ControlEdge HC900 Process & Safety Controller

User and Installation Manual

Doc. No.: 51-52-25-154

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Notices and Trademarks

Revision 13, April 2021

Warranty/Remedy

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose**. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Honeywell Process Solutions

1250 W Sam Houston Pkwy S

Houston, TX 77042

About This Document

Abstract

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

References

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

Document Title	ID #
ControlEdge HC900 Controller Technical Overview Specification	51-52-03-31
ControlEdge HC900 Module Specification	51-52-03-41
ControlEdge HC900 Controlware Specification	51-52-03-42
Designer Software Specification	51-52-03-43
Legacy ControlEdge HC900 Controller Installation and User Guide	51-52-25-107
ControlEdge HC900 Controller Operator Interface User Guide	51-52-25-108
ControlEdge HC900 Designer Software User Guide	51-52-25-110
ControlEdge HC900 Utilities User Guide	51-52-25-126
ControlEdge HC900 Controller Function Block Reference Guide	51-52-25-109
ControlEdge HC900 Designer Software User Guide	51-52-25-110
ControlEdge HC900 Controller Communications User Guide	51-52-25-111
ControlEdge HC900 Controller Redundancy Overview & System Operation	51-52-25-133
900 Control Station For use with ControlEdge HC900 Controller	51-52-25-148
Station Designer Software manual	51-52-25-149
ControlEdge HC900 Process & Safety Controller Safety Manual	51-52-25-153

Revision Information

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First release	2.1	January 2014
Redundancy updates	2.2	June 2014
Cyber Security updates	3.0	July 2014
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Added Network and Security Planning, RoHS compliance. Updated with UIO & SOE support (R640/R650)	7	April 2018
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Inclusion of Ring topology architecture	9	December 2018
Analog Input Module Key-Tabs figure update. Vertical Spacing of Racks figure update. Updated AC/DC Isolated Input Module figure. Updated UIO AI 3-Wire Figure Added “Installation in Hazardous location” section.	10	May 2019
Redundant RTP and UIO added (R700)	11	November 2019
HART	12	September 2020
Split Rack	13	April 2021

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.

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1. Introduction

1.1. Purpose

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

Chapter Title	Page	Content
Introduction	13	Model numbers, how to verify component compatibility, function description of components, feature summary.
Components and Architecture	25	Functional features and physical characteristics of the system and of each major component of the ControlEdge HC900 Controller. Networking components and methods of interconnection.
Pre-Installation Planning	50	Pre-planning considerations and procedural guidelines for planning an installation.
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1.2. Model Selection Guide

Legacy System

Description	Model number	SIL Compatible*
Racks		
4 I/O Slot Rack	900R04 – 0001	No
8 I/O Slot Rack	900R08 – 0101	No
12 I/O Slot Rack	900R12 – 0101	No
8 Slot Rack -Red. Power	900R08R – 0101	No
12 Slot Rack - Red. Power	900R12R – 0101	No
Redundant CPU Rack	900RR0 – 0001	No
Controllers		
Controller C50 CPU	900C52 – 02XX-00	No
Controller C30 CPU	900C32 – 02XX-00	No
Controller C70 CPU	900C72 – 01XX-00	No
Controller C70R CPU	900C72R – 01XX-44	No
Redundancy switch module	900RSM – 0001	No
I/O Scanner - 2 Port (1 per I/O rack)	900C73R – 01XX-44	No
I/O Scanner (for remote rack)	900C53 – 02XX-00	No
Redundant Power Status Module	900PSM – 0001	No
Power Supplies		
120/240VAC, 60W	900P01 – 0001	No
120/240VAC, 28W	900P02 – 0001	No
+24VDC	900P24 – 0001	NA
I/O Modules		
Analog Input (8 channel)	900A01 – 0102	No
High Level Analog Input (16 channel)	900A16 – 0001	No
Analog Output, 0 to 20mA, (4 channel)	900B01 – 0201	No
Analog Output, 0 to 20mA, (8 channel)	900B08 – 0001	No
Analog Output, 0 to 20mA, (16 channel)	900B16 – 0001	No
Digital Input, Contact type, (16 channel)	900G01 – 0102	No
Digital Input, 24VDC (16 channel)	900G02 – 0102	No
Digital Input, 24VDC (32 channel)	900G32 – 0001	No
Digital Input, 120/240 VAC, (16 channel)	900G03 – 0102	No
Digital Input, 120/240VAC, 125VDC (16ch-Iso)	900G04 – 0001	No
Digital Output, Relays (8 channel)	900H01 – 0102	No
Digital Output, 24VDC (16 channel)	900H02 – 0102	No
Digital Output, 24VDC (32 channel)	900H32 – 0001	No
Digital Output, 120/240 VAC (8 channel)	900H03 – 0102	No
Pulse/Frequency/Quadrature	900K01 – 0101	NA

*Reference only – For the latest Hardware and firmware revision numbers can be found at: https://www.honeywellprocess.com/library/support/Public/Downloads/ControlEdge HC900-SafetyControllerModulesRevisions.zip

Description	Model number	SIL Compatible*
I/O Components		
Low VoltageTerminal Block (Euro style)	900TEK – 0001	No
Low VoltageTerminal Block (Barrier Style)	900TBK – 0001	No
High VoltageTerminal Block (Euro style)	900TER – 0001	No
High Voltage Terminal Block (Barrier Style)	900TBR – 0001	No
High Density Terminal Block	900TCK – 0001	No
I/O Components		
Analog Input Remote Terminal Panel (RTP)	900RTA – L001	NA
Relay Output Remote Terminal Panel (RTP)	900RTR – H001	NA
DI, DO, AO Remote Terminal Panel (RTP)	900RTS – 0001	NA
Analog Output (8 channel) RTP Cable (1.0M-L3)	900RTC-BA10	NA
Analog Output (8 channel) RTP Cable (2.5M-L3)	900RTC-BA25	NA
Analog Output (8 channel) RTP Cable (5.0M-L3)	900RTC-BA50	NA
Low Voltage RTP Cable (1.0M, 3.28ft.)	900RTC – L010	NA
Low Voltage RTP Cable (2.5M, 8.2ft.)	900RTC – L025	NA
Low Voltage RTP Cable (5.0M, 16.4ft.)	900RTC – L050	NA
High Voltage RTP Cable (1.0M, 3.28ft.)	900RTC – H010	NA
High Voltage RTP Cable (2.5M, 8.2ft.)	900RTC – H025	NA
High Voltage RTP Cable (5.0M, 16.4ft.)	900RTC – H050	NA
High Density RTP Cable (1.0M, 3.28ft.)	900RTC – 3210	NA
High Density RTP Cable (2.5M, 8.2ft.)	900RTC – 3225	NA
High Density RTP Cable (5M, 16.4ft.)	900RTC-3250	NA
Filler Block Terminal Cover	900TNF – 0001	NA
Shield Terminal Strip (package of 2)	900TSS – 0001	NA
Terminal board jumpers (10, two pos.jumpers)	900J02 – 0001	No
Terminal board jumpers (10, ten pos.jumpers)	900J10 – 0001	No
Manuals		
Full Document set on CD	900ME1 – 00XX-XX	NA
Software		
HC Designer Config. Software CD	900W01 – 00XX-XX	NA
HC Utilities Software/Documentation CD	900W02 – 00XX-XX	NA
Kits & Accessories		
Redundant Power, Rack Extension Kit	900RPE – 0001	NA
Spare I/O Label Kit	51452262 – 501	NA
Replacement Battery Kit	51500638 – 501	NA
Ethernet Cable (10 feet)	51451432 – 010	NA
Ethernet Cable (20 feet)	51451432 – 020	NA
Ethernet Cross-over Cable (20 feet)	51451996 – 020	NA
Null Modem Cable	51404755 – 501	NA
Null Modem Cable used with 900C70R	50004820 – 501	NA
250 ohm Shunt Resistor Kit (8/pkg.)	51205995 – 501	NA
Ethernet Switching Hub (8 Ports)	50008930 – 001	NA
24 VDC Power Supply	50047098 – 001	NA

*Reference only – For the latest Hardware and firmware revision numbers can be found at: https://www.honeywellprocess.com/library/support/Public/Downloads/ControlEdge HC900-SafetyControllerModulesRevisions.zip

Operator Interface	
Description	***Model number***
900 Control Station 10” Screen	900CS10 – xx
900 Control Station 15” screen	900CS15 – xx
Station Designer Software	900SDS – 12-44-00

New Non-SIL System

Description	Model number	SIL Compatible*
Controllers		
Controller C30 CPU	900C30 – 0460	No
Controller C50 CPU	900C50 – 0460	No
Controller C70 CPU	900C70 – 0460	No
Controller C75 CPU	900C75 – 0460	No
I/O Scanner – 2 Port (1 per I/O rack)	900S75 – 0460	No
I/O Scanner – 1 Port (1 per I/O rack)	900S50 – 0460	No
Power Supplies		
120/240 VAC. 60W	900P01-0301	No
24 VDC, 60 W	900P24-0301	No

*Reference only – For the latest Hardware and firmware revision numbers can be found at: https://www.honeywellprocess.com/library/support/Public/Downloads/ControlEdge HC900-SafetyControllerModulesRevisions.zip

SIL System

Description	Model Number	SIL Compatible*
Racks		
4 I/O Slot Rack	900R04 – 0200	Yes
8 I/O Slot Rack	900R08 – 0200	Yes
12 I/O Slot Rack	900R12 – 0200	Yes
8 Slot Rack -Red. Power	900R08R – 0200	Yes
12 Slot Rack - Red. Power	900R12R – 0200	Yes
Redundant CPU Rack	900RR0 – 0101	Yes
Controllers		
Controller C30 CPU – SIL	900C30S – 0460	Yes
Controller C50 CPU – SIL	900C50S – 0460	Yes
Controller C70 CPU – SIL	900C70S – 0460	Yes
Controller C75 CPU – SIL	900C75S – 0460	Yes
I/O Scanner – 1 Port (1 per I/O rack) - SIL	900S50S – 0460	Yes
I/O Scanner – 2 Port (1 per I/O rack) - SIL	900S75S – 0460	Yes
Documentation		
Full Document set on CD – SIL	900ME1S – 0060-00	Yes
Full document set, SIL hard copy – English	900ME2S – 0060-00	Yes
I/O Modules		
Analog Input (8 channel)	900A01-0202	Yes
Analog Input Hi level (16channel)	900A16-0101	Yes
Analog Input Hi level (16 channel @100ms)	900A16-0103	Yes
Analog Output, 0 to 20mA, (4 channel)	900B01-0301	Yes
Analog Output, 0 to 20mA, (8 channel)	900B08-0202	Yes
Analog Output, 0 to 20mA, (16 channel)	900B16-0202	Yes
Digital Input, Contact type, (16 channel)	900G01-0202	Yes
Digital Input, 24VDC (16 channel)	900G02-0202	Yes
Digital Input, 120/240 VAC, (16 channel)	900G03-0202	Yes
Digital In, 120/240 VAC, 125VDC (16 channel-Isolated)	900G04-0101	Yes
Digital Input, 24VDC (32 channel)	900G32-0101	Yes
Digital Output, Relays (8 channel)	900H01-0202	Yes
Digital Output, 24VDC (16 channel)	900H02-0202	Yes
Digital Output, 120/240 VAC (8 channel)	900H03-0202	Yes
Digital Output, 24VDC (32 channel)	900H32-0102	Yes

Pulse/Freq/Quad (4chan, 1Quad)	900K01-0201	Can be used in Safety systems on the Process Worksheet ONLY.
Safety Universal Input/ Output	900U02-0100	Yes
Low VoltageTerminal Block (Euro style)	900TEK-0200	Yes
Low VoltageTerminal Block (Barrier style)	900TBK-0200	Yes
High VoltageTerminal Block (Euro style)	900TER-0200	Yes
High VoltageTerminal Block (Barrier style)	900TBR-0200	Yes
High Density Terminal Block (Euro style)	900TCK-0200	Yes
Filler Block Terminal Cover	900TNF-0200	Yes
Analog Input Remote Terminal Panel (RTP)	900RTA-L001	No
Relay Output Remote Terminal Panel (RTP)	900RTR-H001	No
DI, DO, AO Remote Terminal Panel (RTP)	900RTS-0001	No
Redundant UIO Remote Terminal Panel	900RTI-0100	Yes
Power Supplies		
120/240 VAC. 60W	900P01-0401	Yes
Redundant Power status module	900PSM-0200	Yes
Redundant Switch module	900RSM-0200	Yes

*Reference only – For the latest Hardware and firmware revision numbers can be found at: https://www.honeywellprocess.com/library/support/Public/Downloads/ControlEdge HC900-SafetyControllerModulesRevisions.zip

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.

Note: Model number change: 900*xx where if *= C designates Controller module and *=S designates

Scanner module.

- New System (SIL and Non SIL Model Numbers)*
  - 900C30-0460
  - 900C50-0460
  - 900C70-0460
  - 900C75-0460
  - 900S75-0460
  - 900S50-0460
  - 900C30S - 0460
  - 900C50S - 0460
  - 900C70S - 0460
  - 900C75S-0460
  - 900S50S - 0460
  - 900S75S-0460

  *Reference only – For the latest Hardware and firmware revision numbers can be found at: https://www.honeywellprocess.com/library/support/Public/Downloads/ControlEdge HC900-SafetyControllerModulesRevisions.zip

ATTENTION

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

Checking ControlEdge HC900 Model Numbers for Compatibility

ATTENTION

Be sure to check your model numbers for compatibility before installation. For a ControlEdge 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, ControlEdge 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**
ControlEdge 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** XXXXXX-XX**YY**-ZZ
ControlEdge HC900 CPU	900C51-00**40**-00
Scanner 1	900C53-00**40**-00
HC Designer Software	900W01-00**40**-40
Manuals CD	900ME1-00**40**-40

1.3. Functional Description

All Controllers

The Honeywell ControlEdge HC900 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 ControlEdge HC900 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.

Although the ControlEdge HC900 E1/E2 ports provide protection against Cyber-security/DOS type attacks, additional protection is required for safety applications using a firewall device configured to prevent uncontrolled messages into the controller. The figures in this manual assume the firewall is installed properly above the controller's Ethernet connection(s) E1 and E2.

Figure 1 – Small ControlEdge HC900 Controller Configuration

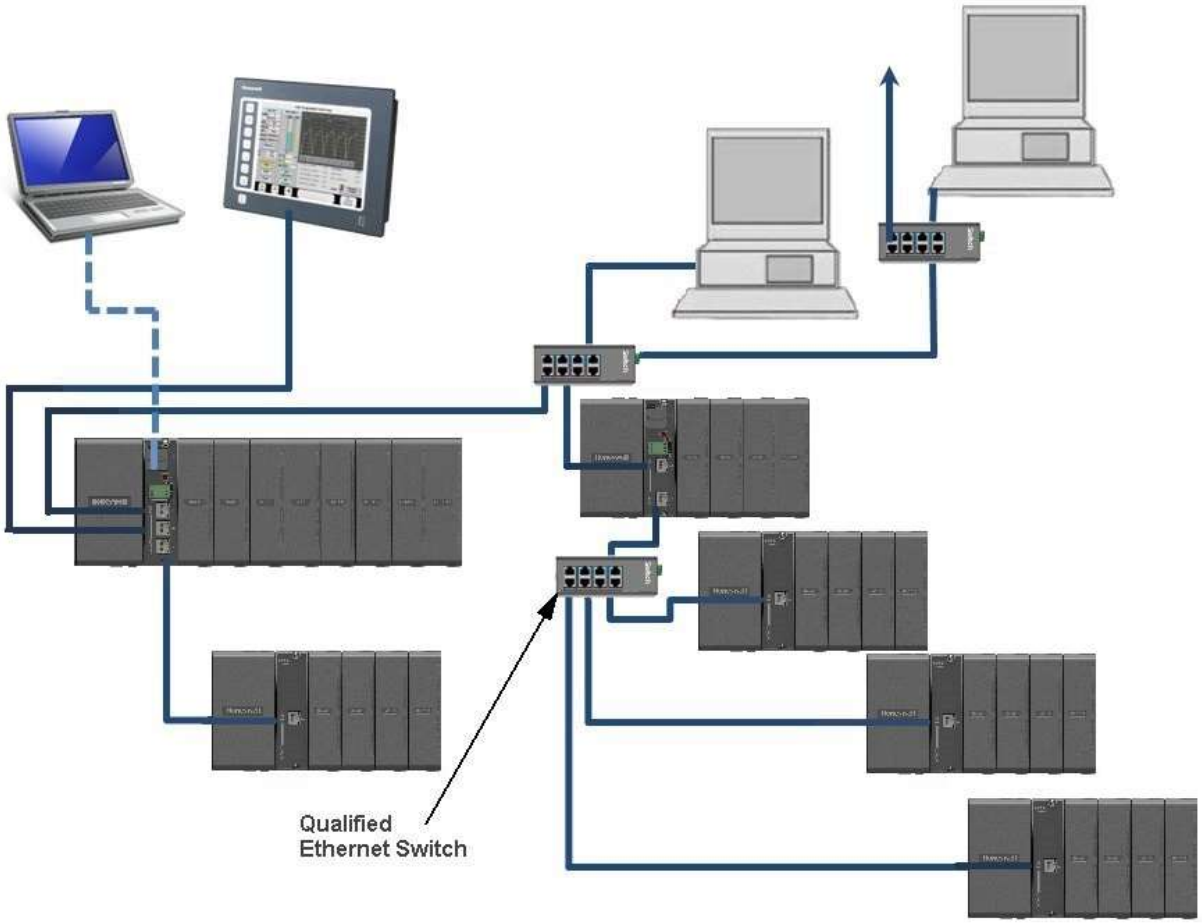


Figure 2 – Expanded ControlEdge HC900 Controller Configuration (C50/C70 CPU only)

The ControlEdge 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 ControlEdge 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 ControlEdge 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 ControlEdge HC900 Controller enables remote placement of input/output components, allowing significant economies in cabling and wiring.

Redundancy

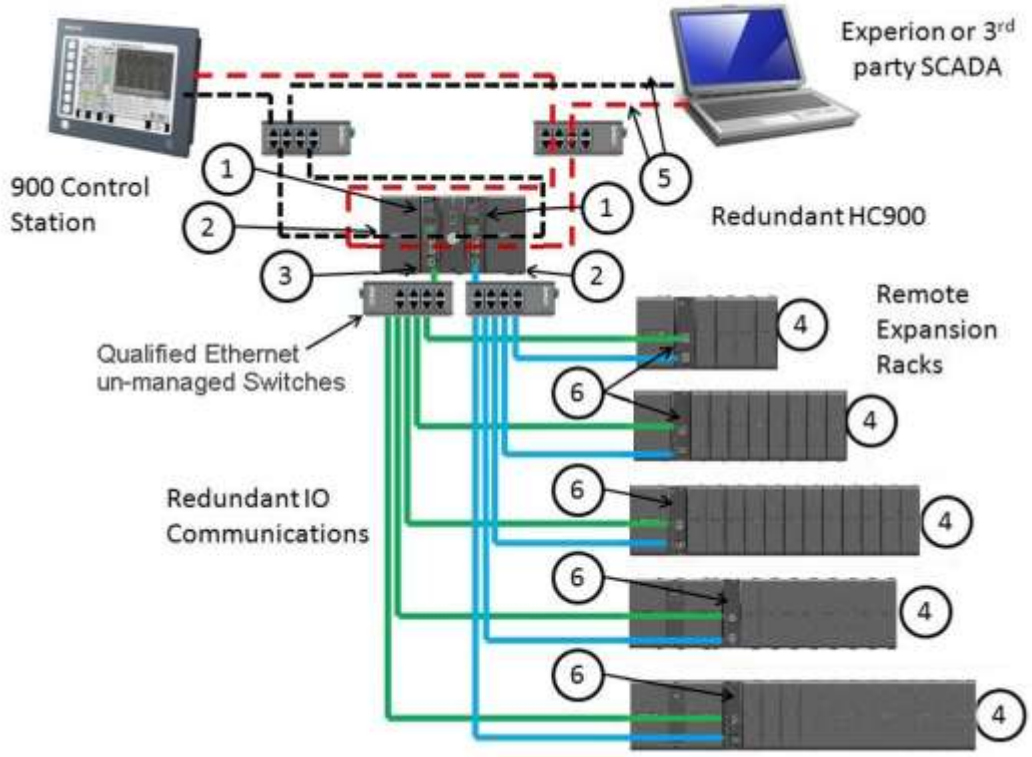


Figure 3 – Single process with redundancies

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, P01 one for each C75 CPU. Model numbers are 900P01-0301 and 900P01-0401.

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 Dual Networks for Host communications - Dual 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 Dual Ethernet communications and automatically transfer communications to the opposite E1/E2 port during a network failure. Connections to these ports are to be considered part of the control network layer and as such care must be taken to reduce exposure to uncontrolled/ unknown network communications. A properly configured firewall such as the MOXA EDR-810 is recommended to help mitigate the exposure.

⑥ Scanner 2 module – has 2 ports, one for each CPU connection to I/O. This IO network between the controllers and scanners is considered proprietary with no other Ethernet traffic.

1.4. Feature Summary

Hardware

- Modular rack structure; components are ordered individually as needed
- CPU with Ethernet and isolated RS485 communications
- Easy to assemble, modify, and expand
- C30 and C30S controllers provide local I/O connections while C50/C70 and C50S/C70S Controllers provide for remote input/output rack connections over a private Ethernet-linked 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 racks

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:
  - New Controllers
    - Two isolated RS 485 communications ports
    - USB to RS485 cable must be obtained to support link to PC for 900 Designer configuration tool
    - Can be configured for Modbus RTU, host or device communications (up to 2000 Ft /600 Meters)

- Ethernet 10/100 Base-T connection:
    - Port(s) configured to Auto Negotiate - default to half duplex
    - C30/C30S controller up to 5 PC hosts via Modbus/TCP protocol. C50/C50S, C70/C70S and C70R Legacy and C75/C75S (new model) support up to 10 PC hosts via Modbus/TCP protocol.
    - Peer-to Peer (UDP) communication with up to 32 other ControlEdge HC900 Controllers.
    - C70/C70S and C70R Legacy and C75/C75S (new model) have 2 Ethernet ports for connection to up to 10 PC hosts. They also support Modbus/TCP Initiator function over both ports and automatically switch between ports to maintain Peer to Peer communications with other C70/C70S or C70R/C75/C75S redundant CPUs.
- Private Ethernet 100 base T connection to I/O expansion racks: (except C30 and C30S CPU)
    - Direct connection to each C70R Legacy and C75/C75S (new model) CPU.

For more information

For complete feature summary and specifications see Specifications on page 221.

2. Components and Architecture

2.1. Overview

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

2.2. Components

The Honeywell ControlEdge HC900 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.
A ControlEdge HC900 Controller configuration with multiple controllers is illustrated in Figure 4. This illustration includes key-numbers that identify components that are described in Table 1.

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.**

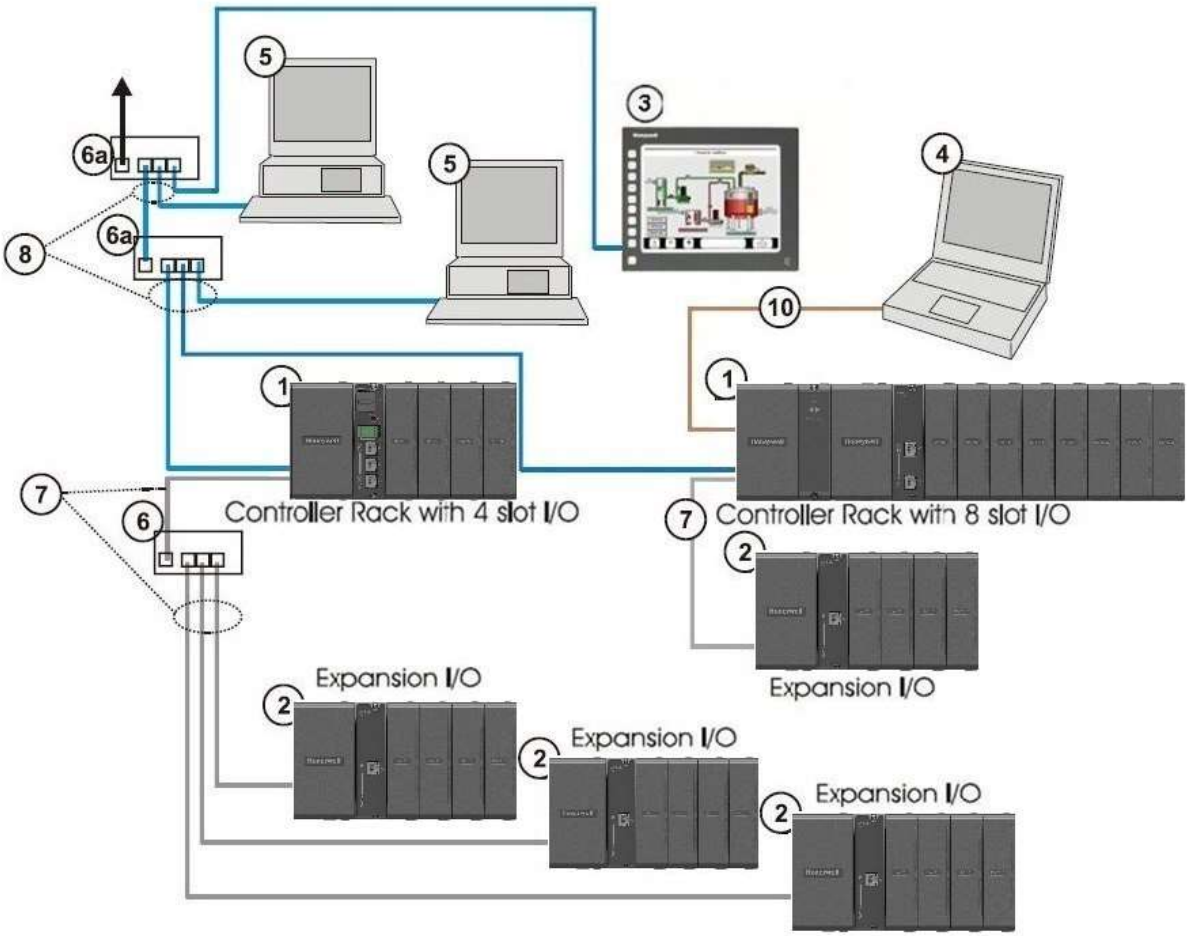


Figure 4 – Configuration with Multiple Controllers

CAUTION

The ControlEdge HC900-expansion I/O link is a private network and the switch used for the interconnection of the ControlEdge HC900 Processor and Scanners must not be connected to any other LAN or WAN. Likewise, no devices other than the ControlEdge 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	Control Station	900 Control Station operator interface communicates via Ethernet or galvanically isolated RS-485 serial link	Honeywell
4	PC Configuration Tool (Serial connection option)	• 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 galvanically isolated 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. RS-485 to USB converter is a third party device available from Honeywell.
5	HMI (Human-Machine Interface)	(Optional) PC link to Ethernet network, which may include other HMIs, other ControlEdge 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 (Experion HS or SpecView32) or from third-party supplier.
6	Qualified un-managed 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 11 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.)	Qualified third party devices available from Honeywell
6a	Ethernet 10/100Base-T Switch or Router/Firewall	Enables inter-connection of several 10/100Base-T Ethernet devices in an Ethernet network. Devices include other ControlEdge HC900 Controllers, HMIs, and can also include routers, 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	Connects I/O expansion racks (C50/C70 CPU only) to controllers with fiber switch.	
8	Ethernet CAT5 shielded cable	Connects devices in Ethernet Open Connectivity network to 900 Control Stations and PC SCADA applications.	Third-party suppliers or Honeywell
10	Serial Interface Cable	For legacy system, Null modem cable, up to 50' (15.24m) (PC modem cable if used with Modems.) For new system, RS-485 to USB converter connects galvanically isolated RS-485 port to USB port.	Third-party suppliers or Honeywell

2.3. Redundant components

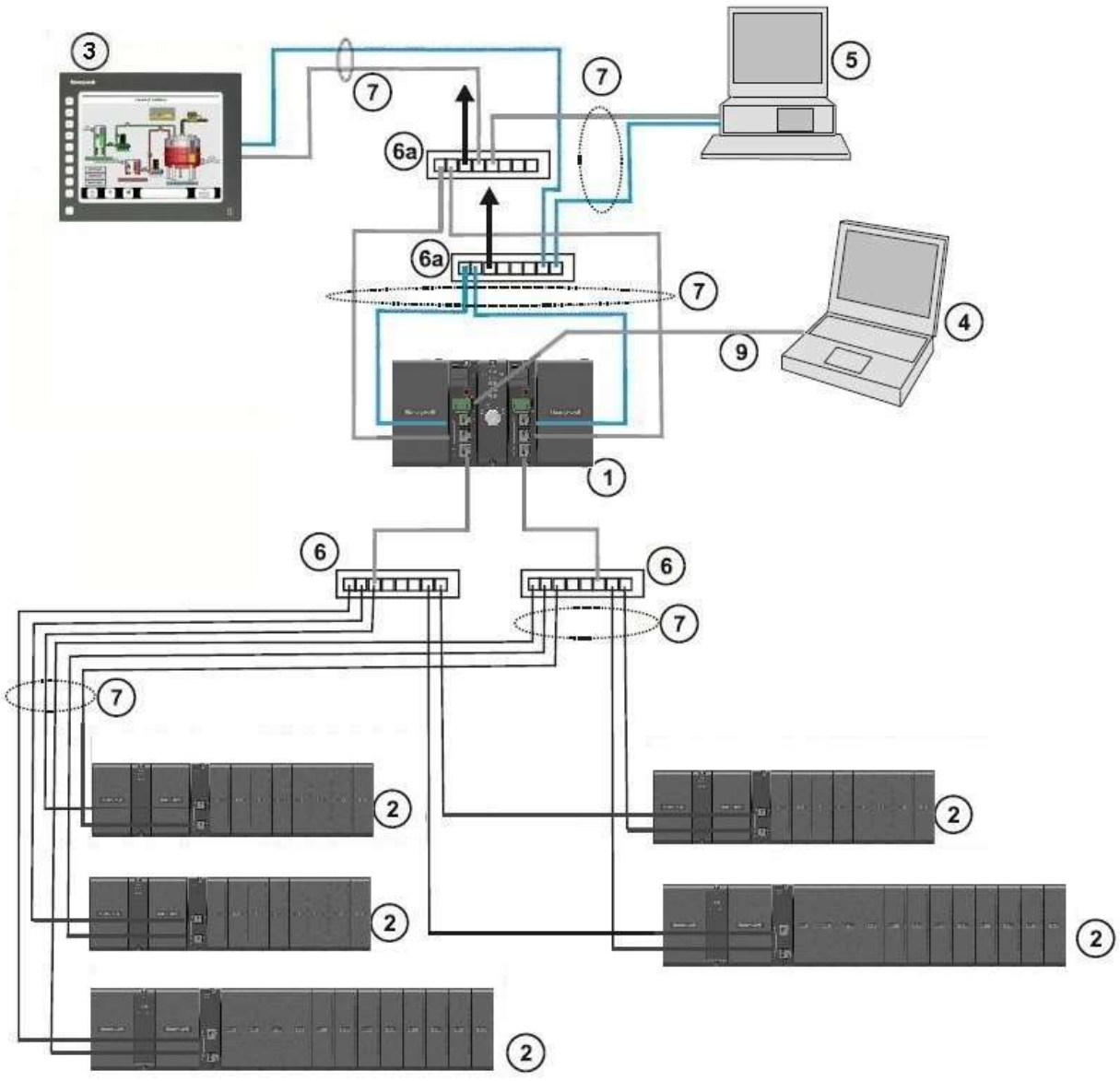


Figure 5 – Redundant Configuration with multiple I/O racks (Star topology)

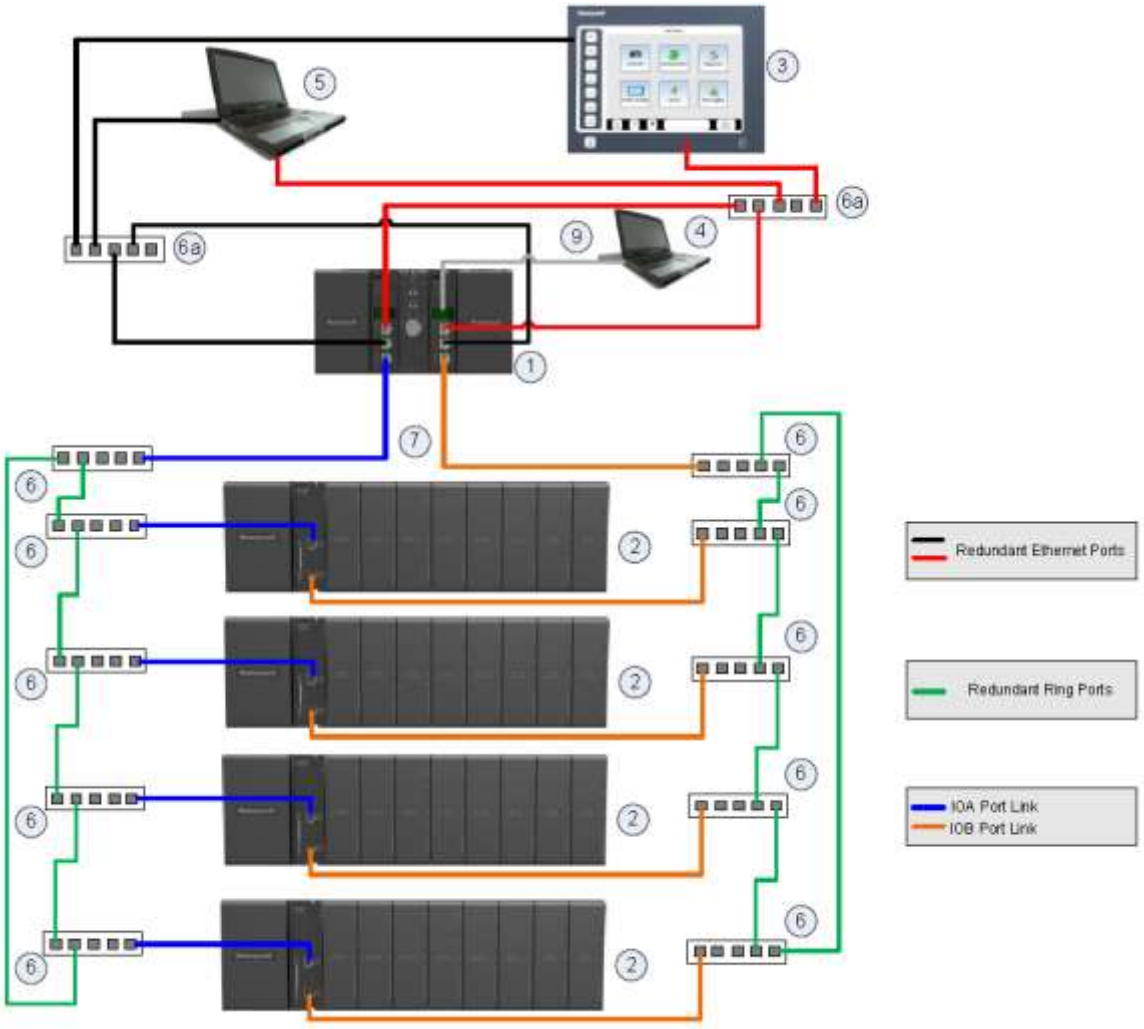


Figure 6 - Redundant Configuration with multiple I/O racks (Ring topology)

CAUTION

The ControlEdge HC900-expansion I/O link is a private network and the switch used for the interconnection of the ControlEdge HC900 Processor and Scanners must not be connected to any other LAN or WAN. Likewise, no devices other than the ControlEdge 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	Control Station	900 Control Station operator interface communicates via Ethernet or RS-485 serial link	Honeywell
4	PC Configuration Tool (Serial Interface option)	• 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 galvanically isolated 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. RS-485 to USB converter is a third party device available from Honeywell.
5	HMI (Human-Machine Interface)	(Optional) PC link to Ethernet network, which may include other HMIs, other ControlEdge 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 (Experion HS or SpecView32) or from third-party supplier.
6	Qualifies un-managed 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.	Qualified third party devices available from Honeywell
6a	Ethernet 10/100Base-T Switch or Router/Firewall	Enables inter-connection of several 10/100Base-T Ethernet devices in an Ethernet network. Devices include other ControlEdge HC900 Controllers, HMIs, and can also include routers, servers, and other devices in wider networks. Use of a properly configured firewall provides a more robust network limiting exposure to uncontrolled network traffic.	Honeywell or third-party suppliers.
7	Ethernet CAT5 shielded cable	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
9	RS-232	For legacy system, Null modem cable, up to 50’ (15.24m) (PC modem cable if used with Modems.) For new systems, RS-485 to USB converter, connects galvanically isolated RS-485 port to USB port.	Third-party suppliers or Honeywell

Note:
The ControlEdge HC900 is equipped with an Ethernet port as a standard feature (two Ethernet ports on the C70
& C75 CPU). These ports can function simultaneously as modbus device and host communications ports. The dual Ethernet ports (C70 & C75 CPU's) can be configured for redundant operation to a host. If the host device does not have the inherent capability to recognize a network failover, the Honeywell HWIOPC Server would be used to perform this functionality.

The dual Ethernet ports will not operate in a redundant configuration through a gateway to a Host / server on another subnet. While both the E1 & E2 Ethernet can be configured with a default Gateway address, only the E1 port will communicate across a gateway to another subnet.

2.4. Hardware Components

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

ControlEdge HC900 Controller Rack

A ControlEdge HC900 Controller ("local rack") is shown in the following figure. As indicated in the figure below, 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

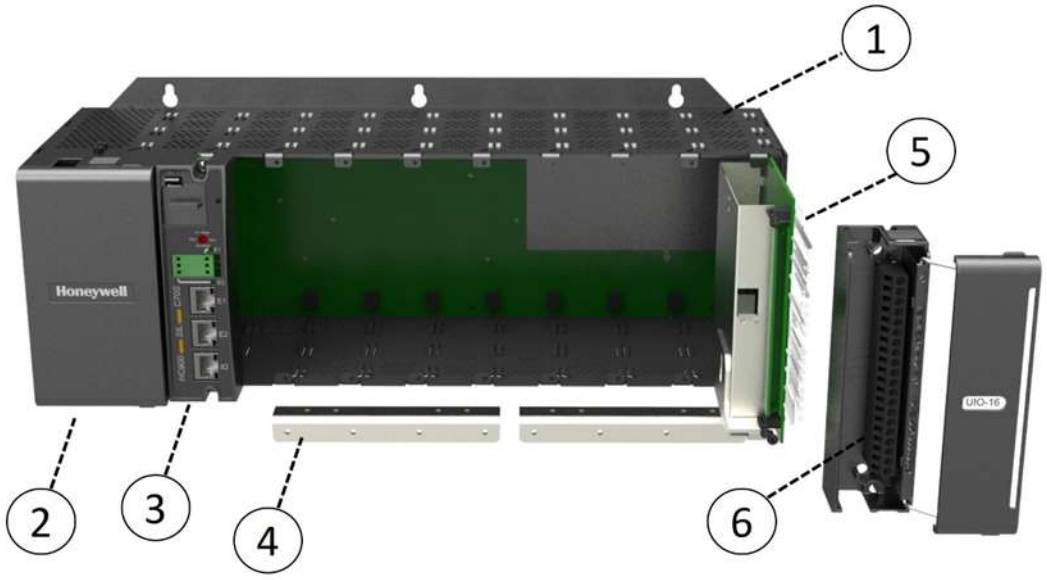


Figure 7 – Controller Rack Components

ControlEdge HC900 Redundant Controller Rack

A ControlEdge HC900 Redundant Controller is shown in the following figure.

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 900P01-xxxx or 900P24-xxxx Power Supplies.

Figure 8 – Redundant Controller Rack Components

I/O Expansion Rack

I/O expansion ("remote") racks, shown in Figure 9, 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/C75S, all I/O is in a rack or racks separate from the controller rack.
Scanner type must match controller type. i.e. example S50**S** may only be used with C50**S**, or C70**S. S50S** cannot be used with a C50 or C70.

An I/O expansion rack includes:

1. Rack, available in 4- 8-, or 12-slot versions
2. Power Supply
3. Scanner 1 Module (S50/S50S) (shown) or Scanner 2 Module (S75/S75S)
4. Grounding bars (for I/O wiring; optional; required for safety applications)
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.

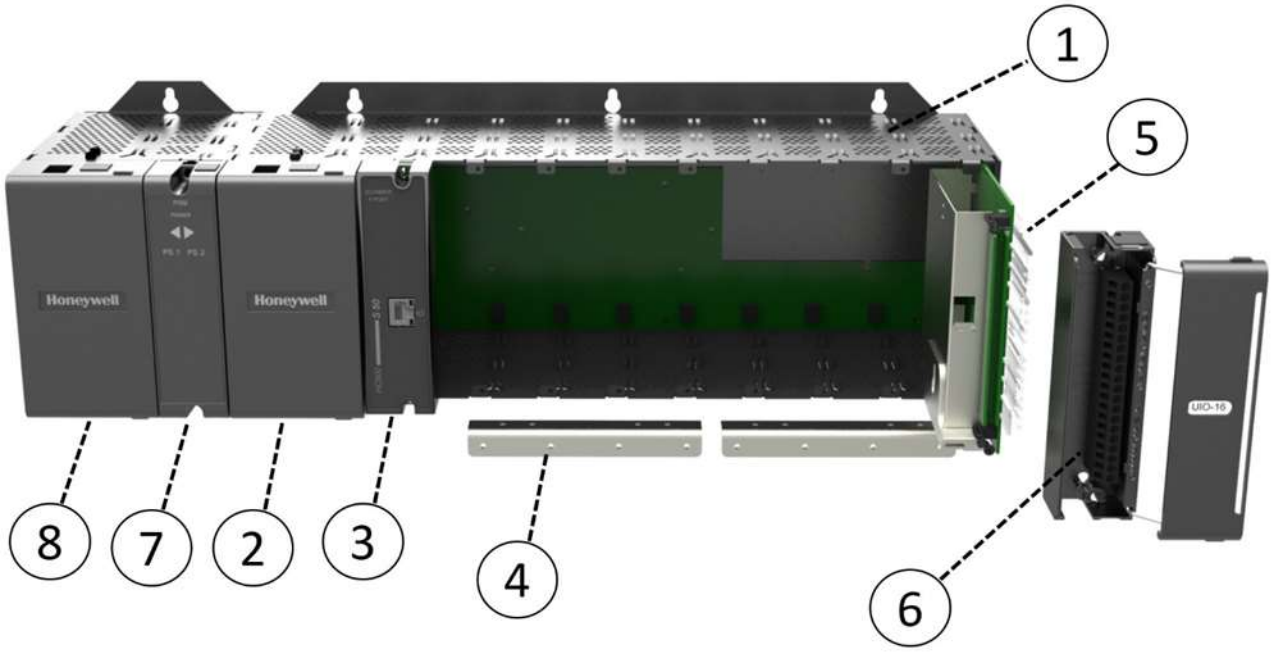


Figure 9 – I/O Expansion Rack Components

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, and all three versions shown in the following figure are available for either purpose.

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 8 or 12 slot I/O rack.

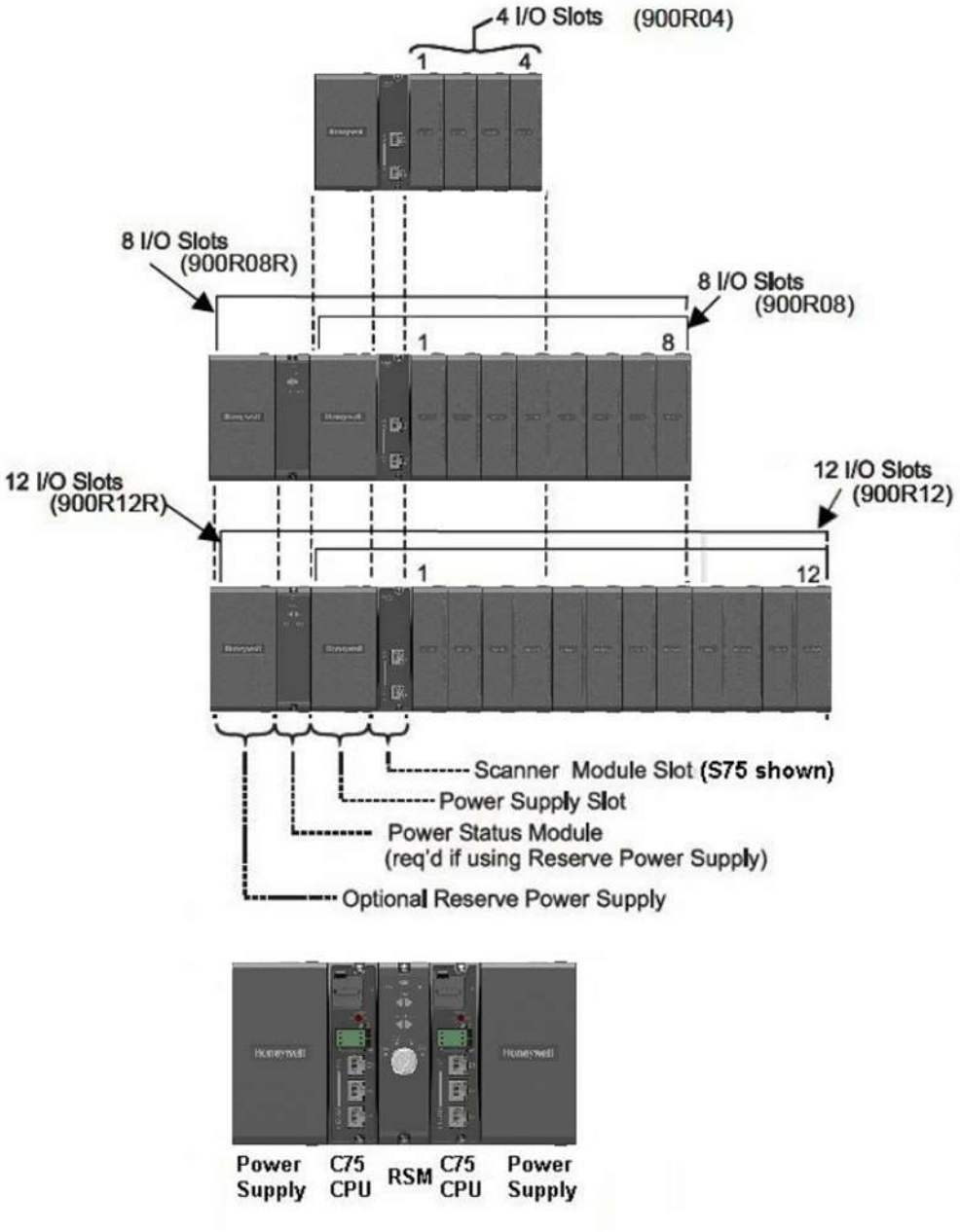


Figure 10 – Rack Options

Power Supply

The 900P01 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 900P24 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 ControlEdge 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 33)
Items shown with key numbers:

1. Voltage test points (P01model only)
   5V ok if: 4.8/ 5.5 VDC
   24V ok if: 22/ 26 VDC
2. AC/DC 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 11 – Power Supply

Power Status Module (PSM)

The Power Status Module (PSM) (Figure 12) sits between redundant power supplies on the I/O rack (see page 34). 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 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 12 – Power Status Module (PSM)

Controller Module

C30 and C30S, C50 and C50S, C70 and C70S, C75 and C75S Controllers share the same features, with exceptions noted.

1	CPU model number (C30 and C30S, C50 and C50S , C70 and C70S, C75 and C75S).
2	Lithium battery (battery tray), which is readily accessible for field replacement. Battery tray on Controllers C30/C30S, C50/C50S, C70/C70S, and C75/C75S.
3	Serial Interface Ports For legacy systems, two serial ports, S1 and S2, each configurable as RS-232 or RS-485 provides interfaces to a PC, external modem, Modbus devices or Operator Interfaces. For new systems, two galvanically isolated RS-485 serial ports, S1 and S2 provide interfaces to PC using RS-485 to USB cable. External modem or Modbus devices may be interfaced using RS-485 to RS-232 converter. RS-485 interfaces to PC, Control Stations or Modbus devices/host.
4	Ethernet LED status indicators for communications functions
5	Connection to I/O port of Scanner Module. C50/C50S/C70/C70S, C75/C75S only
6	Second Ethernet (E2) Host Connection to PC applications or peer ControlEdge HC900 controllers. C70/C70S/C75/C75S only
7	First Ethernet (E1) Host Connection to PC applications or peer ControlEdge HC900 controllers
8	LED status/diagnostic indicator for serial port S2 (left)
9	LED status/diagnostic indicator for serial port S1 (right)
10	LED status/diagnostic indicator for controller module
11	Mode switch (Pgm, Run/Pgm, Run). Not present on C75/C75S; see RSM

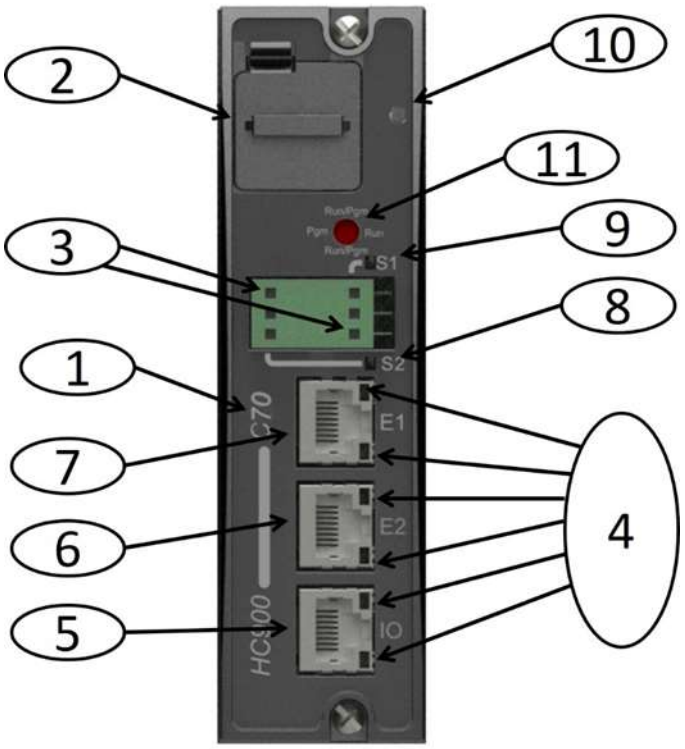


Figure 13 – Controller Module

Redundant controller rack contains two C75s or C75Ss. Left CPU is designated CPU-A, right CPU is CPU-B; either CPU can be Lead.

