Honeywell

ControlEdge PLC

Release 174.1

PROFINET User's Guide

RTDOC-X722-en-174A
December 2022

DISCLAIMER

CONTENTS

CHAPTER

1 ABOUT THIS GUIDE

This document provides information about the PROFINET protocol implementation in ControlEdge PLC and its extent and capacity, assembly and maintenance, field network defintion, and so on.

Revision history

Revision	Date	Description
A	December 2022	Initial release of this document

Intended audience

This documentation is intended for the following audience: Users who plan, install, configure, operate, or maintain ControlEdge™ 900 controllers 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
AR	Application Relationship is a cooperative association between PROFINET IO controller and PROFINET IO device. This association is initiated and activated by PROFINET IO controller by explicit connection establishment procedure as per PROFINET specification.
CBA	Component Based Automation
Consumer	Device that receives data from Provider
DCP	Discovery and basic Configuration protocol used for basic configuration like IP address, station names to PROFINET IO devices on network.
GSD	Generic Station Description that contains a description of a device and its' features.
GSDML	Generic Station Description Markup Language GSD in markup language. XML based representation of PROFINET IO deivces GSD.
IO controller	An IO controller is a programmable controller, in which automation routine is executed. A PROFINET configuration contains at least one IO controller. The IO controller functions correspond to those of a PROFIBUS class-1 master.
IO device	An IO device is a distributed field device which exchanges data with one or more IO controllers using PROFINET IO mechanisms. A PROFINET IO configuration contains at least one IO-device. The IO device functions correspond to those of a PROFIBUS slave.
IO supervisor	Engineering device which manages commissioning and/or diagnosing of an IO system. IO supervisor functions correspond to those of a class-2 master.
IOCS	Input Output Consumer Status - The consumer (receiver) of a cyclic I/O data element uses this to signal the status (good/bad with error location)
IOPS	Input Output Provider Status - The provider (sender) of a cyclic I/O data element uses this to signal the status (good/bad with

Terminology	Description
	error location)
MRP	Media Redundancy Protocol (MRP) is data network protocol standardized as IEC62439-2 by IEC. It the protocol used by PROFINET devices to support Ethernet network redundancy. All devices supporting MRP needs to have inbuilt managed Ethernet switch with minimum two Ethernet interfaces.
PROFINET IO	PROFINET IO as the Ethernet-based automation standard of PROFIBUS International defines a cross-vendor communication, automation, and engineering model. PROFINET IO is based on Switched Ethernet full-duplex operation and a bandwidth of 100 Mbps.
Provider	An entity that sends data to consumers in the form of messages.
PCD	PROFINET Component Description, it is a XML-based file containing information about functions and objects of PROFINET components.
RT	Real Time protocol used in PROFINET for process data exchange and alarm reporting.
Module	Hardware or logical component of a physical device
Slot	Address of a structural unit within an IO device. Within a modular device, slot typically addresses a physical module. Within compact devices, a slot typically addresses a logical function or virtual module.
Submodule	Hardware or logical component of a module
Subslot	Address of a structural unit within a slot. A subslot may address a physical interface for submodules within a module. Generally, a subslot is a second level to structure data within a device.

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 PLC and ControlEdge RTU Getting started

- ControlEdge Builder User's Guide
- ControlEdge 900 Platform Hardware Planning and Installation Guide
- ControlEdge Builder Function and Function Block Configuration Reference Guide
- ControlEdge Builder Protocol Configuration Reference Guide
- ControlEdge PLC and ControlEdge RTU Network and Security Planning Guide
- ControlEdge RTU and PLC DNP3 Device Profile
- Firmware Manager User Guide

CHAPTER

2 OVERVIEW

PROFINET is an Ethernet open standard (IEC 61158) defined by PI (PROFIBUS and PROFINET International) and complies with the industrial Ethernet requirements. PROFINET IO is Ethernet based automation standard. PROFINET uses TCP/IP for diagnostics, non-real time critical data and for communicating with other non PROFINET IO based devices. PROFINET uses real-time protocol for IO data access. This real-time protocol co-exists with TCP/IP stack without restrictions.

PROFINET has two variants:

- PROFINET IO: used to integrate simple distributed field devices and time-critical applications to communicate over Ethernet.

  A PROFINET IO system comprises an I/O controller and I/O devices. I/O controller is ControlEdge 900 Controller, and I/O devices are distributed field devices integrated through PROFINET IO.

  PROFINET IO describes a device model that is based on the key features of PROFIBUS DP and comprises slots and channels. The characteristics of the field devices are described via a General Station Description (GSD) on and XML basis.

- PROFINET Component Based Automation (CBA): A distributed automation system used for intelligent field and automation devices with programmable functionality in distributed automation plants.

  The PROFINET component model describes the autonomous modules of machines or plant as technological modules. A distributed automation system developed on the basis of technological modules simplifies the modular design of plants and machines. PROFINET on the basis of a component model is described via a PROFINET Component Description (PCD) which is created in XML using either the Component Generator of a manufacturer-specific configuration tool or the PROFINET Component Editor.

