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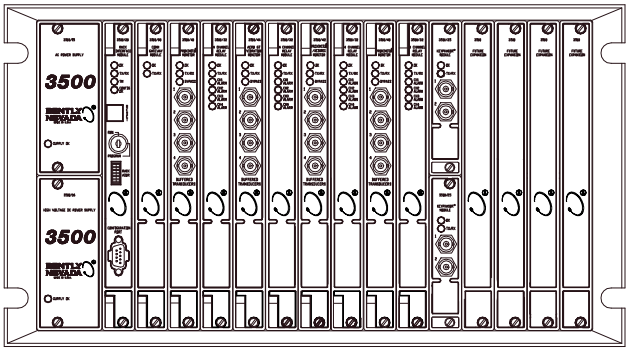
Revision G, January 2003

3500/53 OVERSPEED DETECTION SYSTEM

OPERATION AND MAINTENANCE MANUAL

BENTLY
Nevada



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The following ways of contacting Bently Nevada LLC are provided for those times when you cannot contact your local Bently Nevada representative:

Mailing Address	1631 Bently Parkway South Minden, NV 89423 USA
Telephone	1 775 782 3611 1 800 227 5514
Fax	1 775 782 9259
Internet	www.bently.com

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Additional Information

Notice:

This manual does not contain all the information required to operate and maintain the Overspeed Protection System. Refer to the following manuals for other required information.

3500 Monitoring System Rack Installation and Maintenance Manual (129766-01)

- general description of a standard system
- general description of a Triple Modular Redundant (TMR) system
- instructions for installing and removing the module from a 3500 rack
- drawings for all cables used in the 3500 Monitoring System

3500 Monitoring System Rack Configuration and Utilities Guide (129777-01)

- guidelines for using the 3500 Rack Configuration software for setting the operating parameters of the module
- guidelines for using the 3500 test utilities to verify that the input and output terminals on the module are operating properly

3500 Monitoring System Computer Hardware and Software Manual (128158-01)

- instructions for connecting the rack to 3500 host computer
- procedures for verifying communication
- procedures for installing software
- guidelines for using Data Acquisition / DDE Server and Operator Display Software
- procedures and diagrams for setting up network and remote communications

3500 Field Wiring Diagram Package (130432-01)

- diagrams that show how to hook up a particular transducer
- lists of recommended wiring

Contents

1. Receiving and Handling Instructions

1.1 Receiving Inspection

Visually inspect the module for obvious shipping damage. If shipping damage is apparent, file a claim with the carrier and submit a copy to Bently Nevada Corporation.

1.2 Handling and Storing Considerations

Circuit boards contain devices that are susceptible to damage when exposed to electrostatic charges. Damage caused by obvious mishandling of the board will void the warranty. To avoid damage, observe the following precautions in the order given.

Application Alert
Machinery protection will be affected when this module is removed from the rack.

Do not discharge static electricity onto the circuit board. Avoid tools or procedures that would subject the circuit board to static damage. Some possible causes include ungrounded soldering irons, nonconductive plastics, and similar materials.

Personnel must be grounded with a suitable grounding strap (such as 3M Velostat No. 2060) before handling or maintaining a printed circuit board.

Transport and store circuit boards in electrically conductive bags or foil.

Use extra caution during dry weather. Relative humidity less than 30% tends to multiply the accumulation of static charges on any surface.

When performed properly, this module may be inserted into or removed from the rack while power is applied to the rack. Refer to the Rack Installation and Maintenance Manual (part number 129766-01) for the proper procedure.

1.3 Disposal Statement

Customers and third parties that are in control of product at the end of its life or at the end of its use are solely responsible for proper disposal of product. No person, firm, corporation, association or agency that is in control of product shall dispose of it in a manner that is in violation of United States state laws, United States federal laws, or any applicable international law. Bently Nevada Corporation is not responsible for disposal of product at the end of its life or at the end of its use.

2. General Information

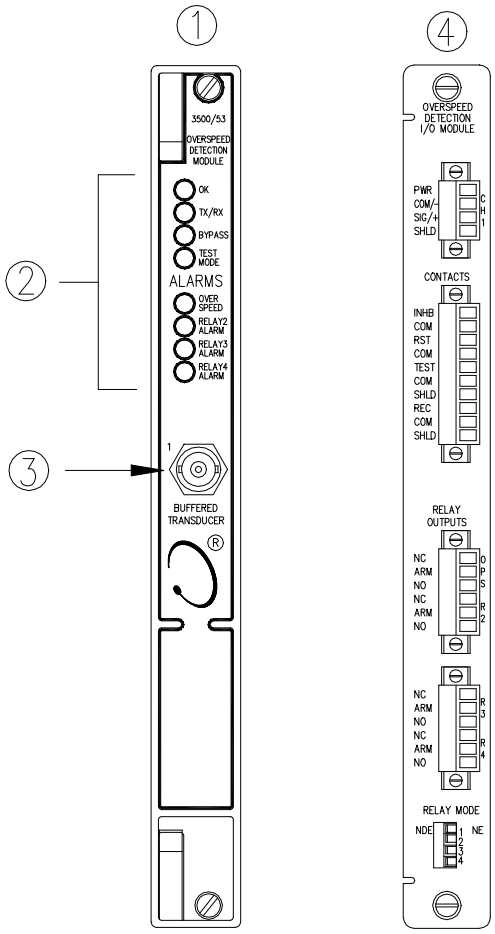
The 3500/53 Overspeed Detection Module is a one channel module designed to be used in either two- or three- module groups for overspeed protection applications. The module accepts a speed pulse input from either a proximity transducer or a magnetic pickup and uses the input to drive alarms. The module provides four fast response alarm relay outputs for machinery protection purposes. The 3500 Overspeed Detection System can be configured in a two module set for 1 out of 2 voting or a 3 module set for 2 out of 3 voting.

1) Main Module, front view.

2) Status LEDs, refer to Section 2.6 (LED Descriptions).

3) Buffered transducer output. Provides an unfiltered output for the transducer. The output is short-circuit protected.

4) I/O Module, rear view. Refer to Section 4.1 (Overspeed Detection I/O Module).



The primary purpose of the 3500 Overspeed Detection System is to provide 1) machinery protection by continuously comparing current machine speed against configured alarm setpoints to drive alarms and 2) essential machine speed information to both operator and maintenance personnel. Alarm setpoints are configured using the 3500 Rack Configuration Software.

When shipped from the factory, the 3500/53 is delivered unconfigured. When needed, the 3500/53 can be installed into a 3500 rack and configured to perform the required monitoring function.

Application Advisory
The Bently Nevada 3500/53 Overspeed Detection System is a component for use in an overspeed shutdown system. The overall performance of the shutdown system is dependent on other components in the system. All of these components need to be incorporated into a working system by a System Integrator who is familiar with overspeed shutdown systems. The System Integrator and the End User are ultimately responsible for proper functioning of the overspeed shutdown system. **The recorder outputs of the 3500/53 should not be used as part of a control system.**

2.1 Three Channel Overspeed Detection System

The Three Channel 3500/53 Overspeed Detection System provides high reliability overspeed protection as part of the 3500 Machinery Management and Protection System. The Three Channel Overspeed Detection System includes the 3500 rack, 3500 Power Supplies, Rack Interface Module, and three separate Overspeed Detection Modules. Three separate transducer inputs are required. The 3500/53 Modules can be installed in any slot to the right of the Rack Interface Module (2 to 15) but must be installed adjacent to each other in a group of three. Only one Overspeed Detection System may be installed in each 3500 rack (unless an appropriate Custom Products modification is installed on the system backplane). The 3500/53 Overspeed Detection System may be installed in a 3500 rack that includes other 3500 monitoring functions.

The Three Channel Overspeed Detection System provides 3 channels of independent speed monitoring. The Three Channel Overspeed Detection System can be configured to provide 2 out of 3 voting on alarming. With this voting, the alarm outputs from each module are compared and two modules must agree before a relay is driven. Communication between modules is done using a high speed inter-module communication network on the system backplane.

Application Advisory
Bently Nevada strongly recommends the use of a Three Channel Overspeed Detection System. A Three Channel Overspeed Detection System can be configured so that no single point failure will cause either a missed overspeed alarm or a false machine shutdown. The use of redundant power supplies in a 3500 rack containing the Overspeed Detection System is required.

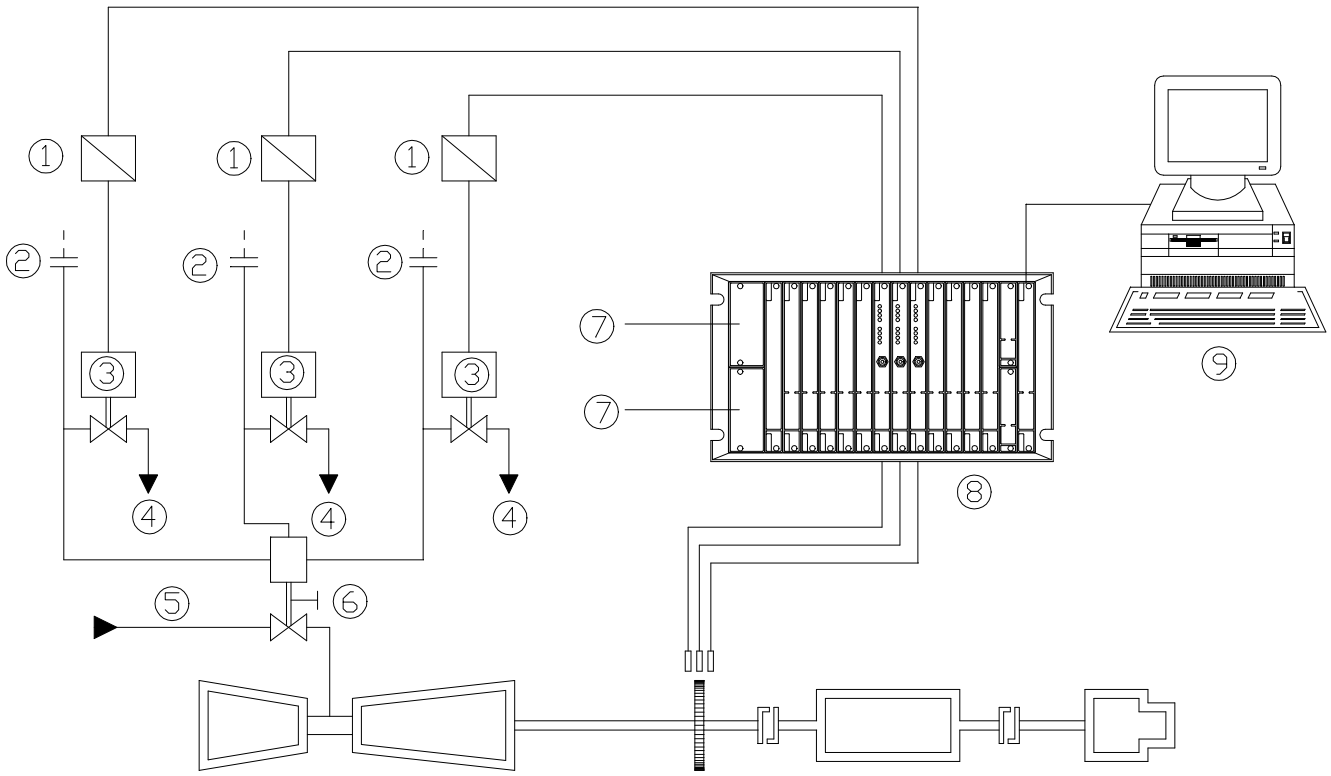


Figure 2-1. Typical Overspeed System

1) Interposing relays
2) Control oil supply
3) Solenoid
4) Drain
5) Fuel

6) Trip valve

7) Power supplies

8) 3500 Overspeed Detection System

9) Operator

2.2 Two Channel Overspeed Detection System

The two channel 3500/53 Overspeed Detection System provides overspeed protection as part of the 3500 Machinery Management and Protection System. The two channel Overspeed Detection System includes the 3500 rack, 3500 Power Supplies, Rack Interface Module, and two separate Overspeed Detection Modules. Two separate transducer inputs are required. The 3500/53 Modules can be installed in any slot to the right of the Rack Interface Module (2-15) but must be installed adjacent to each other in the group of two. Only one Overspeed Detection System may be installed in each 3500 rack (unless an appropriate Custom Products modification is installed on the system backplane). The 3500/53 Overspeed Detection System may be installed in a 3500 rack that includes other 3500 monitoring functions.

The Two Channel Overspeed Detection System provides two channels of independent speed monitoring. The Two Channel Overspeed Detection System provides 1 out of 2 voting on alarming.

Application Advisory
No matter how it is configured, it is still possible for a Two Channel Overspeed Detection System to cause false machine shutdown under certain single point failure conditions. Bently Nevada strongly recommends the use of a Three Channel Overspeed Detection System. The use of redundant power supplies in a 3500 rack containing the Overspeed Detection System is required.

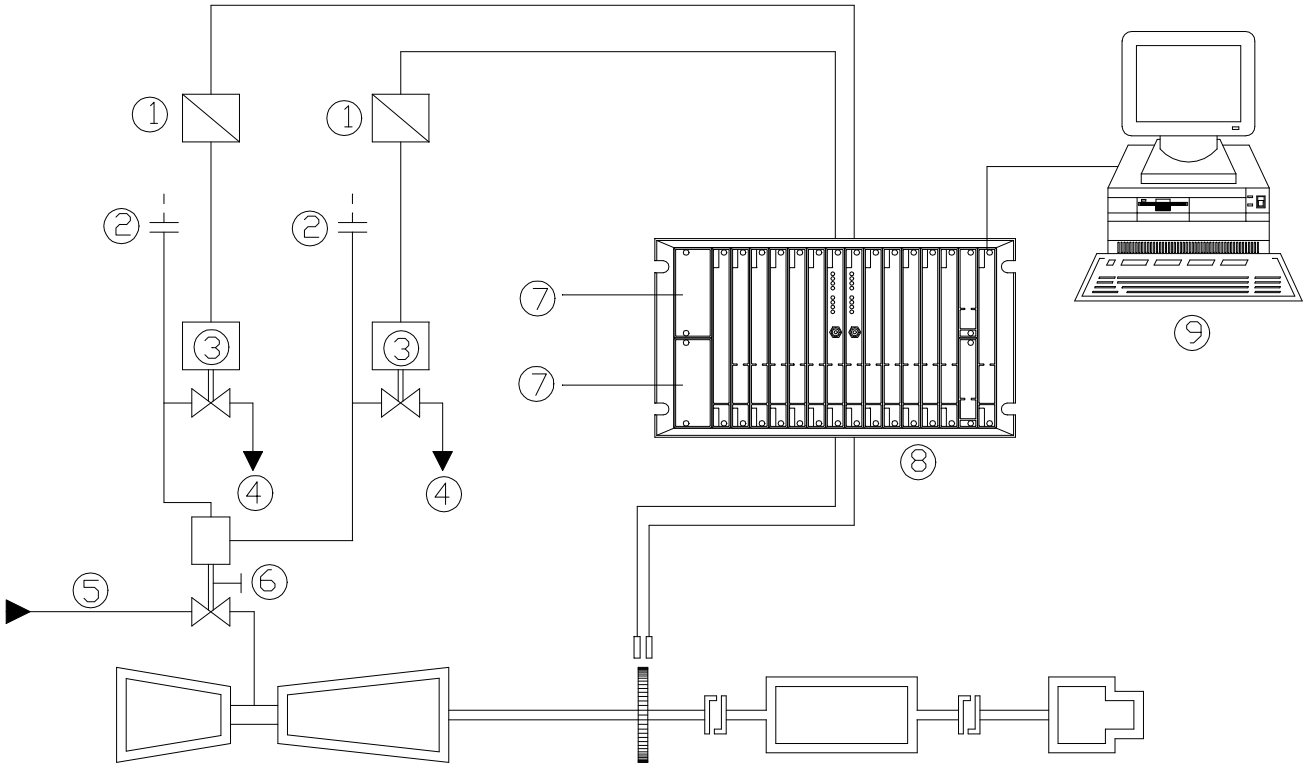


Figure 2-2. Typical Overspeed System

1) Interposing relays
2) Control oil supply
3) Solenoid
4) Drain
5) Fuel
6) Trip valve
7) Power supplies
8) 3500 Overspeed Detection System
9) Operator

2.3 Triple Modular Redundant (TMR) Description

When used in a TMR configuration, a three channel Overspeed Detection System is required with separate transducer input for each of the three modules.

2.4 Using 3500/53 as a Functional Safety System

When used as a Safety Shutdown System for the purposes of Functional Safety, the 3500/53 Overspeed Detection System, as certified by TUV Rheinland, is restricted in its available configurations. Additionally, the certificate is contingent upon certain requirements of use. Reference the limitations stated below.

2.4.1 Configuration Limitations and Requirements

- Installation performed by Bently Nevada personnel
- Discrete configuration only (each monitor channel has dedicated transducers)
- Redundant power supplies are required
- 3 module systems only
- All 3 monitors in the system must be located adjacent to one another
- Inter-Module Comparison enabled
- OR “Not OK” Voting enabled
- Percentage Comparison enabled
- CE Mark required
- Agency Approvals required
- Only 3300XL Proximitors® and certain Magnetic Pick-ups are allowed
- Only accepted Proximity Probes allowed (Reference current FS Mark certificate for the complete list of approved transducers.)
- Reference current FS Mark certificate for a list of intrinsically safe barriers allowed for use in a Functional Safety System
- Only Normally Energized relays are allowed for use

2.4.2 Requirements of Use

- Before attempting to update any firmware for a certified system, verify that the new firmware revision is included in the latest TUV FS Mark certificate. Do not download a firmware version that is not listed in the FS Mark certificate.
- The surge protection devices that are normally present at the relay outputs have been removed. If required, external devices need to be placed in parallel with relay loads.
- After each download of the configuration parameters to the 3500/53 monitors a visual verification must be performed. This can be accomplished by uploading the values into the configuration software and viewing the retrieved configuration parameters. Additionally, a complete validation test must be performed whenever a new configuration is downloaded to certified systems.
- A complete validation test (proof test) must be performed at least every three years. Bently Nevada recommends that interval not exceed 18 months.
- In the event of an individual 3500/53 monitor, within the three module 3500/53 system, fails the certificate will remain in force for a maximum of one week before the failed channel must be repaired or replaced. If more than one week passes prior to the failed module being repaired or replaced, the certificate becomes invalid until the failure is resolved.

2.5 Available Data

The Overspeed Detection Module returns speed proportional values to the Communications Gateway Module, Display Interface Module and to the host software via the Rack Interface Module. The Overspeed Detection Module also returns both module and channel statuses.

2.5.1 Statuses

This section describes the available statuses and where they can be found. The following statuses are provided by the module.

Module Status

OK

This indicates if the module is functioning correctly. A not OK status is returned under any of the following conditions:

- Module Hardware Failure
- Node Voltage Failure
- Configuration Failure
- Transducer Failure
- Slot ID Failure
- Inter Module Communication Failure
- Channel not OK (except trigger not OK)

If the Module OK status goes not OK, then the system OK Relay on the Rack Interface I/O Module will be driven not OK.

Alert/Alarm 1

This indicates whether the module has entered Alert/Alarm 1. A module will enter the Alert/Alarm 1 state when the speed proportional value provided by the module exceeds its configured Alert/Alarm 1 setpoint.

Danger/Alarm 2 (Overspeed)

This indicates whether the module has entered Danger/Alarm 2 (Overspeed). A module will enter the Danger/Alarm 2 (Overspeed) state when the speed proportional value provided by the module exceeds its configured Danger/Alarm 2 (Overspeed) setpoint.

Bypass

This indicates when the module has bypassed alarming for the proportional value of a channel. When a channel bypass status is set, the module bypass status will also be set.

Configuration Fault

This indicates if the module configuration is valid.

