ROBOTICS

Application manual

PROFINET Controller/Device

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Application manual

PROFINET Controller/Device

RobotWare 6.15.05

Document ID: 3HAC065546-001

Revision: Q

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Original instructions.

Table of contents

Overview of this manual

About this manual

This manual describes how to configure PROFINET for IRC5 using the RobotStudio tool I/O Engineering Tool. I/O Engineering Tool is required to configure safe I/O modules.

This manual can be used for the following options:

- PROFIsafe F-Host and Device, option number 997-2 I
- PROFIsafe F-Device, option number 997-1 II
- Prepared for CI502, option number 1241-1 I (this option supports parts of the 997-2 functionality)
- PROFINET Controller/Device, option number 888-2
- PROFINET Device, option number 888-3

I Also requires option 996-1 and 888-2.
II Also requires option 996-1 and 888-2 or 888-3.

> **Note**
>
> Not all aspects of working with PROFINET is described in this manual. It may be necessary to also read *Application manual - PROFINET Controller/Device with 3rd party configurator*, *3HAC050969-001*.

Usage

This manual should be used during installation and configuration of the PROFINET options when using the configuration tool in RobotStudio, I/O Engineering Tool.

Who should read this manual?

This manual is intended for:

- Personnel that are responsible for installations and configurations of industrial network hardware/software.
- Personnel that make the configurations of the I/O system.
- System integrators.

Prerequisites

The reader should have the required knowledge of:

- PROFINET network
- I/O system
- IRC5 controller
- RobotStudio

References

ABB documents

Reference	Document ID
Technical reference manual - System parameters	*3HAC050948-001*

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Reference	Document ID
Technical reference manual - RAPID Instructions, Functions and Data types	*3HAC050917-001*
Product manual - IRC5	*3HAC047136-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Operating manual - RobotStudio	*3HAC032104-001*
Application manual - PROFINET Anybus Device	*3HAC050968-001*
Application manual - PROFIenergy Device	*3HAC050967-001*
Application manual - PROFINET Controller/Device with 3rd party configurator	*3HAC050969-001*
Application manual - Functional safety and SafeMove2	*3HAC052610-001*
Application note - IRC5 Robot Controller and CI502 with Safety I/O modules	*3ADR010316*

Other references

Reference	Description
International standard IEC 61158 Type 3 International standard IEC 61784	The PROFINET industrial network standard is described in the international standards.
PROFINET Cabling and Interconnection Technology	Installation Guideline for PROFINET (Version 2.00, September 1998)
Commissioning PC Stations - Manual and Quick Start	Release 12/2006 C79000-G8976-C156-08
ET200S Distributed I/O System	Manual from Siemens
www.profinet.com	The web site of PROFINET International

Revisions

Revision	Description
A	First edition. Released with RobotWare 6.07.
B	Released with RobotWare 6.08. • Added information about missing or duplicated GSDML definitions to section *Troubleshooting on page 101*.

Continues on next page

Revision	Description
C	Released with RobotWare 6.08.01. • The title is modified, was *PROFINET Controller/Device with IO Configurator*, is now *PROFINET Controller/Device* • For RobotWare 6.08.01 and later, this manual replaces *Application manual - PROFINET Controller/Device with 3rd party configurator, 3HAC050969-001*. The 3rd party configurators are no longer supported. • Information added in *PROFINET for IRC5 on page 16* regarding LLDP mode and Startup mode. • GSDML file changed to GSD file in entire manual. • New images in "Configuring with IO Configurator", *Configuring the internal device using I/O Engineering Tool (for option 997-1 PROFIsafe Device) on page 82* and *Configuring the internal device using I/O Engineering Tool (for option 997-2 PROFIsafe Controller/Device) on page 79* • Information regarding procedure for Fast device startup added in *Using Fast Device Startup on page 73*. • Information added in section System parameters that system parameters Fast Device Startup, Port 1, Port 2, Port 3 and Port 4 are not used as from release 6.08.01. • New sections added to troubeshooting: *Unable to add safety module for option 997-2 PROFIsafe Controller/Device on page 104* and *Mismatch in configuration for option 997-2 PROFIsafe Controller/Device on page 105*. • Sections Configuration file, Fast Device Startup, Port 1, Port 2, Port 3 and Port 4 removed from chapter System parameters.
D	Released with RobotWare 6.09. • Section *Main computer on page 19* updated with new NOTE regarding restrictions for Isolated LAN 3.
E	Released with RobotWare 6.09. • Minor corrections.
F	Released with RobotWare 6.10. • References added to application note regarding IRC5 Robot Controller and CI502 with Safety I/O modules.
G	Released with RobotWare 6.10.01. • Cfg name removed from entire manual.
H	Released with RobotWare 6.11. • Reference to `IOEventMessage` added in section *Using Fast Device Startup on page 73*.
J	Released with RobotWare 6.12. • Added the section *Working with I/O Diagnostics on page 95*. • Added the section *Configuring in commissioning mode on page 85*. • I/O Configurator replaced by I/O Engineering Tool in entire manual. • Sections Terminology and System Parameters have been removed from manual. • New chapter: *Setting up your PROFINET system on page 53*. • GSD version updated in section *PROFINET for IRC5 on page 16*. • Sections updated regarding tool changing with FSU: *Using Fast Device Startup on page 73* and *Troubleshooting scenarios on page 101*.

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Revision	Description
K	Released with RobotWare 6.13. • GSDML information updated in section *Specification overview, internal device on page 17*. • Limitations for selection of LLDP mode added in section *Specification overview, internal controller on page 17*. New section *Configuring the PROFINET network properties on page 57* with information about LLDP mode. • Information regarding the Parameterization Speedup parameter added in section *Poor performance using fast startup on page 102*. • Information regarding GSD files updated in sections *Configuring the internal device using I/O Engineering Tool (for option 997-1 PROFIsafe Device) on page 82* and *Configuring the internal device using I/O Engineering Tool (for option 997-2 PROFIsafe Controller/Device) on page 79*. • Information about temporary IP addresses added in section *Troubleshooting scenarios on page 101*.
L	Released with RobotWare 6.13.03. • Information about supported address types for PROFIsafe updated in *PROFINET for IRC5 on page 16*.
M	Released with RobotWare 6.14. • Information about I/O launch button added in section *I/O Engineering user interface on page 33* and *Setting up your PROFINET system on page 53*. • Section *Configuring in commissioning mode on page 85* updated with information about how to work with projects. • Minor corrections.
N	Released with RobotWare 6.14.01. • GSD version for internal controller updated in section *PROFINET for IRC5 on page 16*.
P	Released with RobotWare 6.15. • Information about calculation of **Faulty Telegrams** added in *Manually adding devices to your network on page 64*.
Q	Released with RobotWare 6.15.05. • Information about naming standards for GSD files added in *Troubleshooting scenarios on page 101*.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

Tip

All documents can be found via myABB Business Portal, *www.abb.com/myABB*.

Product manuals

Manipulators, controllers, DressPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.

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- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

Safety

Safety regulations

Before beginning mechanical and/or electrical installations, ensure you are familiar with the safety information in the product manuals for the robot.

The integrator of the robot system is responsible for the safety of the robot system.

Network security

Network security

This product is designed to be connected to and to communicate information and data via a network interface. It is your sole responsibility to provide, and continuously ensure, a secure connection between the product and to your network or any other network (as the case may be).

You shall establish and maintain any appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Ltd and its entities are not liable for damage and/or loss related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

1 Introduction

1.1 What is PROFINET?

General

PROFINET is an open standard for Industrial Ethernet. PROFINET satisfies requirements for automation technology. PROFINET solutions can be implemented for factory and process automation, for safety applications, and for the entire range of drive technology right up to clock-synchronized motion control.

Standardization

The use of open standards, simple operation, and the integration of existing system segments have driven the definition of PROFINET from the beginning. PROFINET is standardized in IEC 61158 and IEC 61784. The continual further development of PROFINET offers users a long term perspective for the implementation of their automation tasks.

Communication profiles

PROFINET has a modular design and different PROFINET communication profiles are all combinations of modular elements from the groups transmission technology, communication protocol, and application profiles.

Here are some examples of PROFINET communication profiles:

- PROFINET-IO - Distributed I/O (Remote I/O). Here, the familiar I/O view of PROFIBUS is retained, in which the user data from the field devices are periodically transmitted into the process model of the control system.
- PROFINET-CBA - Based on the object-oriented modelling of technological modules. Based on the object model, machines and installations are structured in PROFINET in the form of technological modules.
- PROFIsafe - Defines how safety-oriented devices (emergency shutoff switches, light grids, overfill protection systems, etc.) can communicate safety control information over a network securely enough that they can be used in safety-oriented automation tasks up to EN954's KAT4, AK6, or SIL3 (Safety Integrity Level).
- PROFIdrive - The PROFIdrive profile covers application scenarios from simple frequency converters to highly dynamic servo drivers.
- PROFIenergy - A profile of the PROFINET communications protocol that allows the power consumption of automation equipment in manufacturing (such as robot assembly cells, laser cutters and sub-systems such as paint lines) to be managed over a PROFINET network. It offers an open and standardized means of controlling energy usage during planned and unplanned breaks in production. See also *Application manual - PROFIenergy Device*.

1.2 PROFINET for IRC5

General

The PROFINET network is running on the IRC5 main computer and does not require any additional hardware. PROFINET as described in this manual requires the main computer DSQC1000.

Options

With option *997-2 PROFIsafe Controller/Device*, the IRC5 controller can act as a controller, device, or both on the PROFINET network.

With option *997-1 PROFIsafe Device*, the IRC5 controller can only act as a device.

Tip

If only PROFINET device functionality is required, then the option *PROFINET Anybus Device* can also be used.

For more information see *Application manual - PROFINET Anybus Device*.

Note

Note that the network settings are set for the *Connection*, i.e. the physical connector on the main computer used for the PROFINET network.

This means that the network settings are shared between the internal device and the internal controller if the IRC5 controller acts as both on the PROFINET network.

Compatibility

For RobotWare 6.06 and later, the PROFINET device is certified by PROFIBUS & PROFINET International (PI) with conformance class B/ NetLoad Class II and the device profiles; PROFIenergy and PROFIsafe.

The PROFINET device and controller are certified for the PROFINET version 2.33.

Configuration programs

RobotWare 6.08.01 and later

For RobotWare 6.08.01 and later, the configuration is done in the I/O Engineering Tool in RobotStudio.

RobotWare 6.08 and previous

For RobotWare 6.08 and previous, to be able to configure the PROFINET controller, an external PROFINET configuration tool is needed. There are two different versions available: *PROFINET-IO Configurator Express* and *PROFINET-IO Configurator Professional*. Supplied in the RobotWare distribution package is the Express version. The Professional version have some additional features and can be bought separately.

The PROFINET internal device does not require any external configuration tool for the IRC5 controller. A connecting PLC or other controller needs to use the provided

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GSD file and its vendor specific configuration tool to be able to connect to the PROFINET internal device.

Specification overview, internal controller

Item	Specification
PROFINET version	2.33
PROFIsafe version	2.4
GSD file versions	2.20–2.42
Number of I/O devices connected to controller	Maximum 50 I/O devices
Connection size	Maximum 256 input bytes and 256 output bytes per device.
LLDP mode	Legacy and Standard mode supported: • *Legacy mode* supports communication to I/O devices according to PROFINET I/O specification up to version 2.2. • *Standard mode* supports communication to I/O Devices according to PROFINET I/O specification after version 2.2. **Note** If one device in the configuration only supports legacy mode, all devices must run in legacy mode.
Startup mode	Legacy and Advanced mode supported.

Specification overview, internal device

Item	Specification
PROFINET version	2.33
PROFIsafe version	2.4
GSD version	2.33 **Note** Do *not* import the internal file `GSDML-V2.32-ABB Robotics-INTERNAL-Robot Device-20191114.xml` from the HOME directory.
Slot configuration	Slot 1-2: Digital input or output modules of variable size
Connection size	Maximum 256 input bytes and 256 output bytes per device.

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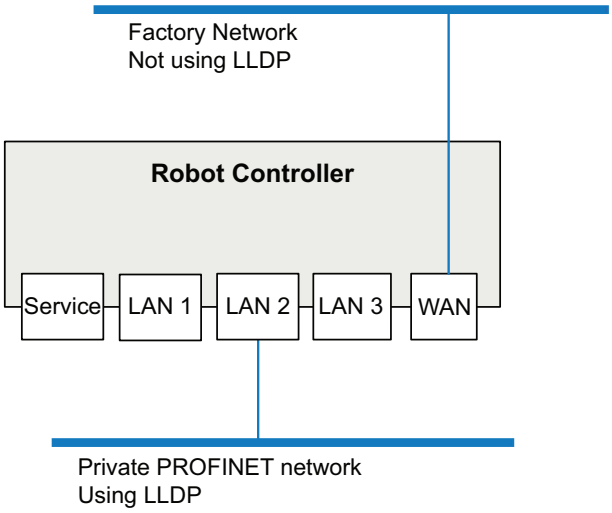
Default gateway

There are multiple default gateways in the system. And hence, it is possible to have two different default gateways in the system, one for the non-PROFINET traffic and one that only manages the PROFINET interface and its traffic. So while using option *PROFINET Controller/Device* the LAN 3 port is used only for PROFINET traffic.

Link Layer Discovery Protocol (LLDP)

The IRC5 controller supports LLDP, but only on one port at a time. Preferably LLDP should be used on the PROFINET network. Any network connected to another port must have LLDP disabled (or use equipment not supporting LLDP).



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Device replacement

PROFINET controller supports the device replacement mechanism. When a device fails, a new, identical device can replace the failed one if plugged in the same topology location. And this does not need any engineering tool. The new device is automatically assigned the same parameters and name as the previous one.

The conditions for device replacement to work are:

- You must replace a previously connected device by an identical device with an empty station name at the same topology location. For example, the new device is plugged in the same port as previously in a switch.
- This feature requires all switches and devices to support Link Layer Discovery Protocol (LLDP). The easiest way to achieve this is to only use Conformance Class B devices and switches in the PROFINET network.

Requirements for PROFIsafe address types

The following applies for the PROFIsafe address types:

- For PROFIsafe Device, **Address type 1** is supported.
- For PROFIsafe Controller, **Address type 1** is supported.

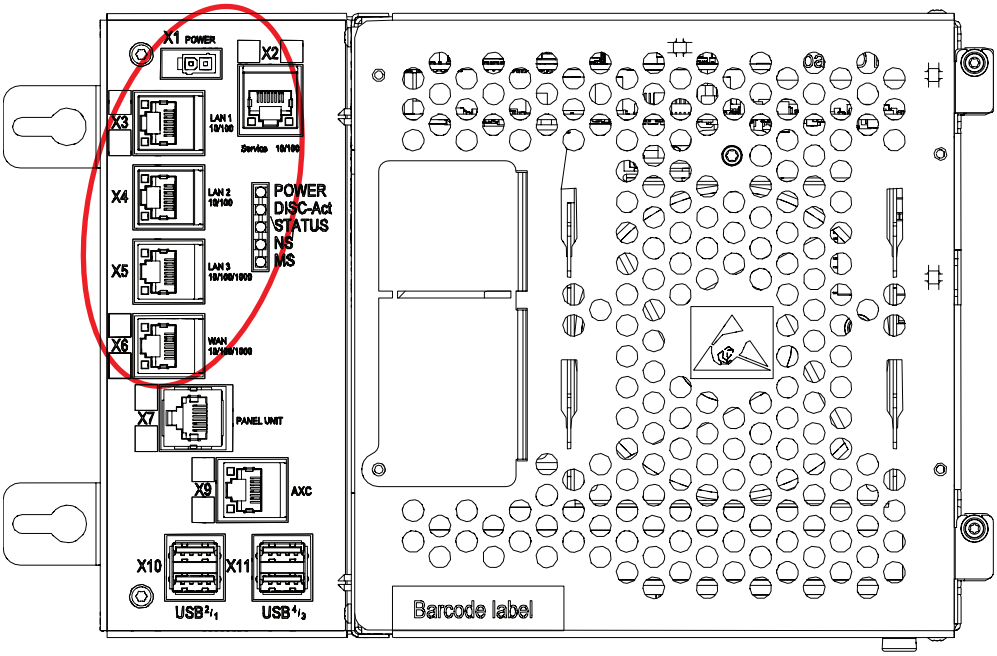
2 Hardware overview

2.1 Main computer

Connections

The I/O network can be connected to one of the the Ethernet ports WAN, LAN 2, or LAN 3 on the main computer.

The following figure illustrates where the Ethernet port connectors, are placed on the main computer.



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Connector	Label	Description
X2	Service	Port to the robot's private network. Intended to be left empty so that service personnel can use it to connect to the computer unit.
X3	LAN 1	Port to the robot's private network. Normally used to connect the FlexPendant.
X4	LAN 2	Port to the robot's private network.
X5	LAN 3	By default LAN 3 is configured for an isolated LAN3 network. Can be reconfigured to be a part of the private network.
X6	WAN	Wide Area Network that can host a public industrial network.

Note

It is not supported to connect multiple ports of the main computer (X2 - X6) to the same external switch, unless static VLAN isolation is applied on the external switch.

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Intended use of WAN and LAN ports

The WAN port is a public network interface to the controller, typically connected to the factory network with a public IP address provided by the network administrator.

The LAN ports are intended for connecting network based process equipment to the controller, for example industrial networks, cameras, and welding equipment.

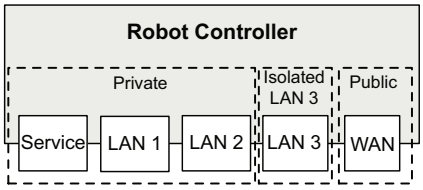
LAN 2 can only be used as a private network to the IRC5 controller.

Isolated LAN 3 or LAN 3 as part of the private network

The default configuration is that LAN 3 is configured as an isolated network. This allows several robot controller to be connected to the same network, see *PROFINET on dedicated industrial network on page 23*.

Note

If isolated LAN 3 is used for PROFINET, only PROFINET traffic will be possible on LAN 3.



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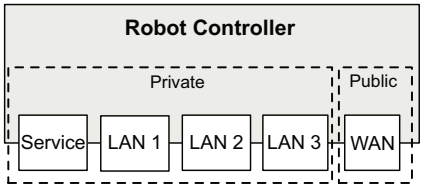
An alternative configuration is that LAN 3 is part of the private network. The ports Service, LAN 1, LAN 2, and LAN 3 then belong to the same network and act just as different ports on the same switch. This is configured by changing the system parameter *Interface*, in topic *Communication* and type *Static VLAN*, from "LAN 3" to "LAN". See *Technical reference manual - System parameters*.



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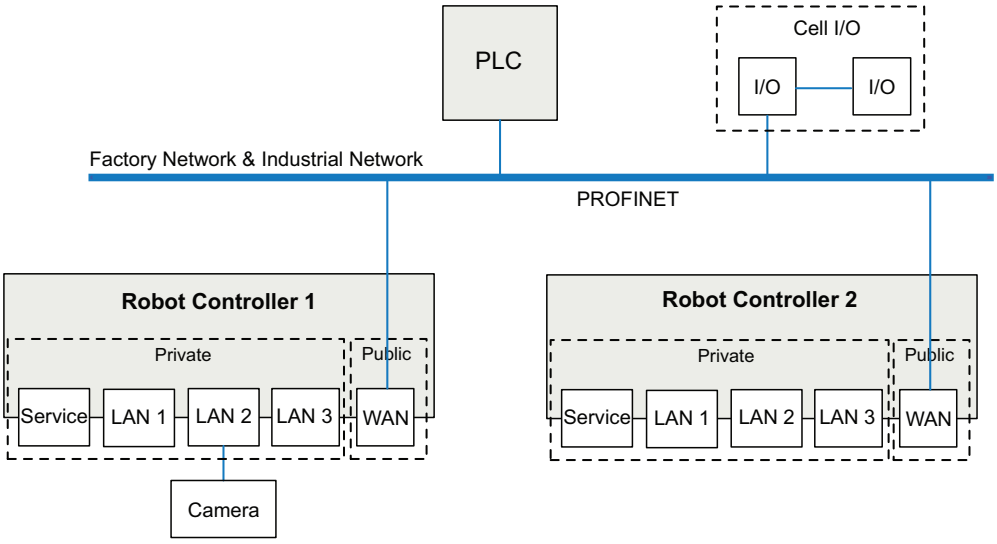
One PROFINET network connected to the robot controller

If PROFINET is used on the public network (WAN port) without an Anybus adapter, PROFINET cannot be used on the private network. Equipment not using PROFINET (for example a camera) can be connected to the private network. To use PROFINET on both the public and private network, an Anybus adapter must be used. See *Using Anybus adapter to connect two PROFINET networks on page 24*.