CHAPTER

3 PLANNING AND DESIGNING PROFINET

The following sections provide more information to help you plan and design a PROFINET interface for the integration between ControlEdge 900 Controller and the PROFINET compatible devices:

- PROFINET network topologies
- PROFINET network components
- PROFINET license

PROFINET network topologies

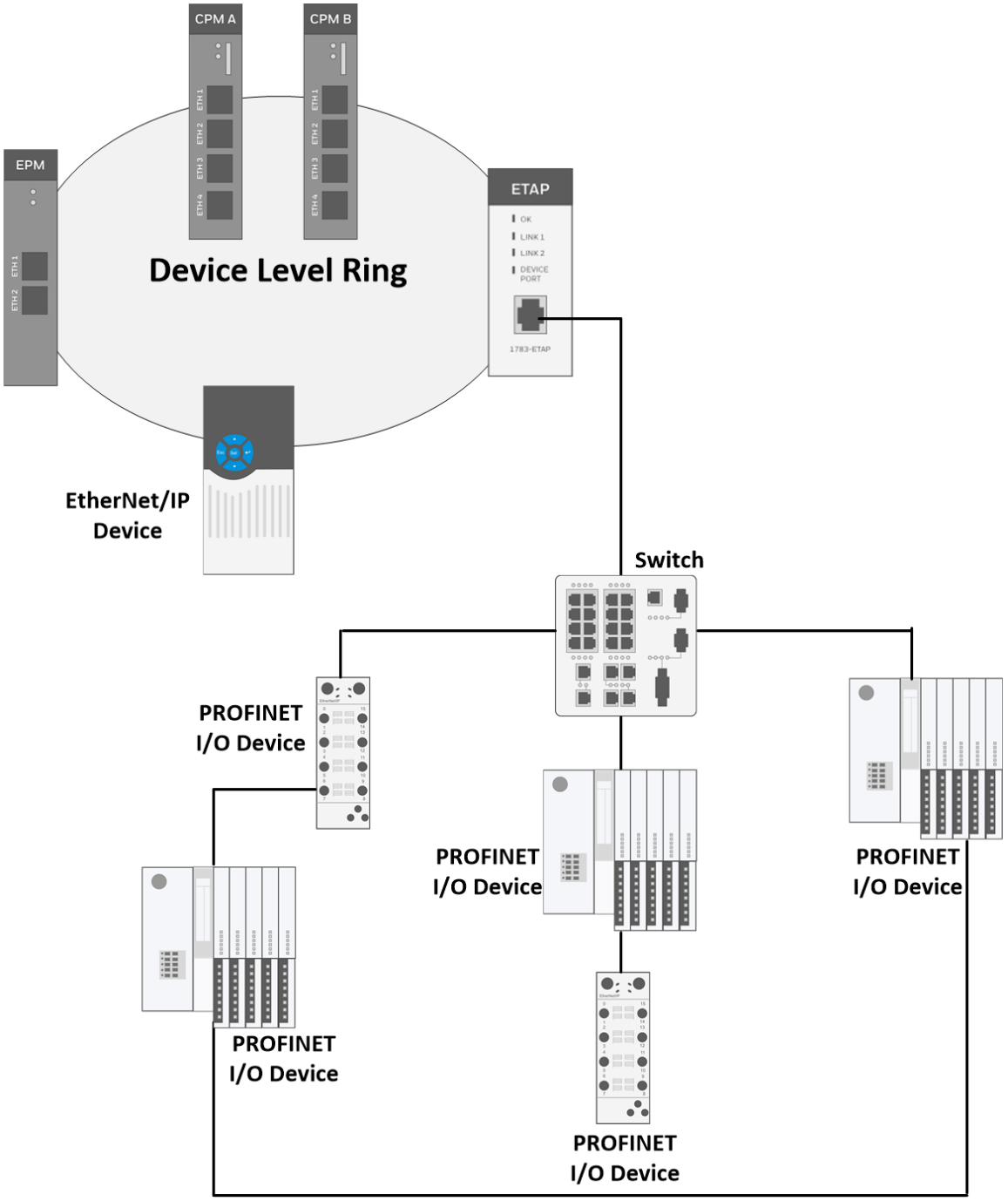
Network topologies must be oriented according to the requirements of the equipment to be networked. The supported topologies are:

- Line (Linear) - Nodes are connected in a linear array, with a single cable hop from one device to the next.
- Star - The nodes of the network are connected to a central hub.
- Ring - The nodes of the network are connected in a circular mode, forming a ring.
- Media Redundancy Protocol (MRP) - No support of MRP, but external switches can be used to connect PROFINET IO devices in ring topology with non-redundant connection to the controller.

The topology can be a hybrid setup with a combination of star, linear, ring and MRP topologies.

> **NOTE:** The ETAP shown below is a device that helps in connecting PROFINET IO devices to DLR topology. ETAP device acts as a hub and can cause extra uni-cast message forwarding on PROFINET IO network.

Figure 3-1: PROFINET topologies



PROFINET network components

A PROFINET network largely consists of active and passive network components. These are hardware components of a network.

- **Passive components** are the components associated with the connection system. They pass on signals without actively influencing them. Passive components include cables, connectors, sockets, and cabinets.
- **Active components** are components that actively influence the signal. Active components include hubs, repeaters, bridges, switches, and routers.

Cables

The PROFINET transmission technology fundamentally corresponds to the Fast Ethernet standard with a full duplex data transfer of 100 Mbps in a switched network. Transmission technologies with lower data transfer rates (10 Mbps) do not satisfy the demands for transmission performance in automation system. The following cable is suitable for transmission of electrical signals in PROFINET.

100Base-TX: electrical transmission system at 100 Mbps (Fast Ethernet) with two pairs of conductors.

Twisted copper cables (100Base-TX) are used for electrical signal transmission at a rate of 100 Mb/s (Fast Ethernet) in full duplex mode. The transmission procedure for 100Base-TX is defined in the IEEE 802.3i/IEEE 802.3u standards of the Institute of Electrical and Electronics Engineers. The transmission medium is a symmetrical and shielded twisted-pair or star-quad copper cable with a characteristic impedance of 100 Ω. The conductors are color-coded: conductor pair 1 is yellow/orange, and is used for sending. The white/blue conductor pair is used as the receive line. Twisted-pair connections are always point-to-point connections between a transmitter block and a receiver block.

