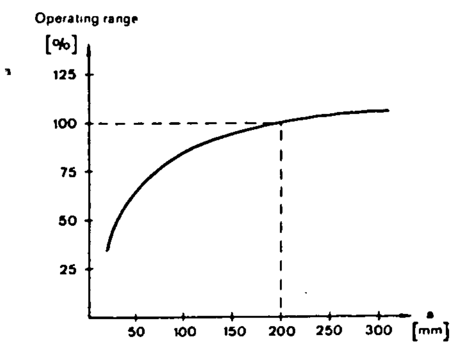
Objects other than white mat paper with 90% reflection require correction factors. The following list shows approximate factors for some materials:

Material	Approx. Correction Factors
metal, polished	1.2 ... 1.6
aluminium, anodised black	1.1 ... 1.8
styrofoam, white	1
PVC, grey	0.5
wood, rough	0.4
cardboard, mat black	0.1

Tab. 1

In addition to its surface, the size of an object affects the operating range. Generally speaking, the sensing range is the shorter, the smaller the size of an object is, however, making an object larger increases the sensing range only up to a certain limit.

Fig. 10

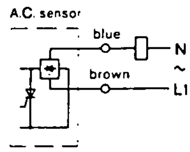


For operation as retroreflective-type sensor, the size of the reflector as well as the degree of air pollution are important. Fog, mist, dust and smoke shorten the maximum range. With our reflector RC 110 (o.d. 84 mm) and clean air, the sensing range is 7-times the one of specular-type operation with white mat paper 200 x 200 mm. The range is shorter with smaller reflectors R 101 (o.d. 21 mm) to R 104 (o.d. 47 mm).

A.C. Proximity Switches (2-Wire)

The inductive, capacitive, and optical proximity switches given in the catalogue for connection to A.C. are constructed on the two conductor system. They can be connected in exactly the same way as mechanical limit switches, that is to say in series with the load (Fig. 11). The sensor receives its supply voltage via the load and is thus operational.

Fig. 11



Thus a low leakage or no-load current flows through the load. When A.C. proximity switches are "on" (carrying load current) there will be a voltage drop of approximately 3 ... 8 volts depending on type.

The A.C. sensors are provided with internal protection against transient voltage peaks from the main power supply.

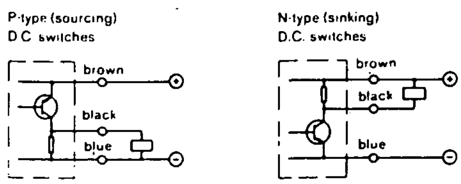
D.C. Proximity Switches (3- and 4-Wire)

The inductive, capacitive, and optical D.C. sensors in this catalogue have a separate circuit for the supply voltage and for this reason an additional lead for the load.

The three-conductor system proximity switches operate as either N.O. or N.C. and the 4-wire sensors have complementary outputs (one N.O. and N.C.) and can be used as changeover switches.

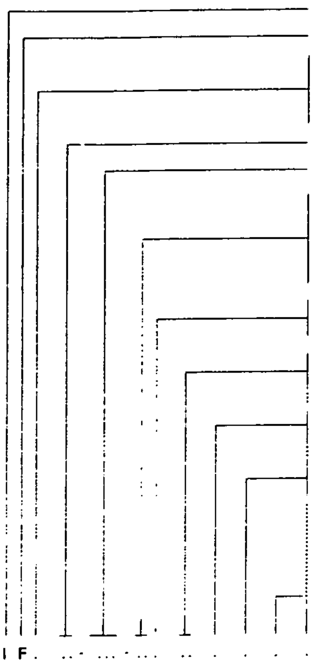
In selection of the electronic signal transmitters attention must be paid to the type of circuit (Fig. 12):
P-type proximity switches (pnp) switch the positive potential to the load (sourcing).
N-type proximity switches (npn) switch the negative potential to the load (sinking).

Fig. 12



All D.C. sensors in this catalogue are provided with protection against reverse polarity connection of the supply lines. The proximity switch is not damaged as a result of reverse connection of the + and − supply leads. No switching function occurs. A built-in diode protects it against inductive voltage peaks. In order that the transistor output does not receive any floating potential as a result of spurious pulses on actuation of an electronic system, it is provided with a series resistor for the load. Some types of the inductive and all types of the optical proximity switches are additionally supplied with short-circuit protection.

Selection Guide



- I = Sensor, proximity switch
- F = With actuating surface
- L = Inductive proximity switch
- C = Capacitive proximity switch
- O = Optical proximity switch
- = Rated operating distance s_n
- = Housing design
- 11 = 1 NC + 1 NO
- 10 = 1 NO
- 01 = 1 NC
- 10/01 = Convertible
- y = Standard of protection IP 65
- z = Standard of protection IP 67
- St = Plug connection
- T = Rigid cable protector
- N = N-type } D.C. sensors
- P = P-type } only
- L = Capacitive sensor also for liquids
- D = Capacitive sensor specially for dielectrics such as plastic, wood, paper etc.
- U = U_B = 15–250 VAC / I_A = 500 mA
- K = Short-circuit protection
- G = LED function indicator

I F . . . .

Parallel Connection Series Connection

In principle series or parallel connection of proximity switches is possible. Here, however, attention must be paid to the peculiarity of the sensors.

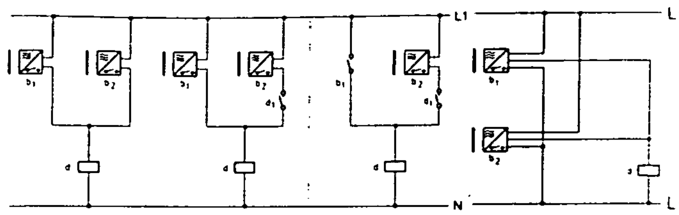
Parallel connection of A.C. sensors

It should be noted that the sum of the no-load currents of the individual sensors is not so great that the connected contactor relay remains activated. The no-load currents are stated in the type table.

In the case of proximity switches which are actuated alternately parallel connection presents no difficulty.

If, however, two sensors switching to one contactor coil are switched on consecutively, only the one first actuated shall switch and, thus, deprives the second one of sufficient supply voltage. If damping of the first proximity switch is eliminated, a quick acting contactor drops out momentarily until the second one is operational again. For this reason a contactor circuit with self-hold is only conditionally possible (Fig. 13). This also applies if a mechanical limit switch takes the place of a sensor.

Fig. 13 Fig. 14



Parallel connection with two sensors — Self-hold control with two sensors — Self-hold control with one sensor and one N.O. pushbutton — Parallel connection, e.g. with two P-type sensors

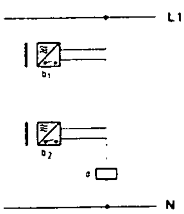
Parallel connection of D.C. sensors

As all proximity switches receive the full supply voltage, any number may be connected in parallel (Fig. 14).

Series connection of A.C. sensors

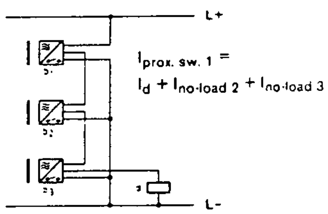
With series connection as well the voltage drop of the individual proximity switches and of the load unit should be taken into account. Two, at the very most three sensors having a voltage drop of 8 volts, may be connected in series (Fig. 15). Up to five sensors of the version with voltage drop 3 volts may be wired in series.