PROFINET on factory network

When the WAN port is used for connecting to an industrial network, the traffic shares the same media as the factory network and will share bandwidth with other non industrial network traffic.

The following figure illustrates the network when connecting a controller and a device to the WAN port of the main computer:



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2.1 Main computer
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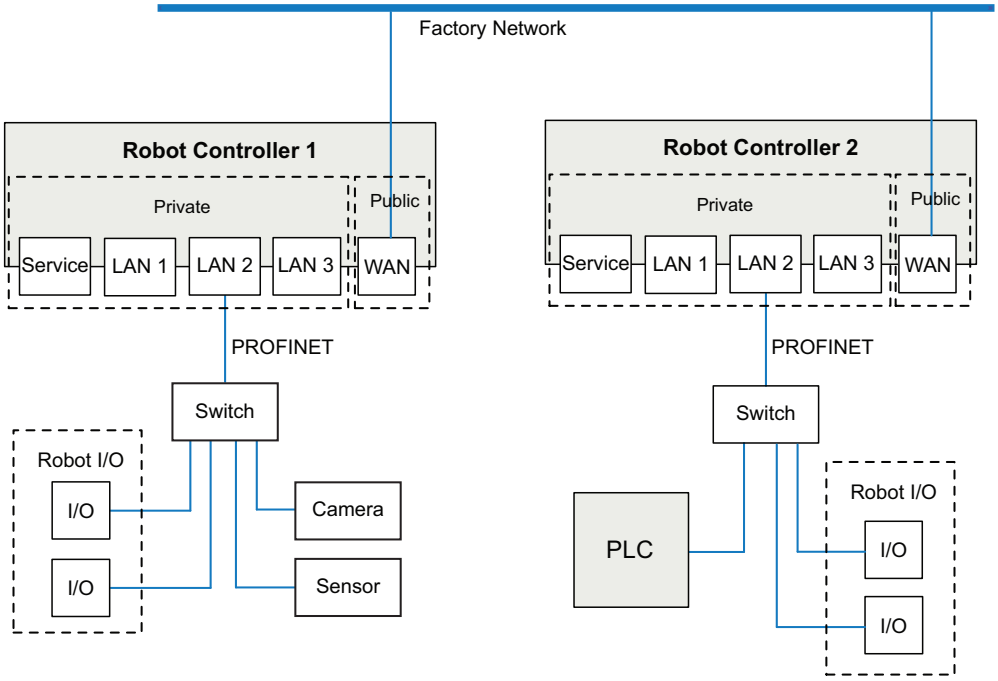
PROFINET on private network

The private network can contain I/O, sensors, etc. for the robot controller. However, it is not possible to connect several robot controllers to the same private network.

The following illustration shows two robot controllers with PROFINET (and other IP traffic) on each private network. The factory network cannot communicate with the robot controller using PROFINET.



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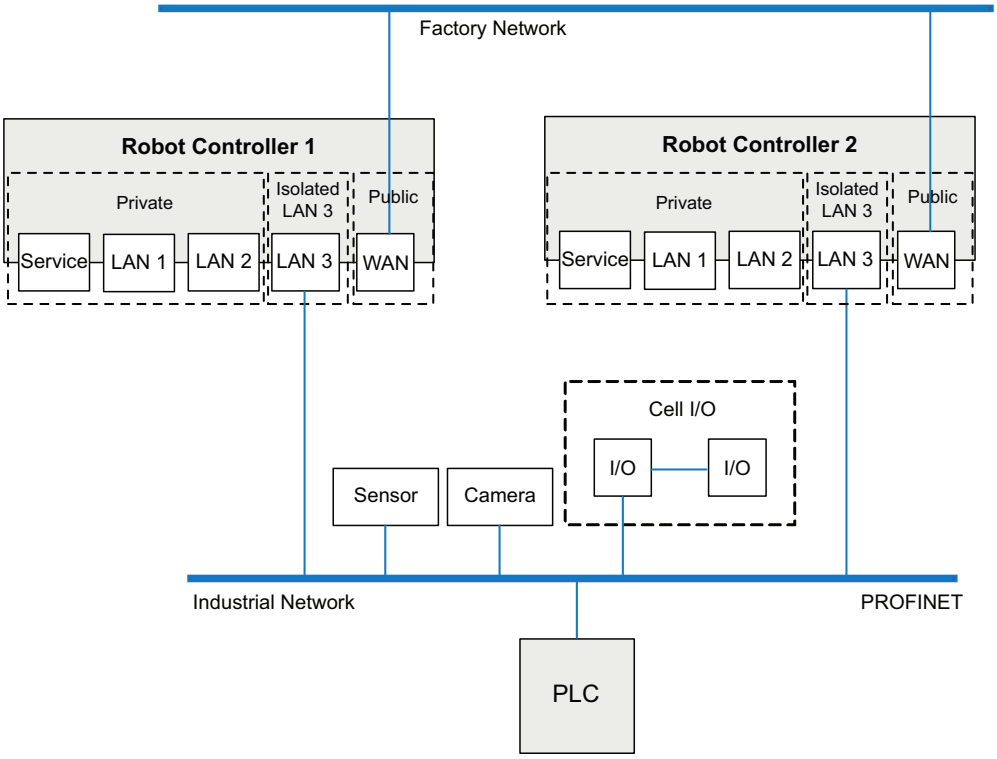
PROFINET on dedicated industrial network

By connecting to the isolated LAN 3 port it is possible to connect several robot controllers to a dedicated industrial network.



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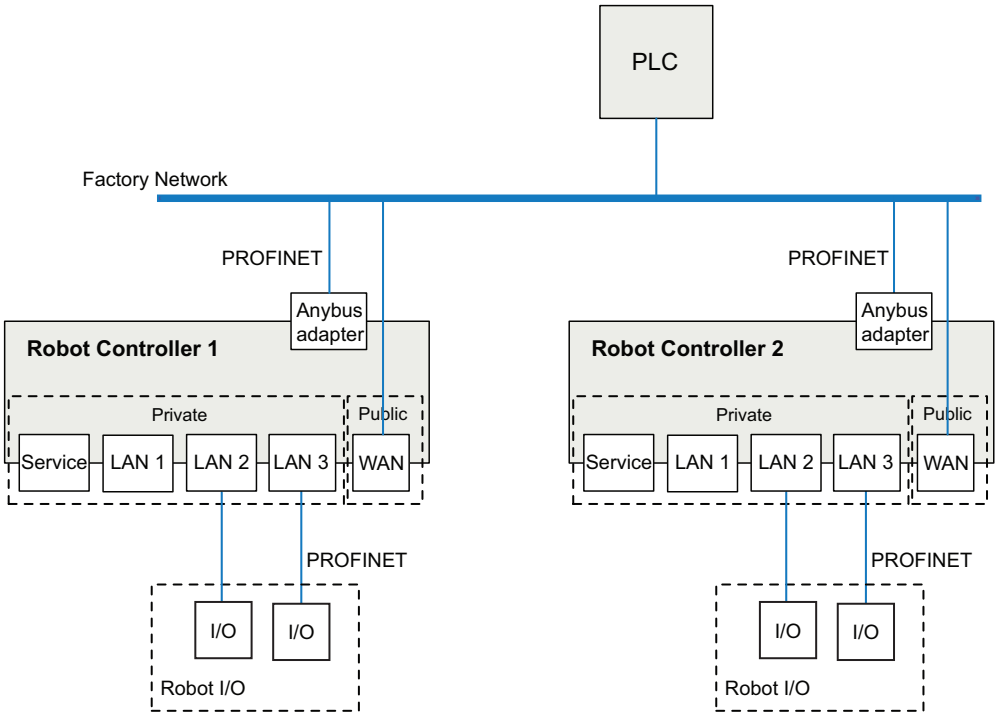
Using Anybus adapter to connect two PROFINET networks

PROFINET on shared factory network and private network

To be able to use PROFINET on both the public and the private network, an Anybus adapter must be used. If the same factory network is used both for PROFINET communication and other communication, both the Anybus adapter and the WAN port must be connected to the factory network. For information about the PROFINET Anybus adapter, see *Application manual - PROFINET Anybus Device*.



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PROFINET on dedicated industrial network

If the PROFINET communication is separated from other communication, an Anybus adapter must be connected to the PROFINET industrial network and the WAN port must be connected to the factory network.

If the PROFINET communication shall be separated from other Ethernet communication, an Anybus adapter must be installed and connected to the public PROFINET industrial network and the WAN port connected to the factory network.

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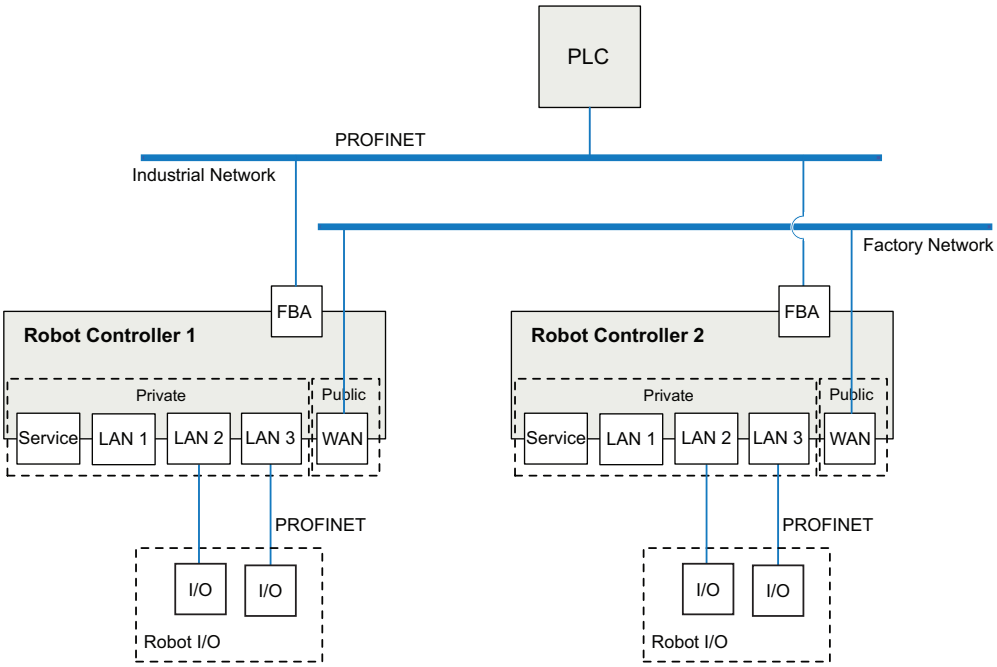
For information about the PROFINET Anybus adapter, see *Application manual - PROFINET Anybus Device*.



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2.2 Ethernet switches

Prerequisites

It is recommended to use PROFINET certified switches.

2.3 I/O devices

Limitations

It is possible to connect most types of PROFINET-IO compliant I/O device on the PROFINET controller network. All I/O devices should comply with the PROFINET standard and be conformance tested by PROFINET international. I/O devices may be mounted inside the controller.

Safety I/O devices

PROFINET network supports safety module. It is possible to configure safety I/O devices and create safety signals to the I/O devices. For more information, see *Application manual - Functional safety and SafeMove2*.

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3 Software overview

3.1 Information about the internal device

General

To use the PROFINET internal device, the IRC5 controller must be installed with either the option *888-2 PROFINET Controller/Device* or *888-3 PROFINET Device*.

The PROFINET internal device can be used to:

- connect an IRC5 controller to a PLC.
- connect the IRC5 controller to another IRC5 controller which acts as a PROFINET controller.

Predefined network

When the robot system is installed with the *PROFINET* option, a predefined network with the name *PROFINET* is created at system startup.

Use RobotStudio or other recommended tool to configure the PROFINET network for initial use. For example, by setting the correct network name and IP settings.

Predefined internal device

When the robot system is installed with the *PROFINET* option, a predefined internal device with the name *PN_Internal_Device* is created at system startup.

It is used to define the internal device in the IRC5 controller, which will enable a PLC to connect to the IRC5 controller. There can only be one internal device defined in the IRC5 controller.

Template I/O configuration file

A template I/O configuration file is available for the internal device. The file contains preconfigured names for all available inputs and outputs. The file can be loaded to the controller, using RobotStudio or the FlexPendant, to facilitate and speed up the configuration.

The I/O template configuration file, *PN_Internal_Device.cfg*, can be obtained from RobotStudio or the IRC5 controller.

- **In the RobotWare installation folder in RobotStudio**: *...\RobotPackages\RobotWare_RPK_<version>\utility\service\ioconfig\PROFINET*
- **On the IRC5 Controller**: *<SystemName>\PRODUCTS\<RobotWare_xx.xx.xxxx>\utility\service\ioconfig\PROFINET*

> **Note**
>
> Navigate to the RobotWare installation folder from the RobotStudio **Add-Ins** tab, by right-clicking on the installed RobotWare version in the **Add-Ins** browser and selecting **Open Package Folder**.

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Input and output size

PROFINET has an internal device with maximum 2048 digital input signals and maximum 2048 digital output signals. Similarly, for safe PROFINET internal device, you can add safety digital input signals and safety digital output signals.

The internal device *PN_Internal_Device* has two system parameters, *Input Size* and *Output Size*. *Input Size* is used to configure the input size of the internal device and *Output Size* configures the output size. A connecting PLC needs to have a slot configuration created in the external PROFINET configuration tool that matches the configuration of the internal device.

The following table shows a few examples of how the *Input Size* and *Output Size* parameters can be used to create different slot configurations of a connecting PLC:

Input Size	*Output Size*	**Step 7 Configuration**
8 bytes	8 bytes	Slot 1: DI 8 bytes Slot 2: DO 8 bytes
8 bytes	16 bytes	Slot 1: DI 16 bytes Slot 2: DO 8 bytes
64 byte	32 bytes	Slot 1: DI 32 bytes Slot 2: DO 64 bytes

Tip

If a configuration mismatch between the connecting PLC and the internal device occurs, an event message is generated on the FlexPendant or the RobotStudio. This event message informs the user of the present slot configuration of the internal device.

Note

The *Input Size* sets the size on digital outputs and *Output Size* sets the size on digital inputs, seen from the PLC's point of view.

3.2 Information about the internal controller

General

To use the PROFINET internal controller, the IRC5 controller must be installed with the option *PROFINET Controller/Device*.

The PROFINET internal controller can be used to:

- connect PROFINET devices to the IRC5 controller.
- connect the IRC5 controller to another IRC5 controller which acts as a PROFINET device.

GSD files

In order to configure a PROFINET network with an external PROFINET configuration tool, GSD files need to be imported into the tool. These files contains vital information about the PROFINET I/O devices and they shall be supplied by the vendor/manufacturer of the specific PROFINET module.

3.3 Software for configuring a device

General

The PROFINET internal device does not need any type of PC software to be activated, but the connecting PLC / PROFINET controller might need a PC software tool to configure all connection parameters used to connect to the IRC5 system.

GSD file for configuring the internal device for a PROFINET controller

The provided GSD file for the IRC5 PROFINET device is used to inform the connecting PLC / PROFINET controller of supported connection parameters.

The GSD file, *GSDML-V2.xx-ABB-Robotics-Robot-Device-YYYYMMDD.xml*, for the internal device can be obtained from the RobotStudio or the IRC5 controller.

- **In the RobotWare installation folder in RobotStudio**: *...\RobotPackages\RobotWare_RPK_<version>\utility\service\GSDML*
- **On the IRC5 Controller**: *<SystemName>\PRODUCTS\<RobotWare_xx.xx.xxxx>\utility\service\GSDML*

Note

Do *not* import the internal file `GSDML-V2.32-ABB Robotics-INTERNAL-Robot Device-20191114.xml` from the HOME directory.

Note

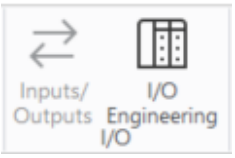
Navigate to the RobotWare installation folder from the RobotStudio **Add-Ins** tab, by right-clicking on the installed RobotWare version in the **Add-Ins** browser and selecting **Open Package Folder**.

4 I/O Engineering user interface

4.1 The user interface

Start I/O Engineering

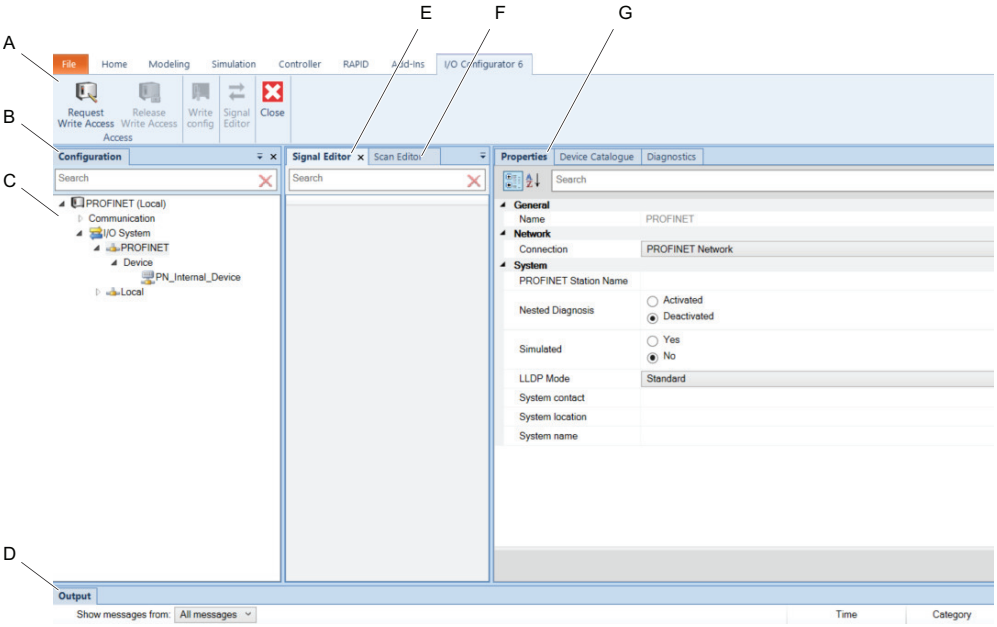
1 Start RobotStudio and connect to the robot system to configure.
2 In the ribbon of the **Controller** tab, select **I/O Engineering**.



xx2200000715

Overview of the user interface

This section presents an overview of the I/O Engineering graphical user interface.



xx2200000934

	Parts	Description
A	Ribbon	Displays command buttons organized in a logical sequence of function.
B	**Configuration** browser	Displays the I/O configuration tree with information of I/O system and its parameters.
C	**I/O System node**	Displays parameters for I/O devices and signals.
D	**Output** window	Displays the information about the events that occur in controller and I/O devices.
E	**Signal Editor**	Displays the signals assigned to the selected I/O device. Enables to add or delete signals of I/O device.

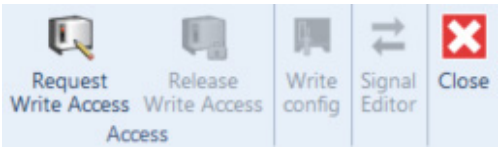
Continues on next page

	Parts	Description
F	**Scan Editor**	Displays the information of the I/O devices that are found on the network seen through the given port in the bus definition.
G	**Properties** browser	Displays all available properties and settings of the selected I/O device or Configuration nodes. The following tabs are available: • **Properties** tab - displays the properties of the selected I/O device. • **Device Catalogue** tab - displays the device catalogues used for configuring the I/O devices.

4.2 The ribbon

Layout of the ribbon

This section describes the functions of the command buttons.



