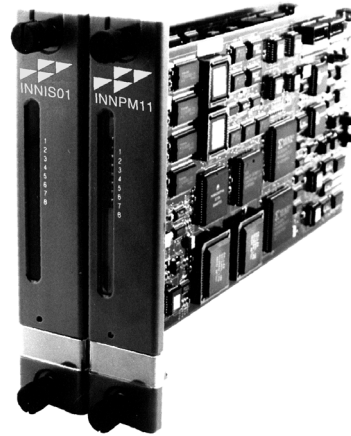


## Features and Benefits

- **Fast plant-wide communication network:** Cnet provides fast response time to insure timely information exchange.
- **Efficient data transfer:** Message packing and multiple addressing increase data handling efficiency and throughput.
- **Plant-wide time synchronization:** Time synchronization of Cnet nodes throughout the entire control process insures accurate data time-stamping.
- **Independent node communication:** Each Cnet node operates independently of other nodes. Requires no traffic directors; each node is its own communication manager.
- **Accurate data exchange:** Multiple self-check features including positive message acknowledgment, cyclic redundancy checks (CRC), and checksums insure data integrity.
- **Automatic communications recovery:** Rack communication modules provide localized start-up/shutdown on power failure without operator intervention. Each type of interface supports redundancy.



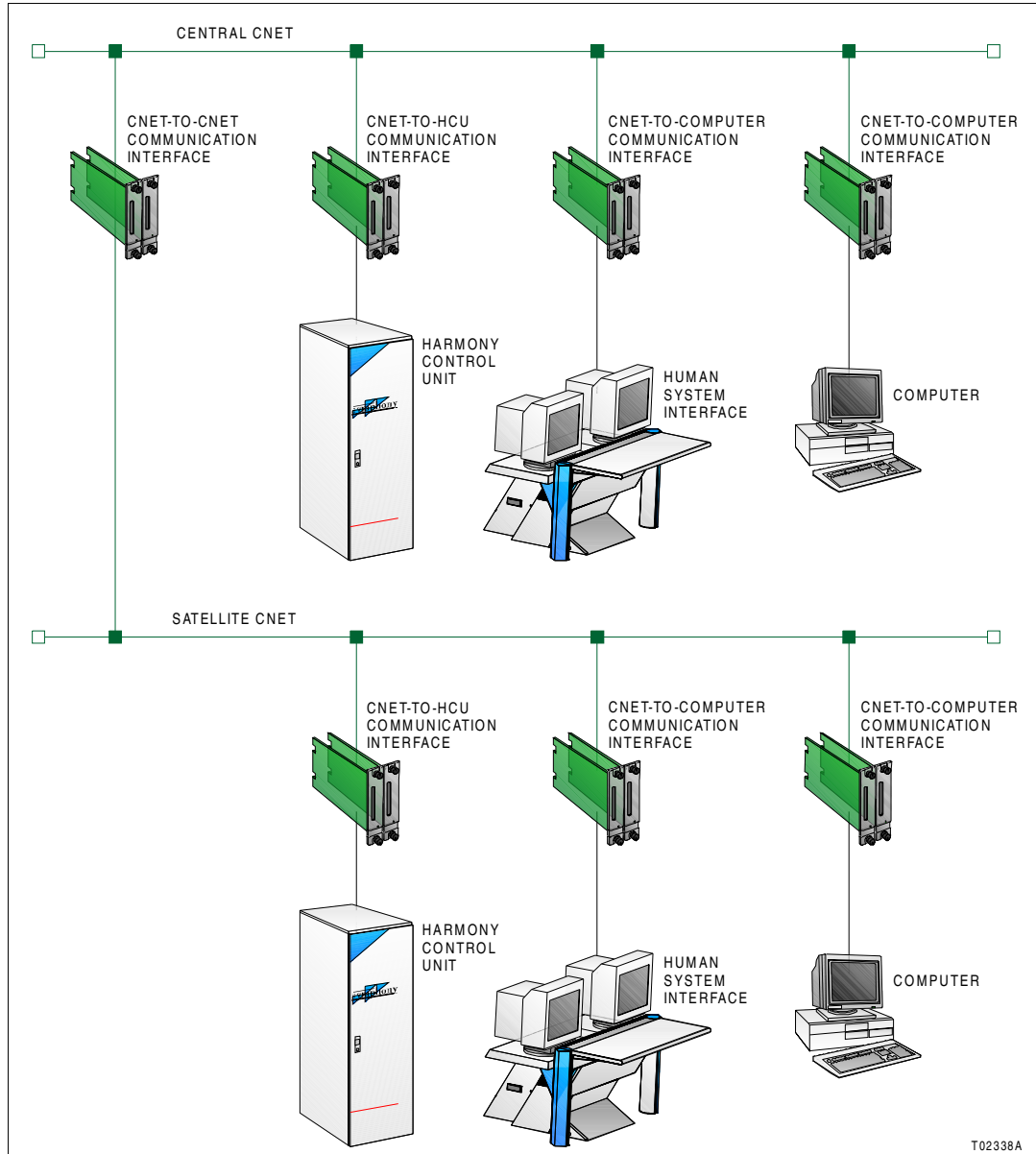
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Control Network, Cnet, is a high-speed data communication highway between nodes in the Symphony™ Enterprise Management and Control System. Cnet provides a data path among Harmony control units (HCU), human system interfaces (HSI), and computers. High system reliability and availability are key characteristics of this mission-critical communication network. Reliability is bolstered by redundant hardware and communication media in a way that the backup automatically takes over in the event of a fault in the primary. Extensive use of error checking and message acknowledgment assures accurate communication of critical process data.