Fig. 15



Series connection with two sensors

Fig. 16



Series connection e.g. with three P-type sensors

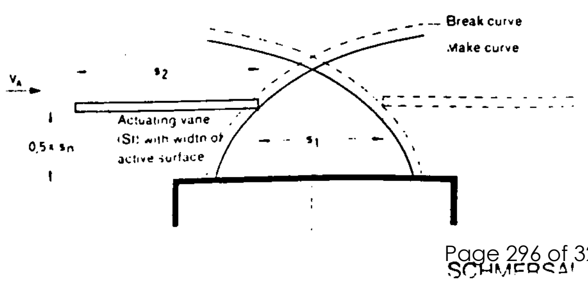
Series connection of D.C. sensors

With series connection the making/breaking capacity of the first proximity switch should be taken into account. Sensor b_1 carries the current of the load, increased by the sum of the no-load currents of the remaining proximity switches in series (Fig. 16).

Response Rate

The switching frequency (see technical data) in most cases is not of as much interest as the minimum length of the actuating target which is necessary with a given target velocity in order to switch the load. It must be taken into account that the load in exactly the same way as the proximity switch also has a distinct response time.

Fig. 17



SCHMERSAL

The maximum target velocity is dependent upon:

1. The response time t_E of the sensor
2. The attenuation range of the sensor
3. The length of the actuating target
4. The response time of the load

Where:

t_E = Response time (ms) of the proximity switch constant for all target velocities; it is the time required for the output to respond after the target reaches the specified operate point (turn-on time).

s_1 = Target travel (mm) in attenuation range (see technical data)

s_2 = Target length (mm)

t_s = Load response time (ms) must be taken from the data sheets of the contactor or relay manufacturer

v_A = Target velocity (m/s)

$$s_2 = v_A (t_E + t_s) - s_1$$

$$v_A = \frac{s_1 + s_2}{t_E + t_s}$$

Example:
Determine the minimum target length to operate IFL 15-30-10zTG 220 VAC, when the target velocity is 2 m/s and the load response time is 20 ms.

Given that: v_A = 2 m/s, s_1 = 13 mm (IFL 15-30-10zTG-220 VAC
t_E = 18 ms, t_s = 20 ms

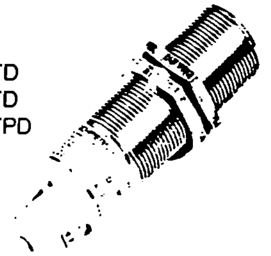
To find: s_2 = ? mm
$s_2 = v_A \cdot (t_E + t_s) - s_1$ $\qquad t_E + t_s = 38$ ms

$$s_2 = v_A (t_E + t_s) - s_1$$
$$= 2 \cdot 38 - 13$$
$$s_2 = 63 \text{ mm}$$

Capacitive Proximity Switches · Series IFC 15-30/D

15 mm operating distance · shielded specially for dielectric materials

IFC 15-30-10yTD
IFC 15-30-01yTD
IFC 15-30-10yTPD

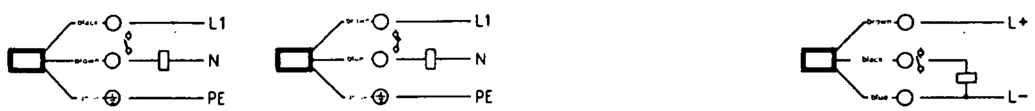


Technical Data:

Housing dimensions as per EN 50 008

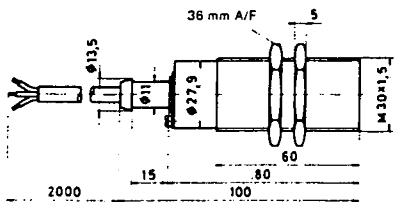
Series:	IFC 15-30-10yTD	IFC 15-30-01yTD	IFC 15-30-10yTPD
Voltage range, U_b:	90 ... 250 VAC		18...30 VDC P-type
Sensing principle capacitive "D" (see page I-5):	2-wire		3-wire
Rated operating distance, s_n:	15 mm, flush mountable		
Output function:	N.O.	N.C.	N.O.
Supply frequency:	48–62 Hz		
Residual ripple:			≤ 5% as per DIN 41 755
Output current, I_A:			max. 50 mA
No-load current:	approx. 3 mA (110 VAC)		max. 15 mA (24 VDC)
Voltage drop, loaded, U_d:	approx. 7 V (100 mA)		max. 4.5 V (50 mA)
Hold power:	4–30 VA		
Pick-up power:	max. 120 VA inductive		
Protective circuit:	induction protection		protected against wrong polarity connection and induction, short circuit protection for approx. 5 min.
Response time, t_E:	approx. 43 ms (220 VAC)		20 ms (24 VDC)
Test target size:	30 x 30 1 mm St 37 (mild steel)		
Effective operating distance, s_r:	adjustable, depending on material[1]) example see table page I-5 (fig. 3)		
Ultimate operating distance, s:	s_r ± 15% at 0 – +65°C		
Switching hysteresis, H:	3–20% s_r, refer to steel		
Temperature range:	−25°C ... + 65°C		
Enclosure sealing:	IP 65 as per DIN 40 050		
Housing:	brass sleeve + 2 nuts[2]), zinc-plated and chromated		
Connections:	cable HO 3VV-F 3 G 0.75		cable LiYY 3 x 0.34 mm²
	2 m long, permanently embedded, with rigid cable protector		

Connection diagram:



Units with function indicator (LED) on request.

[1]) The adjustable effective operating distance should be 75 % of the rated operating distance with significant temperature fluctuations.
[2]) Instead of nuts, mounting clamp H 30 can be supplied (see page I-56).



Section 3 Design Criteria and Process Description

The pump instrumentation comprises monitoring equipment for the following functions:

3.1 Vibration Measurement

The vibration level on each bearing and the pump housing are monitored by Bently Nevada Velometers. The Velometer transducers were used in preference to Accelerometers because of the lower characteristic vibration frequency of larger size machines. The Velometer is accurate over a frequency range of about 8Hz to 2kHz.

The vibration measurement equipment is configured as follows:

- A dual transducer/ local monitor unit is provided for each pair of vibration probes.
- A local panel readout of vibration amplitude in mm/s for each bearing
- A 4-20mA output for each bearing for the BCC control system
- Adjustable alarm and shutdown setpoints with voltage free contacts for connection to the BCC control system.

3.2 Temperature Measurement

The temperature is monitored for the main bearings, motor stator windings and motor cooling air. They are all RTD type sensors with PT 100 platinum elements.

3.2.1 Bearing Temperature

The RTD sensors are located to monitor the outer race temperature of each anti friction bearing on the pump and motor.

The probe is fixed into the bearing housing and positioned at the centre of the outer race. A spring-loaded measurement tip is included to ensure good contact with the surface of the roller bearing outer race.

A hose proof junction box with screwed lid is fitted to each RTD to permit the connection of external wiring and screwed conduit.

All the bearing temperature signals are taken back to the Bently Nevada 6 channel temperature monitor.