Redundancy Switch Module (C75/C75S only)

The Redundancy Switch Module (RSM) is shown in Figure 14.

It sits between C75/C75S controllers in the redundant controller 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 14 – Redundancy Switch Module

Scanner 1 Module (S50/S50S only)

900S50, Scanner1 module is shown in

Figure 15
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/diagnostics indicator for scanner functions.
2. One private Ethernet 10/100 Base-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.

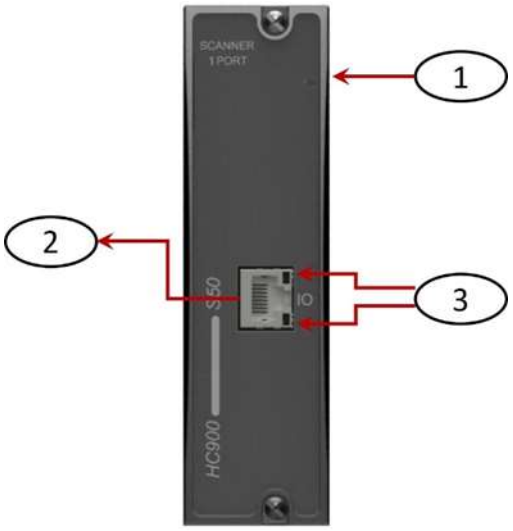


Figure 15 – Scanner 1 Module

Scanner 2 Module (S75/S75S only)

900S75, Scanner 2 Module is shown in

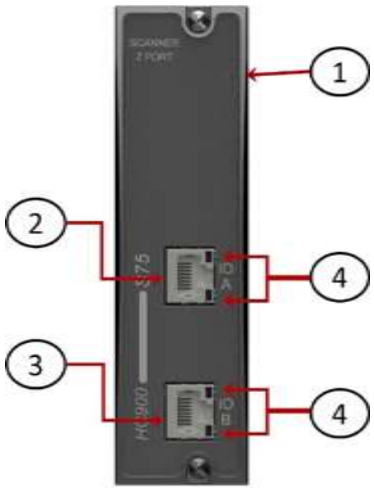


Figure 16
The dual ports provide redundancy through the 2 CPUs. Features at the front of the module include:

1. LED status/diagnostic indicator for scanner functions.
2. I/O port A. Private Ethernet 10/100 Base-T Port. Connects directly to I/O port on CPU-A (or indirectly through a switch).
3. I/O port B. Private Ethernet 10/100 Base-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 16 – 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 galvanic isolation, chassis to input galvanic isolation.
- 4 point galvanic isolated analog output module: Supports from 0 to 20mA each, chassis to output galvanic isolation.
- 8 or 16 point analog output module: Supports from 0 to 20mA each. Galvanically isolated in groups of 4 channels, galvanically isolated chassis to output channels.
- 16 point digital input modules: Contact closure type, DC voltage and AC voltage types. Galvanically isolated chassis to input.
- 32 point digital input module: DC voltage. Galvanically isolated in two groups 1-16, 17-32. Galvanically isolated chassis to input channels.
- 8 point AC (sourcing type) or 16 point DC digital output modules (sinking type). Galvanically isolated output channels to chassis and channel to channel in two groups.
- 32 point digital output: DC voltage (sourcing type). Galvanically isolated output channel to chassis and output to output in two groups.
- 8 point relay output module: four form C type and four form A type relays. Galvanically isolated output to chassis and output to output.
- 8 point Universal Analog Input module. Galvanically isolated input to chassis and input to input. With the exception of RTD types which has four groups of isolation 1-2,3-4,5-6,7-8.

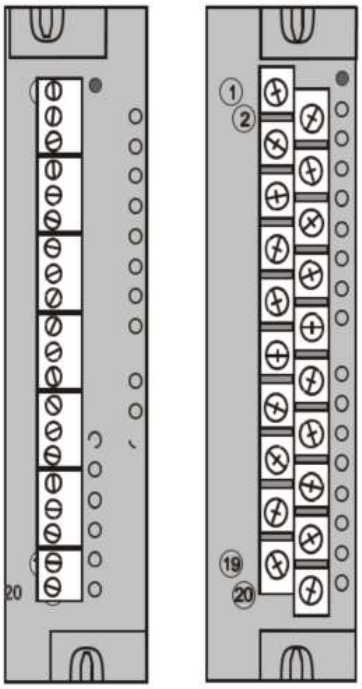


Figure 17 - I/O Module Terminal Block

- 4 channel Pulse/Frequency/Quadrature I/O module. Galvanically isolated channel to chassis.
- 16 Channel Safety Universal Input/Output Module Galvanically isolated Input/Output to Chassis.

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 (left) and the Barrier style (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 to create the control and data acquisition strategy (configuration file) that runs in the controller, using the Designer 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 User's Manual.

RS-232 Modem Devices

In Legacy systems the PC configuration tool can connect 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 galvanically isolated 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.

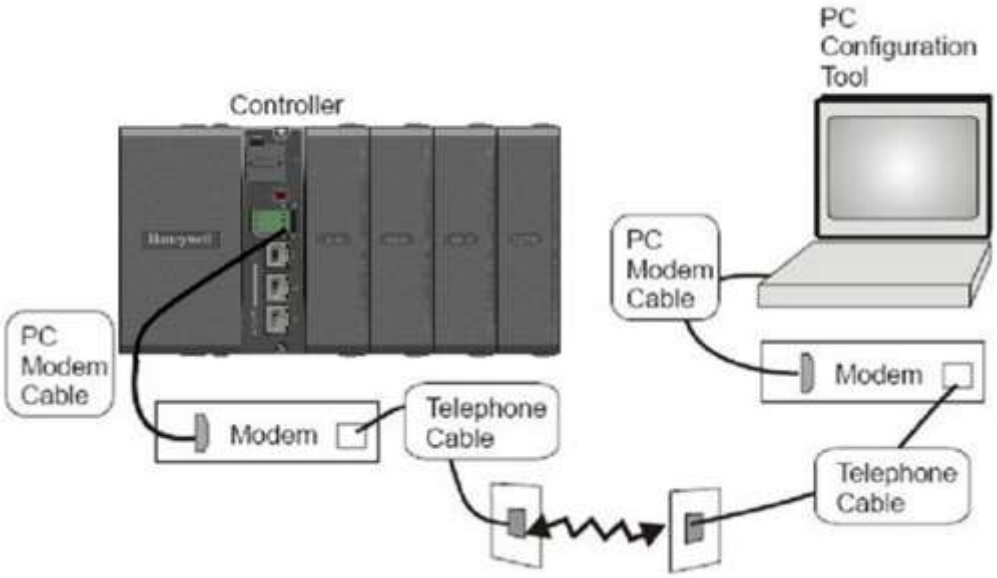


Figure 18 – RS-232 Modem Devices

2.5. I/O Network

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

Examples of ControlEdge HC900 Controller I/O expansion configurations are shown in Figure 19.

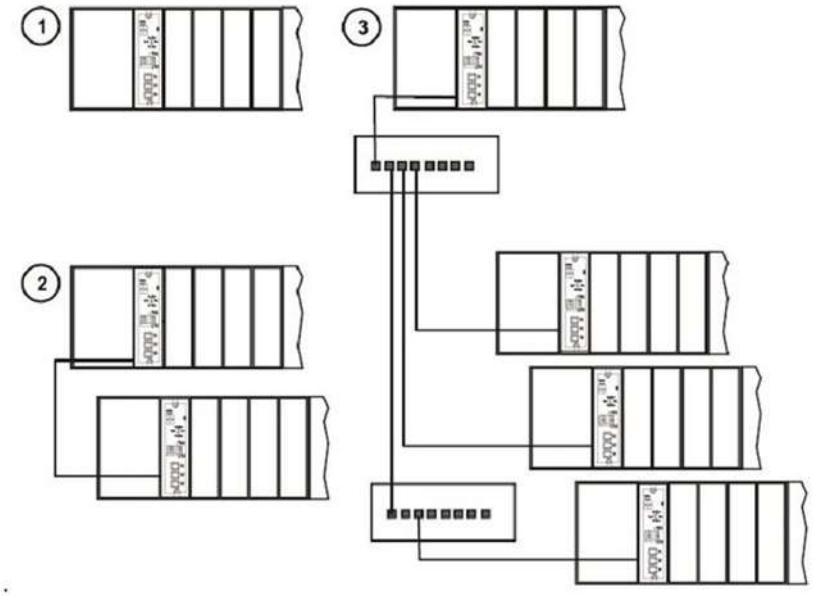


Figure 19 – ControlEdge HC900 Controller Configurations

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 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. Please refer to *ControlEdge HC900 specification document #51-52-03-31* for more details.

Configuration **1** is the C30/C30S/C50/C50S/C70/C70S CPU with I/O but no I/O expansion racks.
Configuration **2** shows the C50/C50S/C70/C70S CPU with 1 I/O expansion rack. The Ethernet cable connects directly between the 10/100 Base-T connectors on the C50/C70 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, 50089785-001). The total number of switches is limited to 2 in series between a CPU and its scanners.
Configuration **3** shows the C50/C50S/C70/C70S 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.

2.6. 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 DIP switch settings 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 ControlEdge 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 /C75S)

I/O for redundant controllers is the same as I/O Expansion Network page 41, with the following exceptions/notes.

- In Figure 19, 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.
- Double the amount of Switches and Ethernet cables are required to configure the redundant I/O Link.
- Maximum of 2 switches between *each* CPU (CPU A and CPU B) and the I/O racks.

2.7. 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 ControlEdge HC900 Controller enables:

- Dual Networks.
- Peer-to-peer communication (Safety peer communication for SIL controller from release 6.300)
- Connection to other PC hosts
- Inter-connection to other networks (such as for sending Alarm/Event messages via e-mail.)
- These ports are to be considered part of the control network layer and as such care must be taken to reduce exposure to uncontrolled network influences. A properly configured firewall such as the MOXA EDR-810 is recommended to help mitigate.

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.**
Use of properly configured managed switch is recommended to mitigate potential cyber-security/DOS problems. Safety applications must include a properly configured Firewall. See page 42 for suggested settings.

Dual Networks

Honeywell Matrikon 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. Dual ports may be used in a simplex mode (non-redundant).

Peer-to-Peer Communication

Peer-to-peer communication enables any given ControlEdge HC900 Controller to request a peer relationship with up to 32 other ControlEdge HC900 Controllers on the same subnet; 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 ControlEdge HC900 Controller Function Block User Guide for additional information.)
  - Safety Peer function blocks, which are included in control strategy (configuration file). Safety Peer function blocks include Safety Peer Monitor, Safety Analog Import and Safety Digital Import. Applicable for Safety controllers with version 6.300 and above.

An illustration of ControlEdge HC900 Controller Peer-to-Peer on a Local Area Network (LAN) is given in Figure 20. Typically, a Router is used for interconnection to another network (LAN, WAN, or other). However, Peer controllers must all be on the same subnet.
For additional details, refer to the ControlEdge HC900 Process & Safety Controller Safety Manual, #51-52-25-153.

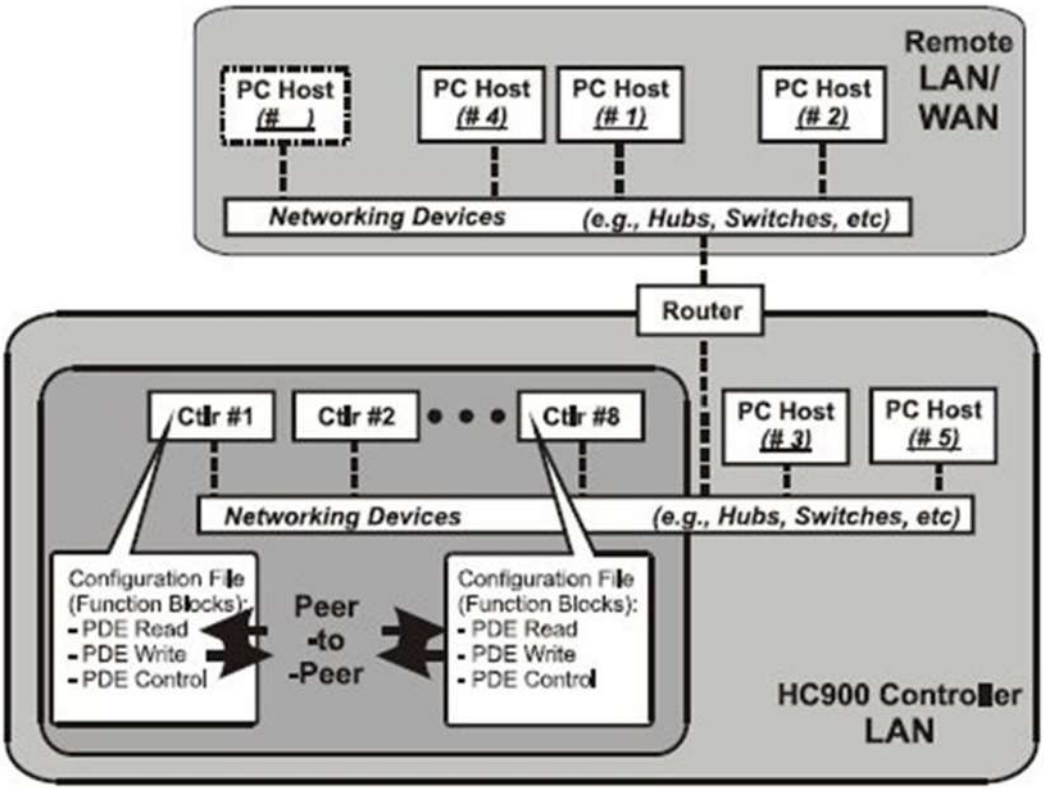


Figure 20 – Modular Network Structure

HART IP

The HC900 controller supports industry standard HART IP protocol to integrate with asset manager (Currently it is qualified with Honeywell FDM).
HART (Highway Addressable Remote Transducer) supports two functionalities:

- HART IP client (FDM) communication
- HART Function Block communication

The controller enables the HART IP client to exchange information with HART field devices connected to the Al/AO channels in the controller via a HART-IP Server. When the HART IP client builds a HART command request and sends it to the TCP/IP port of the HART-IP server, the HART-IP server responds to the HART IP client with information from the field device. Since it takes time for the controller to communicate with the field devices through onboard or remote 1/0 cards, a delayed response mechanism is implemented. The TCP /IP port of the HART-IP server is user-configurable and the default port number is 5094. The end user may change the port number based on the firewall configuration. (From HCDesigner > Utilities > Set Controller Network Parameters)
The controller enables HART function blocks to access to the HART field devices through HART-enabled Al/AO channels. Currently HART command 3, command 48 and command X are implemented.

Note: In the above paragraph AI/AO refers to UIO/RUIO AI/AO channels.

Supported HART Revisions – 5, 6 and 7.

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 modbus host or device.

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

The 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 5 TCP hosts on C30/C30S controllers or up to 10 TCP hosts on C50/C50S, C70/C70S or C75/C75S controllers. (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 ControlEdge HC900 Controller has 5 or 10 "sockets" (software and memory resources), each of which can service data requests from any networked PC on a client (host)/server (controller) basis. 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 21.

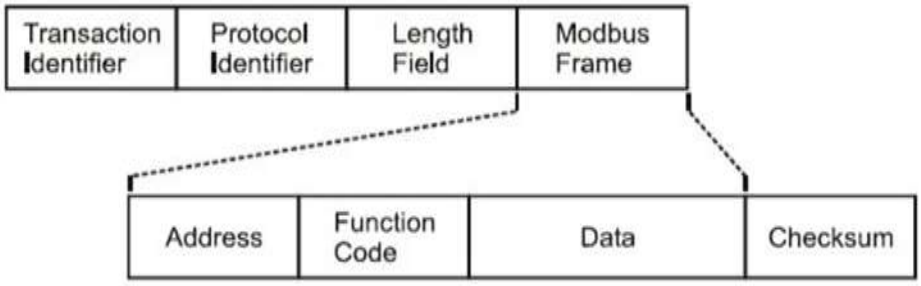


Figure 21 – Modbus/TCP Framing

The ControlEdge HC900 Controller uses either Modbus/TCP or Modbus RTU, not ASCII. The "fixed" Modbus mapping structure for the ControlEdge 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 ControlEdge HC900 Controller includes, but is not necessarily limited to the following packages.

- available from Honeywell
  - Experion HS Software, which operates under Windows™ 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. Experion HS 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, which includes a standard template for creating batch reports.
  - SpecView32 (SpecView Corporation)
  - Matrikon 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, a ControlEdge HC900 Controller application will include a single, free-standing controller that involves no connections via the Ethernet Open Connectivity network. In other cases, the ControlEdge HC900 Controller will be a member of a Local Area Network (LAN) as indicated in Figure 20. The ControlEdge 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 a ControlEdge 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 ControlEdge HC900 Controller: 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 ControlEdge 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 dual 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 **22**) (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.

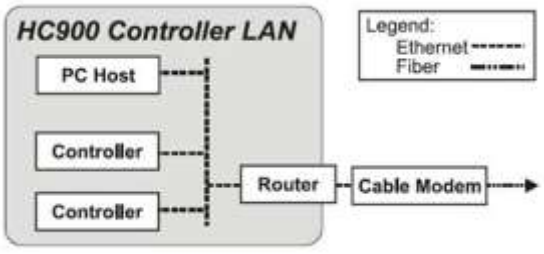


Figure 22 – Typical installation using a Cable Modem

2.8. Serial Ports

RS-232 and RS-485 for legacy systems

Overview

(RS-232 and RS-485 for legacy systems and two galvanically isolated RS-485 ports for new systems)

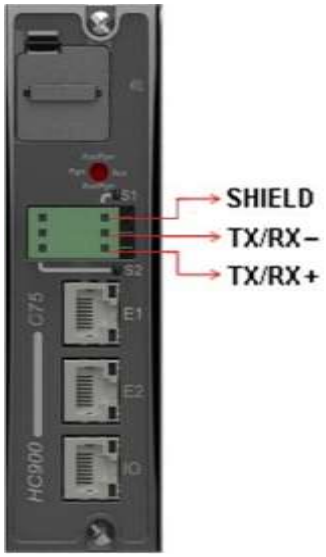


Figure 23 – Controller Serial Ports

- For Legacy systems, the 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 49). *For RS-232 cable connections see page 154. For RS-485 connections see page 171*.
- For new systems, either of two ports S1 and S2 can be configured as RS-485. For SIL applications communication cable shield connection must be made to IO grounding bar instead of the connector shield connector.
- Ports configurable as ELN (default) or Modbus RTU.
- Controller can act as Modbus host or device through either port.
- Controller can be modbus device to hosts such as
  - Honeywell HC Designer PC software
  - Third party PC HMI software
  - Third party Operator Interface
- Controller can be modbus host to devices such as
  - Any Honeywell Modbus device (e.g., recorders, controllers, flame safety)
  - Any non-Honeywell Modbus device.
- Only one host port at a time; can't have both serial ports as host ports.
- Modbus host ports default to modbus device ports, ELN protocol when CPUs are in Program mode.
- Baud rates to 115,200

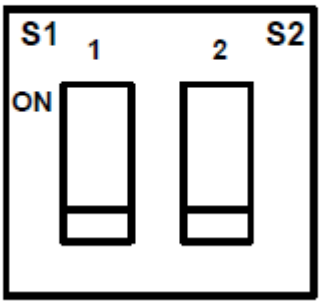
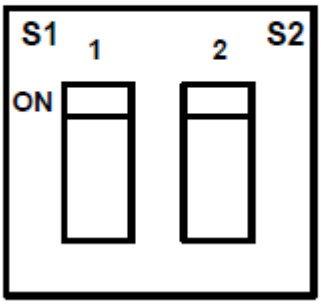
Setting serial ports S1 and S2 to RS-232 or galvanically isolated RS-485

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 (not shown).

For new systems, the serial ports S1 and S2 are galvanically isolated RS-485 unterminated (See Table 3 below).

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

RS-485 unterminated	RS-485 terminated (last link on network)
	

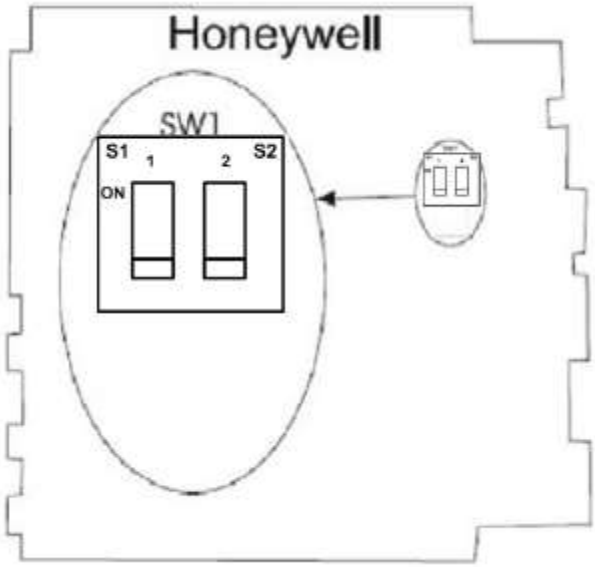


Figure 24 – Serial Ports DIP Switch default settings

3. Network and Security Planning

3.1. Overview

This document contains networking and security-related information applicable to ControlEdge HC900 process & safety controller. It provides information about the recommendations to assist you in planning, setting up, and maintaining a secure environment for your system

Assumptions and prerequisites

This guide is primarily intended for engineers, system administrators, and other technical staff who are responsible for planning the configuration and maintenance of a ControlEdge HC900 system. Therefore, it is assumed that the user must have technical knowledge and familiarity with the following:

- Microsoft Windows™ operating system (7, 8 and 10)
- Networking system and concepts
- Security issues and concepts

! Attention

As you derive a security program for your process control system you must be aware that detailed information, if not protected, can fall into the hands of organizations that could cause harm to your control system or process operations.

3.2. Security Checklists

This chapter provides a number of checklists to help you analyze the security issues that must be considered for your site.
The checklists cover some of the main threats that may exist on a process control network and the steps that can be used to mitigate against them.
Viruses and other malicious software agent
This threat encompasses malicious software agents such as viruses, spy ware (trojans), and worms.

The intrusion of malicious software agents can result in the following:

- Performance degradation
- Loss of system availability
- The capture, modification, or deletion of data
- Loss of prestige if the external access becomes public knowledge

Mitigation steps

- Ensure that your virus protection and Microsoft security hot fixes are up to date on all nodes in your process control network and the system connected to it.
- Ensure that there are no e-mail clients on any nodes of your process control network.
- Use a firewall for the business network to process control network interface.

Unauthorized external access

This threat includes intrusion into the process control system from the business network and possibly an intranet or the Internet.

Unauthorized external access can result in the following:

- Loss of system availability
- Incorrect execution of controls causing damage to the plant, or theft or contamination of product
- Loss of prestige if the external access becomes public knowledge
- Harm to personal safety or environment

Mitigation steps

- Use a firewall for the business network to process control network interface to restrict access from the business network to process control network.
- Set the minimum level of privilege for all accounts, and enforce a strong password policy.

Unauthorized internal access

This threat encompasses unauthorized access from systems within the process control network. This threat is the most difficult to counter since attackers may well have legitimate access to part of the system and they simply want to exceed their permitted access.

Unauthorized internal access can result in the following:

- Loss of system availability
- Incorrect execution of controls causing damage to the plant, or theft or contamination of product
- The capture, modification or deletion of data

Mitigation steps

- Ensure PC security
- Use physical security for process control network systems
- Do not allow the use of unauthorized removable media
- Use strong passwords on network equipment
- Prevent the use of unauthorized laptops on the process control network
- Use and enforce a strong password policy

Accidental system change

This threat encompasses inadvertent changes to executables or configuration files.

Accidental system change can result in the following:

- Loss of system availability
- Loss of data

Mitigation steps

- Set the minimum level of privilege for all accounts and enforce a strong password policy.

Protecting ControlEdge HC900 system components

This section lists the steps you can take towards securing your ControlEdge HC900 system.

PC installed with HC Designer

Protection measure

- Take steps to implement and enforce physical security.
- Enable the worksheet protection and enforce a strong password policy.
- Ensure that your virus protection and Microsoft security hot fixes are up to date on all systems.

Network components

Protection measure

- Take steps to implement and enforce physical security.
- Set the minimum level of privilege for all accounts and enforce a strong password policy.
- Refer to the firewall guidelines in section “Recommended firewall settings”

ControlEdge HC900 Controller:

- Implement and enforce physical access to controllers
- Make sure that the controller is running in RunLock mode by putting Key switch position accordingly. For more information, see the *ControlEdge HC900 Process & Safety Controller User and Installation Manual, #51-52-25-153*.
- Make sure that a Password is set for the controller. For more information, see the *ControlEdge HC900 Control Designer Software User Guide, #51-52-25-110*.
- Take steps to implement and enforce physical security of the network switch used in safety PDEcommunication shall.
- Take steps to implement and enforce physical access to the following system hardware:
    A. Expansion IO
    B. IO racks
    C. Expansion IO network switches

3.3. Backup and Restore

This chapter describes planning considerations for backup and restore policies and the tools that are supported for backing up and restoring your ControlEdge HC900 system.

Formulating a disaster recovery policy

As part of your security strategy, you must define a comprehensive backup and restore policy for disaster recovery purposes.

Consider the following when creating this policy.

- How frequently critical data and configuration changes. This dictates the frequency and completeness of backups.
- The safe onsite and offsite storage of full and incremental backups.
- The safe storage of installation media, license keys, and configuration information.
- Who is responsible for backups, and the testing, storing, and restoring of backups?

Backup and restore configurations

Use the ControlEdge HC Designer to backup and restore your project configuration.
For more information, see the ControlEdge HC Designer User’s Guide, #51-52-25-110.

3.4. Physical and Environmental Considerations

The physical security of a process control network is particularly important. If the hardware is rendered inoperable, the entire system (and hence the plant) is rendered inoperable.

Protecting against unauthorized system access

External media drives can enable anyone to bypass Windows security and gain access to your system. If there is an easy access to a computer, and it has a floppy disk or CD drive, it can be booted from an alternative operating system. This can be used to circumvent file system security, and could be used to install damaging software, or even to reformat the hard disk.
It is therefore of critical importance in relation to the nodes in your process control network that you prevent the use of all unauthorized removable devices and media such as CDs, DVDs, floppy disks, and USB memory sticks.

There are several other steps that can be taken to reduce the risk of unauthorized access, including:

- Setting the BIOS to boot only from the C drive.
- Setting a BIOS password (check that this does not prevent automatic startup).
- Physically securing the computer (for example, in a locked room or cabinet) or fitting locks to the floppy and CD drives.
- Removing (in extreme cases) the floppy and CD drives from the computer.
- Disabling USB ports and other ports capable of being used for memory sticks and other portable storage devices.

Control room access

Providing physical security for the control room is essential to reduce the potency of many threats. The area often contains the Engineering Workstation, ControlEdge HC900 system. Limiting those who can enter this area, using smart or magnetic identity cards, biometric readers and so on is essential. In extreme cases, it may be considered necessary to make the control room blast-proof, or to provide a second off-site emergency control room so that control can be maintained if the primary area becomes uninhabitable.

Network and controller access

ControlEdge HC900 controller is an intelligent programmable device, with the ability to be manipulated through loader software running on a laptop or similar computer connected directly to it. To prevent unauthorized tampering, the controllers and network equipment must be physically protected in locked cabinets, and logically protected with passwords or other authentication techniques. Network cables are also vulnerable to damage or unauthorized connection. For maximum protection, cabling must be duplicated and laid in separate hardened cable runs.

Physical access to critical devices

The malicious operation on the critical ControlEdge HC900 modules like Controller module, Scanner Module, network switches for IO network and host communication network, I/O Modules or Power supply modules will result in system shutdown, starting the system expectedly or impact process control. For maximum security, the ControlEdge HC900 system must be placed in a cabinet or locked closet to protect against unauthorized access to the critical modules.

3.5. Security Updates

Microsoft Security Updates and Service Packs

Microsoft releases a range of security updates and other operating system and software updates. Ensure that your virus protection and Microsoft security hot fixes are up to date on all nodes in your process control network and the system connected to it. Use a firewall for the business network to process control network interface.

Timely information on security updates can be obtained by subscribing to the Microsoft Security Bulletins at http://www.microsoft.com/technet/security/current.aspx

Virus Protection

Protection measure

- Choose supported antivirus software
- Installing antivirus software on Engineering Workstation
- Configure active scanning
- Tune the virus scanning for system performance
- Ensure frequent updates to antivirus signature files

3.6. Network Security

ControlEdge HC900 can be configured as dual controller system or non-redundant controller system. It includes provisions for communication via Ethernet with host systems.

Architecture

ControlEdge HC900 system has two network levels, level 1 network is used for internal I/O communication between controller and related scanners, level 2 is aimed for the communication with the third-party devices, HMI, SCADA or Engineering Workstation, take the following diagram as an example of system architecture.

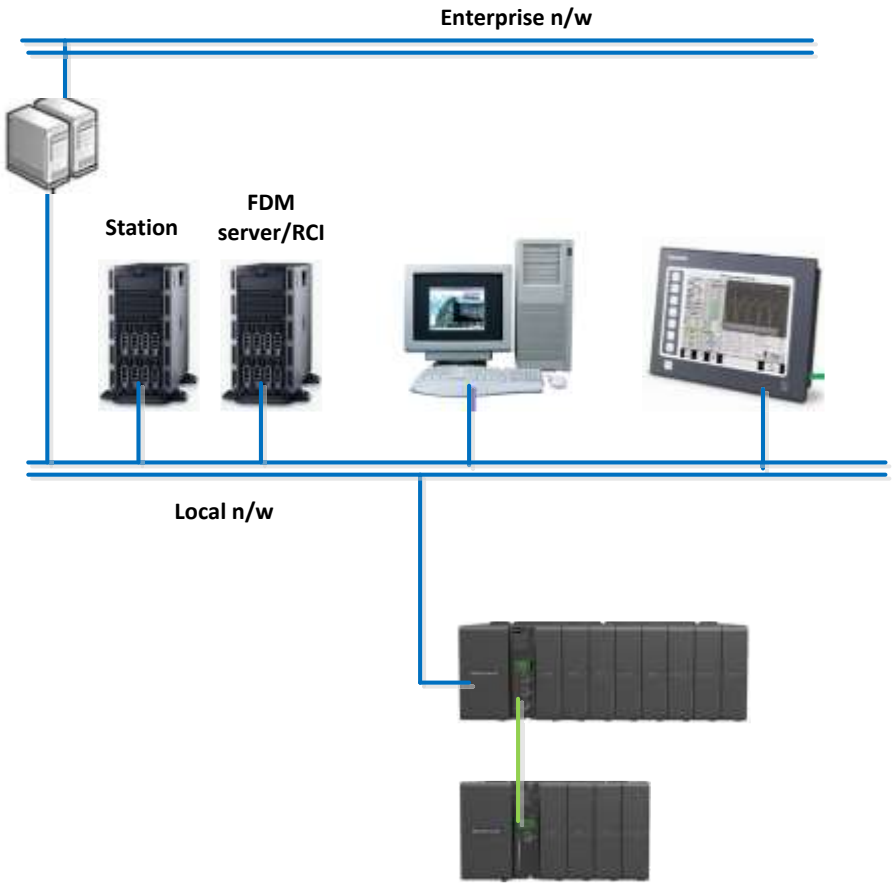


Figure 25 - System Architecture

At level 2 network, the Engineering Workstation, third party devices, HMI, FDM Server, HC900 and SCADA are connected. This local network must be isolated with external network.

CAUTION

The ControlEdge HC900-expansion I/O link is a private network and the switch used for the interconnection of the ControlEdge HC900 Processor and Scanners must not be connected to any other LAN or WAN. Likewise, no devices or communication traffic other than the ControlEdge 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, are those which link a ControlEdge HC900 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.
Note: Although the ControlEdge HC900 E1/E2 ports provide protection against Cyber-security/DOS type attacks, additional protection is required for safety applications using a firewall device configured to prevent uncontrolled messages into the controller.

Recommended firewall settings:

- ***Close all TCP and UDP communication to Ethernet ports into controller except:***
  - Modbus TCP port 502
  - Controller Peer to Peer (UDP port 502. Only if peer communication used.)
  - SNTP port 123 (ONLY if NTP server is enabled)
  - SMTP port 25 (ONLY if email used)
  - HART IP Interface port. It is user configurable (by default 5094). This is required if asset manager like FDM used.

- ***Rate Limiting***

In general, one host should not be allowed to occupy unlimited bandwidth. For example, "broadcast storms" could be caused by an incorrectly configured topology, or a malfunctioning device. Firewalls can prevent storms seen by the PLC ETH1/ETH2 ports. Limit rate of all traffic (Ingress/egress) to ETH1/ETH2 <= 3 MB/s.

- ***Denial-Of-Service***

Settings should also be enabled in the Firewall device if possible. These settings may include the following scan types Null, XMAS, NMAP-XMAS, SYN/FIN, FIN, NMAP-ID, SYN/RST, SYN, Flood and others.

Firewall device(s) should be introduced above the network at the control network level prior to the supervisory control network level. "Figure 1: System architecture".

Recommended network topology with safety peer communication

In the ControlEdge HC900 system where safety peer commwunication is required, it is recommended to have separate peer communication network and add port filtering of peer protocol (UDP port 502) on host communication switch. This ensures that the safety peer communication network is separate from the host network communication.

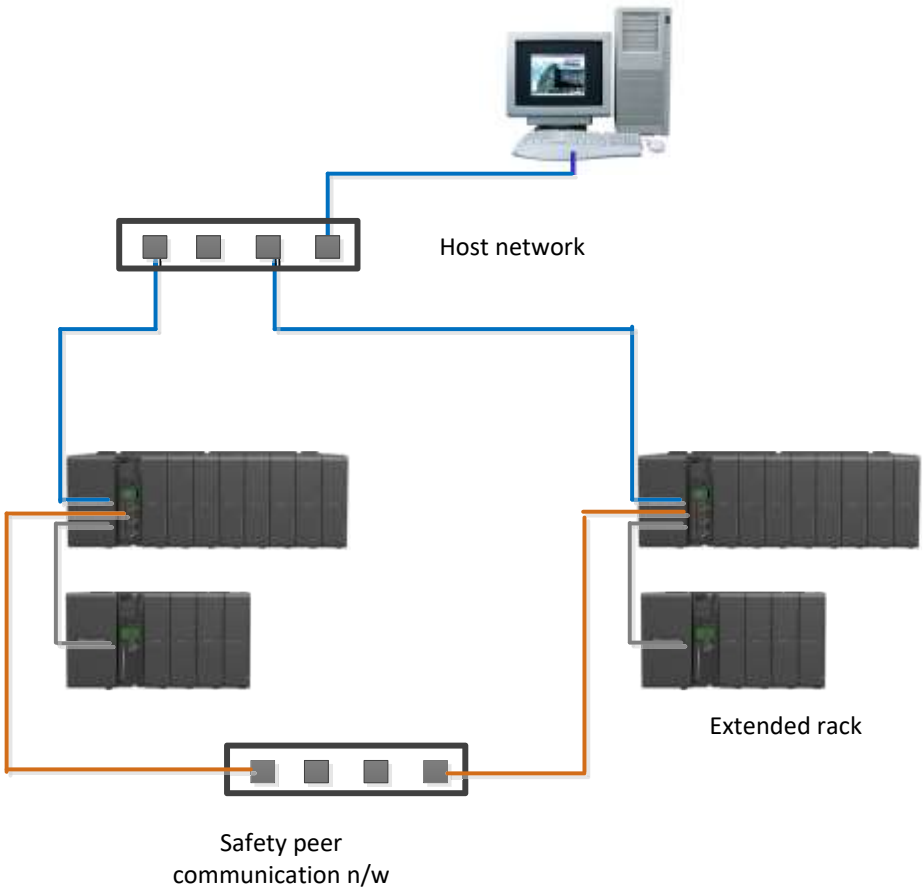


Figure 26 - System with safety peer communication

Communication from Remote location

It is not recommended to connect a ControlEdge HC900 controller installed in a remote location to the public network. The communication to ControlEdge HC900 controller installed in a remote location is recommended to be on a private leased line or secured by setting up VPN device external to the ControlEdge HC900.

The below figure illustrates a scheme of securely connecting to a remote location:

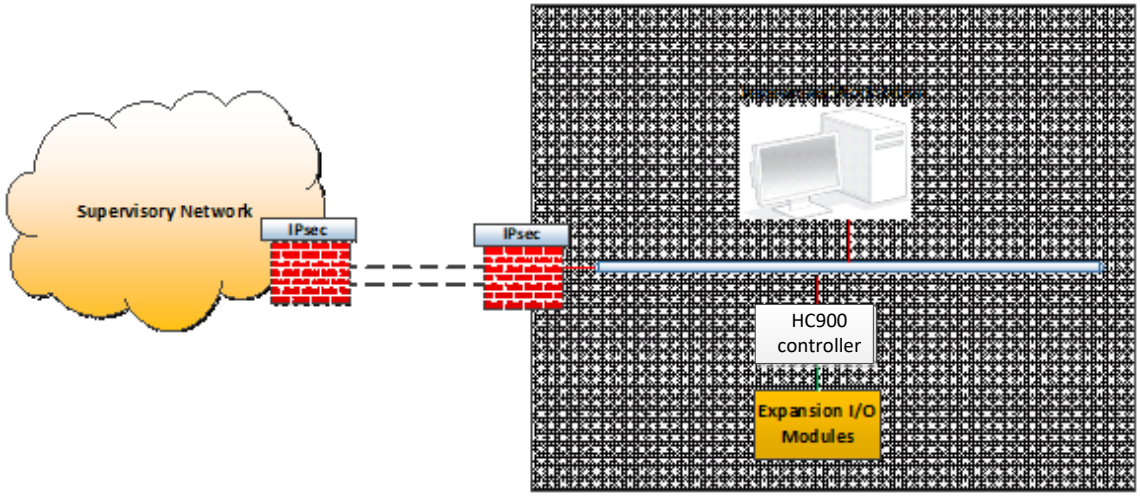


Figure 27 - Communication from Remote location

3.7. ControlEdge HC900 Security Features

Mode Switch

The Mode Switch on the front panel of controller provides a mechanism method to restrict certain operation on the ControlEdge HC900 system. Suggest to switch the Mode Switch to RUN position after commissioning to prevent unauthorized operations like firmware upgrade, configuration download to the running controller.
For more information, see “Controller Modes” in the ControlEdge HC900 Process and Safety Controller User and Installation Manual.

IP whitelisting

The ControlEdge HC900 controller can be configured to accept Modbus TCP writes and peer to peer (UDP) communication writes only from a specific list of IP addresses. This configuration can be done using HC designer tool.
For more information, see “Configure Modbus/Peer Write Access” in the ControlEdge HC900 Process and Safety Controller User and Installation Manual.

The ControlEdge HC900 can be configured to accept HART IP connection form a specific IP address. This can also configure using HC Designer tool.

Controller Password

This feature protects the controller from unauthorized users accessing the controller. It allows the user to set a password for the controller. This password must be provided while accessing the controller utility functions.
For more information, see HC Designer help file.
Note: The physical security for the ControlEdge HC900’s mode switch has to be maintained to prevent unauthorized controller password modifications.
It is a recommended practice to change the controller password periodically.

HART Interface and Channel Lock

User can lock the channel through IO Block for blocking the HART write commands at run time. (Universal and Common practice commands).
Lock can be removed during maintanence and device configuration.
Also, user can disable HART-IP protocol (by default disabled) on controller to avoid unwanted HART IP server connections.

Signed Firmware

HC900 redundant controller firmware C75, C75S, S2, and S2S files are signed and verified after code download by the controller. Digitally signed firmware (C75, C75S, S2 and S2S) for checking the integrity of the file content after download.

Notices

Third-party licenses
This product may contain or be derived from materials, including software, of third parties. The third party materials may be subject to licenses, notices, restrictions and obligations imposed by the licensor. The licenses, notices, restrictions and obligations, if any, may be found in the materials accompanying the product, in the documents or files accompanying such third party materials, in a file named third_party_licenses on the media containing the product, or at http://www.honeywell.com/ps/thirdpartylicenses.

Documentation feedback
You can find the most up-to-date documents on the Honeywell Process Solutions support website at: http://www.honeywellprocess.com/support. For immediate help with a technical problem, contact your local Honeywell Technical Assistance Center (TAC).

How to report a security vulnerability
For submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software.
Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services. To report a potential security vulnerability against any Honeywell product, please follow the instructions at:
https://honeywell.com/pages/vulnerabilityreporting.aspx.
Submit the requested information to Honeywell using one of the following methods:
• Send an email to security@honeywell.com.
• Contact your local Honeywell Technical Assistance Center (TAC) listed in the "Support" section of this document.

Support
For support, contact your local Honeywell Process Solutions Customer Contact Center (CCC). To find your local CCC visit the website, https://honeywellprocess.com/en-US/contact-us/customer-support-contacts/Pages/default.aspx.

Training classes
Honeywell holds technical training classes that are taught by process control systems experts. For more information about these classes, contact your Honeywell representative, or see http://www.automationcollege.com.

4. Pre-Installation Planning

4.1. 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 CPU requires 900P01 power supplies, C70R CPU requires 900P02 power supplies.
- I/O Rack can use AC Power Supply 900P01 (see page 61) or +24DC Power Supply 900P24 (see page 63).
- Limit of ten 4 channel, (five 8 channel or two 16 channel if powered from backplane) Analog Output modules can be installed per rack. Limit of 4 PFQ modules.
- Power Supply rack space (if using redundant I/O power) (see page 64)
- Rack orientation and mounting (see page 63)
- Remote Terminal Panels (see page 66)
- Environmental conditions (see page 66)
- Heat rise de-rating (see page 66)
- Cabling/wiring distance planning (see page 69)
- Electrical considerations: controller grounding, CE conformity, grouping wires, master control relay for emergency shutdown (see page 70)
- System monitor function blocks (see page 77)

4.2. 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 legacy. 1100 mA New.	0 mA	( )	(**0**)
Controller (C50 and C50S)	( )	930 mA legacy. 1100 mA New.	0 mA	( )	(**0**)
Controller (C70 and C70S)	( )	1150mA legacy. 1350 mA New.	0 mA	( )	(**0**)
Controller (C75/ C75S)	( )	1500 mA legacy. 1500 mA New.	0 mA	( )	(**0**)
Scanner 1 Port (S50/S50S)	( )	670 mA legacy. 750 mA New.	0 mA	( )	(**0**)
Scanner 2 Port (S75/S75S)	( )	770 mA , legacy. 950 mA New.	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	( )	( )
Safety Universal Input Output (16 pts)	( )	10 mA	100 mA	( )	( )
*Limit 10, 4 Channel 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-xxxx.	
4. Multiple column D total by 5.1	
5. Multiple column E 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
If the answer to 8 is Yes, use power supply 900P02-xxxx	
If the answer to 8 is No, use power supply 900P01-xxxx	

4.3. 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, 60W.

4.4. 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 28 and Figure 29. Vertical spacing of racks, which is required for rack ventilation and for routing wires, is shown in Figure 30.

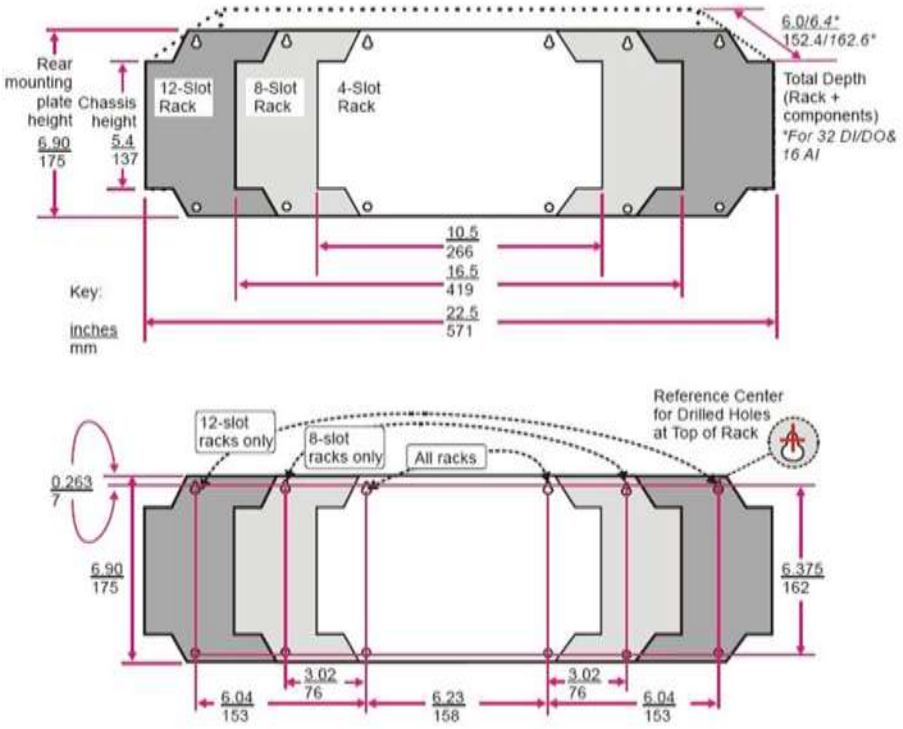


Figure 28 – Rack Dimensions

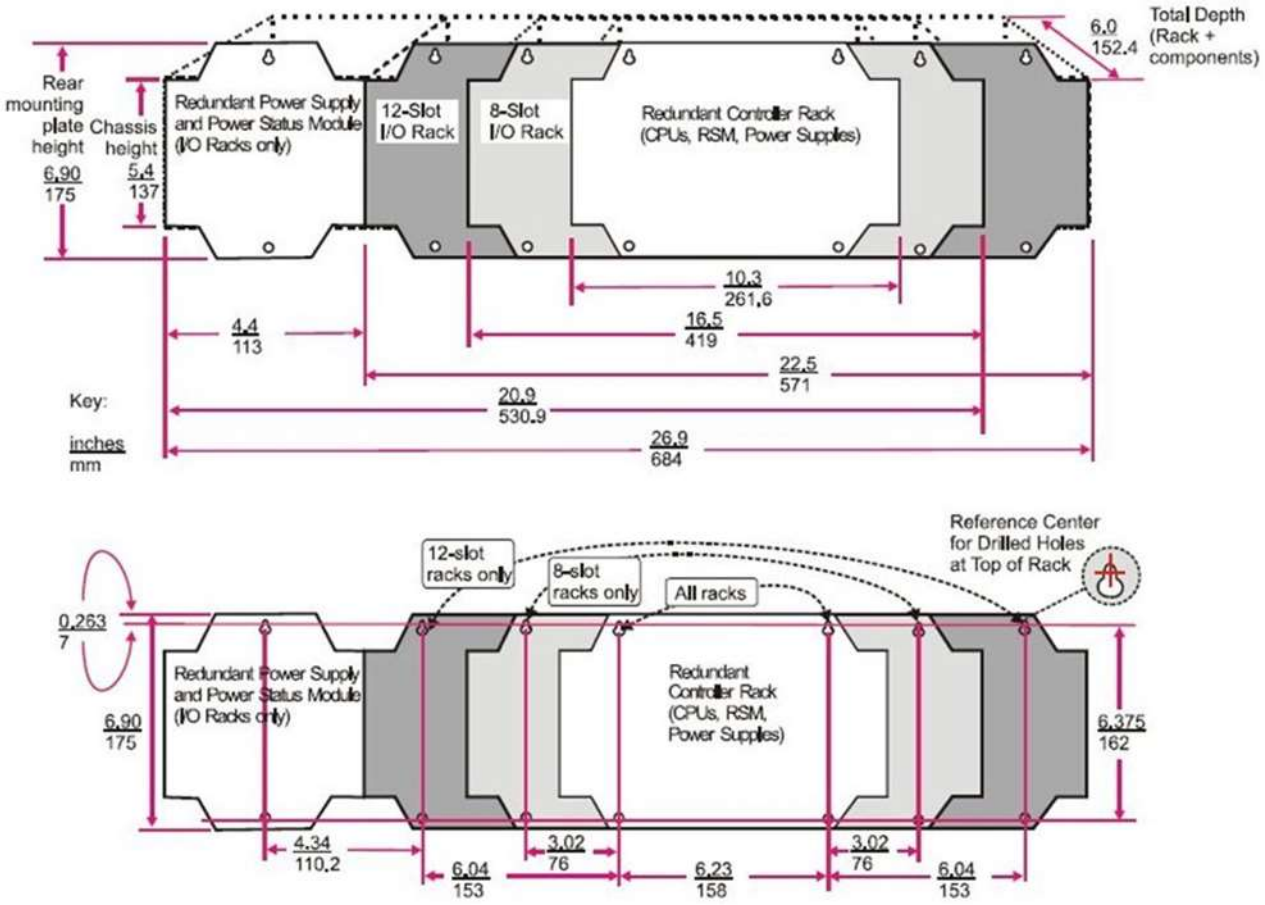


Figure 29 – Rack Dimensions with reserve power supply

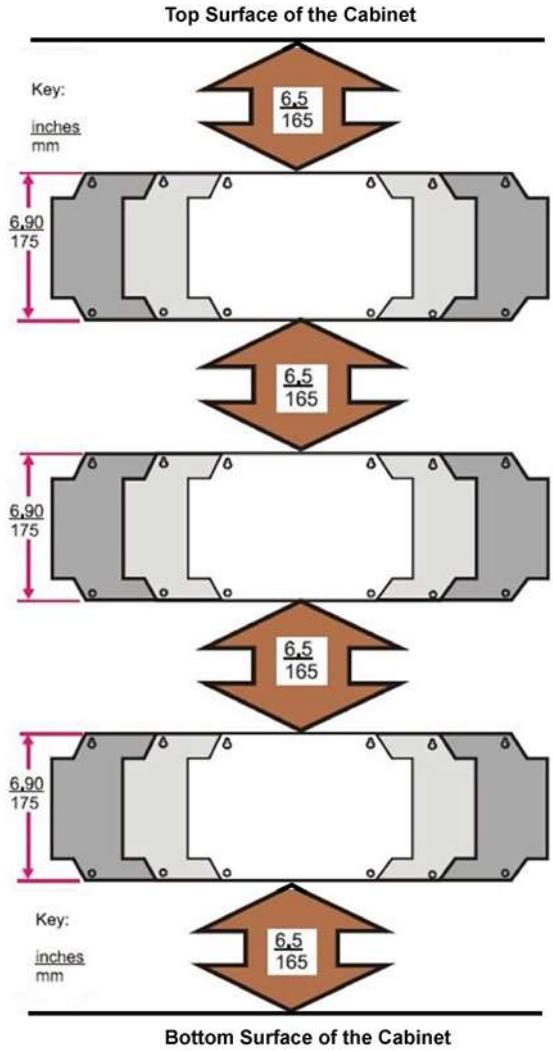


Figure 30 – Vertical Spacing of Racks (all models)

4.5. 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 227.

