Honeywell

HC900 Process Controller
Installation and User Guide

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Honeywell Process Solutions

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About This Document

Abstract

This document provides descriptions and procedures for the installation, operation and maintenance of the HC900 Process Controller hardware.

References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

Document Title	ID #
HC900 Process Controller Technical Overview Specification	51-52-03-31
HC900 Module Specification	51-52-03-41
HC900 Controlware Specification	51-52-03-42
Designer Software Specification	51-52-03-43
HC900 Process Controller Operator Interface User Guide	51-52-25-108
HC900 Designer Software User Guide	51-52-25-110
HC900 Process Control Utilities User Guide	51-52-25-126
HC900 Process Controller Function Block Reference Guide	51-52-25-109
HC900 Process Controller Communications User Guide	51-52-25-111
HC900 Controller Redundancy Overview & System Operation	51-52-25-133
900 Control Station For use with HC900 Process Controller	51-52-25-148
Station Designer Software manual	51-52-25-149

Revision Information

Document Name	Revision Number	Publication Date
This manual … **51-52-25-107 HC900 Controller Installation and User Manual**		
SIL updates/Shielded cable added	Rev.18	February 2014

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Honeywell Process Solutions	*www.honeywellprocess.com*
HPS Technical tips	*https://www.honeywellprocess.com/en-US/explore/products/control-monitoring-and-safety-systems/scalable-control-solutions/hc900-control-system/Pages/hc900-controller.aspx*

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Email Support	Honeywell Process Solutions	Email: (Sales) **FP-Sales-Apps@Honeywell.com** or (TAC) **hfs-tac-support@honeywell.com**

Symbol Definitions

The following table lists those symbols that may be used in this document and on the product to denote certain conditions.

Symbol	Definition
⚠ DANGER	This **DANGER** symbol indicates an imminently hazardous situation, which, if not avoided, **will result in death or serious injury**.
⚠ WARNING	This **WARNING** symbol indicates a potentially hazardous situation, which, if not avoided, **could result in death or serious injury**.
⚠ CAUTION	This **CAUTION** symbol may be present on Control Product instrumentation and literature. If present on a product, the user must consult the appropriate part of the accompanying product literature for more information.
CAUTION	This **CAUTION** symbol indicates a potentially hazardous situation, which, if not avoided, **may result in property damage**.
	WARNING **PERSONAL INJURY:** Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 Vdc may be accessible. **Failure to comply with these instructions could result in death or serious injury.**
	ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	CAUTION, HOT SURFACE: This symbol warns the user of potential hot surfaces which should be handled with appropriate caution.
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national and local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Contents

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Introduction

Purpose

This publication describes the installation, operation, and maintenance of the Honeywell HC900 Process Controller. This publication includes the following sections.

Chapter Title	Page	Content
Introduction	1	Model numbers, how to verify component compatibility, function description of components, feature summary.
Components and Architecture	13	Functional features and physical characteristics of the system and of each major component of the HC900 Process Controller. Networking components and methods of interconnection.
Pre-Installation Planning	37	Pre-planning considerations and procedural guidelines for planning an installation.
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Communications Installation	117	Guidelines for installing RS-232, RS-485 TO USB CABLE, RS-485,and Ethernet cabling and associated components.
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Appendix - Installation of Remote Termination Panels (RTPs)	207	The Remote Termination Panel (RTP) provides an easy way to connect the HC900 controller to the field wiring. The RTP integrates some of the typical externally connected components, reducing wiring and setup time. It also minimizes the need for multiple wires under a single screw connection by expanding the connectivity of the shared terminals of the I/O modules.

Model Selection Guide

Legacy System

Description	Model number
Racks	
4 I/O Slot Rack	900R04 – 0001
8 I/O Slot Rack	900R08 – 0101
12 I/O Slot Rack	900R12 - 0101
8 Slot Rack -Red. Power	900R08R - 0101
12 Slot Rack - Red. Power	900R12R - 0101
Redundant CPU Rack	900RR0 - 0001
Controllers	
Controller C50 CPU Config.SW & Docs	900C51 – 00XX-00
Controller C50 CPU	900C52 – 00XX-00
Controller C30 CPU Config. SW & Docs	900C31 – 00XX-00
Controller C30 CPU	900C32 – 00XX-00
Controller C70 CPU Config.SW & Docs	900C71-00XX-00
Controller C70 CPU	900C72-00XX-00
Controller C70R CPU Config.SW & Docs	900C71R-0000-XX
Controller C70R CPU	900C72R-0000-XX
Redundancy switch module	900RSM - 0001
I/O Scanner - 2 Port (1 per I/O rack)	900C73R-0000-XX
I/O Scanner (for remote rack)	900C53 – 00XX-00
Redundant Power Status Module	900PSM - 0001
Power Supplies	
120/240VAC, 60W	900P01 -0001
120/240VAC, 28W	900P02 -0001
+24VDC	900P24-0001
I/O Modules	
Analog Input (8 channel)	900A01 - 0102
High Level Analog Input (16 channel)	900A16 - 0001
Analog Output, 0 to 20mA, (4 channel)	900B01 -0101
Analog Output, 0 to 20mA, (8 channel)	900B08 – 0001
Analog Output, 0 to 20mA, (16 channel)	900B16 - 0001
Digital Input, Contact type, (16 channel)	900G01 - 0102
Digital Input, 24VDC (16 channel)	900G02 - 0102
Digital Input, 24VDC (32 channel)	900G32 - 0001
Digital Input, 120/240 VAC, (16 channel)	900G03 - 0102
Digital Input, 120/240VAC, 125VDC (16ch-Iso)	900G04 - 0001
Digital Output, Relays (8 channel)	900H01 - 0102
Digital Output, 24VDC (16 channel)	900H02 - 0102
Digital Output, 24VDC (32 channel)	900H32 - 0001
Digital Output, 120/240 VAC (8 channel)	900H03 - 0102
Pulse/Frequency/Quadrature	900K01 - 0001

Description	Model number
I/O Components	
Low VoltageTerminal Block (Euro style)	900TEK - 0001
Low VoltageTerminal Block (Barrier Style)	900TBK -0001
High VoltageTerminal Block (Euro style)	900TER - 0001
High Voltage Terminal Block (Barrier Style)	900TBR - 0001
High Density Terminal Block	900TCK - 0001
Analog Input Remote Terminal Panel (RTP)	900RTA - L001
I/O Components	
Relay Output Remote Terminal Panel (RTP)	900RTR - H001
DI, DO, AO Remote Terminal Panel (RTP)	900RTS - 0001
Low Voltage RTP Cable (1.0M, 3.28ft.)	900RTC - L010
Low Voltage RTP Cable (2.5M, 8.2ft.)	900RTC - L025
Low Voltage RTP Cable (5.0M, 16.4ft.)	900RTC - L050
High Voltage RTP Cable (1.0M, 3.28ft.)	900RTC - H010
High Voltage RTP Cable (2.5M, 8.2ft.)	900RTC - H025
High Voltage RTP Cable (5.0M, 16.4ft.)	900RTC - H050
High Density RTP Cable (1.0M, 3.28ft.)	900RTC - 3210
High Density RTP Cable (2.5M, 8.2ft.)	900RTC - 3225
Filler Block Terminal Cover	900TNF - 0001
Shield Terminal Strip (package of 2)	900TSS - 0001
Terminal board jumpers (10, two pos jumpers)	900J02 - 0001
Terminal board jumpers (10, ten pos.jumpers)	900J10 - 0001
Manuals	
Full Document set on CD	900ME1-00XX-XX
Full document set, hard copy - English	900ME2-00XX-XX
Software	
HC Designer Config. Software CD	900W01-00XX-XX
HC Utilities Software/Documentation CD	900W02-00XX-XX
Kits & Accessories	
Redundant Power, Rack Extension Kit	900RPE-0001
Spare I/O Label Kit	51452262-501
Replacement Battery Kit	51500638-501
Ethernet Cable (10 feet)	51451432-010
Ethernet Cable (20 feet)	51451432-020
Ethernet Cross-over Cable (20 feet)	51451996-020
Null Modem Cable	51404755-501
Null Modem Cable used with 900C70R	50004820-501
250 ohm Shunt Resistor Kit ((8/pkg.)	51205995-501
Ethernet Switching Hub (8 Ports)	50008930-001
24 VDC Power Supply	51452041-501

Operator Interface	
Description	*Model number*
900 Control Station 10" Screen	900CS10- xx
900 Control Station 15" screen	900CS15-xx
OI Accessories & Kits	
CompactFlash Memory Module	50040636-002
USB Programming Cable	50038817-001
10" Screen Protective Films (10)	50038816-501
10" Replacement Backlight	50038818-501
10" Replacement Touch Screen Assy	50038820-501
10" Mounting plate adapter for 1042 replacement	50039118-501
24 VDC Power Supply for 10"	51452041-501
900 Control Station User Manual (paper)	51-52-25-148
15" Screen Protective Films (10)	50038816-502
24VDC Power Supply for 15"	50047098-001
GSM/GPRS Cellular Modem Kit	50047099-501

New Non-SIL System

Description	Model number
Racks	
4 I/O Slot Rack	900R04 - 0200
8 I/O Slot Rack	900R08 - 0200
12 I/O Slot Rack	900R12 - 0200
8 Slot Rack -Red. Power	900R08R - 0200
12 Slot Rack - Red. Power	900R12R - 0200
Redundant CPU Rack	900RR0 - 0001
Controllers	
Controller C30 CPU	900C30-0360-00
Controller C50 CPU	900C50-0360-00
Controller C70 CPU	900C70-0360-00
Controller C70R CPU	900C75-0360-00
I/O Scanner - 2 Port (1 per I/O rack)	900S75-0360-00
I/O Scanner - 1 Port (1 per I/O rack)	900S50-0360-00

SIL System

Description	Model Number
Controllers	
Controller C30 CPU - SIL	900C30S - 0360-00
Controller C50 CPU - SIL	900C50S - 0360-00
Controller C70 CPU - SIL	900C70S - 0360-00
Controller C70R CPU - SIL	900C75S-0360-00
I/O Scanner - 1 Port (1 per I/O rack) - SIL	900S50S - 0360-00
I/O Scanner - 2 Port (1 per I/O rack) - SIL	900S75S-0360-00
Documentation	
Full Document set on CD - SIL	900ME1S-0060-00
Full document set, SIL hard copy - English	900ME2S-0060-00

Conventions

Throughout this guide, where the text "Legacy systems" is used, the following model numbers are applicable.

- **Legacy systems Model Numbers**

    - 900C51 – 00XX-00

    - 900C52 – 00XX-00

    - 900C31 – 00XX-00

    - 900C32 – 00XX-00

    - 900C71-00XX-00

    - 900C72-00XX-00

    - 900C71R-0000-XX

    - 900C72R-0000-XX

    - 900RSM - 0001

    - 900C73R-0000-XX

    - 900C53 – 00XX-00

Throughout this guide, where the text "New systems" is used, the following model numbers are applicable.

- **New System (SIL and Non SIL Model Numbers)**

    - 900C30-0360-00

    - 900C50-0360-00

    - 900C70-0360-00

    - 900C75-0360-00

    - 900S75-0360-00

    - 900S50-0360-00

- 900C30S - 0360-00

- 900C50S - 0360-00

- 900C70S - 0360-00

- 900C75S-0360-00

- 900S50S - 0360-00

- 900S75S-0360-00

ATTENTION

For the Legacy systems, it is specifically mentioned in the guide wherever applicable.
The other text is applicable to the new HC900 system. Modems are not qualified with the
new HC900 system.

Checking HC900 Model Numbers for Compatibility

ATTENTION

Be sure to check your model numbers for compatibility before installation. For a HC900
system to be fully compatible, all components must have matching model numbers.

Each component's model number format is XXXXXXX–XXYY-ZZ. For example, HC900 CPU is
900C71R-0000-40. For redundant CPU systems, component model numbers ZZ numbers must match. For
non-redundant CPU systems, component model numbers YY numbers must match. See examples below.

Example of a compatible redundant system

Component	Model Number XXXXXXX-XXYY-**ZZ**
HC900 CPU	900C71R-0000-40
Scanner 2	900C73R-0000-40
HC Designer Software	900W01-0040-40
Manuals CD	900ME1-0040-40

Example of a compatible non-redundant system

Component	Model Number XXXXXXX-XX**YY**-ZZ
HC900 CPU	900C51R-00**40**-00
Scanner 1	900C53R-00**40**-00
HC Designer Software	900W01-00**40**-40
Manuals CD	900ME1-00**40**-40

Functional Description

All Controllers

The Honeywell HC900 Process Controller is an integrated loop and logic controller that is designed specifically for small-and medium-scale unit operations

It comprises a set of hardware and software modules that can be assembled to satisfy any of a broad range of process control applications. The HC900 Process Controller can consist of a single rack, as indicated in Figure 1, or can be can be networked with other controllers via Ethernet links to expand the dimensions of control over a wider range of unit processes, as indicated in Figure 2.

Figure 1 – Small HC900 Controller Configuration
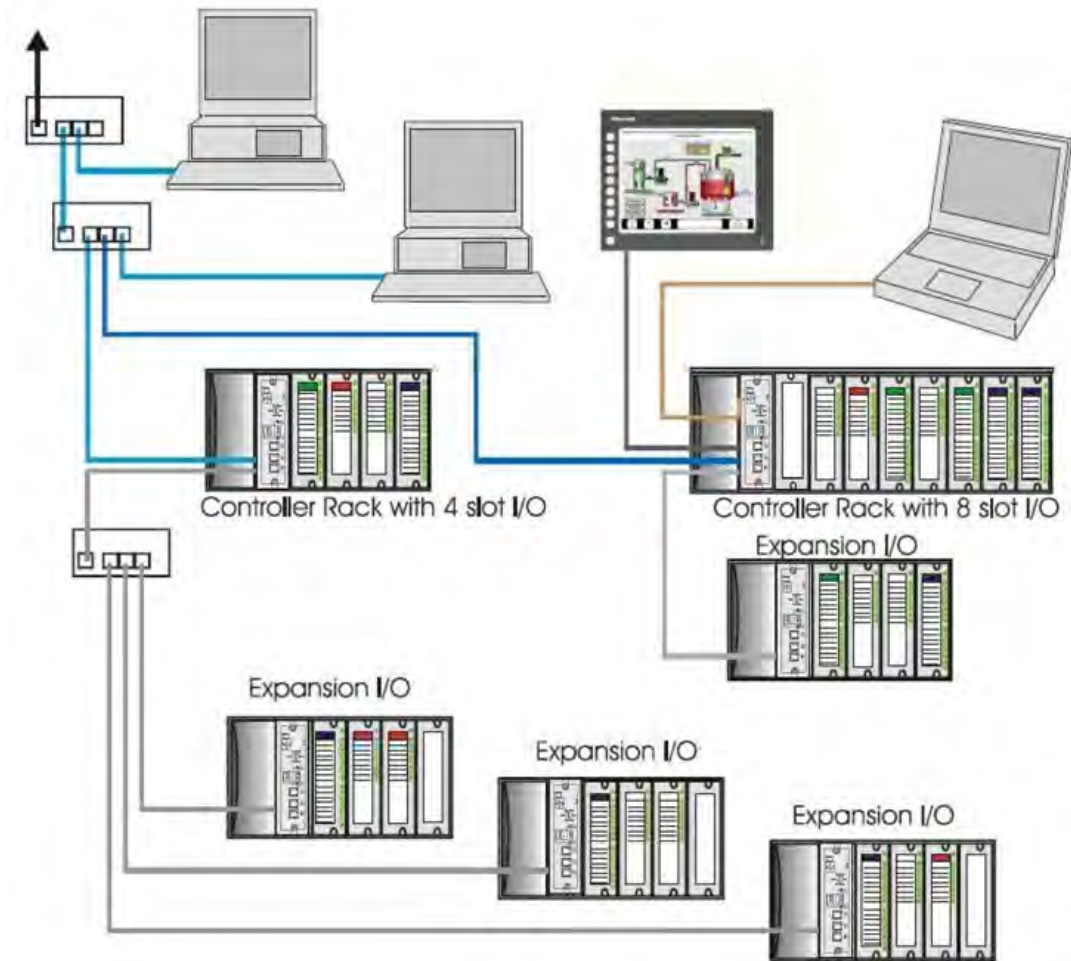
Figure 2 – Expanded HC900 Controller Configuration (C50/C70 CPU only)

The HC900 Controller design enables users and OEMs who are adept in system integration to assemble a system that fits a broad range of requirements. Any configuration can be readily modified or expanded as requirements dictate. In initial configuration and in subsequent modifications, the HC900 Controller affords an optimum balance of performance and economy.

Configurations such as those shown in Figure 1 and in Figure 2, as well as many variations, can be assembled from modular components. Many of the components are available from Honeywell, and some are available from third-party suppliers. These modular components are available in any quantity and mix that make the most sense for a given application.

As indicated in Figure 3, the HC900 Controller includes provisions for communication via Ethernet with host systems such as the Honeywell Experion HMI and other HMI software that supports Ethernet Modbus/TCP protocol. Also, the communication structure of the HC900 Controller enables remote placement of input/output components, allowing significant economies in cabling and wiring.

Redundancy
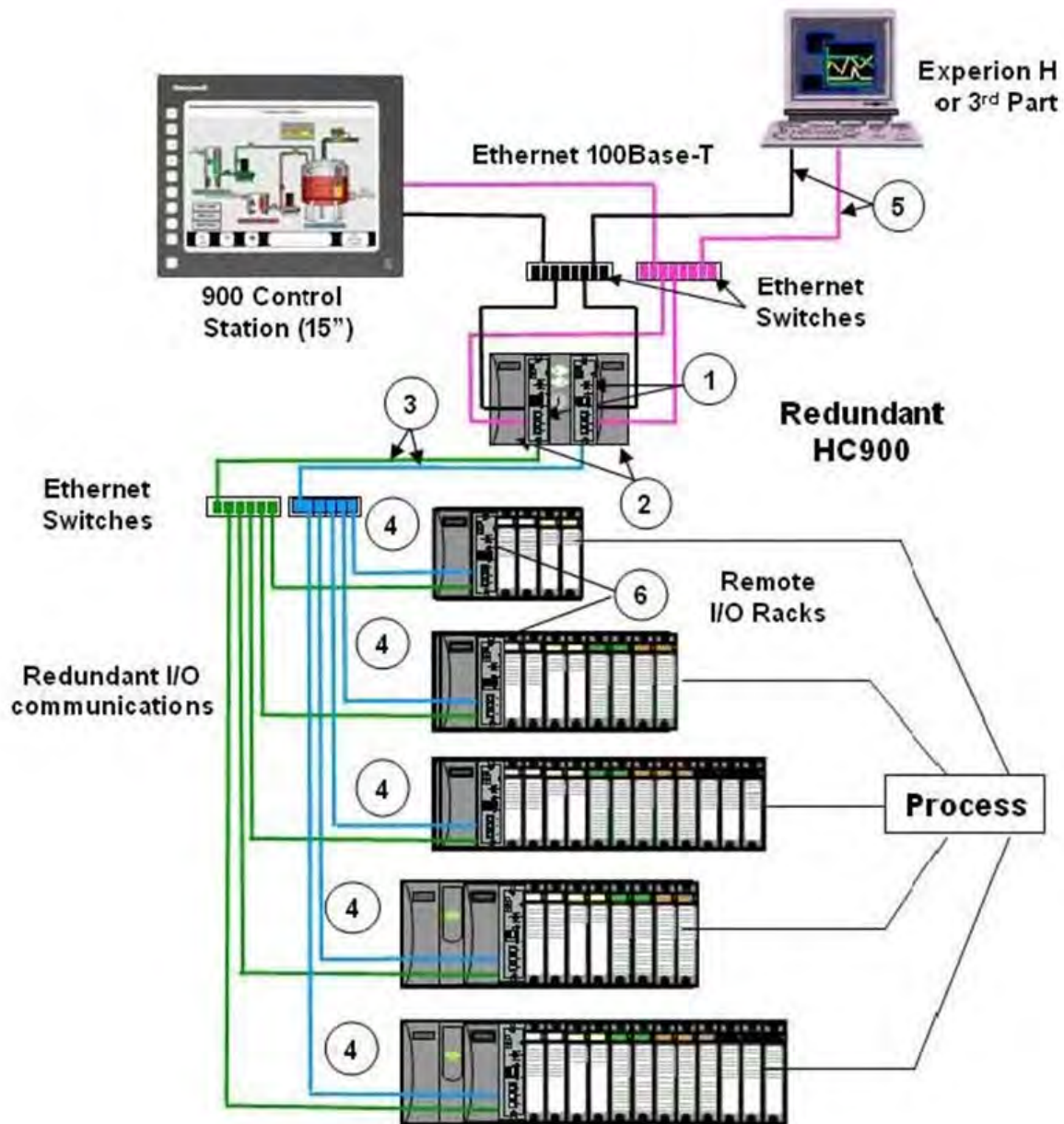
Figure 3 – Single process with redundancies

① Redundant CPUs - Redundancy is provided by two C75 CPUs operating in a controller rack; this rack has no I/O. A Redundancy switch module (RSM) sits between the CPUs.

② Redundant CPU Power - Two power supplies, one for each C75 CPU.

③ Redundant CPU-I/O connection – Each CPU has its own 100 base-T Ethernet physical communication link with one or more racks of I/O. Multiple I/O racks require Ethernet switches.

④ I/O racks – 5 racks shown, top to bottom: 4-slot w/1 power supply, 8-slot w/1 power supply, 12-slot w/1 power supply, 8-slot w/redundant power supplies, 12-slot w/redundant power supplies. A Power Status Module (PSM) is required with redundant power supplies. High and low capacity power supplies are available.

⑤ Redundant Networks for Host communications - Redundant Networks for Host communications are provided on the C75 CPU. Both network ports are continuously active on the Lead controller. The network ports on the Reserve CPU are not available for external communications. Experion HS and the 900 Control Station (15 inch model) support redundant Ethernet communications and automatically transfer communications during a network failure.

⑥ Scanner 2 module – has 2 ports, one for each CPU connection to I/O.

Feature Summary

Hardware

- Modular rack structure; components are ordered individually as needed

- CPU with Ethernet communications

- Easy to assemble, modify, and expand

- Local (C30 and C30S) and Remote input/output racks (C50/C70), private Ethernet-linked sub-network

- Parallel processing - a microprocessor in each I/O module performs signal processing, to preserve update rates

- Power supplies - provide power to CPU rack and Scanner I/O rack

Redundancy

- Redundant C75 CPU

- Redundancy Switch Module (RSM) – required between redundant CPUs

- Redundant Power Supply – provides redundant power to any CPU rack or Scanner2 I/O rack

- Power Status Module (PSM) – required when using a second power supply in Scanner2 I/O rack

Communications

All CPUs (except where noted):

- Serial ports

  - In legacy systems, two serial ports, RS-232 or RS-485 can be configured.

  - In new systems, two RS-485 ports can be configured.

- PC Configuration Tool

  - In legacy systems, RS-232 port used for link to PC configuration tool (up to 50 feet or 12.7 meters) or modem. Port configurable as Modbus RTU/TCP master or slave.

  - In new systems RS-232 to RS-485 cable is used for link to PC configuration tool.

- Link to Operator Interface

  - For legacy and new systems, RS-485 port used for 2-wire link to the Operator Interface (up to 2000 feet or 601 meters). Port configurable as Modbus RTU master or slave.

- Ethernet 10/100Base-T connection to: up to 5 PC hosts via Modbus/TCP protocol, Peer-to Peer communication with other HC900 Controllers, and the Internet. C70 has 2 Ethernet ports for connection to up to 10 PC hosts. It also supports Modbus/TCP Initiator function over both ports.

- Private Ethernet 100Base-T connection to I/O expansion racks (*except C30 and C30S CPU*)

Redundancy

- Supervisory Network – Ethernet 10/100 baseT to PC Applications (HC Designer & HC Utilities), communicates to peer HC900 Controllers over Ethernet. C75 has two Ethernet ports. Lead C75 CPU supports up to 10 concurrent sockets. It also supports Modbus/TCP Initiator function over both ports.

- I/O Network – Direct connection to each C75 CPU.

- Device Network

  – RS-232 or RS-485 Serial Interface; Modbus RTU. Two serial ports available for legacy systems. Each port can be set as Modbus Master or Slave. Host Serial Interface for Honeywell or third party operator interface.

  – For new systems two serial R2-485 ports are available. Each port can be set as Modbus Master or Slave. Host Serial Interface for Honeywell or third party operator interface.

For more information

For complete feature summary and specifications see Specifications on page 194.

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Components and Architecture

Overview

This section provides a description of each of the major components that can be included in an HC900 Controller physical configuration, and indicates some of the methods by which they can be combined.

Components

The Honeywell HC900 Process Controller includes a set of hardware modules that can be combined and configured as required for a wide range of small to medium process control applications.

Some of the modules are required in all configurations. Others are optional; they are selected as appropriate to provide optional functions and/or to "size" the system, either in initial planning, or in modifying and/or expanding the system to meet changing requirements.

An HC900 Controller configuration with multiple controllers is illustrated in Figure 4.

This illustration includes key-numbers that identify components that are described in Table 2

CAUTION

Communications lockout is possible in high network traffic conditions.

Extraneous traffic is possible when sharing bandwidth with other devices. We recommend putting the controller on a private network segment. **Failure to do so could, in high traffic cases, result in communications lockout requiring the controller to be power-cycled.**
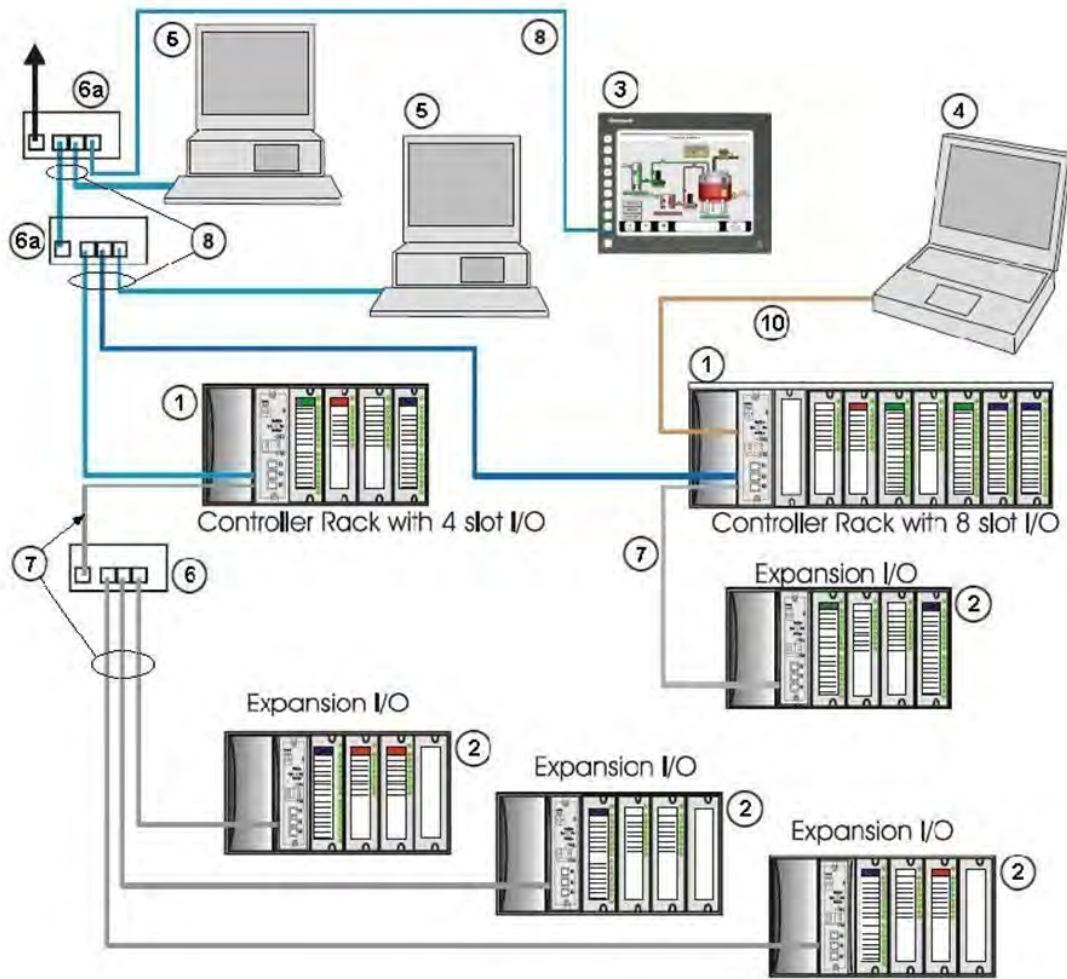
Figure 4 – Configuration with Multiple Controllers

CAUTION

The HC900-expansion I/O link is a private network and the switch used for the interconnection of the HC900 Processor and Scanners must not be connected to any other LAN or WAN. Likewise, no devices other than the HC900 components should be connected to the I/O link Switch. Failure to comply will cause communication failures on the I/O link causing I/O modules to go in and out of their failsafe settings.

Table 1 – Descriptions of Major Components (Figure 4)

Key No.	Component Name	Description	Source
1	Controller (Local) Rack	Includes: Rack, Power Supply, Controller Module, and I/O modules	Honeywell
2	I/O Expansion Rack (C50/C70 CPU only)	(Optional) Includes: Rack, Power Supply, Scanner Module, and I/O modules	Honeywell
3	Operator Interface	900 Control Station operator interface communicates via Ethernet or RS-485 serial link	Honeywell
4	PC Configuration Tool	• For legacy system- The PC configuration tool connects from the RS-232 serial port of the Controller Module to a serial port on the PC • For new system – The PC Configuration tool connects from the RS-485 port of the Controller Module using an external Honeywell qualified RS-485 to USB converter.	PC is from third-party supplier. Configuration software is from Honeywell.
5	HMI (Human-Machine Interface)	(Optional) PC link to Ethernet network, which may include other HMIs, other HC900 Controllers, and other networks (including Internet). Typically includes HMI operating software. May also include Designer Software (configuration tool and utility software).	PC is from third-party supplier. HMI software is available from Honeywell (PlantScape or SpecView32) or from third-party supplier.
6	Ethernet 100Base-T Switch	Enables connection of the private Ethernet 100Base-T port on a Controller Module to the Scanner modules on 2, 3, or 4 I/O Expansion racks. (C50/C70 CPU only) (If a single I/O expansion rack is connected directly to a Controller Module, the Switch is not required.)	Honeywell
6a	Ethernet 10/100Base-T Switch or Router	Enables inter-connection of several 10/100Base-T Ethernet devices in an Ethernet network. Devices include other HC900 Controllers, HMIs, and can also include routers, brouters, servers, and other devices in wider networks.	Third-party suppliers.
7	Ethernet CAT5 shielded cable	Connects I/O expansion racks (C50/C70 CPU only) to controllers and/or to 10/100baseT Ethernet switches. 10'or 20' (3.04 or 6.08m)	Third-party suppliers or Honeywell
	Fiber Optics Cable	Controller to remote rack distance up to 750m (2460 ft.) with one fiber cable. Distances up to 1500m (4920 ft.) are possible with a fiber switch used as a repeater at the midpoint.	
8	Ethernet CAT5 shielded cable IO	Connects devices in Ethernet Open Connectivity network to 900 Control Stations and PC SCADA applications.	Third-party suppliers or Honeywell
9	RS-232 cable	For legacy system, Null modem cable, up to 50' (15.24m) (PC modem cable if used with Modems.)	Third-party suppliers or Honeywell
10	RS-485 to USB converter	Connects RS-485 port to USB port.	Third-party suppliers or Honeywell

Redundant components
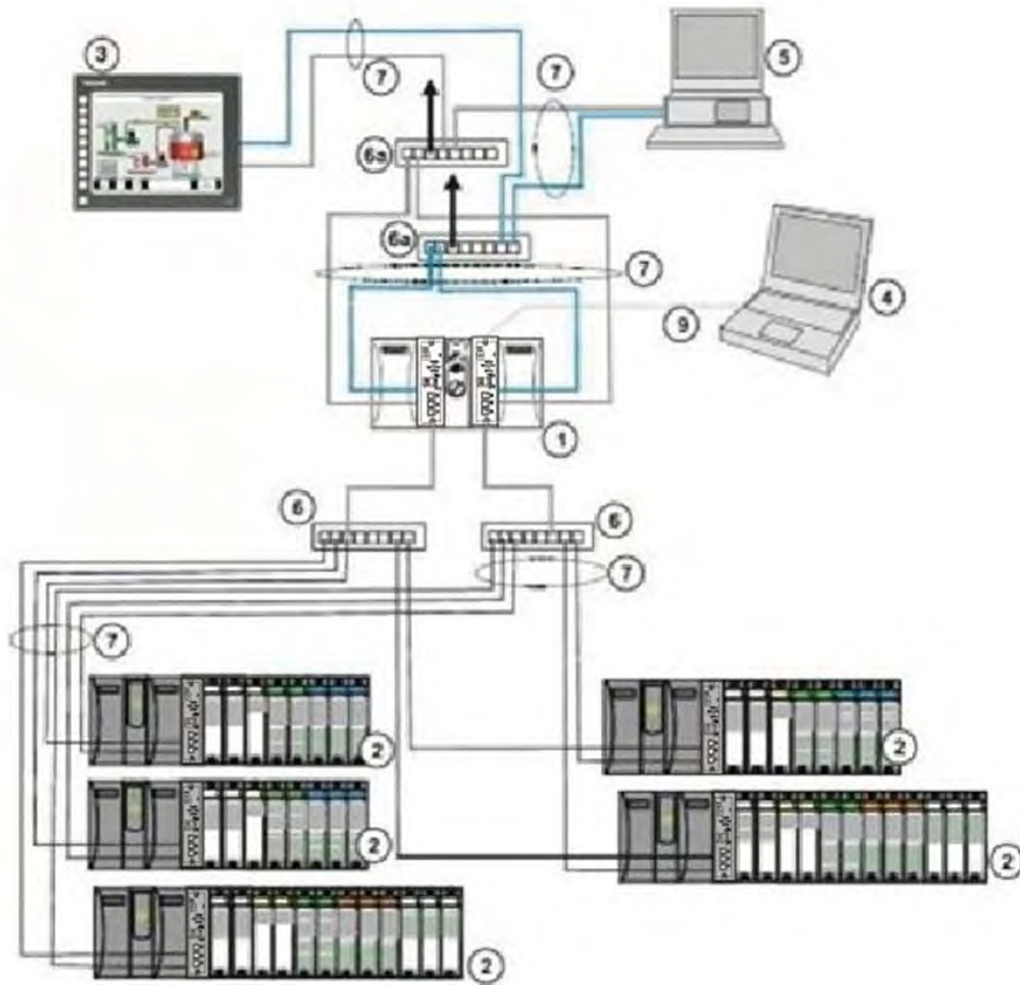
Figure 5 – Redundant Configuration with multiple I/O racks

CAUTION

The HC900-expansion I/O link is a private network and the switch used for the interconnection of the HC900 Processor and Scanners must not be connected to any other LAN or WAN. Likewise, no devices other than the HC900 components should be connected to the I/O link Switch. Failure to comply will cause communication failures on the I/O link causing I/O modules to go in and out of their failsafe settings.

Table 2 – Descriptions of Major Redundancy Components

Key No.	Component Name	Description	Source
1	Controller (Local) Rack	Includes: Rack, 2 Power Supplies, 2 C75 Controllers, 1 Redundancy Switch Module (RSM)	Honeywell
2	I/O Expansion Rack	Includes: 1 Scanner 2 module, 1 Power Supply, and up to 4, 8, or 12 I/O modules. Optional second Power Supply and Power Status Module (PSM) on 8- and 12-slot I/O racks.	Honeywell
3	Operator Interface	900 Control Station operator interface communicates via Ethernet or RS-485 serial link	Honeywell
4	PC Configuration Tool	• For legacy system- The PC configuration tool connects from the RS-232 serial port of the Controller Module to a serial port on the PC • For new system – The PC Configuration tool connects from the RS-485 port of the Controller Module using an external Honeywell qualified RS-485 to USB converter.	PC is from third-party supplier. Configuration software is from Honeywell.
5	HMI (Human-Machine Interface)	(Optional) PC link to Ethernet network, which may include other HMIs, other HC900 Controllers, and other networks (including Internet). Typically includes HMI operating software. May also include Designer Software (configuration tool and utility software).	PC is from third-party supplier. HMI software is available from Honeywell (PlantScape or SpecView32) or from third-party supplier.
6	Ethernet 100Base-T Switch	Required if using 2 or more I/O Expansion racks. Provides connection of the I/O Ethernet 100Base-T port on a Controller Module to the Scanner modules. Switch not required for connection to a single I/O rack.	Honeywell
6a	Ethernet 10/100Base-T Switch or Router	Enables inter-connection of several 10/100Base-T Ethernet devices in an Ethernet network. Devices include other HC900 Controllers, HMIs, and can also include routers, brouters, servers, and other devices in wider networks.	Honeywell or third-party suppliers.
7	Ethernet CAT5 shielded cable IO	Connects I/O expansion racks to controllers and/or to 10/100baseT Ethernet switches. It also connects to 900 Control Stations and PC SCADA software applications.	Third-party suppliers or Honeywell
	Fiber Optics Cable	Controller to remote rack distance up to 750m (2460 ft.) with one fiber cable. Distances up to 1500m (4920 ft.) are possible with a fiber switch used as a repeater at the midpoint.	
9	RS-232	For legacy system, Null modem cable, up to 50' (15.24m) (PC modem cable if used with Modems.)	Third-party suppliers or Honeywell
10	RS-485 to USB converter	Connects RS-485 port to USB port.	Third-party suppliers or Honeywell

Hardware Components

This section contains general descriptions of each of the major components of the HC900 system. For environmental specifications, refer to the section on Pre-Installation Planning.

HC900 Controller Rack

An HC900 Controller ("local rack") is shown in the following figure. As indicated in this figure, the Controller Rack includes:

1. Rack, available in 4- 8-, or 12-slot versions

2. Power Supply

3. Controller Module

4. Grounding bars (for I/O wiring; optional)

5. Input/Output modules.

6. I/O Terminal Blocks
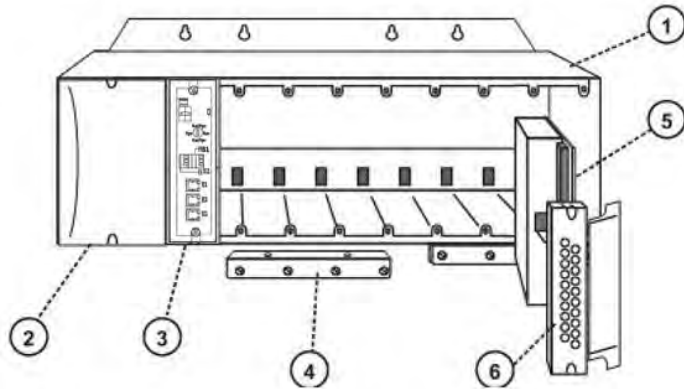
Figure 6 – Controller Rack Components

HC900 Redundant Controller Rack

A HC900 Redundant Controller is shown in Figure 7.

1. Rack

2. Redundancy Switch Module (RSM) . Interface between Lead/Reserve controllers.

3. Lead/Reserve controllers. Two C75 CPUs, designated "CPU-A" (left), "CPU-B" (right).

4. Two 900P02-0001 Power Supplies.
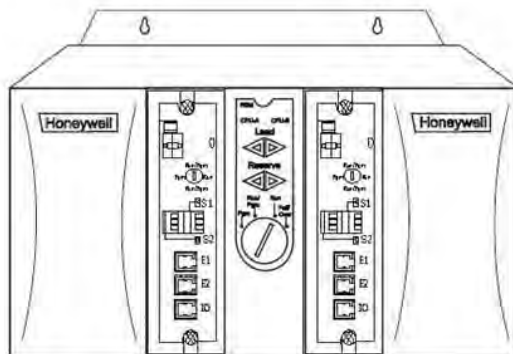
Figure 7 – Redundant Controller Rack Components

I/O Expansion Rack

I/O expansion ("remote") racks, shown in Figure 8, are available to accommodate additional input/output modules, and/or to enable location of I/O modules close to the process and remote from the controller. For C75, all I/O is in a rack or racks separate from the controller rack.

An I/O expansion rack includes:

1. Rack, available in 4- 8-, or 12-slot versions

2. Power Supply

3. Scanner 1 Module (C50 and C50S/C70 and C70S) (shown) or Scanner 2 Module (C75)

4. Grounding bars (for I/O wiring; optional)

5. Input/Output modules

6. I/O Terminal Blocks

7. Power Status Module (PSM)
   (req'd if using Reserve Power Supply)

8. Reserve Power Supply (optional). Available in
   8- or 12-slot racks.
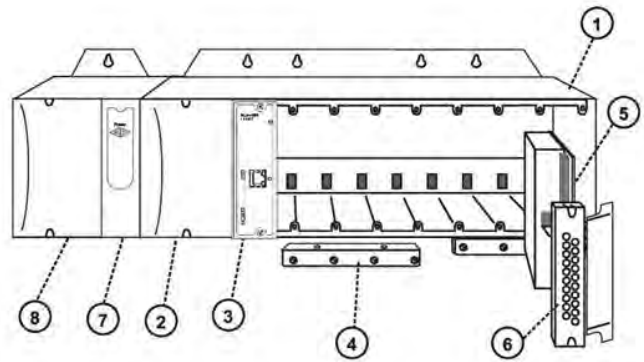
Figure 8 – I/O Expansion Rack Components

Rack Options

Racks are available in 4-slot, 8-slot, and 12-Slot versions. Racks are interchangeable between the Controller rack and an I/O expansion rack (C50, C70, C75 CPU only), and all three versions shown in the following figure are available for either purpose.

C75 only: I/O rack has Scanner 2 Module. 8 and 12 slot I/O racks can be modified with additional slots for optional Reserve Power Supply and Power Status Module.

Note: You can install redundant power on any I/O rack.
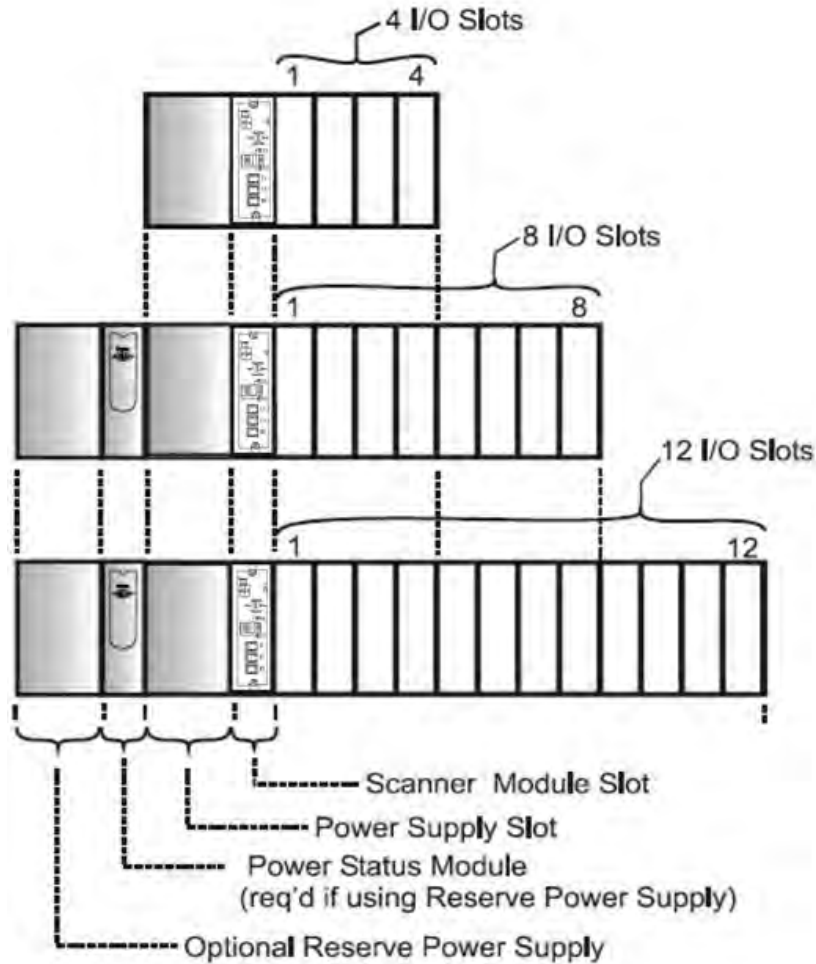
Figure 9 – Rack Options

Power Supply

The P01 Power Supply, shown in

Figure 10, provides 5 Vdc and 24 Vdc to the backplane connectors in the local and remote racks. Power Supply is used in each Controller Rack, I/O expansion racks and for all rack versions (4-slot, 8-slot, and 12-Slot).

The lower capacity P02 power supply is available for reduced I/O applications and for Redundant processor rack power.

P24 power supply provides 5VDC and 24VDC to satisfy the power requirements of a single controller with I/O, a Remote I/O rack or a Redundant C75 CPU. The 60 watt capacity requires minimal de-rating of the available HC900 I/O modules. A tool-secured door covers the voltage connections. An internal non-replaceable fuse limits supply current under certain fault conditions.

Each power supply includes an internal 5.0-amp fuse that is not field-replaceable. (An external fuse may be added by the user. See page 19)

Items shown with key numbers:

1. Voltage test points (P01model only)

2. AC Input terminal block

3. Wiring label

4. Grounding lug (Reference; lug is not part of Power Supply; it is staked to bottom of Rack.)
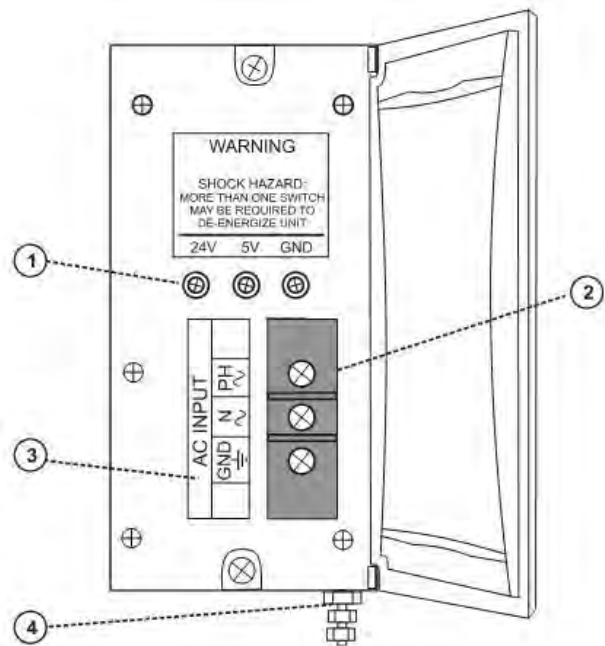
Figure 10 – Power Supply

Power Status Module (C75)

The Power Status Module (PSM) (Figure 11) sits between redundant power supplies on the I/O rack (see page20). It is a status module for both power supplies and indicates which are in use, PS-1 (left) or PS-2 (right) or both (typical).

When the status indicator for either or both of the power supplies is lit, it is reporting that the status of the associated power supply is good and that the outputs are within specified limits. When the status is off, either the power supply is off or the voltages are out of tolerance.
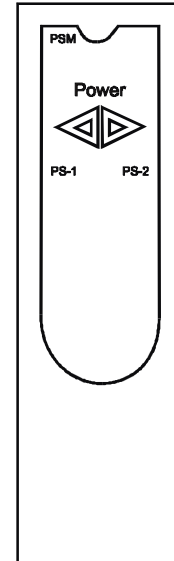
Figure 11 – Power Status Module (PSM)

Controller Module

C30 and C30S, C50 and C50S, C70 and C70S, C75 Controllers share the same features, with exceptions noted.

- CPU model number (C30 and C30S, C50 and C50S , C70 and C70S, C75).

- Lithium battery (beneath cover), which is readily accessible for field replacement.

- Mode switch (Pgm, Run/Pgm). Not present on C75; see RSM.

- Interfaces to PC

- For legacy systems, two serial ports, S1 and S2, each configurable as RS-232 or RS-485 interfaces to a PC.

- For new systems, two serial RS-485 ports, S1 and S2 interfaces to PC using RS-485 to USB cable. External modem or Modbus devices are interfaced using RS-485 to RS-232 converter. RS-485 interfaces to PC, Operator Interface or Modbus devices/host.

1. LED status indicators for communications functions.

2. Connection to I/O port of Scanner Module. C50 and C50S/C70 and C70S/C75 only.

3. Second Ethernet Host Connection to PC applications or peer HC900 controllers. C70/C75 only.

4. First Ethernet Host Connection to PC applications or peer HC900 controllers.

5. LED status/diagnostic indicator for serial port S2 (left).

6. LED status/diagnostic indicator for serial port S1 (right).

7. LED status/diagnostic indicator for controller module.
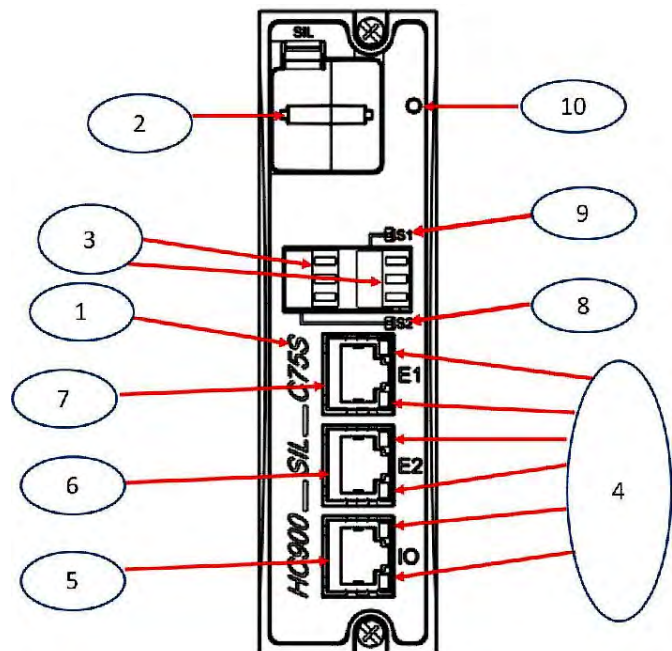
Figure 12 – Controller Module

Redundant controller rack contains two C75s. Left CPU is designated CPU-A, right CPU is CPU-B; either CPU can be Lead.

Redundancy Switch Module (C75 only)

The Redundancy Switch Module (RSM) is shown in Figure 13.
It sits between C75 controllers on rack. Left Controller is designated
 "CPU-A"; right Controller is "CPU-B." Features include:

1. Lead/Reserve controller status indicators.

2. Keyed switch for manual changes to controller modes or to facilitate a Manual Fail Over.
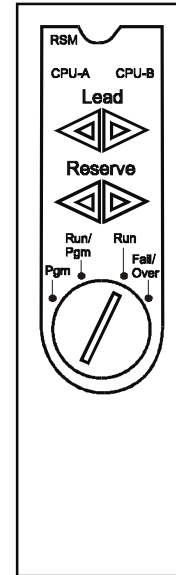
Figure 13 – Redundancy Switch Module

Scanner 1 Module (C50 and C50S/C70 and C70S only)

The Scanner 1 Module is shown in

Figure 14.

 It sits in the I/O rack and provides the link between the controller and remote I/O. Features at the front of the module include:

1. LED status indicator for scanner functions.

2. One private Ethernet 10Base-T Port; connects to the I/O expansion port on Controller Module (or to a port on a Switch that connects to the Controller Module)

3. LED status/diagnostic indicators for communications functions.
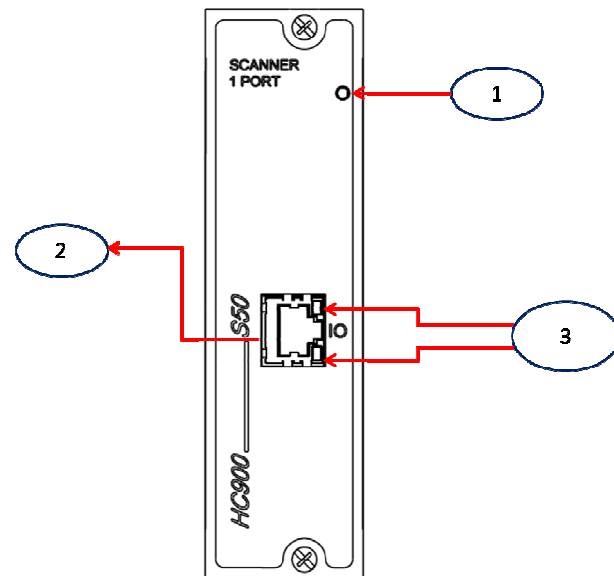
Figure 14 – Scanner 1 Module

Scanner 2 Port Module (C75 only)

The Scanner 2 Port Module is shown in Figure 15.

The dual ports provide redundancy through the 2 CPUs. Features at the front of the module include:

1. LED status/diagnostic indicator for scanner functions.

2. I/O port A. Private Ethernet 10Base-T Port. Connects directly to I/O port on CPU-A (or indirectly through a switch).

3. I/O port B. Private Ethernet 10Base-T Port. Connects directly to I/O port on CPU-B (or indirectly through a switch).

4. LED status/diagnostic indicators for communications functions
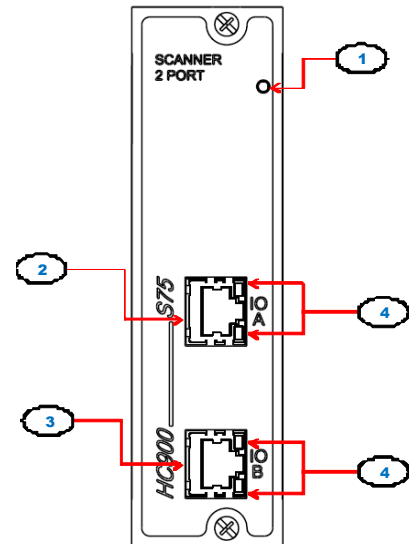
Figure 15 – Scanner 2 Module

Input/Output Modules

I/O module types:

- 16 point high level analog input module: each point is configurable for V or mA. Point-to-point isolation.

- 4 point isolated analog output module: Supports from 0 to 20mA each.

- 8 or 16 point analog output module: Supports from 0 to 20mA each. Isolated in groups of 4 channels.

- 16 point digital input modules: Contact closure type, DC voltage and AC voltage types.

- 32 point digital input module: DC voltage.

- 8 point AC or 16 point DC digital output modules (sinking type).

- 32 point digital output: DC voltage (sourcing type)

- 8 point relay output module: four form C type and four form A type relays.

- 8 point Universal Analog Input module

- 4 channel Pulse/Frequency/Quadrature I/O module
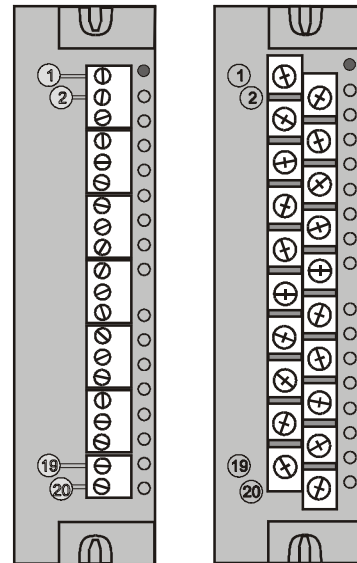
Figure 16 – I/O Module Terminal Blocks

Each I/O module includes a status indicator for the module. Digital Input and Digital Output modules also include a status indicator for each channel. Terminal blocks available include the Euro style (Figure 16 left) and the Barrier style (Figure 16 right).

For more information on I/O modules and associated terminal blocks, refer to the section in this manual on Input/Output Installation and Wiring.

Personal Computer

A Personal Computer is required for creating the control and data acquisition strategy (configuration file) that runs in the controller, using the Designer Software configuration software. The PC can also be used to download/upload configuration files to/from the controller, and can be used to download program updates to firmware in the Controller Module and/or Scanner Modules.

- A PC can be connected to the controller via the RS-232 port for legacy system.

- For the new system, a PC can be connected to the controller via the RS-485 TO USB cable connected to RS485 Port , which can be connected to external Honeywell qualified RS485 to USB converter, and can also be networked to the controller via the Ethernet 10/100Base-T Open Connectivity Network port.

Redundant controllers: PC communicates with Lead Controller only.

NOTE: For specific PC requirements and for specific software requirements, refer to the Designer Software Users Manual.

RS-232 Modem Devices

The PC configuration tool connects from the RS-232 serial port of the Controller Module to a serial port on the PC

For new system, the PC Configuration tool connects to the RS-485 port on the Controller Module using an external Honeywell Qualified RS-485 to USB converter..

The PC can be located remote from the Controller by using Modems and telephone links. Modems and suitable cabling are available from third-party vendors.

Redundant controllers: PC communicates with Lead controller only.
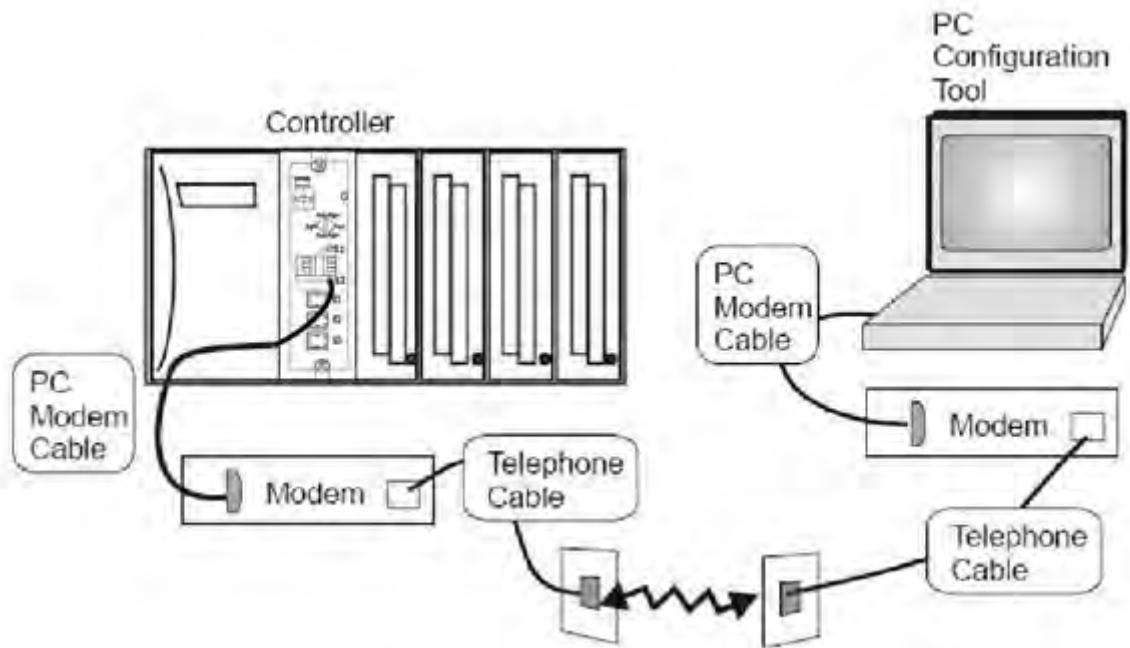
Figure 17 – RS-232 Modem Devices

Ethernet Devices/Considerations

Ethernet device requirements vary with specific applications. Regarding intended use, however, they fall into two categories:

•   **CAUTION**   The HC900-expansion I/O link is a private network and the switch used for the interconnection of the HC900 Processor and Scanners must not be connected to any other LAN or WAN. Likewise, no devices other than the HC900 components should be connected to the I/O link Switch. Failure to comply will cause communication failures on the I/O link causing I/O modules to go in and out of their failsafe settings.

• Components of the Ethernet Open Connectivity Network, which links an HC900 Process Controller to Peers, to HMI Supervisory Stations, and to other Ethernet 10/100Base-T devices that support TCP/IP. The Ethernet Open connectivity Network is potentially more complex than the I/O expansion network, and in some cases, may require the services of an IT networking professional.

I/O Network

I/O Expansion Network (C50 and C50S/C70 and C70S CPU only)

Examples of HC900 Controller I/O expansion configurations are shown in Figure 18.
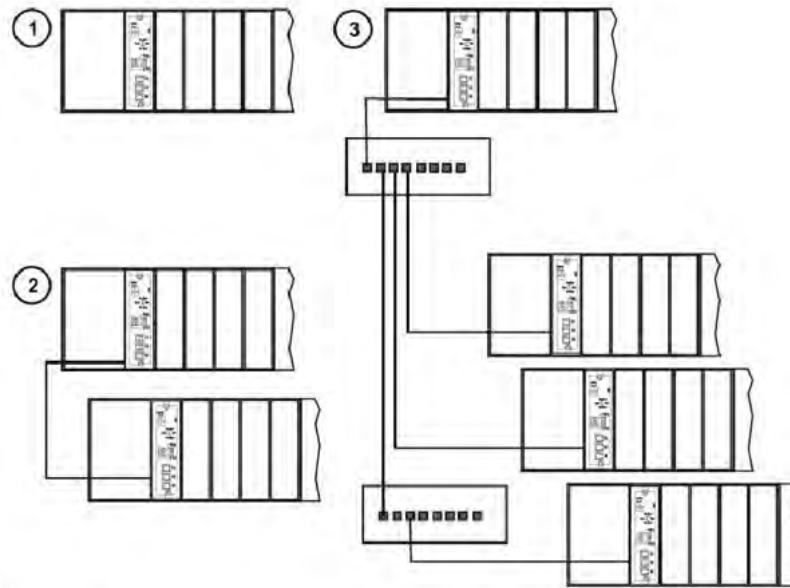
Figure 18 – HC900 Controller Configurations

In any of the racks shown in each controller configuration can be 4-, 8-, or 12-slot versions.

The Ethernet cables for the I/O expansion links are standard shielded Cat 5 IO cables, with standard RJ45 connectors. Each cable segment can be up to 100 meters (328 feet) long.

You can also use fiber optic cable for connections between the controller and a remote rack. Distances up to 750m (2460 ft.) are possible with one fiber cable. Distances up to 1500m (4920 ft.) are possible with a fiber switch used as a repeater at the midpoint. (See page 204)

Configuration **1** is the C50/C70 CPU with I/O but no I/O expansion racks.

Configuration **2** shows the C50/C70 CPU with 1 I/O expansion rack. The Ethernet cable connects directly between the 10Base-T connectors on the C50 CPU Controller Module and the Scanner Module.

ATTENTION:

For 2 or more I/O expansion racks a switch is required. Use only Honeywell recommended switches (part no. 50008930-001). The total number of switches is limited to 2 in series between a CPU and its scanners.

Configuration **3** shows the C50/C70 CPU with 3 I/O expansion racks. Since there are at least 2 I/O expansion racks a switch is required. When an Ethernet switch is used to connect to expansion I/O, a cable goes between the I/O port on the controller to the switch. Two cables go from the switch to 2 scanners. A third cable goes from the switch to a second switch, which connects to a third remote scanner.

I/O implementation requirements include:

Constructing a configuration file, and loading it into the Controller Module. This file includes I/O numbering assignments for each I/O Function Block regarding Rack Number, Module Number ("slot" number, or position in the rack, starting from the left), and Channel Number.

- Physically assigning Rack Numbers, by positioning jumpers or DIP switches in the Scanner Module for each rack.

- Placing the appropriate module type in each slot in each rack.

The I/O expansion network uses Honeywell private protocol that optimizes I/O performance and security.

The configuration and operation of the I/O expansion network is automatic, it is entirely under control of built-in private software that resides in the Controller Module and in each Scanner Module included in the HC900 system. The controller examines the control strategy stored in its memory, verifies that the physical configuration (Rack Numbers, and I/O Module type- by Module Number) matches the stored control strategy, and establishes communication with each of the I/O modules in each of the I/O racks.

I/O Expansion Network (C75)

I/O for redundant controllers is the same as I/O Expansion Network page 28, with the following exceptions/notes.

- In Figure 18, any of the racks shown in each controller configuration can be 4-, 8- or 12-slot versions. Redundant I/O power not available with 4-slot.

- I/O ports are 100 Base-T instead of 10Base-T.

- Maximum of 2 switches between *each* CPU (CPU A and CPU B) and the I/O racks.

Ethernet Open Connectivity Network

The configuration of the Ethernet Open Connectivity Network varies with specific applications in purpose and in complexity. In some applications, configuration is straightforward and within the capabilities of experienced installation technicians. In other applications (for example, those that include inter-connection to other networks such as Intranet and Internet), a working knowledge of networking is required.

The Ethernet Open Connectivity Network for a given HC900 Controller enables:

- Redundant Networks.

- Peer-to-peer communication

- Connection to other PC hosts

- Inter-connection to other networks (such as for sending Alarm/Event messages via e-mail.)

CAUTION

Communications lockout is possible in high network traffic conditions.

Extraneous traffic is possible when sharing bandwidth with other devices. We recommend putting the controller on a private network segment. **Failure to do so could, in high traffic cases, result in communications lockout requiring the controller to be power-cycled.**

Redundant Networks

Honeywell OPC Server supports redundant networks. Up to 10 connections may be distributed in any combination across the controller's 2 network ports (E1 and E2). PC hosts may include, for example, HMI supervisory software and/or Designer Software configuration software. Redundant ports may be used in a simplex mode (non-redundant).

