3500 Monitoring System

Rack Installation and Maintenance Manual
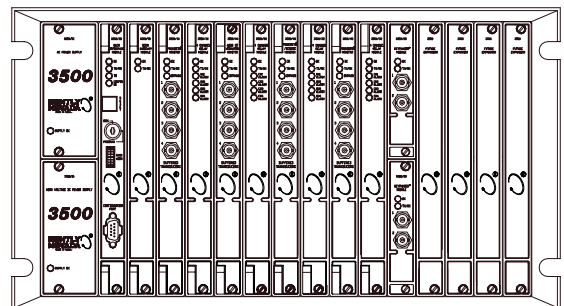
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Contacting Bently Nevada

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Telephone	1 775 782 3611 1 800 227 5514
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Internet	www.bently.com

Additional Information

Note:

This manual does not contain all the information required to operate and maintain the 3500 Monitoring System. Refer to the following manuals for other required information.

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

Operation and Maintenance Manuals for all the modules installed in the rack

Contents

4   Module Installation and Removal

5   Maintenance

6   Ordering Information

7   Specifications

1   Receiving and Handling Instructions

1.1   Receiving Inspection

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

1.2   Handling and Storing Considerations

Handling and storing of printed circuit boards is extremely critical. 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 all the power 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 performing maintenance on 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, modules may be removed from or installed into the rack while power is applied to the rack. Refer to "Module Installation and Removal" on page 57 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

Monitoring and computerized vibration information systems provide the information needed to assess the mechanical condition of rotating and reciprocating machinery. These systems continuously measure and monitor a variety of supervisory parameters, providing crucial information for early identification of machinery problems such as imbalance, misalignment, shaft crack, and bearing failures. As such, they are an efficient and effective means of satisfying plant management, engineering, and maintenance concerns for:

- Increasing plant safety by minimizing the occurrence of hazardous conditions or catastrophic failures.

- Improving product quality by minimizing process variances caused by improperly operating equipment.

- Maximizing plant availability by servicing only those machines that require it and having more efficient turnarounds.

- Reducing plant operating costs by minimizing unplanned shutdowns and by making more efficient use of maintenance resources.

For protection of critical machinery, it is highly recommended to permanently install continuous monitoring systems. The term "protection" means that the system can shut down machinery on alarm, without human interaction. These systems include applicable transducers, each with its own dedicated monitoring circuitry and alarm setpoints. The 3500 Monitoring System is the newest addition to the family of continuous monitoring systems offered by Bently Nevada Corporation.

3500 Monitoring System: Designed using the latest in proven microprocessor technology, the 3500 is a full-feature monitoring system. In addition to meeting the above stated criteria, the 3500 adds benefit in the following areas:

- Enhanced Operator Information

- Improved integration to plant control computer

- Reduced installation and maintenance cost

- Improved reliability

- Intrinsic Safety option

Enhanced Operator Information: The 3500 was designed to both enhance the operator's information and present it in a way that is easy for the operator to interpret. These features include:

- Improved Data Set

  - Overall Amplitude

  - Probe Gap Voltage

  - 1X Amplitude and Phase

  - 2X Amplitude and Phase

  - Not 1X Amplitude

- Windows® Based Operator Display Software

- Data displayed at multiple locations

Improved integration to plant control computer:

- Communication Gateways supporting multiple protocols

- Time synchronized vibration and process information

Reduced installation and maintenance cost:

- Reduced cabling costs

- Downward product compatibility

- Improved space utilization

- Easier configuration

- Reduced spare parts

- Improved serviceability

Improved reliability:

- Redundant power supplies available

- Triple Modular Redundant (TMR) monitors and relay cards available

- Redundant Gateway and Display Modules permitted

Intrinsic Safety Option: To monitor equipment located in hazardous atmospheres, the 3500 Monitoring System has a range of I/O modules with internal zener barriers. These modules provide an Intrinsically Safe interface between the 3500 rack and the transducers located in the hazardous area.

Multiple Output Interfaces: Monitor options (such as full scale ranges, transducer inputs, recorder outputs, alarm time delays, alarm voting logic, and relay configuration) can be conveniently adjusted in the field via software. Modular system design employs plug-in components which allow easy servicing and expansion.

The following three independent interfaces are available with the 3500 system:

- Data Manager Interface (Transient Data Interface External or Dynamic Data Interface External)

- Configuration/Data port

- Communications Gateway (support for Programmable Logic Controllers, Process Control Computers, Distributed Control Systems, and PC-based Control Systems)

These interfaces allow monitored parameters and their statuses to be easily viewed in the following ways:

- Bently Nevada System 1® Software

- Bently Nevada 3500 Operator Display Software

- Remote Display Panel

- DCS or PLC display

Front panel coaxial connectors provide dynamic transducer signals for convenient connection to diagnostic or predictive maintenance instruments.

2.1　Common Features

The common features of the modules in the 3500 rack include hot insertion or removal of modules and external and internal termination of the wiring.

2.1.1　Hot Insertion or Removal of Modules

When performed properly, any module can be removed and replaced while the system is under power without affecting the operation of any unrelated modules. If the rack has two power supplies, removing or inserting a power supply will not disrupt the operation of the 3500 rack. See "Module Installation and Removal" on page 57 for the proper procedure.

2.1.2　External and Internal Termination

External Termination uses multi-conductor cables to connect the I/O modules to the terminal blocks. These blocks make it easier to connect many wires to the rack in tight areas. External Termination is not available on I/O modules with internal zener barriers.
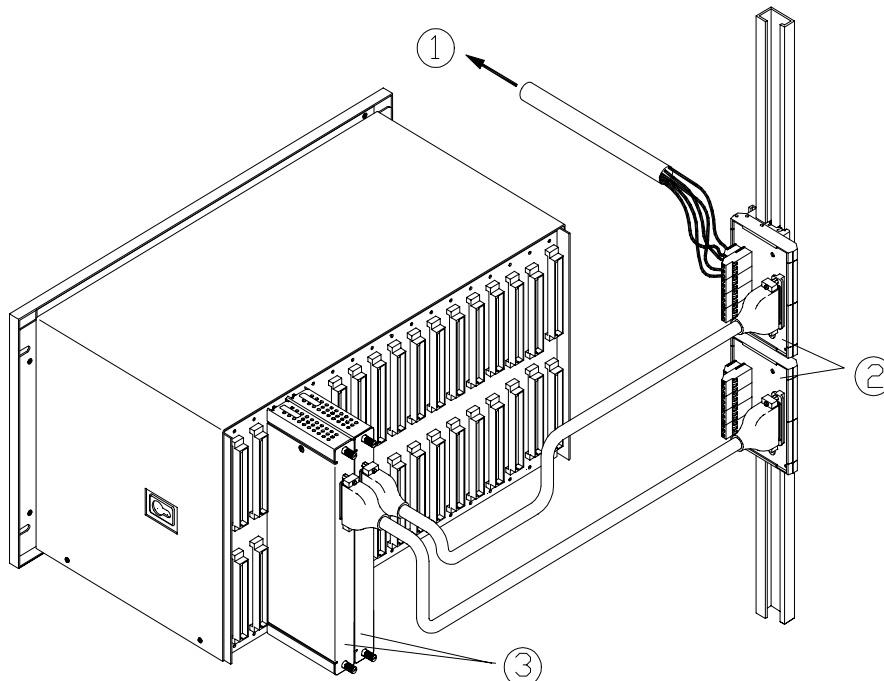
(1)　To Transducers.
(2)　External Termination Blocks.
(3)　External Termination I/O Modules.

Internal Termination lets you connect transducers directly to the I/O modules.
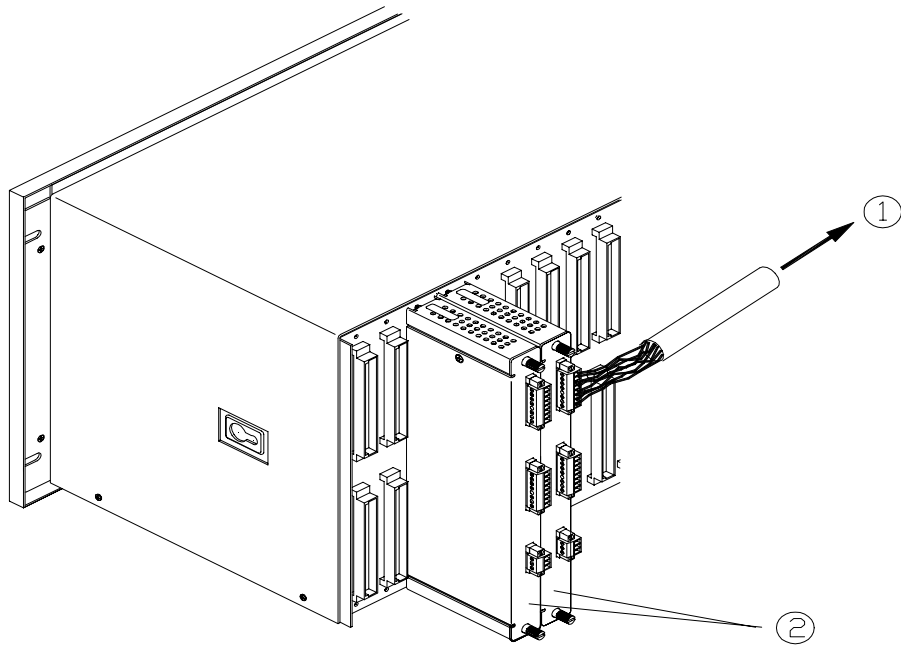
(1) To Transducers.
(2) Internal Termination I/O Modules.

2.2 Components of the System

The 3500 Monitoring System consists of modules that fit into a rack as shown in the following figure (full-size rack shown)[3]:
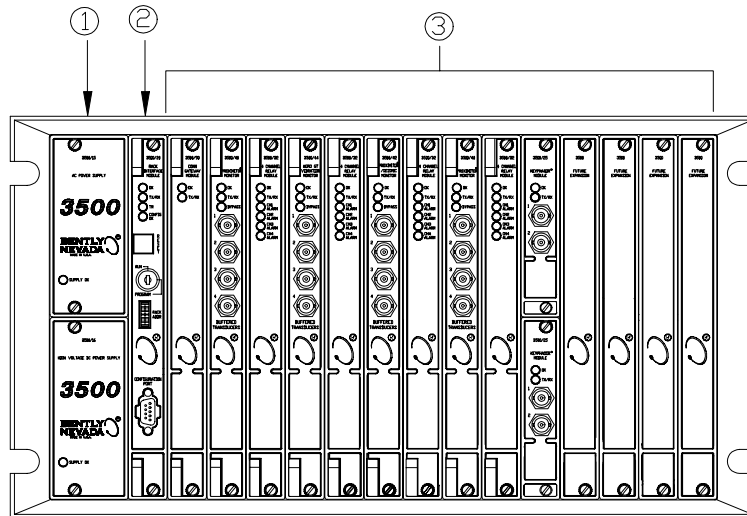
(1) One or Two Power Supplies.

(2) Rack Interface Module (standard, Transient Data Interface (TDI), Triple Module Redundant (TMR) and TMR TDI).

(3) Monitoring Slot Positions

-   Monitor Module

-   Keyphasor Module (2 maximum)

-   Relay Module

-   Communication Gateway Module

-   Display Module[1]

-   3500/04-01 Earthing Module, [2]

Notes:

[1] For System Face Mount option, the Display Interface Module must be inserted in slot 15.

[2] One Earthing Module is required per rack if Internal Barrier I/O's are used.

[3] The Mini-rack has 7 module positions available beyond the Power Supplies and RIM.

This section lists the function of each module. Refer to the individual operation and maintenance manuals for the available options, detailed description, operation and maintenance.

Weatherproof Housing: Protects the 3500 rack from adverse environmental effects, such as excessive moisture, dirt and grime, and even unclean air. The weatherproof housing will not accommodate a Display Unit or VGA Display.

Rack: Two 3500 racks are available: the full-size 19-inch rack and the compact 12-inch Mini-rack. Each rack requires the Power Supplies and Rack Interface Module (RIM) to be installed in certain locations. The full-size version offers 14 additional rack positions and the Mini-rack offers 7 additional rack positions for use with any combination of modules. Both racks offer Standard (non-redundant) and Triple Modular Redundant (TMR) configurations. The TMR system also restricts the location of certain modules.

The following modules may be installed in the 3500 rack:

Power Supply: The Power Supply is a half-height module available in AC and DC versions. One or two power supplies can be installed in the rack. Each power supply has the capacity to power a fully loaded rack. When two power supplies are installed in a rack, the supply in the lower slot acts as the primary supply and the supply in the upper slot acts as the backup supply. If the primary supply fails, the backup supply will provide power to the rack without interrupting rack operation. Any combination of power supply types is allowed. Overspeed Detection and TMR Monitors require dual power supplies.

Rack Interface Module: The Rack Interface Module is a full-height module that communicates with the host (computer), a Bently Nevada Communication Processor, and with the other modules in the rack. The Rack Interface Module also maintains the System Event List and the Alarm Event List. This module can be daisy chained to the Rack Interface Module in other racks and to the Data Acquisition / DDE Server Software. The 3500 Monitoring System Computer Hardware and Software Manual shows how to daisy chain the Rack Interface Modules together. Rack Interface Modules are available in Standard, Triple Modular Redundant and Transient Data Interface versions.

Communication Gateway Module: The Communication Gateway Modules are full-height modules that allow external devices (such as a DCS or a PLC) to retrieve information from the rack and to set up portions of the rack configuration. More than one Communication Gateway Module can be installed in the same rack. Communication Gateway Modules are available for a variety of network protocols.

Monitor Module: The Monitor Modules are full-height modules that collect data from a variety of transducers. Any combination of Monitor Modules can be installed in the 3500 rack.

Relay Module: Relay Modules offer relays that can be configured to close or open based on channel statuses from other monitors in the 3500 rack. Relay modules are available in 4 channel, 16 channel, and 4 channel Triple Modular Redundant.

The TMR Relay Module is a half-height 4-channel module that operates in a Triple Module Redundant (TMR) system. Two half-height TMR Relay Modules must operate in the same slot. If the upper or lower Relay Module is removed or declared as not OK, then the other Relay Module will control the Relay I/O Module.

Keyphasor Module: The Keyphasor Module is a half-height module that provides power for the Keyphasor transducers, conditions the Keyphasor signals, and sends the signals to the other modules in the rack. The Keyphasor Module also calculates the rpm values sent to the host (computer) and external devices (DCS or PLC) and provides buffered Keyphasor outputs. Each Keyphasor Module supports two channels and two Keyphasor Modules may be placed in a 3500 rack (four channels maximum). If two Keyphasor Modules are used, they must be placed in the same full-height slot and will share a common I/O module.

Display Module: 3500 features multiple display options. The Display Interface Module can display rack data on an LCD based Interface unit or a 3rd party modbus based display unit. The VGA Display Module will display rack data on certain touch screen VGA Displays. The Integrated PC display is a complete rack mount touch screen PC pre-loaded with rack configuration software and display utilities.

Earthing Module: The Earthing Module is a full-height module that provides a low resistance connection (must be less than 1 Ω) from the 3500 rack to the plant's intrinsically safe earth ground. The module is used in conjunction with the 3500 internal zener barrier I/O modules. One Earthing Module is required per rack when internal barrier I/O modules are used.

2.3   Standard Rack Relay Options:

The standard (or nonTMR) 3500 rack can be configured to have individual relays, bussed relays, or a combination of individual and bussed relays.

2.3.1 Individual Relays

A rack with individual relays contains one or more relay cards for each monitor module. There are many ways to configure the monitor and relay modules within a 3500 rack.

Example 1:
One relay module is used with one monitor module.

Monitor	Monitor Channel	Alarm Type	Relay Module	Relay Channel
1 1	1 2	Alert Alert	1	1
1 1	1 2	Danger Danger	1	2
1 1	3 4	Alert Alert	1	3
1 1	3 4	Danger Danger	1	4

The Alarm Types are ORed in the above example.

Example 2:
Two relay modules are used with one monitor module.

Monitor	Monitor Channel	Alarm Type	Relay Module	Relay Channel
1	1	Alert	1	1
1	2	Alert	1	2
1	3	Alert	1	3
1	4	Alert	1	4
1	1	Danger	2	1
1	2	Danger	2	2
1	3	Danger	2	3
1	4	Danger	2	4

Example 3:
One relay module is used with one monitor module.

Monitor	Monitor Channel	Alarm Type	Relay Module	Relay Channel
1	1	Alert	1	1
1	2	Alert		
1	3	Alert		
1	4	Alert		
1	1	Danger	1	2
1	2	Danger		
1	3	Danger		
1	4	Danger		

The Alarm Types are ORed in the above example.

