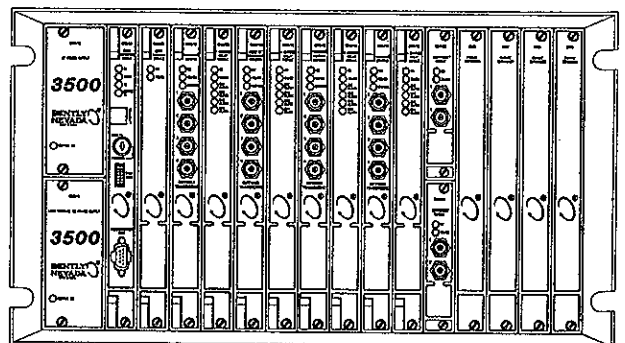


Part number 129771-01
Revision G, October 2001

3500/32 AND 3500/34 4 CHANNEL RELAY MODULE AND TMR RELAY MODULE

OPERATION AND MAINTENANCE MANUAL


BENTLY
Nevada



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Additional Information

NOTICE:

This manual does not contain all the information required to operate and maintain the 4 Channel Relay Module and the TMR Relay Module. 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

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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 lost 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 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.

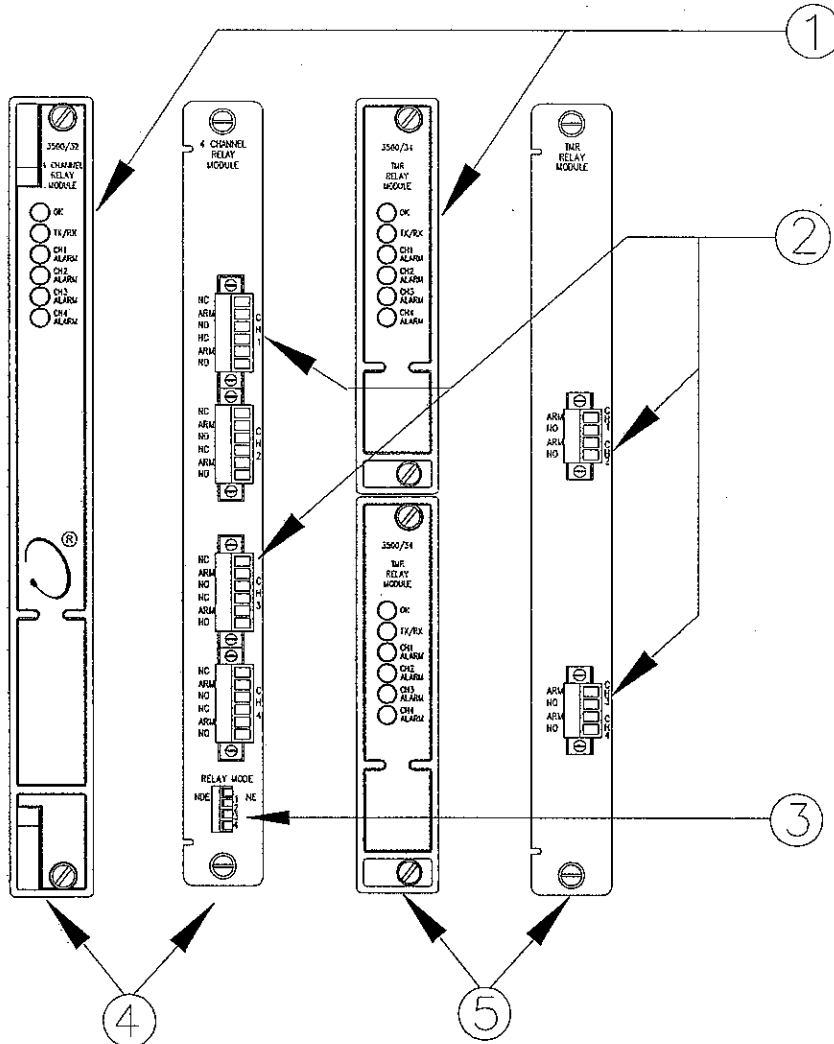
1.3 Disposal Statement

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 system is available with two types of relay modules. The first type is the 4 Channel Relay Module. The 4 Channel Relay Module is used for most monitoring applications. It uses a single relay to drive the output for each channel. See section 2.1 for additional information on the 4 Channel Relay Module.

For applications that require high availability, the 3500 also supports a Triple Modular Redundant (TMR) Relay Module. The TMR Relay Module uses three independent relays to drive a single relay output. The TMR Relay Module works in conjunction with a TMR Rack Interface Module and three monitor modules configured as a TMR set to provide 2 out of 3 voting for inputs. See section 2.2 for additional information on the TMR Relay Module.



- 1) LEDs indicate the status of the relay channels.
- 2) Terminals for connecting relay contacts to external devices.
- 3) Switches that control how the relay contacts work.
- 4) 4 Channel Relay and I/O Modules
- 5) TMR Relay and I/O Modules

2.1 The 4 Channel Relay Module

The 4 Channel Relay Module is a full-height module that provides four relay outputs. Any number of 4 Channel Relay Modules can be placed in any of the slots to the right of the Rack Interface Module.

Each relay output is fully programmable using AND and OR voting. The Alarm Drive Logic for each relay channel can use alarming inputs (alerts and dangers) from any monitor channel in the rack. This Alarm Drive Logic is programmed using the Rack Configuration Software.

The three common types of Alarm Drive Logic are bussed relays, individual relays, and independent relays. Bussed relays use an Alarm Drive Logic that ORs the Alerts or Dangers for all channels in the rack to drive a single relay. Individual relays use Alarm Drive Logic that ORs the Alerts or Dangers for channel pairs (channel 1 and channel 2 or channel 3 and channel 4) in a monitor to drive a single relay. Independent relays use Alarm Drive Logic that cause each alarm level (Alert and Danger) from a channel to drive a separate relay channel. The following examples show the drive logic for these three types of logic.

S = Monitor Slot
C = Channel

A1 = Alert/Alarm 1
A2 = Danger/Alarm 2

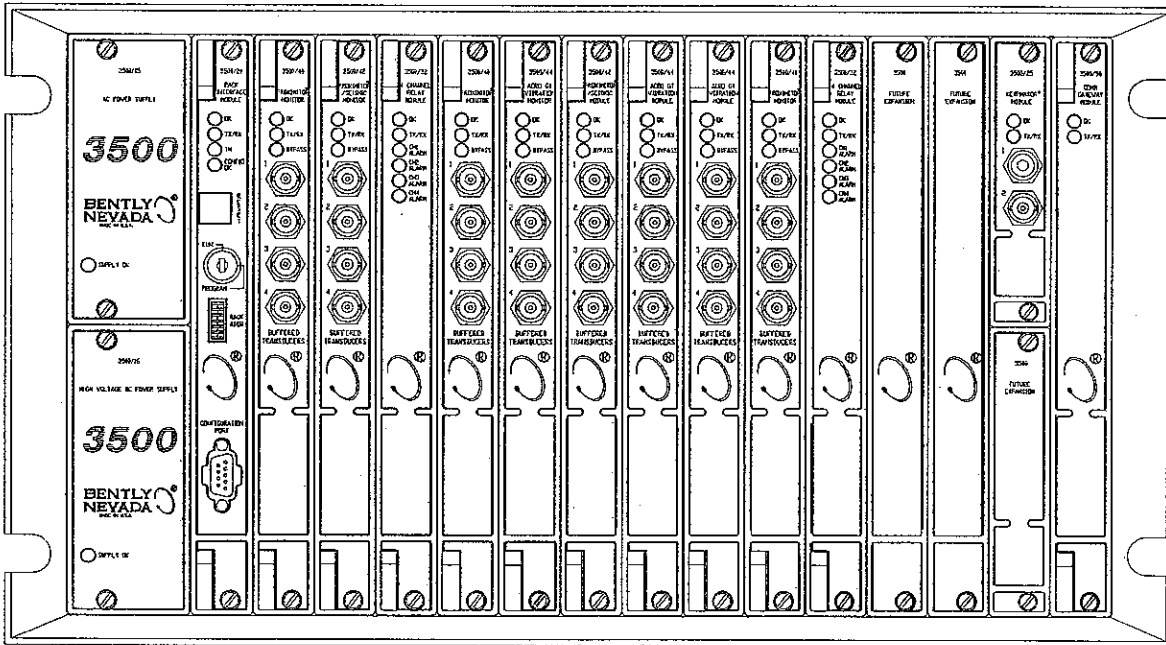
Bussed Relays (Alert and Danger)

##A1 = Any Active Alert

##A2 = Any Active Danger

((S02C##A1) OR (S03C##A1) OR ... OR (S15C##A1)) → Trip Relay Channel 1

((S02C##A2) OR (S03C##A2) OR ... OR (S15C##A2)) → Trip Relay Channel 2

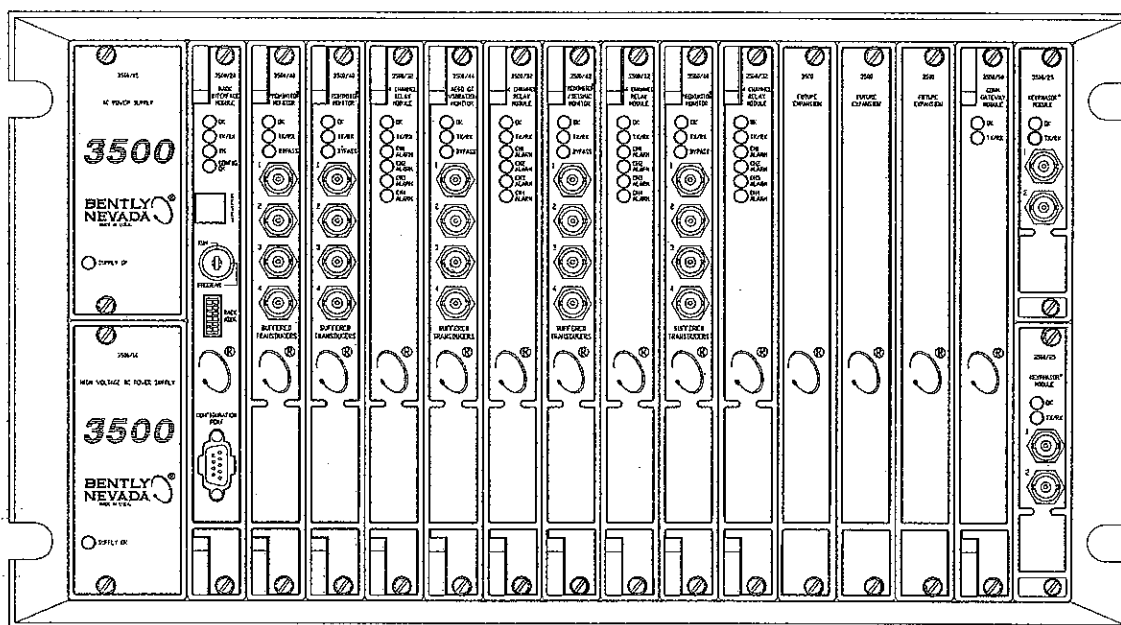


Bussed Relays

Individual Relays (Alert and Danger)

(S02C01A1) OR (S02C02A1) → Trip Relay Channel 1 (Alert Relay)
(S02C01A2) OR (S02C02A2) → Trip Relay Channel 2 (Danger Relay)

(S02C03A1) OR (S02C04A1) → Trip Relay Channel 3 (Alert Relay)
(S02C03A2) OR (S02C04A2) → Trip Relay Channel 4 (Danger Relay)