Peer-to-Peer Communication

Peer-to-peer communication enables any given HC900 Controller to request a peer relationship with up to 32 other HC900 Controllers; other controllers can request a peer relationship with the controller. The total number of peers that a controller can have a relationship with is 32. Peer-to-peer communication uses the Ethernet Open Connectivity network and employs standard User Datagram Protocol (UDP) for fast and efficient transfer of information. Peer-to-peer communication is based on fail-safe and data expiration mechanisms that provide for fault and loading considerations without requiring reserved network bandwidth allocation. Peer-to-peer is designed to be easy to configure as part of a device's standard configuration and does not require the distribution of a global database.

With redundant controllers, peer-to-peer communication always stays with the Lead controller.

Implementing peer-to-peer communications involves:

- Interconnecting controllers with Ethernet media and networking devices (cables, switches, etc)

- Configuration (via Designer Software):

    – Controller configuration, which includes entry of an IP address and a Subnet Mask, and a Controller Name for each controller. (The Controller Name is used only by the Honeywell proprietary software for network access between controllers; it should not be confused with a Network Domain Name or Workgroup Name.)

    – Peer Data Exchange (PDE) function blocks, which are included in the control strategy (configuration file). PDE function blocks include PDE Control, PDE Write, and PDE Read. (Refer to the HC900 Process Controller Function Block User Guide for additional information.)

An illustration of HC900 Controller Peer-to-Peer on a Local Area Network (LAN) is given in Figure 19. Typically, a Router is used for interconnection to another network (LAN, WAN, or other).
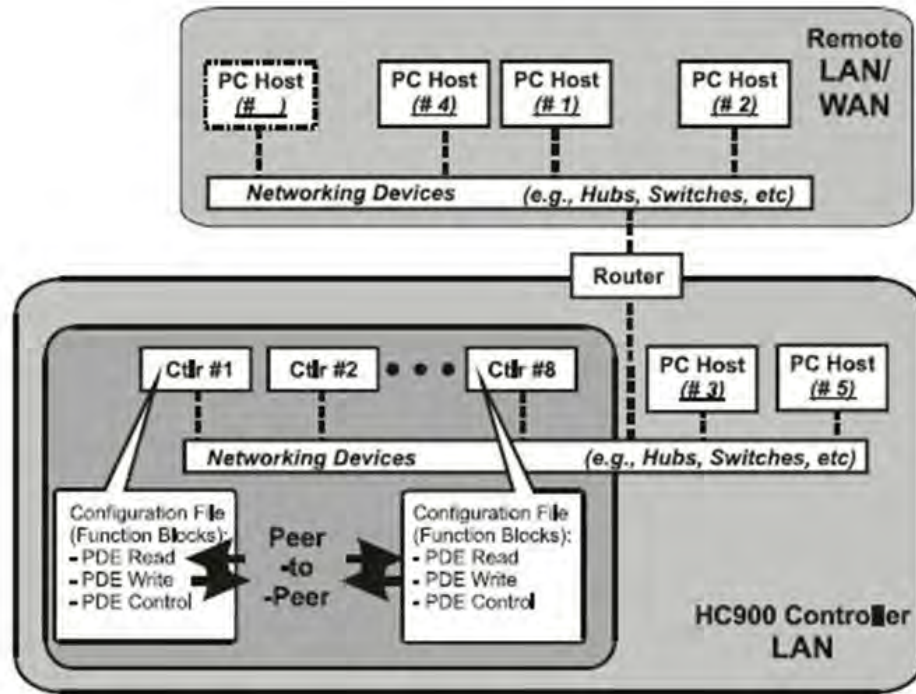
Figure 19 – Modular Network Structure

Connection to PC Hosts

For legacy systems, connection to PC hosts (for example, PCs that include HMI supervisory software and/or Designer Software configuration software) can be via Modbus/TCP as well as serial Modbus RTU over either the RS-485 or RS-232 communications ports. Both ports support Modbus RTU and are configurable as master or slave.

For new systems, connection to PC hosts can be via Modbus/TCP as well as serial Modbus RTU over the RS-485 communication ports.

The 5 TCP hosts can be concurrent with Modbus hosts on one or both of the other ports. Any given controller is capable of concurrent communication with up to five PC hosts. (The meaning of the term "host" varies, but for this definition, a PC host is any PC that is on the same LAN as the controller, or on any LAN or WAN (Wide Area Network) that is network-connected to the controller.

Each HC900 Controller has five "sockets" (software and memory resources), each of which can service data requests from any networked PC on a client (host)/server (controller) basis. C75 has 10 sockets. The sockets are available on a first-come, first-served basis. Typically, when the data service for any PC Host request is completed or times out, it allows the socket to become available to any other PC Host in the hierarchy of networks.

Note: PDE communications, discussed previously, do not use the PC host connection sockets. PDE communications are separate from (and are transmitted concurrent with) PC host-to-controller communications.

The PC host can include software that closely relates to and supports controller functioning and can also include other software that is related remotely or not at all. Closely related software can include:

Either

Designer Software – for generating and managing configuration files,

Or

HMI (Supervisory/Data Acquisition Software) or Operator Panel with Modbus/TCP driver

Or

Both configuration and HMI software (and or panel)

All communications between a controller and a PC host use Open Modbus/TCP protocol, whose widespread use is making it an industry standard. Modbus/TCP is basically an adaptation of the Modbus messaging structure that uses TCP/IP for a message carrier. In general, Modbus messaging is available in two versions: ASCII, in which each eight-bit byte is sent as 2 ASCII characters, and RTU, in which each byte is sent as two four-bit hexadecimal characters. Each Modbus message frame is embedded into a TCP/IP datagram as indicated in Figure 20.
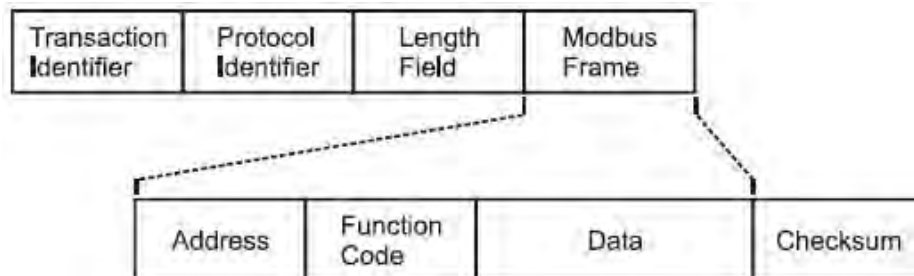
Figure 20 – Modbus/TCP Framing

The HC900 Controller uses either Modbus/TCP or Modbus RTU, not ASCII. The Modbus mapping structure for the HC900 Controller is based on the mapping structure employed in Honeywell's UMC800 Controller, and the function codes and methods for parameter access are also virtually identical.

Modbus Maps

In your controller's configuration certain parameters are each automatically assigned a Modbus address. These include certain types of function blocks (such as loops and set point programmers), signals and variables, among other items. Through their addresses these parameters can be accessed or displayed remotely, such as by a third-party operator interface. Collectively, these Modbus addresses and parameters are known as the Modbus map.

Two Modbus Mapping options exist: Fixed map and Custom map

Using HC Designer, you can use a pre-defined **fixed map** where common parameters are mapped out automatically at fixed addresses, or you can configure a **custom map** for configurations rev. 4.0 or higher.

Function blocks added to the controller in release 4.0 and higher are not automatically included in the Fixed Modbus Map. To access the registers of these function blocks, the Custom Modbus Map must be used and the block data manually inserted into the custom Modbus map.

HMI Supervisory/SCADA software is available from various suppliers, and functionality and setup requirements vary with suppliers and with specific products. In all cases, the software selected must be compatible with Open Modbus/TCP protocol.

The user can use the standard Modbus command set to generate a custom set of drivers for his specific application, or may purchase additional software (for example, OPC with Modbus /TCP protocol) to reduce or virtually eliminate development tasks.

HMI software

HMI software available for use with the HC900 Controller includes, but is not necessarily limited to the following packages.

- *available from Honeywell*

    – Plantscape Vista Software, which operates under Windows 2000/XP Pro operating software, provides PC-based supervisory control and data acquisition. This package includes a large selection of standard operating display templates, which can reduce development time significantly. PlantScape includes a full graphic display development environment, enabling development of custom graphics that include animated responses to changing process conditions. A batch reporting option is available in release 400, which includes a standard template for creating batch reports.

    – SpecView32 (SpecView Corporation)

    – OPC Server (works with redundant and non-redundant networks)

- *Other software (available from third-party sources)*
  The following software, which incorporates Modbus/TCP connectivity, is available from third-party sources:

    – The Fix Family (Intellution Incorporated)

    – Wonderware (Wonderware Corporation)

    – Citect (CI Technologies)

    – OPC server/client software (various; available from Kepware and others)

Note: The items in this list are not sold by Honeywell. They have not all been tested and certified by Honeywell, and are not necessarily recommended or endorsed by Honeywell for any specific use.

Inter-Connection to Other Networks

In many cases, an HC900 Controller application will include a single, free-standing controller that involves no connections via the Ethernet Open Connectivity network. In other cases, the HC900 Controller will be a member of a Local Area Network (LAN) as indicated in Figure 19. The HC900 controller LAN may be very simple, or it may include many devices in a complex and very sophisticated structure. In any case, it must always be regarded as a single, modular entity that can be protected from intrusion by any other networking device to which this LAN is connected.

Various types of networking devices that enable selective connection to other networks are available. A "Router" is commonly used for this purpose.

Routers can examine and "filter" message packets, permitting passage of wanted messages and denying passage of all others.

The feature that gives the Router its name is it enables translation of IP addresses, which enables networks with dissimilar network IP addresses to communicate as though they were members of the same network. This feature is particularly useful when an HC900 Controller LAN is installed under "local addressing rules". That is, IP addressing can be assigned without approval of or conflict with world Internet governing bodies. A default IP address is provided in each C30 and C50 CPU: 192.168.1.254. Later, when connecting to networks with more stringent addressing requirements, it is necessary only to configure the Router with address mapping and connect it between the existing LAN and the other existing network.

Connections to other networks vary in purposes and methods; some of these are described below.

E-Mail Communications

The HC900 Controller includes e-mail software that enables communication of Alarms and Events to up to three Internet addresses. Implementing this feature consists of:

- Using the Designer Software to configure:

    - Alarm Groups and Event Groups

    - Assignment of specific alarms to priority and e-mail enabling

    - E-Mail address lists

    - SMTP mail server IP address

    - Default gateway must be configured in order to send e-mail. With redundant controllers, two default gateways need to be configured; one for each of the redundant networks (assuming both are being used). This will typically be the LAN side IP address of the routers used to connect the controller to the external network.

- Installing and configuring hardware
  Note: This data is included for reference. The following items should be implemented by qualified IT/MIS personnel.

    - Install and configure a Router to provide isolation and security. (Figure 21) (This should be part of standard network installation.)

    - Install and configure internet access to Simple Mail Transport Protocol (SMTP) server. This may include the location of an existing server on an existing network.

Note: Consult your service provider for availability of access to network, local cable, or DSL in your area.
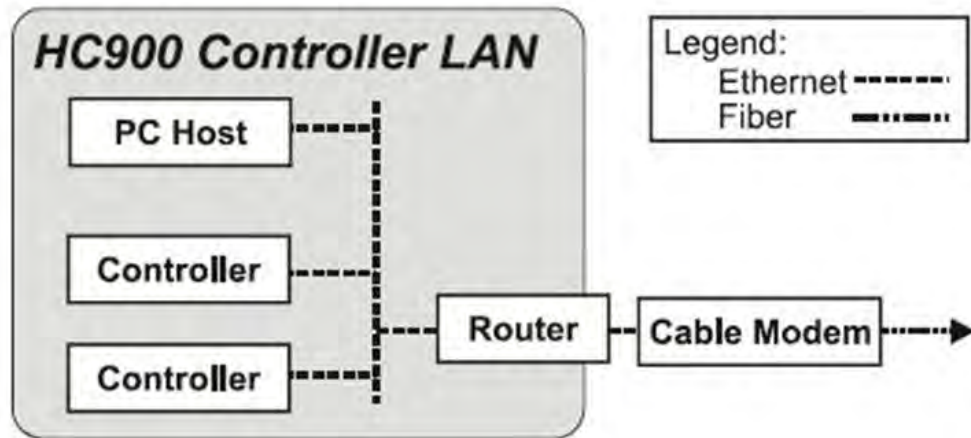
Figure 21 – Typical installation using a Cable Modem

Serial Ports (RS-232 and RS-485 for legacy systems and two RS-485 ports for new systems)

Overview
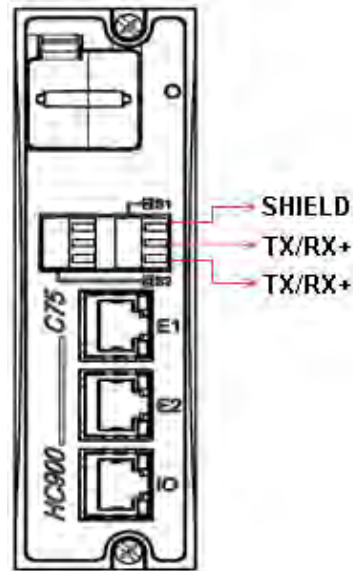
Figure 22 – Controller Serial Ports

- S1 default setting is RS-232; S2 default setting is RS-485. Each port can be set to RS-232 or RS-485 (see page 36). *For RS-232 cable connections see page 124. For RS-485 connections see page 142.*

- For new systems, either of two ports S1 and S2 can be configured as RS-485.

- Ports configurable as ELN (default) or Modbus RTU.

- Controller can act as Modbus master or slave through either port.

- Controller can be slave to masters such as

  – Honeywell Operator Interface (1040, 559). Must be on RS-485 port S2. Will not work on port S1 even if set to RS-485. Will not work on port S1.

  – Honeywell HC Designer PC software

  – Third party PC HMI software

  – Third party Operator Interface

- Controller can master to slaves such as

  – Any Honeywell Modbus device (e.g., recorders, controllers, flame safety)

  – Any non-Honeywell Modbus device.

- Only one master port at a time; can't have RS-232 and RS-485 both as master ports.

- Modbus master ports default to slave ports, ELN protocol when CPUs are in Program mode.

- Baud rates to 57,600

Setting serial ports S1 and S2 to RS-232 or RS-485

For legacy systems, S1serial port default setting is RS-232; S2 serial port default setting is RS-485. Each port can be set to RS-232 or RS-485.

For new systems, the serial ports S1 and S2 are RS-485 unterminated.

Functionality is determined by DIP switch setting on, see the following figure. To change either port's setting, use the switch settings in Table 3. Use a small slotted screwdriver or paperclip to gently move the DIP switches. If you push too hard you could damage the switches or nearby circuitry. Avoid using pencils because the point could break and cause damage.

Table 3 – Serial port DIP switch settings
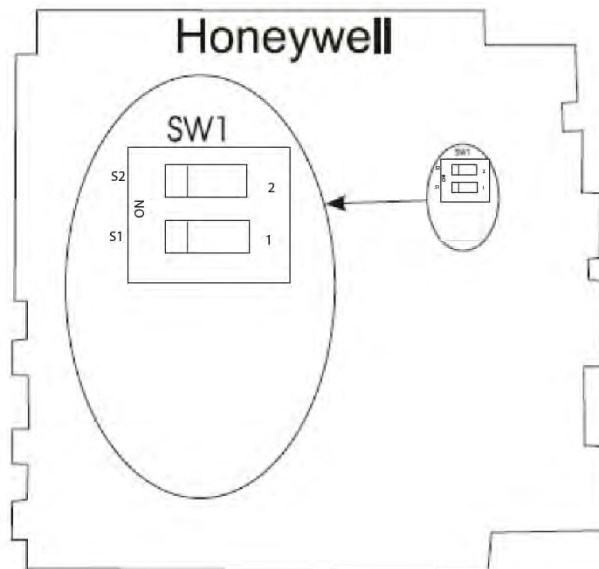
Figure 23 – Serial Ports DIP Switch default settings

Pre-Installation Planning

Overview

Methodical pre-planning of an installation will preclude false starts and errors that can cause costly hardware re-configuration and/or poor system performance. Factors to consider in your pre-installation planning include:

- C75 CPUs require the 900P02 Power Status Module

- I/O Rack can use AC Power Supply 900P01, 900P02 (see page 38) or +24DC Power Supply 900P24 (see page 39).

- Limit of 10 Analog Output modules per rack. Limit of 4 PFQ.

- Power Supply rack space (if using redundant I/O power) (see page 40)

- Rack orientation and mounting (see page 39)

- Remote Terminal Panels (see page 41)

- Environmental conditions (see page 42)

- Heat rise de-rating (see page 43)

- Cabling/wiring distance planning (see page 45)

- Electrical considerations: controller grounding, CE conformity, grouping wires, master control relay for emergency shutdown (see page 47)

- System monitor function blocks (see page 54)

AC Power Supply Selection for racks with I/O

To determine which I/O rack AC power supply to use (P01 or P02), calculate power requirements below.

 ATTENTION

Using inadequate power supply will cause the controller to cycle power on and off.

Module type	A *Enter Quantity*	B Max Current @ 5 V	C Max Current @ 24 V	D *Calculate 5V current (D = A * B)*	E *Calculate 24V current (E = A * C)*
Controller (C30 and C30S)	( )	820 mA	0 mA	( )	(0)
Controller (C50 and C50S)	( )	930 mA	0 mA	( )	(0)
Controller (C70 and C70S)	( )	1150 mA	0 mA	( )	(0)
Controller (C75)	( )	1500 mA	0 mA	( )	(0)
Scanner 1 Port	( )	670 mA	0 mA	( )	(0)
Scanner 2 Port	( )	770 mA	0 mA	( )	(0)
Power Status Module (PSM)	( )	22 mA	0 mA	( )	(0)
Analog Input (8 pts)	( )	40 mA	25 mA	( )	( )
Analog Input (16 pts)	( )	75 mA	50 mA	( )	( )
Analog Output (4 pts)*	( )	40 mA	200 mA	( )	( )
Analog Output (8 pts)	( )	225 mA	350 mA	( )	( )
Analog Output (16 pts)	( )	350 mA	700 mA	( )	( )
AC Digital Input (16 pts)	( )	130 mA	0 mA	( )	(0)
DC Digital Input (16 pts)	( )	130 mA	0 mA	( )	(0)
AC/DC Digital Input (16 pts)	( )	130 mA	0 mA	( )	(0)
Contact Input (16 pts)	( )	130 mA	40 mA	( )	( )
DC Digital Input (32 pts)	( )	215 mA	0 mA	( )	(0)
AC Digital Output (8 pts)	( )	220 mA	0 mA	( )	(0)
DC Digital Output (16 pts)	( )	340 mA	0 mA	( )	(0)
DC Digital Output (32 pts)	( )	235 mA	0 mA	( )	(0)
Relay Output (8 pts)	( )	110 mA	100 mA	( )	( )
Pulse/Frequency/Quadrature**	( )	110 mA	250 mA	( )	( )
*Limit 10 Analog Output modules per I/O rack. ** Limit 4 PFQ modules per I/O rack.				*Total mA @ 5V =* ( )	*Total mA @ 24V=* ( )

Complete columns A, D and E above.
1. Is column D total mA @ 5V less than 2000mA?　　　　Yes/No
2. Is column E total mA @ 24V less than 900mA?　　　　Yes/No
3. If the answers to 1 **and** 2 are YES, go to 4. If the answer to 1 **or** 2 is NO, use power supply 900P01-0001.
4. Multiply *Total* mA @ 5V total by 5.1　　　　　　　　　　　　( )
5. Multiply *Total* mA @ 24V total by 24.5　　　　　　　　　( )
6. Sum results of 4 and 5.　　　　　　　　　( )
7. Divide results of 6 by 1000　　　　　　　( )
8. Is the result of 7 less than 28?　　　　　　Yes/No
9. If the answer to 8 is Yes, use power supply 900P02-0001
10. If the answer to 8 is No, use power supply 900P01-0001

DC Power Supply

The P24 DC power supply is for use with +24V input power applications. The wattage rating is the same as the P01.

Rack Orientation and Mounting

Racks must be mounted as indicated in illustrations throughout this manual, so as to provide for vertical airflow through the racks. That is, racks must never be mounted vertically, and must never be mounted with the backplane horizontal (for example, flat on a horizontal panel or tabletop). Environmental specifications apply only to the normal mounting configuration.

Rack dimensions, including overall dimensions and patterns for drilling holes for mounting, are given in Figure 24 and Figure 25. Vertical spacing of racks, which is required for rack ventilation and for routing wires, is shown in Figure 26.
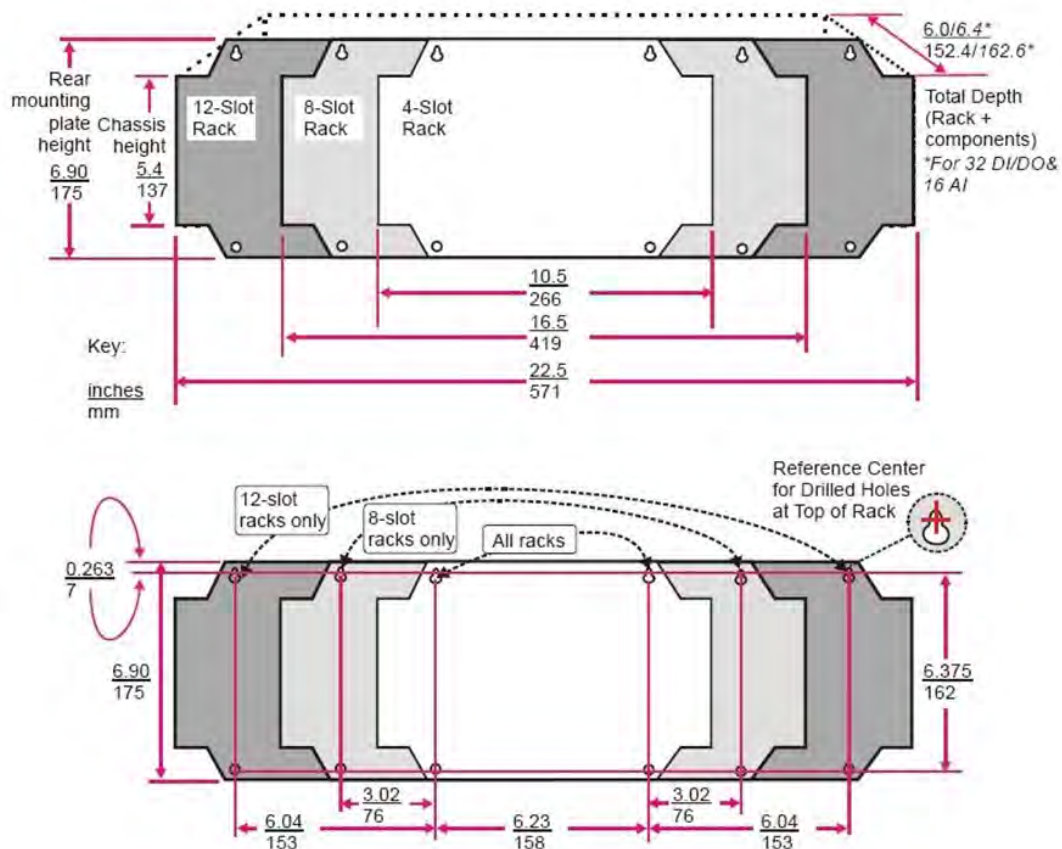
Figure 24 – Rack Dimensions (C30 and C50)
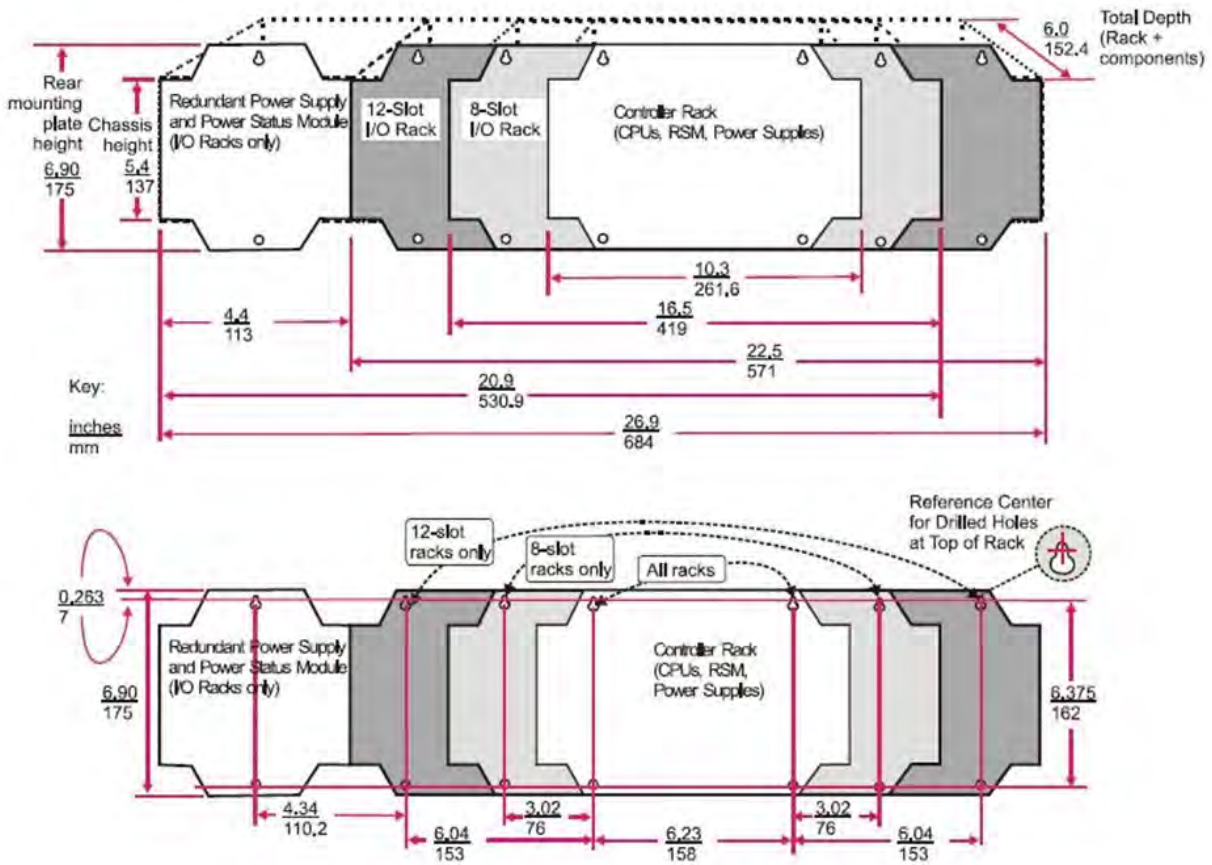
Figure 25 – Rack Dimensions with reserve power supply
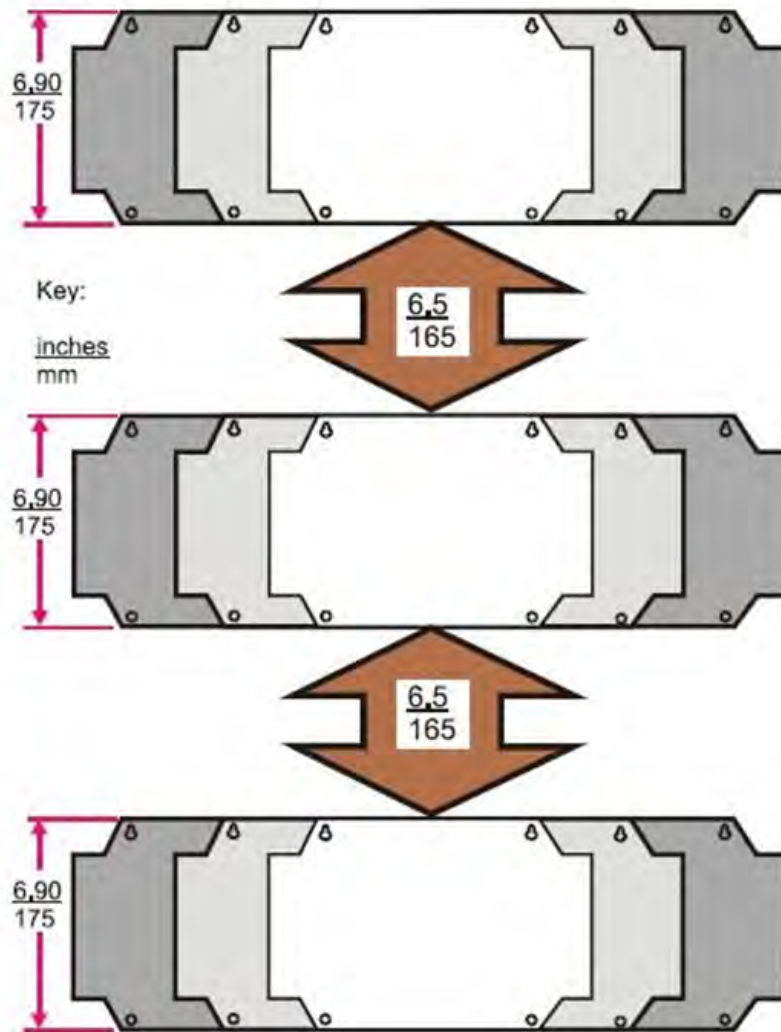
Figure 26 – Vertical Spacing of Racks (all models)

Remote Termination Panels

If your controller will be mounted in a separate panel with intermediate terminations between field wiring and controller wiring, consider using RTPs to replace the intermediate terminations. Pre-wired cable assemblies for the RTPs eliminate the need for separate wiring terminations between the controller and the intermediate terminal boards. For details see page 207.

Environment

The HC900 Controller must be mounted in suitable equipment enclosures. That is, all components such as the Controller rack, I/O Racks, and the Operator Interface manufactured by Honeywell must be mounted in approved furniture designed for industrial applications.

Consideration should be given to the installation so that the potential for the build-up of static electricity is minimized or eliminated.

See Environmental Conditions and Approvals on page 199.

Heat Rise De-rating

The HC900 is rated to operate at 60°C. However, for maximum reliability, the following guidelines should be observed for applications above 52°C.

1. Locate lower-power modules (Analog Input, Contact Input, etc) beside the Controller/Scanner Module, and keep higher-power modules (AC Output, AC Input, etc) away from it. For power consumption of each module, see Table 4.

2. For 240 Vac applications and temperatures above 56°C, or 264Vac, 52°C, de-rate the number of ON inputs per AC input module. (See AC Input de-rating data, see Figure 27.)

3. Limit the number of Analog Output modules to a maximum of 10 per rack. (see Figure 28)

Table 4 – Power Applied, by Module Type

Module	HC900 Hardware Power (Watts)	Field Power (Watts)	Total Power (Watts)
Controller C30 and C30S	4.2	0.0	4.2
Controller C50 and C50S	4.7	0.0	4.7
Controller C70 and C70S	5.9	0.0	5.9
Controller C75	7.7	0.0	7.7
Redundancy switch module (RSM)	0.1	0.0	0.1
Power Status Module (PSM)	0.1	0.0	0.1
Scanner 1 Port	3.4	0.0	3.4
Scanner 2 Port	3.9	0.0	3.9
Analog Input (Universal)	0.8	0.0	0.8
Analog Input (High level)	1.6	0.0	1.6
Analog Output (4 points)	5.1	0.0	5.1
Analog Output (8 pts. internal 24V)	9.4	0.0	9.4
Analog Output (8 pts. external 24V)	1.1	8.3	9.4
Analog Output (16 pts. internal 24V)	18.3	0.0	18.3
Analog Output (16 pts. external 24V)	1.7	16.6	18.3
Contact Input	1.6	0.0	1.6
Relay Output	3.0	0.0	3.0
16 pt DC In (@ 24V)	0.7	2.6	3.3
16 pt DC In (@ 32V)	0.7	5.1	5.7
32 pt DC In (@ 24V)	1.1	3.1	4.2
32 pt DC In (@ 32V)	1.1	5.1	6.2
16 pt DC Out	1.7	1.2	2.9
32 pt DC Out	1.2	1.8	3.0
AC In (@120V)	0.7	1.9	2.6
AC In (@240V)	0.7	7.7	8.3
AC/DC In	0.7	7.7	8.3
AC Out	1.1	12.0	13.1
PFQ	6.7	0.1	6.8
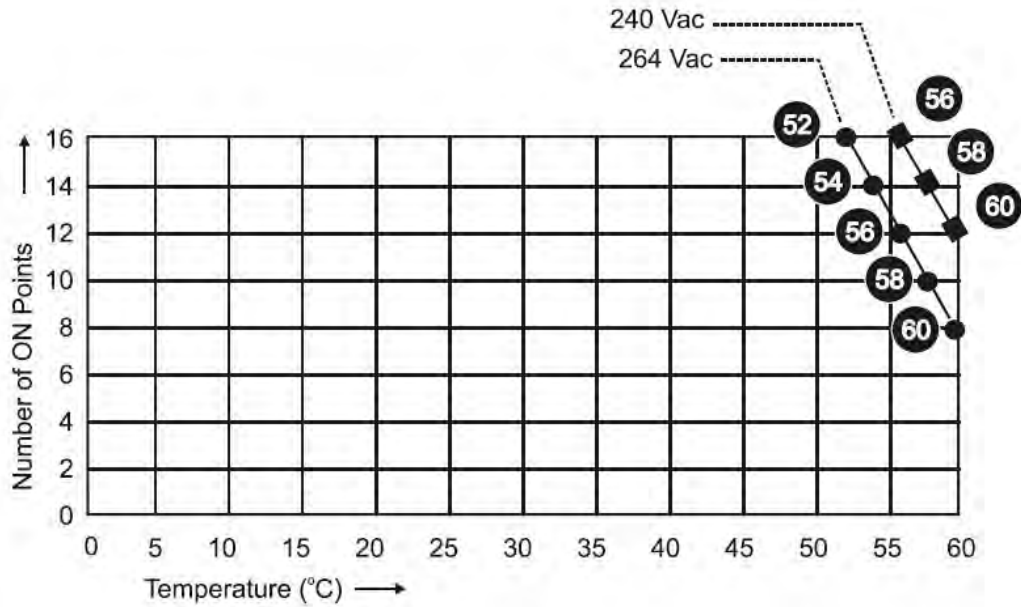
Figure 27 – AC Input Module de-Rating
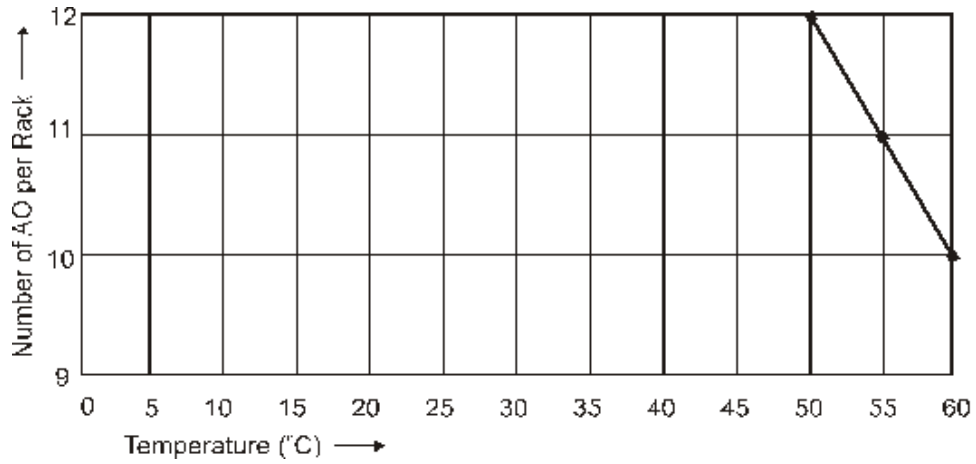
Figure 28 – Power Supply de-Rating

Cable/Wiring Distance Planning

For all installations observe the following guidelines.

- Maximum length of RS-232 cabling (Controller to PC) is 50 feet (15.2 meters).

- Maximum length of RS-485 cabling (Controller to Operator Interface) is 2000 feet (609.6 meters).

- For Ethernet connections, cable length must be less than 100m. For greater than 100m a switch is required. The use of Ethernet cables in excess of 100 meters and/or devices other than recommended Switches will cause transmission delays that could have adverse affects on Controller performance.

- You can also use fiber optic cable for connections between the controller and a remote rack. Distances up to 750m (2460 ft.) can be accomplished with one fiber cable. Distances up to 1500m (4920 ft.) are possible with a fiber switch used as a repeater at the midpoint. (See page 204)

- With redundant CPUs, when using 2 or more I/O racks an Ethernet switch is required between *each* CPU and the I/O racks. Use Honeywell-approved switches only. (see page 204)

- Maximum of 2 switches between *each* CPU's I/O port and all I/O racks.

- Cable lengths specified in this manual are absolute. When planning for routing of cables and wires, be certain to include vertical and horizontal routing within cabinets, raceways, and conduits.

- It is advantageous to minimize length of I/O wiring. However, it is also a good idea to locate racks (and wiring) away from adverse environmental conditions such as sources of RFI, EMI, and away from areas with high levels of moisture, dust, and corrosive materials.

How to make Ethernet cables

Ethernet cable (shielded cable IO Cat 5) contains 4 twisted pairs of wires and a drain wire. Each pair consists of a solid color wire and a color wire with a white stripe.

1. Hold the cable ends and RJ45 connectors side by side as shown:
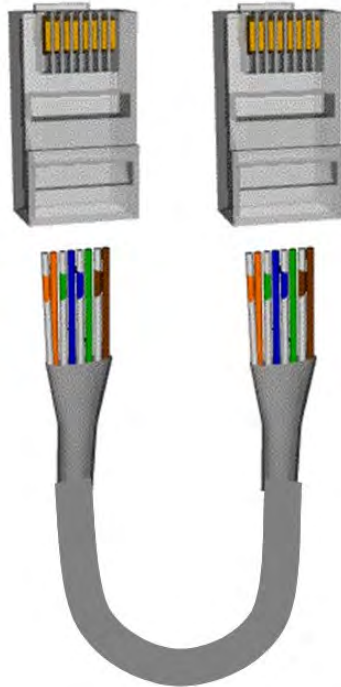
2. For straight through cable, arrange wires as shown in the following table. Wires go "straight through", no crossovers.

Straight-through cable assembly		
Cable left end **Left to right** **Wire color/pin number**	**10Base-T / 100Base-T** **Signal Description**	**Cable right end** **Left to right** **Wire color/pin number**
white/orange/1	Tx +	white/orange/1
Orange/2	Tx -	Orange/2
white/green/3	Rx +	white/green/3
Blue/4	Unused	Blue/4
white/blue/5	Unused	white/blue/5
Green/6	Rx -	Green/6
white/brown/7	Unused	white/brown/7
Brown/8	Unused	Brown/8

3. For crossover cable, arrange wires as shown in the following table. (TX and RX pairs are crossed.)

Crossover cable assembly		
Cable left end Left to right Wire color/pin number	10Base-T / 100Base-T Signal Description	Cable right end Left to right Wire color/pin number
white/orange/1	Tx +	white/green/1
Orange/2	Tx -	Green/2
white/green/3	Rx +	white/orange/3
Blue/4	Unused	Blue/4
white/blue/5	Unused	white/blue/5
Green/6	Rx -	Orange/6
white/brown/7	Unused	white/brown/7
Brown/8	Unused	Brown/8

4. Crimp an RJ45 connector to each cable end. To ensure reliability do not untwist the pairs any more than necessary to complete the crimp connection. Use care to ensure that the cable drain wire is securely connected to the shield of the RJ45 connector when the cable is crimped. Reference the manufacturer's instructions.

Electrical Considerations

All racks should be mounted in an appropriate metal enclosure. A diagram that shows recommended wiring practice for the cabinet enclosure is given in Figure 29 – Cabinet Wiring, Single Chassis, and Figure 30 – Cabinet Wiring, Multiple Chassis.

Deviations from the installation conditions specified in this manual may invalidate this product's conformity with Low Voltage and EMC.

⚠ WARNING ⚡

Hazardous voltages exist in the equipment enclosure.

• Identify and avoid contact with voltage sources.

Failure to comply with these instructions could result in death or serious injury.

Controller Grounding

PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed shall be in accordance with National Electrical Code (ANSI/NFPA 70) and with local electrical codes.
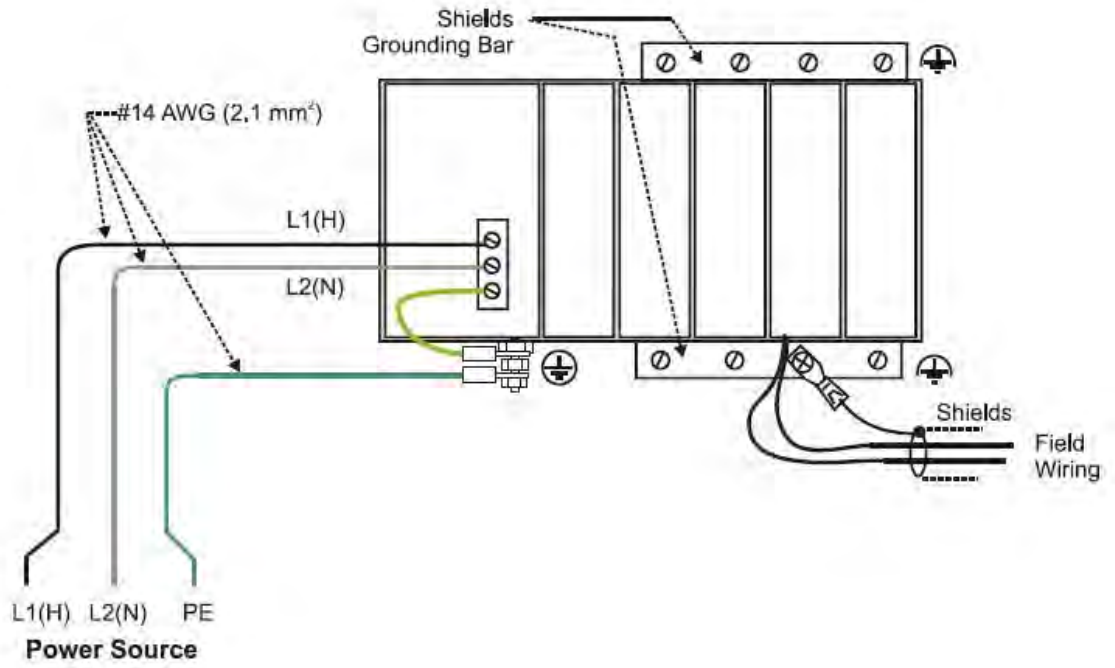
Figure 29 – Cabinet Wiring, Single Chassis
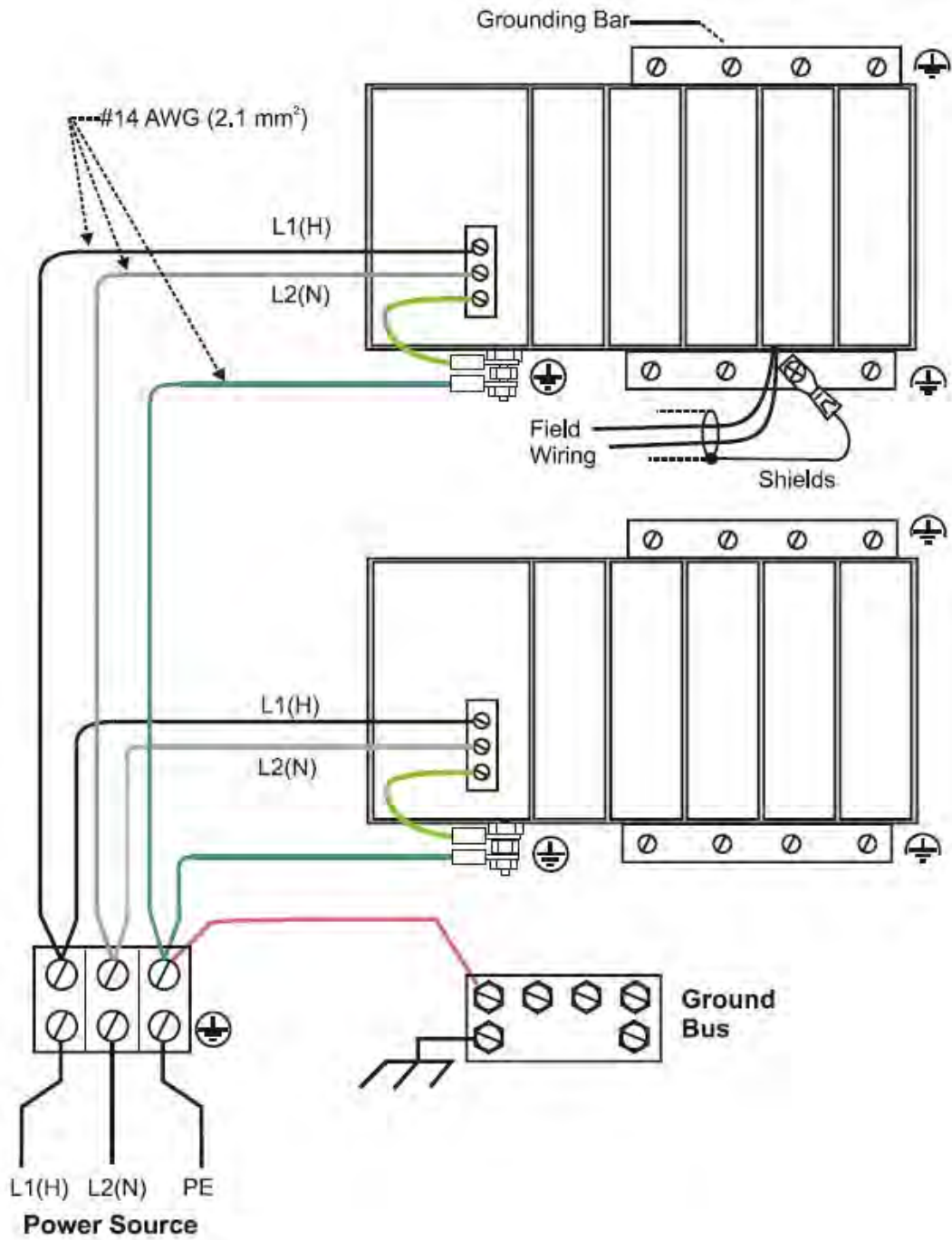
Figure 30 – Cabinet Wiring, Multiple Chassis
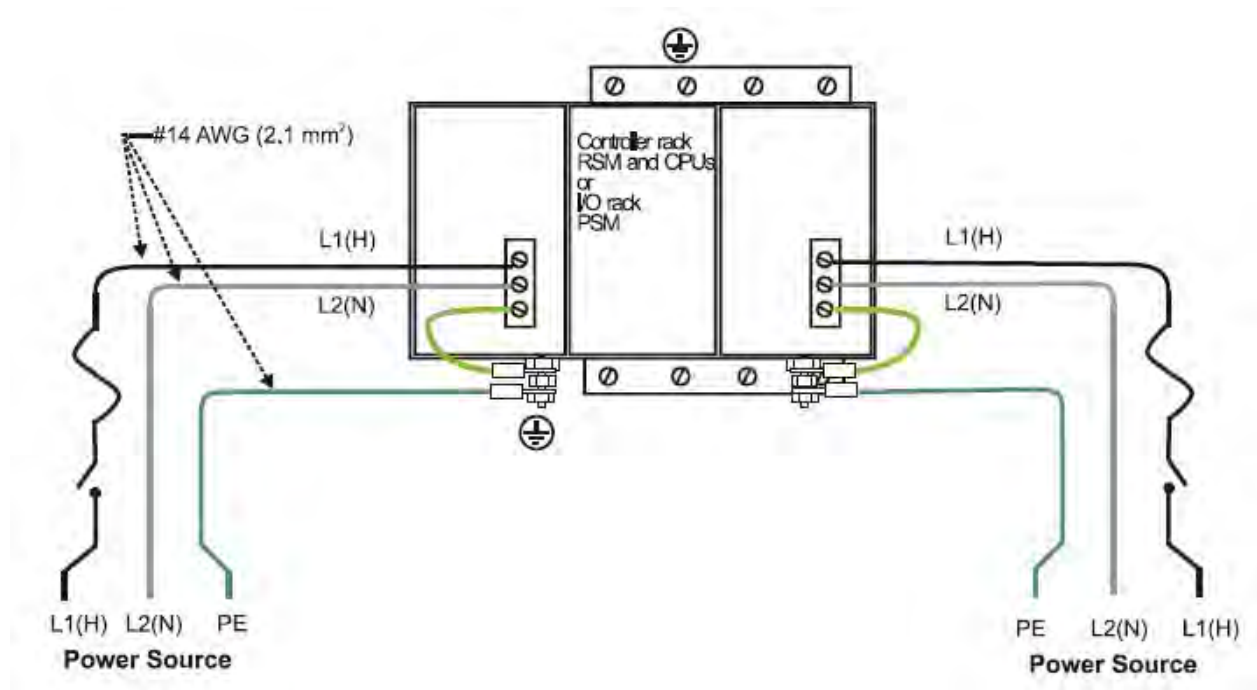
For P01 power supply use 3.0A, slow-blow for 115VAC operation; 2.5A, slow-blow for 230VAC operation. For P02 power supply, use 2.5A, slow-blow for 115VAC operation; 2.0A, slow-blow for 230VAC operation. For P24 power supply use 7.0A slow-blow.

Figure 31 – Redundant power supplies each with external fuse and switch

CE Conformity

Electrical noise produces undesirable effects in measurements and control circuits.

Digital equipment is especially sensitive to the effects of electrical noise. You should use the following methods to reduce these effects:

- Supplementary bonding of the controller enclosure to a local ground, using a No. 12 (4 mm^2) copper conductor, is recommended. This may help minimize electrical noise and transients that may adversely affect the system.

- Separate external wiring – group connecting wires into bundles (see Table 5) and route the individual bundles through separate conduits or metal trays.

- Use shielded cable IO twisted pair cables for all Analog I/O, Process Variable, RTD, Thermocouple, dc millivolt, low level signal, 4-20 mA, Digital I/O, and computer interface circuits. Ground shields as described in the section I/O Module Installation and Wiring page 66.

- Use suppression devices for additional noise protection. You may want to add suppression devices at the external source. Appropriate suppression devices are commercially available.

- Refer to document 51-52-05-01 *How to Apply Digital Instrumentation in Severe Electrical Noise Environments* for additional installation guidance.

Grouping Wires for Routing

Wires that carry relatively high electrical energy can produce unwanted noise in wires that transmit signals of relatively low energy, particularly when they are placed parallel in long wiring runs. Collect and bundle wires of similar type, and route the bundle separate from bundles of other types. Table 6 provides suggested guidelines for grouping wires.

Table 5 – Guidelines for Grouping Wires

Wire Group	Wire Functions
High voltage **(>50 Vdc/Vac)**	• AC Line power wiring • Earth ground wiring • Control relay output wiring • Line voltage alarm wiring
Signal **(<15 Vdc)**	Analog signal wire, such as: • Input signal wire (thermocouple, 4 mA to 20 mA, etc.) • 4-20 mA output signal wiring • Slidewire feedback circuit wiring Communications
Low voltage **(<50 Vdc/Vac)**	• Low voltage alarm relay output wiring • Low voltage wiring to solid state type control circuits

Master Control Relay

A Master Control Relay (MCR) structure is a safety mechanism for shutting down the process control system in emergency conditions. This mechanism, which is hard-wired (provided and installed by the User) can include several Emergency Stop switches., strategically located near process equipment. An example of an MCR structure is given in Figure 32.

Operating any of the Emergency-Stop switches opens the holding path for the MCR. When the MCR de-energizes, the MCR contact opens, disconnecting all AC power that is supplied to AC Input Modules and to AC Output Modules. Notice that AC power is disconnected only from the AC input/output modules. Power is still available to Power Supplies at the Controller Rack and at each I/O expansion rack. The Controller Module and the Scanner Modules in the racks continue to execute diagnostics and other programs.

⚠ **WARNING** ⚡

The Master Control Relay does not remove power from the Controller rack or from any of the I/O expansion racks.

- Before performing service tasks such as installation of terminal connections or fuse replacement, use the appropriate switch(s) to disconnect power from the power supply at each module.

- Ensure that wiring design precludes over-riding of the MCR by operator actions.

Failure to comply with these instructions could result in death or serious injury.

⚠ **WARNING** ⚡ Class 1, Division 2 Installations

- **DO NOT REMOVE OR REPLACE MODULES WHILE CIRCUIT IS LIVE UNLESS THE AREA IS KNOWN NOT TO CONTAIN FLAMMABLE VAPORS.**
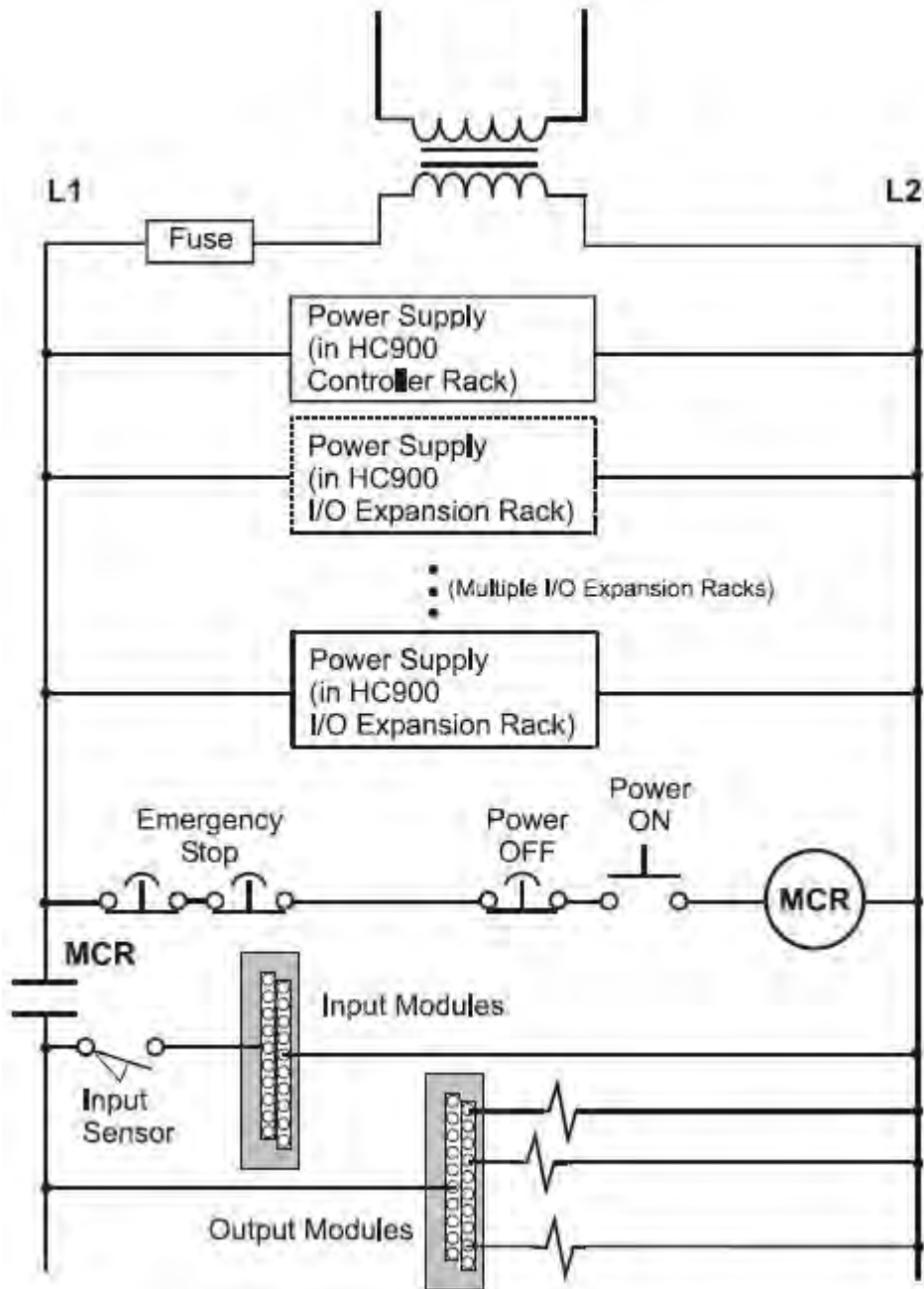
Figure 32 – Master Control Relay Wiring Example

System Monitor Function Blocks

The HC900 Controller includes function blocks that enable the user to monitor the status of system functions. When constructing a control configuration, consider adding the following monitoring function blocks to the control strategy:

- ASYS – System Monitor

- FSYS – Fast System Monitor

- RK – Rack Monitor

These function blocks are described in the HC900 Function Block Reference Guide #51-52-25-109.

Rack Installation

Overview

This section contains procedures for installing one or more HC900 Controllers. It is recommended that the information in this section be reviewed before beginning the installation. Familiarity with the overall procedure will help to prevent errors and will promote efficiency in general.

Tools Required

The primary tools required during installation are listed in Table 6.

Table 6 – Installation Tools

Item	Description	Comments
	Common tools	
1	• Wire strippers	For Power Supply and for I/O Wiring
2	• Crimper	For Terminal Lugs on Power Supply wiring and on I/O wiring shields
	Screwdrivers	
3	• Small flat-tip	For Euro-style Terminal Blocks
4	• Small/medium flat-tip or Phillips	For Barrier style Terminal blocks); also for captured screws in Terminal Blocks
5	• Large (long blade)	For use as I/O Module extractor
	Other	
6	• Electric drill, with drill bits for #10 or M4 screws, and with drill-bit extender	For rack mounting
7	• Vacuum cleaner, brush	For use during and after drilling operations
8	• Pen, ball-point or felt-tip, for entering data on labels for I/O modules)	For entering data on labels for I/O modules
9	• Multi-Meter (Volt/Ohms/Amps)	For safety checks and for equipment test
10	• Soldering pencil or gun (for attaching filter capacitors to I/O wiring shields)	For attaching filter capacitors on I/O wiring shields
	Special tools	
11	• Precision meters	(If required) for testing Analog calibration; refer to Analog Calibration in this manual.

Equipment Preparation

A checklist for site preparation is given in Table 7.

Table 7 – Site and Equipment Preparation
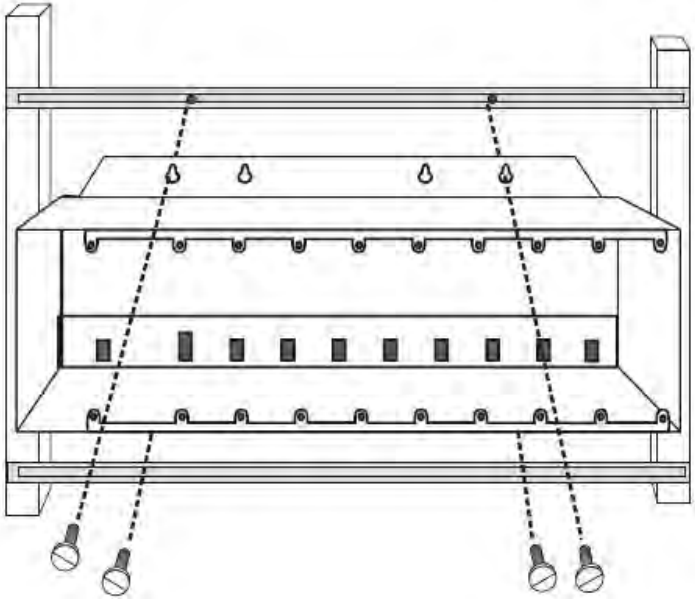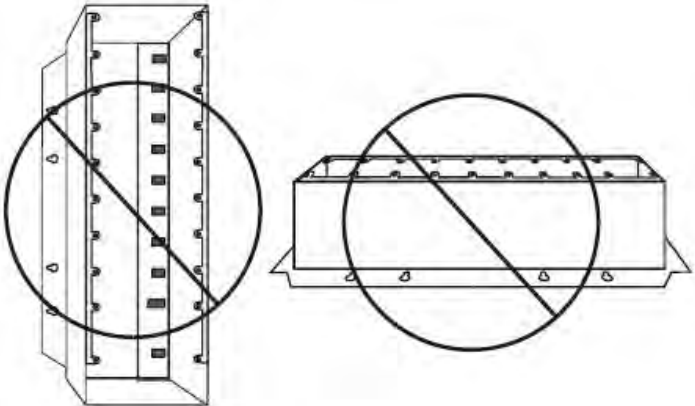
Step	Procedure	Reference
1	Verify that sufficient numbers of the following items are on hand: • Racks (4-, 8- and 12-slot) • Power Supplies: 1 per rack • C30/C50/C70 Controller Module or Scanner 1 port (1 per rack) • Redundancy: – Each Controller Rack: 2 Power Supplies, 2 C75 CPUs, 1 Redundancy Switch Module. – Each I/O Rack: 1 Scanner dual-port module, 1 Power Supply, 1 reserve Power Supply (optional), 1 Power Status Module (optional) • I/O Modules (correct type for each configured slot) • Terminal Blocks, Barrier or Euro style, (1 for each I/O Module) • Jumpers 2-position or 10-position, (for designated Terminal Blocks) • Tie Wraps (1 or 2 for each Terminal Block) • I/O Label (one per terminal block, by module type) • Filler Block Cover (1 for each slot not occupied by an I/O Module) • Blank label (1 for each Filler Block Cover) • Grounding Bars for I/O wiring shields (1 or 2 for each 4-slots in each rack) • Wiring terminal lugs (for connecting I/O shields to grounding bars) • Sheet metal screws, steel #10 or M4, for mounting racks in enclosures (4 screws for 4-slot racks, 8 screws for 8- or 12-slot racks)	• Section on Pre-Installation Planning. • Sections on installation
2	Install (or verify correct installation of) enclosures for HC900 Controllers and ancillary equipment: • Mounting rails or flat-panels • (for cabinet with multiple HC900 Chassis): – grounding bus – barrier strip for AC power • Master control Relay	Mount Racks Table 8 – Mount Rack
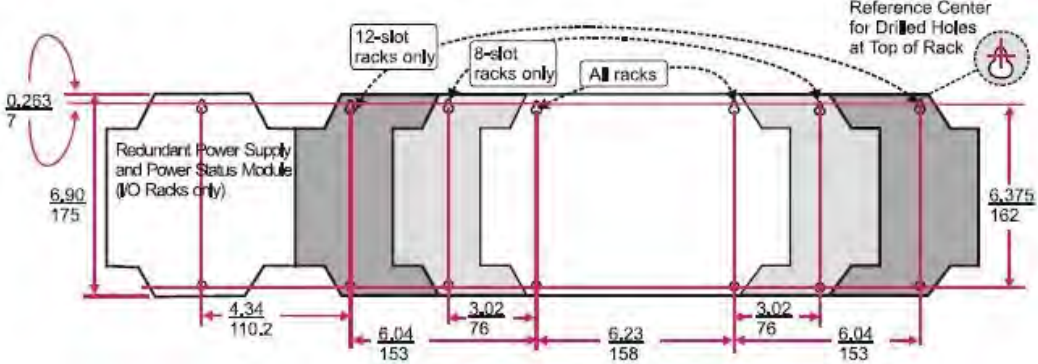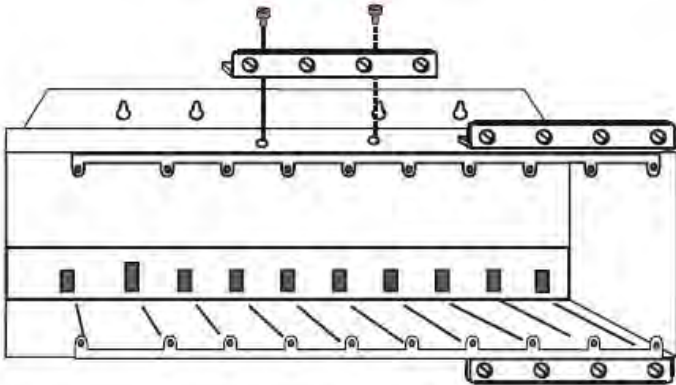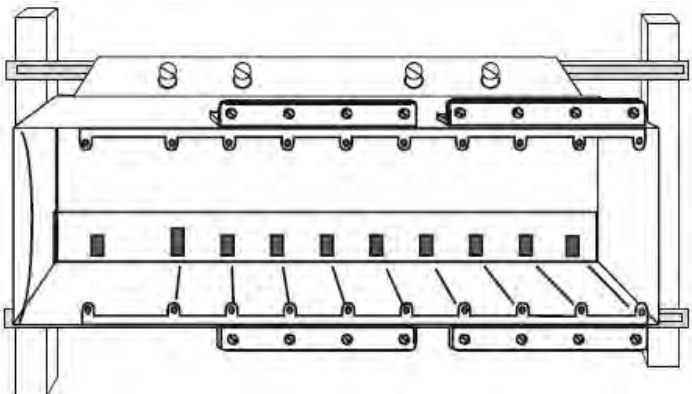
Step	Procedure	Reference
3	Install (or verify correct installation of) enclosures ("closets") for networking devices:	See Pre-installation planning sections. **Note**:Some networking devices may share enclosures with HC900 Controller components.
4	Install (or verify correct installation of): • External disconnect switches • Fuses at the power source associated with input sensor or output devices for I/O modules.	See I/O Module Installation and Wiring on page 66.
5	Arrange and organize items to be installed at or near enclosures.	

Mount Racks

Rack assembly information is given in Table 8.