The following figure shows a typical Individual Relay layout for a standard 3500 rack. The monitors and relay modules can be placed in any slot as long as one monitor is linked to one (or more) relay module(s) in the Rack Configuration Software.
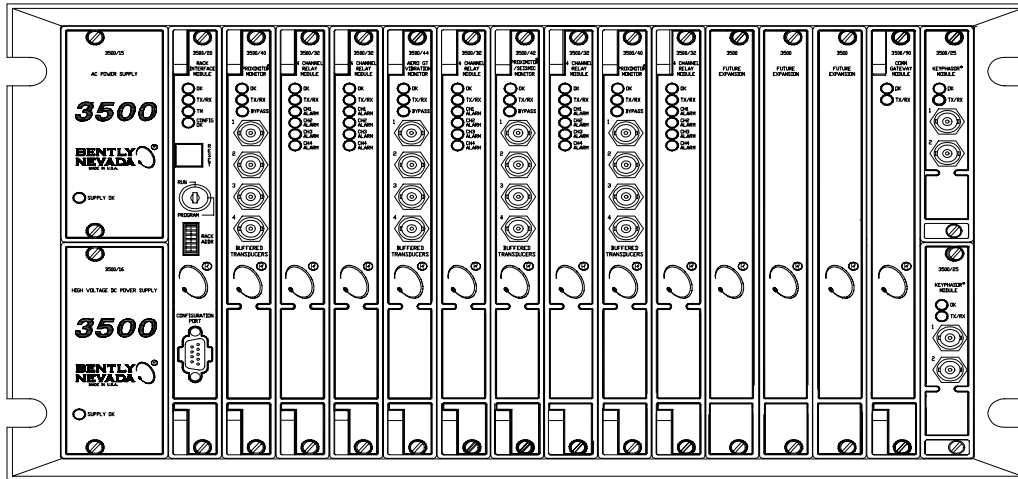

Figure 2-1. Typical Standard 3500 Rack with Individual Relays (Full-size rack shown)

2.3.2   Bussed Relays

Bussed Relays is a configuration where a number of monitor channels share a single relay. Use the Rack Configuration Software to define the combination of alarms that will trigger the relay. The following figure shows a typical Bussed Relay layout for a standard 3500 rack. The monitors and relay modules can be placed in any slot as long as the monitors are linked to the relay module in the Rack Configuration Software.
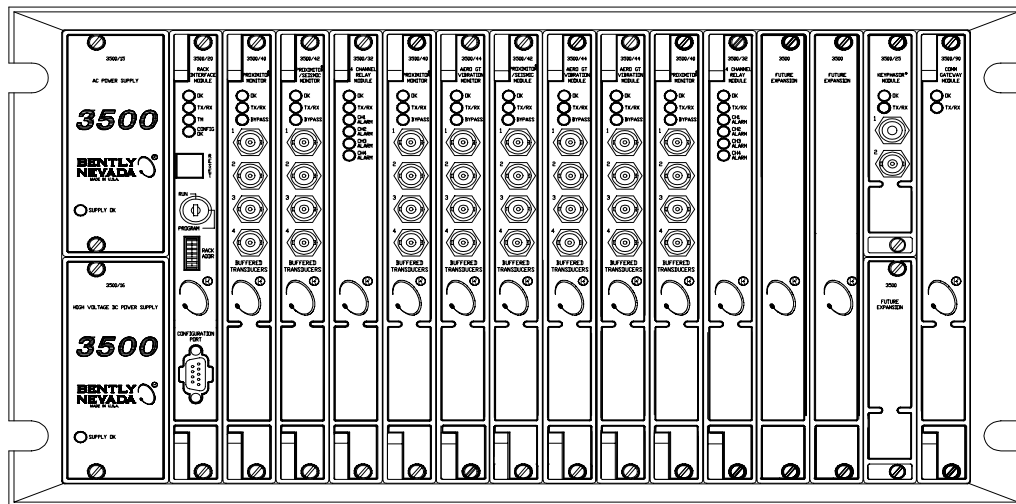

Figure 2-2. Typical Standard 3500 Rack with Bussed Relays (Full-size rack shown)

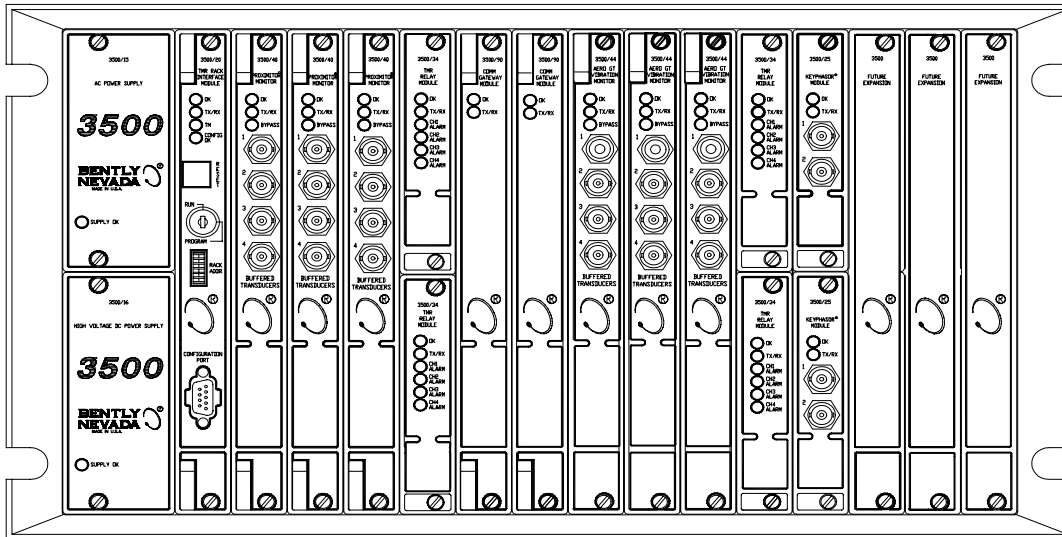## 2.3.3   Triple Modular Redundant (TMR) System

Figure 2-3. Typical TMR 3500 System (Full-size rack shown)

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.

2.3.3.1   Requirements for a 3500 TMR rack:

- Rack Jumper must be set to TMR position (see Rack Jumper section of this manual)

- The TMR version of the 3500/20 or 3500/22 Rack Interface Module (TMR RIM or TMR TDI 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). All I/O modules support TMR with discrete transducers.

- Some 3500 monitors are capable of sharing a common transducer across the triple (bussed). To use bussed transducers the following conditions must be met:

    - The TMR I/O Module for that monitor must be used. If a TMR I/O Module is not available for that monitor, discrete transducers must be used.

- The TMR I/O Module must support the desired channel measurement.

- The Bussed ET Block for that monitor must be used.

- Intrinsic Safety Barriers 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 modules. Non-redundant keyphasors are allowed. There can be a maximum of 2 keyphasor modules per rack.

- Independent monitors may be installed in a TMR rack for monitoring less critical machine points.

- Both standard and TMR relay modules may be used in a TMR rack. The 3500/34 TMR Relay Module can only be configured with to drive relays from channels in a TMR group. Standard relay modules 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.

2.3.3.2   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

2.3.3.3   TMR Relay Module

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.

2.3.3.4   Inside a TMR rack

1. Dual 3500 power supplies Independently supply redundant power to each component in the system

2. TMR Monitor group. Each Channel's status is determined independently in each monitor

3. Triplicate transducers monitor a single point. Typical for 4 channels. (Discrete transducer inputs shown)

4. 2 3500/34 half-height cards process alarm events from the other monitor cards in duplicate.

5. TMR Relay I/O module has triplicate relay logic

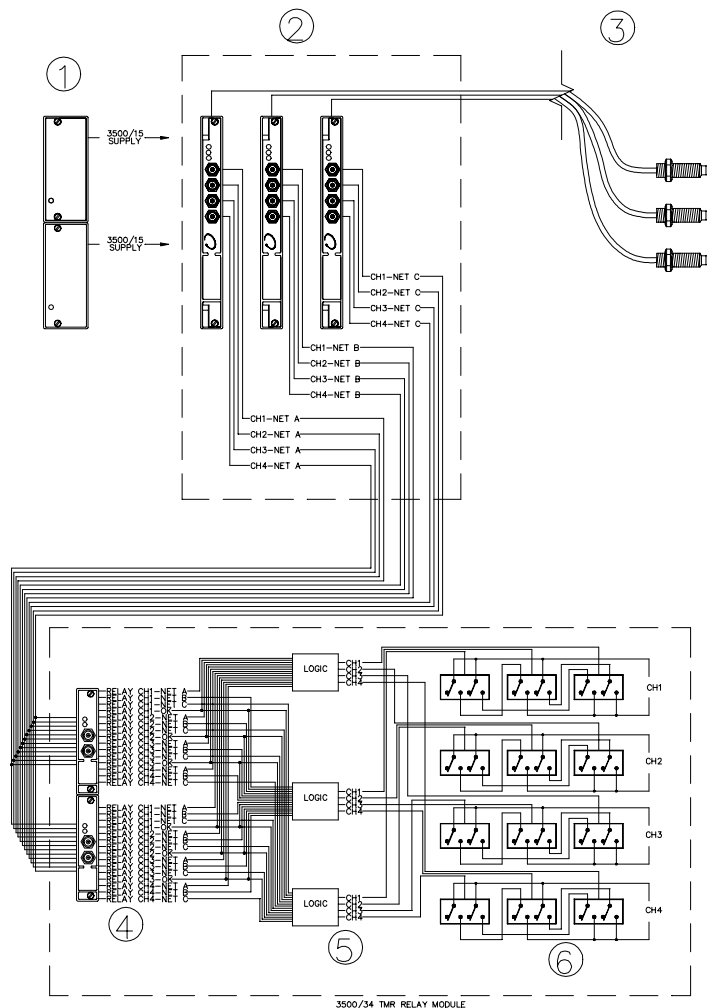6. TMR Relay I/O module features 2 out of 3 relay voting.

Figure 2-4.

2.3.3.5 TMR Individual Relays

The following figure shows a typical TMR rack with Individual Relays. This configuration requires that three identical monitors be placed next to each other and that the monitors be linked to one relay module using the Rack Configuration Software.
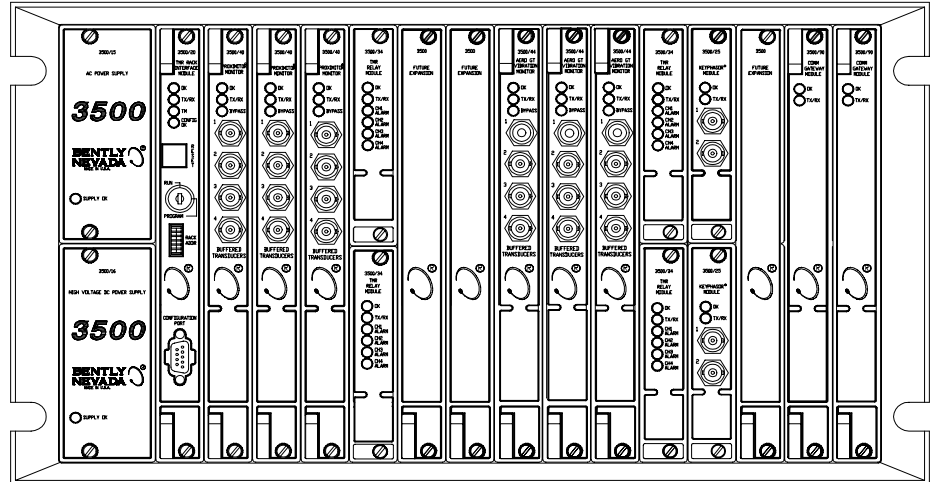

Figure 2-5. Typical TMR 3500 Rack with Individual Relays (Full-size rack shown)

2.3.3.6 TMR Bussed Relays

The following figure shows a typical TMR rack with Bussed Relays. This configuration requires that three identical monitors be placed next to each other and that the monitor groups be linked to one relay module in the Rack Configuration Software.
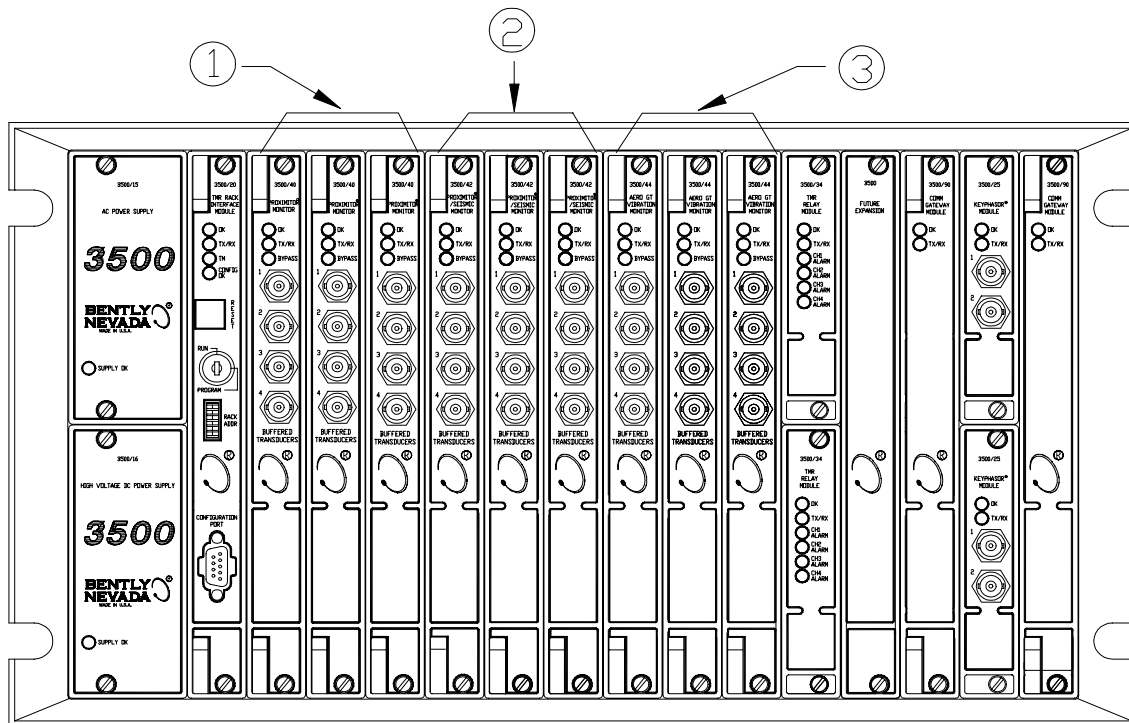

Figure 2-6. Typical TMR 3500 Rack with Bussed Relays (Full-size rack shown)

(1)   TMR Group 1.
(2)   TMR Group 2.
(3)   TMR Group 3.

2.4   Intrinsic Safety — The 3500 Internal Barrier System

To provide Intrinsically Safe (I.S.) vibration and process variable monitoring, the 3500 system has a range of I/O modules with internal zener barriers. When these modules are installed in a 3500 rack with an Earthing Module, they provide an integrated solution for explosion protection for approved Bently Nevada transducer systems that are located within all classifications of hazardous areas (surface industries other than mining).

The following items are required for a 3500 Internal Barrier System:

One 3500/04-01 Earthing Module is required per rack when Internal Barrier I/O modules are used. The Earthing Module does occupy one slot position in the rack.

The 3500/15 Power supplies must have their grounding configuration changed from the default factory setting. See the 3500/15 Operation and Maintenance Manual (PN 129767-01) for instructions.

Any RS-232 connection to any 3500 Module must be isolated (Monitors supporting RS232 connections include: Rack Interface Modules, Communication Gateways, 3500/95 PC Display). See the 3500/20 Operation and Maintenance Manual (PN 129768-01) for instructions. This does not apply to RS422 and RS485 connections to the rack (Monitors supporting RS422 and/or RS485 connections include 3500/20, 3500/90, 3500/92, 3500/93, 3500/95).

The 3500/94 VGA Display is not for use in Internal Barrier Systems

Bussed transducers are not allowed in Internal Barrier Systems (see TMR section of this manual for more information)

The following are features of the 3500 Internal Barrier System:

- The Earthing Module enables dual I.S. Earth connections for cables with cross-sectional areas up to 10 mm^2. This module lets you test I.S. Earth continuity online.

- The design of the internal barrier I/O modules provides the necessary 2 inches (50 mm) of separation between safe and hazardous area field wiring.

- Field wiring connectors are green for safe areas and blue for hazardous areas. In addition the pitch of the connectors is different. This helps to avoid incorrect field wiring installation.

- Quick connect/disconnect connectors provide simplified field wiring installation and removal.

- Standard and internal barrier I/O modules can be located in the same 3500 rack. We recommend that you group the modules together as shown in the diagram below to facilitate connection to field wiring.
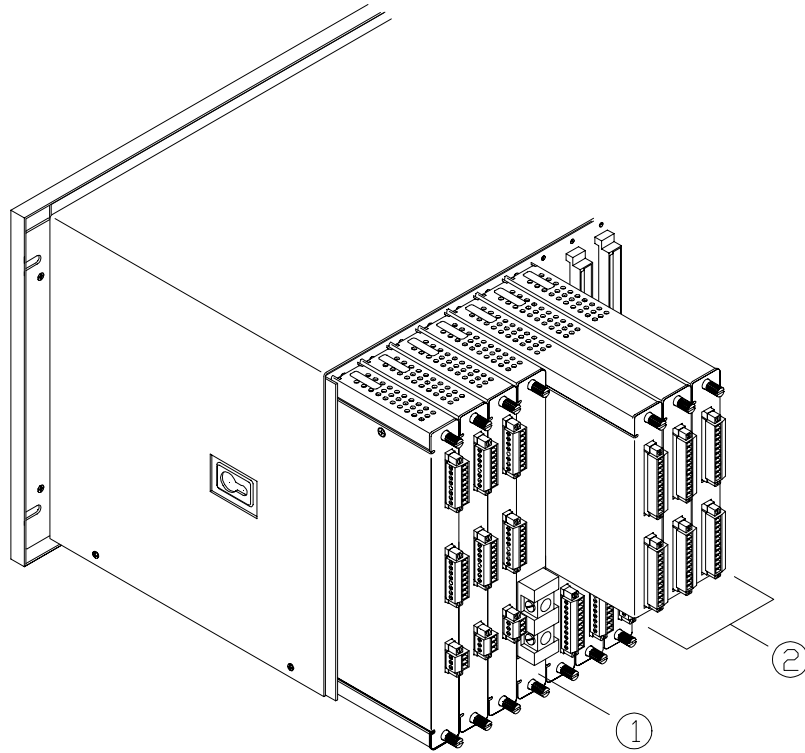
(1)   Earthing Module.
(2)   Internal Barrier I/O Modules.

3   Initial Rack Installation

This section shows how to install a new 3500 rack.

3.1   General Installation Procedure

1. Review the Installation Checklist (see "Installation Checklist" on page 19)

2. Install the Weatherproof Housing (if required) (see "Weatherproof Housing Installation" on page 19)

3. Install the rack (see "Rack Installation" on page 29)

4. Set the jumpers and switches on rack (see "Set rack jumpers and switches" on page 54)

5. Install the External Termination Blocks (if required) (see "External Termination Blocks" on page 44)

6. Install the modules (see "Module Installation and Removal" on page 57)

7. Wire the transducers, relay, and power to the rack and modules (see "Wiring Requirements" on page 55)

8. Perform the Software Portion of the Rack Installation (see "Software Portion of the Rack Installation" on page 56)

3.2   Installation Checklist

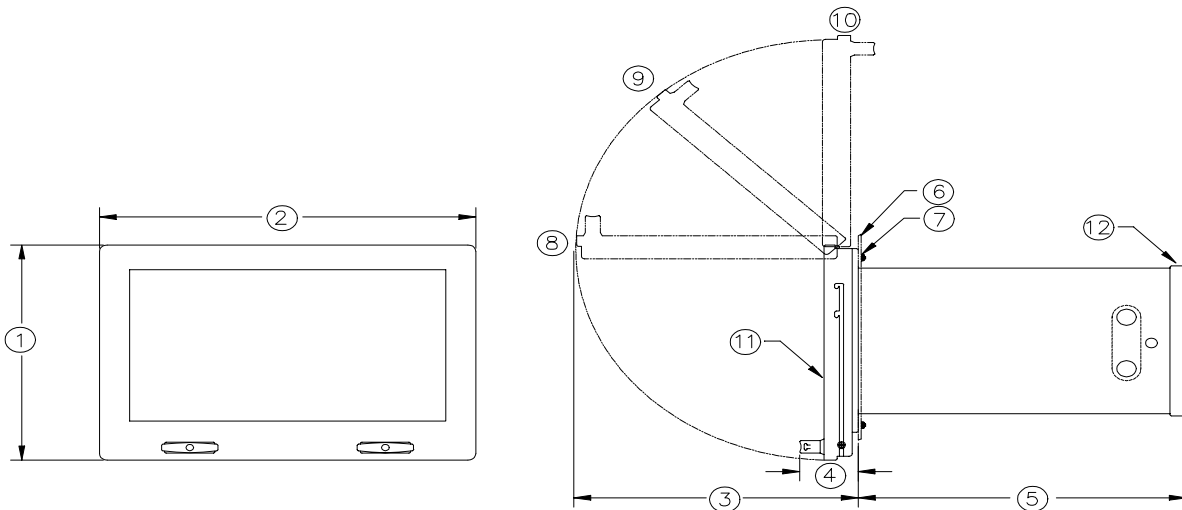Use the following items to plan a 3500 rack installation:

• What are the power requirements?

• Does the rack fit in the proposed location?

• Can the rack be mounted in the proposed location?

• Is there enough air circulation in the proposed location?