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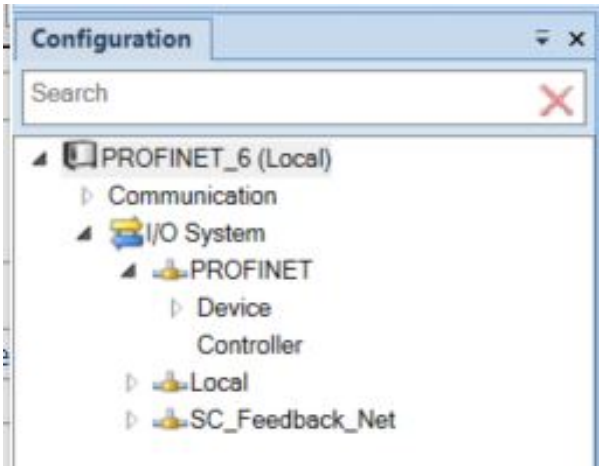
The ribbon contains following command buttons:

Button	Functions used for
Request Write Access	Requests write access.
Release Write Access	Releases the write access after editing I/O configuration.
Write config	Writes configuration to the controller and the pending changes to the controller. **Note** Needs write access.
Signal Editor	Opens the **Signal Editor** which displays the signals assigned to the I/O device.
Close	Closes the I/O Engineering view.

4.3 Configuration browser

Introduction

The Configuration browser displays hierarchical structure of controller and configuration elements in the **I/O Engineering** tab. The following figure displays the Configuration browser that contains *Communication* and *I/O System* node in tree structure. You can click each node to view the parameters and edit the selected parameter in the **Properties** tab.



xx2200000413

Note

Correct the validation error on each element in the Configuration browser before writing the configuration to the controller.

Communication node

The Communication node contains parameters for configuring the main computer's connectivity using Ethernet ports. For more information on parameters, see *Communication* in *Technical reference manual - System parameters*.

The parameters are organized in the following elements:

Element	Description
Ethernet Port	Used for configuring the Ethernet ports on the main computer. You can edit ports X2, X3, X4, X5, and X6 in the **Properties** tab.
IP Setting	Used to set an address to a network interface of the main computer. The parameters in the IP setting is visible in the **Properties** tab. It includes *Label*, *IP*, *Subnet*, and *Interface* parameters. Right-click to add new Industrial networks.
Static VLAN	Used to configure grouping of physical Ethernet ports into static VLAN groups. Ports in the same group are also a part of the same network interface in the main computer. You can configure only port X5 in **Properties** tab.

Continues on next page

I/O System node

The I/O System node contains parameters for I/O devices and signals. You can configure generic I/O devices and safe I/O devices in the I/O System node.

Element	Description
Industrial Network node (for example **PROFINET**)	It displays the industrial network that is used in the controller. The parameters of the corresponding industrial network is visible in the **Properties** tab. It includes *Connection*, *Identification Label*, and *Simulated* parameters. Right-click PROFINET node to show a shortcut menu with options: • Scan network • Import
Device	Under the **Device** node, the internal devices (where the robot controller acts as a PROFINET device) are shown. It displays the parameters of a predefined internal device created at system start. The parameters of the internal device are visible in the **Properties** tab.
Controller	The **Controller** node represents a network where the robot controller acts as PROFINET controller. Under the **Controller** node are representations of a real I/O devices that are connected to the industrial network where the robot controller acts as PROFINET controller. You can configure the parameters of the I/O devices in the **Properties** tab.

Symbols

The following symbols display the status of the I/O device, controller or entity.

Symbol	Explanation
	Indicates incomplete information. You can enter the pending information in the **Properties** tab.
	Indicates that there are unsaved changes.
	Indicates a sub-module belonging to an I/O device. The sub-module is used configure some parameters for the I/O device (e.g. input delay).
	Identifier for an I/O device.
	Identifier for a safety I/O device.
	Indicates that a signal is used by the safety module, for example in the combinatory logic, and cannot be renamed or removed from the signal editor.
	Indicates that a device, module or signal is configured as protected in the safety configuration.
	Identifies an unknown I/O device which is not mapped to a GSD definition.
	Identifies a device with an old configuration where signals are configured directly under the device. In a new configuration, the device would have slots for I/O modules that contains the signals.

Continues on next page

> **Note**
>
> Point to the entity with error to view the corresponding validation error.

Right-click menu

Within the **Configuration** browser tree structure, you can right-click the I/O device to show a shortcut menu with various operations (not all are available for all I/O devices):

Setting	Description
Delete	Removes the I/O device from the **Configuration** browser structure. However, the slot position is available for a new or another slot, which can be inserted in the controller.

4.4 Properties browser

Properties tab

The **Properties** tab displays the parameters of the Communication node and I/O System node. You can configure the parameters visible in the **Properties** tab. For more information about parameters, see *Technical reference manual - System parameters*.

Device Catalogue tab

The **Device Catalogue** tab displays the predefined device templates or catalogues used to configure the I/O device.

For PROFINET devices, GSD files are imported to configure the I/O devices. The installed device templates are visible in the **Device Catalogue** tab.

4.5 Signal Editor

Overview

The **Signal Editor** tab displays the signals that are assigned to the I/O device. It is used to view existing signals and to add new signals to the I/O device and its modules.

For more information about the signal attributes, see *Technical reference manual - System parameters*.

4.6 Scan Editor

Overview

> **Note**
>
> The **Scan Editor** is a specific function used for PROFINET configurations.

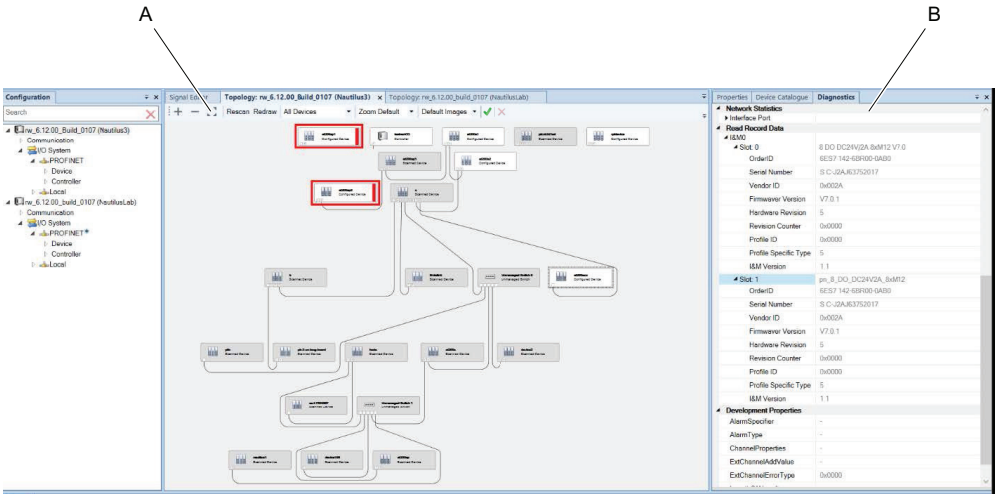
The **Scan Editor** tab displays the I/O devices discovered in the controller network scan. It displays information such as *MAC*, *Station Name*, *IP*, *Subnet*, *Gateway*, *Vendor Id*, and *Device Id*.

When scan network is run, **Scan Editor** displays all the I/O devices in the network. You can then configure the I/O devices that are found but not already configured in the controller. For example, in the Communication node, if LAN3 is configured as the network interface and the scan network is run. Then the LAN3 interface is used as the scan interface and devices are identified with the device details. For more information, see to *Scanning the network on page 62*.

4.7 I/O Diagnostics interface

4.7.1 I/O Diagnostics overview

Overview



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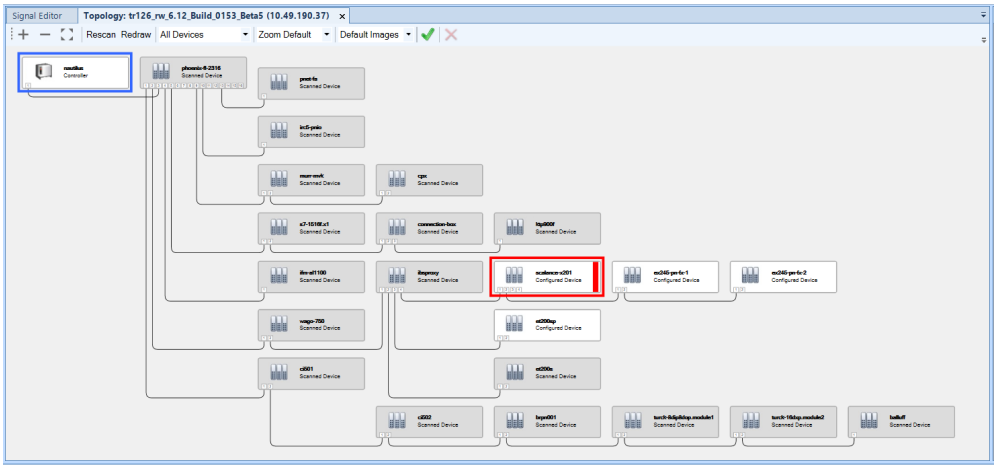
	Views	Description
A	**Topology**	Displays the device topology for the controller that is selected in the **Configuration** tab. **Note** Multiple topology views can be opened for different controllers simultaneously, but complete functionality is only guaranteed for a maximum of 4 views.
B	**Diagnostics**	Shows the PROFINET diagnostic data, network statistics and I&M0 read record data for the selected device.

4.7.2 Topology view

Topology overview

The topology view displays all PROFINET devices that are connected to the controller that is selected in the **Configuration** tab.



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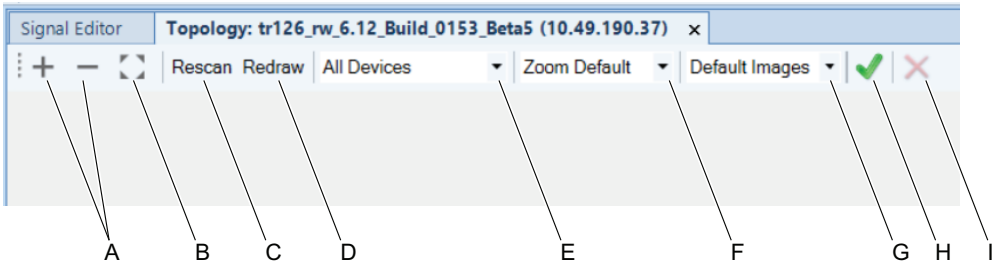
> **Note**
>
> Open the **Topology** view by right-clicking on **PROFINET** in the **Configuration** browser and selecting **Show Topology**.

Topology toolbar



xx2000002401

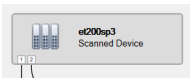
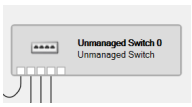
	Tool	Description
A	Zoom in/out	Click **+** and **-** or use the mouse wheel to zoom in/out, and the mouse to pan and scroll.
B	Fit to window	Click **Fit to window** to adjust the whole presented topology to fit into the window.
C	Rescan	Click **Rescan** to scan the topology. Any updates or changes in the configuration will be reflected after the rescanning.
D	Redraw	Click **Redraw** to redraw the topology with the original positions if devices or edges have been moved.
E	Filter	Use the filter to view **All Devices** or **Configured Devices**. If **Configured Devices** is selected, the controller and the configured devices will be shown in a matrix.

Continues on next page

4.7.2 Topology view
Continued

	Tool	Description
F	Zoom option	Use the zoom option to select **Zoom Default** or **Zoom Selected**. For option **Zoom Selected**, the selected node will always be zoomed in.
G	Image option	Use the image option to select if **Default Image** or **Device Image** should be used. If **Device Image** is selected, the images from the GSD files will be used for all available devices.
H	Acknowledge All Alarms	Use this function to acknowledge all alarms for all devices at once.
I	Cancel Topology Operation	Aborts the currently ongoing **Show Topology** or **Rescan** operation.

Topology symbols

Description	Symbol	Displayed information
Controller		Status indication for controller: *Connection*
		Status indication for controller: *No connection*
Configured Device		Status indication for configured device: *Connection*
		Status indication for configured device: *No connection*
		Status indication for configured device: *Warning* (not able to retrieve alarm)
Scanned Device		Status indication for scanned device: *Connection*
Unmanaged Switch		Status indication for unmanaged switch: *Connection*
PROFIsafe Device		Status indication for PROFIsafe device: *Connection*
		Status indication for PROFIsafe device: *No connection*
		Status indication for PROFIsafe device: *Warning* (not able to retrieve alarm)

4.7.3 Diagnostic data and network statistics

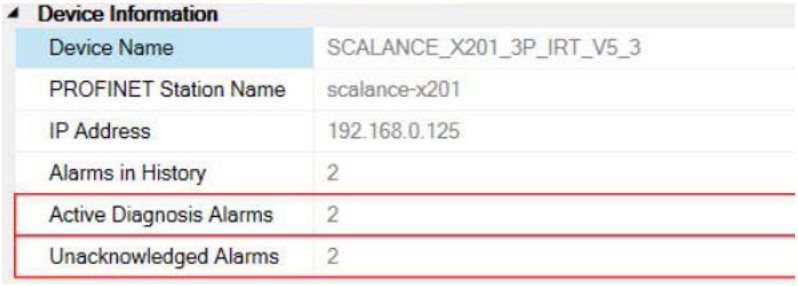
Overview

The **Diagnostics** view displays diagnostic data and statistics, such as information about PROFINET alarms, network statistics, record data and development properties.

> **Tip**
>
> Left clicking on a node in the **Topology** view brings up the **Diagnostics** tab view on the right side showing more detailed information and statistics.

Device Information

The **Device Information** section displays information regarding the device.



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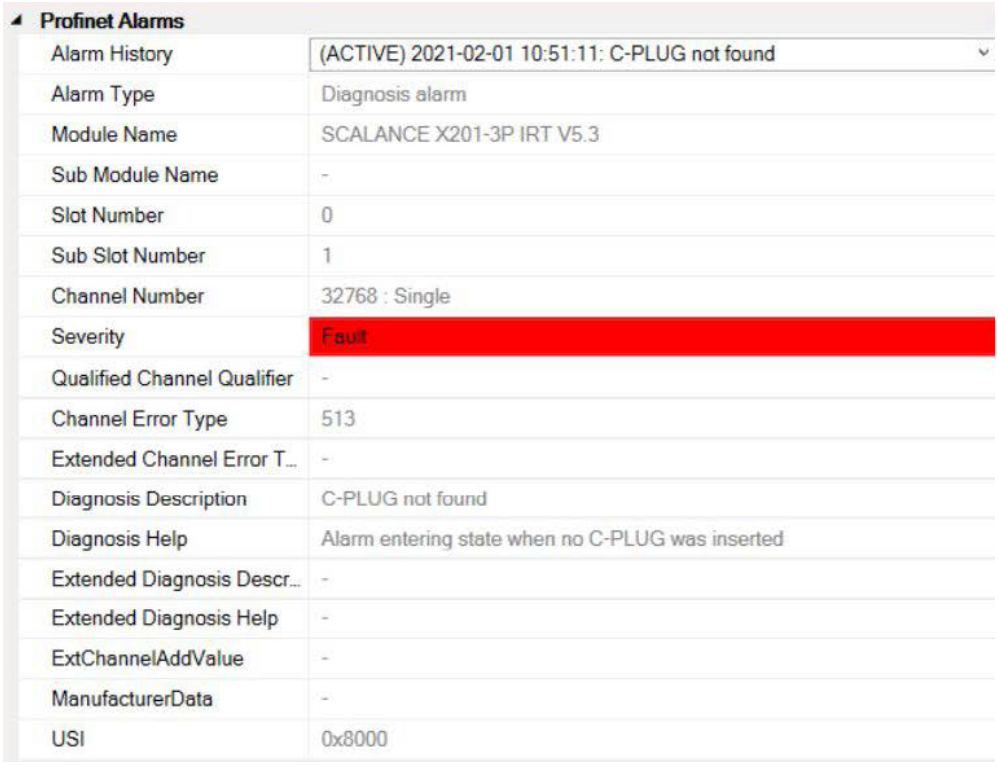
Field	Description
Device Name	Shows the device name.
PROFINET Station Name	Shows the PROFINET station name.
IP Address	Shows the PROFINET IP address.
Alarms in History	Shows the number of alarms in the alarm history list.
Active Diagnosis Alarms	Shows the number of active diagnosis alarms.
Unacknowledged Alarms	Shows the number of new incoming alarms that have not yet been acknowledged.

Continues on next page

Profinet Alarms

The **Profinet Alarms** section displays diagnostic parameters.



xx2000001042

Field	Description
Alarm History	Drop down list displaying a list of the alarms currently in the device object alarms buffer on the controller. Shows timestamp from controller and short alarm description. Data for the alarm that is selected will be displayed in the fields below. **Note** The drop down list has support for free text filtering.
Alarm Type	Shows the alarm type according to the PROFINET specification.
Module Name	Shows the module name according to the PROFINET specification. If no module name is found, the module identification number will be displayed.
Sub Module Name	Shows the sub module name according to the PROFINET specification. If no sub module name is found, the sub module identification number will be displayed.
Slot Number	Shows the slot number according to the PROFINET specification.
Sub Slot Number	Shows the sub slot number according to the PROFINET specification.
Channel Number	Shows the channel number id of the diagnosis source.

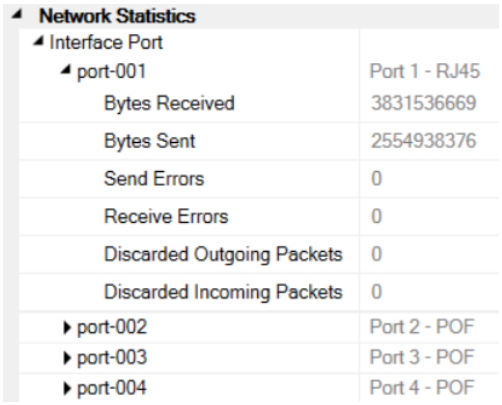
Continues on next page

Field	Description
Severity	Shows information about the diagnosis severity: • Fault • Maintenance required • Maintenance demanded • Severity specified within the Qualified Channel Qualifier
Qualified Channel Qualifier	Shows the severity according to an extended severity scheme. **Note** Only used for qualified channel diagnosis.
Channel Error Type	Shows the channel error type according to the PROFINET specification.
Extended Channel Error Type	Shows the extended channel error type according to the PROFINET specification.
Diagnosis Description	Shows the alarm description according to the PROFINET specification or the GSD file.
Diagnosis Help	Shows diagnosis information, or a description of the received alarm.
Extended Diagnosis Description	Shows extended diagnosis information for the received alarm.
Extended Diagnosis Help	Shows the extended diagnosis help text.
Manufacturer Data	Shows manufacturer specific diagnosis information.
USI	Shows the User Structure Identifier (USI) that identifies the alarm data structure.

For information about how to acknowledge the alarms, see *Acknowledging alarms on page 96*.

Network Statistics description

The **Network Statistics** section displays information regarding network statistics.



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Field	Description
Bytes Received	Shows the number of received bytes for the selected interface port. The total number of octets received on the interface.

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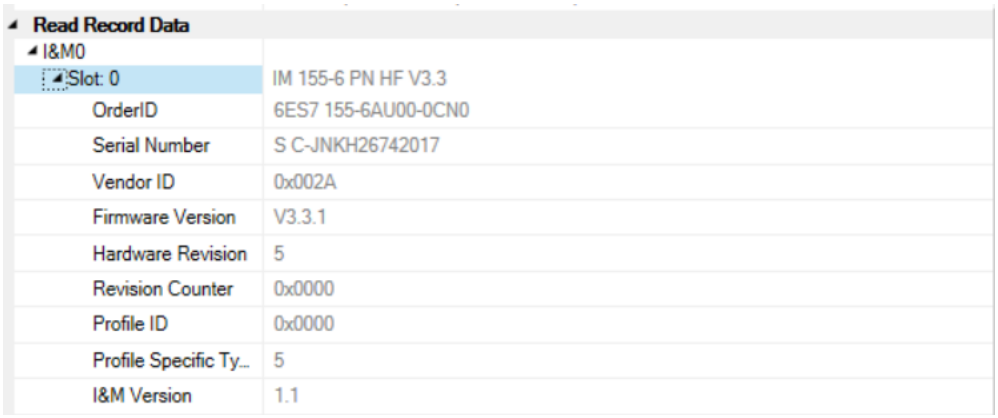
4.7.3 Diagnostic data and network statistics
Continued

Field	Description
Bytes Sent	Shows the number of sent bytes for the selected interface port. The total number of octets transmitted out of the interface.
Send Errors	Shows the number of outbound packets that could not be transmitted because of errors.
Receive Errors	Shows the number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.
Discarded outgoing packets	Shows the number of outbound packets that were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.
Discarded incoming packets	Shows the number of inbound packets that were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space.