Figure 3-2: 100Base-TX cable

Property	Value
Standard	IEC 61158
Cable sort	2-pair, symmetrical and shielded copper cable
Cable type	100Base-Tx, CAT5
Characteristic impedance	100
Transmission rate	100 Mbps
Maximum segment length	100 m
Maximum number of section	3
Connections	RJ45 plug connector, M12 plug
Maximum number of connectors	6 pairs of plugs/sockets per connection

Connectors

The PROFINET cable can be directly connected to all connectors. The connectors used for PROFINET are shielded and designed for use in harsh industrial environments.

PROFINET supports only two connector types:

- RJ45
- M12

RJ45

It is the only option for ControlEdge 900 Controller.

The RJ45 connector type is a rugged metal enclosure immune to interference. It is available in two degrees of protection, as an IP20 solution for use in control cabinets and an IP65/67 solution for system designs without control cabinets. It protects data communication from interference.

Figure 3-3: RJ45 connector

M12

It is not applicable for ControlEdge 900 Controller.

The 4-pin M12 connector with D coding is used with IP65/67. The M12 connector for data transfer is standardized in IEC 61076-2-101. The advantages of M12 connector is the round design, which enables simple sealing to comply with the IP67 degree of protection.

Figure 3-4: M12 connector

Signal	Function	Conductor color	Contact assignment in the RJ45 connector	Contact assignment in the M12 connector
TD +	Transmission data +	Yellow	1	1
TD -	Transmission data -	Orange	2	3
RD +	Receiver data +	White	3	2
RD -	Receiver data -	Blue	6	4

Switches

A network switch is a device that physically connects devices together in a network. Multiple cables can be connected to a switch to enable networked devices to communicate with each other and ensure easy installation.

Transmission cables are assembled with the same connectors and in the same assignment at both ends. The maximum segment length possible between two stations (field devices or switches) is 100 m for data transmission with copper cables. The maximum segment length for fiber-optic cables can be reached up to 14 km.

Switches provide structure to networks. They must be suitable for 100 Mbps and full-duplex operation. This prevents collisions on the line, as data can be sent and received simultaneously in a switch with a port. Because the filed devices ca be found in 10 Mbps systems, network components must support the following features:

- **Auto crossover function**: adaptation of send and receive lines to enable use of standard 1:1 cables.
- **Auto negotiation**: automatic adjustment to transmission speed.

PROFINET stripping tool

The Industrial Ethernet Fast Connect Stripping Tool (IE FCS) is the stripping tool for the IE FC cables. It can be used for removing the exactly required lengths of outer sheath and shield on the FC cables in one operation as a result of the exactly preset cutting depths and distance of the knives. Sources of error resulting from inexact stripping of the cable when assembling the outlets are thus eliminated. The stripping tool can be used for rapidly connecting the IE Outlet RJ45 and IE FC RJ45 plug complying with PROFINET standards and without causing problems to the industrial Ethernet FC cables.

When setting up a PROFINET system, cut the AWG 22 twisted pair cable to the required length, strip it with the stripping tool (for Industrial Ethernet), and fit the Industrial Ethernet Fast Connect RJ45-plugs using the cut-and-clamp technique.

PROFINET security

PROFINET security concept takes account of the higher network security requirements in Ethernet-based automation systems. This concept covers access control, data encryption, authentication, and logging of safety-relevant events.

Ethernet-based communication is taking a central role in the automation world. For example, industrial Ethernet is increasingly being used at the field level, for example, PROFINET.

The visibility of activities at plant level (ongoing work, status of systems and devices, and production schedules) is increased, thereby enabling the design of better end-to- end information systems and facilitating decision making. The information exchange between production systems and other enterprise systems is more direct, which allows the company to react more quickly. Uniform interfaces reduce the total costs for diagnostics and support, in particular, because remote support of production processes is possible.

Security concepts developed for office environments cannot simply be transferred to automation networks. Security measures implemented for automation systems and networks must not conflict with PROFINET-related requirements. The goal of security measures in the automation area is a reliable automation network that meets requirements. Another point to be aware of is that automation systems are designed for maximum performance and not for maximum security. For example, many systems do not employ proper authentication measures to protect access.

The objective is to fulfill the central security objectives of the automation world.

A secure system ensures the confidentiality, integrity, and availability of systems and data, even in the case of malicious attacks.

To achieve the maximum reasonable level of security for automation systems and networks, a suitable security management process is essential. As part of a consistent security management process, consideration must be given to the following:

- Risk analysis, including identification of counter measures for reducing risk to a reasonable level.
- Coordinated organizational/technical measures (systems engineering).
- Periodic/event-triggered repetition.

The basic concept for achieving appropriate security for PROFINET-based automation solutions relies on controlling the necessary accesses to the individual PROFINET domains. This is accomplished by segmentation of the network and establishment of defined zones and by control of communication links between the segments and zones (cell security concept). Together with the use of different technologies and methods, this results in the implementation of a defense-indepth approach. Because different solutions and technologies may be used depending on the specific requirements and these may be applied in any combination and in connection with segments, the result is an integrated security concept.

For more information, see https://www.profibus.com/technology/industrie-40/profinet-security.

PROFINET supportability

The following table provides information about PROFINET functionality specification.

Item	Specification
Number of PROFINET Interfaces	1 (Downlink interface of ControlEdge 900 Controller)
Number of Ports	2 (Downlink mode is set to DLR)
Integrated Switch	Yes
RJ45 (Ethernet)	Yes

Supported functionality of ControlEdge PLC

Functionality	Support
PROFINET IO Controller	Yes
PROFINET IO Device	No
Media Redundancy (MRP)	No (PROFINET I/O cannot be connected to DLR ring of ControlEdge PLC directly, but can be connected to MRP ring using MRP supported switches, and then connect to DLR ring through ETAP.) (If downlink network comprises of mostly EtherNet/IP devices with very few PROFINET IO devices, PROFINET IO devices can be connected to DLR ring using ETAP.)