Cnet uses exception reporting to increase the effective bandwidth of the communication network. This method offers the user the flexibility of managing the flow of process data and ultimately the process. Data is transmitted only when it has changed by an amount which can be user selected, or when a predetermined time-out period is exceeded. The system provides default values for these parameters, but the user can customize them to meet the specific needs of the process under control.

## Overview

Harmony rack communications encompasses various communication interfaces as shown in Figure 1: Cnet-to-Cnet communication, Cnet-to-HCU communication, and Cnet-to-computer communication.



**Figure 1.** Harmony Rack Communications Architecture

The communication interface units transfer exception reports and system data, control, and configuration messages over Cnet. Exception reported data appears as dynamic values, alarms, and state changes on displays and in reports generated by human system interfaces and other system nodes. Exception reporting is automatic at the Harmony controller level. Specifically, the controller generates an exception report periodically to update data, after a process point reaches a defined alarm limit or changes state, or after a significant change in value occurs.

## Control Network

Cnet is a unidirectional, high speed serial data network that operates at a 10-megahertz or two-megahertz communication rate. It supports a central network with up to 250 system node connections. Multiple satellite networks can link to the central network. Each satellite network supports up to 250 system node connections. Interfacing a maximum number of satellite networks gives a system capacity of over 62,000 nodes.

On the central network, a node can be a bridge to a satellite network, a Harmony control unit, a human system interface, or a computer, each connected through a Cnet communication interface. On a satellite network, a node can be a bridge to the central network, a Harmony control unit, a human system interface, or a computer.

## Harmony Control Unit

The Harmony control unit is the fundamental control node of the Symphony system. It connects to Cnet through a Cnet-to-HCU interface. The HCU cabinet contains the Harmony controllers and input/output devices. The actual process control and management takes place at this level. HCU connection to Cnet enables Harmony controllers to:

- Communicate field input values and states for process monitoring and control.
- Communicate configuration parameters that determine the operation of functions such as alarming, trending, and logging on a human system interface.
- Receive control instructions from a human system interface to adjust process field outputs.
- Provide feedback to plant personnel of actual output changes.

## Human System Interface

A human system interface such as a Signature Series workstation running Maestro or Conductor Series software provides the ability to monitor and control plant operations from a single point. It connects to Cnet through a Cnet-to-computer interface. The number of workstations in a Symphony system varies and depends on the overall control plan and size of a plant. The workstation connection to Cnet gives plant personnel access to dynamic plant-wide process information, and enables monitoring, tuning, and control of an entire plant process from workstation color graphics displays and a pushbutton keyboard.

## Computer

A computer can access Cnet for data acquisition, system configuration, and process control. It connects to Cnet through a Cnet-to-computer interface. The computer connection to Cnet enables plant personnel, for example, to develop and maintain control configurations, manage the system database, and create HSI displays remotely using Composer™ engineering tools. There are additional Composer and Performer series tools and applications that can access plant information through a Cnet-to-computer interface.