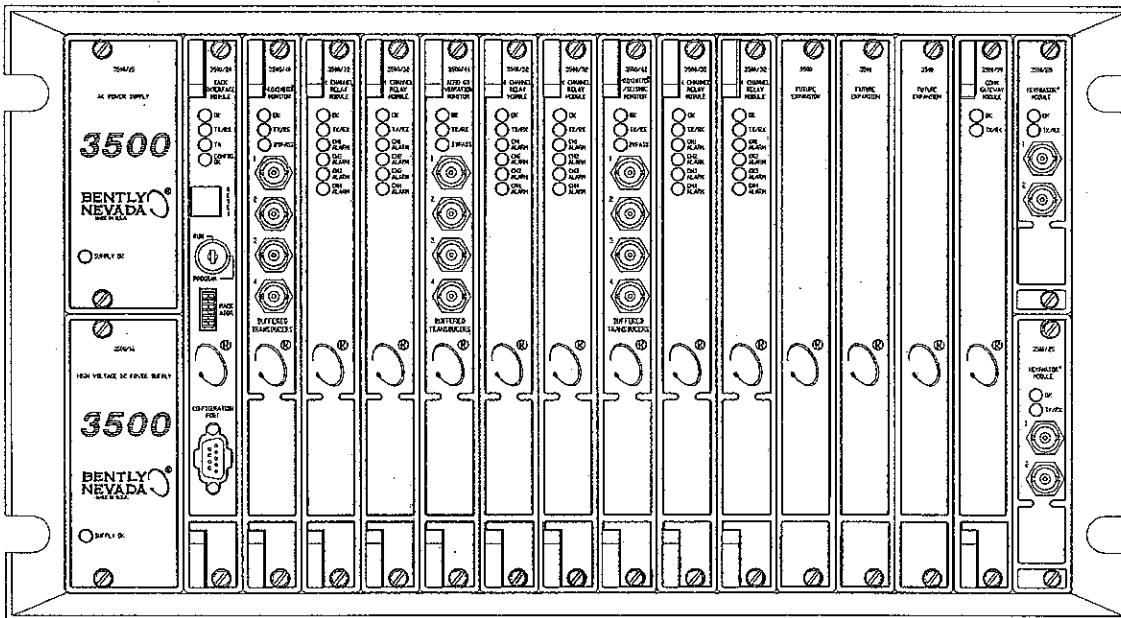
Individual Relays

Independent Relays (Alert and Danger)

- (S02C01A1) → Trip Relay Module in slot 3 Channel 1
- (S02C02A1) → Trip Relay Module in slot 3 Channel 2
- (S02C03A1) → Trip Relay Module in slot 3 Channel 3
- (S02C04A1) → Trip Relay Module in slot 3 Channel 4

- (S02C01A2) → Trip Relay Module in slot 4 Channel 1
- (S02C02A2) → Trip Relay Module in slot 4 Channel 2
- (S02C03A2) → Trip Relay Module in slot 4 Channel 3
- (S02C04A2) → Trip Relay Module in slot 4 Channel 4

Independent relays require that you install two 4 Channel Relay Modules for each monitor module.



Independent Relays

2.2 Triple Modular Redundant (TMR) Description

For applications that require high system reliability, the 3500 rack is capable of Triple Modular Redundancy (TMR). The goal of a TMR setup is such that no single point failure of any component will disable machinery protection for critical machine points. When a TMR system is configured properly, every function of the rack is done in duplicate or triplicate to facilitate this goal.

Requirements for a 3500 TMR rack:

- Rack Jumper must be set to TMR position (see 3500 Rack Installation and Maintenance manual).
- The TMR version of the 3500/20 Rack Interface Module (TMR RIM) must be used.
- Two 3500/15 Power Supplies are required. These power supplies should be connected to independent sources of power. In the event of a failure on the primary supply, the monitors will use the secondary supply.
- TMR monitors are the same as regular monitors only installed in sets of 3 in adjacent slots. The 3 monitors will monitor the same machine point. Only one monitor is configured in 3500 Rack Configuration Software, the other two monitors will automatically be configured the same as the first.
- The TMR group can use separate transducers for each monitor (discrete). Some 3500 monitors are capable of sharing a common transducer across the triple (bussed). Any I/O module can be used for discrete transducers. The TMR I/O module for that monitor must be used for bussed transducers. Channel pair types not supported by the TMR I/O must use discrete transducers; see the Operation and Maintenance manual for the desired monitor. Some monitors do not have TMR I/O modules; these monitors cannot be used with bussed transducers.

Application Alert

When using bussed transducers a single point failure in the transducer or field wiring can cause a loss of machinery protection.

- For truly redundant keyphasors, use 2 3500/25 keyphasor monitors. Configure such that the primary and secondary keyphasors reside on different keyphasor monitors. Non-redundant keyphasors are allowed.
- Independent monitors may be installed in a TMR rack for monitoring less critical machine points.
- Both the 3500/32 and 3500/34 may be used in a TMR rack. The 3500/34 TMR Relay Monitor can only be configured with to drive relays from channels in a TMR group. The 3500/32 4 channel Relay Monitor can only drive relays from channels in an independent monitor.

- Redundant Display modules and Communication Gateways are permitted but not required. Some modules do have configuration restrictions for placing multiple modules in a rack; see the Operation and Maintenance manual for the appropriate module.

Features of a properly configured 3500 TMR rack:

- Duplicate Power Supplies, All monitors capable of switching between primary and backup supplies without interruption of monitoring.
- Triplicate inter-monitor communication networks between RIM, Relay Module and TMR groups.
- Triplicate alarm voting logic and circuitry
- Triplicate relay voting logic and control-circuitry
- Duplicate processing of alarm information from monitors in the rack

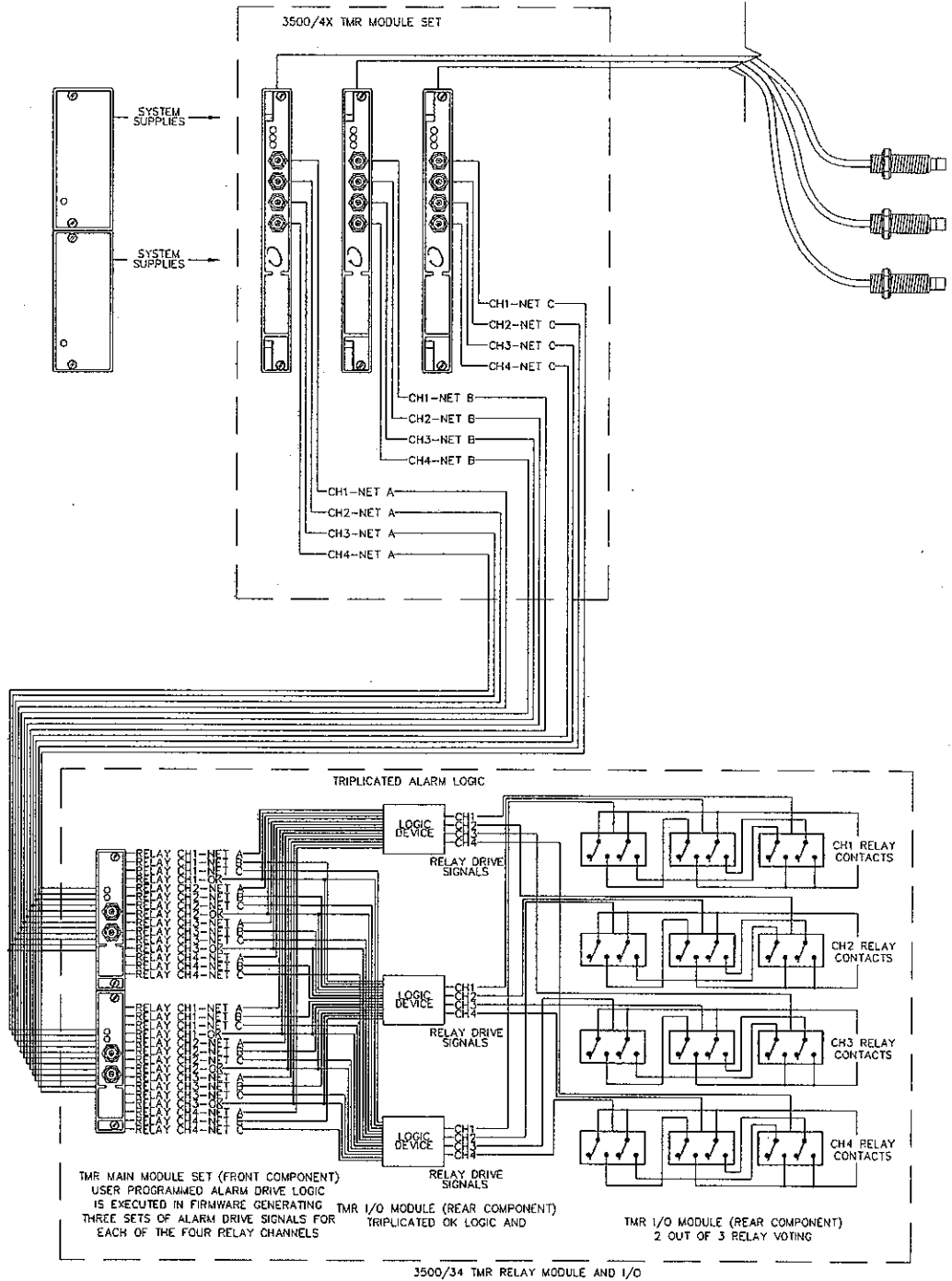
How the TMR Relay Module functions:

A 3500/34 TMR Relay Module consists of 2 half-height Monitors and 1 full size I/O module. The 2 monitors are configured identically and perform the same monitoring function redundantly. The I/O module contains triplicate relays and control logic.

3500 SYSTEM
DUAL POWER SUPPLIES
INDEPENDENTLY SUPPLY REDUNDANT POWER
TO EACH COMPONENT IN THE SYSTEM

TMR GROUP
EACH CHANNEL'S STATUS IS INDEPENDENTLY
DETERMINED IN THE MONITOR'S FIRMWARE

TRIPPLICATED TRANSDUCERS FOR A SINGLE POINT
TYPICAL FOR FOUR CHANNELS
FOR A SINGLE 3500 TMR GROUP
(DISCRETE TRANSDUCER INPUTS SHOWN)



TMR Relay Module:

The TMR Relay Module drives 3 independent Alarm Contact Signals for each of the 4 relay channels, based on the user programmed Alarm Drive Logic. Alarm Drive Logic is programmed for each relay channel via the 3500 Rack Configuration Software. The TMR Relay Module evaluates each data path independently, produces three Alarm Contact Signals, and passes these Alarm Contact Signals to the TMR Relay I/O Module. If the OK Status for a data path is Not OK, the Alarm Contact Signal Associated with that data path is set as Invalid.

TMR Relay I/O Module:

The TMR Relay I/O Module contains 12 relays arranged in 4 channel groups of 3 relays each. This arrangement provides 2 out of 3 relay voting for each of the 4 relay channels. For each relay channel, the TMR Relay Module provides 3 Alarm Contact Signals. Each Alarm Contact Signal is input to one of the relays in the channel group. These relay channel groups are electrically designed to provide the 2 out of 3 voting as listed in the table below. Additionally, each TMR Relay Module provides an OK status that is evaluated on the TMR Relay I/O Module. If the module is Not OK, the Alarm Contact Signals from that module are not evaluated.

Legs in Alarm	Legs Not in Alarm	Legs Faulted	Alarm Status
3	0	0	Alarm
2	1	0	Alarm
1	2	0	No Alarm
0	3	0	No Alarm
2	0	1	Alarm
1	1	1	Alarm
0	2	1	No Alarm
1	0	2	Alarm
0	1	2	No Alarm
0	0	3	Alarm*
* Default is No Alarm but can be configured for Alarm			

Note: Relays will alarm if both TMR relay modules are removed regardless of configuration.

2.3 Statuses

The 4 Channel Relay Module and the TMR Relay Module return both module and channel statuses. This section describes the available statuses and where they can be found.

Module Status**OK**

This indicates if the 4 Channel Relay Module or TMR Relay Module is functioning correctly. A not OK status is returned under any of the following conditions:

- Hardware Failure in the module
- Node Voltage Failure
- Configuration Failure
- Slot ID Failure

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.

Configuration Fault

This indicates if the 4 Channel Relay Module or the TMR Relay Module configuration is invalid.

Bypass

This indicates if any of the channels in the 4 Channel Relay Module or the TMR Relay Module has been bypassed. Any of the following conditions can cause the Relay Module to be bypassed:

- A channel has never been configured
- The Relay Module is in configuration mode
- A Fatal error was found during self-test
- Rack Alarm Inhibit has occurred
- A channel has an invalid configuration
- Any active channel is bypassed

Alarm 1 Active

This indicates that one or more of the channels of the 4 Channel Relay Module or the TMR Relay Module is in alarm.