• Is a weatherproof housing required?

• What termination is required (internal or external)?

• Is a telephone line required?

• Is good rack grounding available?

• If Internal Barriers are to be fitted, is there an Intrinsically Safe Earth?

3.3   Weatherproof Housing Installation

This section describes the 3500 weatherproof housing and provides instructions for proper installation.

3.3.1   General Description

The 3500/06 weatherproof housing is an enclosure designed to meet NEMA 4 requirements and to contain one 3500 series rack (rack mount option only). The housing is not designed to accommodate a Display Unit or VGA display. It is available in painted steel or stainless steel versions, with or without conduit fittings, and with or without air purge accessories. Access to the front of the rack is provided by a hinged door. Access to the rear of the rack is provided by a bolted-on cover.

|	
1. 16.70 inches (424.2 mm).	8. The housing door will latch in this 90 degree position.
2. 23.43 inches (595.1 mm) full-size, 16.43 (417.3 mm) for the Mini-rack.	9. The housing door will latch in this 135 degree position.
3. 16.20 inches (411.5 mm).	10. The door must be opened to this position to latch or unlatch the door in the two shown latching positions.
4. 3.75 inches (95.3 mm).	
5. 21.00 inches (533.4 mm).	
6. Panel to which the housing is mounted.	11. Hinged door for access to front of rack.
7. Thread-seal washers supplied with the housing. To be used under all internal heads of mounting bolts or nuts to obtain a water-tight seal.	12. Bolted cover for access to rear of rack.

⚠ **CAUTION**

The hinged door will NOT latch in the 180 degree position shown in the diagram above. Do not leave the door unsupported in this position or else serious injury could result.

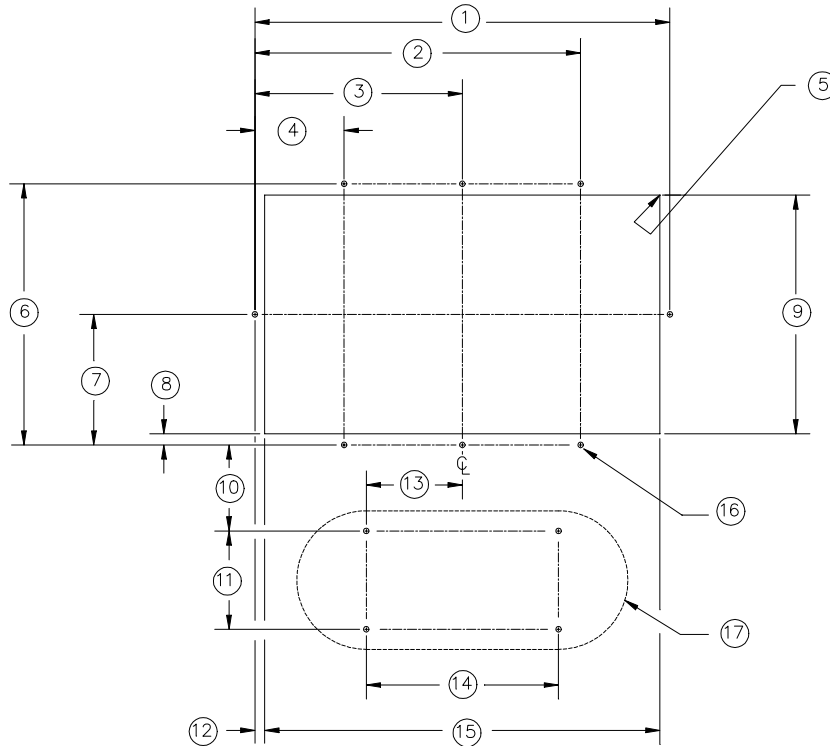### 3.3.2 Rack Temperature Derating

Because the housing restricts ventilation to the rack, the maximum ambient temperature of the rack must be derated. Derating is based on how many watts the rack is dissipating. Refer to the chart below.
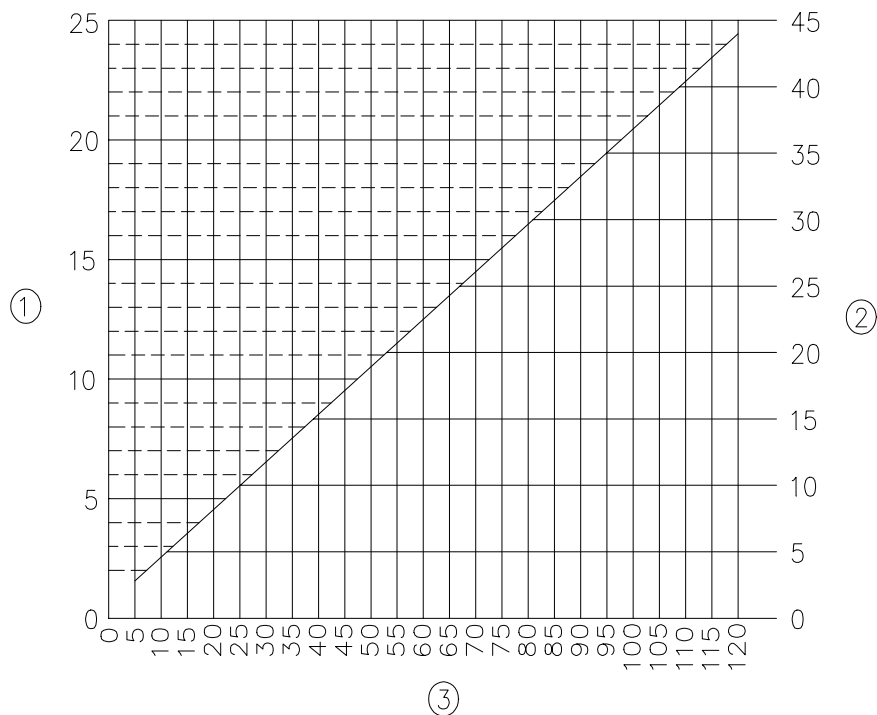
(1) Temperature rise above ambient, degrees C.

(2) Temperature rise above ambient, degrees F.
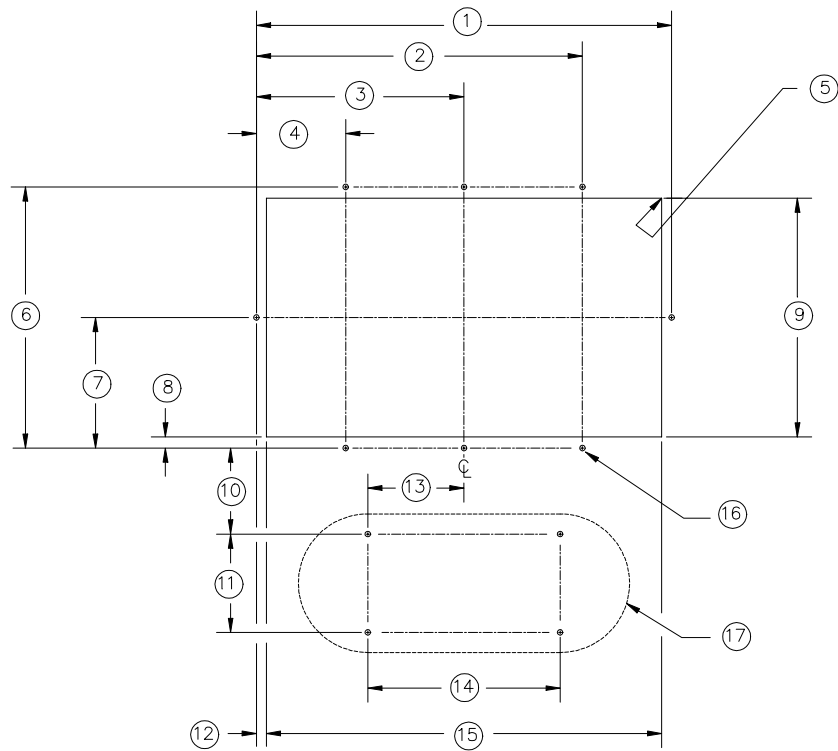
(3) Power dissipated in Watts.

3.3.3   Panel Cutout

The following diagram shows the recommended panel cutout for the 3500/06 weatherproof housing for a full size rack.

1. 21.050 inches (534.7 mm).	12. 0.50 inches (12.7 mm).
2. 16.525 inches (419.7 mm).	13. 4.87 inches (123.7 mm).
3. 10.525 inches (267.3 mm).	14. 9.75 inches (247.7 mm).
4. 4.525 inches (114.9 mm).	15. 20.05 inches (509.3 mm).
5. 0.25 inches (6.4 mm) radius, maximum (4 places).	16. 0.281 inches (7.14 mm) diameter clearance hole for 0.250 inches diameter bolt or mounting studs. 8 places for housing. 12 places for housing and air purge gauge assembly.
6. 13.27 inches (337.1 mm).	
7. 6.635 inches (168.5 mm).	
8. 0.57 inches (14.5 mm).	17. This 4-hole pattern is only used when installing the air purge gauge assembly.
9. 12.13 +/- 0.06 inches (308.1 +/- 0.2 mm).	
10. 4.37 inches (111.0 mm).	
11. 5.00 inches (127.0 mm).	

Dimensions are +/- 0.02 inches (+/- 0.51 mm) unless specified otherwise.

The following diagram shows the recommended panel cutout for the 3500/06 weatherproof housing for a Mini-rack.

1. 14.050 inches (356.87 mm).	12. 0.50 inches (12.7 mm).
2. 11.525 inches (292.74 mm).	13. 4.87 inches (123.7 mm).
3. 7.025 inches (178.44 mm).	14. 9.75 inches (247.7 mm).
4. 2.525 inches (64.135 mm).	15. 13.05 inches (331.47 mm).
5. 0.25 inches (6.4 mm) radius, maximum (4 places).	16. 0.281 inches (7.14 mm) diameter clearance hole for 0.250 inches diameter bolt or mounting studs. 8 places for housing. 12 places for housing and air purge gauge assembly.
6. 13.27 inches (337.1 mm).	
7. 6.635 inches (168.5 mm).	
8. 0.57 inches (14.5 mm).	17. This 4-hole pattern is only used when installing the air purge gauge assembly.
9. 12.13 +/- 0.06 inches (308.1 +/- 0.2 mm).	
10. 4.37 inches (111.0 mm).	
11. 5.00 inches (127.0 mm).	

Dimensions are +/- 0.02 inches (+/- 0.51 mm) unless specified otherwise.

3.3.4   Conduit Fitting Option

The conduit fitting option provides four 1 ¼ NPT weatherproof hubs. The conduit is supplied by the customer, and the percentage of fill should not exceed 40% as specified in National Electrical Code, 1975, Chapter 9, Tables 1 and 2. The upper conduits are to be used for transducer power, signal input and recorder output. The lower conduits are to be used for rack power input and relay wiring. Power input and relay wiring should NOT be mixed with transducer and recorder wiring. The following diagrams show the hubs installed onto the housing.
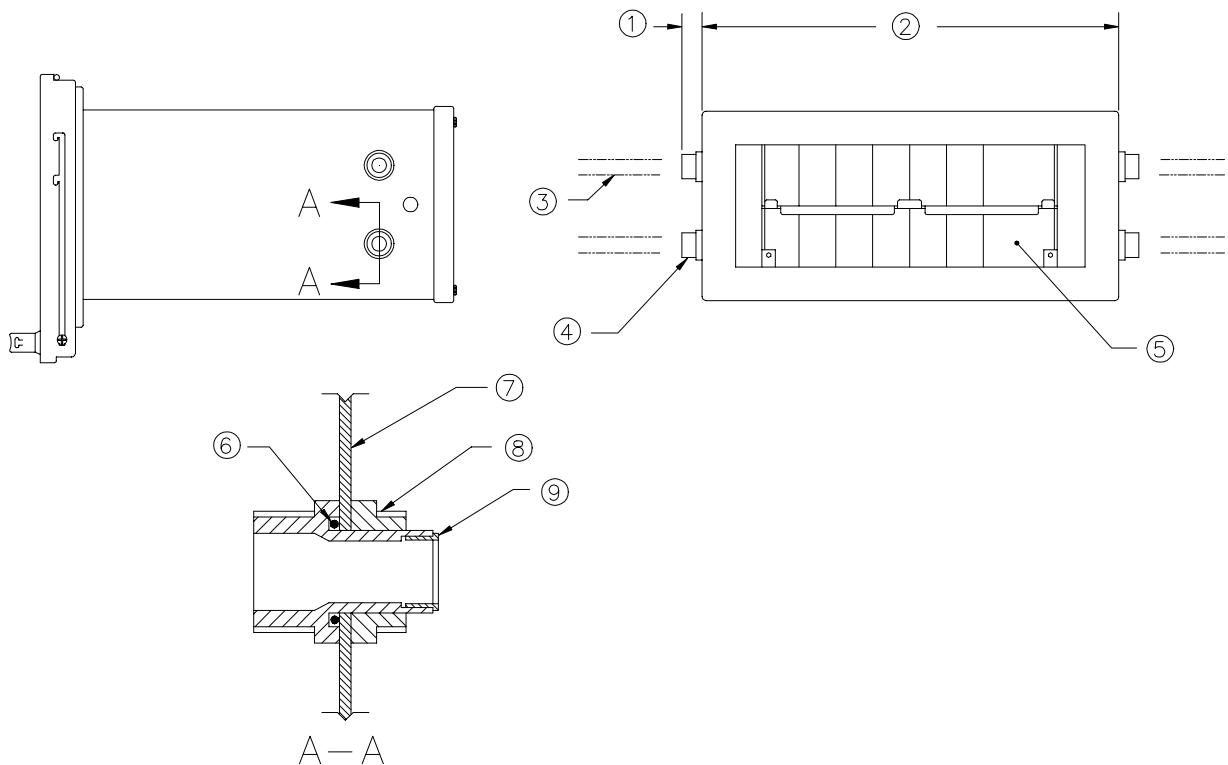
(1)   1.03 inches (26.2 mm), 4 places.
(2)   19.55 inches (496.6 mm) full size, 12.55 inches (318.77 mm) for Mini-rack.
(3)   Customer-supplied conduit, 4 places.
(4)   Weatherproof conduit hub. Also shown in cross-section A-A.
(5)   Rear view of housing with rear cover and typical 3500 rack installed.
(6)   "O"-ring seal.
(7)   Housing wall. Arrow points to inside surface of the housing.
(8)   Lock ring.
(9)   Collar.

3.3.5   Air Purge Option

There are two air purge options:

1. The "fittings only" option provides four 1 ¼ NPT Pour seal type fittings and one ¾ NPT weatherproof hub, with fittings to reduce down to ¼ NPT (female) for air input.

2. The "fittings and gauge" option provides the fittings listed above, a gauge assembly, a bulkhead connector and a connecting tube.

When either of the air purge options is required, the conduit fitting option is also required.

Static purge pressure (the pressure required to insure that a hazardous atmosphere does not enter the housing) must be above 0.2 inches of water (0.05 Kilopascals) for installations that require N.F.P.A. 495-1982 specification. For installations that require Canadian Electrical Code C22.1-1986 specification, pressure must be above 0.25 Kilopascals (1.0 inches of water). This is measured on the gauge (after housing has been purged) with valve in the closed position.

Application Alert

This housing is NOT equipped with over pressure protection. Maximum working pressure should not exceed 2.49 Kilopascals (10 inches of water).

Purge flow rate (the time required to purge 5 or 10 volumes of air through the housing) is determined by:

1. Turn the valve to its vent position and read the gauge to determine housing purge pressure.

2. Find that pressure on the appropriate chart provided below.

3. Determine the size of the housing that is being purged and read from that column the length of time required to purge the system with your housing pressure. This number, in minutes, should be permanently marked in the space provided on the warning label on the housing door.

①

③	④	⑤
0.2	0.33	46
0.4	0.67	23
0.6	0.83	19
0.8	1.00	16
1.0	1.08	14
1.5	1.25	12
2.0	1.42	11
2.5	1.57	10
3.0	1.72	9
3.5	1.85	8
4.0	2.00	8
4.5	2.11	8
5.0	2.22	7
5.5	2.33	7
6.0	2.42	7
6.5	2.50	6
7.0	2.59	6
7.5	2.67	6
8.0	2.74	6
8.5	2.80	6
9.0	2.87	6
9.5	2.93	6
10.0	3.00	5

②

③	⑥	④	⑦	⑤
1.0	0.25	1.08	1.83	28
1.5	0.37	1.25	2.12	24
2.0	0.50	1.42	2.41	22
2.5	0.62	1.57	2.67	20
3.0	0.75	1.72	2.92	18
3.5	0.87	1.85	3.14	16
4.0	1.00	2.00	3.40	16
4.5	1.12	2.11	3.58	16
5.0	1.25	2.22	3.77	14
5.5	1.37	2.33	3.96	14
6.0	1.50	2.42	4.11	14
6.5	1.62	2.50	4.25	12
7.0	1.74	2.59	4.40	12
7.5	1.87	2.67	4.54	12
8.0	1.99	2.74	4.66	12
8.5	2.12	2.80	4.76	12
9.0	2.24	2.87	4.88	12
9.5	2.37	2.93	4.98	12
10.0	2.49	3.00	5.10	10

(1)   Use this table for 5X purge per N.F.P.A. 496-1982.

(2)   Use this table for 10X purge per Canadian
       Electrical Code C22.1-1986, Part 1.
(3)   Pressure in inches of water.
(4)   Flow (in cubic feet per minute) through air
       purge valve.
(5)   Time (in minutes) for purging weather-
       proof housing.
(6)   Pressure in Kilopascals.
(7)   Flow (in cubic meters per hour) through air
       purge valve.

All tests and recommendations are in accordance with specifications and requirements made by N.F.P.A. in pamphlet 496-1982 for type Y purge, or Canadian Electrical Code C22.1-1986, Part 1. For additional information on purge requirements, refer to the above standards.