Special Alarm Inhibit

This indicates that the trigger OK check and under alarms for the channel are inhibited at machine start up. The trigger OK check automatically becomes valid after three consecutive valid transducer pulses are received by the module. Under alarms are inhibited until the under alarm setpoint has been exceeded for the first time. This status is active when:

- The Inhibit contact (INHB/RET) on the Overspeed I/O module is closed (active).

or

- The Channel Special Alarm Inhibit Software Switch is enabled.

Channel Status

OK

This indicates whether or not a fault has been detected on the channel. A not OK status is returned under any of the following conditions:

- Transducer Failure
- Probe Gap OK Check Fault
- Channel Specific Hardware Failure
- Inter Module Communication Failure
- Trigger not OK Condition - Including:
  - Input signal frequency greater than 20 kHz
  - Input signal frequency less than minimum for specified transducer
  - Input speed greater than 99,999 rpm
  - Input signal has 50% or greater change in a period
  - % Comparison check fault.

Alert/Alarm 1

This indicates whether the associated module channel has entered Alert/Alarm 1. A channel will enter the Alert/Alarm 1 state when any proportional value provided by the channel exceeds its configured Alert/Alarm 1 setpoint.

Danger/Alarm 2 (Overspeed)

This indicates whether the associated module channel has entered Danger/Alarm 2 (Overspeed). A channel will enter the Danger/Alarm 2 (Overspeed) state when any proportional value provided by the channel exceeds its configured Danger/Alarm 2 (Overspeed) setpoint.

Bypass

This indicates that the channel has bypassed alarming for its proportional value. A channel bypass status may result from the following conditions:

- Overspeed Module has never been configured
- Overspeed Module is in configuration mode
- Overspeed Channel has an invalid configuration
- Overspeed Module is in power up self-test
- Fatal error found during self-test
- Alarming is bypassed via a software switch
- Rack Alarm Inhibit is enabled.

Special Alarm Inhibit

This indicates that the trigger OK check and under alarms for the channel are inhibited at machine start up. The trigger OK check automatically becomes valid after three consecutive valid transducer pulses are received by the module. Under alarms are inhibited until the under alarm setpoint has been exceeded for the first time. This feature can only be initiated when the under setpoint is enabled and the machine's rpm is less than the under alarm setpoint. This status is active when:

- The Inhibit contact (INHB/RET) on the Overspeed I/O Module is closed (active).

or

- The Channel Special Alarm Inhibit software switch is enabled.

Off

This indicates whether the channel has been turned off. The monitor channels may be turned off (inactivated) using the Rack Configuration Software.

The following table shows where the statuses can be found.

Statuses	Communication Gateway Module	Rack Configuration Software	Operator Display Software
Module OK	X	X	
Module Alert/Alarm 1	X	X	
Module Danger/Alarm 2	X	X	
Module Bypass		X	
Module Configuration Fault		X	
Module Special Alarm Inhibit		X	
Channel OK	X	X	X
Channel Alert/Alarm 1	X	X	X
Channel Danger/Alarm 2	X	X	X
Channel Bypass	X	X	X
Channel Special Alarm Inhibit	X	X	X
Channel Off	X	X	

2.5.2 Proportional Values

Proportional values are speed measurements used to monitor the machine. The Overspeed Detection System Module can calculate two different types of proportional values.

- Speed: The primary value for the channel. You can include this value in contiguous registers in the Communication Gateway Module or the Display Interface Module.
- Peak Speed: No alarming is provided for peak speed. It is provided as a proportional value for display purposes only.

2.6 LED Descriptions

The LEDs on the front panel of the Overspeed Detection Module indicate the operating status of the module as shown in the following figure. Refer to Section 6.2 (LED Fault Conditions) for all of the available LED conditions.

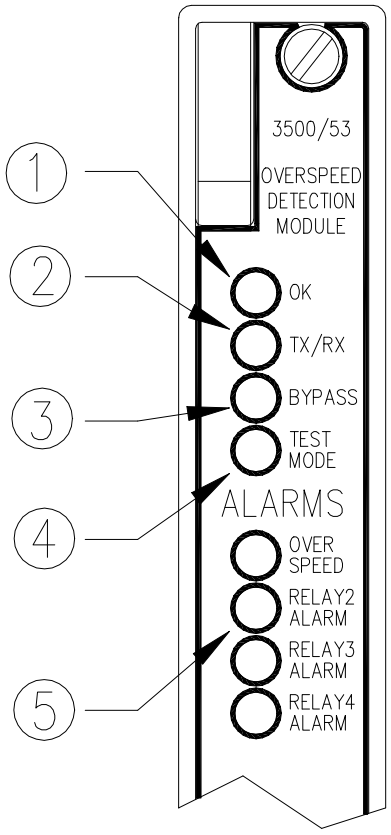
1) OK: Indicates that the Overspeed Detection Module and the Overspeed I/O Module are operating correctly.

2) TX/RX: Flashes at the rate that messages are received and transmitted.

3) BYPASS: Indicates that some of the module functions are temporarily suppressed.

4) TEST MODE: Indicates that the Overspeed Module is in test mode.

5) RELAY ALARM: Indicates that an alarm condition has occurred with this relay.



3. Configuration Information

The 3500/53 Overspeed Detection Module must have a valid configuration to operate properly. This section lists the monitor options (Section 3.2), group options (Section 3.3), relay options (Section 3.4), available setpoints (Section 3.5), and software switches (Section 3.6) for the Overspeed Detection Module.

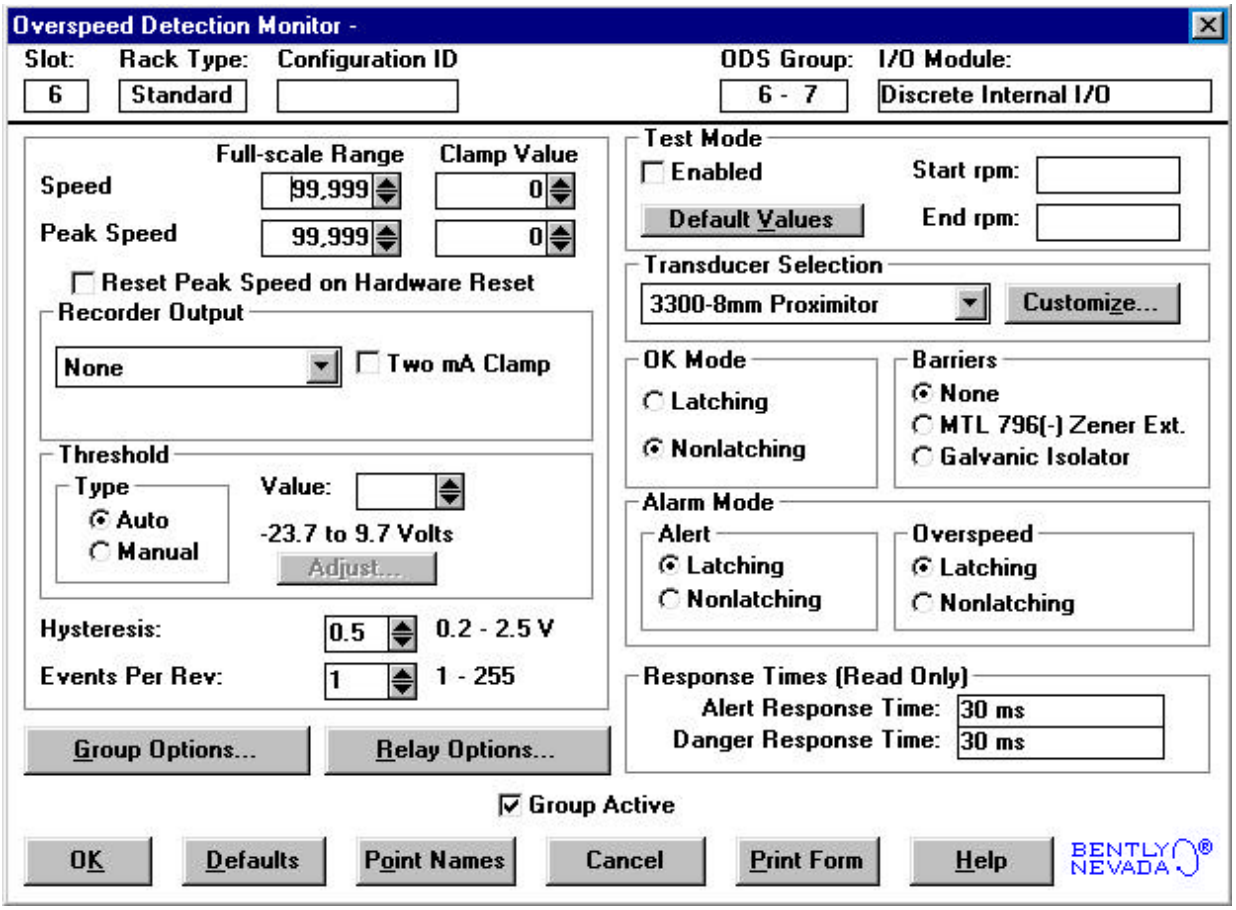
To configure the Overspeed Detection Module, use this section to gather the configuration information and then use the Rack Configuration Software to set options and download the configuration to the module. The 3500 Monitoring System Rack Configuration and Utilities Guide (part number 129777-01) shows how to install and operate the Rack Configuration Software.

3.1 Hardware Considerations

The slots in the rack are numbered from 0 to 15, counting from left to right. The power supplies go into slot 0 and the Rack Interface module goes into slot 1. Slots 2 through 15 are called “monitoring positions”. The 3500/53 modules can be installed into any of the monitoring positions, as long as they are in adjacent slots. However, if the 3500/20 Rack Interface Module and Data Manage I/O are to be used to interface to DDIX, TDIX, or TDXnet refer to the manual on the 3500/20 for slot restrictions this may place on your configuration.

3.2 Monitor Options

This section describes the options available on the Overspeed Detection Monitor configuration screens and discusses configuration considerations.



3.2.1 Configuration Considerations

Consider the following items before configuring an Overspeed Detection System:

- All modules in the Overspeed Detection Group must have identical configurations. The first module in the group is configured and this configuration is copied to all other modules in the group.
- Configuration cannot be down-loaded when the Overspeed Module or Group is in overspeed alarm or user test mode.
- A three-module Overspeed Detection System is the most reliable.
- External barriers are not currently supported with 7200 series 11mm and 14mm Proximitors, the 3300 series 16mm HTPS and magnetic pickups.

- The 3500 Overspeed Detection System does not support the 3000 Proximitor.
- When a full-scale range is modified, the setpoints associated with this proportional value should be re-adjusted.
- Alarming is not provided on the Peak Speed proportional value. Peak Speed is for display purposes only.
- Passive magnetic pickups are not recommended for monitoring at low speeds because of the small signal amplitude provided.
- Proportional value update rate and alarm response times are dependent upon input frequency. At low input frequencies, these times may be very slow.
- The 3500 Overspeed Detection System provides fast response relays for shutdown purposes. Do not use any other 3500 system relays for Overspeed shutdown.
- The 3500/53 Overspeed Detection System is only one of several components in an Overspeed Shutdown System. All components must be verified for proper operation.

3.2.2 Basic Configuration Options

This section describes the options available on the Overspeed Detection Monitor configuration screen.

Reference Information

These fields contain information that indicates which module you are configuring.

Slot

The location of the Overspeed Detection Module in the 3500 rack (2 through 15).

Rack Type

The type of Rack Interface Module installed in the rack (Standard or TMR).

Configuration ID

A unique six character identifier which is entered when a configuration is downloaded to the 3500 rack.

OPS Group

The slots in the 3500 rack that include the modules in the Overspeed Detection System (two- or three-module groups).

Input/Output (I/O) Module

The I/O field lets you identify the type of I/O Module that is attached to the monitor. The Discrete Internal I/O is the only type currently available for the Overspeed Detection System. With this type of I/O module, the transducer and relay field wiring are connected directly to the I/O module.

Group Active

Used to select whether the functions of the Overspeed Detection Group will be turned on (box checked) or off (box blank).

Speed

Speed and Peak Speed proportional values are always provided by the Overspeed Monitor channel.

Speed

The rotative speed of a machine shaft in revolutions per minute.

Peak Speed

Notation for the maximum speed recorded by the Overspeed monitor since the last peak hold reset occurred. The Overspeed monitor retains the peak speed even after loss of module power.

Reset Peak Speed with Hardware Reset

When this option is enabled, it allows the reset contact on the rear of the Overspeed Detection I/O Module to reset latched alarms, latched not OKs, and peak speed. When this option is not enabled, Peak Speed can only be reset via the Peak Hold Reset software switch.

Full-scale Range

The Speed proportional value provides the ability to set the full-scale rpm value. The full-scale range can be set from 0 to any value less than or equal to 99,999 rpm so long as the input frequency is less than 20 kHz. Peak Speed defaults to the full-scale range set for the Speed proportional value.

Clamp Value

The value that a proportional value goes to when that channel or proportional value is bypassed or defeated (for example, when a problem occurs with the transducer). The selected value can be between zero and the maximum full-scale range value. Only the values available from the Recorder Outputs, the Communication Gateway Module and the Display Interface Module are clamped to the specified value when the proportional value is invalid.

Recorder Output

The proportional value that is sent to the 4 to 20 mA recorder. The 4 to 20 mA output is proportional to the measured value over the selected full-scale range for the proportional value. If the channel is bypassed, the output will be clamped to the selected clamp value or to 2 mA (if the 2 mA clamp is selected).

Note: Do Not use 4 to 20 mA recorder outputs for shutdown.

Threshold

The voltage level of the transducer signal where triggering occurs (if the Hysteresis was 0).

Auto

The trigger threshold is automatically set to a value that is midway between the most positive peak and the most negative peak of the input signal. This value tracks any changes in the input signal. Auto threshold requires a minimum signal amplitude of 1 V pp and a minimum frequency of 0.0167 Hz.

Manual

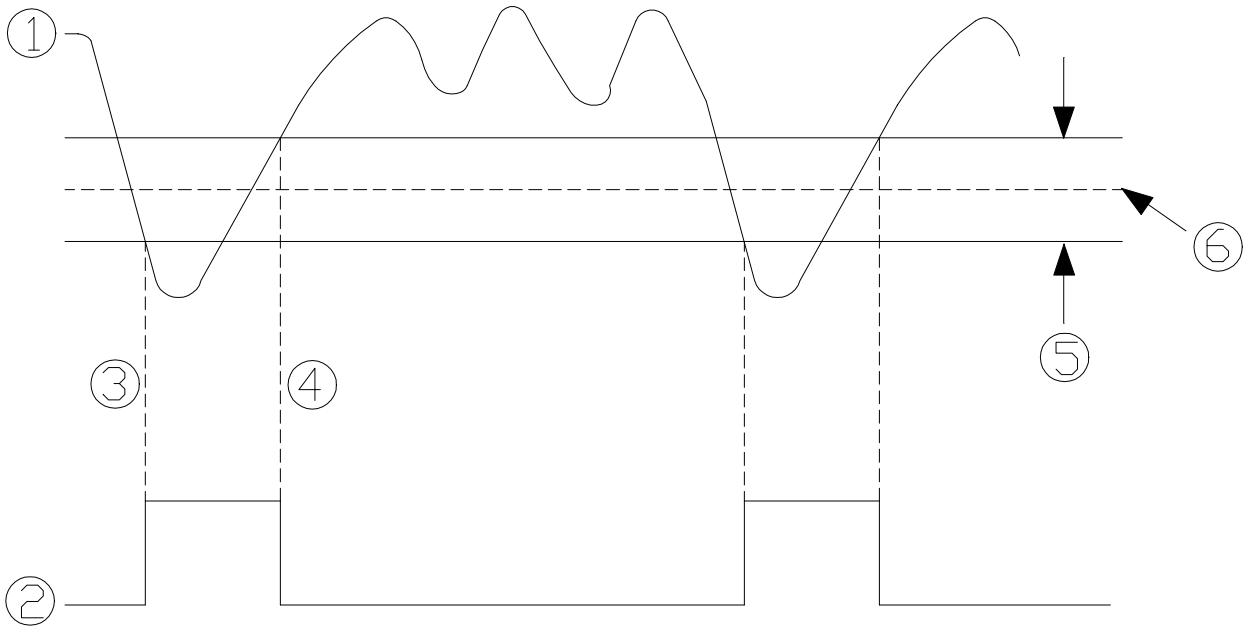
The trigger threshold is set by the user to any value in the range of +9.7 to -23.7 volts. Manual threshold requires a minimum signal amplitude of 500 millivolts peak to peak.

Adjust

Available when Manual Threshold is selected. This is used to display a dialog box which will aid in the setting of the Manual Threshold value.

Hysteresis

Hysteresis is the voltage level around the threshold value (½ above, ½ below) which is required to trigger. For example, when the input voltage level passes the threshold value plus ½ of the hysteresis value, a trigger occurs. The larger the hysteresis value, the greater the immunity to noise on the input signal. You can set hysteresis to any value between 0.2 and 2.5 volts.



1) Input Signal
2) Conditioned Signal (Speed Pulse)
3) Trigger In
4) Trigger Out
5) Hysteresis
6) Threshold

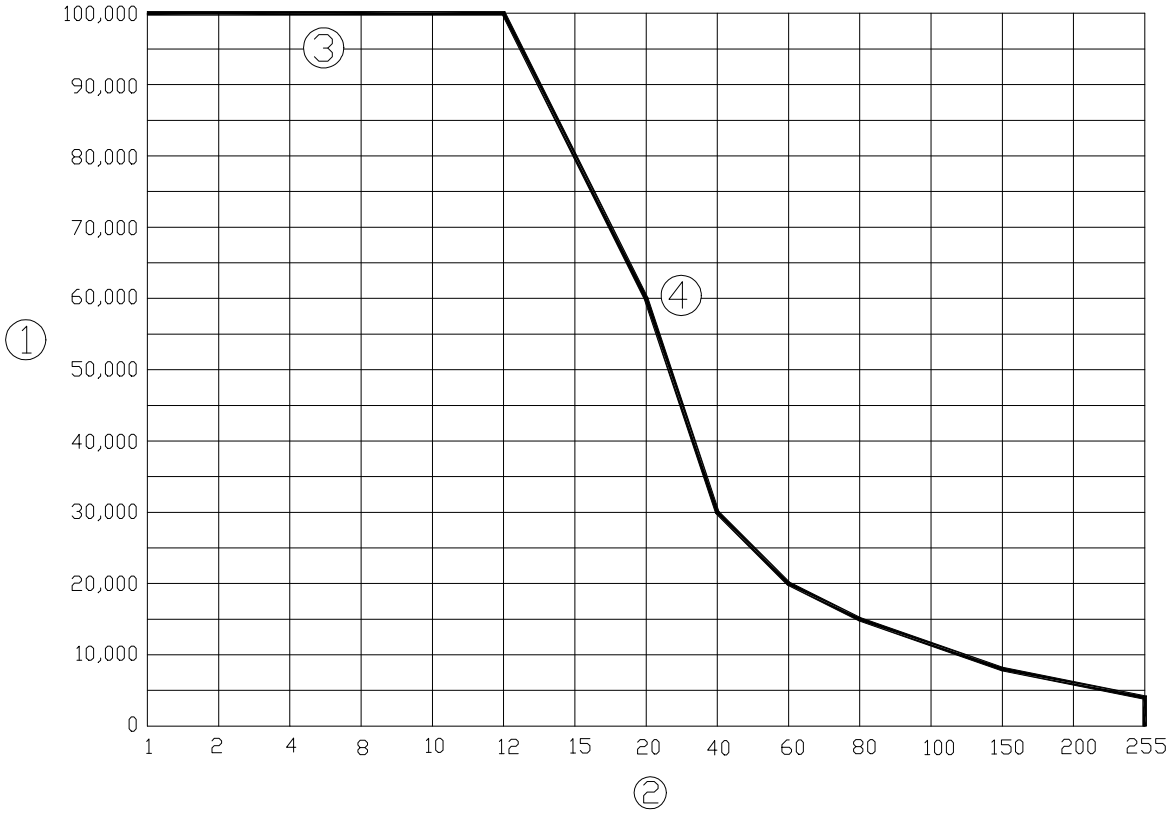
Events Per Revolution (EPR)

The number of pulses in a speed transducer signal for each shaft rotation. If the speed transducer is observing a multi-tooth gear, set the Events Per Revolution to the number of teeth on the gear. Enter the desired Events Per Revolution as an integer value from 1 to 255.