Channel Status**OK**

This indicates that no fault has been detected by the associated 4 Channel Relay Module channel or associated TMR Relay Module channel. If the Channel OK status goes not OK, then the system OK Relay on the Rack Interface I/O Module will be driven not OK.

Bypass

This indicates if the associated 4 Channel Relay Module channel or associated TMR Relay Module channel has been bypassed. Any of the following conditions can cause the channel to be bypassed:

- The channel has never been configured
- The Relay Module is in configuration mode
- A Fatal error was found during self-test
- Rack Alarm Inhibit has occurred
- The channel has an invalid configuration
- The channel is bypassed

Channel Off

This indicates if the associated 4 Channel Relay Module channel or associated TMR Relay Module channel has been turned off. The Relay channels may be turned off (inactivated) using the Rack Configuration Software.

Alarm 1 Active

This indicates if the associated 4 Channel Relay Module channel or the associated TMR Relay Module channel is in alarm.

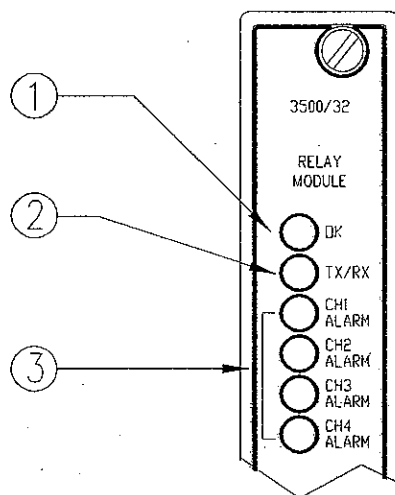
The following table shows where the statuses can be found.

Statuses	Communication Gateway Module	Rack Configuration Software	Operator Display Software
Module OK	X	X	
Module Configuration Fault		X	
Module Bypass		X	
Module Alert/Alarm 1 Active	X	X	
Channel OK	X	X	X
Channel Bypass	X	X	X
Channel Off	X	X	
Channel Alert/Alarm 1 Active	X	X	

2.4 LED Descriptions

The LEDs on the front panel of the 4 Channel Relay Module and the TMR Relay Module indicate the operating status of the module as shown in the following figures. Refer to Section 6.2 for all of the available LED conditions.

2.4.1 4 Channel Relay Module



1) OK

Indicates that the 4 Channel Relay Module and the 4 Channel Relay I/O Module are operating correctly.

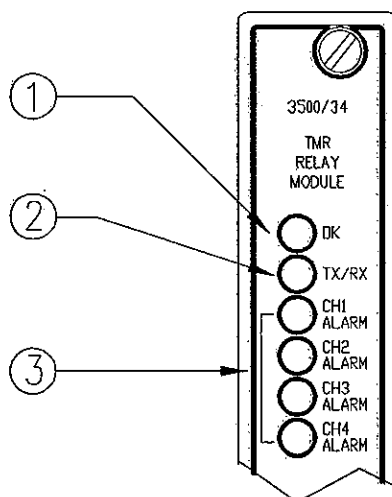
2) TX/RX

Flashes at the rate that messages are received.

3) Channel Alarm

Indicates that an alarm condition has occurred with this relay.

2.4.2 TMR Relay Module



1) OK

Indicates that the TMR Relay Module and the TMR I/O Module are operating correctly.

2) TX/RX

Flashes at the rate that messages are received.

3) Channel Alarm

Indicates that an alarm condition has occurred with this relay.

3 Configuration Information

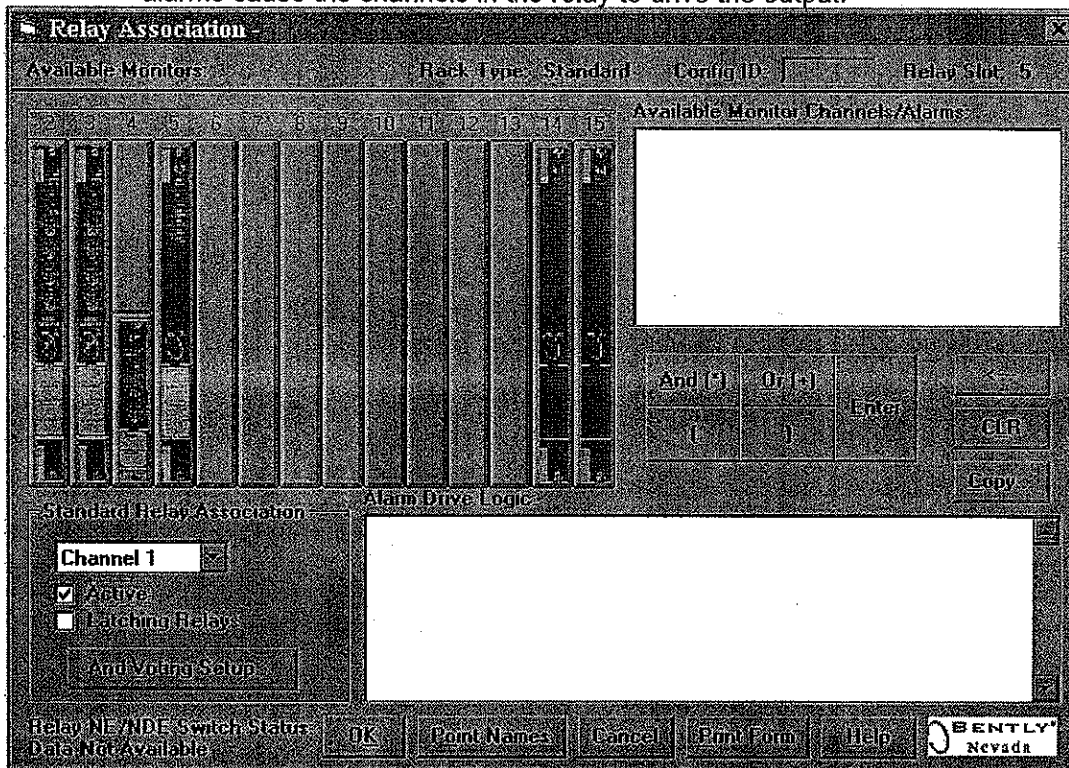
Configure 3500 relay modules by using the Relay Association screen to enter alarm drive logic for each relay channel and by using the Software Switches screen to set software switches. This section defines the options on these configuration screens. The Rack Configuration and Utilities Guide (part number 129777-01) shows how to operate the screens.

3.1 Hardware Considerations

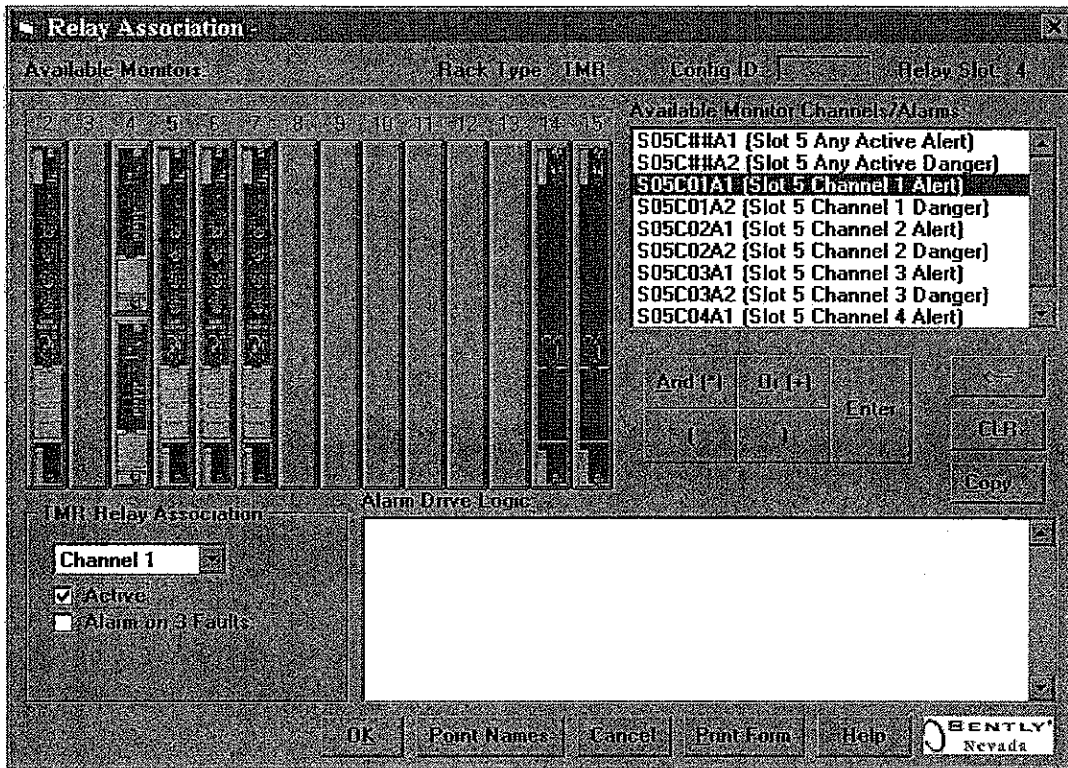
The Slots in the rack are numbered from 0 to 15, counting from left to right. The power supplies go into slot 0 and the Rack Interface module goes into slot 1. Slots 2 through 15 are called "monitoring positions". The 3500/32 or 3500/34 module can be installed into any of the monitoring positions. However, if the 3500/20 Rack Interface Module and Data Manager 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 Entering Alarm Drive Logic

Use the Relay Association screen to enter the alarm logic that controls what alarms cause the channels in the relay to drive the output.



Relay Association Screen for a Standard Relay



Relay Association Screen for a TMR Relay

3.2.1 Relay Module Configuration Considerations

- Add monitor modules to the rack configuration before configuring the Relay Module.
- Activate only the Relay Module channels that will be used.
- Only monitor modules may be used in the alarm drive logic.
- Only the first monitor module of a TMR group needs to be added to the alarm drive logic.
- For the TMR Relay Module, if a channel has an alarm that is part of AND voting and that channel is bypassed, the bypassed channel is removed from the voting logic. Alarms will not be inhibited because of the bypass. The 4 Channel Relay Module is configurable.
- Prior to downloading, the configuration software will determine if the number of instructions exceeds the limit of your relay module. The 4-channel relay monitor is limited to a combined total of 60 tokens, instructions and elements for the 4 channels. The TMR Relay monitor is limited to 10 tokens, instructions and elements per channel.

3.2.2 Relay Module Configuration Options

Available Monitors

A field that shows the monitors in the rack.

Rack Type

The type of Rack Interface Module installed in the rack. Standard indicates that a 4 Channel Relay Module is installed. TMR indicates that a TMR Relay Module is installed.

Config ID

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

Relay Slot

The location in the 3500 rack of the relay module being configured.

Active

A check box that applies to the selected channel in the Channel Association group. The relay channel drives the output only when this box is enabled () and the alarm drive logic for the channel is true.

Latching Relays (only applies to 4 Channel Standard Relay)

When this option is selected, the corresponding relay alarm channel will hold the alarm state until it receives a rack reset or the relay is reconfigured.

Standard Relay Channel Association / TMR Relay Channel Association

A group for selecting the channel to be configured and activated.

Relay NE/NDE Switch Status (only applies to 4 Channel Relay Module)

Indicates how the relay hardware switches are set on the Relay I/O Module. This status is only available after the relay has been uploaded.

Alarm on 3 Faults (only applies to TMR Relay Module)

This option lets you enable or disable alarming on three faults. The default is to not alarm if all three legs (monitors) of a TMR Monitor set are in fault. An alarm will occur if both TMR monitors are removed, regardless of configuration.

Application Alert

Do not enable Alarm on 3 Faults if the relays are associated to Zero Speed channels.

