

Features and Benefits

- **Wide variety of Input/Output (I/O) types:** Analog (high and low levels, and temperature), digital, control, turbine control, field bus, and sequence of events (SOE).
- **Modular to meet varying I/O requirements:** I/O modules are provided to meet nearly all I/O processing requirements (isolation, A/D conversion, auto calibration).
- **Dedicated, secure I/O communications:** Fast response parallel bus supports up to 64 I/O modules to a single controller pair.
- **Graceful degradation of I/O:** Configurable, fail-safe output modes.
- **Compatibility with existing systems:** I/O modules can be used to expand existing INFI 90® OPEN, in conjunction with Harmony block I/O, and can communicate directly with all Harmony controllers.
- **Surface-mount technology:** Provides high reliability and consistent quality.



TC00886A

The Harmony rack I/O system utilizes a wide variety of input, output, and signal conditioning modules to interface process signals to the Symphony™ Enterprise Management and Control System. Module types, ranging from standard analog and digital I/O to specialty I/O such as turbine control, field bus, and SOE, can be combined to provide a comprehensive set of functionality to meet all market and industrial requirements.

In addition, Harmony rack I/O, providing functions at the module mounting unit (MMU) level, and Harmony block I/O can operate in parallel with a single set of Harmony controllers to form an optimum solution for a specific application.

Overview

Figures 1 and 2 are hierarchical views of the Symphony system showing the various system communication levels and the position of Harmony rack I/O within these levels. Figure 1 shows a Harmony area controller interfacing the I/O devices. Figure 2 shows a rack-mounted Harmony rack controller interfacing the I/O devices.