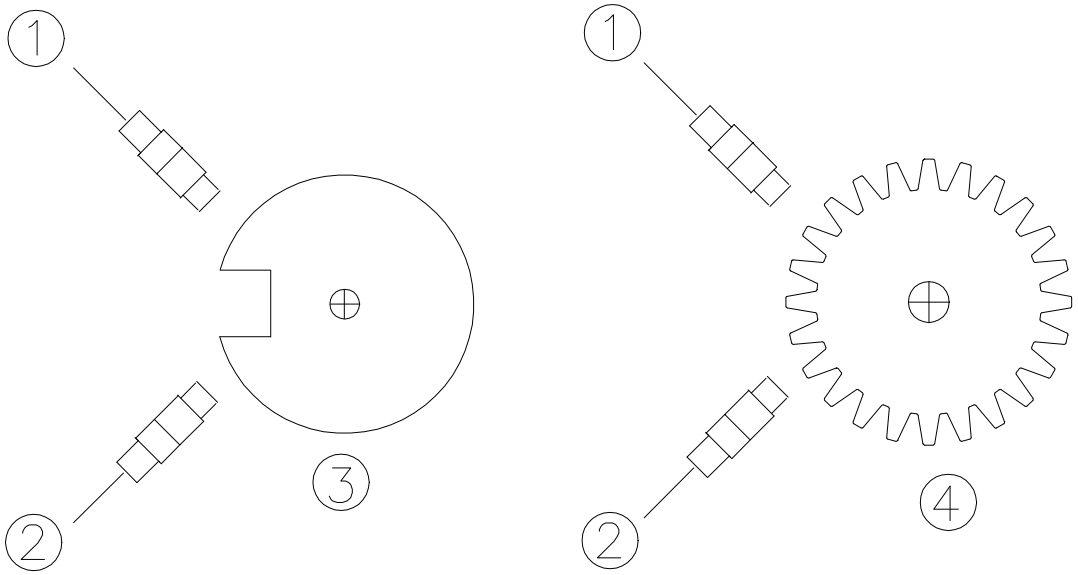
Note

The gear or speed wheel being observed should be rigidly attached to the shaft being monitored for Overspeed to ensure adequate Overspeed Protection.

Maximum Events Per Revolution



1) RPM
2) Event per revolution
3) Upper rpm limit is 99,999
4) Upper frequency limit is 20 KHz



1) Probe A

2) Probe B

3) Shaft with notch. Events per revolution set to 1 event.

4) 24-tooth gear. Events per revolution set to 24 events.

Test Mode

The 3500 Overspeed Detection Module has an on board frequency generator that can generate a test signal for testing the overspeed protection function of the monitor. When the test function is enabled (option box is checked), you can invoke the function by closing a contact on the Overspeed Detection I/O module or via a software switch. Enter a Start RPM (400 rpm minimum) and an End RPM (limited to 99,999 rpm) for the test frequency to sweep through. When the test input speed exceeds the over Alert/Alarm 1 and Overspeed (Danger) setpoints, the associated alarms will be driven. Configure whether or not the relays on the Overspeed I/O Module will be driven by enabling or disabling **Enable Relays While in Test Mode** on the Relay Option screen. Buffered transducer outputs, recorder outputs, and 3500 software will follow the test signal input. Monitor the test by choosing **Verification** under the Utilities menu in the 3500 Rack Configuration Software.

Transducer Selection

The following transducer types are available for the Overspeed Detection Module:

3300 - 5mm Proximitor

3300 - 8mm Proximitor

7200 - 5mm Proximitor

7200 - 8mm Proximitor

7200 - 11mm Proximitor

7200 - 14mm Proximitor

3300 – 16mm HTPS Proximitor

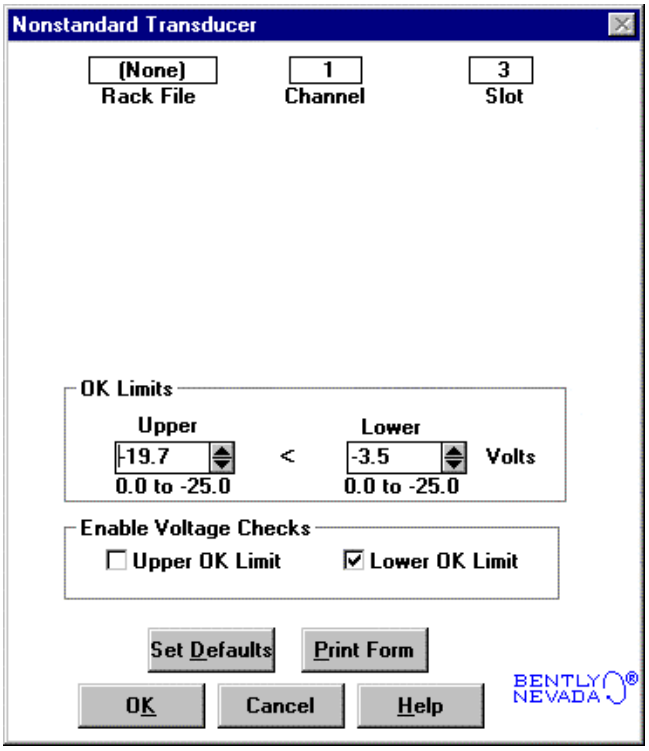
3300 RAM Proximitor

Magnetic Pickup - Passive or Active

Nonstandard

Customize button

Used to enable the Voltage OK Limit check. If Nonstandard is selected as the transducer type, the OK Limits can also be adjusted. There must be at least 2 volts between the Upper and Lower OK Limits.



Enable Voltage Checks

The transducer input DC voltage level is directly proportional to the gap between the face of a proximity probe and the surface being monitored. OK Limits are the upper and lower voltages that mark the range within which a proximity transducer is defined as OK. The upper OK Limit is the more negative voltage and the lower OK Limit is the more positive voltage (closer to zero volts). OK Limits can vary depending on the application the transducer is used in.

By checking the Upper and Lower OK Limit check boxes, you cause an additional transducer check that lets the Overspeed Detection module distinguish between a transducer failure and a stopped machine. With these boxes checked, the Trigger OK status will remain OK when the machine is stopped and the transducer is OK.

Note

A typical notch or gear tooth observed by a proximity probe will cause the transducer to be outside its upper OK Limit. Do not enable the Upper OK Limit Voltage Check unless the notch or tooth is specifically designed to remain within the OK limits of the transducer.

Default OK limits are supplied for all proximity transducers. The lower OK Limit is enabled as the default for proximity transducers. Only the Non-Standard transducer selection lets you change the OK limits of the transducer. Enable Voltage Checks is disabled for magnetic pickups.

Transducer	Upper OK Limit		Lower OK Limit		Center Gap Voltage	
	Without Barriers	With Barriers	Without Barriers	With Barriers	Without Barriers	With Barriers
3300 - 5mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
3300 - 8mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
7200 - 5mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
7200 - 8mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
7200 - 11mm	-19.70 V	N/A	-3.50 V	N/A	-11.60 V	N/A
7200 - 14mm	-16.80 V	N/A	-2.70 V	N/A	-9.75 V	N/A
3300 – 16mm HTPS	-16.80 V	N/A	-2.70 V	N/A	-9.75 V	N/A
3300 RAM	-12.60 V	-12.20 V	-2.40 V	-2.40 V	-7.50 V	-7.30 V
Magnetic Pickup	N/A	N/A	N/A	N/A	N/A	N/A

Barriers

Select MTL 796(-) Zener Ext. or Galvanic Isolator if there are external barriers connected between the monitor and the transducer. Barriers are used to restrict the amount of energy that can flow into a hazardous area.

OK Mode

Options in the OK Mode group determine how the channel OK status is affected when the channel goes not OK and then returns to an OK state. This status affects the state of the channel OK relay on the Overspeed Detection I/O Module.

Latching

If a channel is configured for Latching OK, and if the channel has gone not OK, the status stays not OK until a reset is issued. Reset a latched not OK by using one of the following methods:

- closing the reset contact on the back of the Overspeed Detection I/O Module
- setting the Channel Reset software switch in the 3500 Rack Configuration Software
- issuing a channel reset command through the Communication Gateway Module or Display Interface Module.

When configured for Latching OK, the monitor must be reset after power up to clear the latched condition.

Nonlatching

The channel OK status of the Overspeed Detection Module will return to an OK state once the not OK condition is removed.

Alarm Mode

Latching

Once an alarm is active it will remain active even after the proportional value drops below the configured setpoint level. The channel will remain in alarm until it is reset by using one of the following methods:

- closing the reset contact on the back of the Overspeed Detection I/O Module
- setting the Channel Reset software switch in the 3500 Rack Configuration Software
- issuing a channel reset command through the Communication Gateway Module or Display Interface Module.

Nonlatching

When an alarm is active, it will go inactive as soon as the proportional value drops below the configured setpoint level.

Alert/Alarm 1 should be the first level alarm that occurs when the transducer signal level exceeds the selected value. Overspeed (Danger) should be the second level alarm that occurs when the transducer signal level exceeds the selected value. The Alert and Danger values are set on the Setpoint screen.

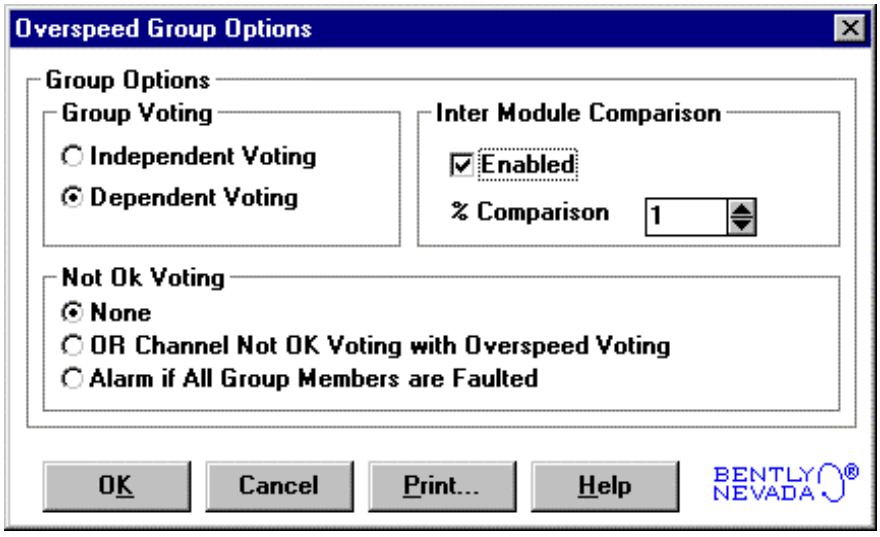
Response Times

The Alarm response times (in milliseconds) for the Alert Over and Overspeed setpoints are calculated and displayed on the monitor configuration screen. The alarm response time is the delay between when shaft speed exceeds the setpoint and when the relays are driven to the alarm condition. These response times are dependent upon the alarm setpoint level and the events per revolution setting. The response time does not include relay contact bounce. Response time is for display purposes only and cannot be adjusted.

3.3 Group Options

This section discusses the Rack Configuration Software screens associated with the Overspeed Detection System group.

3.3.1 Option Descriptions



Group Voting

Independent Voting

Each Overspeed Detection Module in the OPS Group will drive the relays on its Overspeed Detection I/O Module independently of the other modules in the set. This option applies to both the Overspeed relay and the Alert relays. The Channel Not OK relays always vote independently.

Dependent Voting

All Overspeed Detection Modules in the OPS Group will drive their relays simultaneously if group voting criteria is met (for example, two out of three modules vote for shutdown). This option applies to both the Overspeed relay and the Alert relays. The Channel Not OK relays always vote independently.

Inter Module Comparison

When this option is enabled, the current speed proportional values of each module in the group are compared with each other. If the output of one monitor differs from the output of the other monitors in the group by the specified percentage, that monitor will be declared not OK.

- Inter Module Comparison is only available in a three module group.
- The specified percentage difference allowed is the difference between the middle value of the three monitors in the group and the individual values of each monitor.

Not OK Voting

OR Channel not OK Voting with Overspeed Voting

When this option is enabled, either a module not OK event or an Overspeed event will change the state of the Overspeed alarm.

Alarm if All Group Members are Faulted

When this option is enabled, all modules in the Overspeed Detection System will generate an Overspeed alarm when all modules in the group are faulted.

- This option is only available with Dependent Voting.
- This option applies only when “OR Channel not OK Voting with Overspeed Voting” is not selected.

3.3.2 Voting Tables, Considerations

Sections 3.3.3 (Voting Tables, Independent Voting) and 3.3.4 (Voting Tables, Dependent Voting) describe how the Overspeed Detection System will alarm based on configuration options selected. The following items need to be considered when applying those sections:

- User enabled bypass of a module is achieved by performing any of the following actions: 1.) Setting a module or channel alarm disable software switch. 2.) Activating Rack Alarm Inhibit. 3.) Setting the module Configuration Mode software switch.
- Removing one or more modules from a set will introduce an inter-module communication fault in the remaining modules of the set, which will enter a not OK state.
- The following events will cause a module to enter not-OK, but will NEVER vote for an Overspeed alarm:
  - Input signal frequency less than minimum for specified transducer
  - Input signal has 50% or greater change in a period when machine speed is less than 100 rpm
  - Inter Module Comparison (% Comparison) fault
  - Inter-module communication faults
- The following events will vote for an Overspeed alarm when ORing channel not OK with overspeed, but will NEVER latch an Overspeed alarm:
  - Input signal frequency of 20 KHz
  - Input speed greater than 99,999 rpm
- If all modules are removed from the rack or bypassed, no alarming can take place.

  The Channel Not OK relays always vote independently.

3.3.3 Voting Tables, Independent Voting

The following sections show how alarm voting is implemented based on the configuration choices of **Independent Voting** and **OR Channel Not OK with Overspeed Voting.** Refer to Section 3.3.2 (Voting Tables, Considerations) for important considerations.

3.3.3.1 Two-module Overspeed Group, Independent Voting

Condition 1: With no modules bypassed or removed, the group will behave as shown. This behavior applies to overspeed and alert relays.

Module #1 Status	Module #2 Status	Alarm Status	
		#1	#2
OK	OK	No Alarm	No Alarm
Alarm	OK	Alarm	No Alarm
Alarm	Not OK	Alarm	No Alarm
OK	Not OK	No Alarm	No Alarm
Alarm	Alarm	Alarm	Alarm
Not OK	Not OK	No Alarm	No Alarm

Condition 2: When any one of the two modules is bypassed or removed, the remaining module will behave as shown. This behavior applies to overspeed and alert relays. Only the active module is shown.

Active Module's Status	Alarm Status
OK	No Alarm
Not OK	No Alarm
Alarm	Alarm

The bypassed or removed module will remain in the "No Alarm" state.

3.3.3.2 Three-module Overspeed Group, Independent Voting

Condition 1: With no modules bypassed or removed, the group will behave as shown. This behavior applies to overspeed and alert relays.

Module #1 Status	Module #2 Status	Module #3 Status	Alarm Status		
			#1	#2	#3
OK	OK	OK	No Alarm	No Alarm	No Alarm
Alarm	OK	OK	Alarm	No Alarm	No Alarm
Alarm	Alarm	OK	Alarm	Alarm	No Alarm
Alarm	Alarm	Not OK	Alarm	Alarm	No Alarm
Alarm	Not OK	OK	Alarm	No Alarm	No Alarm
Not OK	OK	OK	No Alarm	No Alarm	No Alarm
Not OK	Not OK	OK	No Alarm	No Alarm	No Alarm
Not OK	Not OK	Alarm	No Alarm	No Alarm	Alarm
Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
Not OK	Not OK	Not OK	No Alarm	No Alarm	No Alarm

Condition 2: When any one of the three modules is bypassed or removed, the remaining two modules will behave as shown in Condition 1 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting). The bypassed or removed module will remain in the “No Alarm” state.

Condition 3: When any two of the three modules are bypassed or removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting). The bypassed or removed modules will remain in the “No Alarm” state.

3.3.3.3 Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed

Condition 1: With no modules bypassed or removed, the overspeed relays will behave as shown.

Module #1 Status	Module #2 Status	Overspeed Alarm Status	
		#1	#2
OK	OK	No Alarm	No Alarm
Overspeed	OK	Alarm	No Alarm
Overspeed	Not OK	Alarm	Alarm
OK	Not OK	No Alarm	Alarm
Overspeed	Overspeed	Alarm	Alarm
Not OK	Not OK	Alarm	Alarm

The alert relays will behave per Condition 1 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting).

Condition 2: When any one of the two modules is bypassed or removed, the remaining module's overspeed relay(s) will behave as shown. Only the active module is shown.

Active Module's Status	Overspeed Alarm Status
OK	No Alarm
Not OK	Alarm
Overspeed	Alarm

The alert relays will behave per Condition 2 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting). The bypassed or removed module will remain in the "No Alarm" state.

3.3.3.4 Three-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed

Condition 1: With no modules bypassed, the overspeed relays will behave as shown.

Module #1 Status	Module #2 Status	Module #3 Status	Overspeed Alarm Status		
			#1	#2	#3
OK	OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	OK	OK	Alarm	No Alarm	No Alarm
Overspeed	Overspeed	OK	Alarm	Alarm	No Alarm
Overspeed	Overspeed	Not OK	Alarm	Alarm	Alarm
Overspeed	Not OK	OK	Alarm	Alarm	No Alarm
Not OK	OK	OK	Alarm	No Alarm	No Alarm
Not Ok	Not Ok	OK	Alarm	Alarm	No Alarm
Not OK	Not OK	Overspeed	Alarm	Alarm	Alarm
Overspeed	Overspeed	Overspeed	Alarm	Alarm	Alarm
Not OK	Not OK	Not Ok	Alarm	Alarm	Alarm

The alert relays will behave per Condition 1 of Section 3.3.3.2 (Three-module Overspeed Group, Independent Voting).

Condition 2: When any one of the three modules is bypassed or removed, the remaining two modules will behave as shown in Condition 1 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The bypassed or removed module will remain in the “No Alarm” state.

Condition 3: When any two of the three modules are bypassed or removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The bypassed or removed modules will remain in the “No Alarm” state.

3.3.4 Voting Tables, Dependent Voting

The tables in the following sections show how alarm voting is implemented based on the configuration choices of **Dependent Voting, OR Channel Not OK with Overspeed Voting** and **Alarm if All Group Members are Faulted Voting.** Refer to Section 3.3.2 (Voting Tables, Considerations) for important considerations.

3.3.4.1 Two-module Overspeed Group, Dependent Voting

Condition 1: With no modules bypassed or removed, the group will behave as shown. This behavior applies to overspeed and alert relays.

Module #1 Status	Module #2 Status	Alarm Status	
		#1	#2
OK	OK	No Alarm	No Alarm
Alarm	OK	Alarm	Alarm
Alarm	Not OK	Alarm	Alarm
OK	Not OK	No Alarm	No Alarm
Alarm	Alarm	Alarm	Alarm
Not OK	Not OK	No Alarm	No Alarm

Condition 2: When any one of the two modules is bypassed, the modules will behave as shown. This behavior applies to overspeed and alert relays.

Active Module's Status	Alarm Status	
	Active Module	Bypassed Module
OK	No Alarm	No Alarm
Not OK	No Alarm	No Alarm
Alarm	Alarm	Alarm

Condition 3: When any one of the two modules is removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting). The removed module will remain in the "No Alarm" state.

3.3.4.2 Three-module Overspeed Group, Dependent Voting

Condition 1: With no modules bypassed or removed, the group will behave as shown. This behavior applies to overspeed and alert relays.