Table 8 – Mount Racks

Step	Procedure	Comments/References
1	Mount the Rack in the enclosure as follows. • Using the diagrams below as a guide, mark the locations for rack mounting in the enclosure for the top holes in the rack. **(See CAUTION and Note at right.)** • Drill and tap for # 10 (or M4) screws. • Start the mounting screws (supplied by the user) in the drilled holes. • Hang the Rack on the screws at the top. • Mark the locations for the bottom screws. (**See CAUTION at right.)** • Drill and tap for # 10 (or M4) screws. • Remove the rack from the enclosure.	For dimensions of the pattern for drilling holes, refer to the diagram below. **CAUTION** When drilling holes, prevent metal flakes from falling into the rack, or onto any surface within the electrical cabinet. Note: Always mount racks as shown above. That is, never mount vertically, or with backplane horizontal.
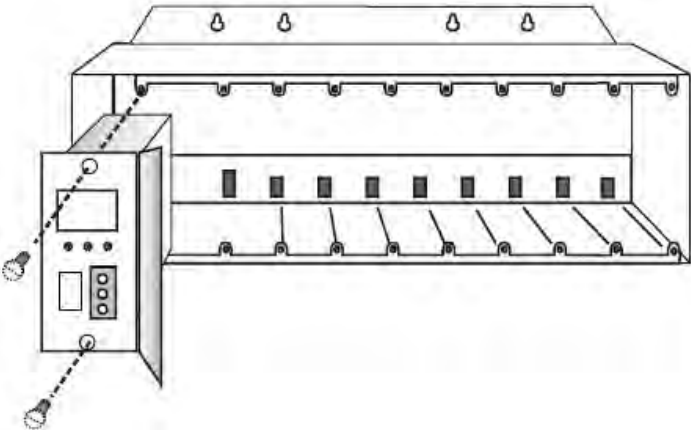
Step	Procedure	Comments/References
		12-slot racks only 8-slot racks only All racks Reference Center for Drilled Holes at Top of Rack 0.263 / 7 Redundant Power Supply and Power Status Module (I/O Racks only) 6.90 / 175 6.375 / 162 4.34 / 110.2 6.04 / 153 3.02 / 76 6.23 / 158 3.02 / 76 6.04 / 153
2	Aluminum grounding bars for I/O module wiring are optional. They can be mounted at top, at bottom, or at top and bottom of the rack, as indicated at right. If grounding bars are included, attach them with two M3 screws (supplied with grounding bars in plastic bag). **Note**: The plastic bag also includes four M4 screws for attaching the grounding wire lugs, which are attached later. Attach the M4 screws loosely to the grounding bars for safe keeping.	
3	Hang the rack in the enclosure on the top screws. Start all screws in the bottom of the rack, then tighten all screws. Note: You may find it easier to postpone this step until after all components have been installed in the rack.	
4	Repeat for each rack in your system.	
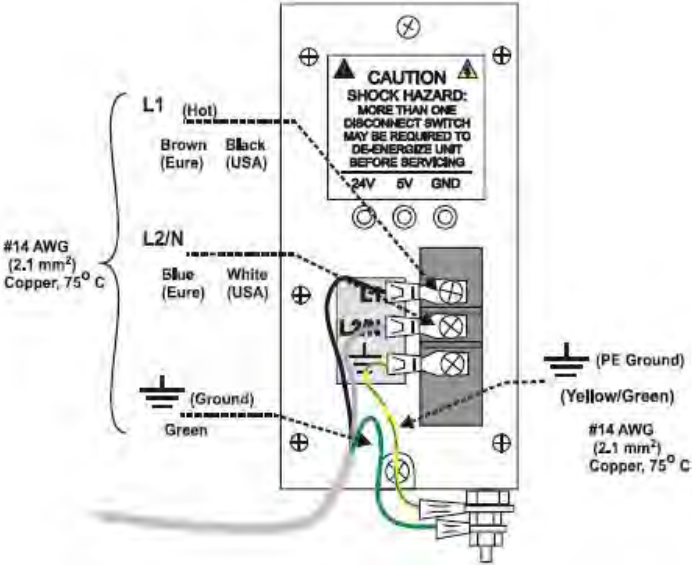
Assemble Controller Rack

C30/C50/C70 Controller Rack assembly information is given in Table 9.

C75 Controller Rack assembly information is given in Table 10.

Table 9 – Assemble C30/C50/C70 Controller Rack

Step	Procedure	Comments/References
1	Carefully place the Power Supply in the leftmost slot in the Rack, ensuring that the connector at the back seats properly. Insert a slot screwdriver in the slots at the top and bottom of the power supply cover while pulling backward to open the cover. Fasten the screws (captured in the face of the power supply) into the tabs at top and bottom of the rack.	
2	**⚠ WARNING ⚡** **Hazardous Voltage** • Ensure that wiring to the Power Supply is disconnected from the site AC source before installing wiring. • Do not remove Yellow/Green wire from grounding stud on the power supply. **Failure to comply with these instructions could result in death or serious injury.**	

Step	Procedure	Comments/References
2	Ensure that wiring to the Power Supply is disconnected from the site source, and then connect AC wiring to the power supply as shown at right. **Note**: The Yellow/Green wire is supplied with the power supply. The nuts (w/star washers) for the grounding stud are on the stud. The power supply has an internal fuse that is not replaceable. A second external fuse may be added if desired. For P01 power supply use 3.0A, slow-blow for 115VAC operation; 2.5A, slow-blow for 230VAC operation. For P02 power supply, use 2.5A, slow-blow for 115VAC operation; 2.0A, slow-blow for 230VAC operation. For P24 power supply use 7.0A slow-blow. ## CAUTION ***The P24 is a +24V DC Power supply. Do not apply AC voltages of any kind to this power supply or you will destroy it.*** Apply power. For P01 only, test voltages at the test points provided on the face of the Power Supply. **Note**: Test-points are electrically connected to the backplane of the rack. If the power supply is not properly seated in the backplane connectors, no voltage will be measured at the test points.	**ATTENTION!** **Do not connect PE Ground (Green) Wire directly to terminal on Power Supply.** L1 (Hot) Brown (Eure) Black (USA) L2/N Blue (Eure) White (USA) #14 AWG (2.1 mm²) Copper, 75° C (Ground) Green ⚠ CAUTION ⚠ SHOCK HAZARD: MORE THAN ONE DISCONNECT SWITCH MAY BE REQUIRED TO DE-ENERGIZE UNIT BEFORE SERVICING 24V 5V GND (PE Ground) (Yellow/Green) #14 AWG (2.1 mm²) Copper, 75° C
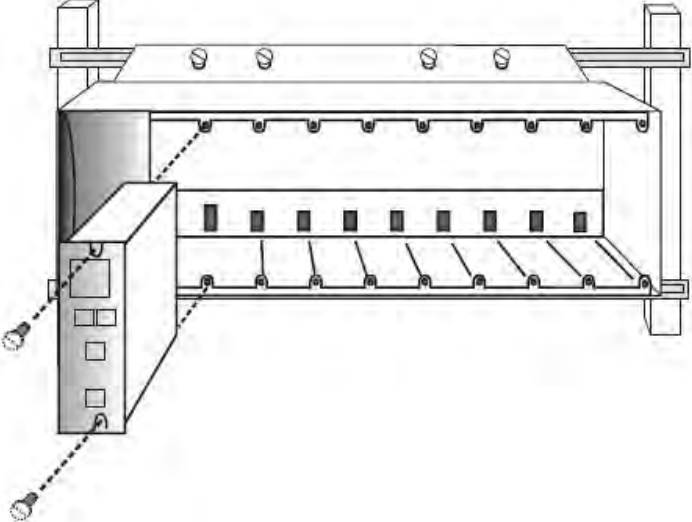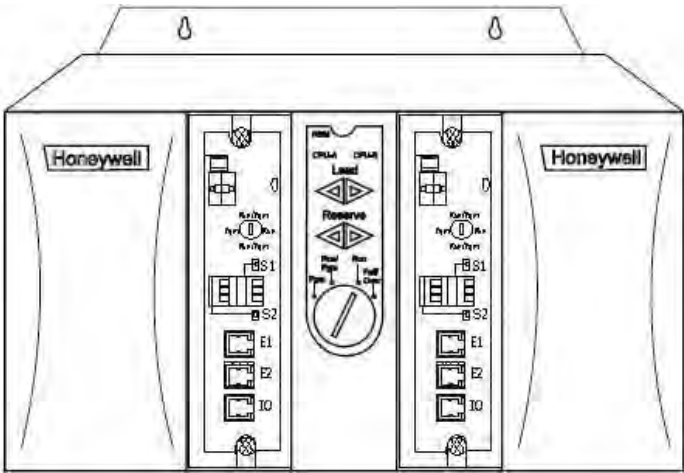
Step	Procedure	Comments/References
3	**⚠ WARNING** ⚡ Ensure that AC power to the rack is disconnected. Set controller module's communication ports to desired settings (page 36). Carefully place the Controller Module in the rack, immediately to the right of the Power Supply. Fasten it in place with two captured screws at top and bottom. **ATTENTION:** **Do not install the battery at this time. Installing the battery before the controller is configured can substantially shorten battery life. Install under power after the controller configuration is complete.** (For more information, refer to Battery Installation/Replacement, page 191.)	
4	I/O will be installed later.	See Page 66.
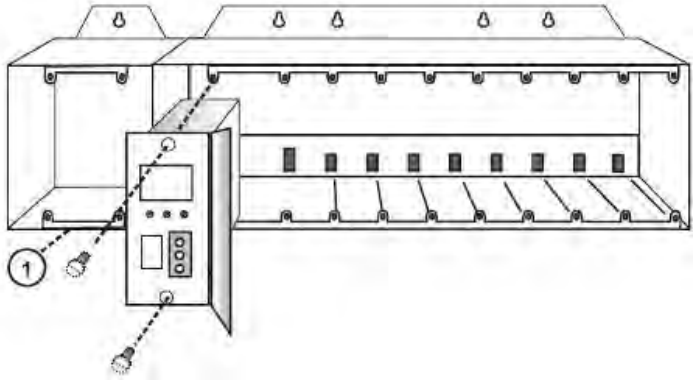
Table 10 – Assemble C75 Controller Rack
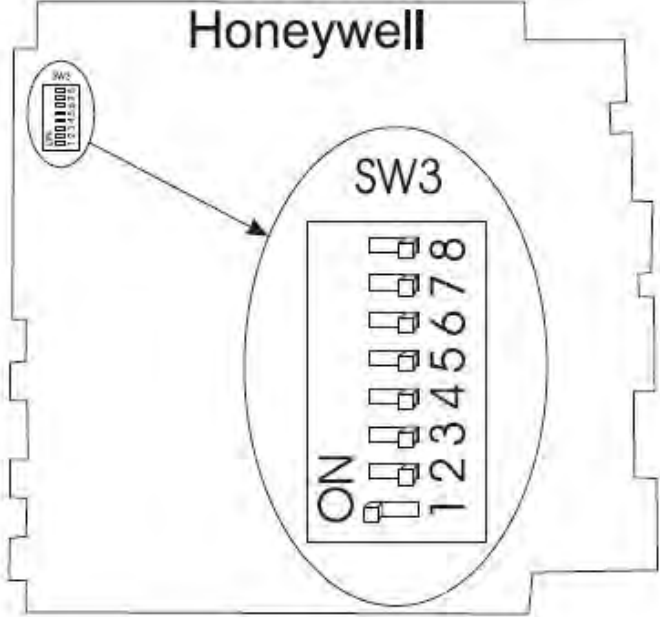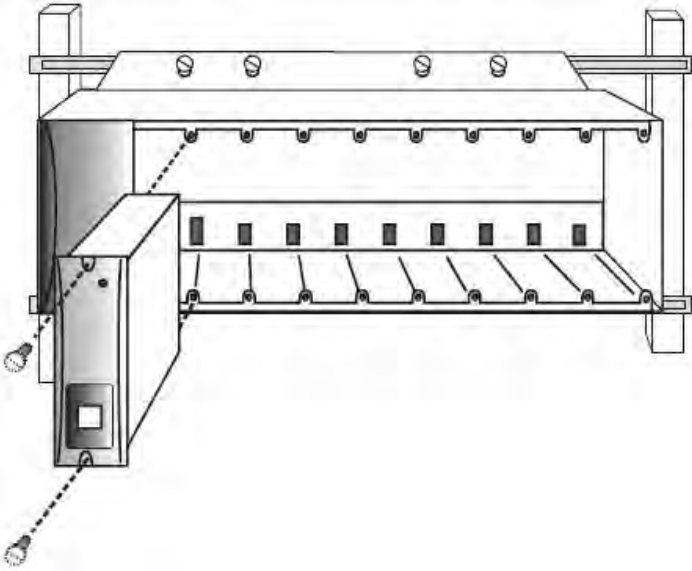
Step	Procedure	Comments/References
1	Carefully place the Power Supplies in the leftmost and rightmost slots in the Rack, ensuring that the connector at the back seats properly. See Table 10 steps 1 and 2 for power supply wiring details.	
2	Set controller communication ports.	See page 36.
3	⚠ **WARNING** ⚡ Ensure that AC power to the rack is disconnected. Carefully place the Controller Modules in the rack, adjacent to the Power Supplies. Fasten them in place with captured screws at top and bottom. **ATTENTION:** **The CPU battery comes installed with a plastic tab protruding from the battery cover. This tab breaks the battery circuit. Do not remove this tab at this time. Removing the tab before the controller is configured can substantially shorten battery life. Remove the tab under power after the controller configuration is complete.** (For more information, refer to Battery Installation/Replacement, page 191.)	See figure in step 1.
4	Insert the RSM in the middle slot and attach with screws at top and bottom.	See figure in step 1.

Assemble I/O Expansion Racks

I/O Expansion Rack assembly information is given in Table 11.

Table 11 – Assemble I/O Expansion Racks

Step	Procedure	Comments/References
1	Insert power supply into left-most slot in the I/O rack. See Table 9 steps 1 and 2 for wiring details.	If using redundant power, your I/O rack will contain a second smaller compartment, see 1 in the following figure. Insert first power supply in the larger compartment as shown, to the immediate right of the plate dividing the two compartments.
2	Redundant Power (optional): Insert the second power supply in the left side of the smaller compartment, see 1 in figure above. See Table 10 steps 1 and 2 for details. Insert the PSM between the 2 power supplies. Fasten it in place with screws at top and bottom.	See 1 in figure above. See Table 9 steps 1 and 2 for details.

Step	Procedure	Comments/References
3	Set scanner address for the I/O rack using the Scanner Module DIP switches on SW3 (shown at right). For C50/C70, use address 1-4. For C75, use address 1-5. **DIP switches 6-8 must be OFF**. Only one DIP switch may be ON: DIP switch 1 ON = Scanner 1 DIP switch 2 ON = Scanner 2 DIP switch 3 ON = Scanner 3 DIP switch 4 ON = Scanner 4 DIP switch 5 ON = Scanner 5 A small slotted screwdriver or paperclip works well; avoid pencils.	
4	Repeat steps 1 through 3 for each I/O expansion rack. Then, for each I/O expansion rack, insert the Scanner Module immediately to the right of the Power Supply, and secure it in place with the two captured screws in the faceplate.	
5	I/O will be installed later.	See Page 66.

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I/O Module Installation and Wiring

Overview

This section contains descriptions of and procedures for installing I/O Modules in controller racks (all CPU models) and in I/O expansion racks (C50, C70, C75 CPU only).

Module Placement in Racks

Each input or output module is placed in an I/O slot in a rack as shown in Figure 33.

Each "slot" in a rack includes a set of guides that locate the circuit board in the rack and a 20-pin (4 x 5) socket in the backplane that receives the associated 4 x 5-pin plug at the back of the I/O module.

At the front of each I/O module, a 20 or 36 pin plug receives the associated socket on the back of a terminal block. When the I/O module is inserted into the rack and the terminal block is placed on the circuit board, two captured screws in the terminal block are fastened to metal tabs on the rack.
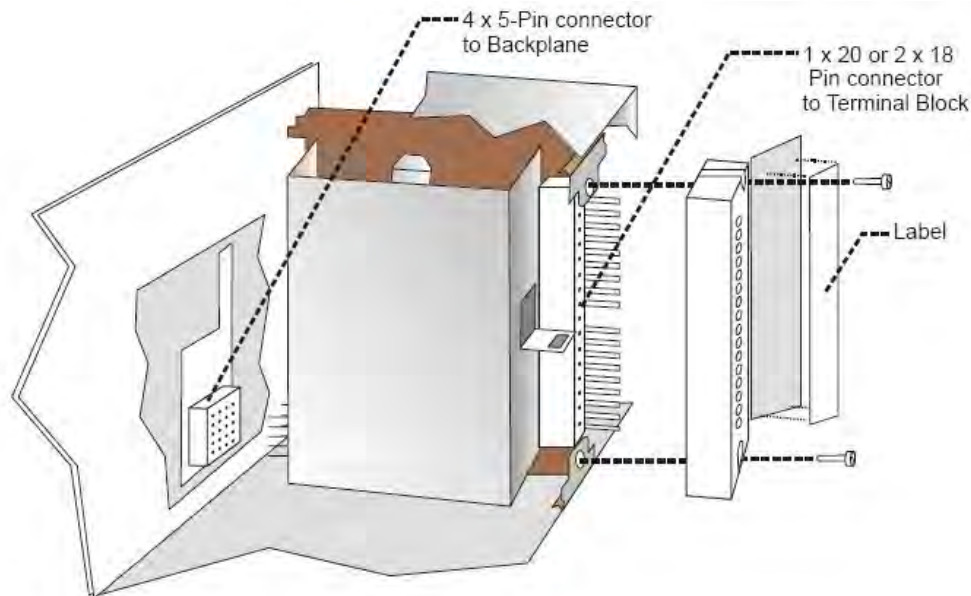
Figure 33 – I/O Module Installation

⚠ **WARNING** ⚠

- Do not use an input/output terminal block if the terminal block is damaged, if the door is missing, or if one or both mounting screws are missing.
- Always tighten both terminal block screws before applying field power to the module.
- Do not apply energized ("live") field wiring to an input/output module that is not installed in one of the racks in the HC900 Controller.
- Do not operate the controller without a Protective Earth connection.

Failure to comply with these instructions could result in death or serious injury.

Terminal Block Styles

The terminal block is available in the barrier style, shown at left in Figure 34, and the Euro style, shown at right. Not shown: a Euro style with 36 connections is also available for certain high capacity modules.

Terminal blocks have an embossed numbering "key" that shows the numbering pattern of the 20/36 connections.

The frame associated with the terminal block has a transparent hinged door. The hinged door is a tool secured cover. To open the door, insert a flat screwdriver into the slot at the top and bottom of the door while pulling out. The door has molded-in tabs that hold labels, which are uniquely color-coded to identify each module type.

Each label is printed on both sides. On the front (visible when the door is closed) are I/O channel numbers, with spaces in which tag names can be written. On the back (visible when the door is open) are wiring patterns for the type of module located in the slot.
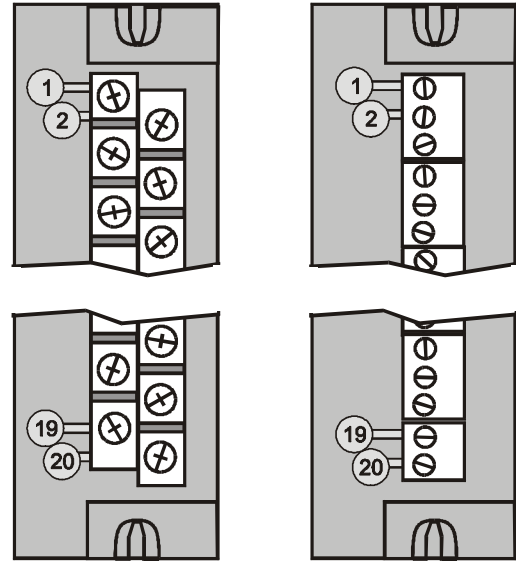
Figure 34 – Terminal Block Styles

The 20-pin, inline connectors at the back of the terminal blocks are universal; that is, any type of I/O module can be used with either the Barrier style or the Euro style terminal block. The 36-pin Euro terminal blocks must be used with High Level AI, High Level AO, 32 DI, and 32 DO modules.

ATTENTION

Before mounting terminal blocks in the rack, be sure they are properly keyed to the module type they will be used with. See I/O Module Installation Procedures, page 74.

Terminal Block Colors and Keying

Both the barrier style and the Euro style are available in two colors (red and black). Black terminal blocks, which have gold contacts, are used for low-voltage, low-energy signals such as contact inputs and low DC voltages. Red terminal blocks, which have tin contacts, are used for higher voltages such as 120/240 Vac.

Colors of each Terminal Blocks must correlate to that of the mating header on I/O modules with which they are used; that is:

- Black terminal blocks, which have gold contacts, are for use with I/O modules that have black headers and gold pins in the 20-pin connector; these include: Analog Input, 4-channel Analog Output, DC Input, DC Output, Contact Input, Pulse Input, Pulse Output, Frequency Input, Quadrature Input.

- Red terminal blocks, which have white (tin) contacts, are for use with I/O modules that have red headers and white- (tin-) contacts in the 20-pin connector; these include: AC Input, AC Output, and Relay Output.

- 36-pin black Euro terminal blocks, which have gold contacts, are for use with 8-point AO, 16-point AO, 16-point AI, 32-point DI, and 32-point DO modules.

- Terminal blocks may be keyed by the installer to prevent high voltage terminal blocks from being installed on low voltage modules. See Table 14.

- Any of the color-coded labels will fit into the door of any terminal block. Use care to ensure that all hardware components match each other, and also match the control strategy in the configuration file.

Remote Termination Panel (RTP)

The optional Remote Termination Panel (RTP) provides an easy way to connect the HC900 controller to the field wiring. The RTP integrates some of the typical externally connected components, reducing wiring and setup time. It also minimizes the need for multiple wires under a single screw connection by expanding the connectivity of the shared terminals of the I/O modules.

See Appendix - Installation of Remote Termination Panels (RTPs) page 207 for details.

Terminal Block-to-Field (Signal) Wiring

Although both of the two available terminal block styles can be used on all I/O module types, wiring methods vary with the module type and with the type of field devices connected to the terminal block. The descriptions that follow provide details.

Wiring can be routed through the terminal block at the top, at the bottom, or both. Wiring should be fixed in place using wire ties at the slotted tabs that are molded in at top and bottom of each terminal block.

Wiring Rules and Recommendations

In general, stranded copper wire should be used for non-thermocouple electrical connections. Twisted-pair wiring with Shielded Cable IO will improve noise immunity if wire routing is suspect.

Wire Gage

Observe all local codes when making power connections. Unless local electrical codes dictate otherwise, the recommended minimum wire size for connections is given in Table 12.

Table 12 – Minimum Recommended Wire Sizes

Wire Gauge	Wire Application
14	Earth ground to common power supply.
14 to 16	AC to power supply
10 to 14	Earth ground wire
20	DC current and voltage field wiring
22	DC current and voltage wiring in control room

Routing and Securing Wires

Typically, field wiring is routed to connections at a terminal panel near the controller and then from the terminal panel to the terminal blocks on the I/O modules.

Whatever method of routing is used, wiring must be mechanically supported along its length, and must be protected from physical damage and electromagnetic (noise) interference. (See Electrical Considerations page 47.)

Also, all wires must be securely terminated, using appropriate wiring practices.

Signal Grounding (

Figure 35)

The shield for each input should be grounded at the grounding bar (optional) at the top or bottom of each rack as indicated in Figure 36. For low-frequency noise rejection, I/O wiring shields should be grounded only at the controller end.

For high-frequency noise rejection, shields should be grounded at the controller and at the field device. If the ground voltage potential at the field device is different from that at the controller, a DC isolation capacitor should be used between the shield and the grounding bar on the rack.

Low-Frequency Noise Rejection

Shield wire

DC isolation Capacitor

Cap

High-Frequency Noise Rejection

Shield wire

Shield wire
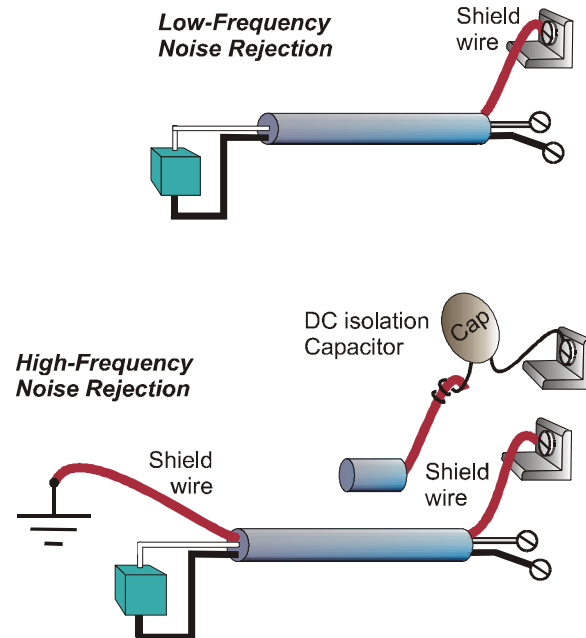
Figure 35 – Signal-Wire Grounding

Aluminum grounding bars for I/O wiring are available as options. When selected for use, they are fastened to the top and/or bottom of each rack, as indicated in Figure 36. To enable connection of multiple ground wires with a single screw, the wires can be twisted together and secured with a wire lug.

To facilitate module replacement, it is advisable in most cases to route all wiring through either the top or the bottom of the terminal block. This allows the terminal block to pivot up or down, allowing ready access to the module, and is the preferred method for a limited number of wires.

For a larger number of wires, or for wires of a heavier gauge, it is advisable to route some wires through the top of the terminal block, and some through the bottom, as indicated in Figure 36. In this case, it is necessary to adjust wire length so as to ensure adequate flexibility of the twisted wires and to provide clearance sufficient to remove the I/O module.
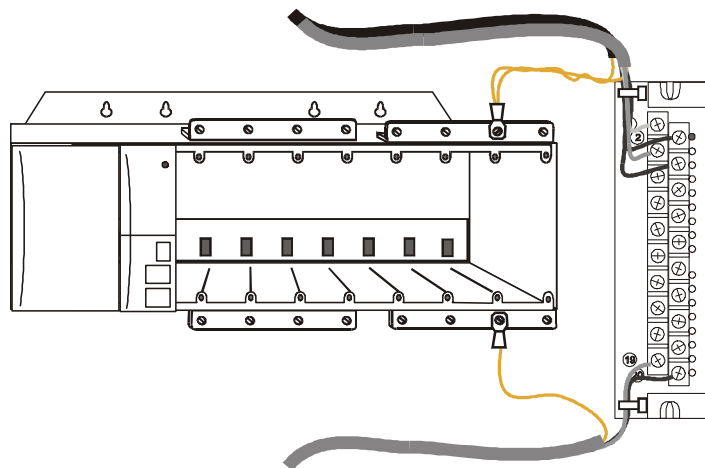
Figure 36 – Wire-Shield Grounding

Terminal Block Jumper Combs

Two styles of terminal block jumper combs are available for use with the barrier-style terminal blocks: ten-position and two position. (Figure 37)

The ten-position jumpers are used with AC output modules to inter-connect L1 (AC Hot) of all channels.

The two-position jumpers are used to connect Common (DC negative or AC neutral) for the DC input module, the DC Output Module, and the AC Input Module. Each of these module types has groups of eight channels, with the two groups isolated from each other. The two-position jumper connects (Common) terminals 10 and 12, making one group of sixteen non-isolated channels.

The two-position jumper can also be used to connect the V+ terminals on the DC Output Module.

Refer to the wiring information on each module, given in this section of this manual.
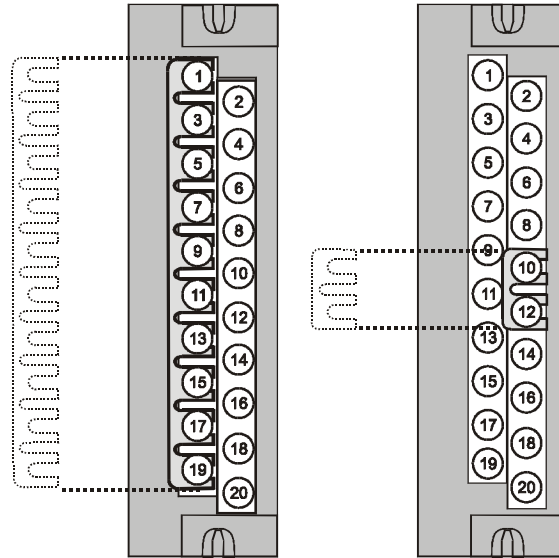
Figure 37 – Terminal Block Jumper Installation

Removal and Insertion Under Power (RIUP)

⚠ **WARNING**

Read and understand all of the following information regarding RIUP before attempting to remove and/or replace any I/O module, particularly in a system that is actively controlling a process.

All of the I/O Module types in the HC900 Controller System include the Removal and Insertion Under Power (RIUP) feature. That is, while the rack is powered, any of the I/O Modules can be removed or inserted:

- With no physical damage to the module, to the rack, or to other modules in the rack

- Without disturbing the functions of *other I/O modules* in the rack or in the system.

Under carefully controlled circumstances, this feature enables the user to remove and insert an I/O module without completely shutting down a running system. However, it must be recognized that removing or inserting an I/O module under power is potentially hazardous to property and to personnel.

Circumstances that dictate prudent actions depend on conditions and specific process applications at each user facility. It is the responsibility of site personnel to know all potential consequences of RIUP, and to take actions to prevent all adverse consequences before removing or inserting an I/O module under power. Table 13 provides some general guidelines for establishing appropriate procedures at a given installation.

Table 13 – RIUP: Potential Hazards and Recommended Actions
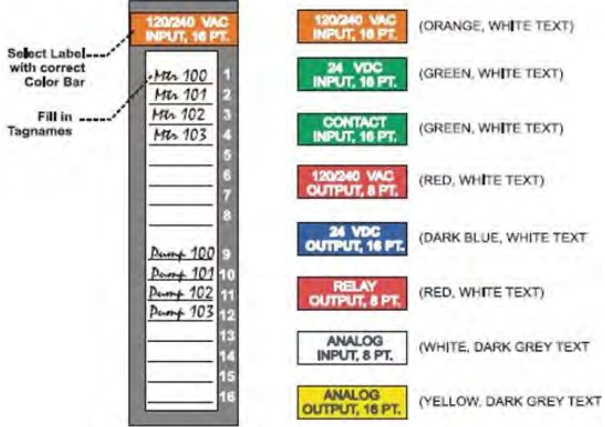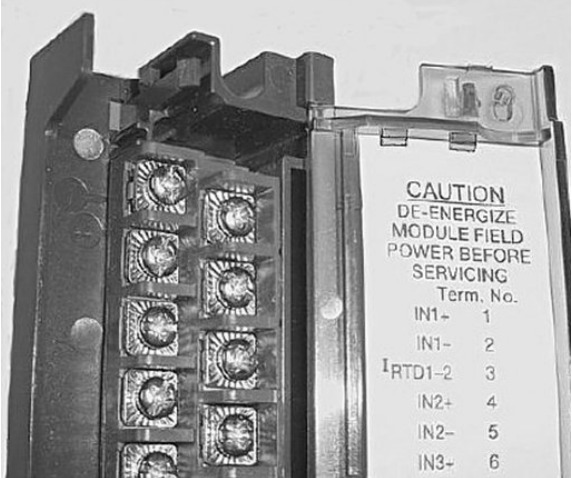
Hazard	Source	Preventive Action(s)
⚠ **WARNING** ⚡ **Hazardous Voltages**	Potentially lethal voltages on Terminal Boards associated with I/O Modules.	Disconnect all signals at terminal blocks from sources of power before removing the terminal block from the I/O module.
⚠ **CAUTION** **Loss of control or view of a running process**	Each signal at each of the terminals for an I/O module has a specific function. Any or all of the signals may be vital for safely controlling a process.	Either: Using trained personnel and appropriate control mechanisms, transfer to manual control for each signal that is necessary to maintain safe process control. Or: Bring the process to a safe stop before initiating the removal or insertion procedure.
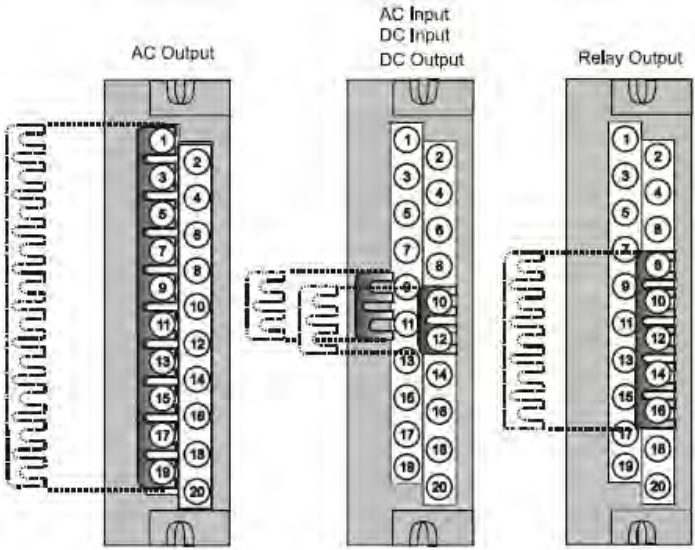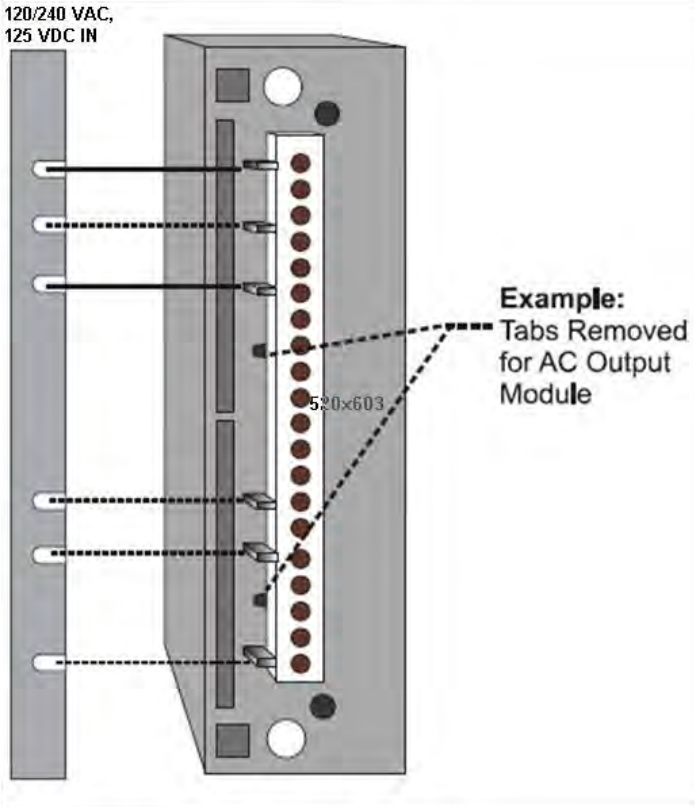
⚠ **WARNING** ⚡ **EXPLOSION HAZARD**   Class 1, Division 2 Installations
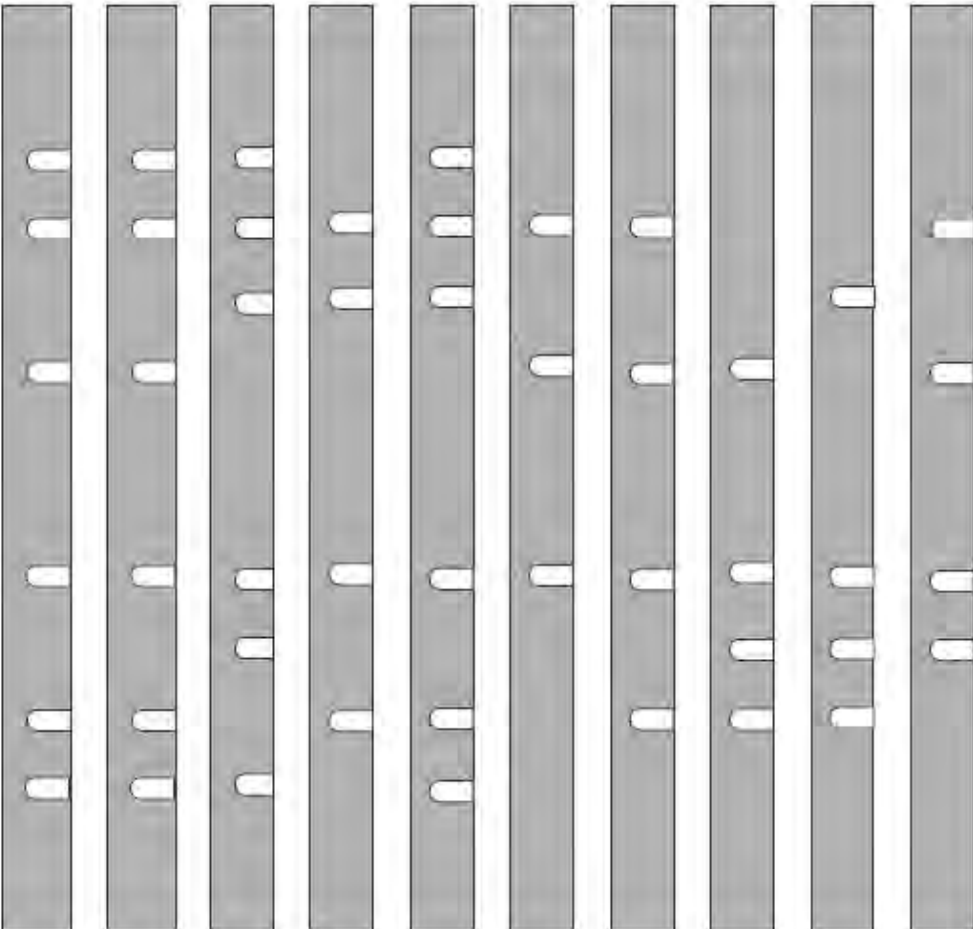
- DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
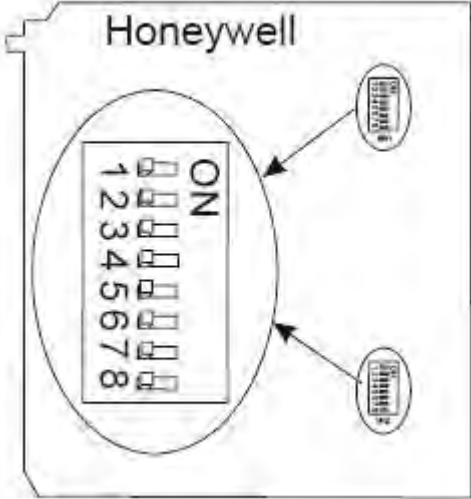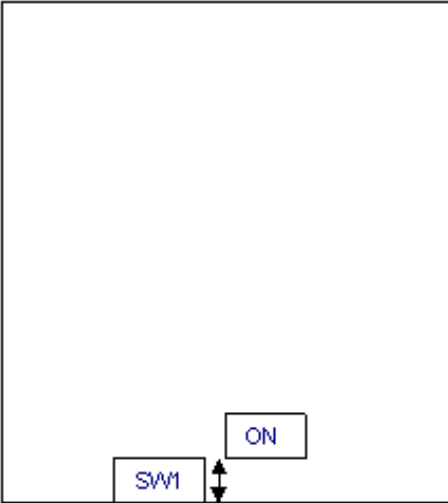
I/O Module Installation Procedures
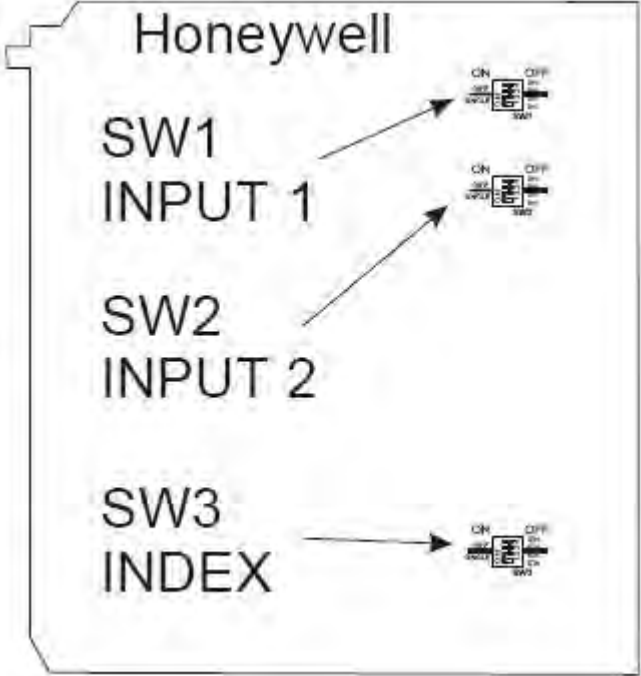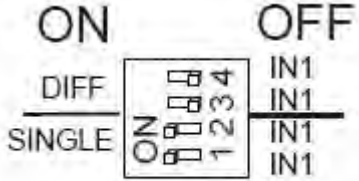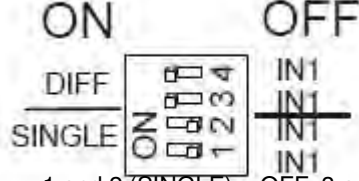
Table 14 – Connect Input/Output Wiring
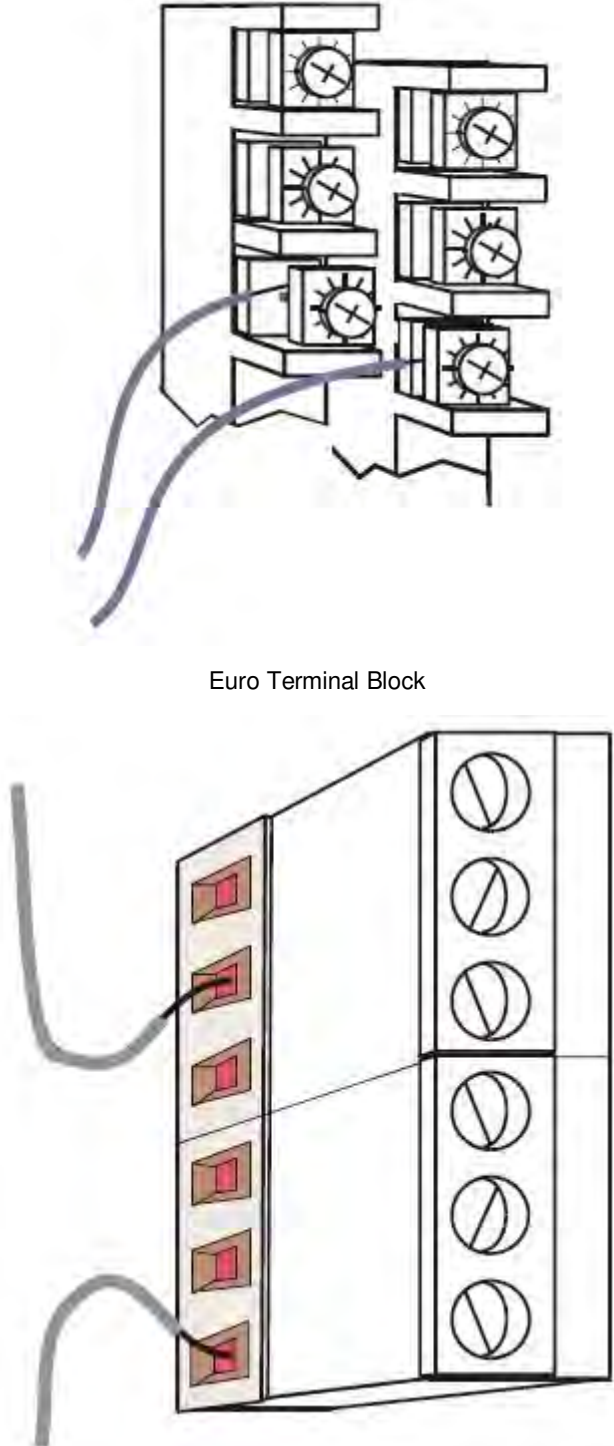
Step	Procedure	Comments	Reference
1	Using Rack #, Slot #, Channel # data from a Designer Software report, fill in the tag names on the Label for each configured I/O Module. Module slot position should take heat de-rating into account. See Heat Rise De-rating page 43. Be sure to use the appropriate label for each module type.		
2	Place the appropriate label supplied with the module (tagname side out) into the hinged door for each I/O Module. Slotted tabs, molded into the door at top and bottom, hold the label in place.		
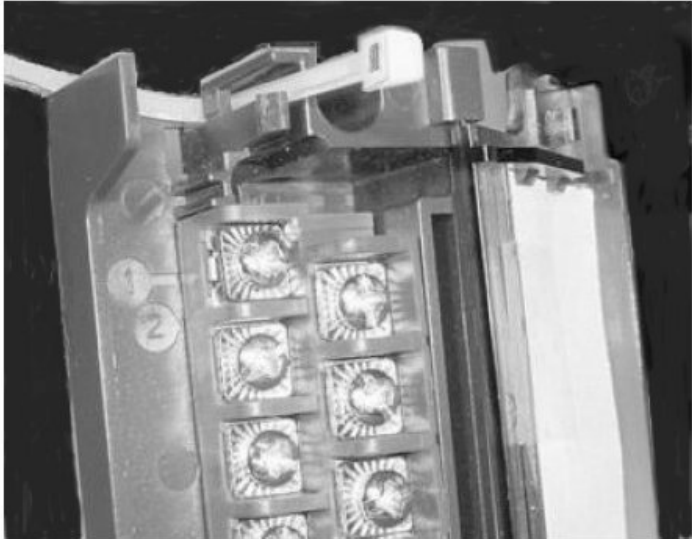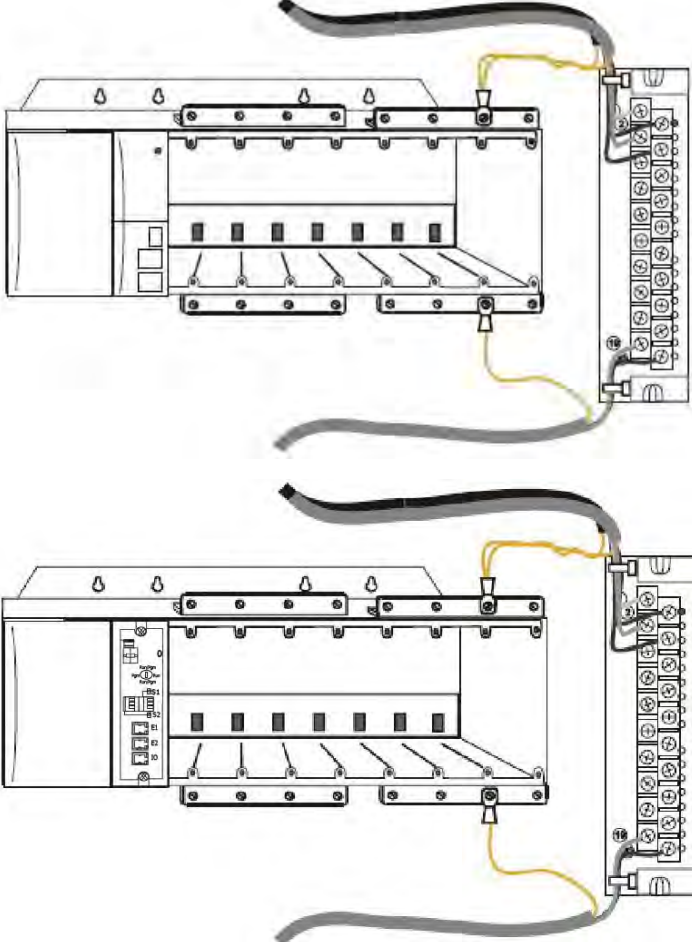
Step	Procedure	Comments	Reference
3	(Optional): Install jumper combs into designated Barrier style Terminal Blocks, to reduce the wiring required to supply power: Two-position jumper for the DC Input Module and/or on the DC Output Module. Ten-position jumper for the AC Output Module. Five-position jumper (10-position jumper cut in half) for a Relay Output Module.	 Refer to terminal block wiring diagrams for specific information.	
4	For each configured and labeled I/O Module, break off the "key-tabs" in the pattern that identifies each module type. (For a diagram of each key-tab pattern, use the I/O Modules and/or the diagram shown next page.		
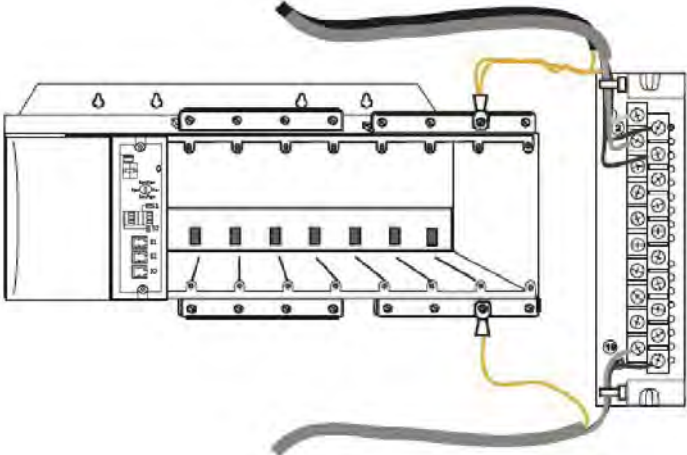
Step	Procedure	Comments	Reference
4 cont'd	**NOTE:** In the diagram below, the white cut-outs represent the cut-outs on the modules that accommodate tabs on the Terminal Block. That is, all key-tabs that line up with the white cut-outs on the diagram should be retained, and all other tabs should be removed. The orientation of the diagrams below corresponds to the picture of the terminal block, shown in the previous picture. **Diagrams for I/O Module Key-Tabs**		

Step	Procedure	Comments	Reference
5	If installing High Level 16 channel Analog Input module, set its SW1 and SW2 DIP switches to ON. This connects an internal 250 ohm resistor. A small slotted screwdriver or paperclip works well; avoid using pencils.		
6	If installing 8- or 16-channel Analog Output module, set its DIP switch as follows. (Switch is located at edge of module, marked "SW1".) • For internal rack power, set DIP switch to ON. • For external power (18-36V), set DIP switch to OFF (default). Note: 24VDC external power is required if using 6 or more 8-pt. AO modules or 3 or more 16-pt. AO modules. A small slotted screwdriver or paperclip works well; avoid using pencils.		

Step	Procedure	Comments	Reference
7	If installing a PFQ module, set its Input 1, Input 2 and Index DIP switches to differential or single ended mode. Inputs mode need not match index mode. See below for switch positions. Switch location on PFQ module: Settings (using Input 1 as example) Single ended (factory setting): 1 and 2 (SINGLE) = ON, 3 and 4 (DIFF) = OFF Differential: 1 and 2 (SINGLE) = OFF, 3 and 4 (DIFF) = ON		

Step	Procedure	Comments	Reference
8	Insert a wire-tie into the top and/or bottom end of the terminal block. Form a bend in each wire to provide strain relief, and secure the wire bundle with the tie.	Euro Terminal Block	

Step	Procedure	Comments	Reference
9	Connect wire-tie into the top and/or bottom of the Rack. Form a bend in each wire to provide strain relief, and secure the wire bundle with the tie.		
10	Install I/O modules in racks. Be sure to follow placement guidelines under Heat Rise De-rating page 43.		

Step	Procedure	Comments	Reference
11	Install I/O module, install a Filler Block cover, Part number 900TNF-0001.		
12	In each slot location not occupied by an I/O module, install a Filler Block cover, Part number 900TNF-0001.	**Note:** The Filler Block Cover looks much like an I/O Terminal Block assembly, except that it does not include the wire terminating block (screw terminals). The Filler Block mounts in the same manner as a Terminal Block (with captured screws at top and bottom). Blank labels are provided for mounting in the hinged door.	

I/O Terminal Block Wiring Diagrams

Universal Analog Input Module Wiring

The Universal Analog Input Module has eight inputs, which can include any combination of the following input types: RTD, TC, Ohms, Millivolt, Volt, or Milliamp. Figure 39 shows wiring examples of each of the analog input types. An example of wiring for eight TC inputs is given in Figure 41.

Specifications for this module and for other modules are given in the Specifications section of this manual.

ATTENTION

To indicate sensor failure the Analog Input software will output a warning if thermocouple resistance > 80 ohms. Use appropriate gauge wiring to prevent inaccurate failure warnings.

Table 15 – Typical Thermocouple resistance in Ohms per Double Foot @ 68 degrees F

AWG No.	Diameter inches	Type K	Type J	Type T	Type E	Type S Pt/PT110	Type R Pt/PT113	Type W5/ W26	Type W/ W26
10	0.102	0.058	0.034	0.029	0.069	0.018	0.018	0.023	0.020
12	0.081	0.091	0.054	0.046	0.109	0.028	0.029	0.037	0.031
14	0.064	0.146	0.087	0.074	0.175	0.045	0.047	0.058	0.049
16	0.051	0.230	0.137	0.117	0.276	0.071	0.073	0.092	0.078
18	0.040	0.374	0.222	0.190	0.448	0.116	0.119	0.148	0.126
20	0.032	0.586	0.357	0.298	0.707	0.185	0.190	0.235	0.200
24	0.0201	1.490	0.878	0.7526	1.78	0.464	0.478	0.594	0.560
26	0.0159	2.381	1.405	1.204	2.836	0.740	0.760	0.945	0.803
30	0.0100	5.984	3.551	3.043	7.169	1.85	1.91	2.38	2.03
Table values are shown as a reference only; actual values may vary. Consult manufacturer specifications.									

Isolation

This module has eight inputs, which are isolated except for RTD current sources.

RTD Inputs

RTD inputs share current sources (two RTD inputs per source), as shown in Figure 38, Figure 39, and Figure 40.

For example, the current source for the RTD input at channel one (terminals 1 and 2) is terminal 3 (I_{RTD} 1 & 2). This same current source (I_{RTD} 1 & 2) is also used for an RTD input at channel two (terminals 4 and 5).

Figure 38 and Figure 42 show examples of RTD input wiring (2-wire and 3-wire RTDs). Four-wire RTD inputs are not available.
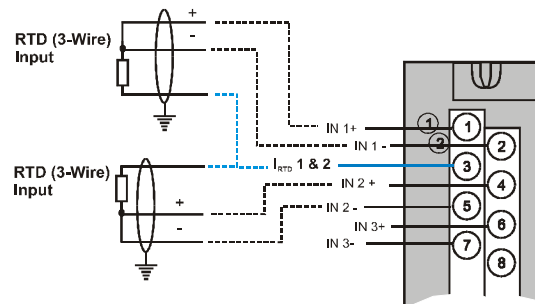
Figure 38 – RTD Inputs

OHMs Inputs

Ohms inputs are wired similar to 2-wire RTD inputs. That is, they require a current source, and thus must use one of the I_{RTD} current sources. Also, two terminals are jumpered together as they are for two-wire RTD inputs.

Analog channels wired for Ohms inputs differ from RTD inputs in these aspects:

- Ohms inputs connect to variable resistance devices other than RTDs, and
- Ohms inputs are configured in Designer Software as Ohms inputs, rather than as RTD inputs.

Examples of wiring for resistance inputs are given in Figure 42 .

Shield Grounding

Shields must be grounded as described under Shield Grounding at the beginning of this section.

⚠ **WARNING** ⚡

Hazardous voltages exist at terminal blocks.

- Using switches at field devices disconnect the field wiring from power sources before servicing.

Failure to comply with these instructions could result in death or serious injury.
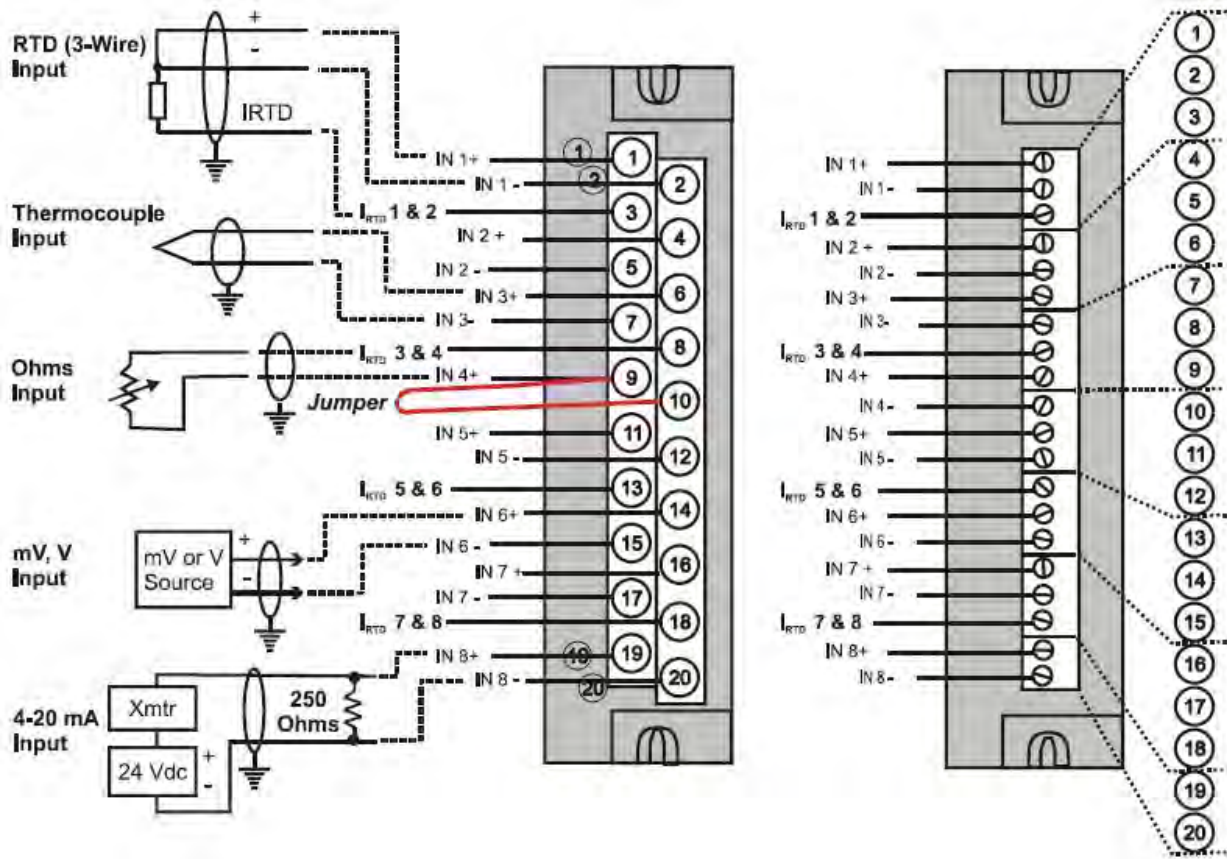
Figure 39 – Universal Analog Input Wiring Diagram
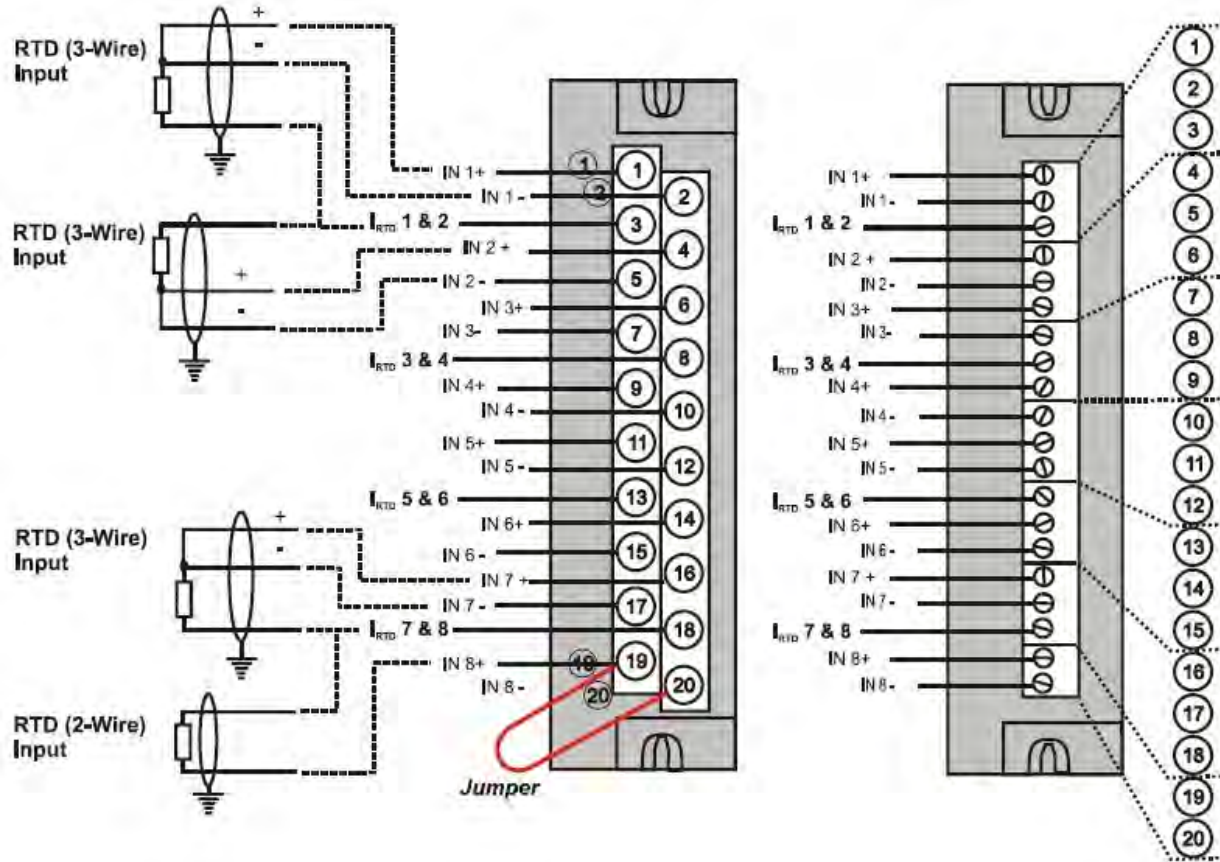
Figure 40 – Examples of RTD Input Wiring
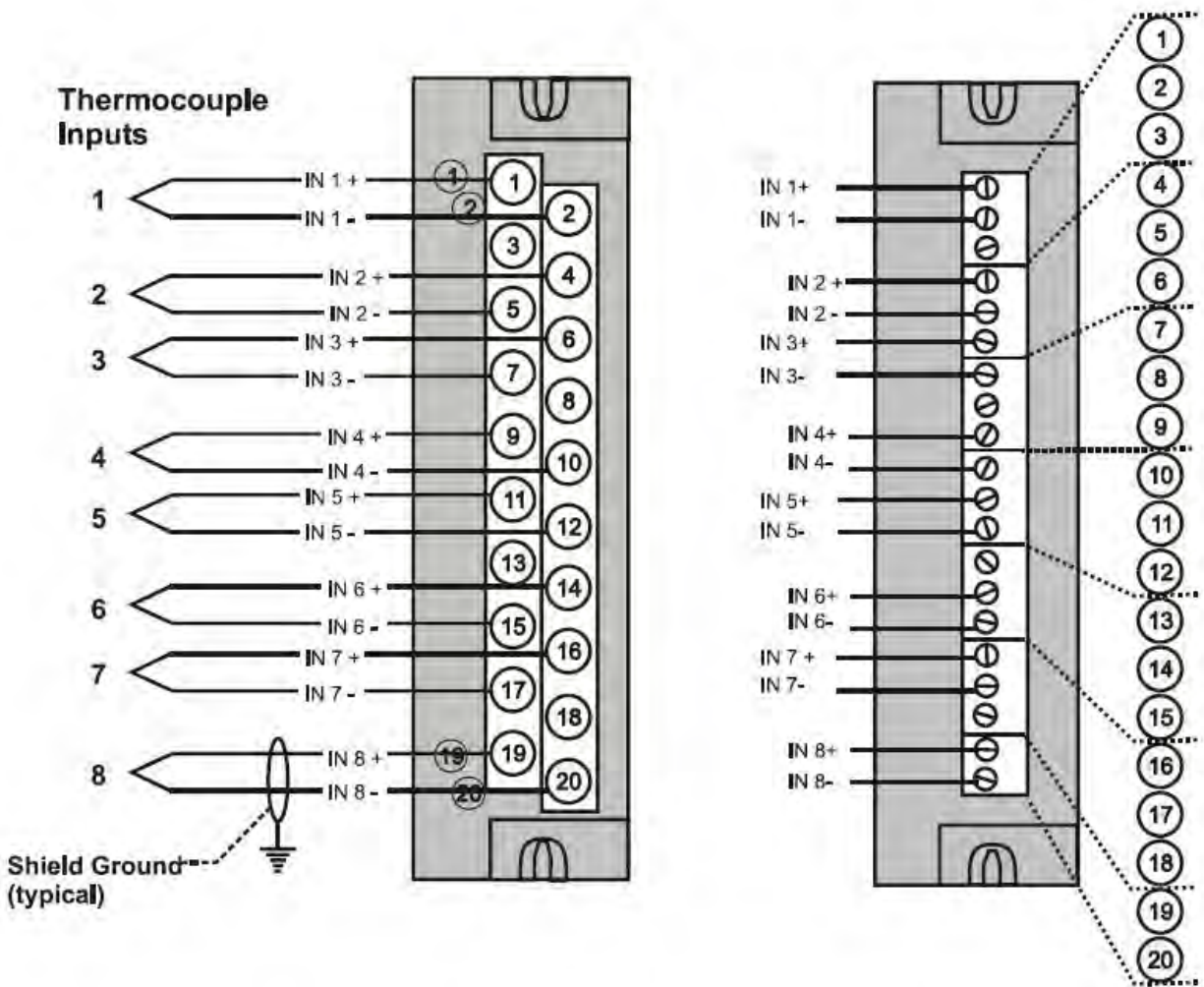
Figure 41 – Analog Input Wiring - Eight TCs
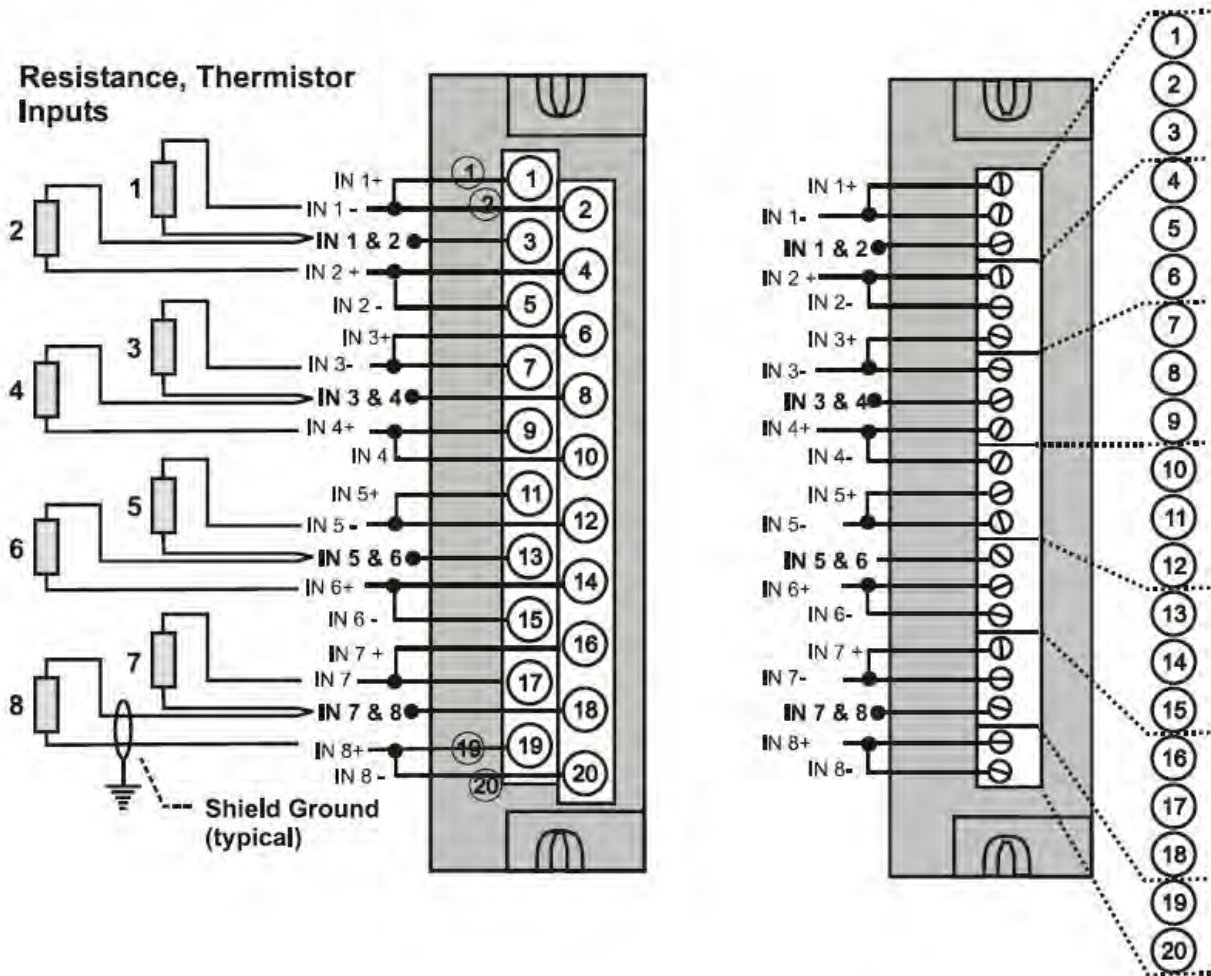
Figure 42 – Analog Input Wiring - Eight Resistance Inputs

