Features and Benefits

- **Integrated controller:** Consolidates area management and control and network communications into one user-replaceable unit, reducing implementation costs.

- **Downloadable firmware:** Downloaded via the network to take advantage of future system enhancements, thereby reducing life cycle costs.

- **Open design:** PCI card slots provide open system connectivity to industry standard communication networks and protocols.

- **Multiple I/O systems support:** Supports both the Symphony™ Harmony I/O blocks as well as Harmony rack I/O modules.

- **Compatible with existing configurations:** Execution environment is compatible with existing INFI 90® OPEN function codes and language configurations.

- **Improved on-line configuration:** New strategy allows function blocks to be added or deleted anywhere within a control segment without interrupting the process.

- **Redundancy:** Provides exceptionally high availability and fault tolerance when configured as a redundant pair.

- **Local interface:** LCD display indicates module type, displays menus, and provides operational feedback.

- **Serial communications channels:** Two independent general purpose serial channels are available to interface third-party devices.

The Harmony Area Controller is an area management and control node for the Symphony Enterprise Management and Control System. The controller communicates with other system nodes over Control Network (Cnet). It collects process I/O, performs control algorithms, and outputs control signals to process level devices. The controller also imports and exports process data from and to other system nodes, and accepts operator control commands through network connected workstations.

The controller communicates with both Harmony I/O blocks and Harmony rack I/O modules to meet the input and output requirements of virtually any process. Each controller can handle thousands of analog and digital I/O points with functions such as multiloop, analog, sequential, batch, and advanced controls. It has advanced data acquisition features such as trending, variable alarming, alarm inhibiting, and sequence of events.

On-board, user-addressable control algorithms (i.e., function codes) enhance processing power and support even the most complex process management and control strategies. A standard library of function codes ranges from simple AND and NOT logic functions to complex Smith Predictor and Linear Regression functions, with no advanced programming knowledge required to apply these powerful capabilities. Programming and control language support includes C, Batch 90™, and UDF (user-defined function).
Additional Features

- **Flexible configuration:** The controller is scalable for a variety of applications from complex control strategies to data acquisition to advanced information processing. It supports multiple programming and control languages including C, Batch 90, and UDF.

- **Enhanced communications:** State-of-the-art hardware and new internal architecture increases process data import and export rates.

- **Modular packaging:** One user-replaceable unit reduces installation costs. Block packaging combines an enclosure mounting panel, a docking station for module interconnection, controller assemblies, and termination assembly.

- **Improved operator interface:** A front panel keypad in conjunction with the LCD screen assist in selecting mode changes and setup options.

- **Station link:** A station link to communicate with Analog Control Stations (IISAC01).

Description

The Harmony area controller is an integrated package that combines control, communication, and power supply functions into one user-replaceable module. The controller consists of a controller module mounted on a docking station with termination units (Fig. 1).

The controller module contains internal printed circuit boards: CPU I/O board, process I/O board, and network I/O board. The backplane for these boards is a high-speed, industry-standard PCI data bus. The docking station provides system power and termination unit connections to the various communication networks, e.g., Cnet network, Harmony Network (Hnet), peer-to-peer, and I/O expander bus (Fig. 2). If redundancy is desired, simply mount another identical module on the docking station, which is engineered to implement the automatic backup feature.

The **CPU** board contains the central processing unit (CPU) for the controller module. It incorporates a 32-bit microprocessor running at 50 megahertz. The resident operating system is a multitasking, interrupt driven, real-time operating system. The memory system consisting of flash-ROM memory, DRAM memory, and NVRAM memory has built-in automatic error detection and correction features that further bolster system reliability and availability. Furthermore, both firmware and configurations are downloadable via the Cnet network minimizing overall life-cycle support costs.

The **process I/O** board provides the links to process I/O, two serial ports, and discrete operator control stations. Direct process I/O is connected to the controller via the Hnet network for I/O blocks and/or the I/O expander bus for rack I/O modules. This board also contains the high-speed data transfer link between redundant controller modules to yield exceptionally high system availability.

The **network I/O** board handles the communication on the Cnet network. This control network is a high speed, high throughput serial data highway implemented in all Harmony control units. Up to 250 nodes can be supported in a central network with satellite networks linked to the central network through local and remote interfaces. The Harmony area controller can be added to existing INFI 90 OPEN INFI-NET® communications networks.

The docking station provides termination and distribution of signals, and the means to mount the controller modules. It contains a printed circuit board backplane, and the physical communication
pathways and the power distribution signal lines between the controller modules and the termination units. External cable connections attach at the termination units and other docking station connectors. Backplane circuitry stores the controller setup information including its loop and node addresses, loop mode, licenses, and setup options. This allows replacing a controller module and having the replacement module automatically retrieve and update its setup and license information.

