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THE POWER OF **CONNECTED**

ControlEdge PLC and ControlEdge RTU

Getting Started

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April 2019

Release 152

ControlEdge PLC

ControlEdge RTU

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ABOUT THIS GUIDE

Revision history

Revision	Date	Description
A	April 2019	Initial release of this document

Intended audience

This documentation allows the following audience to quickly startup ControlEdge PLC and ControlEdge RTU system: Users who plan, install, configure, or operate ControlEdge PLC and ControlEdge RTU running the eCLR (IEC 61131-3) execution environment.

Prerequisite skills

Knowledge of SCADA systems and experience of working in a Microsoft Windows environment are required.

Introduction to ControlEdge Technology

Item	Description
ControlEdge PLC	ControlEdge 900 controllers running the eCLR (IEC 61131-3) execution environment with PLC software options configured with ControlEdge Builder.
ControlEdge RTU	ControlEdge 2020 controllers running the eCLR (IEC 61131-3) execution environment with RTU software options configured with ControlEdge Builder.
ControlEdge UOC	ControlEdge 900 controllers running the Honeywell control execution environment (CEE) configured with Experion Control Builder.

Special terms

The following table describes some commonly used industry-wide and Honeywell-specific terminology:

Terminology	Description
ACE	Application Control Environment
Adapter	A communication device which connects to the EtherNet/IP network to serve data from a set of devices or modules underneath it. Adapter typically supports I/O connectivity from Scanners via implicit EtherNet/IP connections.
Assembly	A set of data passed between a Originator and a Target after an implicit I/O connection has been established on an EtherNet/IP network.
CDA	Control Data Access
ControlEdge Builder	A integrated configuration tool to design, configure, program and maintain ControlEdge controllers.
CPM	Control Processor Module
DTM	Device Type Manager
EDS	Electronic Data Sheet. A text file which specifies all the properties of an EtherNet/IP device necessary for a Scanner module to communicate with it. EDS files my be used in the first step of creating an I/O module or device type for interfacing to an EtherNet/IP device.
EPM	Expansion Processor Module
Expansion I/O rack	I/O rack with EPM installed
Expansion IOM	I/O Module (IOM) external to the CPM that expand the I/O capacity
FDAP	Field Device Access Point
FDM	Field Device Manager
FTE	Fault Tolerant Ethernet
HMI	Human Machine Interface
IOTA	Input Output Termination Assembly
Left End Plate	Left end plate is used only in multi-row 2020 I/O systems. It starts a new row of IOMs and provides connections for 24Vdc supply to the row along with I/O Network connections.
Local I/O rack	I/O rack with CPM installed (non-redundant)
Mixed IOM	Mixed input/output module, which supports DC current or voltage type

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Terminology	Description
	signals, such as analog input, analog output, digital input, digital output and pulse input.
Onboard IOM	I/O Module (IOM) 'onboard' with the CPM
OPC UA	An industrial machine-to-machine (M2M) communication protocol is developed by the OPC Foundation, which provides a path forward from the original OPC communications model (namely the Microsoft Windows only process exchange COM/DCOM) to a cross-platform service-oriented architecture (SOA) for process control, while enhancing security and providing an information model.
Originator	Originator is the controller that initiate any data exchange with EtherNet/IP devices on the EtherNet/IP network.
PSM	Power Status Module
PSU	Power Supply Unit
Redundant CPM Rack	Rack installed redundant CPM
Right End Plate	A right end plate is required at the end of each row of expansion I/O modules, including the row connected to a controller. It allows additional rows to be added or terminates the I/O network.
RIUP	Removal and Insertion Under Power
RPI	Requested Packet Interval. The repetitive interval by which assemblies are periodically transported over EtherNet/IP I/O connections between Producer and Consumer.
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
Scanner	A device which connects to the EtherNet/IP network to act as a client of other EtherNet/IP connected devices. ControlEdge 900 Controller acts as EtherNet/IP Scanner. It connects to and exchanges data with Adapters of Modular IO stations, directly connected devices and Rockwell AB ControLogix controllers.
SIM-300	Simulation for C300
SIM-ACE	Simulation for ACE
Target	Target is the EtherNet/IP device that address any data requests

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Terminology	Description
	generated by the controller.
UIO	Universal Input/Output Module

Related documents

The following list identifies publications that may contain information relevant to the information in this document.

- ControlEdge Builder Software Installation User's Guide

- ControlEdge Builder Software Change Notice

- ControlEdge Builder User's Guide

- ControlEdge 900 Platform Hardware Planning and Installation Guide

- ControlEdge Builder Function and Function Block Configuration Reference

- ControlEdge Builder Protocol Configuration Reference Guide

- ControlEdge PLC and ControlEdge RTU Network and Security Planning Guide

- ControlEdge EtherNet/IP User's Guide

- ControlEdge_PLC_Interface_Reference

- DNP3 Interface Reference

- FDM User's Guide

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OVERVIEW

This document introduces an example for a redundant ControlEdge 900 controller connected with 4-slot, 8-slot and 12-slot expansion I/O racks, and a redundant ControlEdge 2020 controller, to get you quickly set up the hardware, connect and configure the controller from ControlEdge Builder.

This document does not provide any detailed instructions. Please refer to other related documents, and online helps embedded in ControlEdge Builder for more information.

Make sure all the hardware modules used in the system are installed with the right firmware version and the engineering station has the latest ControlEdge Builder. You can find the firmware and software updates on http://honeywellprocess.com with valid credentials.

See the following example of system architectures for ControlEdge PLC and ControlEdge RTU.

Figure 2–1: System architecture for ControlEdge PLC
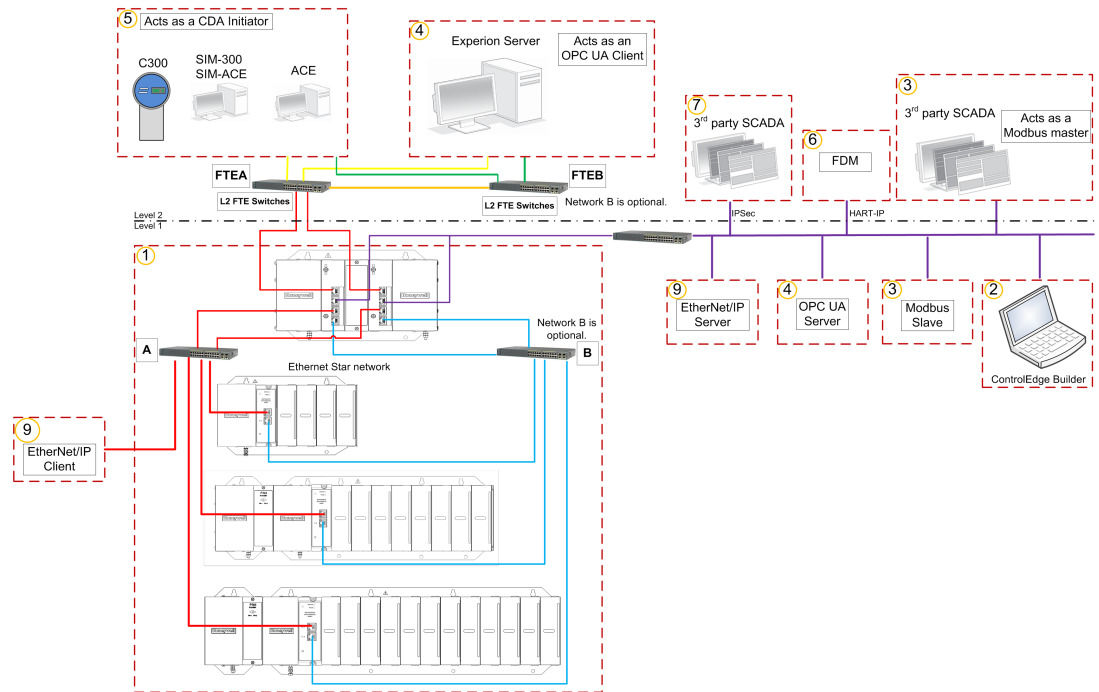
ControlEdge PLC system has two network levels, while level 1 network is used for internal I/O communication between CPM and related IOMs, and level 2 is aimed for the communication with the third party devices, HMI, SCADA or Engineering Workstation.

On the level 1 network, CPMs and EPMs connect to a switch, this network is the most critical network in the system as a failure or loss of service on this network can result in loss of control. On the level 2 network, the Engineering Workstation, third party devices, HMI, and SCADA connect to the switch at this level. A failure of this level network may result in a loss of view of the process if HMI or SCADA is employed. The two network levels must be isolated with each other.

ETH1/ETH2 ports are required to be protected using a firewall device configured to prevent uncontrolled messages into the controller.

Built-in firewall is supported on CPM of ControlEdge PLC.

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Figure 2-2: System architecture for ControlEdge RTU
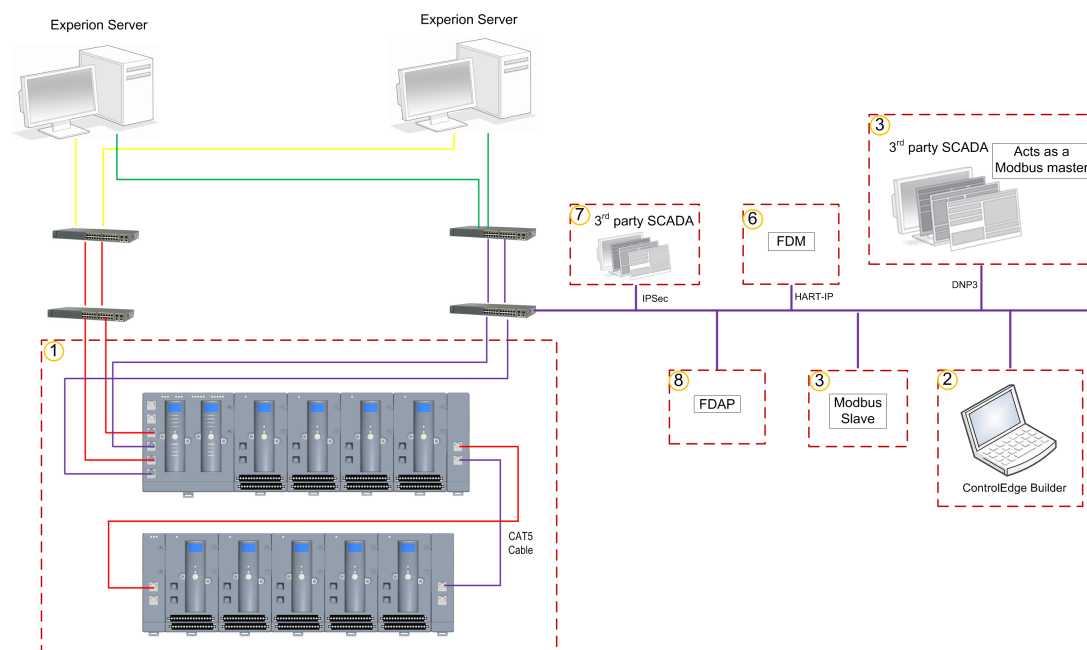
ControlEdge 2020 system has two networks, I/O network is used for internal I/O communication between CPM and Expansion IOMs, control network is aimed for the communication with the third party devices, HMI, SCADA or Engineering Workstation.

I/O network is the most critical network in the system as a failure or loss of service on this network can result in loss of control.

At control network, Engineering Workstation, third party devices, HMI, and SCADA connect to the switches. A failure of this level network may result in a loss of view for operator of the process if HMI or SCADA is employed.

The two networks must be isolated from each other.

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See the following table for the relevant configuration.

Item	Go to...
1	See "Hardware" on page 15 for more information. See "I/O network topologies" on page 1 for more information.
2	See "Software" on page 41 for more information. See "Operating" on page 67 for more information.
3	See "Configuring Modbus " on page 83 for more information. See "Modbus Slave Configuration" on page 1 for more information.
4	See "Configuring OPC UA " on page 94 for more information.
5	See "CDA Configuration" on page 1 for more information.
6	See "FDM integration" on page 115 for more information.
7	See "Security" on page 119 for more information.
8	See "Configuring Wireless I/O" on page 111 for more information.
9	See "Configuring EtherNet/IP devices" on page 92 for more information.

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3 HARDWARE

ControlEdge 900 platform

The Honeywell ControlEdge 900 family comprises a set of hardware and software enabling users and OEMs to assemble a system that fits a broad range of requirements. Any configuration can be readily modified or expanded as requirements dictate.

ControlEdge PLC can be deployed standalone or with a SCADA system such as Experion.

Ethernet Star network
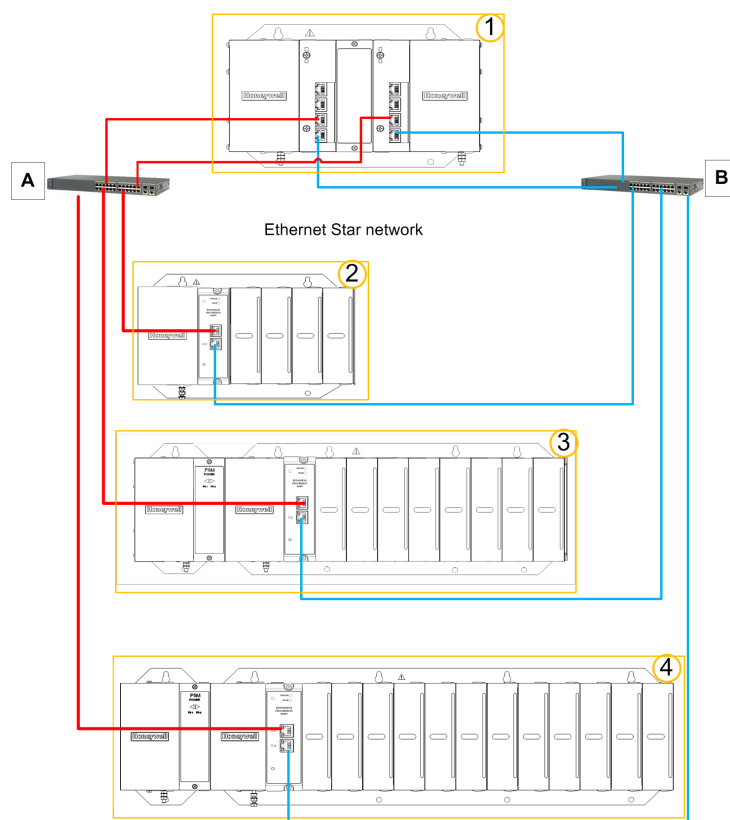
Item	Model number	Description
1	900RR0-0200	Redundant CPM Rack
2	900R04-0200	I/O Rack (4-slot)

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Item	Model number	Description
3	900R08R-0200	I/O Rack (8-slot) can include either a redundant power supply or non-redundant power supply. A Power Status Module (PSM) is required with redundant power supplies. The diagram shows the rack with a redundant power supply. The model number of the rack with a non-redundant power supply is 900R08-0200.
4	900R12R-0200	I/O Rack (12-slot) can include either a redundant power supply or non-redundant power supply. A Power Status Module (PSM) is required with redundant power supplies. The diagram shows the rack with a redundant power supply. The model number of the rack with a non-redundant power supply is 900R12-0200.

Hardware components

This section provides a description of the major components that can be included in a ControlEdge 900 Controller physical configuration and indicates how the components can be combined. Some of the components are required in all configuration. Others are optional and can be used to provide additional functions, or to "size" the system, or to modify or expand the system to meet changing requirements.

Rack

There are two types of racks:

- Redundant CPM Rack
  Rack installed redundant CPMs

- I/O Rack, containing 4, 8 or 12 slots
  I/O racks can include a topology with; either a non-redundant power supply or with redundant power supplies, accommodate a CPM or an EPM, and additional input/output modules. The I/O rack inserted with an EPM enables I/O modules to be located close to the field devices and remote from the CPM.

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Slot number from left to right is 1~n, and n stands for the quantity of the slots.

Figure 3-1: Redundant CPM Rack Components
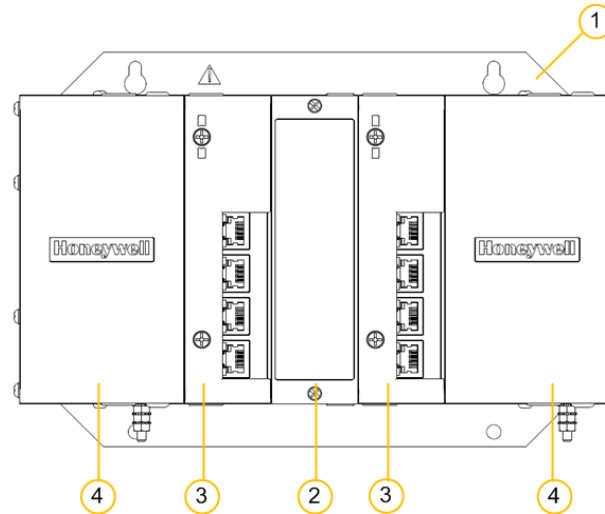
Item	Description
1	Redundant CPM rack
2	Redundant Switchover Module Slot Filler
3	Primary/Secondary CPMs
4	Two Power Supplies

Figure 3-2: I/O rack with non-redundant power supply
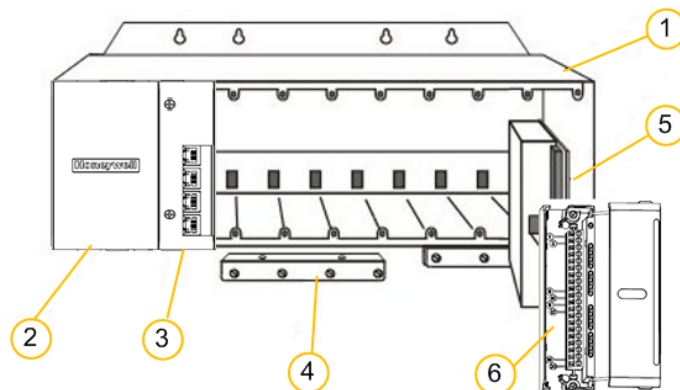
Figure 3-3: I/O rack with redundant power supplies
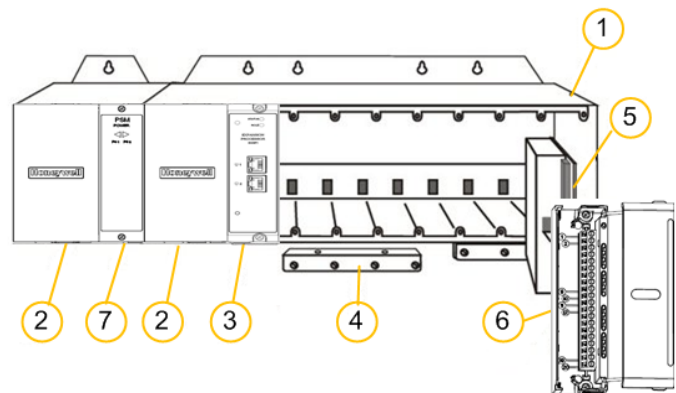
Item	Description
1	Rack, available in 4-, 8- or 12-slot versions
2	Power Supply Redundant power supply is optional and only available in 8- or 12-slot racks. You can only install one power supply in either of the two slots.
3	CPM or EPM with Security Cover
4	Grounding bars (for I/O wiring; optional; required for safety applications)
5	Input/Output modules
6	I/O Terminal Blocks
7	Power Status Module (PSM) (required if using redundant power supply)

Control Processor Module (CPM)

CPM (900CP1-0200) contains most of the electronics required to perform the function of a process controller. A redundant CPM rack contains two CPMs. Either CPM can be primary.

The CPM is shown in the following figure.

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Item	Description
1	Status LED indicator for the CPM.
2	Role LED indicator for the CPM.
3	SD card slot: supports 32GB Class 6 / Class 10 industry standard, not hot–swappable, maximum weight 3g (0.0066 lb, 0.1058 oz) An SD card can be inserted and used to reset the controller to factory settings, or save datalog or DNP3 event. **CAUTION:** Do not insert or remove the SD card when the CPM is powered unless the area is known to be non-hazardous.
4	Mode switch. There are four mode switch positions on CPM: STOP, RUN, and two REMOTE positions. Two REMOTE positions are identical. Rotate the four positions in clockwise or counter-clockwise. When the mode switch is in REMOTE position, the operating modes can be configured in the Configuration tool. For more information for the operating modes, see "Selecting operating modes" in *ControlEdge Builder User's Guide*. **ATTENTION:** For redundant controller system, the position of mode switch in primary CPM determines the system operating mode. If the

Item	Description
	mode switches on the primary and secondary CPMs are in different positions, the system will drop sync.
5	First (ETH1) and second Ethernet (ETH2) Host ports to PC applications and/or other CPMs, or other devices.
6	Third (ETH3) and fourth (ETH4) ports connect to the Ethernet ports of EPM, switch (for star topology), or CPM (for the interconnection between redundant CPM in Ring topology).
7	Ethernet LED status indicators for communications functions.
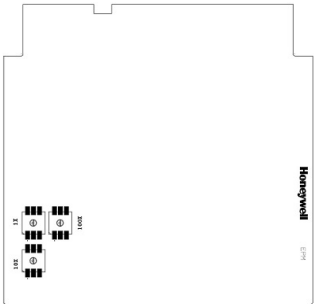
Expansion Processor Module (EPM)

EPM (900SP1-0200) is installed in the expansion I/O rack and provides the link between the CPM and remote I/O modules.