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## Cnet-to-Cnet Communication Interface

The Cnet-to-Cnet interfaces are the INIIR01 Remote Interface and the INIIL02 Local Interface. Figure 2 shows the remote interface and Figure 3 shows the local interface.

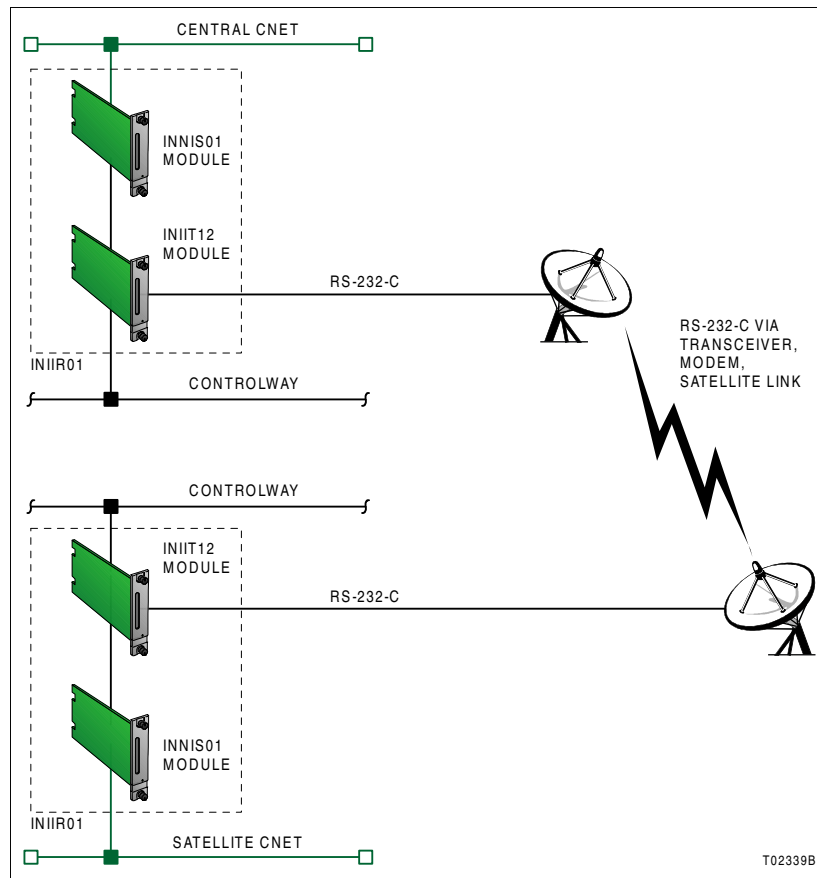


Figure 2. Cnet-to-Cnet Remote Interface (INIIR01)

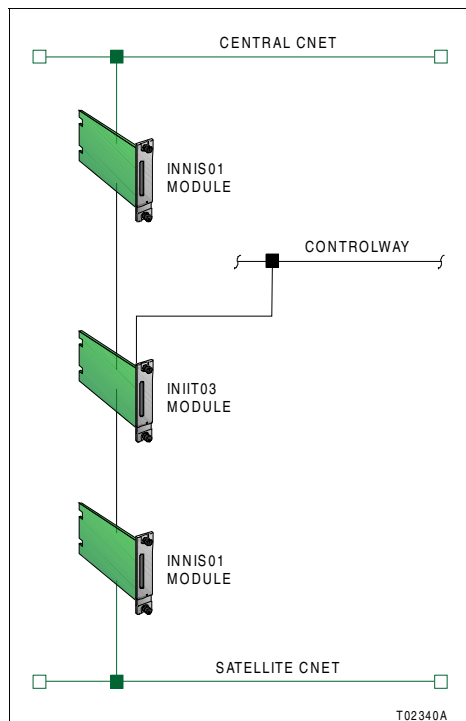


Figure 3. Cnet-to-Cnet Local Interface (INIIL02)

## INIIR01 Remote Interface

The INIIR01 Remote Interface consists of the INNIS01 Network Interface Module and the INIIT12 Remote Transfer Module (Fig. 2). This interface is a node on a central network that can communicate to an interface node on a remote satellite network. In this arrangement, two interfaces are required: one for the central network, and the other for the satellite network. Bidirectional communication from the central network to the remote satellite network is through standard RS-232-C ports.