**Operation**

The Harmony area controller, in conjunction with the associated docking station and termination units, represents one area management and control node in the Symphony system. The controller receives process input and sends output signals via a variety of devices including the Harmony I/O blocks and Harmony rack I/O modules. Additionally, data can be exchanged with other nodes via the Cnet network.

An extensive library of function codes and C, Batch 90, and UDF language support gives the tools needed to design complex control strategies to fit any control application. Each Harmony area controller is scalable from small to large function block capacity. Nonvolatility is provided for both the control algorithms and the user-defined configurations. The control algorithms are resident in flash memories which render them impervious to power losses. Furthermore, future enhancements can be downloaded via the communication network without having to perform physical modifications to each controller such as replacing ROMs or swapping modules, thus reducing life cycle cost of ownership.
A liquid crystal display (LCD) is standard on the front panel of the Harmony area controller. This LCD provides a local operator interface for information such as module type, status, and setup options in easily comprehensible text. Along with the keypad on the front panel, the LCD screen serves as a menu display for those functions available locally such as node or module address, setup options, and status inquiries.

The high-speed redundancy communication link between a pair of controllers provides the means for automatic one-for-one backup thus ensuring high system availability. If the primary controller should fail, the secondary is waiting in standby with the same control strategy and current process data, and immediately assumes control. Diagnostic routines are constantly checking the integrity of the hardware and firmware. The memory subsystem in the Harmony area controller is designed with automatic error detection and correction circuitry, making it extremely fault tolerant and secure for control applications.
Control Network

The controller is a node on the Cnet network. Cnet is a unidirectional, high speed serial data network that operates at a 10-megahertz communication rate. It supports a central network with up to 250 system node connections. Multiple satellite Cnet 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 62,500 nodes. A node can be a satellite network, a Harmony control unit consisting of a Harmony area controller with its I/O devices, and a Harmony network communications coupler connecting human system interfaces and computers operating on the Operations Network (Onet).

The Harmony area controller uses Cnet network for such things as:

- 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.
- Process field input data acquisition.
- Receive control instructions from a human system interface to adjust process field outputs.
- Provide feedback to plant personnel of actual output changes.

Data is transferred in messages that contain system data, control, and configuration information and also in exception reports. 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 for the controller is automatic. 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.

I/O Interface

Figures 3 and 4 show the Harmony area controller interfacing to Harmony I/O blocks and Harmony rack I/O modules. I/O blocks and rack I/O modules can operate in parallel with a single controller.

The Harmony I/O system incorporates a variety of input and output devices (i.e., blocks) to interface process signals to the Harmony area controller. The controller communicates with I/O blocks over Hnet. Block types include analog, digital, and control I/O. Additionally, the Harmony I/O system supports remote I/O communication through Hnet repeaters mounted in repeater mounting units.

The Harmony rack I/O system utilizes a wide variety of input, output, and signal conditioning modules to interface process signals to the Harmony area controller. The controller communicates with rack I/O modules over I/O expander bus. Rack I/O module types range from standard analog and digital I/O to specialty I/O such as turbine control, field bus, and sequence of events.

Peer-to-Peer Communication

Figure 5 shows peer-to-peer Harmony area controller communication. Peer-to-peer communication is intended as a direct means for transferring point data between controllers instead of transferring the data over Cnet network. It is only intended for transferring a small number of
Figure 3. Harmony Area Controller with Harmony I/O Blocks

Figure 4. Harmony Area Controller with Harmony Rack I/O
points (50) at a fast rate of approximately 500 points per second. All controllers that communicate over the peer-to-peer link reside on the same local Cnet network.

![Harmony Area Controller Peer-to-Peer Communication](image)

**Figure 5.** Harmony Area Controller Peer-to-Peer Communication

### Compatibility

The Harmony area controller is compatible with existing INFI 90 OPEN systems. The controller can easily be integrated into established installations that currently use INFI-NET communication networks. Communication with INFI 90 OPEN I/O modules is over I/O expander bus (Fig. 4). Function block configurations in existing INFI 90 OPEN control modules can be downloaded to the Harmony area controller with only minor modifications.

### Configuration Tools

The Harmony area controller can be configured and tuned using any Symphony configuration tool that supports editing function blocks and modifying function code specifications. This includes, for example:

- Composer™ (2.0 and later).
- Conductor NT (2.3 and later).
- Conductor VMS (2.0 and later).

Using the Composer tools is the recommended method for creating and managing controller configurations.

### Software Licenses

The Harmony area controller utilizes software licensing to manage its major available features. A software key is necessary for proper operation of specific functions. This key is written to and stored in the docking station during initial controller setup. The key permits a feature licensed for the particular controller to be executed. The license key can be expanded after initial setup, but a
feature once enabled cannot be removed. The following functions are under license management control:

- Number of function blocks (4,000, 10,000, or 20,000).
- C language support.
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® INFI 90 and INFI-NET are registered trademarks of ABB.

For more information on the Control IT suite of products, contact us at ControlIT@us.abb.com
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