The EPM is shown in the following figure.
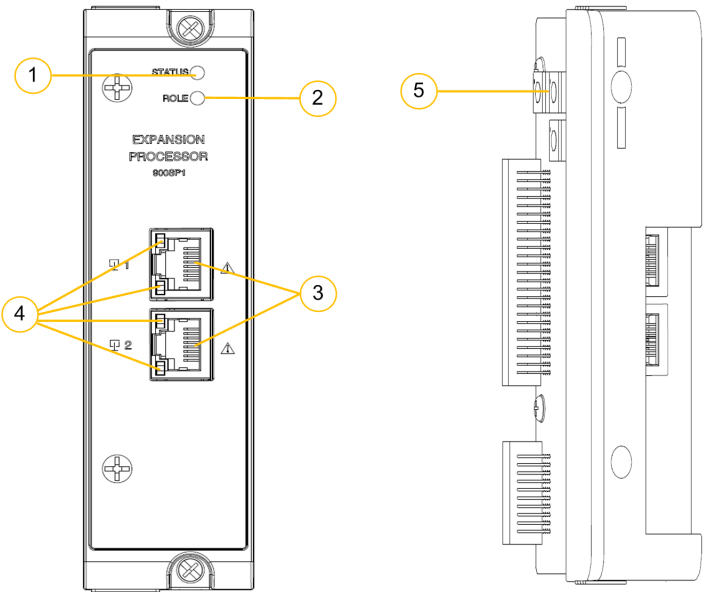
Item	Description
1	Status LED indicator for EPM functions.
2	Role LED indicator for EPM functions.
3	Ethernet 10/100 Base-T Ports; connect to the ports on other EPMs, CPM, or a switch that connects to the CPM (for star topology).

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Item	Description
4	Ethernet LED status indicators for communications functions.
5	Rotary switch: used to set the EPM address and network topology for the I/O rack. Set the 10x and 1x switches to the two digit address ranging from 01 to 99. The lower switch (10x) is used to set the tens digit and the upper switch (1x) sets the ones digit. A small slotted screwdriver works well; avoid pencils. Set the network topology using the 100x switch. 3 is for Ring network topology and 4 is for Star network topology.

Input/Output module

ControlEdge PLC supports the following I/O modules.

For more information, see "I/O module specification" in the *ControlEdge 900 Platform Hardware Planning and Installation Guide*.

Model number	I/O module
900U01-0100	Universal Input/Output Module (UIO)
900A01-0202	Universal Analog Input Module (UAI)
900A16-0103	High Level Analog Input Module (16 channels)
900B01-0301	Analog Output Module (4 channels)
900G03-0202	Digital Input Module (16 channels) – AC Voltage Type
900G32-0101	Digital Input Module (32 channels) – DC Voltage Type
900G01-0202	Digital Input Module – Contact Type (16 channels)
900H03-0202	Digital Output Module (8 channels) – AC Voltage Type

Model number	I/O module
900H32-0102	Digital Output Module (32 channels) – DC Voltage Type
900H01-0202	Relay Output Module (8 channels)
900K01-0201	Pulse Input/Frequency Input Module (4 channels)

Power supply

Both AC power supply (900P01–0301) and DC power supply (900P24–0301) can be used in Redundant CPM rack, Local I/O rack and Expansion I/O rack.

For more information, see "Power supply" in the *ControlEdge 900 Platform Hardware Planning and Installation Guide.*

Figure 3–4: AC Power Supply

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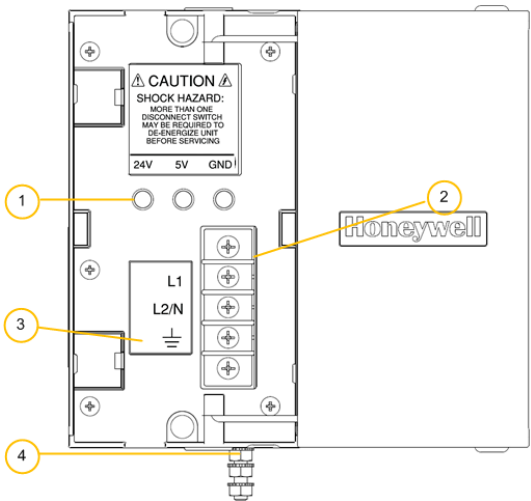
Figure 3-5: DC Power Supply
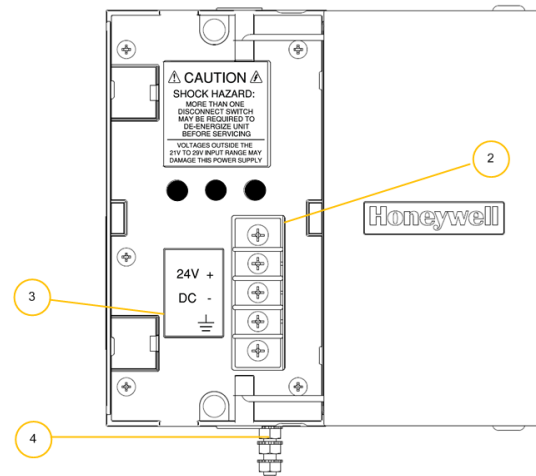
As indicated in the figures, the power supplies include:

Item	Description
1	Voltage test points
2	AC/DC Input terminal block
3	Wiring label
4	Grounding lug (Reference; lug is not part of power supply; it is mounted to bottom of rack.)

Power Status Module (PSM)

The PSM (900PSM-0200), shown in the following figure, sits between redundant power supplies on the I/O rack. It is a status module for both power supplies and indicates which are powered, PS-1 (left) or PS-2 (right) or both (typical).

When the status indicator for either or both of the power supplies is lit, it is reporting that the status of the associated power supply is good and that the outputs are within specified limits. When the status is off, either the power supply is off or the voltages are out of tolerance.

Figure 3-6: Power Status Module
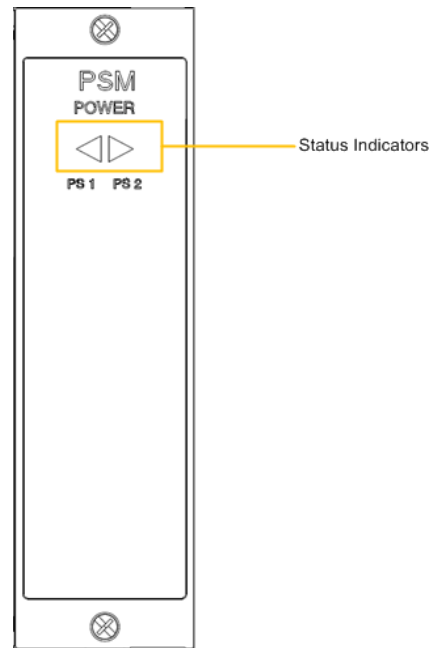
Installing the assembly

This section introduces you to mount the assembly.

1. Mount the rack in the enclosure.

2. Check if your configuration needs a redundant controller.

   - If yes, assemble the redundant CPM rack.

     a. Insert the power supplies in the slots in the rack.

     b. Insert the CPMs in the rack, adjacent to the power supplies.

     c. Insert the filler block cover in the middle slot.
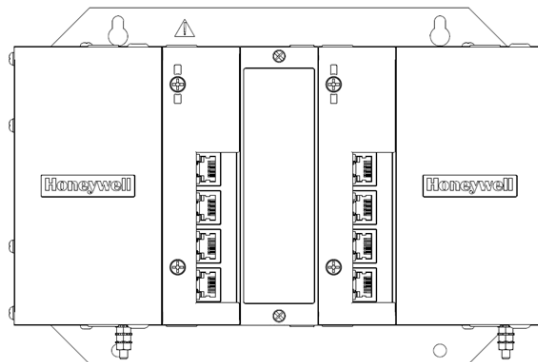
   - If no, assemble I/O racks, take the 8–slot I/O rack as an

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example.

a. Insert the power supply.

b. Insert the PSM between the two power supplies.

c. If a CPM will be inserted, set the mode switch for CPM optionally.

d. If a EPM will be inserted, set the EPM address and network topology for the I/O rack using the rotary switch.

e. Insert CPM or EPM as required.
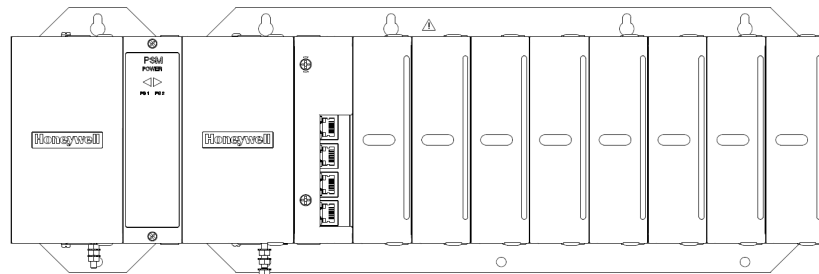
3. Install I/O modules.

> **ATTENTION:** For each configured and labeled I/O module, ONLY break off the "key-tabs" in the pattern that matches that module type. For more information, see "Installing I/O modules" in the *ControlEdge 900 Platform Hardware Planning and Installation Guide*.

Wiring and cabling

Terminal Block 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. The terminal block is removable.

The optional Remote Termination Panel (RTP) provides an easy way to connect the ControlEdge 900 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.

Routing and securing wires

Typically, field wiring is routed to connections at a terminal panel near the racks, 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.

> **ATTENTION:** All wires must be securely terminated, using appropriate wiring practices.

Wire shield grounding

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

Figure 3-7: Wire-Shield Grounding
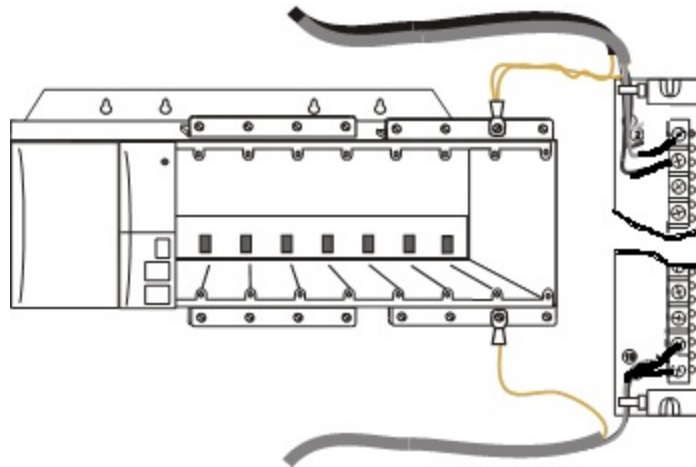
To facilitate module replacement, it is advisable in most cases to route all wiring through either the top or the bottom of the terminal block. This allows the terminal block to pivot up or down, allowing ready access to the module, and is the preferred method for a limited number of wires.

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For more information about each I/O module wiring, see "Terminal Block-to-Field (Signal) Wiring" in the *ControlEdge 900 Platform Hardware Planning and Installation Guide*.

I/O network Topology

ControlEdge PLC can be configured as a redundant controller system or non-redundant controller system. It includes provisions for communication via Ethernet with host systems and the Ethernet ports provide a layer of protection against cyberattacks. Honeywell recommends use of Solarwinds and/or Honeywell Risk Manager to detect unintended and excess network traffic.

ControlEdge PLC supports star and ring I/O topologies for I/O communication.

Star Topology

The following diagram shows an example of the star topology. A switch is required for this topology.

Figure 3–8: Single star topology

Ethernet Star
network

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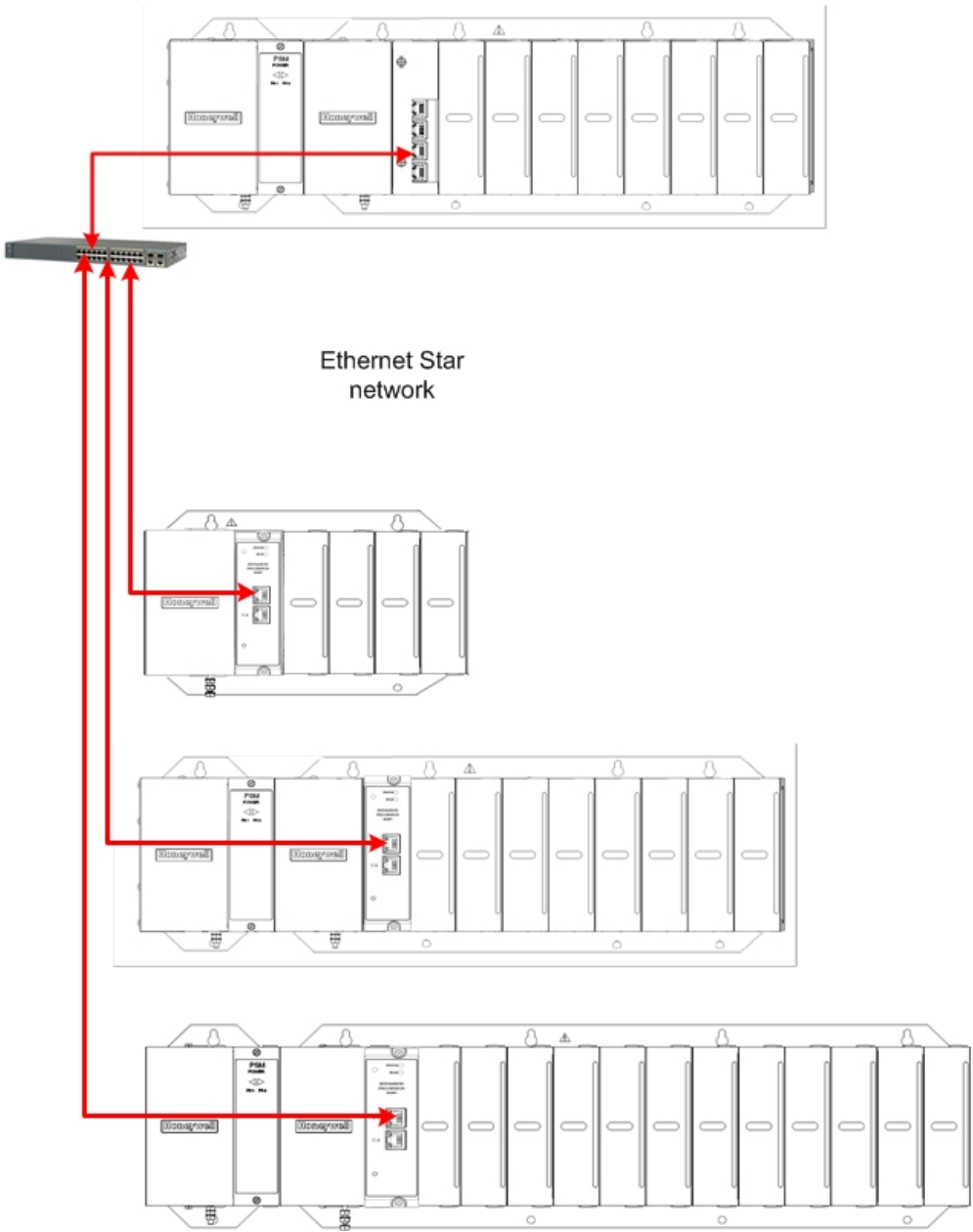
Figure 3-9: Redundant Star topology
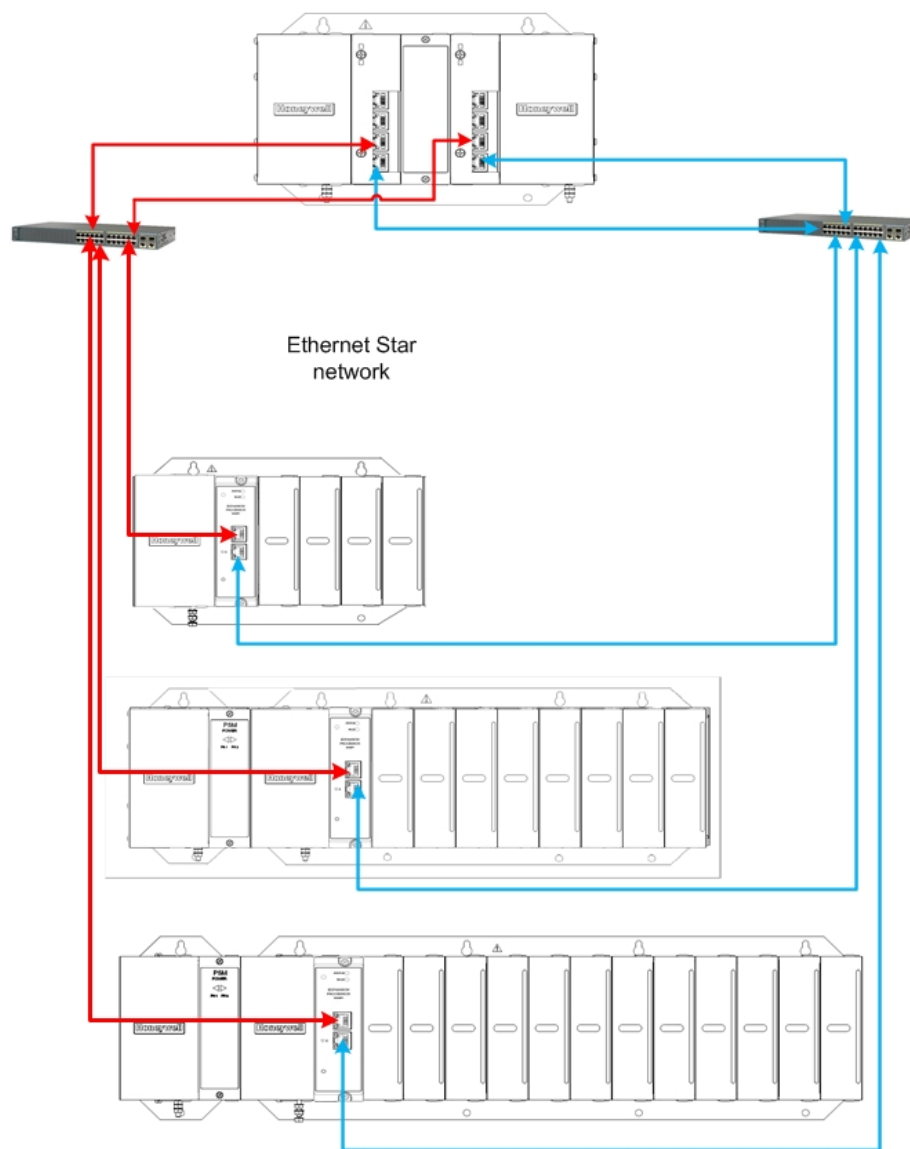
> **CAUTION:** ControlEdge PLC-I/O network is a private network, and the switch used for the interconnection of CPM and EPM must not be connected to any other LAN or WAN. Likewise, no devices or communication traffic other than the ControlEdge PLC components should be connected to the I/O network switch. Failure to comply will cause communication failures on the I/O network causing I/O modules to go in and out of their failsafe settings.

Ring Topology

The following diagram shows an example of the ring topology.
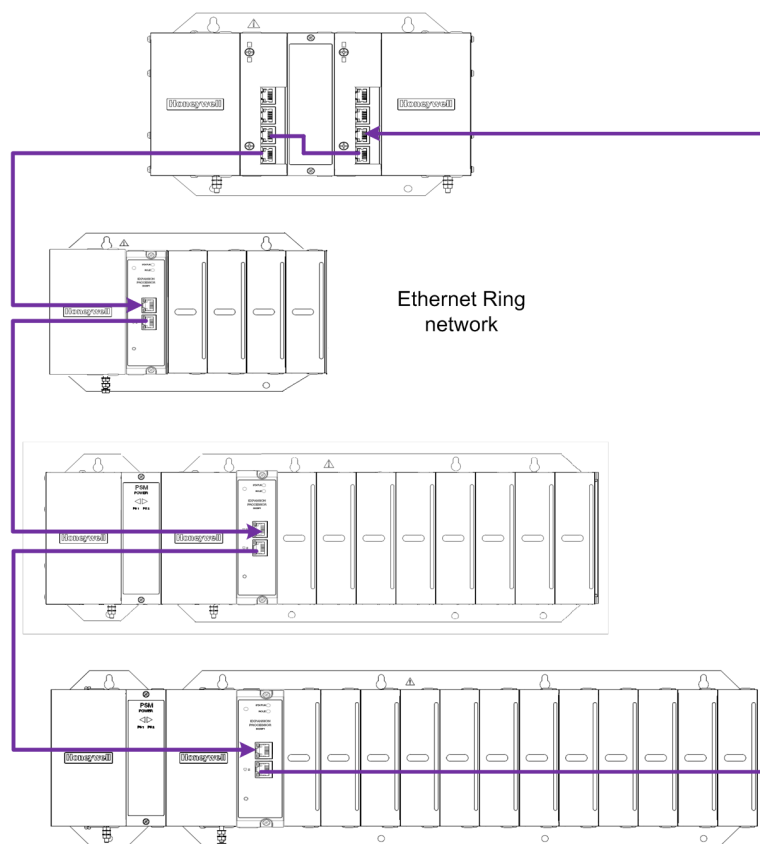
- CPM port 3 (ETH3) must be connected to CPM port 4 (ETH4) or EPM port 2 (ETH2).

- CPM port 4 (ETH4) must be connected to CPM port 3 (ETH3) or EPM port 1 (ETH1).

- EPM port 1 (ETH1) must be connected to EPM port 2 (ETH2) or CPM port 4 (EHT4).

- EPM port 2 (ETH2) must be connected to EPM port 1 (ETH1) or CPM port 3 (EHT3).

For more information, see "Planning for network topology" in the *ControlEdge 900 Controller Hardware Planning and Installation Guide*.