The following diagrams show installation of the air purge fittings and gauge.
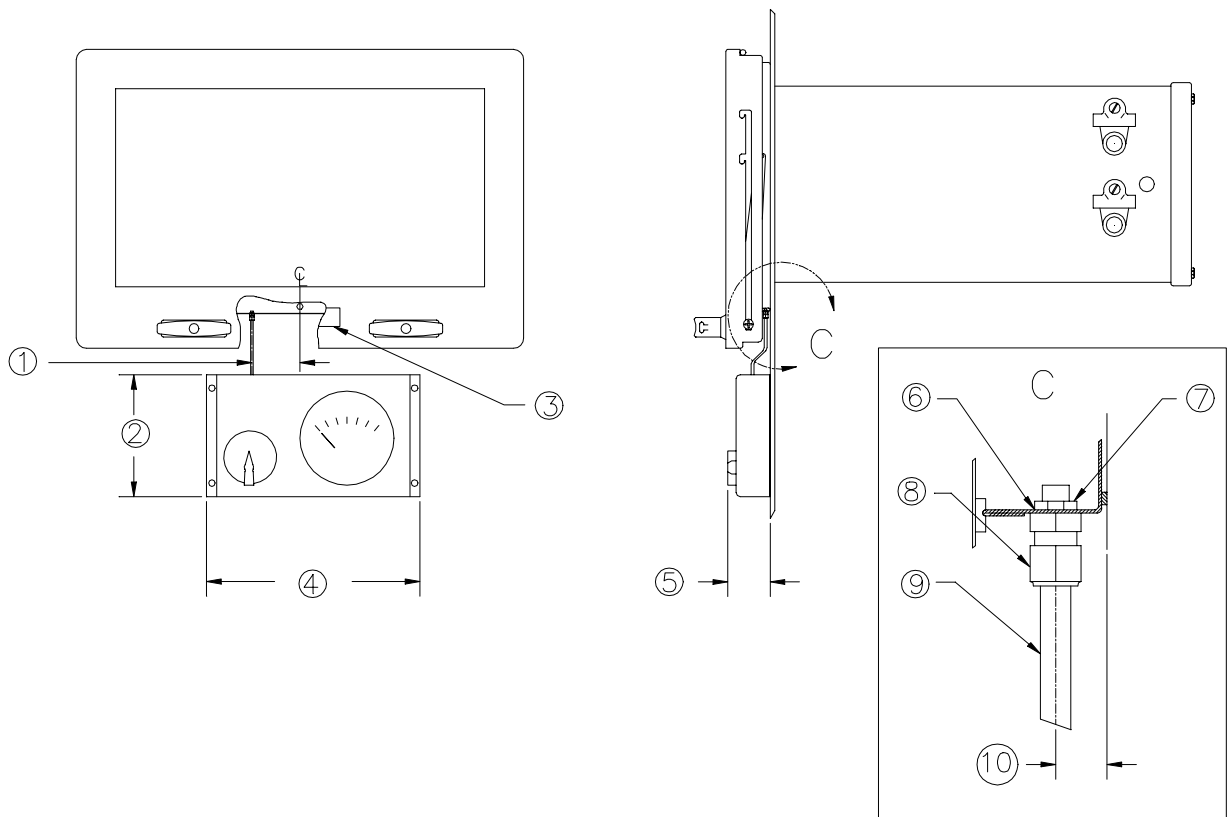
(1)   3.00 inches (76.2 mm).
(2)   6.00 inches (152.4 mm).
(3)   Purge warning label.
(4)   10.50 inches (266.7 mm).

(5)   3.25 inches (88.6 mm).
(6)   Drill a 0.43 inches diameter mounting
       hole.
(7)   Locknut.
(8)   Bulkhead fitting.
(9)   Connecting tube.
(10) 0.50 inches (12.7 mm).

B—B
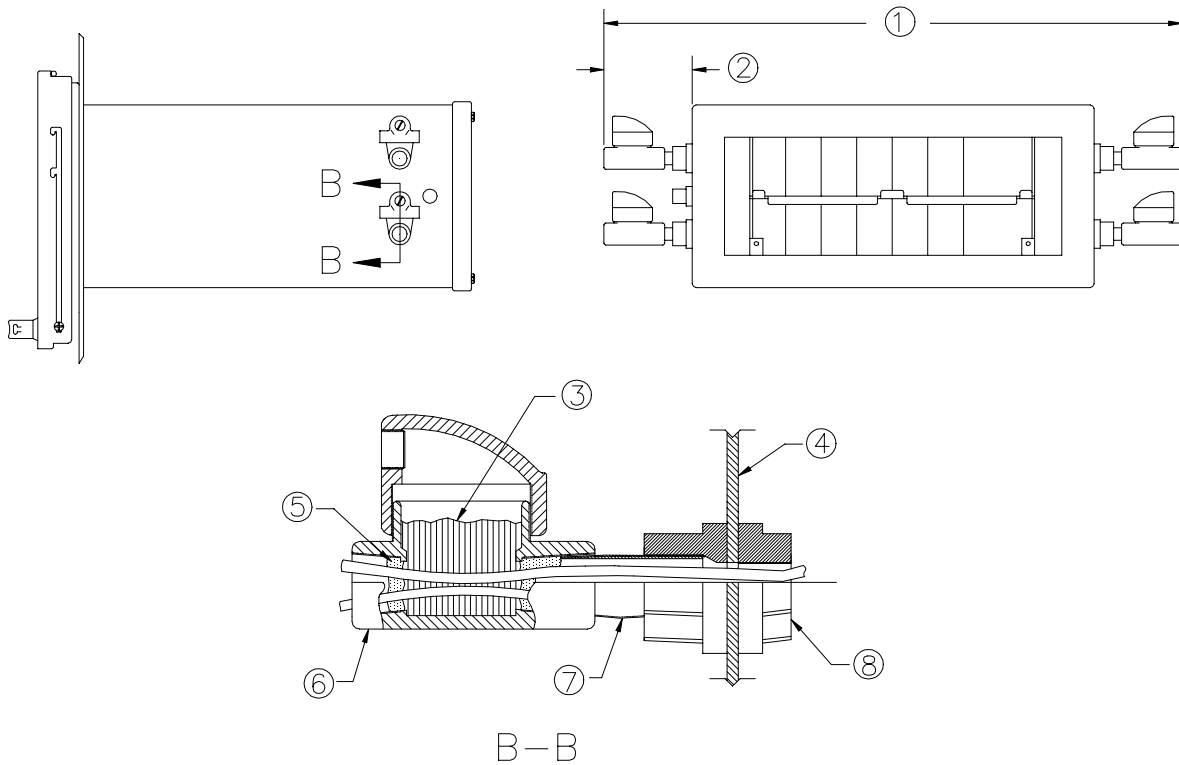
(1)   31.05 inches (788.7 mm) full size, 24.05
       inches (610.87 mm) for Mini-rack.
(2)   5.75 inches (146.1 mm).
(3)   Sealing compound.
(4)   Weatherproof housing wall, inside surface.
(5)   Packing fiber, 2 places.
(6)   Pour seal fitting.
(7)   Adapter.
(8)   Conduit hub.

3.3.6   Installation Instructions

1. Create the appropriate panel cutout for the options to be used.

2. Install the weatherproof housing into the panel cutout.

3. Secure the housing to the panel with eight ¼ inch bolts. Be sure to use the provided thread seals to ensure a water-tight seal.

4. If required, install the optional fittings and gauge.

5. Install the 3500 system rack per the instructions for a rack-mount system.

6. Remove the rear access cover of the housing.

7. Install the field wiring to the rack.

8. Secure all fittings.

9. Install the housing's rear access cover.

Perform the necessary installation tests.

3.4   Rack Installation

This section provides instructions for the proper mounting of each type (Panel Mount, Rack Mount and Bulkhead Mount) of 3500 full-size and mini-racks. When mounting a rack, check that the rack is mounted to a grounded surface and that the features on the front panels of the main modules are accessible. Be sure to also provide for maintenance access to the I/O modules.

3.4.1   Rack Ventilation

The top and bottom of the rack are perforated to allow cooling air in and heated air to escape. In order to help ensure adequate ventilation, maintain the minimum clearances at the top and bottom of the rack as shown below.
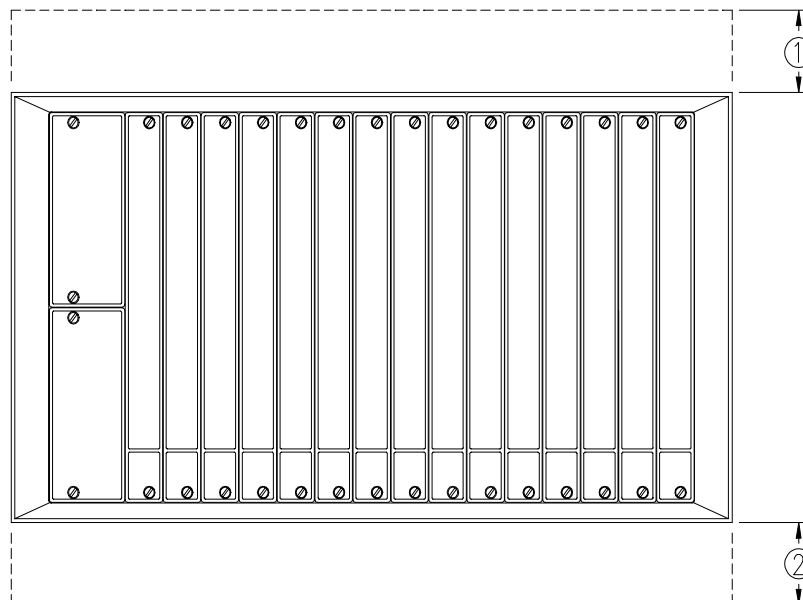
(1)   Minimum top clearance = 2.00 inches
        (50.4 mm).
(2)   Minimum bottom clearance = 2.00 inches
        (50.4 mm).

3.4.2   Panel Mount

A 3500 Panel Mount rack is shown in the following diagram. A Panel Mount rack allows you to install a 3500 rack behind a panel through a sheet metal cutout and clamp into place.
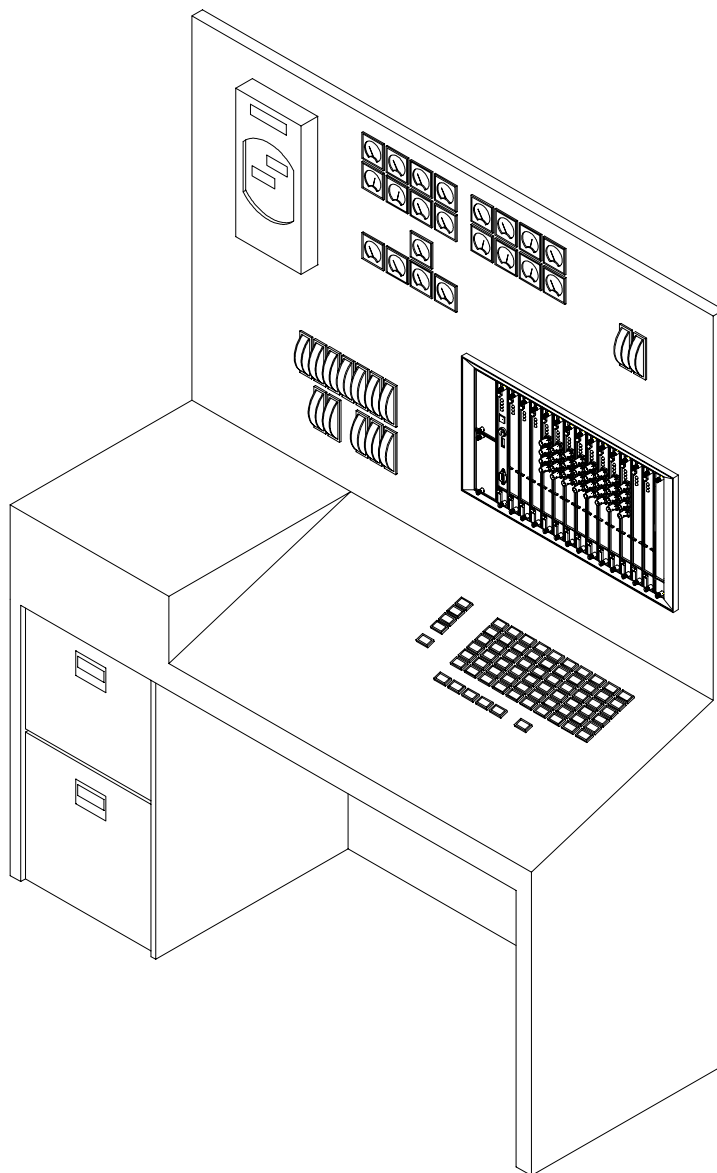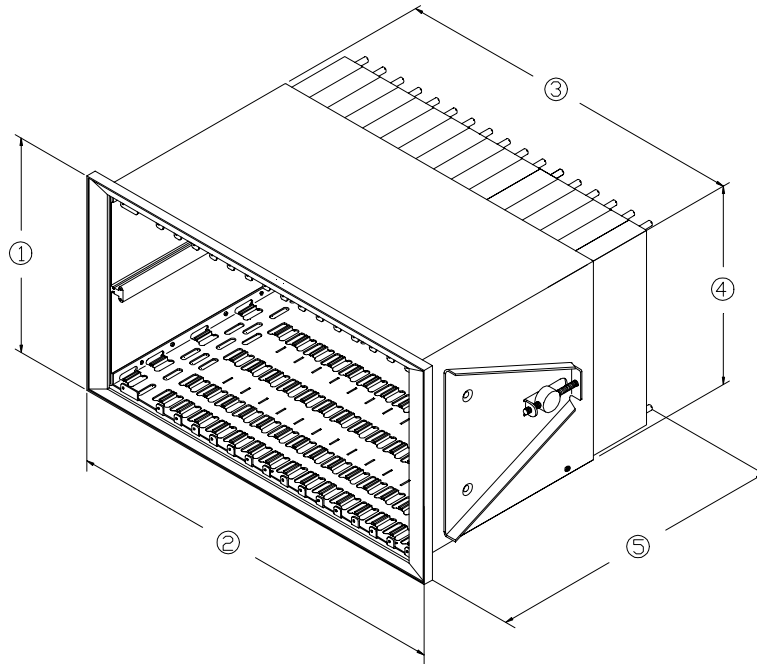
3.4.2.1   Panel Mount Full-Size Rack

Figure 3-1.   Dimensions of a Panel Mount 3500 Full-Size Rack

(1)   10.470 inches (265.94 mm).
(2)   19.000 inches (482.60 mm).
(3)   17.400 inches (441.96 mm).
(4)   9.700 inches (246.38 mm).
(5)   13.750 inches (349.25 mm), 16.650
       inches (422.91 mm) if used with internal
       barriers

⚠   **CAUTION**

**Clamps must not be used as handles while
carrying or installing the rack. The clamps may
fall off resulting in injury to personnel and damage
to the rack.**

The required dimensions for the panel cutout, is shown in the following
diagram.

(1)   17.80 +/- 0.06 inches (452.1 +/- 1.5 mm).
(2)   0.125 inches (3.2 mm) radius, maximum.
(3)   9.90 +/- 0.60 inches (251.5 +/- 1.5 mm).

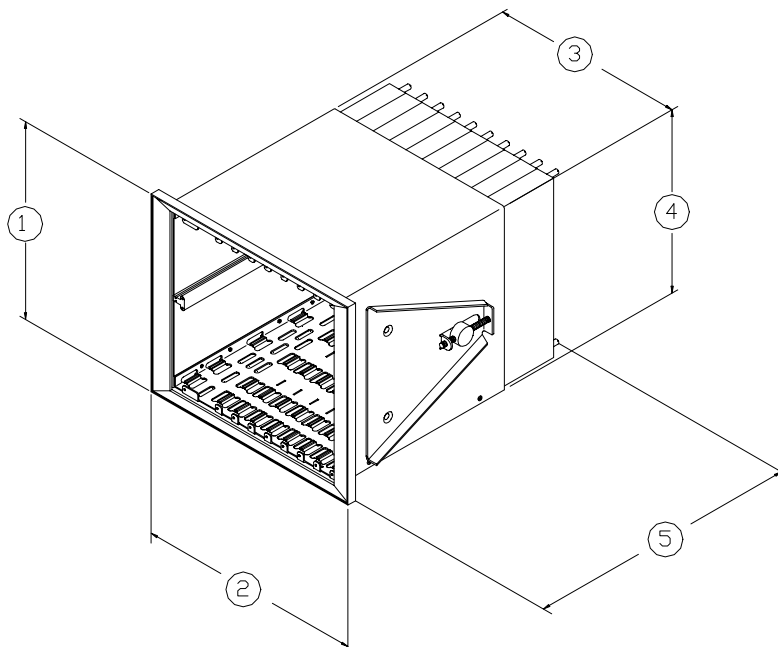### 3.4.2.2   Panel Mount Mini-Rack

Figure 3-2. Dimensions of a Panel Mount 3500 Mini-Rack

(1)   10.470 inches (265.94 mm).
(2)   12.000 inches (304.80 mm).
(3)   10.400 inches (264.16 mm).
(4)   9.700 inches (246.38 mm).
(5)   13.750 inches (349.25 mm), 16.650
       inches (422.91 mm) if used with internal
       barriers

⚠   **CAUTION**

**Clamps must not be used as handles while
carrying or installing the rack. The clamps may
fall off resulting in injury to personnel and damage
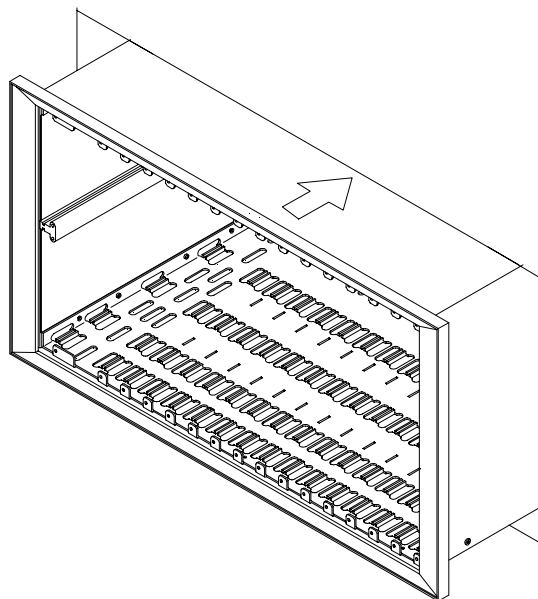to the rack.**

The required dimensions for the panel cutout, is shown in the following
diagram.
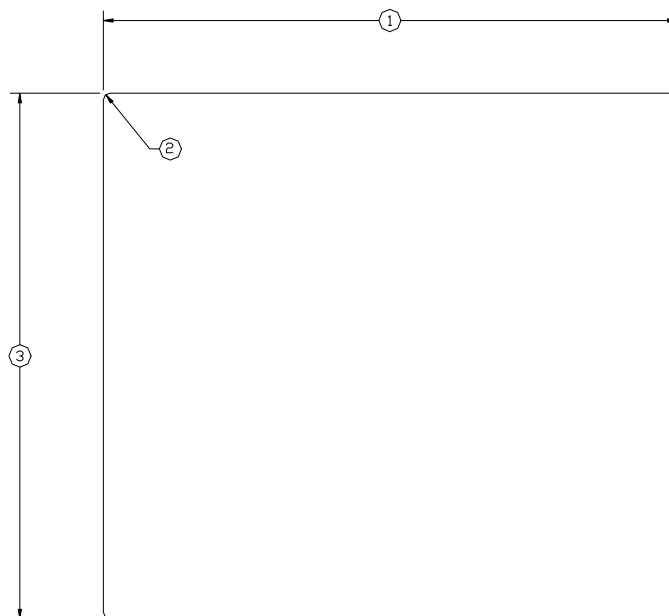
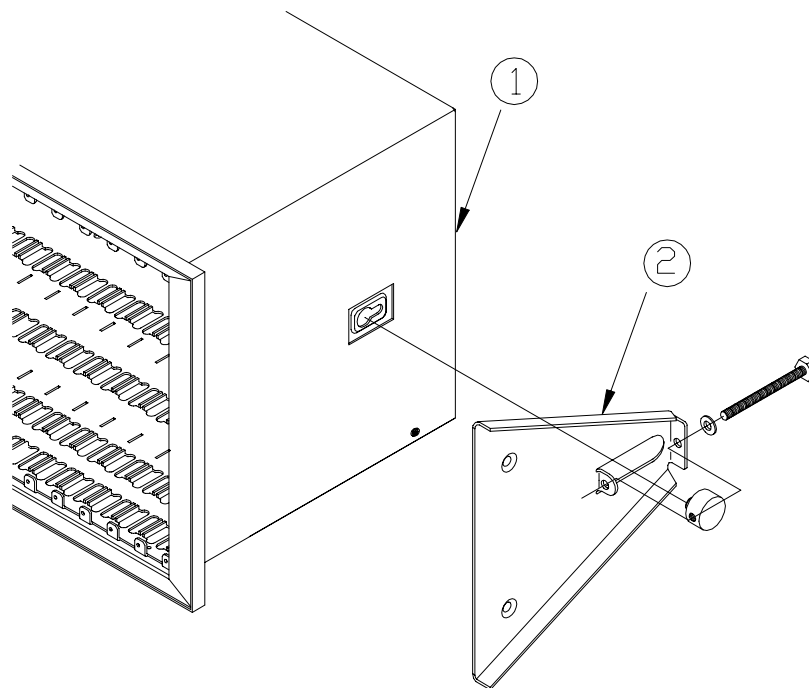(1)   10.80 +/- 0.06 inches (274.3 +/- 1.5 mm).
(2)   0.125 inches (3.2 mm) radius, maximum.
(3)   9.90 +/- 0.60 inches (251.5 +/- 1.5 mm).