Available Monitor Channels/Alarms

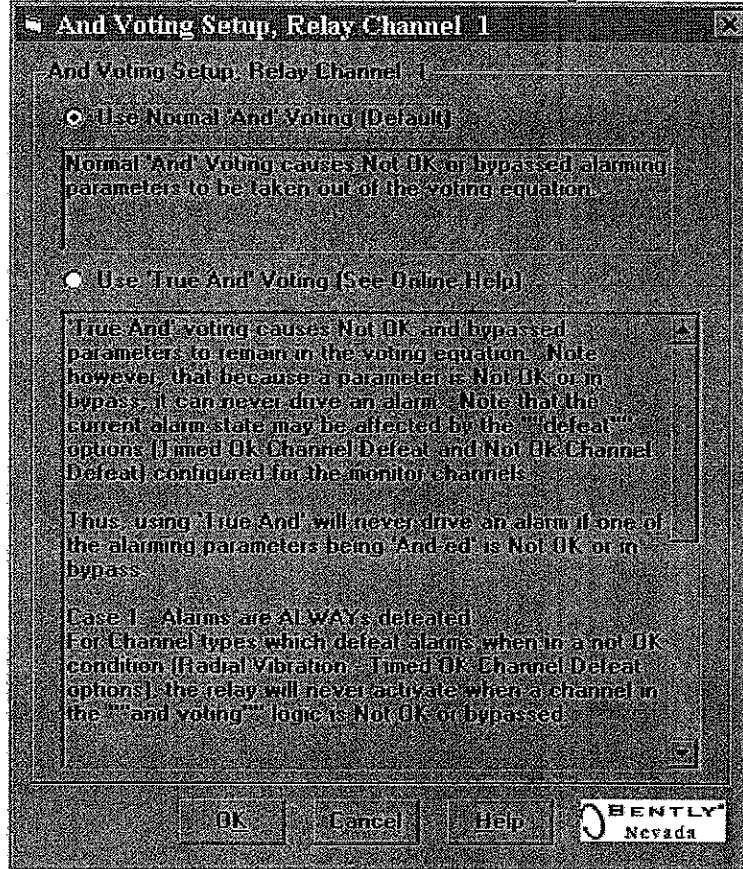
When a monitor is selected, this area shows all the alarms that are available for the monitor.

Alarm Drive Logic

Build the alarm drive logic in this area using the available monitor alarms.

AND Voting Setup

This option allows you to determine the AND voting for a standard relay.



AND Voting Setup Screen

Normal AND Voting (Default)

With this option selected, if an alarming parameter is Not OK or bypassed (either by user selection or monitor failure), then the parameter will be removed from the relay logic.

True AND Voting

Selecting True AND logic causes Not OK and bypassed parameters to remain in the relay logic. Using 'True And' logic will not drive an alarm if an alarming parameter being And-ed is Not OK or in bypass.

Important: Care must be taken when selecting AND the voting to be used; consider the configuration settings for the channel to be used as an alarm parameter. Not OK Channel Defeat (single channel measurements), Not OK Channel Pair Defeat (paired channel measurements), Timed OK Channel Defeat and Latching vs. Non-Latching Not OK modes all affect the circumstances that cause a channel to be "Not OK" or bypassed. The following channel types have special scenarios to consider:

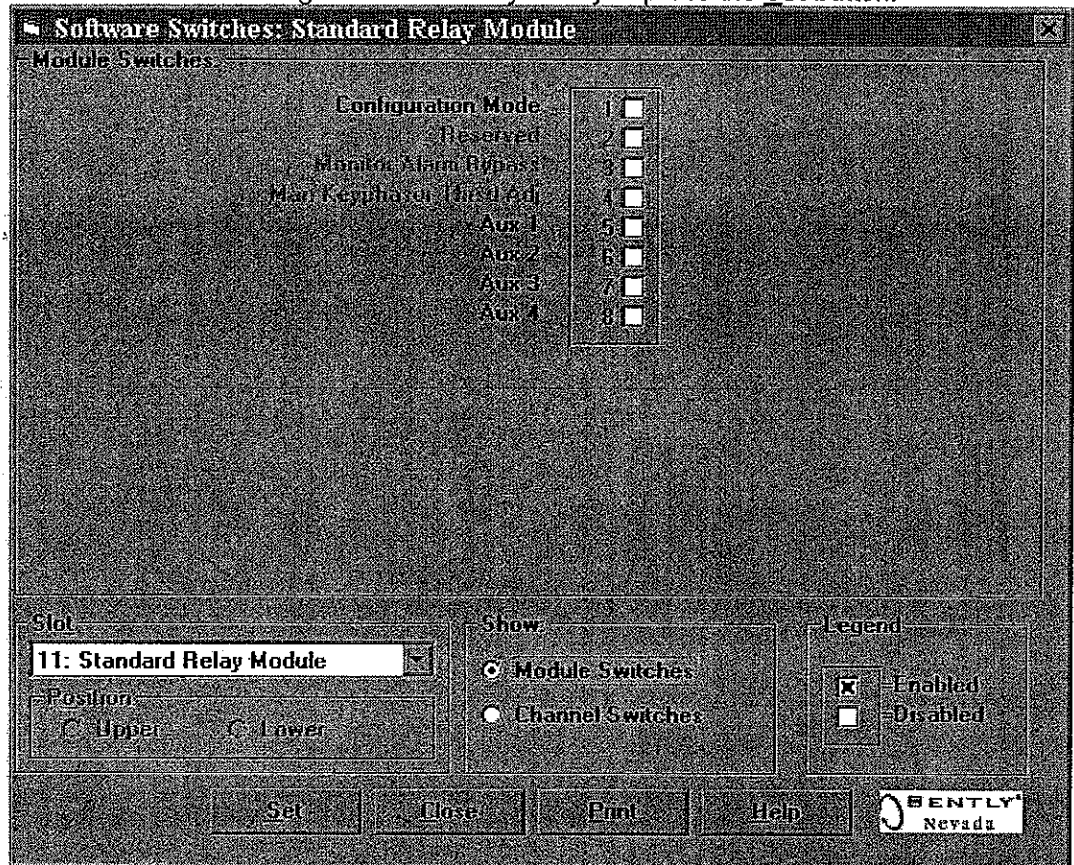
Thrust Position: Monitor reports an Alarm (not a "Not OK" condition) to the relay monitor for a transducer not OK.

Overspeed, Zero-Speed, Rotor Speed: These channel types have optional "OK Voltage Checks" that will determine if the monitor will or will not report a Not OK status to the Relay Monitor due to a transducer voltage error.

Eccentricity: "Direct Channel Above 600 RPM" affects bypass and Not OK status.

3.3 Software Switches

Software switches for relay modules let you temporarily bypass or inhibit relay module and channel functions. Set these switches on the **Software Switches** screen under the **Utilities** Option on the main screen of the Rack Configuration Software. Switch settings take affect only after you press the **Set** button.

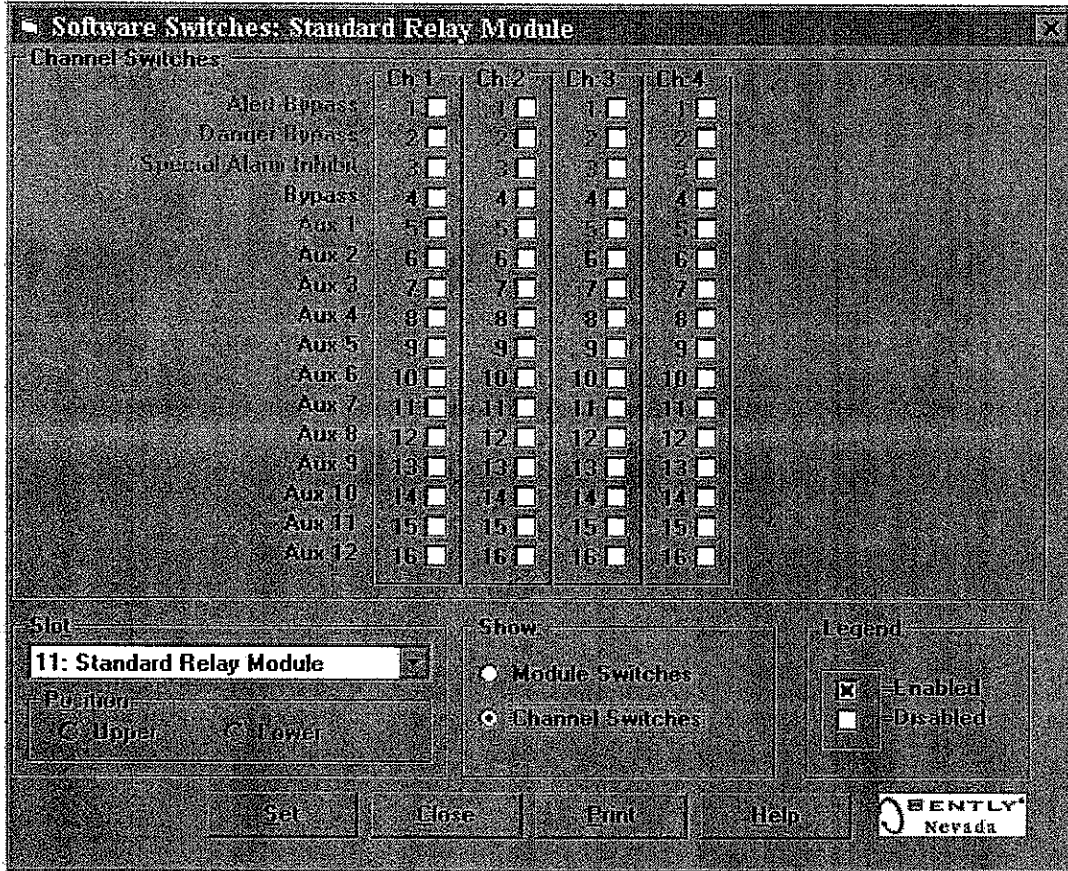


Configuration Mode

A switch that allows the 4 Channel Relay Module or the TMR Relay Module to be configured. To configure a relay module, 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.

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

Module Switch Number	Switch Name
1	Configuration Mode



Bypass

When enabled (☒), the channel will be turned off.

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

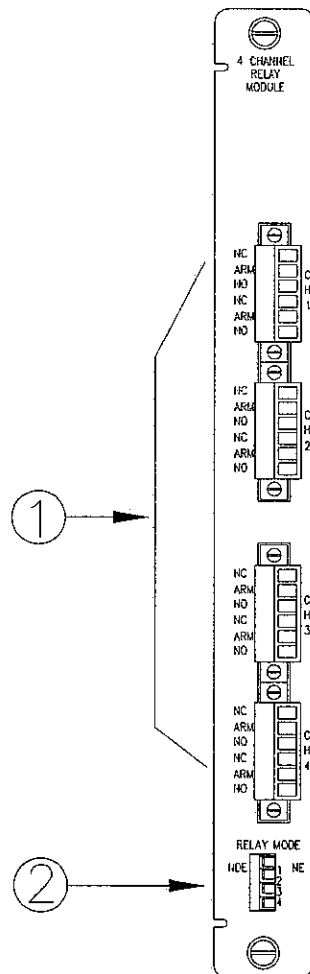
Channel Switch Number	Switch Name
1	Bypass

4 I/O Module Description

This section describes the I/O modules that are associated with the 4 Channel Relay Module and the TMR Relay Module. This section also describes how to use the connectors on the Relay I/O Module and describes where to install each I/O module.

4.1 4 Channel Relay I/O Module (Internal Termination)

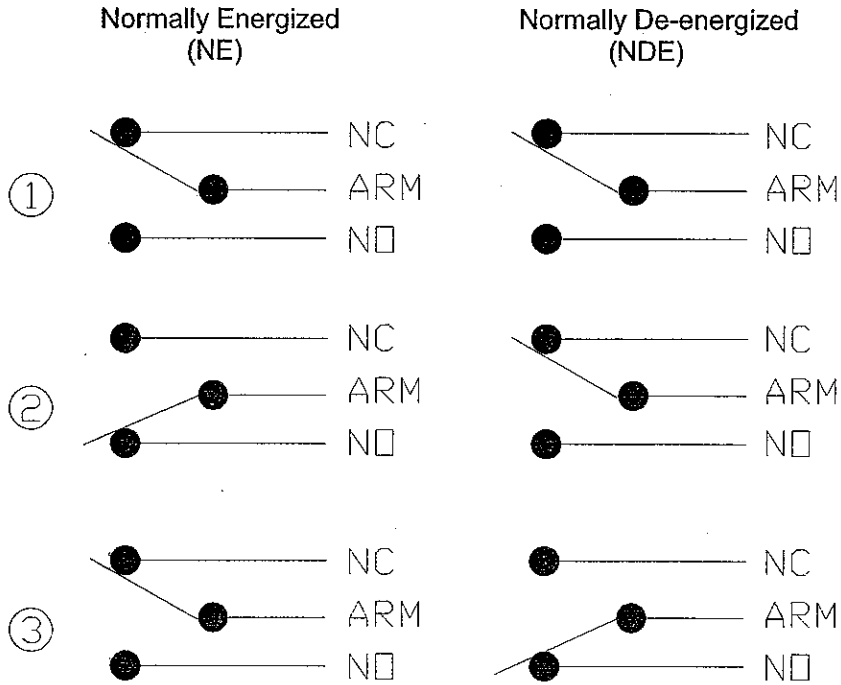
The 4 Channel Relay I/O Module contains four sets of relay contacts (one for each channel) and can be setup so each channel is Normally Energized or Normally De-energized. The 4 Channel Relay I/O Module must be installed behind the 4 Channel Relay Module (in a Rack Mount or a Panel Mount rack) or above the 4 Channel Relay Module (in a Bulkhead rack).