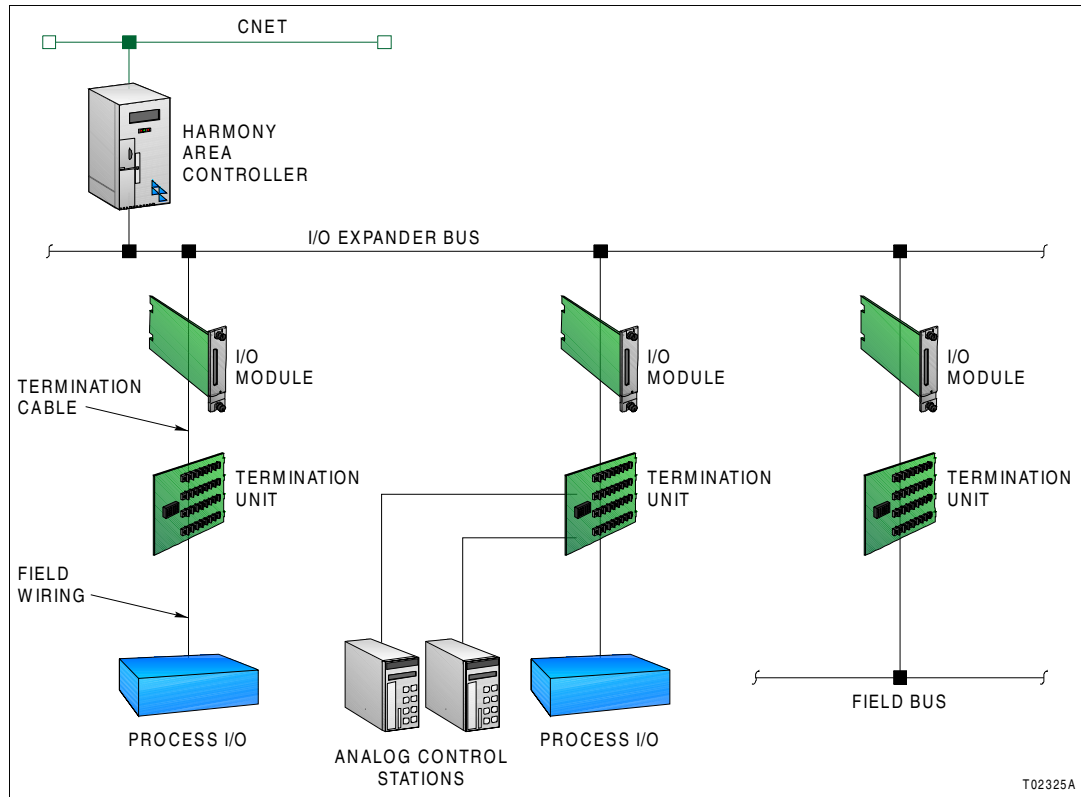


Figure 1. Harmony Area Controller with Harmony Rack I/O

The main components of Harmony rack I/O are I/O modules, termination units, and the I/O expander bus. The Harmony controllers and rack I/O modules communicate over I/O expander bus. Together a controller and its I/O modules form a subsystem within the Symphony system. The controller performs the actual control functions and the I/O modules process any inputs from and outputs to field devices for the controller. The termination units provide field wiring termination for I/O modules. The controller can communicate with up to 64 I/O modules connected to the I/O expander bus.

The rack I/O module types include:

- Analog input (ASI, FEC).
- Analog output (ASO).
- Control input/output (CIS, QRS).
- Digital input (DSI, DSM).
- Digital output (DSO).
- Specialized input/output (FCS, HSS, SED).

Analog control stations (SAC) can connect and communicate through termination units and control I/O modules as shown in Figures 1 and 2. Communication is over an RS-485 serial station link.