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Power on

Both AC power supply and DC power supply can be used in ControlEdge PLC.

1. Connect 24 VDC supply or 120/240 VAC power supply to the controller.

2. Connect an Ethernet cable to the CPM port most appropriate for your situation.

3. Connect the other end of the Ethernet cable to the PC installed ControlEdge Builder directly or through a switch.

ControlEdge Builder
Switch
Ethernet Star network
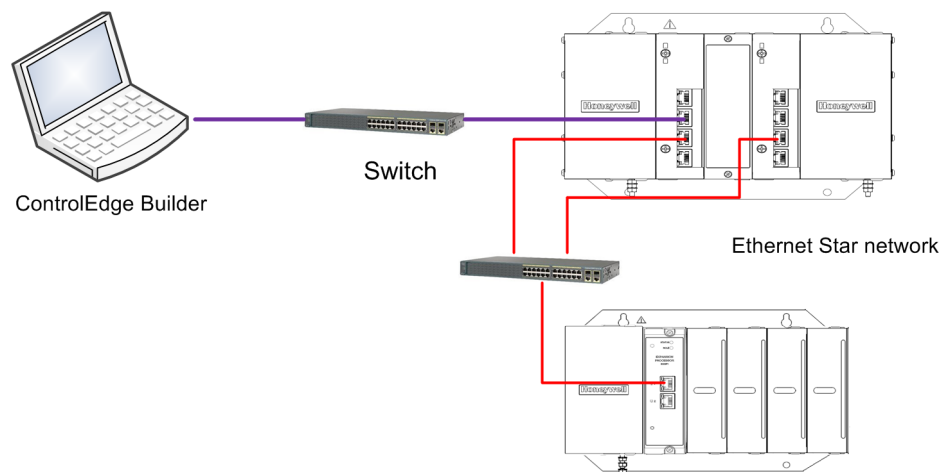
ControlEdge 2020 platform

The Honeywell ControlEdge 2020 process controller is a modular, powerful, and scalable system capable of all remote automation and control applications. When combined with Experion® PKS and its simplified SCADA configuration, it solves the remote automation requirements.

ControlEdge RTU supports controller redundancy, Honeywell wired and wireless I/O and enhanced Experion SCADA integration.

See the following figure for reference as a redundant controller system.

Figure 3-10: Redundant ControlEdge 2020 Controller System Diagram

CAT5 Cable
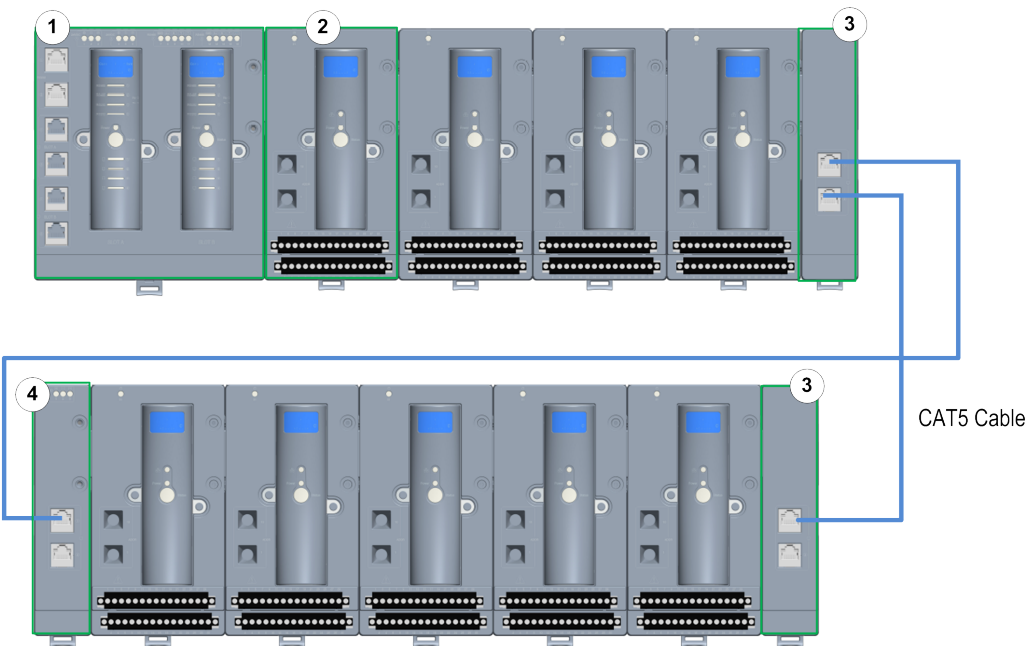
Item	Model Number	Description
1	SC-UCNN11	ControlEdge 2020 Redundant Controller
2	SC-UMIX01	ControlEdge 2020 Mixed I/O Module with 28 I/O
3	SC-TEPR01	ControlEdge 2020 expansion I/O right end plate, includes a CAT-5 termination cable
4	SC-TEPL01	ControlEdge 2020 expansion I/O left end plate

Hardware components

ControlEdge RTU system consists of a controller, expansion I/O modules, right end plate, and left end plate. These components are combined with field devices to make a complete system.

Redundant Controller

The redundant controller consists of two CPMs and an IOTA.

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Figure 3-11: Redundant Controller

Item	Description
1	18–30 VDC power supply (two)
2	RS485 Ports (two)
3	RS232 Ports (two)
4	Ethernet Ports (four) Ethernet port1 and port2 for the left CPM (SLOT1). Ethernet port3 and port4 for the right CPM (SLOT2).
5	Screw hole: used for locking controller IOTA and expansion I/O IOTA.
6	Expansion Connector: used for connecting with expansion I/O module.

Expansion I/O

An Expansion I/O consists of an IOM and an IOTA.

An I/O Module (IOM) contains most of the electronics required to perform a specific I/O function. The IOM plugs onto the IOTA.

> **ATTENTION:** Up to 30 expansion IOMs of Revision B can be connected with the controller.

Figure 3-12: Expansion I/O

Item	Description
1	Chassis ground
2	Left expansion connector: used for connecting with controller, expansion I/O module or left end plate.
3	Rotary switch (two): used for setting the address of IOM. The controller can configure and communicate with IOM according to this address. Set the switches to the two digit address ranging from 01 to 98. The upper switch (10) is used to set the tens digit and the lower switch (1) sets the ones digit. See "Mounting the Controller with Expansion IOM" on page 1 for more information. **ATTENTION:** • The address must be unique across all I/O modules connected to the same ControlEdge 2020 controller. • Unless the location is known to be non-hazardous, do not adjust the switches while the equipment is powered. • Do not set the switch index bigger than 98, or else the system LED of IOM status indicator would blink with yellow, reflecting that IOM is unable to establish the communication with the Controller.
4	Terminal strips: used for connecting I/O cable from the field.
5	Screw holes: used for locking IOTAs between two expansion I/O Modules.
6	Right expansion connector: used for connecting with expansion I/O module or right end plate.

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> **ATTENTION:** The non-redundant controller IOTA (51307198–175) must be at hardware version 'B' or later to work with expansion I/O modules. The hardware version is detailed on the controller IOTA label.

Expansion IOMs and CPMs communicate via a ring topology providing two link paths. If the running link path breaks, the other link path re-establishes communication within in 250ms.

Right End Plate

A right end plate is required at the end of each row of expansion I/O modules including the row connected to a controller. It allows additional rows to be added or terminates the I/O link. The right end plate has two Ethernet ports and a left expansion connector, as numbered in the following picture.

Figure 3-13: Right End Plate
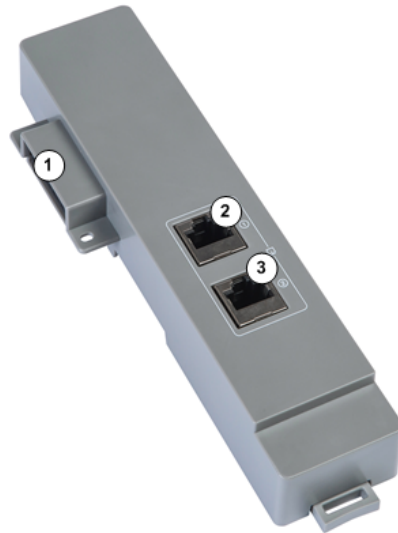
Item	Description
1	Left expansion connector: connects to a controller or an expansion I/O module.
2	Ethernet port 1: allows additional rows to be added or terminates the I/O link.
3	Ethernet port 2: allows additional rows to be added or terminates the I/O link.

> **ATTENTION:** Two ports of the last right end plate should be connected with a termination cable to complete ring formation.

Left End Plate

Left end plate is used only in multi-row ControlEdge 2020 systems for the IOM power supply and Ethernet connection. Left end plate has an 18-30 VDC Power Input, two Ethernet ports and a right expansion connector, as numbered in the following picture.

Figure 3-14: Left End Plate

Item	Description
1	18-30 VDC power supply
2	Right expansion connector: connects to an expansion I/O module.
3	Screw holes: used for locking left end plate and expansion I/O IOTA.
4, 5	Ethernet port 1 and Ethernet port 2: extends the I/O link to another row.

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Installing the assembly

This section introduces you to mount the assembly.

To install the controller with expansion I/O modules

1. Remove the connector cover on the right side of controller IOTA.

2. Mount the controller IOTA onto the DIN rail.

3. Mount the expansion I/O IOTAs onto the DIN rail and insert the IOTA into the controller IOTA.

4. Set the rotary switch to the address of the IOM, ranging from 1 to 99.

5. Insert the CPM onto the IOTA and secure it.

6. Insert IOM onto the expansion I/O IOTA and sure it.

Wiring and cabling

All I/O channels share the power source with the system components while the two analog output devices are powered internally. In most cases, the other 26 channels require external cabling to introduce the voltage to field loops from the system power source.

Grounding and Shielding

> **CAUTION:** ControlEdge 2020 controller must be connected to earth ground.

Connect ControlEdge 2020 Controller to earth ground through power input terminal chassis ground pin (pin 33) as illustrated in the following figure.

Figure 3-15: Redundant Controller Grounding
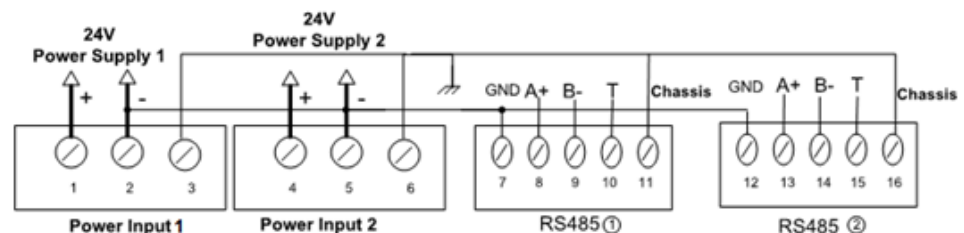
Connect Expansion I/O to earth ground through pin 31 as illustrated in the following figure.

Figure 3-16: Non-redundant Controller Grounding
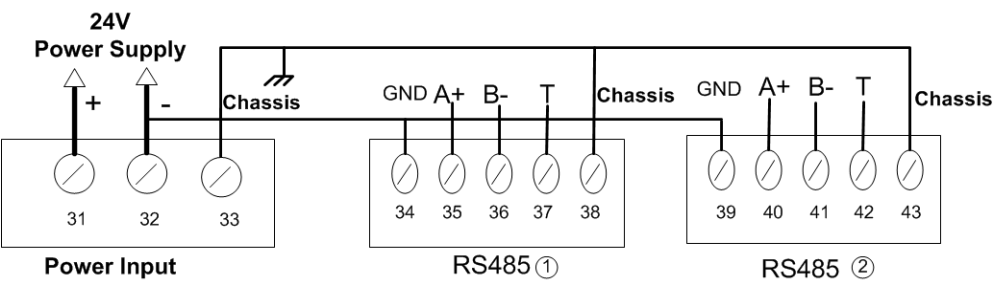
Figure 3-17: Expansion I/O Grounding
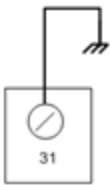
For more information about each I/O module wiring, see "I/O Wiring" in the *ControlEdge 2020 Platform Hardware Planning and Installation Guide*.

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I/O network topology

ControlEdge RTU can be configured as a redundant controller system or non-redundant controller system.

ControlEdge RTU supports ring I/O topology for I/O communication. The following diagram shows an example of the topology.

CAT5 Cable

For more information, see "Planning for network topology" in the *ControlEdge 2020 Controller Hardware Planning and Installation Guide*.

Power on

1. Connect 24 VDC supply to the controller.

2. Connect an Ethernet cable to the port most appropriate for your situation.

3. Connect the other end of the Ethernet cable to the PC installed ControlEdge Builder directly or through a switch.

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24VDC Power Source

ControlEdge Builder

Switch

CAT5
Cable

Honeywell

4 SOFTWARE
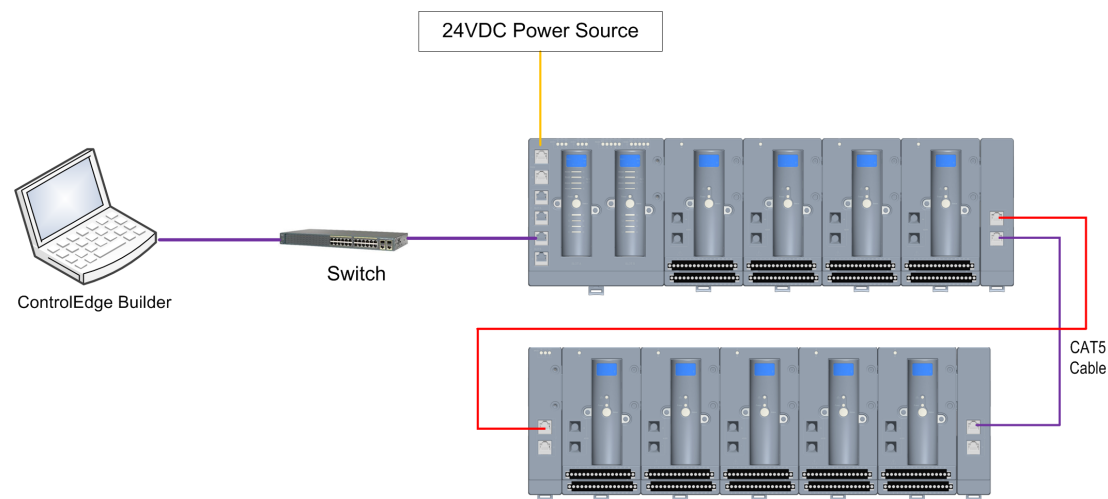
Installing ControlEdge Builder

The following table lists the operation system and resolution requirements for the PC installed ControlEdge Builder.

Item	Specification
Operation system	Windows 7 32-bit or 64-bit with SP1
	Windows 2008 32-bit or 64-bit with SP1
	Windows 10 32-bit or 64-bit (Support secure communication)
	Windows Server 2016 Standard Edition 64-bit
Resolution	Recommended: 1280x800 or above
	Optimal: 1920x1080, 1366x768, 1280x1024 and 1280x800

To install ControlEdge Builder

1. Insert the **ControlEdge Builder Media Kit** into the DVD-ROM drive.
2. Browse to the folder containing **ControlEdge_builder_setup.exe**. Double-click this file.
3. Follow the screen prompts to install ControlEdge Builder.

For full instructions on how to install ControlEdge Builder, see the *ControlEdge Builder Software Installation User's Guide.*

Launching ControlEdge Builder

Click **Start** > **All Programs** > **Honeywell** > **ControlEdge Builder** > **ControlEdge Builder** to launch ControlEdge Builder and the Start Page appears.

Start Page is outside any project context, and enables the user to select an action to start. It provides several actions:

- **Create Project**: click the icon to create a new project with the default controller configuration.
- **Open Project**: click the icon to open an existing project.
- **Connect**: click the icon to connect to a controller.

Figure 4–1: Start Page
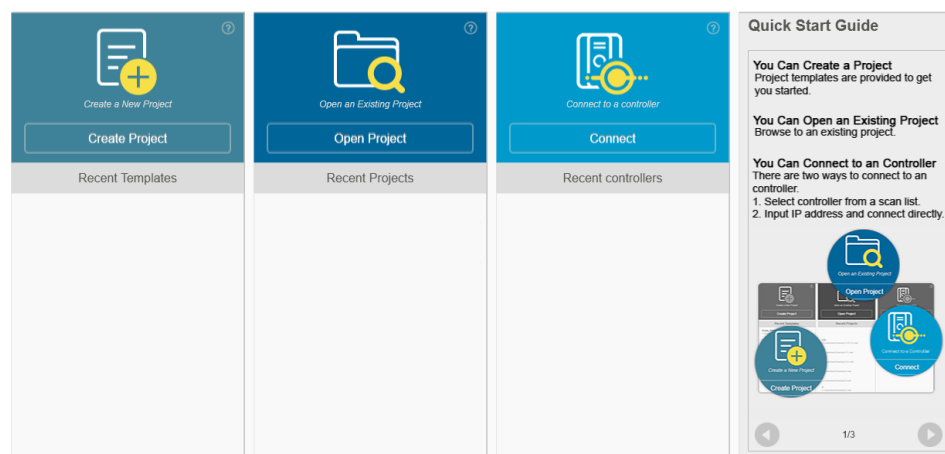
Checking firmware versions

Before configure the controller, make sure all the hardware modules used in the system are installed with the right firmware version. Otherwise, you should upgrade the firmware first. See "Upgrading firmware" on page 70 for more information.

Creating a project

This section introduces how to create a new project. The configuration and programming details are stored in the project.

To create a new project

1. From the Start Page, click **Create Project**.

2. In the **Create New Project from Template** window, click **General** and select the target template from the **Available Templates** list.

   - Select **900cp1** to create a project for a ControlEdge 900 controller.

   - Select **SC-UCMX01** or **SC-UCNN11** to create a project for a ControlEdge 2020 controller.

     - **SC-UCMX01** is for a non-redundant controller.

     - **SC-UCNN11** is for a redundant controller.

3. Click **Next**. The **Save As** window appears.

4. Select an appropriate directory to save the project and enter a name for the project in the **File name** field.

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- The project name must not contain any of the following characters: '.\/:*?"<>|'.

- The project name must not exceed 24 characters.

- The directory path length must not exceed 171 characters.

5. Click Save. A project is created and the Home Page appears. Take the home page of ControlEdge 900 controller as an example here.
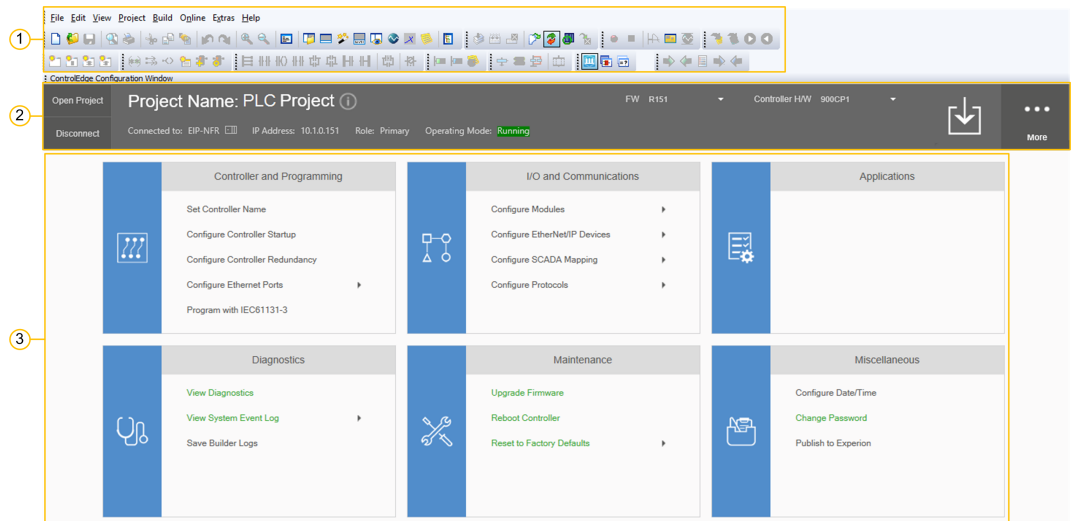
Item	Description
1	This area contains toolbar and menu bar. You can navigate to IEC Programming Workspace, compile a project, build a project, debug on/off, etc.
2	This area contains the following options: open an existing project, connect a controller, upgrade a project and download a project.
3	This area contains configuration options for the controller and project. You can configure the IP address, configure I/O, upgrade firmwares and program the project, etc.
For more information, see "Creating a project" in the *ControlEdge Builder User's Guide*.	

Configuring hardware

Setting controller name

You can set a new name for a controller.

1. From the Home Page, under **Controller and Programming**, click **Set Controller Name**.

2. Enter the desired name for the controller, and click **Save**.

If using Experion integration with ControlEdge 900 or 2020 controller, this name is used to identify the controller during Experion configuration.

Configuring the controller IP address

The first thing you will normally want to do is set the IP address for the controller. The following steps describe how to configure a fixed IP address starting with creating a new project.

The following table lists the factory default network settings. If your controller has been previously configured, these settings may have been changed.