4.6. Environment

The ControlEdge HC900 Controller must be mounted in suitable equipment enclosures. That is, all components such as the Controller rack, I/O Racks, and the 900CS Control Station 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.

4.7. Heat Rise De-rating page

The ControlEdge 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 31.)
3. Limit the number of Analog Output modules to a maximum of 10 per rack. (see Figure 32.)
4. 900U02 modules may not be installed such that the 900U02 is between two 900B16 modules. 900B16 may only be installed in one adjacent slot.

4.8. Installation in Hazardous Location

CSA – Division 2:

1. Control Edge HC900 devices are for rack mounting in a suitable protective enclosure, in accordance with the Honeywell's instruction, subject to acceptance by the local authority having jurisdiction.
2. All the HC900 Models mentioned are Equipment Class I, Pollution Degree 2, Installation Category II, Continuous operation.

FM – Division 2:

Specific condition of use

1. Shall be installed in compliance with then enclosure, mounting, spacing and segregation requirement of the ultimate user application.

ATEX – Zone 2:

Specific condition of use

1. The 900 Control system must be installed in a location with a minimum degree of protection of IP54 in accordance with EN60079-15 or EN60079-7 and in a tool-secured enclosure which meets the requirement of EN60079-15 or EN60079-7 in the ultimate application.
2. Control edge IO models are Equipment Class I, Pollution Degree 2, Installation Category II, Continuous operation.

Table 4 – Power Applied, by Module Type

Module	ControlEdge HC900 Hardware Power (Watts)	Field Power (Watts)	Total Power (Watts)
Controller C30 and C30S	6.0	0.0	6.0
Controller C50 and C50S	6.0	0.0	6.0
Controller C70 and C70S	7.1	0.0	7.1
Controller C75 and C75S	7.8	0.0	7.8
Redundancy switch module (RSM)	0.1	0.0	0.1
Power Status Module (PSM)	0.1	0.0	0.1
Scanner 1 Port (S50/S50S)	3.9	0.0	3.9
Scanner 2 Port (S75/S75S)	5.0	0.0	5.0
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
Universal IO (16 Pts)	2.45	4.5	6.95

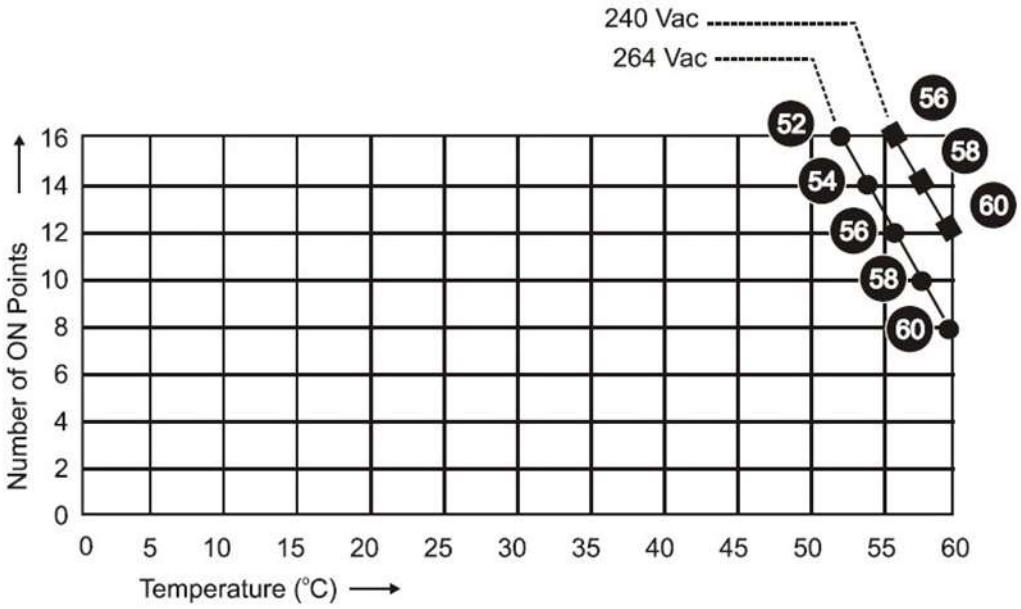


Figure 31 – AC Input Module de-Rating

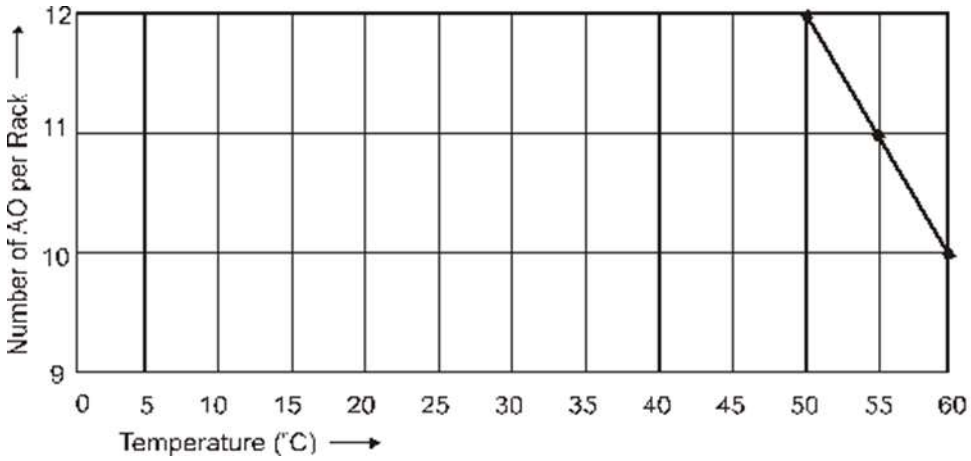


Figure 32 **– Power Supply de-Rating**

4.9. Cable/Wiring Distance Planning

For all installations observe the following guidelines.

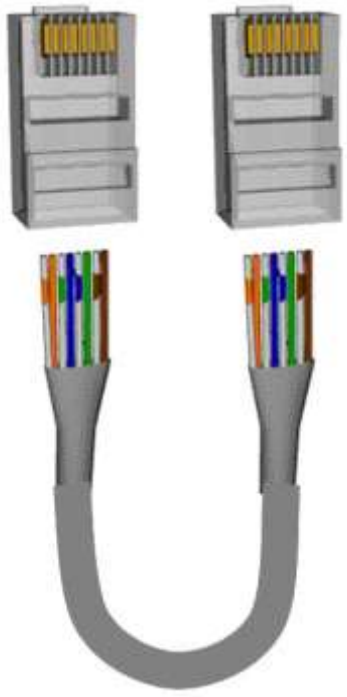
- Maximum length of RS-232 cabling (Controller to PC) is 50 feet (15.2 meters).
- Maximum length of RS-485 cabling is 2000 feet (609.6 meters).
- For Ethernet connections, cable length must be less than 100m. For greater than 100m a switch is required. The use of Ethernet cables in excess of 100 meters and/or devices other than recommended Switches will cause transmission delays on the I/O link which could have adverse affects on Controller performance.
- You can also use fiber optic cable for connections between the controller and a remote rack. Please refer to ControlEdge HC900 specification document (51-52-03-31) for more details.
- 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.
- 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 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. 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.

4.10. 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 33 – Cabinet Wiring, Single Chassis, and Figure 34 – Cabinet Wiring, Multiple Chassis. When Redundant power supplies are used in Redundant controller racks or I/O racks, separate line power sources are recommended to provide the highest level of redundancy and system operation.
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.

The L2/N to earth Ground must be < 0.50 VAC.

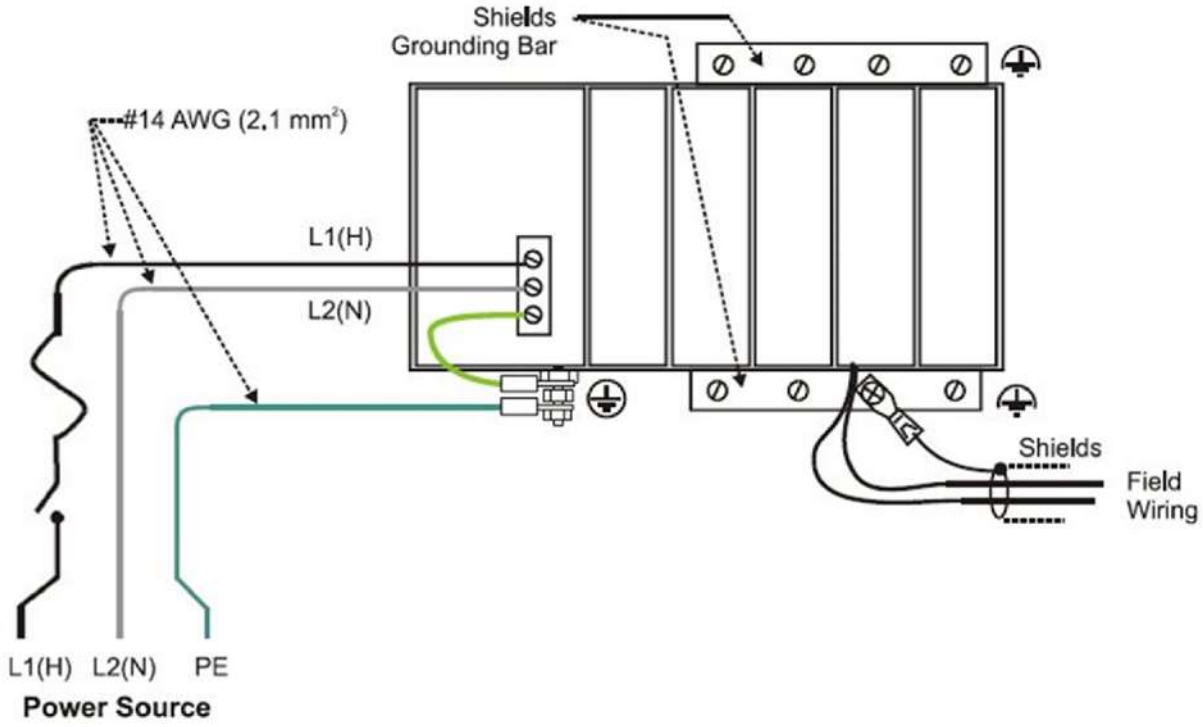


Figure 33 – Cabinet Wiring, Single Chassis

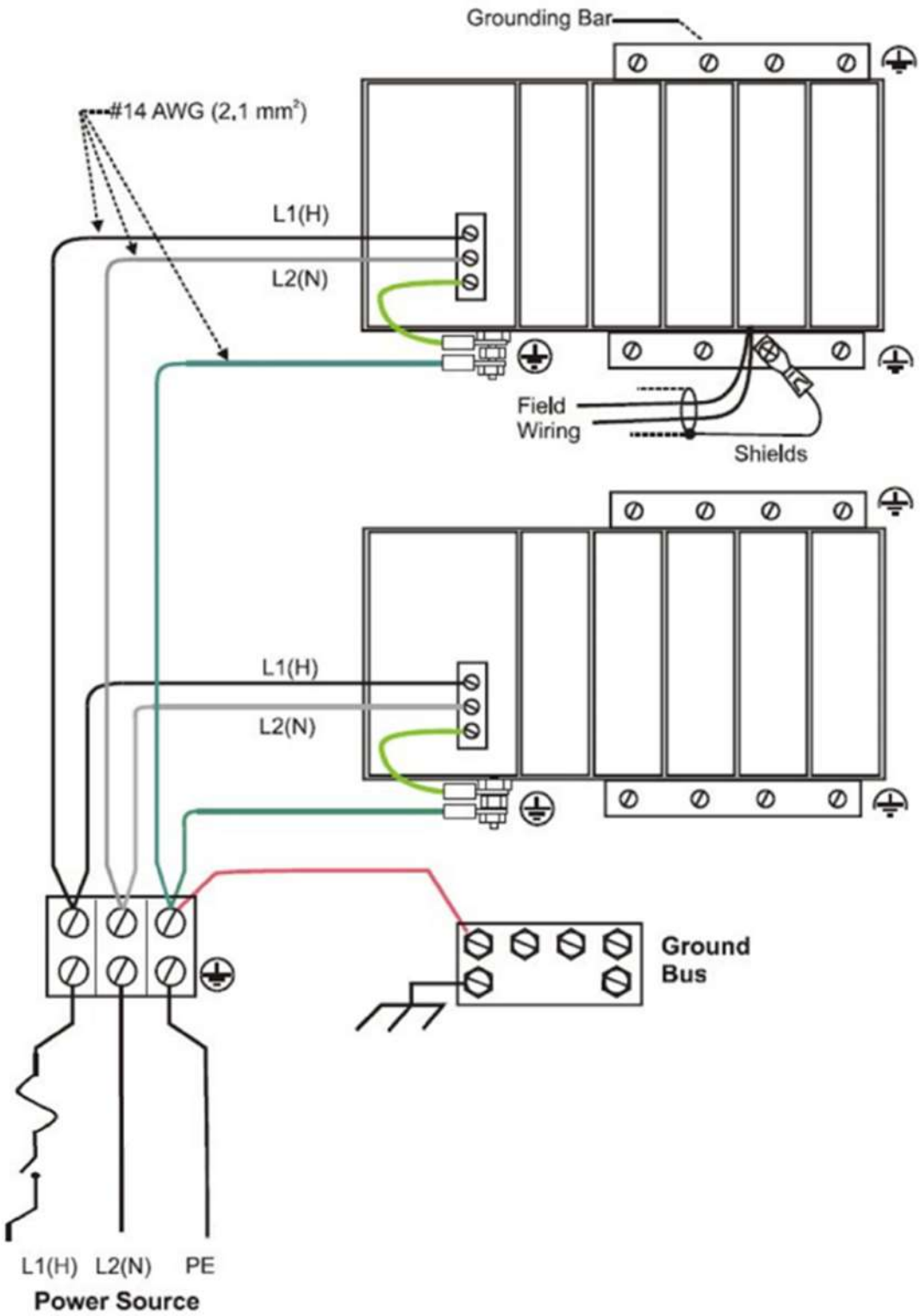
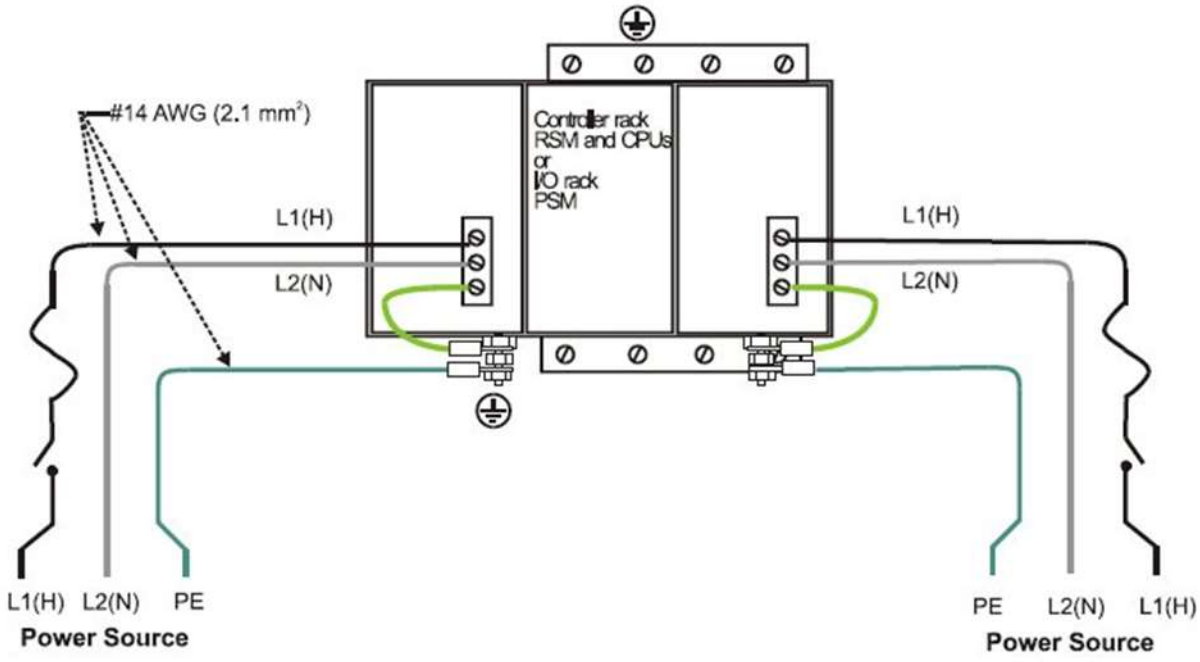


Figure 34 – Cabinet Wiring, Multiple Chassis



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.

Note: Quality Earth Ground is required. For P01 Power Supplies, voltage measured between: L2/N to Earth Ground to be <= 0.50 VAC.

Figure 35 – 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 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 91.
- 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 36.

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.

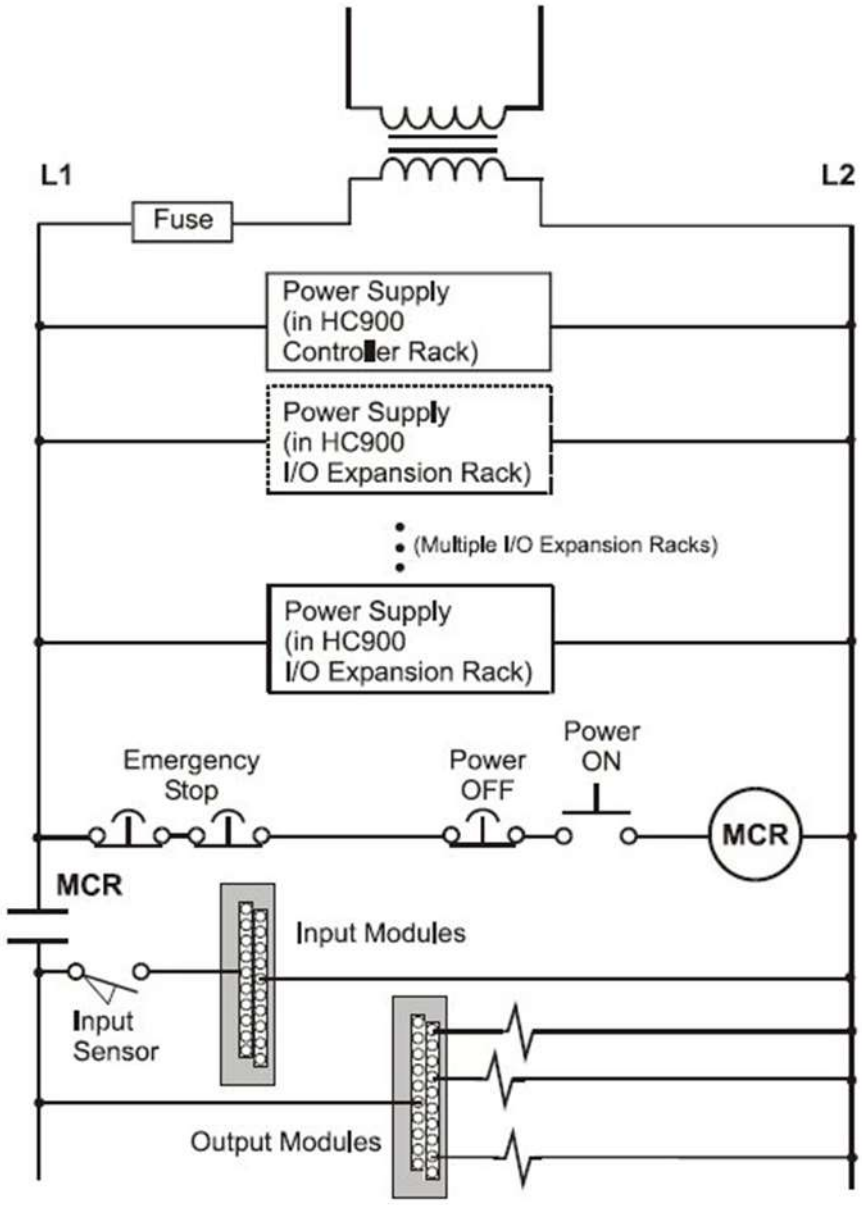


Figure 36 – Master Control Relay Wiring Example

4.11. Hardware and wiring requirements for safety configuration

For the function blocks for safety a special hardware configuration and wiring is required.
Below high level diagram explains the wiring concept for using the validation function blocks.

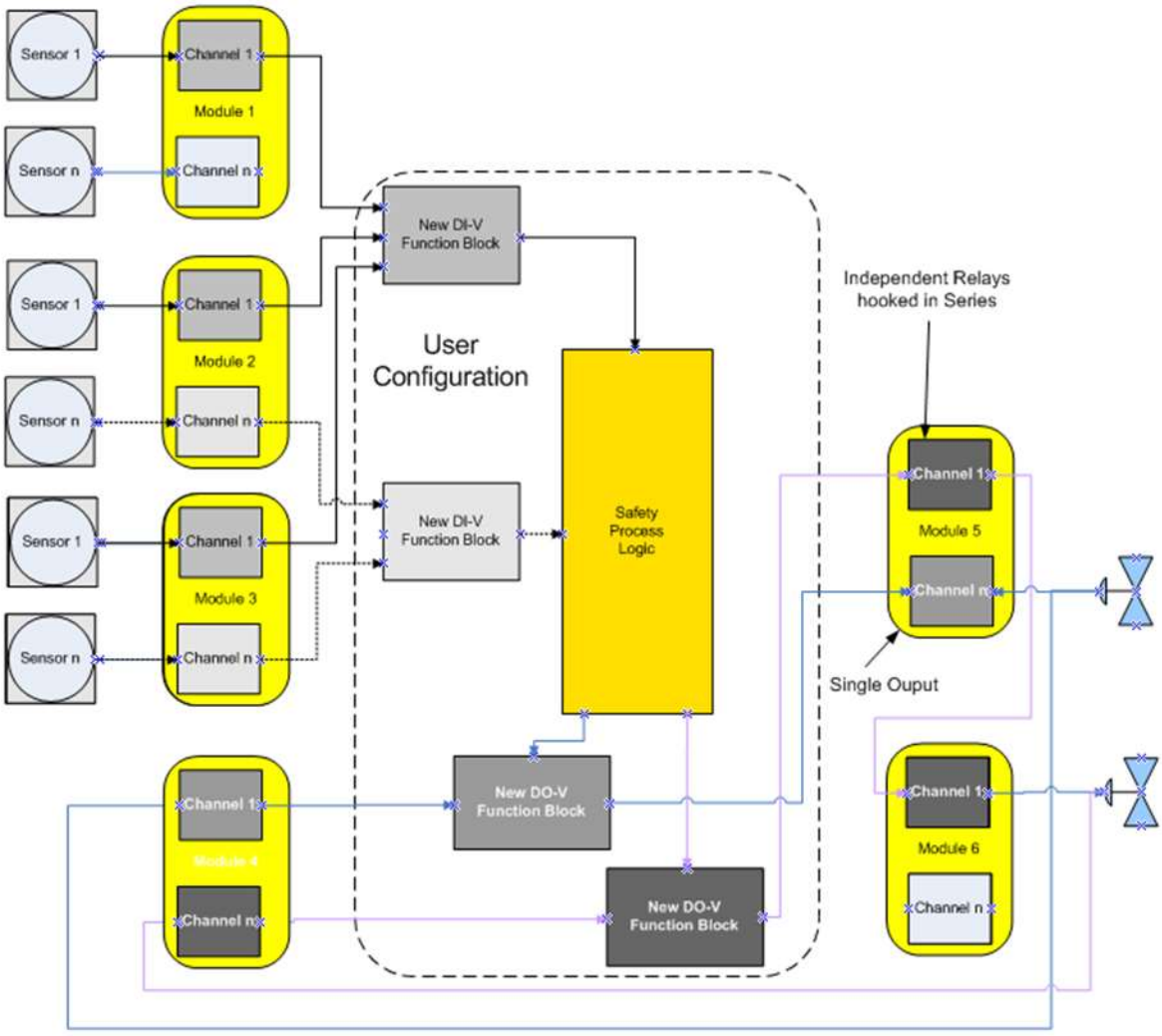


Figure 37 - IO-V function block connections

Figure 38, Figure 39, and Figure 40 demonstrate the connection of a series output relay's normally OPEN contact to protect against outputs that are stuck "ON". This relay may be added individually as shown in Figure 38 and Figure 39 or common for multiple channel outputs as shown in Figure 39 and Figure 40. The series output must be configured to operate when the DO-V's or AO-V's Fail pin or VFail pin goes "ON".

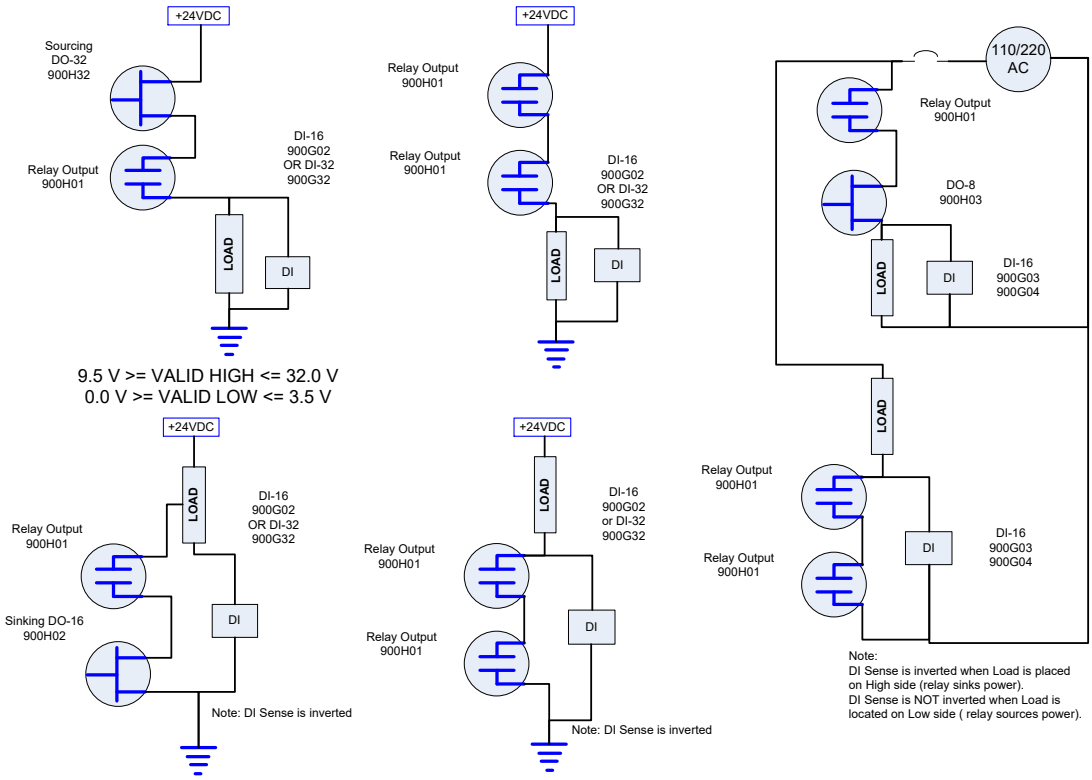


Figure 38 – Individual Series DO connections

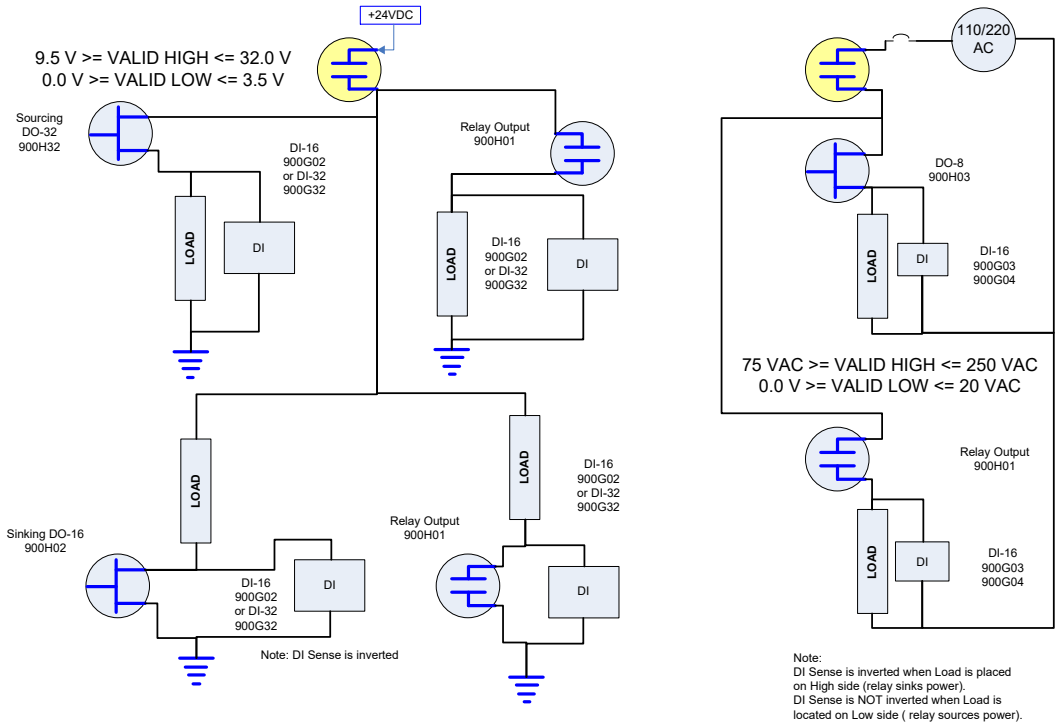


Figure 39 – Common Series DO connections

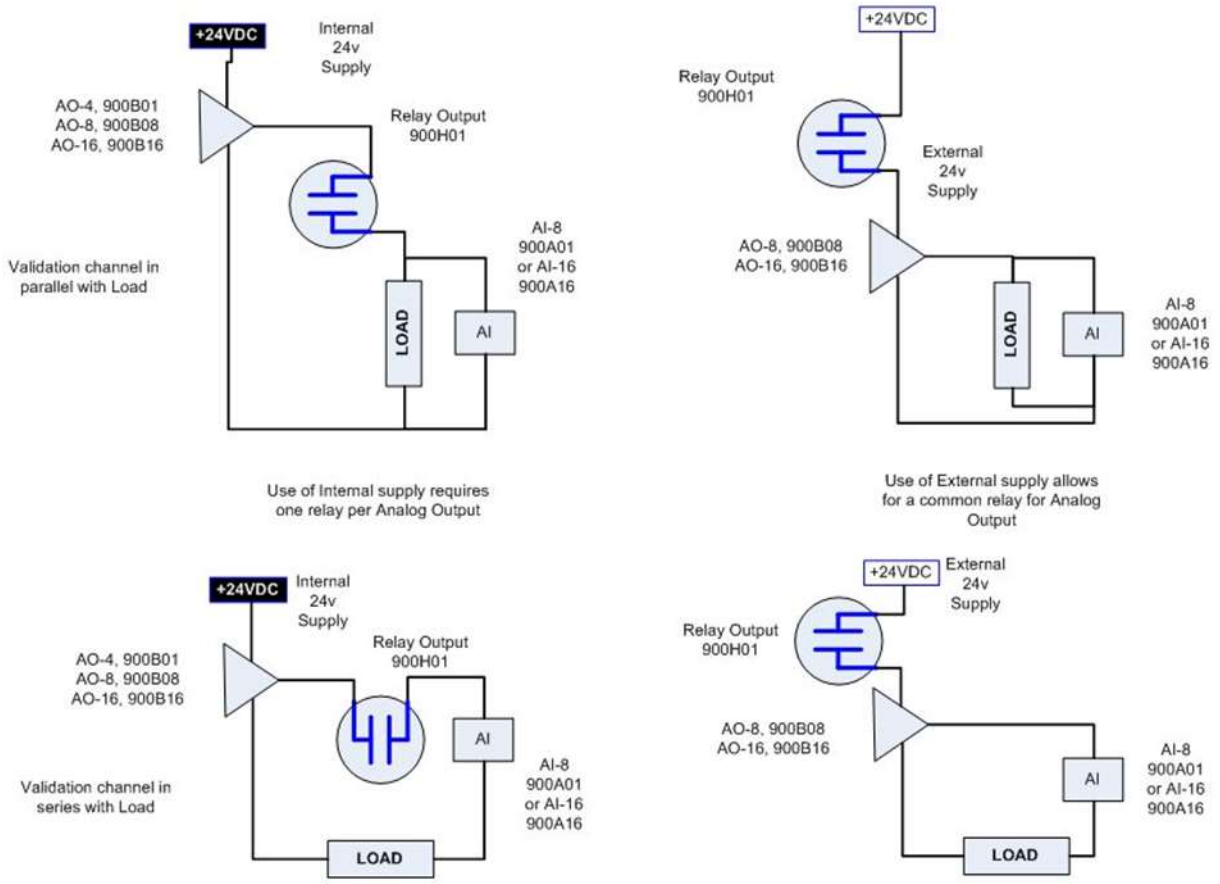


Figure 40 – Series Relay for Analog Outputs

4.12. System Monitor Function Blocks

The ControlEdge 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
- FMON – Fault Monitor

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

5. Rack Installation

5.1. Overview

This section contains procedures for installing one or more ControlEdge 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. ABS installations require additional protection from the environment and must be installed in a grounded metal enclosure.
Note: Un-configured racks will not be detected in 100ms base cycle mode and it is not recommended to connect to IO network/switch

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

Equipment Preparation

A checklist for site preparation is given in Table 7.

Table 7 – Site and Equipment Preparation

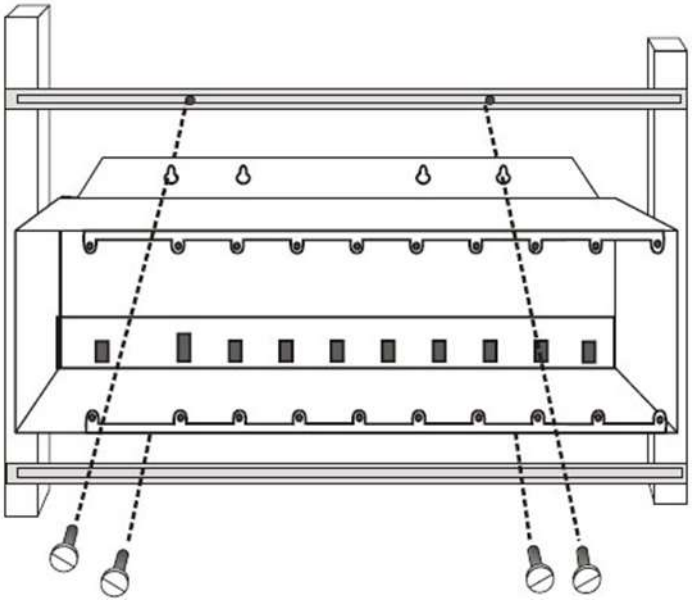
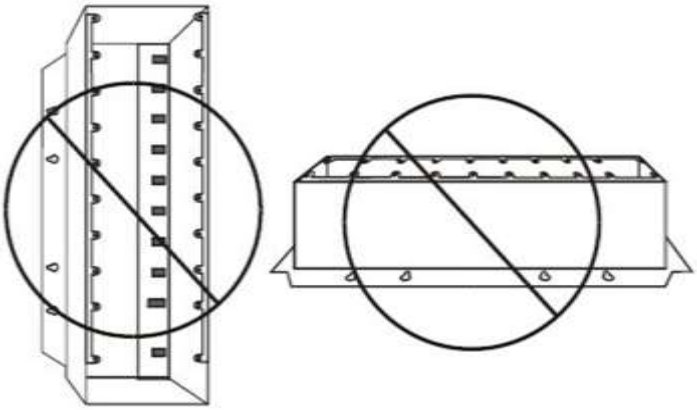
Step	Procedure	Reference
1	Verify that sufficient numbers of the following items are on hand: • Racks (4-, 8- and 12-slot) • Power Supplies: 1 per rack or 2 per rack if redundant powered rack. • C30/C50/C70 Controller Module or Scanner 1 port (1 per rack) • Redundancy: – Each Controller Rack: 2 Power 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

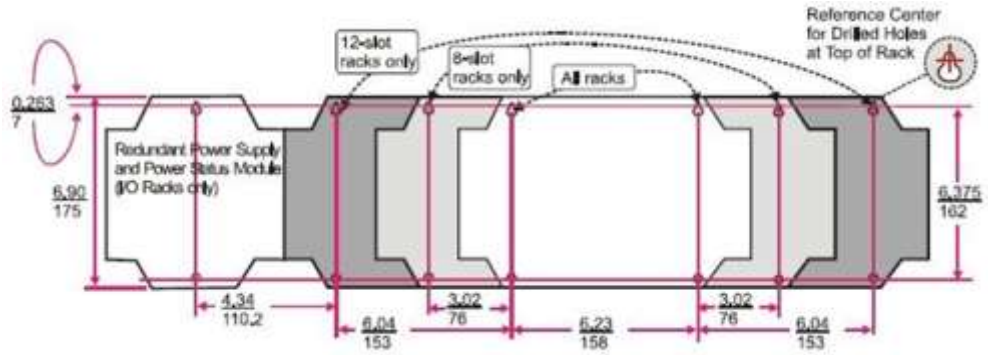
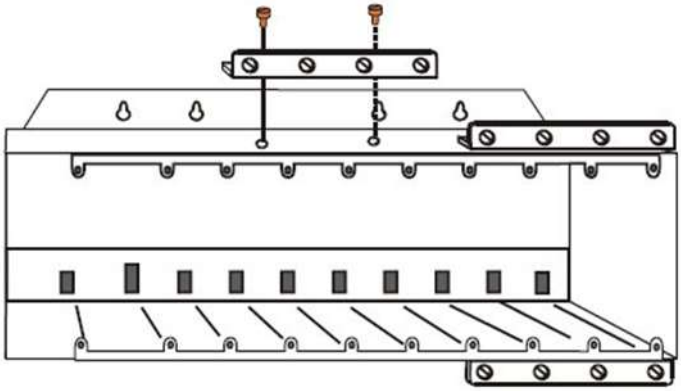
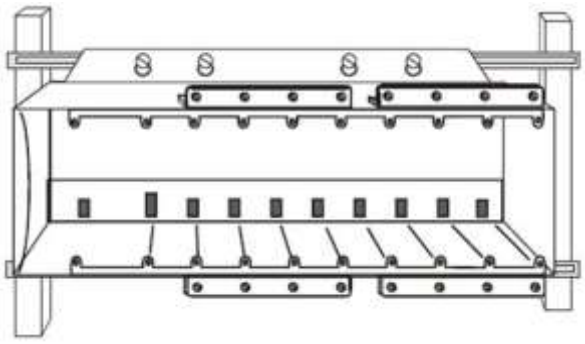
Step	Procedure	Reference
2	Install (or verify correct installation of) enclosures for ControlEdge HC900 Controllers and ancillary equipment: • Mounting rails or flat-panels • (for cabinet with multiple ControlEdge HC900 Chassis): – grounding bus – barrier strip for AC power • Master control Relay	Mount Racks Table 8 – Mount Rack
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 ControlEdge 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 91.
5	Arrange and organize items to be installed at or near enclosures.	

5.2. Mount Racks

Rack assembly information is given in Table 8.

Table 8 – Mount Racks

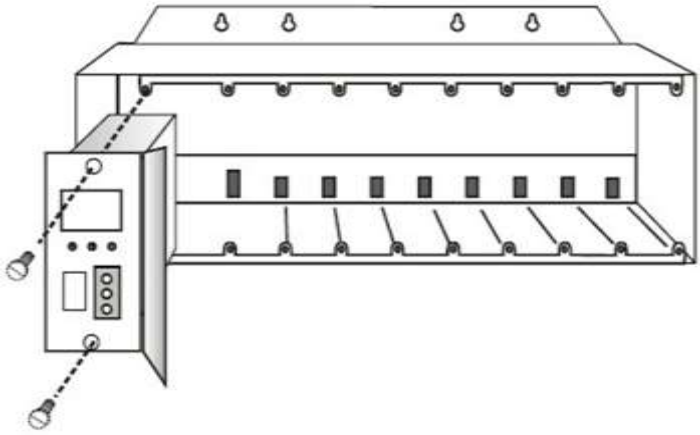
Step	Procedure	Comments/References
1	Mount the Rack in the enclosure as follows. • Using the diagrams below as a guide, mark the locations for rack mounting in the enclosure for the top holes in the rack. **(See CAUTION and Note at right.)** • Drill and tap for # 10 (or M4) screws. • Start the mounting 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. 

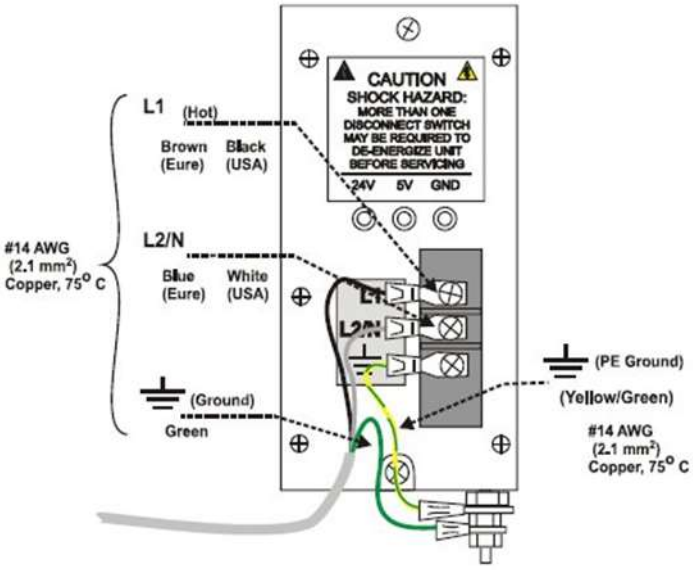
Step	Procedure	Comments/References
		
2	Aluminum grounding bars for I/O module wiring are optional. They can be mounted at top, at bottom, or at top and bottom of the rack, as indicated at right. If grounding bars are included, attach them with two M3 screws (supplied with grounding bars in plastic bag). M3 Screw torque: 0.4/ 0.6 NM (3.5/ 5.3 in/lb). M4 Screw torque: 1.3/ 1.5 NM (11.5/ 13.2 in/lb) **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.	

5.3. 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. Torque to 0,4-0,5 N.m (3.5 – 4.4 Lb-In).	
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 and disconnect is recommended. 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. It is measured from the backplane.	**ATTENTION!** **Do not connect PE Ground (Green) Wire directly to terminal on Power Supply.**   **Image shows strain relief**

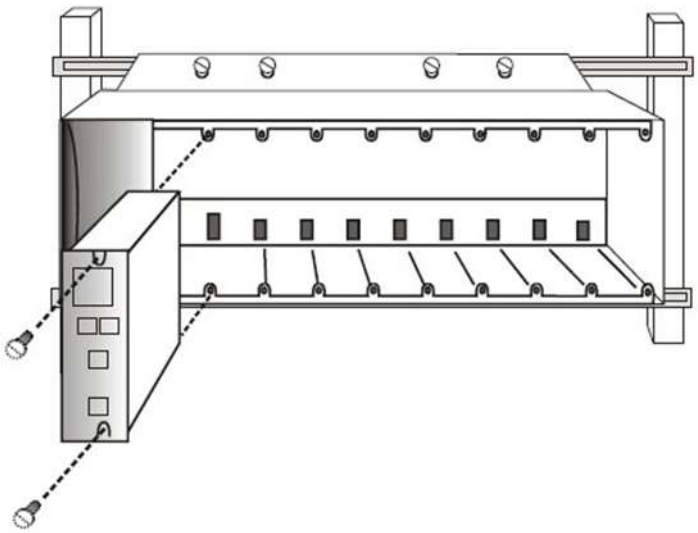
Step	Procedure	Comments/References
3	**⚠ WARNING** Ensure that AC power to the rack is disconnected. Set controller module's communication ports to desired settings (page 48). Carefully place the Controller Module in the rack, immediately to the right of the Power Supply. Fasten it in place with two captured screws at top and bottom. Torque to 0,4-0,5 N.m (3.5 – 4.4 Lb-In). **ATTENTION:** **Do not install the battery at this time. Installing the battery(s) 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 217.)	
4	I/O will be installed later.	See Page 91.

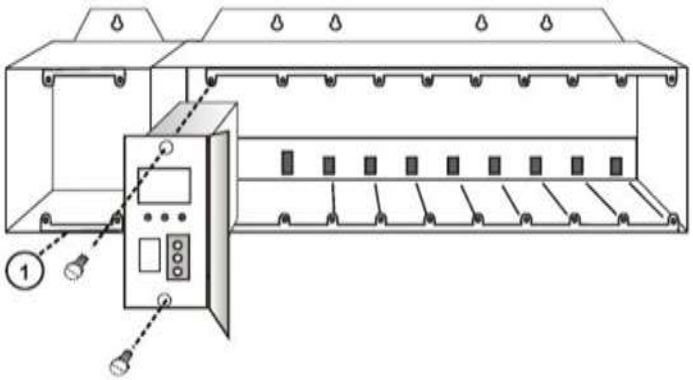
Table 10 – Assemble C75 Controller Rack

Step	Procedure	Comments/References
1	Carefully place the Power Supplies in the slots in the Rack, ensuring that the connector at the back seats properly. See Table 9 steps 1 and 2 for power supply wiring details. Note: It is recommended each power supply should be powered from a separate power source and a power switch should be installed to allow for servicing of each Processor/Supply separately.	
2	Set controller communication ports.	See page 48.
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. Torque to 0,4 -0,5 N.m (3.5 – 4.4 Lb-In). **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 217.)	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.

5.4. 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 9 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 wiring details.

<table>
<tr><th>Step</th><th>Procedure</th><th>Comments/References</th></tr>
<tr><td>3</td><td>Set scanner address for the I/O rack using the Scanner Module DIP switches on SW3 (shown at right). For C50/C70, use addresses 1-11. For C75, use addresses 1-12.

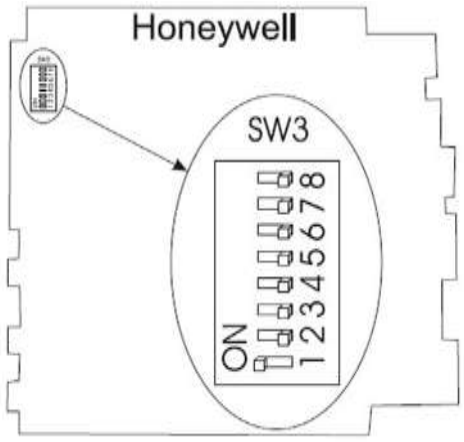
Scheme 1 (upto 5 racks):

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

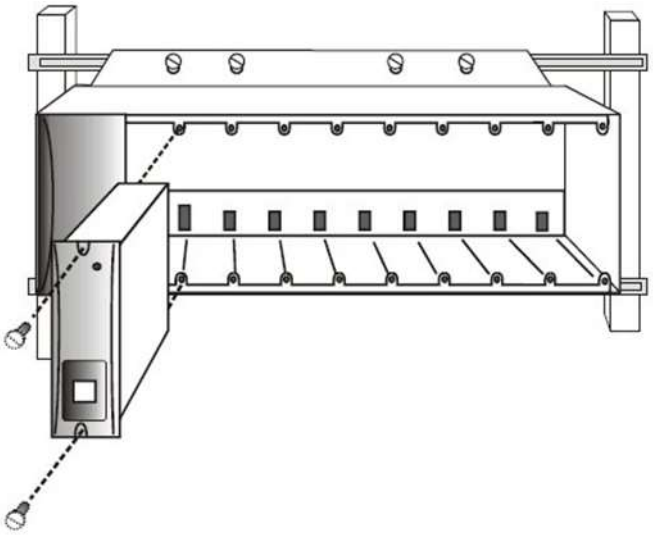
Scheme 2 (upto 12 racks):

DIP switch 6 ON Always and

1 ON = Scanner 1
2 ON = Scanner 2
2 & 1 ON = Scanner 3
3 ON = Scanner 4
3 & 1 ON = Scanner 5
3 & 2 ON = Scanner 6
3 & 2 & 1 ON = Scanner 7
4 ON = Scanner 8
4 & 1 ON = Scanner 9
4 & 2 ON = Scanner 10
4 & 2 & 1 ON = Scanner 11
4 & 3 ON = Scanner 12

A small slotted screwdriver or paperclip works well; avoid pencils.</td><td> 

<table>
<tr><th colspan="7">C50/C70 I/O Rack DIP Switches</th></tr>
<tr><th></th><th colspan="6">Scheme 2: DIP Switch</th></tr>
<tr><th>Rack</th><th>#1</th><th>#2</th><th>#3</th><th>#4</th><th>#5</th><th>#6</th></tr>
<tr><td>2</td><td>ON</td><td></td><td></td><td></td><td></td><td>ON</td></tr>
<tr><td>3</td><td></td><td>ON</td><td></td><td></td><td></td><td>ON</td></tr>
<tr><td>4</td><td>ON</td><td>ON</td><td></td><td></td><td></td><td>ON</td></tr>
<tr><td>5</td><td></td><td></td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>6</td><td>ON</td><td></td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>7</td><td></td><td>ON</td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>8</td><td>ON</td><td>ON</td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>9</td><td></td><td></td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>10</td><td>ON</td><td></td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>11</td><td></td><td>ON</td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>12</td><td>ON</td><td>ON</td><td></td><td>ON</td><td></td><td>ON</td></tr>
</table>
<table>
<tr><th colspan="7">C75 I/O Rack DIP Switches</th></tr>
<tr><th></th><th colspan="6">Scheme 2: DIP Switch</th></tr>
<tr><th>Rack</th><th>#1</th><th>#2</th><th>#3</th><th>#4</th><th>#5</th><th>#6</th></tr>
<tr><td>1</td><td>ON</td><td></td><td></td><td></td><td></td><td>ON</td></tr>
<tr><td>2</td><td></td><td>ON</td><td></td><td></td><td></td><td>ON</td></tr>
<tr><td>3</td><td>ON</td><td>ON</td><td></td><td></td><td></td><td>ON</td></tr>
<tr><td>4</td><td></td><td></td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>5</td><td>ON</td><td></td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>6</td><td></td><td>ON</td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>7</td><td>ON</td><td>ON</td><td>ON</td><td></td><td></td><td>ON</td></tr>
<tr><td>8</td><td></td><td></td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>9</td><td>ON</td><td></td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>10</td><td></td><td>ON</td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>11</td><td>ON</td><td>ON</td><td></td><td>ON</td><td></td><td>ON</td></tr>
<tr><td>12</td><td></td><td></td><td>ON</td><td>ON</td><td></td><td>ON</td></tr>
</table></td></tr>
<tr><td>4</td><td>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.</td><td>  </td></tr>
<tr><td>5</td><td>I/O will be installed later.</td><td>See Page 91.</td></tr>
</table>

6. I/O Module Installation and Wiring

6.1. Overview

This section contains descriptions of and procedures for installing I/O Modules in controller racks (C30/C30S, C50/C50S, C70/C70S, models) and in I/O expansion racks (S50/S50S, S75/S75S only).