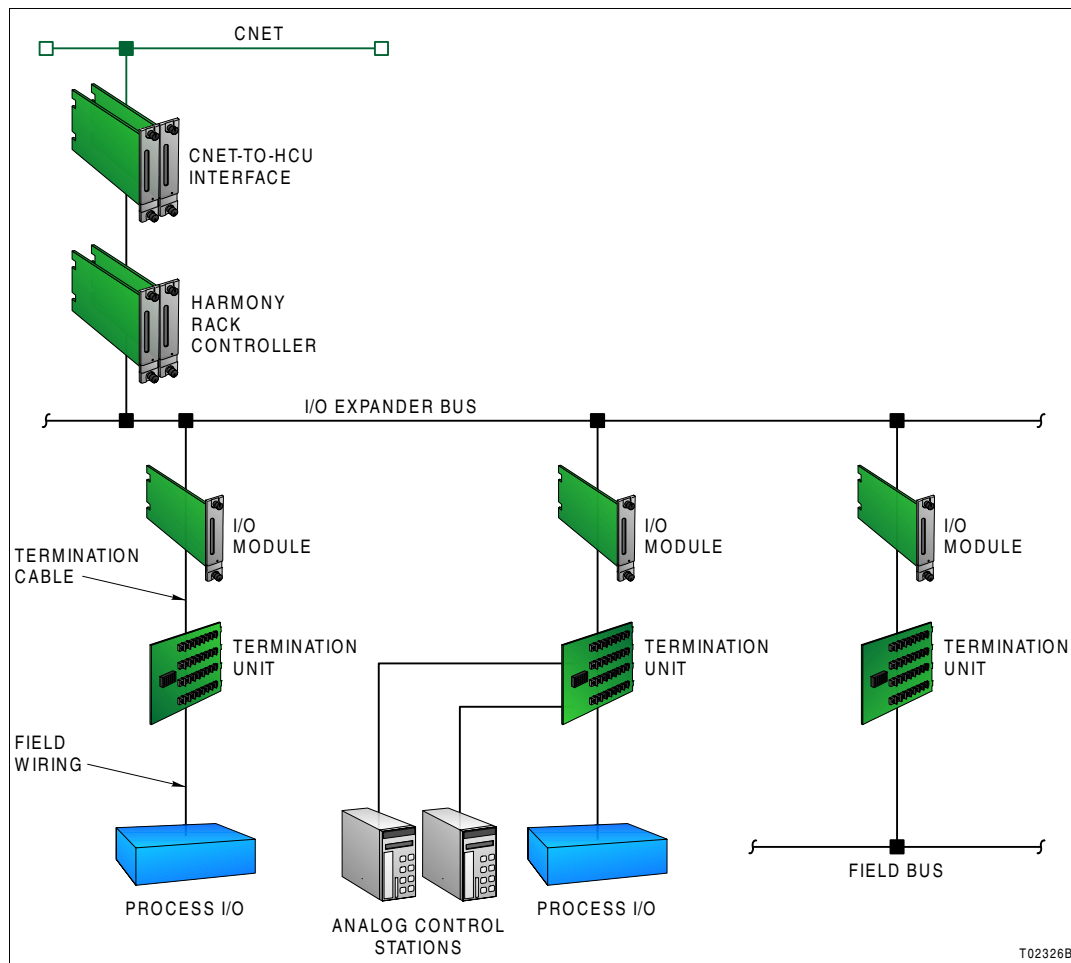


Figure 2. Harmony Rack Controller with Harmony Rack I/O

Inputs/Outputs

Harmony rack I/O supports a variety of input and output signal types, both analog and digital. Analog signals, for example, include pressure and flow transmitter signals, and thermocouple (TC) and RTD temperature inputs. Digital signals are two-state signals that have discrete on and off voltage levels such as relay contacts, switches, and solenoids. Inputs and outputs can be either internally system powered or externally powered. Refer to the *Harmony Rack Input/Output* data sheets for specifics on I/O module input and output capabilities.

Analog Input

The following analog inputs are supported (Fig. 3):

- 4 to 20 milliamperes.
- 0 to 1 VDC.
- -10 to +10 VDC.
- 0 to +10 VDC.
- 0 to +5 VDC.
- 1 to 5 VDC.
- -100 to +100 millivolt (DC).
- 0 to 100 millivolt (DC).

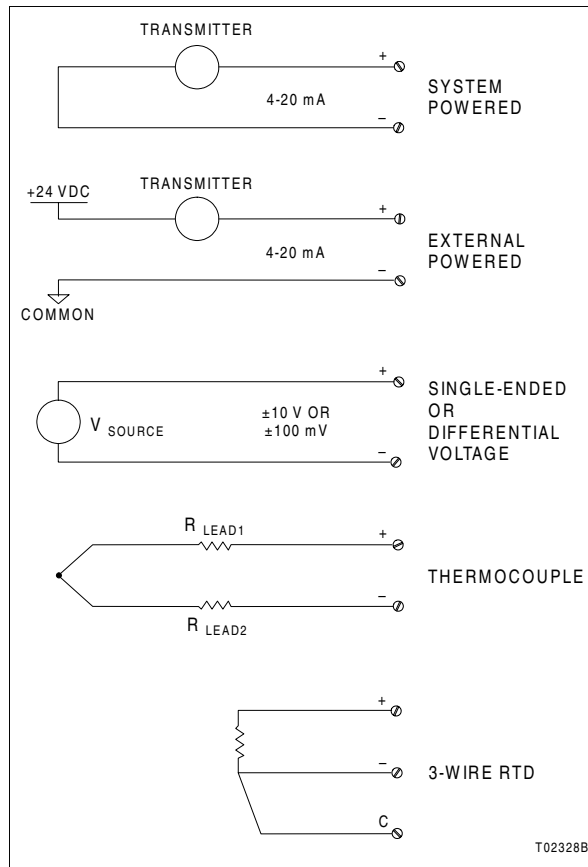


Figure 3. Analog Input

- Thermocouple:
E, J, K, L, N (14 AWG), N (28 AWG), R, S, T, U.
Chinese E, S.
- RTD:
10 Ω copper.
100 Ω platinum (U.S. Lab. Standard, U.S. Industry Standard, European Standard).
120 Ω nickel.
Chinese 53 Ω copper.

Analog Output

The following analog outputs are supported (Fig. 4):

- 4 to 20 milliamper.
- 1 to 5 VDC.