Read Record Data, I&M0

The **Read Record Data** section displays record data for the slots.



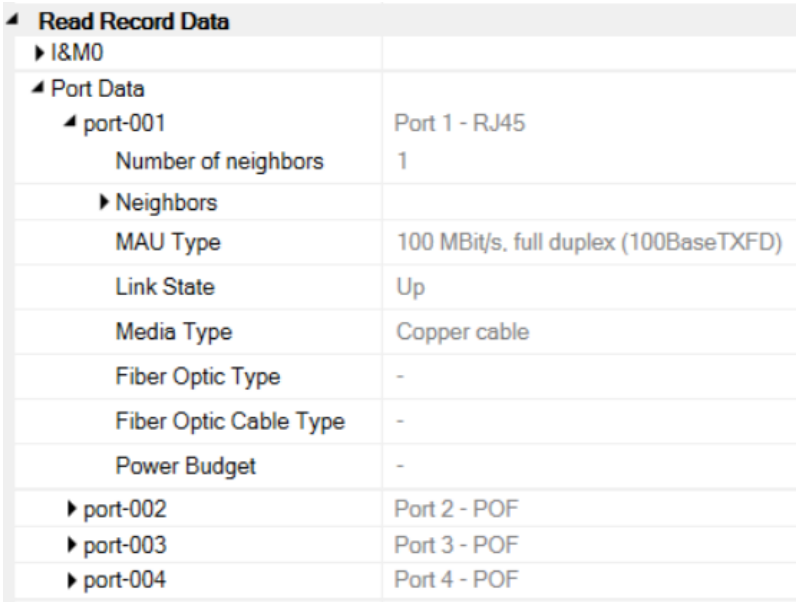
xx2000002417

Field	Description
I&M0	Shows a list of slots where modules are configured.
OrderID	Shows a vendor specific defined order identification.
Serial Number	Shows the product identification number.
Vendor ID	Shows the vendor identification number.
Firmware Version	Shows the software version.
Hardware Revision	Shows the hardware revision.
Revision Counter	Shows the revision counter.
Profile ID	Shows the profile identification number.
Profile Specific Type	Shows the profile specific type.
I&M Version	Shows the I&M version.

Continues on next page

Read Record Data, Port Data

The **Read Record Data, Port Data** section displays port data for the slots.



xx2100000286

Field	Description
Number of Neighbors	Shows the number of neighboring devices connection to this port.
Neighbors	Shows a list of all neighboring devices.
Remote Port	Shows the remote device connection port.
Station Name	Shows the remote device station name.
Peer MAC-Address	Shows the remote device MAC address.
Line Delay	Shows the measured time required for a signal to propagate from sender to receiver.
Cable Length	Shows the cable length based on line delay.
MAU Type	Shows the Medium Attachment Unit (MAU) type.
LinkState	Shows the connection state.
MediaType	Shows the connection media type.
Fiber Optic Type	Shows the fiber optic type. **Note** Only displayed for devices with fiber optic connections.
Fiber Optic Cable Type	Shows the fiber optic cable type. **Note** Only displayed for devices with fiber optic connections.

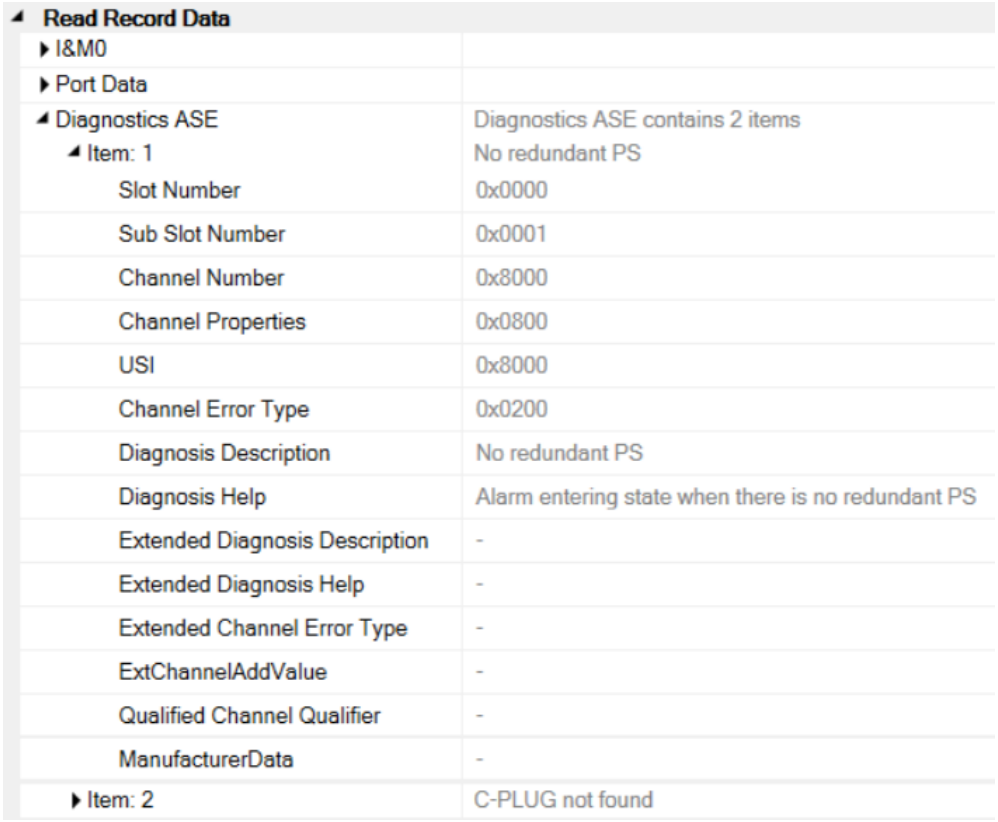
Continues on next page

4.7.3 Diagnostic data and network statistics
Continued

Field	Description
Power budget	Shows the difference between the output power of the transmitter and the input power requirements of the receiver in decibel [dB]. **Note** Only displayed for devices with fiber optic connections.

Read Record Data, Diagnostics ASE

The **Read Record Data, Diagnostics ASE** section displays diagnostic data for the items.



xx2100000287

Field	Description
Slot Number	Shows the slot number according to the PROFINET specification.
Sub Slot Number	Shows the sub slot number according to the PROFINET specification.
Channel Number	Shows the channel number id of the diagnosis source.
Channel Properties	Shows channel properties, such as severity and direction.
USI	Shows the User Structure Identifier (USI) that identifies the alarm data structure.
Channel Error Type	Shows the channel error type according to the PROFINET specification.
Diagnosis Description	Shows the alarm description according to the PROFINET specification or the GSD file.

Continues on next page

Field	Description
Diagnosis Help	Shows diagnosis information, or a description of the received alarm.
Extended Diagnosis Description	Shows extended diagnosis information for the received alarm.
Extended Diagnosis Help	Shows the extended diagnosis help text.
Extended Channel Error Type	Shows the extended channel error type according to the PROFINET specification.
ExtChannelAddValue	Shows the additional value that is defined for the extended channel diagnosis according to the PROFINET specification. **Note** The usage is defined for every **ChannelErrorType**/**ExtChannelErrorType** combination.
Qualified Channel Qualifier	Shows the severity according to an extended severity scheme. **Note** Only used for qualified channel diagnosis.
ManufacturerData	Shows manufacturer specific diagnosis information.

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5 Setting up your PROFINET system

5.1 Logging in with configuration grant

Log in with configuration grant

For configuration in I/O Engineering, the user grant **Modify configuration** is required. See *Operating manual - RobotStudio*, section *Managing user rights and write access on a controller*.

Log in as safety user

If working with safe I/O signals (option 997-2 PROFIsafe Controller/Device or 997-1 PROFIsafe Device), log in as a safety user (the user grant **Safety Services** is required). See *Operating manual - RobotStudio*, section *Managing the user authorization system*.

5.2 Starting I/O Engineering

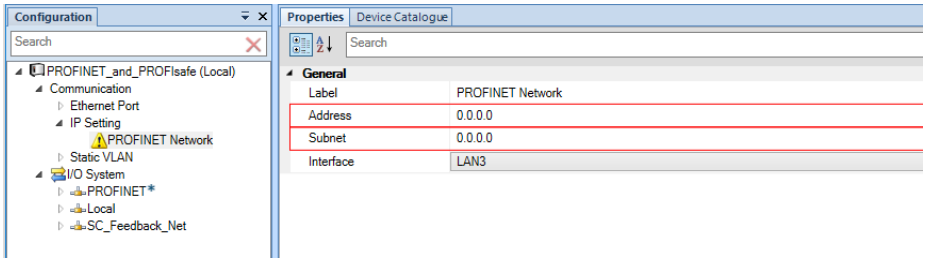
Start I/O Engineering

1 Start RobotStudio and connect to the robot system to configure.
2 In the ribbon of the **Controller** tab, select **I/O Engineering**.

5.3 Configuring the network settings

Configure IP settings

1 In the **Configuration** browser, select **PROFINET Network**.



xx1700002228

Note

The symbol indicates that the configuration of this network is incomplete. A red frame around a property field means that the property is not specified, or causes a validation error.

2 In the **Properties** browser, set the values for:

Parameter	Description
Address	Defines the IP address for the controller on the PROFINET network.
Subnet	Defines the subnet mask.
Interface	Defines where the network is connected to the IRC5 controller, see *Connections on page 19*.

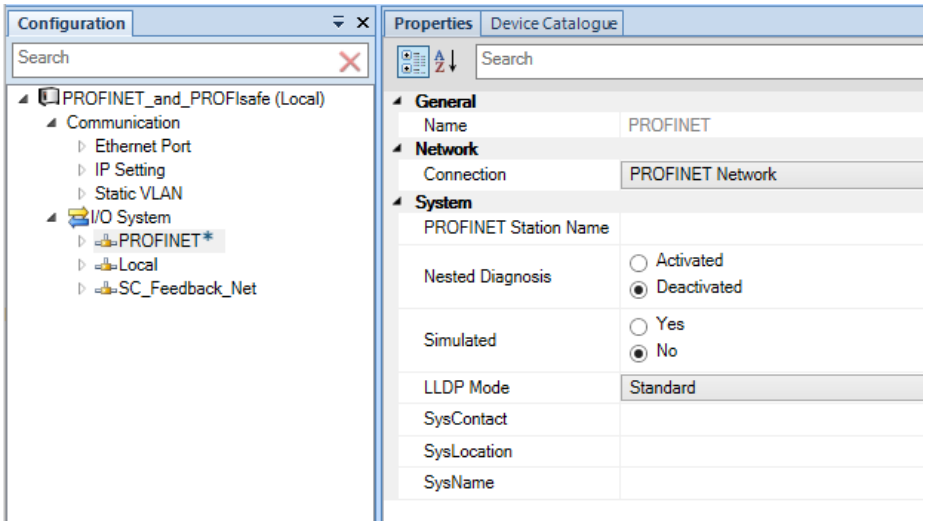
5.4 Setting the station name

Set station name

1 In the **Configuration** browser, select **PROFINET** (under I/O system).

2 In the **Properties** browser, specify **Station name**.

> **Note**
>
> This is the name of the internal device as it appears on the PROFINET network. For example, detectable by a PLC.



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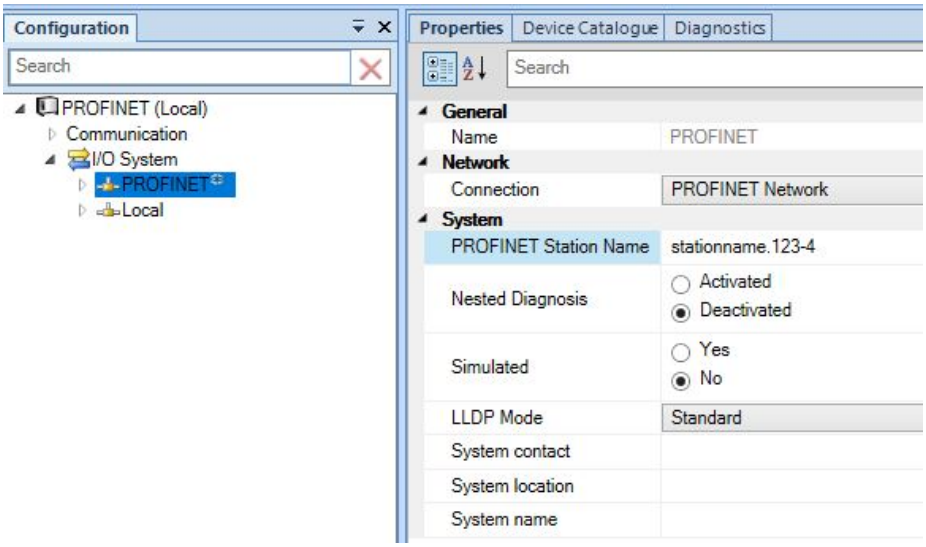
5.5 Configuring the PROFINET network properties

Configure the PROFINET network properties

1 In the **Configuration** browser, select **PROFINET** (under I/O system).

2 In the **Properties** browser, you can configure the following network properties:



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Parameter	Description
Simulated	Select **Yes** or **No**, indicating if the industrial network and all its connected I/O devices should be treated as simulated.
LLDP Mode	Select **Standard** or **Legacy**, indicating what Link Layer Discovery Protocol mode should be supported. **Note** The controller supports LLDP, but only on one port at a time. Any network connected to another port must have LLDP disabled (or use equipment not supporting LLDP). **Note** If one device in the configuration only supports legacy mode, all devices must run in legacy mode.

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6 Configuring the internal controller and external devices

Log in as safety user

If working with safe I/O signals (option 997-2 PROFIsafe Controller/Device or 997-1 PROFIsafe Device), log in as a safety user (the user grant **Safety Services** is required). See *Operating manual - RobotStudio*, section *Managing the user authorization system*.

Continues on next page

6.1 Configuration prerequisites

Prerequisites

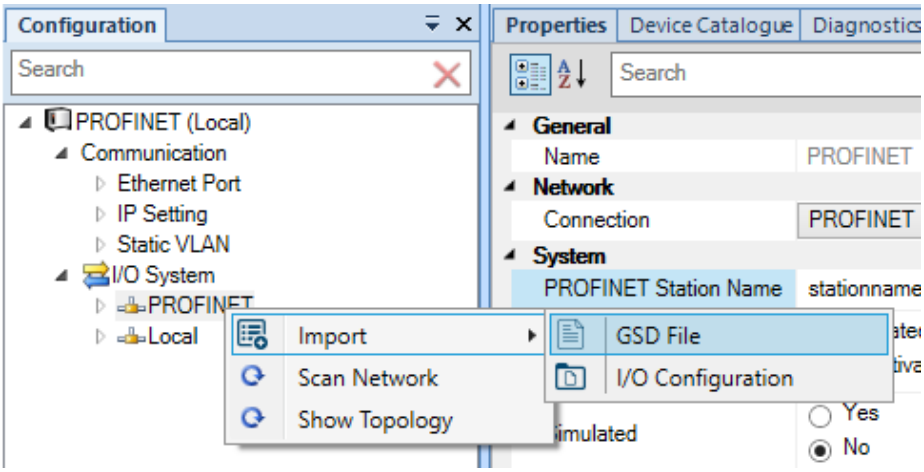
Before configuring the internal controller and external device, make sure to set up your system according to *Setting up your PROFINET system on page 53*.

6.2 Importing the GSD files

Import GSD files

A GSD file contains data about a device. It is necessary to add GSD files for all devices that should be added. It is also possible to add GSD files for any devices that may be added later.

1 In the **Configuration** browser, right-click on **PROFINET** (under I/O System), select **Import** and then **GSD File**.



xx1700002232

2 Select the GSD file for the I/O device to add to the network and click **Open**.

6.3 Scanning the network

Scan Editor options

Within the **Scan Editor**, you can right-click the device row to show a menu of options:

Option	Description
Add as	Select a device and add it to the configuration tree.
Blink	Blink with the device status LEDs in order to identify it.
Factory Reset	Reset the IP settings of the device to factory reset.

The following buttons are available in the **Scan Editor**:

Option	Description
Refresh	Lists all the devices that are reachable on this network.
Export	Exports a .csv file with all devices and the columns with data for each device.
Send Changes	To change a device's parameters, double-click on that device and enter the values that needs to be changed. Clicking **Send Changes** will save these changes in the device.

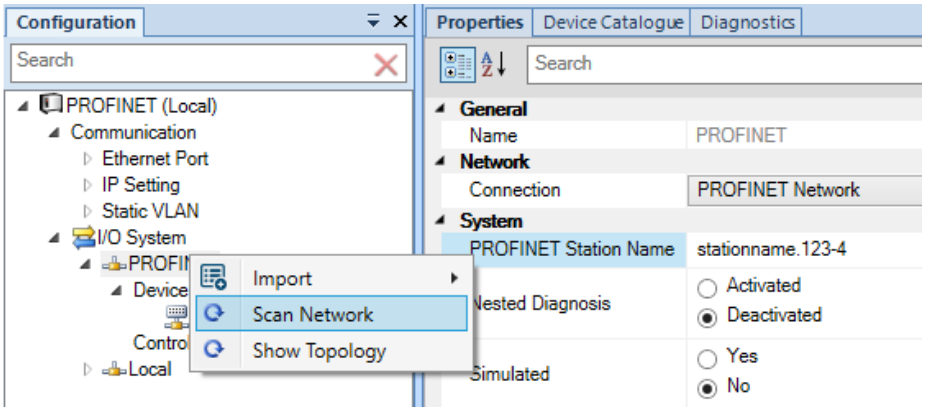
Scan the network

If the controller is connected to a physical PROFINET network with the I/O devices already in place, this describes how to scan the network to find available devices.

This scanning is performed on the network connected to the port selected in **Interface** in the network properties. See *Configuring the network settings on page 55*.

If you want to configure the network before the physical network is in place, follow the instruction *Manually adding devices to your network on page 64*.

1 In the **Configuration** browser, right-click on **PROFINET** (under I/O System) and select **Scan Network**.



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Tip

Use the **Blink** functionality to detect the correct unit when multiple devices are connected.

2 Add the detected device by right-clicking the device and selecting **Add as**. Select the configuration that corresponds to the physical device. The device is now displayed in the **Configuration** browser under the **PROFINET** / **Controller** node.

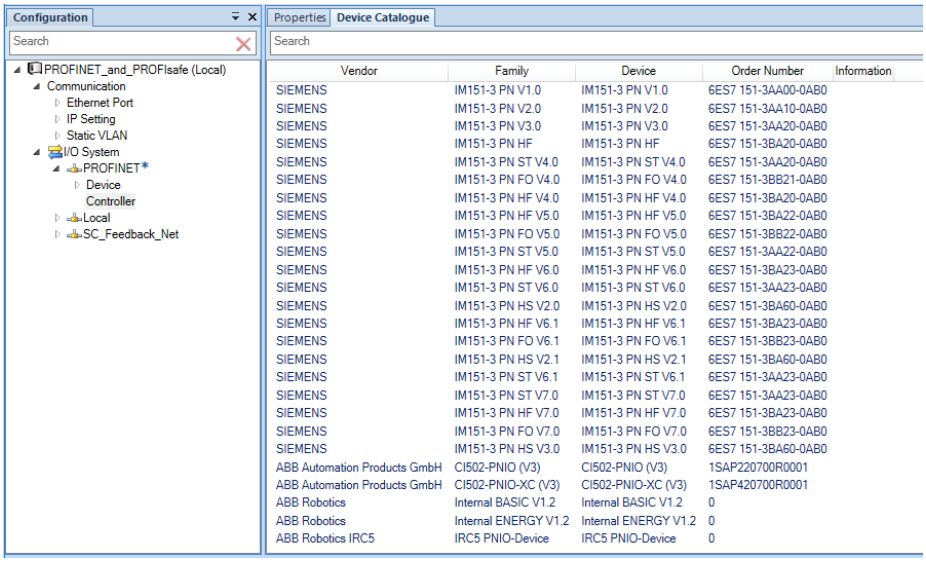
3 The properties for the device are added automatically in the **Properties** browser. Make sure these are correct.