The remote interface supports hardware redundancy. Redundancy requires a full set of duplicate modules (two INNIS01 modules and two INIIT12 modules on each network). The secondary INIIT12 module continuously monitors the primary over dedicated Controlway. A failover occurs when the secondary module detects a primary module failure. When this happens, the secondary interface takes over and the primary interface is taken offline.

## INIIL02 Local Interface

The INIIL02 Local Interface consists of two INNIS01 Network Interface modules and the INIIT03 Local Transfer Module (Fig. 3). This interface acts as a bridge between two local Cnets. One of the INNIS01 modules operates on the central network side and the other operates on the satellite network side. Bidirectional communication from the central network to the local satellite network is through cable connection to the NTCL01 termination unit. The maximum distance between termination units on the two communication networks is 45.8 meters (150 feet).

The local interface supports hardware redundancy. Redundancy requires a full set of duplicate modules (four INNIS01 modules and two INIIT03 modules). The secondary INIIT03 module continuously monitors the primary over dedicated Controlway. A failover occurs when the secondary detects a primary module failure. When this happens, the secondary assumes responsibility and the primary is taken offline.

## Cnet-to-HCU Communication Interface

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The Harmony control unit interface consists of the INNIS01 Network Interface Module and the INNPM12 or INNPM11 Network Processing Module (Fig. 4). This interface can be used for a node on the central network or on a satellite network (Fig. 1). Through this interface the Harmony control unit has access to Cnet and to Controlway at the same time. Controlway is an internal cabinet communication bus between Harmony rack controllers and the communication interface modules.

The HCU interface supports hardware redundancy. Redundancy requires a full set of duplicate modules (two INNIS01 modules and two INNPM12 or INNPM11 modules). The secondary network processing module (INNPM12 or INNPM11) continuously monitors the primary through a direct ribbon cable connection. A failover occurs when the secondary detects a primary module failure. When this happens, the secondary assumes responsibility and the primary is taken offline.

## Cnet-to-Computer Communication Interface

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The Cnet-to-computer interfaces are the INICI03 and INICI12 interfaces. The INICI03 interface consists of the INNIS01 Network Interface Module, the INICT03A Computer Transfer Module, and the IMMPIO1 Multifunction Processor Interface Module (Fig. 5). The INICI12 interface consists of the INNIS01 Network Interface Module and the INICT12 Computer Transfer Module (Fig 6).