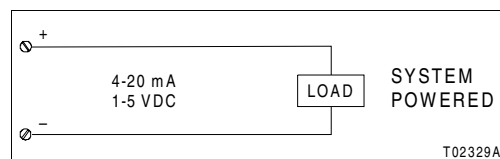


Figure 4. Analog Output

Digital Input

Digital input channels can be used to read the states of switches, relay contacts, and solenoids. The following digital inputs are supported (Fig. 5):

- 24, 48, and 125 VDC.
- 120 VAC.

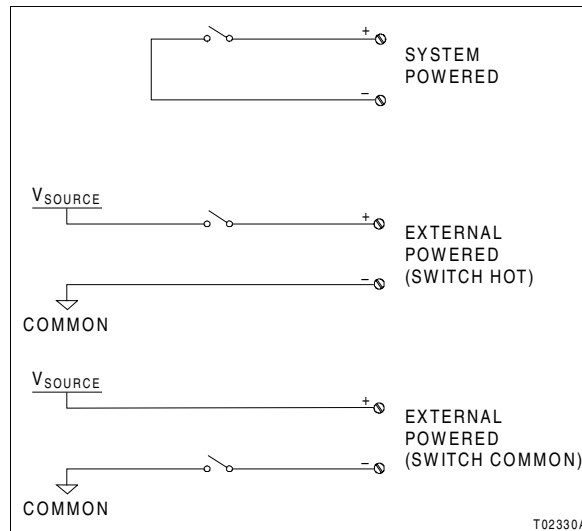


Figure 5. Digital Input

Digital Output

Digital output channels can be used to drive annunciators such as buzzers and lamps and to drive two-state final control elements such as actuators, relays, and solenoids. The following digital output voltages are supported (Fig. 6):

- 24 and 48 VDC.
- 120 VAC.

Specialized I/O

The following I/O is supported for specialized applications such as:

- Pulse input.
- Frequency input.
- Hydraulic servo I/O.
- FSK input (field bus).
- SOE digital input.

Harmony Controllers

A BRC-100 Harmony Bridge Controller and IMMFP11 and IMMFP12 Multifunction Processors are rack-mounted controllers. Each controller occupies one slot in a MMU. These controllers support the function code environment necessary to configure and operate Harmony rack I/O devices. Additionally, the bridge controller supports Hnet communication protocol and device labeling necessary to operate the Harmony I/O system (I/O blocks). Hnet (Harmony I/O communications

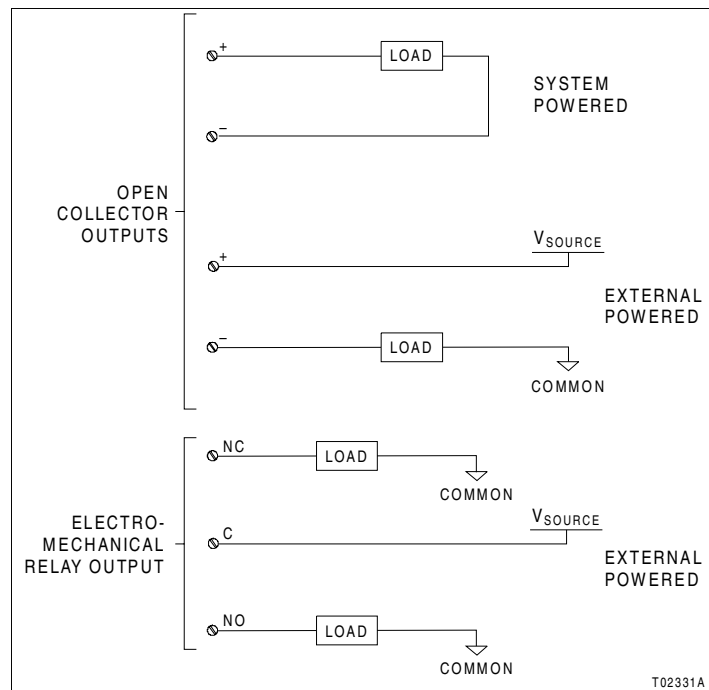


Figure 6. Digital Output

network) is the network over which Harmony controllers and Harmony I/O blocks communicate. The bridge controller can communicate with Harmony rack I/O devices and Harmony I/O blocks simultaneously.