Module #1 Status	Module #2 Status	Module #3 Status	Alarm Status		
			#1	#2	#3
OK	OK	OK	No Alarm	No Alarm	No Alarm
Alarm	OK	OK	No Alarm	No Alarm	No Alarm
Alarm	Alarm	OK	Alarm	Alarm	Alarm
Alarm	Alarm	Not OK	Alarm	Alarm	Alarm
Alarm	Not OK	OK	Alarm	Alarm	Alarm
Not OK	OK	OK	No Alarm	No Alarm	No Alarm
Not Ok	Not Ok	OK	No Alarm	No Alarm	No Alarm
Not OK	Not OK	Alarm	Alarm	Alarm	Alarm
Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
Not OK	Not OK	Not Ok	No Alarm	No Alarm	No Alarm

Condition 2: When any one of the three modules is bypassed, the group will behave as shown. This behavior applies to overspeed and alert relays.

Active Module #1 Status	Active Module #2 Status	Alarm Status		
		Active #1	Active #2	Bypassed Module
OK	OK	No Alarm	No Alarm	No Alarm
Alarm	OK	Alarm	Alarm	Alarm
Alarm	Not OK	Alarm	Alarm	Alarm
OK	Not OK	No Alarm	No Alarm	No Alarm
Alarm	Alarm	Alarm	Alarm	Alarm
Not OK	Not OK	No Alarm	No Alarm	No Alarm

Condition 3: When any two of the three modules are bypassed, the group will behave as shown. This behavior applies to overspeed and alert relays.

Active Module's Status	Alarm Status		
	Active Module	Bypassed Module	Bypassed Module
OK	No Alarm	No Alarm	No Alarm
Alarm	Alarm	Alarm	Alarm
Not OK	No Alarm	No Alarm	No Alarm

Condition 4: When any one of the three modules is removed, the remaining two modules will behave as shown in Condition 1 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting). The removed module will remain in the "No Alarm" state.

Condition 5: When any two of the three modules are removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.1 (Two-module Overspeed Group, Independent Voting). The removed modules will remain in the "No Alarm" state.

3.3.4.3 Two-module Overspeed Group, Dependent Voting, OR Channel Not OK with Overspeed

Condition 1: With no modules bypassed or removed, the overspeed relays will behave as shown.

Module #1 Status	Module #2 Status	Overspeed Alarm Status	
		#1	#2
OK	OK	No Alarm	No Alarm
Overspeed	OK	Alarm	Alarm
Overspeed	Not OK	Alarm	Alarm
OK	Not OK	Alarm	Alarm
Overspeed	Overspeed	Alarm	Alarm
Not OK	Not OK	Alarm	Alarm

The alert relays will behave per Condition 1 of Section 3.3.4.1 (Two-module Overspeed Group, Dependent Voting).

Condition 2: When any one of the two modules is bypassed, the overspeed relays will behave as shown.

Active Module's Status	Overspeed Alarm Status	
	Active Module	Bypassed Module
OK	No Alarm	No Alarm
Not OK	Alarm	Alarm
Overspeed	Alarm	Alarm

The alert relays will behave per Condition 2 of Section 3.3.4.1 (Two-module Overspeed Group, Dependent Voting).

Condition 3: When any one of the two modules is removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The removed module will remain in the "No Alarm" state.

3.3.4.4 Three-module Overspeed Group, Dependent Voting, OR Channel Not OK with Overspeed

Condition 1: With no modules bypassed or removed, the overspeed relays will behave as shown.

Module #1 Status	Module #2 Status	Module #3 Status	Overspeed Alarm Status		
			#1	#2	#3
OK	OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	Overspeed	OK	Alarm	Alarm	Alarm
Overspeed	Overspeed	Not OK	Alarm	Alarm	Alarm
Overspeed	Not OK	OK	Alarm	Alarm	Alarm
Not OK	OK	OK	No Alarm	No Alarm	No Alarm
Not Ok	Not Ok	OK	Alarm	Alarm	Alarm
Not OK	Not OK	Overspeed	Alarm	Alarm	Alarm
Overspeed	Overspeed	Overspeed	Alarm	Alarm	Alarm
Not OK	Not OK	Not Ok	Alarm	Alarm	Alarm

The alert relays will behave per Condition 1 of Section 3.3.4.2 (Three-module Overspeed Group, Dependent Voting).

Condition 2: When any one of the three modules is bypassed, the overspeed relays will behave as shown.

Active Module #1 Status	Active Module #2 Status	Overspeed Alarm Status		
		Active #1	Active #2	Bypassed Module
OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	OK	Alarm	Alarm	Alarm
Overspeed	Not OK	Alarm	Alarm	Alarm
OK	Not OK	Alarm	Alarm	Alarm
Overspeed	Overspeed	Alarm	Alarm	Alarm
Not OK	Not OK	Alarm	Alarm	Alarm

The alert relays will behave per Condition 2 of Section 3.3.4.2 (Three-module Overspeed Group, Dependent Voting).

Condition 3: When any two of the three modules are bypassed, the overspeed relays will behave as shown.

Active Module's Status	Overspeed Alarm Status		
	Active Module	Bypassed Module	Bypassed Module
OK	No Alarm	No Alarm	No Alarm
Overspeed	Alarm	Alarm	Alarm
Not OK	Alarm	Alarm	Alarm

The alert relays will behave per Condition 3 of Section 3.3.4.2 (Three-module Overspeed Group, Dependent Voting).

Condition 4: When any one of the three modules is removed, the remaining two modules will behave as shown in Condition 1 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The removed module will remain in the "No Alarm" state.

Condition 5: When any two of the three modules are removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The removed modules will remain in the "No Alarm" state.

3.3.4.5 Two-module Overspeed Group, Dependent Voting, Alarm if All Group Members are Faulted

Condition 1: With no modules bypassed or removed, the overspeed relays will behave as shown.

Module #1 Status	Module #2 Status	Overspeed Alarm Status	
		#1	#2
OK	OK	No Alarm	No Alarm
Overspeed	OK	Alarm	Alarm
Overspeed	Not OK	Alarm	Alarm
OK	Not OK	No Alarm	No Alarm
Overspeed	Overspeed	Alarm	Alarm
Not OK	Not OK	Alarm	Alarm

The alert relays will behave per Condition 1 of Section 3.3.4.1 (Two-module Overspeed Group, Dependent Voting).

Condition 2: When any one of the two modules is bypassed, the overspeed relays will behave as shown.

Active Module's Status	Overspeed Alarm Status	
	Active Module	Bypassed Module
OK	No Alarm	No Alarm
Not OK	Alarm	Alarm
Overspeed	Alarm	Alarm

The alert relays will behave per Condition 2 of Section 3.3.4.1 (Two-module Overspeed Group, Dependent Voting).

Condition 3: When any one of the two modules is removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The removed module will remain in the "No Alarm" state.

3.3.4.6 Three-module Overspeed Group, Dependent Voting, Alarm if All Group Members are Faulted

Condition 1: With no modules bypassed or removed, the overspeed relays will behave as shown.

Module #1 Status	Module #2 Status	Module #3 Status	Overspeed Alarm Status		
			#1	#2	#3
OK	OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	Overspeed	OK	Alarm	Alarm	Alarm
Overspeed	Overspeed	Not OK	Alarm	Alarm	Alarm
Overspeed	Not OK	OK	Alarm	Alarm	Alarm
Not OK	OK	OK	No Alarm	No Alarm	No Alarm
Not Ok	Not Ok	OK	No Alarm	No Alarm	No Alarm
Not OK	Not OK	Overspeed	Alarm	Alarm	Alarm
Overspeed	Overspeed	Overspeed	Alarm	Alarm	Alarm
Not OK	Not OK	Not Ok	Alarm	Alarm	Alarm

The alert relays will behave per Condition 1 of Section 3.3.4.2 (Three-module Overspeed Group, Dependent Voting).

Condition 2: When any one of the three modules is bypassed, the overspeed relays will behave as shown.

Active Module #1 Status	Active Module #2 Status	Overspeed Alarm Status		
		Active #1	Active #2	Bypassed Module
OK	OK	No Alarm	No Alarm	No Alarm
Overspeed	OK	Alarm	Alarm	Alarm
Overspeed	Not OK	Alarm	Alarm	Alarm
OK	Not OK	No Alarm	No Alarm	No Alarm
Overspeed	Overspeed	Alarm	Alarm	Alarm
Not OK	Not OK	Alarm	Alarm	Alarm

The alert relays will behave per Condition 2 of Section 3.3.4.2 (Three-module Overspeed Group, Dependent Voting).

Condition 3: When any two of the three modules are bypassed, the overspeed relays will behave as shown.

Active Module's Status	Overspeed Alarm Status		
	Active Module	Bypassed Module	Bypassed Module
OK	No Alarm	No Alarm	No Alarm
Overspeed	Alarm	Alarm	Alarm
Not OK	Alarm	Alarm	Alarm

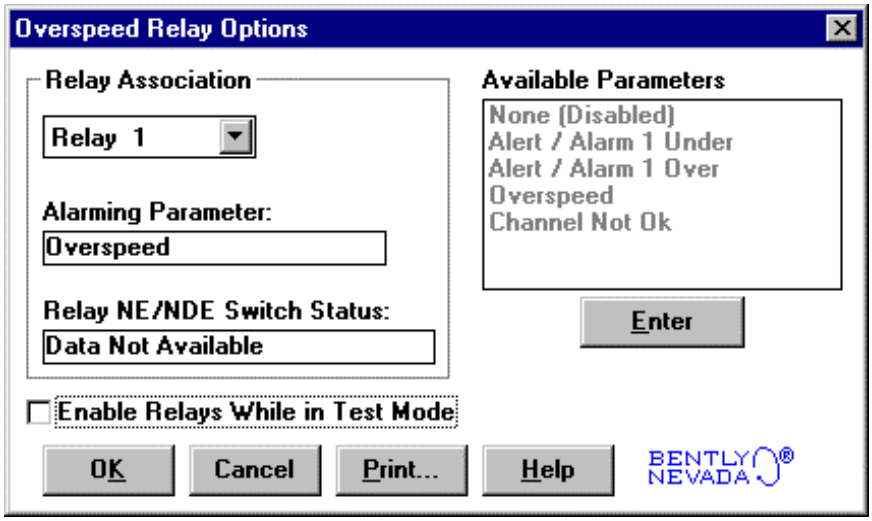
The alert relays will behave per Condition 3 of Section 3.3.4.2 (Three-module Overspeed Group, Dependent Voting).

Condition 4: When any one of the three modules is removed, the remaining two modules will behave as shown in Condition 1 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The removed module will remain in the "No Alarm" state.

Condition 5: When any two of the three modules are removed, the remaining module will behave as shown in Condition 2 of Section 3.3.3.3 (Two-module Overspeed Group, Independent Voting, OR Channel not OK with Overspeed). The removed modules will remain in the "No Alarm" state.

3.4 Relay Options

This section discusses the Rack Configuration Software screens associated with the Overspeed Detection System relays.



Relay Association

Each 3500 Overspeed Detection I/O Module has four independent relays. The Overspeed (Danger) Alarm will always drive relay #1. Use the Relay Association field to configure which events will drive relays #2, #3, and #4. Only one event may be assigned to each relay. When **OR Channel not OK Voting with Overspeed Voting** is enabled in the **Group Options** screen, either an Overspeed alarm or a Channel not OK event can change the state of the Overspeed relay.

Available Parameters

The available events that can be associated with relays #2, #3, and #4 include:

- None (Disabled)
- Alert/Alarm 1 Under - A user defined setpoint that provides alarming when the machine speed passes below a predefined level.
- Alert/Alarm 1 Over - A user defined setpoint that provides alarming when the machine speed passes above a predefined setpoint.
- Overspeed - A user defined setpoint that provides alarming and initiates machine shutdown when the machine speed passes above a maximum running speed.
- Channel not OK.

To choose the alarming parameter for the associated relay, select the desired parameter from the available parameter's list and click the **Enter** button on the relay options configuration screen.

Application Advisory
Alert/Alarm 1 Under setpoints are not intended to be used for turning gear engagement in Zero Speed applications. **Alert/Alarm 1 setpoints are for indication purposes only.**

Enable Relay Drive for Test Mode

When enabled, the relays will change state during the user invoked Overspeed Test Mode.

Application Alert
Configuring the Overspeed Relay to change state during Test Mode may cause machine shutdown.

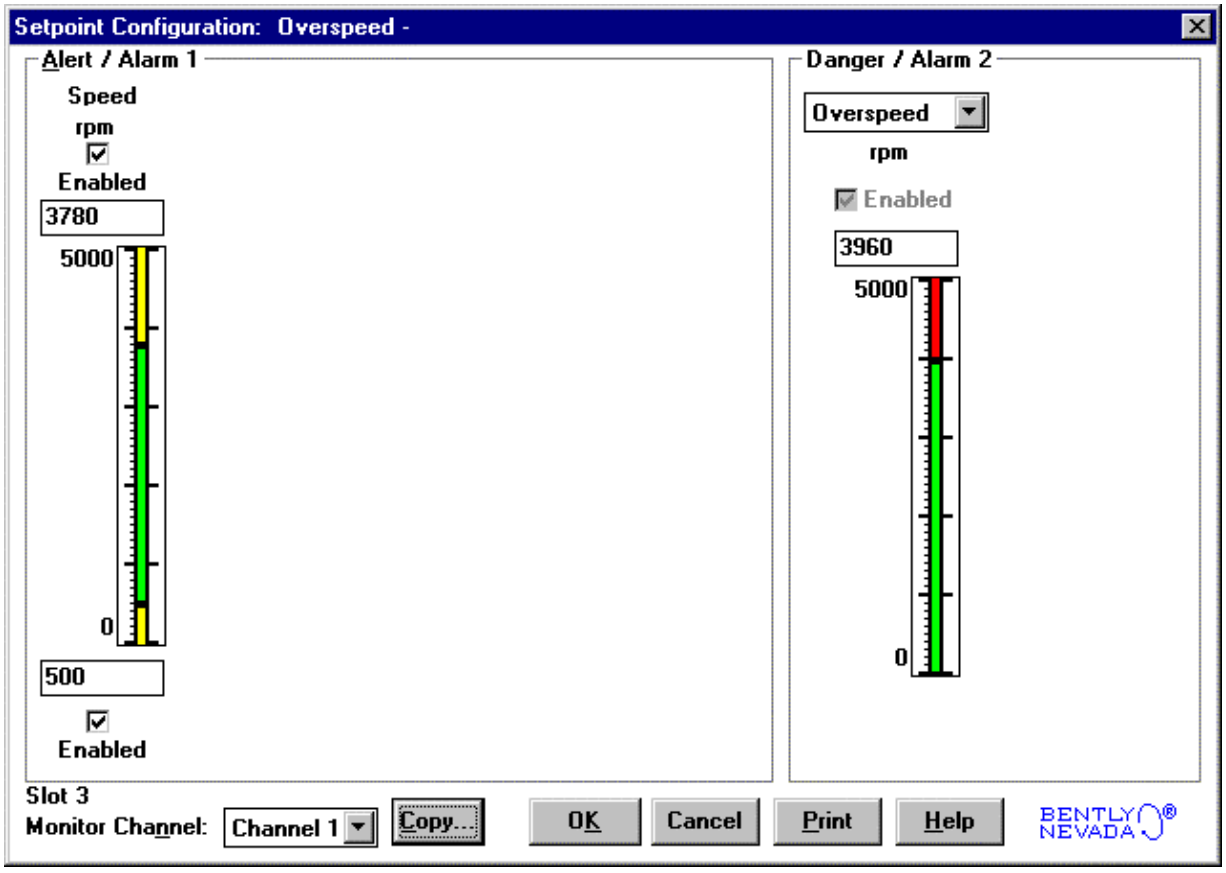
Relay NE/NDE Switch Status

Indicates how the relay hardware switches are set for the relays on the Overspeed Detection I/O Module. This status is only available after the Overspeed Detection System configuration has been uploaded.

3.5 Available Setpoints

This section specifies the available setpoints for the Overspeed Detection System. A setpoint is the level within the full-scale range that determines when an alarm occurs. The 3500 Overspeed Detection System allows Alert/Alarm 1 setpoints to be set for the speed proportional value. The channel will drive an Alert/Alarm 1 indication if the speed proportional values exceeds its setpoints. The 3500 Overspeed Detection System also allows a Danger/Alarm 2 setpoint (Overspeed setpoint) to be set for the speed proportional value.

Use the following screen in the Rack Configuration Software to adjust Alert/Alarm 1 and Danger/Alarm 2 setpoints.



The following table lists the Alert/Alarm 1 and Danger/Alarm 2 setpoints for the Overspeed Detection System. The setpoint number is used in the Communication Gateway Module and Display Interface Module.

Setpoint Number	Speed
1	Alert (Over)
2	Alert (Under)
3	Danger (Overspeed)

All the Alert/Alarm 1 setpoints are provided first, followed by the configured Danger/Alarm 2 setpoints.

Example 1:

A monitor with the Danger/Alarm 2 Overspeed setpoint selected.

Alert/Alarm 1 setpoints: setpoints 1 through 2

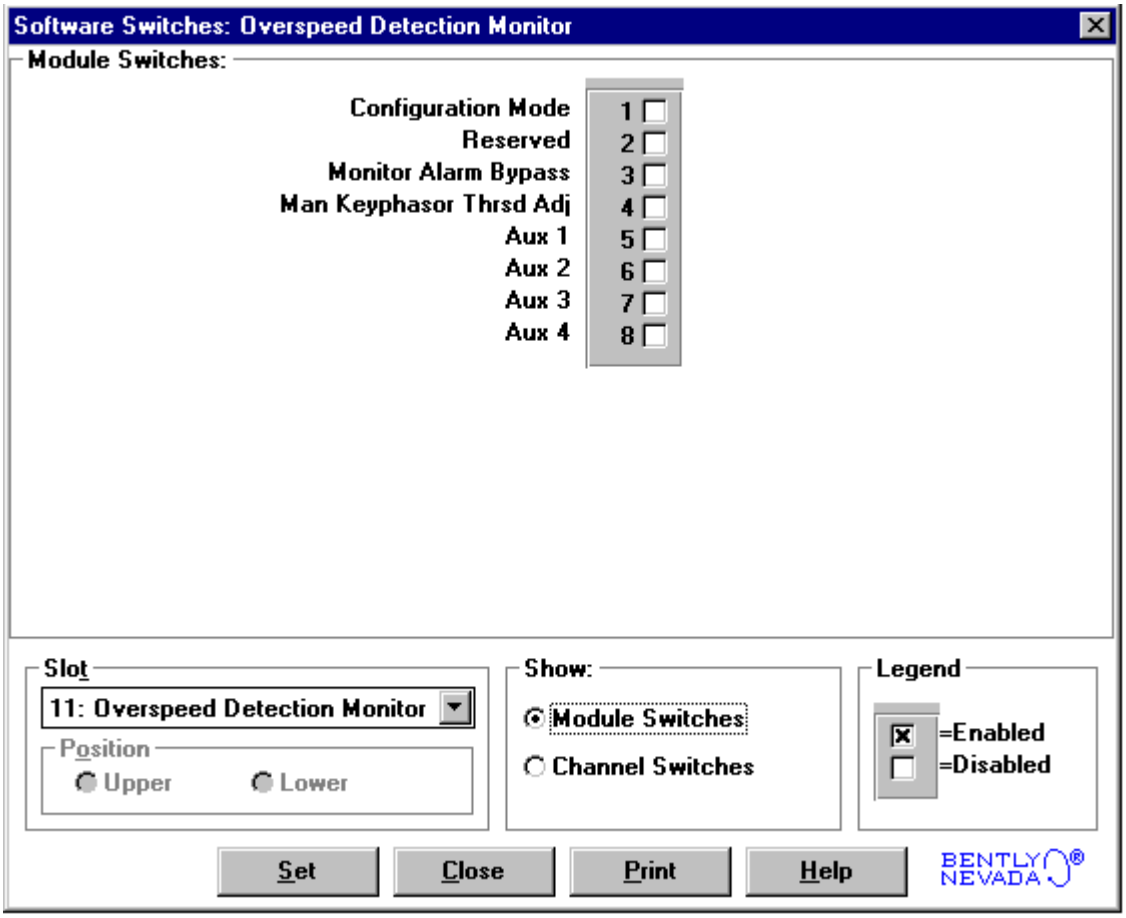
Danger/Alarm 2 setpoints: setpoint 3 is Overspeed (Danger)

Alarm Hysteresis

All setpoints have an Alarm Hysteresis of 0.1% of the setpoint value. The Alarm Hysteresis band for an over setpoint is below the setpoint and the Alarm Hysteresis band for an under setpoint is above the setpoint. For example, if an Overspeed setpoint is set at 10,000 rpm, the hysteresis is 10 rpm (0.1% of 10,000 = 10). The module would enter overspeed alarm at 10,000 rpm but would not go out of alarm until the speed has fallen to 9,990 rpm.