6.2. Module Placement in Racks

Each input or output module is placed in an I/O slot in a rack as shown in Figure 41.
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.

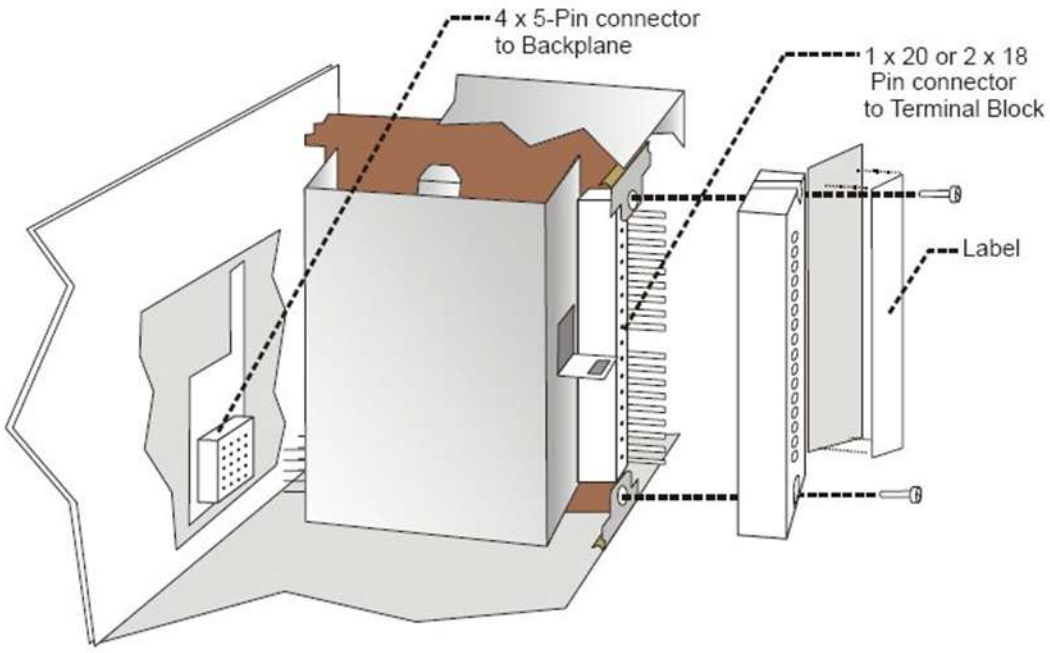


Figure 41 – I/O Module Installation

⚠ 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 to proper torque settings before applying field power to the module. Torque to 0.4 – 0.5 Nm (3.5 – 4.4 Lb-In.)
- Do not apply energized ("live") field wiring to an input/output module that is not installed in one of the racks in the ControlEdge 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 900TBx-... barrier style, shown at left in Figure 42, and the 900TEx-... Euro style, shown at right. Not shown: A 900TCx-... 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.

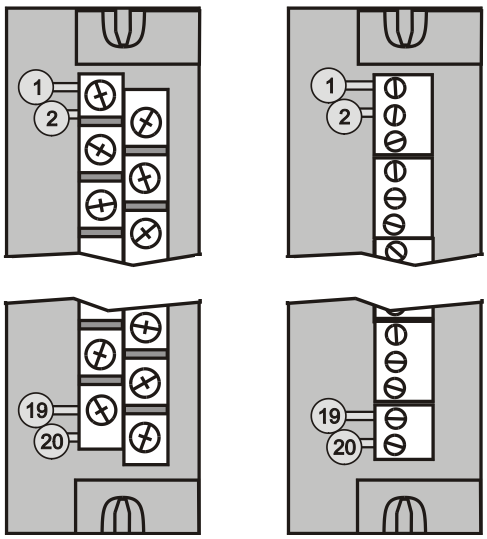


Figure 42 – Terminal Block Styles

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 97.

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 analog inputs, 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, 32-point DO modules and 16-point Isolated DI.
- Terminal blocks must 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.

6.3. Remote Termination Panel (RTP)

The optional RTP (RTP is mandatory for redundancy) provides an easy way to connect the ControlEdge 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.
For Redundant RTP installation procedure, refer to “51-52-33-134”, “51-52-33-135”, “51-52-33-136” and “51-52-33-170” documents.

6.4. 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 is recommended and 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 70). Also, all wires must be securely terminated, using appropriate wiring practices.

Signal Grounding

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 44. 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.

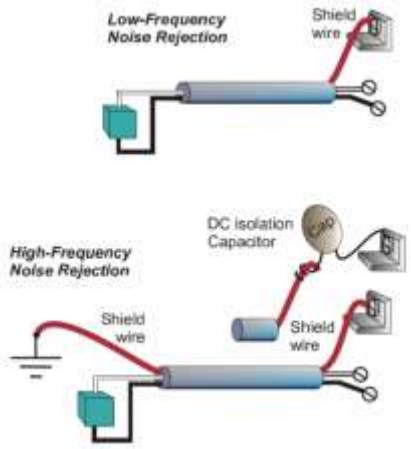


Figure 43 – Signal-Wire Grounding

The 900TSS-xxxx 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 44. 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 44. In this case, it is necessary to adjust wire length to ensure adequate flexibility of the twisted wires and to provide clearance sufficient to remove the I/O module.

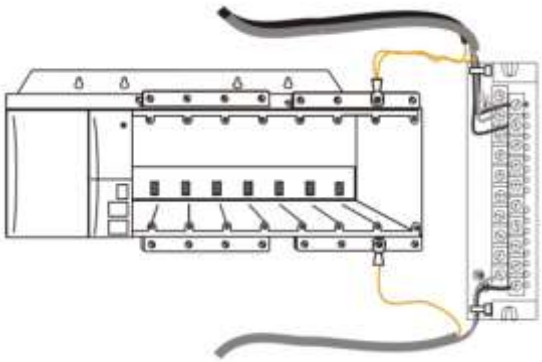


Figure 44 – Wire-Shield Grounding

Terminal Block Jumper Combs

Two styles of terminal block jumper combs are available for use with 900TBx-... barrier-style terminal blocks: 900J10-... ten-position and 900J02-... two position, see Figure 45.
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.

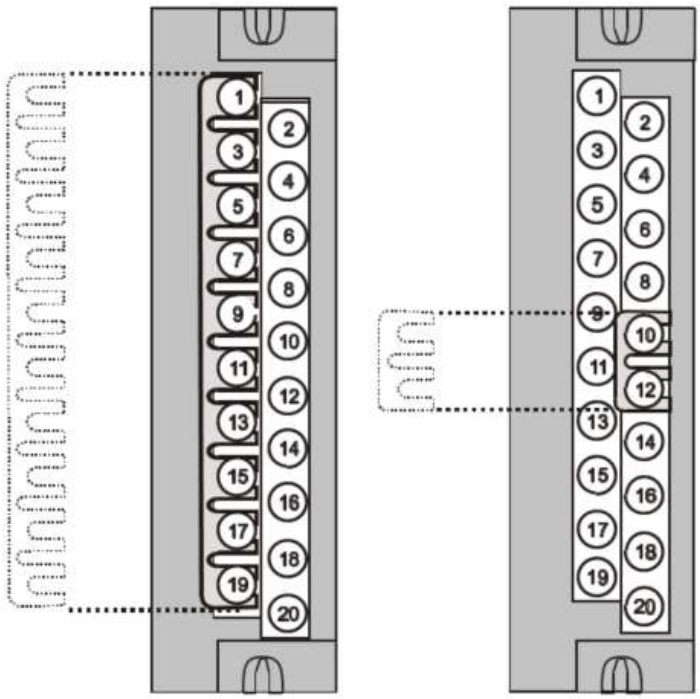


Figure 45 – Terminal Block Jumper Installation

6.5. 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.
In legacy systems, all of the I/O Module types in the ControlEdge 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. In new systems, the CPU and Scanner modules support RIUP. 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.

⚠ WARNING

In the redundant UIO configuration, de-enerzise the active AO channels before attempting to remove and/or replace any Redundant UIO module, particularly in a system that is actively controlling a process. To de-enrzise the AO channel, refer to the section "Redundant I/O Module Replacement" in "51-52-25-133" manual.

Table 13 – RIUP: Potential Hazards and Recommended Actions

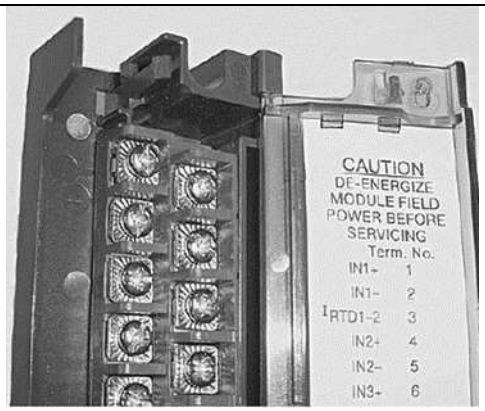
Hazard	Source	Preventive Action(s)
⚠ WARNING  **Hazardous Voltages**	Potentially lethal voltages on Terminal Boards associated with I/O Modules.	Disconnect all signals at terminal blocks from sources of power before removing the terminal block from the I/O module.
⚠ CAUTION **Loss of control or view 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.

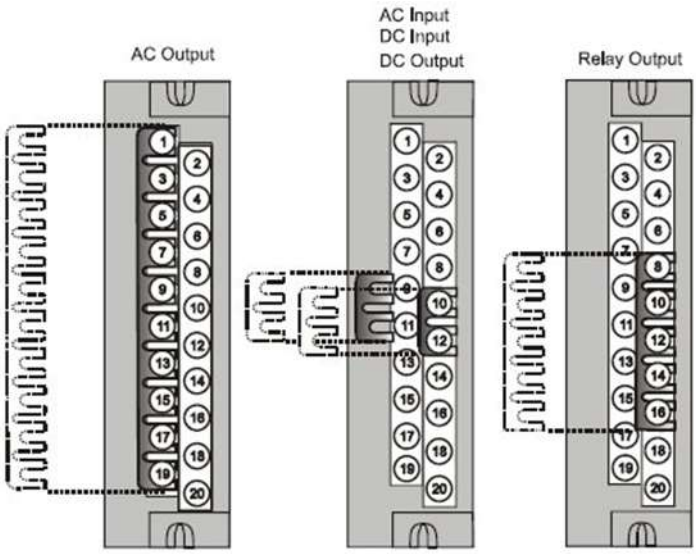
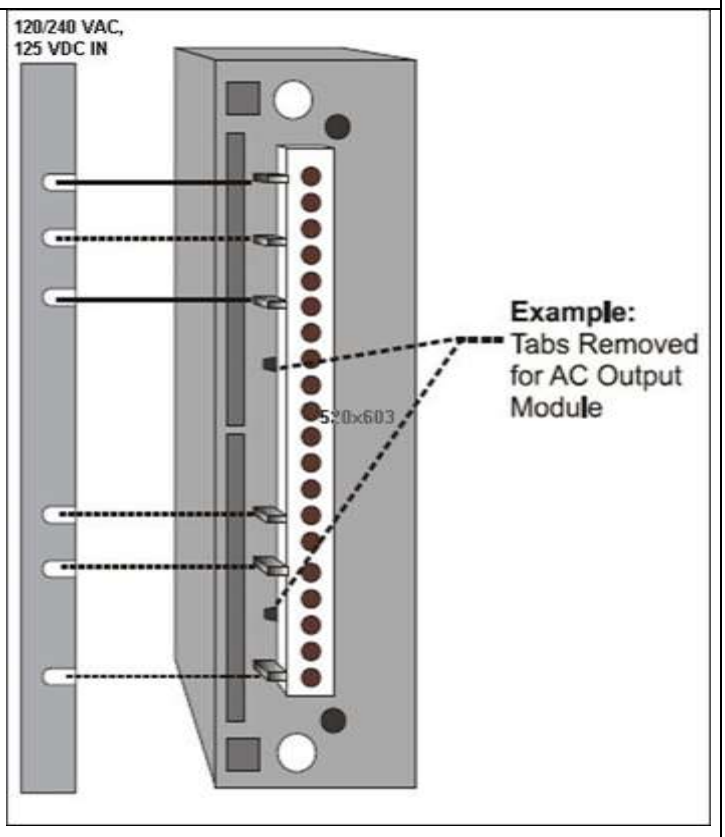
⚠ WARNING  **EXPLOSION HAZARD** Class 1, Division 2 Installations

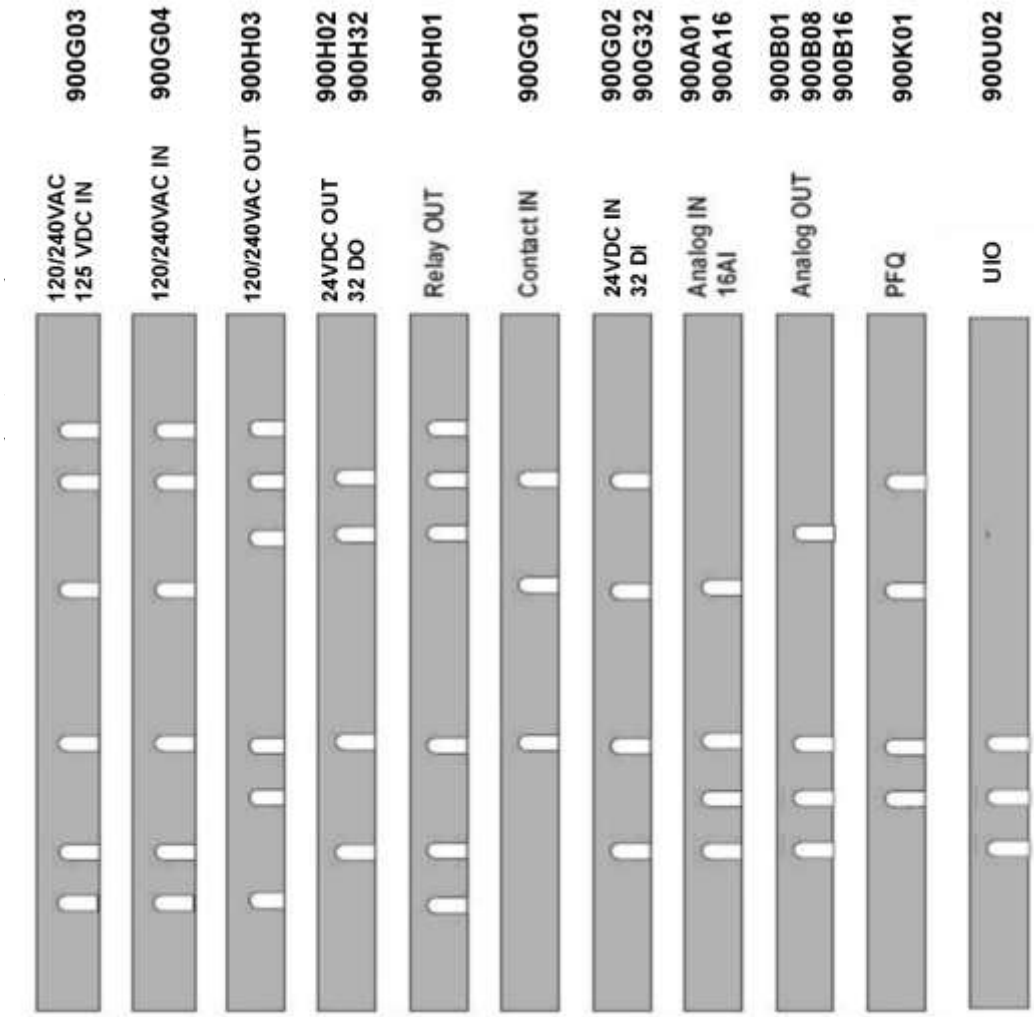
- Do not DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

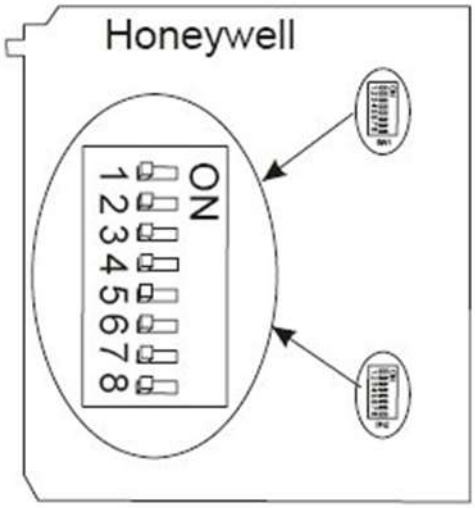
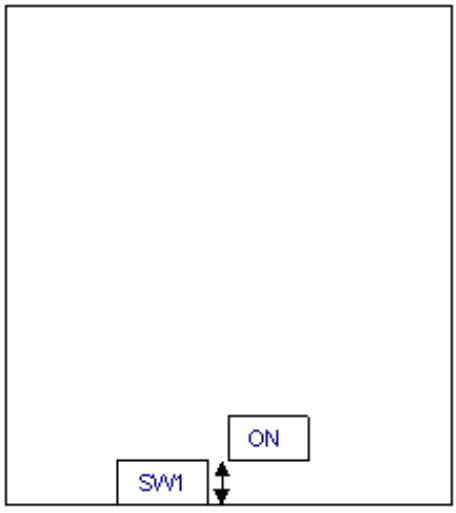
6.6. I/O Module Installation Procedures

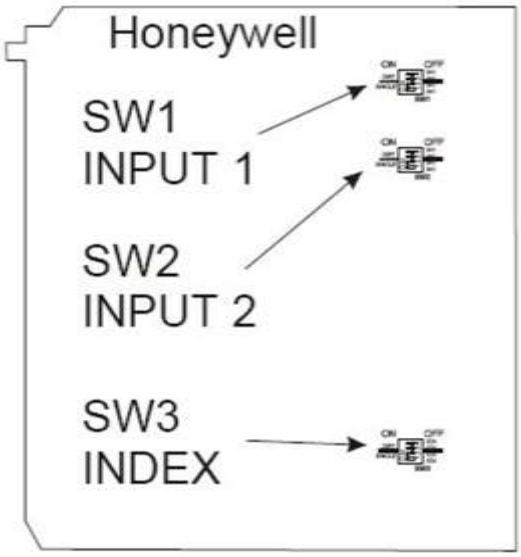
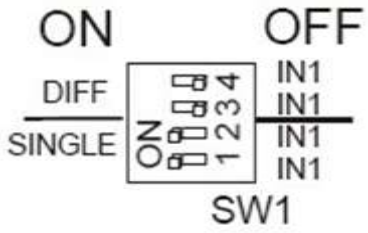
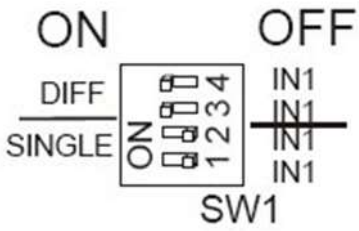
Table 14 – Connect Input/Output Wiring

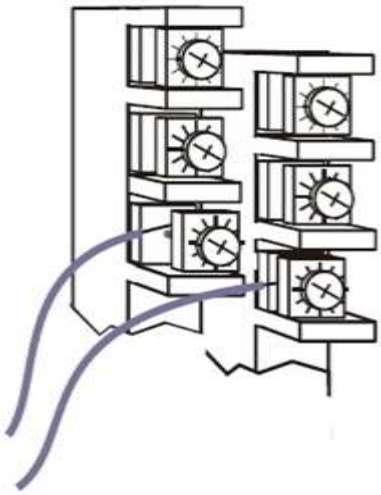
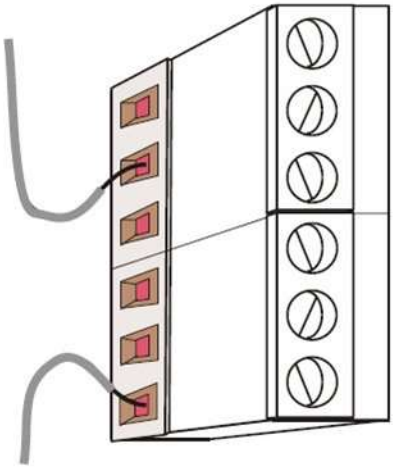
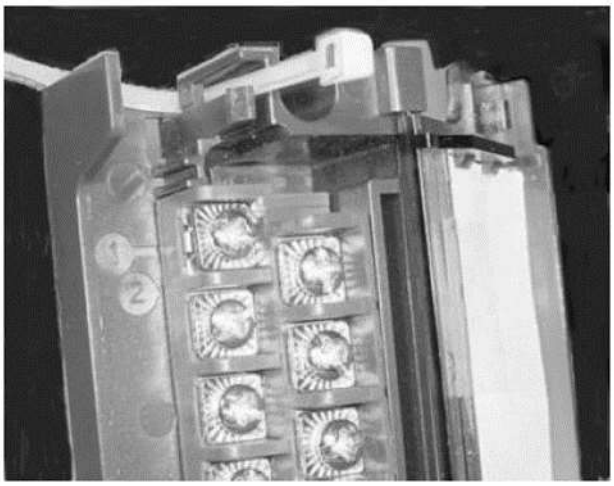
Step	Procedure	Comments	Reference
1	Using Rack #, Slot #, Channel # data from a Designer Software report, fill in the tag names on the Label for each configured I/O Module. Module slot position should take heat de-rating into account. See Heat Rise De-rating page 66. Be sure to use the appropriate label 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.	 	Latest Terminal Block

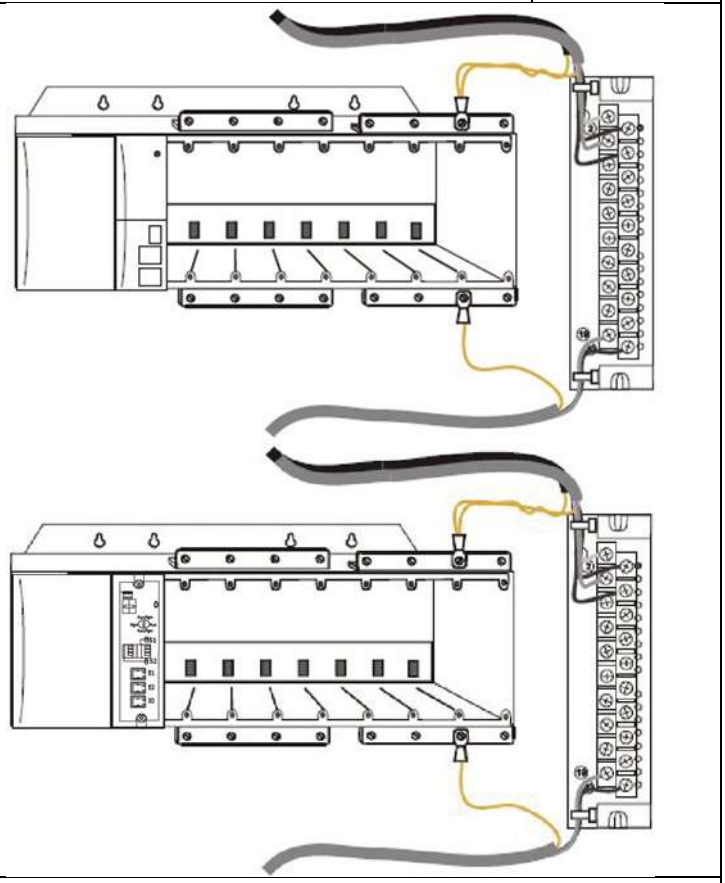
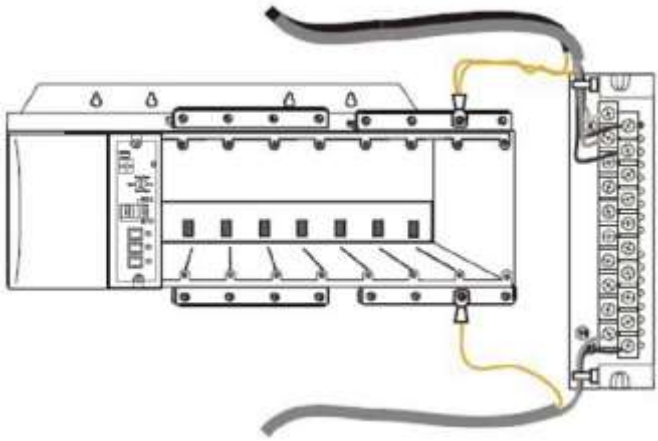
Step	Procedure	Comments	Reference
3	(Optional): Install jumper combs into designated Barrier style Terminal Blocks, to reduce the wiring required to supply power: Two-position jumper for the DC Input Module and/or on the DC Output Module. Ten-position jumper for the AC Output Module. Five-position jumper (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 900A16 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 900B08, 900B16 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.  8-16 Analog output Channels require loop power for open loop detection.		

7	If installing 900K01 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:  <u>Settings (using Input 1 as example)</u> 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	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.	 Euro Terminal Block  	

Step	Procedure	Comments	Reference
9	Install I/O modules in racks. Be sure to follow placement guidelines under Heat Rise De-rating page 66.		
10	Install I/O module, install appropriate terminal block.		
11	In each slot location not occupied by an I/O module, install a Filler Block cover, Part number 900TNF-….	**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.	

6.7. I/O Terminal Block Wiring Diagrams

900A01-... Universal Analog Input Module Wiring

The 900A01-... 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 47 shows wiring examples of each of the analog input types. An example of wiring for eight TC inputs is given in Figure 49.

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 46, Figure 47 and Figure 48.

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 46 to Figure 50 show examples of RTD input wiring (2-wire and 3-wire RTDs). Four-wire RTD inputs are not available.

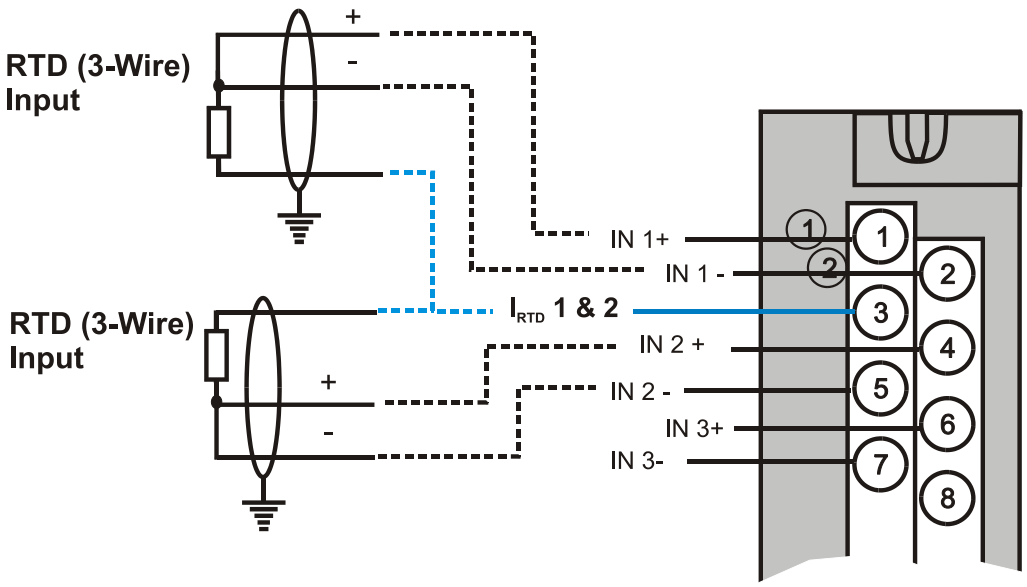


Figure 46 – RTD Inputs

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 jumped 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 50 .

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.

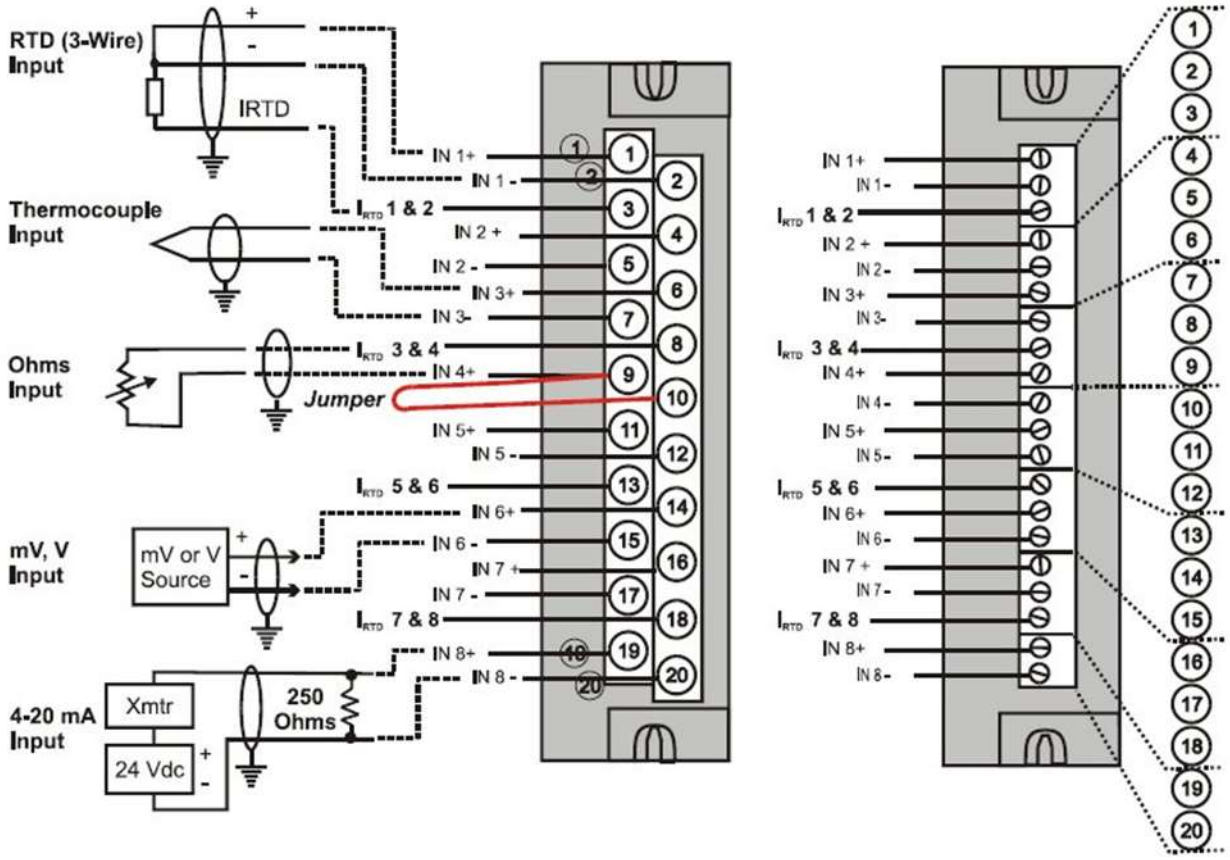


Figure 47 – Universal Analog Input Wiring Diagram

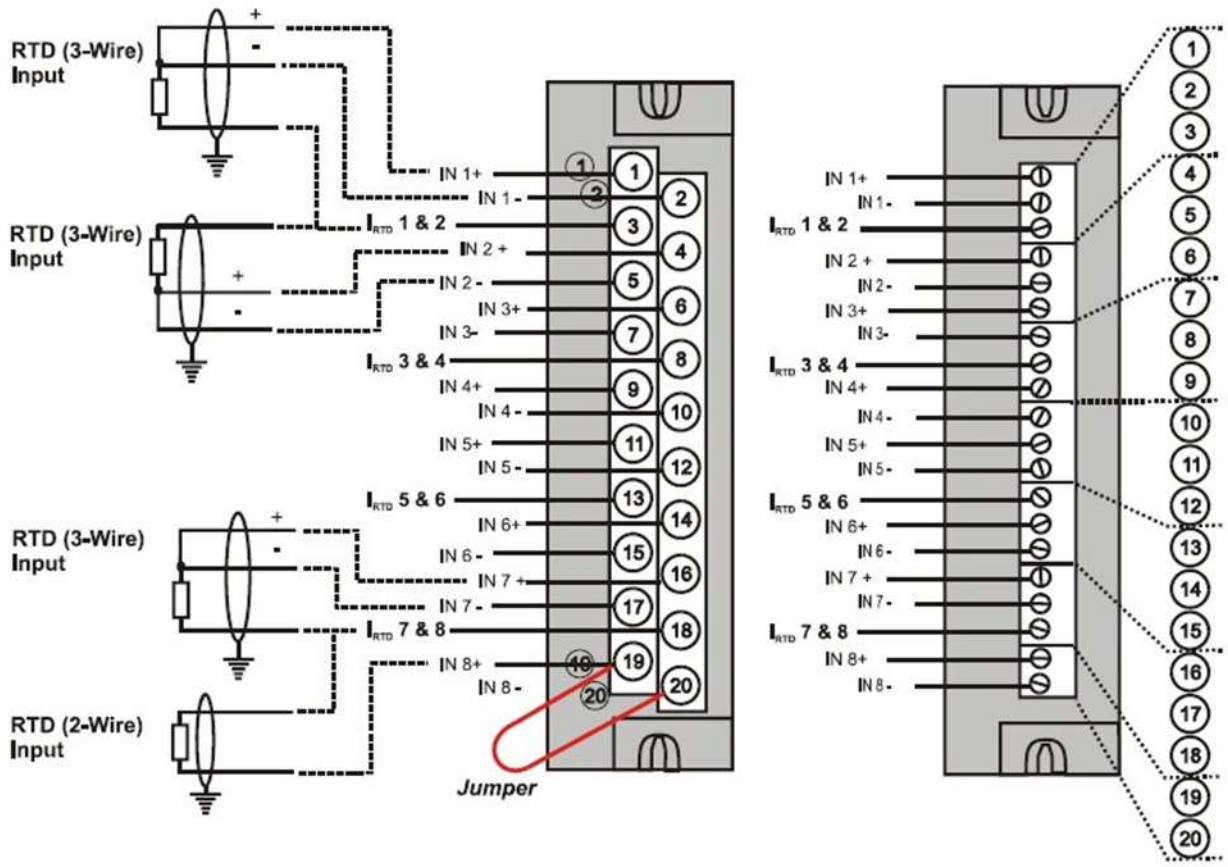


Figure 48 – Examples of RTD Input Wiring

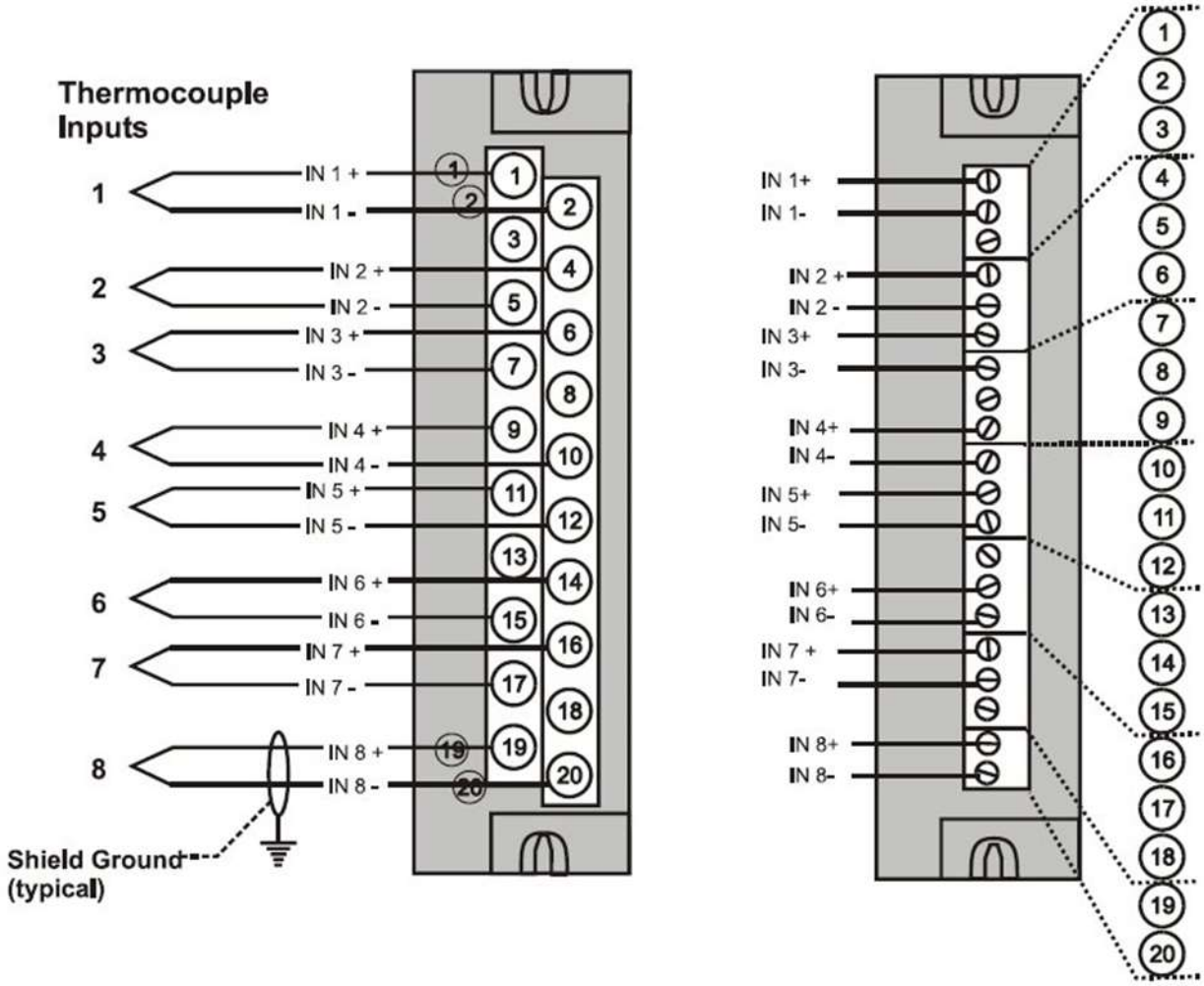


Figure 49 – Analog Input Wiring - Eight TCs

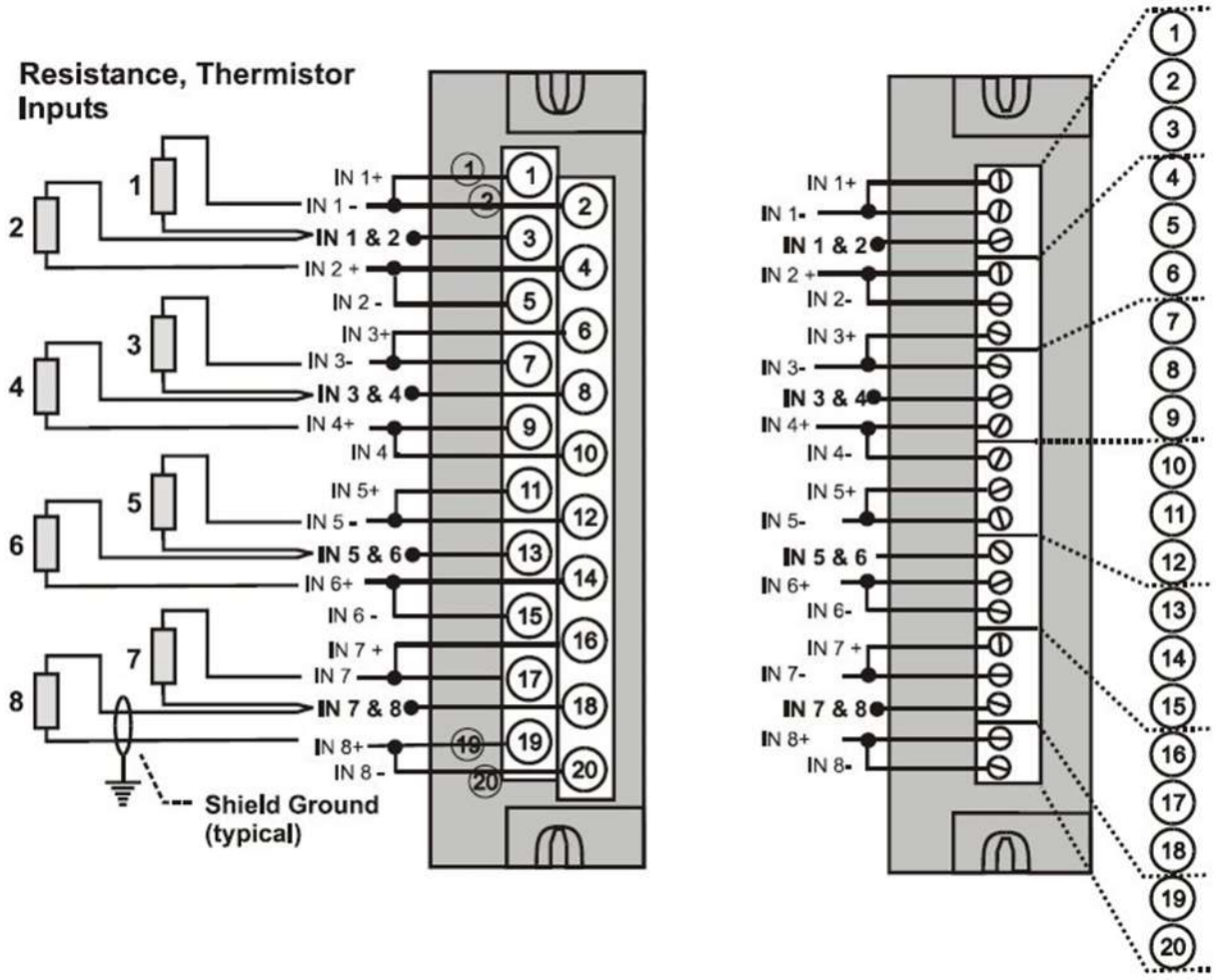


Figure 50 – Analog Input Wiring - Eight Resistance Inputs

Resistance Temperature Device Inputs

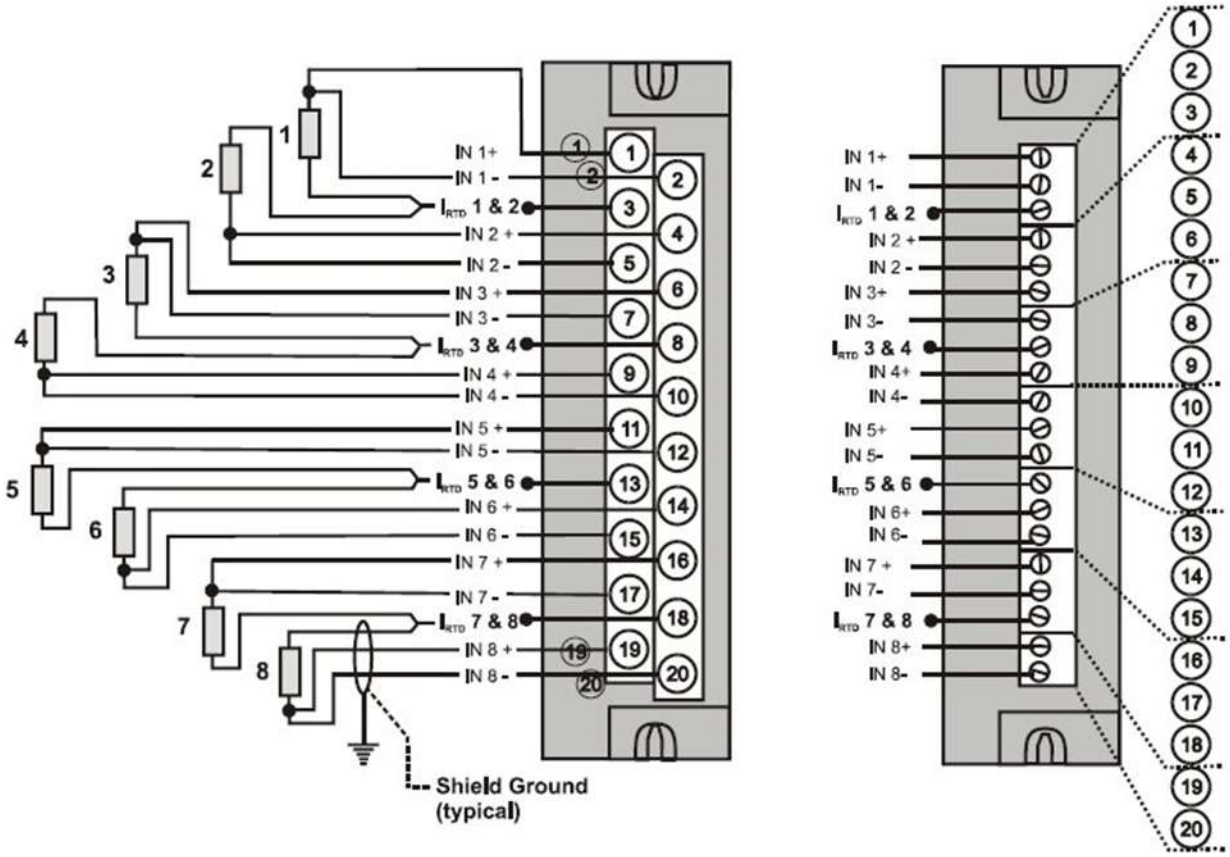


Figure 51 – Analog Input Wiring - Eight RTDs

Slidewires

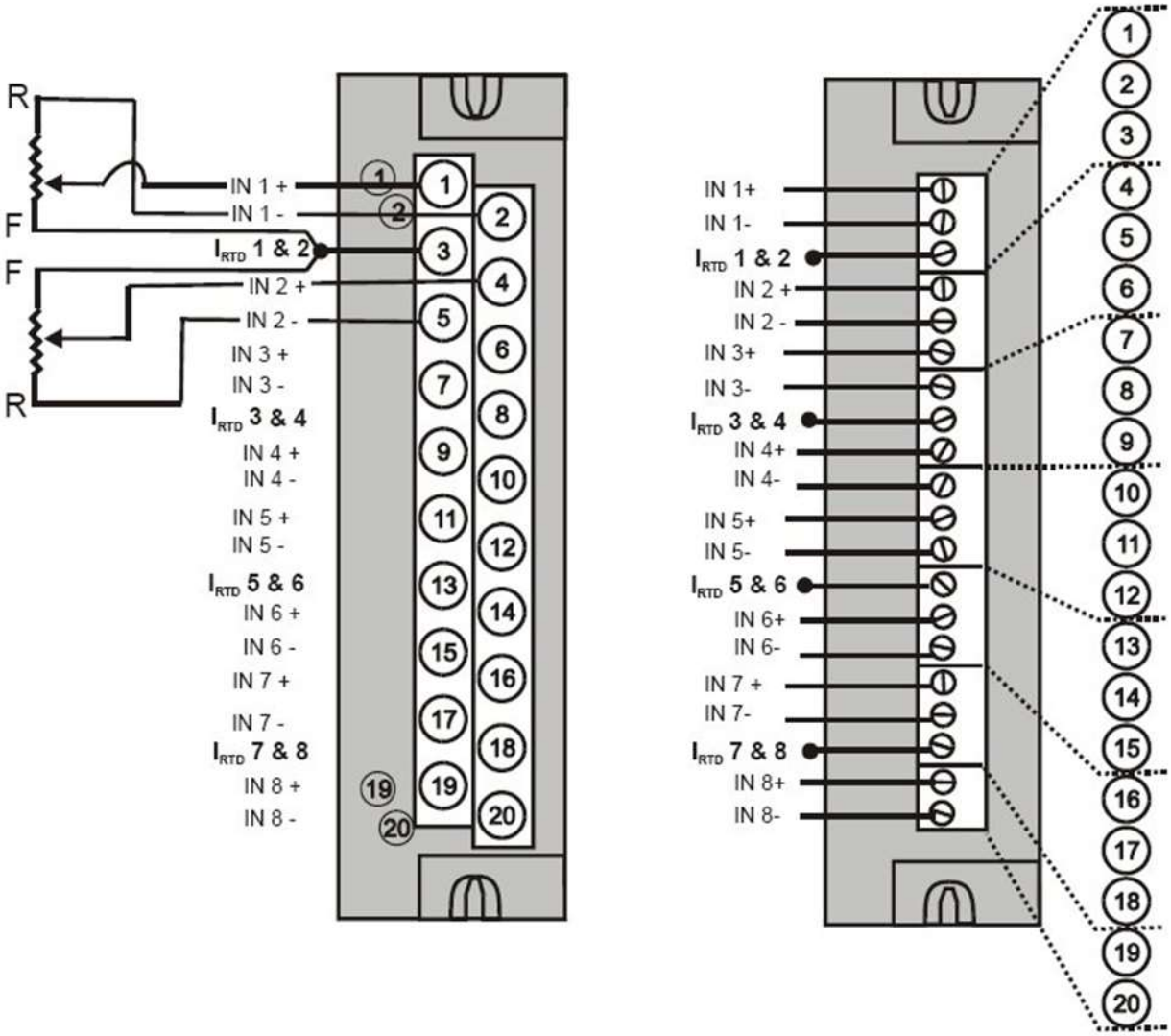


Figure 52 – Analog Input Wiring – Slidewire (Position Proportion Block)

900A16-... 16 point High Level Analog Input Wiring (Figure 53)

Be sure to set the module DIP switches for voltage or current mode. See page 100. This requires Low Voltage Euro style 36-terminal terminal block.