Supported functionality of PROFINET IO Controller:

Functionality	Support
Isochronous Mode	No
MRP	No
MRPD	No
Number of IO devices that can be connected	128

Functionality	Support
Fastest Scan Time Supported (Minimum cycle time)	1ms **NOTE:** The usable cycle time depends on the number of IO devices, input and output data size of used IO devices and the station scan time configured. Number of devices, cycle time and IO data length are related and dependent with each other. E.g. Though maximum number of devices supported are 128, all devices cannot be scanned at 1ms rate.
Maximum size of total Cyclic Input & Output Data	64KB includes IOxS status bytes This is maximum amount of data that the controller can exchange with Devices using cyclic data exchange protocol.
Maximum number of cyclic input data per device	1440 bytes including IOxS status bytes
Maximum number of cyclic output data per device	1440 bytes including IOxS status bytes
Acyclic Communication	No
DCP Function	No
Alarms	No
Diagnostics	Yes
HART support	No
Controller Redundancy	Yes. Support redundant controller on PROFINET network. System Redundancy (S2 Redundancy) is not supported.
Shared Device support	No
iDevice (Intelligent Device support)	No
CiR (Configuration in Run) support	No

Functionality	Support
	New PROFINET IO devices can be added on process. Existing PROFINET devices can be removed on process. But any configuration changes in existing device needs that device to made inactive.
Fast Startup Support	No
Support of Device Profiles	No
Certification from PI	No
RT over UDP	No
Multicast communication	No
DHCP	No Either for PLC downlink interface or for connected PROFINET IO devices.

CHAPTER

4 PROFINET LICENSE

This chapter describes the procedure to obtain the license of PROFINET.

ControlEdge 900 controller as PROFINET controller is a separately licensed feature. Honeywell model number for this license is SP-IPROF1.

Every logic controller requires one instance of this license on which PROFINET function is enabled. For example:

- A non-redundant controller requires one license.
- A redundant controller requires one license.
- If a system has two non-redundant controllers, and one redundant controller, three licenses are required.

CHAPTER

5 CONFIGURATION

PROFINET solution overview

PROFINET IO device is described by Device Access Point (DAP) which describes how many slots a device has. Slots can be real or virtual. Each slot can take one physical module. GSDML (Generic Station Description Markup Language) file contains list of modules that a PROFINET device supports. Each Module can contain multiple submodules. Each submodule can have multiple DataItems categorized under Input and Outputs. Terms inputs and outputs are always from the perspective of controller. Controller receives inputs from and provides outputs to IO devices. PROFINET follows provider consumer model for cyclic data access where data provider sends status, called IOPS (Input Output Provider Status) along with data.

DataItems are entities that are mapped to controller tags. They are equivalent to channels.

Modules or slots do not have IO data or record data. Only submodule can contain cyclic IO data and acyclic record data. Along with cyclical data each submodule provides IOPS (Input Output Provider Status) and /or IOCS (Input Output Consumer Status).

Most of the data types supported for each DataItem in PROFINET are of fixed width. All fixed width data item can be represented as built in PROFINET IO variables. However, for PROFINET devices that do not belong to IO family, DataItem of fixed width might still contain multiple parameters. Such composition of multiple parameters in one DataItem is not defined in GSDML file.

In ControlEdge PLC, a byte array variable is used to represent PROFINET IO device. Since modules are only a container, each slot is represented by a pre-defined variable.

There are 6 types of I/O channel data types that represent submodules as follows:

- AI_xx_Type representing PROFINET submodule that has only inputs with fixed data width as described in GSDML file. This IOM will have AI channels under it and number of channels is per device description in GSDML file.

> **NOTE:** "xx" represents the number of AI channels.

- AO_xx_Type representing PROFINET submodule that has only outputs with fixed data width as described in GSDML file. This IOM will have AO channels under it and number of channels as per GSDML file.

  > **NOTE:** "xx" represents the number of AO channels.

- DI_xx_Type representing PROFINET submodule that has only digital inputs (GSDML description with "UseAsBits" as TRUE and device family is IO). This IOM will have DI channels with number of channels as per GSDML file.

  > **NOTE:** "xx" represents the number of DI channels.

- DO_xx_Type representing PROFINET submodule that has only digital outputs (as described above for DI IOM). This IOM will have DO channels with number as defined in GSDML file.

  > **NOTE:** "xx" represents the number of DO channels.

- AI_xx_Type, AO_xx_Type, DI_xx_Type or DO_xx_Type representing PROFINET submodule that has mix of AI, AO, DI, DO channels. Number of channels will depend on GSDML file.

  > **NOTE:** "xx" represents an unique identifier which is generated automatically.

- PNIO_Bytes_xx_Type representing all other submodule that cannot be represented by above 5 submodule types.

  > **NOTE:** "xx" represents the number of bytes.

  Other PROFINET devices like PLCs, Drives, encoders are not IO modules and submodules desciption in GSDML file for these devices makes IO data available in the form of array of bytes. All these submodules by default will be mapped to PNIO_Bytes_xx_Type.

PROFINET IO data in Control Application

I/O variables for PROFINET device are automatically assigned by the PROFINET configuration tool. To load PROFINET I/O data, make sure that the physical devices are communicating with the controller, otherwise error will occur.

See ControlEdge Builder User's Guide for more information.