Table 4-1: Factory default network settings of the non-redundant controller

Port	Default setting
ETH1	IP address is dynamically assigned from a DHCP server. If no DHCP server is found by the controller, an IPv4 link-local address will be assigned (169.254.x.x).
ETH2	Static IP address: 192.168.1.50

Table 4-2: Factory default network settings of the redundant controller

Port	Default setting
ETH1	IP address is dynamically assigned from a DHCP server. If no DHCP server is found by the controller, an IPv4 link-local address will be assigned (169.254.x.x). The secondary controller IP address is incremented by 1 from the primary controller IP address.
ETH2	The primary controller static IP address: 192.168.1.50

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Port	Default setting
	The secondary controller static IP address: 192.168.1.51

To configure IP address

1. From the Home Page, click the arrow beside **Configure Ethernet Ports**, and select **ETH1** or **ETH2**.

2. Under **Network Setting**, configure the IP address of the Ethernet port for the controller.

3. Under the **Protocol Binding**, select the protocol which you want to bind to the port.

4. Click **Save** to complete the Ethernet port configuration.

5. Click **Back** to return to the Home Page.

> **TIP:** If new IP settings are compiled and downloaded, the controller will be disconnected from the configuring device.

Configuring controller start up

This function enables you to configure the controller status after the power cycle.

For ControlEdge 900 controller, this feature is only applicable when the mode switch is in REMOTE position.

Under **Controller and Programming**, select **Configure Controller Start Up**, the **Configure Controller Start Up** page appears. There are four options for controller start up:

- **Last operating mode, or Running after an abnormal stop**

  This option is the default setting for ControlEdge 2020 controller.

  The controller will start in the operating mode that it was last in prior to a power off, unless there was an abnormal stop caused by a system error such as a watchdog timeout issue. It will then start in *Running* mode.

  - If the controller was in *Running* mode before power off, the controller will warm start in *Running*. If the warm start fails, the controller will go to *Stopped* mode.

  - If the controller was stopped manually before power off, the controller will start in *Stopped* mode.

  - If the controller was stopped abnormally before power off, the

controller will warm start in *Running* mode. If the warm start fails, the controller will go to *Stopped* mode.

■ **Last operating mode, or Stopped after an abnormal stop**

This option is the default setting for ControlEdge 900 controller.

The controller will start in the operating mode that it was last in prior to a power off, unless there was an abnormal stop caused by a system error such as a watchdog timeout issue. It will then start in *Stopped* mode.

- If the controller was in *Running* mode before power off, the controller will warm start in *Running*. If the warm start fails, the controller will go to *Stopped* mode.

- If the controller was stopped manually before power off, the controller will start in *Stopped* mode.

- If the controller was stopped abnormally before power off, the controller will start in *Stopped* mode.

■ **Running**

The controller will warm start in *Running* mode. If the warm start fails, the controller will go to *Stopped* mode.

■ **Stopped**

The controller will start in *Stopped* mode.

> **ATTENTION:** If you reboot the controller manually, the configuration in this section will not take effect. For example: If you select **Running** here, and you select **Reboot Controller** under **Maintenance**, and click **Cold Reboot**. The controller will perform cold start, but not warm start after it reboots.

Configuring controller redundancy

To disable redundancy

1. Under **Controller and Programming**, select **Configure Controller Redundancy.**

2. Select **Disable Controller Redundancy** to disable the redundancy function.

3. Click **OK**. Redundancy has been disabled. The IP address configured for the secondary controller will be disabled.

To enable redundancy

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1. Under **Controller and Programming**, select **Configure Controller Redundancy**.

2. Select **Enable Controller Redundancy**, and then click **OK**.

   The configuration of I/O modules in the rack local to the controller will be removed and a static IP address must be configured for the secondary controller.

3. Configure the IP address of the controllers.

   - If the **Obtain an IP Address Automatically** options of ETH1 and ETH2 were enabled, this option will be disabled automatically. Configure **Primary Controller IP Address** and **Secondary Controller IP Address** manually.

   - If the **Obtain an IP Address Automatically** options of ETH1 and ETH2 were disabled, configure the **Secondary Controller IP Address** manually.

Configuring an I/O module

Configure an I/O module for ControlEdge 900 controller

1. From the Home Page, under **I/O and Communications** and click **Configure Modules** > **Configure I/O Modules**.

2. Click **Add I/O Module**, the **Add I/O Module** dialog appears.

3. Select the **Type**, assign the **Rack** and **Slot**, and set the **IOM Scan Time** for the Module.

4. Click **OK** to add the I/O module.

5. Select the corresponding I/O module, configure I/O channels.

Configure an I/O module for ControlEdge 2020 controller

You can configure onboard I/O modules, expansion I/O modules and a third party I/O ST103A for ControlEdge 2020 controller.

To configure an onboard I/O

1. From the Home Page, under **I/O and Communications** and click **Configure I/O**.

2. Click **Onboard I/O** and you can view the five channels **AI, AO, DI, DO** and **PI**.

3. Select the corresponding channel, and configure parameters.

To add and configure an expansion I/O module

1. From the Home Page, under **I/O and Communications** and click **Configure I/O**.

2. Click **Add I/O Module** > **SC-UMIX01 Mixed I/O Module, 28**, the **Add I/O Module** dialog appears.

3. Enter the **Description** and select the **Address** for the I/O module which must be same as the rotary switch setting of the physical device. The range of the address is from one to nine.

4. Click **OK** to add the I/O module.

5. Click the corresponding expansion I/O module to view channels.

6. Select the corresponding channel, and configure parameters.

To add and configure an third-party I/O, ST103A

1. From the Home Page, under **I/O and Communications**, click **Configure Third-Party I/O** > **ST103A**.

2. Click **Add ST103A Module**. The **Add I/O Module** dialog appears.

3. Enter **Description** for ST103A module which will be a unique identifier for binding with specific meter runs.

4. Select **Slave ID** for the drop-down list. The valid value is from 1 to 15.

   The ST103A should be opened to set Slave ID and row 4 bit switches will be available to configure the value from 1 to 15. See "Configuring ST103A" in the *ControlEdge 2020 Platform Hardware Planning and Installation Guide* for how to set Slave ID.

   > **ATTENTION:** If there are other Modbus devices connected to the same RS485 port along with ST103A, ensure that they do not conflict with each other.

5. Select the port number, and provide values for **Retries** and **Timeout**.

6. Click **OK** to add ST103A module.

7. Click the corresponding module to view channels.

   Only ST103A's analog input, pulse input, frequency and raw pulse

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output can be configured via ControlEdge Builder.

8. Select the corresponding channel, and configure parameters.

Configuring serial modules

The section introduces how to add and configure a serial communication module. Up to six serial modules can be added.

1. From the Home Page, under **I/O and Communications**, click **Configure Modules** > **Configure Serial Modules**.

2. Click **Add Serial Module**, the **Add Serial Module** dialog appears.

3. Select the **Type**, assign the **Rack** and **Slot** for the module.
   See the following table for the parameter descriptions:

Parameter	Description
Type	Serial module type: 900ES1: Serial Comm
Rack	Rack address: • If controller redundancy is enabled, the rack address range is from 1 to 99. • If controller redundancy is disabled, the rack address range is from 0 to 99. 0 is only for the local I/O rack. • For an expansion I/O rack, the address must be the same with the EPM address configured on 1x and 10x rotary switches. For details about the rotary switches, see "Assembling I/O racks" in the *ControlEdge 900 Controller Hardware Planning and Installation Guide*.
Slot	Slot number: the location of the I/O module mounted in the rack • If the I/O module is installed in a 4-slot rack, the slot number is ranging from 1 to 4. • If the I/O module is installed in an 8-slot rack, the slot number is ranging from 1 to 8. • If the I/O module is installed in a 12-slot rack, the slot number is ranging from 1 to 12.

4. Click **OK** to add the serial module.

5. Select a serial module. There are four serial ports to be configured, RS232-1, RS232-2, RS485-1 and RS485-2. Select the target port and configure appropriate values for the following parameters.

Parameter	Description
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	None, ODD, EVEN
Data Bits	7, 8 If you select Modbus RTU Slave or Modbus RTU Master for the Protocol Binding, the Data Bits is set as 8 by default.
Stop Bits	1, 2

For RS232-1 and RS232-2, you should configure one more option: **Flow Control**. See the following table for the parameter descriptions.

Parameter	Description
Flow Control	Only for RS232-1 and RS232-2 • None • RTS-CTS • RTS

6. Under **Protocol Binding**, select a protocol from the **Port Protocol** drop-down list.

   The following table provides information about various protocols supported by serial ports.

Protocol	Description
Modbus RTU Slave	The controller acts as the Modbus Slave and used for communication between: • Controller and SCADA • Controller and third-party Modbus Master devices

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Protocol	Description
	If you select Modbus RTU Slave: • Data Bits is set as 8 by default. • There are two more options to configure: **Slave ID** and **Mapping**. If the Mapping is empty, you must add a mapping table first. See "Adding a Modbus Slave mapping table" on page 1 for more information.
Modbus RTU Master	The controller acts as the Modbus Master and used for communication between The controller and third-party Modbus Slave devices, for example I/O modules. If you select Modbus RTU Master, Data Bits is set as 8 by default.
Modbus ASCII Slave	The controller acts as the Modbus Slave and used for communication between: • Controller and SCADA • Controller and third-party Modbus Master If you select Modbus ASCII Slave, you must configure two more options: **Slave ID** and **Mapping**. If the Mapping is empty, you must add a mapping table first. See "Adding a Modbus Slave mapping table" on page 1 for more information.
Modbus ASCII Master	The controller acts as the Modbus Master and used for communication between The controller and third-party Modbus Slave devices, for example: I/O modules.
User Defined	User Defined protocol. When you select this option, the **Delimiter Mode (Optional)** panel appears including three settings: **Read-interval Timeout (ms)**, **Max Length (Bytes)** and **End Delimiter (Hex)**. You can configure them optionally to validate if a data frame is sent completely. • **Read-interval Timeout (ms)**: The interval between the last data packet sent and the first keepalive probe, ranging from 0 to 10000 (ms). If the interval between the arrivals of any two bytes exceeds this

Protocol	Description
	Timeout, system regards it has already received a complete data frame.
	The default value is 0 which means this option is disabled.
	• **Max Length (Bytes)**: The maximum number of bytes for a data frame, ranging from 0 to 532. If the length of a received data frame exceeds the Max Length, system regards it has already received a complete data frame.
	The default value is 0 which means this option is disabled.
	• **End Delimiter (Hex)**: Configured special characters in hexadecimal and based on bytes validates if a data frame is sent completely. If the received data frame has same characters with the End Delimiter, system regards it has already received a complete data frame.
	The default setting is blank which means this option is disabled.
	For how to configure User Defined protocol, see "User Defined Protocol" in the *ControlEdge Builder Function and Function Block Configuration Reference*.

7. Click **Save** to complete the configuration.

Configuring a controller simulator

Controller simulator can be deployed on a Virtual Machine, and enables the user to configure a controller without connecting a physical controller.

For this release, the controller simulator does not support I/O communication.

> **ATTENTION:** It is not recommended to use the simulator in a production environment, because simulator does not support secured communication.

The following table lists the supported and non-supported features of the controller simulator.

Features	Support
Connect a controller simulator	Yes
Download a project to a controller simulator	Yes
Download a redundant project to a controller simulator	Yes
Debug a program	Yes
Force I/O value through I/O variables	Yes
Force I/O value through I/O channels	No
Upload system event log	Yes
Monitor link status	Yes
System diagnostics	Yes
Secure communication	No
Communication between SCADA and controller simulator	Yes
Communication between controller simulators	Yes
Communication between virtual and physical controllers	Yes
Modbus TCP master/slave	Yes
Modbus UDP slave	No
Enron Modbus slave	No
DNP3 slave	No
OPC UA Server	Yes
OPC UA Client	No
CDA responder	No
EtherNet/IP	No
HART/HART-IP	No

Features	Support
Wireless I/O	No
Data logging	No
EFM	No
Secured communication	No

Prerequisite

Make sure the IP addresses for the PCs installed simulator and ControlEdge Builder are on the same subnet.

One virtual machine only supports one controller simulator.

Procedures

1. Install a virtual machine. Two virtual machines are verified:

    - VMware Workstation Player 12.5.8 or higher hypervisor

    - VMware vCenter Server 6.0.0 or higher hypervisor

    For more information, see the vendor's documents.

2. Import or open an OVA file in the virtual machine, and play the virtual machine. Honeywell provides three OVA files stored in Simulator folder in the Media.
    RXXX indicates the release number.

    - ControlEdge 900 controller: ControlEdge_PLC_900CP1_ RXXX.ova

    - ControlEdge 2020 controller:

        - Non-redundant controller: ControlEdge_RTU_SCUCMX01_ RXXX.ova

        - Redundant controller: ControlEdge_RTU_SCUCNN11_ RXXX.ova

    Take VMware Workstation Player 12.5.8 as an example here:

    a. Click **Player** > **File** > **Open**, the **Open Virtual Machine** dialog appears.

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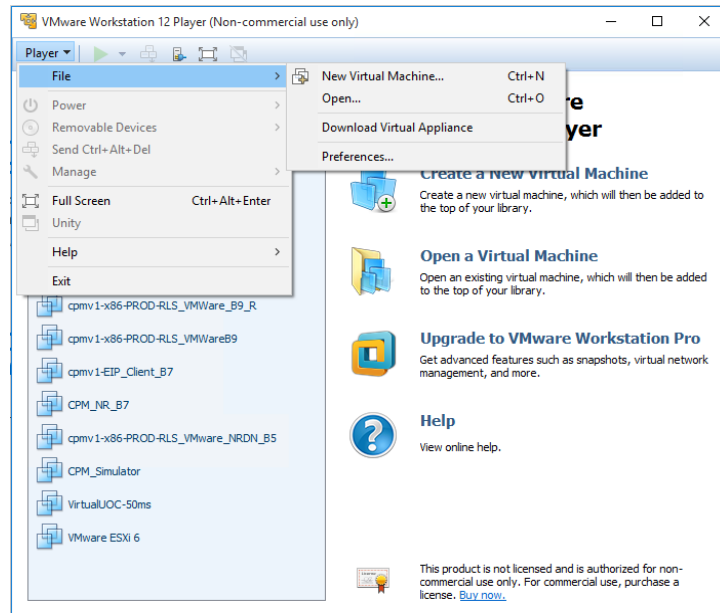
b. Browse to the location stored the target OVA file, select the OVA file and click **Open**.
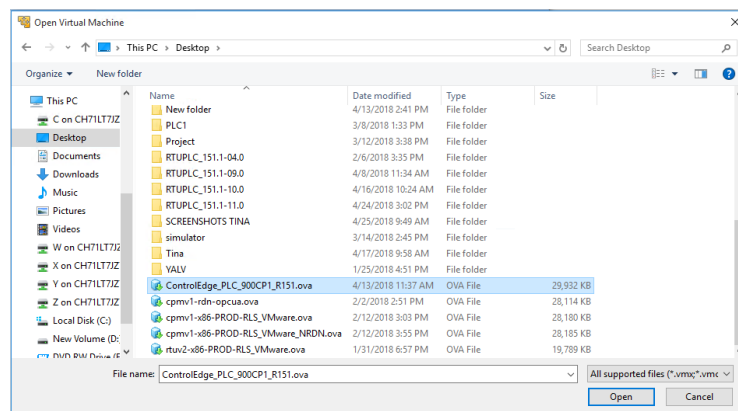
c. From the **Import Virtual Machine** dialog, name the virtual machine, and select a storage location for the virtual machine. Click **Import**.
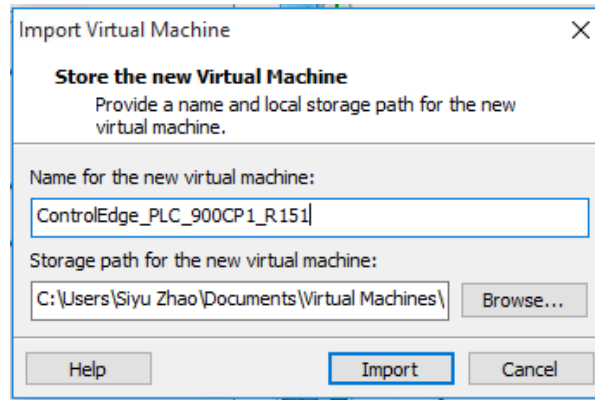
d. Click **Play virtual machine**.
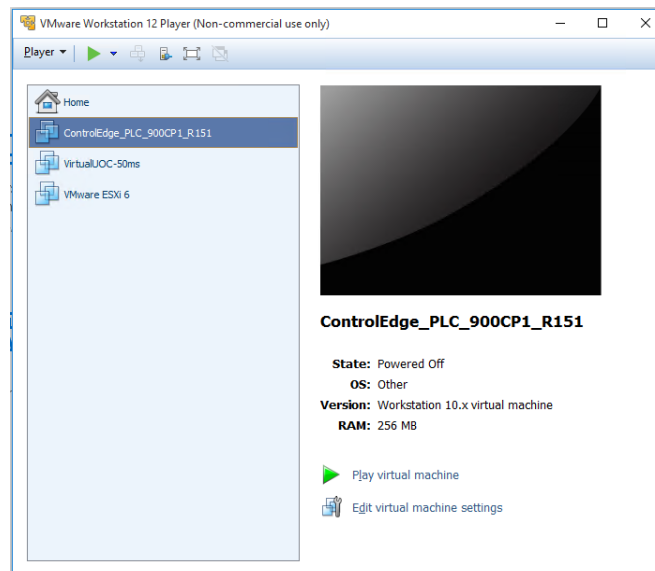
e. For ControlEdge 900 controller, you should configure the controller type.

- Enter 0 to configure the controller type as non-redundant.

- Enter 1 to configure the controller type as redundant.

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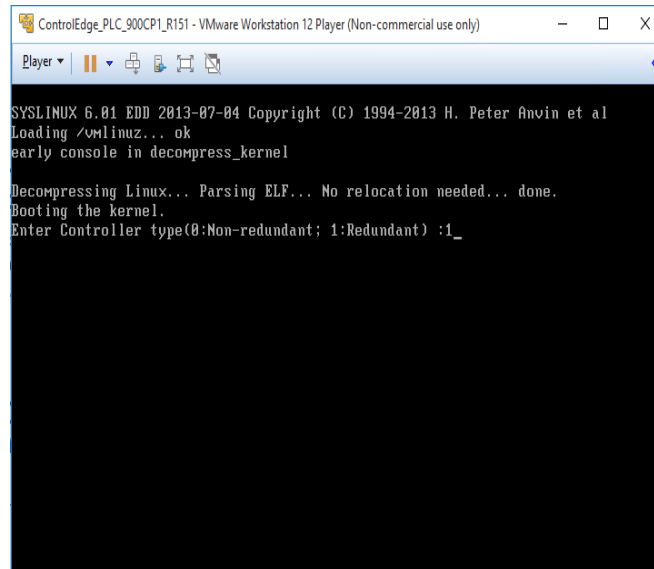
> **NOTE:** The controller type cannot be changed once you configure it, and you should re-import the OVA file and configure it again.

An OVA file defines a controller simulator. To change the controller simulator version, import the corresponding OVA file.

For more information, see the vendor's documents.

3. Connect to a controller simulator. See "Connecting a controller" on page 1 for more information.

   After you connect to a controller simulator, make sure the build settings is I486_LE_GCC3. Click **IEC Programming Workspace** and check the following parameter:

4. Configure a controller simulator. See the table above for the supported configuration. Project version must match with the controller simulator version.

5. Compile the project. See "Compiling a project" on page 1 for more information.

6. Download the project to the controller simulator. See "Downloading a project to the controller" on page 1 for more information.

Programming with IEC 61131-3

This chapter introduces general information about programming with IEC 61131-3.

See the embedded help for details about programming. Select **Help** > **Contents** from the toolbar. In the pop-up help, expand **Programming System Help** and click **Programming a project**.

Adding a library

The Libraries that are included in your project are either user-defined libraries or firmware libraries.

- User Library: contains programs, function blocks, functions and user-defined data types, and can be reused across projects. Honeywell provides user libraries and user can create their own. The file extensions for user library are *.mwt and *.mwe.

- Firmware Library: contains function blocks and functions prepared by Honeywell for specific hardware. The file extension for firmware library is *.fwl.

For more information about the function and function block, see the *ControlEdge Builder Function and Function Block Configuration Reference Guide*.

To add a library

1. Click **IEC Programming Workspace** from the toolbar, or from Home Page, click **Program with IEC61131-3**.

2. Right-click **Libraries** and click **Insert**. Select **User Library** or **Firmware Library**.

   - For **User Library**, select .mwt file and click **Include**.

   - For **Firmware Library**, click the corresponding folder and select the target .fwl file, and then click **Include**.

Creating a data type

Honeywell provides some read-only user-defined data types, and user can also create and define data types. The maximum number of user defined data types is 1024. User-defined data types can be used within user function blocks and programs. They cannot be used in user functions.

To create a data type

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1. Click **IEC Programming Workspace** from the toolbar, or from Home Page, click **Program with IEC61131-3**.

2. From the **Project Tree Window**, right-click **Data Type** and select **Insert > Datatypes** and name the target data type.

3. Double-click the newly added data type, you can edit it in the text editor.

For I/O_DataTypes, each I/O Channel has one or two structures. All of the related information for this channel is grouped together in the structures as shown below. You can use this information as reference for I/O channel configuration and programming.