3.4.2.3   Instructions for installing panel mount rack

1. Cut panel cutout to the required dimensions.

2. If installed, remove the panel mount clamps from the rack. Slide rack through panel cutout.
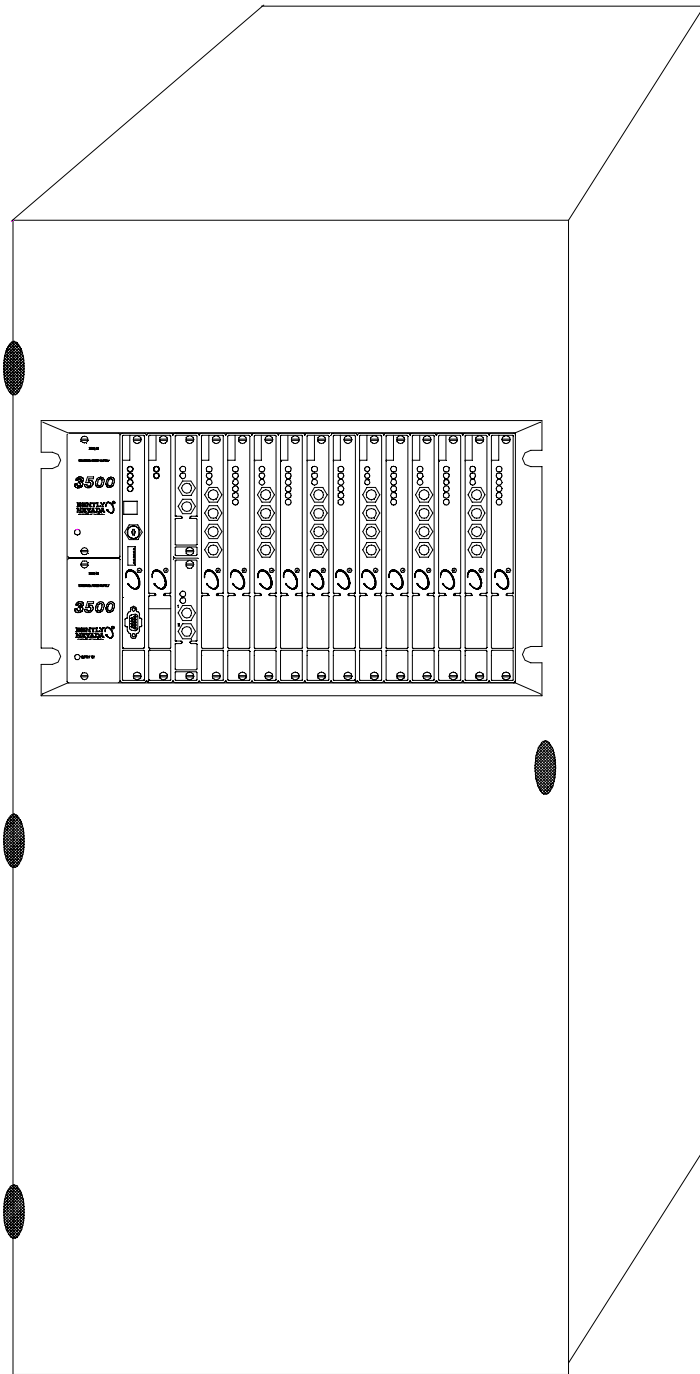
3. Assemble the clamp.

(1)   Rear of Rack.
(2)   Clamp.

4. Align the rack in the cutout.

5. Tighten the clamping screws.

3.4.3 Rack Mount

3.4.3.1 Full-Size Rack Mount

A Rack Mount 3500 full-size rack is shown in the following diagrams. A Rack Mounted 3500 system allows you to install the rack into a standard 19-inch EIA cabinet.

Figure 3-3. Dimensions of a Rack Mount 3500 Full-Size Rack

(1)   10.470 inches (265.94 mm).
(2)   7.500 inches (190.50 mm).
(3)   18.008 inches (457.40 mm).
(4)   19.000 inches (482.60 mm).
(5)   17.400 inches (441.96 mm).
(6)   9.700 inches (246.38 mm).
(7)   13.750 inches (349.25 mm), 16.650
        inches (422.91 mm) if used with internal
        barriers

3.4.3.2   Instructions for installing rack mount 3500 full-size rack

Install the 3500 rack using No. 10 flat washers (4 places) and 10-32 screws (4 places) at the locations shown by the arrows in the diagram below.

3.4.3.3   Mini-Rack Mount

A Rack Mount 3500 mini-rack is shown in the following diagrams. The Mini-Rack Mounted 3500 system also allows you to install the rack into a standard 19-inch EIA cabinet with the use of the mini-rack Adapter Panel.
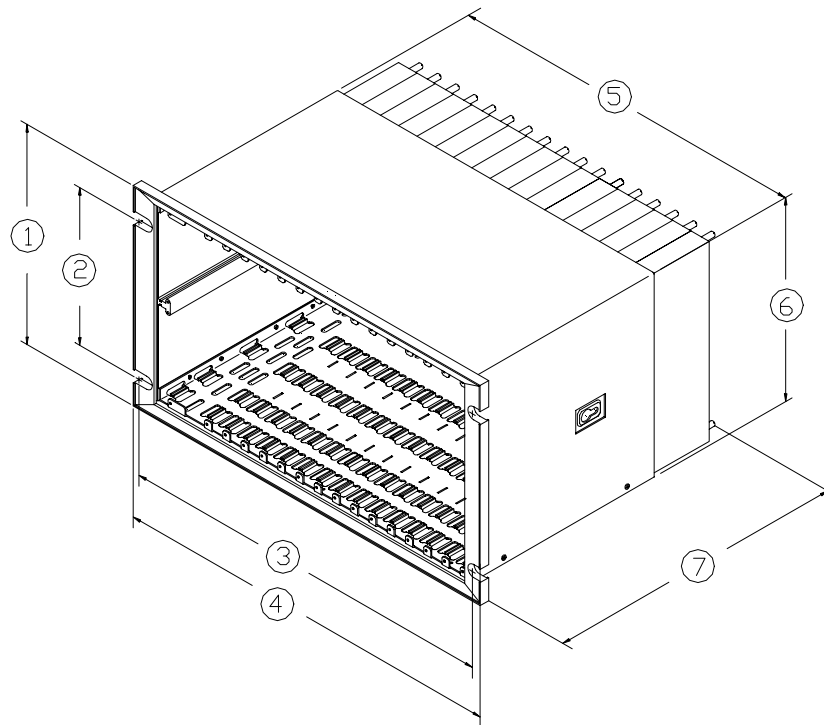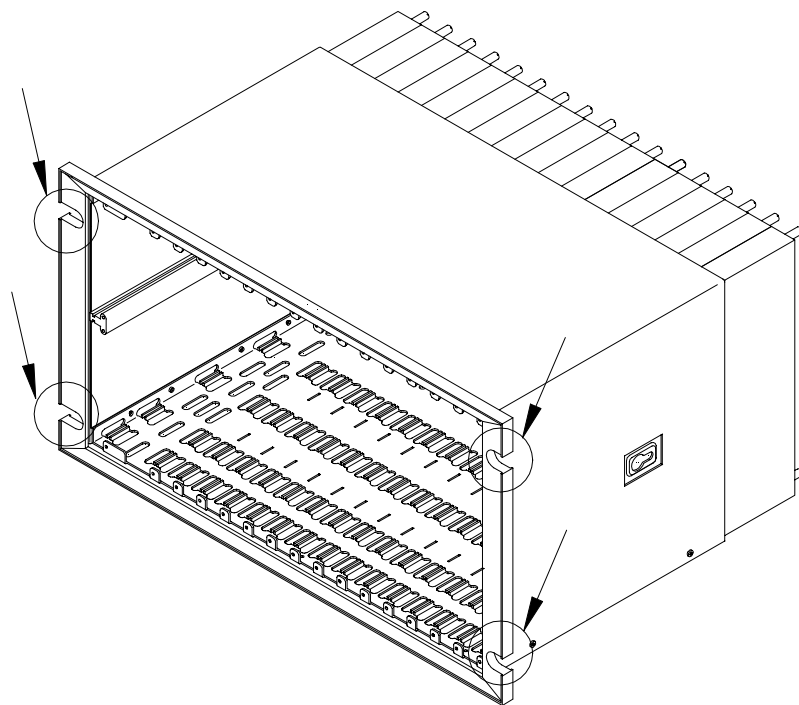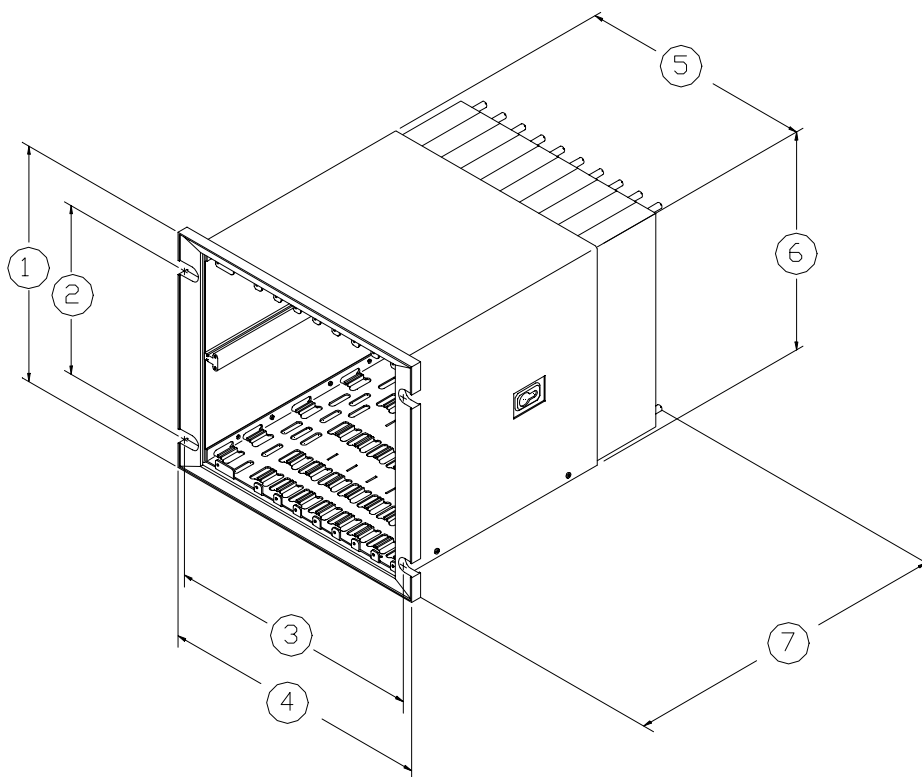
Figure 3-4. Dimensions of a Rack Mount 3500 Mini-Rack

(1)   10.470 inches (265.94 mm).
(2)   7.500 inches (190.50 mm).
(3)   11.008 inches (279.60 mm).
(4)   12.000 inches (304.80 mm).
(5)   10.400 inches (264.16 mm).
(6)   9.700 inches (246.38 mm).
(7)   13.750 inches (349.25 mm), 16.650
        inches (422.91 mm) if used with internal
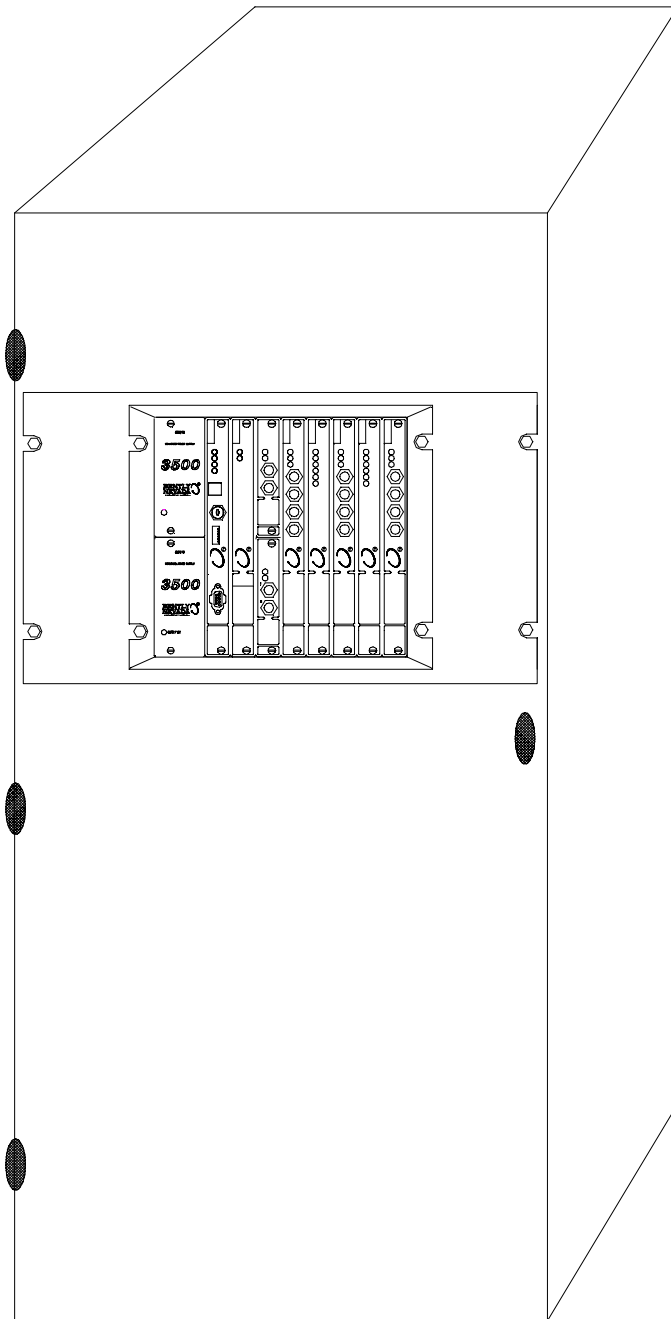   barriers

3.4.3.4   Instructions for installing a rack mount 3500 Mini-rack

Install the Mini-rack adapter panel into the EIA rack using No. 10 flat washers (4 places) and 10-32 screws (4 places). Next, install the 3500 Mini-rack onto the adapter panel using No. 10 flat washers (4 places) and 10-32 screws (4 places).
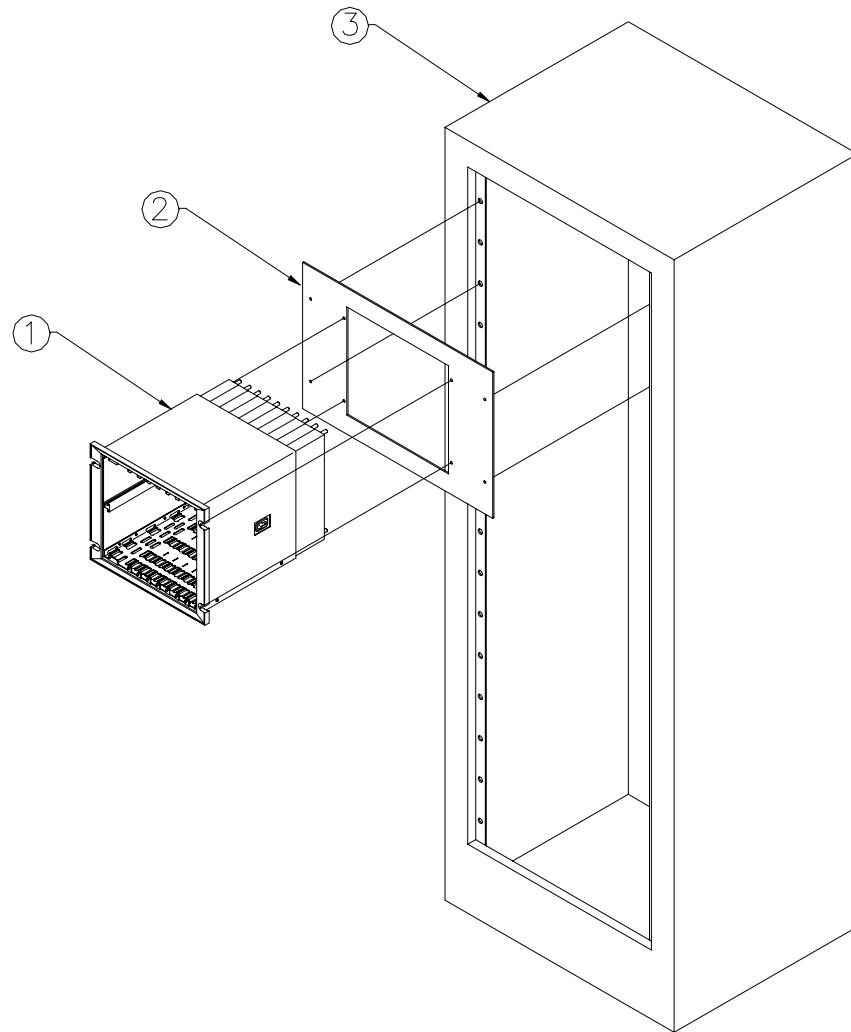
(1)   3500 Mini-rack
(2)   Adapter Panel
(3)   Standard 19-inch EIA rack

3.4.4   Bulkhead Mount

A Bulkhead Mount 3500 rack is shown in the following diagrams. Use a 3500 Bulkhead rack when you want to attach the rack to a wall or want to be able to change the field wiring from the front of the rack.