Note: Unused input channel shall not be left open for 900A16-0102 IO module

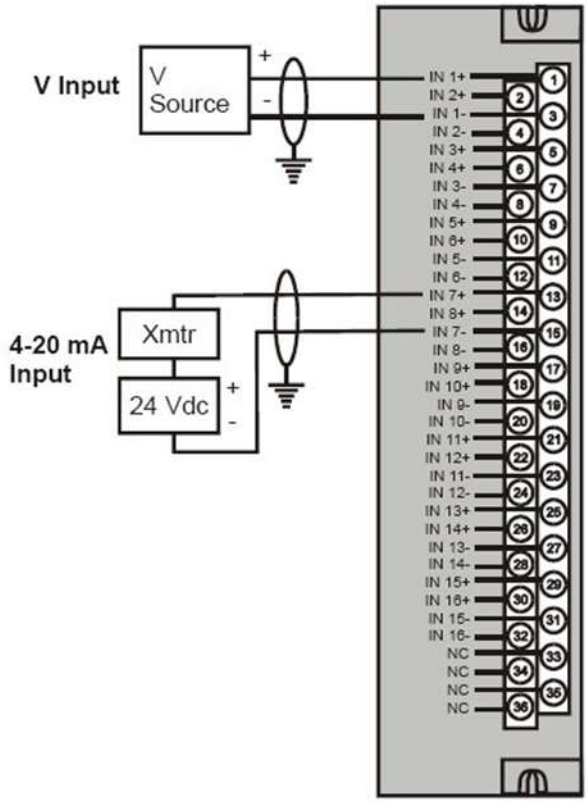


Figure 53 – 900A16-... point High Level Analog Input Wiring

900B01-... 4 channel Analog Output Module Wiring

An example of Analog Output Module wiring is shown in Figure 54. Specifications for this module and for other modules are given in the Specifications manual. SIL applications require an external series relay used to ensure outputs achieve failsafe action. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details.

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.

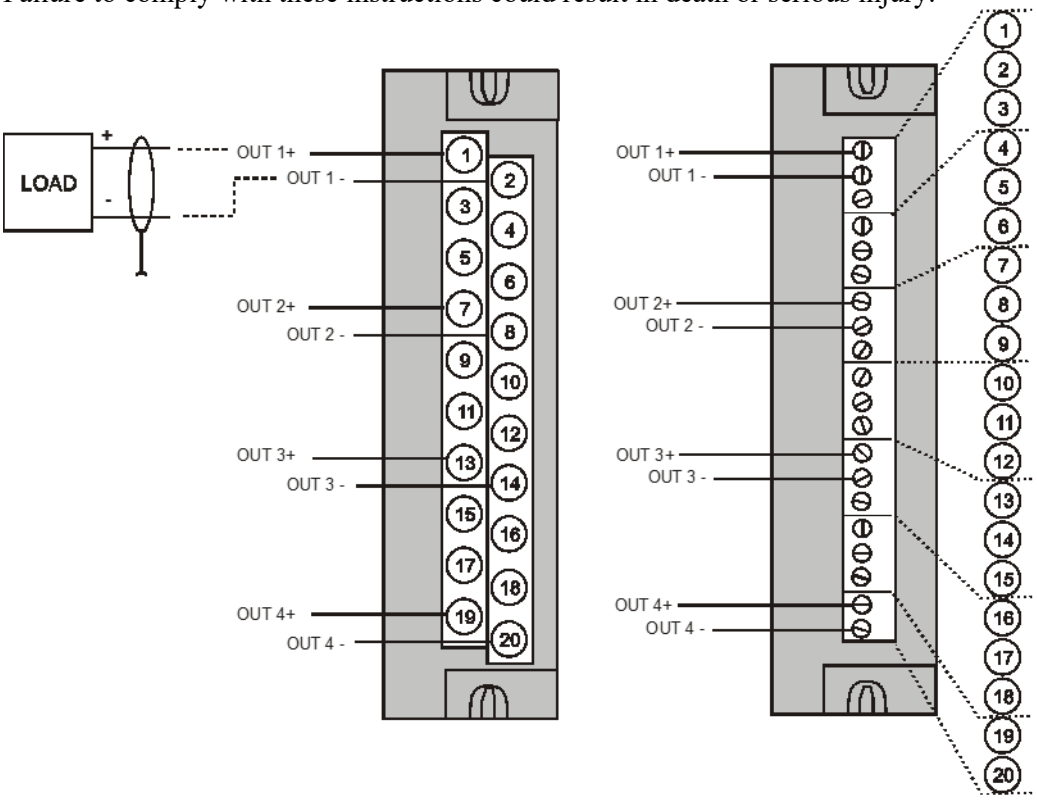


Figure 54 – 900B01-... 4 channel Analog Output Wiring Diagram

900B08-… and 900B16-... 8 and 16 channel Analog Output Module Wiring

⚠ WARNING

Hazardous voltages exist at terminal blocks.
AO8 and AO16 modules require at least one channel to be configured prior to a cold start for the module to work properly. Subsequent channels then may be added with a hot start.
Failure to comply with these instructions could result in death or serious injury.
Examples of high level Analog Output Module wiring are shown in Figure 55 and Figure 56.
Specifications for this module and for other modules are given in the Specifications manual. SIL applications require an external series relay used to ensure outputs achieve failsafe action. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details.
Before installing, be sure to determine power requirements. See page 61 and 100.
Requires Low Voltage Euro style 36-terminal terminal block.

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.

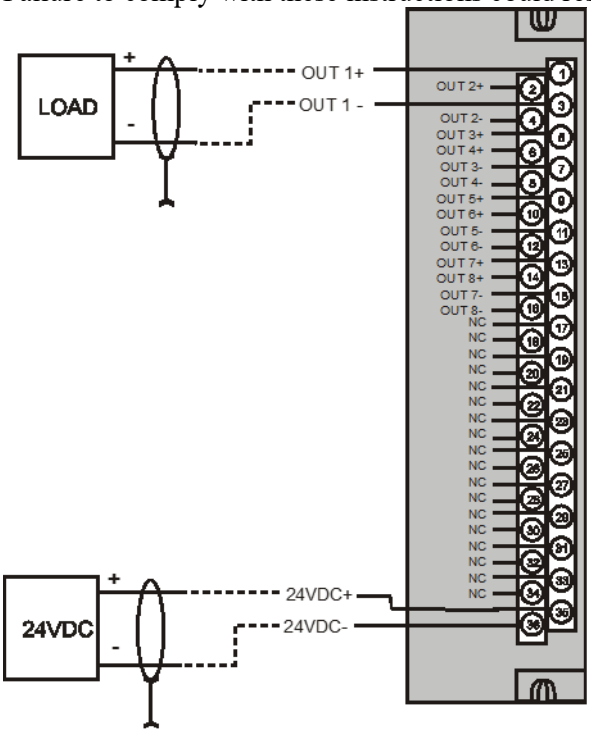


Figure 55 – 8 channel Analog Output Wiring Diagram

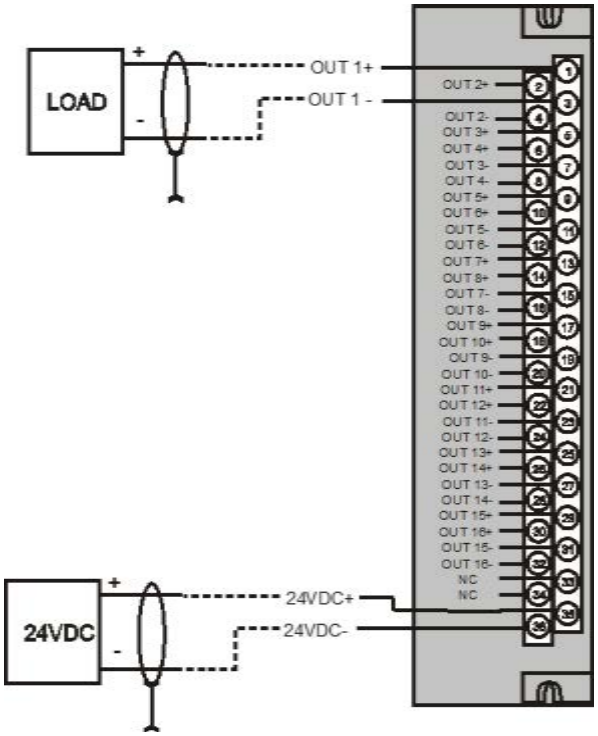


Figure 56 – 16 channel Analog Output Wiring Diagram

900G02-... DC Input Module Wiring

The 900G02-... 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 57. Specifications for this module and for other modules are given in the Specifications 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 58.

⚠ 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.

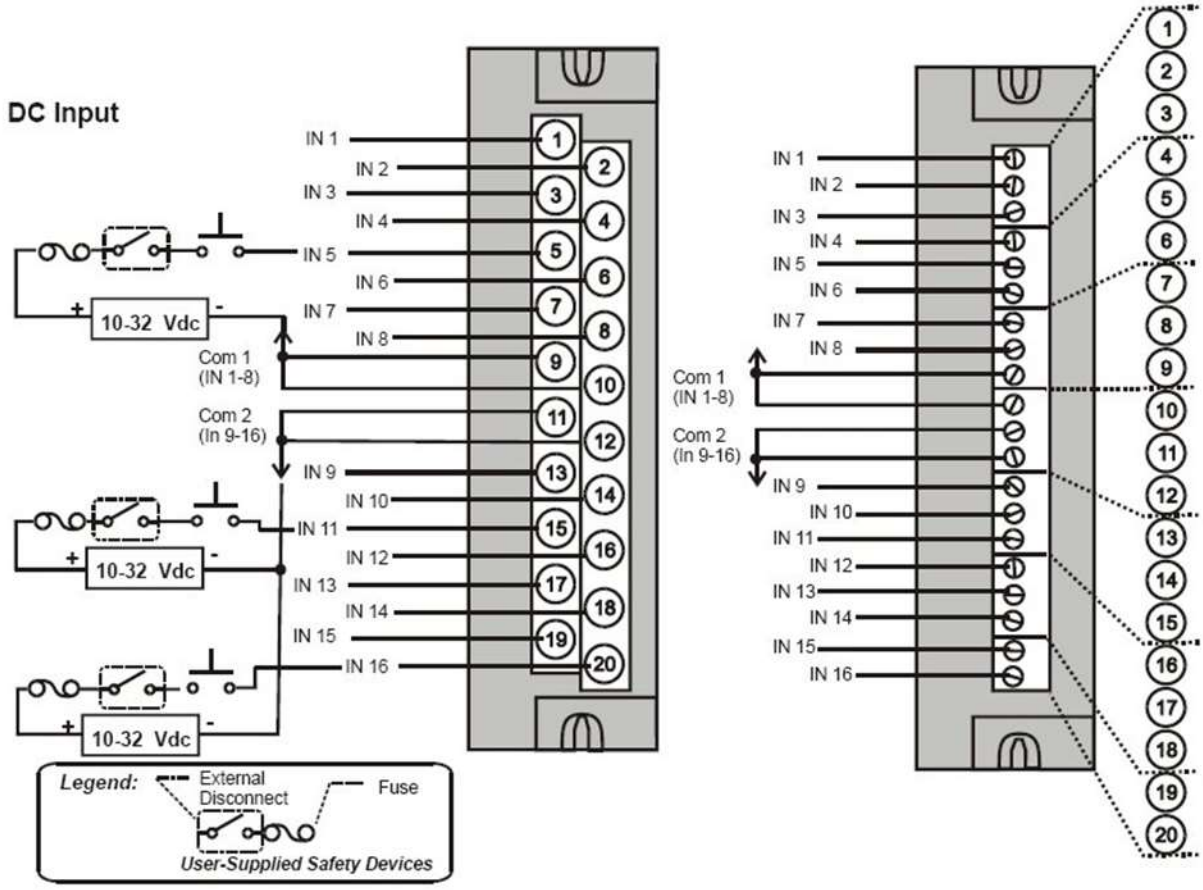


Figure 57 – 900G02-... DC Input Module Wiring Diagram

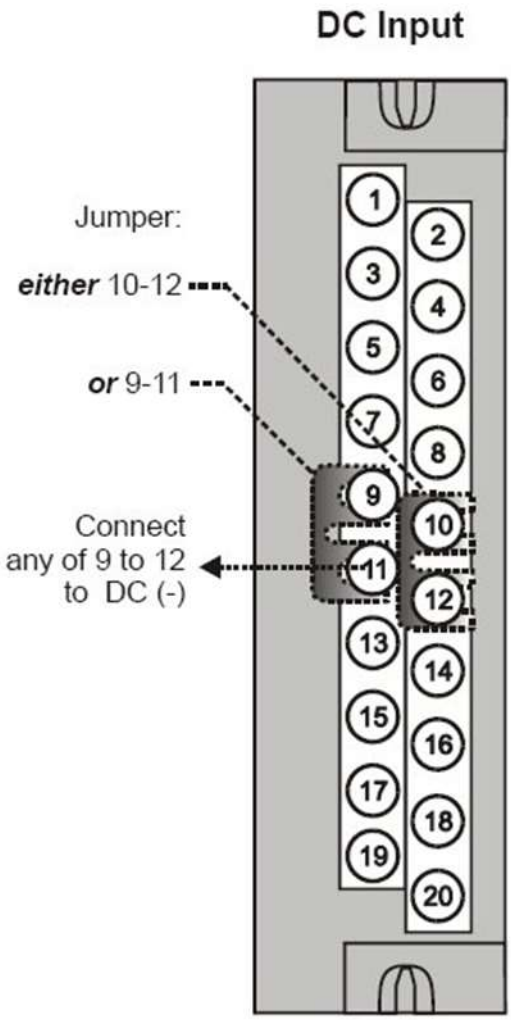


Figure 58 – DC Input Module Jumper

900G32-... 32 point DC Input Module Wiring

The 900G32-... 32-point DC Digital Input module (Figure 59) 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.

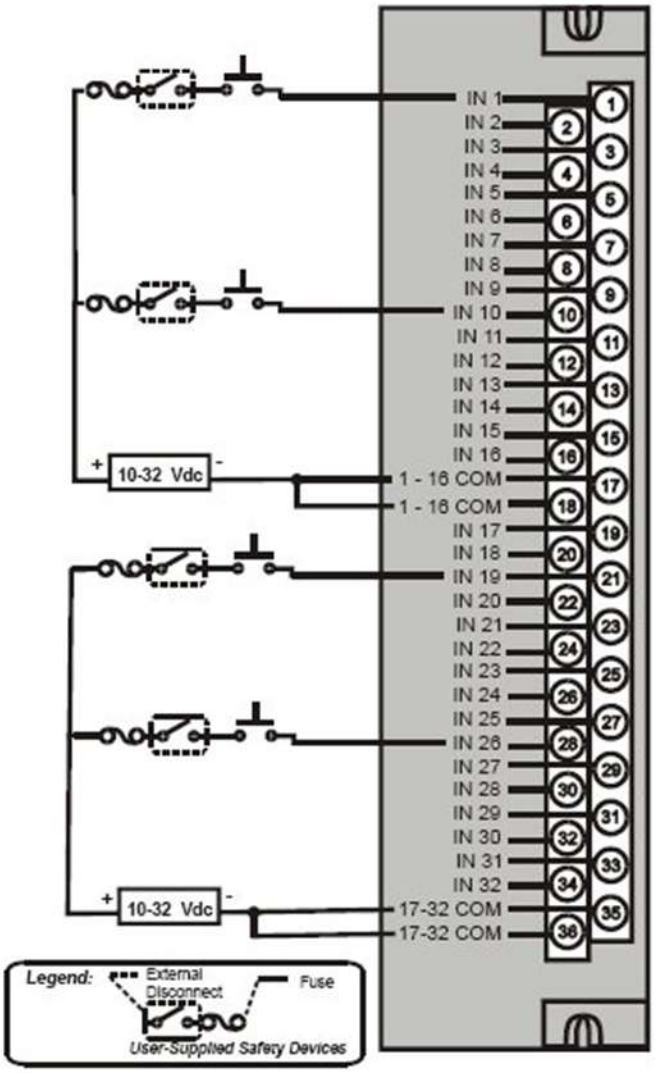


Figure 59 – 900G32-... 32 point DC Input Module Wiring

900G03-... AC Input Module Wiring

The 900G03-... AC Input Module has sixteen inputs. An example of AC Input Module wiring is shown in Figure 60. 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 61.

⚠ 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.

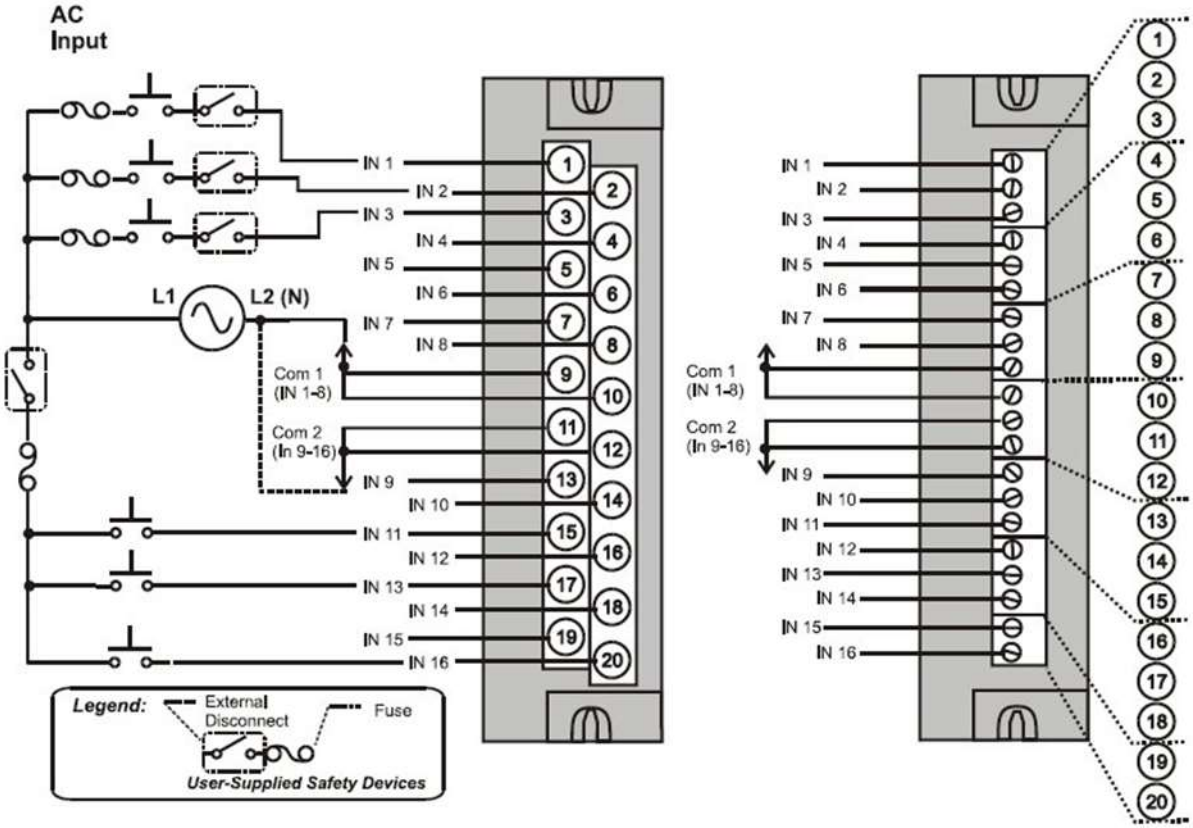


Figure 60 – 900G03-... AC Input Module Wiring Diagram

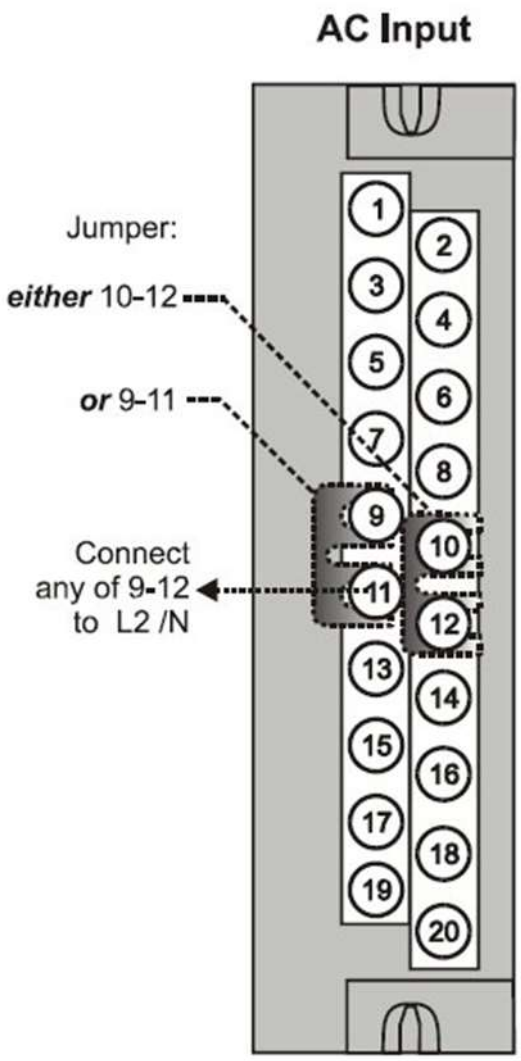


Figure 61 – AC Input Module Jumper

900G04-... AC/DC Isolated Input Module Wiring

The 900G04-... AC/DC Input Module has sixteen isolated inputs. An example of AC Input and DC input Module wiring is shown in Figure 62 and Figure 63. Specifications for this module and for other modules are given in the Specifications manual.
Requires Low Voltage Euro style 36-terminal terminal block.

Isolation

Inputs must be powered from external voltage sources. Inputs are isolated from each other and from controller power.

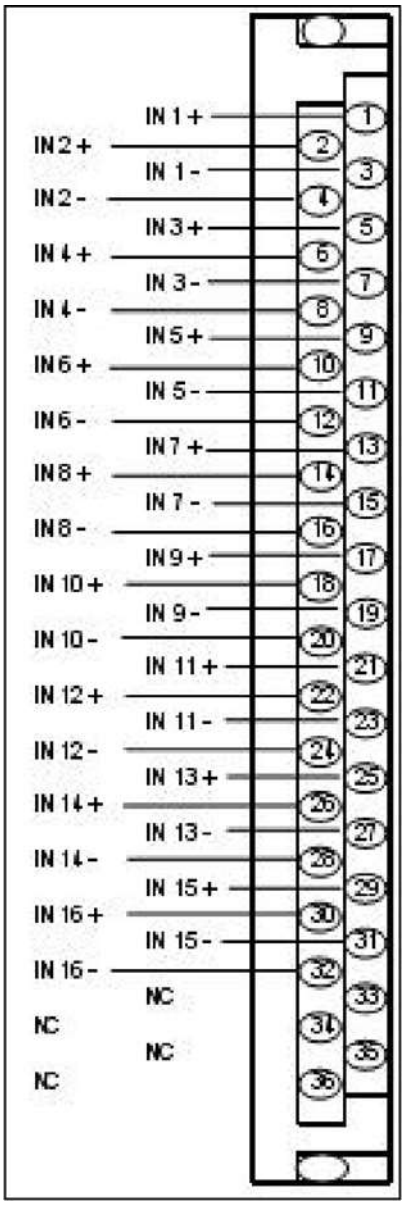


Figure 62 - AC/DC Isolated Input Module

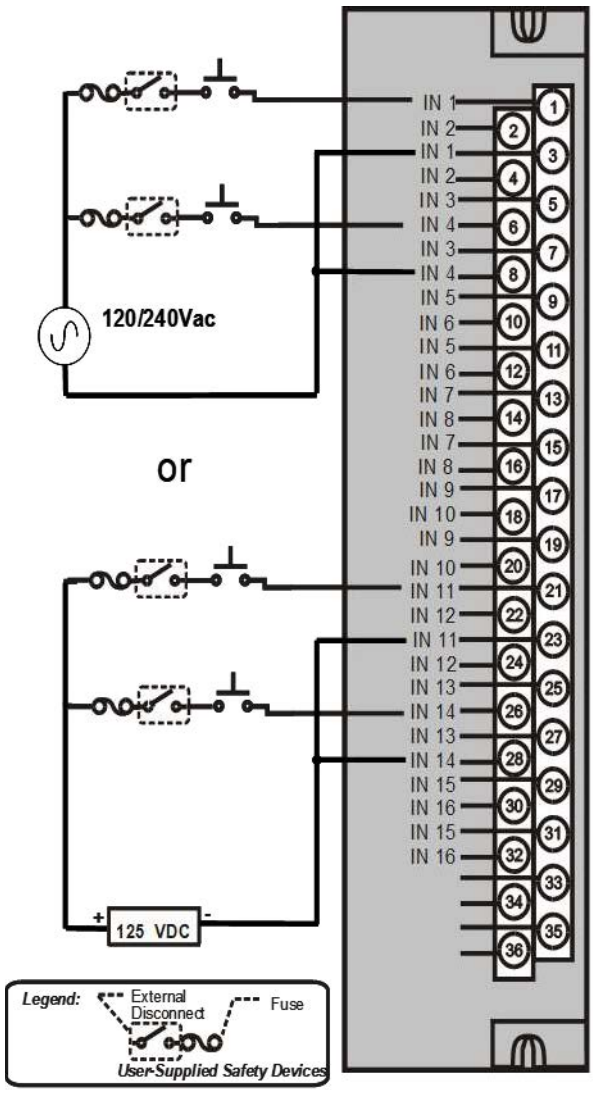


Figure 63 – 900G04-... AC/DC Isolated Input Module Wiring

900G01-... Contact Input Module Wiring

The Contact Input Module has sixteen inputs in one group. An example of Contact Input wiring is shown in Figure 64. SIL applications require an external blocking diode used to insure inputs are protected from ground faults. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details. Specifications for the Contact Input Module and other modules are given in the Specifications 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.

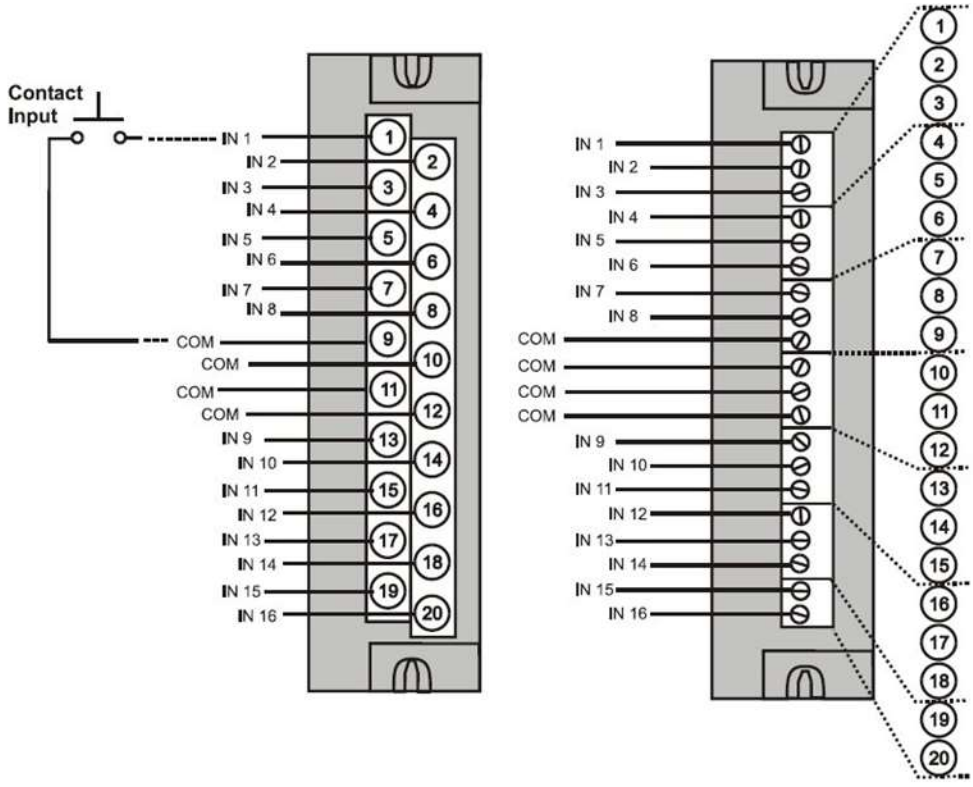


Figure 64 – 900G01-... Contact Input Wiring Diagram

900H02-... DC Output Module Wiring

The 900H02-... 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. SIL applications require an external series relay used to ensure outputs achieve failsafe action. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details.
Specifications for this module and for other modules are given in the Specifications manual. Examples of DC Output wiring are shown in Figure 65 - 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 66.

+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.

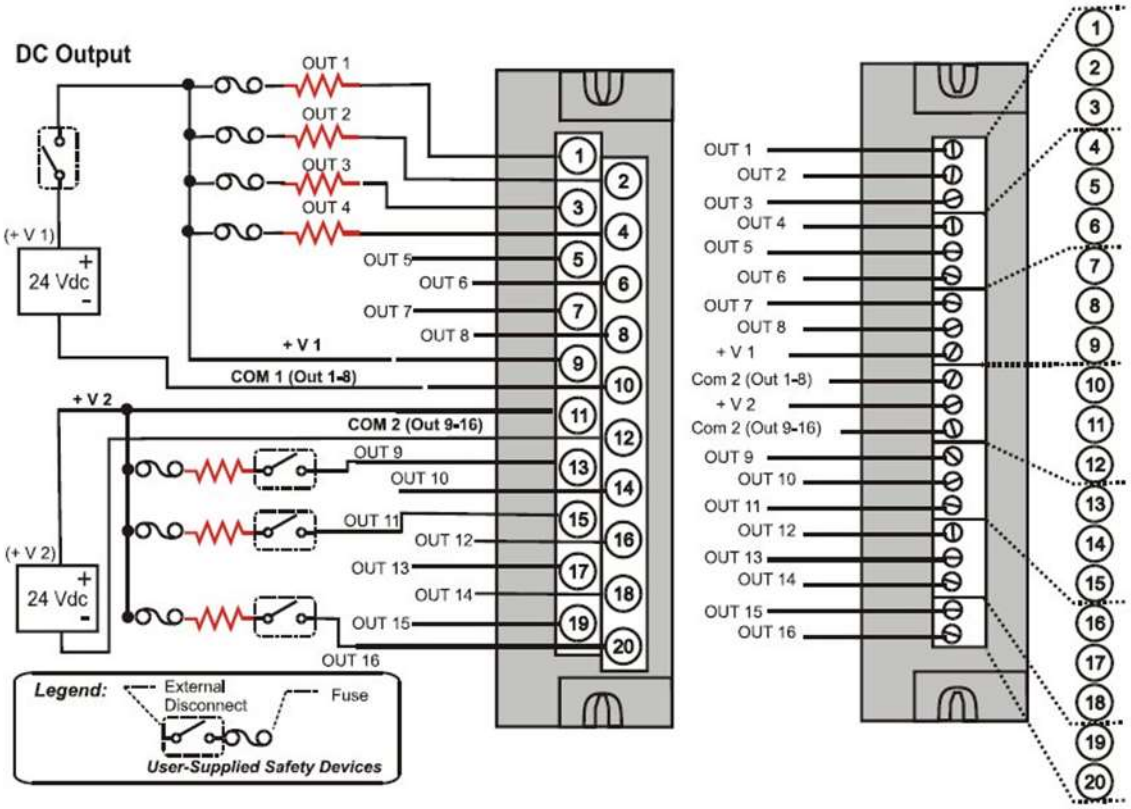


Figure 65 – 900H02-... DC Output Module Wiring Diagram

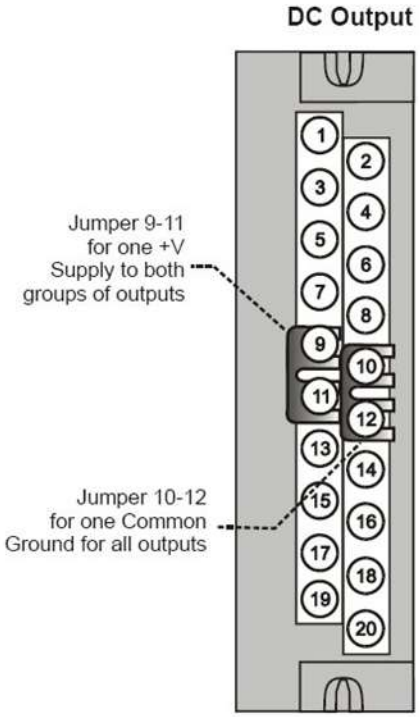


Figure 66 – DC Output Jumpers

900H32-... 32 point DC Output Wiring

The DC digital Output module provides 32 externally powered outputs in 2 groups of 16 (Figure 67). 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. SIL applications require an external series relay used to ensure outputs achieve failsafe action. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details.

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

Requires Low Voltage Euro style 36-terminal terminal block.

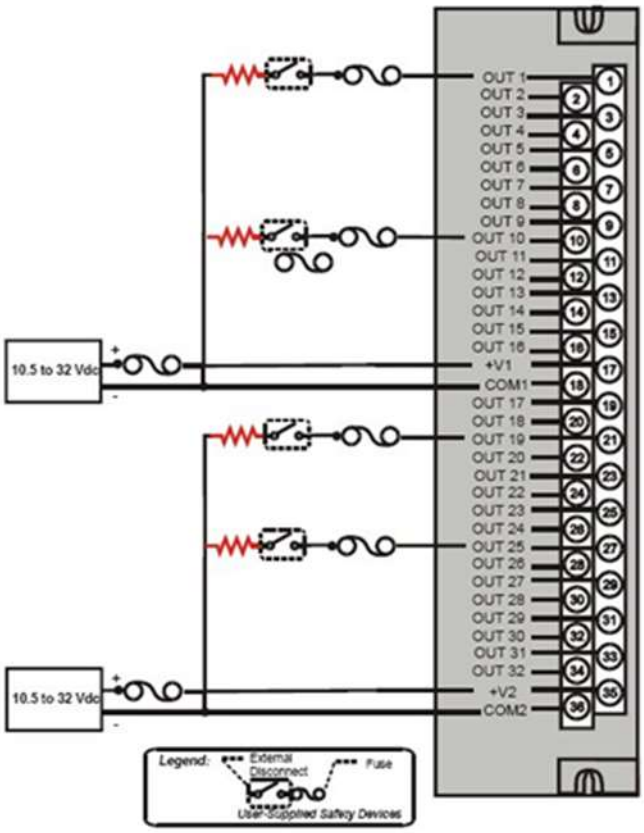


Figure 67 – 900H32-... 32 point DC Output Module Wiring

900H04-... AC Output Module Wiring

The 900H04-... 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 68. Specifications for this module and for other modules are given in the Specifications manual. SIL applications require an external series relay used to ensure outputs achieve failsafe action. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details.

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 69.

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.

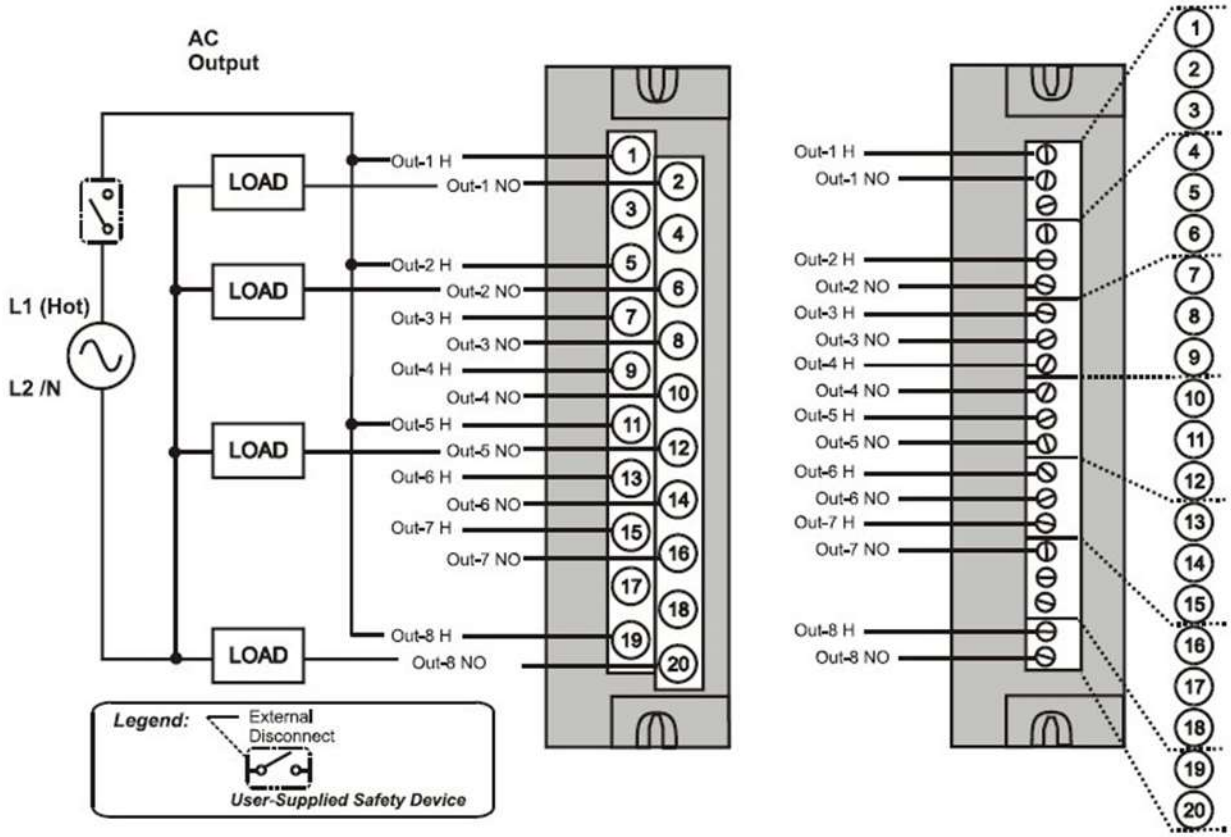


Figure 68 – 900H04-... AC Output Module Wiring Diagram

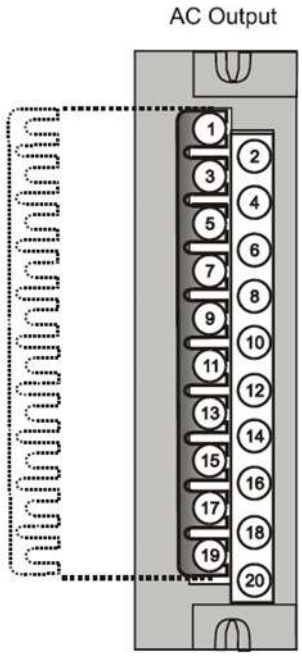


Figure 69 – AC Output Module Jumper

900H01-... Relay Output Module Wiring

The 900H01-... 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 70. SIL applications require an external series relay used to ensure outputs achieve failsafe action. See ControlEdge HC900 Process & Safety Controller Safety Manual for additional details.
Examples of Relay Output wiring as they relate to connections on the Terminal Block are shown in Figure 71.

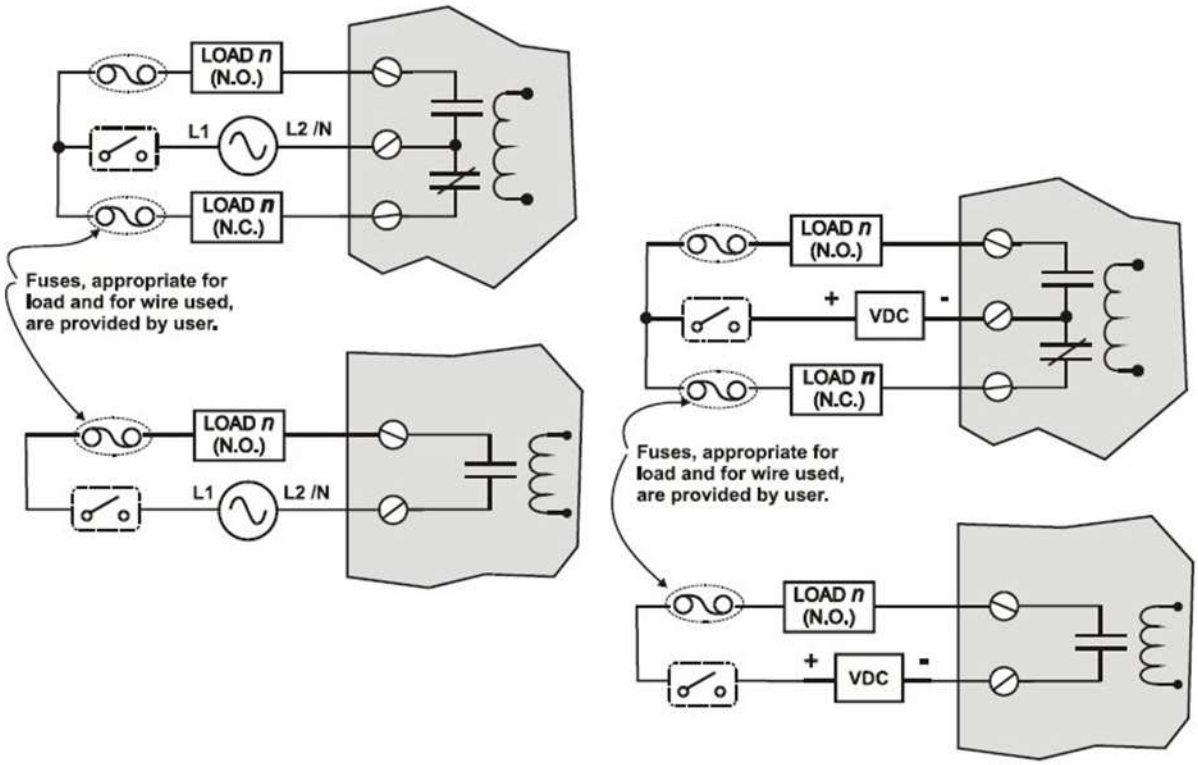


Figure 70 – Schematic Example: Relay Output and External Wiring

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 72 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.

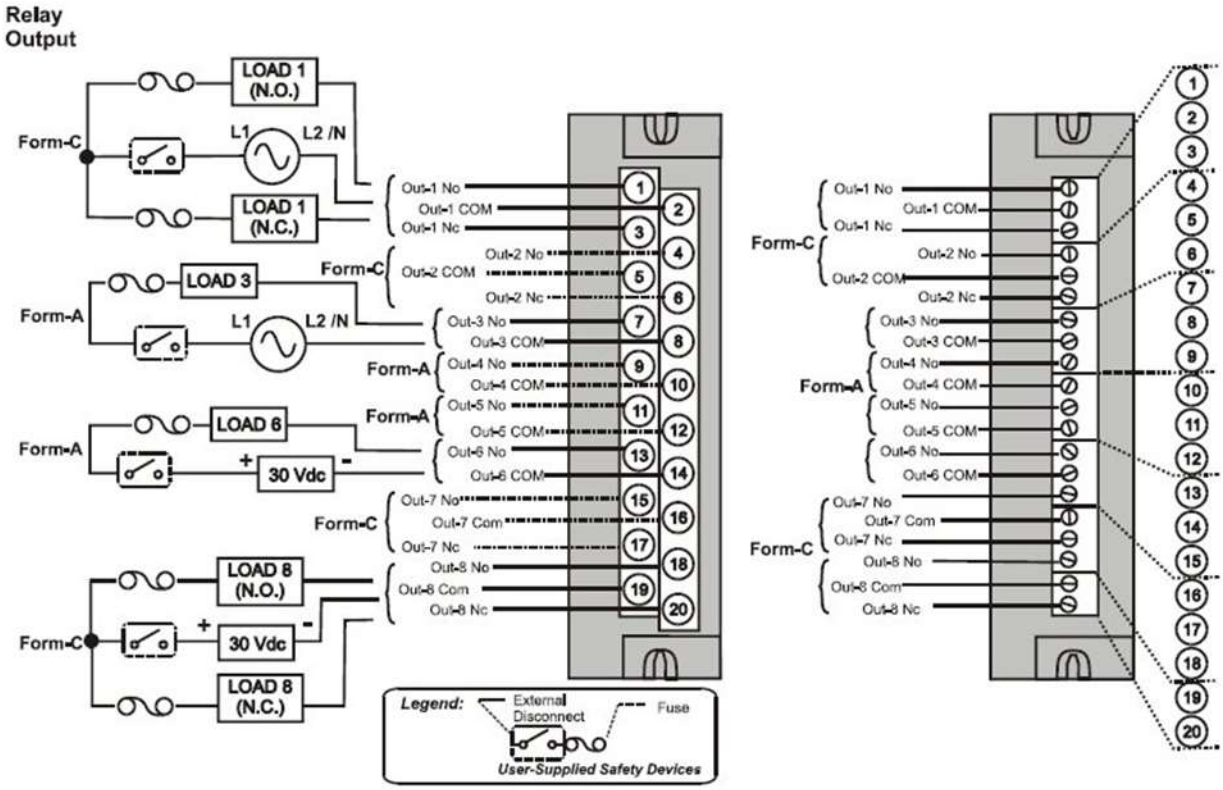


Figure 71 – 900H01-... Relay Output Module Wiring Diagram

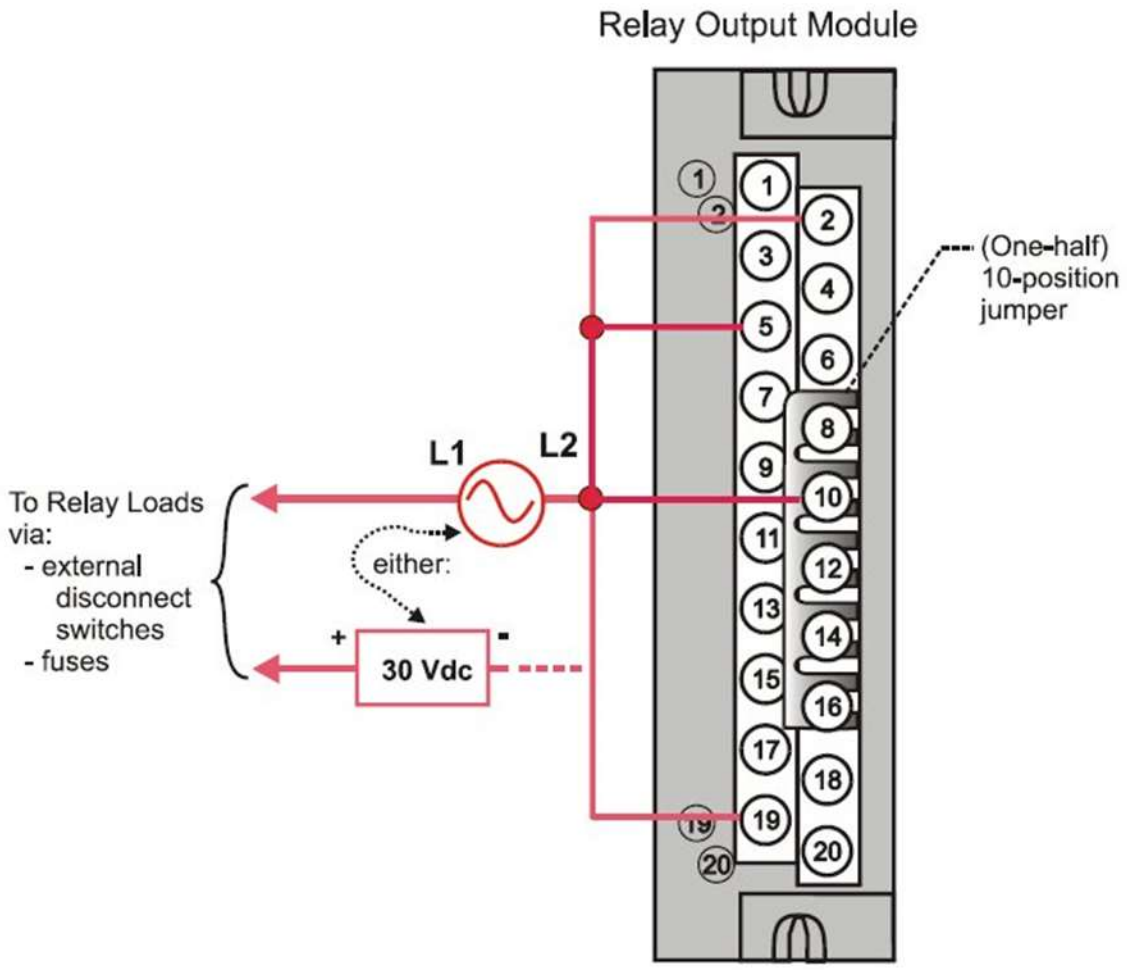


Figure 72 – Relay Output Module Jumpers

900K01-... Pulse/Frequency/Quadrature Module Wiring (Figure 73 through Figure 79)

The 4 Channel 900K01-... 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 101.