3.6 Software Switches

The Overspeed Detection Monitor supports three module software switches and seven channel software switches. These switches let you temporarily bypass, inhibit, or invoke monitor and channel functions. Set these switches on the **Software Switches** screen under the **Utilities** Option on the main screen of the Rack Configuration Software. No changes will take effect until the **Set** button is pressed.



Module Switches

Configuration Mode

A switch that allows the monitor to be configured. To configure the monitor, enable (☒) this switch and set the key switch on the front of the Rack Interface Module in the PROGRAM position. When downloading a configuration from the Rack Configuration Software, this switch will automatically be enabled and disabled by the Rack Configuration Software. If the connection to the rack is lost during the configuration process, use this switch to remove the module from Configuration Mode.

Monitor Alarm Bypass

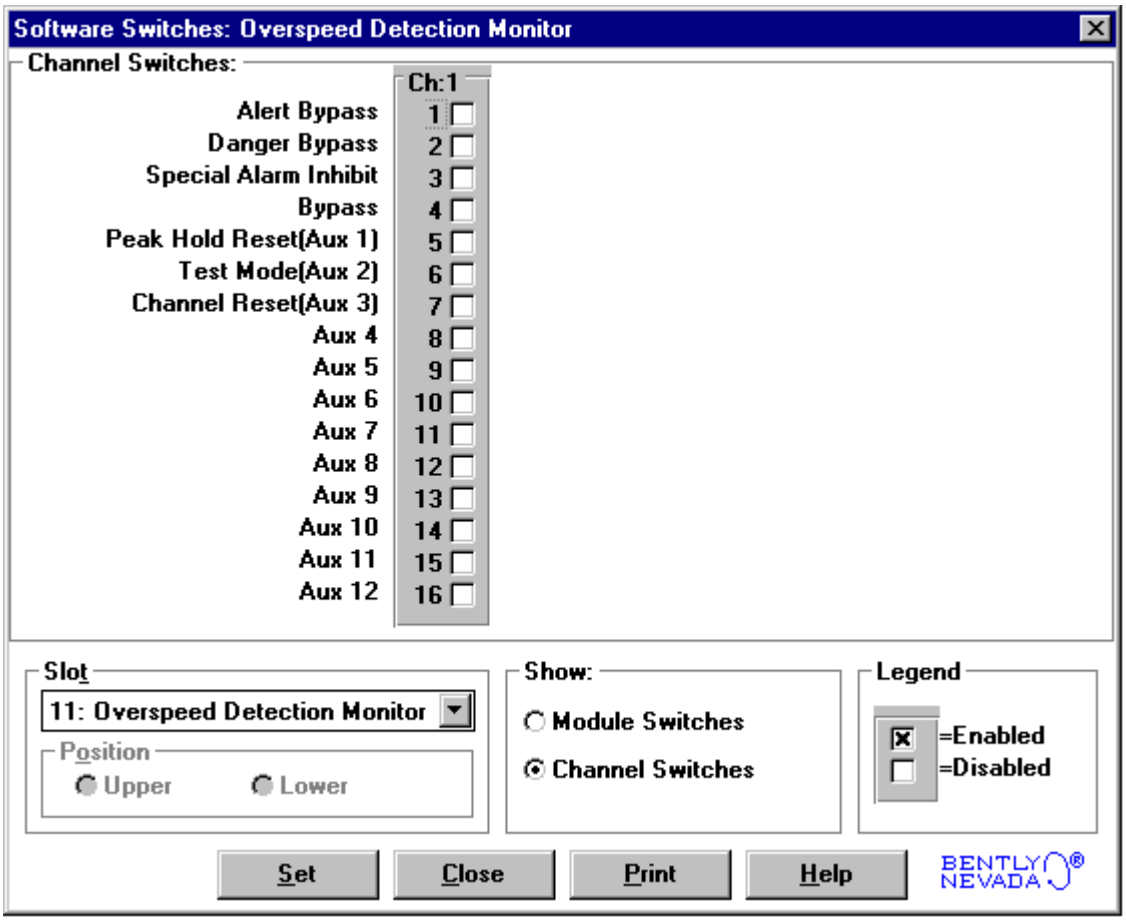
When this switch is enabled, the monitor does not perform alarming functions. All proportional values are still provided.

Manual Keyphasor Threshold Adjust

Used when adjusting the manual threshold. This switch will automatically be enabled and disabled when the **Adjust** button on the Overspeed Detection Monitor options screen is pressed. When in this mode the Overspeed Detection Module will operate with a temporary Manual Threshold supplied by the Rack Configuration Software. Proportional values may go invalid and alarming will be bypassed while the Manual Threshold is being adjusted.

The monitor switch number is used in the Communication Gateway Module and Display Interface Module.

Monitor Switch Number	Switch Name
1	Configuration Mode
3	Monitor Alarm Bypass
4	Manual Keyphasor Threshold Adjust



Channel Switches

Alert Bypass

When this switch is enabled, the channel does not perform Alert alarming functions.

Danger Bypass

When this switch is enabled, the channel does not perform Danger alarming functions.

Special Alarm Inhibit

When this switch is enabled, the Trigger OK check for underspeed and all under alarms are inhibited. This function is used for machine startup. The Trigger OK Inhibit will automatically be removed when the Overspeed Detection System has acquired three consecutive valid rpm readings. The Under Alarm Inhibit will automatically be removed when the machine speed exceeds the under setpoint for the first time.

Bypass

When this switch is enabled, the channel provides no alarming functions and supplies no proportional values.

Peak Hold Reset

When this switch is enabled, the current peak speed reading is cleared from memory.

Test Mode

When this switch is enabled, it invokes the Overspeed Test Mode function. The module will remain in test mode as long as the switch is enabled. Only one module in the Overspeed Detection Group may be in Test Mode at any time. Refer to page 20 for **Test Mode** configuration options.

Channel Reset

A switch that resets latched alarms and latched not OKs.

The channel switch number is used in the Communication Gateway Module and the Display Interface Module.

Channel Switch Number	Switch Name
1	Alert Bypass
2	Danger Bypass
3	Special Alarm Inhibit
4	Bypass
5	Peak Hold Reset
6	Test Mode
7	Channel Reset

4. I/O Module Descriptions

The Overspeed Detection I/O Module receives the signal from the transducer and routes the signal to the Overspeed Detection Module. The I/O module also supplies power to the proximitor transducer and provides a 4 to 20 mA recorder output for the transducer input channel. The Overspeed Detection I/O Module also provides four sets of relay contacts and can be setup so each relay is Normally Energized or Normally De-energized. Install one I/O module for each monitor. Install the I/O module behind the monitor in a rack mount or panel mount rack or above the monitor in a bulkhead rack.

This section describes how to use the connectors on the I/O modules. The 3500 Field Wiring Diagram Package (part number 130432-01) shows how to connect the transducer, system contacts, and recorder output to the I/O module.

4.1 Overspeed Detection I/O Module

The Overspeed Detection I/O Modules require you to wire the transducer and the recorder output to the I/O module directly. This section shows what this I/O module looks like and shows how to connect the wires to the Euro Style connector.

1) Connect the wire from the transducer to the Overspeed I/O Module.

2) INHB/COM: Connect to an external switch. Used to inhibit Trigger OK and under alarms at start-up.

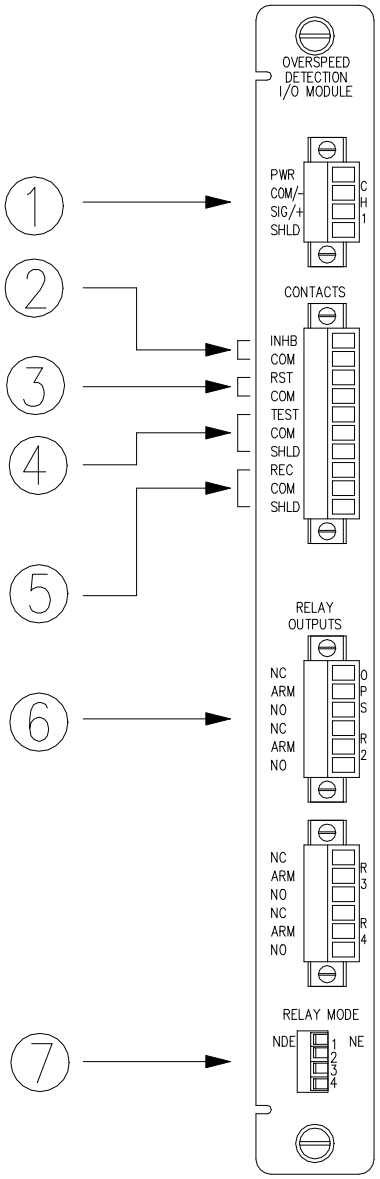
3) RST/COM: Connect to an external switch. Used to reset latched alarms and not OK. When configured, this contact can also reset Peak Speed.

4) TEST/COM: Connect to an external switch. Used to invoke Test Mode.

5) REC/COM: Connect the 4 to 20 mA recorder output to a chart recorder.

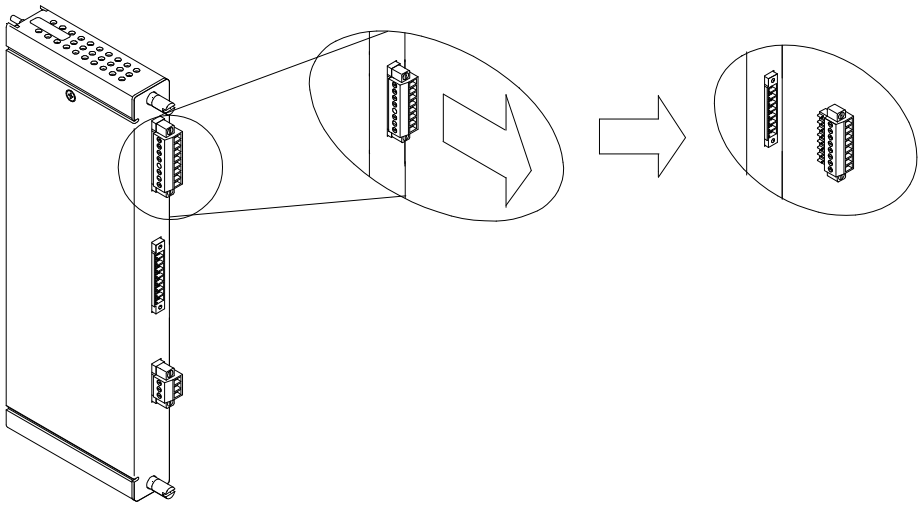
6)Terminals for connecting single pole, double throw (SPDT) relays.

7) DIP switches for configuring the relays for Normally Energized (NE) or Normally De-energized (NDE). Numbers refer to relay number.



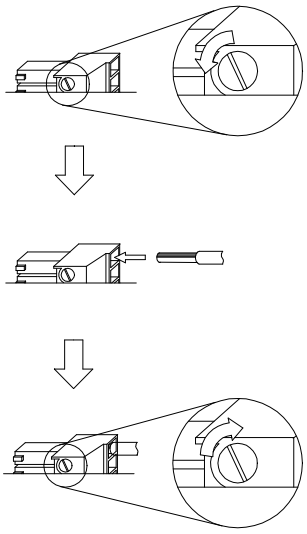
4.1.1 Wiring Euro Style Connectors

To remove a terminal block from its base, loosen the screws attaching the terminal block to the base, grip the block firmly and pull. Do not pull the block out by its wires because this could loosen or damage the wires or connector.



Typical I/O module

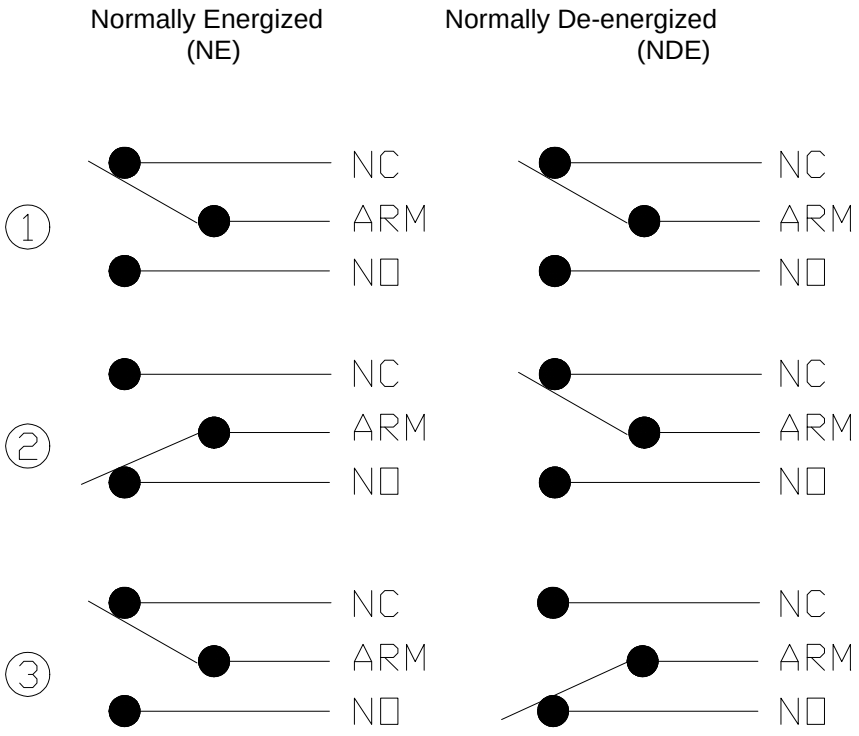
Refer to the 3500 Field Wiring Diagram Package for the recommended wiring. Do not remove more than 6 mm (0.25 in) of insulation from the wires.



4.2 Relay Contacts

Note

Relay contacts are marked NC (Normally Closed), NO (Normally Open), and ARM (Armature). NC and NO define the state of the relay contacts with no power applied to the relay coil (de-energized).



1) No power, no alarm (shelf state)

2) With power, no alarm

3) With power, in alarm

Application Alert
Bently Nevada Corporation strongly recommends the use of Normally Energized (NE) relays for overspeed protection. Normally Energized relays will change states on loss of power and thus provide machine protection.

5. Maintenance

The boards and components inside of the 3500 modules cannot be repaired in the field. Maintaining a 3500 rack consists of testing module channels to verify that they are operating correctly. Modules that are not operating correctly should be replaced with a spare.

This section shows how to verify the operation of channels in an Overspeed Detection System.

When performed properly, this module may be installed into or removed from the rack while power is applied to the rack. Refer to the Rack Installation and Maintenance Manual (part number 129766-01) for the proper procedure.

5.1 Verifying a 3500 Rack - Overspeed Detection System

The 3500 Monitoring System is a high precision instrument that requires no calibration. The functions of monitor channels, however, must be verified at regular intervals. At each maintenance interval, we recommend that you use the procedures in this section to verify the operation of all active channels in the monitor. It is only necessary to verify the alarms and accuracy of channel proportional values that are active.

5.1.1 Choosing a Maintenance Interval

Use the following approach to choose a maintenance interval:

Start with an interval of one year and then shorten the interval if any of the following conditions apply:

- the monitored machine is classified as critical
- the 3500 rack is operating in a harsh environment such as in extreme temperature, high humidity, or in a corrosive atmosphere

- At each interval, use the results of the previous verifications and ISO Procedure 10012-1 to adjust the interval.

5.1.2 Required Test Equipment

The verification procedures in this section require the following test equipment:

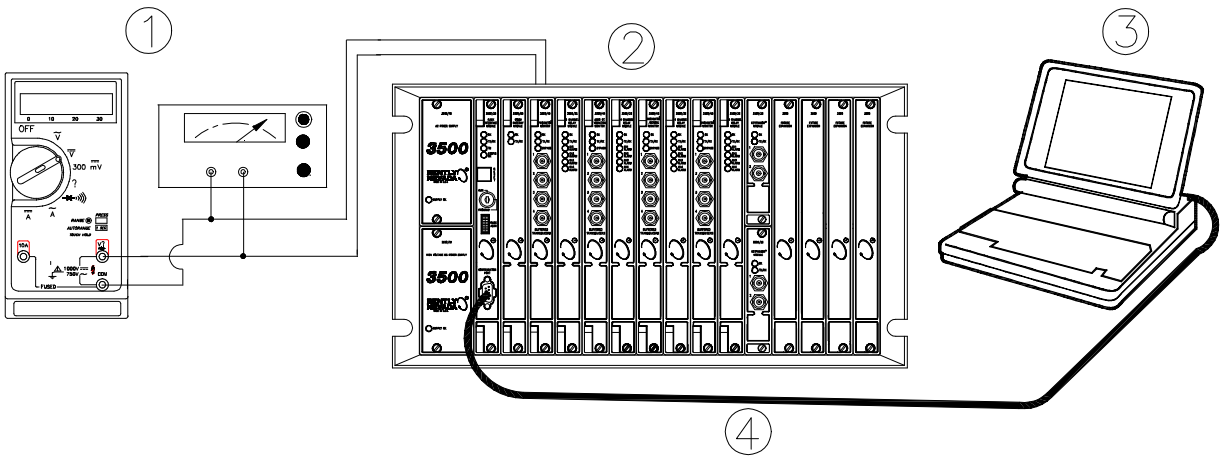
Power Supply (single channel)

Multimeter – 4 ½ digits

Function Generator (with Sync Output)

5.1.3 Typical Verification Test Setup

The following figure shows the typical test setup for verifying an Overspeed Detection Module. The test equipment is used to simulate the transducer signal and the laptop computer is used to observe the output from the rack.



1) Test Equipment

2) 3500 rack

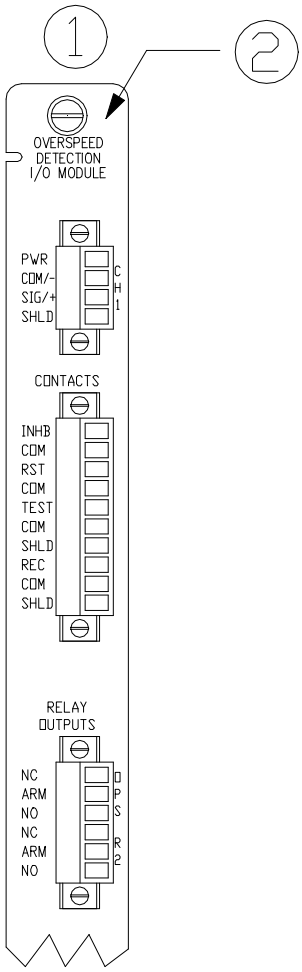
3) Laptop computer

4) RS-232 communications

Transducers can be connected to a 3500 rack in a variety of ways. Connect the test equipment to the Overspeed Detection System Monitor using the following method:

1) Overspeed Detection I/O Module (Internal Termination)

2) Connect test equipment here.



5.1.4 Using the Rack Configuration Software

The laptop computer that is part of the test setup uses the Rack Configuration Software to display output from the rack and to reset certain operating parameters in the rack. To perform the test procedures in this section you must be familiar with the following features of the Rack Configuration Software.