Note:

The 3500/05 Mini-rack is not available in the Bulkhead Mount option
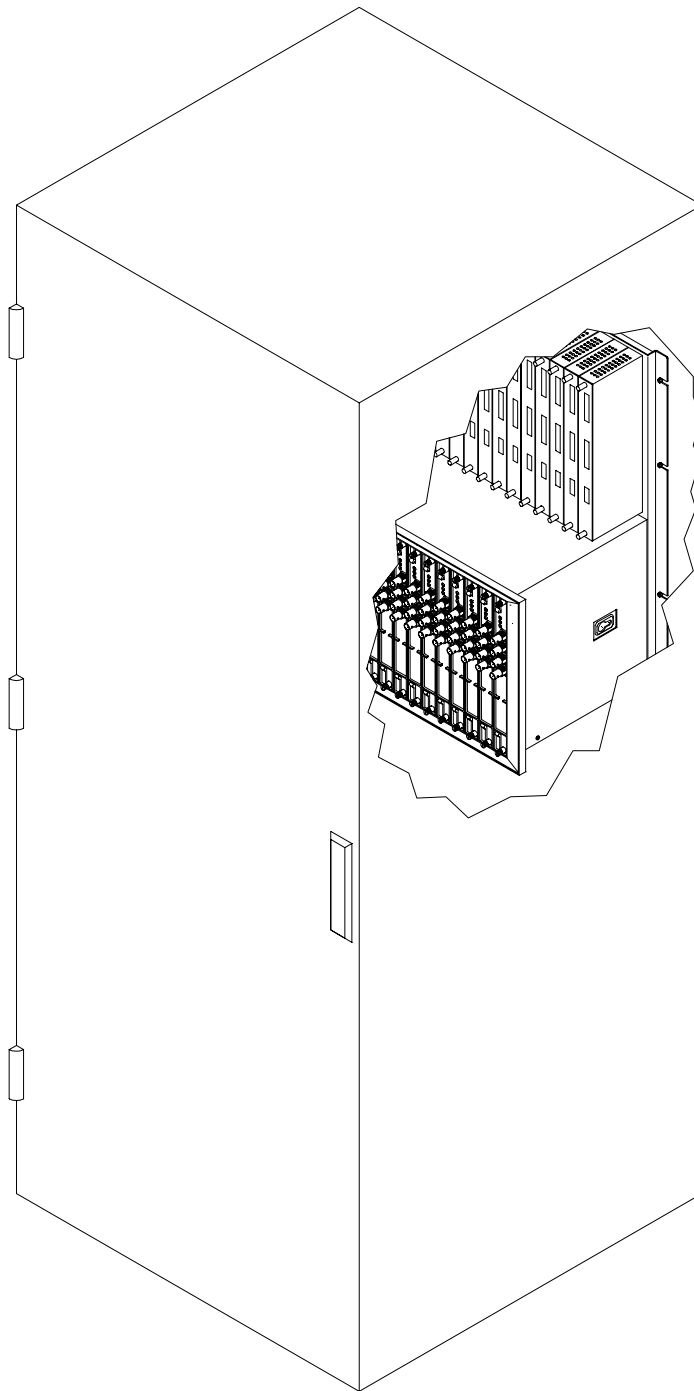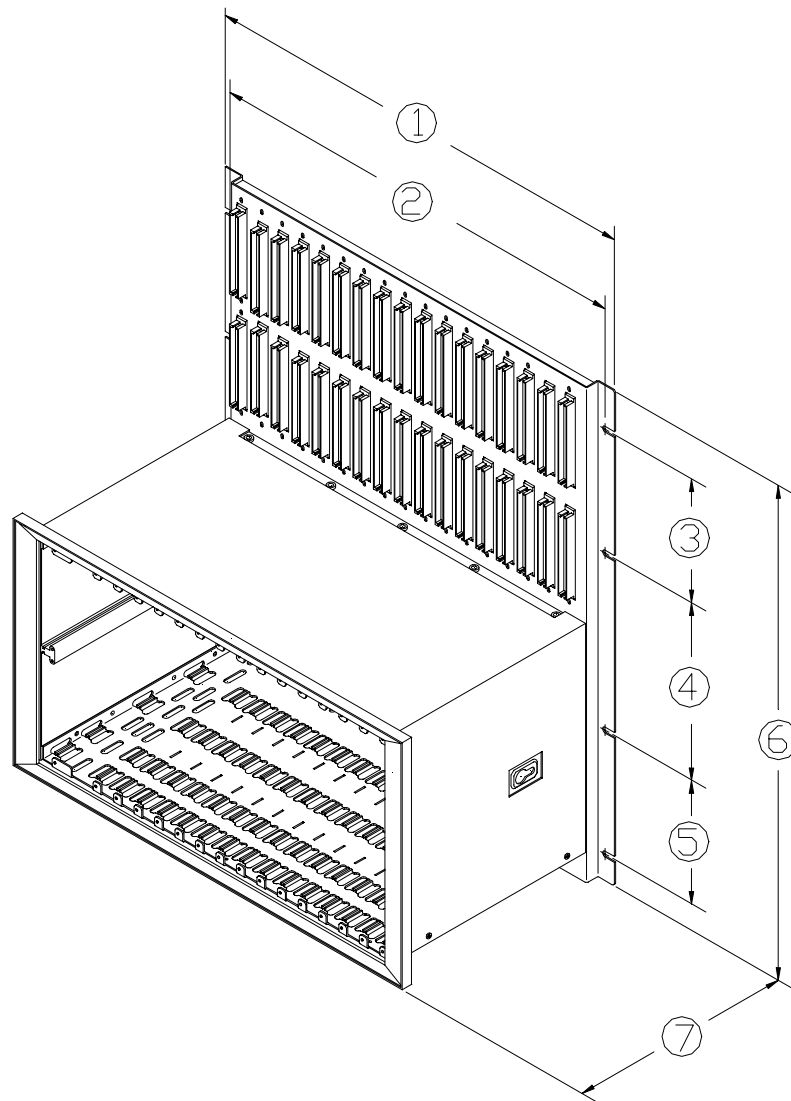
Figure 3-5. Dimensions of a Bulkhead Mount 3500 rack

(1)   19.000 inches (482.60 mm).
(2)   18.094 inches (459.59 mm).
(3)   5.250 inches (133.35 mm).
(4)   7.500 inches (190.50 mm).
(5)   5.250 inches (133.35 mm).
(6)   20.970 inches (532.64 mm).
(7)   10.500 inches (266.70 mm).

3.4.4.1   Instructions for installing bulkhead mount 3500 rack

Install the 3500 rack using No. 10 flat washers (8 places) and 10-32 screws (8 places) in the locations shown in the diagram below.
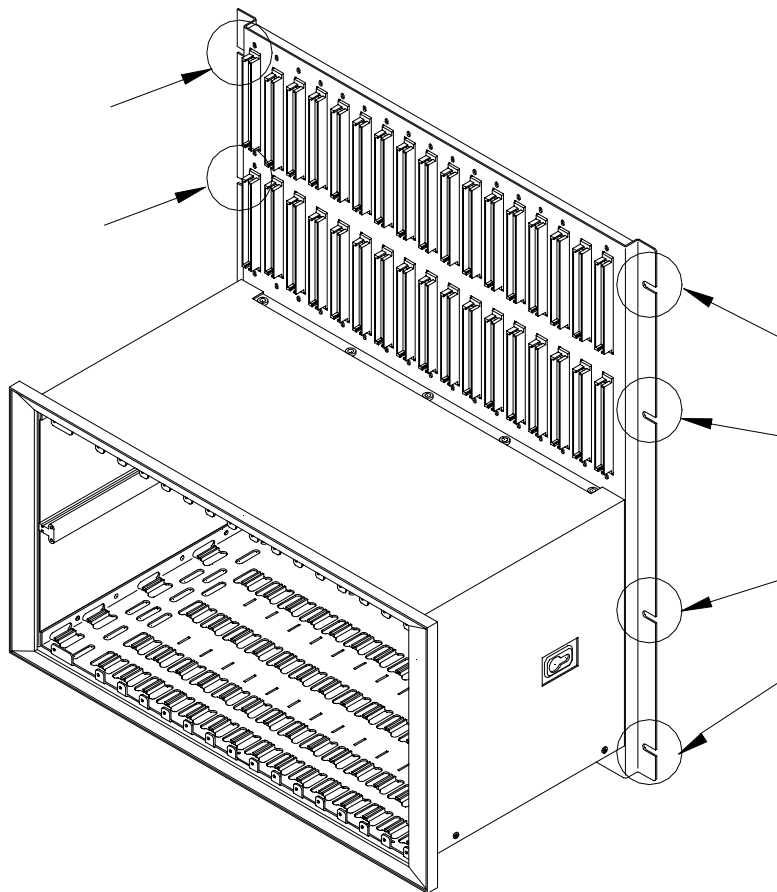
3.5   External Termination Blocks

"External and Internal Termination" on page 4 briefly described when External Termination (ET) Blocks and I/O modules would be used and shows a diagram of the components assembled.

The diagram below shows some of the common DIN rail types that the ET Blocks can mount to.
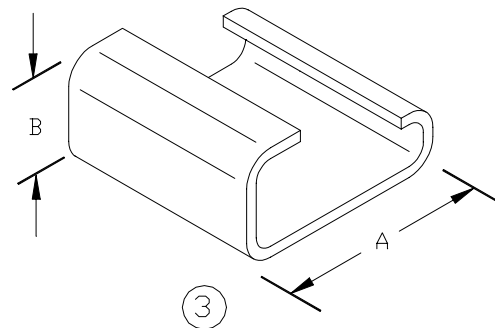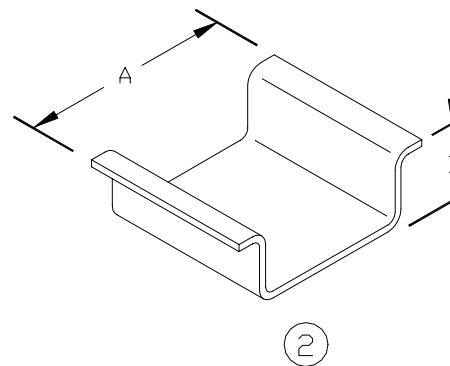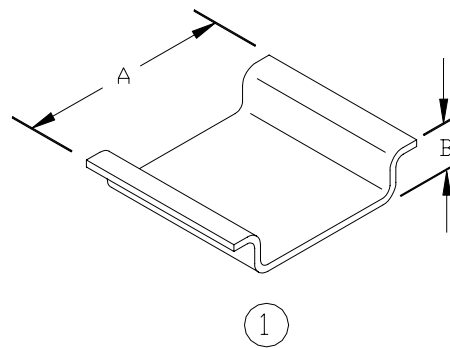
(1)   U-shaped rail. Dimension A = 35mm and
      dimension B = 7.5mm. This rail is referred
      to as U-Rail(7.5) in this section.
(2)   U-shaped rail. Dimension A = 35mm and
      dimension B = 15mm. This rail is referred
      to as U-Rail(15) in this section.
(3)   G-shaped rail. Dimension A = 32mm and
      dimension B = 15mm. This rail is referred
      to as G-Rail in this section.
The diagram below shows a Euro-style ET Block mounted on G-Rail.
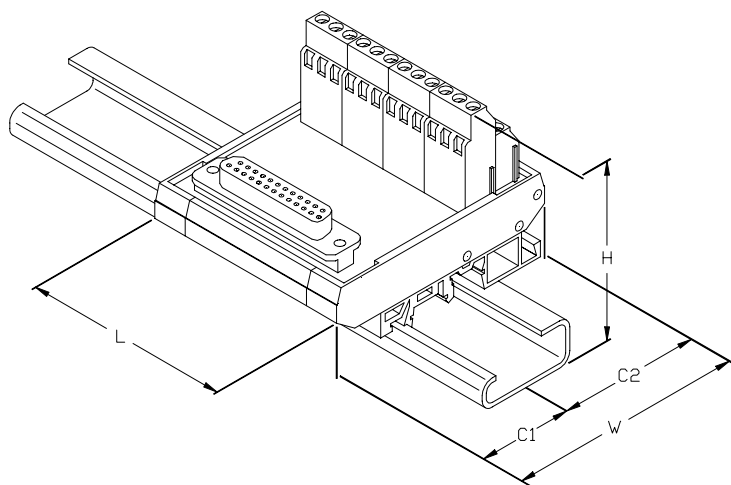
The diagram below shows a Terminal-strip (or barrier type) ET Block mounted on G-Rail.
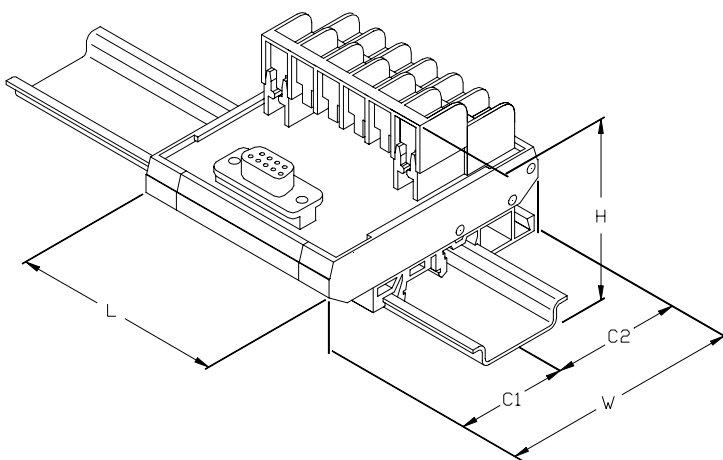
Either ET Block type can be mounted on any of the rail types mentioned above. For a more detailed picture of a particular ET Block, refer to the manual of the applicable 3500 monitor.

The table below lists the available ET Blocks and their dimensions. The location of the dimensions are shown in the diagrams above. All dimensions are in mm.

Part Number	L	W	H – U-Rail(7.5) H – U-Rail (15) H – G-Rail	C1	C2
128710	68	77	51 59 57	39	39

125808 128702 133900 141208	68	77	58 66 63	39	39
128718 133932 136603 140993	90	77	58 66 63	39	39
128726	90	77	51 59 57	39	39
133916	113	77	58 66 63	39	39
128015 133892 133924 136595 141001	113	77	51 59 57	39	39
132242	153	90	67 75 73	46	43
133908 141216	153	90	60 68 65	46	43
132234	178	90	60 68 65	46	43

3.6   Intrinsically Safe Installation

For correct operation of an I.S. installation, you must maintain a low resistance path to the I.S. earth point of the plant. Either one or two cables of less than 1 ohm combined resistance must be connected to the Earthing Module in order to provide a connection between the rack and the plant I.S. earth. These cables must have a cross-sectional area of between 4 mm^2 and 10 mm^2.

The optimum solution is to use two cables to connect from the Earthing Module to plant I.S. earth. This connection lets you test the continuity of the I.S. earth connection on-line. If one cable is disconnected from the Earthing Module then the resistance of the two cables can be measured using a suitable milli-ohm meter. A total resistance of less than 2 ohms will ensure that the parallel combination of the two cables is less than 1 ohm. Continuity between the shield of the field wiring from the hazardous area and the Earthing Module should also be verified.

If the Earthing Module is positioned in the rack such that it would be difficult to remove one of the I.S. earth cables in order to perform on-line testing, then the

standard slotted set screws may be replaced with the Allen headed set screws provided.

Please refer to Bently Nevada drawing number 138547 for additional information regarding the installation requirements for an Intrinsically Safe System.

To avoid ground loops, the system must provide a single point ground. In Intrinsically Safe applications the 3500 Rack is floated and referenced to an intrinsically safe ground instead of earth ground. RS-232 communications are referenced to earth ground, and therefore to keep the rack isolated from earth ground, a serial data isolator must be used. RS-485 uses an isolated ground and no additional isolation is required.

The following diagram shows the connections for testing the I.S. earth resistance.
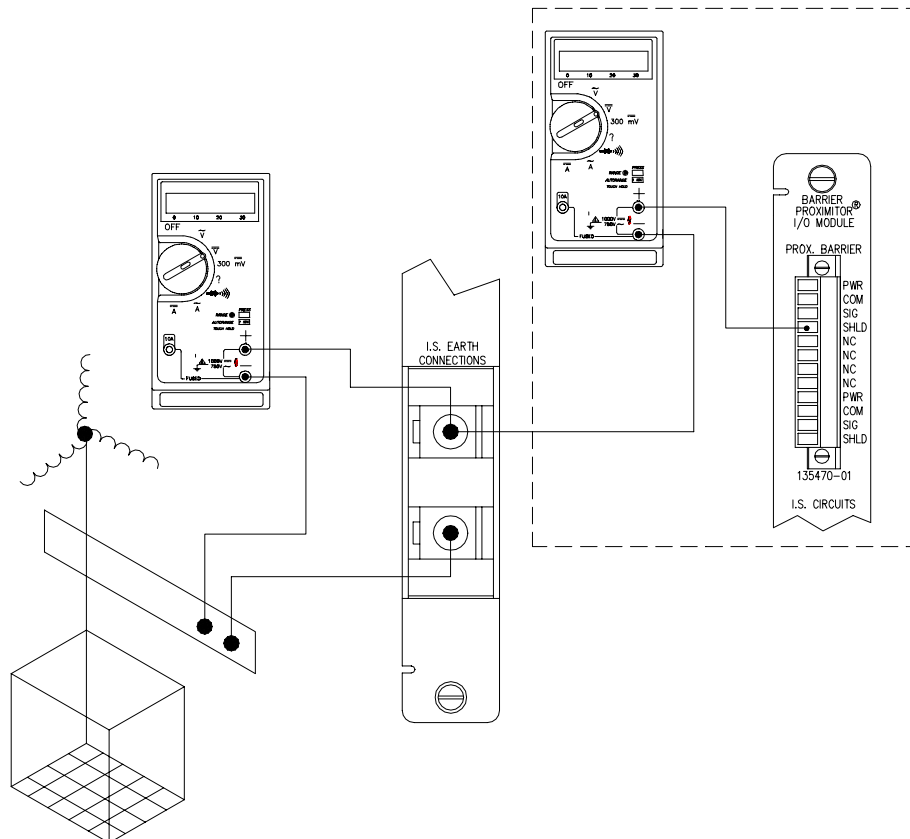
Figure 3-6. Testing I.S. earth resistance.

3.7 High Electromagnetic Noise Environment and European Conformance (CE) Rack Installation

For the high electromagnetic noise environment or CE installation, the system rack, EMI shield, and cables must be thoroughly grounded to provide a ground path for electromagnetic energy (see figures below). The Bulkhead Rack and External Termination Blocks must be mounted inside an Electromagnetic Interference (EMI) shielded area.
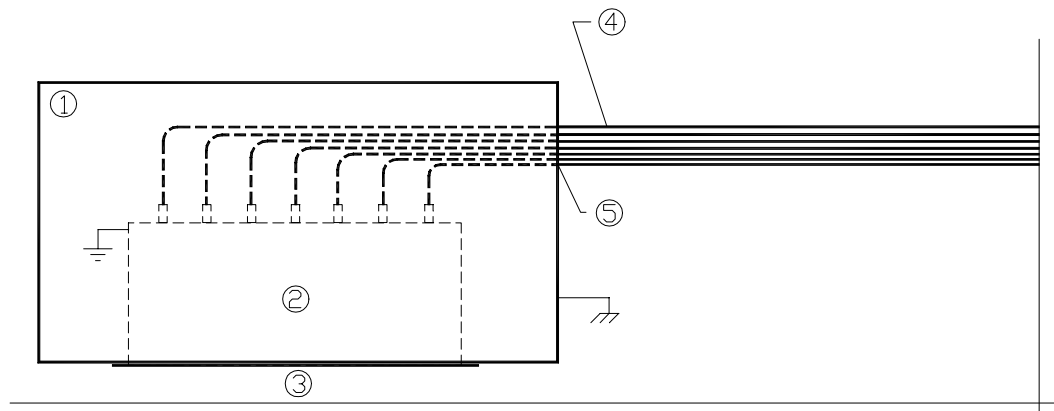
Figure 3-7. Typical Installation - Standard Rack with Internal Termination I/O Modules (Top View of Full-Size Rack Shown).