Configuring PROFINET

The ControlEdge 900 controller supports communication with PROFINET compliant third-party devices, such as I/O modules, drives, and relays. To facilitate the integration of PLC with the PROFINET compliant devices, you must add and configure equivalent devices by using ControlEdge Builder. Each configured device represents an equivalent physical PROFINET compliant-device, which is installed on the PROFINET network.

To enable communication between I/O modules and the PROFINET network, an I/O adapter (Device Access Point) supplied by the PROFINET IO vendor is needed. The adapter provides the Assembly connection feature, which helps you in consolidating connections from a group of I/O modules.

You can create PROFINET device, drive, and I/O module types by using GSDML files.

Binding PROFINET to an Ethernet port

This section introduces how to bind PROFINET to ETH3.

ETH4 has the same configuration as ETH3, so only ETH3 should be configured manually.

DLR Topology is required if you bind PROFINET.

To bind PROFINET

1. From Home Page, click **Configure Ethernet Ports** and select **ETH3**.
2. Under **Network Setting**, configure the IP address and the subnet mask.
   - The default IP address is 172.168.0.101.
   - The range of the IP address is from 101 to 254.

- The IP address cannot be in the same network subnet as ETH1 and ETH2.
- The IP address must be in the same network subnet as the PROFINET device.
- The IP address cannot be conflict with the IP address of PROFINET device.
- The IP address cannot be conflict with the EPM IP address.

3. Under **Protocol Binding**, select **PROFINET**.
4. Under **I/O Network Topology**, select **DLR Topology**.

   This configuration should match the position of 100X switch on the EPM hardware. 5 is for DLR network topology.

   For more information about the switch, see “Assembling I/O racks” in the *ControlEdge 900 Controller Hardware Planning and Installation Guide*.
5. Under **DLR Configuration**, configure the following 4 parameters:
   - **Role**: Specify the role for CPM as **Supervisor** or **Member**. The default value is **Supervisor**. A supervisor yields to another supervisor with a higher precedence, such that the highest precedence is always the Active Supervisor.
   - **Supervisor Precedence**: Set the precedence of a ring supervisor in the network with multiple ring supervisors. Numerically higher value indicates higher precedence. Node with highest Supervisor Precedence value becomes Active Supervisor. The configuration value ranges from 1 to 255. The default value is 250.
   - **Beacon Interval (usec)**: Set Beacon interval (in micro seconds) that supervisor transmits. The configuration value ranges from 400 to 10000. The default value is 400.
   - **Beacon Timeout (usec)**: Set the amount of time (in micro seconds) all nodes in ring network shall wait before timing out reception of Beacon frames and taking the appropriate action. Beacon timeout must be set to 2-3X Beacon Interval. The configuration value ranges from 800 to 50000. The default value is 1960.

> **NOTE:** You must reboot the controller if you change the I/O network topology from **Ring Topology/Star Topology** to **DLR Topology** and vice versa.

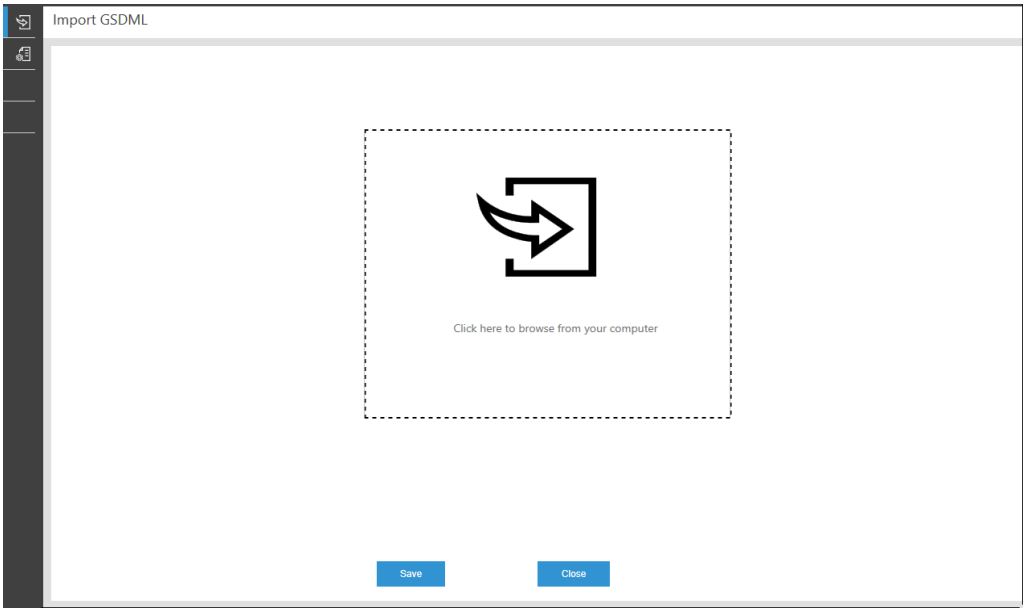
6. Click **Save** to complete the Ethernet port configuration.
7. Click **Back** to return to the Home Page.

Importing GSDML files

You can download GSDML files from secure sites hosted by device vendors, and import them into ControlEdge Builder. The registered information will be stored under the location: C:\ProgramData\Honeywell\ControlEdge Builder\PROFINET\Catalog\GSDMLFiles. The registered information cannot be saved along with project backups. You must back up them manually.

To import GSDML files

1. From the Home Page, click **Configure PROFINET**, and click **PROFINET Device Configuration**. **Import GSDML** dialog appears:



2. Click on the screen to browse the GSDML files from your computer.
3. Select the GSDML files and click **Open**, the GSDML files are imported successfully.