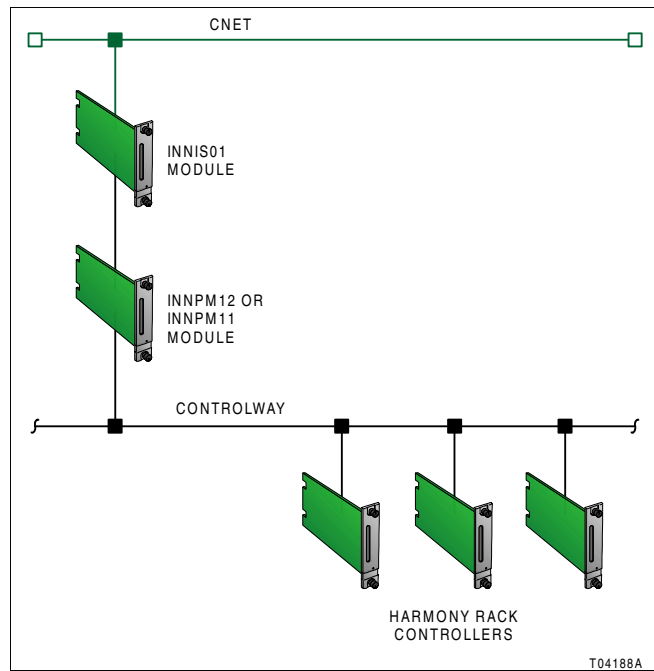


Figure 4. Cnet-to-HCU Interface

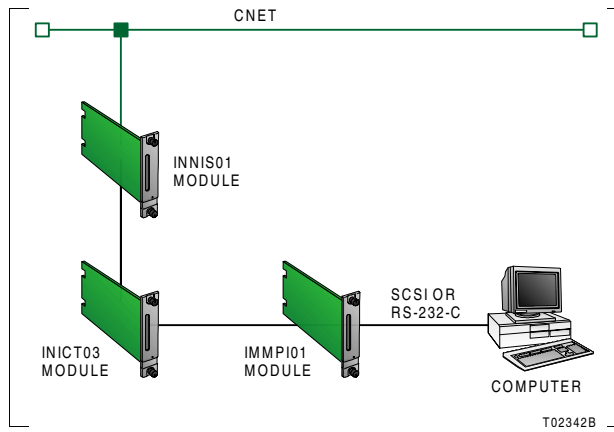


Figure 5. Cnet-to-Computer Interface (INIC103)

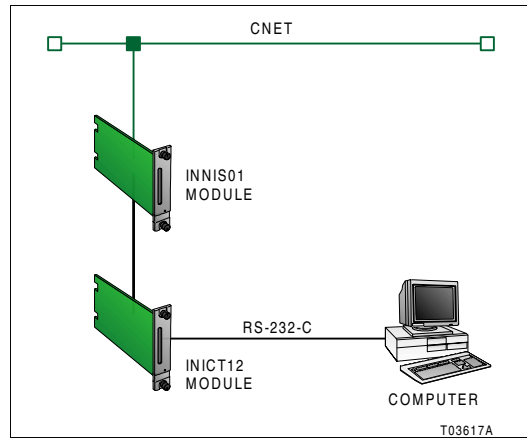


Figure 6. Cnet-to-Computer Interface (INIC12)

A computer interface can be used for a node on the central network or on a satellite network (Fig. 1). It gives a host computer access to point data over Cnet. The computer connects through either an RS-232-C serial link at rates up to 19.2 kilobaud or through a SCSI parallel port when using an INICI03 interface. The computer connects through an RS-232-C serial link at rates up to 19.2 kilobaud when using an INICI12 interface. Each interface is command driven through software on the host computer. It receives a command from the host computer, executes it, then replies to the host computer.

**Note:** A workstation running Conductor VMS software does not use an INICI03 or INICI12 Cnet-to-Computer Interface but instead has its own dedicated version of the Cnet-to-computer interface (IIMCP02 and IIMLM01).

## Communication Modules

Table 1 lists the available Harmony rack communication modules. These modules, in certain combinations, create the various Cnet communication interfaces.

**Table 1.** Harmony Rack Communication Modules

Module	Description	Cnet-to-Cnet		Cnet-to-HCU	Cnet-to-Computer	
		INIIR01	INIIL02		INICI03	INICI12
IMMPI01	Multifunction processor interface				•	
INICT03A	Cnet-to-computer transfer				•	
INICT12	Cnet-to-computer transfer					•
INIIT03	Cnet-to-Cnet local transfer		•			
INIIT12	Cnet-to-Cnet remote transfer	•				
INNIS01	Network interface	•	•	•	•	•
INNPM11 or INNPM12	Network processing			•		

### Network Interface Module

The INNIS01 Network Interface Module is the front end for all the different Cnet communication interfaces. It is the intelligent link between a node and Cnet. The INNIS01 module works in conjunction with the transfer modules and the network processing module. This allows any node to communicate with any other node within the Symphony system.

The INNIS01 module is a single printed circuit board that occupies one slot in the module mounting unit (MMU). The circuit board contains microprocessor based communication circuitry that enables it to directly communicate with the transfer modules and network processing module, and to interface to Cnet.

The INNIS01 module connects to its Cnet communication network through a cable connected to an NTCL01 termination unit. Communication between nodes is through coaxial or twinaxial cables that connect to the termination units on each node.

### Cnet-to-Cnet Remote Transfer Module

The INIIT12 Remote Transfer Module supports bidirectional communication through two RS-232-C ports. Port one passes system data only. Port two passes system data or can be used as a diagnostic port. The central network INIIT12 module can use a variety of means to link to the satellite network INIIT12 module such as modems, microwave, and transceivers. The INIIT12

module directly communicates with an INNIS01 module. Many of the operating characteristics of the INIIT12 module are determined by function code 202 (INIIT12 executive) specifications.