6.4 Manually adding devices to your network

Manually add devices to your network

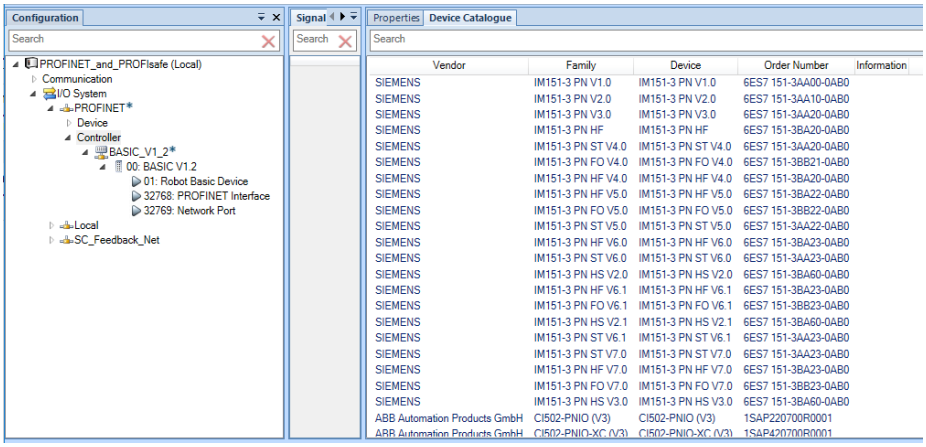
1 In the **Configuration** browser, expand **PROFINET** and select **Controller**.

2 Select the **Device Catalogue** tab to show a list of available devices.



xx1700002233

3 Double-click on a device in the list to add it to the controller.



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The added device is automatically selected. If the device contains an internal I/O module (physically included on the device), it is added as the first I/O module under the device.

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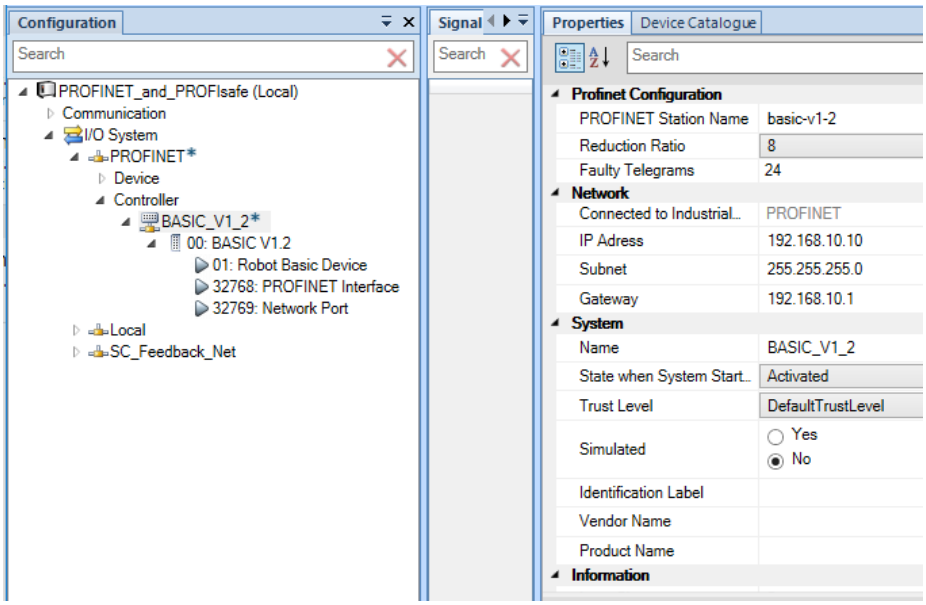
4 In the **Properties** tab, specify the properties for the device:



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Note

A red frame around a property field means that the property is not specified, or causes a validation error.

Parameter	Description	Allowed values
PROFINET Station name	This parameter is used to identify a PROFINET device on the network. The name must be unique on the network.	
Reduction Ratio	This parameter indicates how frequently the cyclic I/O messages should be exchanged. For example, a **Reduction Ratio** of 4 means that I/O data is sent every 4 ms.	Valid range is 1 to 512. Default value is 8.
Faulty Telegrams	The number of missed frames that lead to device time-out, for example the value 3 leads to a time-out for three missed frames in a row.	Valid range is 3 to 255. **Note** The maximum allowed value is defined by the **Data Hold Time** and the **Reduction Ratio** (**Data Hold Time** = **Faulty Telegrams** x **Reduction Ratio**), and the **Data Hold Time** can maximum be 1920 ms. Therefore the max number of **Faulty Telegrams** is calculated as, 1920 / **Reduction Ratio**.
IP Address	Defines the IP address for the external device on the PROFINET network.	

Continues on next page

Parameter	Description	Allowed values
Subnet	Defines the subnet mask for the external device.	
Gateway	Defines the gateway for the external device. **Note** If no IP address is defined for the gateway, the address defined in **IP Address** will be used as default.	
Name	The name of the external device is used as a reference to the specific external device when configuring the I/O signals and device commands.	A string with maximum 32 characters. The string must follow the RAPID rules described in *Technical reference manual - RAPID Overview*. The name must be unique among all named objects in the I/O system configuration. **Note** Names differing only in upper and lower case are considered to be equal.
State when System Startup	Defines the logical state that the robot system shall try to set for the external device at system startup. The available options are: • Establish communication (Activated) • Don't establish communication (Deactivated) • Restore the previously stored logical state for the external device at system shutdown (Last State)	
Trust Level	Defines the behavior for external devices at different execution situations in the robot controller. The **Trust Level** only affects physical devices controlled by an industrial network master in the robot controller. An internal slave device is not controlled by an industrial network master in the robot controller and is therefore not affected by this setting.	A string corresponding to the name of a defined Device Trust Level type. A string with maximum 32 characters. The string must follow the RAPID rules described in *Technical reference manual - RAPID Overview*. **Note** Names differing only in upper and lower case are considered to be equal.

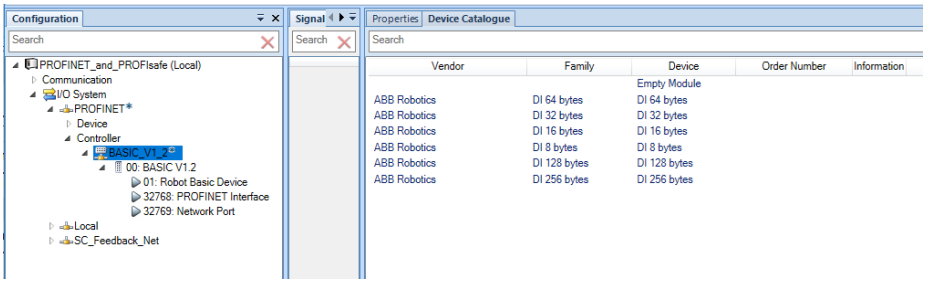
Continues on next page

Parameter	Description	Allowed values
Simulated	Select **Yes** or **No**, specifying if the industrial network and all its connected external devices should be treated as simulated.	
Identification Label	This parameter is an optional way to provide a label that will help the operator to identify the external device.	A string with maximum 80 characters.

6.5 Adding I/O modules

Add I/O modules

1 To add I/O modules, select the device and double-click on the I/O modules in the **Device Catalogue**.



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2 For safe I/O modules, select the I/O module in the **Configuration** browser and configure the properties:

Setting	Description
Source Address	The PROFIsafe address **Source Address** combined with the **Destination Address** uniquely identifies the module. Both addresses are decimal values.
Destination Address	The Destination Address should be the same as the address switch on the I/O module.
Timeout	A valid current safety message frame must arrive within the monitoring time.
SIL	Safety level (SIL1 - SIL3 or NoSIL).
Version	Parameters that are automatically retrieved from the GSD file for the device.
CRC Length	
BlockId	
I Par CRC	The *iParameter Cyclic Redundancy Check (iParCrc)* is a hexadecimal checksum which makes it possible to recognize and trace any modification of the device that was not authorized.
Vendor Tool (button)	Starts the vendor specific tool to calculate the iParCrc hexadecimal checksum. The vendor specific CRC-calculator tool is installed separately and can be started from the **Vendor tool** button if it supports the TCI-interface.

For each safe module, click the **Vendor Tool** button to open the iParCrc checksum tool and calculate the IParCrc value for the module. Copy the hexadecimal value into the Safe I/O Engineering Tool.

Note

Note that the IParCrc checksum must be recalculated if the module configuration is changed, that is, for example, channel configuration and delay filter.

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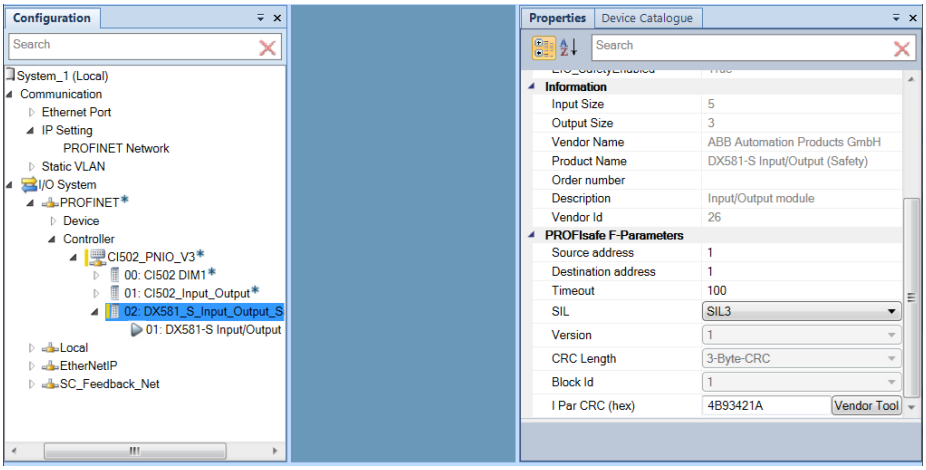

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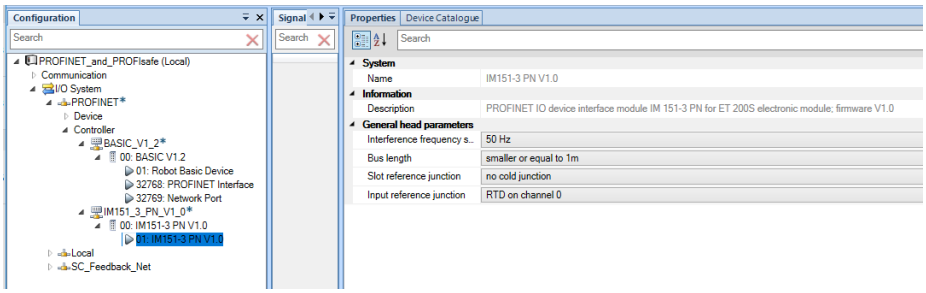
3 Select the module in the **Configuration** browser and configure the module settings in the **Properties** browser. These properties are extracted from the GSD file for the I/O module.



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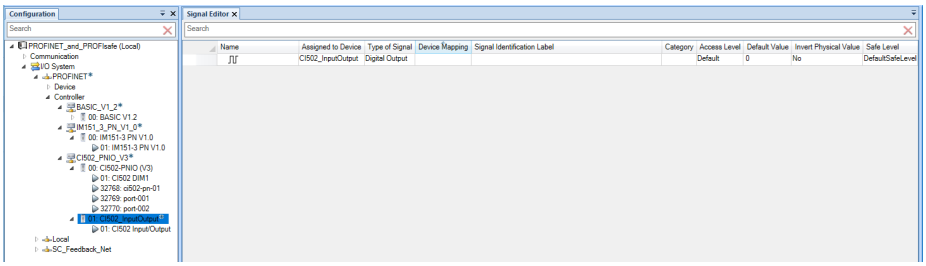
Note

Note that the channel configuration for all inputs and outputs may by default be disabled and may have to be activated before an input or output can be used on the specific channel.

6.6 Working with signals

Edit signals

1. In the ribbon, click **Request Write Access**.
2. Open the **Signal Editor**.
3. In the **Configuration** browser, select the I/O module for which signals are to be configured.
4. In column **Name**, define a name for each signal.



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6.7 Saving the configuration

Save configuration

When the configuration is finished, save the configuration to the robot controller.

If you do not already have write access, click **Request Write Access** in the ribbon to be allowed to configure the controller.

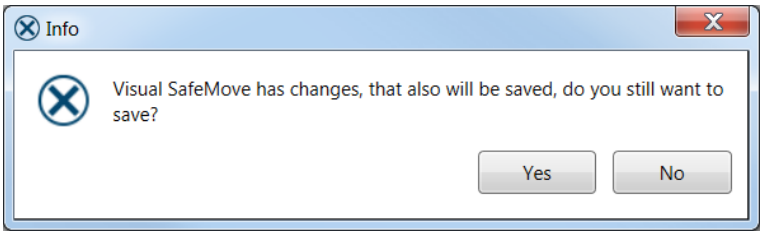
In the ribbon, click **Write config**. When asked if you would like to restart the controller, answer **Yes** for the new configuration to take effect.

> **Note**
>
> The communication to the safe modules is now established which may also be indicated by status diodes on the devices.

> **Note**
>
> If a signal is used by the safety module, for example in the combinatory logic, it cannot be renamed or removed from the signal editor. This is displayed with a shield symbol. For information about the safety module, see *Application manual - Functional safety and SafeMove2*.

Message when changing safe signals

If safe devices or signals have been added, removed or edited, these changes will be saved to the tool Visual SafeMove and affect the safety configuration. To confirm the changes in Visual SafeMove too, click **Yes**.



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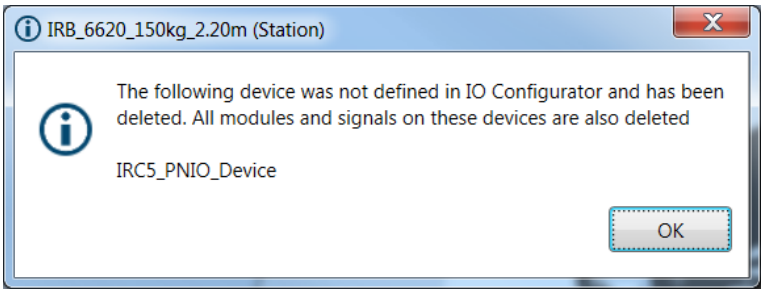
Message about removing device

If there is a safe I/O device defined in the Visual SafeMove memory and this device is not in the current configuration in IO Configurator, a message informs that the device is removed also in the Visual SafeMove memory. This can, for example, be the result of reading a configuration file to Visual SafeMove or be caused by a communication error when saving a configuration.



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6.8 Using Fast Device Startup

About Fast Device Startup

The Fast Device Startup functionality is used in tool changing applications to shorten the connection time between the PROFINET controller and an I/O device. To be able to use this functionality, the I/O device needs to support this functionality. All devices must support fast startup in the communication chain; devices such as switches or other intermediate hardware that could affect the PROFINET communication. For more information, see *Poor performance using fast startup on page 102*.

Some manufacturers also call this functionality Fast Start Up (FSU) or Prioritized Startup.

To activate Fast Device Startup against an I/O device, activate the system parameter *Fast Device Startup* and select the corresponding port(s) to be configured. See *Activating Fast Device Startup for external devices on page 76* and *Configuring port speed for external devices on page 77*.

Note

The system parameter *Event Msg Mode when System Startup* and the RAPID instruction `IOEventMessage` define if I/O event messages should be sent from the device. See *Technical reference manual - System parameters* and *Technical reference manual - RAPID Instructions, Functions and Data types*.

Note

The I/O device with FSU functionality is connected with the IRC5 controller. When the power of the I/O device is switched off and switched on again, the IRC5 controller establishes contact with the I/O device using the fast startup sequence.

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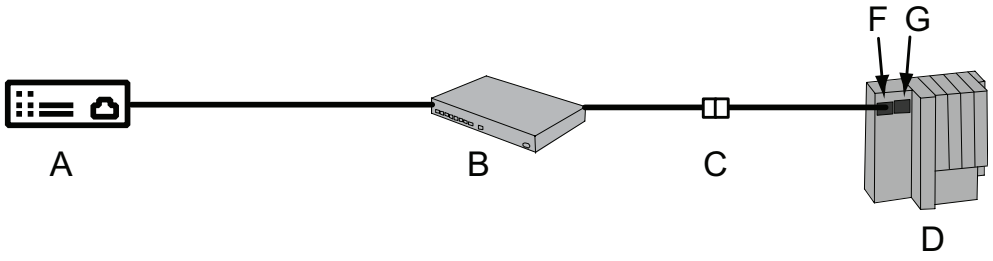
Three alternative connections

I/O device connected via a switch

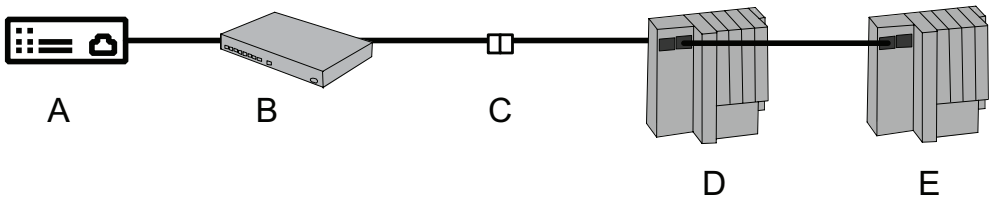


xx1100000093

A	IRC5 controller acting as PROFINET controller
B	Switch
C	Connection point
D	I/O device
F	Port 1 on the device
G	Port 2 on the device

In this alternative the PROFINET controller connects to the I/O device via a switch. Enable fast device startup and select 100 MBit (full duplex) on port 1. The port number is usually displayed upon the I/O device itself.

Two I/O devices connected in serial via a switch



xx1100000094

A	IRC5 controller acting as PROFINET controller
B	Switch
C	Connection point
D	I/O device
E	I/O device

In this alternative, both I/O devices are disconnected at the connection point. Both port 1 and port 2 on the first device (D) and port 1 on the second device (E) needs to be configured to support Fast Device Startup.

Continues on next page

I/O device connected without a switch

xx1100000095

A	IRC5 controller acting as PROFINET controller
C	Connection point
D	I/O device

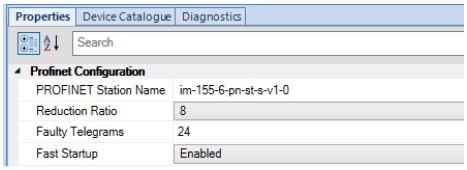
In this alternative there is a direct cable between the PROFINET controller and the I/O device. Enable fast device startup and select 100 MBit (full duplex) on the port. A crossed Ethernet cable needs to be used.

Continues on next page

6.8.1 Activating Fast Device Startup for external devices

The following steps describe how to activate Fast Device Startup for an external device:

1. In the **Configuration** browser, select the external device for which Fast Device Startup should be activated.
2. In the **Properties** browser, set **Fast Startup** to **Enabled**.