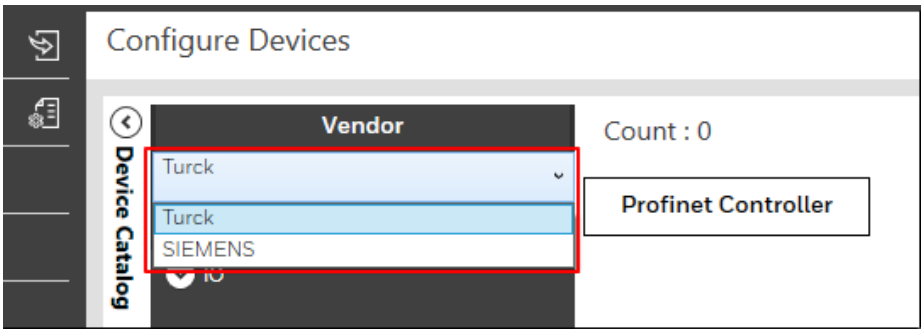
Configuring PROFINET devices

Prerequisites

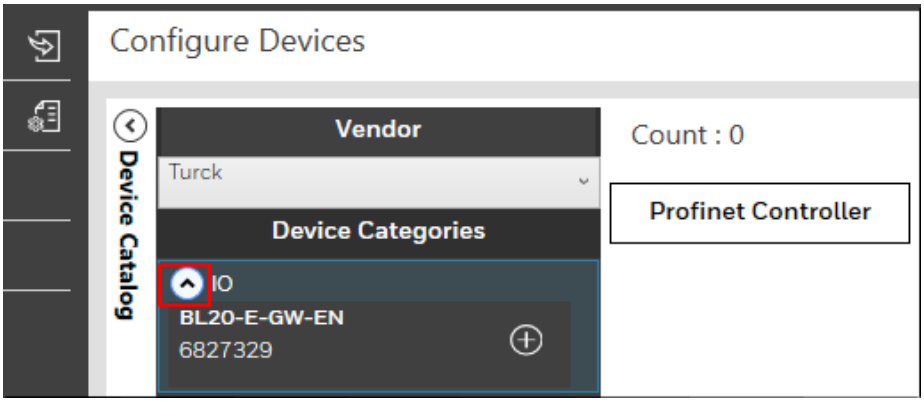
- Bind PROFINET to an Ethernet port. See Binding PROFINET to an Ethernet port for more information.
- Ensure you have imported GSDML files. See Importing GSDML files for more information.

To configure PROFINET devices

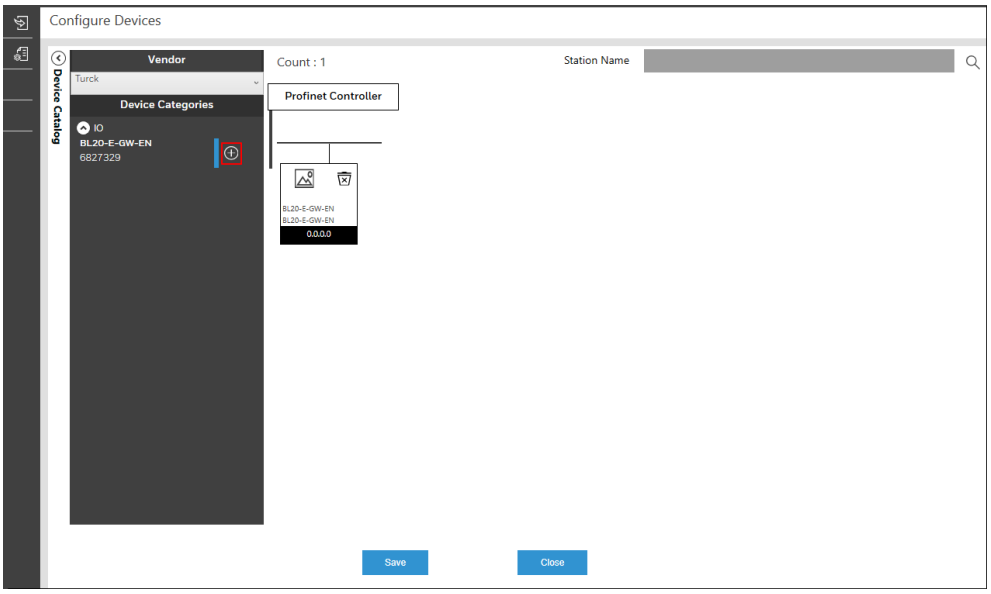
1. From the Home Page, click **Configure Profinet**, and click **Configure Device**.
2. Select the vendor from the drop-down list.



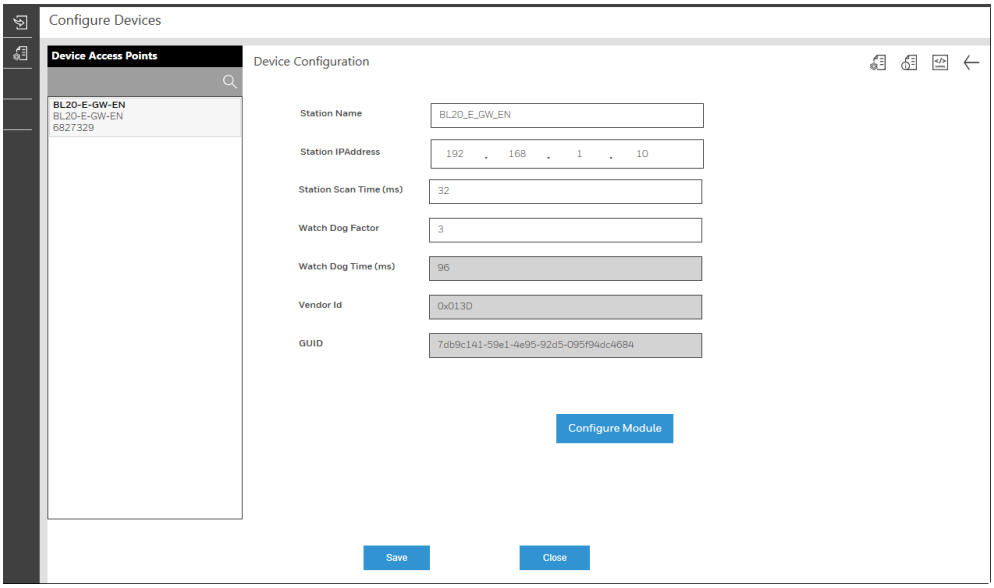
3. Click the arrow icon. PROFINET devices under that category will be displayed:



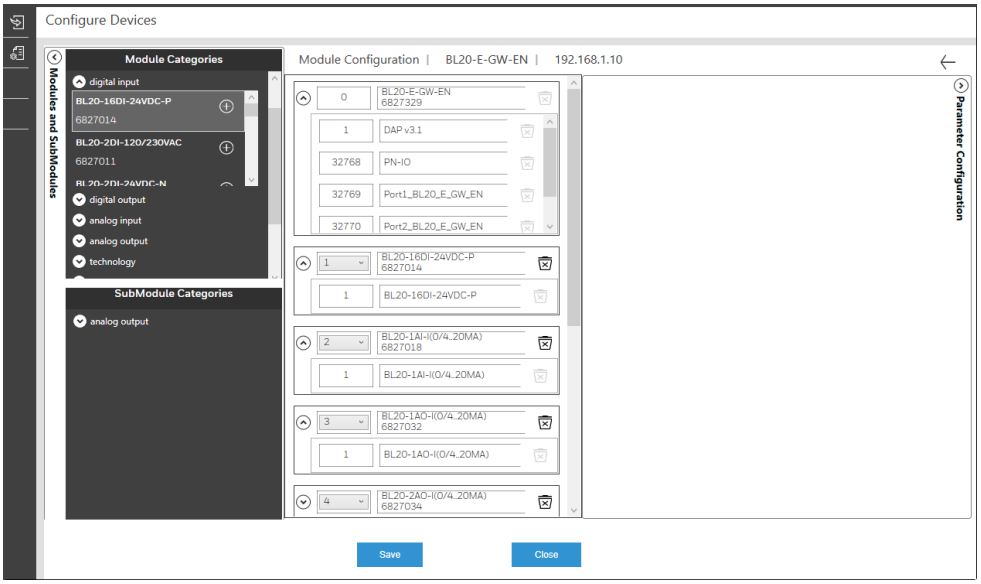
4. Click + to add the device to the PROFINET Controller page.



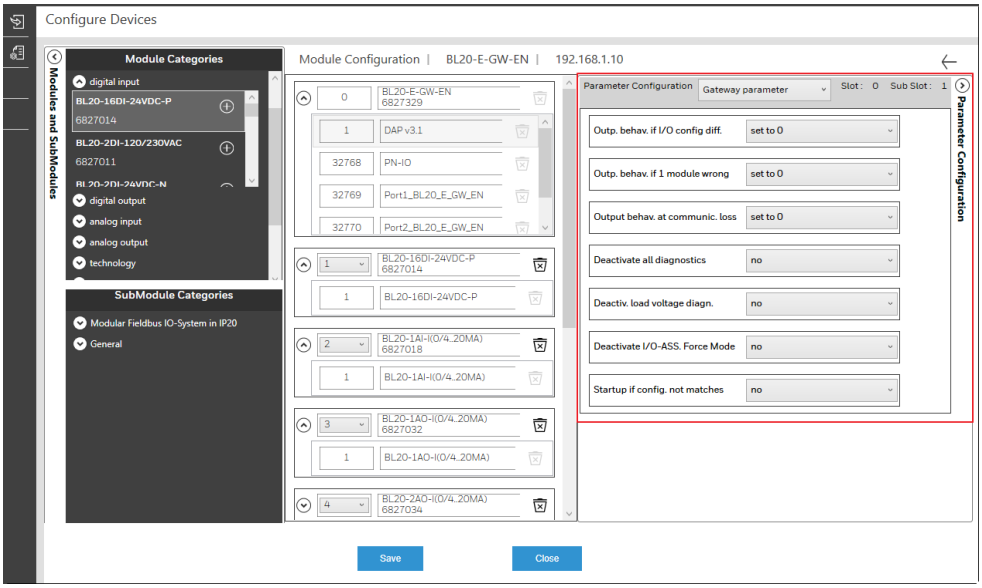
5. Click on the IP address to configure the device, enter the **Station Name**, **Station IPAddress** and **Station Scan Time (ms)**, and click **Configure Module**.



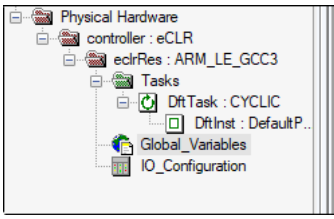
6. In the **Module Configuration** page, select the input and output as required, and set the slot number for each, and then click **Save**.



7. Select a submodule to configure the device parameters. Parameter Configuration page appears:



8. Click **Save** to complete the configuration. Click **Close** to return back to the **Profinet Device Configuration** page.
9. Click **Save** to complete the configuration, and the PROFINET I/O variables are generated automatically. You can check them in **Global_Variables** under **IEC Programming Workspace**.



