ABB

ROBOTICS

Application manual
PROFINET Controller/Device

Application manual
PROFINET Controller/Device

RobotWare 6.11

Document ID: 3HAC065546-001

Revision: H

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Original instructions.

Table of contents

Table of contents

Overview of this manual

About this manual

This manual describes how to configure PROFINET for IRC5 using the RobotStudio tool IO Configurator. IO Configurator 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.

> ℹ️ **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, IO Configurator.

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*
Product manual - IRC5	*3HAC047136-001*

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Reference	Document ID
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 77*.

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 on page 43*, *Configuring the internal device using IO Configurator (for option 997-1 PROFIsafe Device) on page 61* and *Configuring the internal device using IO Configurator (for option 997-2 PROFIsafe Controller/Device) on page 57* • Information regarding procedure for Fast device startup added in *Using Fast Device Startup on page 52*. • Information added in section *System parameters on page 63* 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 troubleshooting: *Unable to add safety module for option 997-2 PROFIsafe Controller/Device on page 81* and *Mismatch in configuration for option 997-2 PROFIsafe Controller/Device on page 83*. • Sections Configuration file, Fast Device Startup, Port 1, Port 2, Port 3 and Port 4 removed from chapter *System parameters on page 63*.
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 52*.

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.

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

Product manuals

Manipulators, controllers, DressPack/SpotPack, 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.
- 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.
- Examples of how to use the application.

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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.

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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.

Terminology

Terms

Term	Explanation
Controller	The *PROFINET master* is referred to as *PROFINET controller*.
Device	In this manual the term *device* is used to describe a physical unit.
External controller	Describes a PROFINET controller on the PROFINET network connected to the IRC5 controller (not the robot controller acting as PROFINET controller).
External device	Describes a PROFINET device on the PROFINET network connected to the IRC5 controller (not the robot controller acting as PROFINET device).
Fast Device Startup	Functionality for shortening the connection time with an I/O device. Other manufacturers refer to this functionality as Fast Start Up (FSU) or Prioritized Startup.
GSD file	A GSD file contains information about a PROFINET device. (Generic Station Description)
Internal controller	Describes when the IRC5 robot controller acts as a PROFINET controller on the PROFINET network.
Internal device	Describes when the IRC5 robot controller acts as a PROFINET device on the PROFINET network.
LAN	Port/connector for Local Area Network.
PROFINET configuration file	XML file created using an external PROFINET configuration tool
Reduction ratio	Poll rate
WAN	Port/connector for Wide Area Network.

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*.

> ℹ️ **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 IO configurator 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

Continues on next page

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 certification version	2.33
GSD file versions supported	Version 2.20–2.34
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
Startup mode	Legacy and Advanced mode supported

Specification overview, internal device

Item	Specification
GSD file	See *GSD file on page 29*.
PROFINET certification version	2.33
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.

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.
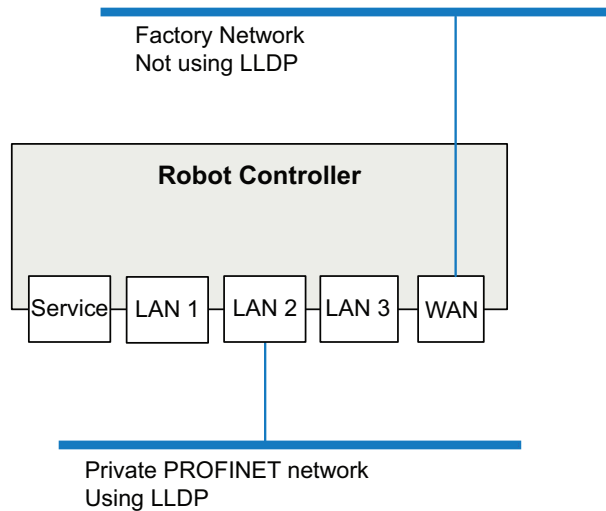
Link Layer Discovery Protocol (LLDP)

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).