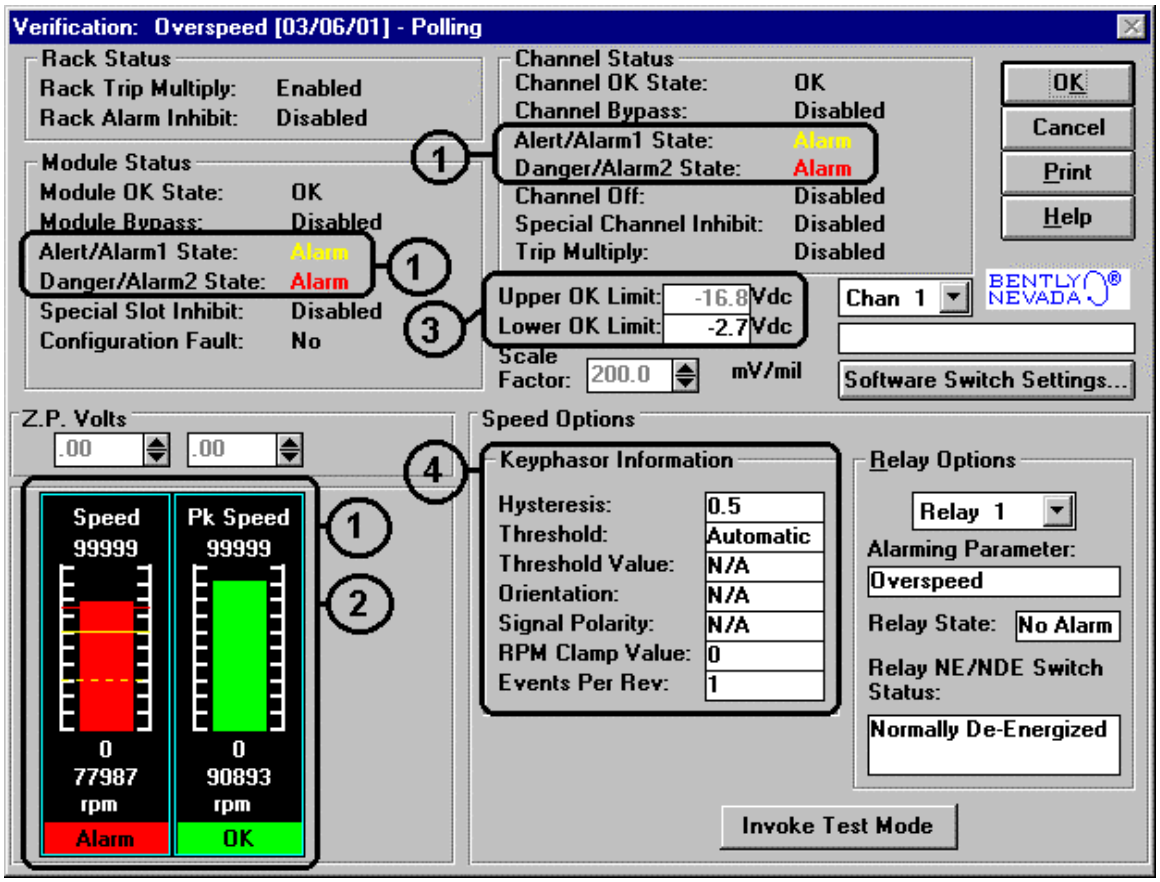
- upload, download, and save configuration files
- enable and disable channels and alarms
- bypass channels and alarms
- display the Verification screen

The Rack Configuration and Test Utilities Guide (part number 129777-01) explains how to perform these operations.

Note

It is important to save the original rack configuration before doing any Maintenance and/or Troubleshooting Procedures. It may be necessary during these procedures to change some configuration settings which must be restored to their original values at the conclusion of the procedures. At that time the original configuration should be downloaded to the rack.

The following figures show how the Verification screen displays output from a 3500 rack:



1) **Alarm Verification Fields:** These fields display output for verifying channel alarms. Alert/Alarm 1 alarms are displayed in yellow. Danger/Alarm 2 (Overspeed) alarms are displayed in red.
2) **Current Value Fields:** The current proportional values are displayed in this box. These fields are used for verifying channel output.
3) **OK Limit Verification Fields:** These fields display output for verifying OK Limits.

4) Keyphasor Information Fields: These fields display information used in the verification procedure.

Alarm Setpoints are indicated on the bar graph as follows:

Danger/Alarm 2 Overspeed - Solid Red Line

Alert/Alarm 1 Over - Solid Yellow Line

Alert/Alarm 1 Under - Dashed Yellow Line

The Alarm Setpoint Value can be determined by selecting the line for the setpoint with the mouse cursor. Any channel bar graph value that enters Alert/Alarm 1 or Danger/Alarm 2 will cause the alarm lines in the Channel Status box to indicate an alarm. Any channel that enters alarm will cause the alarm lines in the Module Status box to indicate an alarm.

5.1.5 Overspeed Channels

The following sections describe how to verify Threshold, test alarms, verify RPM values, verify OK status, and test OK limits for channels configured for Overspeed Detection. The output values and alarm setpoints are verified by varying the speed input signal frequency and DC voltage and observing that the correct results are reported in the Verification screen on the test computer.

5.1.5.1 Test Equipment and Software Setup - Overspeed Detection System

The following test equipment and software setup can be used as the initial set up needed for all the verification procedures (Verify Threshold, Test Alarms, Verify RPM Values, Verify OK Status, and Test OK Limits).

CAUTION

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

Do not touch exposed wires or terminals.

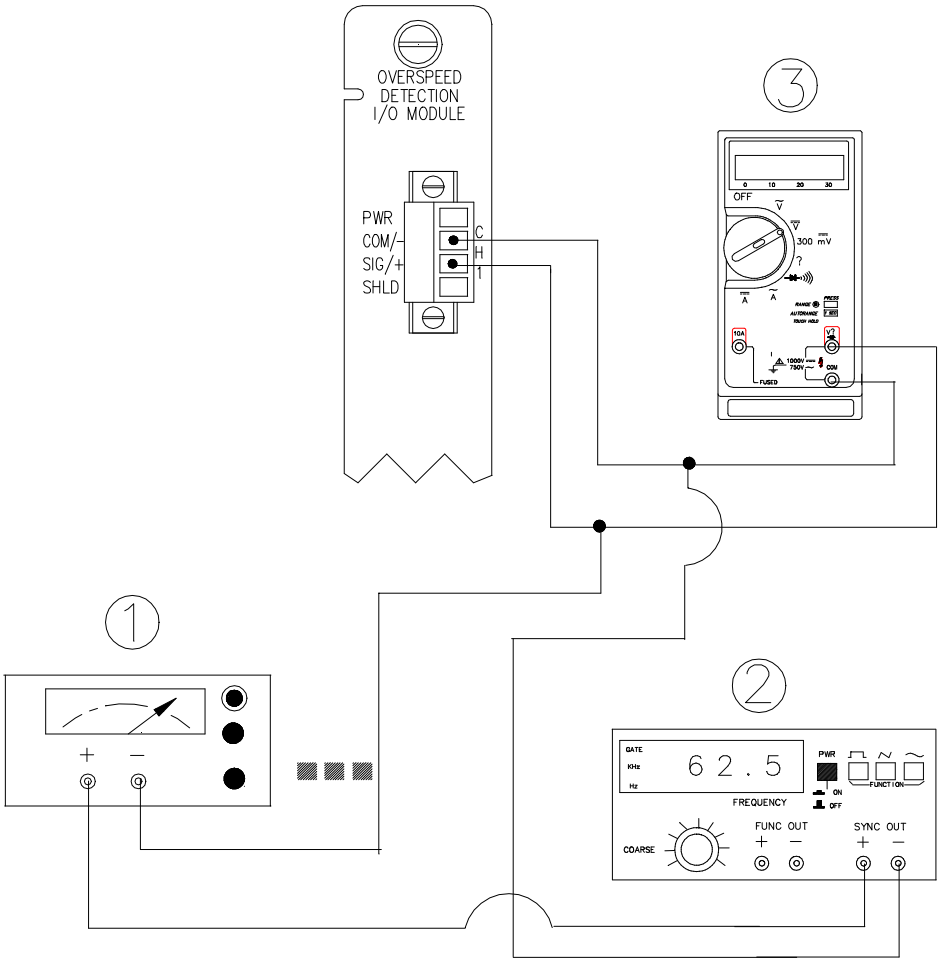
Application Alert
Tests will exceed alarm setpoint levels causing alarms to activate. This could result in a relay contact state change.

Application Alert
Disconnecting the field wiring will cause a not OK condition.

Test Equipment Setup - Overspeed Detection System

Simulate the transducer signal by connecting the power supply, function generator, and multimeter to the Overspeed Detection I/O Module as shown in the figure on page 56 (Overspeed Test Setup). Set the test equipment as specified below.

Equipment	Setting
Power Supply	-10.00 Vdc
Function Generator	Waveform: sinewave DC Volts: 0 Vdc Frequency: 100 Hz Amplitude level: 8 V pp



1) Power supply
2) Function generator
3) Multimeter

Figure 5-1. Overspeed Test Setup

The Test Equipment outputs should be floating relative to earth ground.

Verification Screen Setup - Overspeed Detection System

Run the Rack Configuration Software on the test computer. Choose **Verification** from the Utilities menu and choose the proper Slot number then click on the **Verify** button.

The following table directs you to the starting page of each maintenance section associated with the Overspeed Detection System.

5.1.5.2 Verify Threshold

The Threshold value is the voltage level of the transducer signal where triggering occurs. This value can be set automatically or manually. Use the following procedure to verify that the Overspeed Detection Module Threshold is working correctly.

1. Disconnect PWR, COM/-, and SIG/+ wiring from the channel 1 terminals on the Overspeed Detection I/O Module.
2. Connect test equipment and run software as described in Section 5.1.5.1 (Test Equipment and Software Setup - Overspeed Detection System).
3. Observe the Keyphasor Information Field on the Overspeed Detection Verification Screen:

   If the channel is configured for Auto Threshold:

   Verify that the Channel OK State line reads **OK**

   Verify that the Current Value Fields display an rpm value.

   If the channel is configured for Manual Threshold:

   Adjust the Power Supply voltage to equal the displayed Threshold value voltage level

   Verify that the Channel OK State line reads **OK**

   Verify that the Current Value Fields display an rpm value.

   If the Overspeed channel will not produce an rpm reading, double check the input signal to ensure it is correct. If the module still does not meet specifications or fails any other part of this test, go to Section 5.1.7 (If a Channel Fails a Verification Test).

5.1.5.3 Test Alarms - Overspeed Detection System

The general approach for testing alarm setpoints is to simulate the speed input signal with a function generator and power supply. The alarm levels are tested by varying the output from the test equipment and observing that the correct results are reported in the Verification screen on the test computer. It is only necessary to test those alarm parameters that are configured and being used. The general test procedure to verify current alarm operation will include simulating a transducer input signal and varying this signal:

1. to exceed over Alert/Alarm 1 and Danger/Alarm 2 (Overspeed) Setpoints,

2. to drop below under Alert/Alarm 1 Setpoint,

3. to produce a non-alarm condition.

When varying the signal from an alarm condition to a nonalarm condition, alarm hysteresis must be considered. Adjust the signal well below the alarm setpoint for the alarm to clear.

Rotor Speed

1. Disconnect PWR, COM/-, and SIG/+ field wiring from the channel terminals on the Overspeed Detection I/O Module.
2. Connect test equipment and run software as described in Section 5.1.5.1 (Test Equipment and Software Setup - Overspeed Detection System).
3. Adjust the function generator frequency to provide an rpm level that is below the Rotor Speed Over Setpoints and above the Rotor Speed Under Setpoint.
4. Reset the Overspeed Detection Monitor by shorting the Reset contacts on the Overspeed I/O Module or enabling the Module Reset software switch. Verify that the OK LED is on, the bar graph indicator for Speed is green, and the Current Value Field has no alarm indication.
5. Adjust the function generator frequency such that the rpm level just exceeds the Speed Over Alert/Alarm 1 setpoint level. Verify that the bar graph indicator for Speed changes color from green to yellow and that the Current Value Field indicates an alarm.
6. Reset the Overspeed Detection Monitor by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch. Verify that the bar graph indicator for Speed remains yellow and that the Current Value Field still indicates an alarm.
7. Adjust the function generator frequency such that the rpm level just exceeds the Speed Over Danger/Alarm 2 (Overspeed) setpoint level. Verify that the bar graph indicator for Speed changes color from yellow to red and that the Current Value Field indicates an alarm.
8. Reset the Overspeed Detection Monitor by shorting the Reset contacts on the Overspeed I/O Module or enabling the Module Reset software switch. Verify that the bar graph indicator for Speed remains red and that the Current Value Field indicates an alarm.
9. Adjust the function generator frequency such that the rpm level reads below the Over Alarm setpoint levels. If the nonlatching option is configured, observe that the bar graph indicator for Speed changes color to green and

that the Current Value Field contains no indication of alarms. Reset the latching alarms on the Overspeed Detection Monitor by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch.

10. Repeat steps 3 through 6 to test the Under Alert/Alarm 1 setpoint by adjusting the function generator frequency to drop below the Under Alarm setpoint level.
11. If you can not verify any configured alarm, recheck the configured setpoints. If the monitor still does not alarm properly or fails any other part of this test, go to Section 5.1.7 (If a Channel Fails a Verification Test).
12. Disconnect the test equipment and reconnect the PWR , COM/-, and SIG/+ field wiring to the channel terminals on the Overspeed Detection I/O Module. Verify that the OK LED comes on. Reset the Overspeed Detection Module by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch.

5.1.5.4 Test Overspeed Alarm - User Test Function

The 3500 Overspeed Detection System includes a user test function for verification of the Overspeed Alarm. An on board frequency generator in the Overspeed Detection Module generates the test signal. No external equipment is required to test the Overspeed Alarming function. The channel values are verified by invoking the Overspeed test function and observing that the correct results are reported in the Verification screen on the test computer.

1. Run the Rack Configuration Software on the test computer.
2. Verify that Test Mode is Enabled and properly configured for the Overspeed Detection System Group to be tested. Enter a Start RPM (400 rpm minimum) and an End RPM (limited to the upper full scale range) for the test frequency to sweep through. When configuring the relay options for the Overspeed Detection System Group, you can chose to enable relays while in test mode.
3. Choose **Verification** from the Utilities menu and choose the slot of the Overspeed Detection Module to be tested then click the **Verify** button.
4. Verify that the OK LED is on, that the Channel OK State status on the Overspeed Detection Verification screen reads **OK**, the bar graph indicator for Speed is green, and that the Current Value Field has no alarm indication.
5. Click on the **Invoke Test Mode** button on the Verification screen. This will initiate the Overspeed Test function. The rpm displayed on the bar graph indicator for Speed will begin to ramp from the configured Test Mode Start rpm. Note - the Test Mode function can also be invoked by closing a contact on the Overspeed Detection I/O Module or via a Software Switch.
6. As the rpm level exceeds the Over Alert/Alarm 1 setpoint level, verify that the bar graph indicator for Speed changes color from green to yellow and that the Current Value Field indicates an alarm. If **Enable Relays While in Test Mode** is enabled, verify that the Over Alert/Alarm 1 relay contacts change state.

7. As the rpm level exceeds the Over Danger/Alarm 2 (Overspeed) setpoint level verify that the bar graph indicator for Speed changes color from yellow to red and that the Current Value Field indicates an alarm. If **Enable Relays While in Test Mode** is enabled, verify that the Overspeed relay contacts change state.
8. Click on the **Invoke Test Mode** button on the Verification screen again to remove the module from Test Mode. The Overspeed Detection Module will perform a full self-test before resuming monitoring functions. Verify that the monitor passed the self test. If the monitor failed the self-test, refer to Section 6.3 (System Event List Messages).
9. If you can not verify any configured alarm, recheck the configured setpoints. If the monitor still does not alarm properly or fails any other part of this test, go to Section 5.1.7 (If a Channel Fails a Verification Test).

5.1.5.5 Verify Channel Values - Overspeed Detection System

The general approach for testing these parameters is to simulate the speed input signal with a function generator and power supply. The channel values are verified by varying the output from the test equipment and observing that the correct results are reported in the Verification screen on the test computer.

> **Note**
> Before this procedure can be used, check that the Threshold is set correctly and the channel is OK.

Rotor Speed

1. Disconnect PWR, COM/-, and SIG/+ field wiring from the channel 1 terminals on the Overspeed Detection I/O Module.
2. Connect test equipment and run software as described in Section 5.1.5.1 (Test Equipment and Software Setup - Overspeed Detection System).
3. Adjust the function generator frequency to 100 Hz. Observe the Keyphasor Information Field on the Overspeed Verification screen to determine the configured number of Events Per Revolution. Use the following equation to determine what the displayed rpm value should be:

Displayed Rotor Speed rpm = (Frequency(Hz) x 60) / Events Per Revolution

Example:

Frequency = 100 Hz and Events Per Revolution = 10

Displayed Rotor Speed rpm = (100 x 60) / Events Per Revolution

= 6000 / 10 = 600 rpm

4. Verify that the Speed bar graph display and Current Value Fields are reading within the specified tolerance. If the recorder output is configured, refer to Section 5.1.6 (Verify Recorder Outputs) for steps to verify the recorder output.
5. If the reading does not meet specifications, check that the input signal is correct. If the monitor still does not meet specifications or fails any other part of this test, go to Section 5.1.7 (If a Channel Fails a Verification Test).
6. Disconnect the test equipment and reconnect the PWR , COM/-, and SIG/+ field wiring to the channel terminals on the Overspeed Detection I/O Module. Verify that the OK LED comes on. Reset the Overspeed Detection Module by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch.

RPM Range	**Accuracy**
Less than 100 rpm	± 0.1 rpm
100 to 10,000 rpm	± 1 rpm
10,000 to 99,999 rpm	± 0.01% of current value

5.1.5.6 Verify OK Status - Overspeed Detection System

The general approach for testing this parameter is to cause a not OK condition and observe that the correct results are reported in the Verification Screen on the test computer.

1. Disconnect the wire from the test equipment to the SIG/+ input of the Overspeed Detection I/O module. The OK LED on the Overspeed Detection Module should go off. Note - with low RPMs at one event per revolution, it may take up to several minutes for the OK LED and the software to indicate a not OK condition.
2. Observe the Overspeed Verification screen:

   Verify that the Channel OK State Line reads **Not OK**

   Verify that the Speed Current Value Field reads **Invalid**
3. If the above results do not occur, check that there is no input signal to the monitor. If the monitor still does not meet specifications or fails any other part of this test, go to Section 5.1.7 (If a Channel Fails a Verification Test).
4. Disconnect the test equipment and reconnect the PWR , COM/-, and SIG/+ field wiring to the channel terminals on the Overspeed Detection I/O Module. Verify that the OK LED comes on. Reset the Overspeed Detection Module by

shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch.

5.1.5.7 Test OK Limits - Overspeed Detection System

Note

All other channels in the rack must be OK or bypassed for the OK relay to be energized.

The general approach for testing OK limits is to input a DC voltage and adjust it above the Upper OK limit and below the Lower OK limit. This voltage will cause a not OK condition and the OK Relay to change state (de-energize). The Upper and Lower OK limits are displayed in the Verification screen on the test computer.

1. Disconnect PWR, COM/-, and SIG/+ field wiring from the channel terminals on the Overspeed Detection I/O Module.
2. Connect test equipment and run software as described in Section 5.1.5.1 (Test Equipment and Software Setup - Overspeed Detection System).
3. Bypass all other configured channels.
4. Adjust the power supply voltage to -10.00 Vdc.
5. Reset the Overspeed Detection Module by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch. Verify that the monitor OK LED is on and that the Channel OK State line in the Channel Status group of the Verification screen reads **OK**.
6. Verify that the OK relay on the Rack Interface I/O Module indicates OK (energized). See 3500/20 Rack Interface Module Operation and Maintenance Manual, part number 129768-01.
7. Increase the power supply voltage (more negative) until the OK LED just goes off (upper limit). Verify that the Channel OK State line in the Channel Status section screen reads **not OK** and that the OK Relay indicates not OK. Verify that the Upper OK limit voltage displayed on the Verification screen is equal to or more positive than the input voltage. Note - this check is valid only if the Upper OK Limit Voltage Check is enabled under **Customize** in the Overspeed **Options** screen of the configuration software.
8. Decrease the power supply voltage (less negative) to -10.00 Vdc.
9. Reset the Overspeed Detection Module by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch. Verify that the OK LED comes back on and that the OK relay energizes. Verify that the Channel OK State line in the Channel Status group reads **OK**.
10. Gradually decrease the power supply voltage (less negative) until the OK LED just goes off (lower limit). Verify that the Channel OK State line in the Channel Status group reads **not OK** and that the OK Relay indicates not OK. Verify that the Lower OK limit voltage displayed on the Verification screen is equal to or more negative than the input voltage. Note - this check is valid only if the Lower OK Limit Voltage Check is enabled under **Customize** in the Overspeed **Options** screen of the configuration software.