Like the bridge controller, the Harmony area controller supports the communications protocol and configuration environment necessary to operate both Harmony rack I/O devices and Harmony I/O blocks. It collects process I/O data, performs control algorithms, and outputs control signals to final control elements through either or both types of I/O devices. The area controller offers enhanced communications and process interface abilities.

All Harmony rack I/O configuration is performed through the controller using function codes. Function codes are predefined, fixed function algorithms. The controller supports numerous function codes for building the control configuration. The functions they perform range from computing (function generator, square root, etc.) to control (PID, pulse positioner, etc.) to I/O interface (analog input, digital output, etc.). The Harmony bridge controller and Harmony area controller allow using both rack I/O function codes and I/O block function codes concurrently to communicate with both types of devices simultaneously. The controllers are fully compatible with existing configurations.

Compatibility

Harmony rack I/O devices are fully compatible with existing INFI 90 OPEN systems. The controller can communicate with Harmony rack I/O and INFI 90 OPEN I/O simultaneously. Communication is over an I/O expander bus.

Rack I/O Components

As mentioned previously, the main components of Harmony rack I/O are I/O modules, termination units, and I/O expander bus (Fig. 1 and 2). The following sections provide further explanation.

I/O Expander Bus

The I/O expander bus is a high speed, synchronous, parallel bus. It provides a communication path between controllers and I/O modules. The I/O expander bus parallel signal lines are located on the MMU backplane. Inserting a rack-mounted controller and I/O modules into the mounting unit connects them to the expander bus.

I/O Module

An I/O module interfaces and processes field device input and output signals. There are several different I/O module types available. Table 1 lists the available module types and gives a brief description. All I/O modules share the same layout and connection, configuration, and mounting methods. Refer to the *Harmony Rack Input/Output* data sheets for individual I/O module capabilities.

Table 1. I/O Modules

Nomenclature	Description
IMASI23	Analog input: 4 to 20 mA, 0 to 5 VDC, 1 to 5VDC, 0 - 10VDC, 0 - 100 mVDC, thermocouple, RTD
IMASO11	Analog output: 4 to 20 mA, 1 to 5 VDC
IMCIS22	Control I/O (4 analog in, 2 analog out, 3 digital in, 4 digital out)
IMDSI13	Digital input: 24 VDC
IMDSI14	Digital input: 48 VDC
IMDSI22	Universal digital input: 24 VDC, 48 VDC, 125 VDC, 120 VAC
IMDSM04	Pulse input
IMDSO14	Digital output: 24 VDC, 48 VDC
IMDSO15	Digital output: Onboard electromechanical relay
IMFCS01	Frequency counter
IMFEC11	Analog input: 4 to 20 mA, -10 to +10 VDC, FSK, 1 - 5VDC, 0 - 1VDC, 0 - 5VDC, 0 - 10VDC
IMFEC12	Analog input: 4 to 20 mA, -10 to +10 VDC, 1 - 5VDC, 0 - 1VDC, 0 - 5VDC, 0 - 10VDC
IMHSS03	Hydraulic servo
IMQRS22	Quick response I/O (4 analog in, 2 analog out, 3 digital in, 4 digital out)
IMSED01	SOE digital input (with 16 SOE digital inputs)
IMSET01	SOE timing (with 16 SOE digital inputs and a timesynch input)

Depending on the module type, front panel features include:

- Front panel mode indicator.
- Front panel I/O status indicators.
- Front accessed stop/reset button.

In general, the I/O module functions include:

- Range and mode selection for analog I/O.
- Voltage threshold selection for digital inputs.
- Response time (debounce) selection.
- Signal buffering.
- Signal conditioning.
- Signal isolation.
- Noise rejection.
- Analog-to-digital and digital-to-analog conversion.
- Cold junction compensation for thermocouples.