Factory Network
Not using LLDP

Robot Controller

Service — LAN 1 — LAN 2 — LAN 3 — WAN

Private PROFINET network
Using LLDP

xx1800000140

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.
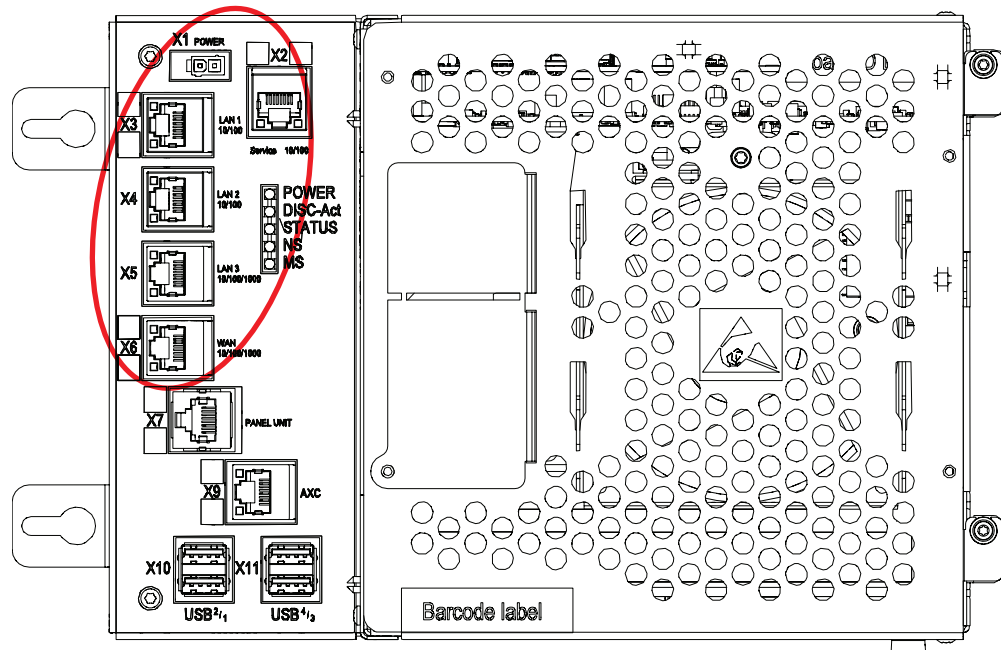
2 Hardware overview

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.

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.

> **ℹ 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 icon] **Note**

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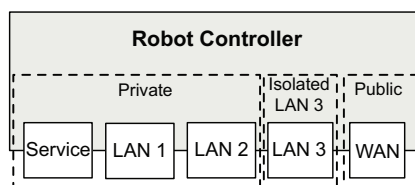
An alternative configuration is that LAN 3 is part of the private network. The ports Service, LAN 1, LAN 2, and LAN 3 then belong to the same network and act just as different ports on the same switch. This is configured by changing the system parameter *Interface*, in topic *Communication* and type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

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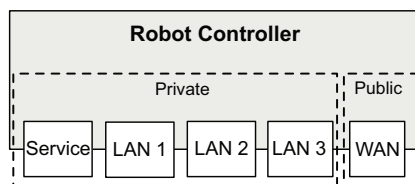
One PROFINET network connected to the robot controller

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:
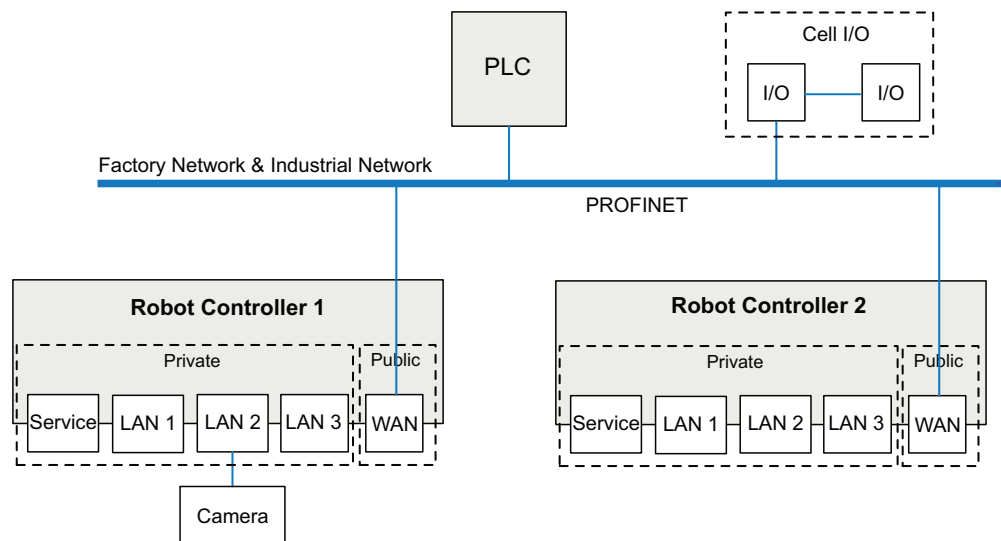
2 Hardware overview