11. Increase the power supply voltage (more negative) to -10.00 Vdc.
12. Reset the Overspeed Detection Module by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch. Verify that the OK LED comes back on and that the OK relay energizes. Verify that the Channel OK State line in the Channel Status section reads **OK**.
13. Disconnect the test equipment and reconnect the PWR, COM/-, and SIG/+ field wiring to the channel terminals on the Overspeed Detection I/O Module. Verify that the OK LED comes on. Reset the Overspeed Detection Module by shorting the Reset contacts on the Overspeed I/O Module or enabling the Channel Reset software switch.
14. If you can not verify any configured OK limit, go to Section 5.1.7 (If a Channel Fails a Verification Test).
15. Return the bypass switch for all configured channels back to their original settings.

Overspeed Detection System Default OK Limits Table

Transducer	Upper OK Limit		Lower OK Limit		Center Gap Voltage	
	Without Barriers	With Barriers	Without Barriers	With Barriers	Without Barriers	With Barriers
3300 - 5mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
3300 - 8mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
7200 - 5mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
7200 - 8mm	-16.80 V	-16.80 V	-2.70 V	-2.70 V	-9.75 V	-9.75 V
7200 - 11mm	-19.70 V	N/A	-3.50 V	N/A	-11.60 V	N/A
7200 - 14mm	-16.80 V	N/A	-2.70 V	N/A	-9.75 V	N/A
3300 – 16mm HTPS	-16.80 V	N/A	-2.70 V	N/A	-9.75 V	N/A
3300 RAM	-12.60 V	-12.20 V	-2.40 V	-2.40 V	-7.50 V	-7.30 V
Magnetic Pickup	N/A	N/A	N/A	N/A	N/A	N/A

Note: Assume ±50 mV accuracy for check tolerance.

5.1.6 Verify Recorder Outputs

The following test equipment and procedure should be used in the verification of the recorder outputs. Recorder outputs for the 3500/53 Overspeed Detection Module are 4 to 20 mA.

1. Disconnect the COM and REC field wiring from the contact terminals on the Overspeed Detection I/O Module.
2. Connect test equipment and run software as described in Section 5.1.5.1 (Test Equipment and Software Setup - Overspeed Detection System).

3. Connect a multimeter to the COM and REC outputs of the Overspeed Detection I/O Module. The multimeter should have the capability to measure 4 to 20 mA.
4. Set the proportional value that the recorder is configured for to full-scale. Verify that the recorder output is reading 20 mA ±1%.
5. Set the proportional value that the recorder is configured for to mid-scale. Verify that the recorder output is reading 12 mA ±1%.
6. Remove input and verify that the recorder goes to the Clamp value.
7. If you can not verify the recorder output, check the recorder configuration and connections. If the monitor recorder output still does not verify properly, go to Section 5.1.7 (If a Channel Fails a Verification Test).
8. Disconnect the multimeter, reconnect the COM and REC field wiring to the contact terminals on the Overspeed Detection I/O Module.

5.1.7 If a Channel Fails a Verification Test

When handling or replacing circuit boards always be sure to adequately protect against damage from Electrostatic Discharge (ESD). Always wear a proper wrist strap and work on a grounded conductive work surface.

1. Save the configuration for the module using the Rack Configuration Software.
2. Replace the module with a spare. Refer to the installation section in the 3500 Monitoring System Rack Installation and Maintenance Manual (part number 129766-01).
3. Return the faulty module to Bently Nevada Corporation for repair.
4. Download the configuration for the spare module using the Rack Configuration Software.
5. Verify the operation of the spare.

5.2 Performing Firmware Upgrades

Occasionally it may be necessary to replace the original firmware that is shipped with the 3500/53 Overspeed Detection System. The following instructions describe how to remove the existing firmware and replace it with upgraded firmware. The monitor will need to be reconfigured using the 3500 Rack Configuration software after having its firmware upgraded. All monitors in the 3500/53 Overspeed Detection System must have the same version of firmware.

Note: If you are using a 3500/53 Overspeed Detection System as a Functional Safety System, do not upgrade firmware until you have verified that the new version has been added to the TUV FS Mark certificate.

The following items will be required to perform a firmware upgrade to the monitor:

Large Flathead Screwdriver.

Grounding Wrist Strap.*

IC Removal Tool.*

Upgrade Firmware IC.*

*Refer to Section 7 (Ordering Information) for part numbers. Users may use their own grounding wrist strap or IC removal tool.

5.2.1 Installation Procedure

The following steps will need to be followed to complete the monitor firmware upgrade:

Ensure that the monitor's configuration is saved using the 3500 Rack Configuration software.

Refer to Section 1.2 (Handling and Storing Considerations) before handling the monitor or the upgrade firmware IC.

Remove the monitor from the 3500 rack.

Remove the Top Shield from the monitor.

Remove the original firmware IC from the monitor PWA.

Install the upgrade firmware IC into the socket on the monitor PWA.

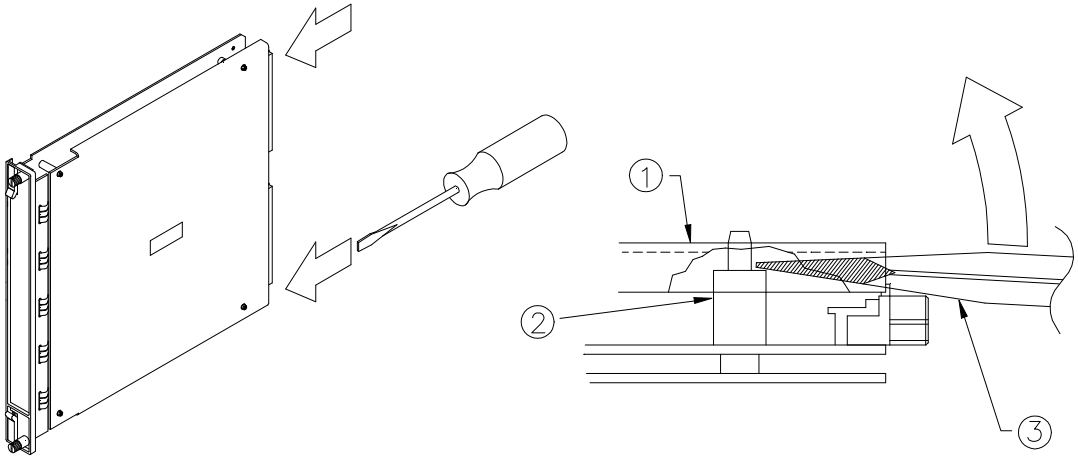
Replace the monitor Top Shield.

Replace the monitor into the 3500 system.

Reconfigure the monitor using the 3500 Rack Configuration software.

Detailed instructions for some of the steps listed above are provided on the following pages. Please review completely before proceeding.

Top Shield Removal



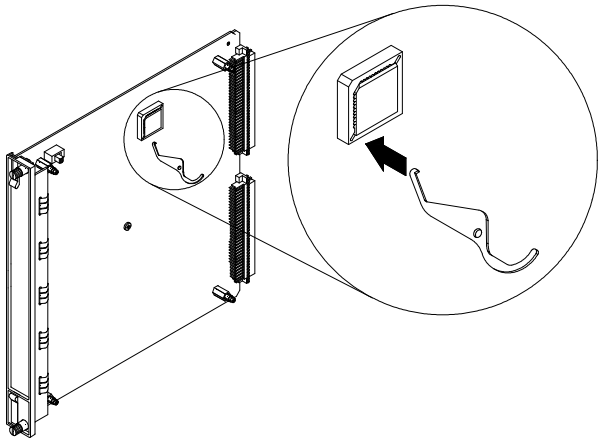
1) Top Shield.
2) Standoff.
3) Screwdriver.

Step 1. Place the large flathead screwdriver under the top shield and on the ridge of the rear standoffs and lift upward on the screwdriver to pop the cover loose from the rear standoffs.

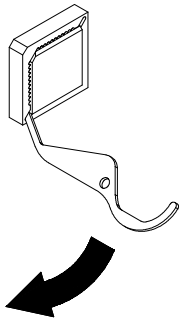
Step 2. Move the top shield up and down to work it loose from the two front standoffs.

Original Firmware IC Removal

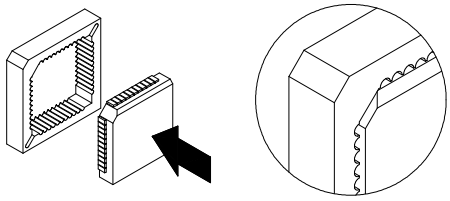
Step 1. Insert the removal tool in one of the two slots at the corner of the socket on the PWA. The diagram shows the approximate location of the chip to be removed, but not necessarily its orientation.



Step 2. Slightly lift the corner of the chip by gently pulling back on the tool. Move to the other slotted corner and repeat. Continue this process until the chip comes loose from the socket.



Upgrade Firmware IC Installation



Install the upgrade firmware IC into the PWA. Be sure that the keyed corner on the IC is matched to the keyed corner of the socket. Ensure that the IC is firmly seated in the socket.

Top Shield Replacement

Replace the top shield. Be sure that the notch on the top shield is positioned at the top left corner of the module as shown in the diagram under “Top Shield Removal”. Align the holes in the top shield with the standoffs and press down around each standoff until they snap in place.

6. Troubleshooting

This section describes how to troubleshoot a problem with the Overspeed Detection Module or the I/O module by using the information provided by the self-test, the LEDs, System Event List, and the Alarm Event List .

6.1 Self-test

To perform the Overspeed Detection Module self-test:

1. Connect a computer running the Rack Configuration Software to the 3500 rack (if needed).
2. Select **Utilities** from the main screen of the Rack Configuration Software.
3. Select **System Events/Module Self-test** from the Utilities menu.
4. Press the **Module Self-test** button on the System Events screen.

Application Alert
Machinery protection will be lost while self-test is being performed.

5. Select the slot that contains the Overspeed Detection Module and press the **OK** button. The monitor will perform a full self-test and the System Events screen will be displayed. The list will not contain the results of the self-test.
6. Wait 30 seconds for the module to run a full self-test.
7. Press the **Latest Events** button. The System Events screen will be updated to include the results of the self-test.
8. Verify if the monitor passed the self-test. If the monitor failed the self-test, refer to Section 6.3 (System Event List Messages).

6.2 LED Fault Conditions

The following table shows how to use the LEDs to diagnose and correct problems.

OK	TX/RX	BYPASS	TEST MODE	Scenario	Action
1 Hz	1 Hz			Monitor is not configured, is in Configuration Mode, or in Calibration Mode.	Reconfigure the Monitor or exit Configuration or Calibration Mode.
5 Hz				Monitor error	Check the System Event List for severity.
ON	Flashing			Monitor is operating correctly.	No action required.
OFF				Monitor is not operating correctly or the transducer has faulted and has stopped providing a valid signal.	Check the System Event List and the Alarm Event List.
	Not Flashing			Monitor is not operating correctly.	Monitor is not executing alarming functions. Replace immediately.
		OFF		Alarming Enabled.	No action required.
		ON		Some or all Alarming Disabled.	No action required.
			OFF	Overspeed Test Mode not Invoked.	No action required.
			ON	Overspeed Test Mode Invoked.	No action required.

= behavior of the LED is not related to the condition.

ALARM LED	Scenario	Action
OFF	Relay is not in Alarm.	No action required.
ON	Relay is in Alarm.	No action required.

6.3 System Event List Messages

This section describes the System Event List Messages that are entered by the Overspeed Detection Module.

Example of a System Event List Message:

Sequence Number	Event Information	Event Number	Class	Event Date DDMMYY	Event Time	Event Specific	Slot
0000000123	Device Not Communicating	32	1	02/01/90	12:24:31:99		5L

Sequence Number: The number of the event in the System Event List (for example 123).

Event Information: The name of the event (for example Device Not Communicating).

Event Number: Identifies a specific event.

Class: The severity of the event. The following classes are available:

Class Value	Classification
0	Severe/Fatal Event
1	Potential Problem Event
2	Typical logged Event
3	Reserved

Event Date: The date the event occurred.

Event Time: The time the event occurred.

Event Specific: Provides additional information for the events that use this field.

Slot: Indicates the module that the event is associated with. If a half-height module is installed in the upper slot or a full-height module is installed, the field will be 0 to 15. If a half-height module is installed in the lower slot then the field will be 0L to 15L. For example, a module installed in the lower position of slot 5 would be 5L.

The following System Event List Messages may be placed in the list by the Overspeed Detection Module and are listed in numerical order. If an event marked with a star (*) occurs, the monitor will stop alarming. If you are unable to solve any problems, contact your nearest Bently Nevada Corporation office.

EEPROM Memory Failure

Event Number: 13
Event Classification: Potential Problem or Severe/Fatal Event
Action: Replace the Monitor Module as soon as possible.

Device Not Communicating

Event Number: 32
Event Classification: Potential Problem
Action: Check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

Device Is Communicating

Event Number: 33
Event Classification: Potential Problem
Action: Check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

*** Neuron Failure**

Event Number: 34
Event Classification: Severe / Fatal Event
Action: Replace the Monitor Module immediately.
Monitor Module will stop alarming.

Fail Relay Coil Sense

Event Number: 55
Event Classification: Potential Problem
Action: Check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Module

Pass Relay Coil Sense

Event Number: 56
Event Classification: Potential Problem
Action: Check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Module

*** I/O Module Mismatch**

Event Number: 62
Event Classification: Severe / Fatal Event
Action: Verify that the type of I/O module installed matches what was selected in the software. If the correct I/O module is installed, there may be a fault with the Monitor Module or the Monitor I/O module. Monitor Module will stop alarming.

I/O Module Compatible

Event Number: 63
Event Classification: Severe / Fatal Event
Action: Verify that the type of I/O module installed matches what was selected in the software. If the correct I/O module is installed, there may be a fault with the Monitor Module or the Monitor I/O module.

Fail Main Board +5V-A (Fail Main Board +5V - upper Power Supply)

Event Number: 100
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot

Pass Main Board +5V-A (Pass Main Board +5V - upper Power Supply)

Event Number: 101
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot

Fail Main Board +5V-B (Fail Main Board +5V - lower Power Supply)

Event Number: 102
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the lower slot

Pass Main Board +5V-B(Pass Main Board +5V – lower Power Supply)

Event Number: 103
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the lower slot

*** Fail Main Board +5V-AB** (Fail Main Board +5V - upper and lower Power Supplies)

Event Number: 104
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass Main Board +5V-AB (Pass Main Board +5V - upper and lower Power Supplies)

Event Number: 105
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

Fail Main Board +15V-A (Fail Main Board +15V - upper Power Supply)

Event Number: 106
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot

Pass Main Board +15V-A (Pass Main Board +15V - upper Power Supply)

Event Number: 107
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot

Fail Main Board +15V-B (Fail Main Board +15V - lower Power Supply)

Event Number: 108
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the lower slot

Pass Main Board +15V-B (Pass Main Board +15V - lower Power Supply)

Event Number: 109
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the lower slot

*** Fail Main Board +15V-AB** (Fail Main Board +15V - upper and lower Power Supplies)

Event Number: 110
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass Main Board +15V-AB (Pass Main Board +15V – upper and lower Power Supplies)

Event Number: 111
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
The Monitor Module
The Power Supply installed in the supper slot
The Power Supply installed in the lower slot

Fail Main Board -24V-A (Fail Main Board -24V - upper Power Supply)

Event Number: 112
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot

Pass Main Board -24V-A (Pass Main Board -24V - upper Power Supply)

Event Number: 113
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot

Fail Main Board -24V-B (Fail Main Board -24V - lower Power Supply)

Event Number: 114
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the lower slot

Pass Main Board –24V-B (Fail Main Board –24V – lower Power Supply)

Event Number: 115
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the lower slot

*** Fail Main Board -24V-AB** (Fail Main Board -24V - upper and lower Power Supplies)

Event Number: 116
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass Main Board -24V-AB (Pass Main Board -24V - upper and lower Power Supplies)

Event Number: 117
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

*** Fail Main Board +5VA-AB** (Fail Main Board Analog +5V - upper and lower Power Supplies)

Event Number: 126
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass Main Board +5VA-AB (Pass Main Board Analog +5V - upper and lower Power Supplies)

Event Number: 127
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

*** Fail Main Board -15V-AB** (Fail Main Board -15V - upper and lower Power Supplies)

Event Number: 144
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass Main Board -15V-AB (Pass Main Board -15V - upper and lower Power Supplies)

Event Number: 145
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

*** Fail OK Limit Volt Check**

Event Number: 146
Event Classification: Severe/Fatal Event
Action: Verify that the transducer is properly gapped. If gap is OK, check to see if one of the following components is faulty:
the Transducer
the Overspeed Detection I/O Module
the Overspeed Detection Module
Monitor Module will stop alarming.

Pass OK Limit Volt Check

Event Number: 147
Event Classification: Severe/Fatal Event
Action: Verify that the transducer is properly gapped. If gap is OK, check to see if one of the following components is faulty:
the Transducer
the Overspeed Detection I/O Module
the Overspeed Detection Module

*** Fail Transducer Power**

Event Number: 148
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass Transducer Power

Event Number: 149
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

*** Fail I/O Board +2.5V-AB** (Fail I/O Board +2.5V - upper and lower Power Supplies)

Event Number: 150
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass I/O Board +2.5V-AB (Pass I/O Board +2.5V - upper and lower Power Supplies)

Event Number: 151
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

Device Configured

Event Number: 300
Event Classification: Typical Logged Event
Action: No action required.

*** Configuration Failure**

Event Number: 301
Event Classification: Potential Problem or Severe/Fatal Event
Action: Download a new configuration to the Monitor Module. If the problem still exists, replace the Monitor Module immediately.
Monitor Module will stop alarming.

*** Module Entered Cfg Mode** (Module Entered Configuration Mode)

Event Number: 302
Event Classification: Typical Logged Event
Action: No action required.
Monitor Module will stop alarming.

Software Switches Reset

Event Number: 305
Event Classification: Potential Problem
Action: Download the software switches to the Monitor Module. If the software switches are not correct, replace the Monitor Module as soon as possible.

Monitor TMR PPL Failed (Monitor TMR Proportional Value Failed)

Event Number: 310
Event Classification: Potential Problem
Action: Verify that the transducer is properly installed. If the transducer is properly installed, check to see if one of the following components is faulty:

the Transducer
the Overspeed Detection I/O Module
the Overspeed Detection Module

Monitor TMR PPL Passed (Monitor TMR Proportional Value Passed)

Event Number: 311
Event Classification: Potential Problem
Action: Verify that the transducer is properly installed. If the transducer is properly installed, check to see if one of the following components is faulty:

the Transducer
the Overspeed Detection I/O Module
the Overspeed Detection Module

Module Reboot

Event Number: 320
Event Classification: Typical Logged Event
Action: No action required.

*** Module Removed from Rack**

Event Number: 325
Event Classification: Typical Logged Event
Action: No action required.
Monitor Module will stop alarming.

Module Inserted in Rack

Event Number: 326
Event Classification: Typical Logged Event
Action: No action required.

Device Events Lost

Event Number: 355
Event Classification: Typical Logged Event
Action: No action required.
This may be due to the removal of the Rack Interface Module for an extended period of time.

Module Alarms Lost

Event Number: 356
Event Classification: Typical Logged Event
Action: No action required.
This may be due to the removal of the Rack Interface Module for an extended period of time.