- 1) Terminals for connecting double-pole, double-throw (DPDT) relays.
- 2) DIP switches for configuring the relays for Normally Energized (NE) or Normally De-energized (NDE). The numbers refer to relay channel. For example, 1 is for relay Channel 1.

Note

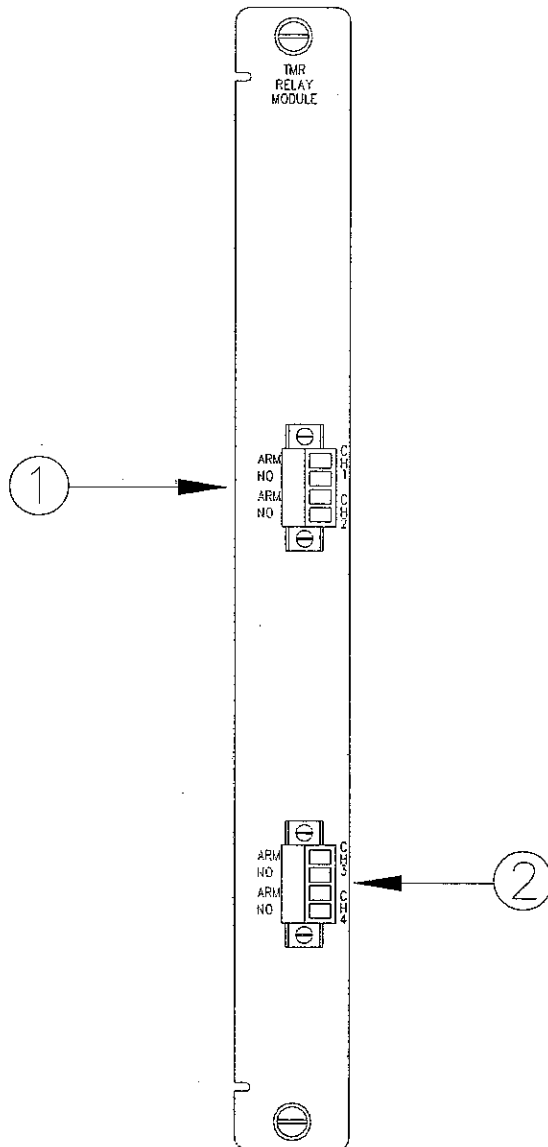
Relay contacts are marked NC (Normally Closed), NO (Normally Open), and ARM (Armature). NC and NO define the state of the relay contacts with no power applied to the relay coil (de-energized).



- 1) No Power/ No Alarm (shelf state)
- 2) With Power/ No Alarm
- 3) With Power/ In Alarm

4.2 TMR Relay I/O Module (Internal Termination)

Each relay channel in the TMR Relay I/O Module contains a set of relay contacts that are setup so that each channel is always Normally Energized. The TMR Relay I/O Module must be installed behind the TMR Relay Modules (in a Rack Mount or a Panel Mount rack) or above the TMR Relay Modules (in a Bulkhead rack).

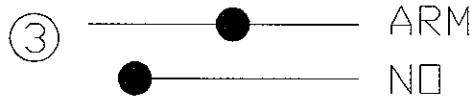
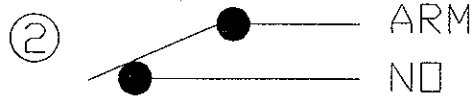
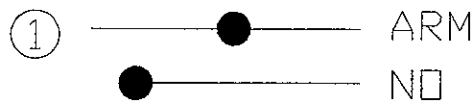


- 1) Relay connections for relay Channel 1 and relay Channel 2.
- 2) Relay connections for relay Channel 3 and relay Channel 4.

Note

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

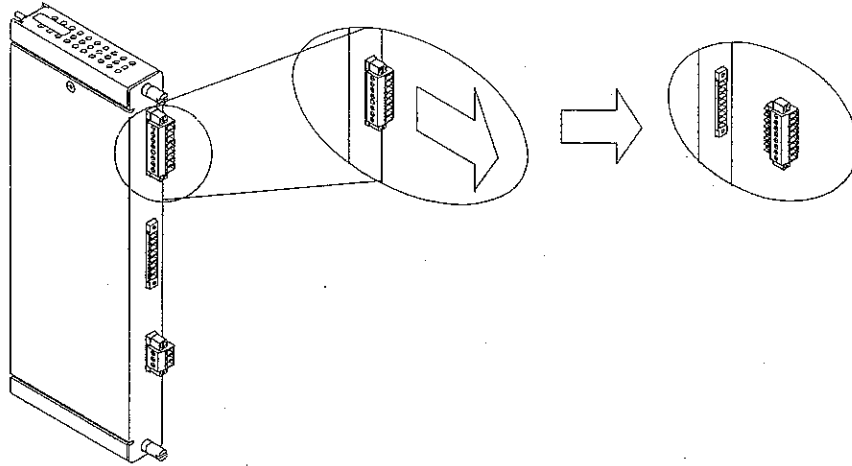
Normally Energized
(NE)



- 1) No Power/ No Alarm (shelf state)
- 2) With Power/ No Alarm
- 3) With Power/ In Alarm

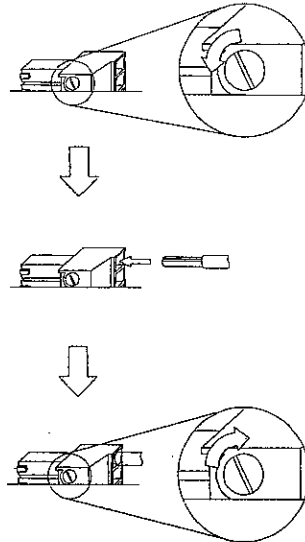
4.3 Wiring Euro Style Connectors

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.



5 Maintenance

The boards and components inside of 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.

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.

This section shows how to verify the operation of the 3500/32 4 Channel Relay Module and the 3500/34 TMR Relay Module.

5.1 Verifying a 3500 Rack - Relay Module

The 3500 Monitoring System is a high precision instrument that requires no calibration. The functions of Relay Module 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 Relay Module.

Section Number	Topic	Page Number
5.1.1	Choosing a Maintenance Interval	26
5.1.2	Required Test Equipment	27
5.1.3	Typical Verification Test Setup	27
5.1.4	Using the Rack Configuration Software	29
5.1.5	Standard Relay Channels	30
5.1.6	TMR Relay Channels	31

5.1.1 Choosing a Maintenance Interval

Use the following approach to choose a maintenance interval:

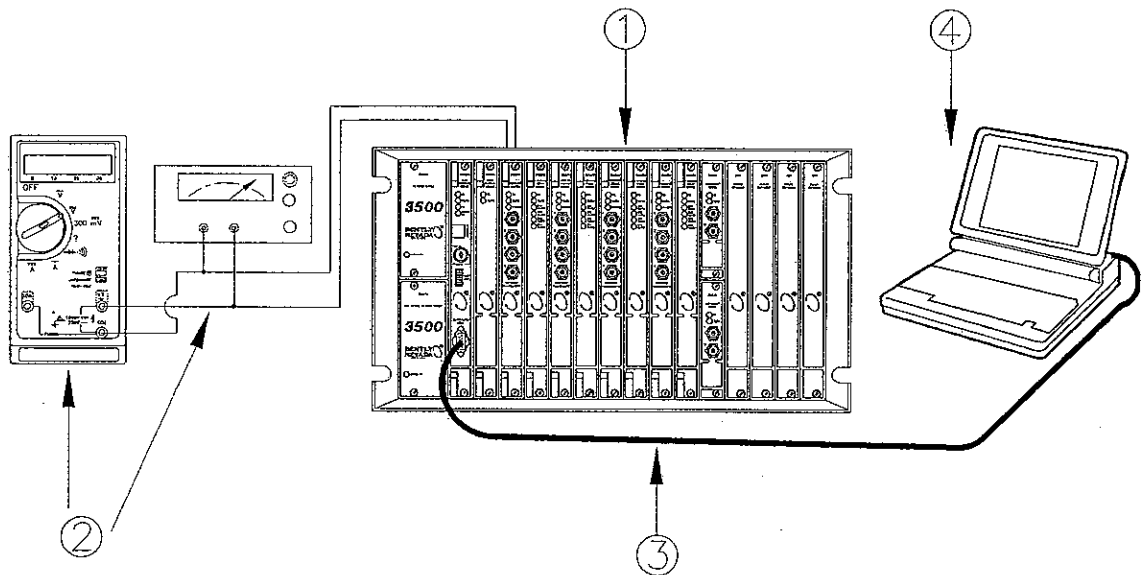
- Start with an interval of one year and then shorten the interval if any of the following conditions apply:
 - Monitored machine is classified as critical
 - 3500 rack is operating in a harsh environment such as in extreme temperature, high humidity, or in a corrosive atmosphere
- At each interval, use the results of the previous verifications and ISO Procedure 10012-1 1992(E) to adjust the interval.

5.1.2 Required Test Equipment

The test equipment needed to simulate the inputs for the relay channel will depend on the type of monitor providing inputs to the Relay Alarm Drive Logic. This equipment can be found under Required Test Equipment in the Maintenance section of the specific monitor manual.

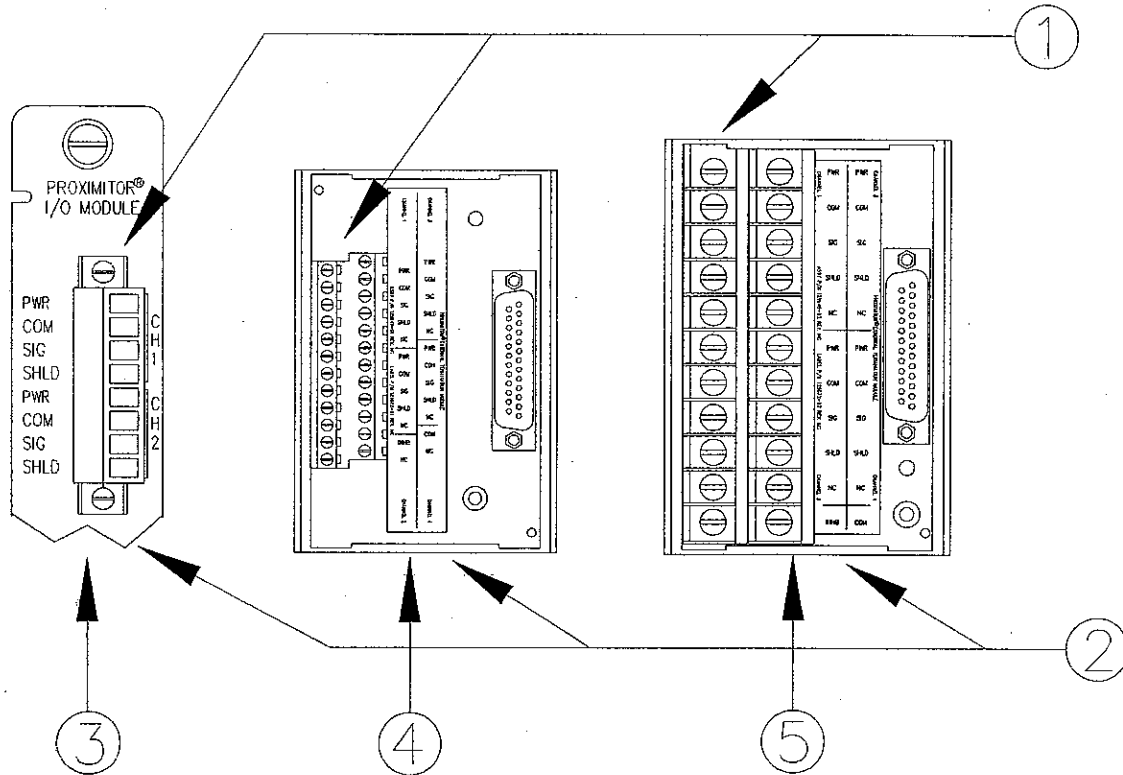
5.1.3 Typical Verification test setup

The following figure shows the typical test setup for verifying a Relay Module. The test equipment is used to simulate the transducer signal to selected monitors and the laptop computer is used to observe the output from the rack.