The INIIT12 module is a single printed circuit board that occupies one slot in the module mounting unit. The circuit board contains microprocessor based communication circuitry that enables it to serially communicate with another INIIT12 module, to directly communicate with its INNIS01 module, and to interface to Controlway.

The INIIT12 module connects through a cable to an NTMP01 termination unit. The two RS-232-C ports are located on the termination unit.

## **Cnet-to-Cnet Local Transfer Module**

The INIIT03 Local Transfer Module serves as the bridge between two local Cnet communication networks. It holds the node database and is responsible for transferring all messages between networks. Messages include exception reports, configuration data, control data, and system status. This module directly communicates with the INNIS01 module of the central network and of the satellite network simultaneously.

The INIIT03 module is a single printed circuit board that occupies one slot in the module mounting unit. The circuit board contains microprocessor based communication circuitry that enables it to directly communicate with its two INNIS01 modules and to interface to Controlway.

## **Cnet-to-Computer Transfer Module**

The INICT03A Computer Transfer Module and INICT12 Computer Transfer Module handle all communication with a host computer. These modules are command driven through software on the host computer. The module receives a command from the host computer, executes it, then replies. Its firmware enables the host computer to issue commands for data acquisition, process monitoring, and process control, and to perform system functions such as security, time synchronization, status monitoring, and module configuration.

The INICT03A and INICT12 modules are single printed circuit boards that occupy one slot in the module mounting unit. Their capabilities and computer connection methods differ. The INICT03A module can store up to 30,000 point definitions (depending on point types). The INICT12 module can store up to 10,000 point definitions.

For the INICT03A module, the circuit board contains microprocessor based communication circuitry that enables it to directly communicate with its INNIS01 module and to directly communicate with an IMMPIO1 module. It communicates with the IMMPIO1 module through a ribbon cable connection. The IMMPIO1 module handles the actual host computer interface and supports RS-232-C or SCSI serial communication.

For the INICT12 module, the circuit board contains microprocessor based communication circuitry that enables it to directly communicate with its INNIS01 module and to directly communicate with a host computer using RS-232-C serial communication. The module cable connects to an NTMP01 termination unit. Two RS-232-C ports are located on the termination unit. The NTMP01 jumper configuration determines DTE or DCE operation.

## **Multifunction Processor Interface Module**

The IMMPIO1 Multifunction Processor Interface Module handles the I/O interface between the host computer and the INICT03A Computer Transfer Module. The IMMPIO1 module supports either a SCSI or RS-232-C computer interface. When communicating through the RS-232-C port, the module can act as data communication equipment (DCE) or data terminal equipment (DTE).



The IMMPIO1 module is a single printed circuit board that occupies one slot in the module mounting unit. The circuit board contains microprocessor based communication circuitry that enables it to communicate with its INICT03A module through a ribbon cable connection.

For RS-232-C computer interface, the module cable connects to an NTMP01 termination unit. Two RS-232-C ports are located on the termination unit. The NTMP01 jumper configuration determines DTE or DCE operation. The SCSI port is located at the module faceplate. In this case, no termination unit is required.

## Network Processing Module

The INNPM12 or INNPM11 Network Processing Module acts as a gateway between Cnet and Controlway. The module holds the Harmony control unit database and handles the communication between controllers residing on Controlway and the INNIS01 module.

The INNPM12 or INNPM11 module is a single printed circuit board that occupies one slot in the module mounting unit. The circuit board contains microprocessor based communication circuitry that enables it to directly communicate with its INNIS01 module and to interface to Controlway.

## Rack Communications Power

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Harmony rack communication modules are powered by 5, 15, and -15 VDC logic power. Modular Power System II supplies the logic power. These operating voltages are distributed from the power system through a system power bus bar mounted in the cabinet. A module mounting unit connects to this bus bar then routes the power to individual modules through backplane connectors.

## Rack Communications Mounting Hardware

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Harmony rack communication modules and their 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. Modules of an interface are always mounted in adjacent slots.

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 standard 483-millimeter (19-inch) width side rails. Front mount and rear mount MMU versions are available to provide flexibility in cabinet mounting.