Resistance Temperature Device Inputs
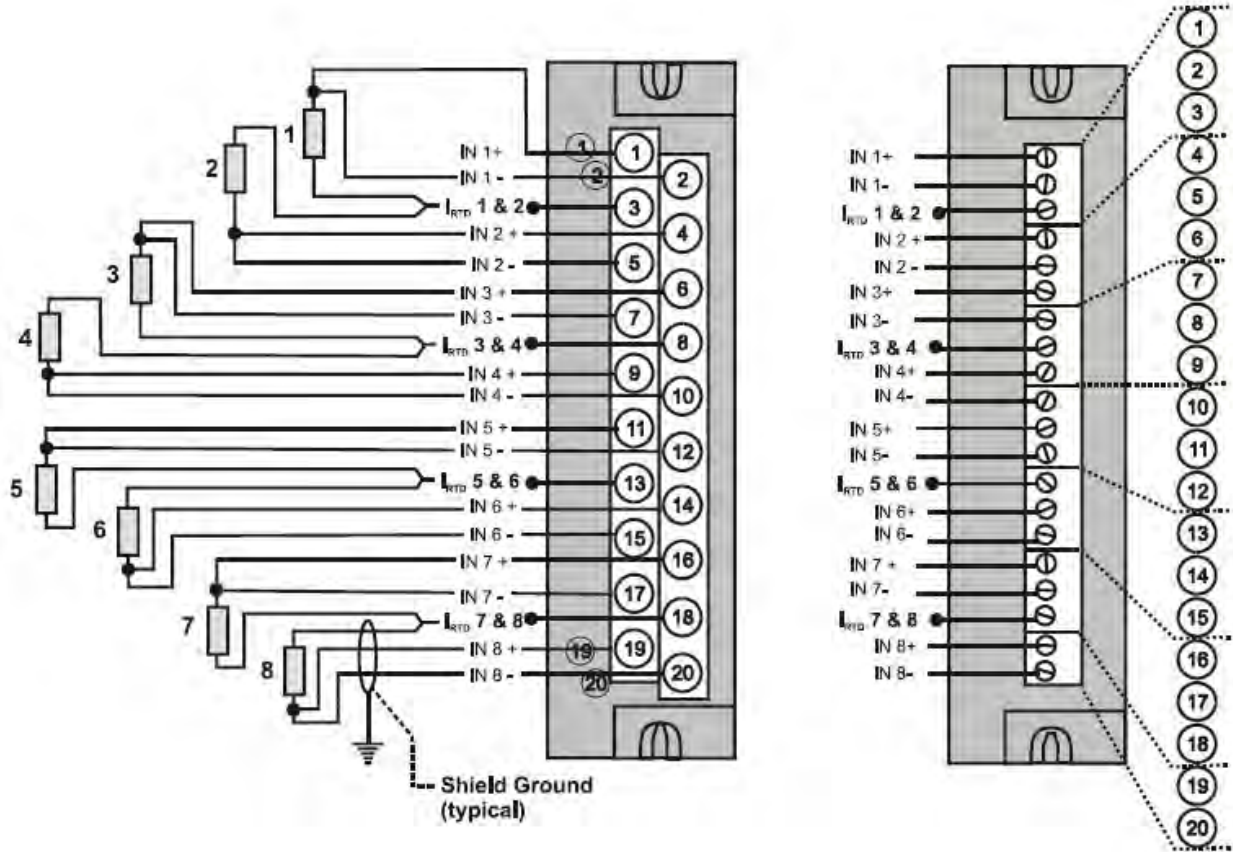
Figure 43 – Analog Input Wiring - Eight RTDs

Slidewires
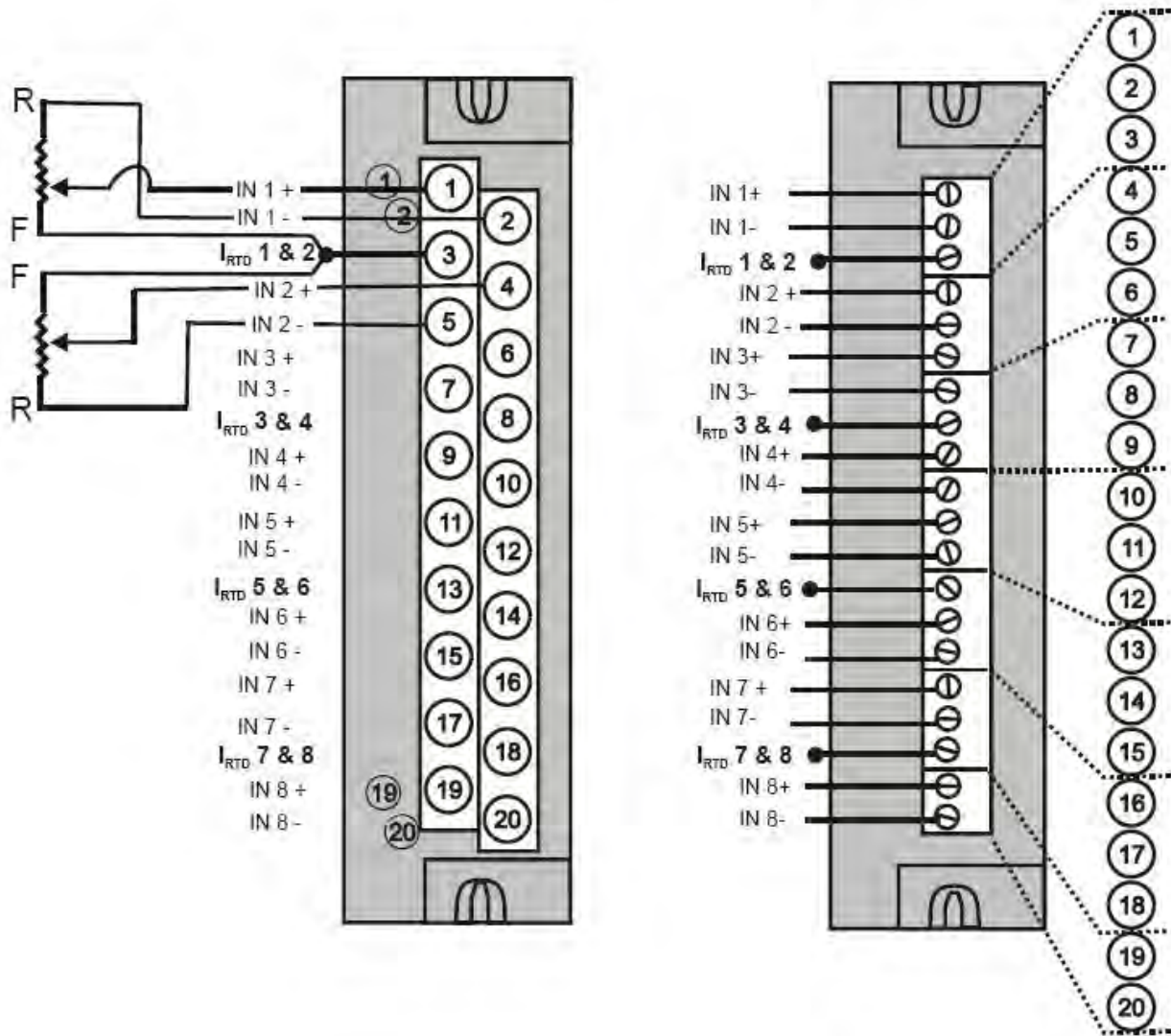
Figure 44 – Analog Input Wiring – Slidewire (Position Proportion Block)

16 point High Level Analog Input Wiring (Figure 45)

Be sure to set the module DIP switches for voltage or current mode. See page 77.
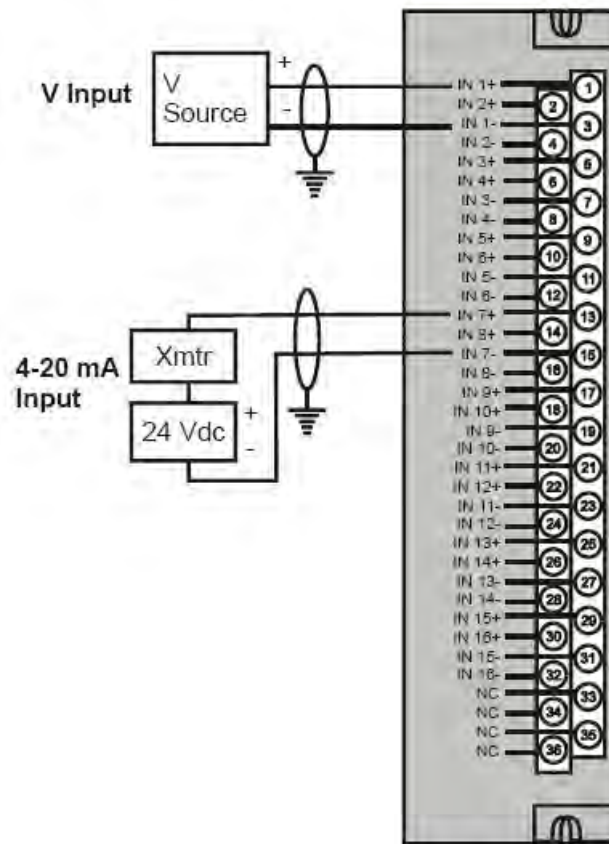
Figure 45 – 16 point High Level Analog Input Wiring

4 channel Analog Output Module Wiring

An example of Analog Output Module wiring is shown in Figure 46. Specifications for this module and for other modules are given in the Specifications section of this manual.

Isolation

The four outputs are isolated from each other.

Shield Grounding

Shields must be grounded as described under Shield Grounding at the beginning of this section.

⚠ **WARNING** ⚡

Hazardous voltages exist at terminal blocks.

• Using switches at field devices disconnect the field wiring form power sources before servicing.

Failure to comply with these instructions could result in death or serious injury.
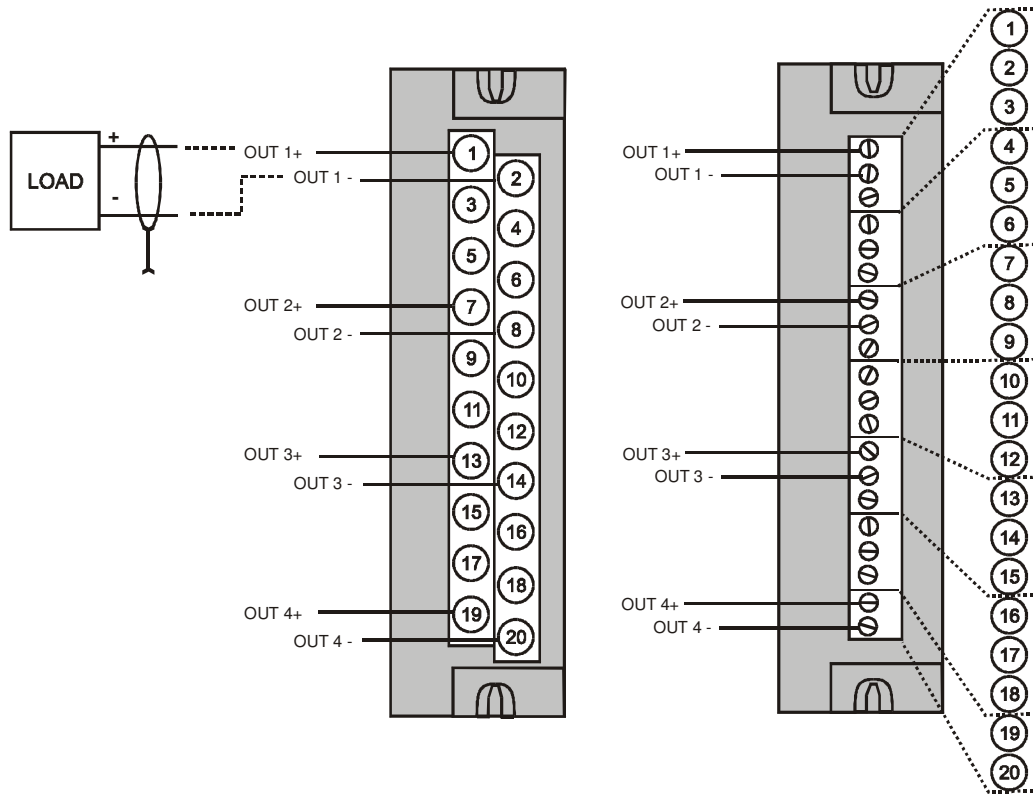
Figure 46 – 4 channel Analog Output Wiring Diagram

8 and 16 channel Analog Output Module Wiring

Examples of high level Analog Output Module wiring are shown in Figure 47 and Figure 48. Specifications for this module and for other modules are given in the Specifications section of this manual.

Before installing, be sure to determine power requirements. See page 38 and 77.

Isolation

The outputs are grouped with 4 outputs per group (outputs 1-4, 5-8, 9-12, 13-16). Groups are isolated from each other; outputs are non-isolated within each group.

Shield Grounding

Shields must be grounded as described under Shield Grounding at the beginning of this section.

⚠ WARNING ⚡

Hazardous voltages exist at terminal blocks.

• Using switches at field devices disconnect the field wiring form power sources before servicing.

Failure to comply with these instructions could result in death or serious injury.
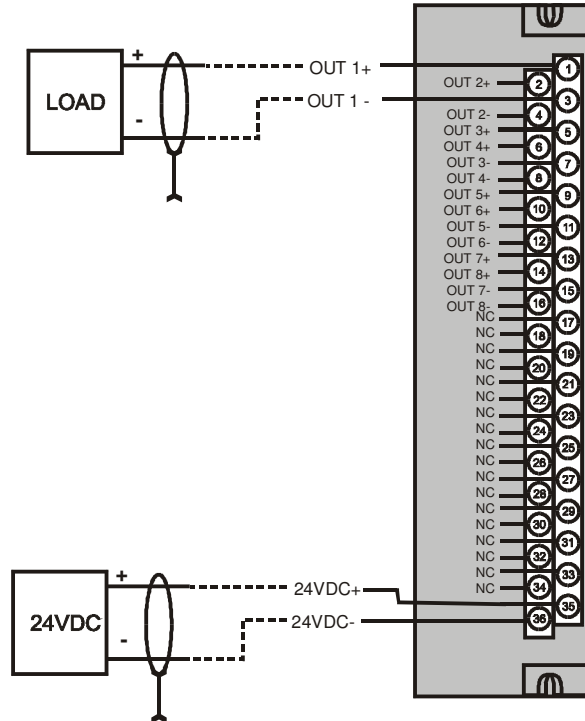
Figure 47 – 8 channel Analog Output Wiring Diagram

Figure 48 – 16 channel Analog Output Wiring Diagram

DC Input Module Wiring

The DC Input Module has sixteen inputs, in two groups of eight inputs per group. The groups are isolated from each other; inputs are non-isolated within each group. An example of Digital Input Module wiring is shown in Figure 49. Specifications for this module and for other modules are given in the Specifications section of this manual.

Shield Grounding

Shields must be grounded as described under Shield Grounding at the beginning of this section.

Common Terminals

Two common terminals are provided for each group of eight inputs. Terminals 9 and 10 are connected in the input module, and terminals 11 and 12 are connected in the module.

Jumper Comb

A two-position jumper comb is available (as an option, for barrier-style terminal blocks only) for connecting digital common wiring (at terminals 9 and 11 *or* 10 and 12). See Figure 50.

⚠ **WARNING** ⚡

Hazardous voltages exist at terminal blocks.

- Using switches at field devices disconnect the field wiring from power sources before servicing.

**Failure to comply with these instructions could result in death or serious injury.**
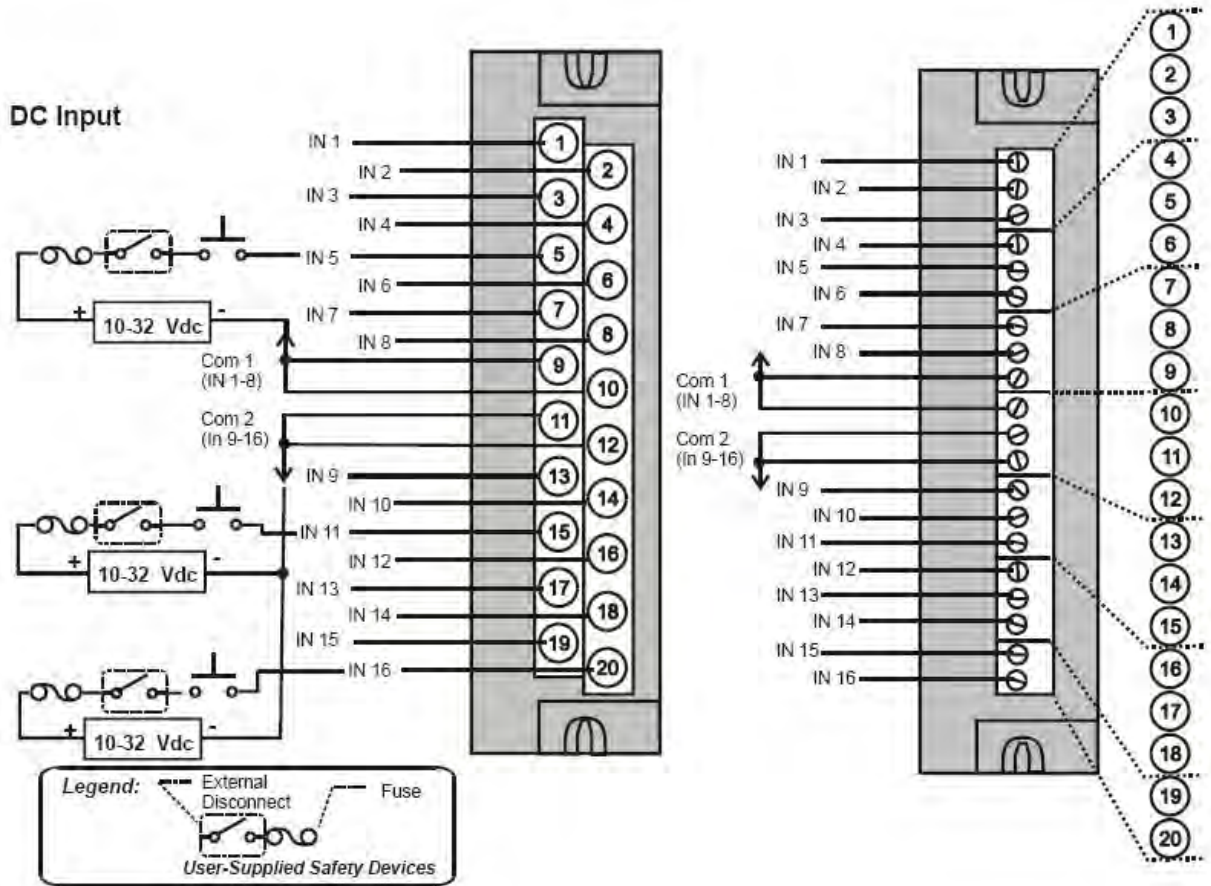
**Figure 49 – DC Input Module Wiring Diagram**
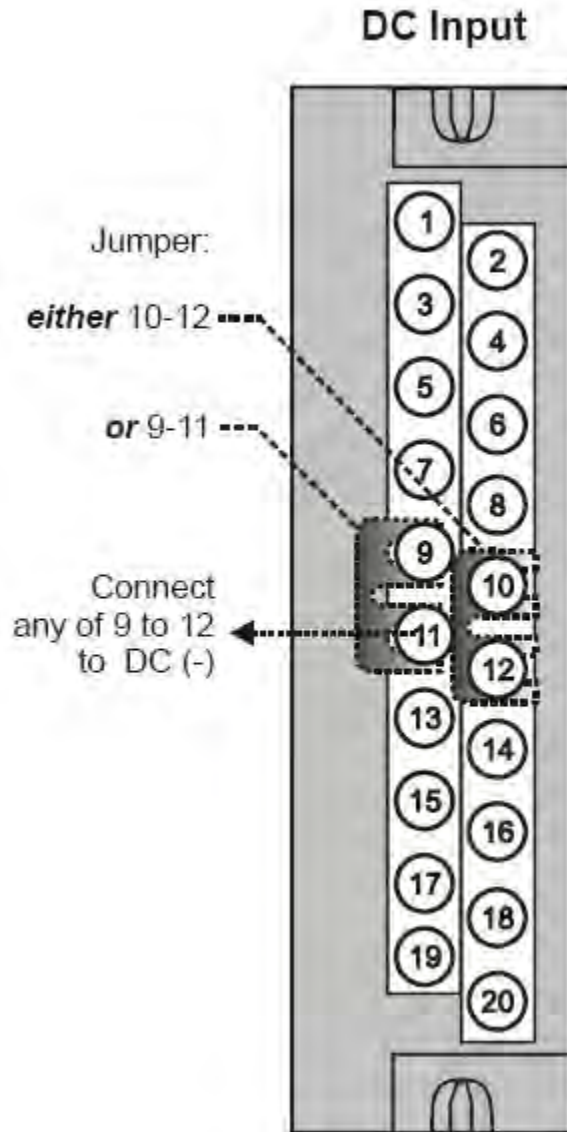
DC Input

Figure 50 – DC Input Module Jumper

32 point DC Input Module Wiring

The 32-point DC Digital Input module (Figure 51) provides two groups of 16 inputs, each with a pair of terminals for connection to common. DC power applied between the common terminal and an input cause the input to turn ON. A green LED on the module provides indication of an ON state. Logic in the controller allows the state to be inverted when necessary.

Requires Low Voltage Euro style 36-terminal terminal block.
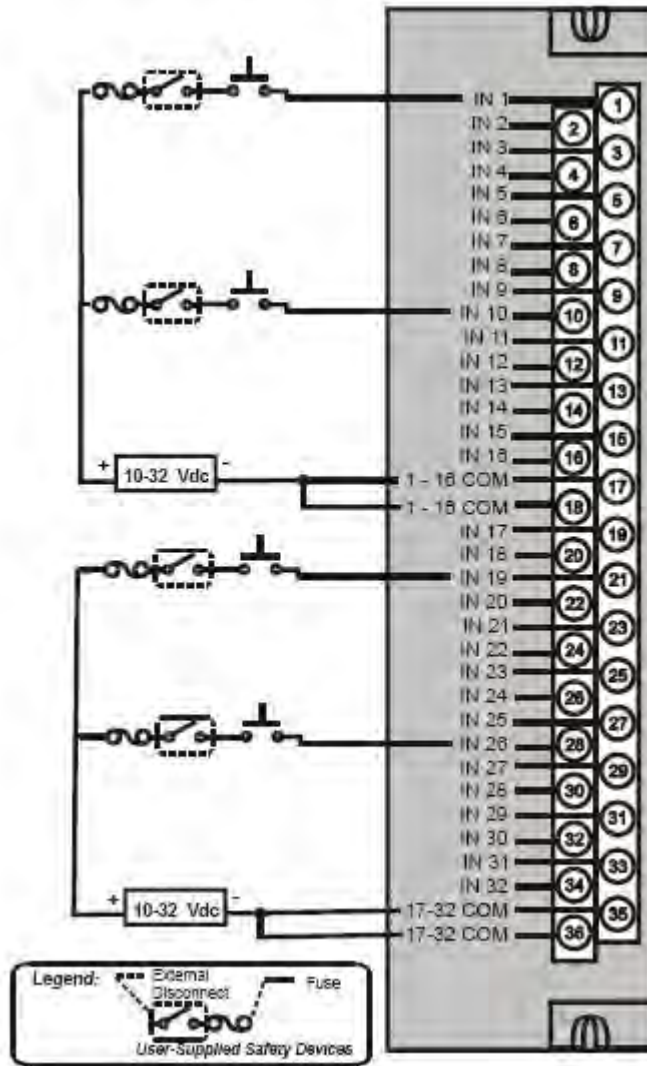
Figure 51 – 32 point DC Input Module Wiring

AC Input Module Wiring

The AC Input Module has sixteen inputs. An example of AC Input Module wiring is shown in Figure 52. Specifications for this module and for other modules are given in the Specifications section of this manual.

Common Terminals

Two common terminals are provided for each group of eight inputs. Terminals 9 and 10 are connected in the input module, and terminals 11 and 12 are connected in the module.

Jumper Comb

An optional two-position jumper comb is available as an option (for barrier style terminal blocks only) for connecting digital common wiring at terminals 9 and 11 **or** terminals 10 and 12. See Figure 53.

⚠ WARNING ⚡

Hazardous voltages exist at terminal blocks.

- Using switches at field devices, disconnect the field wiring from power sources before servicing.

Failure to comply with these instructions could result in death or serious injury.
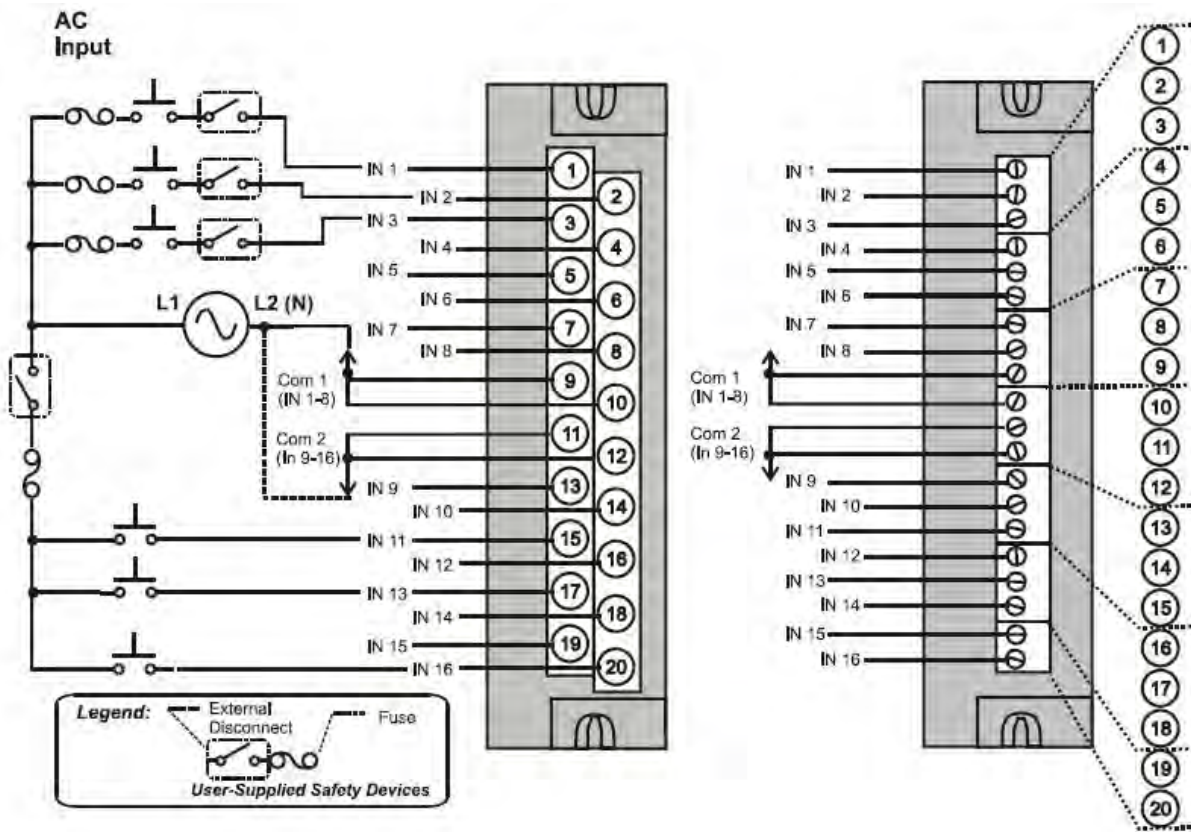
Figure 52 – AC Input Module Wiring Diagram
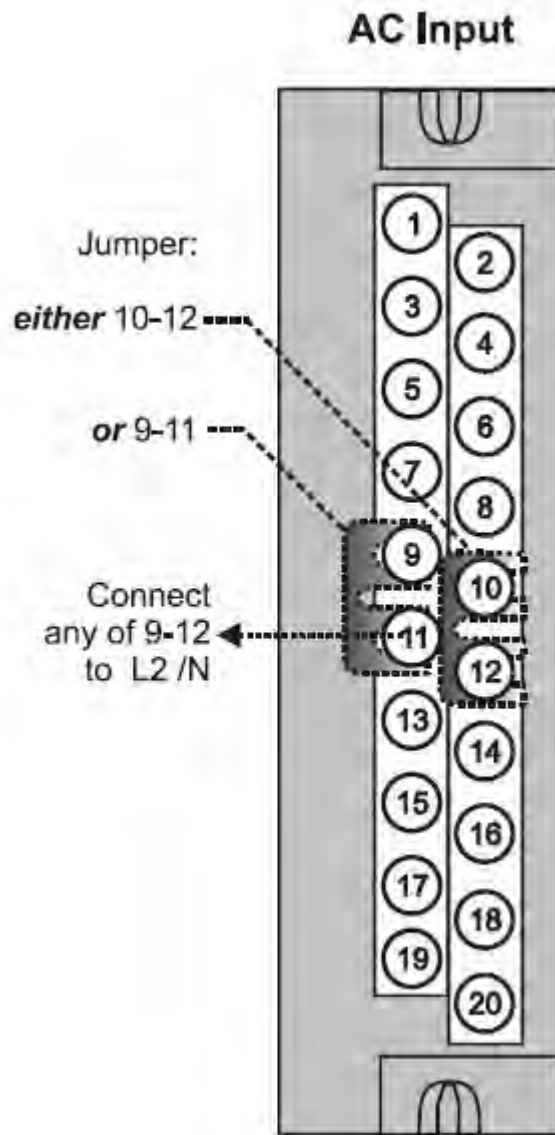
Figure 53 – AC Input Module Jumper

AC/DC Isolated Input Module Wiring

The AC/DC Input Module has sixteen isolated inputs. An example of AC Input and DC input Module wiring is shown in Figure 54. Specifications for this module and for other modules are given in the Specifications section of this manual.

Isolation

Inputs must be powered from external voltage sources. Inputs are isolated from each other and from controller power.
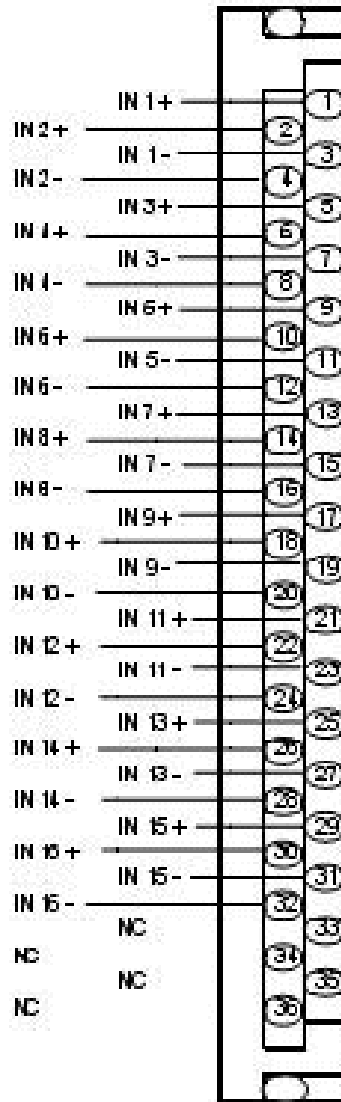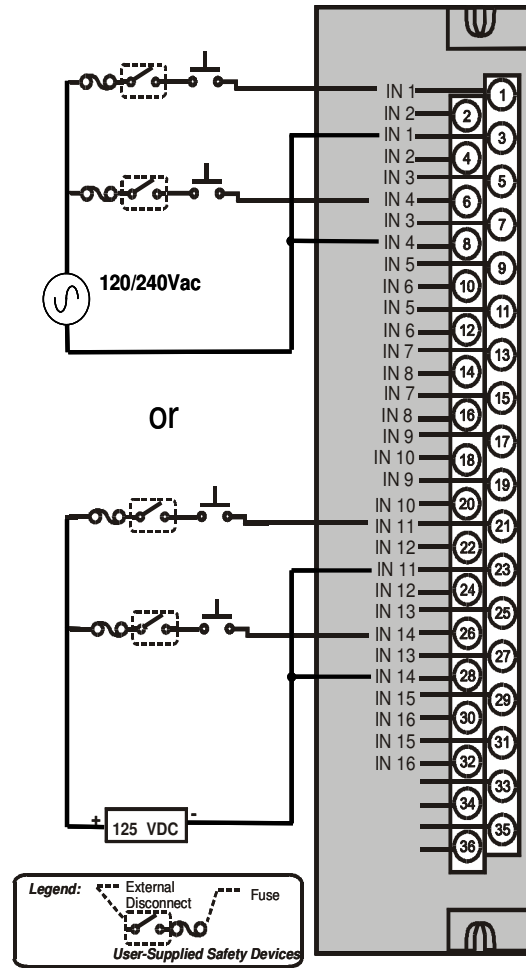
Figure 54 – AC/DC Isolated Input Module Wiring

Contact Input Module Wiring

The Contact Input Module has sixteen inputs in one group. An example of Contact Input wiring is shown in Figure 55.

Specifications for the Contact Input Module and other modules are given in the Specifications section of this manual.

Internally Powered Input Channels

The Contact Input Module provides voltage to the field contacts.

> ⚠️ **CAUTION**
>
> Do not apply any external power to the field device or to the input terminals. Doing so could damage the module.

Common terminals

Four common terminals are provided for the 16 inputs. Terminals 9, 10, 11, and 12 are connected in the Contact Input module.

⚠️ **WARNING** ⚡

Hazardous voltages exist at terminal blocks.

- Using switches at field devices disconnect the field wiring from power sources before servicing.

**Failure to comply with these instructions could result in death or serious injury.**
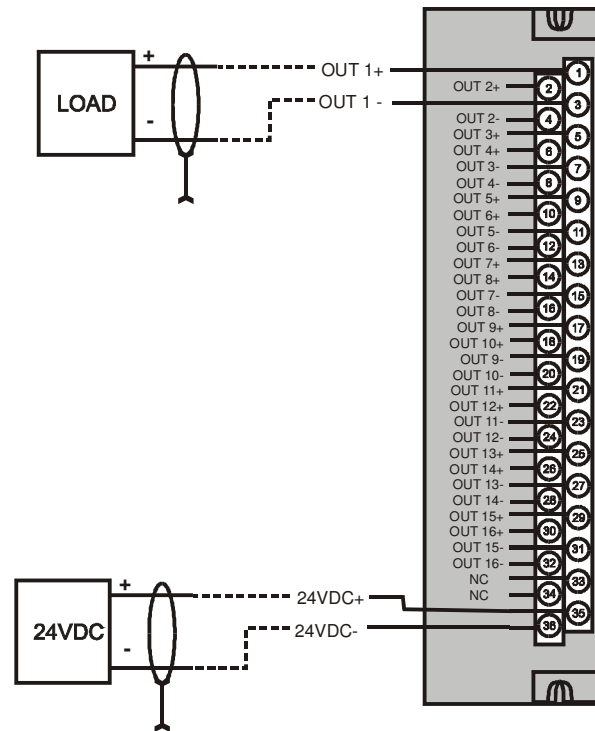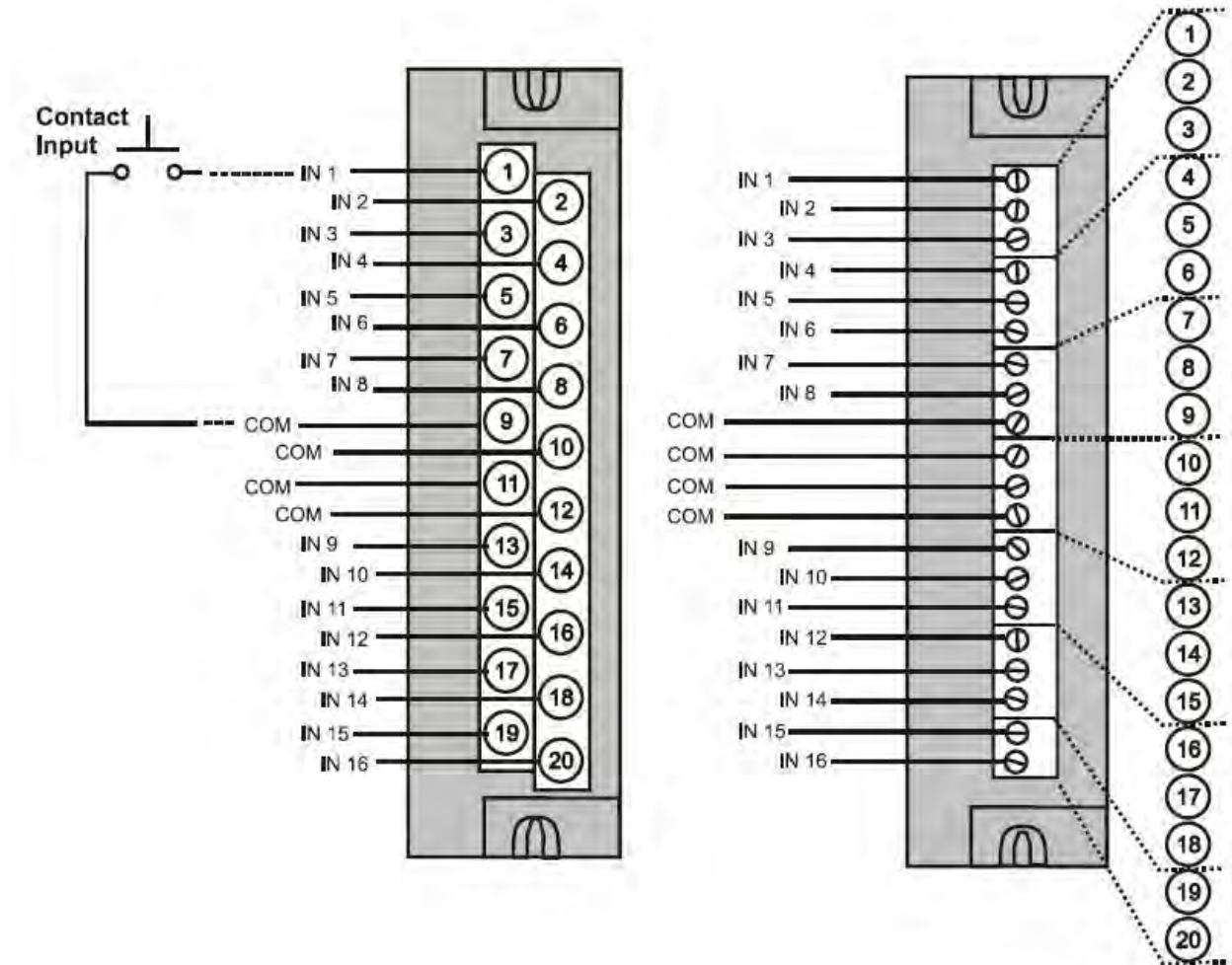

Figure 55 – Contact Input Wiring Diagram

DC Output Module Wiring

The DC Output Module provides 16 current-sinking outputs in two groups of eight points per group. The two groups are isolated from each other; outputs are non-isolated within each group. Current sinking means that a positive voltage potential is continuously applied to one side of each DC output load, and the negative side of the load is switched internally in the module.

Specifications for this module and for other modules are given in the Specifications section of this manual. Examples of DC Output wiring are shown in Figure 56 - DC Output Module Wiring Diagram

Over-Current Protection

Electronic high-current and high-temperature limiting provides overload protection; resets after cycling power. Conventional external fuses may be used if desired.

Reverse-Polarity Protection

A potential of ± 34 Volts will cause no damage to the module; a reverse polarity power supply connection allows continuous current flow to the loads that are not controlled by the On/Off state of the output circuits.

Jumper Comb

Two-position jumper combs are available (as an option for barrier style terminal blocks only) for connecting digital common wiring between terminals 10 and 12, and for connecting +24Vdc between terminals 9 and 11. See Figure 57.

+V Terminals

The +V1 (terminal 9) and +V2 (terminal 11) are the positive power supply input to power the output circuits for the two groups of eight inputs per group. The +V supply must provide minimum 24 Vdc at 65 mA (min) per group.

⚠ **WARNING** ⚡

Hazardous voltages exist at terminal blocks.

• Using switches at field devices disconnect the field wiring from power sources before servicing.

**Failure to comply with these instructions could result in death or serious injury.**
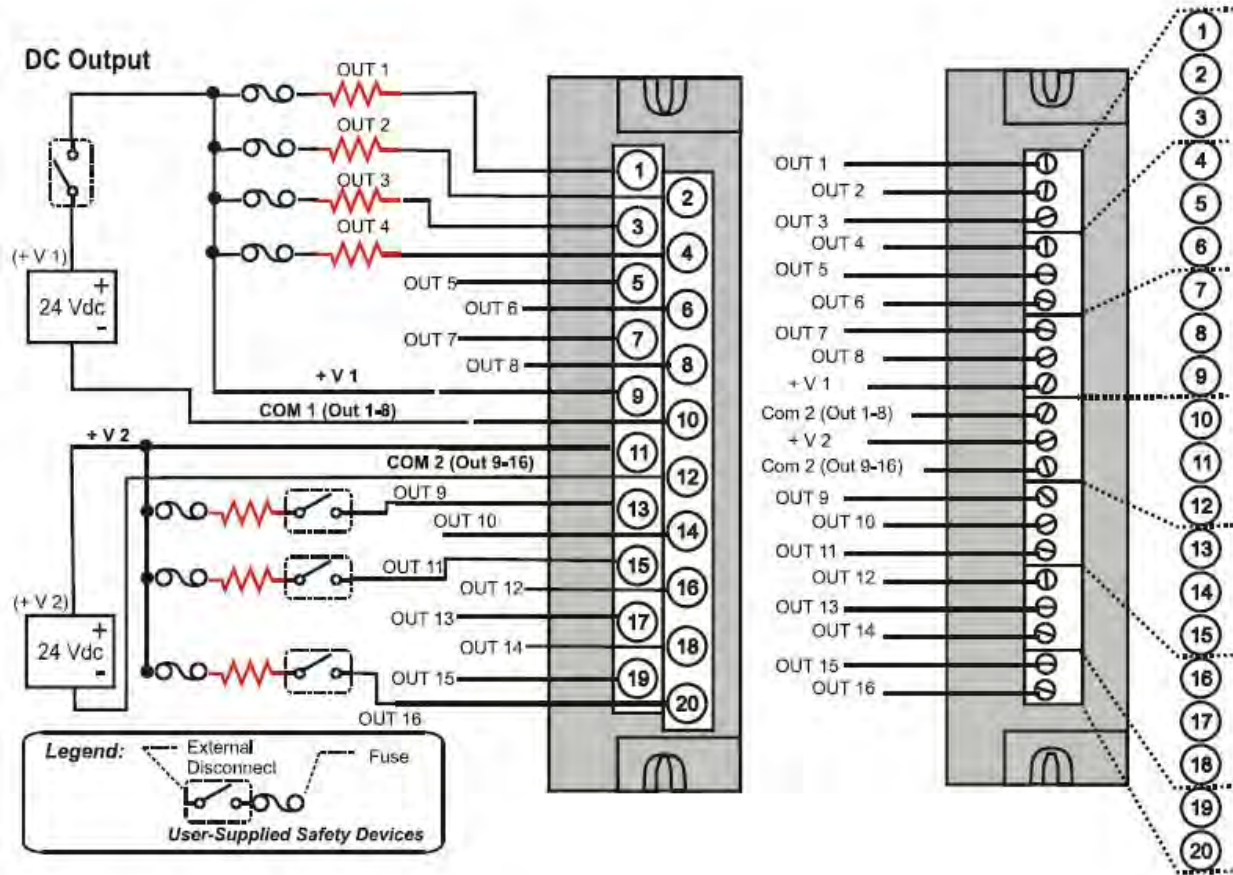

Figure 56 – DC Output Module Wiring Diagram
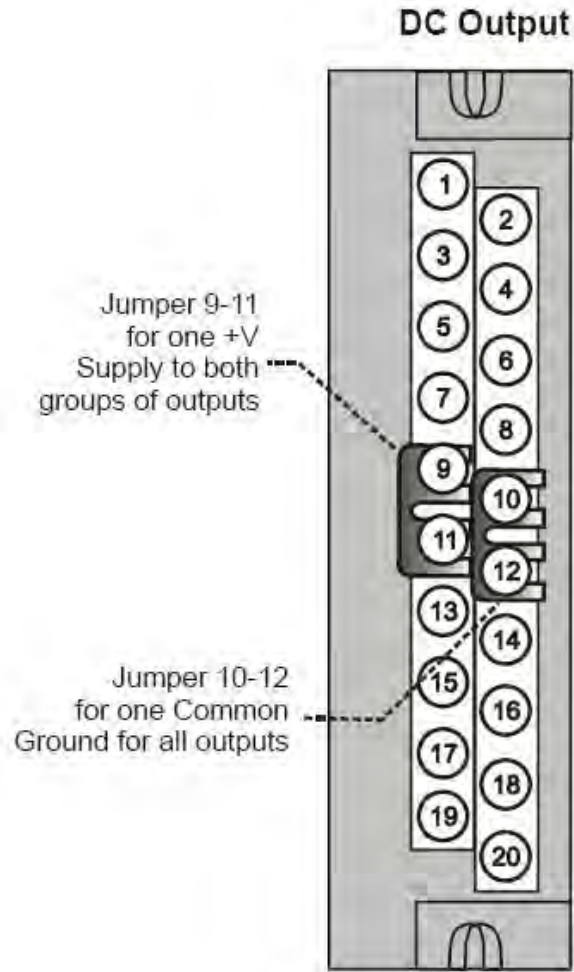
Figure 57 – DC Output Jumpers

32 point DC Output Wiring

The DC digital Output module provides 32 externally powered outputs in 2 groups of 16 (Figure 58). The outputs are high side switching (current sourcing) type. Over-current protection is provided for each channel, in 4 groups of 8 channels. In case of short circuit for any output channel, that whole group of 8 is switched off. Power cycling is not required to reset the module.

A green LED on the module provides indication of an ON state for each output.

Requires Low Voltage Euro style 36-terminal terminal block.
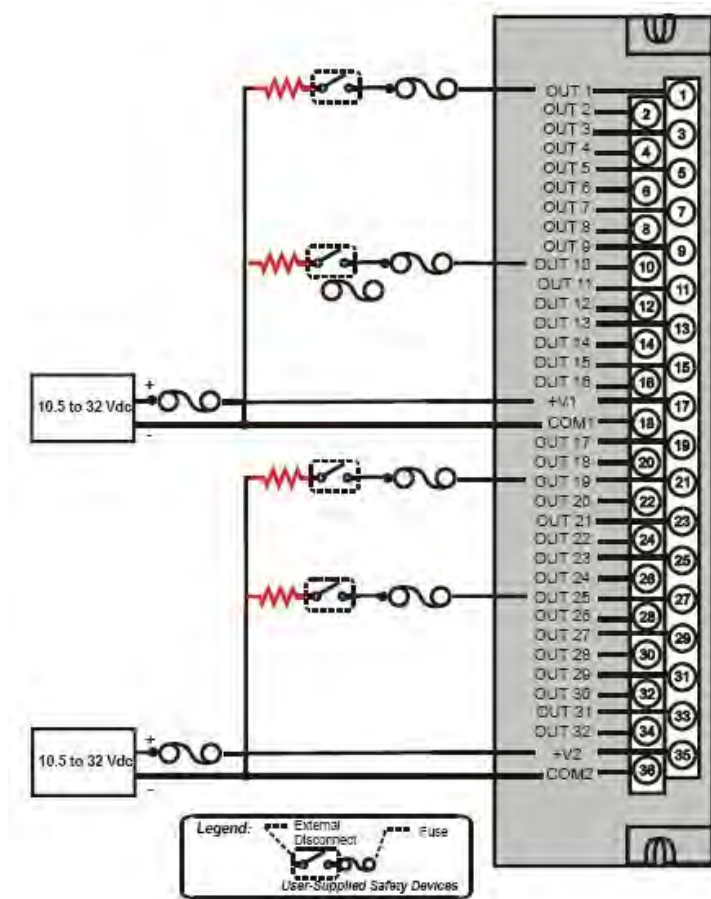
Figure 58 – 32 point DC Output Module Wiring

AC Output Module Wiring

The AC Output Module provides eight output circuits. Each output is isolated from the other outputs. An example of AC output wiring is shown in Figure 59. Specifications for this module and for other modules are given in the Specifications section of this manual.

Output Loading

Voltage: 85 to 240 Vac

Maximum per output: 2.0A resistive load

Maximum per module: 8.0A

NOTE

When exceeding 1.0 A per output, it is recommended (but not required) to connect the high-current loads to every other output - for example, outputs 1, 3, 5, 7 or 2, 4, 6, 8. This distributes heat more evenly across the heat sink.

Jumper Comb

A ten-position jumper comb is available for inter-connecting all L1 (Hot) terminals (1, 3, 5, 7, 9, 11, 13, 15, 17, 19). See Figure 60.

Replaceable Fuses

Each output circuit on the AC Output Module includes a (plug-in) replaceable fuse.

Replacement fuse is from Wickmann, part #3741315041. This is a 3.15 Amp time lag fuse with UL/CSA approval for 250 VAC.

⚠ WARNING ⚡

Hazardous voltages exist at terminal blocks.

• Using switches at field devices disconnect the field wiring from power sources before servicing.

**Failure to comply with these instructions could result in death or serious injury.**
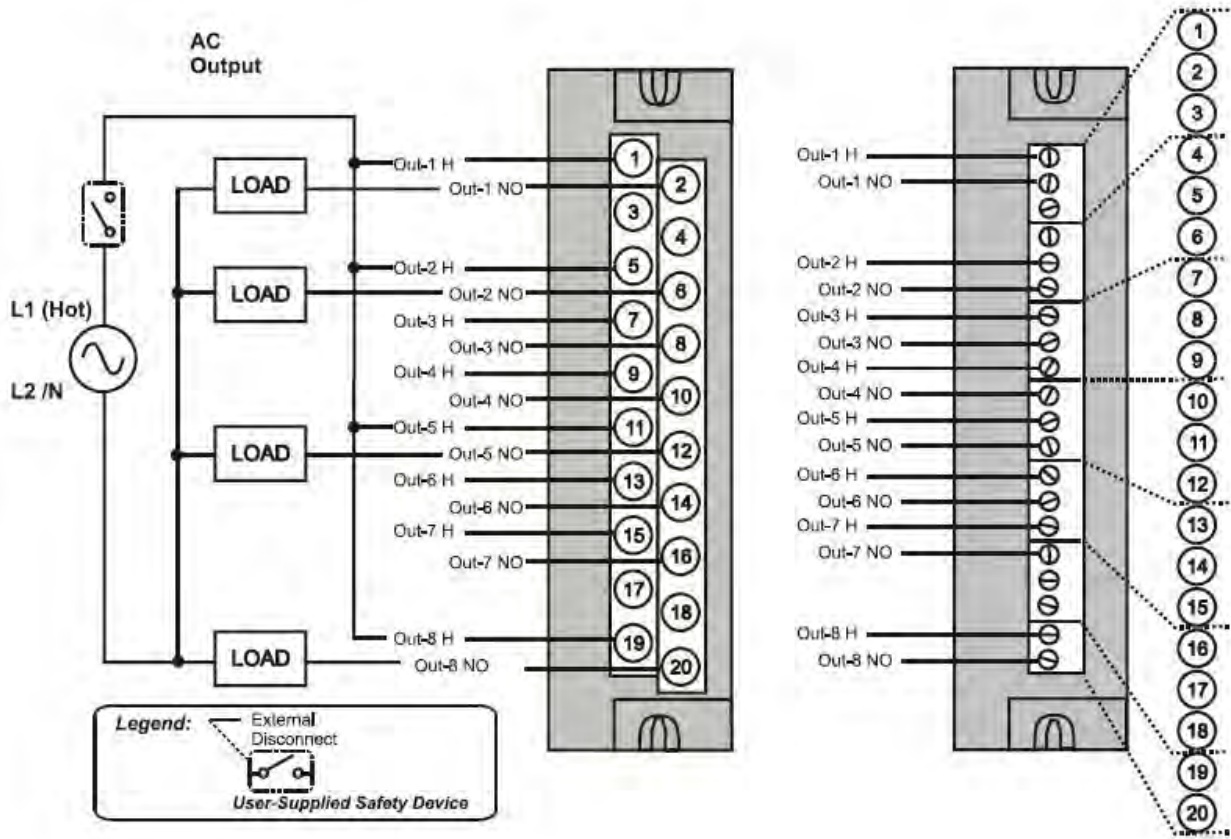
Figure 59 – AC Output Module Wiring Diagram
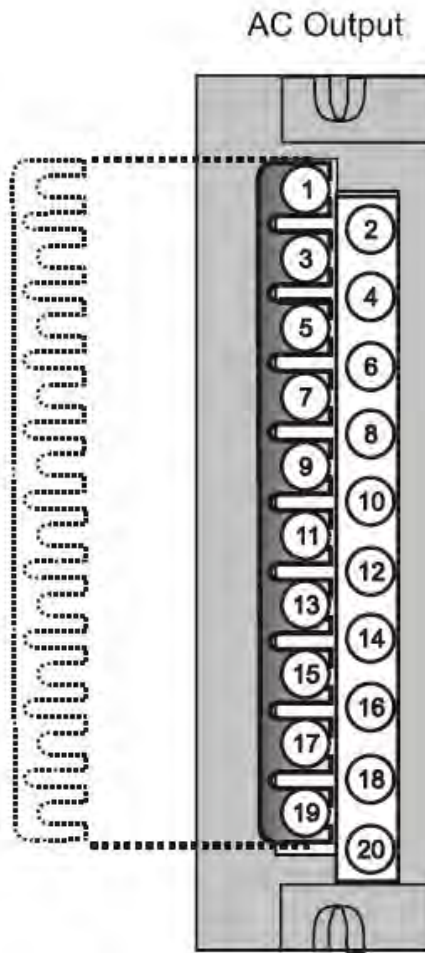
Figure 60 – AC Output Module Jumper

Relay Output Module Wiring

The Relay Output Module provides eight individually isolated, electromechanical relay outputs. Four of the outputs are Form-C, and the other four are Form-A. A schematic showing the relationship of individual Form-A relays and Form-C relays to external (user) connections is given in Figure 61.

Examples of Relay Output wiring as they relate to connections on the Terminal Block are shown in Figure 62.
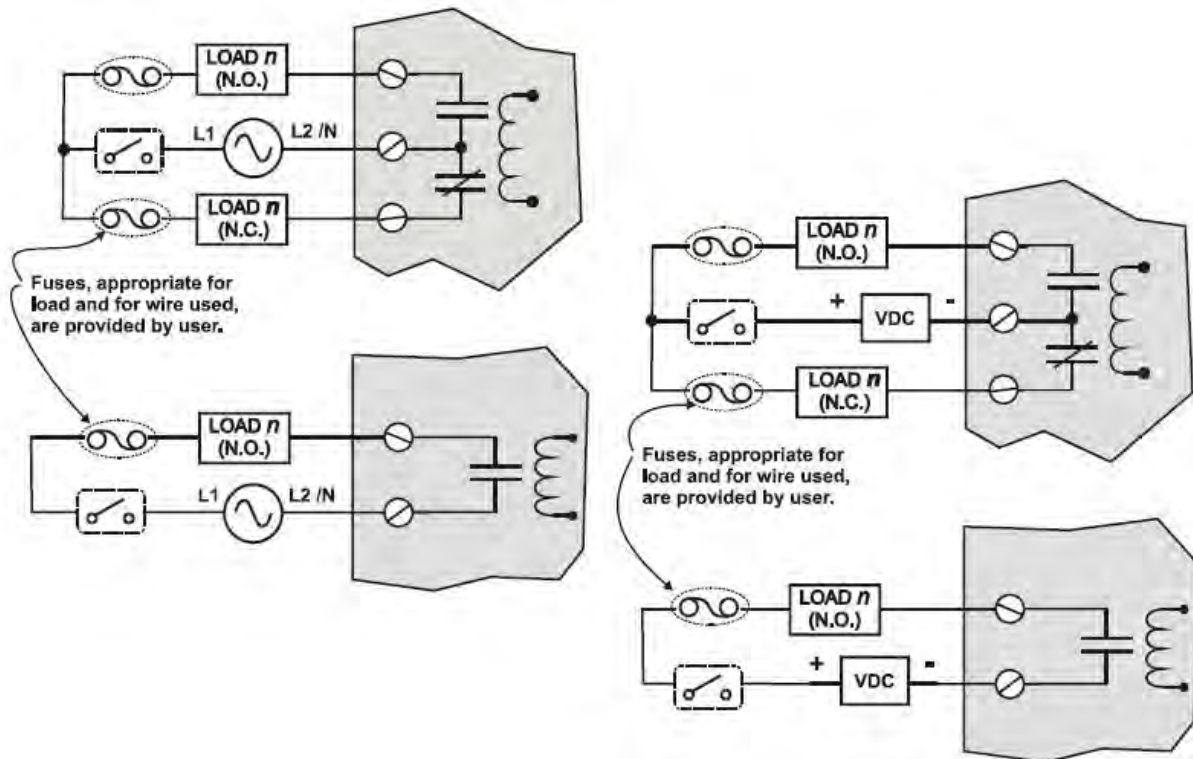
Figure 61 – Schematic Example: Relay Output and External Wiring

Contact Rating

Maximum current/output: 4A at 250Vac/30Vdc with resistive load

Maximum current per module: No de-rating per module, but ensure compliance with maximum ratings for each output.

Note: specified relay life is 1,000,000 cycles. For applications requiring constant cycling of output, Honeywell recommends using a solid state AC or DC output module.

Required Output Fusing

Outputs are not fused in the Relay module. Install a fuse for each output at the field device that is appropriate for the load and the wire used.

Jumper Comb

A ten-position jumper comb, available for the AC Output Module, can be cut in half and used as shown in Figure 63 to reduce the number of wires required to connect the Relay Output Module to AC Neutral or to DC Common.