Table 4-3: I/O channel structures of the I/O_DataTypes

Structure type	Parameter	Parameter type
ANALOG_INPUT_TYPE	STS	USINT
	PV	REAL
	EUHI	REAL
	EULO	REAL
	EUHIEX	REAL
	EULOEX	REAL
ANALOG_OUTPUT_TYPE	OP	REAL
ANALOG_OUTPUT_READBACK_TYPE	STS	USINT
	OP_READBACK	REAL
	EUHI	REAL
	EULO	REAL
	EUHIEX	REAL
	EULOEX	REAL
DIGITAL_INPUT_TYPE	STS	USINT
	PV	BOOL
DIGITAL_OUTPUT_TYPE	OP	BOOL

Structure type	Parameter	Parameter type
DIGITAL_OUTPUT_READBACK_TYPE	STS	USINT
	OP_READBACK	BOOL
PULSE_INPUT_TYPE	STS	USINT
	COUNTER[1]	UDINT
	RATE[2]	REAL
	PREI[3]	BOOL
PULSE_INPUT_CONTROL_TYPE	RST[4]	BOOL
	HOLD[5]	BOOL
FREQUENCY_INPUT_TYPE	STS	USINT
	FREQUENCY	REAL
PULSE_OUTPUT_TYPE	PULSES	UDINT
	ENABLE	BOOL
	START	BOOL
	CONTINUE	BOOL
PULSE_OUTPUT_READBACK_TYPE	STS	USINT
	REMAIN	UDINT

1. COUNTER: The accumulated Engineering Unit (EU) count.

2. RATE: Rate in EU/Time Period. Input pulses are counted over a specified Sample Time and scaled to EU/Second, EU/Minute or EU/Hour.

3. PREI: Preset indicator. OFF [0] when COUNTER = less than the local or remote preset value, ON when the count reaches the local or remote preset value. The hardware module determines the state of the PREI output. PREI is cleared by the RST input. A preset value of 0 effectively turns off the Preset allowing the counter to count continuously until held or reset.

4. RST: An OFF to ON transition resets the module's pulse counter and the OUT to zero. It also clears the FAIL, Overflow in STS and PREI.

5. HOLD: A Boolean value when set to 1 holds the EU count at its current value.

Creating a variable

This section introduces how to create and declare variables to diagnose and monitor the system.

To create a variable

1. Click **IEC Programming Workspace** from the toolbar, or from Home Page, click **Program with IEC61131-3**.

2. You can create local variables or global variables from the corresponding grid worksheet. is the grid worksheet for local variables, and is the grid worksheet for global variables. For the following steps, let us take the global variable as an example.

3. Double-click **Global_Variables** under **Physical Hardware**, the global variable sheet appears.

4. Right-click under the corresponding group, and select **Insert variable** to add a new I/O variable.

   For output channel variables, you must add corresponding read back variables with suffix "_READBACK" in the **Input I/O Variables** group.

5. Double-click the **Name** and **Description** fields to modify, and select **Type** and **Usage** from the drop-down lists.

   The maximum quantity of characters for a variable name is 30.

   IEC address of the I/O variable is generated automatically after you bind it with an I/O channel and click **Make**. If you add a new I/O variable by copying an existing bound one in a compiled project, you should delete the IEC address of the new variable manually and click **Make** to generate it automatically.

6. If a variable will be used for Modbus, EFM or PID, you should select **Retain** for it. Perform either of the following methods:

   - From the variable sheets, select **Retain**.

	Name	Address	Init	Retain	CDA	EIP
1	⊟ System Variables					
2	PLC_SYS_TICK_CNT	%MD1.0		☑	☐	☐
3	PLC_TASK_DEFINED	%MW1.4		☐	☐	☐

- From the variable properties dialog, select **Retain**, and click **OK**.
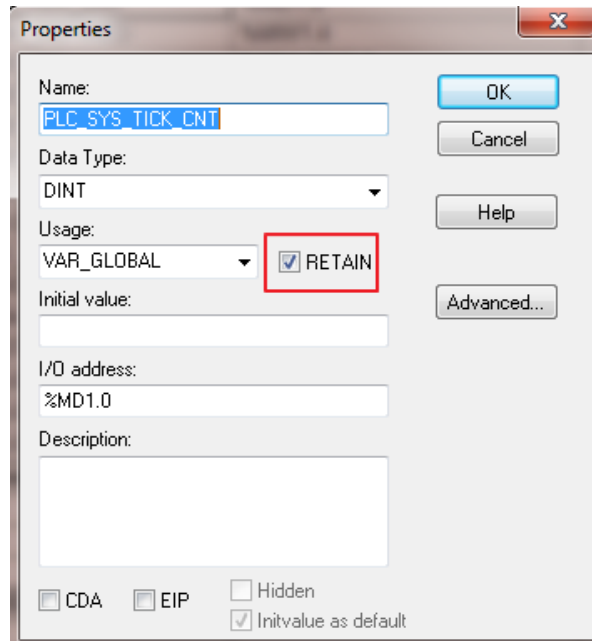
Creating a Programming Organization Unit

Logical Program Organization Units (POUs) are the language elements of a program. They are small, independent software units containing the program code. The name of a POU must be unique within the project.

There are three different POU types:

- **Program**: contains a logical combination of function or function block calls. Programs have input and output parameters and they can have an internal memory.

- **Function Block**: POUs with multiple input/output parameters and internal memory.

- **Function**: POUs with multiple input parameters and exactly one output parameter.

To create a POU

1. Click **IEC Programming Workspace** from the toolbar, or from Home Page, click **Program with IEC61131-3**.

2. From the **Project Tree Window**, right-click **Logical POUs** and select **Insert** > **Program/Function Block/Function**, the **Insert** dialog appears.

3. Enter the **Name** for the new POU.

4. Select the desired programming Language. Depending on your system configuration, some programming language are possibly not available.

5. Enter a **PLC type** and/or a **Process type** if required.

6. Click **OK**, the new POU is inserted in the project tree. It contains one code worksheet in the chosen language, a variable worksheet and a description worksheet.

7. Expand the POU, and double-click the code worksheet, the workplace appears.

8. Drag the target function or function block from the Edit Wizard pane, and the function or function block is displayed.

9. Double-click the pin-outs of the function or function block, the **Variable Properties** dialog appears.

10. Accept the proposed name, or enter a new name or select an already existing name from the **Name** combo box.

11. Select the **Data Type** and **Usage** from the drop-down lists.

    - If you are creating a Program, there are two options for Usage: VAR and VAR_GLOBAL.

    - If you are creating a Function Block, there are five options for Usage: VAR, VAR_INPUT, VAR_OUTPUT, VAR_IN_OUT and VAR_GLOBAL.

    - If you are creating a Function, there are two options for Usage: VAR and VAR_INPUT.

    See the following table for the description of variables.

Variable	Description
VAR	Local variable
VAR_GLOBAL	Global variable
VAR_INPUT	Local FB input variable
VAR_OUTPUT	Local FB output variable
VAR_IN_OUT	Local input/output variable

12. Assign the initial value and I/O address.

13. It is optional to select the target group from **Global Variable Groups**. Click **OK** and the new variables are added to the selected groups.

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If you do not select a **Global Variable Group**, the variables are added to the **Common Variables** group by default.

Associating a program to a task

Tasks determine the time scheduling of the programs associated with them. This means that programs have to be associated to tasks in order to be executed. The settings of the task determine the time scheduling.

To create a task and associate a program

1. Click **IEC Programming Workspace** from the toolbar.

2. From the **Project Tree Window**, under **Physical Hardware**, right-click **Task** and select **Insert** > **Task**.

3. Enter the **Name**.

   Task name and Instance name must start with a letter or an underscore. The rest of the characters can be letters, numbers or underscores. The maximum quantity of characters which a task name can have is 7 and that of a program instance is 24.

4. Select the **Task type**. See the following table for the descriptions of task types.

Task type	Description
DEFAULT	Each resource can contain one default task. It is the task with the lowest priority (lower than cyclic tasks) and is not time scheduled.
CYCLIC	Cyclic task executes their associated programs in fixed time intervals.
EVENT	Event task executes their associated programs each time a particular event occurs.
SYSTEM	System task executes its associated programs each time a particular system event occurs.

5. Click **OK**.

6. Configure the parameters as required in the **Task settings** dialog.

   Depending on the associated task type, only some of the parameters are available.

7. Click **OK**. The new task is inserted.

8. Right-click the task you have inserted, and select **Insert** > **Program**

instance.

9. Enter a name in the **Program instance** field.

   The program instance must not be named "RTU" or "GlobalVariable".

10. Select the program you want to associate in the **Program type** drop-down list.

11. Click **OK**.

Compiling a project

After configuring the project, you have to compile it.

To compile a project

Click **Make** or **Rebuild Project** as required to compile the project.

- **Make**: It is used to compile the changed worksheets.

- **Rebuild Project**: It is used to compile the whole project for the first time or if an announced user library has been changed. The command Rebuild Project should only be used if 'Make' generates compiling errors or you have unzipped your project without the frontend code.

While compiling, the message window displays the compilation process. Any detected errors and warnings (e.g. syntax errors, memory or file problems) and additional information are also displayed in the appropriate message window sheet. You can use the message window to access the suspected code body worksheet by double clicking on the error message.

After compiling without any error, you have to download the project to the controller. See "Downloading a project to the controller" on page 1 for more information.

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5 OPERATING

Connecting a controller

Click **Connect** from the Home Page, and the **Connect controller** page appears.

1. From the Home Page, click **Connect**, the **Connect controller** page appears.

2. Click **Scan and Select** tab and select the target controller.

   Or click **IP Address** tab and enter the IP address of the target controller.

   You can connect to a physical controller or a controller simulator. Select the controller type:

   - : ControlEdge 2020 controller

   - : ControlEdge 2020 controller simulator

   - : ControlEdge 900 controller

   - : ControlEdge 900 controller simulator

3. Select the user name and enter the password.

4. Click **Connect**.

   If the current and previously connected controller types are different, the following dialog appears. Click **OK** to automatically configure the settings.
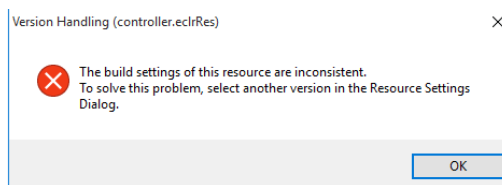
> **TIP:** Due to the cyber security, ControlEdge Builder will disconnect with the controller automatically if there is no communication between them including displaying the diagnostic view, uploading the datalog, downloading the

onfiguration, and upgrading the firmware for over ten
inutes.

Downloading a project to the controller

After compiling a project without any error, you have to download the
project to the controller.

Before downloading the project to the controller, you have to ensure:

- The project is opened in ControlEdge Builder.

- The project is compiled without any error. See "Compiling a
project" on page 65 for more information.

- Log in as the Administrator or Engineer to connect the target
controller. See "Connecting a controller" on the previous page for
more information.

- The primary CPM is connected if the controller is redundant.

- See "Connecting a controller" on the previous page for more
information.

To download a project

1. From the Home Page, click **Download**. A **eclrRes** window appears:

   For more information about the items in the **eclrRes** window, see
   the embedded online help. Select **Help** > **Contents**, and search for
   PLC state machine to display the corresponding content.

2. A Download confirmation dialog appears to make sure you want
   to download. Click **Yes**.

   > **ATTENTION:** If you want to upload this project in the future,
   > you should select **Download the project archive**, and a zip file
   > of the archived project will be stored in the controller.

3. There are two scenarios:

   - If the controller does not contain any project or the project you
     are going to download has a different name with the project is
     already stored in the controller, you should click **Stop** in the
     eclrRes window to stop the program execution. Then click
     Download in the **eclrRes** window to continue the download.

   - If the project with the same name is already stored in the

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controller, the system recognizes the differences between the "old" and the modified project version.

- If there is a lot of differences, a warning message appears indicating that the program execution will be stopped if you continue the download. Click **Yes** to continue the download. Click **No** to cancel the download.

- If there is a few of differences, the modified project is downloading without stopping program execution.

4. Click **OK** after the project is downloaded to the controller successfully.

Configuring date/time

Setting time source

The section introduces how to synchronize the controller time to the SNTP server.

For ControlEdge 900 controller, the synchronization is required in order to ensure robust operation of the embedded OPC UA server.

1. From the Home Page, under **Miscellaneous**, click **Configure Date/Time Options**.

2. Select **Enable** and enter the IP addresses of SNTP servers in the **Primary Server** and **Secondary Server** fields.

   If you select **Enable** here, under **Configure ProtocolsDNP3 Slave**, you should not select **Enable DNP3 Time Synchronization** in **Application Layer** tab at the same time.

3. Adjust the **Poll Interval** to synchronize current controller time to the SNTP server.

   The SNTP message poll interval is Poll Interval power of 2 ($2^{(Poll\ Interval)}$) in unit of second.

   The maximum poll interval is 17 (approx. 36 hours) and the minimum is 6 (64 seconds).

   It is recommended to set Poll Interval as 16 (approx. 18 hours). To avoid the communication storm, the controller will pick a random poll interval time in the range [2**(Poll Interval)**, 2**(Poll Interval+1)**], not exactly what is configured.

   If the NTP server is not available, you can use the function block (Set_RTC) to configure the controller time. For more information,

see "Set_RTC" in the *ControlEdge Builder Function and Function Block Configuration Reference Guide*.

> **TIP:** The recommended poll interval for EFM application is 14.

Setting time zone

1. Click **Configure Date/Time Options** under **Miscellaneous**.

2. Select **Set Time Zone** tab, and select the target time zone from the **Time Zone** drop-down list.

3. Select **Automatically Switch to Daylight Saving Time** if it is applicable.

Upgrading firmware

> **ATTENTION:** Do not power off when upgrading firmware.

- If a connected field device or FDAP is OWR300 firmware, the controller must be upgraded to R140 or later releases.

- If a connected field device is Honeywell OW R300 or Third party ISA100 2011 device, the controller must be upgraded to R140 or later releases, and FDAP must be upgraded to OW R300.

- For ControlEdge 2020 controller:

  - You can upgrade firmware from R110 to R151, R140 to R151, R150 to R151 directly. For other versions, please contact with GTAC.

  - Expansion I/O modules must be upgraded before controllers.

- For ControlEdge 900 controller, make sure the CPM version is same as or higher than the EPM version. In this case:

  - No specific upgrade sequence

  - Downgrade EPM before CPM

Before upgrading the firmware, it is required to:

- Log in as the Administrator to connect the target controller. See "Connecting a controller" on page 1 for more information.

- Install the latest ControlEdge Builder on your computer. See the *ControlEdge Builder Software Installation User's Guide* for details.

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Upgrading firmware for a non-redundant controller

> **ATTENTION:** It is recommended to upgrade the firmware without opening a project.

The firmware upgrade is ONLY allowed in **Stop Locked**, **Running** or **Stopped** operating modes.

For ControlEdge 900 controller, you can rotate the mode switch on CPM to change operating modes, see "CPM mode switch" in *ControlEdge 900 Platform Hardware Planning and Installation Guide*. If the mode switch is in the REMOTE position, See "Setting operating modes" on page 119 for more information.

To upgrade the firmware

1. From the Start Page, click **Connect** to connect the target controller.

2. From the Home Page, select **Upgrade Firmware** under **Maintenance**, and select the controller you want to upgrade.

3. Click **Upgrade**. The **Upgrade firmware** dialog appears.

   The controller is keeping running when you transfer the firmware to the controller, and will be stopped when you upgrade the firmware. So when the controller is running, we provide the interactive mode to control when the controller stops.

   - If you select the Interactive mode, a dialog appears confirming that the transfer is complete. Click **Next** to upgrade the firmware, and the controller is stopped. You can also click **Cancel** to quit the upgrade process.

   - If you do not select the Interactive mode , the firmware will be upgraded directly after the transfer. The controller will be stopped without any prompt.

4. Click **Proceed with Upgrade** to continue.

5. From the **Release Number** list, select the target release module. The target firmware version is displayed.

6. Click **Next**, the target firmware name, state and version are displayed.

7. Click **Next** to transfer and upgrade the firmware.

8. After the boot firmware is upgraded, enter the password to re-connect the controller. The application firmware is transferred and upgraded.

9. After the application has been upgraded, enter the password to re-connect the controller.

10. Click **OK** to complete the firmware upgrade.

Upgrading firmware for a redundant controller

> **ATTENTION:** It is recommended to upgrade the firmware without opening a project.

There are two procedures for the firmware upgrade of an redundant controller.

- **On-process**: The primary CPM is synced with the secondary CPM.

  > **ATTENTION:** On-process is ONLY applicable for upgrading R150 to later release firmwares.

- **Off-process**: The primary CPM is not synced with the secondary CPM.

  For ControlEdge 900 Controller, it is ONLY allowed in **Stopped, Running** or **Stop Locked** operating mode.

  You can rotate the mode switch on CPM to change the operating mode, see "CPM mode switch" in *ControlEdge 900 Platform Hardware Planning and Installation Guide*. If the mode switch is in the REMOTE position, See "Setting operating modes" on page 1 for more information.

Prerequisites

- Assume the primary CPM is at slot A and the secondary CPM is at slot B.

- Both primary (slot A) and secondary (slot B) CPMs are powered on.

To upgrade the firmware with On-process procedure

> **ATTENTION:** For ControlEdge 2020 controller, on-process procedure is ONLY applicable for a standalone redundant controller without EFM configured and IOM connected.

1. From the Start Page, click **Connect** to connect the target primary CPM (slot A).

2. From the Home Page, select **Upgrade Firmware** under **Maintenance,**

and select the CPM you want to upgrade.

3. Click **Upgrade**. The **Upgrade firmware** dialog appears.

4. From the **Release Number** list, select the target release module. The target firmware version is displayed.

5. Click **Next**, the target firmware name, state, and version are displayed.

6. Click **Next** to transfer and upgrade the firmware.

7. After the boot and application firmware is upgraded, enter the password to re-connect the controller.

8. Click **Go Back** to revert to the previous firmware version, or click **Proceed** to complete the upgrade.

9. The primary CPM is synchronizing with the secondary CPM. Click OK to complete the firmware upgrade.

   The secondary CPM (slot B) becomes the primary one and the original primary CPM (slot A) becomes the secondary one.

To upgrade the firmware with Off-process procedure

> **ATTENTION:** This procedure could cause loss of control in an operating process.

> **ATTENTION:** For ControlEdge 2020 controller, if the controller is connected with I/O modules, you must stop the program before performing the off-process procedure.

1. From the Start Page, click **Connect** to connect the target primary CPM (slot A).

2. From the Home Page, select **Upgrade Firmware** under **Maintenance**, and select the CPM you want to upgrade.

3. Click **Upgrade**. The **Upgrade firmware** dialog appears.

   The controller is keeping running when you transfer the firmware to the controller, and will be stopped when you upgrade the firmware. So when the controller is running, we provide the interactive mode to control when the controller stops.

   - If you select the Interactive mode, a dialog appears confirming that the transfer is complete. Click **Next** to upgrade the firmware, and the controller is stopped. You can also click **Cancel** to quit

the upgrade process.

- If you do not select the Interactive mode , the firmware will be upgraded directly after the transfer. The controller will be stopped without any prompt.

4. Click **Proceed with Upgrade** to continue.

5. From the **Release Number** list, select the target release module. The target firmware version is displayed.

6. Click **Next**. The target firmware name, state and version are displayed.

7. Click **Next** to transfer and upgrade the firmware.

8. After the boot firmware is upgraded, enter the password to re-connect the controller. The application firmware is transferred and upgraded.

9. After the application has been upgraded, enter the password to re-connect the controller.

10. The firmware upgrades.

11. Perform the relevant procedures for ControlEdge 2020 controller and ControlEdge 900 controller.

- For ControlEdge 2020 controller:

  a. Click **OK**. The primary CPM synchronizes the firmware with the secondary CPM, and upgrades the firmware of the secondary CPM automatically.

  b. To check whether the secondary CPM upgrade is complete, click **Connect** from the Home Page and check that the **Firmware version** is the same as the primary CPM.

- For ControlEdge 900 controller:

  - Upgrading the previous release to R150

    a. Connect to the secondary CPM (slot B).

    b. Repeat Step 1 to Step 10 to upgrade the firmware on the secondary CPM.

  - Upgrading R150 to the later release

    a. Click **OK**. The primary CPM synchronizes the firmware with the secondary CPM, and upgrades the firmware of the secondary CPM automatically.

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b. To check whether the secondary CPM upgrade is complete, click **Connect** from the Home Page and check that the **Firmware version** is the same as the primary CPM.

Upgrading EPM firmware

EPM firmware upgrade is ONLY allowed in **Stop Locked**, **Running** or **Stopped** operating modes.

You can rotate the mode switch on CPM to change operating modes, see "CPM mode switch" in *ControlEdge 900 Platform Hardware Planning and Installation Guide*. If the mode switch is in REMOTE position, See "Setting operating modes" on page 1 for more information.

> **ATTENTION:** If the EPM is being upgraded, all I/O modules in the same rack will keep in failsafe state until the firmware upgrade is completed.

Prerequisites:

For a redundant system with ring topology, you must disable the synchronization first.

To upgrade EPM

1. From the Start Page, click **Connect** to connect the target controller.

2. From the Home Page, select **Upgrade Firmware** under **Maintenance**, The **Upgrade Firmware** dialog appears.

3. Click **EPM** tab, all available EPMs are displayed.

   At least one I/O module, which is in the same rack with the target EPM, must be added in the Configure I/O page, then the target EPM will be displayed here. See "Configuring an I/O module" on page 47 for more information.

4. Select or multiselect the target EPMs and click **Upgrade**. The **Upgrade firmware** dialog appears.

   The controller is keeping running when you transfer the firmware to the controller, and will be stopped when you upgrade the firmware. So when the controller is running, we provide the interactive mode to control when the controller stops.

   - If you select the Interactive mode, a dialog appears confirming that the transfer is complete. Click **Next** to upgrade the firmware,

and the controller is stopped. You can also click **Cancel** to quit
the upgrade process.