The I/O module connects to field signals through the termination unit. The module and termination unit connect using a termination cable. The module connects to power and the I/O expander bus at the MMU backplane connectors. Inserting the module into the mounting unit makes both the power and communication connections. An I/O module can be removed and installed while system power is applied.

Termination Unit

In general, a termination unit is a passive device that connects and distributes signals between the I/O module and field wiring terminals. The terminal block field wiring connection points are located on the termination unit. Field wiring can enter the cabinet from either the top or the bottom then attaches to a termination unit. A termination unit has several purposes:

- Field wiring termination.
- I/O channel signal routing.
- Range and mode selection for analog I/O.
- Voltage threshold selection for digital inputs.
- Field power or system powered I/O selection.
- Circuit protection (fuses).
- Shield (chassis ground) connection.

Field connections remain undisturbed if the I/O module is removed or replaced. Each type of I/O module requires its own type of termination unit. The number of wiring terminals depends on the number and types of I/O channels. To simplify the installation process, the terminals are clearly marked to identify wiring connections. Harmony rack I/O supports alternate termination methods such as intrinsic barriers, rail mount termination, and third-party supplied termination.

Circuit Protection

Most I/O modules along with their termination units incorporate some type of current limiting or fusing where appropriate to protect against short circuits. Current limiting prevents excessive current levels at faulted terminals which could cause circuit damage.

Rack I/O Power

Harmony rack I/O uses two types of power:

- 5, 15, and -15 VDC logic power.
- 24, 48, 125 VDC, and 120 VAC field power.

Logic power operates the I/O module circuitry. Field power operates field devices and some I/O channel circuitry depending on the module type. Modular Power System II supplies the logic power and field power.

Logic Power

The Harmony rack I/O operating voltages are distributed from the power system through a system power bus bar mounted in the cabinet. An MMU connects to this bus bar then routes the power to individual modules through backplane connectors.

Field Power

The system power bus bar mounted in the cabinet also distributes 24 VDC field power from the power system. A termination unit connects to this bus bar if necessary and routes the power to individual I/O channels and in some cases to the I/O module. The power can be used to power 4 to 20 milliampere analog inputs and outputs, and 24 VDC digital inputs and digital outputs.

The 48 VDC and 125 VDC field power are wired directly from the power system to the termination units. For example, the power to drive system powered 125 VDC digital inputs connects from the power system chassis to the power terminals located on the termination unit.

Rack I/O Mounting Hardware

Harmony rack I/O modules and termination units mount in standard ABB cabinets. The option for small cabinet mounting is provided. The number of modules that can be mounted in a single cabinet varies.

An IEMMU11, IEMMU12, IEMMU21, or IEMMU22 Module Mounting Unit and an NFTP01 Field Termination Panel are used for module and termination unit mounting respectively (Fig. 7). The mounting unit and termination panel both attach to the side rails in standard 483-millimeter (19-inch) cabinets. Front mount and rear mount MMU versions are available to provide flexibility in cabinet mounting.

An MMU is required to mount and provide power to rack-mounted modules. The unit is for mounting controllers, I/O modules, and communication interface modules. The MMU backplane connects and routes:

- Controlway.
- I/O expander bus.
- Logic power to control, I/O, and interface modules.

The Controlway and I/O expander bus are internal cabinet, communication buses. Communication between rack controllers and communication interface modules is over Controlway.