> ⚠️ **WARNING** ⚡
>
> **Hazardous voltages** exist at terminal blocks.
>
> • Using switches at field devices disconnect the field wiring from power sources before servicing.
>
> **Failure to comply with these instructions could result in death or serious injury.**
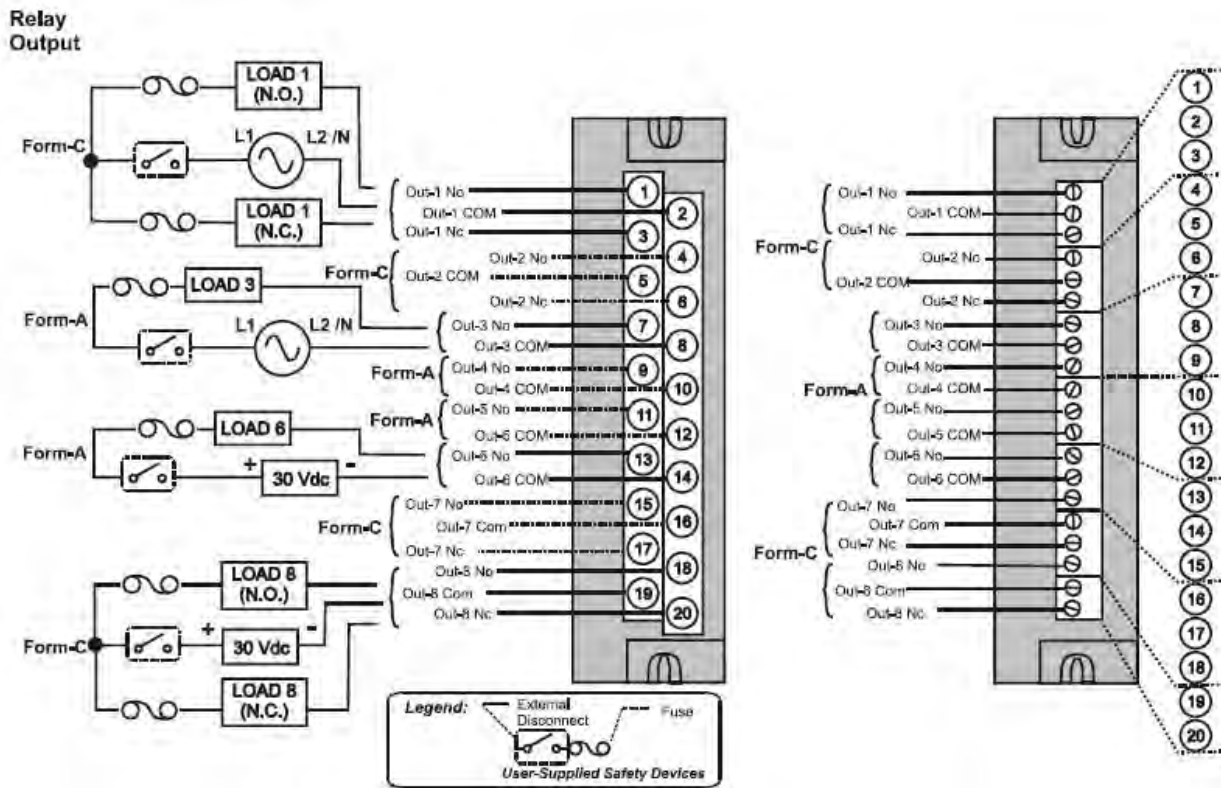
Figure 62 – Relay Output Module Wiring Diagram
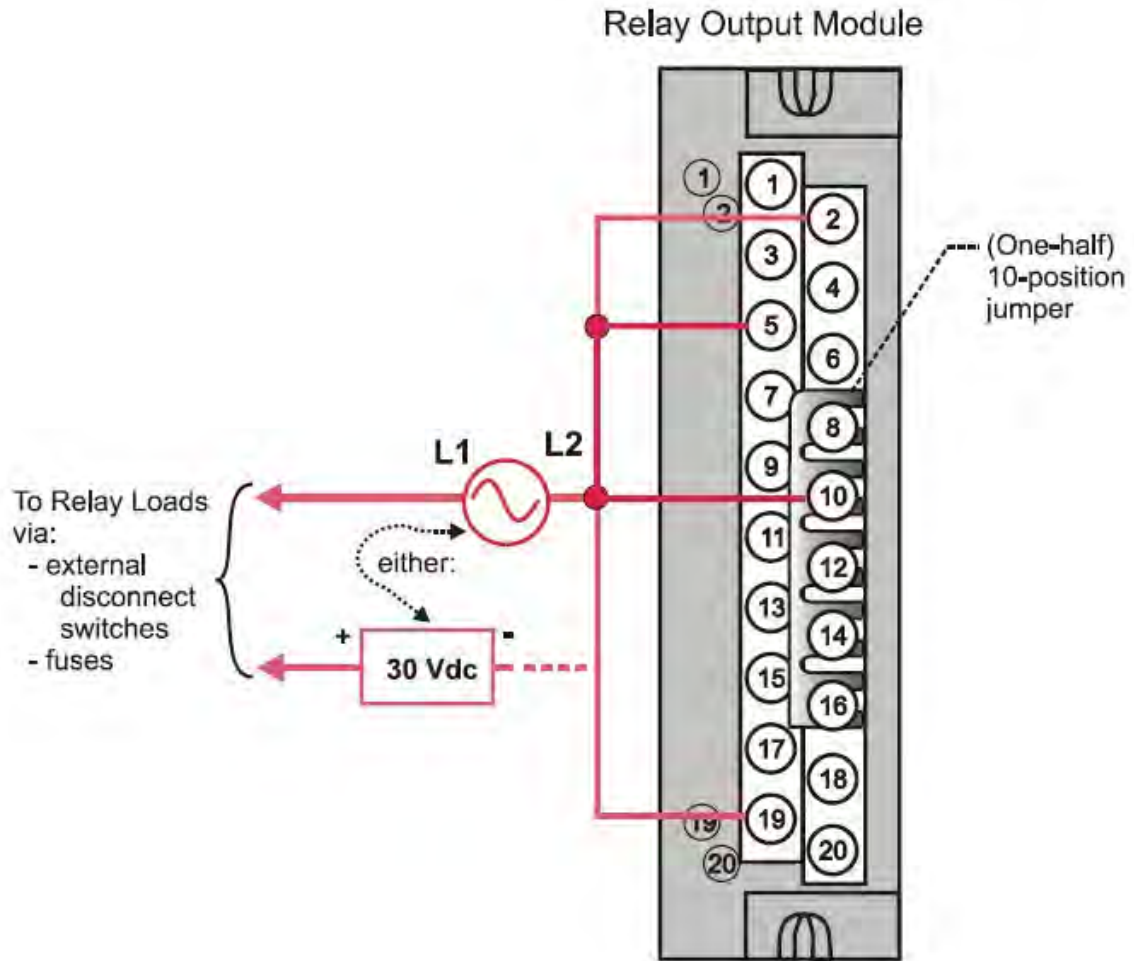
Figure 63 – Relay Output Module Jumpers

Pulse/Frequency/Quadrature Module Wiring (Figure 64 through Figure 70)

The 4 Channel Pulse/Frequency/Quadrature Module provides four different functionalities in the form of Pulse Input, Frequency measurement, Quadrature encoder input and Pulse Output. Each of the 4 channels can be configured for any one of these four functionalities; with the exception that quadrature encoder input (A and B pulses) can be applied to only Channels 1 and 2 respectively. When configured for quadrature, Channels 3 and 4 will still be available for use.

The Pulse Output functionality uses the digital output available on the module for outputting pulses.

Before installing be sure to set the module DIP switches for differential or single ended. See page 78.
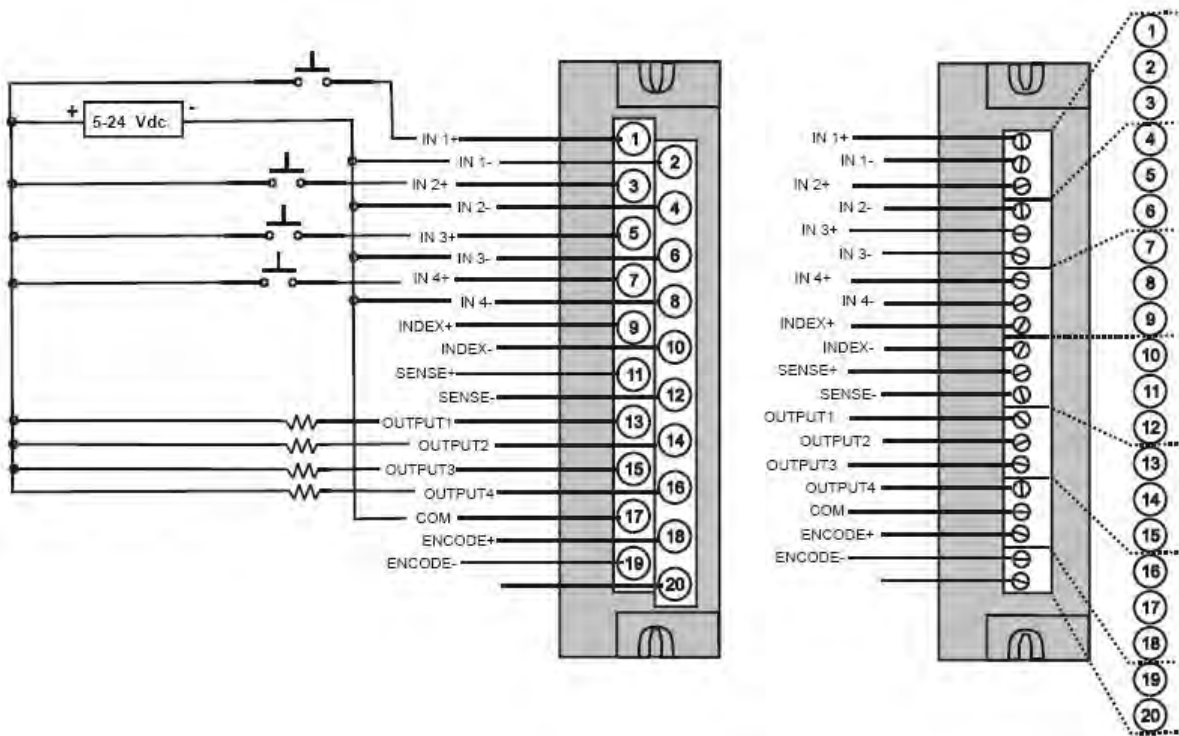
Figure 64 – Pulse Counting Wiring
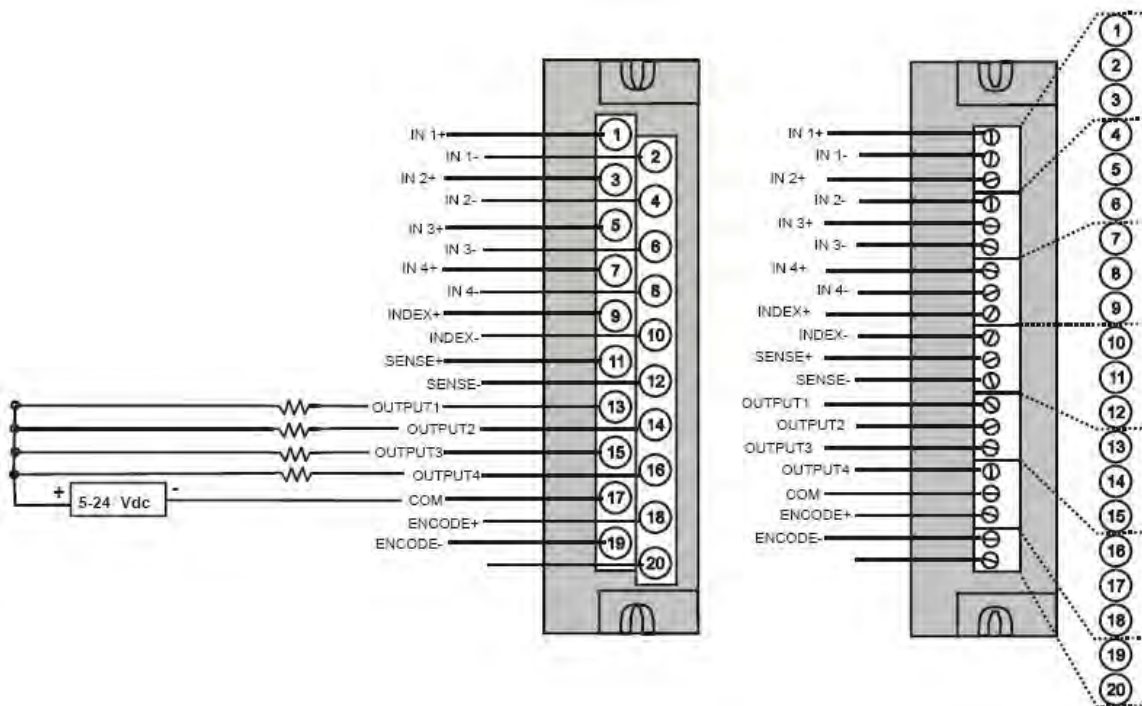
Figure 65 – Pulse Output Wiring
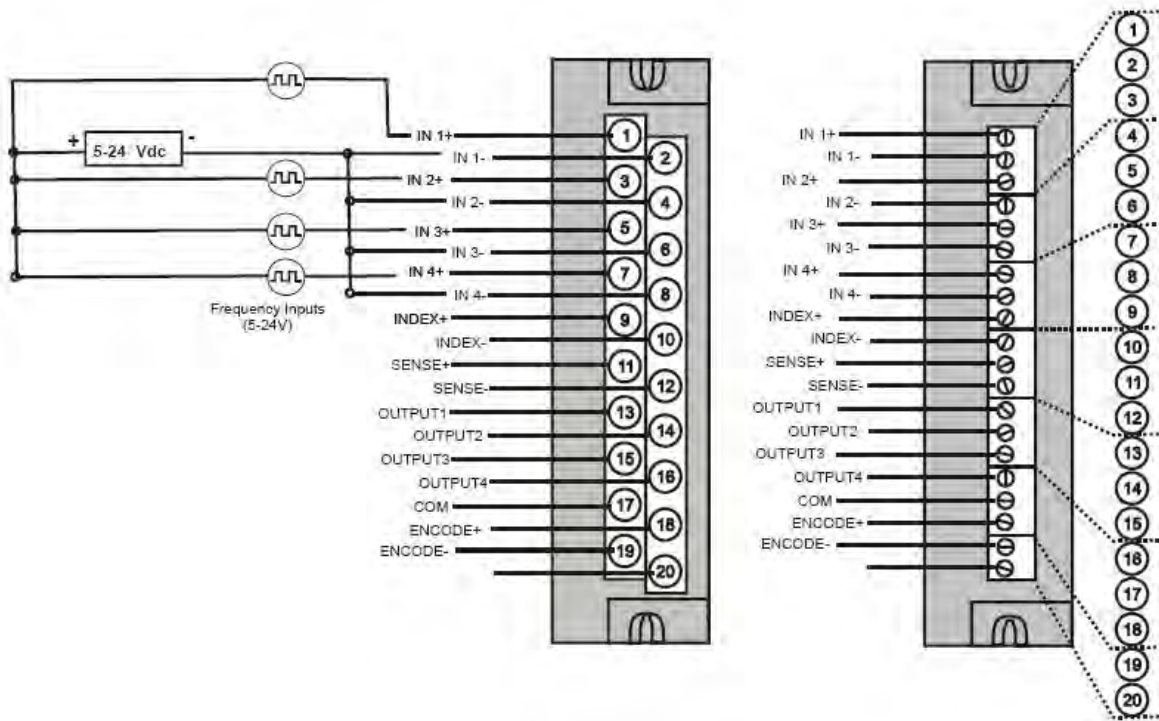
Figure 66 – Frequency Wiring
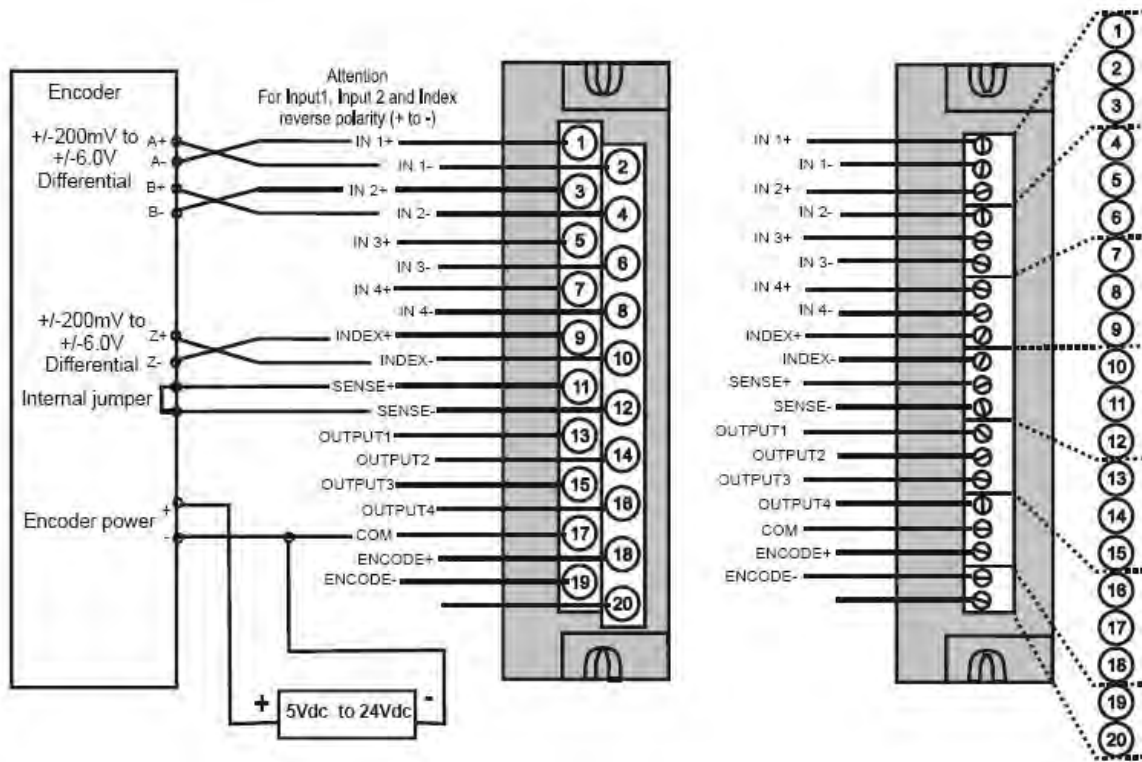
Figure 67 – Quadrature, Differential, External Power Wiring
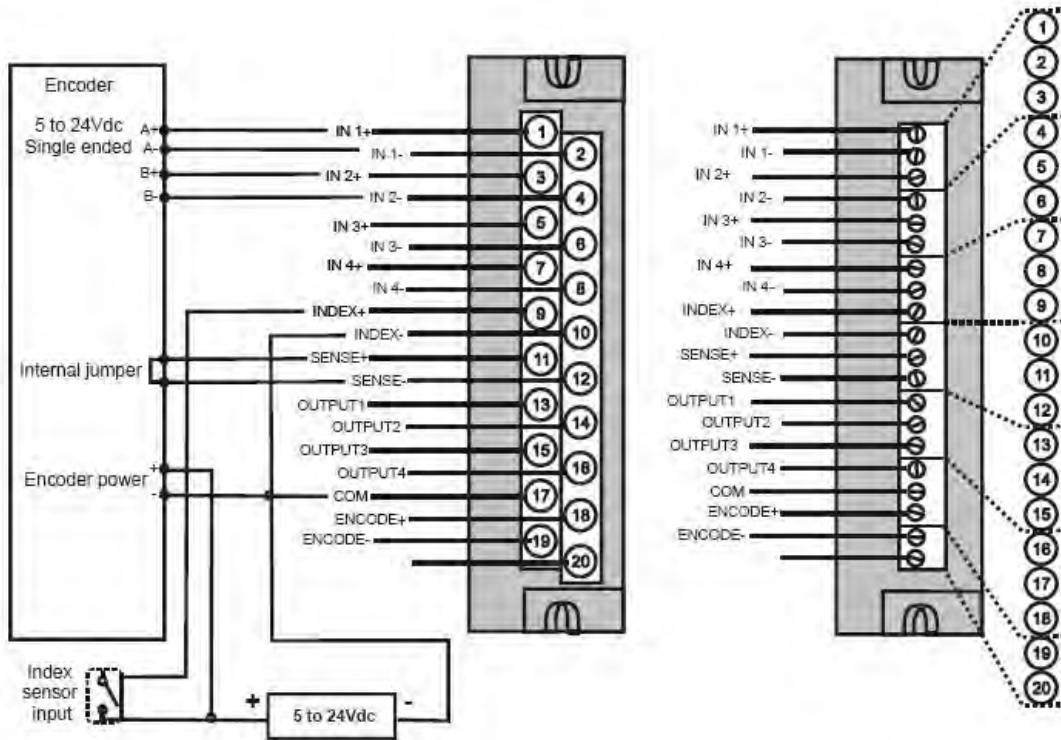
Figure 68 – Quadrature, Single Ended, External Power Wiring
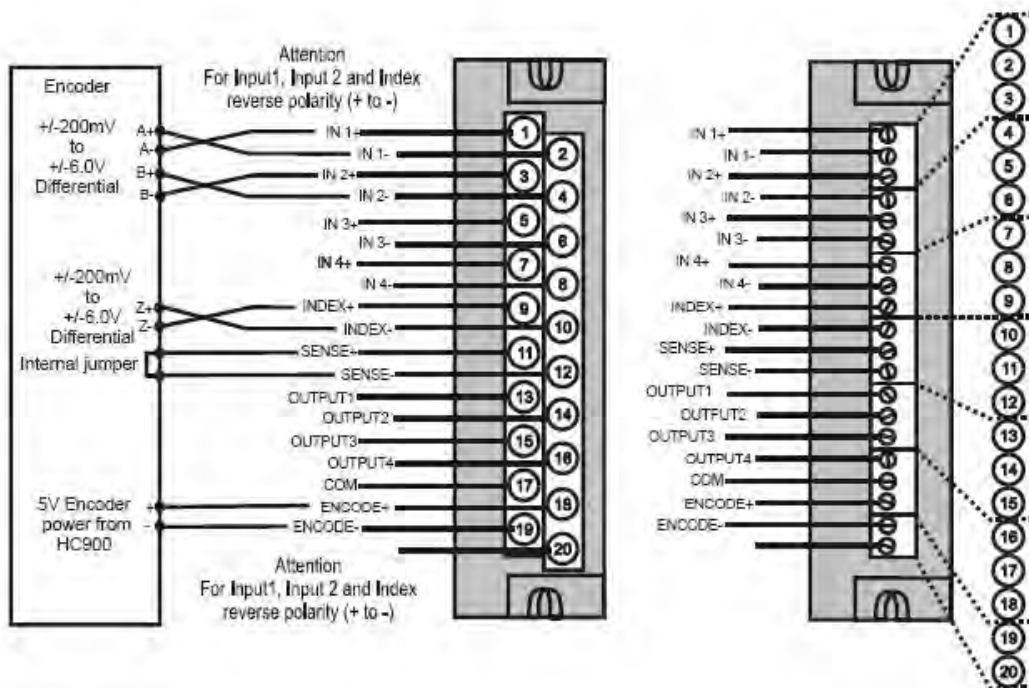
Figure 69 – Quadrature, Differential, HC900 Power Wiring
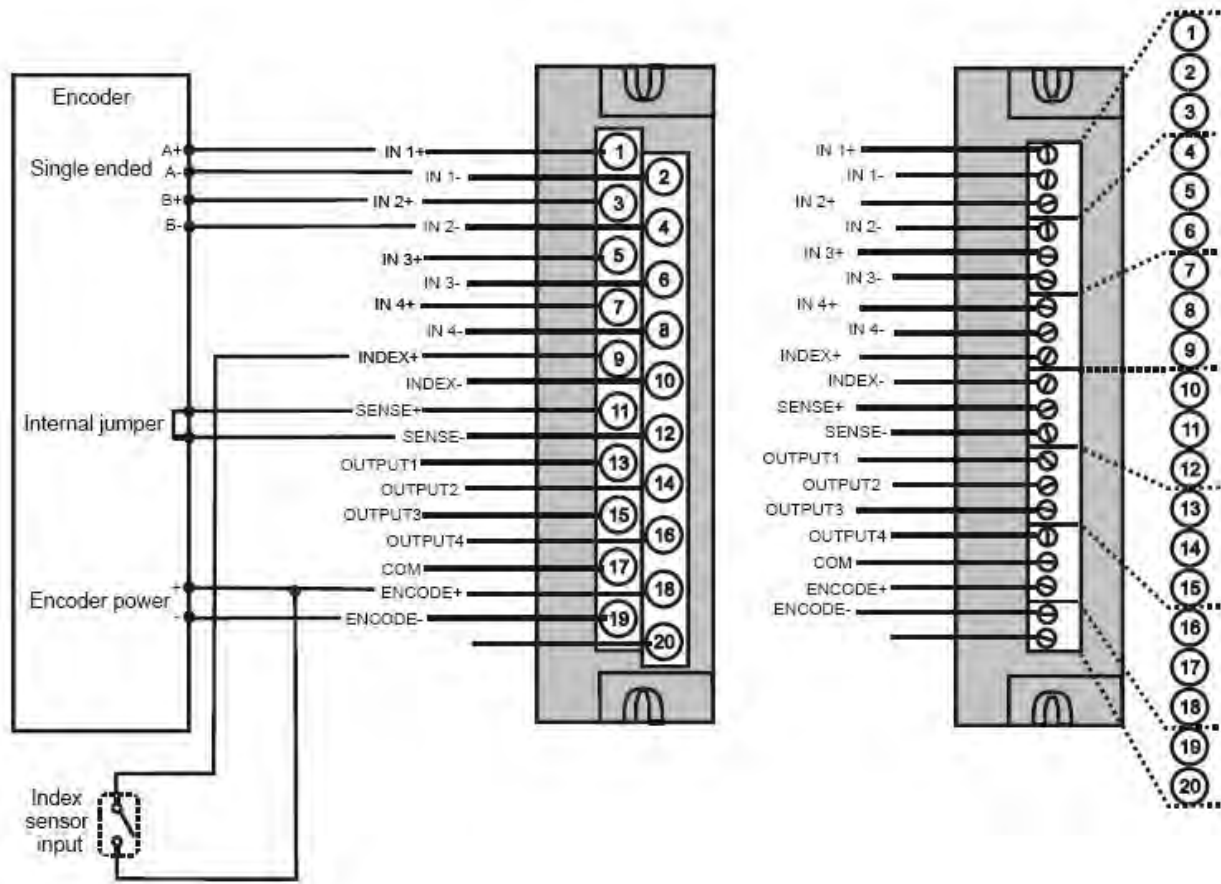
Figure 70 – Quadrature, Single Ended, HC900 Power Wiring

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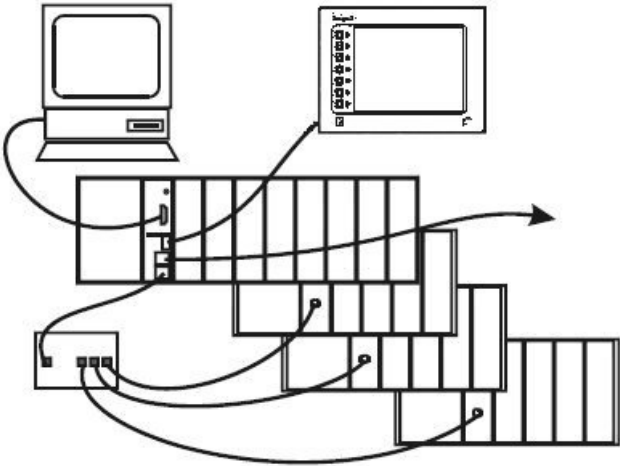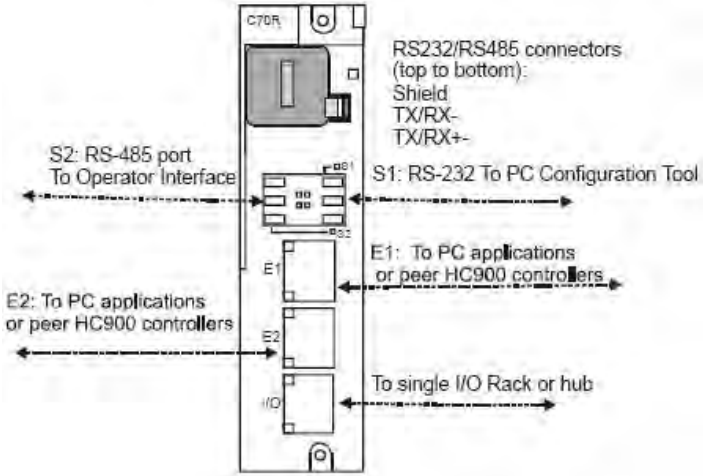
Communications Installation

Overview

This section contains descriptions, procedures and recommendations for installing communications systems and components.

Wiring and cabling

Table 16 – Connect Communications Wiring and Cabling

Step	Procedure	Comments/Reference
1	Determine requirements for communications links. See: • Ethernet Devices/Considerations on page 27 • For legacy system, serial Ports (RS-232 and RS-485) on page 35. For new system, two RS-432 serial ports on page 35 • Cabling/Wiring Distance Planning on page 45.	
2	Refer to the diagram at right, and to Table 17 Links to Controller Communication Ports for connection details. All ports are shown. (Availability depends on controller model, see Figure 12 page 23.) Connect communications cabling. For Modbus connections, see page 142.	 **Communication Ports (all ports shown)**

Step	Procedure	Comments/Reference
	Set IP addresses and subnet masks.	Default IP addresses: C30/C50: 192.168.1.254 and Subnet Mask of 255.255.255.0. C70/C75: E1: 192.168.1.254, E2: 192.168.2.254. Must be on different subnets.

Links to controller communication ports

Refer to Table 17 and the figure in Step 2 above. Port availability depends on Controller model.

Table 17 – Links to Controller Communication Ports

Controller Port /Connector Type	Link Type: Controller to	Cable Type	To Device/Port	Details
RS-232 3-plug connector	Desktop or Laptop PC	RS-232 Null Modem cable, up to 50' Or RS-232 PC modem cable, up to 50'	Serial port of PC (w/ Null Modem cable) or Modem. Refer to RS-232 Remote Connection to PC Configuration Tool on page 125.	For Wiring details of Null Modem cable see Table 19.
RS-232 3-plug connector	Modbus master (controller is single slave)	RS-232 Null Modem cable, up to 50' Or RS-232 PC modem cable, up to 50' RS-232 to RS-485 converter	Refer to device's port instructions	
RS-232 3-plug connector	Modbus master (controller is one of multiple slaves)	RS-232 to RS-485 converter	Refer to device's port instructions	
RS-232 3-plug connector	Modbus slave network (controller is master)	RS-232 to RS-485 converter	Refer to device's port instructions	
RS-485 3-Plug connector	Operator interface	Belden #9271 (or equivalent)	Terminal connector of operator interface. (Refer to Table 18.) Connect from each CPU (A and B) to the OI.	
RS-485 3-Plug connector	Modbus master (controller is slave)	Belden #9271 (or equivalent)	Refer to device's port instructions	

Controller Port /Connector Type	Link Type: Controller to	Cable Type	To Device/Port	Details
RS-485 3-Plug connector	Modbus slave network (controller is master)	Belden #9271 (or equivalent)	Refer to device's port instructions	
E1 10/100 Base-T RJ45	Host, Peer, and Internet Devices	CAT5 cable IO, up to 100 meters.	RJ45 connector on Host, Peer, or Internet Device	Default IP address is 192.168.1.254
E2 10/100 Base-T RJ45	Host, Peer, and Internet Devices	CAT5 cable IO, up to 100 meters.	RJ45 connector on Host, Peer, or Internet Device	Default IP address is 192.168.2.254
E1 10/100Base-T RJ45	Lead CPU supports redundant Modbus/TCP Protocol to OPC server, PC supervisory and data acquisition software packages and Designer Software configuration software.			Default IP address is 192.168.1.254
E2 10/100Base-T RJ-45	Lead CPU supports redundant Modbus/TCP Protocol to OPC server, PC supervisory and data acquisition software packages and Designer Software configuration software.			Default IP address is 192.168.2.254
I/O 100Base-T	Single I/O rack	Shielded Ethernet CAT5 cable IO with RJ-45 connectors	C50/C70 Controller's I/O port to Scanner 1's I/O port.	
I/O 100Base-T	Single I/O rack	Shielded Ethernet CAT5 cable IO with RJ-45 connectors	C75 CPU A's I/O port to Scanner 2's I/O A port. C75 CPU B's I/O port to Scanner 2's I/O B port.	

Controller Port /Connector Type	Link Type: Controller to	Cable Type	To Device/Port	Details
I/O 100Base-T	2 or more I/O racks	Shielded Ethernet CAT5 cable IO with RJ-45 connectors	C75 CPU A's I/O port to approved switch. From this switch to each Scanner 2's I/O A port. One (1) additional switch may be used, for a total of 2 switches between CPU A and the I/O racks. C75 CPU B's I/O port to approved switch. From this switch to each Scanner 2's I/O B port. One (1) additional switch may be used, for a total of 2 switches between CPU B and the I/O racks.	

Connecting the Operator Interface to the Controller

Using parts in Table 18 connect the Operator Interface to the RS-485 port on the controller for legacy systems. For new systems, the parts in Table 18 connect to either of the two RS-485 ports on the controller. See page 35 for port location. Typically, the cable that interconnects this port to the Operator Interface must be made during installation, because it will probably be necessary to run the cable through conduit.

On C75 connect cable from each CPU's RS-485 port to the Operator Interface. See Operator Interface manual #51-52-25-108 for connection details.

Table 18 – Parts needed to make RS-485 Cable

Part #	Quantity	Description
Belden #9271 (or equivalent), with 120 ohm resistors (2,000 feet Maximum) Or Belden #9182 (or equivalent), with 150 ohm resistors (4, 000 feet maximum)	Variable	Commercially available communication cable
	1	10-terminal connector (Supplied with the operator interface)
Phoenix #1840379 (or equivalent) for C30/C50 Phoenix 1803581 for C75.	1	Connector (3-pin) (Supplied with the controller CPU module)
047260	1	Ferrite cable clamps (Supplied with the operator interface)
089037	2	Nylon cable ties

Connecting the HC900 Controller to a PC with the Designer Software

To establish communications between the HC900 controller and the Process Control (HC) Designer configuration software use any of the following methods.

- A. Direct Serial RS-232 connection. See page 123.

- B. Modem connection. See page 126.

- C. Direct Ethernet connection. See page 138.

- D. Networked Ethernet connection. See page 140.

These methods are described below.

ATTENTION:

Always observe the wiring/cabling guidelines on page 45.

A. Direct Serial RS-232 Connection

Com1 - Com 8

RS-232 Configuration port

PC

(9.6 - 38.4 KB)

Null Modem cable
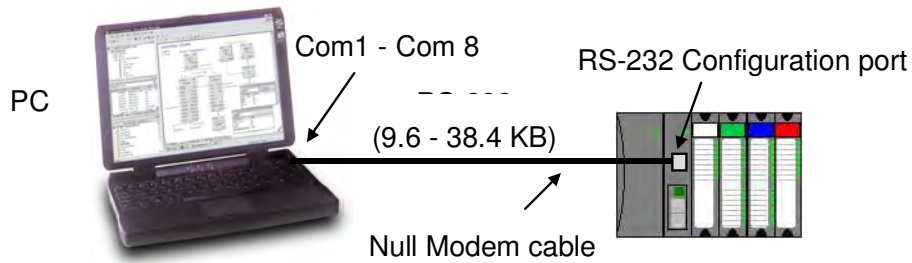
Figure 71 – A Direct Serial RS-232 Connection
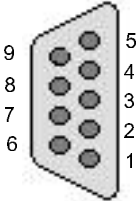
ATTENTION:
Always observe the wiring/cabling guidelines on page 45.

Step	Procedure
1	Prepare a null modem cable. Refer to RS-232 Converter Direct Link to PC Configuration Tool (page 124) for specific instructions on the null modem cable.
2	Connect one end of the null modem cable to the HC900 controller's RS-232 configuration port.
3	Connect the other end to an available serial port (COM1 through COM8) on your PC. Refer to RS-232 Converter Direct Link to PC Configuration Tool (page 124) for specific instructions on the null modem cable.
4	If a configuration is not available, start a new configuration in HC Designer by selecting File, New. After selecting controller type and revision, select OK.
5	From the Utilities Worksheet (Utilities tab in the main window) in the HC Designer software, set up the PC's serial port attributes for use with the controller. Make sure that the same baud rate is set up for the PC port and the controller. In general, the faster the baud rate the better the performance, however, your PC may not communicate reliably at the faster baud rates. (Refer to the HC900 Designer Software User's Guide or its respective on-line help, **Setting Up PC Com Ports and Connections - PC Serial Com Port Setup** and **Utilities Worksheet** - **Set Controller Serial Port,** for details on this step).
6	On the PC, use the Utilities Worksheet in the HC Designer software to select the Com port as the current port.

RS-232 Direct Link to PC Configuration Tool

The Controller can be connected directly to the PC, in which case a Null Modem Cable is required. The Null Modem Cable can be ordered from Honeywell (Part# 50004820-501). Cable connections are shown in Table 19.

Table 19 – Null Modem Cable Connections

9-pin D female connector			3-plug connector	
Signal Name	Pin No.	Connection	Signal Name	Plug No.
DCD	1	None		
RXD	2	Connects to	TXD	2
TXD	3	Connects to	RXD	3
DTR	4	None		
GND	5	Connects to	GND	1
DSR	6	None		
RTS	7	None		
CTS	8	None		
RI	9	None		

Rs-232 Remote Connection to PC Configuration Tool

The Controller can also be connected remotely by a set of modems, which are available from third-party suppliers. A Null Modem Cable is used between the Controller and the modem, shown in Figure 72 and shown in Table 19.

A second Null Modem cable is used between the PC and the internal or external modem at the other end, as shown in Figure 72. This cable is?

Remote controller access via dial-up modem is available via the communication setup in the PC configuration tool. All functions of the Designer Software configuration tool can be performed over this link. Remote access functions include on-line monitoring, configuration upload and download, and firmware upgrade.
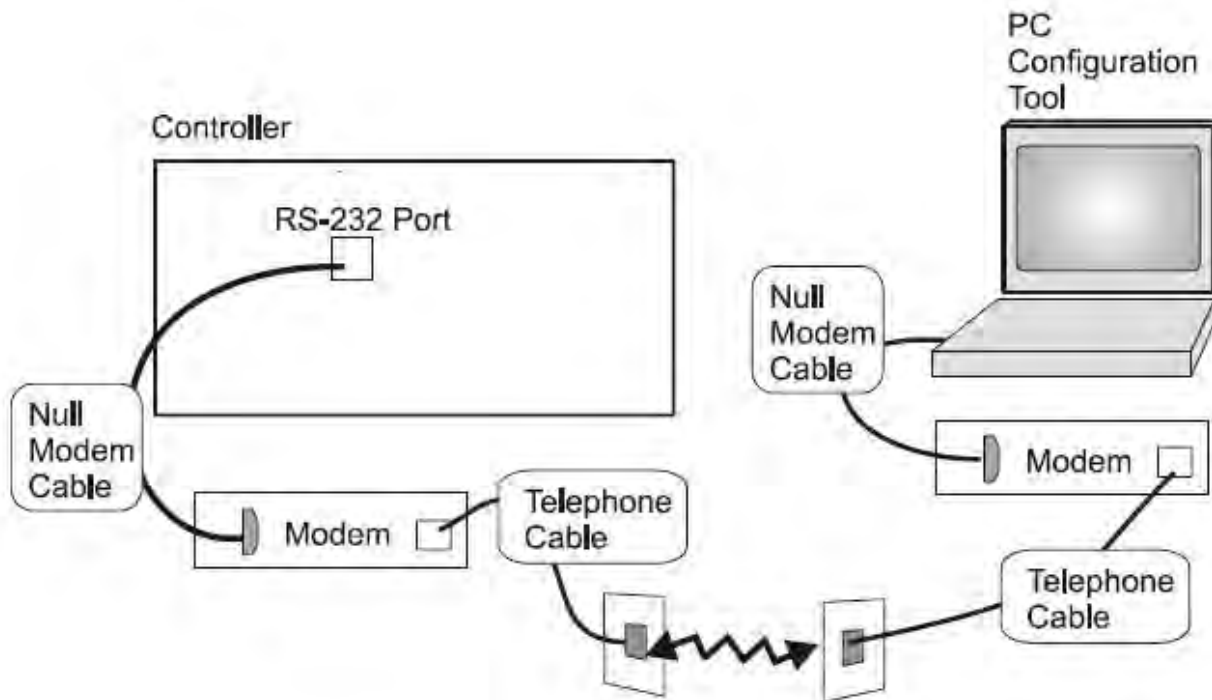
Figure 72 – RS-232 Remote Access via Modems

B. Modem Connection
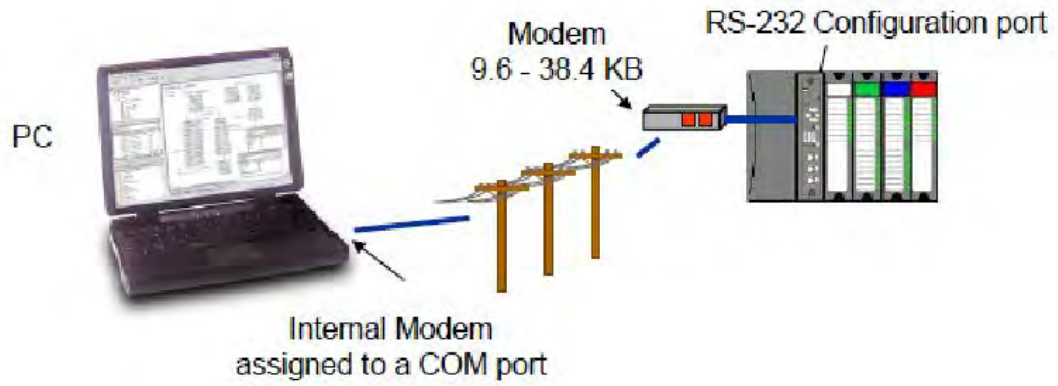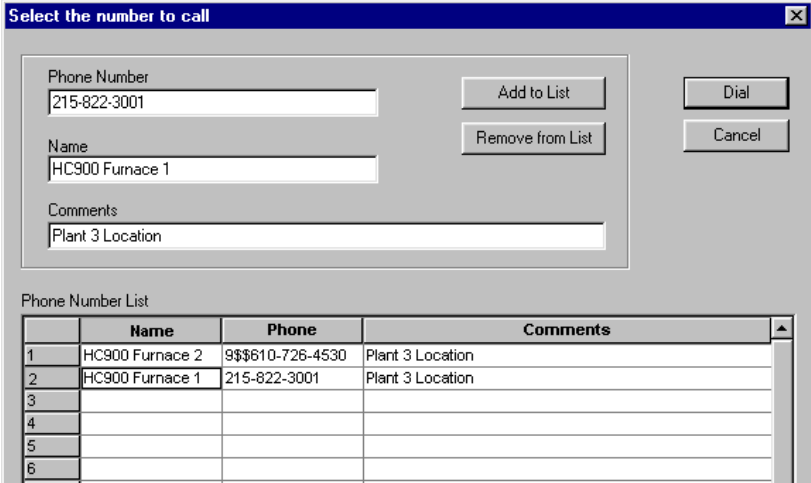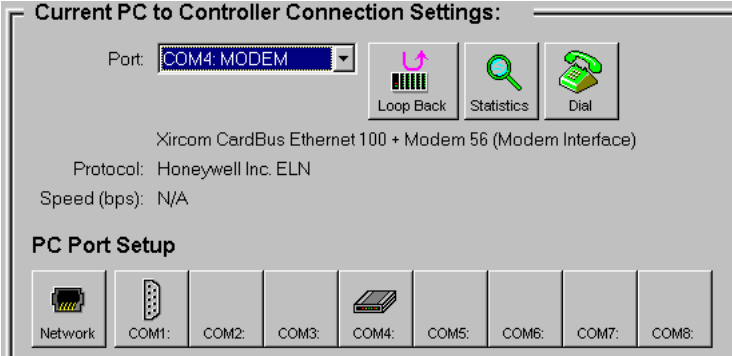
Figure 73 Modem Connection

ATTENTION:
Always observe the wiring/cabling guidelines on page 45.

Step	Procedure
1	Connect a modem to the HC900 controller's for a list of approved modems, their settings, and the connection specifics.
2	On the PC, check on the Utilities Worksheet in the HC Designer software to see if the PC modem is properly installed. A modem icon on the associated COM port button indicates the PC modem is properly installed (internal or external). If the modem icon is not visible on the associated COM port button, use the modem supplier's instructions to properly install the modem and verify the installation using the Windows' Control Panel Modem property page to confirm proper installation.
3	Set up the phone book in the HC Designer software. This list includes the phone numbers for each of the HC900 controllers that can be connected using a modem. The phone book can be accessed from the Main Menu (View | Phone Book) or from the Utilities Worksheet by selecting the modem port as the current port. (Refer to the HC900 Designer Software User's Guide or its respective on-line help, **Setting Up PC Com Ports and Connections** - **PC Serial Com Port Setup** and **Remote Access**, for details on this step.)
4	On the PC, use the Utilities Worksheet in the HC Designer software to select the modem as the current port. A button will appear to allow you to dial a selected controller.

Modem requirements

Most commercially available modems can be used with the HC900 Controller. The modem must have the following capabilities:

- RS-232 interface

- Auto answer

- Can operate at 1200, 2400, 4800, 9600, 19200, 38400, 57600 baud; recommended 9600 or 19200 or 38400 baud, 8 data bits, 1 stop bit, and no parity

- Hardware handshaking can be disabled

- Software handshaking can be disabled

- Data Terminal Ready (DTR) input can be disabled

- Result codes can be suppressed

- Echo can be disabled

- Must be equipped with non-volatile memory (NVRAM) so that settings that are configured using command strings can be retained during a power-outage

- Must be able to load the NVRAM settings automatically on power-up

Cable requirements

You will need an interface cable to connect the modem to the 25-pin connector, be sure to use a DB-25 to DB-9 modem cable.

TIP

The Null Modem cable used to directly connect a PC running Designer Software to the controller may typically not be used to connect the PC to the modem or to connect the modem to the controller.

If your modem requires command string configuration, you will need an interface cable to connect the modem to your PC. Refer to your modem and computer documentation to determine this cable's requirements.

Modem configuration

Before connecting a modem to the controller's RS-232 port (marked "CONFIGURATION"), the modem must be configured with the following settings:

- Baud Rate = 1200, 2400, 4800, 9600, 19200, 38400, 57600 (Must match Baud Rate configured in HC900 Controller)

- Parity = None

- 1 stop bit

- 8 data bits

- No handshaking

- Ignore DTR

- Suppress result codes

- Suppress echo

- Auto answer

- Disable command recognition (only necessary if the modem has this capability)

Some of these settings may be settable via switches. Others may require command strings to be written to the modem using a PC terminal program such as Hyperterminal. You will need to refer to your modem's documentation to make this determination. Those settings that are configured using command strings must be saved to the modem's non-volatile RAM (NVRAM), and the NVRAM must be configured as the profile that gets loaded when the modem is powered up.

Most modems are equipped with auto-recognition to set the baud rate, parity, stop bits, and data bits. If your modem has no means of setting these using switches, then most likely it is equipped with auto-recognition. To configure the port settings of a modem with auto recognition, do the following:

Step	Action
1	Connect the modem to a PC.
2	Power up the modem.
3	Start up a PC terminal program such as Hyperterminal.
4	Configure the PC COM Port for 1200, 2400, 4800, 9600*, 19200*, 38400*, 57600 baud (must match Baud Rate configured in HC900 Controller), no parity, 1 stop bit, and 8 data bits. *recommended
5	Establish communications with the modem. *A common way of doing this is simply entering the AT E1 Q0 command and seeing if the modem responds with OK.* Once you establish communication to the modem, its port settings are configured.
6	Save the port settings to the profile that gets loaded on power-up.

Modem configuration examples

Below are procedures for setting up the following commercially available modems:

- 3Com US Robotics 56K Data/Fax External Modem

- Zoom 56K Dualmode External Modem (page 132)

- Best Data 56SX Data Fax External Modem (page 133)

- SixNet VT-MODEM Industrial External Modem (page 134)

3Com US Robotics 56K Data/Fax External Modem

Step	Action
1	Ensure that the switches are set to the factory settings:

Switch	Setting	Position	Function
1	OFF	UP	Normal DTR operations
2	OFF	UP	Verbal (word) results
3	ON	DOWN	Enable result codes
4	OFF	UP	Displays keyboard commands
5	ON	DOWN	Disables auto answer
6	OFF	UP	Modem sends CD signal when it connects with another modem
7	OFF	UP	Loads Y0-Y4 configuration from user-defined nonvolatile memory (NVRAM)
8	ON	DOWN	Enables recognition (smart mode)

Step	Action
2	Connect the modem to a PC. If your computer's RS-232 port has a 25-pin connector, use a DB-25 male to DB-25 female **RS-232** cable. If your computer's RS-232 port has a 9-pin connector, use a DB-25 male to DB-9 female **modem** cable.
3	Power-up the modem.
4	Run a serial communication port program such as Hyperterminal.
5	Within the communication program, select the port to which the modem is connected.
6	Configure the port to these settings:

> baud rate = 1200, 2400, 4800, 9600, 19200, 38400, 57600 (Must match Baud Rate configured in HC900 Controller)
> data bits = 8
> parity = none
> stop bits = 1
> flow control = none

Step	Action
7	In the program's terminal window, restore factory defaults by keying-in the following command string:

```
AT &F0
```

Then, press the **ENTER** key.

The modem should respond with OK.

Step	Action
8	Key in the following command string:
	AT Y0
	Then, press the **ENTER** key.
	The modem should respond with OK.
9	Key in the following command string:
	AT &B1
	Then, press the **ENTER** key.
	The modem should respond with OK.
10	Key-in the following command string:
	AT E0 Q1 &W0
	The Modem will not respond.
11	Power down the modem and disconnect it from the PC.
12	Set the modem switches to the following:

Switch	*Setting*	*Position*	*Function*
1	ON	DOWN	Modem ignores DTR (Override)
2	OFF	UP	Verbal (word) results
3	OFF	UP	Suppresses result codes
4	ON	DOWN	Suppresses echo
5	OFF	UP	Modem answers on first ring
6	ON	DOWN	CD always ON (Override)
7	OFF	UP	Loads Y0-Y4 configuration from user-defined nonvolatile memory (NVRAM)
8	OFF	UP	Disables command recognition (dumb mode)

Step	Action
13	Connect the modem to the?
14	Connect the modem to a telephone jack.
15	Power up the modem and the HC900 Controller.
16	On a remote computer, run Designer Software.
17	Set up Designer Software to dial the HC900 Controller.
18	Verify that communications is established with the remote HC900 Controller.

Zoom 56K Dualmode External Modem

Step	Action
1	Connect the modem to a PC. If your PC's RS-232 port has a 25-pin connector, use a DB-25 male to DB-25 female RS-232 cable. If your PC's RS-232 port has a 9-pin connector, use a DB-25 male to DB-9 female modem cable.
2	Connect power to the modem.
3	Power up the modem.
4	Run a serial communication port program such as Hyperterminal.
5	Within the communication program, select the port to which the modem is connected.
6	Configure the port to these settings: baud rate = 1200, 2400, 4800, 9600, 19200, 38400, 57600 (Must match Baud Rate configured in HC900 Controller) data bits = 8 parity = none stop bits = 1 flow control = none
7	In the program's terminal window, restore factory defaults by keying-in the following command string: `AT &F0` Then, press the **ENTER** key.
8	In the program's terminal window, key-in the following command string: `AT E1 Q0` Then, press the **ENTER** key. The Modem should respond with `OK`.
9	Key-in the following command string: `AT &Y0 &C0 &D0 &R1 &S0 &K0 S0=1` Then, press the **ENTER** key. The Modem should respond with `OK`.
10	Key-in the following command string: `AT E0 Q1 &W0` Then, press the **ENTER** key. The Modem will not respond.
11	Power down the modem and disconnect it from the PC.
12	Connect the modem to the?
13	Connect the modem to a telephone jack.
14	Power up the modem and the HC900 Controller.
15	On a remote computer, run Designer software.
16	Set up the PC software to dial the HC900 Controller.
17	Use the PC software "Loop-back" feature to verify that communications are established with the remote HC900 Controller.

Best Data 56SX Data Fax External Modem

Step	Action
1	Connect the modem to a PC. If your PC's RS-232 port has a 2- pin connector, use a DB-9 male to DB-25 female modem cable. If your PC's RS-232 port has a 9-pin connector, use a DB-9 male to DB-9 female RS-232 cable.
2	Connect power to the modem.
3	Power-up the modem.
4	Run a serial communication port program such as Hyperterminal.
5	Within the communication program, select the port to which the modem is connected.
6	Configure the port to these settings: baud rate = 1200, 2400, 4800, 9600, 19200, 38400, 57600 (Must match Baud Rate configured in HC900 Controller) data bits = 8 parity = none stop bits = 1 flow control = none
7	In the program's terminal window, restore factory defaults by keying-in the following command string: `AT &F0` Then, press the **ENTER** key.
8	In the program's terminal window, key-in in the following command string: `AT E1 Q0` Then, press the **ENTER** key. The modem should give an `OK` response.
9	Key-in the following command string: `AT &C0 &D0 &K0 &R1 &S0 &Y0 S0=1` The Modem should respond with `OK`.
10	Key-in the following command string: `AT E0 Q1 &W0` The Modem will not respond.
11	Power down the modem and disconnect it from the PC.
12	Connect the modem's serial cable to the?
13	Connect the modem to a telephone jack.
14	Power up the modem and the HC900 Controller.
15	On a remote computer, run Designer software.
16	Set up the PC software to dial the HC900 Controller.
17	Use the PC software "Loop-back" feature to verify that communications are established with the remote HC900 Controller.

SixNet VT-MODEM Industrial External Modem

Step	Action
1	Connect the modem to a PC. If your PC's RS-232 port has a 25 pin connector, use a DB-9 male to DB-25 female modem cable. If your RS-232 port has a 9 pin connector, use a DB-9 male to DB-9 female RS-232cable.
2	Connect power to the modem. You will need to supply an external power supply with a DC voltage between 10 and 30 VDC.
3	Power-up the modem.
4	Run a serial communication port program such as Hyperterminal.
5	Within the communication program, select the port to which the modem is connected.
6	Configure the port to these settings: baud rate = 1200, 2400, 4800, 9600, 19200, 38400, 57600 (Must match Baud Rate configured in HC900 Controller) data bits = 8 parity = none stop bits = 1 flow control = none
7	In the program's terminal window, restore factory defaults by keying-in the following command string: `AT &F0` Then, press the **ENTER** key.
8	In the program's terminal window, key-in the following command string: `AT E1 Q0` Then, press the **ENTER** key. The modem should give an `OK` response.
9	Key-in the following command string: `AT &Y0 &C0 &D0 &R1 &S0 &K0 S0=1` `The` Modem should respond with `OK`.
10	Key-in the following command string: `AT E0 Q1 &W0` The Modem will not respond.
11	Power down the modem and disconnect it from the PC.
12	Connect the?
13	Connect the modem to a telephone jack.
14	Power-up the modem and the HC900 Controller.
15	On a remote computer, run Designer software.
16	Set up the PC software to dial the HC900 Controller.
17	Use the PC software "Loop-back" feature to verify that communications are established with the remote HC900 Controller.

Connecting C75 Redundant Ethernet to a PC with HC Designer or other applications

Only use Shielded CAT 5 cable IO for network connections. See Figure 74 and Table 20.

.
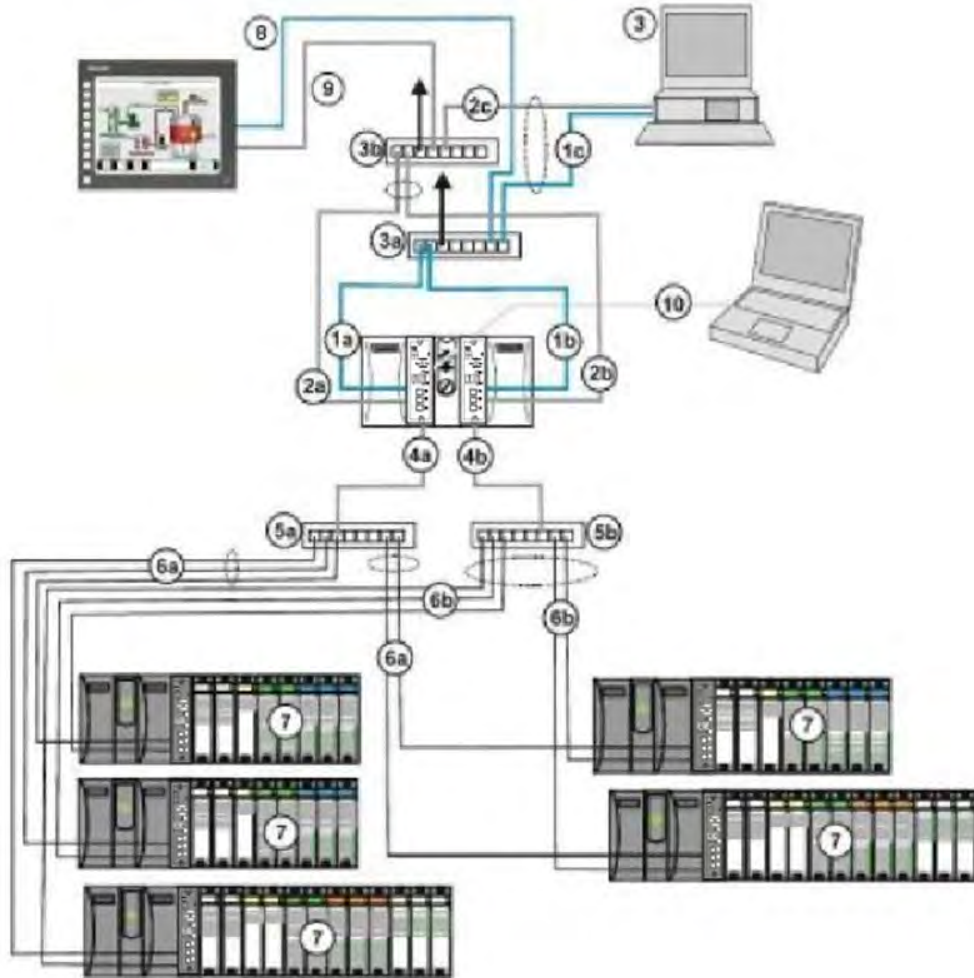
Figure 74 – Redundant Networks (see Table 20)

ATTENTION:

Always observe the wiring/cabling guidelines on page 45.

Table 20 – Redundant Network connections in Figure 74

Key No.	Connection/Description
1a	Connect CPU-A E1 port to Ethernet switch (3a)
1b	Connect CPU-B E1 port to Ethernet switch (3a)
1c	Connect Ethernet switch (3a) to PC Ethernet port
2a	Connect CPU-A E2 port to Ethernet switch (3b)
2b	Connect CPU-B E2 port to Ethernet switch (3b)
2c	Connect Ethernet switch (3b) to Ethernet port
3a	Ethernet switch for CPU-A E1 port
3b	Ethernet switch for CPU-B E1 port
4a	Connect CPU-A I/O port to Ethernet switch (5a)
4b	Connect CPU-B I/O port Ethernet switch (5b)
5a	Ethernet switch for CPU-A's I/O racks
5b	Ethernet switch for CPU-B's I/O racks
6a	Connect Ethernet switch (5a) to each I/O rack's I/O A port
6b	Connect Ethernet switch (5b) to each I/O rack's I/O B port
7	I/O Racks
8	Connect the (primary) Ethernet port of the 900 control Station to the Ethernet switch, which is assigned to port E1 of the controller CPUs
9	Connect the Auxiliary Ethernet port of the 900 Control Station to the Ethernet switch, which is assigned to port E2 of the controller CPUs
10	Connect CPU-A S1 port to PC USB port through RS-485 to USB converter.

Table 21 – Redundant network connections

Step	Procedure
1	Make sure the PC has 2 Ethernet NICs (Network Interface Cards) installed and enabled.
2	Connect Ethernet 10Base-T straight or crossover cables to the HC900 controller's E1 and E2 ports.
3	Connect the other end of the cables to the PC's Ethernet ports.
4	On the PC, use the Utilities Worksheet in the HC Designer software to connect to the controller over Ethernet. Every HC900 C75 controller is shipped with the default IP addresses for port E1 192.168.1.254 and port E2 192.168.2.254. Default Subnet Mask is 255.255.255.0. You can use these network parameters initially for testing or configuration use. In the Current PC to Controller Connection Settings area of the dialog box, click on the Network button to bring up the Network Port Properties dialog box and Add the default IP addresses. Be sure both PC Ethernet NICs have fixed IP addresses on the same subnet as the controller (192.168.1.x and 192.168.2.x, where x= 2 to 253).
5	In the Current PC to Controller Connection Settings area of the dialog box, select Network for the Port to be used and the default IP address for the Address. Click on Loopback to assure communications between the PC and the controller. You may now use the Ethernet port for configuration interface.
6	Consult your IT systems administrator for allocating IP addresses if this controller will require a unique IP address within a plant network. Also ensure that the PC Network Interface Cards have an IP address that allows access to the controller on the subnet after changing the controller's network parameters.
7	You may change the controller's IP address and related network parameters from its default using the Utilities Worksheet in the HC Designer software. This may be done using either the RS-232 serial port (typically used) via a null modem cable connection or the Ethernet connection from the PC to the controller. If the RS-232 connection is desired, make sure the proper PC serial Com port to be used has been set up (See Direct Serial RS-232 Connection page 123). **Attention: IP addresses for E1 and E2 must be on different subnets.**
8	Select the Set Controller's Network Parameters button. Using the wizard (bottom radio button), select the PC port to be used, then set the controller's new network parameters including IP address, Subnet Mask (if other than the default), and Default Gateway IP address (if required, otherwise use default). Refer to the HC900 Designer Software User's Guide or its respective online help, Utilities Worksheet - Set Controller's Network Parameters, for further details on this step. Note: This step will require the controller to be placed temporarily in the Program mode. After the new network parameters have been downloaded, the controller will conduct a Cold Start in its transition to RUN. This will cause an initialization if there is a current configuration in the controller. Note: Network communication will only occur with the Lead CPU. If using a single network connection during initial setup, verify connection is made with the Lead CPU.

Two redundant systems with PC supervision
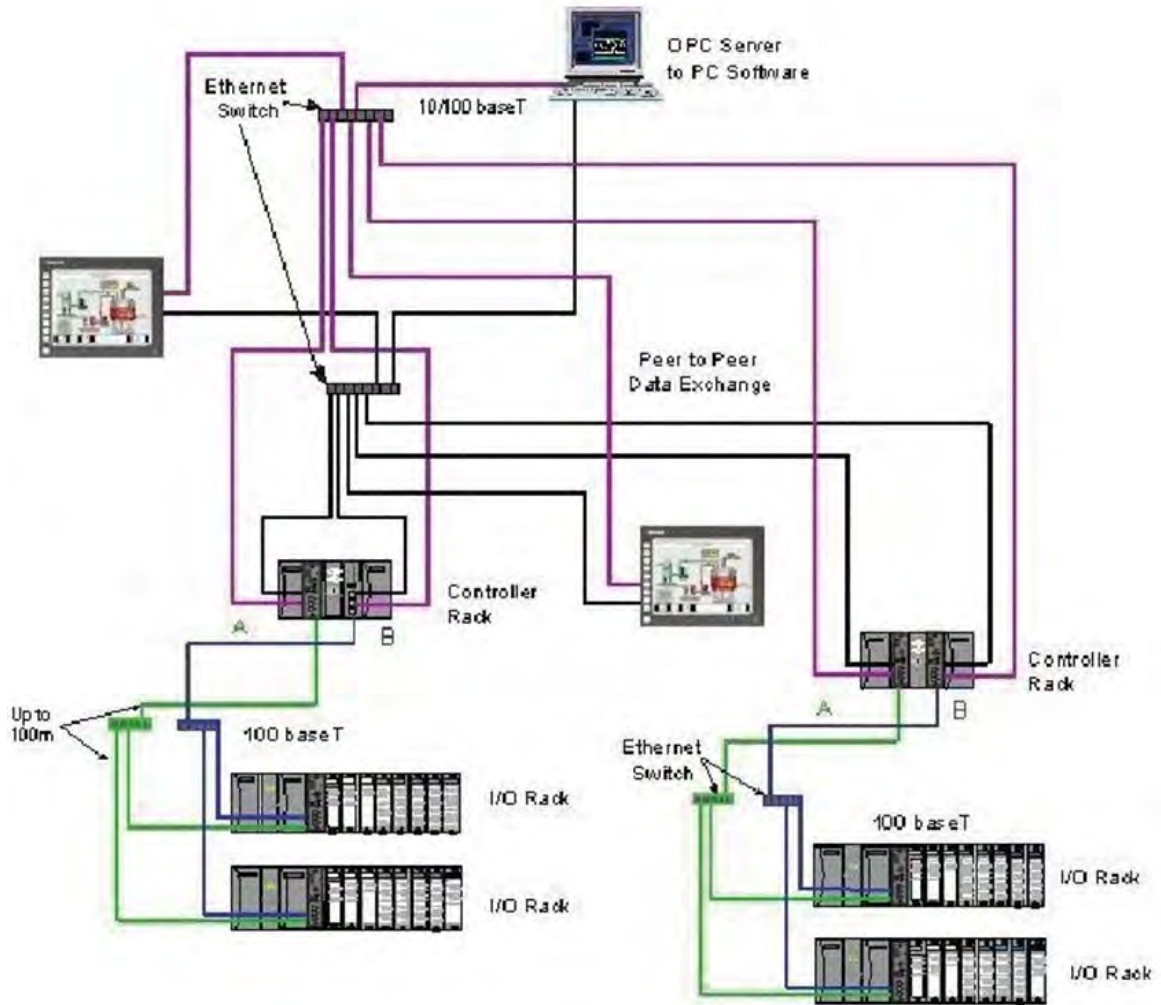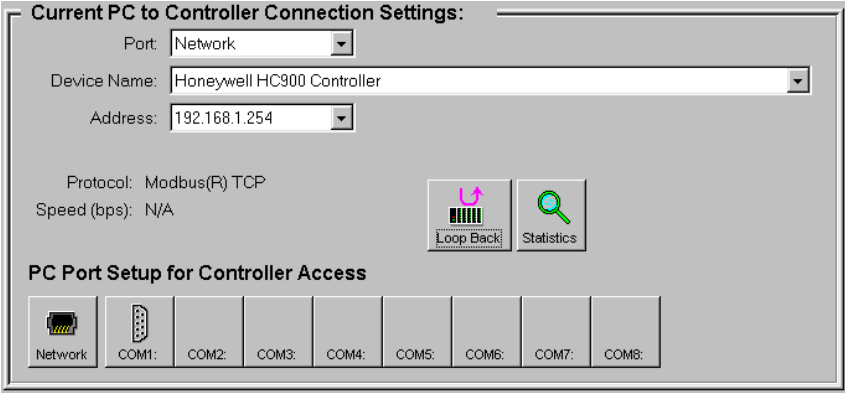
Figure 75 – Two redundant systems with PC supervision

C. Direct Ethernet Connection to one HC900 controller

ATTENTION:
Always observe the wiring/cabling guidelines on page 45.

Step	Procedure
1	Make sure the PC has an Ethernet NIC (Network Interface Card) installed and enabled.
2	Connect an Ethernet 10Base-T crossover cable to the HC900 controller's Open Ethernet RJ-45 port (top RJ-45 port).
3	Connect the other end of the Ethernet 10Base-T crossover cable to the PC's network port.
4	On the PC, use the Utilities Worksheet in the HC Designer software to connect to the controller over Ethernet. Every HC900 controller is shipped with the default IP address of 192.168.1.254 and Subnet Mask of 255.255.255.0. You can use these network parameters initially for testing or configuration use. In the Current PC to Controller Connection Settings area of the dialog box, click on the Network button to bring up the Network Port Properties dialog box and Add the default IP address. Be sure the Ethernet Network Interface Card in the PC has a fixed IP address on the same subnet as the controller (192.168.1.x, where x= 2 to 253).
5	In the Current PC to Controller Connection Settings area of the dialog box, select Network for the Port to be used and the default IP address for the Address. Click on Loopback to assure communications between the PC and the controller. You may now use the Ethernet port for configuration interface.
6	Consult your IT systems administrator for allocating IP addresses if this controller will require a unique IP address within a plant network. Also ensure that the PC Network Interface Card has an IP address that allows access to the controller on the subnet after changing the controller's network parameters.
7	You may change the controller's IP address and related network parameters from its default using the Utilities Worksheet in the HC Designer software. This may be done using either the RS-232 serial port (typically used) via a null modem cable connection or the Ethernet connection from the PC to the controller. If the RS-232 connection is desired, make sure the proper PC serial Com port to be used has been set up (See Direct Serial RS-232 Connection page 123).
8	Select the Set Controller's Network Parameters button. Using the wizard (bottom radio button), select the PC port to be used, then set the controller's new network parameters including IP address, Subnet Mask (if other than the default), and Default Gateway IP address (if required, otherwise use default). Refer to the HC900 Designer Software User's Guide or its respective online help, Utilities Worksheet - Set Controller's Network Parameters, for further details on this step. Note: This step will require the controller to be placed temporarily in the Program mode. After the new network parameters have been downloaded, the controller will conduct a Cold Start in its transition to RUN. This will cause an initialization if there is a current configuration in the controller.