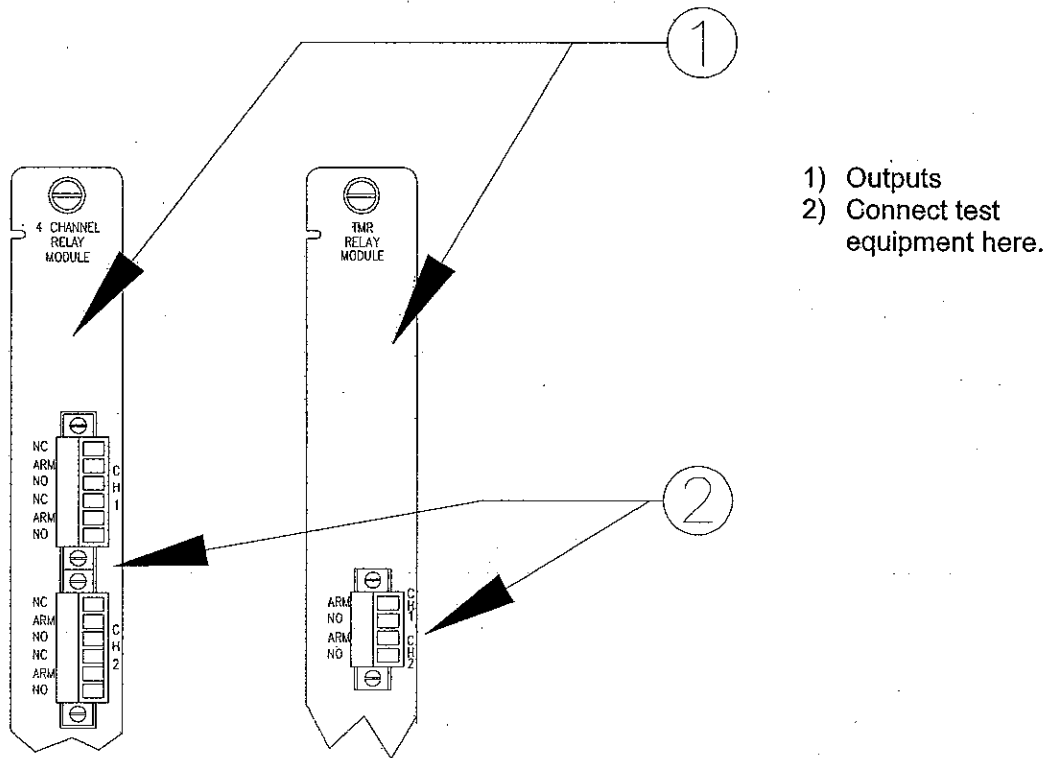


- 1) 3500 Rack
- 2) Test Equipment
- 3) RS-232 communications
- 4) Laptop Computer

Transducers can be connected to a 3500 rack in a variety of ways. Depending on the wiring option for the I/O module of your monitor, connect the test equipment to the Monitor Module and Relay Module using one of the following methods:



- 1) Connect test equipment here.
- 2) Inputs
- 3) Monitor I/O Module (Internal Termination)
- 4) External Termination Block (Euro Style Connectors)
- 5) External Termination Block (Terminal Strip Connectors)



4 Channel Relay I/O Module (Internal Termination) TMR Relay I/O Module (Internal Termination)

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.

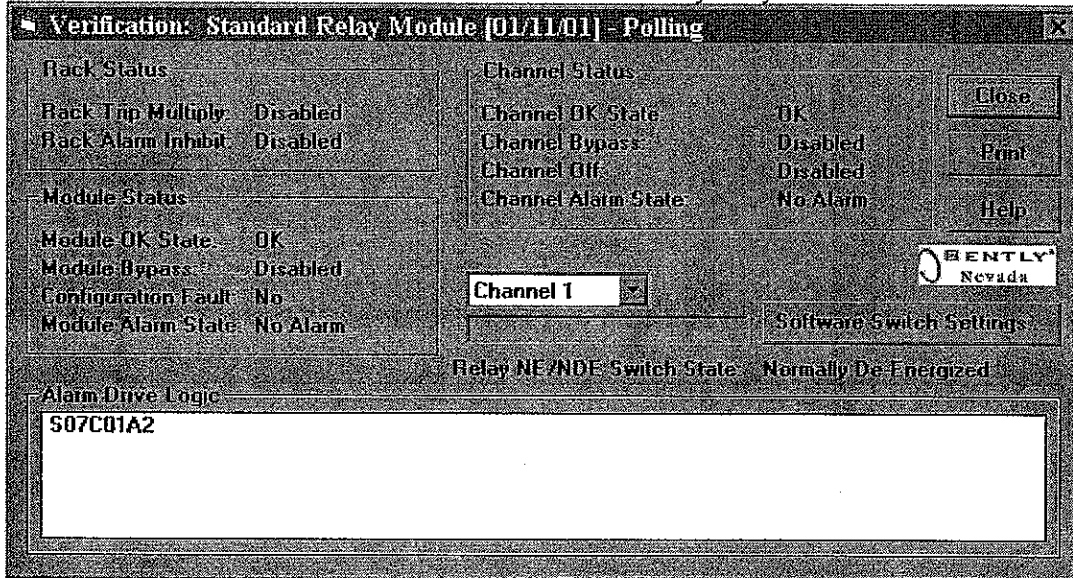
- upload and save configuration files
- display the Verification screen

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

Note

Save the original rack configuration before doing any maintenance or troubleshooting procedures.

The Verification screen displays relay channel output from a 3500 rack as shown in the following figure. Information such as Alarm Drive Logic, Channel Alarm State and Channel OK State are used to verify relay channels.



5.1.5 Standard Relay Channels

Verify relay channels by forcing alarms from the monitors that provide inputs for the Relay Alarm Drive Logic. When the logic is true, the Channel Alarm State will change to Alarm on the Verification screen and the alarm relay for that channel will change state. Verify only those channels that are active and configured.

To verify that a 4 Channel Relay channel is working correctly.

1. Run the Rack Configuration Software on the test computer.
2. Choose **V**erification from the Utilities menu. A screen prompting for the slot and channel number of the relay to be tested will appear.
3. Choose the proper Slot number and Channel number and then click on the **V**erify button. The Verification screen will appear.
4. Verify that the Channel OK State status on the Relay Verification screen reads **OK**.
5. Use the Relay Verification screen to determine what inputs must be simulated.
6. Simulate the required Alarm Drive Logic inputs to cause the relay to change states.

For example, a 3500 Rack with the following configuration:

Slot Number	Module Type
1	Rack Interface Module
2	3500/42 – 4 Channel Monitor
3	3500/42 – 4 Channel Monitor
4	3500/42 - 4 Channel Monitor
5	3500/32 - 4 Channel Standard Relay

A relay channel with the following Alarm Drive Logic:
(S02C01A1 * S03C01A1) + S04C01A2

Send test signals to the monitors in the rack to cause Slot 2 Channel 1 **AND** Slot 3 Channel 1 to be in Alert **OR** cause Slot 4 Channel 1 to be in Danger.

7. Verify that the Channel Alarm State status on the Relay Verification screen changes to Alarm. Verify that the relay contacts change state.
8. If the Relay channel does not respond correctly, check the inputs to ensure they meet the Alarm Drive Logic requirements. If the module still does not meet specifications, go to Section 5.1.7 (If a Channel Fails a Verification Test).
9. Select the next channel to be tested by using the Channel drop down list on the Verification screen. Repeat steps 4 through 8 to test the next relay channel.

5.1.6 TMR Relay Channels

The TMR Relay Module contains two half-height TMR Relay Modules that work with one TMR Relay I/O module in one slot of the 3500 rack. The two half-height TMR Relay Modules work in parallel. Both see the same inputs at the same time and perform the same function within the same time frame. The inputs to the two TMR Relay Modules are from one or more groups of three 4-channel monitors. Each channel from each monitor in the group of three is redundant.

Verify relay channels by forcing alarms from the monitors that provide inputs for the Relay Alarm Drive Logic. When the logic is true, the Channel Alarm State will change to Alarm on the Verification screen and the alarm relay for that channel will change state. Verify only those channels that are active and configured.

To verify that a TMR Relay channel is working correctly.

1. Run the Rack Configuration Software on the test computer.
2. Choose **Verification** from the Utilities menu. A screen prompting for the slot and channel number will appear.

3. Choose the proper Slot number and Channel number of the relay to be tested then click on the **Verify** button. The Verification screen will appear.
4. Verify that the Channel OK State status on the Relay Verification screen reads **OK**.
5. Use the Relay Verification screen to determine what inputs must be simulated.
6. Simulate the required Alarm Drive Logic inputs to cause the relay to change states.

For example, for a 3500 Rack with the following configuration:

Slot Number	Module Type	
1	Rack Interface Module	
2	3500/42 - 4 Channel Monitor	 -- TMR group
3	3500/42 - 4 Channel Monitor	
4	3500/42 - 4 Channel Monitor	
5	3500/34 - TMR Relay Module	
6	3500/42 - 4 Channel Monitor	 --TMR group
7	3500/42 - 4 Channel Monitor	
8	3500/42 - 4 Channel Monitor	

For a relay channel with the following Alarm Drive Logic:
S02C01A1 * S06C01A1

Send test signals to the monitors in the rack to cause Slot 2 Channel 1, Slot 3 Channel 1, and Slot 4 Channel 1 **AND** Slot 6 Channel 1, Slot 7 Channel 1, and Slot 8 Channel 1 to be in Alert.

7. Verify that the Channel Alarm State status on the Relay Verification screen changes to Alarm. Verify that the relay contacts change state.
8. If the Relay channel does not respond correctly, check the inputs to ensure they meet the Alarm Drive Logic requirements. If the module still does not meet specifications, go to Section 5.1.7 (If a Channel Fails a Verification Test).
9. Select the next channel to be tested by using the Channel drop down list on the Verification screen. Repeat steps 4 through 8 to test the next relay channel.

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 3500/32 4 Channel Relay Module and the 3500/34 TMR Relay Module. The following instructions describe how to remove the existing firmware and replace it with upgrade firmware. The monitor will need to be reconfigured using the 3500 Rack Configuration software after having its firmware upgraded.