3.2.2 Motor Cooling Air Temperature

The RTD sensors are located to monitor the motor cooling air temperature to and from each heat exchanger.

A hose proof junction box with screwed lid is fitted to each RTD to permit the connection of external wiring and screwed conduit.

All the air temperature signals are taken directly back to the BCC control system.

3.2.3 Motor Stator Winding Temperature

The RTD sensors are embedded in the motor stator windings to measure the winding temperature in each phase. There are three RTD's provided per phase.

All of the signals are taken to a junction box located on the side of the motor.

All the stator winding temperature signals are taken directly back to the BCC control system.

3.3 Speed Measurement

The motor and pump speed is measured independently via proximity sensors located on the drive shaft. A digital pulsed signal is sent back to the speed-monitoring module in the Bently Nevada system rack.

Normally both signals will be identical unless there is a sheared coupling. The signals are monitored by the BCC control system for this occurrence.

The pump speed sensor has two proximity probes, phase displaced so that the rotation direction can be determined and an alarm raised for reverse rotation.

3.4 3300 System Compatibility Guide

The following publication entitled 3300 System Compatibility Guide (Part No 104003-01 Rev D) is prepared by Bently Nevada for plant personnel who operate and maintain the system. It provides basic design information on 3300 monitoring system and a system compatibility guide.

The following sections are included:

3.4.1 Operating Information

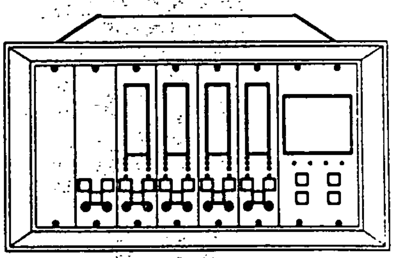
3.4.2 Installation

3.4.3 Maintenance and Trouble Shooting

PART NO. 104003-01
REVISION D,
JUNE 1994

3300 SYSTEM COMPATIBILITY GUIDE

BENTLY NEVADA®



NOTICE

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 system. Pay particular attention to those areas designated by the following symbols.

⚠ WARNING

High voltage present. Contact could cause shock, burns, or death.

Do not touch exposed wires or terminals.

⚠ CAUTION

Machine protection will be lost during calibration.

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CONTENTS

List of Tables

1 INTRODUCTION

The 3300 system has been enhanced to upgrade the computer/communications interface options. The computer/communication interface options are called the Serial Data Interface/Dynamic Data Interface or SDI/DDI and were released in April 1992. The external interfaces for dynamic and transient data, DDIX and TDIX, were released in Aug 1992 and July 1993 respectively. 3300 components that have been changed to implement these interface options are the System Monitor, AC and DC Power Supply, rack backplane, and monitor firmware. 3300 systems that consist of these upgraded components are called the SDI/DDI system.

Although the upgraded components have replaced the older components, there will continue to be occasions when questions on compatibility between old and new components will come up. This compatibility guide addresses questions created by this enhancement by showing how to:

- Identify the three supported configurations of the 3300 system.
- Choose spare parts for use in the original and SDI/DDI system.
- Choose 3300 systems that are compatible with your computer interfaces.

The information in this guide is divided into these two sections:

Section 2, System Identification, lists the three configurations of the 3300 Monitoring System which are authorized by Bently Nevada Corporation and shows how to identify each one. Identifying your system will help you make decisions about replacement parts and computer/communications interfaces.

Section 3, Compatibility, presents guidelines about using spare parts with different configurations of the 3300 system. It also describes the compatibility between 3300 systems, communication interfaces, and monitoring and diagnostic software.

The table on the following page shows some definitions and explanations for the part numbers and abbreviations used in this guide.

1 INTRODUCTION

PART NUMBER ABBERVIATION	DESCRIPTION	FUNCTION
3300/01-01	Original version of the basic 3300 System Monitor.	Basic service to the rack including setpoint adjust, reset, OK Relay, and system Keyphasor signals.
3300/01-02	Serial Interface System Monitor.	All of the functions of the 3300/01-01 plus serial communications interface using Allen-Bradley or Modicon Modbus communication protocol.
3300/03-01	Enhanced version of the basic System Monitor.	All of the functions of the 3300/01-01 System Monitor. Can be upgraded to a Serial Data Interface or Dynamic Data Interface System Monitor through an authorized service center. Contact your local Bently Nevada Sales and Service office for more details.
3300/03-02	Serial Data Interface, SDI, System Monitor.	All of the functions of the 3300/01-02 plus enhanced serial communications capability.
3300/03-03	Dynamic Data Interface, DDI, System Monitor.	All of the 3300/03-02 functions plus the functions of a Dynamic Data Manager Communications Processor with added features.
DDM CP	Dynamic Data Manager Communications Processor.	Acquires steady state dynamic and static data from a monitor rack and provides temporary data storage and communications to a Bently Nevada host computer.
TDM CP	Transient Data Manager Communications Processor.	Provides all of the functions of a DDM CP plus acquires transient (start-up/coast down) dynamic and static data from a monitor rack and provides temporary data storage and communications to a Bently Nevada host computer.
TDIX	Transient Data Interface/ Serial Data Interface	External communications module that provides all of the functions of the TDM and 3300/03-02, plus additional features.
PDM CP	Process Data Manager Communications Processor.	Acquires process variable data, provides temporary storage and communication to a Bently Nevada host computer.
SDIX/DDIX	External Serial Data Interface/Dynamic Data Interface.	An externally housed communications module designed for use with a 3300/03-01 System Monitor in an original 3300 system. Provides the same communications interface functions as a 3300/03-02 or 3300/03-03 System Monitor.
DDM/TDM Software	Monitoring and diagnostic software package.	Applications software for online monitoring and diagnostics. Interfaces to monitor systems through DDM and TDM CP's and to process variable measurements through a PDM CP.
DDM2/TDM2 Software	Monitoring and diagnostic software package.	Second generation of the DDM/TDM software. Interfaces to DDI, DDIX and TDIX in addition to all the communication processors which the original DDM/TDM software worked with.
System 64	A computer-based online monitoring and diagnostic system.	Communicates with up to 64 monitor racks using DDM CP interfaces to the racks.
PIM	Power Input Module	Located behind the Power Supply and System Monitor on a 3300 rack. This module contains the Input/Output connections for computer/communication interfaces, system functions and rack power.

2 SYSTEM IDENTIFICATION

Bently Nevada supports the three configurations of the 3300 Monitoring System, as shown in the following table. The configurations are defined by the rack (backplane version), Power Supply, System Monitor, and firmware installed in individual monitors. These configurations are as follows:

Original System

This is the first generation 3300 System. This system may have serial communication capability, but it predates the internal data interfaces (SDI/DDI) and most recent external data interfaces (SDIX/DDIX and TDIX). These systems can be upgraded to the Mixed System or SDI/DDI System configuration, depending on your interface requirements. See the System Compatibility section for more information.

Mixed System

This is the Original System with a System Monitor upgrade to allow use of the new generation external data interfaces: SDIX/DDIX and TDIX.

SDI/DDI System

This is the newest generation of the 3300 System. The SDI/DDI System provides enhanced serial communication capabilities to machinery control systems and direct data interface capability to a computer operating with Bently Nevada monitoring software.