D. Network Access to one or more controllers

10/100BaseT LAN

Hub/Switch

PC

165.125.163.25   165.125.163.26

ATTENTION:

Always observe the wiring/cabling guidelines on page 45.

Step	Procedure
1	Make sure the PC has an Ethernet NIC (Network Interface Card) installed and enabled. Be sure the NIC has an IP address (fixed or DHCP served) that allows access to controllers with IP addresses on the same or other subnet. Consult your IT department or network administrator for allocating IP addresses to the controllers if required.
2	You will need to set each controller's IP address prior to network connection since every HC900 controller is shipped with the default IP address of 192.168.1.254. Placing multiple controllers on the same network before they have been given unique IP addresses will cause problems.
3	On the PC, use the Utilities Worksheet in the HC Designer software to set up the serial RS-232 connection to the controller at the desired baud rate (see Direct Serial RS-232 Connection above). This will require a null modem cable.
4	Select the Set Controller's Network Parameters button. Using the wizard (bottom radio button), select the PC COM port to be used, then set the controller's new network parameters including IP address, Subnet Mask, and Default Gateway (if required). See your IT network administrator for proper entries. (Refer to the on-line help provided with the HC Designer software, Utilities Worksheet, Set Controller's Network Parameters, for further details on this step). Note: This step will require the controller to be placed temporarily in the Program mode. After the new network parameters have been downloaded, the controller will conduct a Cold Start in its transition to RUN. This will cause an initialization if there is a current configuration in the controller.
5	Repeat step 4 for each controller on the same network.
6	Select the Network button at the bottom of the dialog box and Add any or all of controller IP addresses configured to the list. This will allow selection of any of these Addresses for downloading or uploading configurations.
7	You may now connect the controllers to your network for access by the Designer software. For the Networking Example shown, connect one end of the Ethernet 10Base-T cable to the PC's network port. Connect the other end of the Ethernet 10Base-T cable to the Ethernet switch.
8	Connect an Ethernet 10Base-T cable to each HC900 controller's Open Ethernet RJ-45 port (top RJ-45 port). Connect the other end of each Ethernet 10Base-T cable to the Ethernet switch.

Step	Procedure
9	You may now access any controller on the network for configuration access by assigning Network as the Port and the respective IP Address as the Address of the controller. **ATTENTION: When multiple controllers are on the network, be careful to check for the correct IP address of the destination controller prior to download of a new configuration or when downloading edits to a configuration while in RUN mode. Otherwise, you may inadvertently download a configuration to the wrong controller.**

Setting Up the Controller Network Parameters

See the Designer Software Users Guide, Doc. # 51-52-25-110 or respective HC Designer Help Files for setting up following network parameters:

- IP Address, Subnet Mask (optional), Default Gateway IP Address (optional)

- Network Name (optionally used in Peer Data Exchange)

- Local Name (optional, user identifier for controller)

- E-mail Server IP Address (required if e-mail alarms are configured)

 ATTENTION

This setup will require the controller to be placed temporarily in the Program mode. After the new network parameters have been downloaded, the controller will conduct a Cold Start in its transition to RUN. This will cause an initialization if there is a current configuration in the controller.

Connecting the HC900 Controller to Modbus device(s)
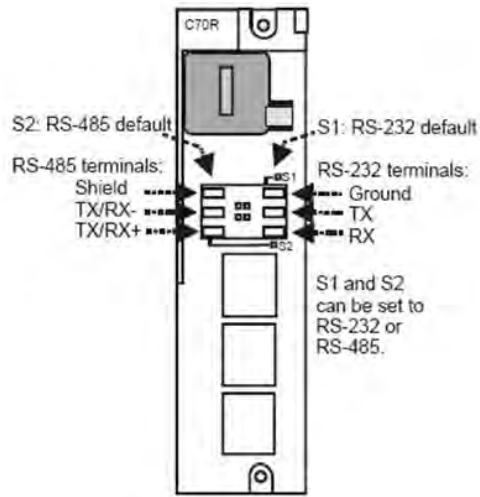
RS-485 Modbus connections

Use HC Designer software to configure the controller's RS-485 port as a master or slave. Install resistor as shown for terminated devices except HC900. For terminating HC900, do not install resistor. Instead, set internal DIP switches for termination (page 36).

When using the HC900 XYR5000 transmitter function blocks and RS-485 serial communications ports, connect Base Stations to the HC900 controller as shown in Figure 76.
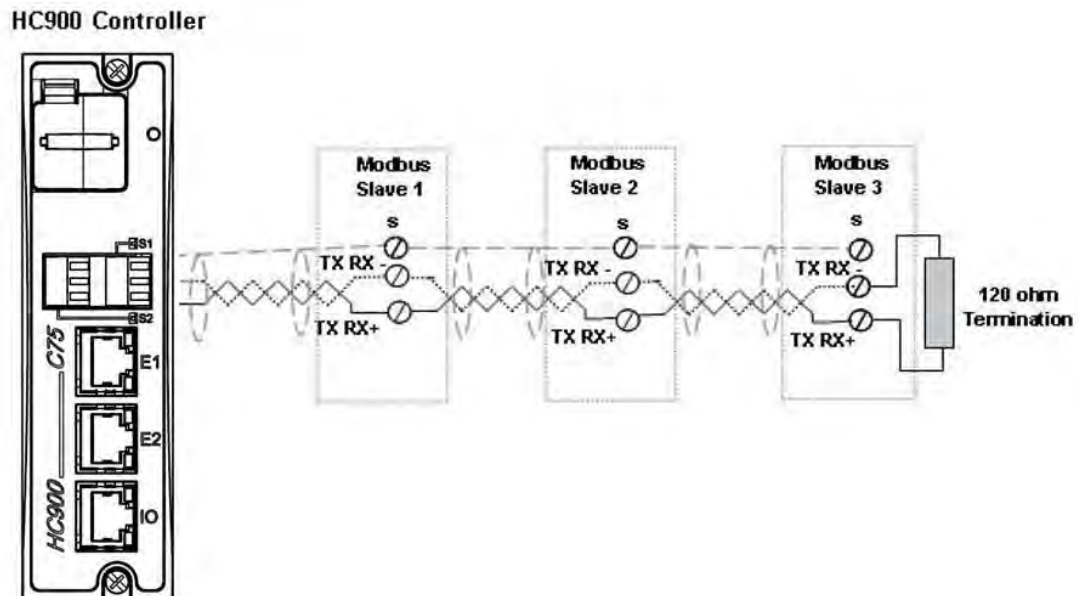
Figure 76 - RS-485 Modbus slave wiring

If the RS-485 network to slave devices is intermittent or fails completely over short durations and recovers after the controller is power cycled, use an external isolator with additional port biasing. See Figure 77.

.
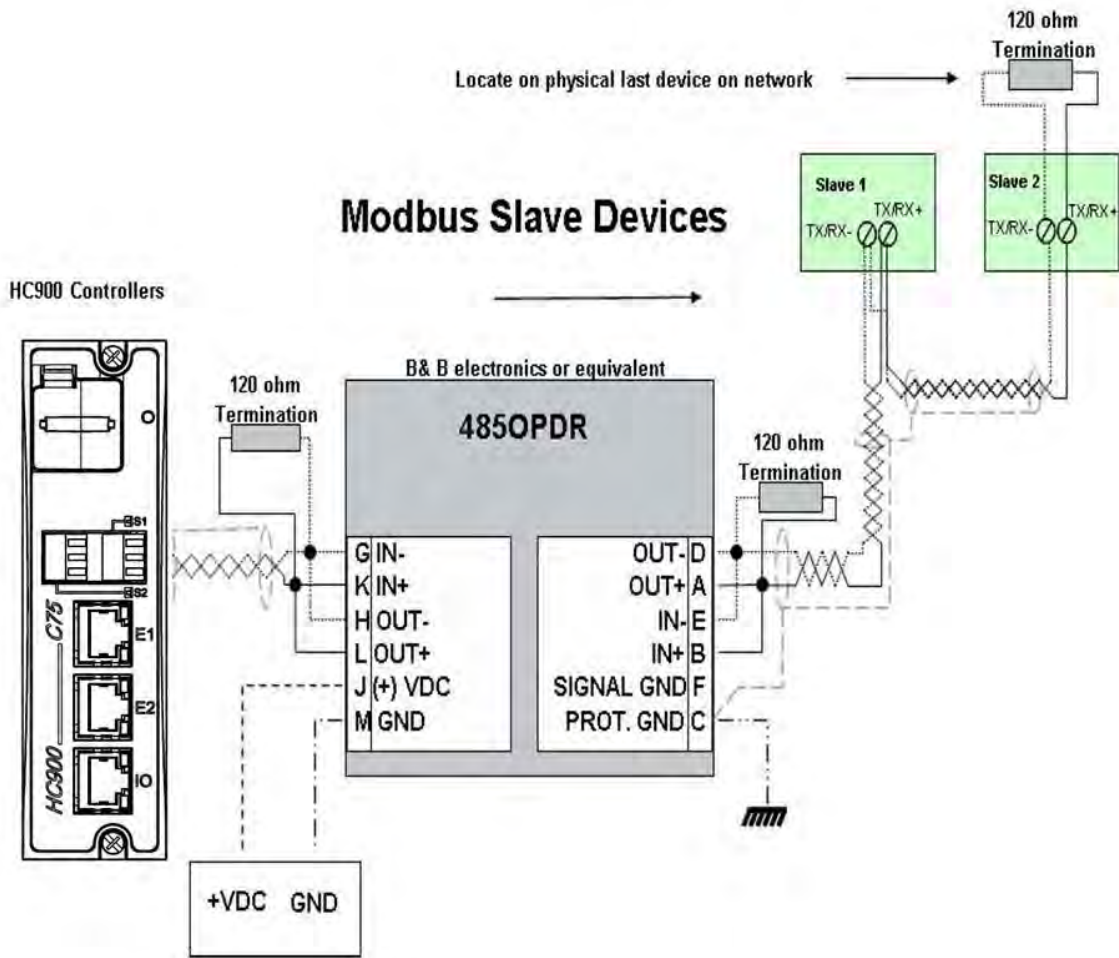
Figure 77 - RS-485 Modbus slave wiring with isolation

For XYR 5000 base stations, if the RS-485 network is intermittent or fails completely over short durations and recovers after the controller is power cycled, the need for additional port biasing may be required.

Figure 78 shows recommended installation procedure for using an external isolator and additional port bias.
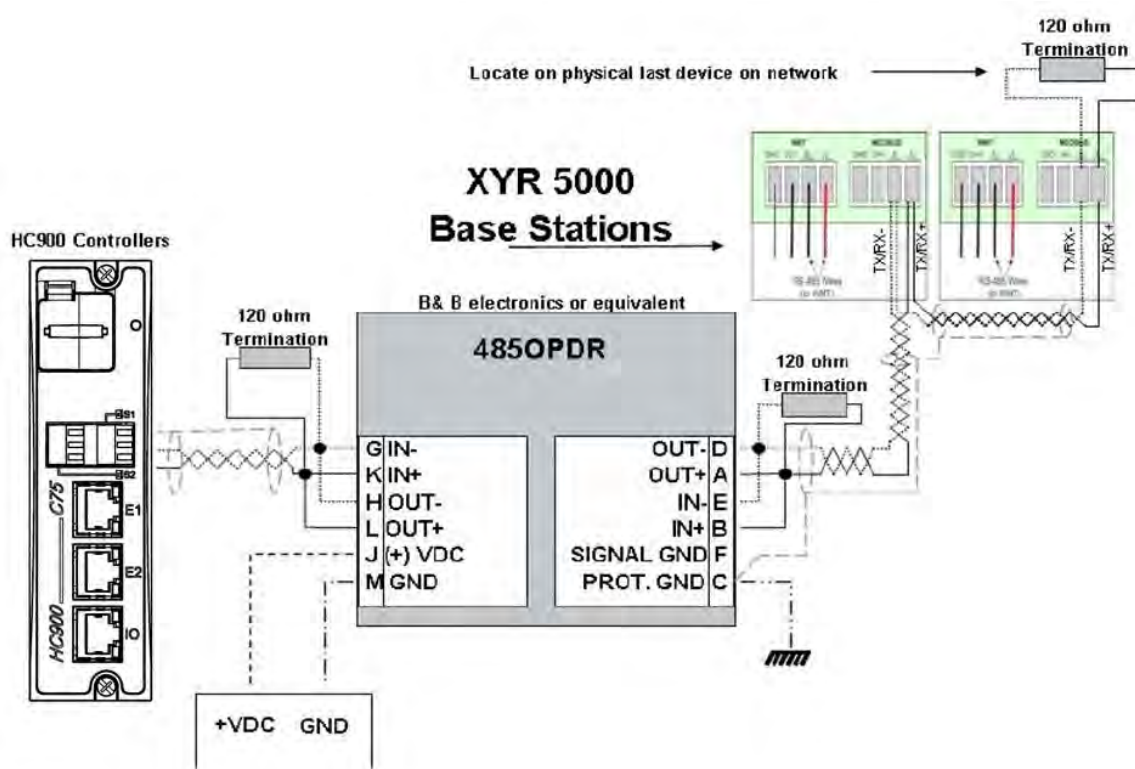
Figure 78 - XYR 5000 RS-485 Modbus connections with isolator

RS-232 Modbus Connections

Connect to the RX, TX, and ground pins of the controller's 3-pin RS-232 port. (See page 36 for RS-232 DIP switch settings.)

Table 19 (page 124) identifies the pins. For connections on other device, refer to its product manual.

For multiple devices on RS-232, use an approved RS-232-to-RS-485 converter.

Use HC Designer software to configure the controller's RS-232 port as a master or slave.

Operating Characteristics

Introduction

This section applies to all controllers, that is, non-redundant and redundant. For operating characteristics unique to redundant controllers, see Redundant Operating Characteristics on page 155.

This section provides insights into system functioning that are useful in configuration, in installation /commissioning tasks, and also in normal and abnormal operation. For related information regarding diagnostic indications, how they should be interpreted, and determining appropriate actions, refer to the Diagnostics section in this user manual.

Overview

The HC900 Controller components begin operation as soon as power is applied, and continue until power is removed. The operation of the system varies according to the following interacting factors:

- **Power transitions**: **Power DOWN / Power UP**
  Power DOWN transitions are usually planned and controlled, but in some cases such as power outages, are unintended. To ensure proper operation in either case, the HC900 Controller includes software that controls operation at power restoration. The controller handles a Power-UP transition as one of two types: **Cold Start** or **Warm Start**

- **Operating Modes**: **Program (Locked), Program, Offline, Run, and Run (Locked)**
  Operating Modes are selected:

  – by positioning the (Operating) Mode switch on the Controller Module or RSM,

  – by selecting parameters on displays (operator interface, Designer Software).

  In some cases, mode transitions also restart (Cold Start or Warm Start) controller operation.

- **Results of diagnostics:** in case of system hardware or software fault, the controller automatically alters operation as appropriate for the diagnosed conditions.

Power Down / Power Up

The HC900 Controller is designed to facilitate restoration of process operation after a power outage. The active control configuration is maintained in battery-backed RAM, and the last configuration update performed in the program mode is also stored in Flash memory on the Controller Module. When power is restored, the system automatically enters a diagnostic procedure that checks the integrity of hardware, software, and the control database. Depending on the results of the diagnostic, the controller will execute either a Warm Start or a Cold Start.

Warm Start

A Warm Start is a restart of the control strategy using dynamic data that is stored in battery backed RAM to allow control action to resume exactly as it was before the restart. In the Warm Start procedure (flowcharted in the main flow of Figure 79), diagnostic testing proves the integrity of the hardware, software, and configuration database resulting in an automatic Warm Start of process control. Control action is resumed exactly as it was before the outage.

This flowchart also indicates actions that would be taken by the controller in case of fault. Notice that if primary diagnostic testing determines that RAM or firmware is faulty, all process control functions cease, and the Status LED (red color) strobes one blink, periodically. If RAM and firmware tests pass, but the database in RAM is faulty, the controller initiates the Cold Start operation.
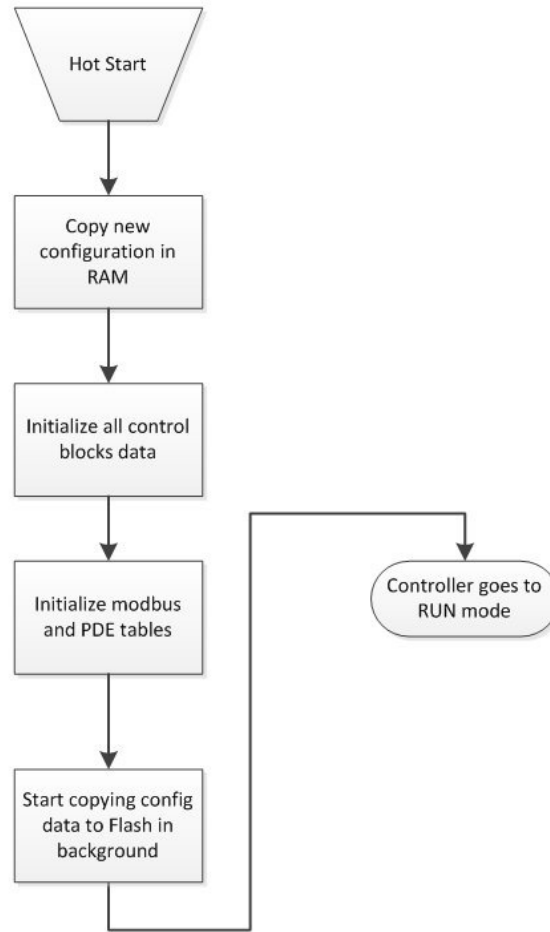
Figure 79 – Warm Start Operation

Cold Start

A Cold Start clears the data in battery backed RAM, turns all outputs off, transfers the configuration file from flash memory to RAM and reinitializes all dynamic data.

The Cold Start procedure is flowcharted in Figure 80. The controller initiates the Cold Start procedure:

- After a power outage, when diagnostics indicate that the controller hardware and software program are intact, but the content of the RAM database is incorrect. (See Figure 79.)

- On a Mode transition from PROGRAM to RUN. (This Mode transition can be initiated by operating the Mode switch on the controller or RSM, or by exiting the Program mode at an operator interface.)

- When initiated by the user (after download with Cold Start selected, or any transition from PROGAM Mode to RUN Mode.)
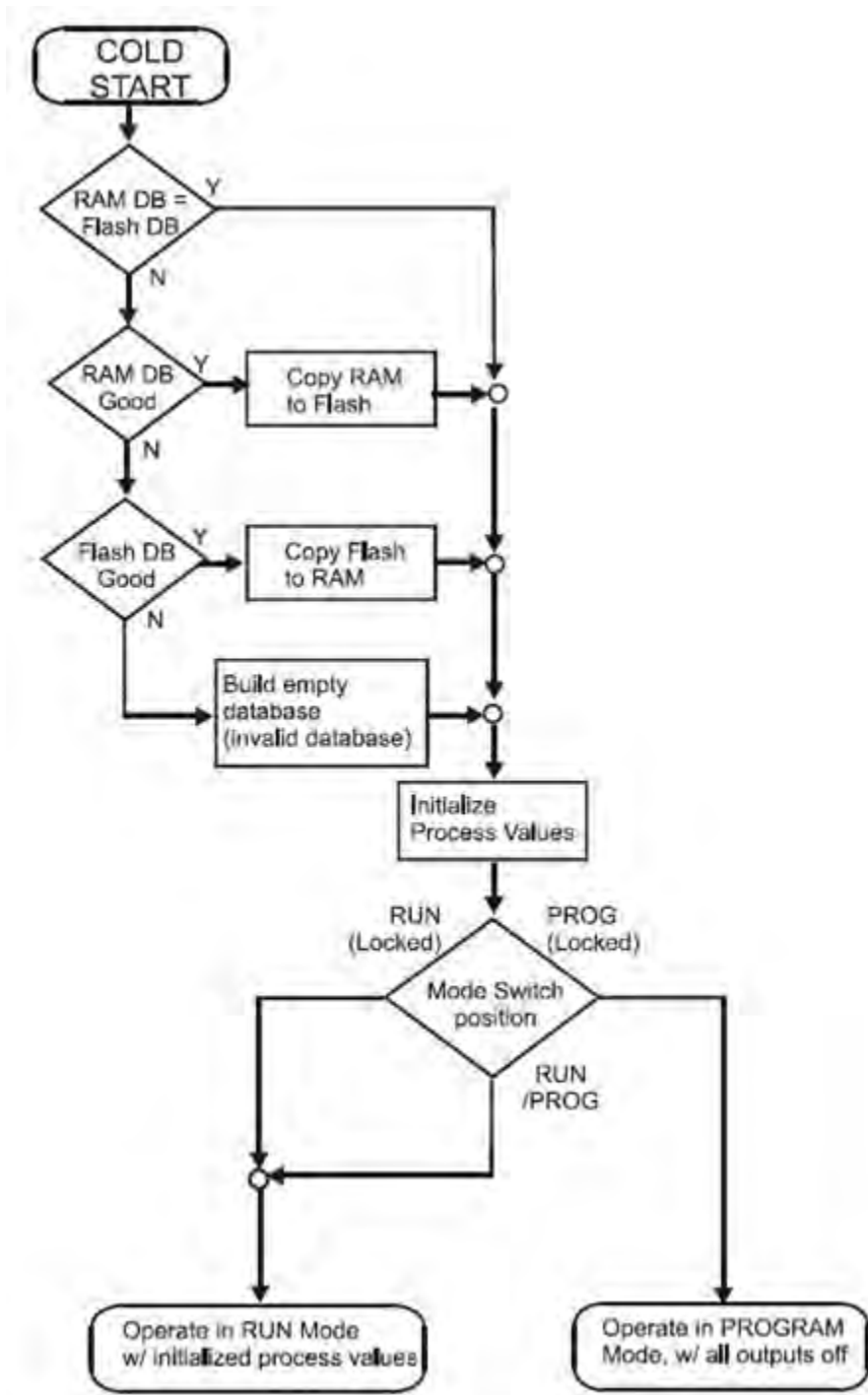
Figure 80 – Cold Start Operation

Execution sequence

- The type of control functions executed during a scan is determined by the system configuration.

  - Controller configurations contain a series of algorithms in the form of function blocks that get executed in a fixed sequence. The first 100 function blocks are pre-assigned by the system to handle communication tasks, alarm processing, system monitoring functions, etc. and cannot be changed by the user. Starting with function block number 101, the user may select the type of function to be executed.

- The sequence of function block execution is initially determined by the sequence in which the function blocks are placed on the graphic diagram in HC Designer.

  - Final desired sequence must be set by the user to achieve proper and optimum performance.

⚠ **CAUTION**

Incorrect execution sequences can contribute to delays in processing outputs and/or improper or unexpected operation.

- The HC900 controller samples all inputs before the start of a controller scan.

  - Each input being used in the configuration must be assigned to a function block. The sequence order of the function block determines when in time the actual value will be updated. It is important that algorithms that need updated input values for their calculations have the inputs execute first in the sequence.

- Except for Time Proportioning Output (TPO), Three-Position-Step-Control (TPSC) and Position Proportional Output (PPO) function block types that update their physical output values while the function blocks are being executed, all physical outputs are updated at the end of a scan.

Controller Modes

The HC900 Controller includes three operating modes. The purpose of each mode is described immediately below, and salient characteristics of each are described in Table 22. The functions of the Mode Switch are described in Table 23, and the procedures that the controller performs in transitions between modes are described in Table 24.

PROGRAM Mode

In the PROGRAM Mode, active control processing is suspended. This mode is used for safe execution of utility functions such as configuration download and calibration of analog inputs and outputs.

All outputs are Off.

RUN Mode

The Run Mode is used for normal operation of the controller; that is, for running the control configuration that was previously downloaded. Configuration download and other utility functions can be performed in this mode. See the Designer Software User Guide for precautions, restrictions, and procedures.

OFFLINE Mode

The OFFLINE Mode can be entered only from the RUN Mode, and is intended primarily for performing AI calibration.

⚠️ **CAUTION**

Because Function Blocks are not processed and outputs are Frozen in this mode, inputs (that is, process values) can vary from the values that existed when the OFFLINE Mode was entered.

Before entering the OFFLINE Mode:

- KNOW all potential consequences of suspending control action..

- PLAN for all operator actions required to preclude adverse consequences while processing is suspended, and when resuming control processing.

- EXECUTE prudent control actions (such as placing all control loop in the Manual Mode).

Failure to comply with these instructions may result in product damage.

Table 22 – Controller Operating Modes

Mode Name	Functions in selected mode
RUN	I/O scanning (Controller and Expander Racks)
	Function block execution; outputs are set according to function block algorithms.
	Monitoring of Diagnostics (controller rack and I/O expander racks)
	Detection of I/O Modules
	Other functions permitted:
	• Downloading of configurations
	• Indications of Forces at Status LEDs on I/O modules
	Other functions NOT permitted:
	• AI calibration
	• AO calibration
PROGRAM	I/O scanning (Controller and expansion Racks[C50 CPU only]) is performed, but function blocks are not executed, and all outputs (digital and analog) are set to OFF. (See Note 1.)
	Monitoring of Diagnostics (Controller and Expander Racks)
	Detection of I/O Modules
	Other functions permitted:
	• AI calibration
	• AO calibration
	• Downloading of configurations
	• Downloading controller firmware (Program Locked or Program)
	Other functions NOT permitted:
	• Indications of Forces at Status LEDs at I/O modules
OFFLINE	IO scanning (Controller and Expander Racks) is performed, but function blocks are not executed, and all outputs (digital and analog) are Frozen (see Note 2) at the states they were in when the OFFLINE mode was selected.
	Monitoring of Diagnostics (local and expanded racks)
	Detection of I/O Modules
	Other functions permitted:
	• AI calibration
	• Indications of Force at Status LEDs of I/O modules
	Other function NOT permitted: AO calibration

Note 1: The Off state of the module outputs are defined as:
• Digital output - low state
• Time proportional Output (TPO) : 0% duty cycle
• PPO and TPSC Outputs: Both Fwd and Rev are Off.
• Analog output: 0.0 mA

Note 2: The Frozen states of module outputs are defined as:
• Digital output: same state as previous (last active state)
• Time Proportional Output (TPO): Same duty cycle as in last active state
• PPO and TPSC Outputs: digital outputs are Off to freeze the motor position.
• Analog output: same current as previous (last active current level)

Controller Mode Transitions

Mode changes are controlled primarily by positioning of the MODE switch (Figure 81) on the controller module or RSM, and secondarily by selection of mode names on operator interface displays. That is, the Mode switch takes precedence. In the RUN (Locked) position or in the PROG (Locked) position, selecting a mode name at the operator interface has no effect on the operational mode. In the RUN/PROG position, the mode may be changed from any mode to any other mode.

The effects of the Mode switch operator interface selections are described in Table 23. The effects on controller operation for each mode transition are described in Table 24.
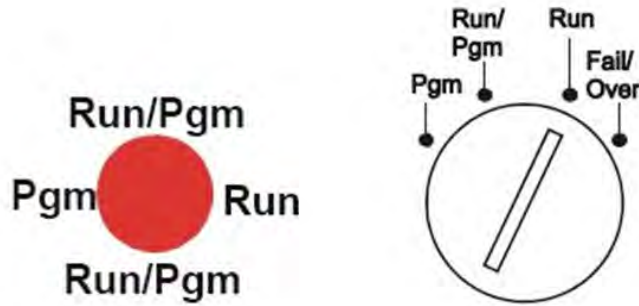
Figure 81 – Mode Switches: Controller (left), RSM (right)

Table 23 – Mode Switch Functions

Mode Name	Mode Selections at Operator Interface	Switch Function
RUN (Locked)	None (locked in RUN)	In this position, the Controller is locked in the RUN mode of operation. Run mode configuration changes are disabled and mode cannot be changed at any operator interface.
RUN/PROG	PROGRAM RUN OFFLINE	In this position, the mode can be changed at any operator interface using screen selections PROGRAM, RUN, or OFFLINE.
PROG (Locked)	None (locked in Program)	In this position, the Controller is locked in the PROGRAM mode of operation. Mode cannot be changed at any operator interface. While in PROG position the S1 serial port is set to Honeywell ELN protocol. This temporarily overrides the configured settings for S1 port. With your PC's serial com port connected to S1, use Designer Software's Utilities to view any setting of any controller port (such as network IP address) and change if needed. Refer to Designer Software documentation for details. Placing the Run/Program switch in RUN or RUN/PROG mode returns S1 to its configured protocol and settings.
Failover	N/A	Transfers all primary tasks to the Reserve Controller, establishing this controller as the new Lead. Does not affect controller mode. Turn key to Failover and hold it there until both Reserve lights are on, then release key.

Table 24 – Controller Behavior in Mode Transition

Initial Mode	New Mode	Controller Behavior
PROGRAM	RUN	Validate configuration database.
		Reset all I/O scanners.
		Upon startup, initiate Cold Start sequence.
		Diagnostic: Identify and configure all I/O racks and modules. (All output modules are configured with Failsafe values. Any modules not included in the configuration are configured with default values, which cause outputs to be Off.)
		While in transition, all output modules are Off; when transition procedures are completed, Function Block processing begins, and output values are set to Function Block output values.
		Any calibration process that was in progress is immediately aborted, and the results are discarded.
PROGRAM	OFFLINE	Same as PROGRAM to RUN transition, except that Function Blocks are not processed, and outputs remain Off.
		Any calibration process that was in progress is immediately aborted, and the results are discarded.
RUN	PROGRAM	Set all channels of all output modules to Off.
		Set all output module Failsafe values to the Off state.
		Turn off the LED indications on all output modules.
OFFLINE	PROGRAM	Same as RUN to PROGRAM transition.
		Any calibration process that was in progress is immediately aborted, and the results are discarded.
RUN	OFFLINE	Freeze output module channels.
		Freeze Force LED indications on all output modules.
OFFLINE	RUN	Function Block execution starts immediately.
		Any calibration process that was in progress is immediately aborted, and the results are discarded.

File Download/Upload Functions

The following is a general description of file transfers between the controller and computer devices external to the controller.

⚠️ **CAUTION**

Performing download procedures incorrectly could cause loss of control in an operating process or loss of data and program files in a controller.

Refer to the appropriate User's Manuals for download/upload procedures.

Failure to comply with these instructions may result in product damage.

Two types of software files can be downloaded to the controller:

• Configuration files

• Firmware files.

Configuration files can also be uploaded from the controller for archiving. Firmware can only be downloaded to the controller. Pathways for file transactions between the controller and computer devices external to the controller are shown in Figure 82.
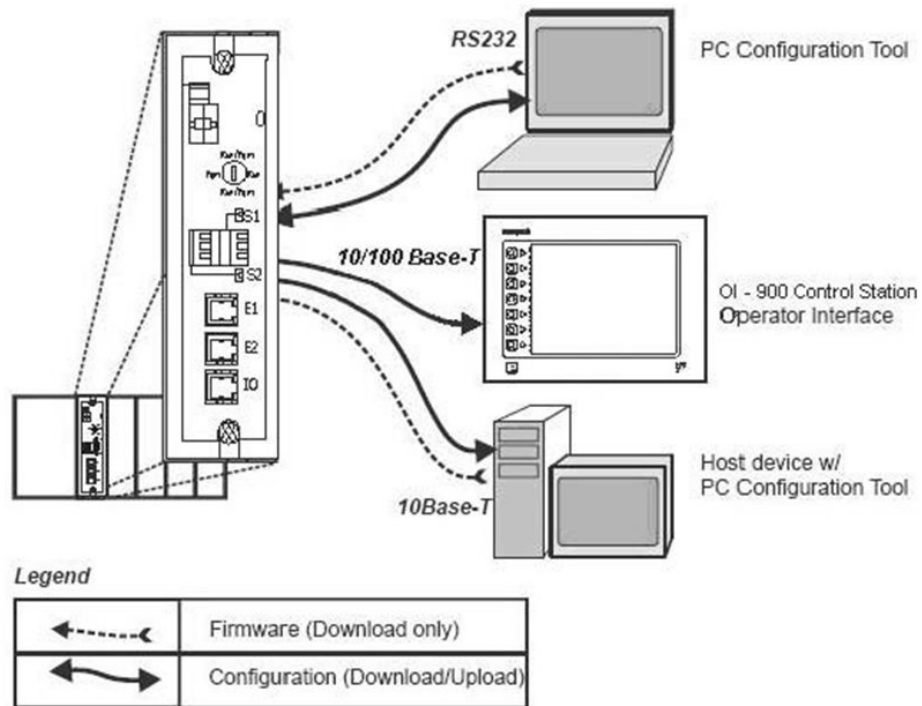
Figure 82 – Pathways for Upload/Download Transactions

Configuration Download

Configuration files include the items indicated in Table 25. Downloading of some items is mode dependent. That is, downloading of some file types is not permitted in the Run mode or in the Offline mode.

Table 25 – Configuration file downloading

Downloading of Configuration items:	Permitted When Controller is in . . .		
	PROGRAM Mode	**RUN Mode**	**OFFLINE Mode**
Controller Configuration Files	Yes	Yes/No (Note 1)	No
Setpoint Profiles / Setpoint Schedule	Yes	Yes	Yes
Recipe Files	Yes	Yes	Yes
Data Storage Configuration Files	Yes	Yes	Yes
Data Storage Non-volatile parameters	Yes	Yes	Yes

Note 1 - Controller files can be downloaded with the controller in Run Mode with the Mode switch set to Run/Program, but not with the switch set to Run/Lock.

The download from the host processor is directed to an area of controller memory separate from that used for running the controller, and hence has no effect on the active process.

The host signals the controller when the download is complete, and requests a configuration validation test and report from the controller. The controller then checks the new database and compares it to the current (running) database. Using the test report as a basis, the host then presents the operator (user) with a dialog box containing a set of choices: begin using the new database with no cold start, use it with a re-start, or abort the download.

For downloading procedures, refer to the Operator Interface User Manual #51-52-25-108.

Configuration Upload

Controller configuration files, setpoint profiles, and recipe files can be uploaded for storage and archiving in a PC and/or to a disk in the Operator Interface. Using the PC, the Upload function is accessed from the Designer Software.

For details of uploading configuration items, refer to Designer Software and Operator Interface manuals.

Firmware Download

Firmware Download provides a mechanism to upgrade the firmware in your CPU and Scanners. It is available in Program or Program Locked modes only. Specific instructions are provided with the upgrade files.

Redundant Operating Characteristics

Overview

This section describes operating characteristics specific to redundant controllers.

In a redundant HC900 system, the Lead Controller performs all primary tasks including interfacing with remote I/O racks, communicating with a local HMI, exchanging data with peer controllers, interfacing with Modbus slave devices, and communicating with a Host PC application. Detection of a fault or removing power from a Reserve Controller will initiate a diagnostic prompt in the Lead Controller, but will have no impact on the process under control. The detection of a fault or removing power from a Lead Controller will initiate failover, that is, transfer all primary tasks to the Reserve Controller, establishing this controller as the new Lead. Following a failover, the new Lead Controller will remain the Lead, even if the condition that caused the failover is corrected.

Start-Up

- Assignment of Lead and Reserve status is determined at start-up
  - First available C75 assumes Lead
  - In case of a tie, CPU mounted in the left position of the rack will Lead
  - No user configuration or manual operations required to establish Lead / Reserve status
- Lead Controller assumes control of I/O and all external communication interfaces.
- Reserve Controller receives the configuration from the Lead Controller

Modes of operation (Figure 83)

The modes of operation are:

- Run
- Run/Program
- Program

You can change modes with:

- key-switch on the redundancy control module
- HC Designer software
- HC Utilities software
- local 1042 or 449 operator interfaces.
- a command from a supervisory host

Both Lead and Reserve Controllers maintain the same mode. Placing the Lead Controller into the Program mode will also place the Reserve Controller in the Program mode.
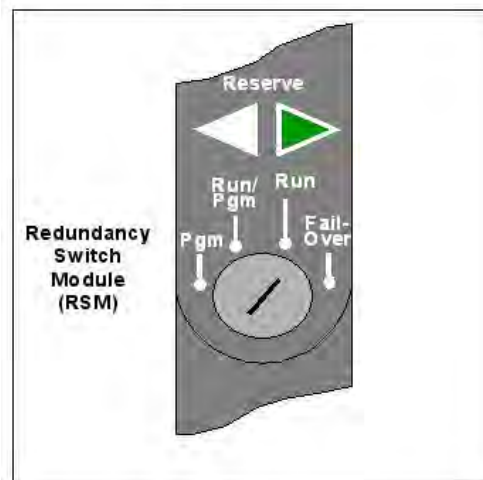
Figure 83 – Modes of operation on RSM

RUN Mode (Locked)

In the Run mode, the controller performs all control and communication tasks needed for steady-state operation. On-line configuration edits and configuration changes are inhibited.

RUN/PROGRAM Mode (Unlocked)

In the Run/Program mode, steady-state tasks are executed and on-line configuration edits are permitted. Configuration changes made in this mode are retained in both RAM and Flash memory in the controller.

PROGRAM Mode (Locked)

In the program mode, all outputs are turned OFF, function blocks do not execute and configuration changes are permitted. Exiting the Program Mode performs a cold-start, which clears all timers, counters, totalizers and other function blocks with residual data. Function blocks are initialized to their initial state with no reference to previous history.   Exiting the Program mode updates the RAM and Flash memory of the controller with the most recent configuration data.

Steady State Operations

- Lead Controller issues polls to I/O Racks for inputs

- Both Lead and Reserve read I/O responses from I/O Racks

- Lead and Reserve both execute function blocks in the control strategy

- Only the Lead Controller writes physical outputs to the I/O Racks

- Lead Controller responds to communication messages from host devices on the Supervisory Network and RS-485 interfaces

- Lead Controller handles communications with HC900 peers

- Lead Controller handles communications with Modbus RTU slave devices

- Lead and Reserve exchange system status data to determine conditions for failover.

- I/O Scanners relay system status data between each Controller to determine conditions for failover

Execution time

HC900 Controllers are designed to execute control functions within fixed scan cycles for analog data types and logic data types. In redundant controllers, the maximum scan time is 500ms for analog data types and 53ms for logic data types.

Execution sequence

- The type of control functions executed during a scan is determined by the system configuration.

    – Controller configurations contain a series of algorithms in the form of function blocks that get executed in a fixed sequence. The first 100 function blocks are pre-assigned by the system to handle communication tasks, alarm processing, system monitoring functions, etc. and cannot be changed by the user. Starting with function block number 101, the user may select the type of function to be executed.

- The sequence of function block execution is initially determined by the sequence in which the function blocks are placed on the graphic diagram in HC Designer.

    – Final desired sequence must be set by the user to achieve proper and optimum performance.

> **CAUTION**
>
> Incorrect execution sequences can contribute to delays in processing outputs and/or improper or unexpected operation.

- The HC900 controller samples all inputs before the start of a controller scan.

    – Each input being used in the configuration must be assigned to a function block. The sequence order of the function block determines when in time the actual value will be updated. It is important that algorithms that need updated input values for their calculations have the inputs execute first in the sequence.

- Except for Time Proportioning Output (TPO), Three-Position-Step-Control (TPSC) and Position Proportional Output (PPO) function block types that update their physical output values while the function blocks are being executed, all physical outputs are updated at the end of a scan.

Lead/Reserve controller synchronization

- Lead Controller automatically synchronizes the Reserve with the configuration database

    – During download of a configuration from a Host to the Lead

    – During process operation to bring a Reserve Controller from the Unavailable state to the On-Line state

- Lead Controller automatically synchronizes the Reserve with run-time data during each function block execution cycle

- Both the Lead and Reserve Controllers execute the function blocks in the control strategy, but only the Lead Controller writes the physical outputs to the I/O Racks. See

- Figure 84.

- The Lead and Reserve controllers exchange system status to determine conditions for failover.
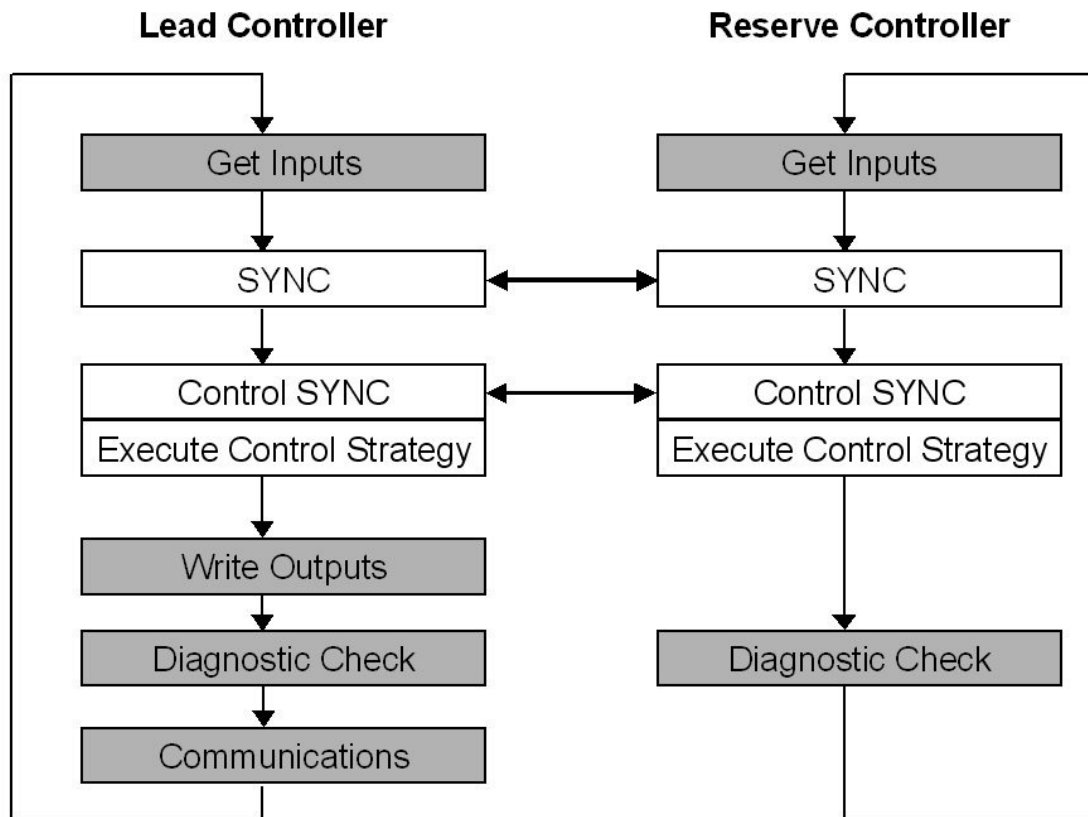
Figure 84 – Lead/Controller synchronization

Failover

Automatic Failover

- Triggered on any of the following conditions of the Lead Controller:
  - Loss of communications with I/O Rack(s)
  - Processor exception conditions
- Error conditions that occur in the following areas will not cause a failover:
  - Loss of communications to a Host on a network
  - Loss of communications to Modbus Slave devices
  - Loss of communications to Operator Interface
  - Loss of communications with a Peer controller
- During the transition from the Lead to the Reserve, analog and digital output status is maintained at the I/O racks.

Manual Failover

- Via Key Switch on the Redundancy Switch Module in the Redundant Controller Rack. When doing manual failover with keyed switch, turn key to Failover and hold it there until both Reserve lights are on, then release the key.

- Via Software Command from HC Designer & HC Utilities PC Software

- Via Software Command from Modbus / TCP & Serial Modbus RTU Hosts

- Via Software Command from OI-1042 & OI-559 Operator Interfaces

Failover Performance

Failure condition detection and failover from Lead to Reserve CPU executed in 4 analog control cycles or less.

Redundancy Diagnostic Monitoring

- From HC Designer and HC Utilities PC Software

  – Redundant System Status - current status of Lead/Reserve Controller CPU's

  – On-Line Monitoring, Controller Diagnostics, Communications Loop-Back tests

  – Redundant Link Status – status of communications between Lead and Reserve controllers.

  – Lead CPU status

  – Reserve CPU status

  – Scanner status

File Download/Upload Functions

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Diagnostics and Troubleshooting

Overview

The HC900 system incorporates a comprehensive set of diagnostic tools that test hardware and software operation. Diagnostic software elements are contained in each system component. The diagnostic elements that are executed at any given time depend on operating conditions such as current operating mode and the current status of hardware and software. As long as power is applied, each major component of the controller will execute one or more diagnostic elements.

Diagnostics have two functions; they:

- Automatically alter system operation to react appropriately to operating conditions (particularly in the event of a system fault).

- Provide external indications that enable operating and maintenance personnel to react appropriately when external actions are required.

External Indications of Diagnostic Information

The following diagnostic indicators are provided.

- Light Emitting Diodes (LEDs) included in controller hardware. Locations of LEDs are shown in the following figures and tables. The LEDs are useful when personnel are performing troubleshooting activities solely at the controller. Also, they are useful for verifying indications viewed as screen items.

LED indicators	See page
Controller CPU indicators	161
Scanner indicators	171
I/O Module Indicators	175
Ethernet Switch indicators	178

- Screen items on:

  - The Operator Interface connected to the RS-485 port. See Operator Interface manual 51-52-25-108.

  - A PC with Designer Software/Process Control Utilities connected to the controller module via the RS-232 Converter or the Ethernet 10Base-T Open Connectivity port. See the Diagnostics section in the application's help.

Controller CPU indicators
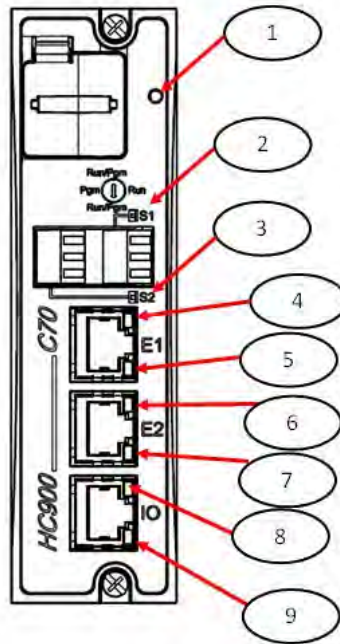
Figure 85 – LED Indicators on Controller CPUs (See Table 26)

Table 26 – LED Indications on Controller CPUs

CPU model	Figure 79 item	LED	LED State/Color	Description
All models	1	Controller Status	Off	No power.
			Solid Red	Failed
			Blinking Yellow	Failed
			Blinking Red	**(Diagnostic Code; refer to** Table 27**.)**
			Solid Green	PROGRAM Mode
			Blinking Green	RUN Mode
			Solid Yellow	OFFLINE Mode
All models	2	For legacy systems, RS-232/RS-485 S1 port For new systems, RS-485 S1 port XMT/RCV	Yellow/Green	Yellow when transmitting, green when receiving.
All models	3	For legacy systems, RS-232/RS-485 S2 port For new systems, RS-485 S2 port XMT/RCV	Yellow/Green	Yellow when transmitting, green when receiving.
All models		E1 port		
	4	Upper LED	Yellow (On/Off)	On for 100Base-T, Off for 10Base-T
	5	Lower LED	Green (On/Off/Flash)	On for connection, Off for no connection, Flash for activity
C70 C75		E2 port		
	6	Upper LED	Yellow (On/Off)	On for 100Base-T, Off for 10Base-T
	7	Lower LED	Green (On/Off/Flash)	On for connection, Off for no connection, Flash for activity
C50 C70 C75		I/O port		
	8	Upper LED	Yellow (On/Off)	On for 100Base-T, Off for 10Base-T
	9	Lower LED	Green (On/Off/Flash)	On for connection, Off for no connection, Flash for activity

HC900 Process Controller Installation and User Guide

Controller Status LED Diagnostic indicators

When the Controller Status LED (Figure 85 on page 162, item 1) is flashing red, consult Table 27.

> **⚠ WARNING** ⚡
>
> **Hazardous voltages** exist in the equipment enclosure.
> - Identify and avoid contact with voltage sources.
> - Disconnect power before servicing. (More than one switch may be required to disconnect all power.)
>
> **Failure to comply with these instructions could result in death or serious injury.**

Table 27 – Controller Status LED Diagnostics

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
1	RAM or ROM failed on power-up.	Executes an infinite loop that toggles the LED. Communications and control are disabled.	1. Cycle power 2. Replace CPU 3. Replace power supply 4. Replace rack 5. Check grounding 6. Ensure system is properly isolated from noise	Not available because the C75 communication ports are disabled.	Not available because the C75 communication ports are disabled.
2	At least one function block has an output that is forced.	The block's output(s) is/are forced to the value(s) specified.	If it is not desirable to have forced block outputs, use HCDesigner to locate and remove the forced outputs.	See **SYSTEM** in the "Controller Diagnostics Overview" display.	See **System Diagnostics** in the "Diagnostic Overview" dialog box.
2	The RAM and FLASH copies of the configuration database were corrupted and are now set to a valid empty database. Usually this is a result of a firmware upgrade.	An empty database is created, and the lead and reserve will not synchronize. The reserve's RSM LED is flashing to indicate it's not synchronized with the lead.	Use HCDesigner, HCUtilities, or OI to download a valid configuration.		
2	One of the following RSM failures was detected: 1. The RSM module is not installed. 2. The RSM switch position is invalid. 3. The lead and reserve switch positions do not agree.	The lead uses its own switch reading and dictates to the reserve what the mode is. If the lead's switch position is invalid, then the lead uses the last good known position prior to the failure. If failover occurs, the new lead will assume the mode prior to failover until a good switch reading is acquired. If after the power is cycled to both the lead and reserve, and the lead is unable to acquire a valid switch position, the system will default to the run-program mode of operation. This diagnostic will cause the **HWOK** pins of the analog and fast logic "System Monitor" blocks (AYSY and FSYS) to be turned off.	1. Install RSM if none present. NOTE: WHEN PLUGGING IN THE RSM INTO A LIVE UNIT, YOU MUST MAKE SURE THE SWITCH IS IN THE PROPER STATE PRIOR TO INSERTION. 2. If the key is installed in the RSM, remove it to make sure the switch is seated properly. If the key does not pull out, turn it slightly to the proper position until it can be removed. 3. Replace the RSM 4. Replace reserve CPU 5. Replace lead CPU 6. Replace rack		

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
2	There are slave blocks in the configuration, and no communication port is configured as a Modbus master.	• MSTRFAIL pins on ASYS and FSYS blocks turn on. • All Modbus slave and Modbus read blocks freeze their output pins to the last value. • All slave blocks have their BAD COMM pin on. • All slave blocks have their NO SCAN pin on. • IN SCAN STATUS is set to NO for all slaves. • COMM STATUS is set to BAD for all slaves in the function block diagram. • Statistical counters for all slaves are 0.	1. Use the OI, HCDesigner, or HCUtilities to configure one of the serial ports (S1 or S2) as a master. 2. Use the OI, HCDesigner, or HCUtilities to download a configuration that has no slave blocks.		
2	Controller mode is changed to RUN-Locked while there are forces present on safety worksheet.	• Controller will not go to RUN-Locked mode.	1. Change mode back to RUN mode OR 2. Clear all safety forces using HCD through Monitor->Forced Blocks OR 3. Force a cold-start		In HCD, "System Diagnostics" shows status as "Invalid Change of Mode"
2	Controller mode is changed to RUN-Locked when safety configuration is changed at run-time.	• Controller will not go to RUN-Locked mode.	1. To clear the diagnostic: 2. Change mode back to RUN mode OR 3. Force a cold-start		In HCD, "System Diagnostics" shows status as "Safety Configuration mis match"
3	One of the following microprocessor exceptions occurred: • Watchdog timer timeout • Address error • Prefetch error • Data abort error • Software interrupt • Undefined instruction error	At the time of the exception, the microprocessor resets. If it's the Lead controller, and there is an available reserve, a failover occurs. When the microprocessor completes its reset condition, it will become an available reserve if a lead is present or become a lead if no lead is present. This diagnostic will cause the **HWOK** pins of the AYSY and FSYS blocks to be turned off.	To clear the diagnostic, force a cold start. If the problem reoccurs, try the following: 1. Ensure the system is properly grounded 2. Ensure the system is properly isolated from external noise sources 3. Upgrade the firmware 4. Replace the CPU board. 5. Contact Honeywell Personnel.	If the lead's status LED is indicating the failure, see **CPU** in the "Lead CPU Diagnostics" display. If the reserve's status LED is indicating the failure, see **CPU** in the "Reserve CPU Diagnostics" display.	If the lead's status LED is indicating the failure, see **CPU Diagnostics** in the "Lead Diagnostics Overview" dialog box. If the reserve's status LED is indicating the failure, see **CPU Diagnostics** in the "Reserve Diagnostics Overview" dialog box.
3	One of the exception vectors located in RAM became corrupted.	The exception vector was automatically corrected in the controller's RAM and the controller continues to operate normally. This diagnostic will cause the **HWOK** pins of the AYSY and FSYS blocks to be turned off.			

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
4	Estimated battery life is less than 5 days.	• ASYS and FSYS blocks' **HW OK** pins are turned off. • Firmware upgrade is still permitted.	Replace battery.	If the lead's status LED is indicating the failure, see **MEMORY** in the "Lead CPU Diagnostics" display. If the reserve's status LED is indicating the failure, see **MEMORY** in the "Reserve CPU Diagnostics" display.	If the lead's status LED is indicating the failure, see **Memory Diagnostics** in the "Lead Diagnostics Overview" dialog box. If the reserve's status LED is indicating the failure, see **Memory Diagnostics** in the "Reserve Diagnostics Overview" dialog box.
4	Battery voltage is low.	• ASYS and FSYS blocks' **LOWBTRY** pins are turned on. • ASYS and FSYS blocks' **HW OK** pins are turned off. • Firmware upgrade is inhibited until both the Lead and Reserve batteries are good.	Replace battery.		
4	Flash failed to burn	ASYS and FSYS blocks' **HW OK** pins are turned off.	1. Force a cold start 2. If diagnostic does not clear, replace CPU module.		
5	The Real-time Clock (RTC) is not programmed. This is usually a result of the lead's battery failing when it was powered-down.	1. On power-up, time and date is initially set to 00:00:00, January 1, 1970 on both the lead and the reserve. 2. ASYS and FSYS blocks' HW OK pins are turned off. Note: If the reserve's battery fails when it is powered-down. The lead will automatically program the reserve's RTC with the correct date and time when the lead and reserve are synchronized.	Use HCDesigner, HCUtilities, or OI to program the real-time clock (RTC).	If the lead's status LED is indicating the failure, see **RTC** in the "Lead CPU Diagnostics" display. If the reserve's status LED is indicating the failure, see **RTC** in the "Reserve CPU Diagnostics" display.	If the lead's status LED is indicating the failure, see **Real-Time Clock Diagnostics** in the "Lead Diagnostics Overview" dialog box. If the reserve's status LED is indicating the failure, see **Real-Time Clock Diagnostics** in the "Reserve Diagnostics Overview" dialog box.

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
5	One of the following RTC conditions occurred: • RTC was previously programmed, but when it was last read, its date and time were deemed invalid. • An attempt was made to program the RTC, but it was unsuccessful. • The RTC is unable to be read. Usually indicating a serious hardware failure.	Same actions as described above.	1. Use HCDesigner, HCUtilities, or OI to program the real-time clock (RTC). 2. If problem persists, replace the CPU module		
6	One of the following remote I/O conditions exist: • Communications between the CPU and a Scanner 2 is failing. • Scanner 2 is unable to communicate to a module or a wrong module is installed. • A module in the I/O rack is reporting a diagnostic. • C75 and Scanner 2 firmware versions are incompatible. • Scanner 2, I/O rack, or power-supply is defective. • C75 module is defective • A bad channel has been detected on one of the modules.	1. Associated blocks set their fail pins on, their warn pins off, and their output pins to the failsafe value. 2. Associated blocks set their IO statuses to either "Channel No Comm" if the module cannot be communicated to or a message indicating the bad channel condition. 3. Associated rack monitor block's module fail pin is turned on. 4. Associated rack monitor block's RACK OK pin is turned off. 5. ASYS and FSYS blocks' HW OK pins are turned off.	Locate the Scanner 2 that has a status LED indicating a diagnostic, and follow the scanner 2 diagnostic section to solve the problem.	See the associated rack's "Rack Diagnostics Overview" display for details regarding the diagnostic.	See "Rack Diagnostics" dialog box.

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
6	High temperature condition in a Scanner 2 rack has been detected.	1. Associated AI blocks that are configured as T/Cs set their fail pin on, their warn pin off, and their output pin to the failsafe value. 2. Associated AI blocks that are configured as T/Cs set their IO status to either: "CJ High Temperature" if one of the two CJs on an AI card is indicating a temperature greater than 70 degrees C "CJ Failure" if both CJ sensors are failing to convert. 3. Associated rack monitor block's module fail pin is turned on. 4. Associated rack monitor block's RACK OK pin is turned off. 5. Associated rack monitor block's HITEMP pin is turned on. 6. ASYS and FSYS blocks' HITEMP pins are turned on. 7. ASYS and FSYS blocks' HW OK pins are turned off.			
6	Scanner 2 has a CPU or Memory diagnostic.	1. Associated rack monitor block's RACK OK pin is turned off. 2. ASYS and FSYS blocks' HW OK pins are turned off.		See **CPU** or **MEMORY** in the associated rack's "Rack Diagnostics Overview" display.	See **CPU** or **Memory** in "Rack Diagnostics" dialog box.
7	A Scanner 2 rack has a bad power supply.	1. Associated rack monitor block's RACK OK pin is turned off. 2. ASYS and FSYS blocks' HW OK pins are turned off.	Locate the Scanner 2 that indicates a bad power-supply diagnostic, and replace the defective supply.	See **POWER SUPPLY DIAGNOSTICS** in the associated rack's "Rack Diagnostics Overview" display.	See **Power Supply Diagnostics** in "Rack Diagnostics" dialog box.

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
8 or 9	If 8 flashes, the S1 serial port is reporting a diagnostic. If 9 flashes, the S2 serial port is reporting a diagnostic. Possible causes are: • If the port is configured as a Modbus or ELN slave, the data link layer is reporting that at least 75% of the last characters received have had a failure reported by the UART or at least 75% of the last messages received have been invalid. • If the port is configured as a Modbus Master, at least 75% of the last requests to a particular slave resulted in no response or a reply that failed the data link protocol.	1. ASYS and FSYS blocks' HW OK pins are turned off. 2. If configured as a Modbus master: • ASYS and FSYS blocks' Modbus Master Fail pins are turned on. • Slave and read blocks associated with the slaves experiencing the failure have their read pins frozen to the last value read. • Slave blocks associated with the slaves experiencing the failure have their BAD COMM and NO SCAN pins turned on. • IN SCAN STATUS is set to NO for all slaves experiencing the failure. • COMM STATUS is set to BAD for all slaves experiencing the failure. • The slaves with the data link errors have a non-zero data link error count. • The slaves experiencing the failure are moved to the background scan rate.	1. Check baud rate 2. Check connectors 3. Check cable polarity 4. Isolate cabling from electrical interference 5. If RS-232 to RS-485 converter is used, check its power, switch/jumper settings, and polarity. 6. If configured as a Modbus master, use the slave status screens to determine which slaves are experiencing the problem. For those slaves check: • Power • Connections • address • baud rate • parity • number of stop bits • for electrical interference • grounding • termination resistor (if at end of link) 7. The diagnostic is cleared by clearing the port's statistics.		
	The UART failed its power-up tests	See above	Replace CPU module		
10	Ethernet port tests failed during power-up.	1. E1 or E2 port diagnostic is set to FAILED. 2. ASYS block's HW OK pin is turned off.	Replace CPU module.	If the lead's status LED is indicating the failure, see **NETWORK PORT E1** or **NETWORK PORT E2** in the "Lead CPU Diagnostics" display. If the reserve's status LED is indicating the failure, see **NETWORK PORT E1** or **NETWORK PORT E2** in the "Reserve CPU Diagnostics" display.	If the lead's status LED is indicating the failure, see **Lead Port E1: Network Port Diagnostics** or **Lead Port E2: Network Port Diagnostics** in the "Lead Diagnostics Overview" dialog box. If the reserve's status LED is indicating the failure, **Lead Port E1: Network Port Diagnostics** or **Lead Port E2: Network Port Diagnostics** in the "Reserve Diagnostics Overview" dialog box.

Scanner indicators
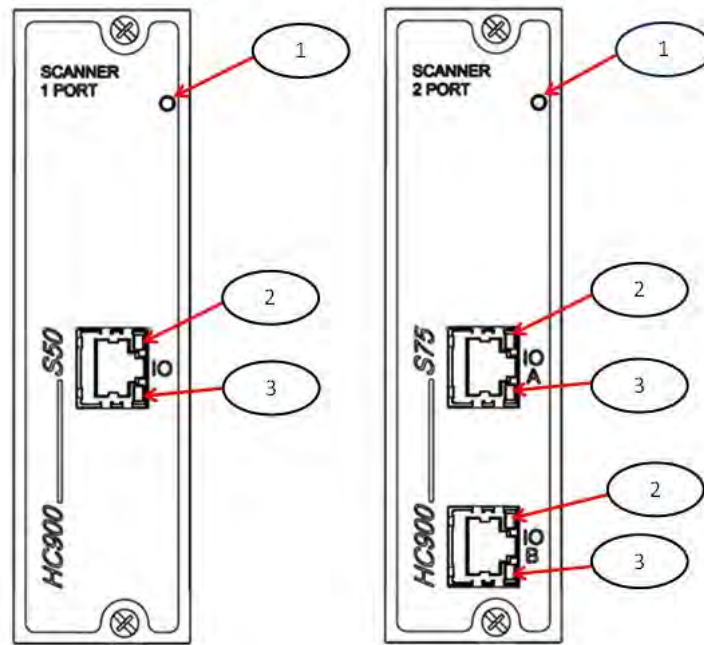
Figure 86 – LED Indicators on Scanners—1 port (left), 2 port (right) (See Table 28)

Table 28 – LED Indications on Scanner Module

Figure 80 item	LED	LED State/Color	Description
1	Scanner Status	Off	No power
		Solid Red	Failed
		Blinking Red	(Diagnostic Code; refer to Table 29 - Scanner LED Diagnostics.)
		Solid Green	Startup Mode
		Blinking Green	Scan Mode
2	10Base-T port XMT (upper LED)	Green (On/Off)	
3	LINK (lower LED)	Green (On/Off)	On while a message is being sent from the Main CPU; otherwise Off.
			On while the Main CPU is receiving a message. Remains On as long as host is present; Off when the host is removed from the link.
		NOTE: These LEDs indicate activity on the communication port, they are controlled by hardware (PHY chip), not by software.	

Scanner Diagnostic LED Indication

The scanner uses its LED to communicate diagnostic information. These diagnostics are a subset of the main CPU's and are listed below.

Table 29 – Scanner LED Diagnostics

Number of Strobes	Possible Cause	Scanner Action	User Action
1	RAM or ROM failed diagnostics on power-up.	Executes an infinite loop that toggles the LED. Communications and module scanning are disabled. Module outputs are in the power-off state -- DO outputs are off, and AO outputs are at zero milliamps.	1. Cycle power 2. Replace scanner 3. Replace rack 4. Check grounding 5. Ensure system is properly isolated from noise
2	The scanner has no configuration data because it is unable to communicate to the controller CPU. Possible causes include: 1. Scanner address switches are not correctly set. 2. C75 only: The C75 I/O port is connected to the wrong Scanner 2 I/O port. 3. If a switch is used, there may be a problem with it. 4. Cables are defective or are not properly shielded. 5. Controller CPU is not powered. 6. Controller CPU and Scanner firmware versions are incompatible. 7. Defective Controller CPU, Scanner, power supply, or rack.	Modules are not scanned and the outputs are either at failsafe or in the power-down state. If communication was lost while the modules were being scanned, then the module outputs are in their failsafe state. If communication was never established to the Scanner, then the module outputs are in the power-off state.	1. Verify that the address switches on the scanner are set correctly. 2. C75 only: Verify that the CPU A cable is connected to the A port, and the CPU B cable is connected to the B port on the Scanner 2. 3. If a switch is used, check that all cables are properly connected to the switch, proper crossover cables are used, that the switch is powered, and it supports 100 Base-T. 4. Check cable shielding for proper grounding and noise immunity. 5. Make sure the cables have the correct pinout. 6. Cycle power to the Scanner. 7. Cycle power to the switch. 8. Cycle power to the controller CPU. 9. Replace the expansion rack's scanner module. 10. Ensure that the Scanner and Controller CPU software versions are compatible. If not, perform a firmware upgrade. 11. Replace the expansion rack's power supply. 12. Replace the expansion rack. 13. Replace the main CPU.