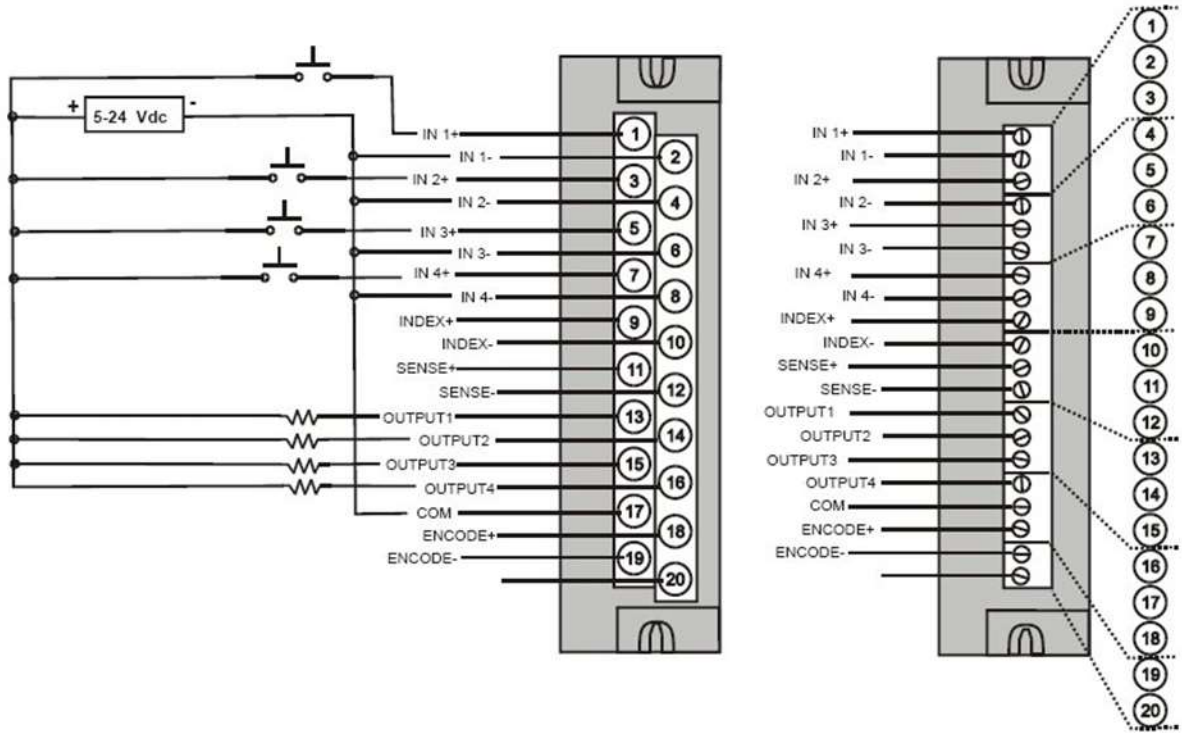


Figure 73 – Pulse Counting Wiring

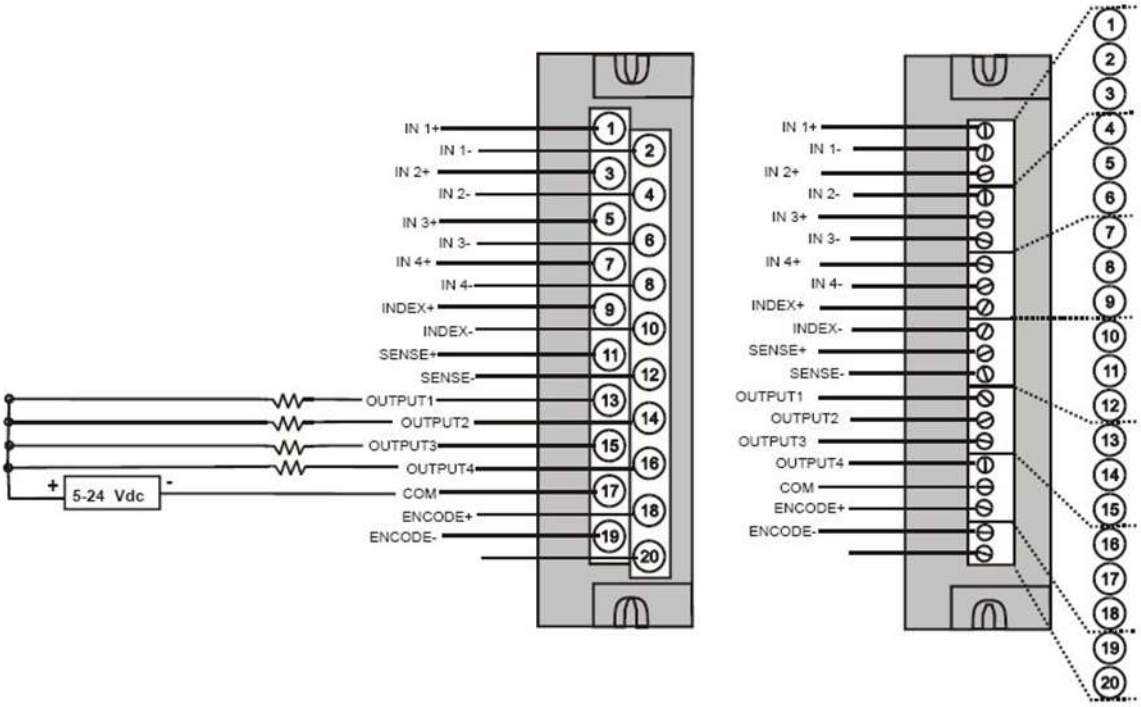


Figure 74 – Pulse Output Wiring

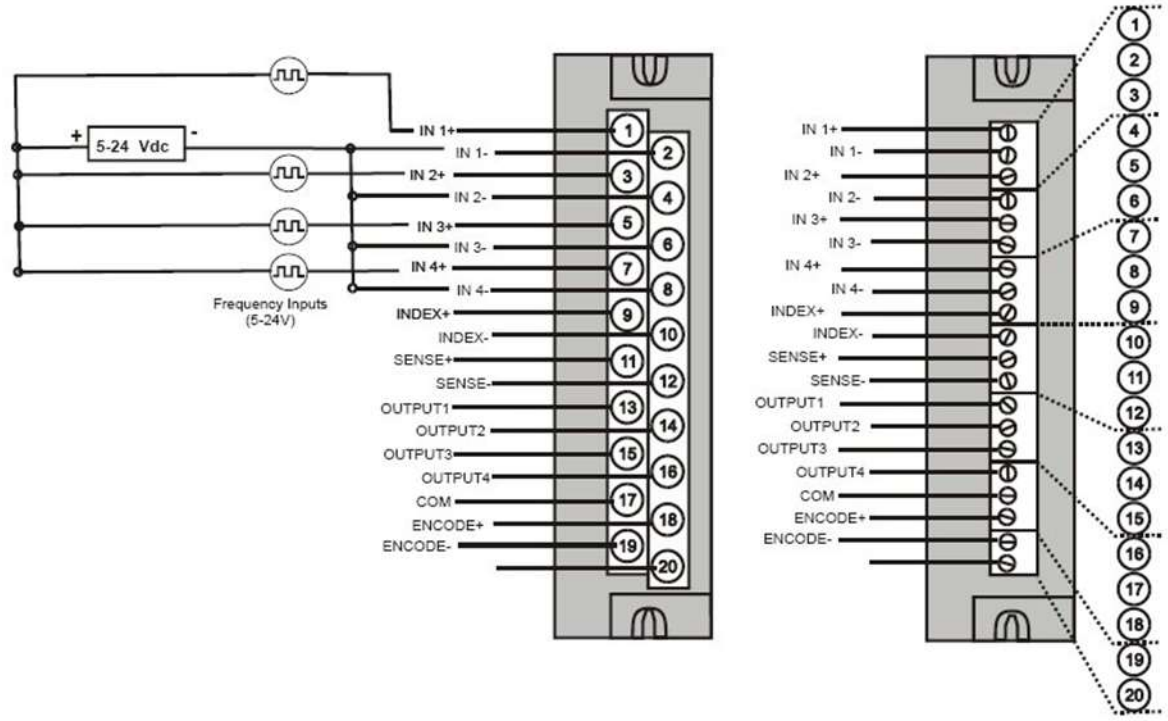


Figure 75 – Frequency Wiring

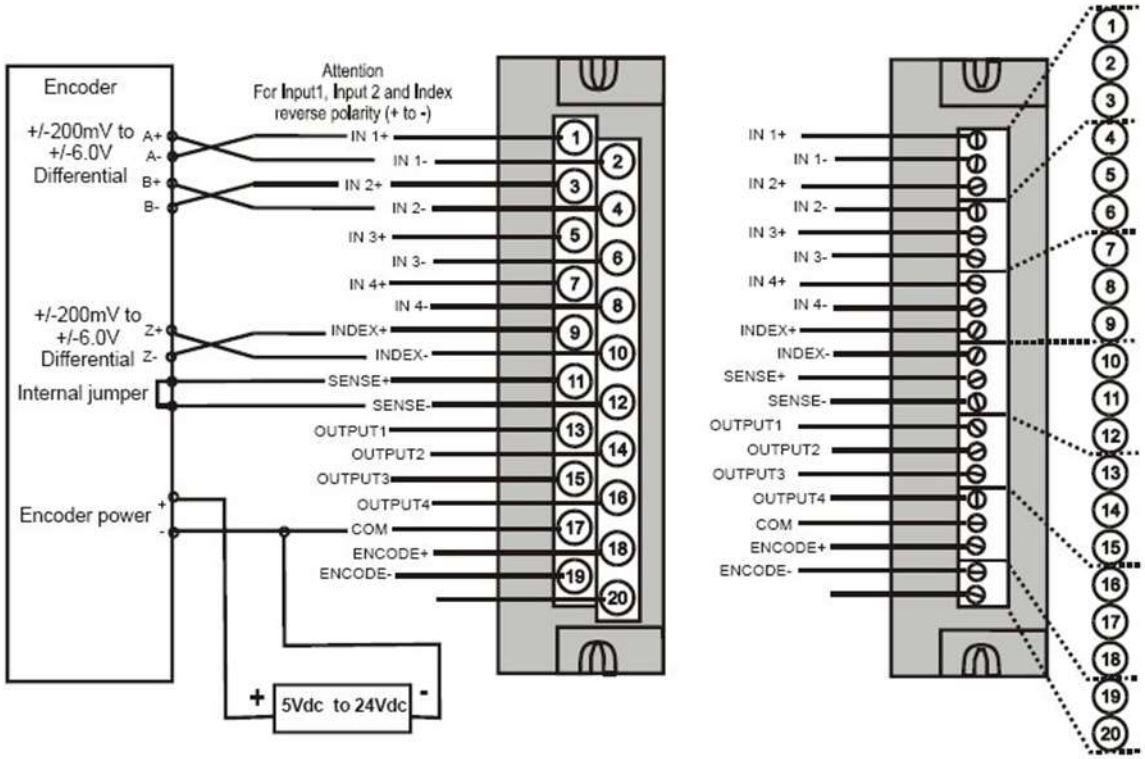


Figure 76 – Quadrature, Differential, External Power Wiring

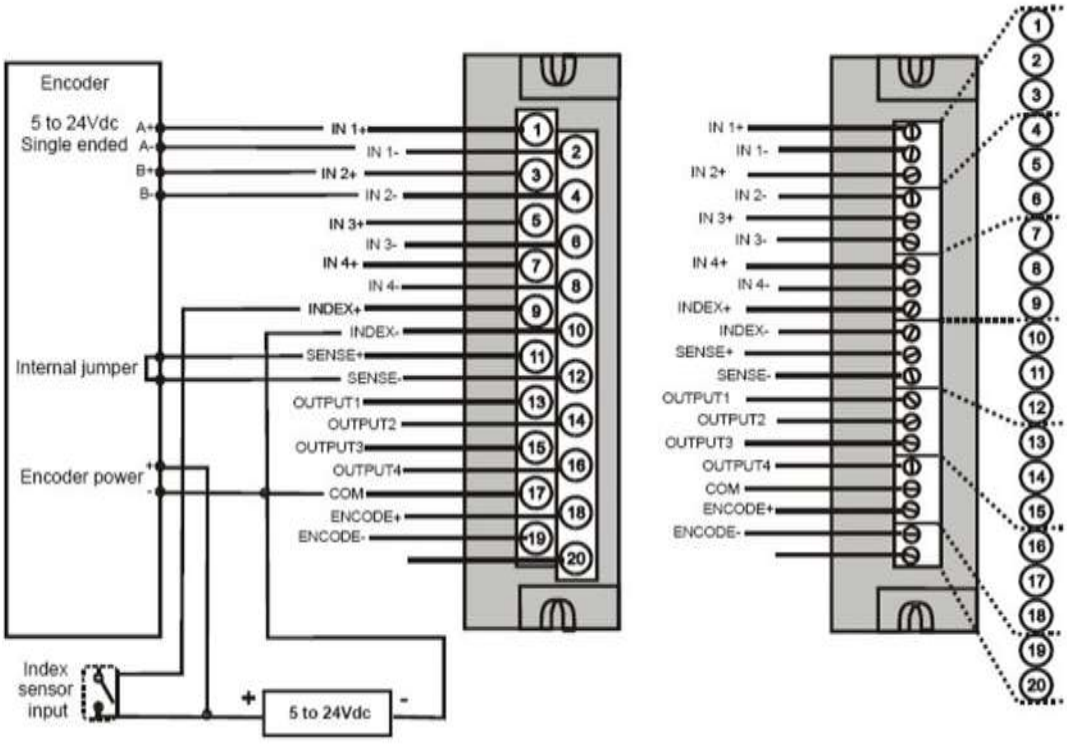


Figure 77 – Quadrature, Single Ended, External Power Wiring

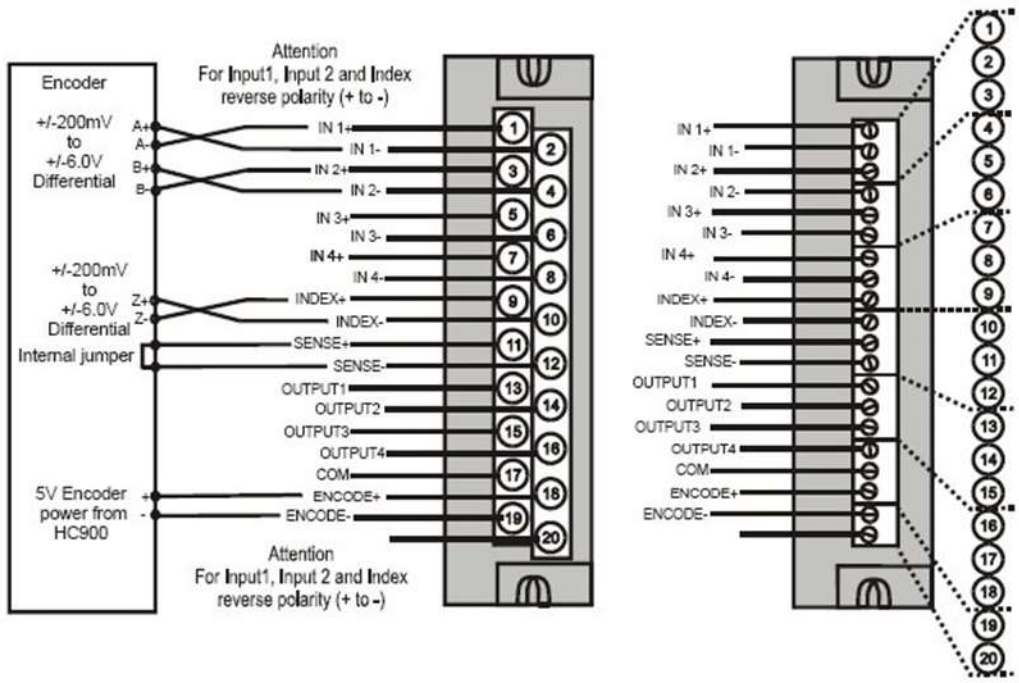


Figure 78 – Quadrature, Differential, ControlEdge HC900 Power Wiring

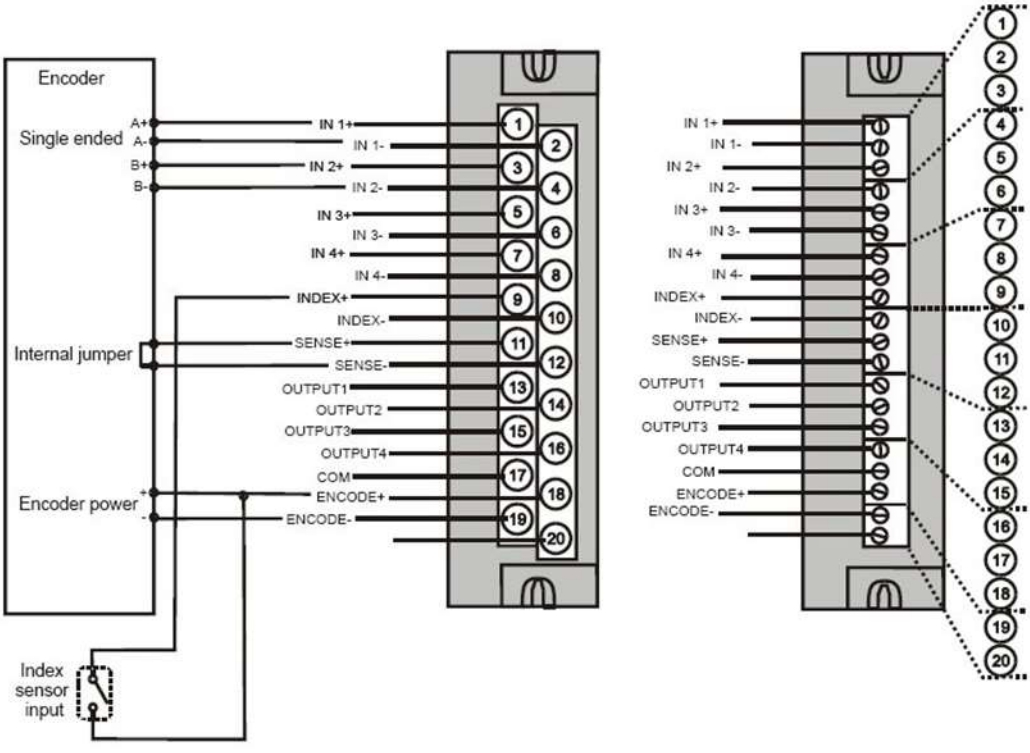


Figure 79 – Quadrature, Single Ended, ControlEdge HC900 Power Wiring

900U02-... Safety Universal Input/ Output (16 Pts) Module Wiring

It is 16 Channel 900U02-... safety universal I/O module, and each channel can be configured for AI, DI and DO. AO type can configured for channel 9 to 16. The channels on Safety UIO are source type.

Note: The SIL-2 UIO has inbuilt advanced diagnostics such as, SIL certified microcontroller and critical voltage monitoring. Due to its higher reliability, for SIL-2 UIO there is no need to do 1oo2 or 2oo3 for wiring of IOs for SIL-2 application. For more details refer safety manual (51-52-25-153) and PFD calculation sheet.

Note: For Redundant configuration, channels 1 and 2 are used for internal purpose and are not available for field device connection.

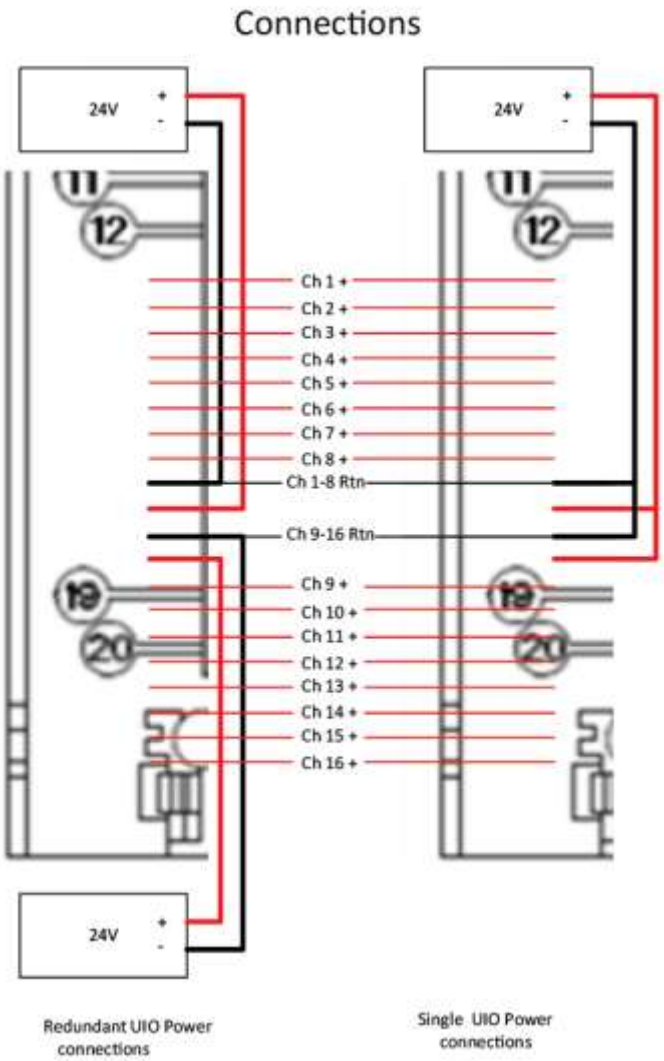
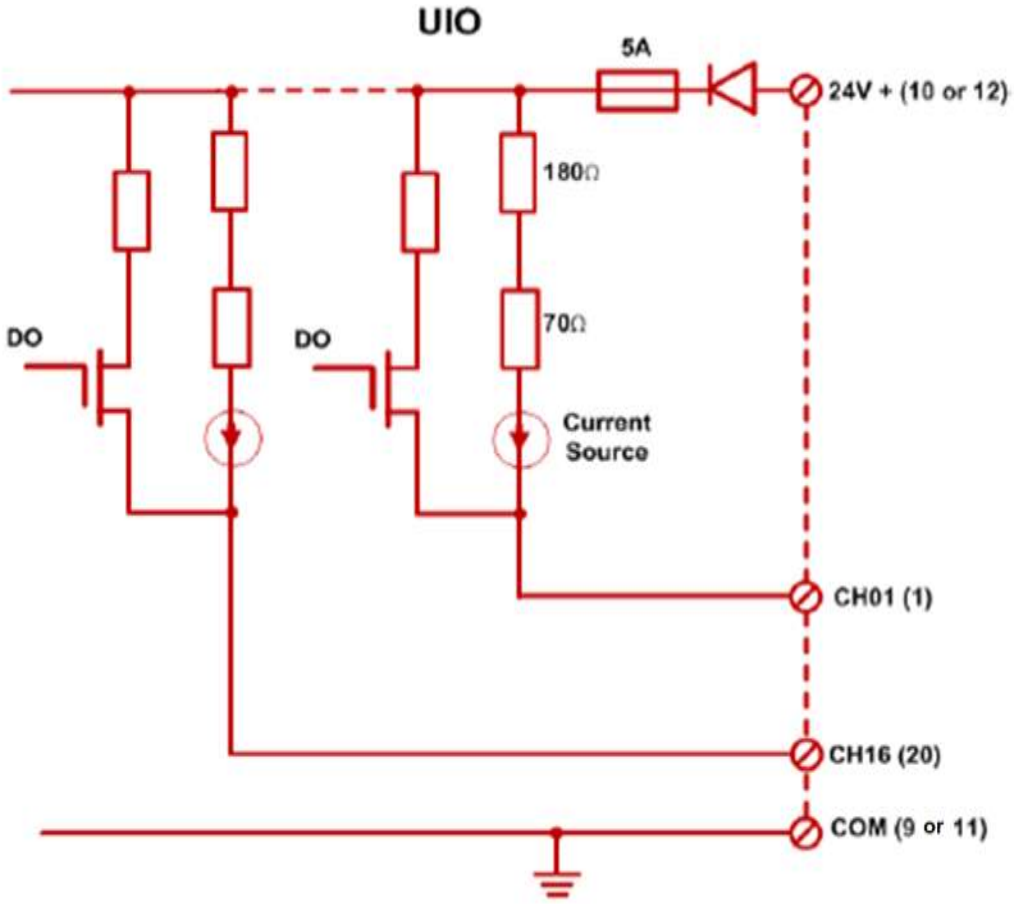


Figure 80 - Safety UIO with Power Wiring

In Figure 80, each power supply source supplies power to the whole module. If redundant power supply is provided, the UIO module still can work in case of failure on one power source.
At least one power supply is required, otherwise UIO module cannot work and "External power" error is reported.

UIO Overview



Field wiring for Analog Input

The UIO is optimized for use with 2-wire, 3-wire or 4-wire transmitters. All 16 channels can accept inputs from most 2-wire, 3-wire or 4-wire transmitters without any special wiring.

The following are the items that UIO AI supports.

- 4-20mA current inputs;
- Devices that accept external power to power a 4-20mA current source and(optionally) the device;
- Devices that return the current to the ground terminal of the external 24V power supply;
- External devices that can moderate non-compliant devices. For example: 'moderators' = current mirrors, isolators, GI/IS barriers, mv-to-I.

See Table 16 for the specification of AI Channel:

Table 16 – AI Channel

Parameter	Specification
Input type	Current (2, 3, or 4 wire devices)
Input Channels	16 Maximum per module (with or without open wire detect)
A/D Converter Resolution	16 Bit
Input Range	4-20 mA Input Extreme that can be measured
Crosstalk, dc to 60 Hz (channel-to-channel)	58 dB
Input Impedance	250 Ω nominal
Maximum Input Voltage (any input referenced to common, no damage)	0 – 30 V
Input Scan Rate	10 ms
Hardware accuracy	0.1 % of full-scale (23.5 ± 2 °C) 0.17 % of full-scale (0 to +60 °C)
Transmitter Field Power Conditioning	Current limited to 24 mA
Input Filter	First-order low-pass 1 kHz

The following items are not directly supported by UIO AIs:

- Voltage inputs (1-5 or mv)
- Thermocouples
- RTDs
- NAMUR devices
- Devices that supply current, which is not first supplied by the external 24 V to the device. For example, a device that creates current (even if referenced to Honeywell ground).

Standard 2-wire transmitter with UIO

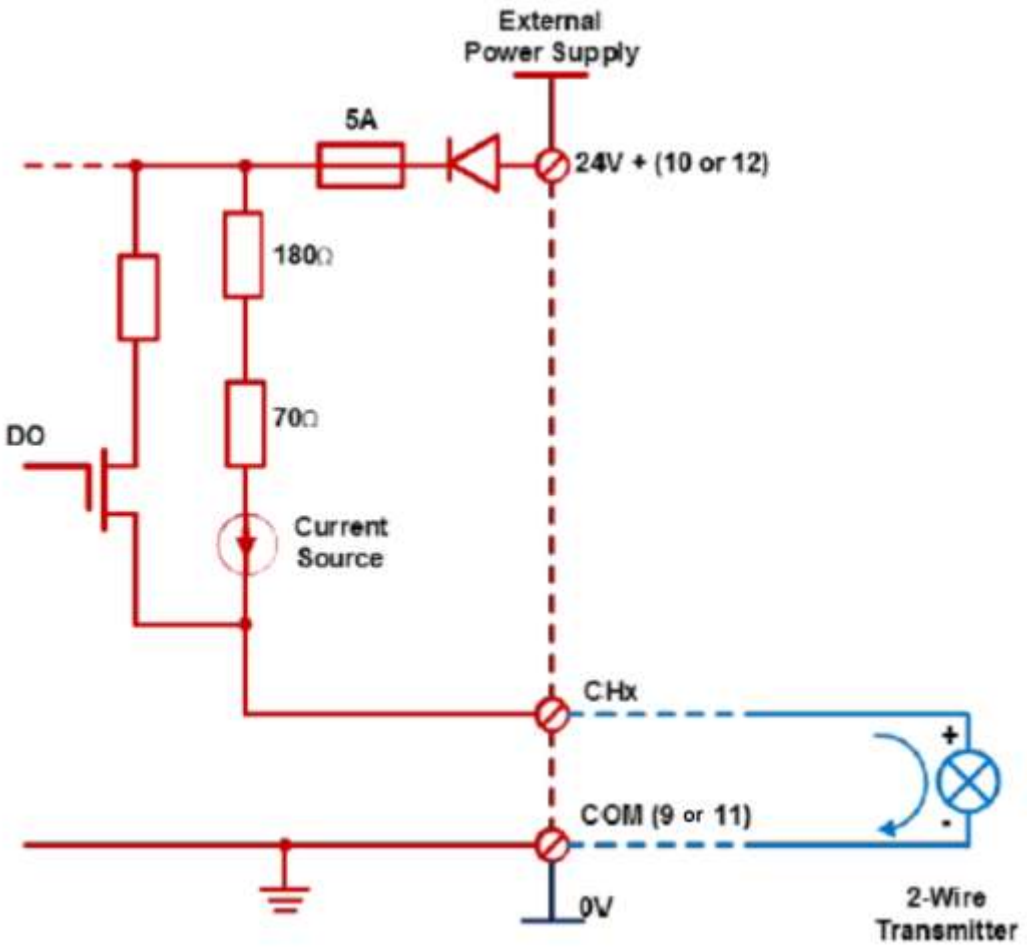


Figure 81 - Standard 2 Wire Transmitter with UIO

Self-powered 3-wire transmitter with Sink Type Input

This can be applied to any channels from 1 through 16.

The UIO channel will be connected to Sink type transmitter +Ve terminal. The below figure shows the simple wiring diagram for connecting UIO to 3-wire transmitter.

The device must reference its 'DCS-side' common to ControlEdge 900 common.

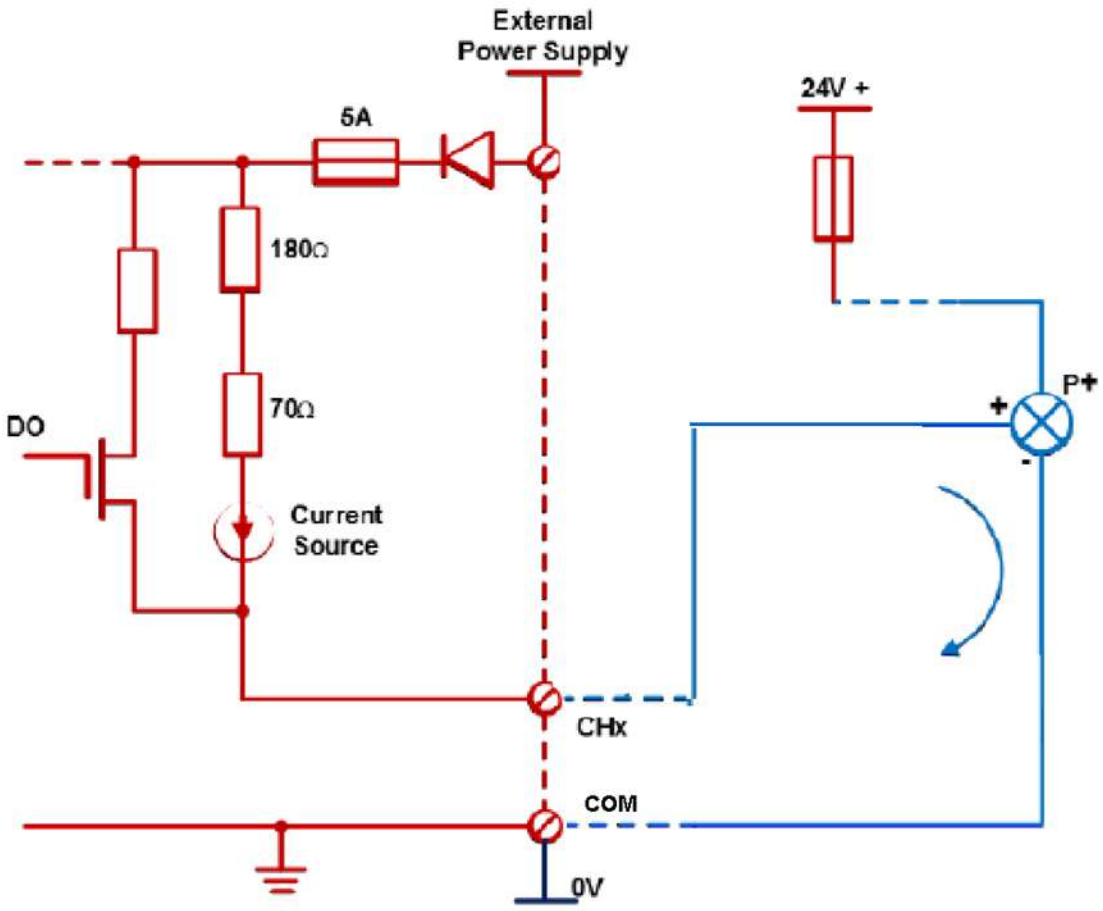


Figure 82 - Self-powered 3-wire transmitter with system ground

Self-powered 4-wire transmitter sinking type transmitter with UIO

This wiring method can be applied to any of the channels 1 through 16.

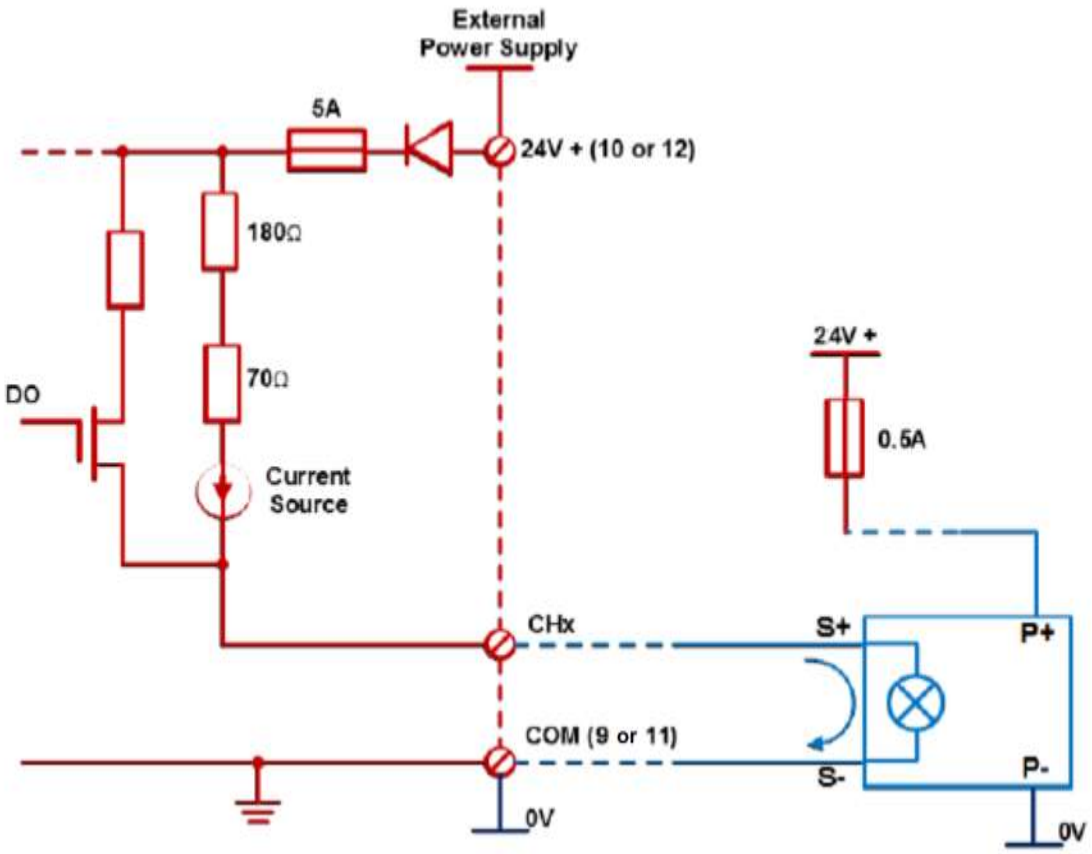


Figure 83 - Self-powered 4-wire sinking type transmitter with UIO

UIO does not support the following input types:

- Self-powered 4-wire transmitter with ground-referenced current source:
  This is because the current return path is on the negative side of the wire-pair.
- Voltage input: This is because UIO supports only current measurements.
- Slidewire: This is because UIO supports only current measurements.

Allowable field wiring resistance – Safety UIO - Analog Input channel

The maximum allowable field wiring resistance between the transmitter and the connection terminal is dependent upon the voltage requirement of the transmitter. The formula for calculating the maximum wiring resistance for the UIO channel used as an analog input is given by the following equation:

Rmax= [(19.0-Vtx) / (0.022)]

Where, Vtx=Voltage required at the transmitter terminal.

Field wiring for Analog Output

The UIO can drive 4-20mA. See the following table for AO specification:

Table 17 - Field wiring for analog output

Parameter	Specification
Output Type	4-20 mA current loop
Output Channels	8 Maximum per module [1] (with line monitoring) Assignable to channels 9 to 16
Output Ripple	=< 125 mV peak-to-peak at power line frequency, across 250 Ohm load
Output Readback Accuracy	0.17% of full scale
Output Current Linearity	± 0.1% of Full Scale nominal
Resolution	12 Bit
Calibrated Accuracy	<0.5% of Full Scale (25ºC) including linearity, entire operating temperature
Directly Settable Output Current Range	2.4 mA to 21 mA
Maximum Resistive Load	750* Ohms
Minimum Resistive Load	250 Ohms
Maximum Output Compliant Voltage (24 V supply = 22 VDC through 28 VDC)	14 VDC
Maximum Open Circuit Voltage	24 VDC
Maximum Load capacitance	< 1 uF

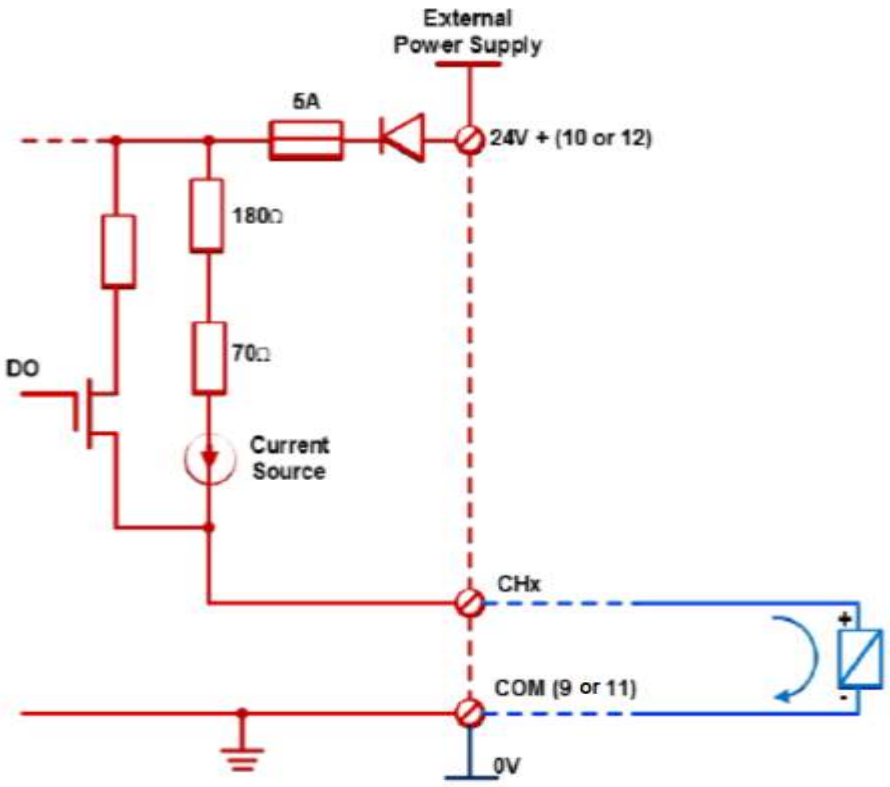


Figure 84 - Field wiring for analog output

Field wiring for Digital Input (Dry Contact)

A UIO channel configured as a Digital Input. See the following table for DI specification:

Parameter	Specification
Open Voltage	**24V**
Short Circuit Current	7 mA
Open Contact	15 kΩ > 0.1 W [A]
Closed Contact	5 kΩ > 0.25 W [B]
Short circuit detection:	I > 6mA +/-5%
Closed contact detection:	2.8mA < I < 6mA +/-5%
Lead Breakage Detection	I < 0.9mA +/-5%
Input filter	First-order low-pass 1kHz
Note A: At 24 VDC, equates to 8.57 KΩ > R > 4 KΩ (where R = total loop resistance) Note B: At 24 VDC, equates to 26.7 KΩ > R > 10 KΩ	

When the DI channel is configured with open wire detection (OWD), a 15kΩ shunt resistor required in the field near the switch contact as displayed in the following figure.

For both Open Circuit and Short Circuit Detection (SCD) a 15K shunt resistor and a 7.5K series resistor are required closed to the contact in field side. Refer to the following block diagram of this channel configuration, and a field wiring example.

Attention:

For Channels that are configured with a debounce, the UIO will declare that the channel has changed state if all then consecutive samples are in the new state for the configured debounce time period.
See the following wiring diagram of the UIO channel configuration.

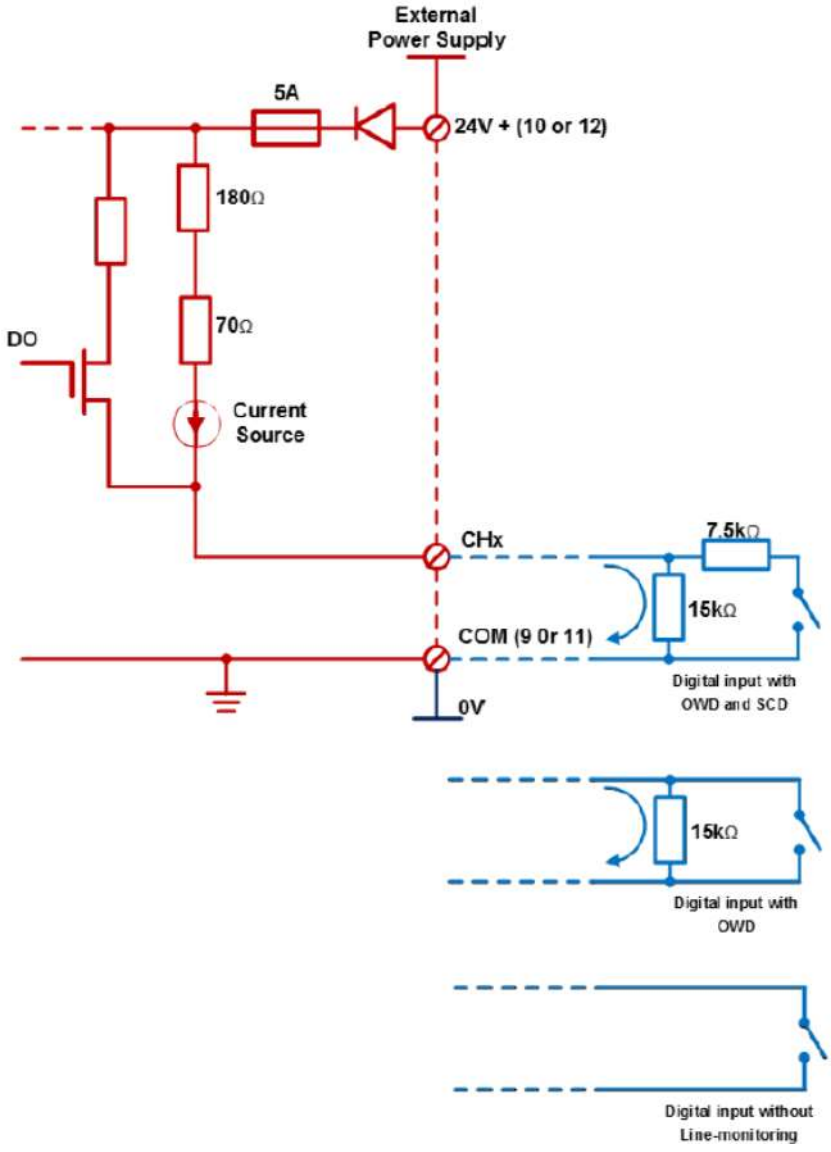


Figure 85 – UIO DI channel configuration

Field wiring for Digital Output

When you configure Safety UIO as a Digital Output, the channel can supply up to 0.5A to the field. See the following table for the specification of DO.

Parameter	Specification
Output Channels	16 Maximum per module (with line monitoring) [4]
Output Type	Solid state source, short circuit protected
DO read back current Accuracy	DO Current : 0-10 mA +/- 1 mA 11-100 mA +/- 5 mA 101-500 mA +/- 20 mA
Load Current	0mA Minimum to 0.5A Maximum per channel [2] 4 A Maximum per module [1]
On-State Voltage	24 V (typ), load current @ 0.5A
Off-State Voltage	0 VDC (max) Open Load
Off-State Leak Current	< 0.1 mA
Maximum Load Inductance	< 10 H
Maximum	< 1 uF

See the following Figure 86 for the channel configuration.

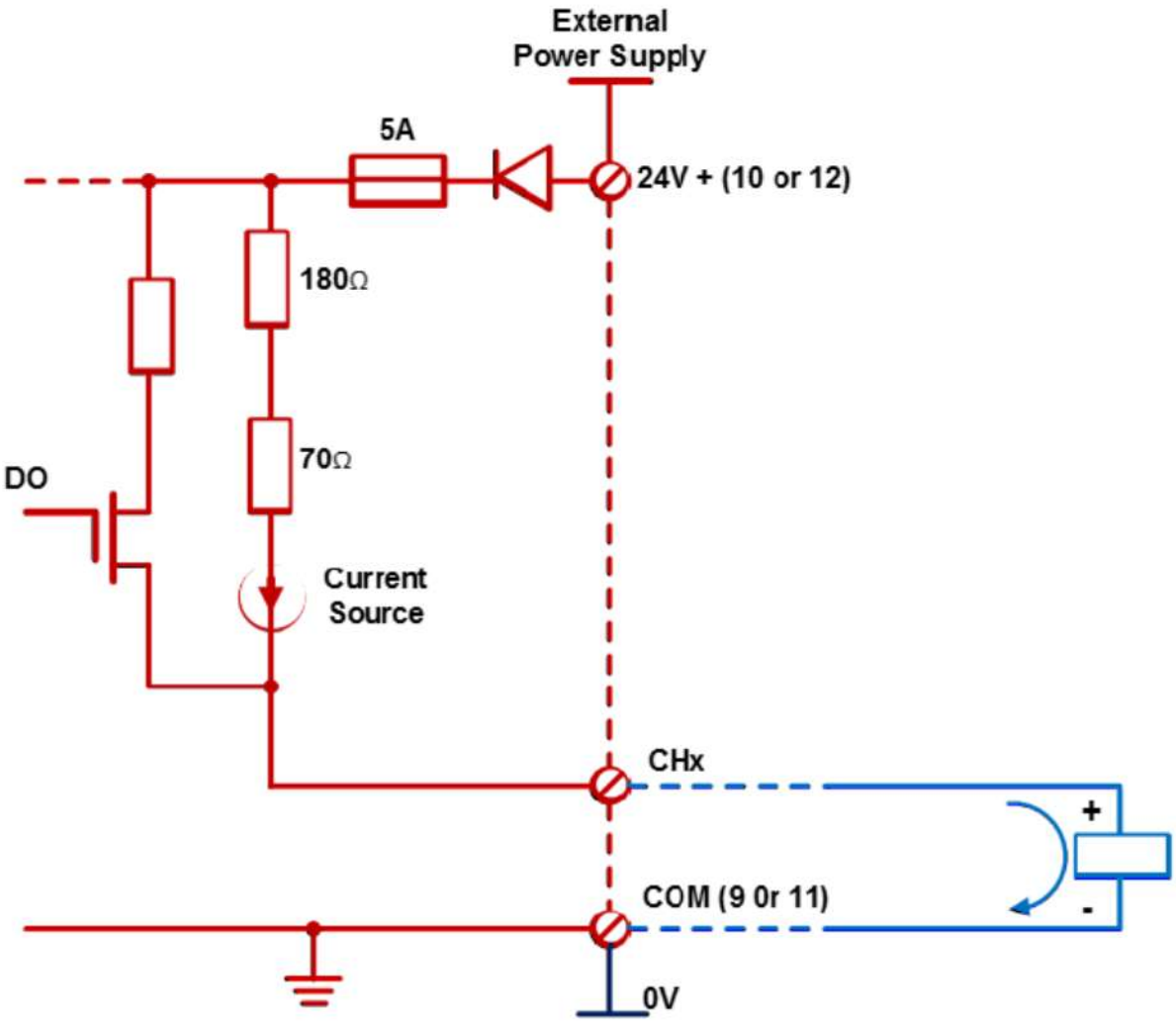


Figure 86 - Safety UIO_DO channel configuration

Note: For Redundant configuration above 60 °C ambient, it is recommended to connect Shunt resistor of 1.5KOhms 1 Watt across the load (device side) for DO with load current of < 25 mA.

Safety Redundant Universal Input/ Output (14 Pts) Module Wiring

It is 14 Channel safety redundant universal I/O module, and each channel can be configured for AI, DI and DO. AO type can configured for channel 9 to 16. The channels on Safety UIO are source type.