Configuration	System Monitor	Rack (Backplane)	Power Supply	Monitor Firmware
Original (old) System	3300/01-01 or 3300/01-02	3300/05 Option A = 01 through 17	3300/10 or /11	Original firmware or SDI/DDI firmware
Mixed System	3300/03-01	3300/05 Option A = 01 through 17	3300/10 or /11	Original or SDI/DDI firmware
SDI/DDI system	3300/03-01, 3300/03-02, or 3300/03-03	3300/05 Option A = 21 through 37	3300/12 or /14	SDI/DDI firmware

The following subsections discuss how to determine the configuration of your 3300 System. You may use the following steps as a guideline to identify your monitoring system.

1. Examine the front panels of the System Monitor and Power Supply and check the Power Input Module on the back of the rack. Use the information in subsections 2.1, 2.2 and 2.3 to determine your system configuration.

2. If there is any question as to the system configuration after completing step 1, use subsection 2.4 to identify the backplane. The backplane determines whether the rack is an SDI/DDI System rack or an Original System rack.

3. Use subsection 2.5 to determine the firmware identitiy on individual 3300 monitors. The firmware in some early 3300 monitors is not compatible with newer generation data interfaces. Similary, some new multi-channel monitors are not compatible with older external Communications Processors. See Section 3 for compatibility information.

2 SYSTEM IDENTIFICATION

2.1 Original System

- A system which is not compatible with the SDI/DDI system will consist of the System Monitor, Power Supply and one of the Power Input Modules shown here.
- The system backplane will be either the original backplane or the original backplane with Serial Interface capability.
- If any question exists about the version of the backplane see Section 2.4.
- To upgrade this system to use the 3300/03 Serial or Dynamic Data Interfaces requires a new backplane, Power Supply, System Monitor, and monitor firmware. Bently Nevada part number 104002 is a complete rack upgrade kit. Contact your Bently Nevada representative to upgrade a system.
- You can determine what parts can be used as spares in this system by using Section 3.

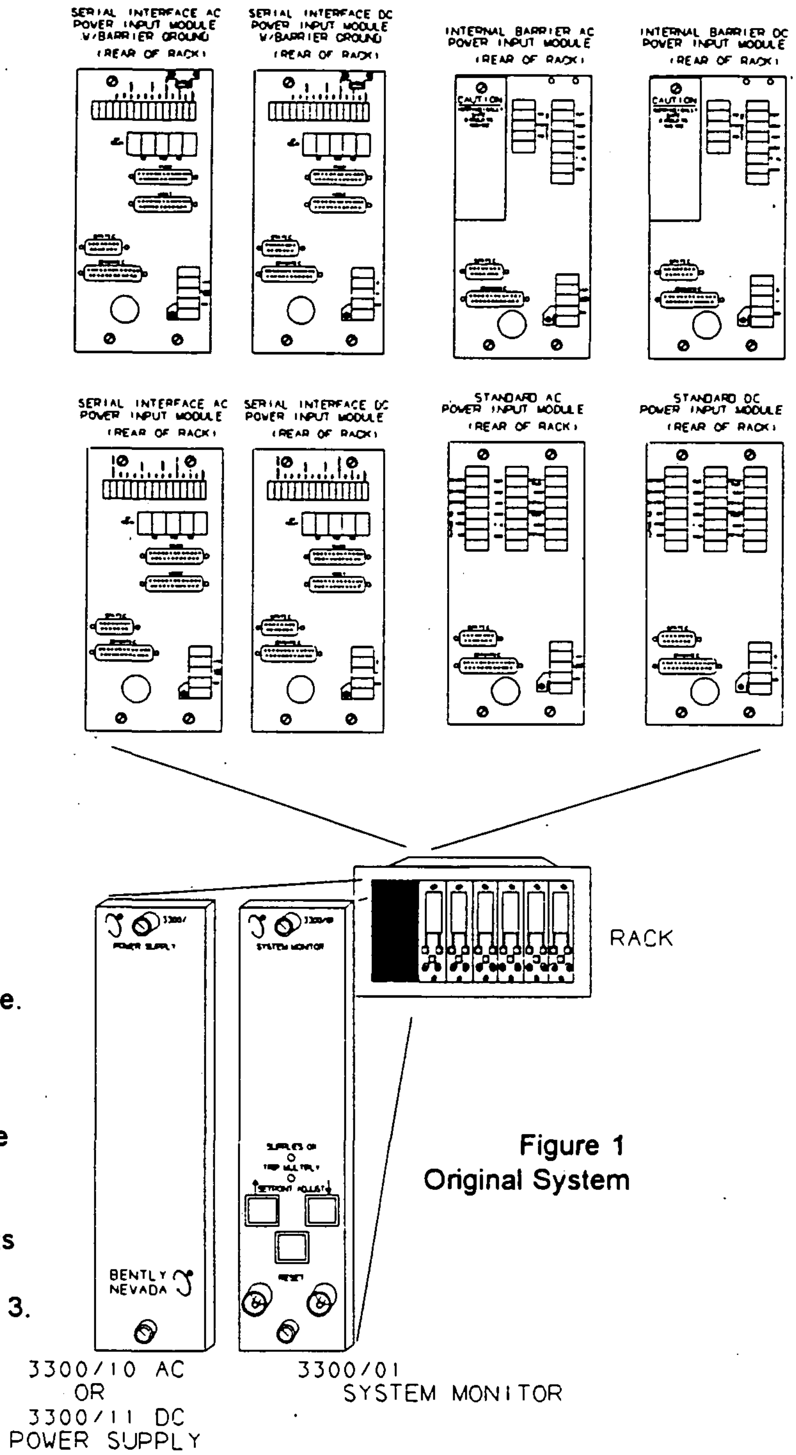


Figure 1
Original System

2 SYSTEM IDENTIFICATION

2.2 SDI/DDI system

- A SDI/DDI system is shown here.
- You can determine what parts can be used as spares in this system by using Section 3.