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

- Phillips Screwdriver.
- Large Flathead Screwdriver.
- Small 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 4 Channel Relay Firmware Installation Procedure

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

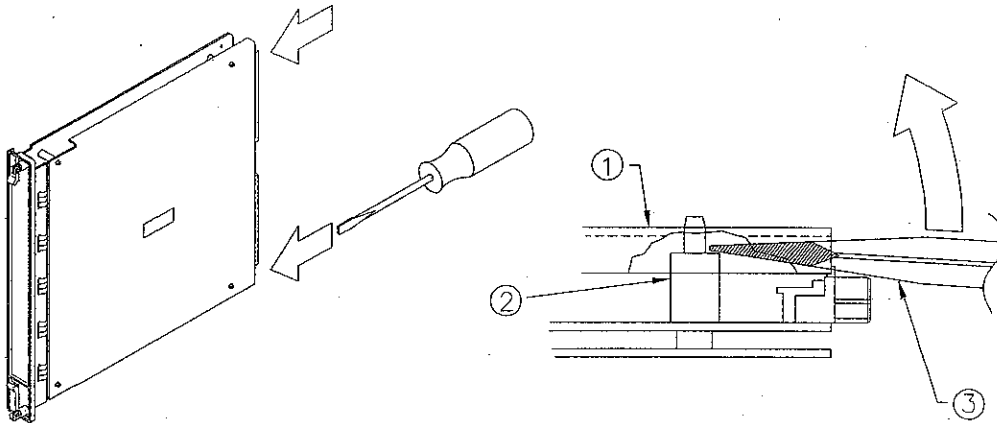
- Ensure that the monitor's configuration is saved using the 3500 Rack Configuration software.
- Refer to Section 1.2 (Handling and Storing Considerations) before handling the monitor or the upgrade firmware IC.
- Remove the monitor from the 3500 rack.
- Remove the Top Shield from the monitor.
- Remove 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



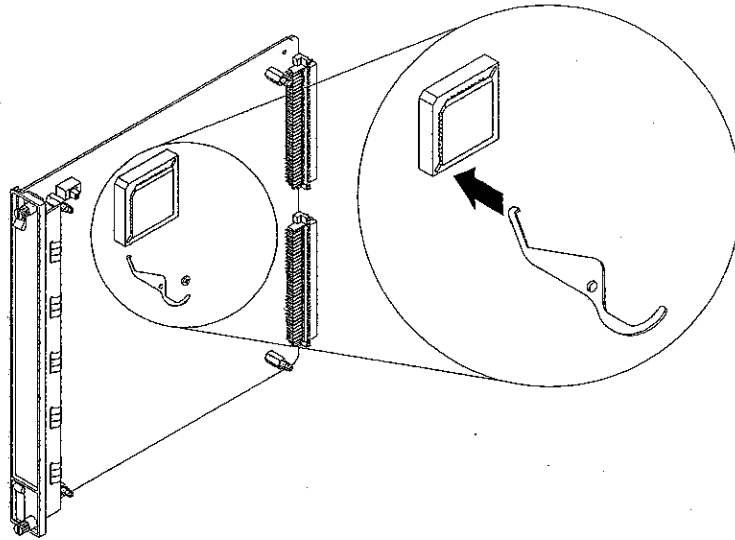
- 1) Top Shield.
- 2) Standoff.
- 3) Screwdriver.

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.

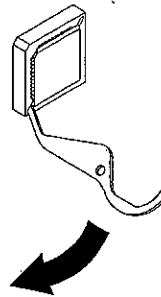
Step 2. Move the top shield up and down to work it loose from the two front standoffs.

Original Firmware IC Removal

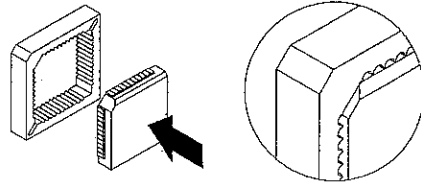
Step 1. Insert the removal tool in one of the two slots at the corner of the socket on the PWA. The diagram shows the approximate location of the chip to be removed, but not necessarily its orientation.



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.

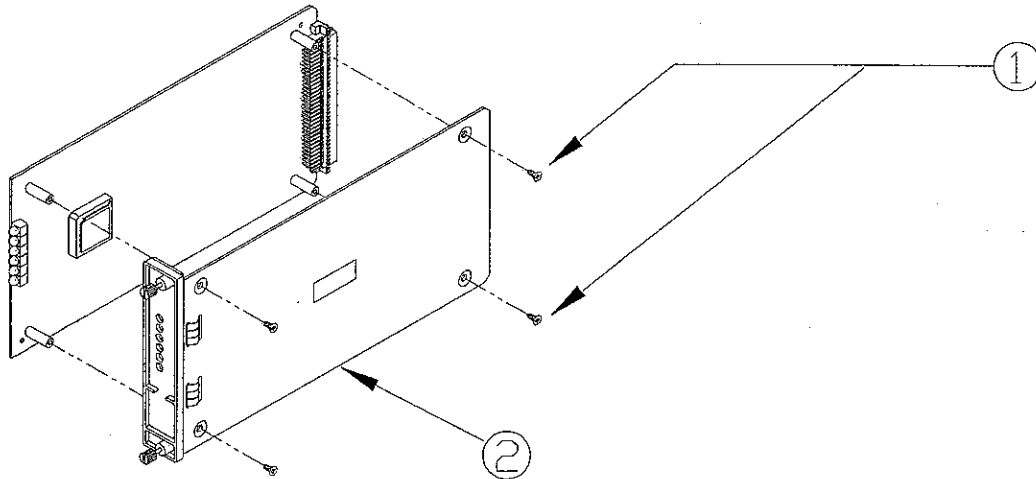
5.2.2 TMR Relay Firmware Installation Procedure

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.

Shield Removal

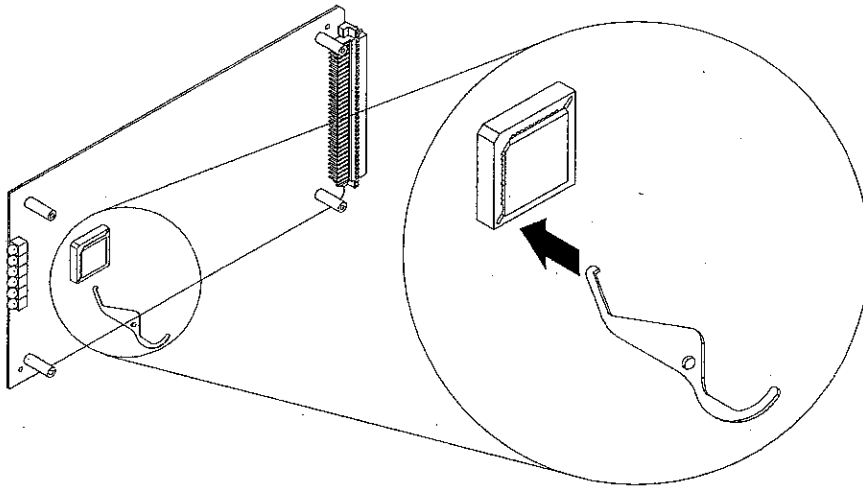


Step 1. Remove the 4 screws (item 1) that hold the shield and PWA together using a Phillips screwdriver.

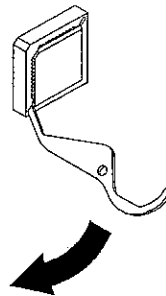
Step 2. Remove the shield (item 2) from PWA.

Original Firmware IC Removal

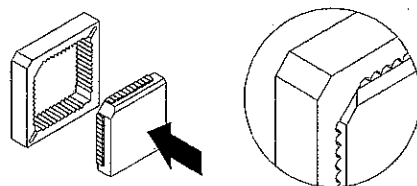
Step 1. Insert the removal tool in one of the two slots at the corner of the socket on the PWA. The diagram shows the approximate location of the chip to be removed, but not necessarily its orientation.



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.

Shield Replacement

Replace the shield. Align the holes in the shield with the standoffs and replace the 4 Phillips-head screws to fasten the shield to the PWA.

6 Troubleshooting

This section describes how to use the module self-test, the LEDs, and System Event List to troubleshoot a problem with the 4 Channel Relay Module, the TMR Relay Module, or the I/O module.

6.1 Self-test

To perform a 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 the self-test is being performed.
--

5. Select the slot that contains the relay module and press the **OK** button. The relay module 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 results of the self-test.
8. Verify if the relay module passed self-test. If the module failed the self test, refer to Section 6.3.

6.2 LED Fault Conditions

The following table shows how to use the LEDs to diagnose and correct problems with the 4 Channel Relay Module and the TMR Relay Module.

OK Led	TX/RX	Condition	Solution
1 Hz	1 Hz	Relay Module is not configured.	Reconfigure the Relay Module.
5 Hz		Relay Module or the Relay I/O Module has detected an internal fault and are not OK.	Check the System Event List.
ON	Flashing	Relay Module and the Relay I/O Module are operating correctly.	No action is required.
OFF		Relay Module is not operating correctly.	Replace the Relay Module.
	Not flashing	Relay Module is not communicating correctly or the Relay Module is not associated with any monitors in the rack that are communicating.	Check the System Event List.
 behavior of the LED is not related to the condition.			

Alarm LED	Condition	Solution
ON	Channel is in Alarm.	No action is required.
OFF	Channel is not in Alarm.	No action is required.

6.3 System Event List Messages

This section describes the System Event List Messages that are entered by the 4 Channel Relay Module and the TMR Relay Module and gives an example of one.

Example of a System Event List Message:

Sequence Number	Event Information	Event Number	Class	Event Date DDMMYY	Event Time	Event Specific	Slot
0000000123	EEPROM Memory Failure	13	1	02/01/90	12:24:31:99		5

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

Event Information: The name of the event (for example EEPROM Memory Failure).

Event Number: Identifies a specific event.

Class: Used to display 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: Identifies 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 half-height module installed in the lower position in slot 5 would be 5L.

The following System Event List Messages may be placed in the list by the 4 Channel Relay Module and the TMR Relay Module and are listed in numerical order. If an event marked with a star (*) occurs the relays on the 4 Channel Relay I/O Module and the TMR Relay I/O Module will not be driven. 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

Action: Replace the Relay Module as soon as possible.

Internal Network Failure

Event Number: 30

Event Classification: Severe/Fatal Event

Action: Replace the Relay Module immediately.

Device Not Communicating

Event Number: 32

Event Classification: Potential Problem

Action: Check to see if one of the following components is faulty:

- the Relay 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 Relay Module
- the rack backplane

Fail Relay Coil Sense

Event Number: 55

Event Classification: Potential Problem

Action: Check to see if the Relay I/O Module is installed. If installed, check to see if one of the following components is faulty:

- the Relay Module
- the Relay I/O 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 Relay Module
- the Relay 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 Relay 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 Relay 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 Relay 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 Relay 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 Relay Module
- the Power Supply installed in the lower slot
- the Power Supply installed in the upper slot

Pass Main Board +5V-AB

(Pass Man 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 Relay Module
- the Power Supply installed in the lower slot
- the Power Supply installed in the upper slot

Configuration Failure

Event Number: 301

Event Classification: Severe/Fatal Event

Action: Replace the Relay Module immediately.

Configuration Failure

Event Number: 301

Event Classification: Potential Problem

Action: Download a new configuration to the Relay Module. If the problem still exists, replace the Relay Module as soon as possible.

Software Switches Reset

Event Number: 305

Event Classification: Potential Problem

Action: Download the software switches to the Relay Module. If the software switches are not correct replace the Relay Module as soon as possible.

*** Fail I/O Board +5V-AB**

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

Event Number: 390

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 Relay I/O Module
- the Relay Module
- the Power Supply installed in the lower slot
- the Power Supply installed in the upper slot

Pass I/O Board +5V-AB

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

Event Number: 391

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 Relay I/O Module
- the Relay Module
- the Power Supply installed in the lower slot
- the Power Supply installed in the upper 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 Relay I/O Module
- the Relay 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 Relay I/O Module
- the Relay 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 Relay I/O Module
- the Relay 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 Relay I/O Module
- the Relay 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: 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 Relay I/O Module
- the Relay Module
- the Power Supply installed in the lower slot
- the Power Supply installed in the upper slot

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

Event Number: 397

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 Relay I/O Module
- the Relay Module
- the Power Supply installed in the lower slot
- the Power Supply installed in the upper slot

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

Event Number: 398

Event Classification: Potential Problem

Action: Verify that the Relay I/O Module is installed. If the Relay I/O Module is installed, replace the Relay 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 Relay I/O Module is installed. If the Relay I/O Module is installed, replace the Relay 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.

Disabled Ch Bypass (Disabled Channel Bypass)

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

Invalid Alm Drive Logic (Invalid Alarm Drive Logic)

Event Number: 451
Event Classification: Severe/Fatal Event
Action: Download a new configuration to the Relay Module. If the problem still exists replace the Relay Module as soon as possible.

Fail Slot Id Test

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

- the Relay Module
- the rack backplane

Pass Slot Id Test

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

- the Relay Module
- the rack backplane

6.4 Alarm Event List Messages

The following messages may be placed in the Alarm Event List by the 4 Channel Relay Module and the TMR Relay Module.