*** Fail I/O Board +5V-AB** (Fail I/O Board +5V -upper and lower Power Supplies)

Event Number: 390
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass I/O Board +5V-AB (Pass I/O Board +5V -upper and lower Power Supplies)

Event Number: 391
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

Fail I/O Board +14V-A (Fail I/O Board +14V -upper Power Supply)

Event Number: 392
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the upper slot

Pass I/O Board +14V-A (Pass I/O Board +14V -upper Power Supply)

Event Number: 393
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the upper slot

Fail I/O Board +14V-B (Fail I/O Board +14V -lower Power Supply)

Event Number: 394
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the lower slot

Pass I/O Board +14V-B (Pass I/O Board +14V -lower Power Supply)

Event Number: 395
Event Classification: Potential Problem
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the lower slot

*** Fail I/O Board +14V-AB** (Fail I/O Board +14V -upper and lower Power Supplies)

Event Number: 396
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot
Monitor Module will stop alarming.

Pass I/O Board +14V-AB (Pass I/O Board +14V -upper and lower Power Supplies)

Event Number: 397
Event Classification: Severe/Fatal Event
Action: Verify that noise from the power source is not causing the problem. If the problem is not caused by noise, check to see if one of the following components is faulty:
the Overspeed Detection I/O Module
the Overspeed Detection Monitor Module
the Power Supply installed in the upper slot
the Power Supply installed in the lower slot

Fail I/O Module DIP Sw (Fail I/O Module DIP Switch)

Event Number: 398
Event Classification: Potential Problem
Action: Verify that the Overspeed Detection I/O Module is installed.
If the Overspeed I/O Module is installed, replace the Overspeed Detection I/O Module as soon as possible.

Pass I/O Module DIP Sw (Pass I/O Module DIP Switch)

Event Number: 399
Event Classification: Potential Problem
Action: Verify that the Overspeed Detection I/O Module is installed.
If the Overspeed I/O Module is installed, replace the Overspeed Detection I/O Module as soon as possible.

Pass Module Self-test

Event Number: 410
Event Classification: Typical Logged Event
Action: No action required.

*** Enabled Ch Bypass** (Enabled Channel Bypass)

Event Number: 416
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.
Alarming has been inhibited by this action.

Disabled Ch Bypass (Disabled Channel Bypass)

Event Number: 417
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

Enabled Threshold Adj (Enabled Threshold Adjustment)

Event Number: 418
Event Classification: Typical logged event
Action: No action required.

Disabled Threshold Adj (Disabled Threshold Adjustment)

Event Number: 419
Event Classification: Typical logged event
Action: No action required.

*** Enabled Alert Bypass**

Event Number: 420
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.
Alarming has been inhibited by this action.

Disabled Alert Bypass

Event Number: 421
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

*** Enabled Danger Bypass**

Event Number: 422
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.
Alarming has been inhibited by this action.

Disabled Danger Bypass

Event Number: 423
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

*** Enabled Special Inh** (Enabled Special Inhibit)

Event Number: 424
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.
Alarming has been inhibited by this action.

Disabled Special Inh (Disabled Special Inhibit)

Event Number: 425
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

*** Enabled Mon Alarm Byp** (Enabled Monitor Alarm Bypass)

Event Number: 426
Event Classification: Typical logged event
Action: No action required.
Monitor Module will stop alarming.

Disabled Mon Alarm Byp (Disabled Monitor Alarm Bypass)

Event Number: 427
Event Classification: Typical logged event
Action: No action required.

Enabled SW Channel Reset (Enabled Software Channel Reset)

Event Number: 432
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

SW Peak Reset (Software Peak Reset)

Event Number: 433
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

*** Fail Slot Id Test**

Event Number: 461
Event Classification: Severe/Fatal Event
Action: Verify that the Monitor Module is fully inserted in the rack. If the Monitor Module is installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane
Monitor Module will stop alarming.

Pass Slot Id Test

Event Number: 462
Event Classification: Severe/Fatal Event
Action: Verify that the Monitor Module is fully inserted in the rack. If the Monitor Module is installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

* **Fail Comm Id Mismatch**

Event Number: 463
Event Classification: Potential Problem
Action: Verify that the Monitor Module is fully inserted in the rack. If the Monitor Module is installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane
Monitor Module will stop alarming.

Pass Comm Id Mismatch

Event Number: 464
Event Classification: Potential Problem
Action: Verify that the Monitor Module is fully inserted in the rack. If the Monitor Module is installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

*** Fail DAC Test** (Fail Digital to Analog Converter Test)

Event Number: 471
Event Classification: Severe/Fatal Event
Event Specific: Ch x
Action: Replace the Overspeed Detection Module immediately.
Monitor Module will stop alarming.

Pass DAC Test (Pass Digital to Analog Converter Test)

Event Number: 472
Event Classification: Severe/Fatal Event
Event Specific: Ch x
Action: Replace the Overspeed Detection Module immediately.

*** Enabled Test Signal**

Event Number: 481
Event Classification: Typical logged event
Action: No action required.
Monitor Module will stop alarming.

Disabled Test Signal

Event Number: 482
Event Classification: Typical logged event
Action: No action required.

Setpoint Updated

Event Number: 511
Event Classification: Typical logged event
Action: No action required.

*** I/O Module Removed**

Event Number: 550
Event Classification: Typical logged event
Action: No action required.
Monitor Module will stop alarming.

*** Enabled User Test Mode**

Event Number: 570
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.
Monitor Module will stop alarming.

Enabled HW Channel Reset (Enabled Hardware Channel Reset)

Event Number: 571
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

Disabled HW Channel Reset (Disabled Hardware Channel Reset)

Event Number: 572
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

Fail Test Signal Verify

Event Number: 573
Event Classification: Potential Problem
Action: Replace Monitor Module as soon as possible.

Peak Hold Speed Cleared

Event Number: 574
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

Inter-Module Comm Fault (Inter-Module Communication Fault)

Event Number: 575
Event Classification: Potential Problem
Action: Verify that all modules in the OPS group are properly installed. If the Monitor Modules are installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

Inter-Module Comm OK (Inter-Module Communication OK)

Event Number: 576
Event Classification: Potential Problem
Action: Verify that all modules in the OPS group are properly installed. If the Monitor Modules are installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

OPS In Wrong Slot

Event Number: 577
Event Classification: Severe/Fatal Event
Action: Verify that the Monitor Module is fully inserted in the rack. If the Monitor Module is installed correctly, check to see if one of the following components is faulty:
the Monitor Module
the rack backplane

Disabled User Test Mode

Event Number: 586
Event Classification: Typical logged event
Event Specific: Ch x
Action: No action required.

XDCR Signal Too Slow (Transducer Signal Too Slow)

Event Number: 590
Event Classification: Potential Problem
Action: This may be due to a machine stopped condition. Verify that the transducer is functioning properly.

XDCR Signal Too Fast (Transducer Signal Too Fast)

Event Number: 591
Event Classification: Potential Problem
Action: This may be due to an input frequency above 20 kHz. Verify that the transducer is functioning properly.

XDCR Fifty Percent Error (Transducer Fifty Percent Error)

Event Number: 592
Event Classification: Potential Problem
Action: Verify that the transducer is functioning properly.

RPM Reading Too Low

Event Number: 593
Event Classification: Potential Problem
Action: This may be due to a machine stopped condition. Verify that the transducer is functioning properly.

RPM Reading Too High

Event Number: 594
Event Classification: Potential Problem
Action: This may be due to a speed input above the configured full-scale range for the monitor. Verify that the transducer is functioning properly.

XDCR Signal Now Valid (Transducer Signal Now Valid)

Event Number: 597
Event Classification: Typical logged event
Action: No action required.

6.4 Alarm Event List Messages

The following Alarm Event List Messages are returned by the Overspeed Detection Monitor.

Alarm Event List Message	When the message will occur
Entered Alert / Alarm 1	A proportional value in the channel has entered Alert / Alarm 1 and changed the channel Alert / Alarm 1 status
Left Alert / Alarm 1	A proportional value in the channel has left Alert / Alarm 1 and changed the channel Alert / Alarm 1 status
Entered Danger / Alarm 2	A proportional value in the channel has entered Danger / Alarm 2 and changed the channel Danger / Alarm 2 status
Left Danger / Alarm 2	A proportional value in the channel has left Danger / Alarm 2 and changed the channel Danger / Alarm 2 status
Entered not OK	Module went not OK
Left not OK	Module returned to the OK state
Relay Activated	Condition for driving the relay has been met
Relay De-activated	Condition for driving the relay is no longer met

7. Ordering Information

A B

Part number 3500/53- [ ][ ] - [ ][ ]

A [ ][ ] I/O Module Type

02 2-Channel Overspeed Detection System
03 3-Channel Overspeed Detection System

B [ ][ ] Agency Approval Option

00 None
01 CSA-NRTL/C

Spares

3500/53 Module	133388-01
Overspeed Detection I/O Module	133396-01
3500/53 Module Manual	134939-01
3500/20 RIM Firmware Upgrade Kit	135632-01
Grounding Wrist Strap (Single use only)	04425545
IC Removal Tool	04400037
Firmware IC	134129-01
Connector Header, Internal Termination	
4 position, Green	00580438
6 position, Green	00580436
10 position, Green	00580432

Note

If the 3500/53 Overspeed Detection System is added to an existing 3500 Monitoring System, the following (or later) firmware and software versions are required:

3500/20 RIM Firmware - Revision G or later,

3500 Rack Configuration Software - Version 2.0 or later,

3500 Data Acquisition Software - Version 2.03 or later,

3500 Operator Display Software - Version 1.13 or later.

8. Specifications

INPUTS

Signal:	Each Overspeed Detection module accepts a single transducer signal from a proximity probe transducer or magnetic pickup. The input signal range is +10.0 V to -24.0 V. Signals exceeding this range are limited internally by the module.
Input Impedance:	20 kΩ
Power:	Nominal consumption of 8.0 watts

OUTPUTS

OK LED:	Indicates when the 3500/53 is operating properly.
TX/RX LED:	Indicates when the 3500/53 is communicating with other modules in the 3500 rack.
Bypass LED:	Indicates when the 3500/53 is in Bypass Mode.
Test Mode LED:	Indicates when the 3500/53 is in Test Mode.
Alarm LEDs:	Indicates that an alarm condition has occurred with associated relay.
Buffered Transducer Outputs:	The front of each module has one coaxial connector for buffered output. Each connector is short circuit and ESD protected. The following specifications assume a load impedance of 100 Kohms +/- 1%.
Output Impedance:	550 Ω
DC Offset:	35 mV maximum
DC or AC Gain:	0.98 to 1.01
Transducer Supply Values:	-21.5 to -24.7 Vdc, 40 mA maximum
Recorder:	+4 to +20 mA. Values are proportional to module full-scale range (rpm). Module operation is unaffected by short circuits on recorder output.

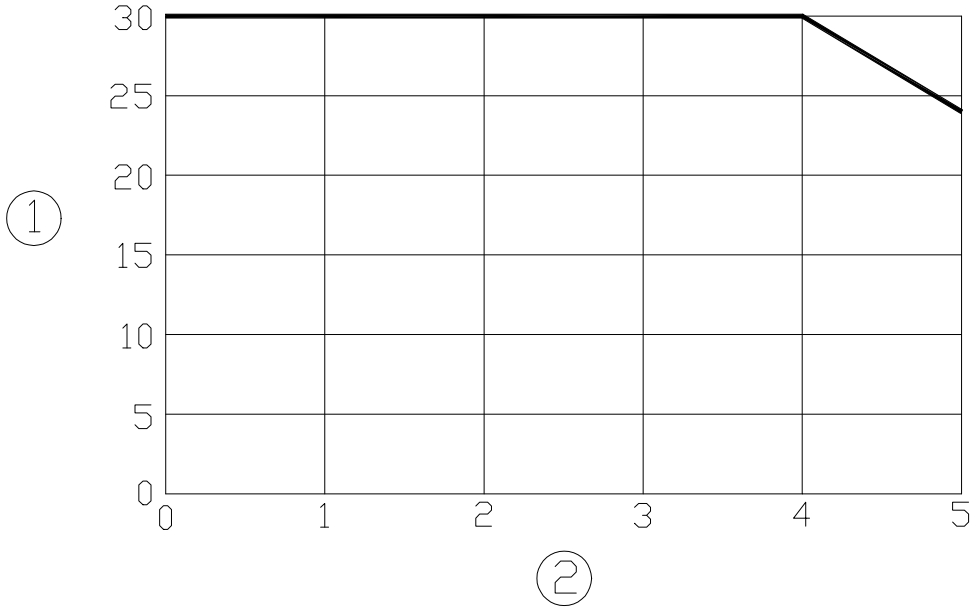
Voltage Compliance (current output):	0 to +12 Vdc range across load. Load resistance is 0 to 600 Ω.
Resolution:	0.3662 μA per bit ±0.25% error at room temperature ±0.70% error over temperature range update rate approximately 100 ms

RELAYS

Type:	Single-pole, double-throw (SPDT) relays
Environmental Sealing:	Epoxy sealed
Arc Suppressors:	250 Vrms, installed as standard
Contact Ratings: Resistive Load:	Max switched power: DC:120 W AC:600 VA Max switched current: 5 A Min switched current: 100 mA @ 5 Vdc Max switched voltage: DC:30 Vdc AC:250Vac
Contact Life:	100,000 @ 5A, 24 Vdc or 120 Vac
Operation:	Each relay is switch selectable for Normally De-energized or Normally Energized

Maximum Switching Capacity

DC Resistive Load

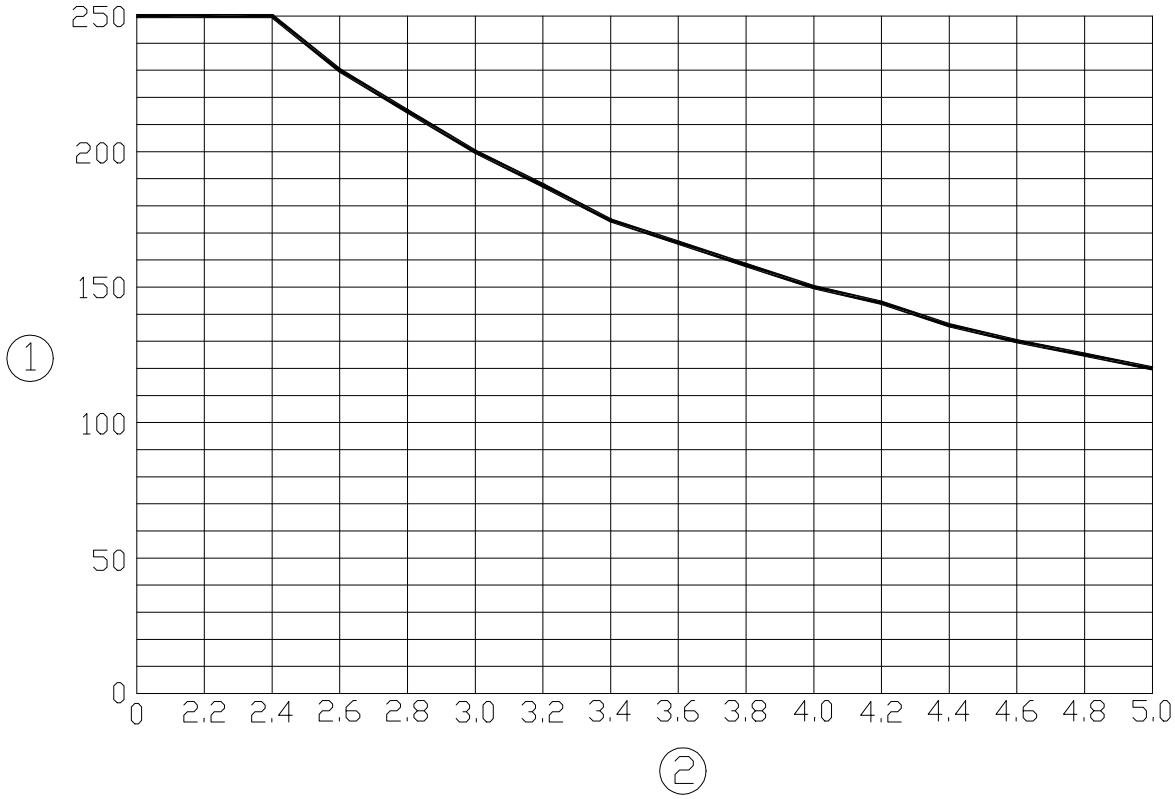


1) Volts (Vdc)

2) Current (Adc)

Maximum Switching Capacity

AC Resistive Load



1) Volts (Vac)

2) Current (Aac)

SIGNAL CONDITIONING

Specified at +25° C (77° F)

Frequency Response:	
Speed Input:	The 3500 Overspeed Detection module will support from 1 to 255 events per revolution with a maximum full scale range of 99,999 rpm and a maximum input frequency of 20 kHz. Minimum input frequency for proximity transducers is 0.0167 Hz (1 rpm for 1 event/revolution) and for passive magnetic pickups is 3.3 Hz.
RPM Accuracy:	Less than 100 rpm = ± 0.1 rpm 100 to 10,000 rpm = ± 1 rpm 10,000 to 99,999 rpm = ± 0.01% of the true shaft speed at the time the value was calculated

TRANSDUCER CONDITIONING

Auto Threshold:	Use for any input above 0.0167 Hz (1 rpm for 1 event/revolution). Minimum signal amplitude for triggering is 1 volt peak to peak.
Manual Threshold:	User selectable from +9.9 Vdc to -23.9 Vdc. Minimum signal amplitude for triggering is 500 millivolts peak to peak.
Hysteresis:	User selectable from 0.2 to 2.5 volts.

ALARMS

Alarm Setpoints	Under and Over Alert/Alarm 1 levels (setpoints) can be set for speed. In addition, a Danger/Alarm 2 (Overspeed) setpoint can be set for speed. All alarm setpoints are set using software configuration. Alarms are adjustable and can normally be set from 0 to 100% of speed Full-scale range.
Alarm time Delay:	less than 30 ms above 300 Hz input frequency

PROPORTIONAL VALUES

Proportional values are speed measurements used to monitor a machine. The Overspeed Detection Module returns the following proportional values:

Overspeed
Speed *
Peak Speed **

* The primary value for the channel. This value can be included in contiguous registers in the Communications Gateway Module.

** Peak Speed proportional values are for display purposes only. No alarming is provided for Peak Speed.

ENVIRONMENTAL LIMITS

Temperature	-30° C to 65° C (-22° F to 149° F) operating -40° C to 85° C (-40° F to 185° F) storage
Humidity:	95% non-condensing

CE MARK DIRECTIVES:

EMC Directives:

EN50081-2:

Radiated Emissions:	EN 55011, Class A
Conducted Emissions:	EN55011, Class A

EN50082-2:

Electrostatic Discharge:	EN 61000-4-2, Criteria B
Radiated Susceptibility:	ENV 50140, Criteria A
Conducted Susceptibility:	ENV 50141, Criteria A
Electrical Fast Transient:	EN 61000-4-4, Criteria B
Surge Capability:	EN 61000-4-5, Criteria B
Magnetic Field:	EN 61000-4-8, Criteria A
Power Supply Dip:	EN 61000-4-11, Criteria B
Radio Telephone:	ENV 50204, Criteria B

Low Voltage Directives:

Safety Requirements:	EN 61010-01

HAZARDOUS AREA APPROVALS

CSA-NRTL/C	Class I, Division 2, Groups A through D

PHYSICAL

Main Board:	
Dimensions (Height x Width x Depth)	241.3 mm x 24.4 mm x 241.8 mm (9.50 in x 0.96 in x 9.52 in)
Weight:	0.82 kg (1.8 lbs)
I/O Modules:	
Dimensions (Height x Width x Depth)	241.3 mm x 24.4 mm x 99.1 mm (9.50 in x 0.96 in x 3.90 in)
Weight:	0.45 kg (1.0 lbs)

RACK SPACE REQUIREMENTS

Main Board:	1 full-height front slot
I/O Modules:	1 full-height rear slot