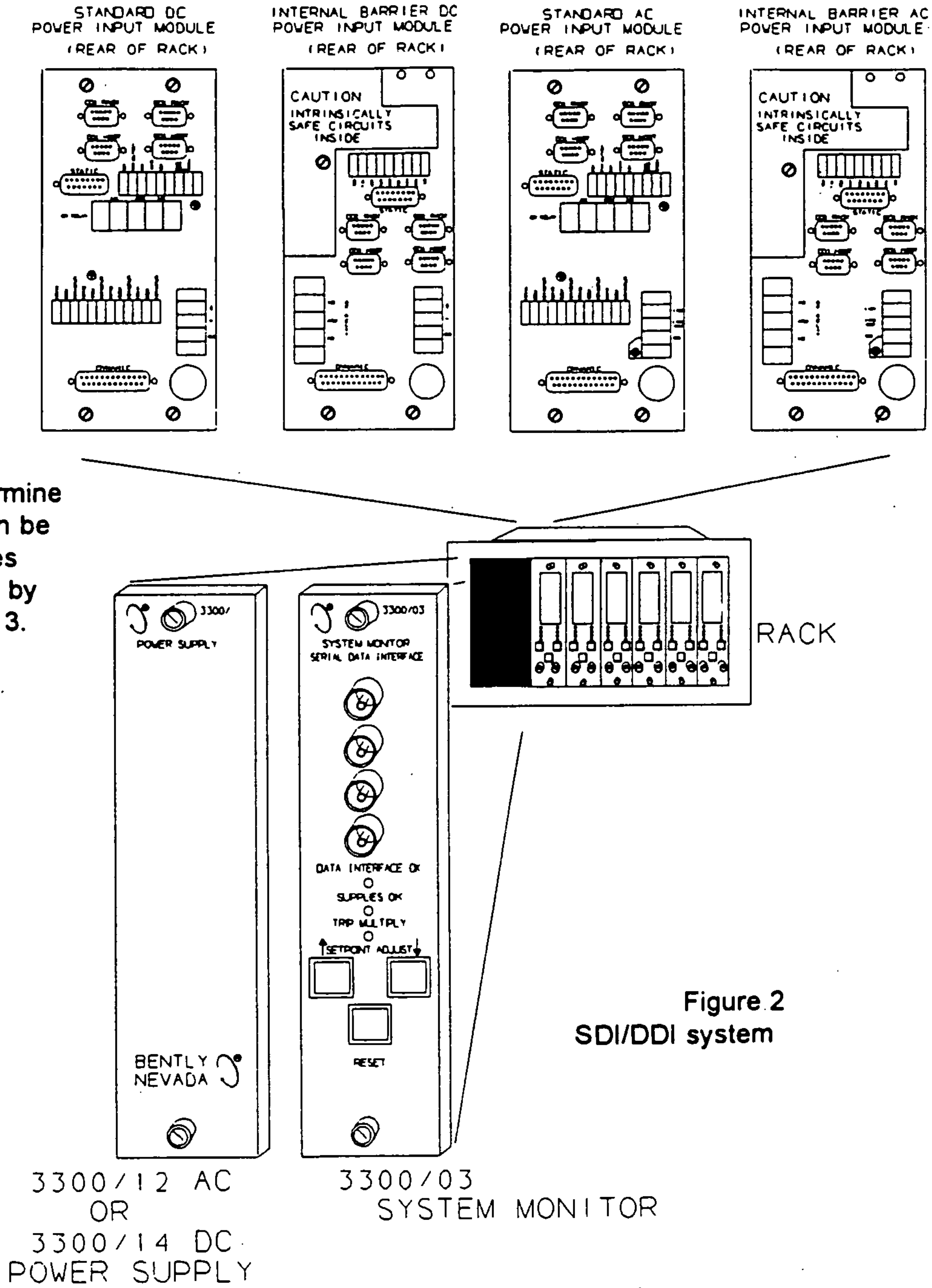


Figure 2
SDI/DDI system

2 SYSTEM IDENTIFICATION

2.3 Mixed System

- A mixed system is an original system with a 3300/03-01 System Monitor a 3300/10 or 3300/11 Power Supply, an original backplane, and one of the original Power Input Modules shown here.
- In this configuration the 3300/03-01 is a replacement for the 3300/01-01 System Monitor. Note that only two Keyphasors®, KΦ1 and KΦ2, are available.
- See Section 3 for information on compatibility for this system configuration.