<u>Alarm Event List Message</u>	<u>When the message will occur</u>
Entered not OK	module went not OK
Left not OK	module returned to the OK state
Relay Activated	condition for driving the relay channel met
Relay Deactivated	condition for driving the relay channel is no longer met

7 Ordering Information

This section contains the ordering information for the 3500/32 4 Channel Relay Module and the 3500/34 TMR Relay Module.

7.1 4 Channel Relay Module

A B

Part number 3500/32-□□ - □□

A □□ **Output Module**

01 4 Channel Relay I/O Module

B □□ **Agency Approval Option**

00 None

01 CSA-NRTL/C

Spares

4 Channel Relay Module	125712-01
4 Channel Relay I/O Module	125720-01
Relay Internal Termination Headers	00580436
Relay Module Manual	129771-01
Firmware IC	132319-01
Grounding Wrist Strap (single use only)	04425545
IC Removal Tool	04400037

7.2 TMR Relay Module

A B

Part number 3500/34 - □□ - □□

A □□ **TMR Relay Module Type**

01 TMR Relay Module

B □□ **Agency Approval Option**

00 No Approvals Required

01 CSA-NRTL/C

Spares

TMR Relay Module	125696-01
TMR Relay I/O Module	125704-01
Relay Internal Termination Headers	00580438
Relay Module Manual	129771-01
Firmware IC	132317-01
Grounding Wrist Strap(single use only)	04425545
IC Removal Tool	04400037
Half-height Module Adapter	
Chassis	125388-01
Card Guide	125565-01
Screws (order 3 per adapter)	04300111

Note

When ordered as a new system, the TMR relay module includes two half-height modules with required mounting hardware. When the spare is ordered, a single half-height TMR Relay Module is shipped.

8 Specifications

This section contains the specifications for the 3500/32 4 Channel Relay Module and the 3500/34 TMR Relay Module.

8.1 3500/32 4 Channel Relay Module

TYPE

Two single-pole, double-throw (SPDT) relays connected in a double-pole, double-throw (DPDT) configuration.

ENVIRONMENTAL SEALING

Epoxy-sealed

ARC SUPPRESSORS

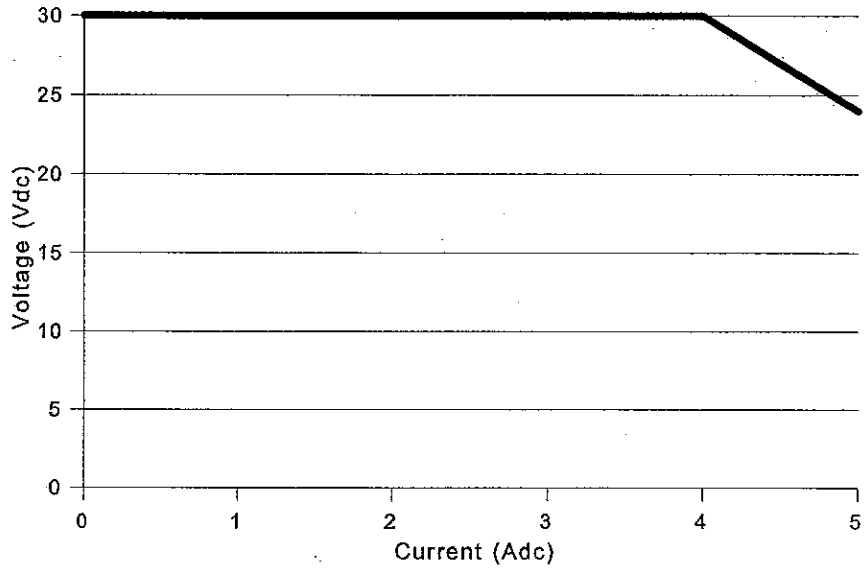
250 Vrms, installed as standard.

CONTACT RATINGS (resistive load):

Max switched power:	DC: 120 W	AC: 600 VA
Min switched current:	100 mA @ 5 Vdc	
Max switched current:	5 A	
Max switched voltage:	DC: 30 Vdc	AC: 250 Vac

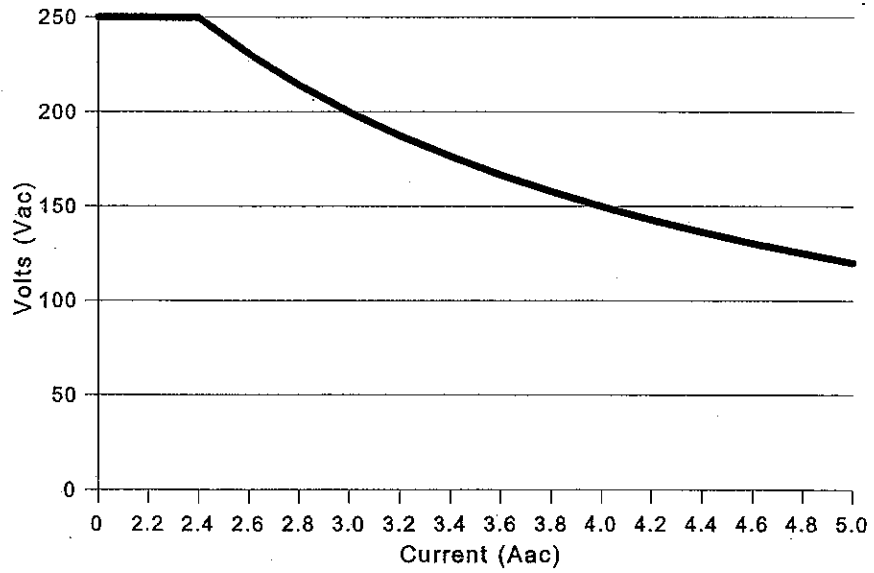
Maximum Switching Capacity

DC Resistive Load



Maximum Switching Capacity

AC Resistive Load



CONTACT LIFE

100,000 @ 5 A, 24 Vdc or 120 Vac

OPERATION

Each channel is switch selectable for Normally De-energized or Normally Energized.

ENVIRONMENTAL LIMITS

Temperature: -30° C to 65° C (-22° F to 150° F) operating
-40° C to 85° C (-40° F to 185° F) storage

Humidity: 95% non-condensing

ELECTROMAGNETIC COMPATIBILITY**EN50081-2:**

Radiated Emissions: EN 55011, Class A

Conducted Emissions: EN 55011, 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: EN61010-01

APPROVALS

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

PHYSICAL

Main Module:

Dimensions (Height x Width x Depth):

241 mm x 24.4 mm x 242 mm
(9.50 in x 0.96 in x 9.52 in)

Weight:

0.7 kg (1.6 lbs)

I/O Module:

Dimensions (Height x Width x Depth):

241 mm x 24.4 mm x 99.1 mm.
(9.50 in x 0.96 in x 3.90 in)

Weight:

0.4 kg (1.0 lbs)

RACK SPACE REQUIREMENTS

Main Module:

1 full-height front slot

I/O Module:

1 full-height rear slot

8.2 3500/34 TMR Relay Module**TYPE**

Three Double-pole, double-throw (DPDT) relays connected in a single-pole, single-throw (SPST) configuration.

ENVIRONMENTAL SEALING

Epoxy-sealed

ARC SUPPRESSORS

Not Supported

CONTACT RATINGS (resistive load)

Max switched power: DC: 60 W, AC: 125 VA

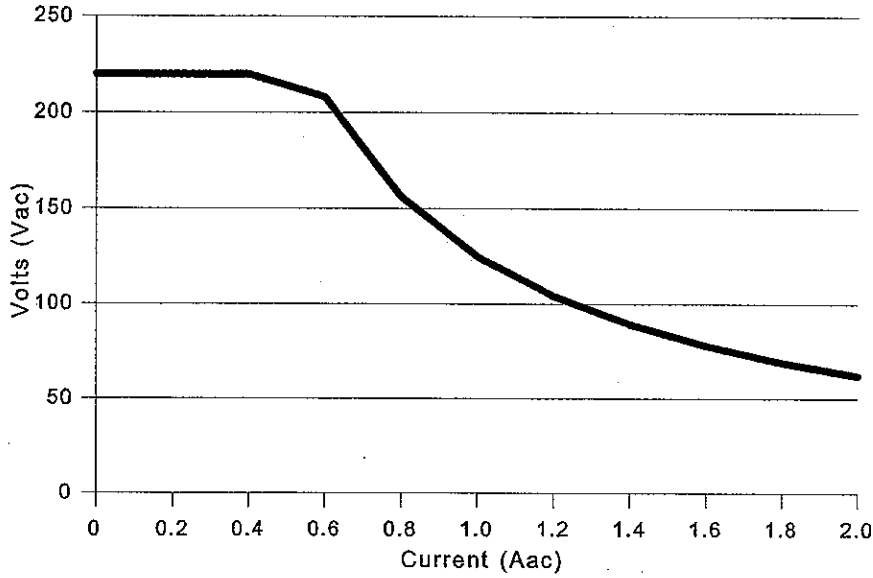
Min switched current: 100 mA @ 5 Vdc

Max switched current: 2 A

Max switched voltage: 150 Vdc or 220 Vac

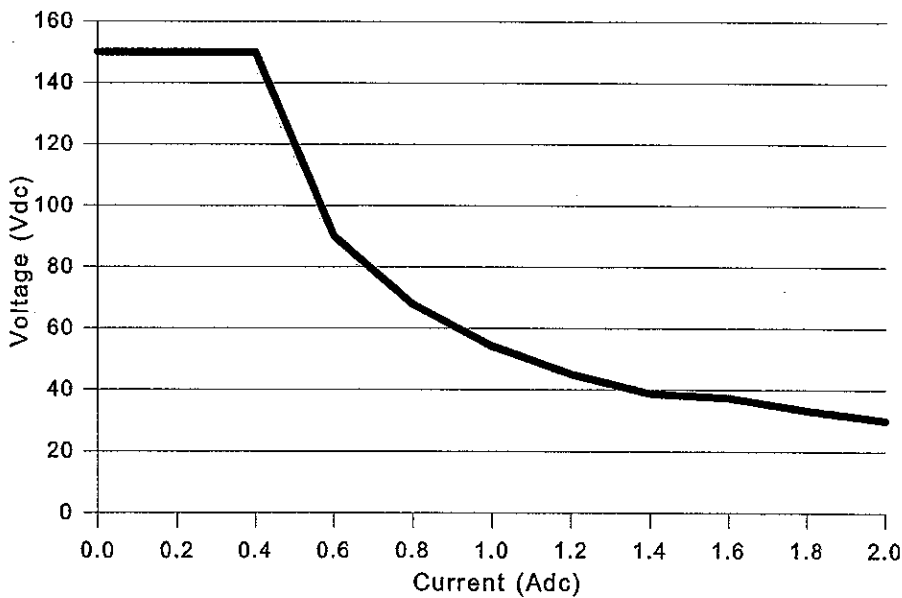
Maximum Switching Capacity

AC Resistive Load



Maximum Switching Capacity

DC Resistive Load



CONTACT LIFE

100,000@ 1.5 A, 24 Vdc or 1 A, 120 Vac

OPERATION

Each channel is Normally Energized.

ENVIRONMENTAL LIMITS

Temperature: -30° C to 65° C (-22° F to 150° F) operating
-40° C to 85° C (-40° F to 185° F) storage

Humidity: 95% non-condensing

ELECTROMAGNETIC COMPATIBILITY**EN50081-2:**

Radiated Emissions: EN 55011, Class A

Conducted Emissions: EN 55011, 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: EN61010-01

APPROVALS

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

PHYSICAL

Main Module:

Dimensions (Height x Width x Depth):

120.4 mm. x 24.6 mm x 241.8 mm

(4.74 in x 0.97 in x 9.52 in)

Weight:

0.34 kg (0.74 lbs)

I/O Modules:

Dimensions (Height x Width x Depth):

241 mm x 24.4 mm x 99.1 mm

(9.50 in x 0.96 in x 3.90 in)

Weight:

0.5 kg (1.0 lbs)

RACK SPACE REQUIREMENTS

Main Module:

1 half-height front slot

I/O Modules:

1 full-height rear slot