Number of Strobes	Possible Cause	Scanner Action	User Action
3	One of the following microprocessor exceptions occurred: • Watchdog timer timeout • Address error • Prefetch error • Data abort error • Software interrupt • Undefined instruction error	Scanner restarts. The main CPU detects that the Scanner restarted, and places the Scanner back into the scan mode.	Cycling power to the scanner will clear the diagnostic. If the problem reoccurs, try the following: 1. Ensure the system is properly grounded. 2. Ensure the system is properly isolated from external noise sources. 3. Upgrade scanner firmware 4. Replace scanner module 5. Contact Honeywell Personnel.
3	One of the exception vectors located in RAM became corrupted.	The vector is restored to the proper value and the Scanner continues to operate normally.	
4	Flash failed to burn properly when the firmware was being upgraded.	The boot code is the only software running. This software waits for a request to burn the flash. It does no scanning of modules. Module outputs remain in their off state.	Perform a code download.
5	C75 only. The communications with the reserve is failing for the following reasons: 1. There is a problem with the connection between the scanner and the reserve. 2. The scanner port used to communicate to the reserve has a hardware failure	C75 only. This problem may cause on-demand failover attempts to be unsuccessful.	C75 only: 1. Verify that the CPU A cable is connected to the A port, and the CPU B cable is connected to the B port on the Scanner 2. 2. If a switch is used, check that all cables are properly connected to the switch, proper crossover cables are used, that the switch is powered, and it supports 100 Base-T. 3. Check cable shielding for proper grounding and noise immunity. 4. Make sure the cables have the correct pinout. 5. Cycle power to the Scanner 2. 6. Cycle power to the switch. 7. Cycle power to the reserve. 8. Replace the expansion rack's scanner module. 9. Ensure that the Scanner 2 and reserve software versions are compatible. If not, perform a firmware upgrade. 10. Replace the expansion rack's power supply. 11. Replace the expansion rack. 12. Replace the main CPU.
6	The modules installed do not agree with those required by the configuration.	No action is taken.	Verify that the correct modules are installed for the configuration.

Number of Strobes	Possible Cause	Scanner Action	User Action
6	The Scanner cannot communicate to a module or the module is experiencing a diagnostic condition.	No action is taken.	For each module with a red blinking LED, follow the actions described in the I/O Module Diagnostic Indication, page 176.
6	An AI module's CJ temperature reading is indicating a thermal problem. The scanner determines this problem not the AI module; therefore, the module's status LED will not indicate this diagnostic. Possible reasons for this diagnostic are: 1. One of the two CJs on the module is indicating a temperature reading greater than 70 degrees C. 2. Both cold-junction sensors are failing to convert. 3. The CJs are converting properly, but their differential is greater than 10 degrees C.	No action is taken.	1. Improve ventilation to rack 2. Replace AI module
6	The scanner determined that a module has a bad channel. In this condition, the module's status LED will not indicate the failure because the Scanner determines the condition, not the module itself.	No action is taken	Refer to the Bad I/O Channel Diagnostics on page 177 to determine the nature of the problem and possible user actions.
7	One of the power-supplies failed.	No action is taken	Replace the power-supply

I/O Module Indicators
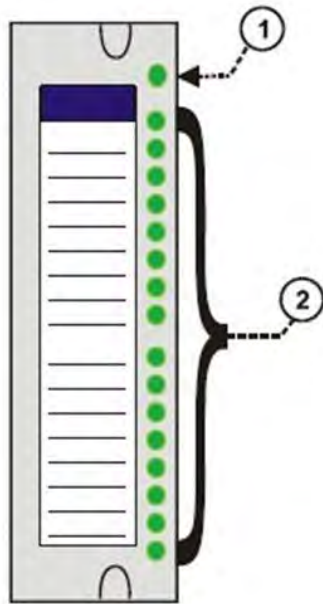
Figure 87 – I/O Module LED indicators

Table 30 – LED Indications on I/O Module

Figure 87 item	LED	LED State/Color	Description
1	Module Status	Off	No power.
		Solid Red	Hardware failure
		Blinking Red	**Diagnostic Code; refer to** Table 31 **– I/O Module LED Diagnostics.**
		Blinking Yellow	At least one output is Forced.
		Solid green	Cold start with passing diagnostics
		Blinking Green	Normal scanning
2	Channel LEDs (one per input or output)	Green (On/Off)	For Inputs, indicates On or Off status of the field input even if Forced to the opposite state. For Outputs, indicates On or Off status of the output including if Forced.

I/O Module Diagnostic Indication

To indicate the type of diagnostic failure, the module's status LED is flashed red with a number of quick strobes followed by a long off time. Table 31 outlines the potential module diagnostics.

Table 31 – I/O Module LED Diagnostics

Number of Strobes	Failure	Description	AI	AO	DI			DO			PFQ	User Action
					Contact	AC	DC	Relay	AC	DC		
1	FAIL SAFE	The module is in the failsafe state because it is not receiving message requests from the CPU or Scanner at a rate that satisfies the configured failsafe timeout.	√	√	√	√	√	√	√	√	√	1. If expansion I/O rack, go to step 2. If no expansion I/O rack, go to step 3. 2. Check the Scanner status LED (see p. 171). If it's flashing 6 times, proceed with step 3. If it's flashing some other red status code, refer to Table 29 to solve that problem first. If it's flashing green, the module probably is not required in the configuration. If it's not on or steady, cycle power to the scanner. 3. Make sure the module is the correct one for the configuration. 4. Remove the module and check for a bent pin, then reinsert the module 5. Replace the module 6. Remove other modules and replace one at a time until the problem reoccurs. Most likely the last module inserted needs to be replaced. 7. Replace the rack.
2	EAROM	EA ROM Failed its checksum	√	√								1. Remove/reinsert module. 2. Replace module.
3	RAM		√	√	√	√	√	√	√	√	√	
4	ROM			√	√	√	√	√	√	√		
5	+24 V		√	√	√			√				1. Remove the module and check for a bent pin, then reinsert the module 2. Measure power supply voltage. If not correct, replace power supply. 3. Replace module 4. Replace rack
6	FACTORY CAL	CRC failure of primary and backup factory calibration	√	√								Replace module.
7	FIELD CAL	CRC failure of field calibration values	√	√								1. Remove/reinsert module. 2. Replace module.
8	HARDWARE	General Hardware Failure (AI=convertor not working)	√									Replace module.
9	HW/SW Key	The software residing on the module does not match the module type. This diagnostic should only result in the factory.			√	√	√	√		√		Replace module
11	Shift Register	The loopback test of the shift register failed.			√	√	√	√	√	√		Replace module

Bad I/O Channel Diagnostics

Individual channels on I/O modules indicate their diagnostics by 6 flashes on the Scanner and CPU; the channel's LED does not indicate a diagnostic. Table 32 is a list of conditions that can cause a bad channel diagnostic.

Table 32 – Bad I/O Channel Diagnostics

Module Type	Failure message indicated on Honeywell OI or Honeywell HCDesigner/Utilities function block monitor	Description	User Action
AI	Burnout Failure	The sensor – T/C, RTD, or mV source -- is failing burnout checks.	Check terminal block connections Replace source element Replace module.
	Under range	The signal at the terminals is less than 10% below the range of the sensor.	Check the signal level being applied to the terminals. Replace module.
	Over range	The signal at the terminals is more than 10% over the range of the sensor.	Check the signal level being applied to the terminals. Replace module.
	Failing to convert	When attempting to take a reading, the ADC fails. This could result if the incoming signal is either too large or small. It also could result if the ADC circuit is failing. If the problem is the ADC circuit, most likely other channels will have the same failure.	Check the signal level being applied to the terminals. Replace module.
AO	Bad Channel	The board indicates that the channel is failing to output the correct value.	Check terminal connections. Replace module.
DO	Bad Channel	The number of configured channels in the DO function block exceeds the number of hardware channels on the DO card.	Reconfigure the DO function block. Replace DO card with correct number of channels.

Ethernet Switch indicators

Table 33 – LED Indications on Ethernet Switch

LED	LED State/Color	Description
10Base-T port		
XMT (upper LED)	Green (On/Off)	On while a message is being sent from the Main CPU; otherwise Off.
LINK (lower LED)	Green (On/Off)	On while the Main CPU is receiving a message. Remains On as long as host is present; Off when the host is removed from the link.
	NOTE: These LEDs indicate activity on the communication port, they are controlled by hardware (PHY chip), not by software.	

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Analog Calibration

Overview

All calibration data for Analog Input Modules and Analog Output Modules is stored in non-volatile memory in the I/O modules. Calibration data is stored for each channel of each AI or AO module. Calibration data for each channel can be either:

- Factory calibration, which is stored permanently in the module, and

- Field Calibration, which is entered from an HMI (OI- on the RS-485 Port, and/or a PC on the RS-232 Port and/or the Ethernet 10Base-T Port using Designer Software .

A field calibration procedure consists of two parts:

- Connecting a calibration device to each channel of an AI or AO module, and

- Using the Operator Interface, HC Designer, or HC Utilities to select actions and enter custom calibration data values calibration into the I/O module.

This section contains information and instructions for connecting calibration devices.

⚠ WARNING

Hazardous voltages exist at the Power Supply and at the terminal boards on I/O Modules

Only trained and authorized personnel should perform the procedures in this section.

Failure to comply could result in death or serious injury.

ATTENTION

For calibration procedures, refer to the Operator Interface manual or Process Control Designer manual.

Analog Input Calibration

Analog input modules can accommodate five input types:

- RTD*
- Thermocouple*
- Ohms*
- Volt
- milliVolt*
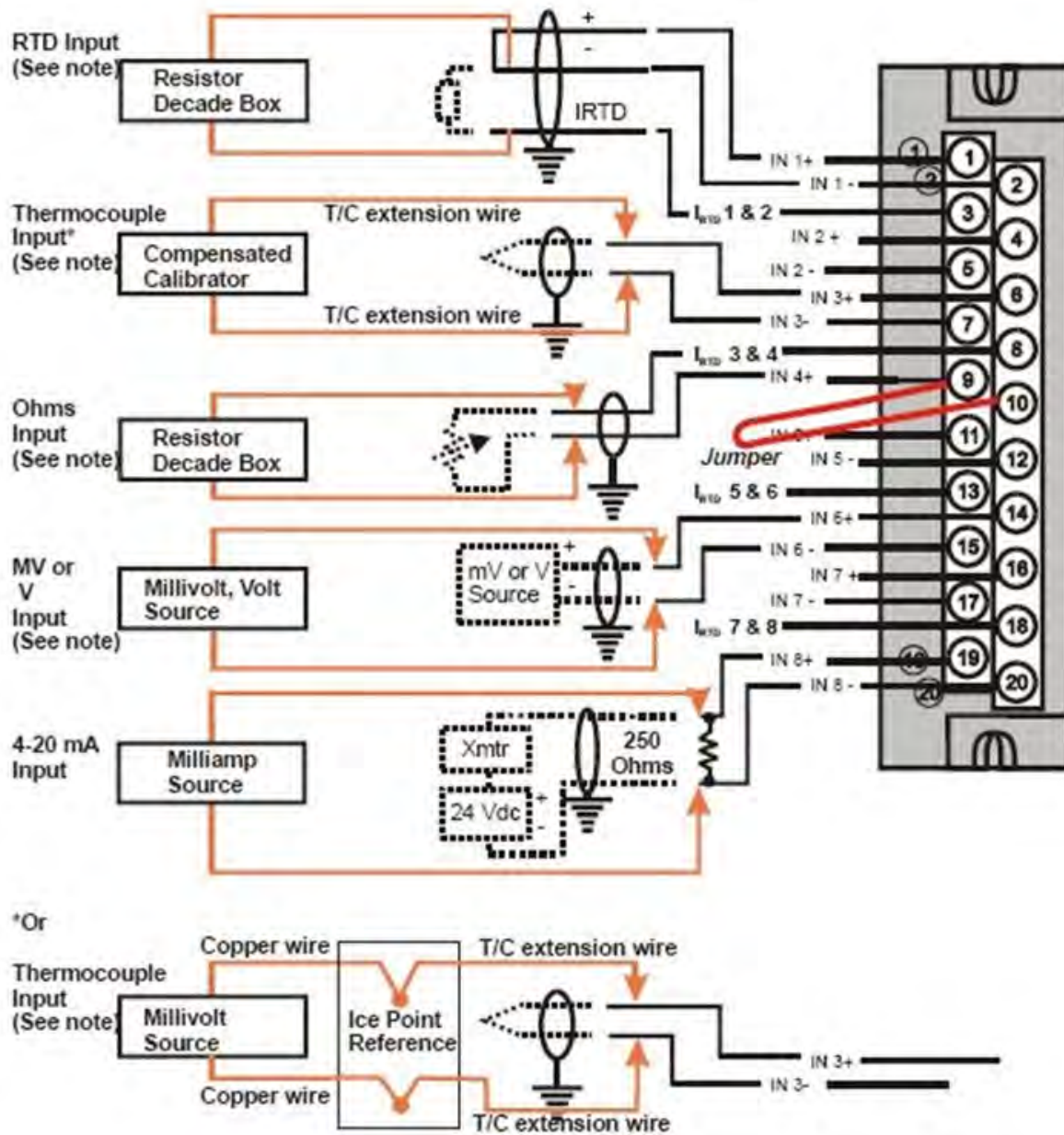- 4-20 mA

*Not available on high level analog input modules.

Calibration values for each channel are stored in the module as numeric values paired with A/D conversion counts corresponding to those numeric values. The numeric values are those identified as 'REFERENCE' on the OI or HCD calibration displays; apply these values to the input terminals during the calibration procedure.

For AI channels configured as thermocouple inputs, the stored calibration values are compensated by the measured temperature of the terminals. Because of this observe the following rules:

- If you plan on calibrating the 2 cold junction compensation devices, perform this operation first before performing any thermocouple calibrations. However, because cold junction measurement inaccuracies will be compensated in each individual thermocouple calibration, cold junction calibration may be skipped.

- After connecting the thermocouple extension wire to the terminals, you must wait for the terminal temperature to stabilize.

- If using a compensated calibrator, input the equivalent simulated temperature values corresponding to the REFERENCE mV values. These will be the hi and low range values for the particular thermocouple configured.

Figure 88 is an adaptation of the wiring diagram given in the installation section of this manual. This figure indicates how a calibration device can be connected to the appropriate terminals of an analog input module. The calibration device(s) must have the following precision characteristics:

- TC, mVolts, Volts inputs: 1 microvolt resolution
- Ohms, RTD inputs: .01 ohm resolution
- 4-20mA inputs: 4 microamp resolution

Figure 88 – Terminal Board Connections for AI Calibration

Analog Output Calibration

Analog output modules have essentially one output type.

A diagram of a precision ammeter connected to the terminals of a 4-channel Analog Output module is given in Figure 89. The specifications of the meter must be consistent with calibration requirements.
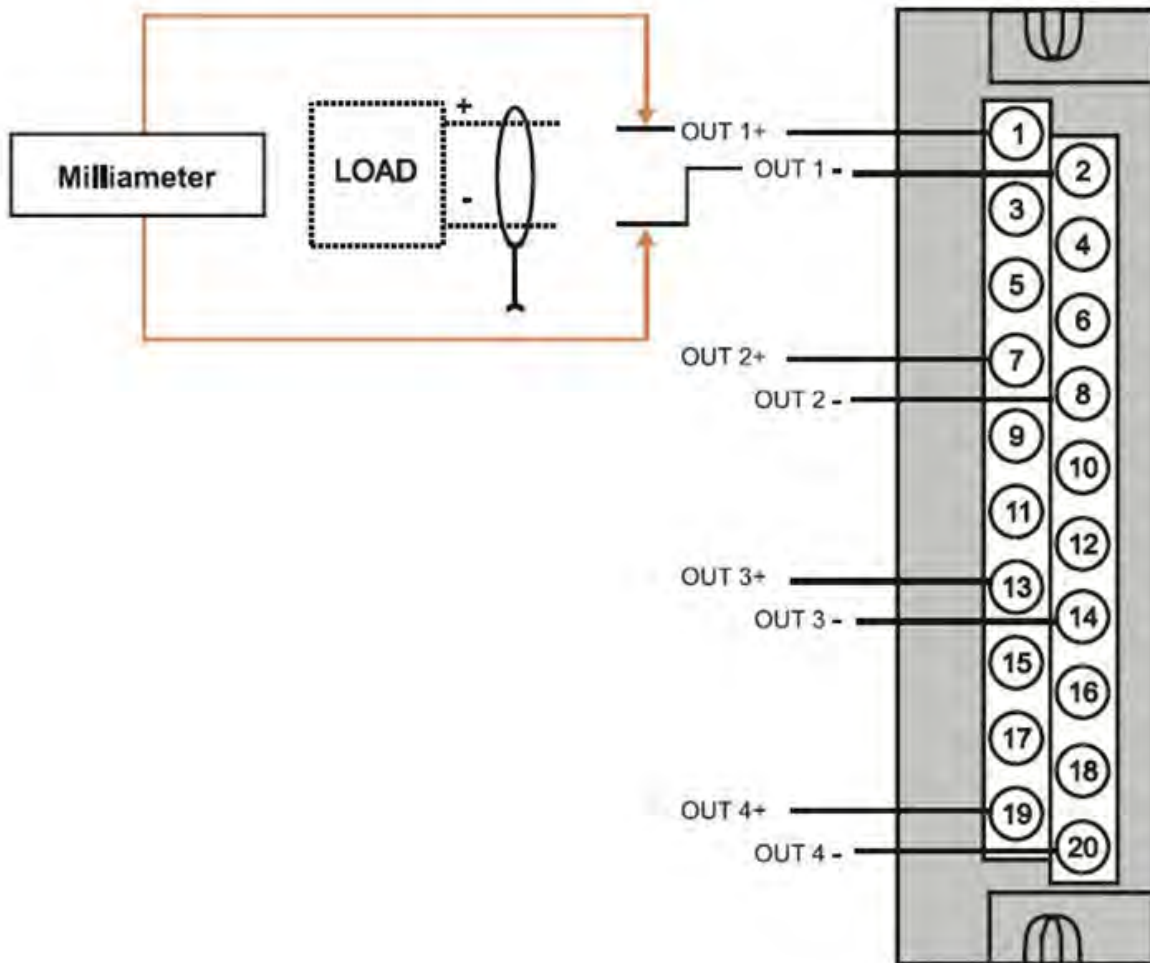
Figure 89 – Terminal board Connections for AO Calibration

Removal and Replacement Procedures

Overview

This section contains procedures for removing and replacing the active components of an HC900 Process Controller. It also includes recommendations, suggestions, and hints as they apply to the circumstances under which the procedures are used.

Safety Considerations - PLAN AHEAD!

When using the procedures in this section, plan the sequence of procedural actions so as to ensure:

- The safety of personnel

- The protection of property

- The integrity of operating processes

⚠ The first consideration is safety of personnel. While there is always an inclination to preserve the materials and time invested in a running process, no action should ever be taken that would risk injury to personnel.

Protection of personnel property is an important consideration that always requires comprehensive knowledge of the entire control process: the control equipment, the process control strategy, and the conditions and circumstances that exist when the removal and replacement procedures are taken.

The procedures in this section include notices of potential hazard as they apply to various components in the controller. Because each control process and the set of conditions and circumstances at each user site are unique, it is the user's responsibility to know the potential consequences of each action as it relates to a running process.

It is recommended that the user becomes familiar with the significant aspects of each set of circumstances and has a plan for execution of the proper action sequence.

⚠ **CAUTION**

All of the modules (input, output, RSM, PSM) available for use in the HC900 Controller have a RIUP designation. That is, they can be Removed and Inserted Under Power, where "power" refers to DC power at the backplane of the rack. (It does **not** refer to power for field wiring at the terminal board associated with the I/O module, which **must** be disconnected (using a user-supplied switch) at the field device before removing or inserting the module.

For all other components of the controller, AC power to the controller must be removed before removal or replacement of the component.

⚠ **WARNING** ⚡

Hazardous voltages exist at the Power Supply and at the terminal boards on I/O Modules

- Only trained and authorized personnel should perform the procedures in this section.

- Disconnect all sources of power associated with these components before removal or insertion.

Failure to comply with these instructions could result in death or serious injury.

⚠ **WARNING** ⚡ **EXPLOSION HAZARD**   Class 1, Division 2 Installations

- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

⚠ **WARNING** ⚡ **EXPLOSION HAZARD**   Class 1, Division 2 Installations

- DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN NOT TO BE HAZARDOUS.

Replacing the Power Supply

The power supply for the HC900 Process Controller is available in two models and is used in the local (controller) rack and in the remote (I/O expansion) racks, in 4-, 8-, and 12-module sizes. This reduces required inventories of spare parts, and also simplifies removal and replacement procedures.

Removing the power supply from a rack will remove all DC voltages from the rack that powers the Controller Module or Scanner Module, and from all I/O modules within the rack.

NOTE:
The power supply includes an internal fuse, rated at 5 amperes. This fuse is not replaceable in the field. If desired, the user can provide an external fuse that has a current rating lower than that of the internal fuse. See page 61.

Table 34 – Power Supply Replacement (all except C75)

Step	Action
1.	**ATTENTION:** This procedure does not apply to C75 power supplies.
	If the power supply to be replaced is powering a rack that is currently controlling a running process, then:
	Either:
	- Ensure that powering the rack down will not have adverse consequences on any running process.
	Or:
	- Bring the process to a safe and orderly shutdown.
2.	Using an external, user-supplied switch, disconnect the power supply from the source of site AC power. Use a meter to ensure that power is off.
3.	Depending on the type of wire lugs used, loosen or remove the three screws on the terminal board, and remove the three wires from the terminal board.
	NOTE: DO NOT remove the nut that secures the lug for the PE Ground wire (green) to the grounding stake at the bottom of the rack.
4.	At the top and bottom of the module, loosen the captured screws that secure the module in the rack, and remove the power supply from the rack.
5.	Place the new power supply in the rack. (cont'd)

Step	Action
6.	Secure the lugs for AC wiring to the terminals on the new power supply. • L1 (top terminal) - Black (USA) or Brown (Europe) • L2 /N (middle terminal - White (USA) or Blue (Europe). • Ground (bottom terminal)
7.	Ensure power can be applied safely, and use the external (user-supplied) switch to re-connect power to the power supply.
8.	Using a meter and the test points on the face of the power supply, ensure that voltages (measured on the backplane) are within specifications.

Replacing the Controller Module

Removing and replacing the Controller Module requires that that the source of AC power is removed from the rack. Removing power from the Controller rack has the following consequences:

- All control action stops

- All power to all I/O modules in the rack is lost; hence all control outputs to the process are lost. Because external power connected to terminal boards (from or to field devices) will still be present, it is essential that field devices are maintained in a safe condition during replacement procedures.

- Control to all I/O expansion racks is lost. If power is available to the expansion racks, outputs go to configured Failsafe values.

C75 module

- Does not impact the other C75 CPU module, which will continue to control the process

- Contains start-up diagnostics after replacement to verify proper operation

- If there is a Lead Controller, the configuration database is automatically copied from the Lead to the newly replaced C75 CPU module.

Before replacement:

- (If possible), upload and SAVE a copy of the configuration, or ensure that a previously saved copy of the current configuration is available.

- (If possible), bring the process to a safe and orderly shutdown.

Table 35 – Controller Module Replacement

Step	Action
1.	If a process is currently in operation, bring it to a safe and orderly shutdown.
2.	Using an external (user-supplied) switch, disconnect the power supply in the Controller rack from the site AC power source.
3.	Observe where communications cables are plugged into the Controller Module, and if necessary, tag them to identify their functions. Unplug all communications cables.
3.	At the top and bottom of the module, loosen the captured screws that secure the module in the rack, and remove the Controller Module from the rack.
4.	Ensure that the new Controller Module is properly aligned with the slot guides, insert the new Controller Module in the rack, and secure it in place with the captured screws at top and bottom of the module.
5.	Re-install communications cables.
6.	Using the (user-supplied) switch, re-connect site AC power to the rack.
7.	*If using the Ethernet port for configuration, use the Designer software to set the proper network address.*
8.	Download the configuration.
9.	Set the Real-Time Clock.
10.	If all status indications are green, power may be restored to the I/O modules per the application's procedures.

Replacing the Scanner Module

Removing and replacing the Scanner Module from an I/O expansion rack (C50, C70, C75 CPU controllers only) requires that the source of AC power is removed from the rack. Removing power from the Expansion rack has the following consequences:

- All power to all I/O modules in the rack will be lost; hence all control outputs from the rack to the process are lost.

- Redundant controllers will operate with the affected I/O in failsafe state during Scanner2 module replacement

- Does not impact other I/O Racks in the same configuration

Table 36 – Scanner Module Replacement

Step	Action
1.	If a process is currently in operation, then: • Either ensure that powering-down the expansion rack will not have adverse consequences on any running process, or • bring the process to a safe and orderly shutdown.
2.	Using an external (user-supplied) switch, disconnect the power supply or supplies in the expansion rack from the site AC power source.
3.	Unplug the cable(s) from the scanner port(s).
4.	At the top and bottom of the Scanner Module, loosen the captured screws that secure the module in the rack, and remove the module from the rack.
5.	Configure the scanner address jumpers/DIP switches on the replacement module to match those of the removed module.
6.	Ensure that the new Scanner Module is properly aligned with the slot guides, insert the new Scanner Module in the rack, and secure it in place with the captured screws at top and bottom of the module.
7.	Re-install the cable(s).
8.	Using the external (user-supplied) switch, connect the power supply or supplies in the expansion rack to the site AC power source. The Scanner Module should resume communications with I/O modules in the rack and with the Controller Module with which it is connected.
9.	Check status indications at the Scanner Module, at the Controller Module, and at the OI.

Replacing an I/O Module

CAUTION
Read and understand all of the following information regarding RIUP before attempting to remove and/or replace any I/O module, particularly in a system that is actively controlling a process.

All of the I/O Module types in the HC900 Controller System include the Removal and Insertion Under Power (RIUP) feature. That is, while the rack is powered, any of the I/O Modules can be removed or inserted:

- With no physical damage to the module, to the rack, or to other modules in the rack

- Without disturbing the functions of ***other I/O modules*** in the rack or in the system.
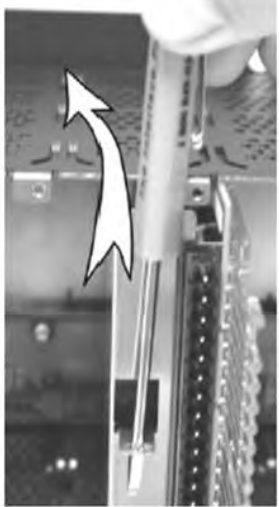
Under carefully controlled circumstances, this feature enables the user to remove and insert an I/O module without completely shutting down a running system. However, it must be recognized that removing or inserting an I/O module under power is potentially hazardous to property and to personnel.

Circumstances that dictate prudent actions depend on conditions and specific process applications at each user facility. It is the responsibility of site personnel to know all potential consequences of RIUP, and to take actions to prevent all adverse consequences before removing or inserting an I/O module under power. Table 37 provides some general guidelines for establishing appropriate procedures at a given installation.

Table 37 – RIUP: Potential Hazards and Recommended Actions

Hazard	Source	Preventive Action(s)
⚠ **CAUTION** Loss of control or view of a running process can cause damage to equipment and/or to process product.	Each signal at each of the terminals for an I/O module has a specific function. Any or all of the signals may be vital for safely controlling a process.	Either: Using trained personnel and appropriate control mechanisms, transfer to manual control of each signal that is necessary to maintain safe process control. Or: Bring the process to a safe stop before initiating the removal or insertion procedure.
⚠ **WARNING** Human contact with high voltage sources will result in death or serious injury.	Potentially lethal voltages on Terminal Blocks.	**Disconnect all signals at terminal blocks from sources of power before removing the terminal block from the I/O module.** Ensure that the Protective Earth (PE) ground is properly connected and properly functioning.

Table 38 – I/O Module Replacement

Step	Action
	⚠ CAUTION Removal or Insertion Under Power of an I/O module is an option, but if operating circumstances permit, disconnecting power from the rack is the preferred option. Plan and develop an action sequence before beginning the replacement procedure. Primary considerations include: **When replacing I/O module, the voltages to the modules must be disconnected at the field device before removing the terminal block from the module.** *Loss of control/monitoring in a running process* - Each signal at each of the terminals for an I/O module has a specific function. Any or all of the signals may be vital for safely controlling a process. Determine the functions of all signals to the modules and know the potential consequences of losing each. If possible, transfer control to alternate mechanisms; otherwise, bring the process to a safe and controlled shutdown.
1.	**⚠ WARNING** Disconnect all signals from power sources, using (user-supplied) switches at field devices. Use a meter to ensure that all voltages are disconnected. If a power-down replacement procedure is opted, also disconnect power from the rack, using the (user-supplied) switch in the site AC power source.
2.	Loosen the captive screws at top and bottom of the module; loosening the screws will cause the terminal block to be partly extracted from the module connector. Remove the terminal block from the module.
3.	Using the extractor loop on the cover on the module, pull the module from the slot as shown in the illustration at right. As shown in the illustration, a long flat-tip screwdriver is used as an extraction lever. Insert the screwdriver tip into the extraction tab on the front of the module cover, and rotate the screwdriver handle toward the back, using the top edge of the rack as a fulcrum.
4.	Verify that the replacement module is of the proper type. Then, carefully insert it into the slot in the rack so as to make proper contact with the connector in the backplane.
5.	Replace the terminal block on the module.
6.	If the rack was powered-down for the procedure, restore power to the rack.
7.	Re-connect signals to field devices.

Battery Installation/Replacement

Advisory Regarding Battery Installation

Memory for the CPU in the Controller Module includes:

- Volatile memory and

- Non-volatile memory (Flash)

Only volatile RAM requires battery backup.

When power is applied to the Controller Module, the CPU is initialized automatically. If the battery is installed after initialization, and if site power is maintained, the current draw from the battery is very low - approximately 4 microamps. If site power is disconnected with the battery in place and with the CPU in the initialized state, the current draw on the battery is approximately 800 microamps. However, if the battery is installed before power is applied (and the CPU initializes), the SDRAM will draw approximately 40 milliamps.

At the 4 microamp level, the battery will retain energy over an extended period.

At the 800 microamp level, the battery will retain sufficient energy to maintain the content of SDRAM for 50 weekends (approximately 100 days) of backup service.

At the 40 milliamp level, battery life is severely reduced. The battery could be rendered useless in less than 60 hours.

CAUTION

Installing the backup battery when the CPU is not initialized will cause undue battery drain.

Do not install or replace the backup battery until after site power is applied.

Battery Installation Procedures

Table 39 – Installing Backup Battery (CPU not initialized)

Step	Action	
1.	**⚠ CAUTION** Improper application of site power can cause damage to equipment. Ensure that the controller rack is ready and safe for application of AC power.	
2.	Apply site AC power to the Power Supply that is associated with the controller Module..	
3.	Press the latch on the battery cover (1) to release the battery holder, and pull on the handle (2) to remove the battery holder. Note the orientation of the battery-holder assembly (battery toward the left).	
4.	The battery is retained in the holder by spring tension of the plastic holder itself. Insert the negative end of the battery into the back end of the holder, and press on the battery (see arrow) so that it snaps into the holder. To ensure that the battery is seated properly, rotate it in the holder, using finger or thumb pressure toward the positive (front) end of the battery.	
5.	While maintaining proper orientation (battery toward the left), slide the battery holder into the slot in the Controller Module until it snaps into place.	

Battery Replacement Procedures

Table 40 – Replacing a Backup Battery (CPU Powered))

Step	Action
1.	**⚠ CAUTION** If the battery is removed from the Controller Module when AC power is not applied, the content of SDRAM will be lost. Before beginning this procedure, upload and SAVE a copy of the configuration, or ensure that a previously saved copy of the current configuration is available.
2.	Apply site AC power to the Power Supply that is associated with the controller Module..
3.	Press the latch on the battery cover (1) to release the battery holder, and pull on the handle (2) to remove the battery holder. Note the orientation of the battery-holder assembly (battery toward the left).
4.	The battery is retained in the holder by spring tension of the plastic holder itself. Extract the battery from the holder by using your thumb to apply pressure to the front end of the battery, and rotating it to the left. Insert the negative end of the new battery into the back end of the holder, and press on the battery so that it snaps into the holder. To ensure that the battery is seated properly, rotate it in the holder, using finger or thumb pressure toward the positive (front) end of the battery.
5.	While maintaining proper orientation (battery toward the left), slide the battery holder into the slot in the Controller Module until it snaps into place.

Specifications

General Specifications

	C30	C50	C70	C75
Controller Design	Modular design with metal rack enclosure, power supply, controller CPU and user selectable I/O module types.			
Rack Mounting and Installation	Surface mounting with 4 screws in back of rack. Installation Category II, Pollution Degree 2, IEC 664, UL840 Installation coordination			
Controller I/O support	4, 8, or 12 I/O slots per Rack			None (requires remote I/O racks)
Remote I/O racks	None	1 w/o switch, using Ethernet direct cable. Up to 4 with recommended Honeywell switches (part no. 50008930-001).		1 w/o switch, using Ethernet direct cable. Up to 5 with recommended Honeywell switches (part no. 50008930-001)
Remote I/O interface type	None	Separate Ethernet 100Base-T port on CPU, RJ-45 connection, dedicated communications link		
Remote I/O Distance	None	100 m (328 ft.) – Ethernet cable, controller to remote rack or controller to switch. Up to two switches per connection, 300m (984 ft.), and maximum distance. 750m (2460 ft.) – Fiber optic cable, controller to remote rack or controller to switch. Up to two switches per connection, 1500m (4920 ft) maximum distance.		

Fiber Optics Equipment Recommendations	
Ethernet Switch	Moxa Unmanaged Ethernet Switch model EDS-308-MM-SC with (6) 10/100 Ethernet ports, (2) multi-mode fiber ports with SC Connectors (require 24VDC power)
Converter	Moxa Media Converter model IMC-101-M-SC with (1) 10/100BaseT(X) to 100BaseFX multi-mode fiber port with SC connectors (require 24VDC power)
Fiber Cable	Multi-mode, Duplex, 62.5/125 with SC connectors on both ends
Copper Ethernet Cable	Shielded Cat5 Ethernet cable

I/O Capacity		
Combined Analog and Digital	384	1920
Analog Inputs	192	960
Analog Outputs	40 48 with heat de-rating 192 with external power source	200 240 with heat de-rating 960 with external power source

Rack Size	
4 I/O slot chassis	5.4"(137mm) H" x 10.5"(266.7mm) W x 6.0" * (151.7 mm) D (rear mounting plate extends height to 6.9" (175.3mm)
8 I/O slot chassis	5.4"(137mm) H x 16.5"(419.1mm) W x 6.0" * (151.7mm) D (rear mounting plate extends height to 6.9" (175.3mm)
8 I/O slot chassis with redundant power support	5.4"(137mm) H x 20.9"(530.9.1mm) W x 6.0" * (151.7mm) D (rear mounting plate extends height to 6.9" (175.3mm)
12 I/O slot chassis	5.4"(137mm) H x 22.5"(571.5mm) W x 6.0" * (151.7mm) D (rear mounting plate extends height to 6.9" (175.3mm)

	C30	C50	C70	C75
12 I/O slot chassis with redundant power support	5.4"(137mm) H x 26.9"(683.3mm) W x 6.0" * (151.7mm) D (rear mounting plate extends height to 6.9" (175.3mm)			
Redundant CPU rack	N/A * 6.4 (162.6) for 32 DI/DO and 16 AI Modules			5.4"(137mm) H x 10.3"(261.6mm) W x 6.0,," * (151.7mm) D (rear mounting plate extends height to 6.9" (175.3mm)
I/O Wiring				
Type	Removable terminal blocks			
Terminal Block Styles	20 screw: Barrier or Euro-style, tin-plated or gold-plated (for DC connections) 36 screw: Euro style gold plated (Required with certain higher capacity modules)			
Gauge wires	20 screw: Barrier style – #14 to 26 AWG, solid or stranded Euro-style - #14 to 26 AWG, solid or stranded 36-screw: Euro-style - #12 to 26 AWG, solid or stranded			
Shield terminals	Optional brackets mounted top/bottom of rack			
Power (P01)				
Voltage	Universal power, 90 to 264VAC, 47 to 63 Hz			
In Rush Current	7 Amps peak-to-peak for 150 ms at 240VAC			
Input rating	130 VA			
Output rating	60W			
Fuse	Internal non-replaceable fuse. User installed external fuse.			
Power (P02)				
Voltage	Universal power, 90 to 264VAC, 47 to 63 Hz			
In Rush Current	7 Amps peak-to-peak for 120 ms at 240VAC			
Input rating	90 VA			
Output rating	28W			
Fuse	Internal non-replaceable fuse. User installed external fuse.			
Power (P24)				
Voltage	21 to 29VDC			
In Rush Current	30A for 3ms @29VDC			
Input rating	72.5W			
Output rating	60W			
Fuse	Internal non-replaceable fuse. User installed external fuse.			
Normal Scan Time	500ms. Each analog input card has its own A/D converter providing parallel processing.			
Fast Scan Time	53ms for up to~250 fast logic blocks 67ms for up to ~315 fast logic blocks 107ms for up to ~400 fast logic blocks	27ms for up to ~250 fast logic blocks 53ms for up to~500 fast logic blocks 67ms for up to ~780 fast logic blocks 107ms for up to ~1040 fast logic blocks 133ms for up to ~1300 fast logic blocks	27ms for up to ~330 fast logic blocks 53ms for up to~660 fast logic blocks 67ms for up to ~1040 fast logic blocks 107ms for up to ~1380 fast logic blocks 133ms for up to ~1700 fast logic blocks 267ms for up to~3300 fast logic blocks	53ms for up to~500 fast logic blocks 67ms for up to ~780 fast logic blocks 107ms for up to ~1040 fast logic blocks 133ms for up to ~1300 fast logic blocks 267ms for up to~2500 fast logic blocks
Detection+Failover Time from Lead to Reserve CPU	N/A			Up to 4 analog scan cycles
Run-Mode Edit Transfer Time	3 normal scan times (1.5 sec. typical) for all configuration edits not including I/O changes			
Operating Modes	Run (No configuration download in this position) Run/Program (Download allowed) Program (Outputs Off, initialization on download). Offline mode is available via software selection (for AI calibration).			

Features				
	C30	**C50**	**C70**	**C75**
Maximum user-configurable Function Blocks	400	2000	5000	
Maximum Control Loops	Quantity based on available memory			
System Blocks (Not user configurable)	100 (not part of 400, 2000 or 5000), for Alarm Group blocks, System block, Rack Monitor blocks, Communications			
Loop Outputs	Current, time proportional, position proportional, 3-position step (motor positioning), dual output [heat/cool])			
Control Loop Types	PID A, PID B, Duplex A, Duplex B, Ratio, Cascade, % Carbon, Dewpoint, Relative Humidity, On-Off, Auto/Manual-Bias			
Auto-tuning	Accutune III, fuzzy logic overshoot suppression, applicable to all control loops			
Setpoint Programmers	Ramp Types: Ramp Rate or Ramp Time Time Units: Hours or Minutes Segment Time: 0-99,999.999 hours or minutes Program Cycles: Up to 100 or infinite, configurable segment range			
Programmer Events	Assignable to DO or internal status			
Setpoint Profiles	50 segments per profile. Number of stored profiles is user-configurable.			
Setpoint Scheduler	Ramp type: Ramp time Time units: Hours or minutes Segment time: 0.001 to 9999.999 hours or minutes Cycles: Per segment to 999 or infinite			
Auxiliary Scheduler Setpoints	Up to 8 setpoints, soak only			
Schedule events	Up to 16, assignable to DO or internal status			
Setpoint Scheduler Schedules	50 segments per schedule. Number of stored schedules is configurable.			
Sequencers	States: 50 State text: 12 characters Steps: 64 Time Units: Minutes or Seconds Digital Outputs: 16 Analog Output: 1, configurable value/step Step Execution: On Time, Event 1, Event2, or via Advance Next Step: Any step			
Sequences	Number of stored Sequences is user-configurable			
Recipes (Variables)	Number of stored Recipes (Variables) is user-configurable			
Recipe Parameters	Up to 50 analog or digital Variables — (may include profile numbers)			
Signal Tags (Read only)	Up to 65,535			
Tag Identification	16-character tagname, 16-character descriptor,6-character units of measure (analog only), 6 character on/off state (digital only)			
Variables (Read/Write)	Up to 2048			
Variable Identification	16-character tagname, 16-character descriptor,6-character units of measure (analog only), 6 character on/off state (digital only)			

Communications				
	C30	**C50**	**C70**	**C75**
Network Communications Ports				
Number of Ethernet 10/100Base-T connections	1	1	2	2
Ethernet 10/100Base-T, RJ-45 connection	Supports Modbus/TCP Protocol to PC supervisory and data acquisition software packages, OPC server, Modbus/TCP Initiator, Peer to Peer, and Designer Software configuration software		Supports redundant Modbus/TCP Protocol to PC supervisory and data acquisition software packages, OPC server, Modbus/TCP Initiator (non-redundant), Peer to Peer, and Designer Software configuration software	
Max. number of concurrent Ethernet host connections	Up to 5 (peer data exchange does not consume a host connection)	Up to 10 shared between two ports (peer data exchange does not consume a host connection).		
RS-232 Port				
Ports per controller	RS-485 with Modbus RTU or Honeywell protocol. 3-Plug connectors supplied.			
Baud rates	1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6 K, 115.2K configured by Designer software or OI.			
Modem	For remote connection to Designer software, requires external modem at controller, 1200 baud to 57.6KB			
RS-485 Ports				
Ports per controller	Two, (connector supplied), Honeywell or Modbus RTU protocol. Only one port for 1042/ 559 operator interface support.			
Cable type	2-wire plus shield, Belden 9271 or equivalent			
1042, 559 Distance from controller	2000 ft. (600 m.)			
1042, 559 Power to OI	24VDC, user-provided at OI			
Unit addresses	1 to 247			
RS-485 Ports				
Parity (user selectable)	Odd, even, none			
Stop bits (user selectable)	1 or 2			
Speed (user selectable)	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200			
Double Register Format for Modbus RTU Slave and Master data (User selectable)	Selectable byte order			
RS-485 Modbus, Slave Operation				
Number of ports per controller	Up to two			
Masters per port	One			
Principal Function Block Address Range	User selectable starting address range for registers assigned to each principal block type.			
RS-485 Modbus Master Operation				
Number of ports per controller	One RS485			
Function Block Types	Slave – 4 read and 4 write data points Read (Slave extension block) up to 16 parameters Write (Slave extension) up to 8 parameters (No limit on the number of Read and Write extension blocks per Slave block up to the maximum 1024 parameters per controller.)			
Slave devices per controller	Up to 32			
Number of read/write Modbus Parameters	Up to 1024 max. per controller			
Double Register Format	Selectable per device			
Speed	1 second fastest – load dependent			
Modbus Master Advanced Application	Recommended for use with gateway devices			
Speed	As fast as 500ms			

Communications				
	C30	**C50**	**C70**	**C75**
Ethernet Modbus/TCP Initiator Operation				
Number of ports per controller	One (Models C30 and C50) - Two (Models C70 and C75) RS485			
Function Block Types	Slave – 4 read and 4 write data points Read (Slave extension block) up to 16 parameters Write (Slave extension) up to 8 parameters (No limit on the number of Read and Write extension blocks per Slave block up to the maximum 1024 parameters per controller.)			
Slave devices per controller	Up to 32			
Number of read/write Modbus Parameters	Up to 1024 max. per controller			
Double Register Format	Selectable per device			
Speed	1 second fastest – load dependent			
Peer-to-peer				
10/100Base-T via Network port	Supports UDP protocol and Peer Data Exchange function blocks for peer data exchange			
No. of Peers/Controller	32			
Update rate	500 ms to 5 sec., selectable			
Peer Data	Digital and Analog Signal Tags, Variables - up to 2240 parameters			
Ethernet				
Ethernet Network Connection	10/100 Base-T, RJ-45			
Host Network Protocol	Modbus/TCP			

Maximum distances per Ethernet specifications		
Controller rack to I/O Rack	Ethernet CAT5 shielded cable with RJ-45 connectors Fiber Optic cable with switch Fiber Optic cable with switch and repeater	100m /328 ft 750m 1500m (see page 204)
Controller to Ethernet Switch	Ethernet CAT5 shielded cable with RJ-45 connectors	100m /328 ft
Ethernet Switch to I/O Rack	Ethernet CAT5 shielded cable with RJ-45 connectors	100m /328 ft
Controller to Network Switch	Ethernet CAT5 shielded cable with RJ-45 connectors	100m /328 ft
Network Switch to PC	Ethernet CAT5 shielded cable with RJ-45 connectors	100m /328 ft
Controller to 1042 Operator Interface	Shielded cable, Twisted pair	610m /2000 ft

Approvals	
CE Conformity	This product is in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed. EN61326: Electrical Equipment For Measurement, Control and Laboratory use. EMC requirements.
ATEX	The apparatus fulfills the requirements for Group II, Category 3 equipment in accordance with Directive 94/9/EC.
ABS Type Approval	Certificate of Design Assessment - No. 06-HS186538-PDA Certificate of Manufacturing Assessment - No. 06-BA766694-X
General Purpose Safety	Compliant with EN61010-1, UL, UL 61010C-1, CSA C22.2 No. 1010-1
Hazardous (Classified) Location Safety	FM Class I, Div. 2, Groups A, B, C, D CSA Class I, Div. 2 Groups A, B, C, D Class 1, Zone 2, IIC

Module Temperature Classifications	Module Type	"T" Rating	Module Type	"T" Rating
	Redundant CPU Rack	T6	Scanner 2 Port	T6
	Redundant PS Ext. Rack	T6	Analog Input (8 channels)	T6
	8 Slot Redundant PS Ext. Rack	T6	Analog Input (16 chan)	T6
	12 Slot Redundant PS Ext. Rack	T6	Analog Output (4 chan)	T4
	4 I/O Slot Rack	T6	Analog Output (8 chan)	T4
	8 I/O Slot Rack	T6	Digital Input, Contact type (16 chan)	T5
	12 I/O Slot Rack	T6	Digital Input, 24 Vdc (16 chan)	T4
	Power Supply (P01)	T4	Digital Input, 120/240 Vac (16 chan)	T3C@ Ta= 60 deg. C T4 @ Ta = 40 deg. C
			Digital Input 120/240VAC, 125VDC (16 Channel)	T3@Ta=60 deg. C T4@Ta=40 deg. C
	Power Supply (P02)	T4	Digital Input Vdc (32 chan)	T5
	Power Supply (P24)	T4	Digital Output, Relay type (8 chan)	T5
	Power Status Module (PSM)	T6	Digital Output, 24 Vdc, (16 chan)	T4
	C30/C50/C70/C75 CPU	T5	Digital Output, 120/240 Vac (* chan)	T4
	Redundancy Switch Module (RSM)	T6	Digital Output Vdc (32 chan)	T6
	Scanner 1 Port	T6	Pulse/Frequency/Quadrature (4 chan)	T5

Environmental Conditions				
Ambient Temperature	Reference	Rated	Extreme	Transportation & Storage
F C	77+/-5 25+/-3	32 to 140 0 to 60	32 to 140 0 to 60	-40 to 158 -40 to 70
Ambient Relative Humidity	*45 % to 55 % RH non-condensing	*10% to 90 % RH non-condensing	*5 % to 90 % RH non- condensing	*5 % to 95 % RH non-condensing
Mechanical Acceleration Duration	0 g 0 ms	1 g 30 ms	1 g 30 ms	Not rated
Vibration	0 Hz 0 g	0 Hz to 14 Hz—amplitude 2.5 mm (peak-to-peak) 14 Hz to 250 Hz—acceleration 1 g	0 Hz to 14 Hz—amplitude 2.5 mm (peak-to-peak) 14 Hz to 250 Hz—acceleration 1 g	
* Applies up to 40C				

HC900 Analog Input Ranges vs. UMC800 Analog Input ranges

Users of UMC800 Controllers from Honeywell will find the analog range selections of the HC900 Controller differ slightly from those available in the UMC800. These differences are indicated in Table 41 in the column identified "(Reference): Corresponding UMC800 Input type and range". The number to the right of the range data indicates the range number reference for the UMC800 range table.

When using the Designer Software configuration software to convert UMC800 configuration files to HC900 configuration files, the HC900 range to the left of the UMC800 data will be used by the conversion program. There may also be UMC800 ranges that are not supported by the HC900 Controller. For these ranges the conversion process will default the range data to a null, not-programmed, range.

Table 41 - HC900 PV Input Types and Ranges

Type	Range Low	Range High	EU	(Reference): Corresponding UMC800 Input type and range
None				n/a
B	-18	1815	C	B 40 1820 C 58
B	0	3300	F	B 104 3308 F 59
E	-270	1000	C	n/a
E	-454	1832	F	n/a
E	-129	593	C	n/a
E	-200	1100	F	n/a
J	-18	871	C	J –200 870 C 4
J	0	1600	F	J –328 1598 F 5
J	-7	410	C	J 0 400 C 2
J	20	770	F	J 32 752 F 3
K	-18	1316	C	K 0 1200 C 16
K	0	2400	F	K 32 2192 F 17
K	-18	982	C	K 0 800 C 14
K	0	1800	F	K 32 1472 F 15
K	-29	538	C	K 0 400 C 12
K	20	1000	F	K 32 752 F 13
Ni-NiMo	0	1371	C	NiMo 0 1400 C 50
Ni-NiMo	32	2500	F	NiMo 32 2552 F 51
Ni-NiMo	0	682	C	n/a
Ni-NiMo	32	1260	F	n/a
NiMo-NiCo	0	1371	C	MoCo 0 1400 C 110
NiMo-NiCo	32	2500	F	MoCo 32 2552 F 111
NiMo-NiCo	0	682	C	n/a
NiMo-NiCo	32	1260	F	n/a
NiCroSil-NiSil	-18	1300	C	N 0 1200 C 24
NiCroSil-NiSil	0	2372	F	N 32 2192 F 25
NiCroSil-NiSil	-18	800	C	N 0 800 C 22
NiCroSil-NiSil	0	1472	F	N 32 1472 F 23
R	-18	1704	C	R -20 1760 C 28
R	0	3100	F	R -4 3200 F 29
S	-18	1704	C	S 0 1600 C 30

Type	Range Low	Range High	EU	(Reference): Corresponding UMC800 Input type and range
S	0	3100	F	S 32 2912 F 31
T	-184	371	C	T –200 400 C 40
T	-300	700	F	T –328 752 F 41
T	-129	260	C	T -50 150 C 34
T	-200	500	F	T -58 302 F 35
W_W26	-20	2320	C	W_W26 -20 2320 C 52
W_W26	-4	4200	F	W_W26 -4 4208 F 53
W5W26	-18	2316	C	W5W26 -20 2320 C 54
W5W26	0	4200	F	W5W26 -4 4208 F 55
W5W26	-18	1227	C	n/a
W5W26	0	2240	F	n/a
Platinel	0	1380	C	PLTNL 0 1380 C 118
Platinel	32	2516	F	PLTNL 32 2516 F 119
Platinel	0	750	C	PLTNL -70 750 C 116
Platinel	32	1382	F	PLTNL -94 1382 F 117
Pt100	-184	816	C	Pt100 –200 800 C 68
Pt100	-300	1500	F	Pt100 –328 1472 F 69
Pt100	-184	649	C	n/a
Pt100	-300	1200	F	n/a
Pt100	-184	316	C	Pt100 -50 150 C 60
Pt100	-300	600	F	Pt100 -58 302 F 61
Pt500	-184	649	C	n/a
Pt500	-300	1200	F	n/a
Pt1000	-40	260	C	Pt1000 –50 400 C 120
Pt1000	-40	500	F	Pt1000 –50 752 F 121
JIS100	-200	500	C	JIS -200 500 C 78
JIS100	-328	932	F	JIS -328 932 F 79
JIS100	-200	260	C	JIS 0 100 C 72
JIS100	-328	500	F	JIS 32 212 F 73
Cu10	-20	250	C	Cu10 -20 250 C 84
Cu10	-4	482	F	Cu10 -4 482 F 85
YSI405	10	37.8		n/a
YSI405	50	100		n/a
Ohms	0	200		Ohms 0 200 86
Ohms	0	500		n/a
Ohms	0	1000		n/a
Ohms	0	2000		Ohms 0 2000 87
Ohms	0	4000		n/a
MA	4	20		mA 4 20 100
MA	0	20		mA 0 20 99
MV	0	10		mV 0 10 88
MV	0	50		mV 0 50 92
MV	0	100		mV 0 100 95
MV	-10	10		mV -10 10 89

Type	Range Low	Range High	EU	(Reference): Corresponding UMC800 Input type and range
MV	-50	50		mV -50 50 93
MV	-100	100		mV –100 100 96
MV	-500	500		mV –500 500 98
V	0	1		V 0 1 101
V	0	2		V 0 2 103
V	0	5		V 0 5 105
V	0	10		V 0 10 108
V	1	5		V 1 5 107
V	-1	1		V -1 1 102
V	-2	2		V -2 2 104
V	-5	5		V -5 5 106
V	-10	10		V -10 10 109
Carbon	0	1250	mV	n/a
Oxygen	-30	510	mV	n/a

System Sizing and Availability Summary

Table 42 – System Size and Availability Summary

Specification	C30	C50	C70	C75
Combined Analog and Digital I/O	384 points	1920 points	1920 points	1920 points
Analog Inputs	142 points	960 points	960 points	960 points
Analog Outputs	40 points	200 points	200 points	200 points
Block inputs	Quantity based on available memory			
Block parameters	Quantity based on available memory			
Block values	375,000	375,000	375,000	375,000
FDB worksheets	20	20	40	40
Function blocks	400	2000	5000	5000
Local I/O	Yes	Yes	Yes	No
Loop blocks	Quantity based on available memory			
Modbus registers used by slave blocks	1024	1024	1024	1024
Modbus slave blocks	32	32	32	32
Numeric constants	Quantity based on available memory			
Page connectors	200	1000	2500	2500
Peer blocks	32	32	32	32
Peer data exchange items	2240	2240	2240	2240
Position proportional output blocks	Quantity based on available memory			
Profiles in Pool	User Configurable			
Ramp blocks	Quantity based on available memory			
Recipes in Pool	User Configurable			
Redundancy capability	No	No	No	Yes
Redundant host comms.	No	No	Yes	Yes
Schedules in Pool	User Configurable			
Segments per profile	50	50	50	50
Sequencer blocks	Quantity based on available memory			
Sequences in Pool	User Configurable			
Setpoint programmer blocks	Quantity based on available memory			
Setpoint scheduler blocks	Quantity based on available memory			
Signal tags	Quantity based on available memory			
Soft Wire bytes	Quantity based on available memory			
Stage blocks	Quantity based on available memory			
Steps per schedule	50	50	50	50
Steps per sequence	64	64	64	64
Support of dual port scanner	No	No	No	Yes
Tag descriptor	Quantity based on available memory			
Text bytes	Quantity based on available memory			
Variables	2000	2000	2000	2000
Variables in a Recipe	50	50	50	50

Fiber Optics Recommendations

Honeywell recommends that you use the following equipment for extended distances:

Table 43 – Fiber Optics Equipment Recommendations

Ethernet Switch	Moxa Unmanaged Ethernet Switch model EDS-308-MM-SC with (6) 10/100 Ethernet ports, (2) multi-mode fiber ports with SC Connectors (require 24VDC power)
Converter	Moxa Media Converter model IMC-101-M-SC with (1) 10/100BaseT(X) to 100BaseFX multi-mode fiber port with SC connectors (require 24VDC power)
Fiber Cable	Multi-mode, Duplex, 62.5/125 with SC connectors on both ends
Copper Ethernet Cable	Shielded Cat5 Ethernet cable
FO Connector	SC Type

Figure 90 and

Figure 91 are examples of Extended Distance configurations
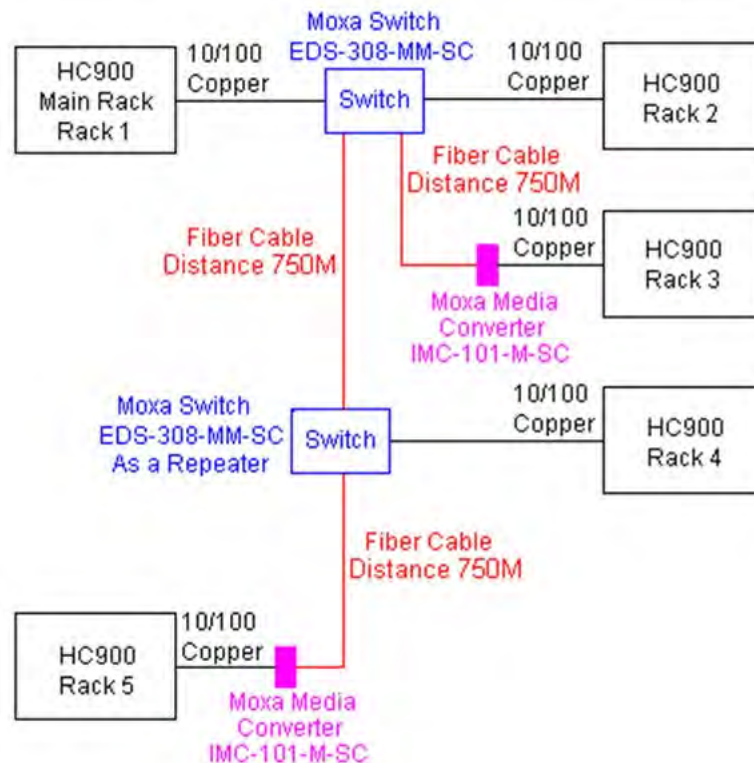
Figure 90 – Extended Distance Example #1
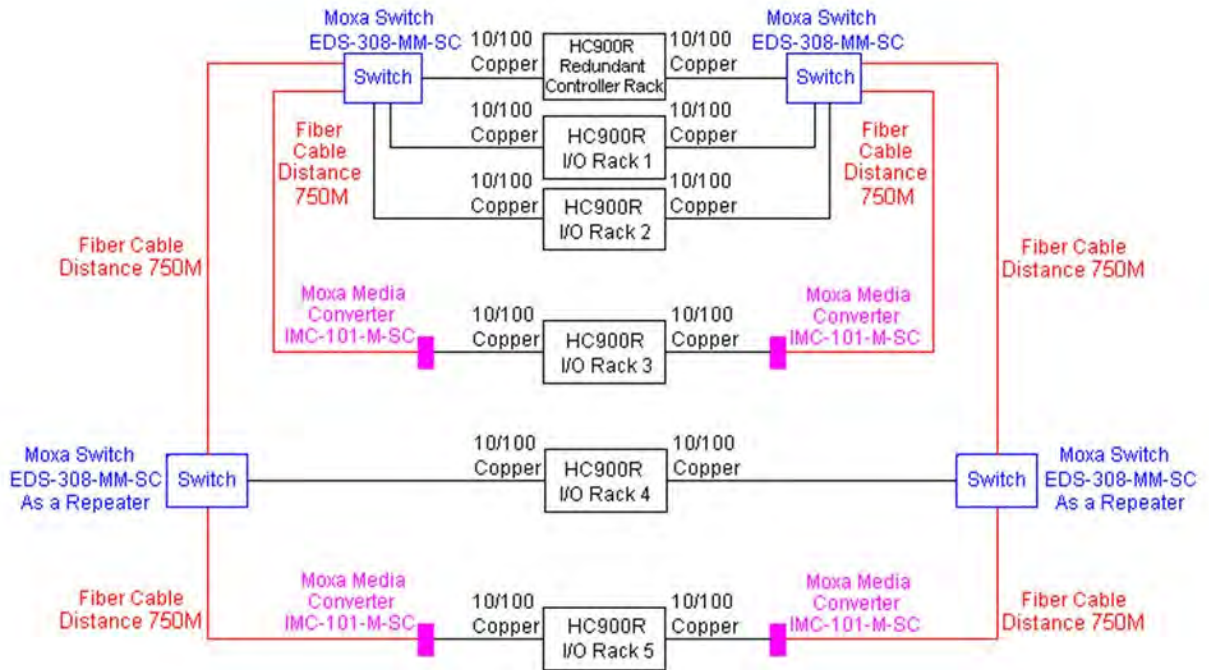
Figure 91 – Extended Distance Example #2

Appendix - Installation of Remote Termination Panels (RTPs)

Overview

The Remote Termination Panel (RTP) provides an easy way to connect the HC900 controller to the field wiring. The RTP integrates some of the typical externally connected components, reducing wiring and setup time. It also minimizes the need for multiple wires under a single screw connection by expanding the connectivity of the shared terminals of the I/O modules.