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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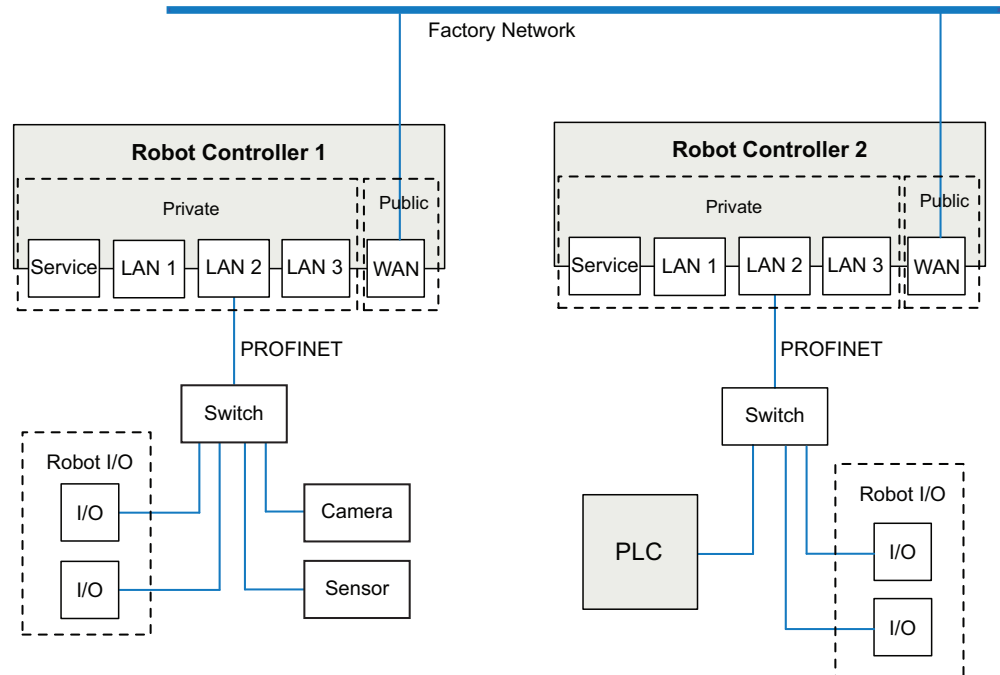
PROFINET on dedicated industrial network