6.8. UMS-HC900 UIO Wiring

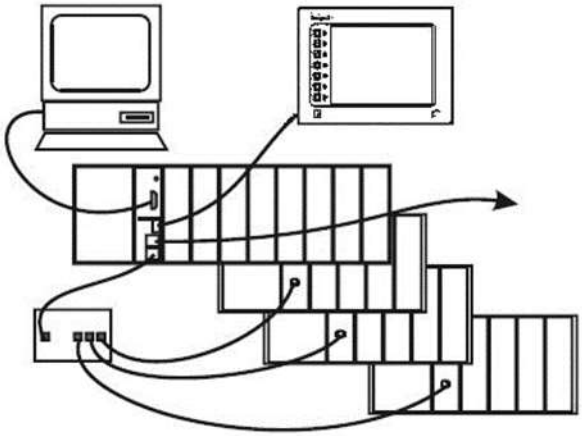
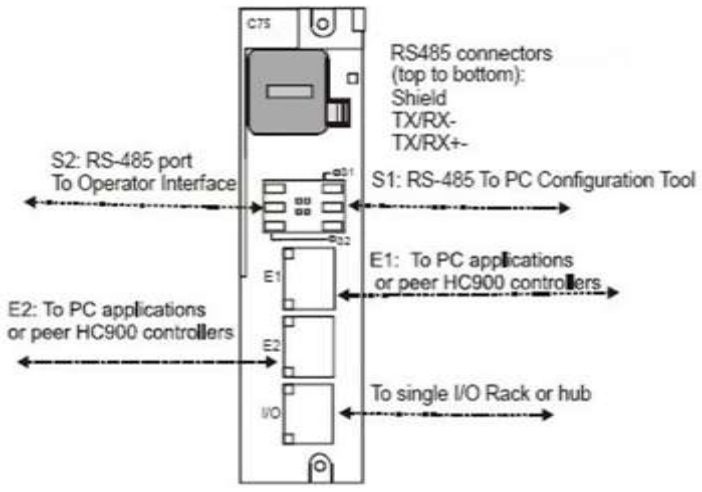
7. Communications Installation

7.1. Overview

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

7.2. Wiring and cabling

Table 18 – Connect Communications Wiring and Cabling

Step	Procedure	Comments/Reference
1	Determine requirements for communications links. See: • Ethernet Network on page 42 • For legacy system, serial Ports (RS-232 and RS-485) on page 48. For new system, two RS-485 serial ports on page 48 • Cabling/Wiring Distance Planning on page 69.	
2	Refer to the diagram at right, and to Table 19 Links to Controller Communication Ports for connection details. All ports are shown. (Availability depends on controller model, see Figure 12 page 37.) Connect communications cabling. For Modbus connections, see page 171.	 **Communication Ports (all ports shown)**
	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 19 and the figure in Step 2 above. Port availability depends on Controller model.

Table 19 – Links to Controller Communication Ports

Controller Port /Connector Type	Link Type: Controller to	Cable Type	To Device/Port	Details
Legacy controller only 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 155.	For Wiring details of Null Modem cable see Table 21.
Legacy controller only RS-232 3-plug connector	Modbus host (controller is single device)	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	
Legacy controller only RS-232 3-plug connector	Modbus host (controller is one of multiple modbus devices)	RS-232 to RS-485 converter	Refer to device's port instructions	
Legacy controller only RS-232 3-plug connector	Modbus device network (controller is host)	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 20.) Connect from each CPU (A and B) to the OI.	SIL applications require shield drain wire to be connected to grounding bar.
RS-485 3-Plug connector	Modbus host (controller is device)	Belden #9271 (or equivalent)	Refer to device's port instructions	SIL applications require shield drain wire to be connected to grounding bar.
RS-485 3-Plug connector	Modbus device network (controller is host)	Belden #9271 (or equivalent)	Refer to device's port instructions	SIL applications require shield drain wire to be connected to grounding bar.

E110/100 Base-T RJ45	Host, Peer, and Internet Devices	Shielded CAT5 cable, up to 100 meters.	RJ45 connector on Host, Peer, or Internet Device	Default IP address is 192.168.1.254
E210/100 Base-T RJ45	Host, Peer, and Internet Devices	Shielded CAT5 cable, up to 100 meters.	RJ45 connector on Host, Peer, or Internet Device	Default IP address is 192.168.2.254
E110/100Base-T RJ45	Lead CPU supports redundant Modbus/TCP Protocol to OPC server, PC supervisory and data acquisition software packages and Designer 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 with RJ-45 connectors	C50/C70 Controller's I/O port to Scanner 1's I/O port.	No foreign messaging permitted
I/O 100Base-T	Single I/O rack	Shielded Ethernet CAT5 cable 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.	No foreign messaging permitted

I/O 100Base-T	2 or more I/O racks	Shielded Ethernet CAT5 cable with RJ-45 connectors	C75 CPU A's I/O port to approved unmanaged switch. From this unmanaged switch to each Scanner 2's I/O A port. One (1) additional unmanaged switch may be used, for a total of 2 unmanaged switches between CPU A and the I/O racks. C75 CPU B's I/O port to approved unmanaged switch. From this unmanaged switch to each Scanner 2's I/O B port. One (1) additional unmanaged switch may be used, for a total of 2 unmanaged switches between CPU B and the I/O racks.	No foreign messaging permitted

7.3. Connecting the Operator Interface to the Controller

Using parts in Table 20 connect the Operator Interface to the galvanically isolated RS-485 port on the controller for legacy systems. For new systems, the parts in Table 20 connect to either of the two galvanically isolated RS-485 ports on the controller. See page 48 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 galvanically isolated RS-485 port to the Operator Interface. See Operator Interface manual #51-52-25-108 for connection details.

Table 20 – 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

7.4. Connecting the ControlEdge HC900 Controller to a PC with the Designer Software

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

- A. Direct Serial RS-232 connection. See page 153. Direct with RS-485 and RS-485 to USB converter with supplied instructions.
- B. Modem connection. See page 155.
- C. Direct Ethernet connection. See page 168.
- D. Networked Ethernet connection. See page 169.

These methods are described below.

ATTENTION:
Always observe the wiring/cabling guidelines on page 69.

A. Direct Serial RS-232 Connection (Legacy Controllers)

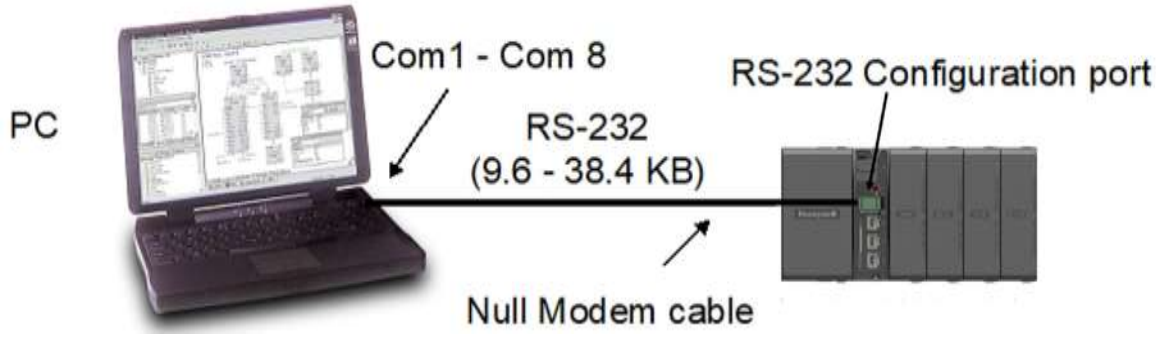
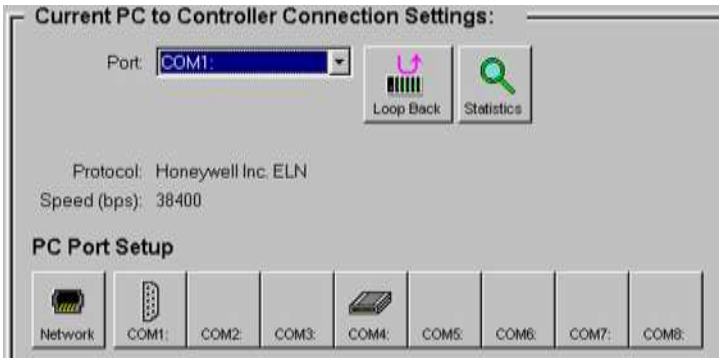


Figure 87 – A Direct Serial RS-232 Connection

ATTENTION:

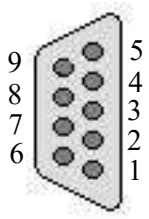
Always observe the wiring/cabling guidelines on page 69.

Step	Procedure
1	Prepare a null modem cable. Refer to RS-232 Converter Direct Link to PC Configuration Tool (page 154) for specific instructions on the null modem cable.
2	Connect one end of the null modem cable to the ControlEdge 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 154) 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 ControlEdge 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 (Legacy Controllers)

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 21.

Table 21 – 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 (Legacy Controllers)

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 88 and shown in Table 21.

A second Null Modem cable is used between the PC and the internal or external modem at the other end, as shown in Figure 88. 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.

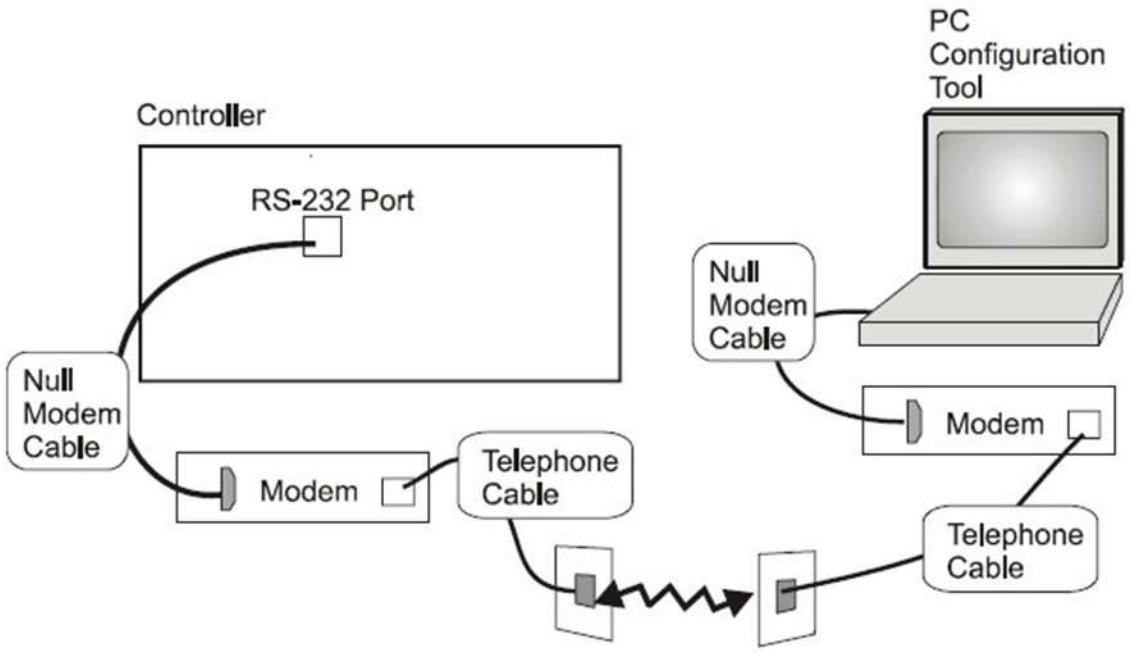


Figure 88 – RS-232 Remote Access via Modems

B. Modem Connection

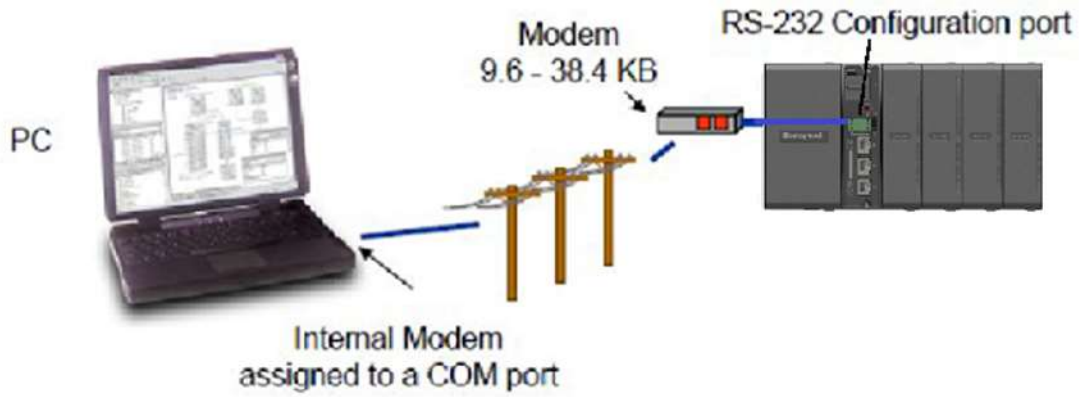
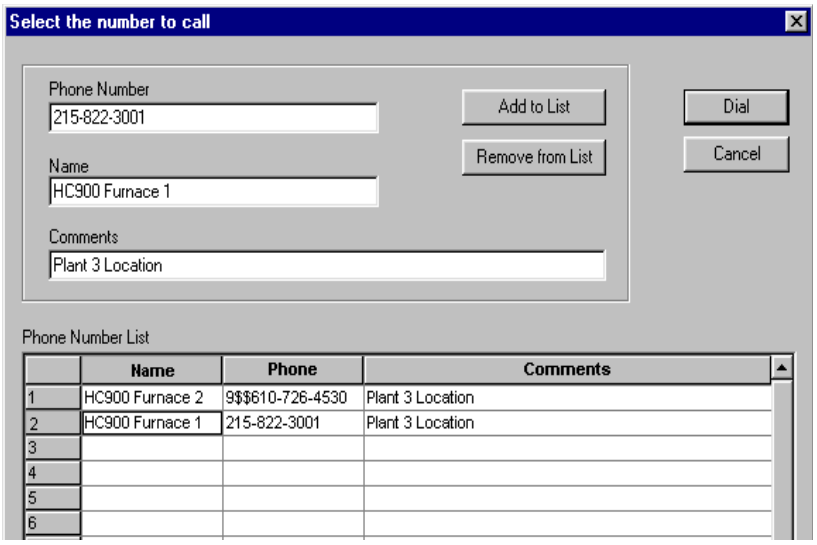
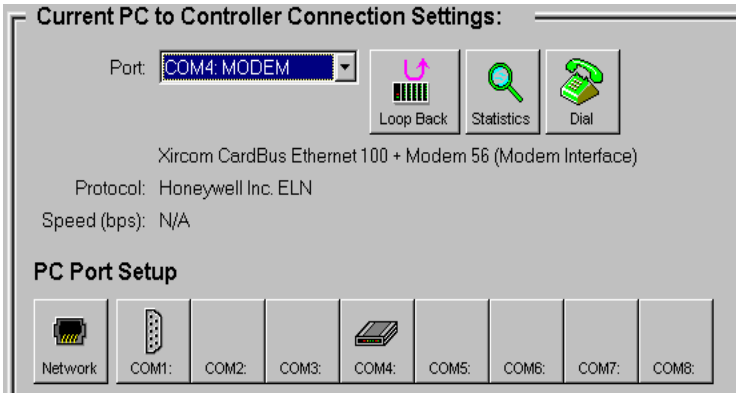


Figure 89 - Modem Connection

ATTENTION:

Always observe the wiring/cabling guidelines on page 69.

Step	Procedure
1	Connect a modem to the ControlEdge HC900 controller 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 ControlEdge 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 ControlEdge 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 ControlEdge 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 ControlEdge 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 ControlEdge 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 Dual Mode External Modem (page 161)
- Best Data 56SX Data Fax External Modem (page 162)
- SixNet VT-MODEM Industrial External Modem (page 163)

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)

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 ControlEdge 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.

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)

13	Connect the modem to the 25 pin cable connector.
14	Connect the modem to a telephone jack.
15	Power up the modem and the ControlEdge HC900 Controller.
16	On a remote computer, run Designer Software.
17	Set up Designer Software to dial the ControlEdge HC900 Controller.
18	Verify that communications are established with the remote ControlEdge HC900 Controller.

Zoom 56K Dual Mode 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 ControlEdge 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 25 pin cable connector.
13	Connect the modem to a telephone jack.
14	Power up the modem and the ControlEdge HC900 Controller.
15	On a remote computer, run Designer software.
16	Set up the PC software to dial the ControlEdge HC900 Controller.
17	Use the PC software "Loop-back" feature to verify that communications are established with the remote ControlEdge 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 ControlEdge 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 25 pin cable connector.
13	Connect the modem to a telephone jack.
14	Power up the modem and the ControlEdge HC900 Controller.
15	On a remote computer, run Designer software.
16	Set up the PC software to dial the ControlEdge HC900 Controller.
17	Use the PC software "Loop-back" feature to verify that communications are established with the remote ControlEdge 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 ControlEdge 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 modem to the 25 pin cable connector.
13	Connect the modem to a telephone jack.
14	Power-up the modem and the ControlEdge HC900 Controller.
15	On a remote computer, run Designer software.
16	Set up the PC software to dial the ControlEdge HC900 Controller.
17	Use the PC software "Loop-back" feature to verify that communications are established with the remote ControlEdge HC900 Controller.

Connecting C75/C75S dual Ethernet to a PC with Designer Software or other applications
Only use Shielded CAT 5 cable for network connections. See Figure 90 and Table 22.

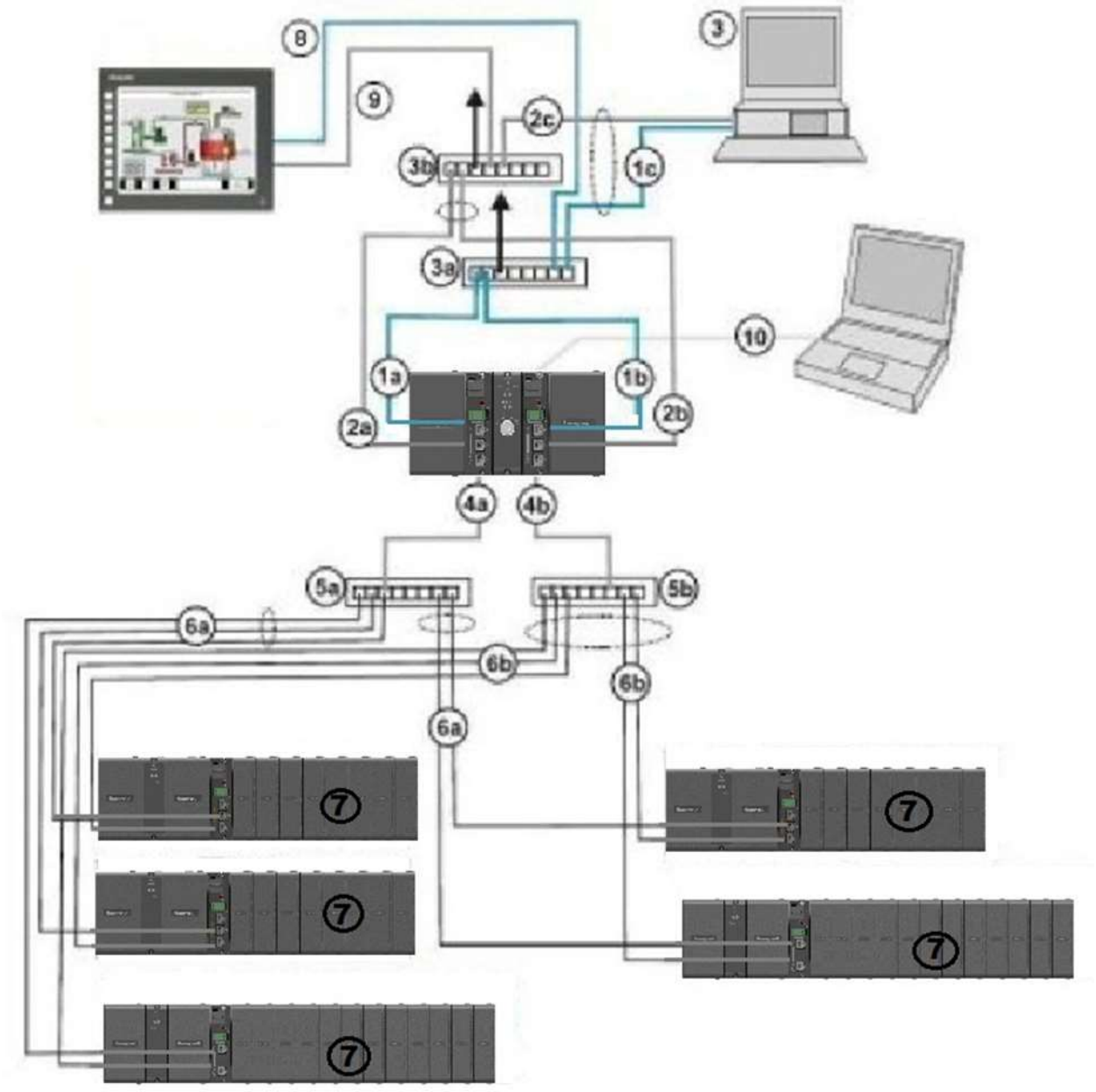


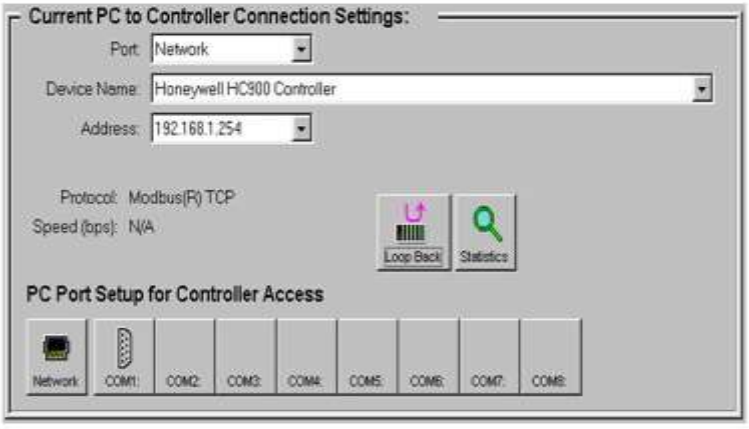
Figure 90 – Dual Networks

ATTENTION:
Always observe the wiring/cabling guidelines on page 69.

Table 22 – Dual Network connections in Figure 90

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 or router/firewall for CPU-A E1 port
3b	Ethernet switch or router/firewall 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 (50089787-001)

Table 23 – Dual network connections

Step	Procedure
1	Make sure the PC has 2 Ethernet NICs (Network Interface Cards) installed and enabled.
2	Connect Ethernet 10/100 Base-T straight or crossover cables to the ControlEdge 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 Designer software to connect to the controller over Ethernet. Every ControlEdge 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). Note: 900 Control Station uses IP 192.168.1.253 as default.
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 (legacy systems) 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 153). **Attention: IP addresses for E1 and E2 must be on different subnets.**

Step	Procedure
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 ControlEdge 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

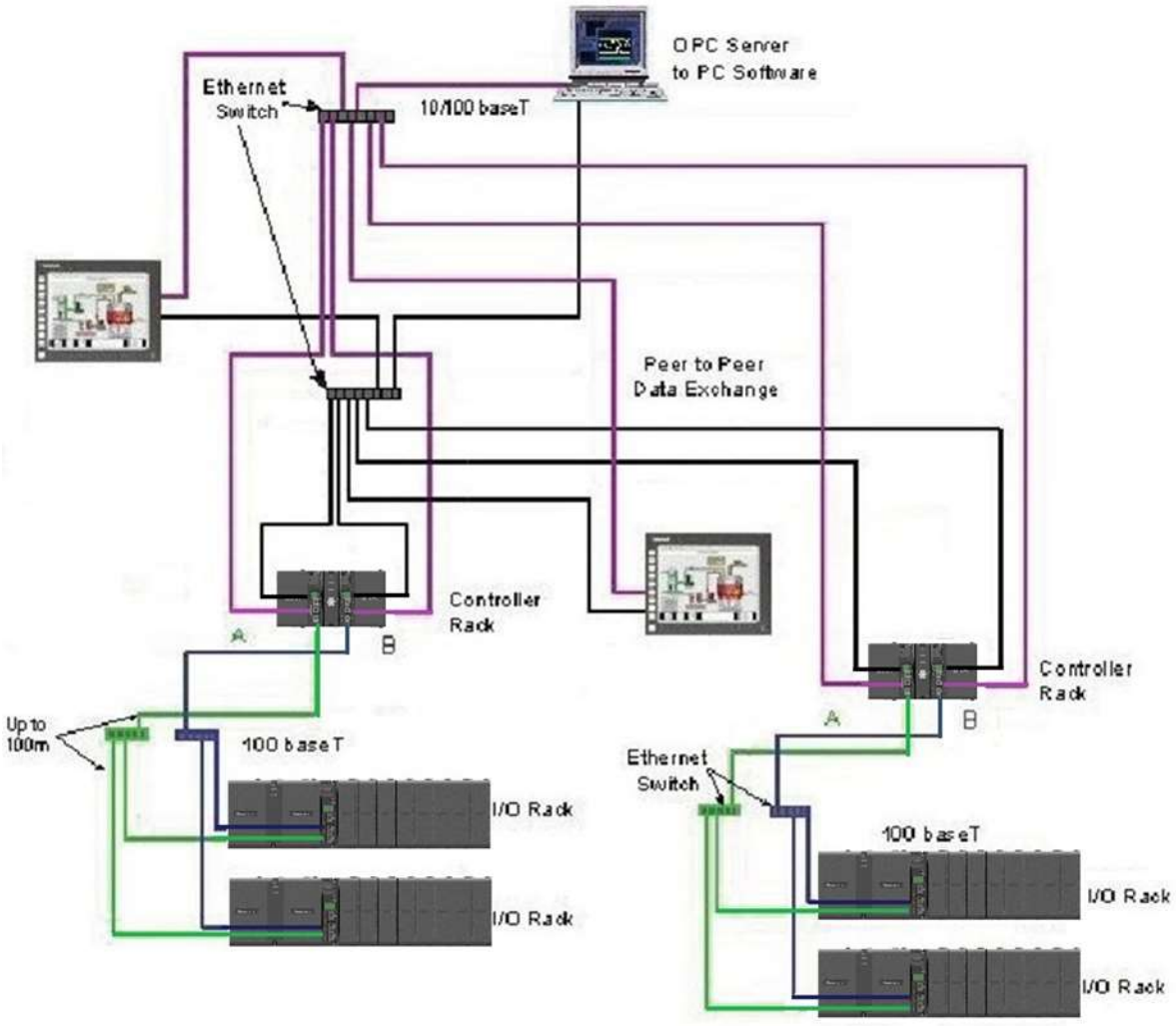
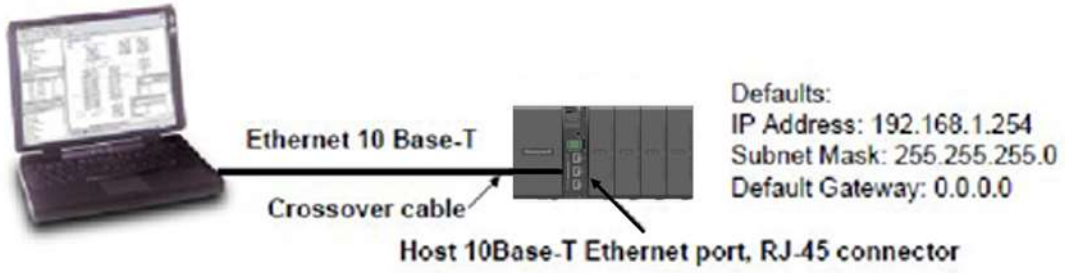
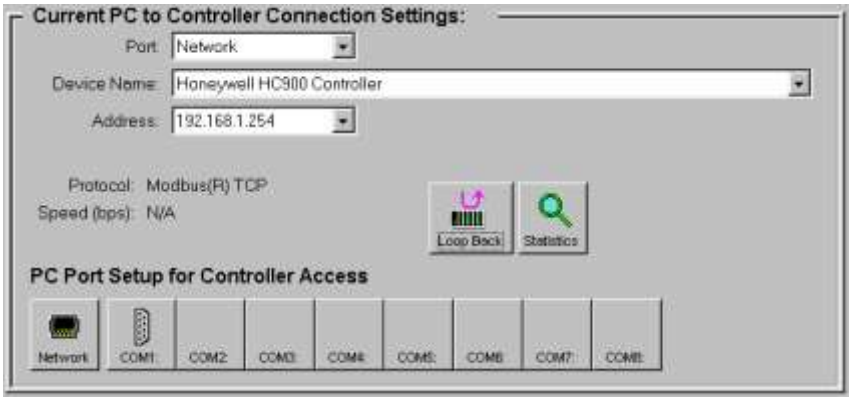


Figure 91 – Two redundant systems with PC supervision

C. Direct Ethernet Connection to one ControlEdge HC900 controller

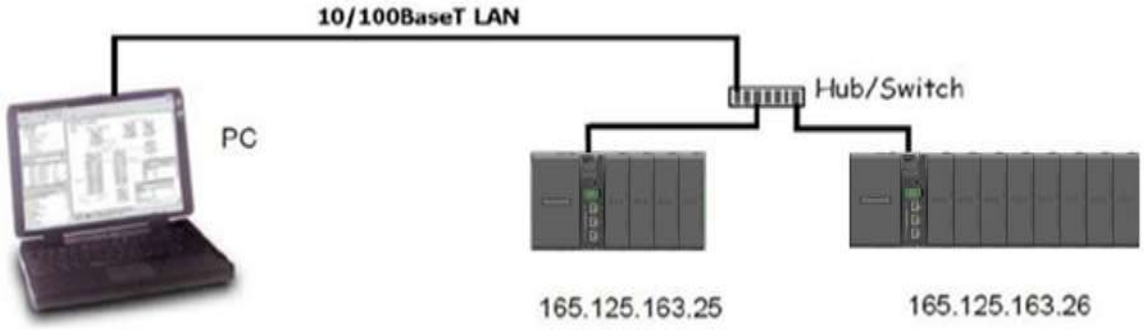


ATTENTION:
Always observe the wiring/cabling guidelines on page 69.

Step	Procedure
1	Make sure the PC has an Ethernet NIC (Network Interface Card) installed and enabled.
2	Connect an Ethernet 10/100 Base-T crossover cable to the ControlEdge HC900 controller's Open Ethernet RJ-45 port (top RJ-45 port).
3	Connect the other end of the Ethernet 10/100 Base-T crossover cable to the PC's network port. **Note**: Crossover cable only required for Legacy < rev: 4.x.
4	On the PC, use the Utilities Worksheet in the Designer software to connect to the controller over Ethernet. Every ControlEdge 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). Note: 900 Control Station uses IP 192.168.1.253 as default.
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. 

Step	Procedure
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 (legacy systems) 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 153).
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 ControlEdge 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



ATTENTION:
Always observe the wiring/cabling guidelines on page 69.

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 ControlEdge 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 (Legacy) or USB-RS485 connection to the controller at the desired baud rate (see Direct Serial RS-232 Connection above). This will require a null modem cable.

Step	Procedure
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 10/100 Base-T cable to the PC's network port. Connect the other end of the Ethernet 10/100 Base-T cable to the Ethernet switch.
8	Connect an Ethernet 10/100 Base-T cable to each ControlEdge HC900 controller's Open Ethernet RJ-45 port (top RJ-45 port). Connect the other end of each Ethernet 10/100 Base-T cable to the Ethernet switch or router/firewall.
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

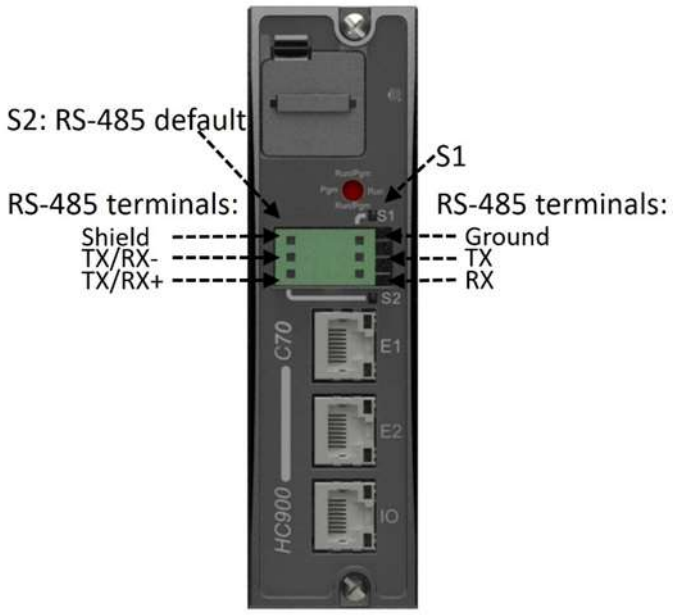
See the Designer Software Users Guide, Doc. # 51-52-25-110 or respective HC Designer Help Files for setting up following network parameters:

- 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.

7.5. Connecting the ControlEdge HC900 Controller to Modbus device(s)



RS-485 Modbus connections

Use Designer software to configure the controller's galvanically isolated RS-485 port as a modbus host or device. Install resistor as shown for terminated devices except ControlEdge HC900. For terminating ControlEdge HC900, do not install resistor. Instead, set internal DIP switches for termination (page 48). When using the ControlEdge HC900 XYR5000 transmitter function blocks and RS-485 serial communications ports, connect Base Stations to the ControlEdge HC900 controller, shown in Figure 92.

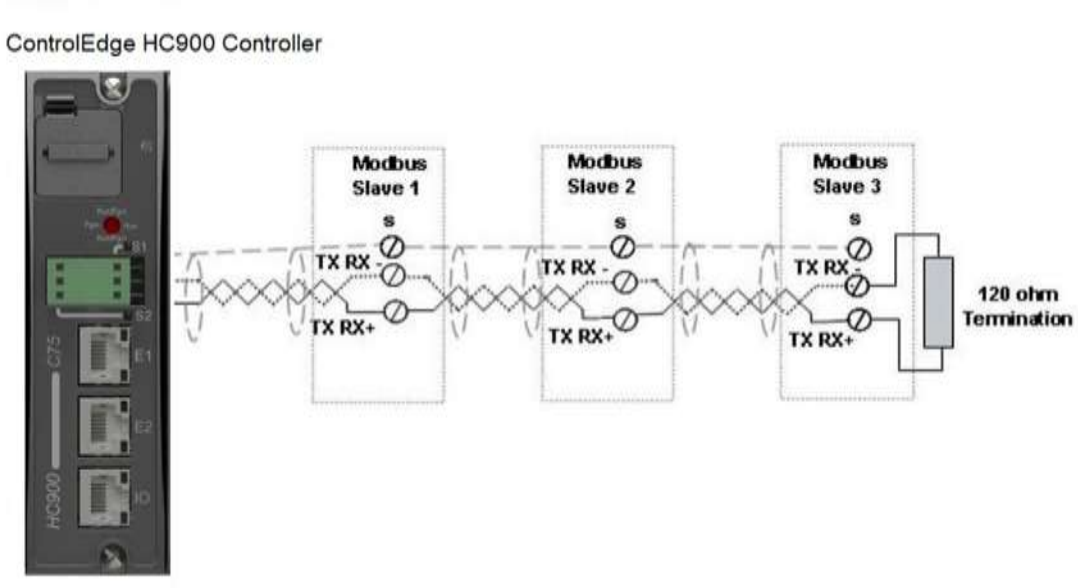


Figure 92 - RS-485 Modbus device wiring

If the RS-485 network to modbus device 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 93.
Note: Legacy Controllers do not provide biasing.

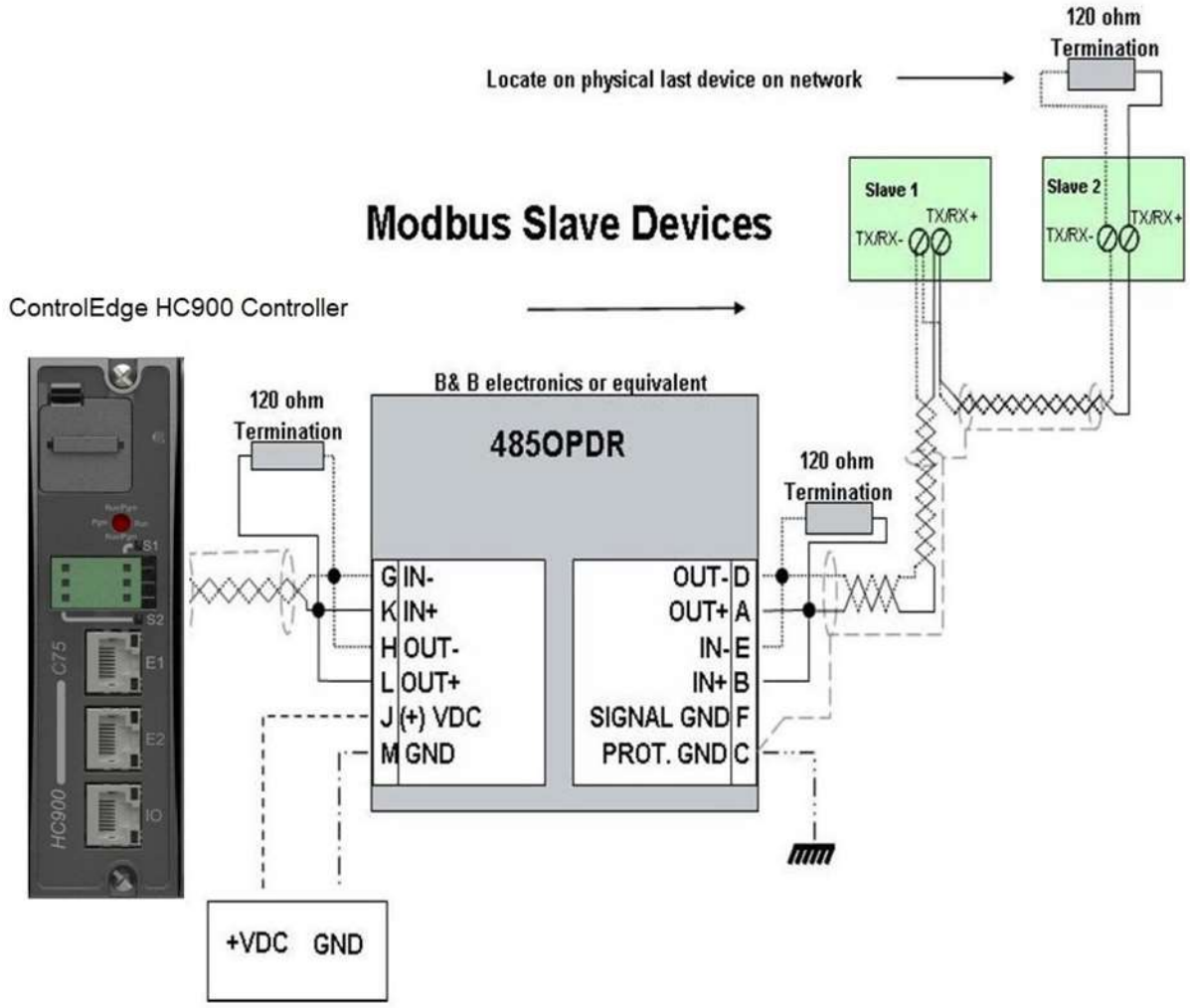


Figure 93 - RS-485 Modbus device wiring with isolation

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 94 shows recommended installation procedure for using an external isolator and additional port bias.

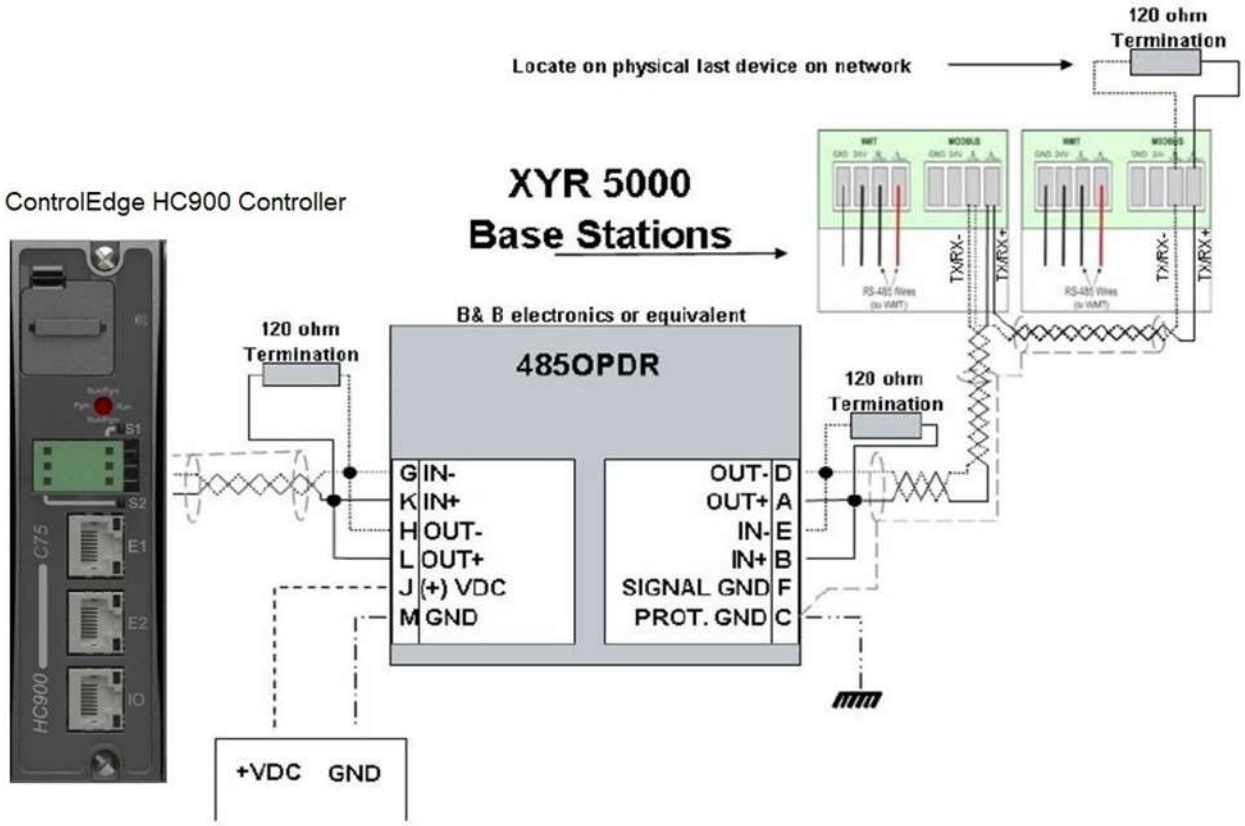


Figure 94 - XYR 5000 RS-485 Modbus connections with isolator

RS-232 Modbus Connections

For Legacy controllers, connect to the RX, TX, and ground pins of the controller's 3-pin RS-232 port. (See page 48 for RS-232 DIP switch settings.)
Table 21 (page 154) identifies the pins. For connections on other devices, refer to its product manual.
For new 6.x controllers use an RS232-RS485 converter.
Use Designer software to Configure the legacy controller's RS232 port or New 6.x controllers RS485 port as a Host of Device. Use HC Designer software to configure the controller's RS-232 port as a host or device.

8. Operating Characteristics

8.1. Introduction

This section applies to all controllers, that is, non-redundant and redundant. For operating characteristics that unique to redundant controllers, see Redundant Operating Characteristics on page 184.
This section provides insights into system functioning that are useful in configuration, in installation /commissioning tasks, and 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.

8.2. Overview

The ControlEdge 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 ControlEdge 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 (Control Station, 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.

8.3. Power Down / Power Up

The ControlEdge 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 95), 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.

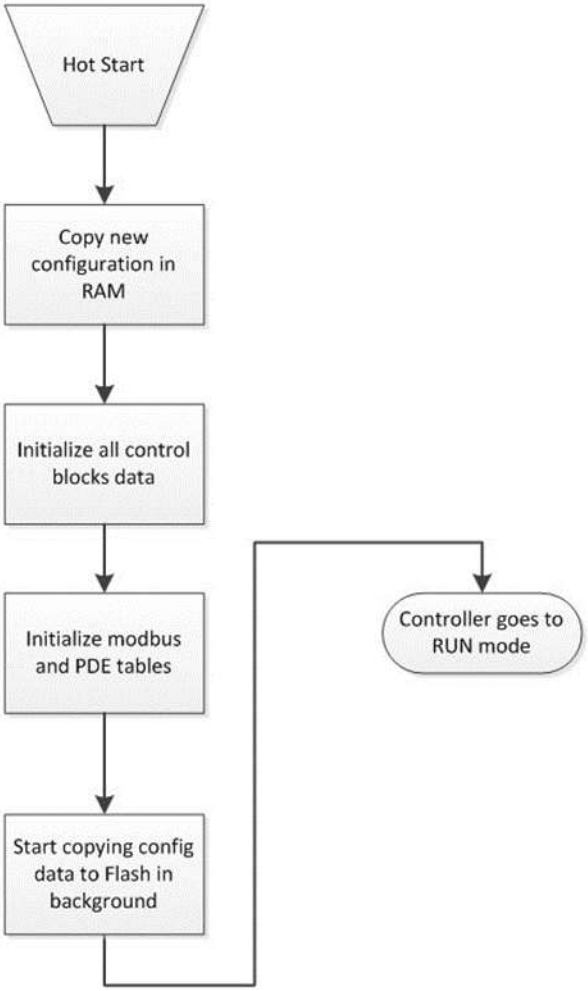


Figure 95 – Warm Start Operation

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 96. 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 95.)
- 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 a Control Station.)
- When initiated by the user (after download with Cold Start selected, or any transition from PROGAM Mode to RUN Mode.)

CAUTION

During controller restart (during cold start or hot insertion of controller/scanner) local IO module will get reset and all outputs will go to un-power state regardless of configured failsafe state.

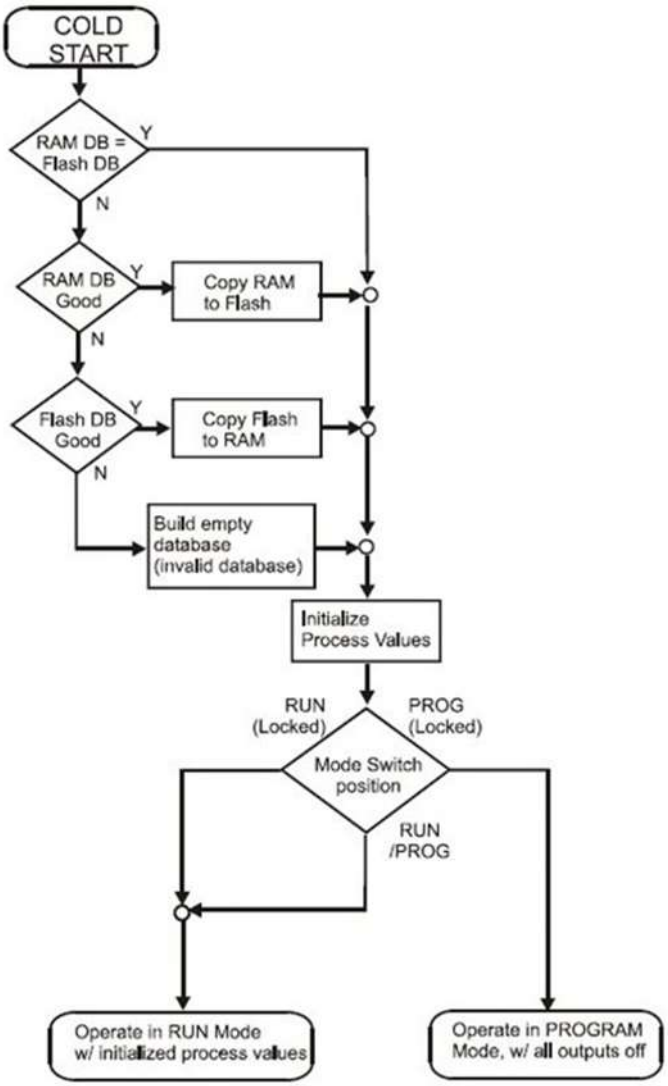


Figure 96 – Cold Start Operation

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 ControlEdge 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.

8.4. Controller Modes

The ControlEdge HC900 Controller includes three operating modes. The purpose of each mode is described immediately below, and salient characteristics of each are described in Table 24. The functions of the Mode Switch are described in
Table 25, and the procedures that the controller performs in transitions between modes are described in Table26.

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 when the physical mode switch is placed in the Run/Program position. See the Designer Software User Guide for precautions, restrictions, and procedures. Functions placed on the Safety worksheet may not be forced or written to in this operational mode when the physical mode switch is placed in the RUN position. The mode switch must be placed in the RUN position. for runtime on Safety applications. The physical mode switch while in the RUN position prevents unintentional configuration changes and is the recommended operational position when modifications to the configuration are not anticipated.

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.

In Controllers with firmware earlier than V 6.0, the controller will resume program execution with current available data when controller returns to RUN mode.
In Controllers with firmware version 6.0 or greater, the controller's memory will get re-initialized, outputs will be de-energized and the controller will restart when changing from Offline to Run mode.

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 24 – 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 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

Mode Name	Functions in selected mode
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 97) 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 25.
The effects on controller operation for each mode transition are described in Table 26.

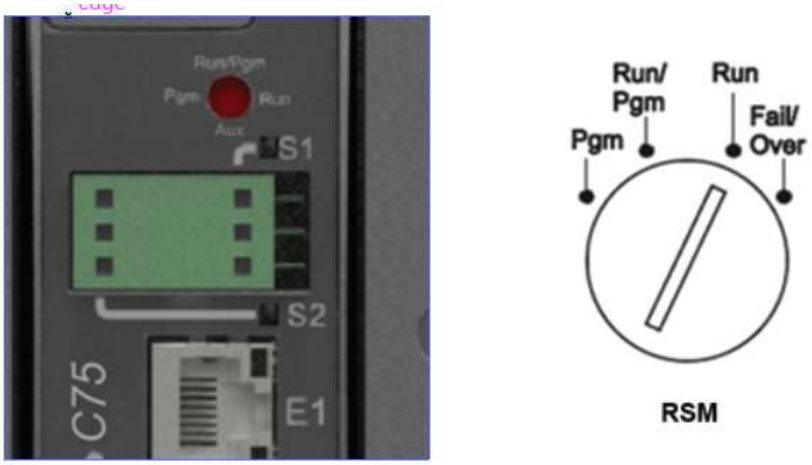


Figure 97 – Mode Switches: On Controller (Split Rack) and RSM (Single Rack)

Table 25 – 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. SIL application must operate in this position. SIL requirements may not occur in other operational modes. This RUN-locked mode is the Safety mode for Safety controllers and the proper normal operational mode for All controllers.
RUN/PROG	PROGRAM RUN OFFLINE	In this position, the mode can be changed at any operator interface using screen selections PROGRAM, RUN, or OFFLINE. The Run/Program mode should be used only when changes are anticipated. The Run-Locked mode is the preferred operational mode to prevent any unintentional changes.
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 (RSM only)	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.
Aux	PROGRAM RUN OFFLINE	In this position, the mode can be changed at any operator interface using screen selections PROGRAM, RUN, or OFFLINE. This mode should be used only when changes are anticipated. The Run-Locked mode is the preferred operational mode to prevent any unintentional changes.