(1)   Grounded Cabinet.
(2)   3500 Monitoring System.
(3)   Front of Rack.
(4)   Field Wiring Cables with Both Foil and
        Braid Shield.
(5)   Cable Shields Terminated to EMI Shield.

Figure 3-8. Typical Installation - Standard Rack with External Termination I/O Modules, External Termination Blocks Installed Inside the Cabinet (Top View of Full-Size Rack Shown).

(1)   External Termination Blocks, Mounted
        Inside EMI Shielded Area.
(2)   EMI Shielded Area.
(3)   3500 Monitoring System.
(4)   Front of Rack.
(5)   Field Wiring Cables with Both Foil and
        Braid Shielding.
(6)   Cable Shields Terminated to EMI Shield.

Figure 3-9. Typical Installation - Standard Rack with External Termination I/O Modules, External Termination Blocks Installed in a Junction Box (Top View of Full-Size Rack Shown).

(1)   Grounded Cabinet.
(2)   3500 Monitoring System.
(3)   Front of Rack.
(4)   Multi-Conductor Cables with Both Foil and
        Braid Shielding.
(5)   Cable Shields Terminated to EMI Shield.
(6)   External Termination Block Junction Box.
        Is Also an EMI Shielded Area.
(7)   Field Wiring Cables with Both Foil and
        Braid Shielding.
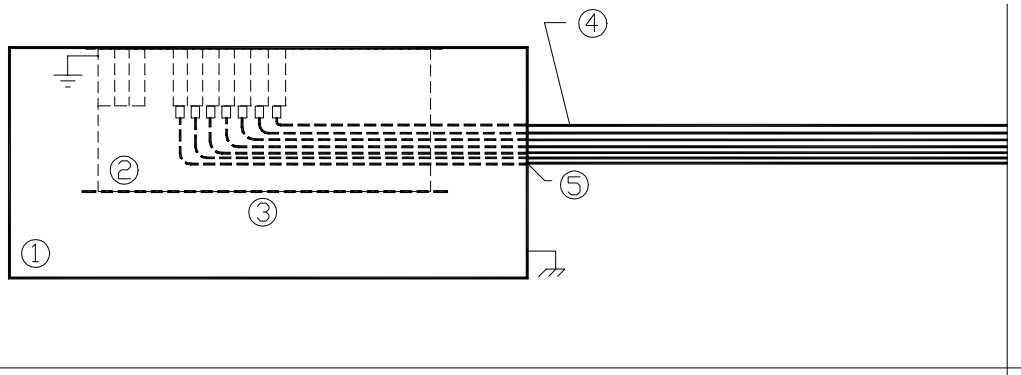
Figure 3-10. Typical Installation - Bulkhead Rack with Internal Termination I/O Modules (Top View Shown).

(1)   EMI Shielded Area.
(2)   3500 Monitoring System.
(3)   Front of Rack.
(4)   Field Wiring Cables with Both Foil and
         Braid Shielding.
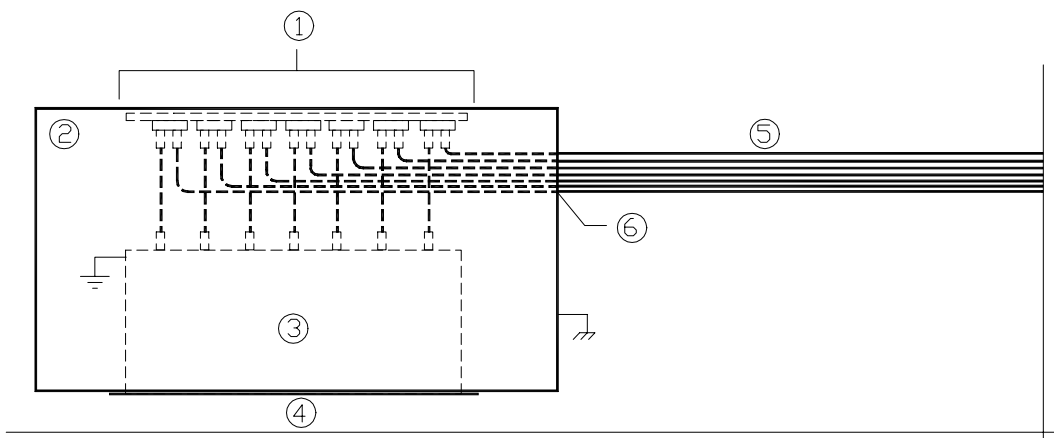(5)   Cable Shields Terminated to EMI shield.
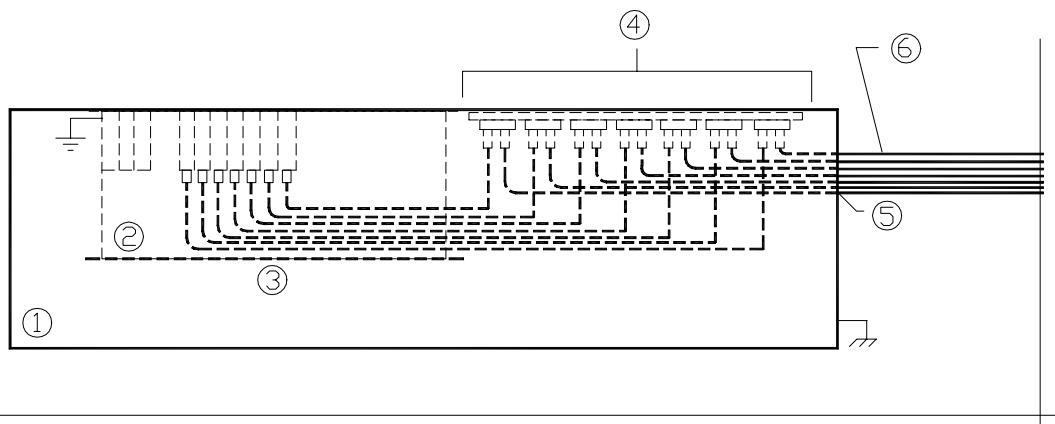
Figure 3-11. Typical Installation - Bulkhead Rack with External Termination I/O Modules, External Termination Blocks Installed Inside the Cabinet (Top View Shown).

(1)   EMI Shielded Area.
(2)   3500 Monitoring System.
(3)   Front of Rack.

(4)   External Termination Blocks, Mounted
        Inside EMI Shielded Area.
(5)   Cable Shields Terminated to EMI Shield.
(6)   Field Wiring Cables with Both Foil and
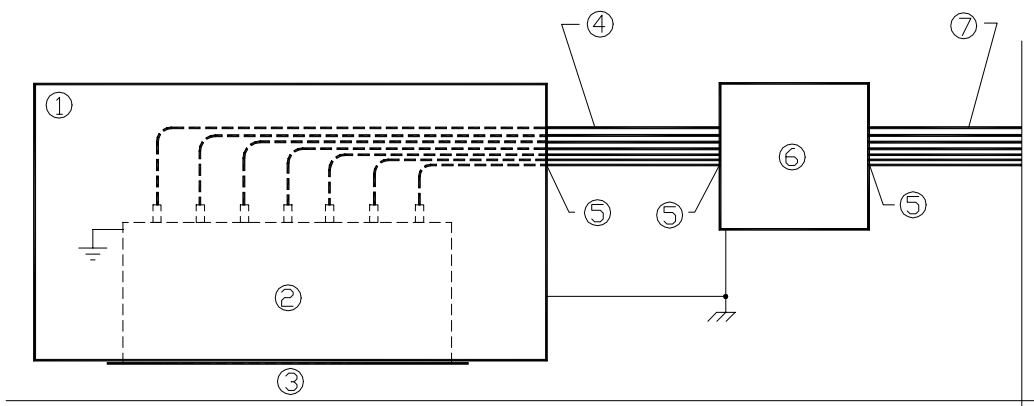   Braid Shielding.
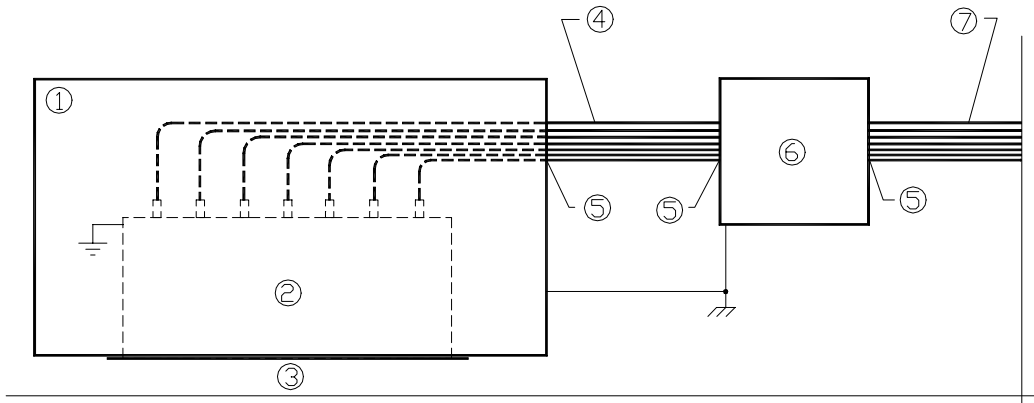
Figure 3-12. Typical Installation - Bulkhead Rack with External Termination I/O Modules, External Termination Blocks Installed in a Junction Box (Top View Shown).

(1)   EMI Shielded Area.
(2)   3500 Monitoring System.
(3)   Front of Rack.
(4)   Multi-conductor Cable with Both Foil and
        Braid shielding.
(5)   Cable Shields Terminated to EMI shield.
(6)   External Termination Block Junction Box.
        Is Also an EMI Shielded Area.
(7)   Field Wiring Cables with Both Foil and
        Braid Shielding.

3.7.1   Wiring

All wiring exiting the metal cabinet or EMI shielded area must be shielded. Acceptable EMI shielding includes metal conduit or multi-conductor cables with both foil and braid shielding. In places where cables enter shielded areas, the cable shield should make good electrical contact with the EMI shield and any subsequent junction enclosure. This contact drains off EMI energy from the cable before the cable enters the shielded area.

3.7.2   Considerations for CE Installation to a Public Power Supply

For systems installed in areas that require compliance to EN61000.3.2, the equipment shall only be used in industrial environment with a connection to

the industrial power supply network. If the system is connected to the public power supply mains, EN61000.3.2 must be met by using a third party device that provides power factor correction.

3.7.3 Considerations for I.S. systems

3.7.3.1 Field Wiring to the Hazardous Area

This should be of steel wire armored construction and should be connected to the EMI shielded area using a suitable cable gland. The inner cores should have an overall screen of foil with a drain wire to connect to the barrier shield terminal of the I/O module. Cables manufactured to BS5308 Part 1, or similar national or international standards, are suitable.

3.7.3.2 Connecting the I.S. Earth

To ensure that EMI is not picked up by or radiated from the I.S. earth cables, install a feed-through capacitor on each I.S. earth cable. These capacitors must be installed at the boundary of the EMI shielded area. A Schaffner FN7000 Series or similar bulkhead mounting type is recommended.

Critical filter parameters are:

- 500 V isolation.

- 25 A continuous rated current.

- Less than 0.1ohm resistance.

- At least 47 nF capacitance.

- Screw terminals with locking washers at each end.

⚠ **CAUTION**

The series resistance of the filter has to be taken into account when planning the installation of the I.S. cables, since the total resistance of the combination of cables and filters must be less than 1 ohm.

3.7.4 Additional Notes

- Larger scale factors are less susceptible to EMI than smaller scale factors.

- Larger full-scales are less susceptible to EMI than smaller full-scale.

- Monitors with narrow bandwidth filter configurations are less susceptible to EMI than monitors configured with wide bandwidth.

- Larger Keyphasor® or hysteresis settings are less susceptible to EMI than smaller hysteresis settings.

- Shorter Alarm delay times may increase monitor susceptibility to transient EMI.

- Environments with higher levels of EMI than tested may cause unpredictable monitor readings and may cause system malfunction.

3.8   Set rack jumpers and switches

Set the following jumpers and switches before operating the rack:

- Rack address switch (on the front of the Rack Interface Module)

- Transducer jumpers on each I/O Module, as required

- Certain I/O Modules have switches to control their mode of operation. Examples include:

    - RIM and Comm Gateway I/O's that support both RS232 and RS422 have a protocol selection switch

    - Overspeed and non-TMR Relay I/O's have Normally Energized/De-energized Relay mode switches

    - Comm Gateway I/O's that support RS485 have termination mode switches

- Setup phone connection to rack / host (if you use an internal or external modem)

    Phone cable to internal modem in rack
                            OR
    Phone cable to modem and RS-232 cable from modem to rack

- TMR / SIM jumper on the inside of the 3500 Rack backplane between the Power Supply and the Rack Interface Module as shown in the diagrams below.

(SIM)   (SIM)

①   ②

(TMR)   (TMR)
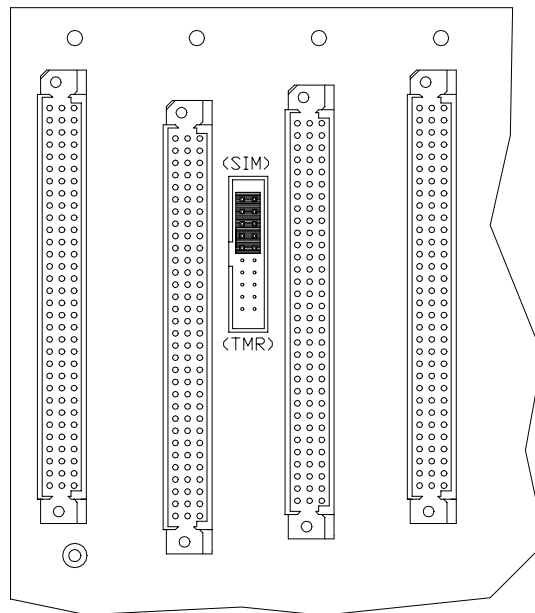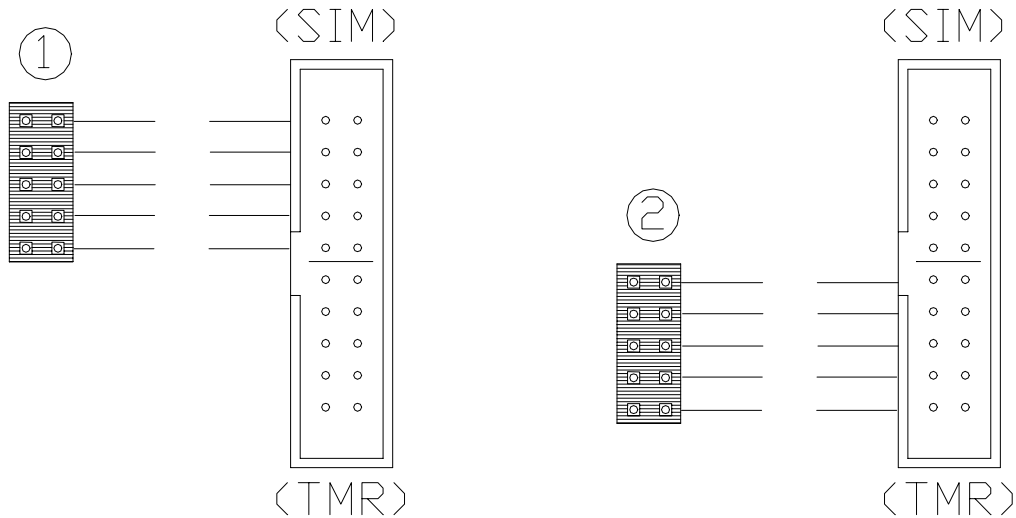
(1)   Ten-legged jumper must be placed in this
       position for Standard 3500 rack.
(2)   Ten-legged jumper must be placed in this
       position for TMR 3500 rack.

Note:

If the ten-legged jumper is not installed in one of the
above positions, the rack will not operate correctly.

3.9   Wiring Requirements

Refer to the individual module manuals and field wiring diagrams for detailed
instructions for connecting components to the I/O module. Refer to the
weatherproof housing section for information specific to those installations.
Refer to the high electromagnetic noise environment section for information
applicable to those installations.

Connect the I/O modules in the 3500 rack to the following items.

• Transducers (match the selected transducer jumpers)

• Keyphasor® transducers

• Power

Connect the external devices to the following terminals.

• Relay outputs

• OK Relay on the back of the Rack Interface I/O Module

- System Contacts (Trip Multiply, Inhibit, Rack Reset, etc)

3.10 Software Portion of the Rack Installation

Now that the hardware portion of the 3500 rack installation is complete, refer to 3500 Monitoring System Rack Configuration and Utilities Guide to configure and verify the 3500 Monitoring System. The following steps should be performed in the order presented to configure your rack.

- Verify the Rack Communication

- Upload Default Configuration from the rack

- Customize the Rack Configuration

- Download the Configuration to rack

- Adjust the Scale Factor, Zero Position, and Manual Keyphasor® Threshold

- Download any adjustments

- Perform Rack Verification

4 Module Installation and Removal

This section shows how to install and remove the individual modules (including I/O modules) in a 3500 rack.

In all discussions, the main module is the part that gets installed in the front of the rack-mount and panel-mount racks or in the bottom of the bulkhead rack. They have the blue overlays with the model number printed on them.

The input or I/O modules are the parts that get installed at the rear of the rack-mount and panel-mount racks or in the top of the bulkhead rack. This is where the power and field wiring connections are made.

4.1 Installation of Modules

The following section describes how to install modules in a 3500 rack. It is assumed that the applicable slot is empty. Power to the rack does not need to be removed before installing a module if the procedures below are followed.

4.1.1 Power Supplies

The following lists general steps for installing the 3500/15 power supplies. Refer to the specific manual for the power supply for details and safety considerations. Verify that the main module and the Power Input Module (PIM) are compatible before proceeding.

1. Install the PIM.

   - Configure the PIM for Single Point Ground, if necessary.

   - Attach power cord to the PIM, if it is deemed to be more convenient at this time. Be sure that the power cord is not live.

   - Place the PIM into place at the back (or top for bulkhead racks) of the rack. Tighten the screws to pull the PIM securely against the rack.

2. Install the main module.

   - Slide the main module into place. Ensure that the module is properly in the guides provided on the rack.

   - Tighten the screws securely.

Note:

It is important to tightly secure the thumb screws to ensure each module is Chassis grounded. Loose thumb screws may allow noise to show on the channel readings.

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3. Verify operation.

   - When appropriate, apply power to the PIM and verify operation of the power supply.

4.1.2   Full-height modules

The following lists general steps for installing any full-height 3500 module. Refer to the specific manual for the module for details and safety consider- ations. Verify that the main module and the I/O module are compatible before proceeding.