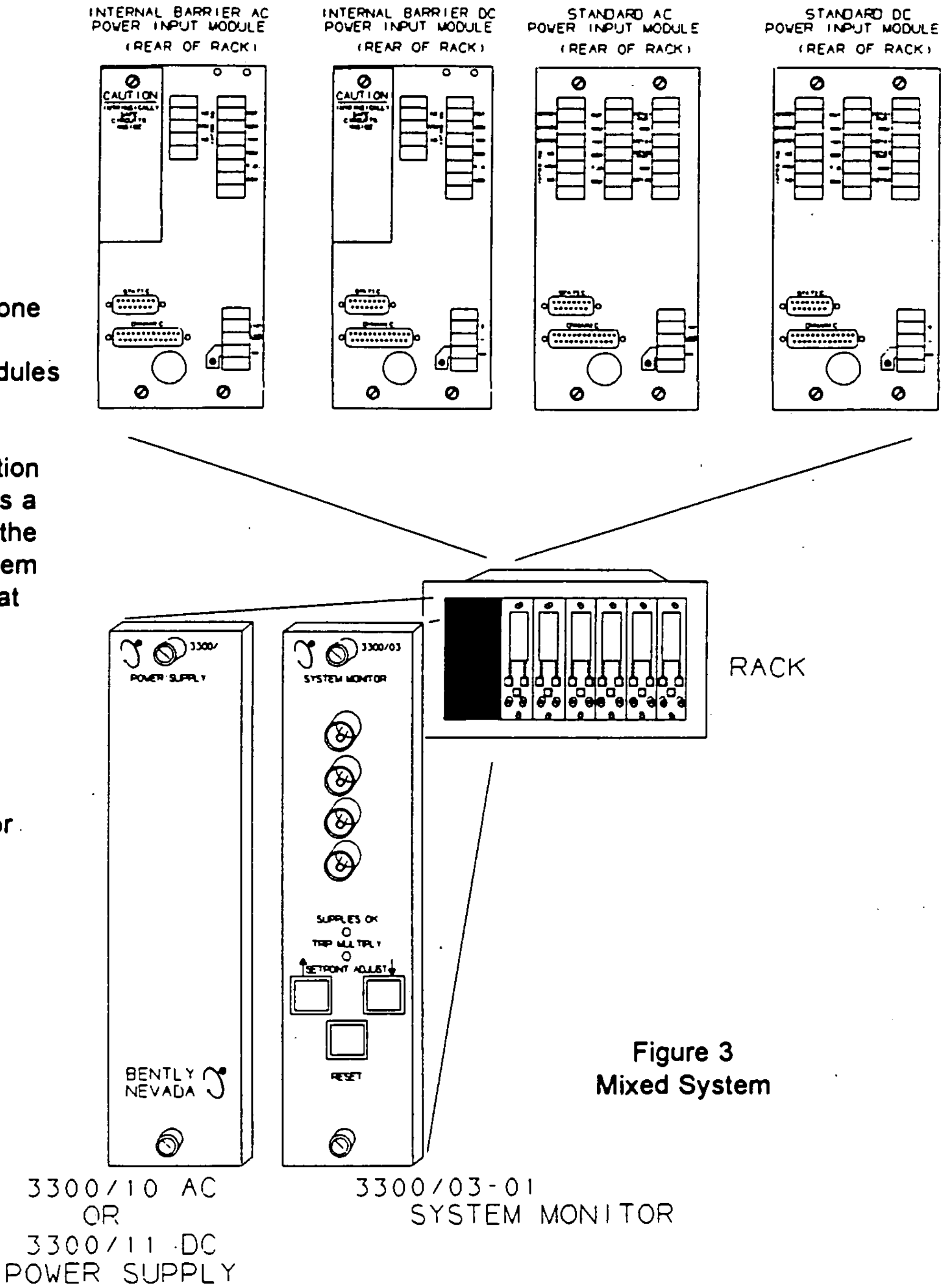


Figure 3
Mixed System

2 SYSTEM IDENTIFICATION

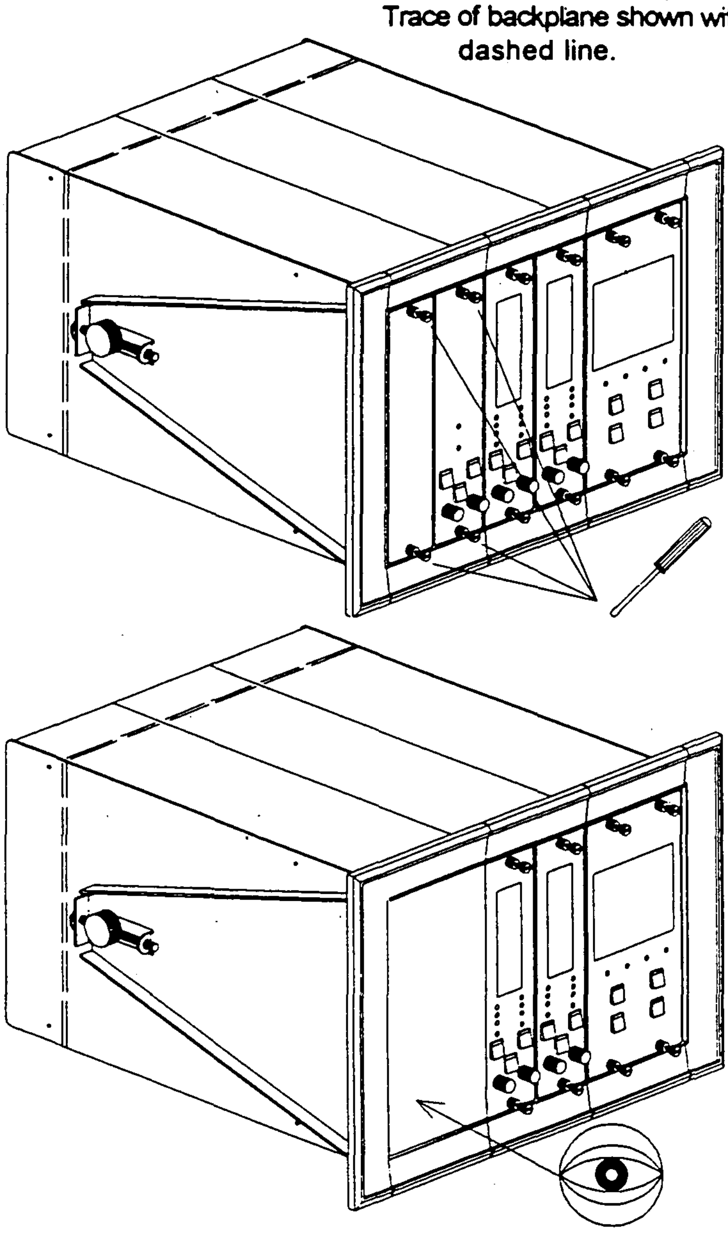
2.4 Rack

Use Figures 1 through 3 on the previous pages to identify whether a rack contains a SDI/DDI backplane or an original backplane. If some question still remains then an installed 3300 rack backplane circuit board can be identified by following these steps:

CAUTION

Machine protection will be lost during this procedure

1. Disconnect power from the rack.
2. Remove the Power Supply and System Monitor.
3. Observe the location and position of the connectors on the backplane behind the Power Supply and System Monitor rack slots. Use the front view of the backplanes shown on the following pages to identify your backplane.

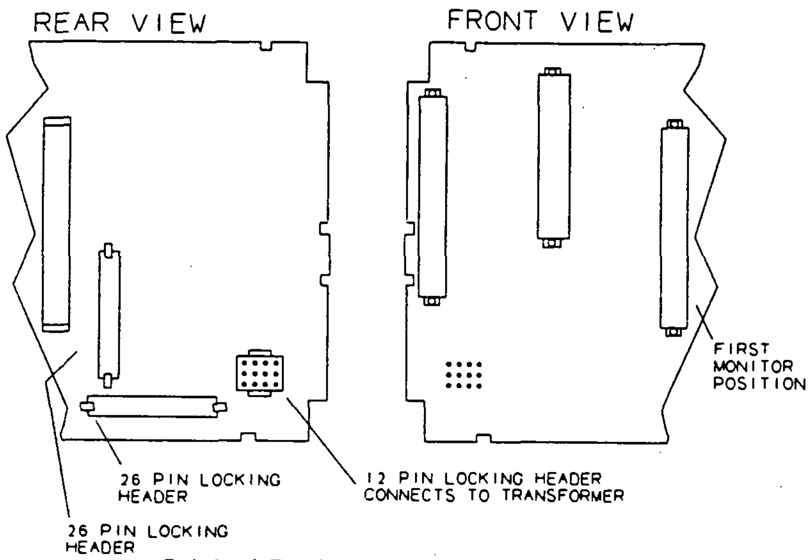


2 SYSTEM IDENTIFICATION

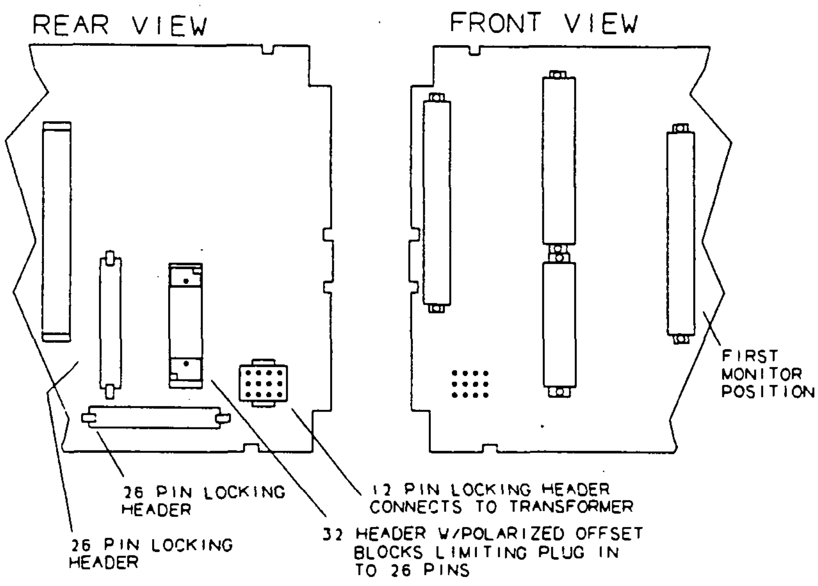
Original Backplane

Two versions of the backplane may be installed in an Original System. Identifying features are shown in the figures below.