Note: The lead controller mode switch position is considered for redundant system in the split rack installation. Position the reserve controller mode switch same as the lead controller mode switch to operate in the redundant mode.

Table 26 – 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.

8.5. 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 98.

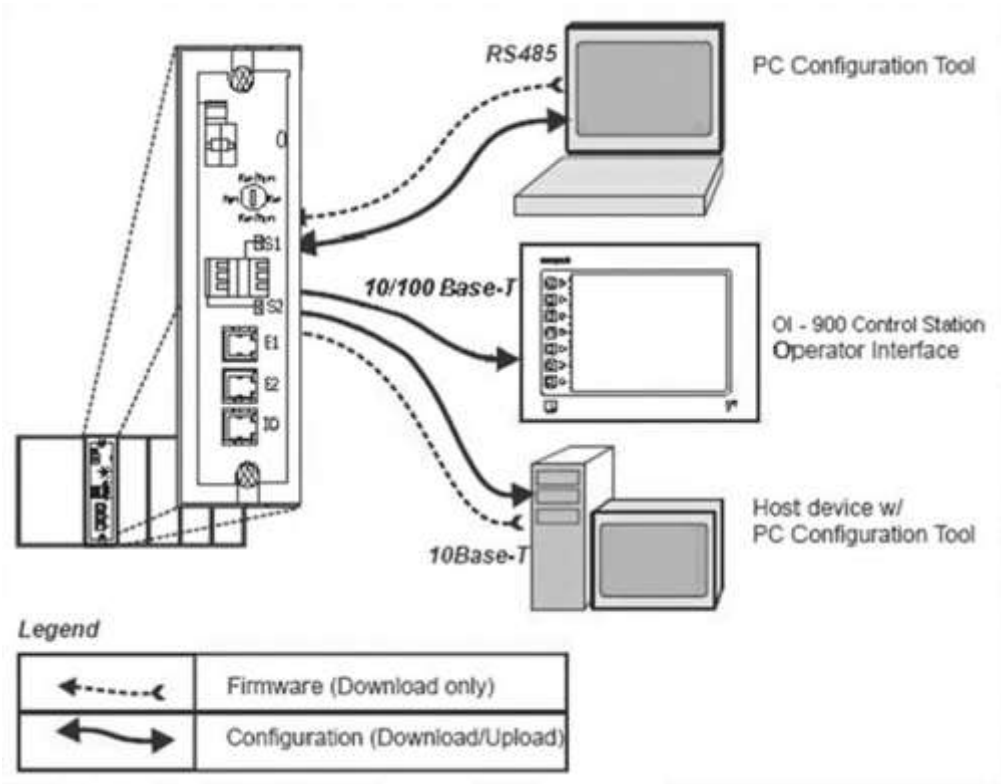


Figure 98 – Pathways for Upload/Download Transactions

Configuration Download

Configuration files include the items indicated in Table 27. 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 27 – 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.

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 Control Station. Using the PC, the Upload function is accessed from the Designer Software.
For details of uploading configuration items, refer to ControlEdge HC900 Control Designer Software User Guide and 900 Control Station For use with ControlEdge HC900 Controller.

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.

9. Redundant Operating Characteristics

Refer to section “Operation” in the Redundancy manual (51-52-25-133).

10. Diagnostics and Troubleshooting

10.1. Overview

The ControlEdge 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.

10.2. 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	186
Scanner indicators	196
I/O Module Indicators	202
Ethernet Switch indicators	206

- Screen items on:
  - A PC with Designer Software/Process Control Utilities connected to the controller module via RS-485 or Ethernet 10Base-T Open Connectivity port. See the Diagnostics section in the application's help.
  - Control Station connected to controller. For more details, see "51-52-25-148" manual.

10.3. Controller CPU indicators

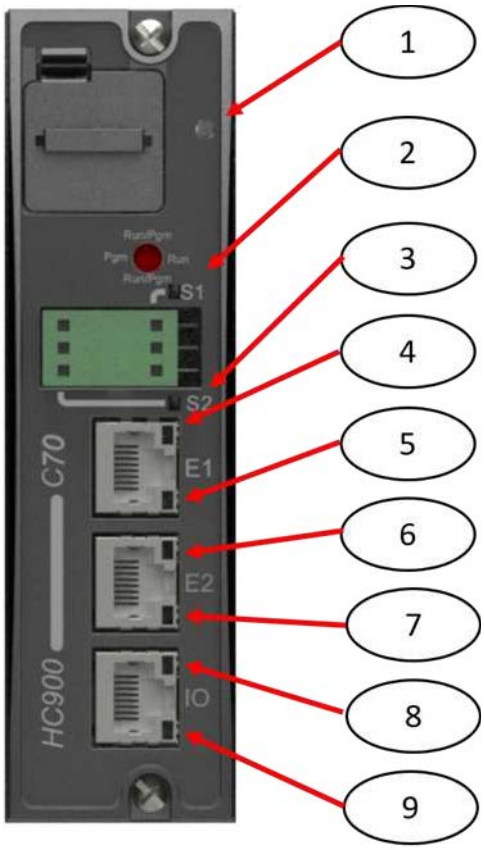


Figure 99 – LED Indicators on Controller CPUs

(See Table 28)

Table 28 – LED Indications on Controller CPUs

CPU model	Figure 99item	LED	LED State/Color	Description
All models	1	Controller Status	Off	No power.
			Solid Red	Failed
			Blinking Yellow	Constant: Failed
				12-Flash Count SIL CPU installed in Legacy, requires new Rack
			Blinking Red	**(Diagnostic Code; refer to**
			Solid Green	Table 29**.)**
			Blinking Green	PROGRAM Mode
			Solid Yellow	RUN Mode
				OFFLINE Mode/while Flash RAM programming
			Rate of Blinking	
			250 ms	Lead Controller in split rack Lead/Reserve in single rack
			1 sec	Reserve Controller in split rack
All models	2	RS-485 S1 port XMT/RCV	Yellow/Green	Yellow when transmitting, green when receiving.
All models	3	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

Controller Status LED Diagnostic indicators

When the Controller has a flashing amber status LED after power-up a critical, power-on-self-test, error has occurred that requires controller module replacement. When the Controller Status LED (Figure 99 on page 186, item 1) is flashing red, consult Table 29.

⚠ 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 29 – 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 device blocks in the configuration, and no communication port is configured as a Modbus host.	• MSTRFAIL pins on ASYS and FSYS blocks turn on. • All Modbus device and Modbus read blocks freeze their output pins to the last value. • All modbus device blocks have their BAD COMM pin on. • All modbus device blocks have their NO SCAN pin on. • IN SCAN STATUS is set to NO for all modbus devices. • COMM STATUS is set to BAD for all modbus devices in the function block diagram. • Statistical counters for all s modbus devices are 0.	1. Use the OI, HCDesigner, or HCUtilities to configure one of the serial ports (S1 or S2) as a modbus host. 2. Use the OI, HCDesigner, or HCUtilities to download a configuration that has no modbus device 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.	To clear the diagnostic: 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.	To clear the diagnostic: 1. Change mode back to RUN mode OR 2. 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.

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
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.			
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.		

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
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.
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		

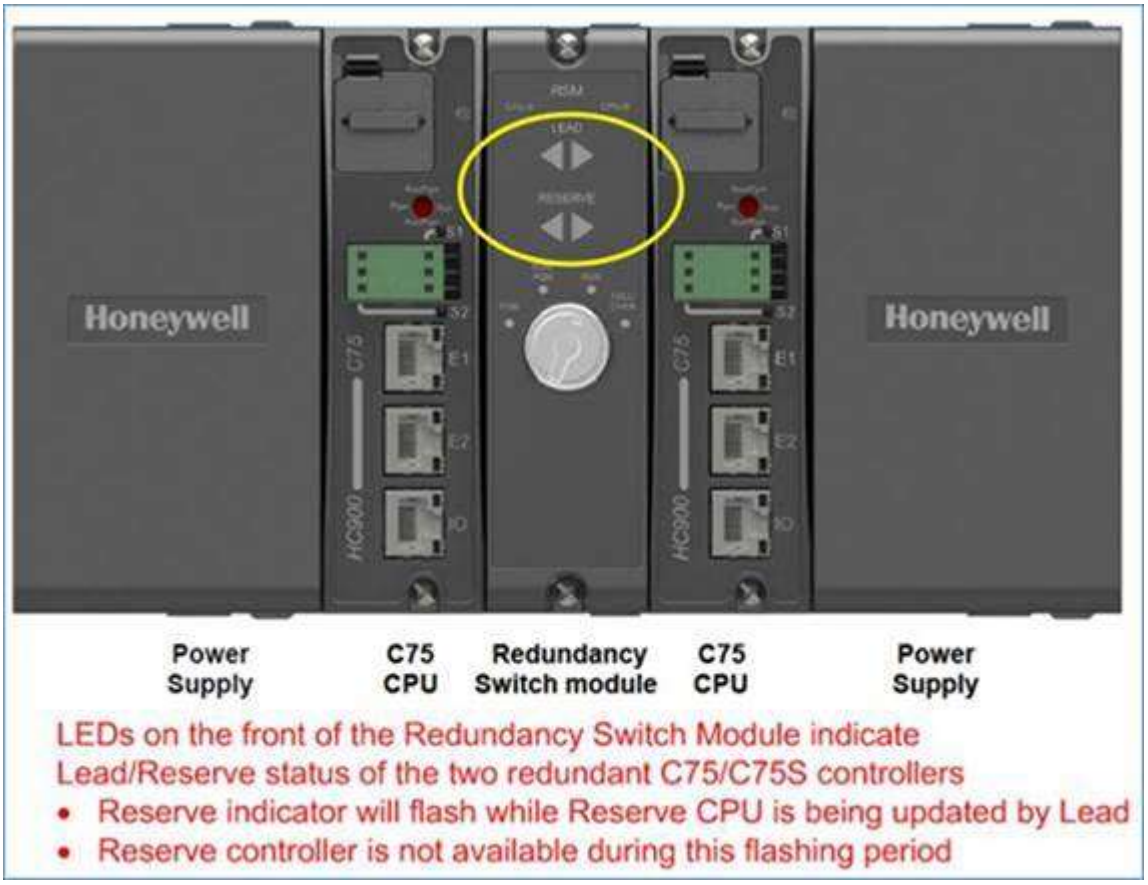
Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
6	One of the following remote I/O conditions exist: • Communications between the CPU and a Scanner 2 is failing. • Scanner 2 is unable to communicate to 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 modbus device, 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 Host, at least 75% of the last requests to a particular modbus device 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 host: • ASYS and FSYS blocks' Modbus Host Fail pins are turned on. • Modbus Device and read blocks associated with the modbus devices experiencing the failure have their read pins frozen to the last value read. • Modbus Device blocks associated with the modbus devices experiencing the failure have their BAD COMM and NO SCAN pins turned on. • IN SCAN STATUS is set to NO for all modbus devices experiencing the failure. • COMM STATUS is set to BAD for all modbus devices experiencing the failure. • The modbus devices with the data link errors have a non-zero data link error count. • The modbus devices 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 host, use the modbus device status screens to determine which modbus devices are experiencing the problem. For those modbus devices check: • Power • Connections • address • baud rate • parity • number of stop bits • for electrical interference • grounding • termination resistor (if at end of link) 9. The diagnostic is cleared by clearing the port's statistics.	•	•
2	The UART failed its power-up tests	See above	Replace CPU module		

Number of Red Strobes	Possible Causes	Lead and/or Reserve Controller Action(s)	User Action	Honeywell OI Indication	HCDesigner/HC Utilities Indication
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.
11	Fault address configured using Dip switch or Duplicate address configured with Dip-switch (**Applicable only for split rack**)	Controller does not boot-up	Remove controller and correct the dip switch settings	N/A	N/A

10.4. RSM LED indicator



Scanner indicators

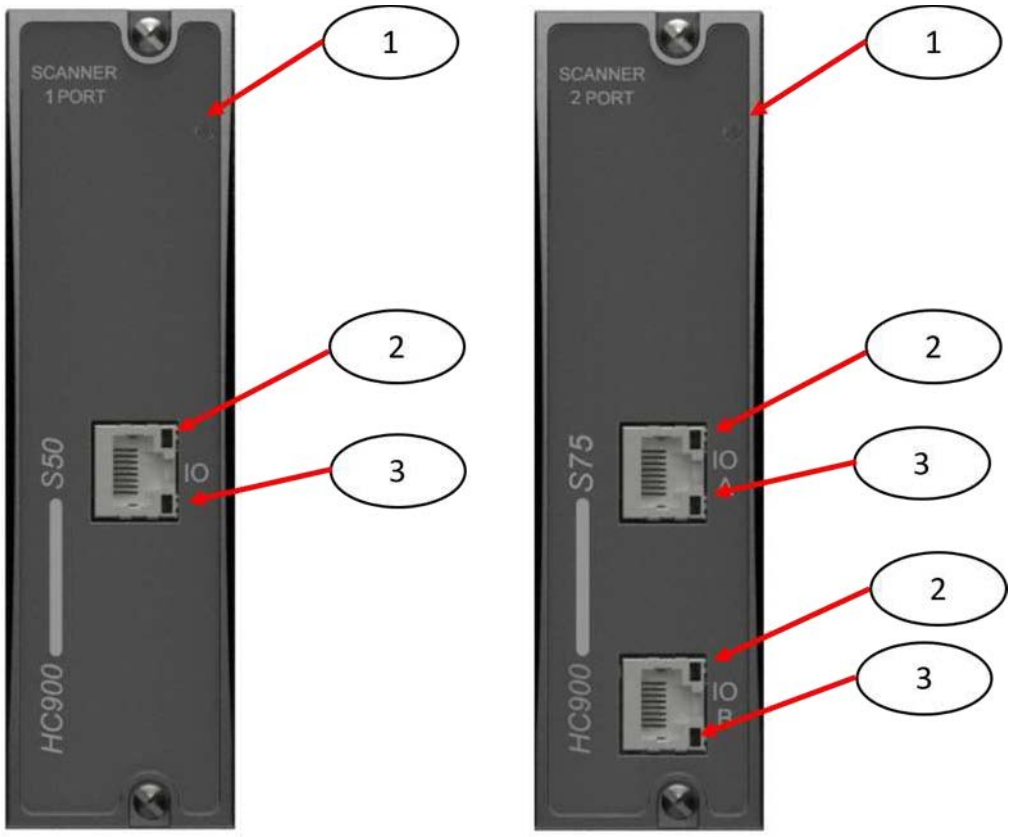


Figure 100 – LED Indicators on Scanners—1 port (left), 2 port (right)

When the Scanner is flashing an amber Status LED after power-up a power-on-self-test error has occurred that requires scanner module replacement.

Table 30 – LED Indications on Scanner Module

Figure 100 item	LED	LED State/Color	Description
1	Scanner Status	Off	No power
		Solid Red	Failed
		Blinking Red	(Diagnostic Code; refer to Table 31 - Scanner LED Diagnostics.)
		Solid Green	Startup Mode
		Blinking Green	Scan Mode
		12 Flash Count Amber	12-Flash Count SIL I/O Scanner installed in Legacy, requires new Rack
	10/100 Base-T port		
2	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 31 – 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

Number of Strobes	Possible Cause	Scanner Action	User Action
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.
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.

Number of Strobes	Possible Cause	Scanner Action	User Action
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.
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 203.

Number of Strobes	Possible Cause	Scanner Action	User Action
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 205 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

10.5. I/O Module Indicators

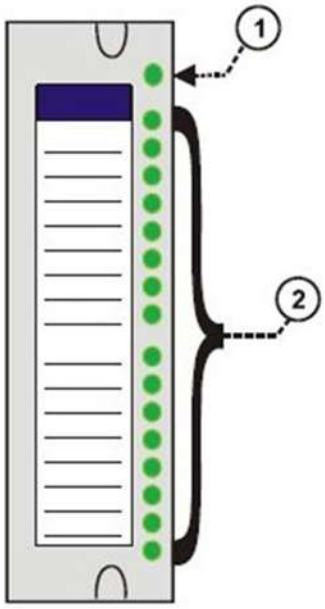


Figure 101 – I/O Module LED indicators

Table 32 – LED Indications on I/O Module

Figure 101 item	LED	LED State/Color	Description
1	Module Status	Off	No power.
		Solid Red	Hardware failure
		Blinking Red	**Diagnostic Code; refer to** Table 33 **– I/O Module LED Diagnostics.**
		Blinking Yellow	At least one output is Forced. Analog point in calibration.
		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 33 outlines the potential module diagnostics.

⚠ WARNING

Hazardous voltages exist at terminal blocks.
AO8 and AO16 modules require at least one channel to be configured prior to a cold start for the module to work properly. Subsequent channels then may be added with a hot start.
Failure to comply with these instructions could result in death or serious injury.

Table 33 – I/O Module LED Diagnostics

Number of Strobes	Failure	Description	UIO	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. 198). If it's flashing 6 times, proceed with step 3. If it's flashing some other red status code, refer to Table 31 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	EEPROM	EEPROM Failed its checksum		√	√								1. Remove/reinsert module. 2. Replace module.
3	RAM			√	√	√	√	√	√	√	√	√	

Number of Strobes	Failure	Description	UIO	AI	AO	DI			DO			PFQ	User Action
						Contact	AC	DC	Relay	AC	DC		
	Field faults	Field power supply failures, Line monitor faults	√										1. Repair field power supply/connection 2. Repair field wiring 3. Contact TAC if the RED Led strobe coming intermittently and not having any fault on the channels. 4. Replace module
4	ROM				√	√	√	√	√	√	√		1. Remove/reinsert module. 2. Replace module.
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
10	CRC FAIL	Cyclic Redundancy check failed for the data received from controller.		√	√	√	√	√	√	√	√	√	1. Remove/reinsert module. 2. Replace module and controller.
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 34 is a list of conditions that can cause a bad channel diagnostic.

Table 34 – Bad I/O Channel Diagnostics

Channel 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.
UIO channels	Openwire	Either field wire is open or channel HW is open	Check the field wiring
	Short circuit	Either field wire is shorted or channel HW inside module is shorted	Check the field wiring
	Readback fail	IO module is not able to drive output	1. Check load is within supported range 2. Check field wiring 3. Restart module 4. Replace module
	Input compare fail	AI/DI voting failing within module	1. Restart module 2. Replace module
	External field supply failure	Field supply voting is not within supported range	1. Check the field supply voltage 2. Check field supply wiring

Channel Type	Failure message indicated on Honeywell OI or Honeywell HCDesigner/Utilities function block monitor	Description	User Action
	ECxx where xx is a number	IO module detected internal HW fault during self-diagnostics	1. Restart module 2. Replace module
	Relinquish fail	Fault on other AO channels or Cross COMM channels between modules.	Check RTP cable for channels 1 and 2 connections on both modules.

Ethernet Switch indicators

Table 35 – LED Indications on Ethernet Switch

LED	LED State/Color	Description
10/100 Base-T port	Legacy	
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.
	New Systems	
Upper LED	Link / Yellow	On while the as long as electrical connection host is detected; Flashes during message transactions.
Lower LED	Speed / Green	OFF for 10Base-T connections ON for 100 Base-TX connections
	NOTE: These LEDs indicate activity on the communication port, they are controlled by hardware (PHY chip), not by software.	

11. Analog Calibration

11.1. 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.

A field calibration procedure consists of two parts:

- Connecting a calibration device to each channel of an AI or AO module, and
- Using the Control Station, 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 Control Station 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 102 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

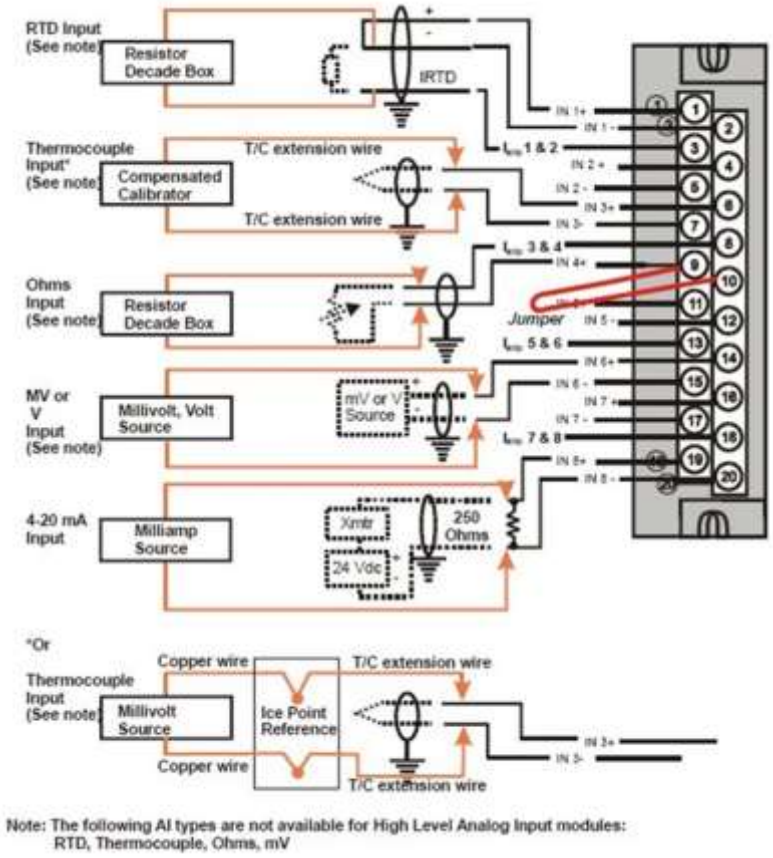


Figure 102 – Terminal Board Connections for AI Calibration

Note: Refer "Figure 47 – Universal Analog Input Wiring Diagram" for the latest terminal block illustration.

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 103. The specifications of the meter must be consistent with calibration requirements.
See page 114 for terminal connections for 8 and 16 channel AO.

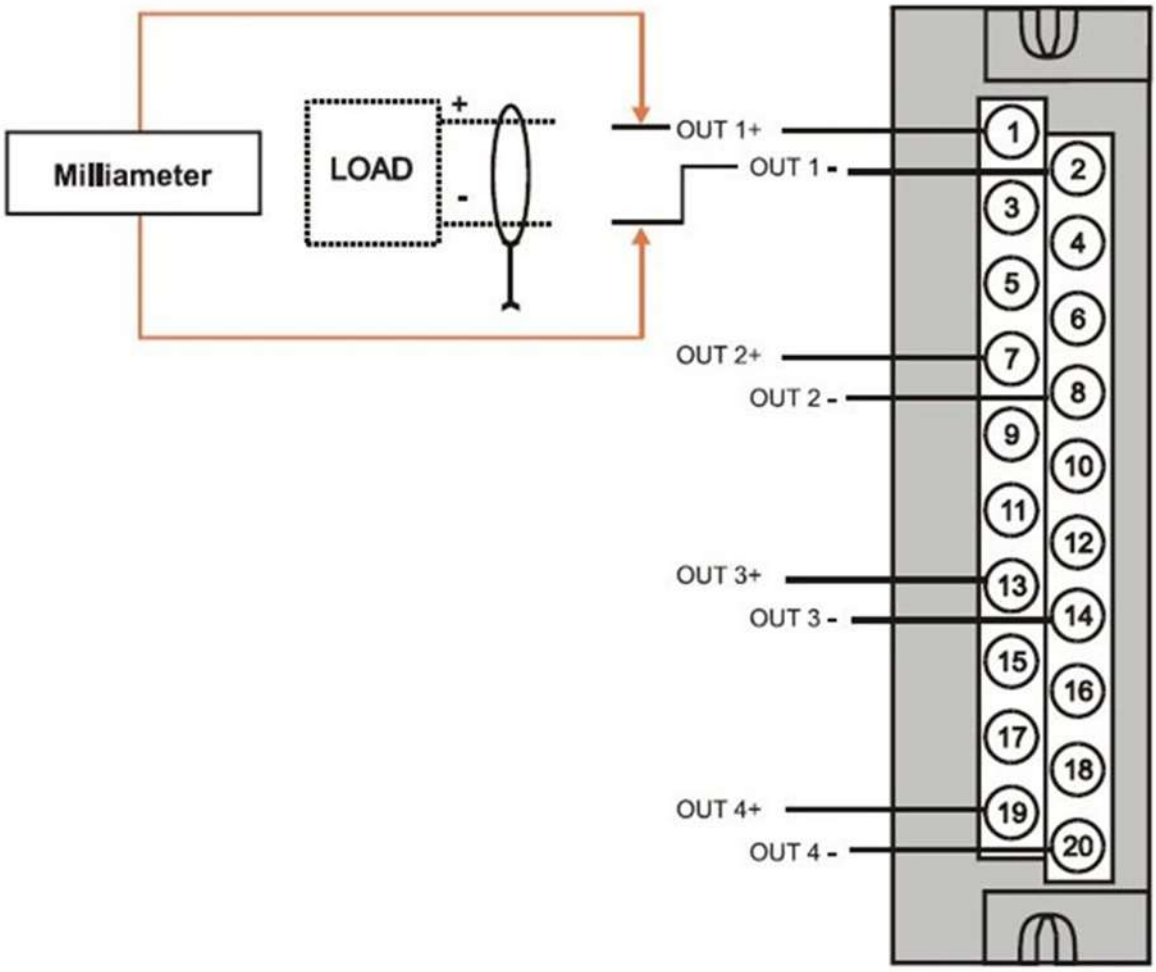


Figure 103 – Terminal board Connections for AO Calibration

12. Removal and Replacement Procedures

12.1. Overview

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

12.2. 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

⚠ WARNING

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 ControlEdge 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

In the redundant UIO configuration, de-enerzise the active AO channels before attempting to remove and/or replace any Redundant UIO module, particularly in a system that is actively controlling a process. To de-enrzise the AO channel, refer to the section "Redundant I/O Module Replacement" in "51-52-25-133" manual.

⚠ 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 ControlEdge HC900 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 86.

Table 36 – 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)
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)

Step	Action
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. 5V ok if: 4.8/ 5.5 VDC 24V ok if: 22/ 26 VDC

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 37 – 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.
4.	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.
5.	Ensure that you set the S1, S2, and RS-485 terminal dip switches as applicable.
6.	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.
7.	Re-install communications cables.
8.	Using the (user-supplied) switch, re-connect site AC power to the rack.
9.	*If using the Ethernet port for configuration, use the Designer software to set the proper network address.*
10.	Download the configuration.
11.	Set the Real-Time Clock.
12.	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 38 – 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 ControlEdge 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:

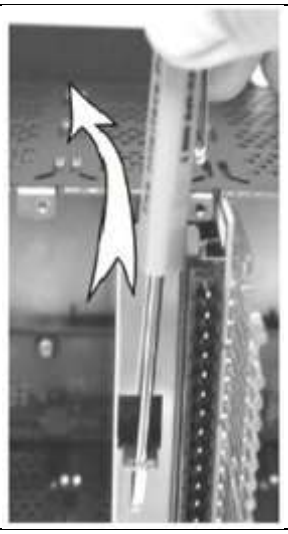
- With no physical damage to the module, to the rack, or to other modules in the rack
- Without disturbing the functions of ***other I/O modules*** in the rack or in the system.

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 39 provides some general guidelines for establishing appropriate procedures at a given installation.

Table 39 – 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 40 – 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. Match any DIP Switches same as original. 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 (SDRAM) and
- Non-volatile memory (Flash)

Only volatile memory requires battery backup.

Care during Installation

HC900 controller comes with an insulator tab which keeps the front battery disconnected from the controller during the transportation. User should not remove the insulator tab and install the rear battery until controller is powered and initialized providing Red Flash count. If this is not followed during installation, significantly higher current drawn will occur to the batteries (40 mA) and this will greatly reduce battery life.

Once volatile memory is initialized, in the absence line power the SDRAM draws low current from batteries ~86 uA.

Below table provides details of current drawn from batteries by different variants of HC900 Controller:

Controller	Current Drawn from Batteries	
	Controller Line Power ON	Controller Line Power OFF
900C30, 900C50, 900C30S, 900C50S	86 uA	6 mA
900C70, 900C75, 900C70S, 900C75S	86 uA	9 mA

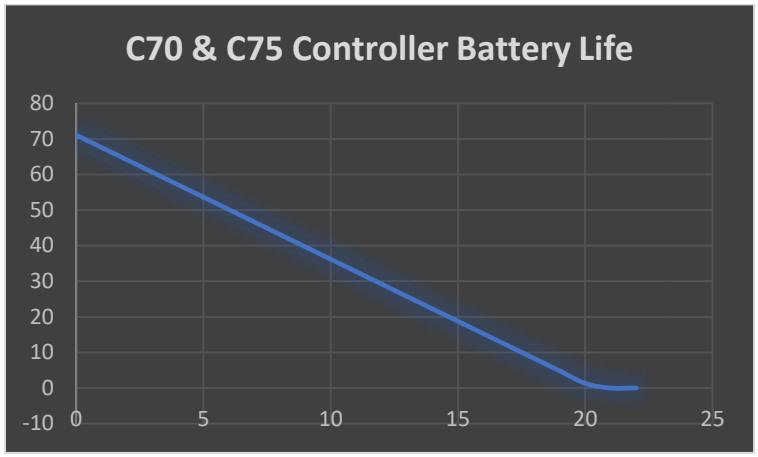
900C30, 900C30S, 900C50, 900C50S

When CPU is initialized and at the 86 microamp level, the battery will retain energy over an extended period. At the 6 mA level, the battery will retain sufficient energy to maintain the content of SDRAM for approximately 30 days.

900C70, 900C70S, 900C75, 900C75S

When CPU is initialized and at the 86 microamp level, the battery will retain energy over an extended period. At the 9 mA level, the battery will retain sufficient energy to maintain the content of SDRAM for approximately 22 days.

The below graph shows typical Battery Life for different HC900 controller:



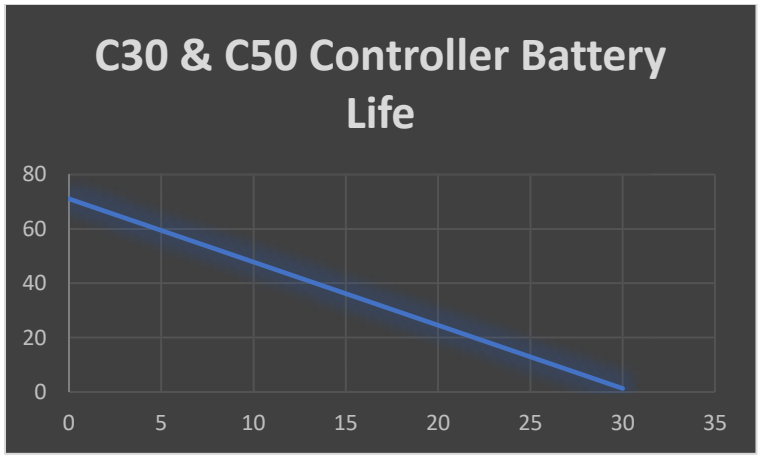


Figure 104 – Battery Life in Months

Note: The above graph is assuming,

- Honeywell supplied batteries are New when installed
- Initialization sequence is followed as described in above paragraph

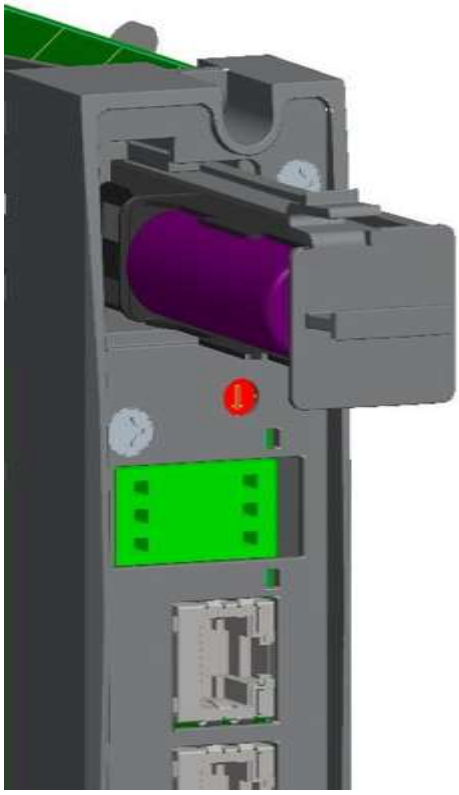
⚠ CAUTION

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.

Note:
Upon power up of a controller which had been powered down with a marginal battery, the initial battery test result will latch and hold for three minutes. This is done so that subsequent battery checks will not falsely indicate "Good", should the battery voltage recover after removal of the load. After the 3-minute wait period, battery removal and replacement with a new battery will restore the battery diagnostic to Good and reset the battery life accumulator.

Battery Installation Procedures

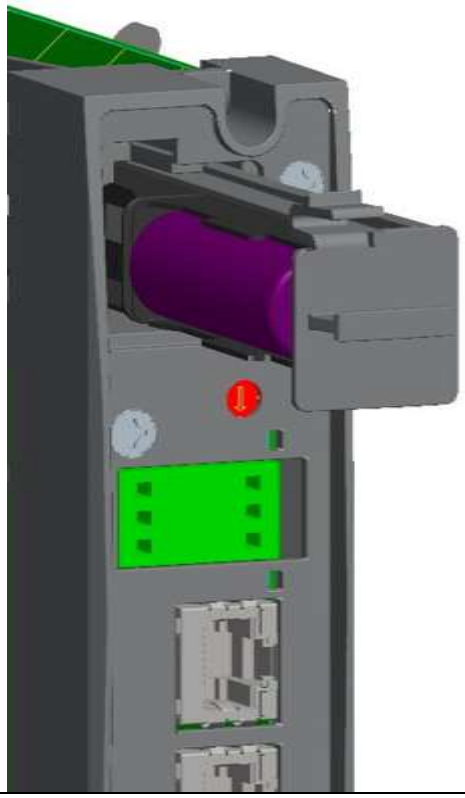
Table 41 – Installing Backup Battery (CPU not initialized)

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. Wait until CPU changes to Red Flash count (expect 2-4).
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 42 – 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 RAM 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 to release the battery holder, and use the molded-in extension on the battery holder to extract the holder. Note the orientation of the battery-holder assembly for re-insertion afterwards
4.	The battery is retained in the holder by spring tension of the plastic holder itself. Extract the battery (single battery for older models, two batteries for new models), 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.



13. Specifications

13.1. General Specifications (Refer to Specification manual)

Table 43 - ControlEdge HC900 PV Input Types and Ranges

Type	Range Low	Range High	EU	(Reference): Corresponding HC900 Input type and range
None				n/a
B	-18	1815	C	B 40 1820 C
B	0	3300	F	B 104 3308 F
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
J	0	1600	F	J –328 1598 F
J	-7	410	C	J 0 400 C
J	20	770	F	J 32 752 F
K	-18	1316	C	K 0 1200 C
K	0	2400	F	K 32 2192 F
K	-18	982	C	K 0 800 C
K	0	1800	F	K 32 1472 F
K	-29	538	C	K 0 400 C
K	20	1000	F	K 32 752 F
Ni-NiMo	0	1371	C	NiMo 0 1400 C
Ni-NiMo	32	2500	F	NiMo 32 2552 F
Ni-NiMo	0	682	C	n/a
Ni-NiMo	32	1260	F	n/a
NiMo-NiCo	0	1371	C	MoCo 0 1400 C
NiMo-NiCo	32	2500	F	MoCo 32 2552 F
NiMo-NiCo	0	682	C	n/a
NiMo-NiCo	32	1260	F	n/a
NiCroSil-NiSil	-18	1300	C	N 0 1200 C
NiCroSil-NiSil	0	2372	F	N 32 2192 F
NiCroSil-NiSil	-18	800	C	N 0 800 C
NiCroSil-NiSil	0	1472	F	N 32 1472 F
R	-18	1704	C	R -20 1760 C
R	0	3100	F	R -4 3200 F
S	-18	1704	C	S 0 1600 C
S	0	3100	F	S 32 2912 F
T	-184	371	C	T –200 400 C
T	-300	700	F	T –328 752 F
T	-129	260	C	T -50 150 C

Type	Range Low	Range High	EU	(Reference): Corresponding HC900 Input type and range
T	-200	500	F	T -58 302 F
W_W26	-20	2320	C	W_W26 -20 2320 C
W_W26	-4	4200	F	W_W26 -4 4208 F
W5W26	-18	2316	C	W5W26 -20 2320 C
W5W26	0	4200	F	W5W26 -4 4208 F
W5W26	-18	1227	C	n/a
W5W26	0	2240	F	n/a
Platinel	0	1380	C	PLTNL 0 1380 C
Platinel	32	2516	F	PLTNL 32 2516 F
Platinel	0	750	C	PLTNL -70 750 C
Platinel	32	1382	F	PLTNL -94 1382 F
Pt100	-184	816	C	Pt100 –200 800 C
Pt100	-300	1500	F	Pt100 –328 1472 F
Pt100	-184	649	C	n/a
Pt100	-300	1200	F	n/a
Pt100	-184	316	C	Pt100 -50 150 C
Pt100	-300	600	F	Pt100 -58 302 F
Pt500	-184	649	C	n/a
Pt500	-300	1200	F	n/a
Pt1000	-40	260	C	Pt1000 –50 400 C
Pt1000	-40	500	F	Pt1000 –50 752 F
JIS100	-200	500	C	JIS -200 500 C
JIS100	-328	932	F	JIS -328 932 F
JIS100	-200	260	C	JIS 0 100 C
JIS100	-328	500	F	JIS 32 212 F
Cu10	-20	250	C	Cu10 -20 250 C
Cu10	-4	482	F	Cu10 -4 482 F
YSI405	10	37.8		n/a
YSI405	50	100		n/a
Ohms	0	200		Ohms 0 200
Ohms	0	500		n/a
Ohms	0	1000		n/a
Ohms	0	2000		Ohms 0 2000
Ohms	0	4000		n/a
MA	4	20		mA 4 20
MA	0	20		mA 0 20
MV	0	10		mV 0 10
MV	0	50		mV 0 50
MV	0	100		mV 0 100
MV	-10	10		mV -10 10
MV	-50	50		mV -50 50
MV	-100	100		mV –100 100
MV	-500	500		mV –500 500
V	0	1		V 0 1

Type	Range Low	Range High	EU	(Reference): Corresponding HC900 Input type and range
V	0	2		V 0 2
V	0	5		V 0 5
V	0	10		V 0 10
V	1	5		V 1 5
V	-1	1		V -1 1
V	-2	2		V -2 2
V	-5	5		V -5 5
V	-10	10		V -10 10
Carbon	0	1250	mV	n/a
Oxygen	-30	510	mV	n/a

13.2. System Sizing and Availability Summary

Table 44 – System Size and Availability Summary

Specification	C30	C50	C70	C75
Combined Analog and Digital I/O	384 points	4608 points	4608 points	4608 points
Analog Inputs	142 points	2304 points	2304 points	2304 points
Analog Outputs	40 points	400 points	400 points	400 points
Block inputs	Quantity based on available memory (65535 Maximum)			
Block parameters	Quantity based on available memory (65535 Maximum)			
Block values	375,000	375,000	500000*	249997*
FDB worksheets	20	20	160*	160*
Function blocks	400	2000	15000*	15000*
Local I/O	Yes	Yes	Yes	No
Loop blocks	Quantity based on available memory			
Modbus registers used by modbus device blocks	1024	1024	1024	1024
Modbus modbus device blocks	32	32	32	32
Numeric constants	Quantity based on available memory			
Page connectors	200	1000	2500	2500
Peer blocks (including both SAFPDE blocks & PDE Blocks)	32	32	32	32
Peer data exchange items (including both PDE items and safety peer import items)	2240	2240	2240	2240
Safety Peer Export Signals	300	300	300	300
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 (maximum 65535)			
Soft Wire bytes	Quantity based on available memory(520,000 bytes max for C70/C75)			
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	1500	1500	3500*	3500*

Specification	C30	C50	C70	C75
Text bytes	Quantity based on available memory			
Variables	2000	2000	6144*	6144*
Variables in a Recipe	50	50	50	50

*-Applicable only for version 6.6 and above

13.3. Extended distance configuration with Fiber Optics

Please refer to ControlEdge HC900 specification document (51-52-03-31) for more details on recommended models.
Also Figure 105 andFigure 106 are examples of Extended Distance configurations.

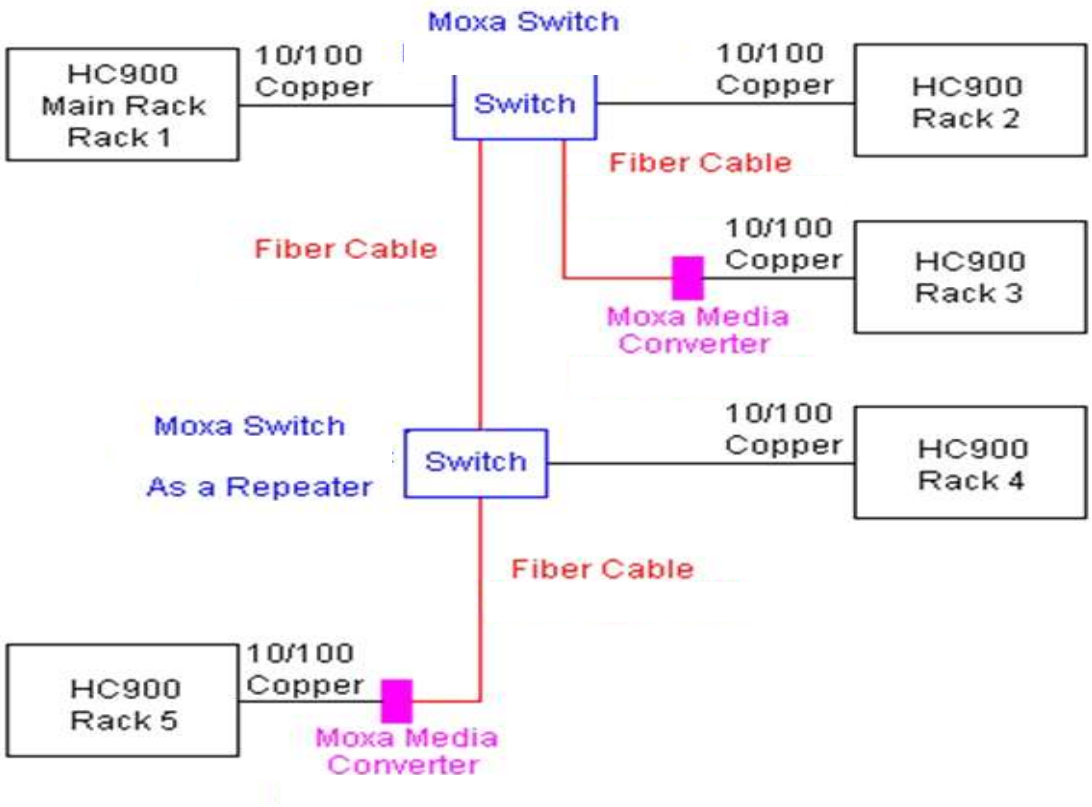


Figure 105 – Extended Distance Example #1

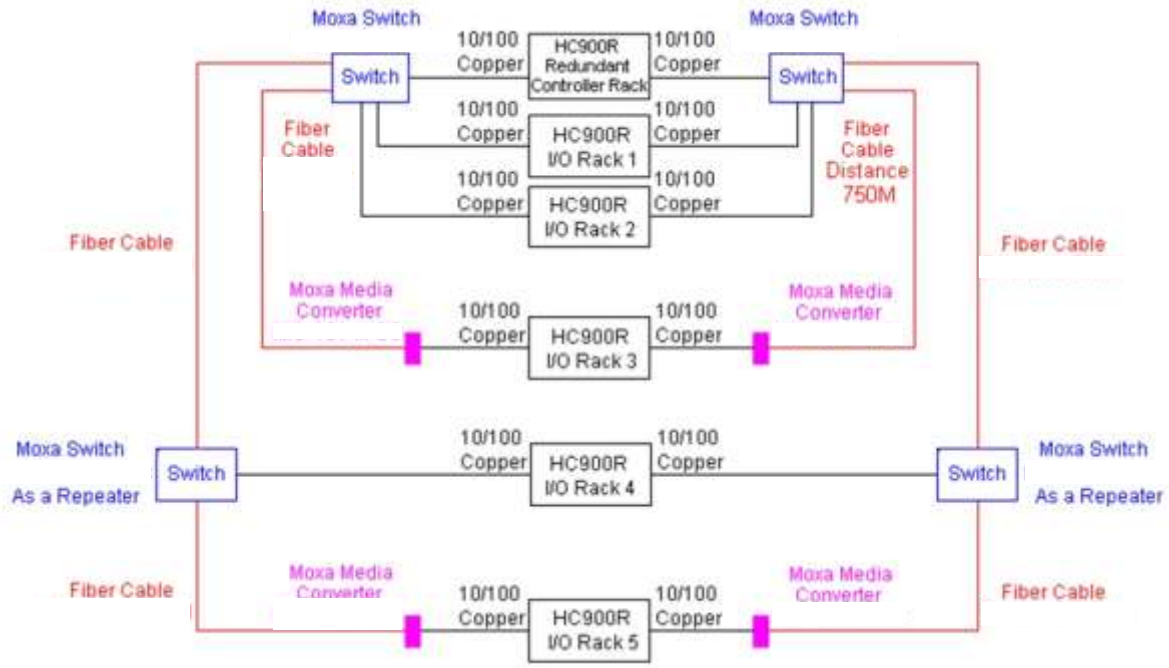


Figure 106 – Extended Distance Example #2

14. Appendix - Installation of Remote Termination Panels (RTPs)

14.1. Overview

The Remote Termination Panel (RTP) provides an easy way to connect the ControlEdge 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.

For more details on Installation Remote Termination Panels (RTPs), refer to the following RTP documents:

- 51-52-33-134 - HC900 Remote Terminal Panel for Analog Inputs
- 51-52-33-135 - HC900 Remote Terminal Panels for Relay Outputs
- 51-52-33-136 - HC900 Remote Terminal Panels for DI/DO/AO and high density modules.
- 51-52-33-170 - HC900 Remote Terminal Panel for Redundant UIO

15. Declaration of Conformity

CE Honeywell

51452401 Issue: V

EU DECLARATION OF CONFORMITY

We,

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

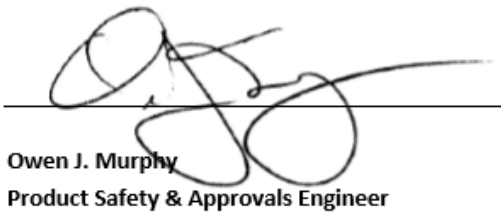
declare under our sole responsibility that the following products,

CONTROL EDGE 900 ASSEMBIES
(For Details of the Assemblies Covered See Schedule Starting on Page 2)

to which this declaration relates, is in conformity with the provisions of the European Community Directives, including the latest amendments, as shown in the attached schedule.

Assumption of conformity is based on the application of the harmonized standards and when applicable or required, a European Community notified body certification, as shown in the attached schedule.

The CE Mark was first applied in April of 2002. The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person is identified below.



Owen J. Murphy
Product Safety & Approvals Engineer
Issue Date: 6 July 2018
Location: Fort Washington, PA 19468, USA

16. ATEX Certification

Honeywell

TYPE EXAMINATION CERTIFICATE

CERTIFICATE NUMBER: HON 08.0201X **ISSUE NUMBER:** Revision G

EQUIPMENT INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES- DIRECTIVE 2014/34/EU

EQUIPMENT: **Control Edge 900 System**
Modules (Per attached List)

MANUFACTURER: Honeywell International Inc.
512 Virginia Drive
Fort Washington, PA 19034-3260
United States of America

This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

Honeywell Process Solutions certifies that this equipment has been found to comply with the Essential Health and Safety Requirements that relate to the design of Category 3 equipment, which is intended for use in potentially explosive atmospheres. These Essential Health and Safety Requirements are given in Annex II to European Union Directive 2014/34/EU of the European Parliament and of the Council, 26 February 2014.

COMPLIANCE WITH THE ESSENTIAL HEALTH AND SAFETY REQUIREMENTS HAS BEEN ASSURED BY COMPLIANCE WITH:

EN 60079-0: 2012/ A11:2013 EN 60079-15: 2010 EN 60079-7: 2015

If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to Specific Conditions of Use specified in the schedule to this certificate.

This Type Examination Certificate relates only to the design of the specified equipment, and not to specific items of equipment subsequently manufactured.

MARKING OF THE EQUIPMENT SHALL INCLUDE THE FOLLOWING:

II 3 G Ex nA IIC T* Gc
AMBIENT TEMPERATURE: 0 °C to +60 °C

II 3 G Ex ec IIC T* Gc
AMBIENT TEMPERATURE: 0 °C to +60 °C

- Temperature Code, T Code is listed in the Table in the Schedule

Owen Murphy
Product Safety & Approvals Engineer

Issue Date: 10 September 2018

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Sales and Service

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

ASIA PACIFIC

Honeywell Process Solutions,

Phone: + 800 12026455 or
+44 (0) 1202645583

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

Australia
Honeywell Limited
Phone: +(61) 7-3846 1255
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

Singapore
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

EMEA

Honeywell Process Solutions,

Phone: + 800 12026455 or
+44 (0) 1202645583

Email: (Sales)

FP-Sales-Apps@Honeywell.com

or

(TAC)

hfs-tac-support@honeywell.com

Web
Knowledge Base search
engine **http://bit.ly/2N5VIdi**

AMERICAS

Honeywell Process Solutions,

Phone: (TAC) (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

Web
Knowledge Base search
engine **http://bit.ly/2N5VIdi**

For more information
To learn more about ControlEdge HC900 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
Bracknell, England, RG12 1EB

Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

www.honeywellprocess.com

51-52-25-154, Rev.13
April 2021