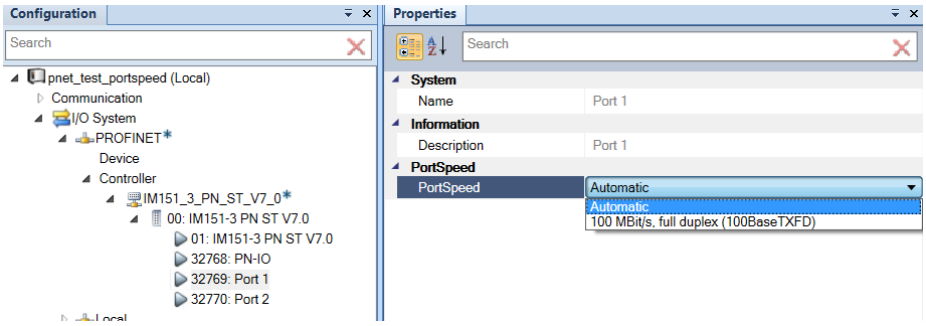


xx1800003277

6.8.2 Configuring port speed for external devices

The following steps describe how to configure port speed for an external device:

1. In the **Configuration** browser, select the external device. Select the port for which port speed should be configured.
2. In the **Properties** browser, select one of the available speed options in **PortSpeed**.



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Note

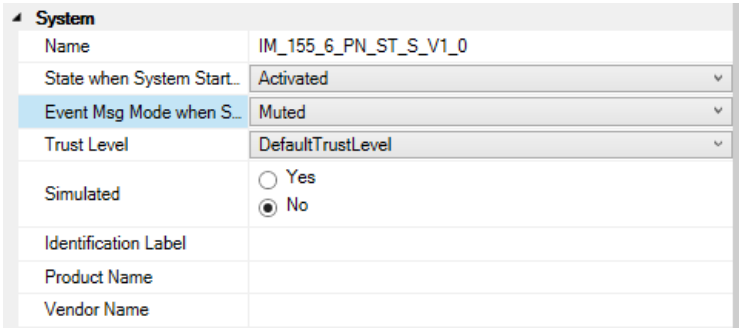
The GSD file defines what port speeds are allowed for the external device.

6.8.3 Configuring I/O event messages for external devices

The following steps describe how to configure the use of I/O Event Messages for an external device.

The parameter Event Msg Mode when System Startup, in combination with the RAPID instruction `IOEventMessage`, is used with tool changing applications and at fast startup.

1. In the **Configuration** browser, select the external device for which I/O Event Messages should be configured.
2. In the **Properties** browser, use parameter **Event Msg Mode when System Startup** to define if event messages should be sent from the I/O device:



xx2100000325

The following options are available:

Value	Description
Reported	Receive event messages from I/O device.
Muted	Do not receive event messages from I/O device.
Last	Restore the previously stored mode for the I/O device at system shutdown.

Note

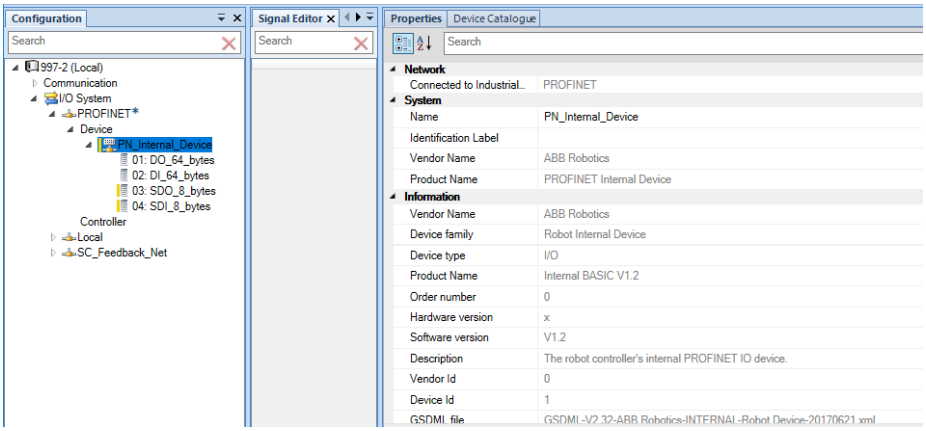
For information about how to use the instruction `IOEventMessage`, see program execution example in *Technical reference manual - RAPID Instructions, Functions and Data types*, section "IOEventMessage - Turn on/off I/O event messages from device".

7 Configuring the internal device

7.1 Configuring the internal device using I/O Engineering Tool (for option 997-2 PROFIsafe Controller/Device)

View the internal device

1 In the **Configuration** browser, expand **PROFINET**, then **Device**, and then **PN_Internal_Device**.



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The default internal device is of type *Internal Basic*. If you want to replace this, see *Change type of internal device on page 79*.

By default, **PN_Internal_Device** is configured with four I/O modules: **DO_64_bytes**, **DI_64_bytes**, **SDO_8_bytes**, and **SDI_8_bytes**. If you want to replace any of the I/O modules, see *Change I/O modules on page 80*.

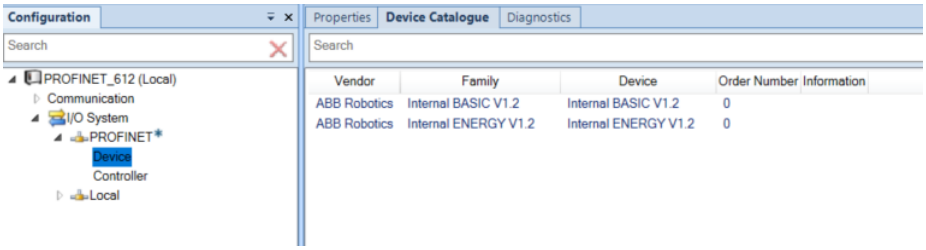
Change type of internal device

The default internal device is of type *Internal Basic*. The following steps describes how to replace this.

1 In the **Configuration** browser, right-click on **PN_Internal_Device** and select **Delete**.

2 In the **Configuration** browser, select **Device**.

3 Click on the tab **Device Catalogue** to show a list of available internal devices.



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7.1 Configuring the internal device using I/O Engineering Tool (for option 997-2 PROFIsafe Controller/Device)
Continued

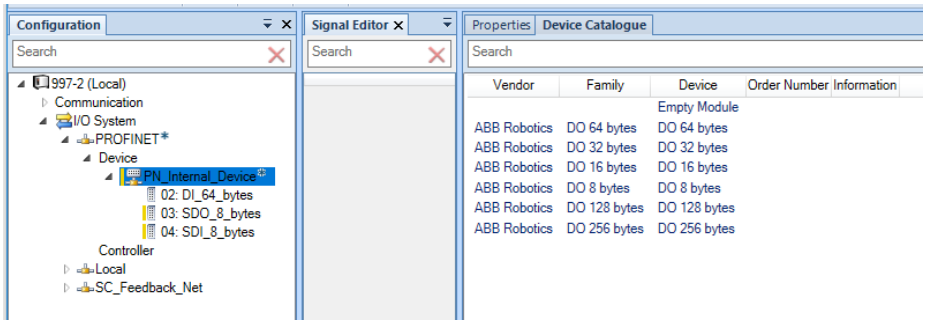
4 Double-click on the internal device type to be used for the configuration:

Type of internal device	Description
Internal BASIC V1.2	Device with basic functionality.
Internal ENERGY V1.2	Device with basic and PROFIenergy functionality.
DSQC688	Device with a PROFINET Anybus-adapter. **Note** Only applicable for option 840-3 PROFINET Anybus Device

Change I/O modules

By default, there are four I/O modules. The following steps describe how to replace an I/O module:

1 In the **Configuration** browser, right-click on the I/O module and select **Delete**.
2 In the **Configuration** browser, select **PN_Internal_Device**.
3 Click on the tab **Device Catalogue** to show a list of available I/O modules.



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4 Double-click on the I/O module you want.

Note

There are a set of rules for which type of I/O modules that are allowed for each slot. Only the the modules presented in the Device Catalogue are allowed to select for that slot.

Note

All unconfigured slots are configured in numerical order. For example, if the modules are deleted from slot 1 and 2, you may have to select a DO in slot 1 before being able to select a DI in slot 2.

Continues on next page

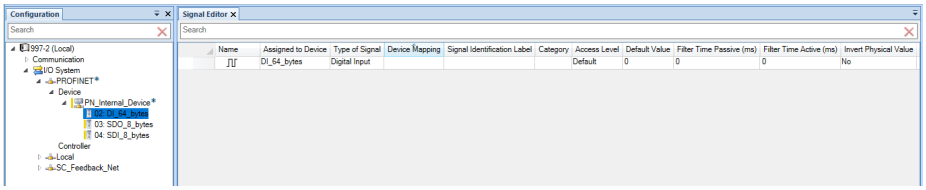
7.1 Configuring the internal device using I/O Engineering Tool (for option 997-2 PROFIsafe Controller/Device)

Continued

> **Note**
>
> A yellow marking beside the module symbol indicates a safe I/O module. If any safe module is included in the internal device, a yellow marker is shown by the internal device as well.

Edit signals

1. In the ribbon, click on **Signal Editor**.
2. In the **Configuration** browser, select an I/O module to configure signals for.
3. In the column **Name**, type the name each signal should have.



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Save configuration

When the configuration is finished, save the configuration to the robot controller.

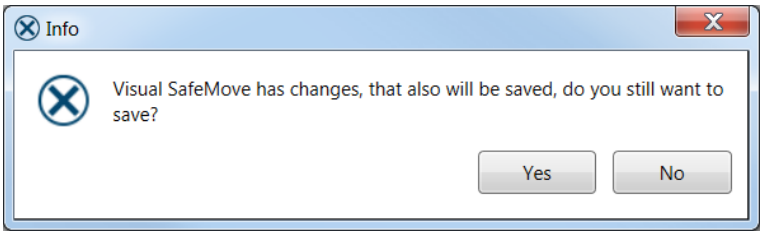
If you do not already have write access, click **Request Write Access** in the ribbon to be allowed to configure the controller.

In the ribbon, click **Write config**. When asked if you would like to restart the controller, answer **Yes** for the new configuration to take effect.

> **Note**
>
> If a signal is used by the safety module, for example in the combinatory logic, it cannot be renamed or removed from the signal editor. This is displayed with a shield symbol.

Message when changing safe signals

If safe devices or signals have been added, removed or edited, these changes will be saved to the tool Visual SafeMove and affect the safety configuration. To confirm the changes in Visual SafeMove too, click **Yes**.



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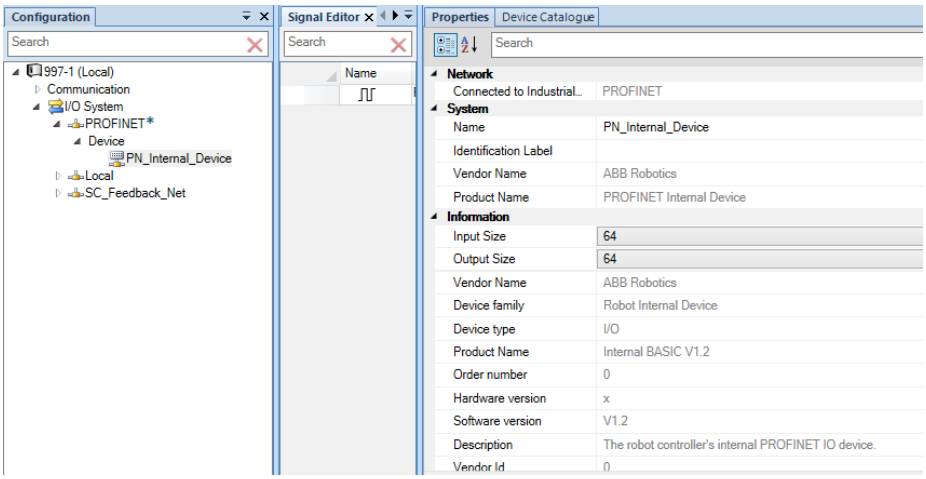
7.2 Configuring the internal device using I/O Engineering Tool (for option 997-1 PROFIsafe Device)

View the internal device

1 In the **Configuration** browser, expand **PROFINET**, then **Device**, and then **PN_Internal_Device**.



xx1800000056

The default internal device is of type *Internal Basic*. If you want to replace this, see *Change type of internal device on page 82*.

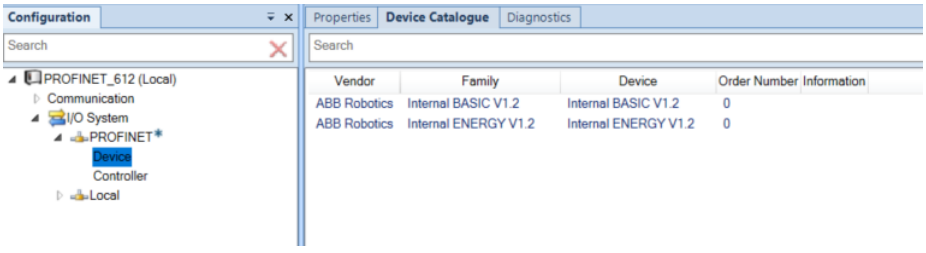
Change type of internal device

The default internal device is of type *Internal Basic*. The following steps describes how to replace this.

1 In the **Configuration** browser, right-click on **PN_Internal_Device** and select **Delete**.

2 In the **Configuration** browser, select **Device**.

3 Click on the tab **Device Catalogue** to show a list of available internal devices.



xx2100002141

4 Double-click on the internal device type to be used for the configuration:

Type of internal device	Description
Internal BASIC V1.2	Device with basic functionality.
Internal ENERGY V1.2	Device with basic and PROFIenergy functionality.

Continues on next page

Type of internal device	Description
DSQC688	Device with a PROFINET Anybus-adapter.  **Note** Only applicable for option 840-3 PROFINET Anybus Device

Edit signals

Signals are edited in Visual SafeMove, see *Application manual - Functional safety and SafeMove2*.

Save configuration

When the configuration is finished, save the configuration to the robot controller.

If you do not already have write access, click **Request Write Access** in the ribbon to be allowed to configure the controller.

In the ribbon, click **Write config**. When asked if you would like to restart the controller, answer **Yes** for the new configuration to take effect.

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8 Configuring in commissioning mode

Overview and prerequisites

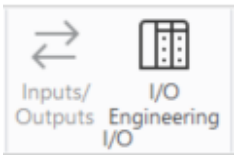
Using the I/O Project functionality, I/O configuration can be made *without* a controller connected. The configuration can be prepared offline and later be written to a selected controller. It is also possible to read/load an existing configuration from a controller to an I/O project.

> **Note**
>
> The commissioning mode is only accessible if *no* controller is connected to the system.

Starting the commissioning mode

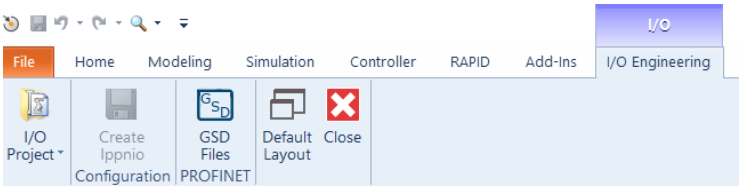
1 Start RobotStudio without connecting to a controller.

2 In the ribbon of the **Controller** tab, select **I/O Engineering**.



xx2200000715

3 The **I/O Engineering** tab is displayed:



xx2000002440

- For new projects, select **I/O Project** and then **New Project**.
- For existing projects, select **I/O Project** and then **Open Project**.

See *Working with I/O projects on page 86* for more information.

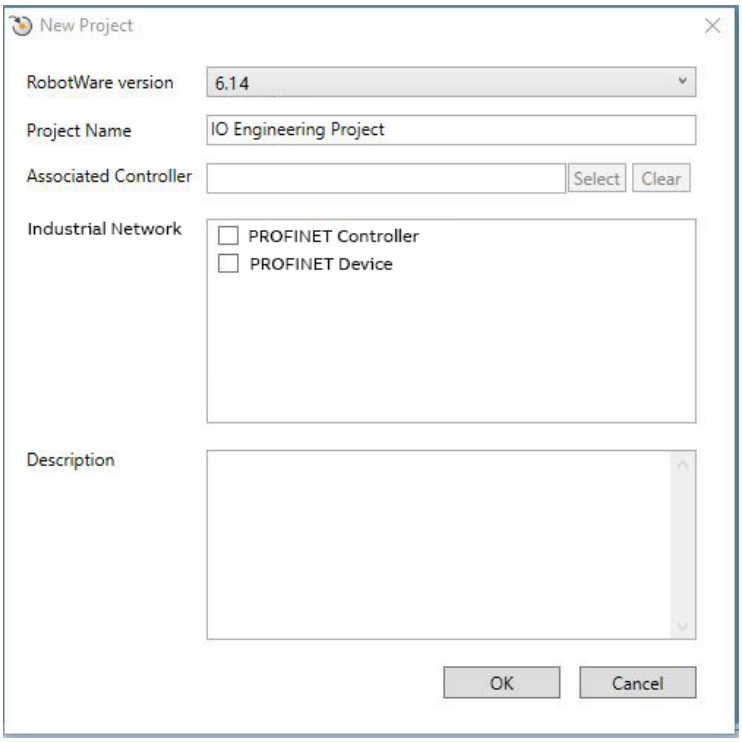
Continues on next page

8.1 Working with I/O projects

8.1.1 Creating a new project

Creating a new project

1 Select **I/O Project** and then **New Project**. The **New Project** window is displayed:



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Complete the following fields and select **OK**:

Field	Description
RobotWare version	Select the RobotWare version to be used for the project.
Project Name	Enter a unique project name.
Associated Controller	Select a controller to be associated with the project. If defined, the associated controller will automatically be selected in certain functions such as writing the configuration to a controller or scanning for devices that are connected to the controller.
Industrial Network	Select the industrial networks to be used for the project.
Description	If applicable, enter a project description.

2 A new project has now been created.

To configure the project, see the Application manual for the respective industrial network.

To save the project, see *Saving an I/O project on page 87*.

8.1.2 Saving an I/O project

Save the I/O project

> **Note**
>
> The I/O Project cannot be saved if errors are detected (see *Symbols on page 37*). It is, however, possible to save projects with warnings.

1. In the **I/O Project** menu, select one of the following:
   - Select **Save Project** to update the last saved project version.
   - Select **Save Project As** to save the project file with a new project name.
2. When the configuration has been completed and the project file is saved, continue by writing the configuration to the controller. See *Writing an I/O configuration to the controller on page 88*.

8.1.3 Writing an I/O configuration to the controller

Prerequisites

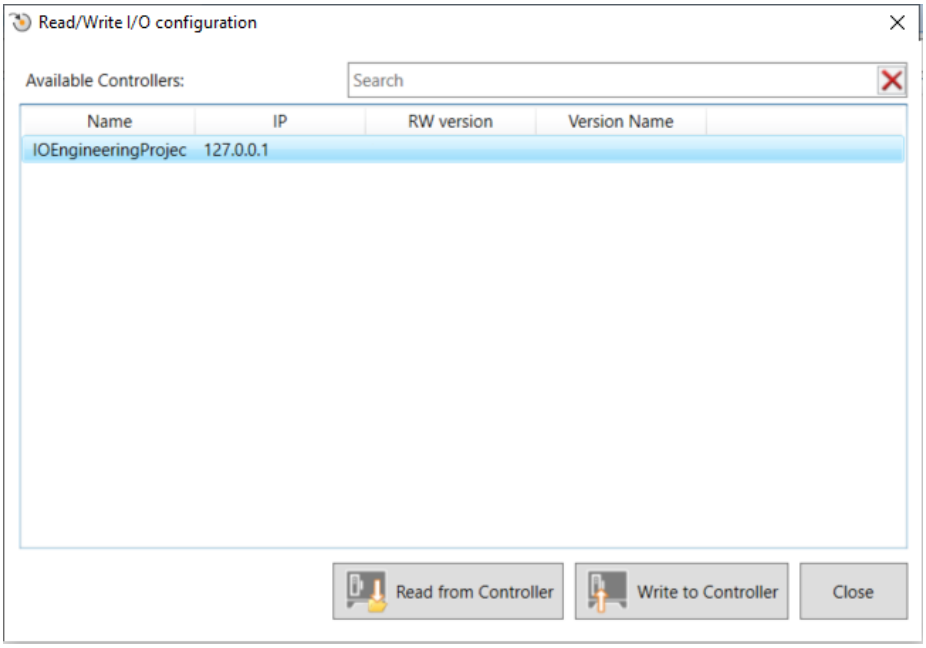
- An added robot controller in the **Controller** tab in RobotStudio.
- The I/O project must be saved.
- Request write access to the controller.