- If you do not select the Interactive mode , the firmware will be
upgraded directly after the transfer. The controller will be
stopped without any prompt.

5. Click **Proceed with Upgrade** to continue.

6. From the **Release Number** list, elect the target release module. The
target firmware version is displayed.

7. Click **Next**. The target firmware name, state and version are
displayed.

8. Click **Next** to transfer and upgrade the fireware.

9. After the upgrade is completed, a dialog appears. You can check
which EPM is upgraded successfully, which one is failed.

10. Click **OK**.

Upgrading ControlEdge 900 I/O module firmware

I/O module firmware upgrade is ONLY allowed in **Stop Locked**, **Running**
or **Stopped** operating modes.

> **ATTENTION:** The target I/O module must be added in the
> Configure I/O page. See "Configuring I/O modules and
> channels" on page 1 for more information.

To upgrade I/O module

1. From the Start Page, click **Connect** to connect the target controller.

2. From the Home Page, select **Upgrade Firmware** under **Maintenance**,
The **Upgrade Firmware** dialog appears.

3. Click the **UIO 16** tab, all available I/O modules are displayed.

4. Select or multiselect the target I/O modules and click **Upgrade**. The
Upgrade firmware dialog appears.

The controller is keeping running when you transfer the firmware
to the controller, and will be stopped when you upgrade the
firmware. So when the controller is running, we provide the
interactive mode to control when the controller stops.

- If you select the Interactive mode, a dialog appears confirming
that the transfer is complete. Click **Next** to upgrade the firmware,

and the controller is stopped. You can also click **Cancel** to quit the upgrade process.

- If you do not select the Interactive mode , the firmware will be upgraded directly after the transfer. The controller will be stopped without any prompt.

5. Click **Proceed with Upgrade** to continue.

6. From the **Release Number** list, select the target release module. The target firmware version is displayed.

7. Click **Next**, the target firmware name, state and version are displayed.

8. Click **Next** to transfer and upgrade the firmware.

9. After the upgrade is completed, a dialog appears. You can check which module is upgraded successfully, which one is failed.

10. Click **OK**.

Upgrading serial module firmware

Serial module firmware upgrade is ONLY allowed in **Stop Locked**, **Running** or **Stopped** operating modes.

> **ATTENTION:** The target serial module must be added in the Configure Serial Modules page. See "Configuring serial modules" on page 49 for more information.

To upgrade serial modules

1. From the Start Page, click **Connect** to connect the target controller.

2. From the Home Page, select **Upgrade Firmware** under **Maintenance**, The **Upgrade Firmware** dialog appears.

3. Click the **Serial Comm** tab, all available serial modules are displayed.

4. Select or multiselect the target serial modules and click **Upgrade**. The **Upgrade firmware** dialog appears.

   The controller is keeping running when you transfer the firmware to the controller, and will be stopped when you upgrade the firmware. So when the controller is running, we provide the interactive mode to control when the controller stops.

- If you select the Interactive mode, a dialog appears confirming that the transfer is complete. Click **Next** to upgrade the firmware, and the controller is stopped. You can also click **Cancel** to quit the upgrade process.

- If you do not select the Interactive mode , the firmware will be upgraded directly after the transfer. The controller will be stopped without any prompt.

5. Click **Proceed with Upgrade** to continue.

6. From the **Release Number** list, select the target release module. The target firmware version is displayed.

7. Click **Next**, the target firmware name, state and version are displayed.

8. Click **Next** to transfer and upgrade the firmware.

9. After the upgrade is completed, a dialog appears. You can check which module is upgraded successfully, which one is failed.

10. Click **OK**.

Upgrading ControlEdge 2020 Expansion I/O firmware

> **ATTENTION:** It is recommended to upgrade the firmware without opening a project.

1. From the Start Page, click **Connect** to connect the target controller.

2. From the Home Page, select **Upgrade Firmware** under **Maintenance**, The **Upgrade Firmware** dialog appears.

3. Click **Expansion I/O** tab, all available expansion I/Os are displayed.

4. Select or multiselect the target Expansion I/O modules and click **Upgrade.** The **Upgrade firmware** dialog appears.
   The controller is keeping running when you transfer the firmware to the controller, and will be stopped when you upgrade the firmware. So when the controller is running, we provide the interactive mode to control when the controller stops.

   - If you select the Interactive mode, a dialog appears confirming that the transfer is complete. Click **Next** to upgrade the firmware, and the controller is stopped. You can also click **Cancel** to quit the upgrade process.

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- If you do not select the Interactive mode , the firmware will be upgraded directly after the transfer. The controller will be stopped without any prompt.

5. Click **Proceed with Upgrade** to continue.

6. From the **Release Number** list, elect the target release module. The target firmware version is displayed.

7. Click **Next**. The target firmware name, state and version are displayed.

8. Click **Next** to transfer and upgrade the fireware.

9. After the upgrade is completed, a dialog appears. You can check which Expansion I/O is upgraded successfully, which one is failed.

10. Click **OK**.

Upgrading the FDAP and field device firmware via Wireless

The FDAPs and field devices have radio firmware that can be upgraded. Some field devices may have a separate application firmware, which handles the functioning of the sensor in the device. This can also be upgraded over the wireless network. For more information about upgrading the firmware of field devices, refer to the field device vendor's documentation. Honeywell field devices usually have separate firmware files for radio firmware and application firmware. FDAPs have only radio firmware.

> **ATTENTION:** If either of the field device and FDAP is upgraded to OW R300, the other one should be upgraded too.

Upgrading the field device firmware

The devices at the farthest hop level must be upgraded first.

To upgrade a field device firmware

1. On the Selection Panel, select the field device. You can select multiple devices of the same type using the Selection Panel. Click and hold SHIFT key on the keyboard and select multiple items in a successive list. Click and hold CTRL key on the keyboard and select multiple items not in succession.

> **TIP:** It is recommended to select and accept up to three devices at a time.

2. Click one of the following icons as required in the **Upgrade** group from the Ribbon Bar. Application firmware must be upgraded before upgrading the radio firmware.

   - **Application**: To upgrade the application firmware of the selected field device.

   - **Radio**: To upgrade the radio firmware of the selected field device.

   The **Application/Radio Firmware Upgrade** dialog box appears.

3. Depending on the firmware type, the available upgrade files appear by default. Select the required file from the list of upgrade files. If the file is not available in the list, perform the following steps.

   a. Click **Add** to browse to the directory location of the firmware upgrade file.

   b. Select the target firmware upgrade file, and click **Open**.

4. Click **Upgrade**. The **Application/Radio Firmware Upgrade** dialog box closes. The **Firmware Upgrade Status** dialog box displaying the status of the upgrade appears. Closing the dialog box allows the upgrade operation to run in the background.

   Once the upgrade is complete, the status column displays the status as complete. If firmware upgrade fails for a device, you can abort the upgrade and start again. To abort firmware upgrade for individual devices, click the abort button next to the status indicator.

   See the following tips for other operations:

   - To abort any firmware upgrade operation, click the **Abort Upgrade** icon besides the upgrade status.

   - To remove the devices whose firmware was upgraded successfully, click the **Clear Upgrade** icon besides the upgrade status.

   - The field device will be rebooted after the field device radio firmware upgraded successfully.

5. Close the **Firmware Upgrade Status** dialog box.

6. Verify the upgraded version of the field device firmware as follows:

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a. On the Selection Panel, select the field device.

b. On the Property Panel, expand **Device Manager Summary**.

c. Under **Identification**, check **Revision**.

Upgrading the FDAP firmware

1. On the Selection Panel, select the target FDAP. You can select multiple devices of the same type using the Selection Panel. Click and hold SHIFT key on the keyboard and select multiple items in a successive list. Click and hold CTRL key on the keyboard and select multiple items not in succession.

2. Click **Radio** in the **Upgrade** group from the Ribbon Bar. The **Radio Firmware Upgrade** dialog box appears.

3. In the **Available Firmware Files** list, select the required firmware upgrade file. The firmware upgrade file should appear in the list by default. If the file is not available in the list, perform the following steps to open the firmware file.

   a. Click **Add** to browse to the directory location of the firmware upgrade file.

   b. Select the target firmware upgrade file, and click **Open**.

   Firmware files are stored in volatile memory due to memory limitations in the controller. Hence these files will be removed on power cycle.

4. Click **Upgrade**. The **Firmware Upgrade Status** dialog box appears. The Progress column displays the progress of the upgrade.

   See the following tips for other operations:

   - To abort any firmware upgrade operation, click the **Abort Upgrade** icon besides the upgrade status.

   - To remove the devices whose firmware was upgraded successfully, click the **Clear Upgrade** icon besides the upgrade status.

   - The field device will be rebooted after the field device radio firmware upgraded successfully.

5. Close the **Firmware Upgrade Status** dialog box.

6. Verify the upgraded version of the FDAP firmware as follows:

 a. On the Selection Panel, select the FDAP.

 b. On the Property Panel, expand **Device Manager Summary**.

 c. Under **Identification**, check **Revision**.

Uploading a project

It is only applicable for ControlEdge 900 controller and Redundant ControlEdge 2020 controller.

If a project is archived in a controller, you can upload and open this project in ControlEdge Builder. Alternatively, you can upload and save it to the PC.

> **ATTENTION:** Only Administrator or Engineer levels can upload a project.

Prerequisite

The project must be archived as a zip file in the controller. See "Downloading a project to the controller" on page 1 for more information.

To upload a project

1. From the Home Page, select **More** > **Project Upload**. The **Upload Confirmation** dialog appears.

2. There are two options:

- Click **Open**. If a project is already open when you upload this project, the open project will be saved and closed.

  The uploaded project is saved to the following location by default: C:\Users\Public\Documents\ControlEdge Builder\ArchivedProjects

  Click **OK** to open the project in ControlEdge Builder.

- Click **Save As**, and select a location to save this project. Click **OK**.

The uploaded project is stored in a folder named "Project name_ Date_Time".

CHAPTER

6 COMMUNICATION

Configuring Modbus

Configuring a Modbus Slave

This section introduces how to set a controller as a Modbus TCP Slave or Modbus Serial Slave.

1. From the Home Page, click **Configure Ethernet Ports** to select an Ethernet port, or click **Configure Serial Ports** to select a serial port.

2. Configure corresponding parameters for the Ethernet or serial port.

3. Under **Protocol Binding**:

   - Select **Modbus Slave** for an Ethernet port.

   - Select **Modbus RTU Slave** or **Modbus ASCII Slave** for a serial port.

4. Click **Save** to save the configuration, and click **Back** to return to the Home Page.

5. Click **Configure Protocols** > **Modbus Slave**, select the target Ethernet or serial port you want to bind.

6. Select **Slave ID**.

7. For Ethernet ports, configure the TCP port number.

8. Select the required mapping table from the **Mapping** drop-down list.
   If the list is empty, you should add a mapping table first. See "Adding a Modbus Slave mapping table" in the *ControlEdge Builder User's Guide*.
   The same mapping table may be selected for use on multiple ports. For example, this could be used when a SCADA system communicates through 2 ports in for redundancy.

9. For Ethernet port, select **TCP** or **UDP** from drop-down list of **Type**.

10. Click **Save**.

11. Click **Connect** from the Home Page to connect a controller. For the user name and password, see "User Privileges" in *ControlEdge*

Builder User's Guide.

12. Click **Download** from the Home Page to load the configuration of the Modbus Slave to the controller.

Configuring a Modbus TCP Master

Modbus TCP Master is used for communication between the controller and third-party Modbus slave devices over Ethernet.

Prerequisite

A new project is created and connected to a controller in ControlEdge Builder.

To set a controller as a Modbus TCP Master

1. From the Home Page, click **Configure Ethernet Ports** and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the details in the **IP Address**, **Subnet Mask** and **Gateway** fields.

3. Under **Protocol Binding**, select **Modbus TCP Master** to bind Modbus TCP Master to the Ethernet port.

4. Click **Save** to save the configuration, and click **Back** to return to the Home Page.

5. Click **Connect** from the Home Page to connect a controller.

6. Click **Download** from the Home Page to load the configuration of Modbus TCP Master to the controller.

7. Click **IEC Programming Workspace** from the toolbar.

8. Right-click **Logical POUs** and select **Insert** > **Program** to add a new POU.

9. Under **Physical Hardware**, right-click **Task** and select **Insert** > **Task** to add a task.

10. Right-click the task you have inserted, and select **Insert** > **Program instance** to add a program instance.

11. Right-click **Libraries** and select **Insert** > **Firmware Library**, select MODBUS.FWL. Then click **Include**.

12. Right-click **Data Types** and select **Insert** > **Datatypes**. In the pop-up window, enter the **Name** and click **OK**.

13. Double-click the data type you have inserted and define an array in worksheet shown as below as an example, then click **Save** button

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from the toolbar. Click **Make**.

14. Under Logical POUs, double-click the code worksheet of the program that you have inserted.

15. Drag the target function or function block of modbus from the Edit Wizard pane into the code worksheet, and configure the parameters. Take MB_RD_MHR as an example.

16. Double-click the pin-outs of the function or function block to assign variables.

    To assign initial values to CONFIG_INFO:

    CONFIG_INFO, a predefined data structure for Modbus configuration information, is the crucial input for Modbus master function blocks and contains key Modbus communication parameters such as IP address of slave, slave ID, port number of the controller to be used, etc. This data structure is read-only and cannot be viewed and edited in ControlEdge Builder. See "Description of CONFIG_INFO" on page 1 for more details. Slave1 is the variable name assigned by the user of CONFIG_INFO.

    ```
    IP————————————SLAVE1.IP_ADDR

    SLAVEID—————————SLAVE1.MB_SLAVE_ID

    PORTNUM—————————SLAVE1.PORT_NUM

    RETRIES—————————SLAVE1.RETRIES

    TCP_PORT————————SLAVE1.TCP_PORT_NUM

    TIME_OUT————————SLAVE1.TIMEOUT
    ```

17. Assign the data returned by the function block to variables to

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monitor.

DATA1 is the variable name assigned by the user of OUTPUT pin of MB_RD_MHR and it is an array.

After the basic programming steps as described, the workplace will appear as shown below.
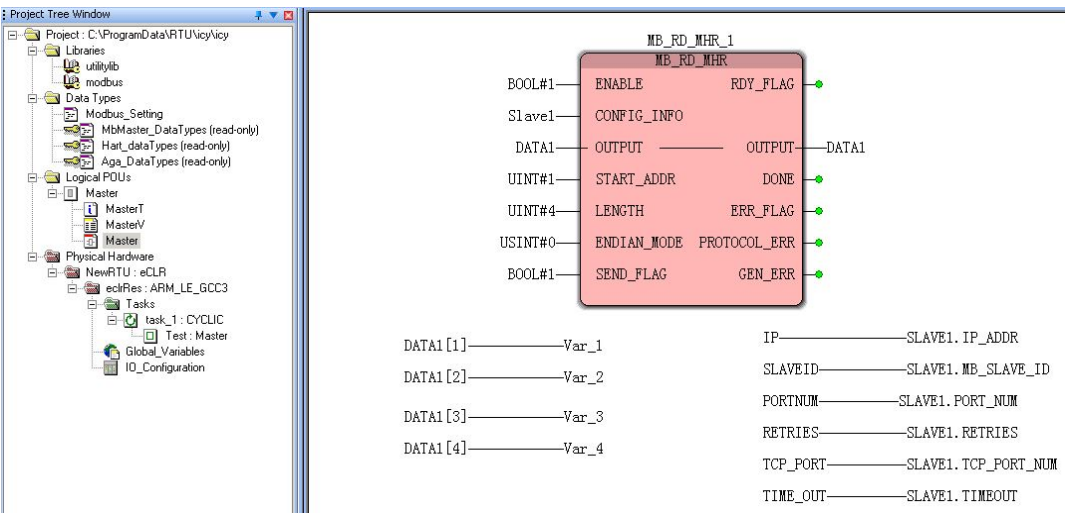
18. Click **Make** from the toolbar to compile the programs.

19. Click **Download** from the toolbar to download the compiled programs of Modbus TCP Master to the controller.

Configuring a Modbus Serial Master

Modbus Serial Master is used for communication between the controller and third-party Modbus slave devices over serial port. It is only applicable for ControlEdge RTU.

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Prerequisite

A new project is created and connected to a controller in ControlEdge Builder.

To set the controller as a Modbus Serial Master

1. From the Home Page, click **Configure Serial Ports** and select the target serial port to configure.

2. Under **General,Port Name** and **Port Type** are displayed automatically. Select appropriate values for **Baud Rate**, **Parity**, **Data Bits**, **Stop Bits**, **Flow Control** and **Force Online** if applicable. See the following tables for parameter descriptions.

    Table 6-1: Serial Port Parameters

Parameter	Description
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 RS232 does not support 57600 and 115200.
Parity	None, ODD, EVEN
Data Bits	7, 8
Stop Bits	1, 2

    For RS232-1 and RS232-2, there are two more options to configure: **Flow Control** and **Force Online**. See the following table for the parameter descriptions.

    Table 6-2: RS232 Serial Port Parameters

Parameter	Description
Flow Control	Only for RS232-1 and RS232-2 • None • RTS-CTS
Force Online	Only for RS232-1 and RS232-2. Force Online is used to save energy when there is no device connected to the controller RS232 ports by disabling it. Select the desired option from the Force Online drop-down list:

Parameter	Description
	• **Disable** It is selected by default and the controller is on power saving mode. RS232 transmitter will detect the connection of external device. If external device is connected to the controller, the local transmitter will be enabled for communication. If there is no external device connected, the local transmitter will remain disabled to save energy. • **Enable** RS232 transmitter will not detect external device and if you force enable, more energy is consumed.

The following table describes four scenarios that will happen for **Force Online** option between the controller and the device it communicates.

Table 6-3: Force online scenarios between the controller and devices

Controller Force Online Option	Third-party Device Force Online Option	Communication
Enabled	Enabled	Normal
Disabled	Enabled	Normal, with energy saving on the controller
Enabled	Disabled	Normal, with energy saving on Device
Disabled	Disabled	It is forbidden. Both devices would consider there is no device connected to it and hence there is no communication between them.

3. Under **Protocol Binding**, select **Modbus RTU Master** or **Modbus ASCII Master** to bind Modbus Serial Master to the serial port. See the following table for parameter descriptions.

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
Table 6-4: Parameter descriptions of Modbus RTU Master and Modbus ASCII Maste

Protocol	Description
Modbus RTU Master	The controller acts as the Modbus Master and used for communication between The controller and third-party Modbus Slave devices, for example I/O modules.
Modbus ASCII Master	The controller acts as the Modbus Master and used for communication between The controller and third-party Modbus Slave devices, for example: I/O modules.

4. Click **Save** to save the configuration, or click **Back** to return to the Home Page.

5. Click **Connect** from the Home Page to connect a controller. For the user name and password, see "User Privileges" in *ControlEdge Builder User's Guide*.

6. Click **Download** from the Home Page to load the configuration of Modbus Serial Master to the controller.

7. Click **IEC Programming Workspace** from the toolbar.

8. Right-click **Logical POUs** and select **Insert** > **Program** to add a new POU.

9. Under **Physical Hardware**, right-click **Task** and select **Insert** > **Task** to add a task.

10. Right-click the task you have inserted, and select**Insert** > **Program instance** to add a program instance.

11. Right-click **Libraries** and select **Insert** > **Firmware Library**, select MODBUS.FWL. Then click **Include.**

12. Right-click **Data Types** and select **Insert** > **Datatypes**. In the pop-up window, enter the **Name** and click **OK.**

13. Double-click the data type you have inserted and define an array in worksheet shown as below as an example, then click **Save** button from the toolbar. Click **Make.**
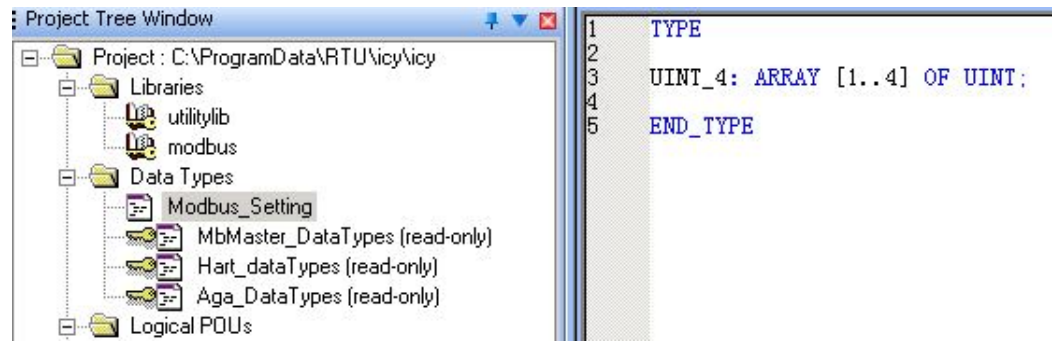
14. Under Logical POUs, double-click the code worksheet of the program that you have inserted. The workspace appears.

15. Drag the target function or function block of modbus from the Edit Wizard pane into the workspace, the function or function block is displayed. There are twelve function blocks available for Modbus master programming. For more details, see "Description of Modbus Function Block" on page 1. For the following steps, the function block MB_RD_MHR is taken as an example.

16. Double-click the pin-outs of the function or function block to assign variables. In the pop-up **Variable Properties** window, select the **Name**, **Data Type** and **Usage** from the drop-down list, and assign Initial value and I/O address. Then click **OK**.