Original Backplane
Power Supply and System Monitor positions



Original Backplane, W/Serial Interface
Power Supply and Sysytem Monitor Positions

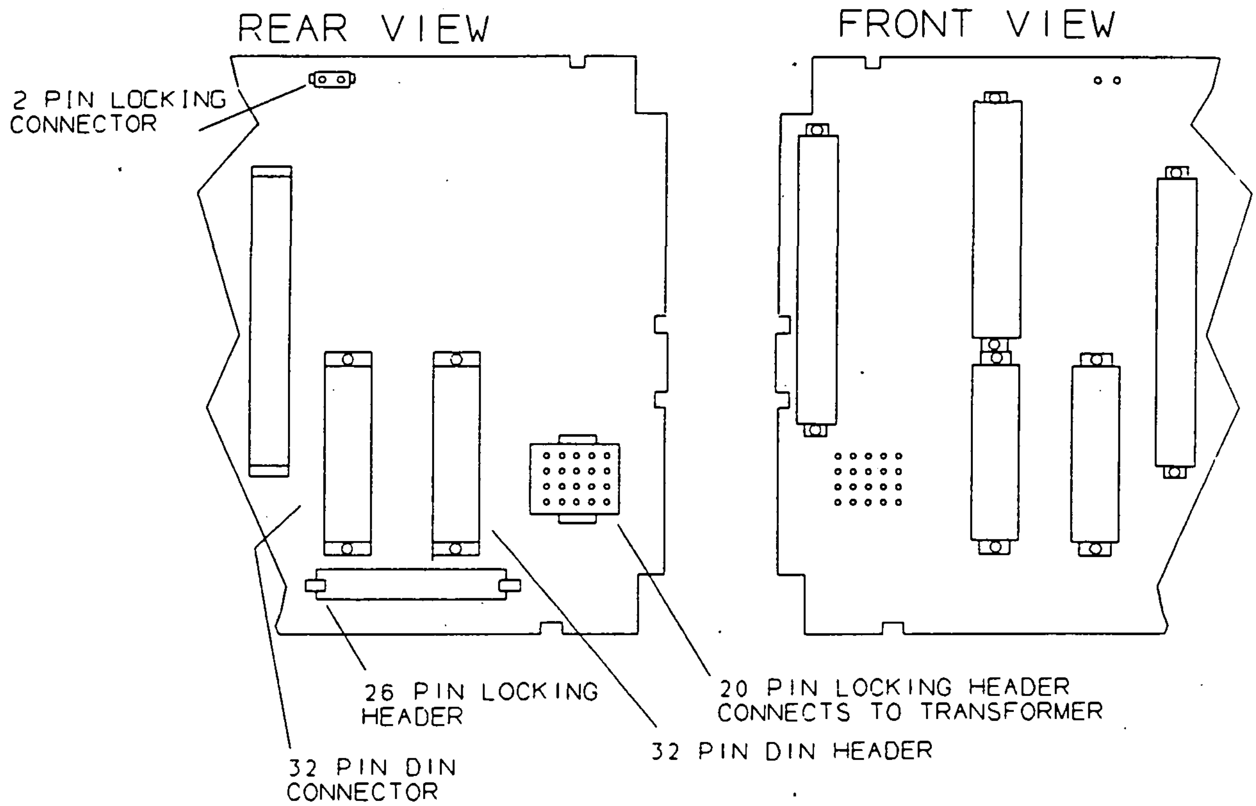


2 SYSTEM IDENTIFICATION

SDI/DDI BACKPLANE

The SDI/DDI Backplane is shown in the figure below. Identifying features are the two 32 pin DIN connectors and 20 pin transformer connector. The 2 pin connector may not be present on some systems.

SDI/DDI BACKPLANE
Power Supply and System Monitor Positions



2 SYSTEM IDENTIFICATION

2.5 Firmware

Part numbers for SDI/DDI monitor firmware are shown in Table 1. Firmware resides in either an EPROM or in the microprocessor ROM. Some monitors are not listed. The 3300/90 Diagnostic Instrument and the 3300/60 Vector Monitor are not supported by SDI/DDI. The original firmware in the 3300/17, 3300/36, 3300/39, 3300/40, 3300/52, 3300/53, 3300/54, 3300/56, 3300/75, 3300/80, 3300/85, and 3300/95 monitors is SDI/DDI compatible.

Table 1
Monitor Firmware Part Numbers for SDI/DDI Firmware

MONITOR NUMBER	PART NUMBER	PART DESCRIPTION
3300/15	104044-01	Microprocessor
3300/16	00800119	Microprocessor
3300/20	00800120	Microprocessor
3300/25	104044-02	Microprocessor
3300/26	104044-03	Microprocessor
3300/30	89809-01	EPROM
3300/35	89818-01	EPROM
3300/45	89836-01	EPROM
3300/46	89845-01	EPROM
3300/47	89854-01	EPROM
3300/48	89863-01	EPROM
3300/50	89872-01	EPROM
3300/55	104044-04	Microprocessor
3300/61	89890-01	EPROM
3300/65	89899-01	EPROM
3300/70	104044-05	Microprocessor

Use the following steps to check the firmware part number for the monitors in Table 1.

1. Disassemble the monitor by following the steps in the appropriate monitor manual. The microprocessor is located on the main circuit board which slides into the rack card guides. The EPROM is either on a small board which plugs into the main board or is on the main board. The part number is marked on the EPROM or microprocessor.

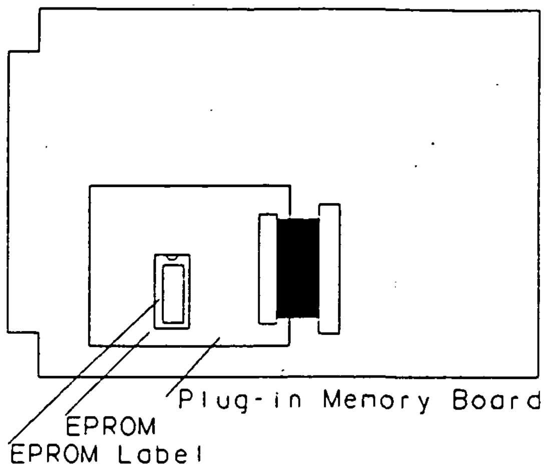
2 SYSTEM IDENTIFICATION

2. Locate the EPROM or microprocessor on the circuit board by referring to the following sketches:

Firmware on the plug-in Memory Board

The following monitors have SDI/DDI firmware installed in an EPROM located on a small plug in board:

3300/30	3300/47
3300/35	3300/48
3300/45	3300/50
3300/46	3300/65

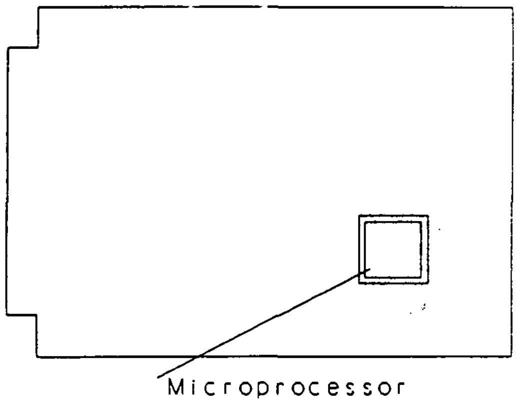


If the firmware is not SDI/DDI firmware, then the part number will not match Table 1 and the firmware may be installed in either the microprocessor ROM or in the EPROM (as shown).