> **Note**
>
> I/O Engineering automatically requests write access when a configuration is written to the controller. If write access is not granted, the configuration will not be written to the controller.

- The correct options must be installed in the controller.
- The validation error on each element in the **Configuration** browser must be corrected.

Write the I/O configuration to the controller

1 In the **I/O Project** menu, select **Read/Write Configuration** to write the configuration to a controller. The **Read/Write I/O configuration** window is displayed:



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2 Select a controller and click **Write to Controller** to write the current project to the controller.

> **Note**
>
> If an **Associated Controller** is defined for the I/O project, this controller will automatically be selected when the **Read**/**Write** function is selected.

3 The project configuration has now been written to the selected controller.

8.1.4 Reading an I/O configuration to a project file

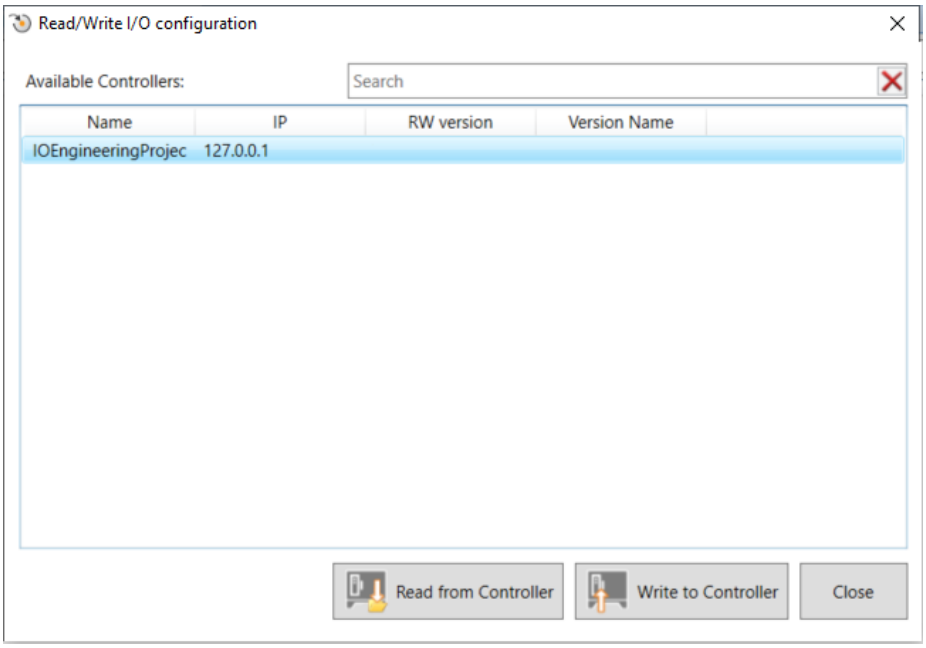
Prerequisites

An added robot controller in the **Controller** tab in RobotStudio.

> **Note**
>
> This functionality resembles saving the configuration parameters to an *EIO.cfg* file from the **Controller** tab in RobotStudio. However, using the I/O Engineering read function, the entire project including all the configuration data needed for the I/O configuration will be saved, not just the cfg file.

Read the I/O configuration to the project file

1 In the **I/O Project** menu, select **Read/Write Configuration**. The **Read/Write I/O configuration** window is displayed:



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2 Select a controller and click **Read from Controller** to read the I/O configuration from the selected controller and save to a project file.

3 In the **Save As** dialog, select the project file to which the configuration should be written, or create a new I/O project name. Click **Save**. The controller I/O configuration has now been written to the selected project.

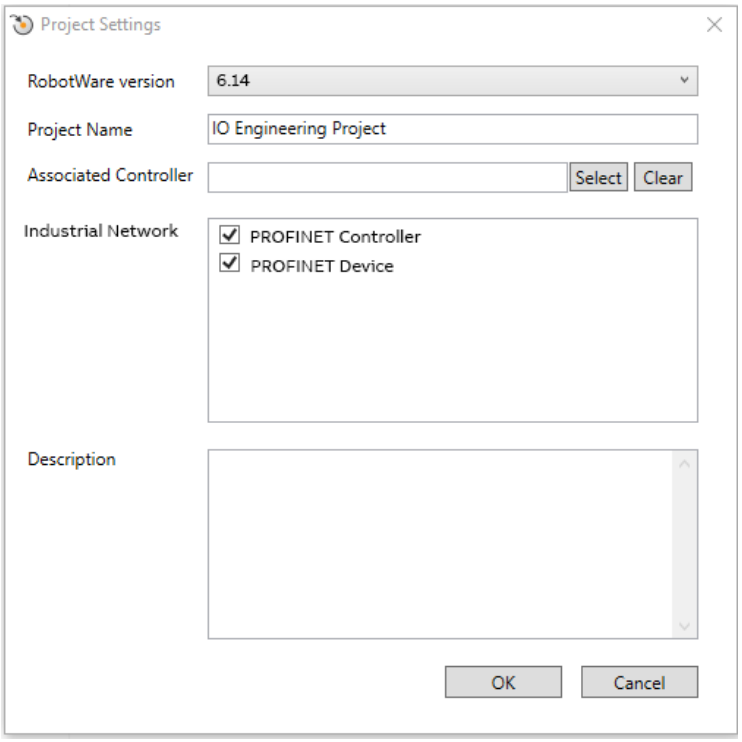
8.1.5 Changing RobotWare version for an I/O project file

Prerequisites

The robot controller and the I/O project must have the same RobotWare version. If this is not the case, the I/O project must be updated to the same version so that it is possible to write the I/O configuration to the robot controller.

Change RobotWare version for a project file

1 In the **I/O Project** menu, select **Project Settings**. The **Project Settings** window is displayed:



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2 Select a new **RobotWare version** to used for the project file and click **OK**.

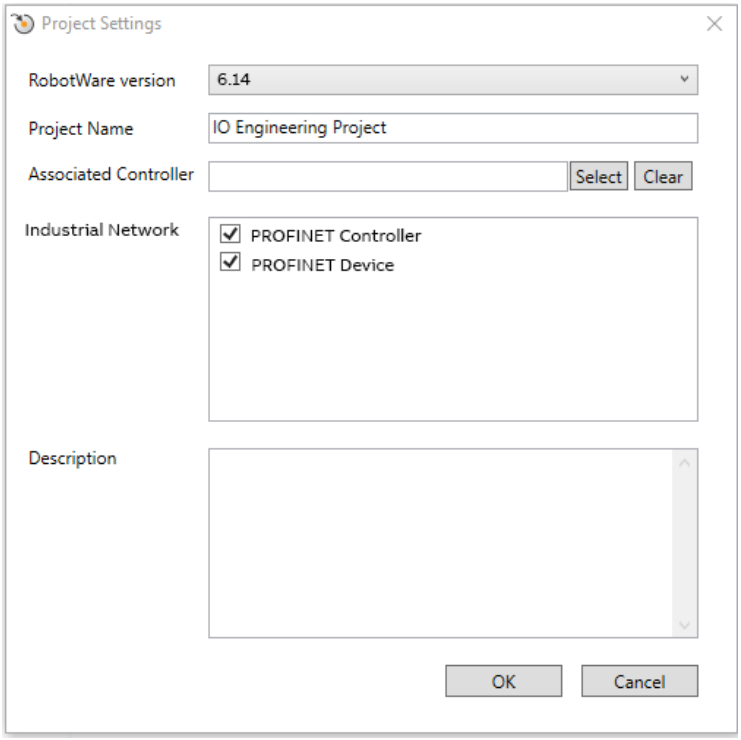
3 Select **I/O Project**/**Save Project** to save the changes.

8.1.6 Defining an associated controller to an I/O project

> **Note**
>
> If an **Associated Controller** is defined for the I/O project, this controller will automatically be selected when the **Read/Write Configuration** function is selected.

Associate a controller to a project file

1. Open the I/O project to which a controller should be associated.
2. In the **I/O Project** menu, select **Project Settings**. The **Project Settings** window is displayed:



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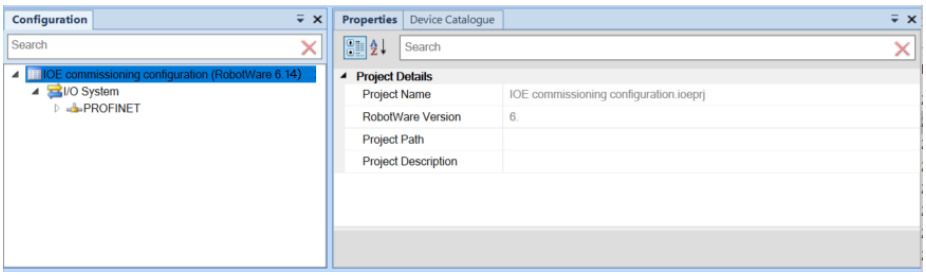
   Click **Select** to browse for a controller to be associated with the project, and then click **OK**.
3. In the **Save As** dialog, select the project file to which the configuration should be written, or create a new I/O project name. Click **Save**. The controller I/O configuration has now been written to the selected project.
4. Select **I/O Project/Save Project** to save the changes.

Configuring projects

1. Select **I/O Project** and then **Open Project** and select the project to be configured.

2 The **Configuration**, **Properties** and **Device catalogue** windows are displayed:



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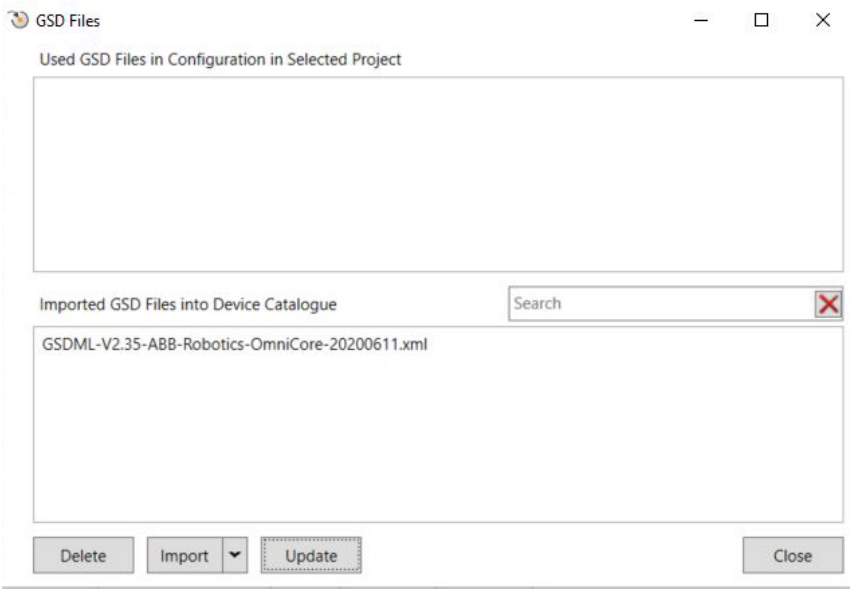
From here, configuration can be made in the same way as when a controller is connected to the system. The following options are available:

- Configuring the IP settings, see *Configuring the network settings on page 55*.
- Adding devices from the **Device catalogue** and configuring device parameters, see *Manually adding devices to your network on page 64*.
- Add I/O modules, see *Adding I/O modules on page 68*.
- Importing GSD files. Select **GSD Files** to import one or several GSD files.

  The **GSD Files** window displays all used and/or imported GSD files. Select **Import** to import a new GSD file, or **Delete** to remove a file.



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Note

GSD files that are imported in commissioning mode are persistent.

3 Save the project. See *Saving an I/O project on page 87*.

4 When the configuration has been completed and the project file is saved, continue by creating the PROFINET configuration file *ippnio.xml*. See *Create PROFINET configuration file on page 94*.

Create PROFINET configuration file

The PROFINET configuration file, *ippnio.xml*, is used when the configuration project is imported into a robot controller.

Note

The file is already included in the configuration project, but using this function, the file can be exported.

1 In the **I/O Engineering** tab, click **Create Ippnio** to select a location for the *ippnio.xml* file, and then click **Save**.

The file is now stored locally in the selected PC location.

2 The *ippnio.xml* can be loaded into the controller through RobotStudio or other FTP tools. To load the *ippnio.xml* file through RobotStudio, use the **File Transfer** functionality in the **Controller** tab. When the file has been transferred to the controller, it must be placed under *HOME* in the **Configuration** window.

9 Working with I/O Diagnostics

9.1 Requirements and limitations

Limitations

- There is limited support for unmanaged switches. It is recommended to use network switches that support LLDP (PROFINET Switches).
- The topology view handles networks with up to 80 devices. If the number of devices in the network exceeds 80, only configured devices will be shown and the topology might not be complete.
- Some devices do not report network statistics data using read recording. For these devices, no information will be displayed in field **Network interface**.

9.2 Acknowledging alarms

Overview

When technical problems occur, such as lost connections, the I/O Diagnostics system triggers alarms for the devices.

> **Note**
>
> The alarms are displayed in the **Topology** and **Diagnostics** views. For more information about the interface, see *I/O Diagnostics interface on page 42*.

New and active alarms

Alarms are classified as either *New/Unacknowledged* or *Active*:

- *New/Unacknowledged Alarms* are all alarms that have not yet been acknowledged. These are indicated with a *blinking* red frame.

  When *New Alarms* have been acknowledged, the blinking will stop.
- *Active Alarms* are diagnostics that are currently found in the Diagnostics ASE on the device. These are indicated with a *steady* red indication to the right.

  The red indication is displayed until all *Active Alarms* are removed from the device.

> **Note**
>
> When RobotStudio is started, all active history will be displayed as *New/Unacknowledged Alarms* for all configured devices. To remove the blinking indications, read and acknowledge all alarms.

> **Note**
>
> When the controller is restarted, all alarms will be cleared in the controller, but the **Alarm History** list will remain in the **Diagnostics** view.

Alarm indications

The alarms for the devices are indicated in the system in the following ways:

Alarm indication	I/O Diagnostics view	Description
	Device in **Topology** view	Unacknowledged alarm, blinking red frame
	Device in **Topology** view	Active alarm, red indication
	Device tool tip	

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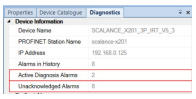
Alarm indication	I/O Diagnostics view	Description
	**Diagnostics** view	

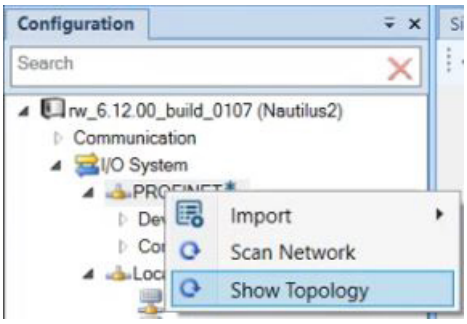
Closing active alarms

The active alarms are indicated in the system until the reported problem is solved. When the problem is solved, the alarm will be removed from the **Alarm History** list, and the red indication will no longer be visible in the **Topology** view.

The alarm will get the status *Disappeared*.

Acknowledge new alarms for a selected device

1. In the ribbon of the **Controller** tab, click **Configuration** and select **I/O Engineering Tool**.
2. In the **Configuration** browser, right-click on **PROFINET** (under I/O system) and select **Show Topology**.



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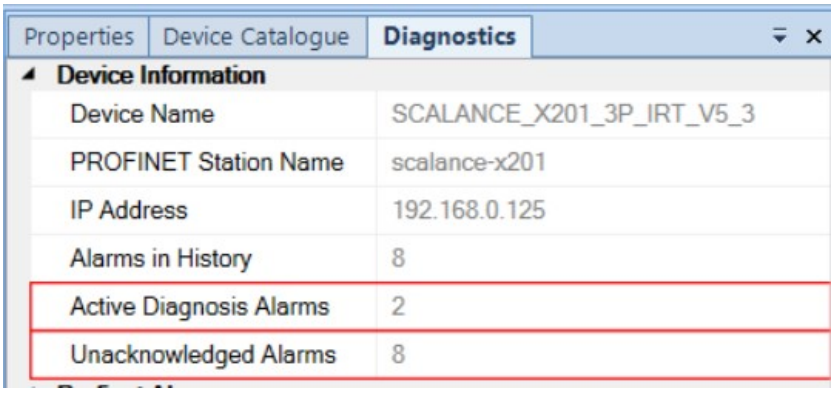
3. In the **Topology** view, select the device with the alarms that should be acknowledged.

   Device Information in the **Diagnostics** tab displays the number of unacknowledged alarms for the selected device:



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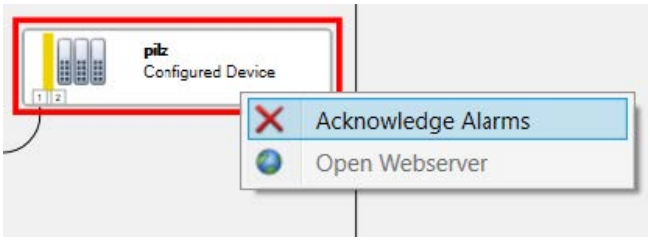
> **Tip**
>
> The **Alarm History** drop down list in section **Profinet Alarms** displays the time stamp and description of the current alarms on the controller. Use the free text search to find, and view data for, a specific alarm.

4 In the **Topology** view, right-click the device and select **Acknowledge Alarms**.



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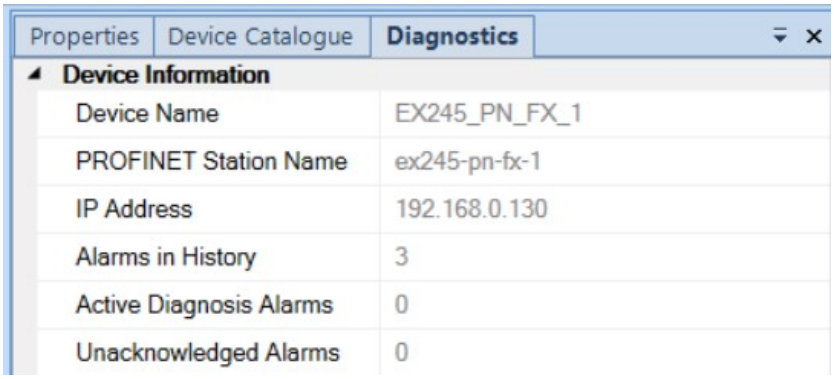
5 All alarms for the selected device have now been acknowledged.
The **Device Information** in the **Diagnostics** tab is updated:



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Acknowledge new alarms for all devices

Using this function, you can acknowledge all new alarms for all devices at once.

1 In the ribbon of the **Controller** tab, click **Configuration** and select **I/O Engineering Tool**.

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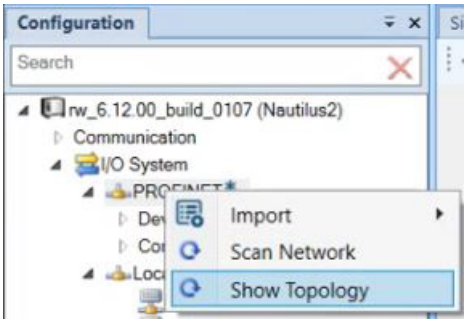
2 In the **Configuration** browser, right-click on **PROFINET** (under I/O system) and select **Show Topology**.



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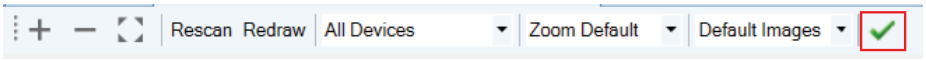
3 In the **Topology** view, select **Acknowledge All Alarms**:



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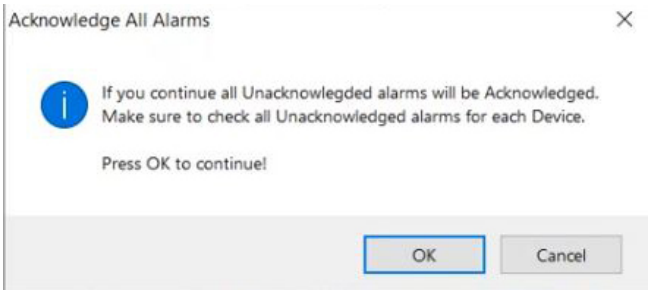
4 The following prompt is displayed:



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5 Select **OK** to acknowledge all alarms for all devices.