   To assign initial values to CONFIG_INFO:

   CONFIG_INFO, a predefined data structure for Modbus configuration information, is the crucial input for Modbus master function blocks and contains key Modbus communication parameters such as IP address of slave, slave ID, port number of the controller to be used, etc. This data structure is read-only and cannot be viewed and edited in RTU Builder. See "Description of CONFIG_INFO" on page 1 for more details. Slave1 is the variable name assigned by the user of CONFIG_INFO.

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```
SLAVEID————————SLAVE1.MB_SLAVE_ID

PORTNUM————————SLAVE1.PORT_NUM

RETRIES————————SLAVE1.RETRIES

TIME_OUT————————SLAVE1.TIMEOUT
```

17. Assign the data returned by the function block to variables to monitor.

```
DATA1[1]————————Var_1

DATA1[2]————————Var_2

DATA1[3]————————Var_3

DATA1[4]————————Var_4
```

DATA1 is the variable name assigned by the user of OUTPUT pin of MB_RD_MHR and it is an array.

After the basic programming steps as described, the workplace will appear as shown below.
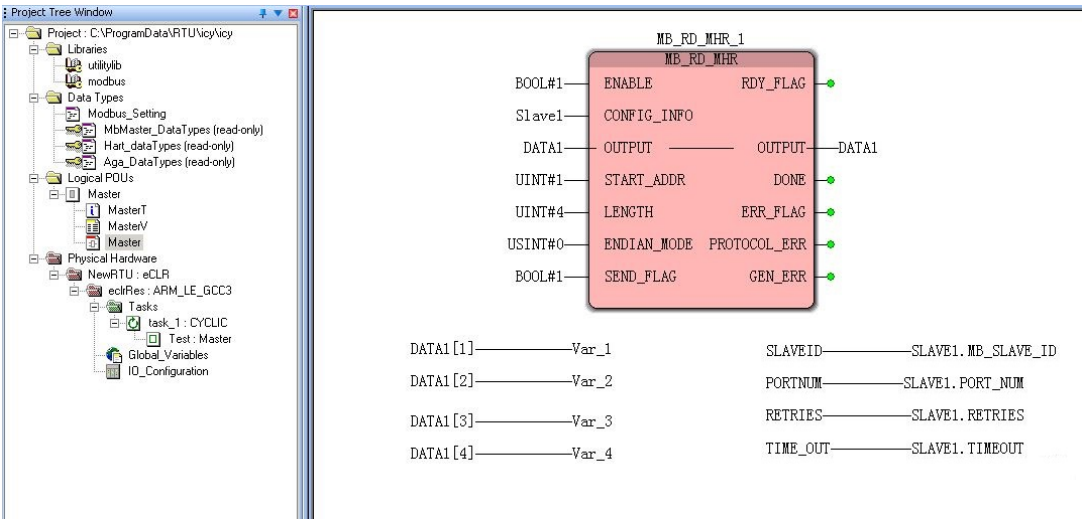
18. Click **Make** from the toolbar to compile the programs.

19. Click **Download** from the toolbar to download the compiled programs of Modbus Serial Master to the controller.

Configuring EtherNet/IP devices

EtherNet/IP™ is a communications protocol, currently managed by the Open DeviceNet Vendors Association (ODVA). EtherNet/IP is used in process control and other industrial automation applications. As per ODVA, "EtherNet/IP is a member of a family of networks that implements the Common Industrial Protocol (CIP™) at its upper layers. CIP encompasses a comprehensive suite of messages and services for a variety of manufacturing automation applications, including control, safety, synchronization, motion, configuration and information."

ControlEdge 900 controller supports an efficient EtherNet/IP interface. The EtherNet/IP interface facilitates a comprehensive integration between ControlEdge 900 controllers and the EtherNet/IP compatible nodes and I/O devices.

ControlEdge Builder provides options to create new device types for the supported EtherNet/IP compatible devices. To enable easy integration between ControlEdge 900 Controller and third-party controllers, ControlEdge Builder also provides a function block for the communication between controllers.

The EtherNet/IP I/O devices, drives and relays can be set up in one of the following network topologies:

- Device Level Ring (DLR) topology – The nodes of the network are connected in a circular mode, forming a ring.

- Linear bus topology – Nodes are connected in a linear array, with a single cable hop from one device to the next.

- Star topology – The nodes of the network are connected to a central hub.

This section only simply introduces how to configure EtherNet/IP devices.

For more information, see *ControlEdge EtherNet/IP User's Guide*.

Configuring an EtherNet/IP client

1. Bind EtherNet/IP Client to ETH3.

2. If you want to configure EtherNet/IP devices using EDS file, you must register EDS files first.

3. Configure EtherNet/IP devices.

  - Configure EtherNet/IP devices using EDS file.

  - Configure generic EtherNet/IP devices.

Configuring an EtherNet/IP server

1. Bind EtherNet/IP Server to ETH1 or ETH2. Only one port can be bound at a time.

2. Select EtherNet/IP for variables which will be read and write by EtherNet/IP client.

Configuring communication with third–party controllers

- **Configure communication with C300/UOC**
  In this case, ControlEdge 900 controller acts as an EtherNet/IP server. Only user–defined data type **STRUCT** is supported.

  a. Bind EtherNet/IP Server to ETH1 or ETH2. Only one port can be bound at a time.

  b. Declare a STRUCT data type.

  c. Configure target variables data type as the STRUCT data type.

d. Select EtherNet/IP for the target variables which will be read and write by EtherNet/IP client.

- **Configure communication with ControlLogix controllers**

    In this case, ControlEdge 900 controller can act as EtherNet/IP client or EtherNet/IP server.

    - If ControlEdge 900 controller acts as an EtherNet/IP client, ControlEdge Builder provides function blocks to enable communication between 900 controller and third-party controllers. For how to configure function blocks, see "EtherNet/IP" in the ControlEdge Builder Function and Function Block Configuration Reference.

    - If ControlEdge 900 controller acts as an EtherNet/IP server:

        a. Bind EtherNet/IP Server to ETH1 or ETH2. Only one port can be bound at a time.

        b. Select EtherNet/IP for variables which will be read and write by EtherNet/IP client. Do not support variables with user-defined data types communicating with third-party controllers.

Configuring OPC UA

ControlEdge 900 controller supports OPC UA server and client which are built-in protocols in the controller, and it provides an IIoT-ready open platform that enables users to better leverage data across their assets.

This chapter introduces how to quickly configure OPC UA Server and OPC UA client. For more information, see "OPC UA Configuration" in the *ControlEdge Builder Protocol Configuration Reference Guide*.

Configuring an OPC UA Server

ControlEdge 900 controller OPC UA Server enables the native OPC UA client access to information on ControlEdge 900 controller.

Configuring the controller as an OPC UA Server

You must establish the physical address or endpoint that enables OPC UA client access to OPC UA Server. A maximum of two endpoints can be defined by binding the ETH1 or ETH2 ports on the ControlEdge 900 controller to OPC UA Server. One or two endpoints are possible depending on if both ETH1 and ETH2 are bound to OPC UA Server.

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1. From the Home Page of ControlEdge Builder, click the arrow beside **Configure Ethernet Ports**, and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the IP address of the Ethernet port.

3. Under **Protocol Binding**, select **OPC UA Server**.

4. Click **Save** to complete the configuration. Click **Back** to return to the Home Page.

5. Click **Configure Protocols** > **OPC UA Server** to configure the parameter of OPC UA Server if required. It is recommended to use the default values for the parameters.

   For more information about the parameter descriptions, see the specification in the https://opcfoundation.org/.

Key Parameters to establish OPC UA communication

To establish the communication between OPC UA Sever and OPC UA client, below key parameters of Server must be provided and be required in the configuration in OPC UA side.

Server Endpoint URL

The URL of ControlEdge 900 controller OPC UA Server defined as follows:

<ControlEdge 900 controller OPC Server URL>:= "opc.tcp://" <IP>":"<Port>

"opc.tcp://" is the protocol string portion of the URL. This string is constant since the protocol used by the ControlEdge 900 controller OPC UA Server is TCP.

<IP> is the IP address of ETH1 or ETH2 on the ControlEdge 900 controller.

<Port> is the port number for the transport protocol. Port number 4840 is the default for OPC UA.

In the following URL examples, the IP address of ETH1 port on the ControlEdge 900 controller is set to 192.168.1.10. The IP address of ETH2 port on the ControlEdge 900 controller is set to 192.168.2.10.

> **TIP:** One or both URLs may exist depending on the port configuration.