614	**Profinet Input Variables**		
615	BL20_E_GW_EN_1_1_Input	DI_16_Type	VAR_GLOBAL
616	BL20_E_GW_EN_2_1_Input	AI_1_UINT_T...	VAR_GLOBAL
617	BL20_E_GW_EN_5_1_Input	PNIO_Bytes...	VAR_GLOBAL
618	**Profinet Output Variables**		
619	BL20_E_GW_EN_3_1_Output	AO_1_UINT_...	VAR_GLOBAL
620	BL20_E_GW_EN_4_1_Output	AO_2_UINT_...	VAR_GLOBAL
621	BL20_E_GW_EN_5_1_Output	PNIO_Bytes...	VAR_GLOBAL

NOTE: To convert bytes array to any other data types, use BUF_TO_XXXX function block in PROCONOS library. XXXX indicates the target data type you want to convert to. For more information, see the embedded online help of the corresponding function block.

CHAPTER

6 PROFINET I/O BEHAVIOR DURING SWITCHOVER

This chapter provides information on I/O channel role during controller switchover.

ControlEdge 900 Controller does not support S2 System Redundancy as defined by PROFINET specification. Please refer to PROFINET specifications to understand S2 System Redundancy. Only primary CPM maintains PROFINET connection with PROFINET IO devices. On controller switchover, new primary CPM will re-establish PROFINET connection (AR) to PROFINET IO devices. Establish new primary connection after old connection is dropped by the IO devices. Connection drop by IO devices depends on the Watchdog time configuration. It is typically three times of configured scan time. Fastest scan time is 1ms and slowest scan time is 2048 ms, so typically range of watchdog time will be between 3 ms to 6144 ms. Default scan time is 32 ms and watchdog time is 96 ms.

State of outputs (hold, fail-safe, etc.) from the controller to PROFINET IO devices between the time of loss of the primary CPM connection to new connection establishment by new primary CPM depends on the PROFINET IO device. Connection establishment from new primary will take 3~6 seconds depending on the size of network and configuration size of PROFINET IO device. Verify how PROFINET IO device manages outputs during connection drop.

During this time the IOM and channel blocks in the controllers will hold and work on with the last I/O data received before switchover.

CHAPTER

7 DIAGNOSTIC

Viewing PROFINET device diagnostics

You can log in as the Administrator, Engineer or Operator to connect the target controller and view PROFINET device diagnostics.

1. From the Home Page, click **View Diagnostics** under **Diagnostics**. The diagnostics page appears.
2. Click the down arrow on the right of the **PROFINET Device** tab to expand the group. The overview of the PROFINET devices which are connected with the controller appears at the rightmost page.

   See the following table for the configuration parameters:

Parameter	Description
Num of PROFINET Devices	The number of the connected PROFINET devices.
Total Input Image Size	The total byte length of configured PROFINET devices' input data, including IOPS&IOCS.
Total Output Image Size	The total byte length of configured PROFINET devices' output data, including IOPS&IOCS.
Device Name	PROFINET device name
Communication Status	Communication status of PROFINET devices
Input Image Size	The byte length of configured PROFINET devices' input data, including IOPS&IOCS.
Output Image Size	The byte length of configured PROFINET devices' output data, including IOPS&IOCS.
Device IP Address	IP Address of the PROFINET device

Auto-refresh is selected by default. You can set a refresh rate to update diagnostics regularly. You can also click **Auto-refresh** to close it, and click **Refresh** to update diagnostics manually.

You can click **Reset Statistics** to reset statistic values to the default values.

3. Click a PROFINET device name to view its diagnostics displayed at the rightmost page.

Parameter	Description
Device Name	PROFINET device name
IP Address	IP Address of the PROFINET device
Vendor ID	PROFINET device vendor ID which is defined in GSDML file
Device ID	PROFINET device ID which is defined in GSDML file
Scan Time	The configured scan time interval of the PROFINET device
Watch Dog Time	Watch dog timer factor
Communication Status	Communication status of PROFINET devices

4. Click the down arrow at the right of the device to view Slot list. Click a Slot to view its diagnostics.

Parameter	Description
Slot number	Configured PROFINET device slot number
Submodule type	Submodule type of configured subslot, Input or Output
Subslot Number	Configured PROFINET subslot number
Input Provider Status	The provider (sender) of a cyclic I/O data element uses this to signal the input status (good/bad with error location)
Input Consumer Status	The consumer (receiver) of a cyclic I/O data element uses this to signal the input status (good/bad with error location)
Output Provider Status	The provider (sender) of a cyclic I/O data element uses this to signal the output status (good/bad with error location)

Parameter	Description
Output Consumer Status	The consumer (receiver) of a cyclic I/O data element uses this to signal the output status (good/bad with error location)

APPENDIX

A STATUS CODES

The error codes are returned with the response to a Connection Manager Service Request that resulted in an error. These error codes shall be used to help diagnose the problem with a Service Request. The error code shall be split into an 8 bit general status and one or more 16- bit words of extended status. Unless specified otherwise, only the first word of extended status shall be required. Additional words of extended status may be used to specify additional device specific information. All devices that originate messages shall be able to handle multiple words of extended status.

Table A-1: Status codes for device level

Status code	Description
0	The profinet device is deactivated.
1	The profinet device is connecting.
2	The profinet device is connected.
3	The connection has errors.

Table A-2: Status codes for slot level

Status code	Description
0	Bad by subslot The associated submodule data is not valid and should not be used for process control. The submodule detected the issue.
32	Bad by slot The associated submodule data is not valid and should not be used for process control. The module detected the issue.
64	Bad by device The associated submodule data is not valid and should not be used for process control. The IO device detected the issue.
96	Bad by controller The associated submodule data is not valid and should not be used for process

Status code	Description
	control. The IO controller detected the issue.
128	Good The associated submodule data is valid and can be used.

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