Firmware on the Microprocessor

These monitors have SDI/DDI firmware installed in the microprocessor:

3300/15	3300/26
3300/16	3300/55
3300/20	3300/70
3300/25	



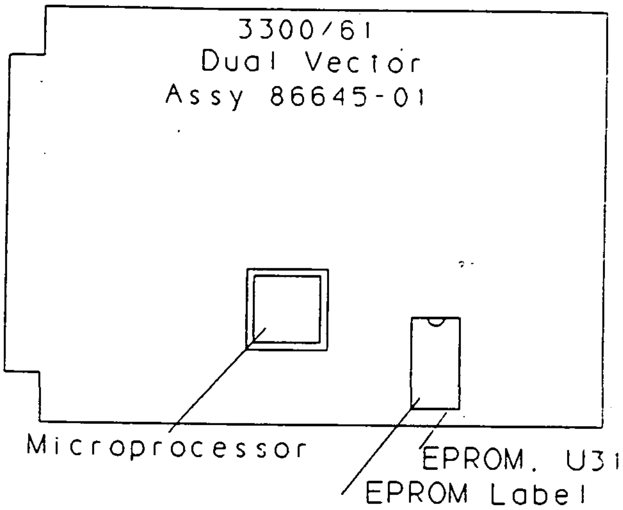
If the firmware is not SDI/DDI firmware then the part number will not match Table 1. The older firmware may be installed in either the microprocessor ROM (as shown) or in an EPROM on a plug-in board as shown above.

2 SYSTEM IDENTIFICATION

Firmware in the 3300/61 Dual Vector Monitor

The SDI/DDI firmware and original firmware for the 3300/61 Dual Vector Monitor is located in an EPROM on the main circuit board as shown.

If the firmware is not SDI/DDI firmware then the part number on the EPROM will not match Table 1.



If your firmware is not SDI/DDI firmware and you plan to use a 3300/03-02 SDI System Monitor, 3300/03-03 DDI System Monitor, SDIX/DDIX, or TDIX with your 3300 system then you can order firmware upgrade kits by contacting your Bently Nevada Corporation representative.

3 SYSTEM COMPATIBILITY

After using Section 2, System Identification, to determine the configuration of your 3300 system, use this section to determine which components will or will not work in your system.

Guidelines for spare parts, parts interchangeability and compatibility with Bently Nevada computer interfaces are given in Sections 3.1, 3.2, and 3.3 for each of the three supported system configurations.

3.1 Original System

The original system is compatible with all standard Bently Nevada computer/communication interfaces and monitoring software except SDIX/DDIX and TDIX. To make this system compatible with SDIX/DDIX or TDIX, replace the 3300/01-01 with a 3300/03-01 and use SDI/DDI firmware in the monitors.

This system is shown in Section 2.1, Figure 1.

Table 2
Compatibility for the Original 3300 System

PART DESCRIPTION	PART NUMBER	ACCEPTABLE REPLACEMENT
System Monitor	3300/01-01 3300/01-02	3300/01-01 or 3300/03-01 3300/01-02
Power Supply	3300/10 (includes PIM, transformer, and mounting bracket). 3300/11 (includes PIM and DC filter board).	3300/10 3300/11
Rack	3300/05, Option A = -01 through -17.	3300/05, Option A = -01 through -17.
3300 Monitors	Any 3300 monitor. (With or without SDI/DDI firmware). *	Original part.

NOTE:
A 3300/03-01 used in the original system **cannot be expanded** to a 3300/03-02 Serial Data Interface System Monitor or a 3300/03-03 Dynamic Data Interface System Monitor without converting the system to an SDI/DDI system.

* Information from the 3300/75 and 3300/80 monitors is not available over the 3300/01-02 serial communications interface.

3 SYSTEM COMPATIBILITY

3.2 SDI/DDI System

The SDI/DDI system is compatible with all standard Bently Nevada computer interfaces.

This system is shown in Figure 2 in Section 2.2.

Table 3
Compatibility for the SDI/DDI 3300 System

PART DESCRIPTION	PART NUMBER	ACCEPTABLE REPLACEMENT
System Monitor	3300/03-01 3300/03-02 3300/03-03	3300/03-01 3300/03-02 3300/03-03
Power Supply	3300/12 (includes PIM, transformer, and mounting bracket). 3300/14 (includes PIM and DC filter board).	3300/12 3300/14
Rack	3300/05, Option A = -21 through -37.	3300/05, Option A = -21 through -37.
3300 Monitors	Any 3300 monitor with SDI/DDI firmware. (The 3300/60 can be used but will not have SDI/DDI communications ability. The 3300/90 can also be used, it does not require SDI/DDI communications).	Original part with SDI/DDI firmware. (A spare monitor without SDI/DDI firmware can be used in this system but the SDI/DDI functions will not operate).

3 SYSTEM COMPATIBILITY

Table 4
Computer Interface and Monitoring Software Compatibility
for a
SDI/DDI System

SOFTWARE OR COMMUNICATIONS PROCESSOR	SYSTEM MONITOR		
	3300/03-01	3300/03-02 (SDI)	3300/03-03 (DDI)
DDM CP	C	NC	NC
TDM CP	C	NC	NC
TDIX CP	C	NC	NC
DDM/TDM SOFTWARE	C[1]	NC	NC
DDM2/TDM2 SOFTWARE	C[3,4]	C[3,4]	C[4]
HOST SYSTEM USING ALLEN-BRADLEY OR MODICON MODBUS COMMUNICATIONS PROTOCOL	C[2]	C	C
SYSTEM 64	C[6]	NC	NC

NOTES

C = compatible NC = not compatible

1 A DDM or TDM CP must be installed.
2 Must be upgraded to a 3300/03-02 SDI System Monitor, or used with a TDIX.
3 Must be upgraded to a 3300/03-03 DDI System Monitor, or used with a TDM or TDIX.
4 DDI can be daisychained with DDI, DDM, TDM, TDIX, and PDM CPs.
5 Host software developed for the 3300/01-02 Serial Interface System Monitor will work with the SDI but the additional features of the SDI will not be available to the host unless the software is updated.
6 A DDM CP must be installed.

Refer to the Serial Data Interface/Dynamic Data Interface Manual, Bently Nevada Corporation part number 89541-01, for details on daisychaining racks and cabling requirements.

3.3 Mixed System

The mixed system is compatible with all standard Bently Nevada external computer/ communication interfaces including SDIX/DDIX and TDIX. (See notes in table.)

This system is shown in Figure 3, Section 2.3.

Table 5
Compatibility for a Mixed System

PART DESCRIPTION	PART NUMBER	ACCEPTABLE REPLACEMENT
System Monitor	3300/03-01	3300/03-01 or 3300/01-01
	3300/03-01 connected to a SDIX/DDIX or TDIX	3300/03-01
Power Supply	3300/10 (includes PIM, transformer, and mounting bracket).	3300/10
	3300/11 (includes PIM and DC filter board).	3300/11
Rack	3300/05, Option A = -01 through -17	3300/05, Option A = -01 through -17.
3300 Monitors	Any 3300 monitor	Original Part
	Any 3300 monitor connected to a SDIX/DDIX or TDIX.	Monitor with SDI/DDI firmware.

NOTE:
The 3300/03-01 in this system **cannot be upgraded** to a 3300/03-02 or -03 without converting the system to an SDI/DDI system.

3 SYSTEM COMPATIBILTY

3.4 Additional Compatibility Issues

Monitors

The 3300/75 and 3300/80 monitors support SDI(X)/DDI(X) and TDIX only. Older communications processors cannot be used with these monitors. These monitors also do not support the older 3300/01-02 Serial Interface.

Communications Processors

If a TDIX and TDM communications processor are on the same communications chain, and the TDM firmware is Rev C or earlier, the TDM firmware needs to be upgraded. Contact your Bently Nevada Corporation representative to order a firmware upgrade kit for your TDM communications processor.