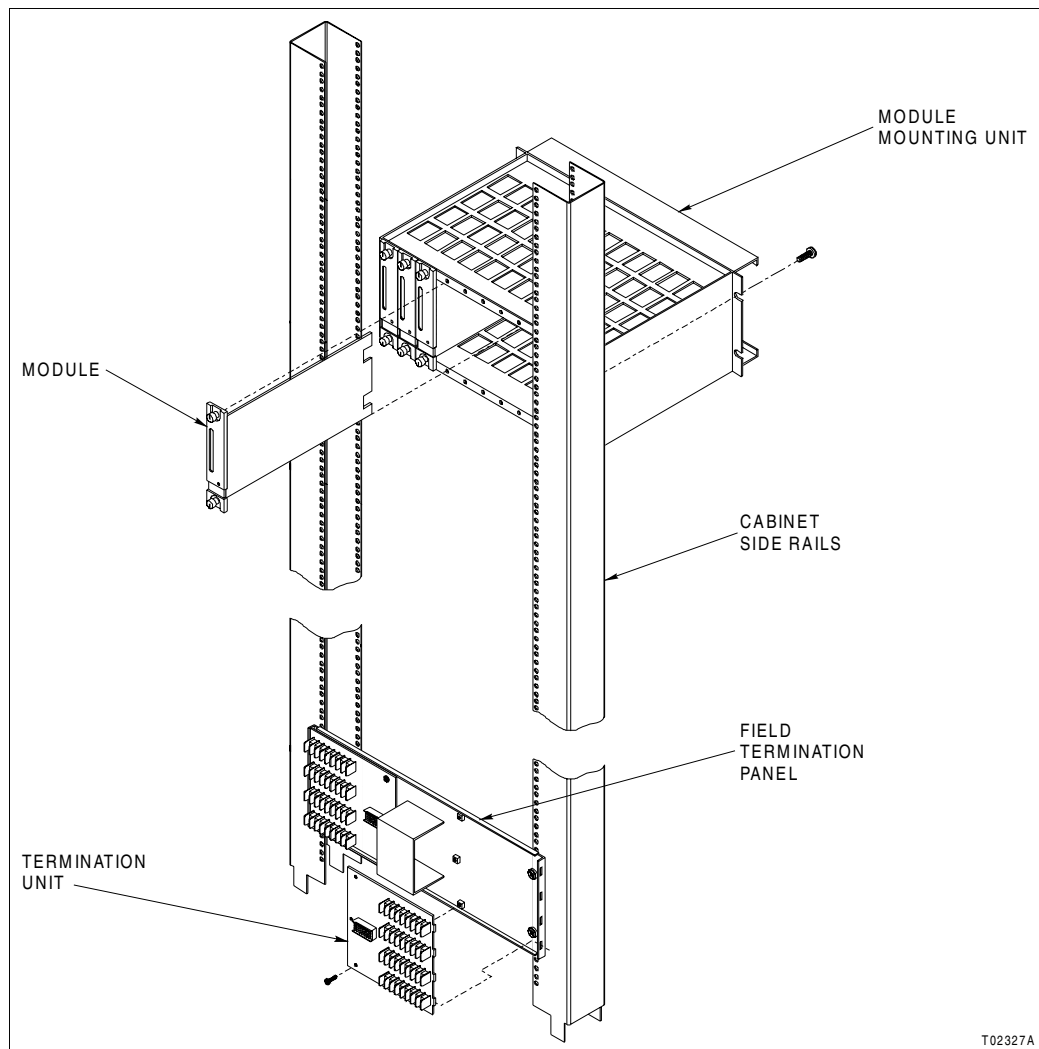


Figure 7. Rack I/O Mounting Hardware

Configuration Tools

The Harmony I/O system can be configured and tuned using any configuration tool that supports the rack I/O function codes. This includes, for example:

- Composer™ for Harmony.
- Conductor Human System Interfaces.

Related Documents

Number	Document Title
WBPEEUD240005??	Harmony Rack Analog I/O, Data Sheet
WBPEEUD240006??	Harmony Rack Digital Input/Output, Data Sheet
WBPEEUD240007??	Harmony Rack Control Input/Output, Data Sheet
WBPEEUD240008??	Harmony Rack Sequence of Events, Data Sheet
WBPEEUD240009??	Harmony Analog Control Station, Data Sheet
WBPEEUD240010??	Harmony Rack Turbine Control, Data Sheet

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