1. Install the I/O module.

    -    Configure the I/O module for available options, if necessary.

    -    Place the I/O module into place at the back (or top for bulkhead racks) of the rack. Tighten the screws to pull the I/O module securely against the rack.

    -    Attach field wiring to the I/O module, if appropriate at this time.

2. Install the main module.

    -    Ensure that the ejectors are in their normal position, flush with the front of the module.

-    Slide the main module into place, ensuring that they are properly in the guides provided on the floor and roof of the rack chassis.

- Tighten the screws securely.
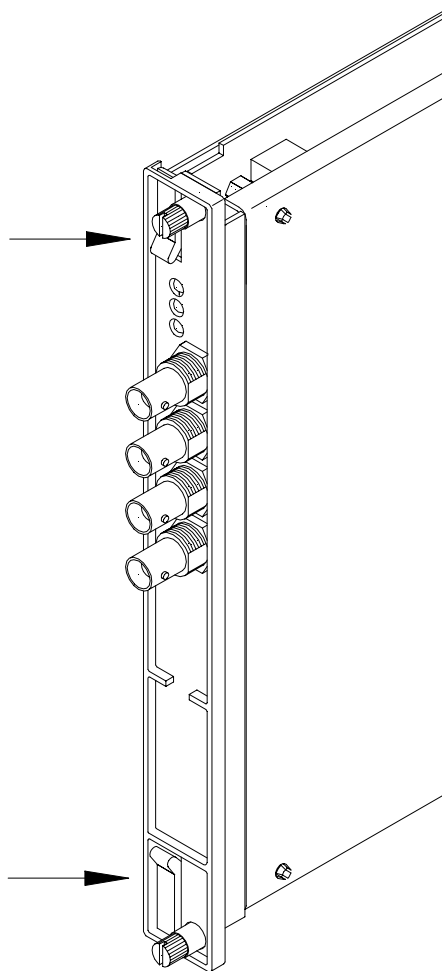
3. Verify operation.

Note:

It is important to tightly secure the thumb screws to ensure each module is Chassis grounded. Loose thumb screws may allow noise to show on the channel readings.

4.1.3   Half-height modules

The following lists general steps for installing any half-height 3500 module other than the power supplies. Refer to the specific manual for the module for details and safety considerations. Verify that the main module and the I/O module are compatible before proceeding.

1. Install the half-height card guide. This may require removing other modules in the rack in order to make room for getting the guide into place.

2. Install the I/O module.

- Configure the I/O module for available options, if necessary.

- Place the I/O module into place at the back (or top for bulkhead racks) of the rack. Tighten the screws to pull the I/O module securely against the rack.

- Attach field wiring to the I/O module, if appropriate at this time.

3. Install the main module.

- Slide the main module into place, ensuring that they are properly in the guides provided on card guide and the rack chassis.

- Tighten the screws securely.
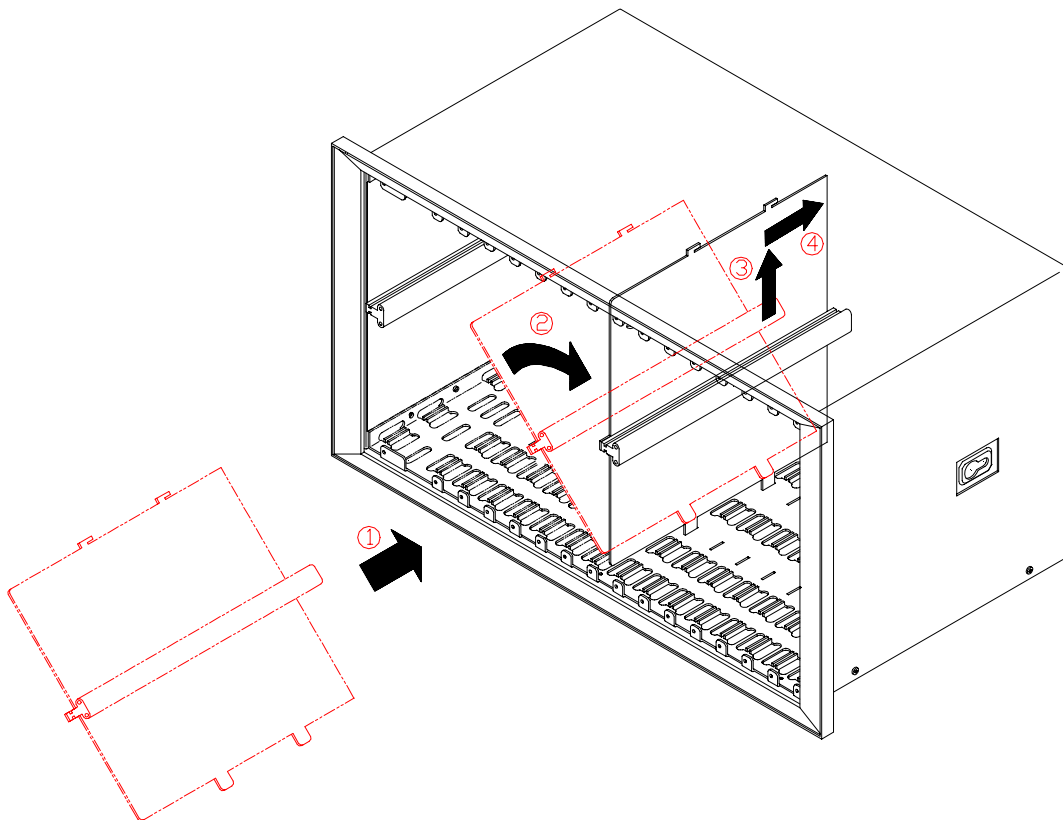
4. Verify operation.

Note:

It is important to tightly secure the thumb screws to ensure each module is Chassis grounded. Loose thumb screws may allow noise to show on the channel readings.

4.2   Removal of Modules

The following section describes how to remove the modules in a 3500 rack. Power to the rack does not have to be removed if the following procedures are followed.

4.2.1   Power Supplies

The following lists general steps for removing the 3500/15 power supplies. Refer to the specific manual for the power supply for details and safety considerations.

1. Remove power to the PIM.

- Remove power to the PIM that is to be removed. Observe applicable safety precautions while handling the power cables.

2. Remove the main module.

- Loosen the screws to the main module so that they are free of the rack chassis, but still attached to the main module.

- Use the loose screws as handles to pull the main module out of the rack.

- Use caution when handling because the unit may still be carrying a charge.

3. Remove the PIM.

- Loosen the screws holding the PIM to the rack. As the screws are loosened, they will push the PIM away from the rack.

- Use caution when handling because the unit may still be carrying a charge.

4.2.2   Full-height modules

The following lists general steps for removing any full-height 3500 module. Refer to the specific manual for the module for details and safety consider-ations.

1. Remove the main module.

    -    Loosen the screws to the main module so that they are free of the rack chassis, but still attached to the main module.

    -    Use the ejectors to pry the main module loose from the backplane con-nectors.
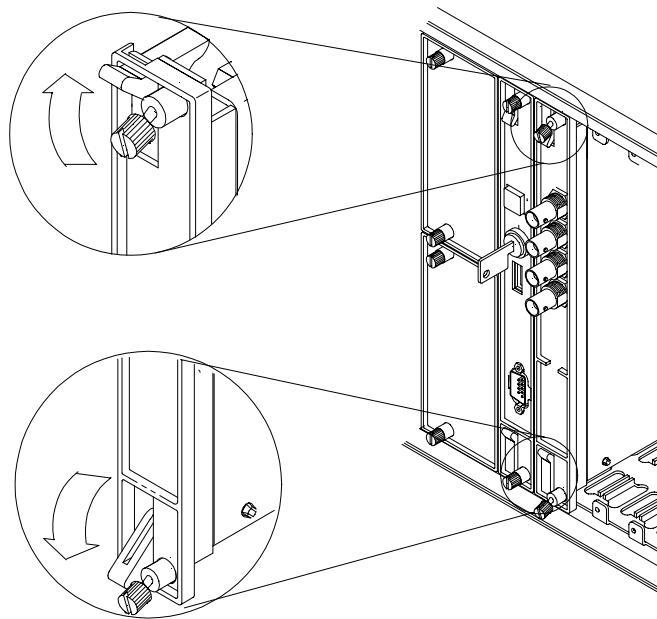
    -    Once freed from the backplane, the main module can be removed completely from the rack.

2. Remove the field wiring from the I/O module.

    -    See the applicable manual for removing the connector headers or computer-type cables.

3. Remove the I/O module.

    -    Loosen the screws holding the I/O module to the rack. As the screws are loosened, they will push the I/O module away from the rack.

4.2.3   Half-height modules

The following lists general steps for removing any half-height 3500 module other than the power supplies. Refer to the specific manual for the module for details and safety considerations.

1. Remove the main modules. It does not matter if the upper or lower main module is removed first.

    -   Loosen the screws to the main module so that they are free of the rack chassis, but still attached to the main module.

    -   Use the loose screws as handles to pull the main module out of the rack.

2. Remove the half-height card guide.
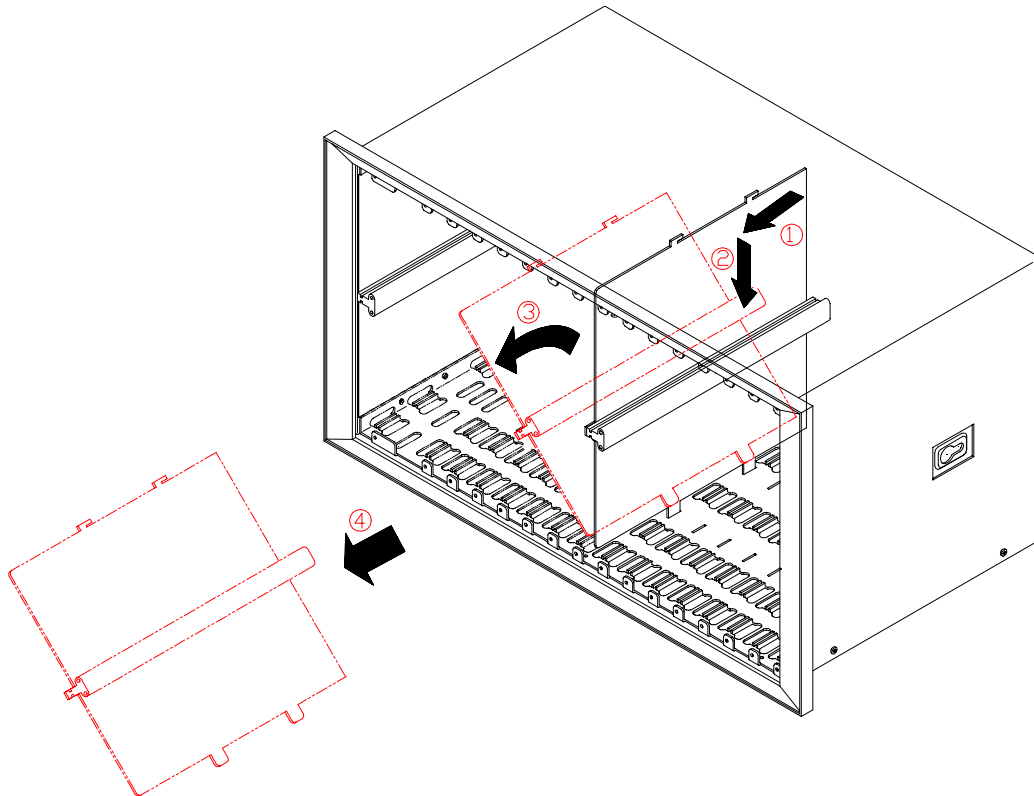
3. Remove the field wiring from the I/O module.

    -   See the applicable manual for removing the connector headers or computer-type cables.

4. Remove the I/O module.

    -   Loosen the screws holding the I/O module to the rack. As the screws are loosened, they will push the I/O module away from the rack.

4.3   Replacing Modules

When replacing modules, whether main or I/O, power does not need to be removed from the rack if the following procedures are followed. Refer to applicable steps in the procedures above for removing or installing a module.

4.3.1   Main Modules

This assumes that only the main module of a monitor or power supply is to be replaced. Prior to removing any module, refer to the applicable manual to see how rack behavior may be affected, and for any special handling requirements required for personal safety.

1. If necessary, upload and save the configuration of the module to be replaced.
2. Remove the main module from the rack.
3. Install the new main module into the rack.
4. If necessary, configure the new main module.
5. Verify operation.

4.3.2   I/O Modules

This assumes that only the I/O module of a monitor or the PIM of a power supply is to be replaced. Prior to removing any module, refer to the applicable manual to see how rack behavior may be affected, and for any special handling requirements required for personal safety.

1. If necessary, upload and save the configuration of the module to be replaced.
2. Remove the main module from the rack.
3. Remove the field wiring from the I/O module.
4. Remove the old I/O module from the rack.
5. Install the new I/O module into the rack.
6. Connect the field wiring to the new I/O module.
7. Install the main module into the rack.
8. If necessary, re-configure the main module.
9. Verify operation.

5　　　　　　　　　　Maintenance

5.1　　General Maintenance Instructions

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, modules may be removed from or installed into the rack while power is applied to the rack. Refer to "Initial Rack Installation" on page 19 for the proper procedure.

The 3500 Monitoring System is a high precision instrument that requires no calibration. The functions of the 3500 modules, however, must be verified at regular intervals. All modules in the 3500 Monitoring System should be verified at these maintenance intervals. The procedures in the Maintenance and Troubleshooting sections of the module manuals describe the verification and troubleshooting process.

5.2　　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.

6   Ordering Information

6.1   Rack Ordering Information

3500/05-AXX-BXX-CXX-DXX-EXX

A: *Rack Size*

         0 1   19-inch Rack (14 Module Slots)

         0 2   12-inch Mini-Rack (7 Module Slots)

B: *Mounting Options*

         0 1   Panel Mount Option, Full-Size Rack

         0 2   Rack Mount Option, Full-Size Rack (mounts to19-inch EIA Rack)

         0 3   Bulkhead Mount Option (Not available in Mini-Rack)

         0 4   Panel Mount Option, Mini-Rack

         0 5   Rack Mount Option, Mini-Rack

C: *Agency Approval Option*

         0 0   None

         0 1   CSA-NRTL/C

D: *Reserved*

         0 0

E: *European Compliance Option*

         0 0   None

         0 1   CE

6.2   Weatherproof Housing Ordering Information

3500/06-AXX-BXX-CXX-DXX

Note:

The 3500/06 Weatherproof Housing does not provide a smaller version designed specifically for the 3500/05 Mini-rack. Use of the Mini-rack in the Weatherproof Housing will require installation of the Mini-rack Adapter Panel. A Door Only option does exist for the Mini-Rack.

Note:

The 3500/06 Weatherproof Housing is not designed to accommodate a Display Unit or a VGA Display.

A: Housing Type

0 1	Painted Steel Housing
0 2	Stainless Steel Housing
0 3	Painted Steel Door Only, Full-Size Rack
0 4	Stainless Steel Door Only, Full-Size Rack
0 5	Painted Steel Door Only, Mini-Rack
0 6	Stainless Steel Door Only, Mini-Rack

B: Conduit Fitting Option

0 0	No Fittings Required
0 1	Conduit Fittings Required

C: Air Purge Option

0 0	No Air Purge Accessories Required
0 1	Air Purge Fittings Only
0 2	Air Purge Fittings and Gauge

D: Agency Approval Option

0 0	None

6.3   Earthing Module Ordering Information

3500/04-AXX

A: Module Type

0 1	Earthing Module

Note:

This option requires one monitor slot position in the rack.

6.4   Spares

Part Number:	Description
00517016:	TMR/SIM jumper (installed on the 3500 backplane)
00530843:	3500/42 Prox/Seismic I/O Module four pin connector shunt
131150-01:	Power Supply Blank Front Panel
131151-01:	Half-height Blank Front Panel
130944-01:	Full-height Blank Front Panel
130768-01:	Blank Slot Assembly (Front and Rear)
136719-01:	Earthing Module
138257-01:	Earthing Module Front Panel Assy
144863-01:	Adapter Panel, Mini-rack, 19-inch

Half Height Module Adapter:

125388-01:	Chassis
125565-01:	Card Guide
04300111:	Screws (order 3 per adapter)

7   Specifications

7.1   Dimensions (overall)

Panel Mount Full-Size Rack:

Width:	482.6 mm (19.0 in)
Height:	265.9 mm (10.47 in)
Depth:	349.3 mm (13.75 in)
Depth with internal barriers:	423.0 mm (16.65 in)

Rack Mount Full-Size Rack:

Width:	482.6 mm (19.0 in)
Height:	265.9 mm (10.47 in)
Depth:	349.3 mm (13.75 in)
Depth with internal barriers:	423.0 mm (16.65 in)

Bulkhead Mount Rack:

Width:	482.6 mm (19.0 in)
Height:	532.6 mm (20.97 in)
Depth:	266.7 mm (10.50 in)
Depth with internal barriers:	266.7 mm (10.50 in)

Panel Mount Mini-Rack:

Width:	304.8 mm (12.0 in)
Height:	265.9 mm (10.47 in)
Depth:	349.3 mm (13.75 in)
Depth with internal barriers:	423.0 mm (16.65 in)

Rack Mount Mini-Rack:

Width:	304.8 mm (12.0 in)
Height:	265.9 mm (10.47 in)
Depth:	349.3 mm (13.75 in)
Depth with internal barriers:	423.0 mm (16.65 in)

Weatherproof Housing:

Width:	595.1 mm (23.43 in)
Height:	424.2 mm (16.70 in)
Depth:	628.7 mm (24.75 in)

7.2 Weight

Basic (Unloaded Full-Size Rack):

Panel Mount Configuration:	7.03 kg (15.5 lb)
Rack Mount Configuration:	6.67 kg (14.7 lb)
Bulkhead Mount Configuration:	11.93 kg (26.3 lb)

Standard Fully Loaded Full-Size System:

Panel Mount Configuration:	31.07 kg (68.5 lb)
Rack Mount Configuration:	30.71 kg (67.7 lb)
Bulkhead Mount Configuration:	35.97 kg (79.3 lb)

Internal Barrier System (typical fully loaded configuration): This will add approximately 4.00 kg (8.96 lb) to the above weights.

Basic (Unloaded Mini-Rack):

Panel Mount Configuration: 4.76 kg (10.5 lb)

Rack Mount Configuration: 4.40 kg (9.7 lb)

Standard Fully Loaded Mini-Rack System:

Panel Mount Configuration: 22.86 kg (50.4 lb)

Rack Mount Configuration: 22.50 kg (49.6 lb)

Internal Barrier Mini-Rack System (typical fully loaded configuration): This will add approximately 2.39 kg (5.27 lb) to the above weights.

7.3 Environmental **(All 3500 Components)**

Temperature:

Operating: -30 °C to 65 °C (-22 °F to 150 °F)

Operating (Internal Barriers): 0 °C to 65 °C (32 °F to 150 °F)

Storage: -40 °C to 85 °C (-40 °F to 185°F)

Humidity: 0% to 95% non-condensing

Mechanical:

Impact: 10 g for 11 ms

Shipping: per mil Std 810D - Category G equipment

Vibration, Sinusoidal: 3 g at 5 to 100 Hz