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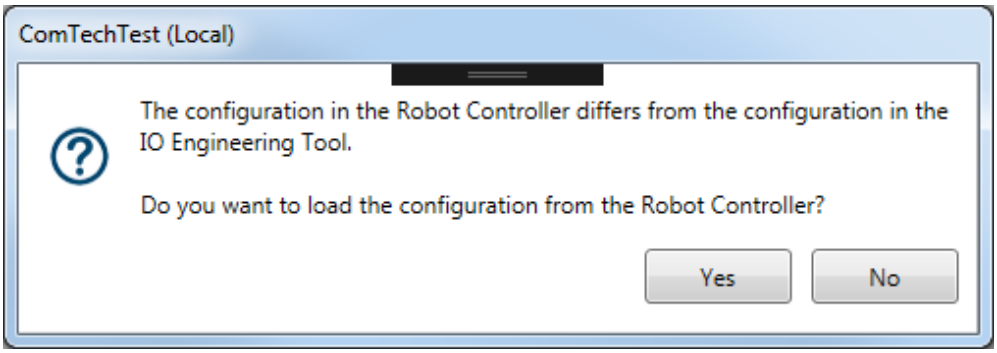
10 Troubleshooting

10.1 Troubleshooting scenarios

Inconsistency between IO Configurator and system parameters

The configuration of the IO Configurator is stored in a memory, that can be written to the robot controller. If the system parameters are updated on the robot controller in any other way while IO Configurator is running (or in some cases of failure in communication), the configuration memory of the IO Configurator will be inconsistent with the robot controller. In this case, the following message is shown.



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Take Controller Configuration will read the system parameters from the robot controller to the IO Configurator memory. This means that any configurations made in IO Configurator but not yet written to the robot controller will be lost.

Keep local I/O Configuration will not apply any changes to the IO Configurator memory. This means that when the configuration is written to the robot controller, the changes made in another tool will be overwritten.

Note

A similar message can appear in Visual SafeMove, see *Application manual - Functional safety and SafeMove2*. Please note that any changes to the safety configuration requires a new validation process.

Problem assigning IP address or station name

If an external PROFINET configuration tool is used to set IP address or station name for a controller or device, it may not be possible to perform that operation. In such a case, make sure that the device or PLC is not involved in any I/O data exchange. If, for example, a device or PLC is exchanging data with another device or PLC, it is not possible to change the IP address or station name of those devices.

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Unidentified devices

Devices can be identified using RobotStudio, or other PROFINET tools. To identify the internal device in the robot controller, the PC-STAT LED will flash green with a frequency of 1 Hz.

- For RobotStudio, use the **Blink** functionality in the **Scan Editor**, see *Scanning the network on page 62*.
- For other tools, see the respective supplier user manuals.

Unable to connect to a device

If all parameters are correct, but it is still not possible to connect to an device using the PROFINET controller, make sure that the device does not already have an active connection with another controller. Most I/O devices do not accept that two controllers are connected against the same I/O device at the same time. That is, if the device does not allow shared device functionality.

Connections are lost randomly

Lost connections can occur for a number of reasons.

- Bad network
- Overloaded Ethernet switches
- Ethernet cable problems

Another possible reason is that the IRC5 PROFINET is not able to process all the PROFINET requests within the specified time frame. If, for example, 20 I/O devices are used with 1 ms reduction ratio (poll rate), the slightest variation of CPU load on the main computer might cause a protocol disturbance which can lead to a connection timeout. The maximum possible devices that can be used depends on the reduction ratios used, CPU load and data lengths transferred at every data cycle.

There can be connection loss while configuring PROFINET Master on the same logical subnet as other applications, on the WAN port. It might cause sporadic loss of communication for the applications as well as for the PROFINET communication.

Poor performance using fast startup

In general the startup time for one I/O device using fast startup is less than a second, together with the robot controller. This is highly dependent upon the device itself. Check with the device vendor for detailed description about I/O devices that support fast startup with corresponding performance figures.

- If there are other intermediate hardware on the connection link, that might interfere with the PROFINET connection.
- If there is a chained setup containing multiple devices, there is an increased latency before all devices are running. Depending upon the number of chained devices the total connection time can be more than a second.
- Make sure that the port/ports used for fast startup is selected in the I/O configuration.
- Check with the device vendor for optimal settings when using the I/O device with fast startup. Sometimes device behavior is configurable with a vendor

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specific tool or through the network configuration tool. According to the GSD file.

- If the device does not support parameterization speedup, the connection time may be longer. If supported by the device, it is included in the GSD file.
- Check that the switch settings are correct according to below:
  - 100 Mbit speed rate with full duplex.
  - Auto negotiation shall be switched off.
  - Disable "switch intelligent features" such as flow control and MDIX (medium dependent interface crossover) that might cause delays during startup.
- For FSU configuration of devices, use the RAPID instruction `IOEventMessage`. See program execution example in *Technical reference manual - RAPID Instructions, Functions and Data types*, section "IOEventMessage - Turn on/off I/O event messages from device".

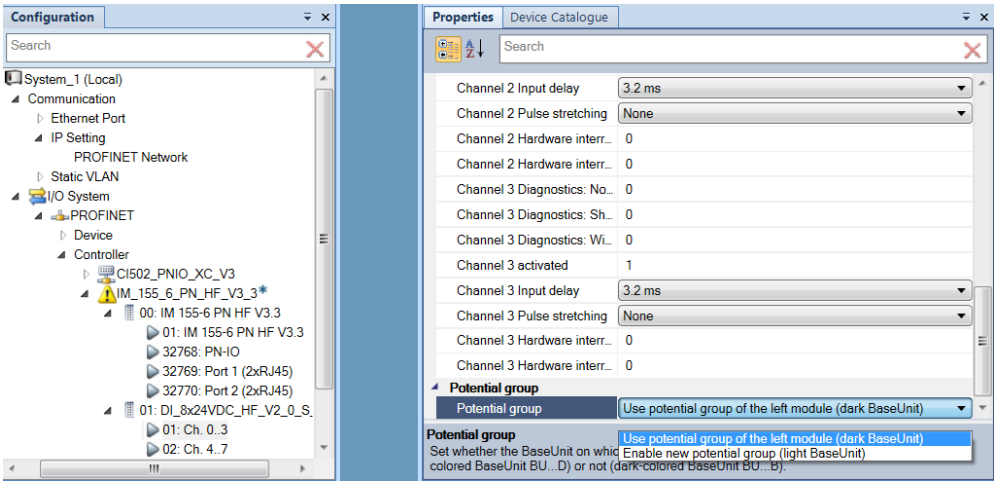
> **Note**
>
> If `IOEnable` and `IODisable` are used for this purpose, the connection may become standard instead of FSU.

Configuring Siemens™ ET200SP I/O device

For Siemens™ ET200SP I/O devices, it is important to select the correct **Potential group**.

If the back plane of the device is dark, select **Use potential group of the left module (dark BaseUnit)**.

If the back plane of the device is light colored, select **Enable new potential group (light BaseUnit)**.



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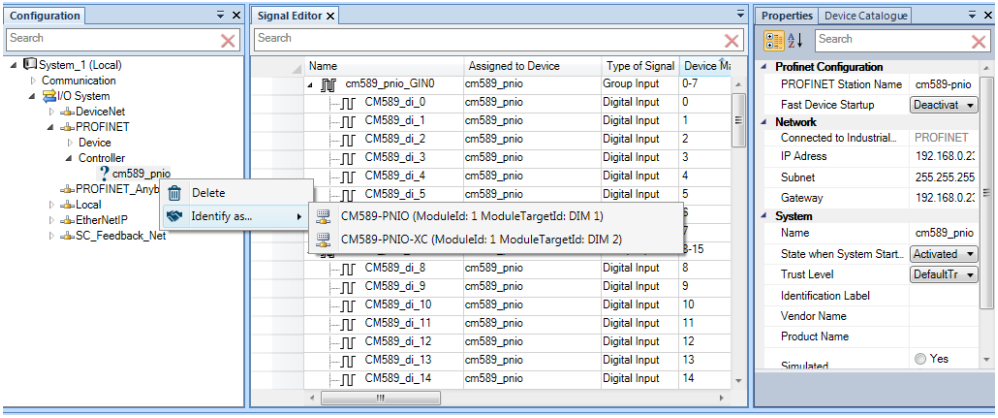
Duplicated module id in GSD file

If the error message "Exception: GSD file includes dap's with the same module id for device ...", then duplicates of the module id exist in the GSD file and you must select which one to use.

Right-click on the device, select **Identify as** and select the definition to use.



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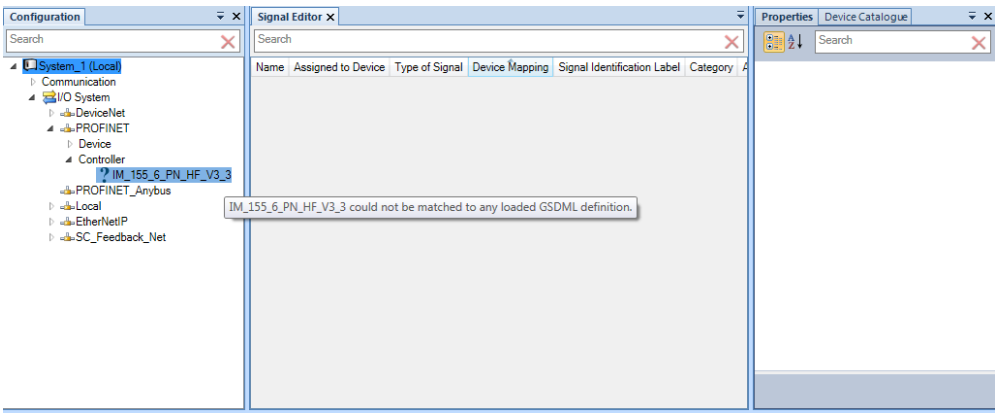
Missing GSD definition

If the warning message "... could not be matched to any loaded GSD definition" is shown, there can be two reasons:

- If the message "Exception: GSD file includes dap's with the same moduleId for device ..." is also shown, see *Duplicated module id in GSD file on page 104*.
- If the message "Exception: GSD file includes dap's with the same moduleId for device ..." is not shown, load the GSD definitions. See *Importing the GSD files on page 61*.



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Unable to add safety module for option 997-2 PROFIsafe Controller/Device

If an old configuration is restored into I/O Engineering Tool, it will only be possible to add a safety module if this is supported by the safety configuration. If this is the case, a warning message will be displayed in the RobotStudio output window stating that the safety configuration has to be upgraded.

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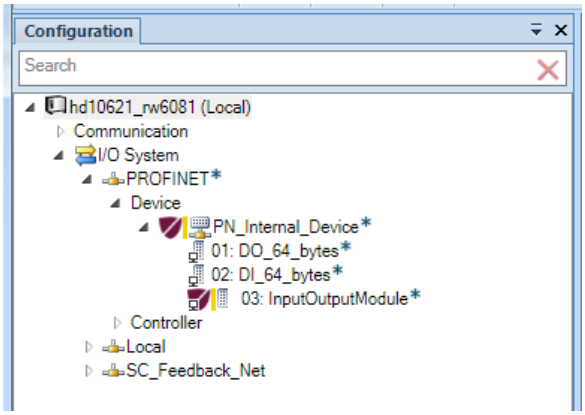
To upgrade the safety configuration, open Visual SafeMove and select **Upgrade to latest configuration to latest version.** If there are differences in the configuration between I/O Engineering Tool and Visual SafeMove, a dialog will be shown where the user can select which names to use. These names can be changed at a later stage in I/O Engineering Tool.

Note

It is possible to have an internal device in the I/O Engineering Tool that shows virtual modules. The small monitor icon displayed next to a module indicates that the module is virtual:



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The virtual modules will not be saved to the IO configuration, but are needed in the configuration of the safety parameters on the safe modules for the internal device.

The internal device will always show the * indicating changes, if the internal device has virtual modules.

Mismatch in configuration for option 997-2 PROFIsafe Controller/Device

If there are inconsistencies between the safety and the non-safety IO configuration, a dialog will be displayed. If the system has an internal device with modules, then the name for the internal device and its modules must be the same in both the I/O Engineering Tool and in Visual SafeMove.

Another inconsistency that can cause problems is if the safe modules in the safety configuration do not match the safe modules in the I/O Engineering Tool. If this is

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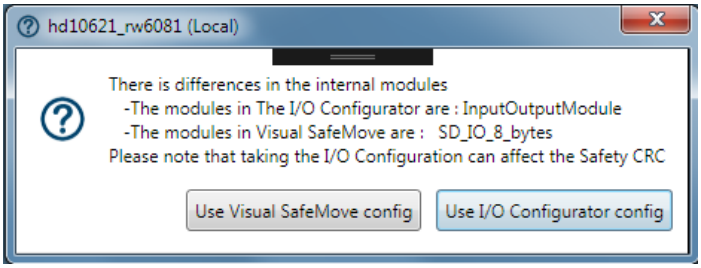
the case, a dialog will be displayed where the user is asked to select the configuration to be used.



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The selected configuration can be changed at a later stage in I/O Engineering Tool.

IP address goes to 0.0.0.0 after restart of robot controller

If a PROFINET controller, for example a PLC, sets a temporary IP address for the internal PROFINET device in the robot controller, then the IP address will go to 0.0.0.0 after a restart.

GSD file is not loaded

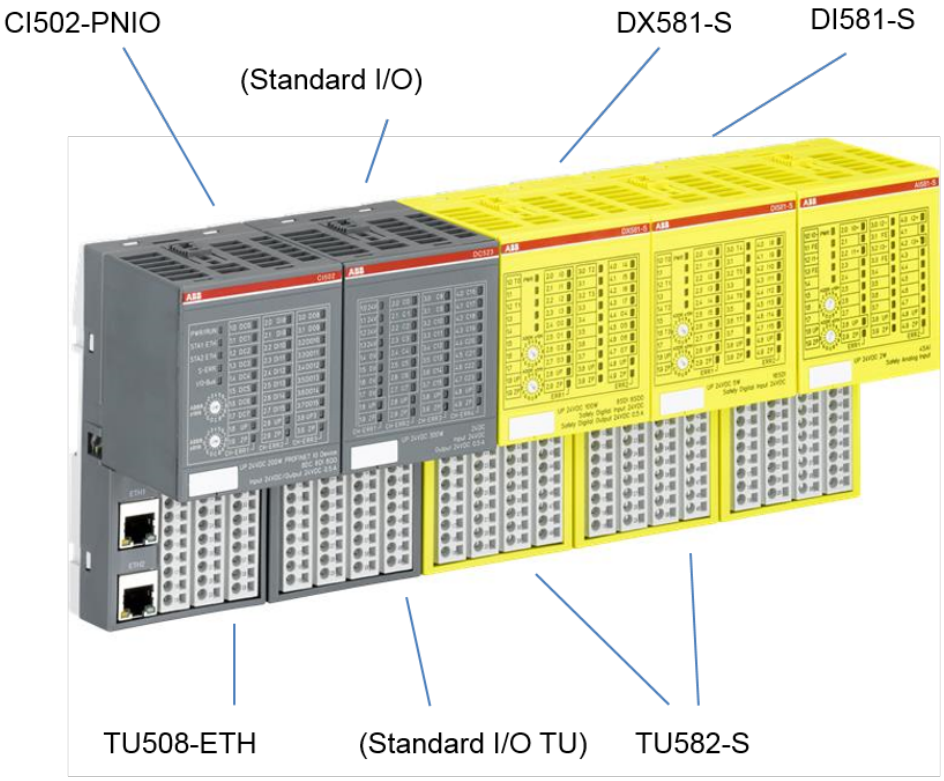
The GSD file is not loaded if the file name does not follow the PROFINET standard.

A ABB CI502 PROFINET I/O device

Introduction

When using the option *Prepared for ABB CI502* the IRC5 controller acts as a PROFIsafe controller (*F-Host*) and can host ABB S500 safe I/O devices (*F-Devices*) directly.

The only safe I/O devices that can be used are the S500 unbundled safe I/Os DX581-S and DI581-S with the CI502-PNIO PROFINET I/O device.



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A RobotWare license with the options *PROFINET Controller/Device* and *Prepared for ABB CI502* or *PROFIsafe F-Host and Device* is required to host ABB safe I/O devices on the IRC5 controller.

The required GSD file for setting up the ABB S500 safe I/O devices is included by default in I/O Engineering Tool.

For more information see *Product specification - Controller IRC5*, the application note *Unbundled S500 Safety I/Os (3ADR024128K0201)* and abb.com/plc. Details about how to set up the ABB IRC5 robot controller with the option "Prepared for ABB CI502" can be found in the application note *IRC5 Robot Controller and CI502 with Safety I/O modules(3ADR010316)*.

Limitations

- This option is using PROFIsafe F-Host, but it does not have full F-Host functionality since it is limited to the specific safe I/O devices from ABB.

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Install and configure the ABB S500 safe I/O devices

Use the following procedures to install and configure the ABB S500 safe I/O devices:

Prerequisites

In addition to RobotStudio, the following tools are needed to be able to configure the ABB S500 safe I/O devices:

- Download and install the *ABB_AC500-S F_iPar_CRC Calculator* tool from the *RobotStudio Online Community*, where it is included in the *Tools and Utilities* package. Once installed, it is started from the **Vendor Tool** button in the Safe IO Configurator in Visual SafeMove.

Configure ABB S500 in the I/O Engineering Tool

1. Start RobotStudio, connect to the robot system where the ABB S500 safe I/O devices are installed, and login as a safety user.
2. Start the I/O Engineering Tool from the **Controller** tab in RobotStudio.
3. Configure the standard communication parameters for the network, i.e. ports, IP-address, etc. This can also be configured from RobotStudio without using the Add-In.
4. Right-click the **PROFINET** node and select **Scan Network** to detect the I/O device.

   

   Tip

   Use the **Blink** functionality to detect the correct unit when multiple devices are connected.

5. Add the detected device by right-clicking the device and selecting **Add as**. Select the configuration that corresponds to the physical device. The device is now displayed in the **Configuration** browser under the *PROFINET/Controller* node.
6. Add safe modules to the device from the **Device Catalogue** browser by double-clicking. When adding safe modules, they are also added in the Safe IO Configurator in Visual SafeMove.
7. Select the sub-module in the **Configuration** browser and configure the module settings in the **Properties** browser, i.e. channel configuration, input delay, etc.
8. Configure the properties for the safe modules in the **Properties** browser.

   Set the following default values for each S500 safe module:

   - **Source Address**: 1
   - Set the decimal **Destination Address** to the same address that is set on the rotary switches on the device. Note that the values on the rotary switches are hexadecimal.
   - Click the **Vendor Tool** button to open the ABB_AC500-S F_iPar_CRC Calculator tool and calculate the IParCrc value for the module. Copy the hexadecimal value into the Safe IO Configurator.

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Note

Note that the **I Par CRC** checksum must be recalculated if the module configuration is changed, i.e. channel configuration, delay filter, etc.

Note

Note that the channel configuration for all inputs and outputs are by default disabled and must be activated before an input or output can be used on the specific channel.

9 The next step is to configure signals, see *Configure signals on the ABB S500 safe I/O devices on page 109*.

Note

The signal configuration is not included in the IParCrc checksum.

10 Request write access and write the configuration to the controller. Restart the controller.

Note

This requires that some basic SafeMove conditions are met, for example a tool must have been created. For more information, see *Application manual - Functional safety and SafeMove2*.

The communication to the S500 safe modules is now established which is also indicated by the status diodes on the devices.

Configure signals on the ABB S500 safe I/O devices

1 Open the **Signal Editor** in I/O Engineering Tool.
2 Configure safe input and output signals for the S500 safe modules. When adding safe signals, they are available for use in the Safe IO Configurator in Visual SafeMove.
3 Request write access and write the configuration to the controller. Restart the controller.

Note

If a signal is used by the safety module, for example in the combinatory logic, it cannot be renamed or removed from the signal editor. This is displayed with a shield symbol.

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Index

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