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

- Controlway.
- I/O expander bus.
- Logic power to rack modules.

The Controlway and I/O expander bus are internal cabinet, communication buses. Communication between rack controllers and HCU communication interface modules is over Controlway. The Cnet-to-Cnet interfaces use dedicated Controlway for redundancy communication. This dedicated Controlway is isolated from all other modules.

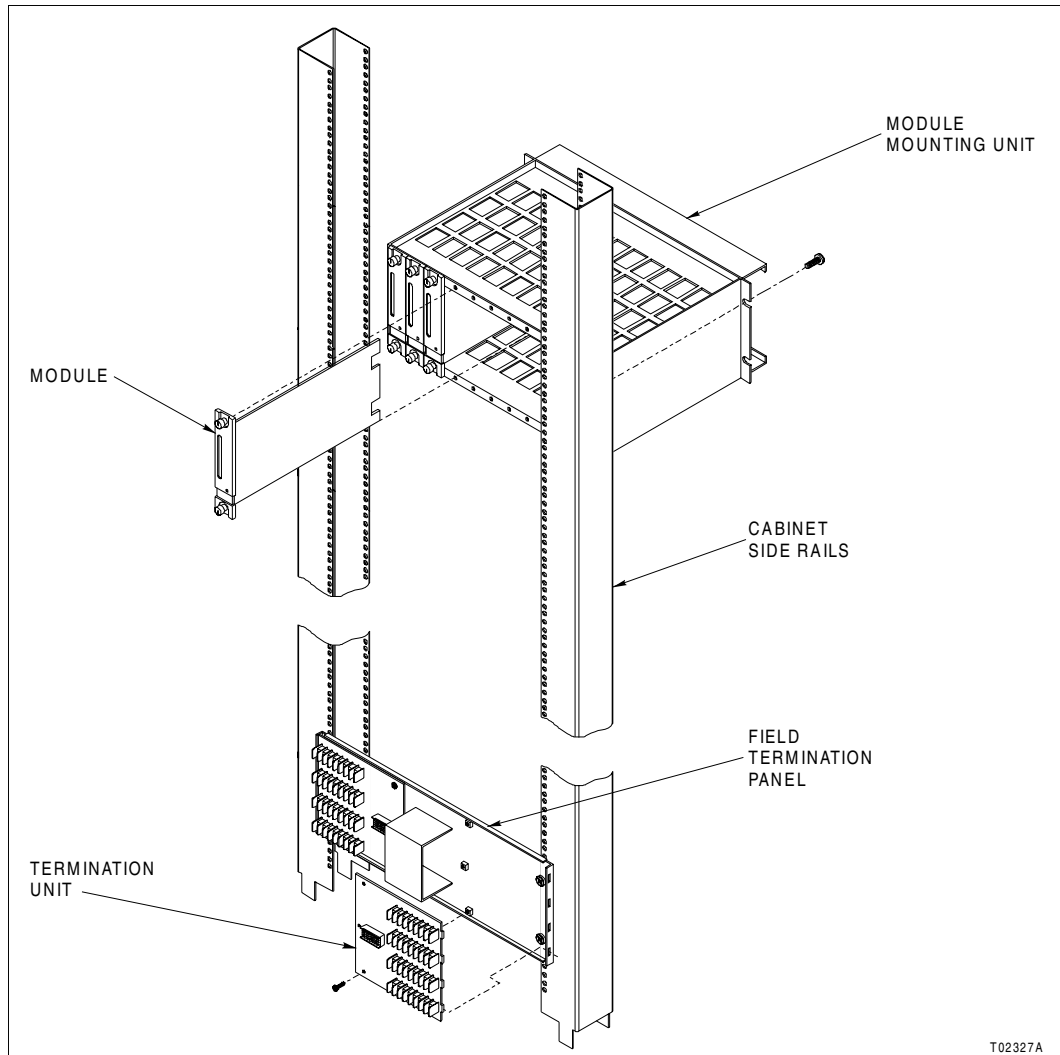


Figure 7. Rack I/O Mounting Hardware

## Related Documents

Number	Document Title
WBPEEUD250001??	Harmony Rack Communications, Data Sheet



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