There are three RTP types: <u>See page</u>

- 8 ` Analog Input   208
- Relay Output   215
- 16 point Analog Input/Digital Input/Digital Output/Analog Output   219
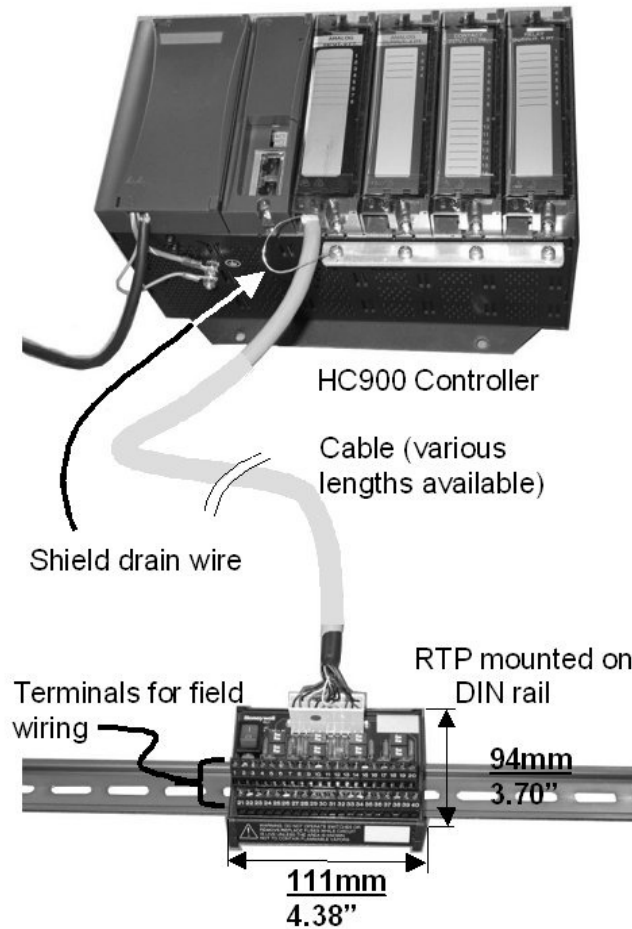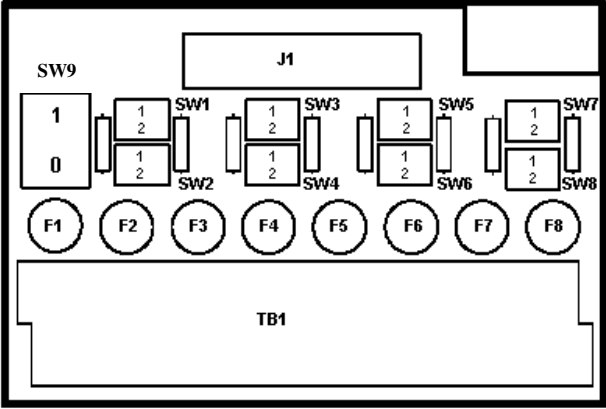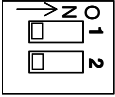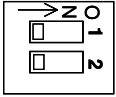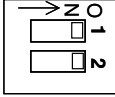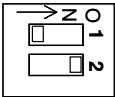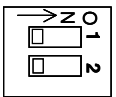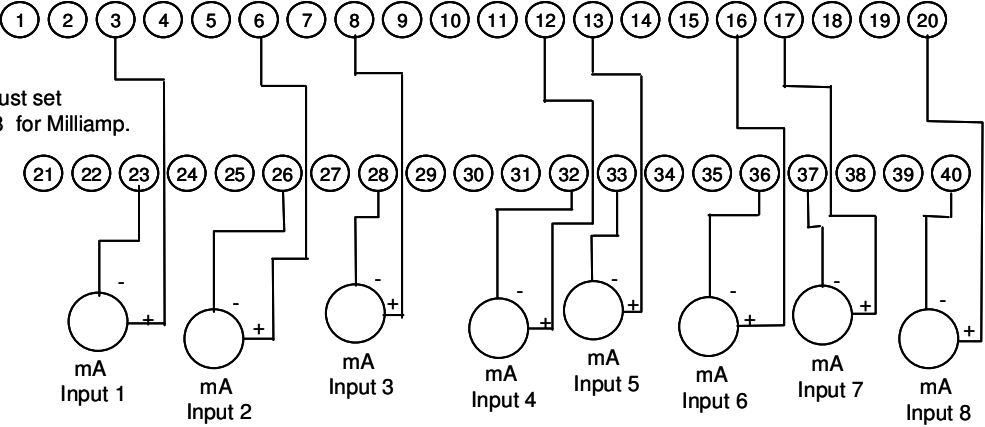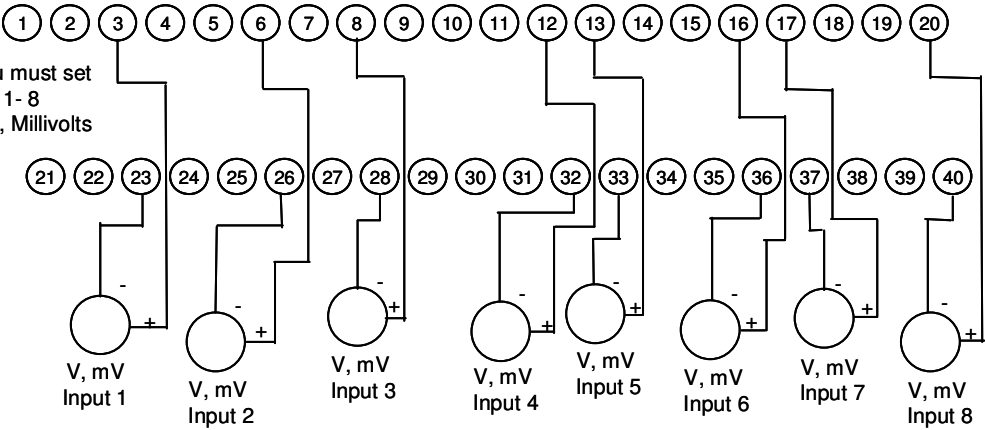
Figure 92 – Example installation (not shown: 2nd RTP & cable for high capacity AI/DI/DO)
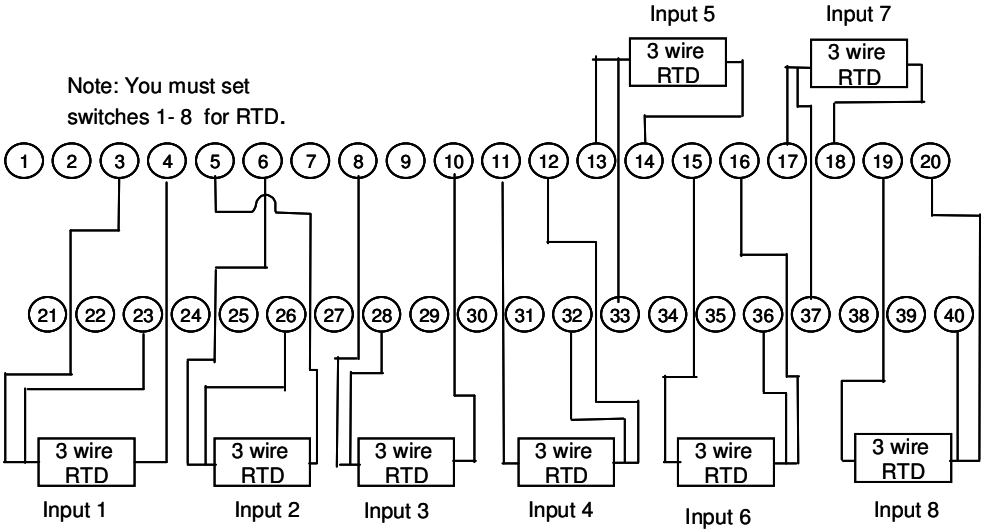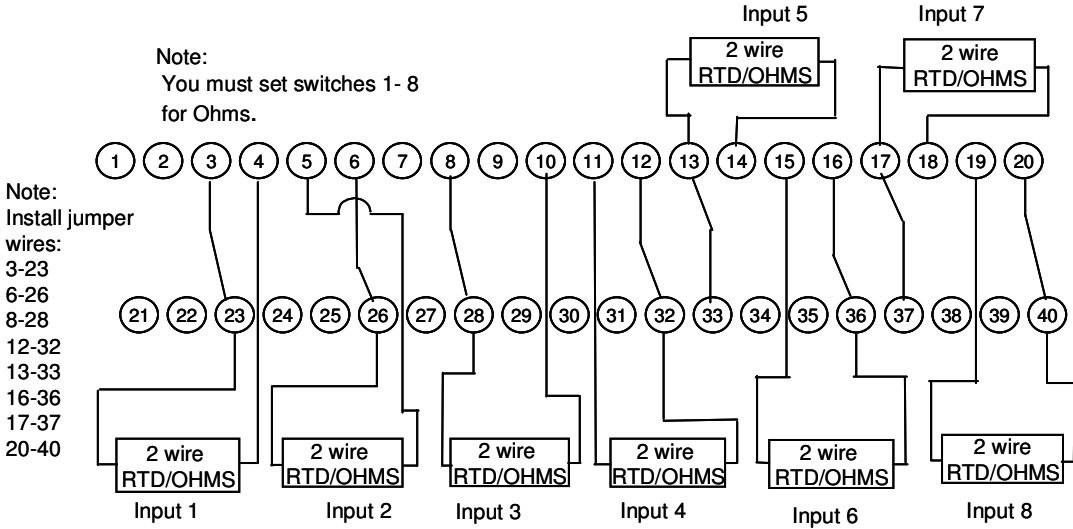
Analog Input

Step	Action
	8 Point Analog Input
1	**ATTENTION: RTP is not for use with thermocouples.**
	ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	- Remove appropriate key tabs from terminal block to allow mating with the module. See page 75. - Connect desired cable to AI module at controller. Choose from: 900RTC-L010 Remote Terminal Low Voltage Cable Assembly, 1.0 meters long 900RTC-L025 Remote Terminal Low Voltage Cable Assembly, 2.5 meters long. 900RTC-L050 Remote Terminal Low Voltage Cable Assembly, 5.0 meters long - Install AI module label onto the module connector cover. - Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).
2	**Mount RTP to DIN rail.**
	- Latch to rail. See page 244. - Connect cable to RTP.

8 Point Analog Input	
Step	**Action**
3	**Set DIP switch positions SW1 through SW8.** Set each input's DIP switch positions according to the input type. For Input n use Switch n. For example, for Input 1 use Switch 1, for Input 2 use Switch 2, etc. If an input is not used, set its DIP switch positions to OFF. **Volt, millivolt:** **Ohms:** **Transmitter: Loop Powered** **Milliamp: Externally Powered** **RTD:** **Transmitter** SW9 is the red power switch for 24 volt supply. Module RIUP is not affected by using the RTP. See page 214 for RTP internal schematic.

8 Point Analog Input	
Step	**Action**
4	**Connect field wiring.** Refer to Figure 93 through Figure 99 for field wiring. Any input type can be wired to any of the 8 inputs. After wiring, double-check DIP switches settings for each input type (Step 3). **Figure 93 – Analog input terminals** **Figure 94 – Two–wire transmitter connections with common 24 VDC supply**

8 Point Analog Input	
Step	**Action**
	Figure 95 – Milliamp input connections with 250 ohm shunt resistance Figure 96 – Volt, millivolt input connections

8 Point Analog Input	
Step	**Action**

Figure 97 – Three-wire RTD input connections

Figure 98 – Two-wire RTD or ohm input connections |

8 Point Analog Input	
Step	**Action**

Figure 99 – Slidewire feedback connections for actuators |
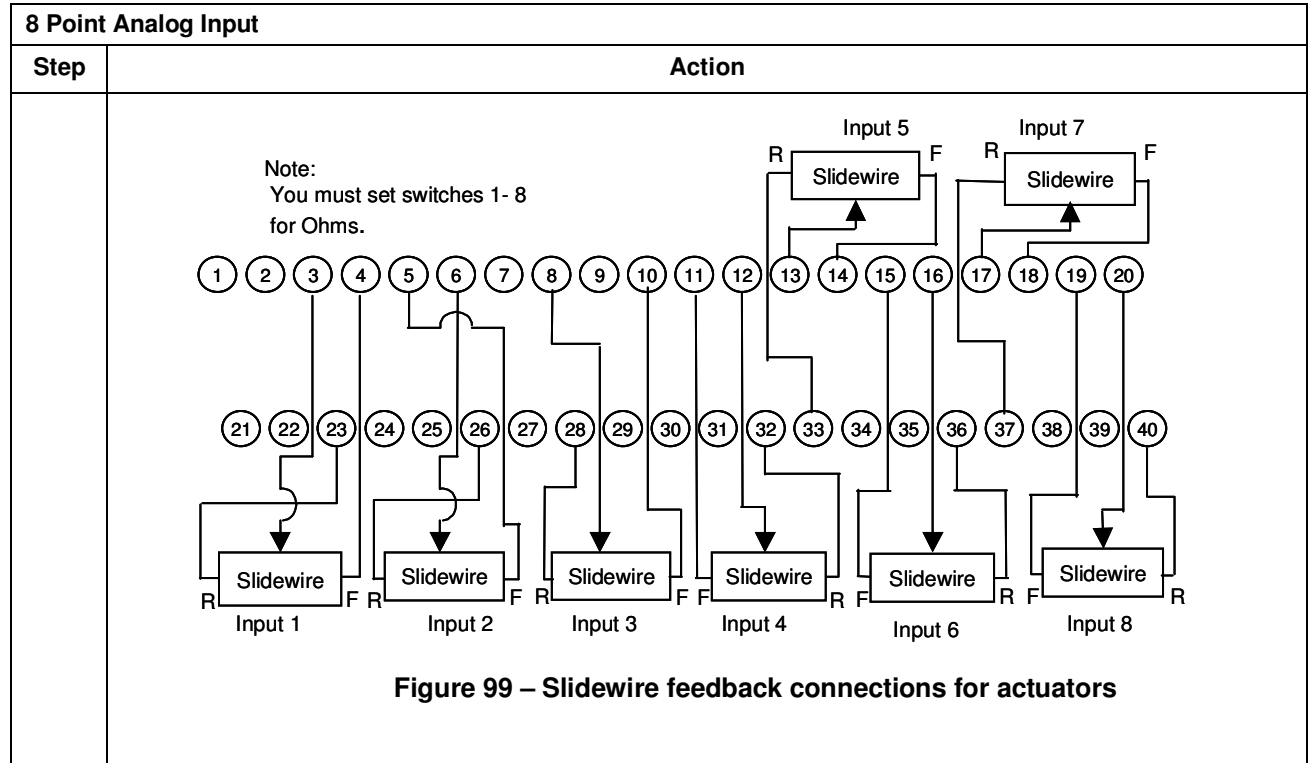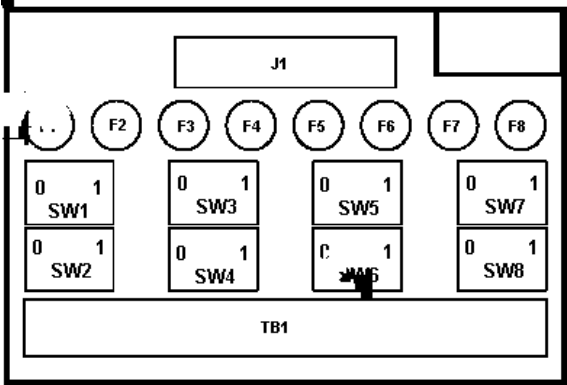
Analog Input accuracy specification

Range	AI Module Accuracy	RTP + Cable Accuracy	AI Module + RTP Accuracy
100Ω Plat. RTD	±0.1% of Range	±0.04% Range (0.357°C)	±0.14% of Range
JIS RTD	±0.1% of Range	±0.12% Range (0.824°C)	±0.22% of Range
10Ω Cu. RTD	±0.1% of Range	±0.57% Range (1.540°C)	±0.67% of Range
200Ω OHMS	±0.1% of Range	±0.07% Range (0.140Ω)	±0.17% of Range
0-10mV LINEAR	±0.1% of Range	±0.04% Range (0.004mV)	±0.14% of Range

Analog Input RTP Internal schematic
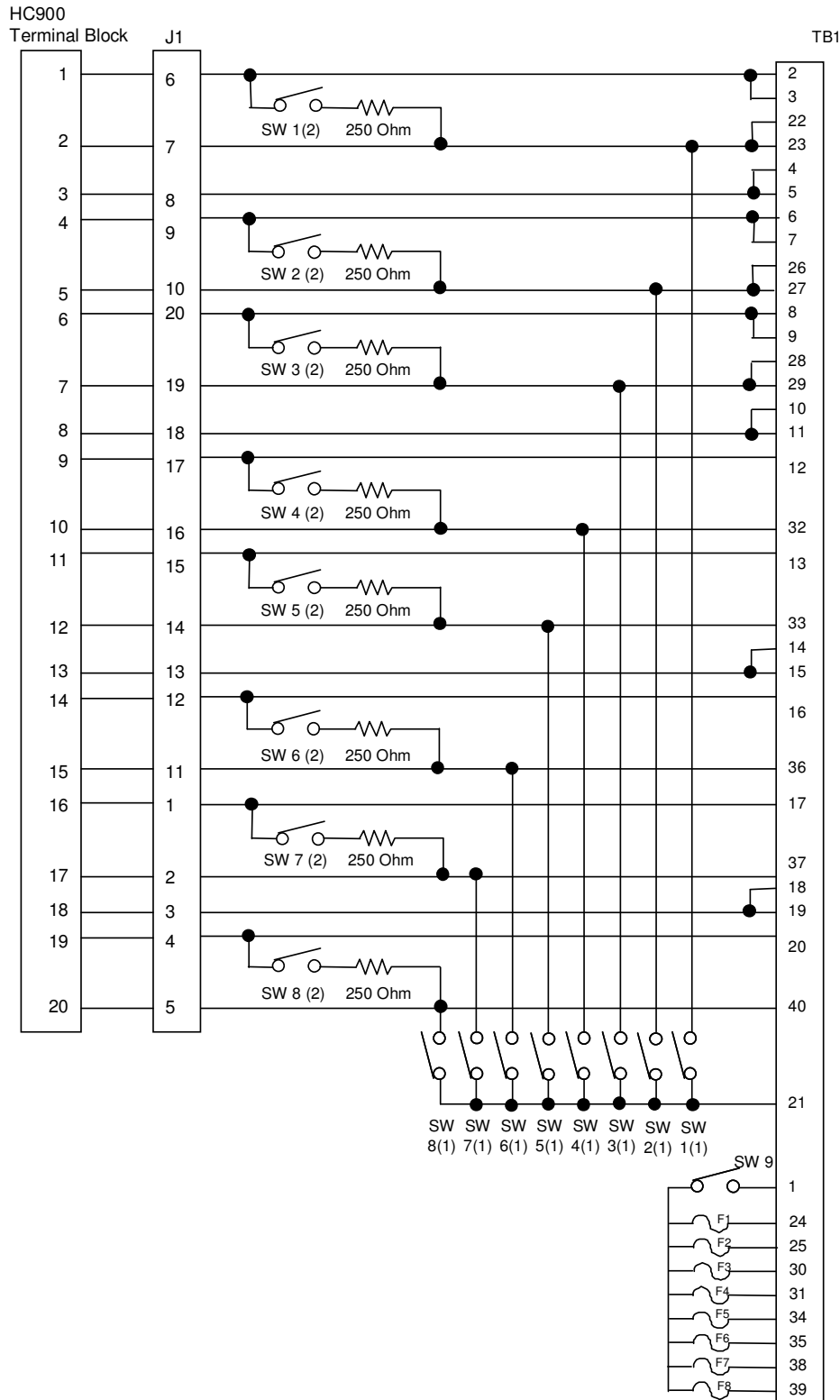
Relay Output

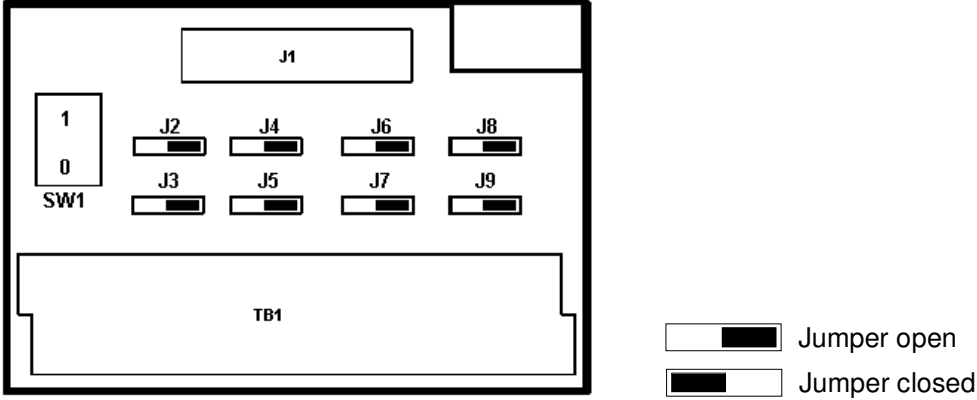| Relay Output	
Step	**Action**

1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	
	Mount RTP cable assembly to HC900 Controller (Figure 84).
	
	    • Remove appropriate key tabs from terminal block to allow mating with the module. See page 75.
	
	    • Connect desired cable to relay output module at controller. Choose from:
	        900RTC-H010 Remote Terminal High Voltage Cable assembly, 1.0 meters long
	        900RTC-H025 Remote Terminal High Voltage Cable assembly, 2.5 meters long
	        900RTC-H050 Remote Terminal High Voltage Cable assembly, 5.0 meters long
	
	    ATTENTION:
	    Cable power is limited to 24 Amps per module at 60C (140 degrees F) and 32 Amps at 54C (129 degrees F).
	
	    • Install relay output module label onto the module connector cover.
	
	    • Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

2	**Mount RTP to DIN rail.**
	
	    • Latch to rail. See page 244.
	
	    • Connect cable to RTP.

3	**Set switch positions SW1 through SW8.** Fuses: 6.3A Time Lag Wickmann part #3741630041 UL/CSA approved for 250V Module Removal / Insertion Under Power (RIUP) is supported by turning off all eight switches to allow removal of the module from the rack without causing an arc. Please see page 73 for more details. See page 217 for RTP internal schematic.

Relay Output	
Step	**Action**
4	**Connect field wiring.**

LOAD NO LOAD NC LOAD NO LOAD NC LOAD NO LOAD NO LOAD NO LOAD NO LOAD NO LOAD NC LOAD NO LOAD NC

DO-1 DO-2 DO-3 DO-4 DO-5 DO-6 DO-7 DO-8

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

ATTENTION

- Cable power is limited to 24 Amps per module at 60C (140 degrees F) and 32 Amps at 54C (129 degrees F).

- As shown in the schematic, each switch is SPST and opens and closes one lead of the relay wiring. If your application requires opening and closing both sides of the load wiring, then an external DPST switch is required.

Relay Output RTP Internal schematic

HC900
Terminal Block

J1

TB1

HC900 Terminal Block	J1		TB1
1	6		1
2	7	F1 SW1	2
3	8		3
4	9		4
5	10	F2 SW2	5
6	20		6
7	19		7
8	18	F3 SW3	8
9	17		9
10	16	F4 SW4	10
11	15		11
12	14	F5 SW5	12
13	13		13
14	12	F6 SW6	14
15	11		15
16	1	F7 SW7	16
17	2		17
18	3		18
19	4	F8 SW8	19
20	5		20
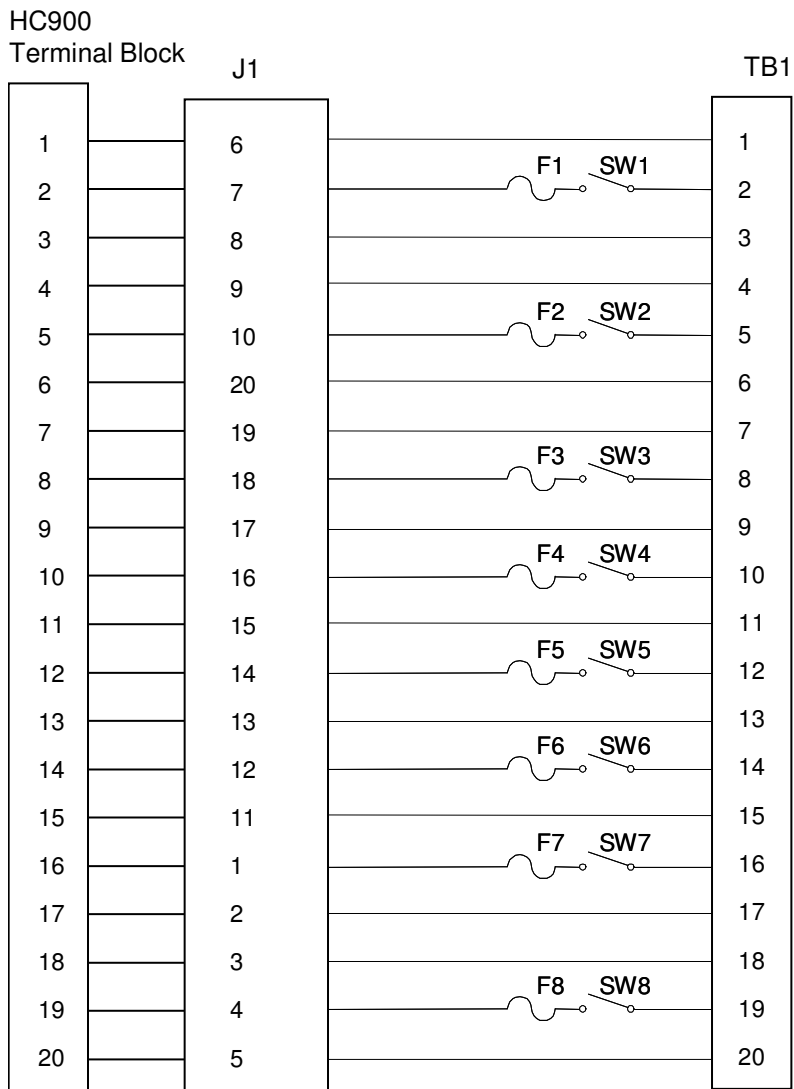
RTP Cable wire positions and colors (applies to 8 point AI and Relay Output)

Twisted Pair Number	HC900 Module TB Position	RTP J1 Plug Connector	Color
1	1	6	Black
	2	7	Red
2	4	9	Black
	5	10	White
3	6	20	Black
	7	19	Green
4	9	17	Black
	10	16	Blue
5	11	15	Black
	12	14	Yellow
6	14	12	Black
	15	11	Brown
7	16	1	Black
	17	2	Orange
8	19	4	Red
	20	5	White
9	3	8	Red
	8	18	Green
10	13	13	Red
	18	3	Blue

Analog Input/Digital Input/Digital Output/Analog Output
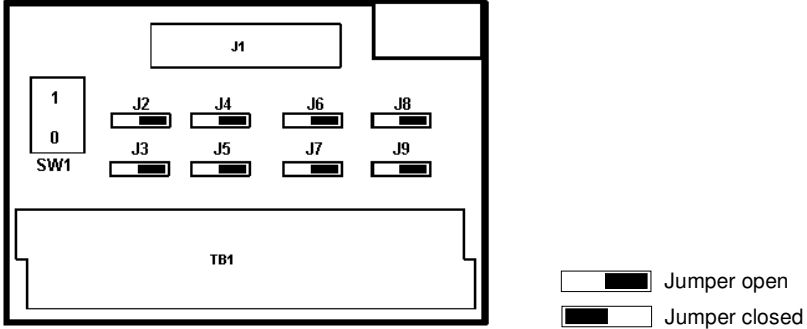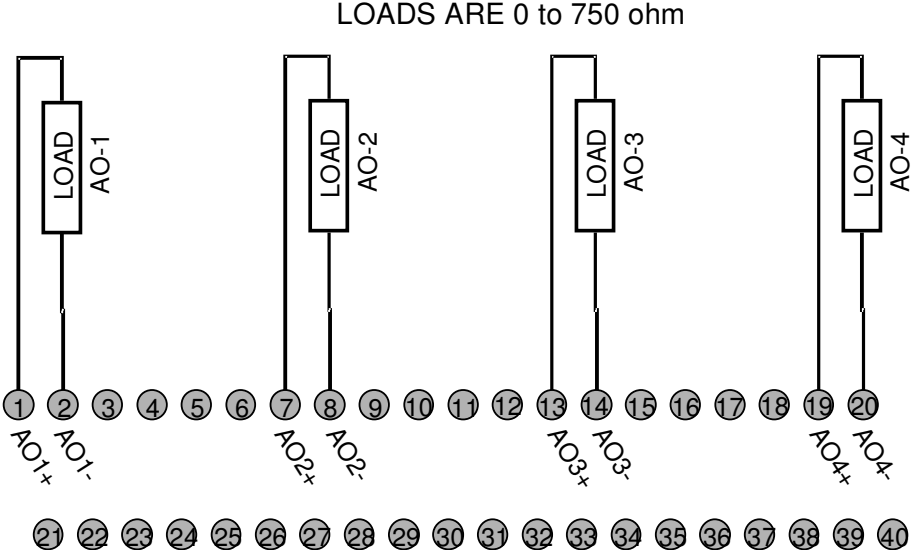
A single DI/DO/AO-RTP and cable is used with the following modules: <u>See page</u>
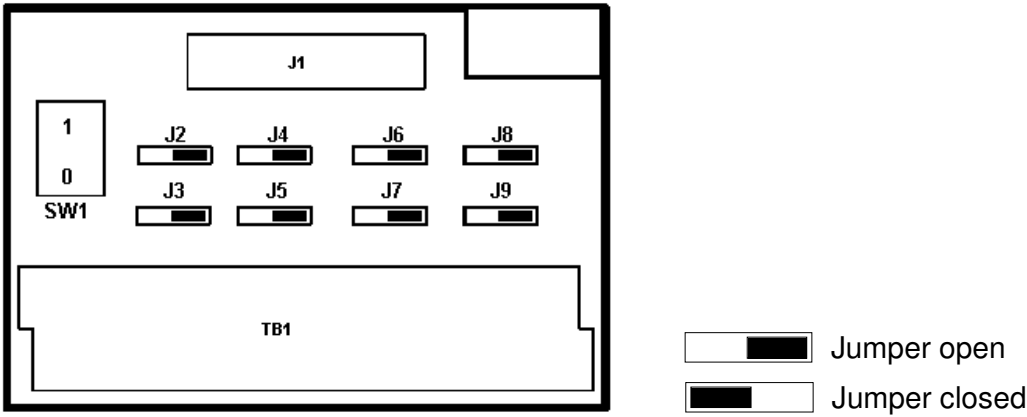
Dual DI/DO/AO-RTPs and cables are used with the following modules: <u>See page</u>

4 Point Analog Output	
Step	**Action**
1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.** **Mount RTP cable assembly to HC900 Controller** (Figure 92). • Remove appropriate key tabs from terminal block to allow mating with the module. See page 75. • Connect desired cable to AO module at controller. Choose from: 900RTC-L010 Remote Terminal Low Voltage Cable Assembly, 1.0 meters long 900RTC-L025 Remote Terminal Low Voltage Cable Assembly, 2.5 meters long 900RTC-L050 Remote Terminal Low Voltage Cable Assembly, 5.0 meters long • Install AO module label onto the module connector cover. • Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).
2	**Mount RTP to DIN rail.** • Latch to rail. See page 244. • Connect cable to RTP

4 Point Analog Output	
Step	**Action**
3	**Set/verify jumper positions as shown for use with an analog output module.** SW1 is not used. Module RIUP is not affected by using the RTP. See page 230 for RTP internal schematic.
4	**Connect field wiring.** LOADS ARE 0 to 750 ohm

16 Point Contact Digital Input	
Step	**Action**

1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	
	   • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75.
	
	   • Connect desired cable to 16 point Contact DI module at controller. Choose from:
	     900RTC-L010 Remote Terminal Low Voltage Cable Assembly, 1.0 meters long
	     900RTC-L025 Remote Terminal Low Voltage Cable Assembly, 2.5 meters long
	     900RTC-L050 Remote Terminal Low Voltage Cable Assembly, 5.0 meters long
	
	   • Install 16 point contact DI module label into the module connector cover.
	
	   • Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

2	**Mount RTP to DIN rail.**
	
	   • Latch to rail. See page 244.
	
	   • Connect cable to RTP

3	**Set jumper positions as shown for the 16 point contact digital input module.** SW1 is not used. Module RIUP is not affected by using the RTP. See page 230 for RTP internal schematic.

16 Point Contact Digital Input

Step	Action
4	**Connect field wiring.**

16 Point DC Digital Input

Step	Action
1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	ATTENTION: The RTP combines the two groups of 8 inputs into one group of 16.
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	• Remove appropriate key tabs from terminal board to allow mating with the module. See page 75.
	• Connect desired cable to 16 point DC DI module at controller. Choose from:
	900RTC-L010 Remote Terminal Low Voltage Cable Assembly, 1.0 meters long
	900RTC-L025 Remote Terminal Low Voltage Cable Assembly, 2.5 meters long
	900RTC-L050 Remote Terminal Low Voltage Cable Assembly, 5.0 meters long
	• Install 16 point DC DI module label into the module connector cover.
	• Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).
2	**Mount RTP to DIN rail.**
	• Latch to rail. See page 244.
	• Connect cable to RTP.

16 Point DC Digital Input	
Step	**Action**
3	**Set/verify jumper positions as shown for the 16 point digital input module.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. Please see page 73 for more details. **ATTENTION: SW1 only disconnects the positive terminal, not both sides of the DC power.** See page 230 for RTP internal schematic.
4	**Connect field wiring.** Note: SDC+ in the wiring figure below refers to power that is disconnected from these screw terminals when switch SW1 is open (0).

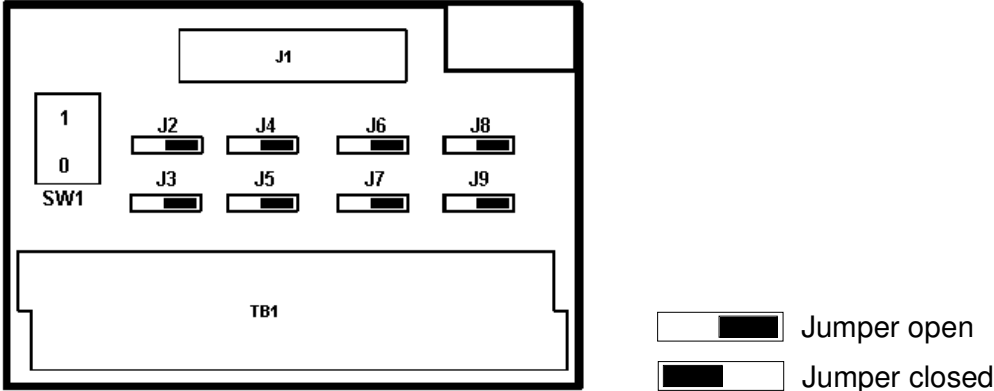| 16 Point AC Digital Input	
Step	**Action**

1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	
	ATTENTION: The RTP combines the two groups of 8 inputs into one group of 16.
	
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	
	  • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75.
	
	  • Connect desired cable to 16 point AC DI module at controller. Choose from:
	    900RTC-H010 Remote Terminal High Voltage Cable assembly, 1.0 meters long
	    900RTC-H025 Remote Terminal High Voltage Cable assembly, 2.5 meters long
	    900RTC-H050 Remote Terminal High Voltage Cable assembly, 5.0 meters long
	
	  • Install 16 point AC DI module label into module connector cover.
	
	  • Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

2	**Mount RTP to DIN rail.**
	
	  • Latch to rail. See page 244.
	
	  • Connect cable to RTP

3	**Set/verify jumper positions as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION: SW1 only disconnects L1, not both sides of the AC powerline.** See page 230 for RTP internal schematic.
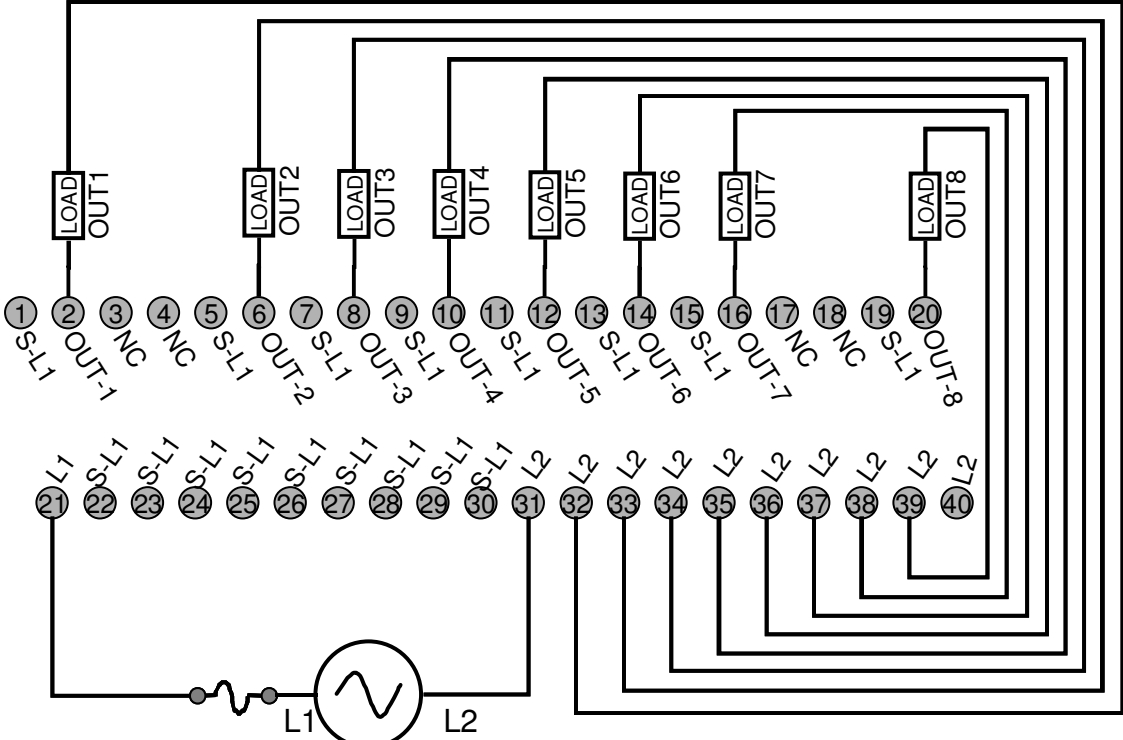
16 Point AC Digital Input	
Step	**Action**
4	**Connect field wiring.** Note: S-L1 in the wiring figure below refers to power that is disconnected from these screw terminals when switch SW1 is open (0). Install jumper wires

16 Point DC Digital Output	
Step	**Action**

1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	
	ATTENTION: 16 point DC Digital Output is rated at 8A per module and 1A per output. Limited to 4A per group of 8.
	
	ATTENTION: The RTP combines the two groups of 8 outputs into one group of 16.
	
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	
	• Remove appropriate key tabs from terminal board to allow mating with the module. See page 75.
	
	• Connect desired cable to 16 point DC DO module at controller. Choose from:
	  900RTC-L010 Remote Terminal Low Voltage Cable Assembly, 1.0 meters long
	  900RTC-L025 Remote Terminal Low Voltage Cable Assembly, 2.5 meters long
	  900RTC-L050 Remote Terminal Low Voltage Cable Assembly, 5.0 meters long
	
	• Install 16 point DC DO label into the module connector cover.
	
	• Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

16 Point DC Digital Output	
Step	**Action**
2	**Mount RTP to DIN rail.** • Latch to rail. See page 244. • Connect cable to RTP
3	**Set/verify jumper positions as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION: SW1 only disconnects the positive terminal, not both sides of the DC power.** See page 230 for RTP internal schematic.

16 Point DC Digital Output	
Step	**Action**
4	**Connect field wiring.** Note: SDC+ in the wiring figure below refers to power that is disconnected from these screw terminals when switch SW1 is open (0). Note: DC Outputs provide electronic overload protection in the module, but adding a fuse (see picture) protects the wiring.

8 Point AC Digital Output	
Step	**Action**

1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	
	ATTENTION: 8 point AC Output is limited to maximum of 2A per output for any VAC, 6A per RTP for 240VAC, 8A per RTP for 120VAC.
	
	ATTENTION: The RTP combines the 8 isolated outputs into one group of 8.
	
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	
	• Remove appropriate key tabs from terminal board to allow mating with the module. See page 75.
	
	• Connect desired cable to 8 point AC DO module at controller. Choose from:
	   900RTC-H010 Remote Terminal High Voltage Cable assembly, 1.0 meters long
	   900RTC-H025 Remote Terminal High Voltage Cable assembly, 2.5 meters long
	   900RTC-H050 Remote Terminal High Voltage Cable assembly, 5.0 meters long
	
	• Install 8 point AC DO label into the module connector cover.
	
	• Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

2	**Mount RTP to DIN rail.** • Latch to rail. See page 244. • Connect cable to RTP.
3	**Set/verify jumper positions as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION: SW1 only disconnects L1, not both sides of the AC powerline.** See page 230 for RTP internal schematic.

8 Point AC Digital Output

Step	Action
4	**Connect field wiring.** **CAUTION: S-L1 terminals in the wiring figure below are live when switch SW1 is on (1).** Note: AC Outputs are individually fused in the module, but adding a fuse here protects the wiring.

RTP Cable wire positions and colors (Applies to 4 AO, 16 DI, 16 DO, 8 DO)

Twisted Pair Number	HC900 Module TB Position	RTP J1 Plug Connector	Color
1	1	6	Black
	2	7	Red
2	4	9	Black
	5	10	White
3	6	20	Black
	7	19	Green
4	9	17	Black
	10	16	Blue
5	11	15	Black
	12	14	Yellow
6	14	12	Black
	15	11	Brown
7	16	1	Black
	17	2	Orange
8	19	4	Red
	20	5	White
9	3	8	Red
	8	18	Green
10	13	13	Red
	18	3	Blue

RTP Internal schematic (Applies to 4 AO, 16 DI, 16 DO, 8 DO)
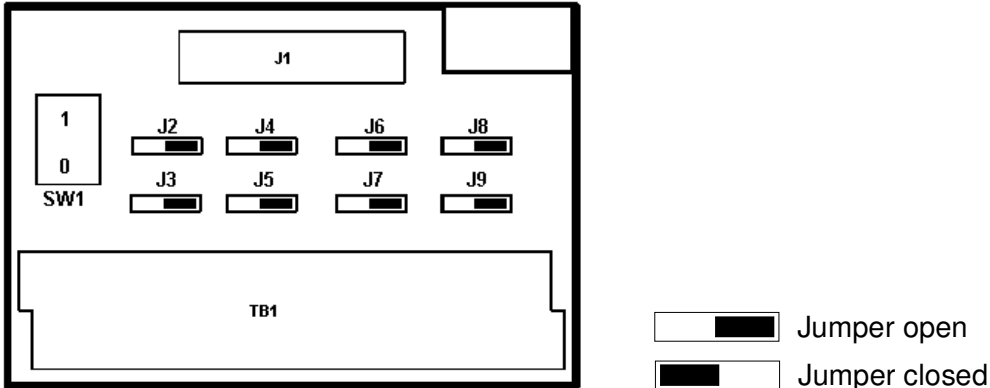
8 Point Analog Output	
Step	**Action**
1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.** **Mount RTP cable assembly to HC900 Controller** (Figure 92). • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75. • Connect terminal block end of desired cable assembly to 8 point Analog Output module at controller. Choose from: 900RTC-B810 Remote Terminal Cable assembly, 1.0 meters long 900RTC-B825 Remote Terminal Cable assembly, 2.5 meters long 900RTC-B850 Remote Terminal Cable assembly, 5.0 meters long • Install 8 point Analog Output label into the module connector cover. • Connect shield drain wire to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).
2	**Mount RTP to DIN rail.** • Latch to rail. See page 244. • Connect cable to RTP.
3	**Set/verify jumper positions on each RTP as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION: SW**1 opens the + side of the External 24V Power so that RIUP of module is possible. See page 233 for RTP internal schematic.

8 Point Analog Output	
Step	**Action**

4	**Connect field wiring.**
	
	 LOADS ARE 0 to 750 ohm
	
	 ETC.
	
	 RTP A for Inputs 1 to 8
	
	 EXT +24V Install 24V wires as shown:
	 EXT 24V RTN 22 to 10
	 External 24VDC supply 22 to 12
	              24VRTN to 9
	              24VRTN to 11

RTP A Cable wire positions and colors (for cable assembly drawing, applies to 8 AO)
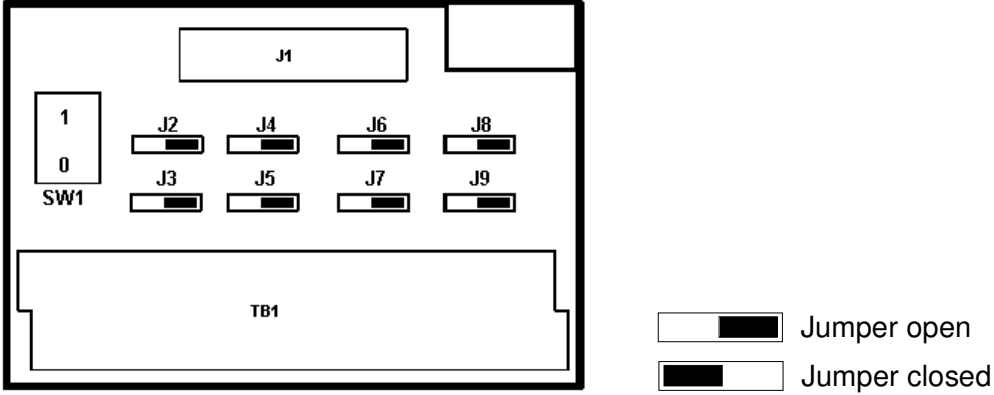
Twisted Pair Number of Cable A	HC900 Module TB Position	RTP A J1 Plug Connector	Color
1	1	6	Black
	2	7	Red
2	4	9	Black
	5	10	White
3	6	20	Black
	7	19	Green
4	36	17	Black
	35	16	Blue
5	36	15	Black
	35	14	Yellow
6	10	12	Black
	11	11	Brown
7	12	1	Black
	13	2	Orange
8	15	4	Red
	16	5	White
9	3	8	Red
	8	18	Green
10	9	13	Red
	14	3	Blue
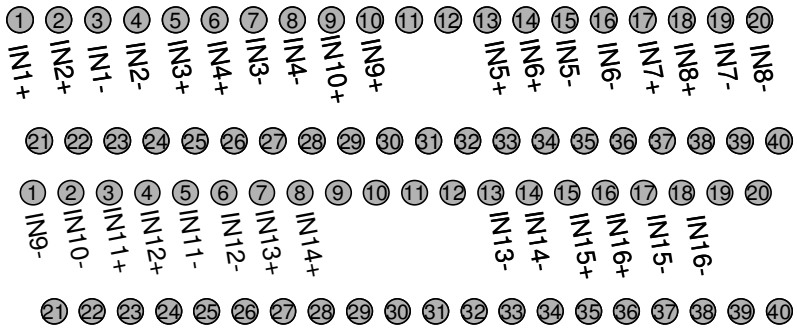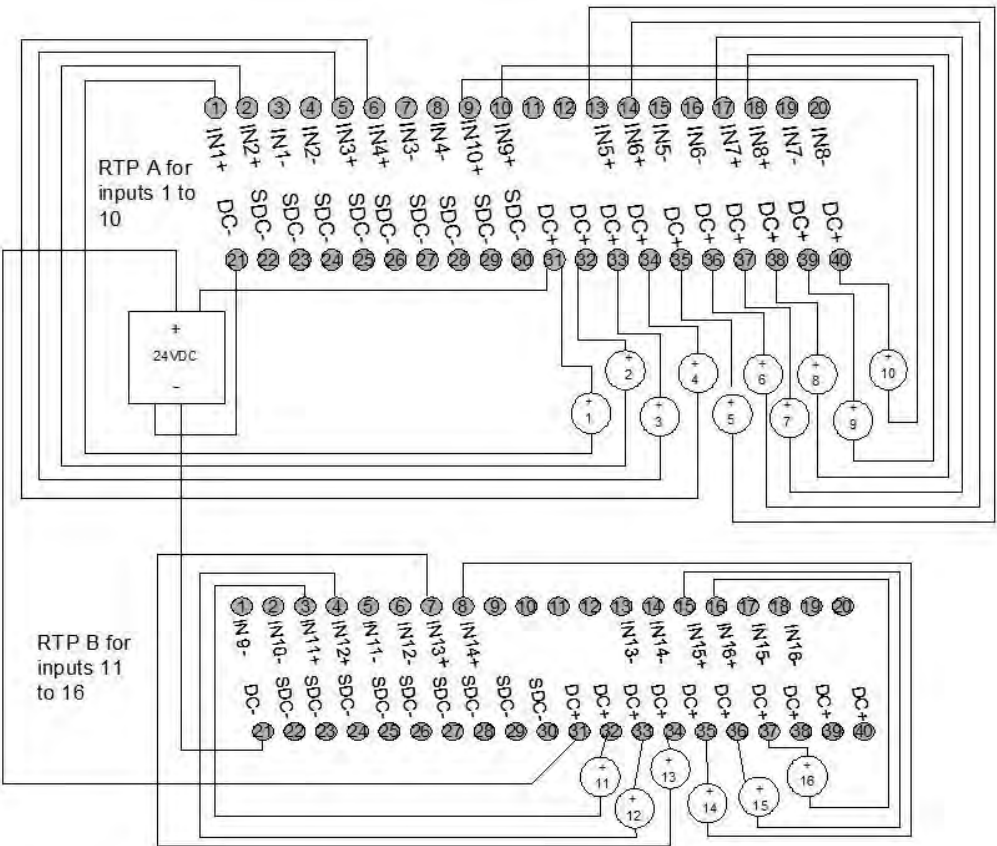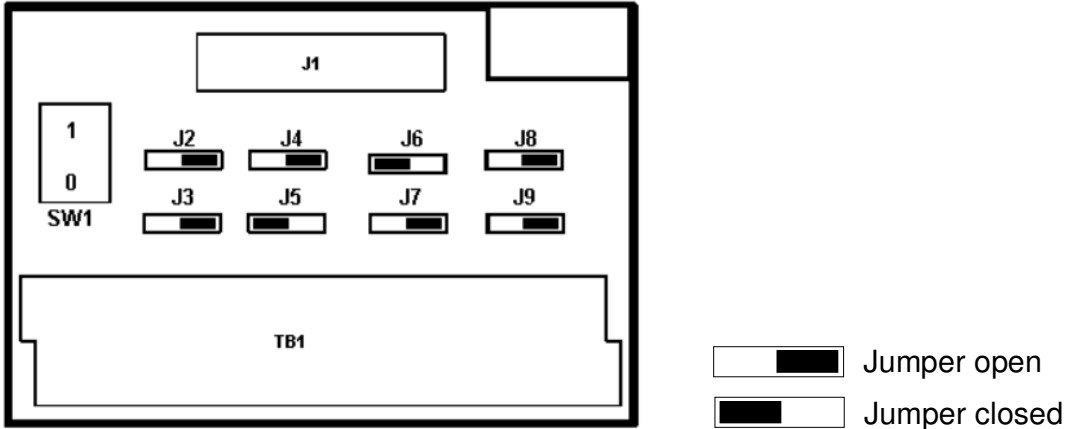
16 Point Analog Output	
Step	**Action**
1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.** **Mount RTP cable assembly to HC900 Controller** (Figure 92). • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75. • Connect terminal block end of desired cable assembly to 16 point Analog Output module at controller. Choose from: 900RTC-3210 Remote Terminal Cable assembly, 1.0 meters long 900RTC-3225 Remote Terminal Cable assembly, 2.5 meters long 900RTC-3250 Remote Terminal Cable assembly, 5.0 meters long • Install 16 point Analog Output label into the module connector cover. • Connect both shield drain wires to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).
2	**Mount RTPs to DIN rail.** • Latch to rail. See page 244. • Connect cables to RTPs. Cables are marked "RTP A" and "RTP B." In step 4, RTP A will be wired to Inputs 1-10, RTP B to Inputs 9-16. You can write on the RTPs' labels to distinguish them. • Note: Inputs 9 and 10 are wired between both RTPs.
3	**Set/verify jumper positions on each RTP as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION**: SW1 opens the + side of the External 24V Power so that RIUP of module is possible. See page 233 for RTP internal schematic.

16 Point Analog Output

Step	Action
4	**Connect field wiring.** RTP A for Outputs 1 to 8, 9+ and 10+ RTP B for Outputs 11 to 16, 9- and 10-)
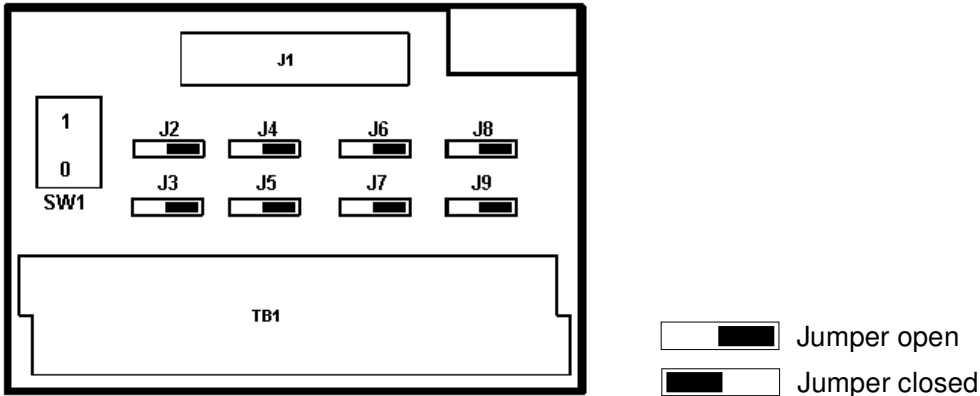
16 Point Analog Input

Step	Action
1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.** **ATTENTION: The RTP labeled "DI, DO, AO RTP ASSY" with jumpers J2-J9 is the correct one for 16 point AI.** **Mount RTP cable assembly to HC900 Controller** (Figure 92). • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75. • Connect terminal block end of desired cable assembly to 16 point Analog Input module at controller. Choose from: 900RTC-3210 Remote Terminal Cable assembly, 1.0 meters long 900RTC-3225 Remote Terminal Cable assembly, 2.5 meters long • Install 16 point Analog Input label into the module connector cover. • Connect both shield drain wires to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

16 Point Analog Input	
Step	**Action**
2	**Mount RTPs to DIN rail.** • Latch to rail. See page 244. • Connect cables to RTPs. Cables are marked "RTP A" and "RTP B." In step 4, RTP A will be wired to Inputs 1-10, RTP B to Inputs 9-16. You can write on the RTPs' labels to distinguish them. • Note: Inputs 9 and 10 are wired between both RTPs.
3	**Set/verify jumper positions on each RTP as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION: SW1 opens current loop on the ground side so that RIUP of module is possible, but voltage is still present on the positive side at RTP and module terminals.** See page 242 for RTP internal schematic.

16 Point Analog Input

Step	Action
4	**Connect field wiring. Refer to the appropriate figure for your type of analog input.**

RTP A for inputs 1 to 10

RTP B for inputs 9 to 16

Notice that Inputs 9 and 10 are connected across RTP A and RTP B.

Figure 100   Voltage input connections

RTP A for inputs 1 to 10

RTP B for inputs 11 to 16

Not shown: recommended external current loop fuses.
Additionally, on RTP A connect the following terminals: 3-22, 4-23, 7-24, 8-25, 15-26, 16-27, 19-29, 20-30
On RTP B connect the following terminals: 1-22, 2-23, 5-24, 6-25, 13-26, 14-27, 17-28, 18-29

Figure 101 Current connections with 2-wire transmitter

32 Point DC Digital Output	
Step	**Action**

1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.**
	
	ATTENTION: 32 point DC Digital Output is limited to 6A per RTP and 0.5A per output.
	
	Mount RTP cable assembly to HC900 Controller (Figure 92).
	
	  • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75.
	
	  • Connect terminal block end of desired cable assembly to 32 point Digital Output module at controller. Choose from:
	    900RTC-3210 Remote Terminal Cable assembly, 1.0 meters long
	    900RTC-3225 Remote Terminal Cable assembly, 2.5 meters long
	
	  • Install 32 point DC DO label into the module connector cover.
	
	  • Connect both shield drain wires to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).

2	**Mount RTPs to DIN rail.**
	
	  • Latch to rail. See page 244.
	
	  • Connect cables to RTPs. Cables are marked "RTP A" and "RTP B." In step 4, RTP A will be wired to outputs 1-16, RTP B to outputs 17-32. You can write on the RTPs' labels to distinguish them.

3	**Set/verify jumper positions on each RTP as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. **ATTENTION: SW1 opens current loop on the ground side so that RIUP of module is possible, but voltage is still present on the positive side at RTP and module terminals.** See page 242 for RTP internal schematic.

32 Point DC Digital Output

Step	Action
4	**Connect field wiring.** RTP A for outputs 1 to 16 Install jumper wire DC Supply RTP B for outputs 17 to 32 Install jumper wire DC Supply Note: SDC- refers to the switched negative side of the DC supply. Note: Terminals 9 and 11 (DC-) are connected through the RTP cable. Same for terminals 10 and 12 (DC+).

32 Point DC Digital Input	
Step	**Action**
1	**ATTENTION: RTP and cables are intended for permanent installation within their own enclosure.** **Mount RTP cable assembly to HC900 Controller** (Figure 92). • Remove appropriate key tabs from terminal board to allow mating with the module. See page 75. • Connect terminal block end of desired cable assembly to 32 point Digital Input module at controller. Choose from: 900RTC-3210 Remote Terminal Cable assembly, 1.0 meters long 900RTC-3225 Remote Terminal Cable assembly, 2.5 meters long • Install 32 point DC DI label into the module connector cover. • Connect both shield drain wires to the grounding bars at the base of the HC900 rack. All field-wiring shields must be grounded as described in the shield grounding section (page 70).
2	**Mount RTPs to DIN rail.** • Latch to rail. See page 244. • Connect cables to RTPs. Cables are marked "RTP A" and "RTP B." In step 4, RTP A will be wired to Inputs 1-16, RTP B to Inputs 17-32. You can write on the RTPs' labels to distinguish them.
3	**Set/verify jumper positions on each RTP as shown.** Module Removal / Insertion Under Power (RIUP) is supported by turning off Switch SW1 to allow removal of the module from the rack without causing an arc. See page 73. See page 242 for RTP internal schematic.

32 Point DC Digital Input

Step	Action
4	**Connect field wiring.**

RTP A for inputs 1 to 16

Install jumper wires

DC Supply

RTP B for inputs 17 to 32

Install jumper wires

DC Supply

Note: SDC+ refers to switched positive side of the DC supply.

Note: Terminals 9 and 11 (DC-) are connected through the RTP cable. Same for terminals 10 and 12 (DC-).

RTP A Cable wire positions and colors (for cable assembly drawing, applies to 16 AI, 32 DI, 32 DO)

Twisted Pair Number of Cable A	HC900 Module TB Position	RTP A J1 Plug Connector	Color
1	1	6	Black
	2	7	Red
2	4	9	Black
	5	10	White
3	6	20	Black
	7	19	Green
4	18	17	Black
	17	16	Blue
5	18	15	Black
	17	14	Yellow
6	10	12	Black
	11	11	Brown
7	12	1	Black
	13	2	Orange
8	15	4	Red
	16	5	White
9	3	8	Red
	8	18	Green
10	9	13	Red
	14	3	Blue

RTP B Cable wire positions and colors (for cable assembly drawing, applies to 16 AI, 32 DI, 32 DO)
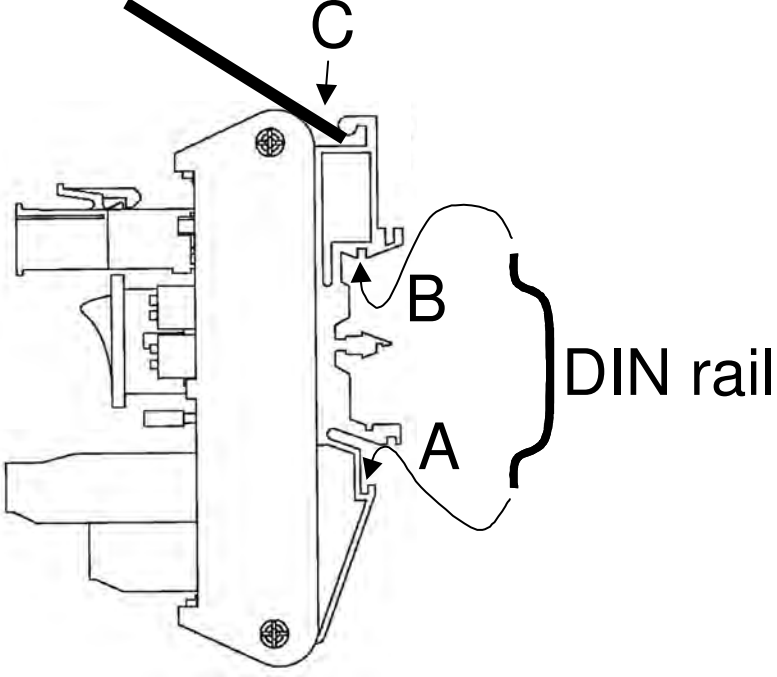
Twisted Pair Number of Cable B	HC900 Module TB Position	RTP B J1 Plug Connector	Color
1	19	6	Black
	20	7	Red
2	22	9	Black
	23	10	White
3	24	20	Black
	25	19	Green
4	36	17	Black
	35	16	Blue
5	36	15	Black
	35	14	Yellow
6	28	12	Black
	29	11	Brown
7	30	1	Black
	31	2	Orange
8	33	4	Red
	34	5	White
9	21	8	Red
	26	18	Green
10	27	13	Red
	32	3	Blue
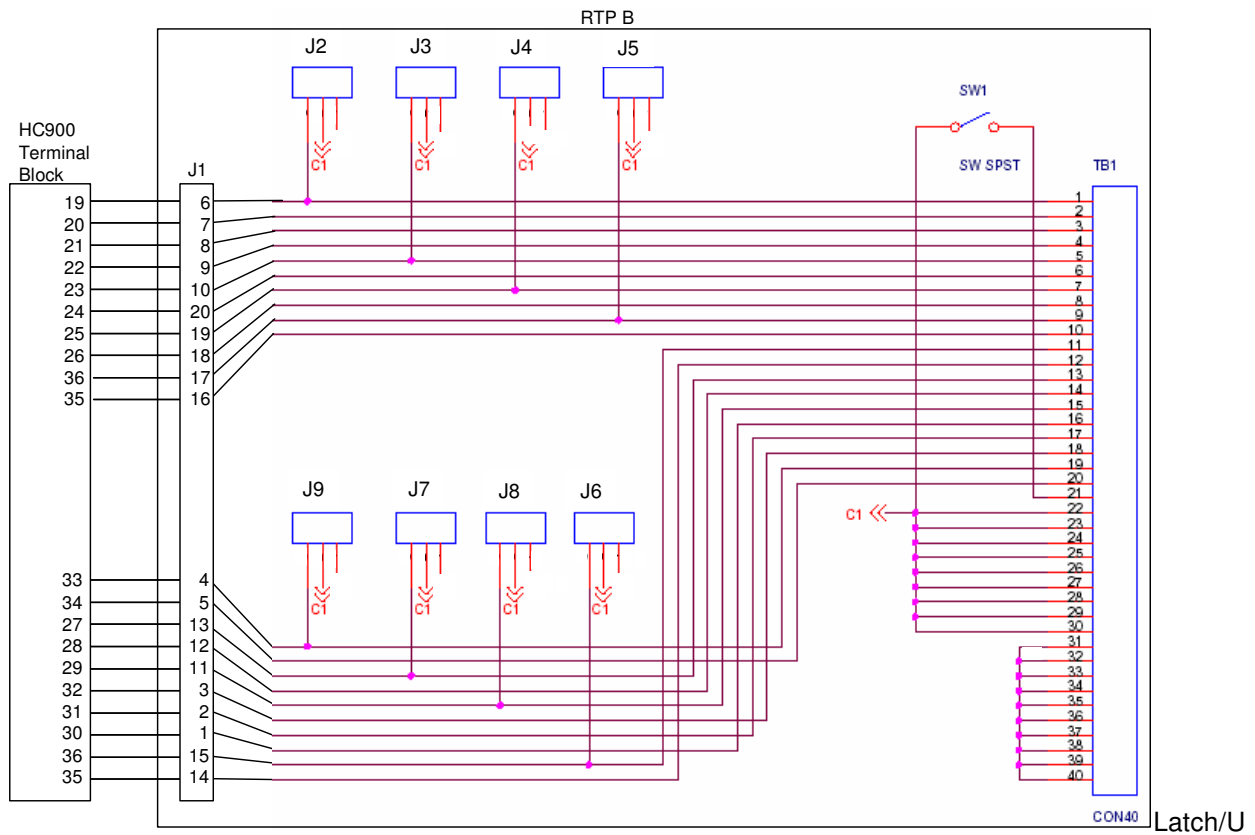
nlatch RTP to rail

Step	Action
1	Mounting screws must be installed at each end of the mounting rail; with additional screws approx. every 8"(203mm) to prevent twisting of the rail.

Step	Action
2	Insert one side of DIN rail at A.
3	Insert other side of DIN rail at B, and push B over the rail to snap into place.
4	To remove, using slot screwdriver to lift C up gently (plastic is fragile) to disengage at B. Lift up and over rail, then disengage at A.

Declaration of Conformity

Honeywell

DECLARATION OF CONFORMITY

$C\epsilon$

We declare that the following product,

HC900 Hybrid Controller

Models:

900A01 900A16 900B01 900B08 900B16 900G01 900G02 900G03
900G32 900H01 900H02 900H03 900H32 900K01 900RSM 900PSM

900C31 900C32 900C51 900C52 900C53 900C71 900C72 900C71R
900C72R 900C73R

900P01 900P02 900P24 900RTA 900RTR 900RTC

900R04 900R08 900R12 900RR0 900R08R 900R12R 900RPE

is in conformity with the protection requirements of Council Directives: 89/336/EEC as amended by 92/31/EEC and 93/68/EEC on the harmonization of the laws of the Member States relating to Electromagnetic Compatibility, and 73/23/EEC as amended by 93/68/EEC on the harmonization of the laws of the Member States relating to the safety of equipment designed for use within certain voltage limits.

The models covered by this Declaration are listed in, and evidence of conformity is provided by, Technical Files: **51452404** and **51452405**

The following standards are referenced in the file:

EN 55011-1991   Limits and Methods of measurement of electromagnetic disturbances of ISM radio frequency equipment
EN 61326 –1998   Electrical equipment for measurement, control and laboratory use - EMC requirements.
EN 61010-1-1993 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.
                    Part 1: General Requirements

Manufacturer: Honeywell Automation India Ltd.
                    55 & 56 Hadapsar Ind. Estate
                    PUNE 411 013, India

Honeywell International, Inc
512 Virginia Drive
Fort Washington, PA 19034

Edward A. Child

Edward A. Child
Principle Engineer
Regulatory Compliance & Approvals Engineering

Issue Date: 25 July   20   08

HC900_51452401_E.doc

ATEX Certification

Honeywell

HON 08 ATEX 0001X Revision <u>A</u>

Manufacturer's ATEX Declaration of Conformity

⟨Ex⟩ II 3 G   Ex nA IIC   C E

This Declaration applies to the following apparatus:

HC900 Modular Control System
Low Power Modules (per attached list)

The apparatus fulfills the requirements for Group II, Category 3 equipment in accordance with Directive
94/9/EC. The design incorporates requirements of IEC 60079-15:2005 and is documented within
Honeywell Technical File 51453806. The apparatus is incapable of producing arcs, sparks or hot surfaces
which may cause ignition and is designed to be installed and used in accordance with IEC 60079-14:2002.

The marking of the apparatus shall include the following:

⟨Ex⟩   II 3 G Ex nA IIC T* (Ta $\leq$ 60ºC)
Doc. No. HON 08 ATEX 0001X

Manufacture of the apparatus is controlled by an ISO 9001 approved system.

The apparatus satisfies the EMC requirements of IEC 61326 related to measurement, control and
laboratory equipment and satisfies the requirements of IEC 61010-1 for operator safety.

* See attached list of modules for individual Temperature Classifications

<u>Conditions for the installation of the apparatus in Zone 2 hazardous areas:</u>

1. The HC900 must be mounted in an enclosure that provides a degree of protection not less than
    IP54 per EN60529.

2. External transient protection is required at the power supply terminals and shall not exceed 140%
    of the rated power supply voltage.

3. Modules are not to be inserted or removed unless the area is known to be non-hazardous.

4. All necessary precautions are to be taken to avoid the danger of ignition due to electrostatic
    charge build-up during installation, use and maintenance.

Manufacturing Location: **Honeywell Automation India, Ltd.**
55 & 56 Hadapsar Ind. Estate
Pune 411 013, India

Honeywell International Inc.
512 Virginia Drive
Fort Washington, PA 19034 USA

Edward A Child
Edward A. Child
Regulatory Compliance & Approvals Engineering

Issue Date: _____12 May 2007_____

ATEX_CERT_HC900

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Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

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(TAC) **hfs-tac-support@honeywell.com**

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FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

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Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

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Phone: + 80012026455 or
+44 (0)1202645583

Email: (Sales)

FP-Sales-Apps@Honeywell.com

or

(TAC)

hfs-tac-support@honeywell.com

AMERICA'S

Honeywell Process Solutions,

Phone: (TAC) 1-800-423-9883 or
215/641-3610

(Sales) 1-800-343-0228

Email: (Sales)

FP-Sales-Apps@Honeywell.com

or

(TAC)

hfs-tac-support@honeywell.com

For more information

To learn more about HC 900 Process
Controller, visit **www.honeywellprocess.com**

Or contact your Honeywell Account Manager

Process Solutions
Honeywell

1250 W Sam Houston Pkwy S
Houston, TX 77042

Honeywell Control Systems Ltd
Honeywell House, Skimped Hill Lane
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Shanghai, China 20061

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