```
opc.tcp://192.168.1.10:4840
```

`opc.tcp://192.168.2.10:4840`

When both Ethernet ports are configured as shown in the example above, the ControlEdge 900 controller OPC UA Server considers the links to be redundant. In this case, the ControlEdge 900 controller OPC Server is listening on both endpoints. When one link is lost, clients can use the URL of the second link to connect to the Server. It is worth noting that the ControlEdge 900 controller OPC UA Server maintains the session created on the failed link until the session timeout period expires after which the session will be deleted.

In the case of redundant ControlEdge 900 controller, the IP address follows the primary CPM. Therefore, if a switchover occurs, the client reconnects to the ControlEdge 900 controller OPC UA Server on the new primary with the same URL that was used to connect to the server on the failed primary.

Namespace

OPC UA uses namespaces to uniquely differentiate between the names and IDs it defines and those defined by companion specifications or the local server. The ObjectTypes defined in the UA specification for IEC 61131-3 derive from the OPC UA Device Integration Types which in turn derive from the OPC UA Core ObjectTypes. Thus the ControlEdge 900 controller OPC UA Server includes these 3 namespaces in addition to its own namespace. The list of namespaces used in the Server is shown below:

Namespace Index	Namespace	Description
0	http://opcfoundation.org/UA/	Namespace for NodeIds and BrowseNames defined in the OPC UA specification.
1	URL:<IP Address>: Honeywell:ControlEdgePLC:UAServer where IP Address is the IP of the Ethernet port that is bound to OPC UA Server. If UA is enabled on both ETH1 and ETH2, then the IP of ETH1 is used for IP Address.	Namespace index 1 is reserved for the local server, for nodes specific to the server like those shown in section 4.1. Note that this URI is also the ServerURI (appears in index 0 of the ServerArray property). It is also the ApplicationURI in the subjectAltName field of the server's certificate.
2	http://opcfoundation.org/UA/DI/	Namespace for NodeIds and BrowseNames defined in [DI].

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Namespace Index	Namespace	Description
3	http://PLCopen.org/OpcUa/IEC61131-3/	Namespace for NodeIds and BrowseNames defined in [PLC].
5	URN: Honeywell:UA:ControlEdgePLC	Namespace for NodeIds and BrowseNames of nodes used to access the underlying ControlEdge 900 controller data. The exception is when these nodes provide a standard Property in which case the BrowseName shall have the namespace of the standards body, even though the NodeId will use this namespace. For example, the ParameterSet and the GlobalVars object components of eclrRes shown in section 6.1 – the BrowseName for ParameterSet will use [DI] namespace and the BrowseName for GlobalVars will use the [PLC] namespace. Namespace Uri is used for OPC UA client to get the NameSpaceIndex.

Configuring an OPC UA Client

This section only introduces simple procedures to configure the OPC UA Client. For more information, see "OPC UA Client" in the *ControlEgde Builder Protocol Configuration Reference Guide*.

Binding protocol to Ethernet ports

You must establish the physical address or endpoint that enables ControlEdge 900 controller OPC UA client access to the OPC UA Server.

1. From the Home Page of ControlEdge Builder, click the arrow beside **Configure Ethernet Ports**, and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the IP address of the Ethernet port.

3. Under **Protocol Binding**, select **OPC UA Client**.

4. Click **Save** to complete the configuration.

Configuring parameters for OPC UA Client

OPC UA client maintains sessions in response to each execution of the UaConnect function block. One execution of the UaConnect function block contains that one corresponding session will be created by the OPC UA client on the controller and correspondingly one session will be created on the target OPC UA server.

> **ATTENTION:** Make sure that the OPC UA client's time is synchronized to the controller's time.

To configure an OPC UA client

1. Click **Configure Protocols** > **OPC UA Client**. The **OPC UA Client** page appears.

2. Select the values for the **Max Session Count** and **Max Subscription Per Session** parameters. It is recommended to use the default values.
   See the following table for the parameter description.

Parameter	Description
Max Session Count	The maximum number of concurrent sessions allowed by the client. If you enter a value of 0, the number of sessions allowed is unlimited. The default value is 100.
Max Subscriptions Per Session	The maximum number of subscriptions allowed by the client for one session. If you enter a value of 0, the number of subscriptions allowed is unlimited. The default value is 10.

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3. Click Save.

Configuring an OPC UA Logic

1. Import OPC UA library, Data types and OPC UA POU.

2. Establish connection with HonUaConnectSecurityNone.

3. Configure target function blocks:

    - If you want to read or write variables, configure HonUaRead, HonUaReadList, HonUaWrite and HonUaWriteList function blocks.

    - If you want to use a method, configure HonUaCallMethod function block.

    - If you want to obtain NodeIds, configure HonUaTranslatePathList function block.

Communicating with Experion via OPC UA

Experion server to ControlEdge 900 Controller communication is with the OPC UA protocol, so the OPC UA Server must be enabled on the Ethernet port(s) connected to the same network as the Experion Server.

Experion can read, write and monitor global variable, program local variable and function block instance variable through the Identifier defined by OPC UA protocol. The maximum length of the Identifier is 73 characters.

Global variable's Identifier is @GV. <Varname>.

Program local variable's Identifier is <Program Instance Name>.<Varname>.

Function block instance variable's Identifier is <Program Instance Name>.<Function Block Instance>.<Varname>.

For more details about the Experion integration with ControlEdge 900 controller, see the *Experion PKS ControlEdge PLC Integration Reference*.

Configuring an OPC UA server

A new project is created and a controller is added to the project in ControlEdge Builder.

To set a controller as an OPC UA server

1. From the Home Page, click **Configure Ethernet Ports** and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the details in the **IP Address**, **Subnet Mask** and **Gateway** fields.

3. Under **Protocol Binding**, select **OPC UA Server** for the Ethernet port.

4. Click **Save** to save the configuration, and click **Back** to return to the Home Page.

5. Click **Make** to compile the configuration to the controller.

Publishing to Experion

This function enables the user to publish the related configuration for Experion to configure point and system status for ControlEdge 900 controller in Experion.

For how to publish the configuration to Experion, See "Publishing to Experion" on page 110 for more information.

Configuring DNP3 Slave

DNP3 is used for communication between the controller and a DNP3 master such as a SCADA system like Experion. The controller acts as a DNP3 slave.

Binding protocol to Ethernet ports

1. From the Home Page of ControlEdge Builder, click the arrow beside **Configure Ethernet Ports**, and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the IP address of the Ethernet port.

3. Under **Protocol Binding**, select **DNP3**.

4. Click **Save** to complete the configuration.

Configuring DNP3 slave protocol

This section only introduces simple procedures to configure DNP3 slave. For more information, see "Configuring DNP3 slave" in the *ControlEgde Builder User's Guide*.

1. Click **Configure Protocols** > **DNP3 Slave** tab and select the target Ethernet ports which you want to bind.

2. In the **Physical Layer** tab, configure the TCP port number. It should be the same as the DNP3 master.

3. In the **Data Link Layer** tab, configure corresponding parameters as required.

   It is recommended to select **Never** for **Data Link Confirmation** and select the value in **Data Link Retries** and **Data Link Retry Timeout**. Maximum value for data link retries is 255 and maximum value for retry timeout is 3,600,000ms.

   If you select **MultiFrag** or **Always**, ensure that the **Data Link Retries** and **Data Link Retry Timeout** are set.

4. In the **Application Layer** tab, configure corresponding parameters as required.

   > **ATTENTION:** If you select **Enable DNP3 Time Synchronization** here, you cannot enable Primary Server and Secondary Server under **Miscellaneous** > **Configure Date/Time** options at the same time, or else you cannot download your configuration.

5. In the **Mapping** tab, and select the required mapping table from the **Mapping** drop-down list.

   If the list is empty, you should add a mapping table first. See "Adding a DNP3 Slave mapping table" in the *ControlEdge Builder User's Guide*.

   The same mapping table may be selected for use on multiple ports. For example, this could be used when a SCADA system communicates through 2 ports in a redundant arrangement.

6. In the **Default Variation** tab, configure the default variation for each type of DNP3 point. Default variation defines the data format that is used by the controller to send data to the DNP3 Master, when the Master does not ask for a specific data variation.

7. Select **Flash** or **SD card** from the drop-down list besides **Save DNP3 Events to:**.

   ◦ If you want to save DNP3 events to SD card, you must allocate the space for DNP3 events first. See "Preparing SD card" on page 1 for more information.

- ○ Up to 80000 DNP3 events can be saved to Flash.

- ○ Up to 200000 DNP3 events can be saved to SD card.

8. Click **Save**.

Communicating with Experion via DNP3

Experion server to ControlEdge 2020 Controller communication is with the DNP3 protocol, so DNP3 must be enabled on the Ethernet port(s) connected to the same network as the Experion Server.

For more details about the Experion integration with ControlEdge 2020 controller, see the *Experion PKS DNP3 Interface Reference*.

Configuring a DNP3 slave

A new project is created and a controller is added to the project in ControlEdge Builder.

To set a controller as a DNP3 slave

1. From the Home Page, click **Configure Ethernet Ports** and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the details in the **IP Address**, **Subnet Mask** and **Gateway** fields.

3. Under **Protocol Binding**, select **DNP3** to for the Ethernet port.

4. Click **Save** to save the configuration, and click **Back** to return to the Home Page.

5. Click **Make** to compile the configuration to the controller.

Publishing to Experion

This function enables the user to publish the related configuration for Experion to configure point and system status for ControlEdge 2020 controller in Experion.

1. From the Home Page of ControlEdge Builder, click **Publish to Experion** under **I/O and Communications**. The project configuration will be published to Experion directly.

2. If the publish fails for ControlEdge 2020 controller, you can export the configuration manually.

   a. A warning message appears that the publish has failed. Click **OK**.

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    b. Click the browse icon, and select a location to store the exported file.

> **TIP:** It is recommended to save the file to the folder "\\ControllerIntegration" shared on the current primary Experion server.

    c. Enter a name for the exported file, and click **Save**.

> **TIP:** It is recommended to name the file as "ControllerName_SAVED". For example, the controller name is "NewController", then enter "NewController_SAVED" for the file name.

    d. Click **Export**. The exported file is saved successfully.

    e. Click **OK**.

Configuring HART

HART 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 AI/AO channels in the controller via a HART-IP Server.

The controller enables HART function blocks to access to the HART field devices through HART-enabled AI/AO channels. Currently HART command 3, command 48 and command X are implemented.

For more information, see "HART Configuration" in the *ControlEdge Builder Protocol Configuration Reference Guide*.

Configuring a HART-IP Server

Prerequisite

A new project is created and a controller is added to the project in ControlEdge Builder.

To set a controller as the HART-IP Server

1. From the Home Page, click **Configure Ethernet Ports** and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the details in the **IP Address**, **Subnet Mask** and **Gateway** fields.

3. Under **Protocol Binding**, select **HART-IP** to bind HART-IP to the Ethernet port.

4. Click **Save** to save the configuration, and click **Back** to return to the Home Page.

5. Click **Configure Protocols** > **HART-IP Server**, select the target Ethernet port and configure the port number in the **Port**. The default value is 5094.

6. From the Home Page, click **Configure I/O**, and configure the target AI or AO channel. For more information, see "Configuring I/O modules and channels" in the *ControlEdge Builder User's Guide*.

7. Select the **Enable** checkbox for HART, and click **Save**.

8. Click **Connect** from the Home Page to connect a controller.

9. Click **Download** from the Home Page to load the configuration of HART IP to the controller.

Configuring a HART Function Block

After downloading the configuration, you need to program the HART device for the project in **IEC Programming Workspace**.

To configure a HART function block

1. From the **IEC Programming Workspace**, under the **Project Tree Window**:

   a. Create a Programming Organization Unit (POU).

   b. Create and associate a task to the program.

   c. Insert HART library.

2. Under Logical POUs, double-click the code worksheet of the program that you have created.

3. From the Edit Wizard, select **hart** from the **Group** list. There are three function blocks available for HART programming: HART_CMD3 and HART_CMD48 as well as HART_CMDx.

4. Drag the target function block into the workplace to display the function block.

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For more information about the function block, right-click it and select **Help on FB/FU** to display the embedded help.

5. Double-click the pin-outs of the function block to assign variables. The **Variable Properties** dialog appears.

6. Select the **Name**, **Data Type** and **Usage** from the list.

   - For the parameter **GEN_DEV_STATUS**, you should select **HAR_GEN_DEV_STATUS** from the **Data Type** list.
   - For the parameter **DEV_INFO**, you should select **HART_CMD48_DEV_INFO** from the **Data Type** list.

7. Assign Initial value and I/O address details.

   - For the parameter **IOM**, enter the target module number in the **Initial Value** field. For example, if the target module name is "Expansion I/O 01", enter "01".
   - For the parameter **CHN**, enter the target channel number in the **Initial Value** field.

8. Click **OK**. The workplace will appear as shown below.
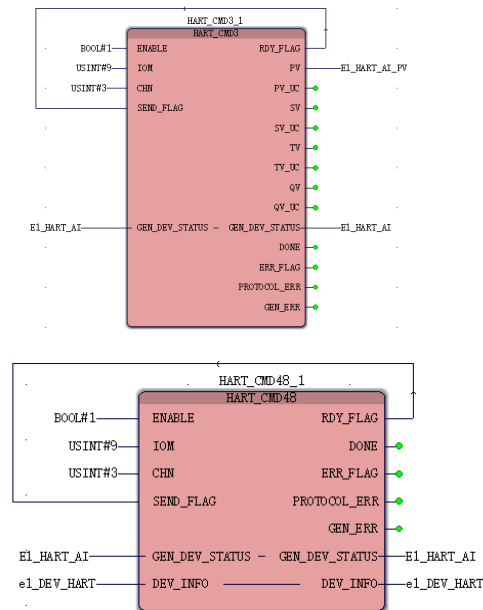
9. Click **Make** from the toolbar to compile the programs.

10. Click **Download** from the toolbar to download the compiled programs of HART to the controller.

Configuring CDA

CDA is short for Control Data Access. CDA protocol supports peer to peer communication between ControlEdge 900 controller with C300 controller or ACE or SIM–300 or SIM–ACE. ControlEdge 900 controller acts as the CDA responder and C300 Controller(or the others mentioned above) acts as the CDA initiator.

It supports:

■ Maximum 20 CDA initiators connected to a single CPM

■ Maximum 1000 PPS (parameters per second) between CDA initiators and CPM

■ Both read and write access from C300 or ACE Controller

■ Read access from SIM–300 or SIM–ACE

■ Communication Security including IPsec and embedded Firewall

To configure a CDA responder, perform the following steps:

In this section:

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Installing ControlEdge integration service

Starting with Experion R501.1, you can communicate with the following controllers in the Experion PKS system through CDA. You should install and start the ControlEdge integration service on the Experion Server.

- C300
- ACE
- Sim-C300
- Sim-ACE

> **ATTENTION:** It is required to install the ControlEdge integration service on both Experion servers when using Experion Server redundancy, and all Server nodes in the Experion Backup Conotrol Center topology.

To install the ControlEdge integration service

1. Insert the **ControlEdge Builder Media Kit** into the DVD-ROM drive.

2. Browse to the folder ControlEdgeIntegrationService, and double-click the file **ControlEdgeIntegrationService.exe**.

3. The **ControlEdgeIntegrationService – InstallShied** Wizard dialog appears. Click Next.

4. In the **License Agreement** page, click **I accept the terms in the license agreement** and click **Next**.

5. In the **Customer Information** page, enter your information if required. Click **Next**.

6. In the **Setup Type** page, select the setup type that best suits your needs. It is recommended to select **Complete**. Click **Next**.

7. In the **Ready to Install the Program** page, click **Install** to begin the installation. You can click **Cancel** to abort the installation.

8. The installation is in progress, and then the **Set Service Login** dialog appears.

9. Enter the **Username**, **Password** and **Confirm password** for the user account that the ControlEdge Integration Service shall log on as. Click **OK**.

> **ATTENTION:** The user name must be started with ".\". The user should have a "Security level" of at least "Engineer" in the Experion server. See "Configuring system security" in the *Experion Server and Client Configuration Guide* for more information.

10. The **InstallShield Wizard Completed** dialog appears, click **Finish**.

To check the status of the ControlEdge integration service

1. Click **Start button** of PC, and enter **services.msc** in the search bar. The **Services** dialog appears.

2. Find **Honeywell ControlEdge Integration Service**, check the **Status** is **Running**. If it is not, right-click the service and click **Start**.

3. Check the **Startup Type** is **Automatic**. If it is not, right–click the service and select **Properties**, and then select **Automatic** from the **Startup type** drop-down list.

Configuring a CDA Responder

A new project is created and a controller is added to the project in ControlEdge Builder. See "Creating a project" and "Connecting a controller" in *ControlEdge Builder User's Guide* for more details.

To set a controller as a CDA responder

1. From the Home Page, click **Configure Ethernet Ports** and select **ETH1** or **ETH2**.

2. Under **Network Setting**, select **Use the following IP address** and enter the details in the **IP Address**, **Subnet Mask** and **Gateway** fields.

> **TIP:** The IP addresses for the controller and Experion devices to be communicated must be on the same subnet.

3. Under **Protocol Binding**, select **CDA Responder** to bind CDA responder to the Ethernet port.

4. Click **Save** to save the configuration, and click **Back** to return to the Home Page.

5. Select CDA from the global variables or local variables you want to publish to Experion.

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See the following table for the data type matching between the ControlEdge 900 controller variables and Experion Server parameters.

Data type in ControlEdge 900 controller	Data type in Experion
IEC_BOOL	BOOLEAN
IEC_SINT	INT8
IEC_INT	INT16
IEC_DINT	INT32
IEC_USINT	UINIT8
IEC_UINT	UINT16
IEC_UDINT	UINT32
IEC_REAL	FLOAT32
IEC_LREAL	FLOAT64
IEC_BYTE	UINT8
IEC_WORD	UINT16
IEC_DWORD	UINT32
IEC_ULINT	UINT64
IEC_LWORD	UINT64
IEC_STRING	STRING
IEC_STRUCT	See Note 1 below.
Note 1: Structure is a data type of I/O variable, so you should create a single variable for each parameter in the structure for CDA communication.	

a. Click **IEC Programming Workspace** from the toolbar.

b. Perform either of the following methods to select CDA.

- From the variable sheets, select CDA.

Name	Type	Usage	Description	Address	Init	Retain	CDA
1	⊟ **System Variables**						
2	PLC_SYS_TICK_CNT	DINT	VAR_GLOBAL		%MD1.0		☐	☑

- From the variable properties dialog, select CDA.
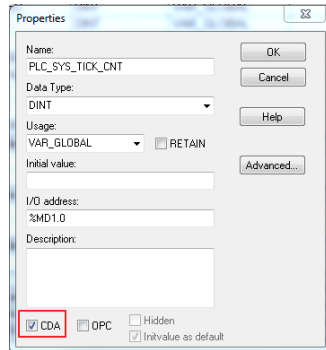
6. Click **Make** to compile the configuration to the controller.

Publishing to Experion

For peer to peer connection to C300 or other Experion CEE based controller, you need to publish the configuration to the Experion Server through CDA.

There are three installation scenarios that need to be considered for the behavior of the **Publish to Experion** function.

- Publishing when ControlEdge Builder is launched from Configuration Studio
- Publishing when ControlEdge Builder is launched separately on an Experion node
- Publishing when ControlEdge Builder is launched on non-Experion node

  In this scenario, the "Experion client components" optional installation package must be installed from the Experion Installation Media which you want to communicate with for the Publish to Experion function to work.

  ControlEdge Builder is installed on a same version of Microsoft Windows that is supported for either Experion Client or Server that you want to communicate with.

It is recommended to publish configuration when ControlEdge Builder is launched from Configuration studio.

From the Home Page of ControlEdge Builder, click **Publish to Experion** under **I/O and Communications**. The project configuration will be published to Experion directly.

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Configuring Wireless I/O

ControlEdge 2020 Controller supports wireless I/O configuration enabling the user to design, configure, commission and monitor ISA100 wireless networks and associated wireless field devices by ControlEdge Builder.

FDAP: Field Device Access Point (FDAP) is a wireless infrastructure node that acts as an ISA100.11a access point and a mesh node member. FDAP can only communicate through ISA100.11a.

Field Device: A field instrument with no routing capability, provides input or output channels for process control data.

Wireless I/O Device: A logical instance of a wireless field device.

Channel: A logical instance that presents the real value acquired from field devices.

Provision: Associating field devices to the controller.

Commission: Configuration for FDAP and field device, including enabling over-the-air provisioning, associating field devices to the controller, configuring field device channels and so on.

> **ATTENTION:** For wireless I/O, you must use time source as a precision NTP server.

The following table list the wireless I/O configuration procedure.

Table 6-5: Wireless I/O Configuration procedure

	Task	Go to
Wireless I/O device configuration – offline		
Step 1	Set the controller time.	• See "Setting time source" on page 69 for more information. • If the NTP server is not available, see "Set_RTC" in the *Function and Function Block Configuration Reference Guide* to configure the controller time.
Step 2	Enable Wireless I/O protocol on one of the Ethernet port of the controller.	See "Configuring the ISA100 wireless network" > "Configuring Ethernet port" in the *ControlEdge Builder User's Guide*.

	Task	Go to
Step 3	Configure ISA100 network ID.	See "Configuring the ISA100 wireless network" > "Configuring ISA100 network ID" in the *ControlEdge Builder User's Guide*.
Step 4	Import DD files.	See "Importing DD files" in the *ControlEdge Builder User's Guide*.
Step 5	Add wireless I/O devices.	See "Adding wireless I/O devices" in the *ControlEdge Builder User's Guide*.
Step 6	Configure channels for wireless I/O devices.	See "Configuring channels" in the *ControlEdge Builder User's Guide*.
Step 7	Bind channels to I/O variables.	See "Binding channels to I/O variables" in the *ControlEdge Builder User's Guide*.
Step 8	Configure wireless I/O diagnostic parameters	See "Configuring wireless I/O diagnostic parameters" in the *ControlEdge Builder User's Guide*.
Step 9	Download the project.	See "Downloading a project to the controller" on page 68 for more information.
Configure and commission FDAP and field device - online		
Step 10	Enable over-the-air provisioning for the controller.	See "Enabling over-the-air provisioning" in the *ControlEdge Builder User's Guide*.
Step 11	Accept un-provisioned FDAPs.	See "Provisioning the devices using over-the-air provisioning method" in the *ControlEdge Builder User's Guide*.
Step 12	Enable over-the-air provisioning for FDAPs.	See "Enabling over-the-air provisioning" in the *ControlEdge Builder User's Guide*.
Step 13	Configure field devices.	See "Configuring field devices" and "Configuring field device channels" in the *ControlEdge Builder User's Guide*.
Step 14	Accept un-provisioned field devices.	See "Provisioning the devices using over-the-air provisioning method" in the *ControlEdge Builder User's Guide*.
Step 15	Bind wireless I/O devices to field devices.	See "Binding and unbinding field devices to wireless I/O devices" in the *ControlEdge Builder User's Guide*.
Step 16	Activate channels for	See "Activating channels" in the *ControlEdge*

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Task	Go to
bound field devices.	*Builder User's Guide.*

Configuring User Defined protocol

You can configure User Defined protocol for serial ports of ControlEdge 2020 controller, and serial communication modules of ControlEdge 900 controller.

This section only provides simplified configuration procedures. For more information, see "User Defined Protocol" in the *ControlEdge Builder Protocol Configuration Reference Guide*.

See the following rules for using user defined protocol:

- User defined protocol can be bound on RS232 and RS485 ports. For each serial port, it allowed to connect one device via user defined protocol.

- Two function blocks are provided: COM_SEND and COM_RECV.

- Another function block CRC_16 can be used to handle CRC.

- You can make data type and use function blocks under library *PROCONS* to group or ungroup data frame.

To configure User Defined protocol

1. Bind User Defined protocol to a serial port.

2. Create a data type for User Defined protocol.

3. Configure User Defined protocol function block.

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FDM integration

Field Device Manager (FDM) is a complete instrument asset management system that can range from a single self-contained server/client node to a very distributed architecture. FDM is used for configuration, commissioning, and maintenance of smart field devices based on HART, and ISA100 Wireless.

This section only introduces how to configure and monitor field devices connected to ControlEdge PLC and ControlEdge RTU through FDM.

For more information about FDM, see the *FDM User's Guide*.

Getting started with FDM

FDM supports US-English locale. Ensure the local time zone format is set to English (United States).

1. Click **Control Panel** > **Clock, Language, and Region**.

2. Select **English (United States)** from the **Format** list.

3. Retain the default date and time formats of US English locale.

4. Click **Apply** and click **OK**.

Updating the FDM license

You can view or update FDM license using the FDM Server Management Tool. After installing FDM, you must first update the license in the FDM Server Management Tool.

In the **FDM Server Management** dialog box, when you click the Licensing icon, the following license information is displayed.

- **Option**: Indicates the name of the licensed feature.

- **Status**: Refers to the present status of the license for a feature. It is either Licensed or Not Licensed.

- **Value(s)**: Specifies the value of each licensed feature. For some features, the values can either be License Enabled or Disabled.

For more information about the different licensing options, see "Updating the FDM license" in the *FDM User's Guide*.

Prerequisites

- FDM license file
- FDM Server is in Stop mode

To update the FDM license

1. In the **FDM Server Management** dialog box, click the **Licensing** icon.
2. Under **Upgrade license**, click **Select**, browse to the folder where the license file is stored and choose the file.
3. Click **Open** in the **Select a License File** dialog box. A confirmation message appears.
4. Click **OK**. The path for the license file with the **.xml** extension appears and the license information is updated and appears under **Licensing Information**.
5. Verify that the **Licensing Information** is correct before closing the Server Management Tool.

Configuring FDM for ControlEdge PLC/RTU network

ControlEdge 900/2020 controllers and connected devices are supported by FDM via the creation of the ControlEdge PLC/RTU Network. Before using FDM with any ControlEdge PLC/RTU connected device, it is recommended (but not necessary) that the devices are commissioned first. After commissioning, use the FDM Server Management tool to configure the network. To configure a network, specify the IP address range of all connected controllers in that network. Use the Build Network operation to discover all controllers and available HART/ISA Wireless devices.

Prerequisites

- All PLC/RTU connected devices are commissioned.
- Enable the HART-IP interface as applicable in ControlEdge PLC.
- Enable the HART-IP interface and Wireless I/O as applicable in ControlEdge RTU.

To configure a network

1. On the FDM Server computer, click **Start** > **All Programs** > **Honeywell FDM** > **FDM Server Management Tool**.
2. Log on to the FDM Server Management Tool. The **FDM Server**

Management dialog appears.

3. In the left pane, click **Network Configurator**. The **Network Configuration** page appears.

4. Click **Add New** to add a new network. The **Add Network** page appears.

5. In the **Network Type** drop-down list, click **Honeywell ControlEdge PLC Network** or **Honeywell ControlEdge RTU Network** as required.

6. Under **IPAddress Configuration:**

   - Configure ControlEdge 900 controller

     - To configure a single ControlEdge 900 controller, click **Add IP** and enter the IP address.

     - To configure dual IP addresses, enter the second IP address in the second text box.

   - Configure ControlEdge 2020 controller

     - To configure a ControlEdge 2020 controller, click **Add IP** and enter the IP address.

     - To configure multiple ControlEdge 2020 controller nodes simultaneously, click **Add IP Range(s)** and enter the range of IP addresses for those devices. From address in the **Add IP** field and To address in the **Add IP Range(s)** field.

7. In the **Port No** box, default port number is displayed as 5094. If a different port number has been set in ControlEdge 900/2020 controller, enter that port number in the box.

8. Click **Add IP**. The specified IP address appears under **Configured IP (s)**.

   To change the IP address or to delete the existing IP address, click Delete IP. The IP address will be deleted under Honeywell PLC/RTU Configuration and you can enter the new IP address.

9. Type the name of the Remote Communication Interface Server (RCI Server) in **RCI Server Name** box. The configured network is connected to the RCI Server.

   By default, FDM populates RCI Server Name with LOCALHOST. If you do not change this, FDM considers the local host as the RCI Server.

10. Click **OK**.

Building networks

Prerequisites

Ensure that the network is configured in the FDM Server Management tool.

To build the network

1. From the **Network View** under Online view, expand **FDM Server** network tree. The list of network interfaces appears.

2. Perform any one of the following to build the network.

   - Right-click the network interface and then click **Build Network**. FDM detects the devices connected to the network and are displayed in the network view.

   - You can also build a network by, right-clicking the target gateway and then clicking **Build Network**. FDM detects the devices connected to the network and are displayed in the network view.

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8 SECURITY
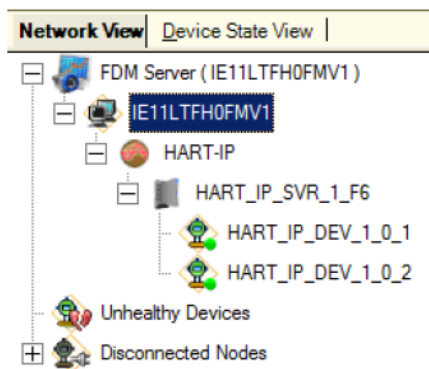
Logon feature

To prevent unauthorized access to a running system, ControlEdge Builder supports three user types including Operator, Engineer and Administrator, and this user management controls the operating privileges. A password is required when operating as a specific user type connecting to a running controller. The default password of each user type is listed as follows:

User Name	Password
Operator	Oper@123
Engineer	Engr@123
Administrator	Admin@123

It is recommended to changed the passwords periodically. It is also recommended to share the passwords with only the minimum required people, who need to perform configuration operations on ControlEdge 900 controller and ControlEdge 2020 controller.

For more information, see "User Privileges" in the *ControlEdge Builder User's Guide*.

Setting operating modes

The operating modes for the CPM are:

- (Only apply to ControlEdge 900 Controller) **Stop Locked**: All tasks are inactive and ready to be executed, therefore the I/O channels hold last value and no output signals are transmitted to the I/Os.

- (Only apply to ControlEdge 900 Controller) **Run Locked**: CPM performs all control and communication tasks and on-line configuration editing and configuration changes are inhibited.

- **Running**: CPM performs all control and communication tasks and on-line configuration editing are permitted.

- **Stopped**: All tasks are inactive and ready to be executed, therefore

the I/O channels hold last value and no output signals are transmitted to the I/Os.

See the following table as a reference when determining your CPM operating mode:

Table 8-1: Operating modes for ControlEdge 900 Controller

Mode Switch position on CPM	STOP	RUN	REMOTE	
Operating mode	Stop Locked	Run Locked	Running	Stopped
Switchover command	Yes	Yes	Yes	Yes
Enabling sync	Yes	Yes	Yes	Yes
Disabling sync	Yes	Yes	Yes	Yes
Becoming primary	Yes	Yes	Yes	Yes
Resetting statistics	Yes	Yes	Yes	Yes
Configuration download	Yes	No	Yes^1	Yes
Firmware download	Yes	No	Yes^2	Yes
Forcing outputs	Yes^3	Yes	Yes	Yes^3
Warm/Cold reboot	Yes	No	No	Yes
Factory reset	Yes	No	No	Yes
Warm/Cold start command	No	N/A	N/A	Yes
Stop Command	N/A	No	Yes	N/A
Note: 1. Two types of configuration download: download changes and download all. Download all is only available when the system is in Stopped or Stop Locked				

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Mode Switch position on CPM	STOP	RUN	REMOTE
operating mode.			
2.	Only on-process firmware upgrade is allowed in the Running operating mode.		
3.	When forcing outputs are in the Stopped state, the forced values are pending until it transits to the Running mode. When forcing outputs are in the Stopped or Stop Locked operating mode, the forced values are pending until it transits to the Running or Run Locked operating mode.		
To change the operating modes, turn the mode switch on CPM or configure from the configuration tool when the mode switch is in Remote position.			

Table 8-2: Operating modes for ControlEdge 2020 Controller

Operating mode	Running	Stopped
Switchover command	Yes	Yes
Enabling sync	Yes	Yes
Disabling sync	Yes	Yes
Becoming primary	Yes	Yes
Resetting statistics	Yes	Yes
Configuration download	Yes[1]	Yes
Firmware download	Yes[2]	Yes
Forcing outputs	Yes	Yes[3]
Warm/Cold reboot	No	Yes
Factory reset	No	Yes
Warm/Cold start command	N/A	Yes
Stop Command	Yes	N/A

Note:

1. Two types of configuration download: download changes and download all. Download all is only available when the system is in Stopped or Stop Locked operating mode.
2. Only on-process firmware upgrade is allowed in the Running operating mode.

Operating mode	Running	Stopped
3. When forcing outputs are in the Stopped state, the forced values are pending until it transits to the Running mode. When forcing outputs are in the Stopped or Stop Locked operating mode, the forced values are pending until it transits to the Running or Run Locked operating mode.		

To change the operating mode

1. From the Home Page, click the **Project Control Dialog** icon on the toolbar.

2. Click **Warm** or **Cold** to change the operating mode to Running. Click **Stop** to change the operating mode to Stopped. About **Warm**, **Cold** and **Stop**, See "Downloading a project to the controller" on page 1 for more information.

Built-in Firewall

This feature only applies to ControlEdge 900 controller and the redundant ControlEdge 2020 controller.

Firewall is default to be enabled. The user can not turn off the Firewall or can not reconfigure it. Only two uplink Ethernet ports are supported by the Firewall function of the CPM.

Configuring IPsec

To support secure communications between the Experion (from R500) and redundant ControlEdge 900 controller and redundant ControlEdge 2020 controller, network layer security provided by IPsec policies will be employed. To achieve this, both ControlEdge 900/2020 controller and the server node need a certificate issued by a certification authority (CA) trusted by both.

For more information, see "Configuring a Secure Connection for Experion Integration" in the *ControlEdge PLC and ControlEdge RTU Network and Security Guide*.

To configure IPsec

1. Create the Certificate Authority.

2. Create a certificate for a Windows node.

   a. Create a certificate.

   b. Import certificate and private key on the target machine.

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3. Configure ControlEdge 900 controller or 2020 controller for use with IPsec.

    a. Installing Certificate Manager Configuration Console (CMCC).

    b. Setup certificates and IPsec policy in ControlEdge 900 or 2020 controller.

4. Configure IPsec to secure traffic to ControlEdge 900 or 2020 controller.

    a. Enable IPsec policy on PCs.

    b. Enable IPsec policy rules in ControlEdge 900 or 2020 controller.

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How to report a security vulnerability

For the purpose of 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.

  or

- Contact your local Honeywell Technical Assistance Center (TAC) listed in the "Support" section of this document.

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