By connecting to the isolated LAN 3 port it is possible to connect several robot controllers to a dedicated industrial network.
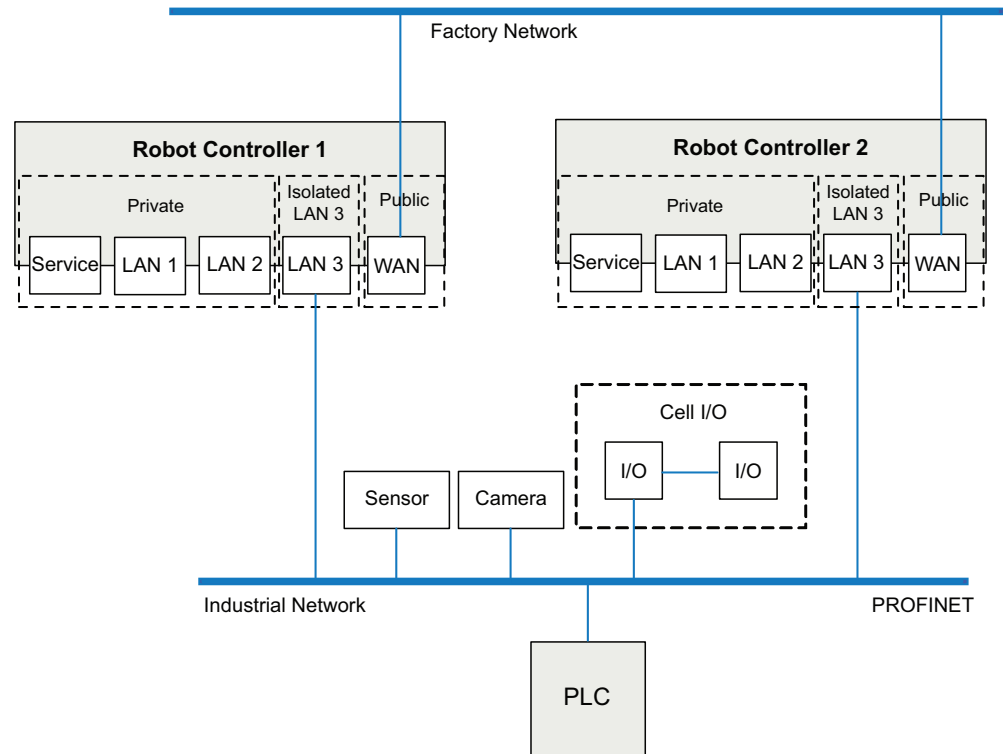
Using Anybus adapter to connect two PROFINET networks

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*.
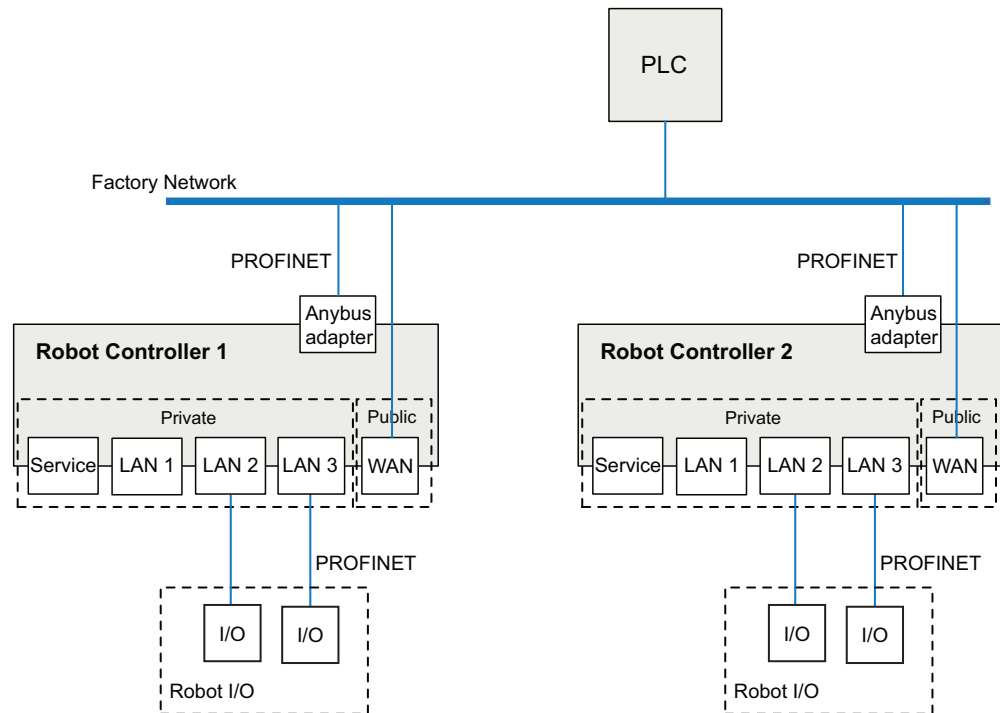

PROFINET on dedicated industrial network

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*.
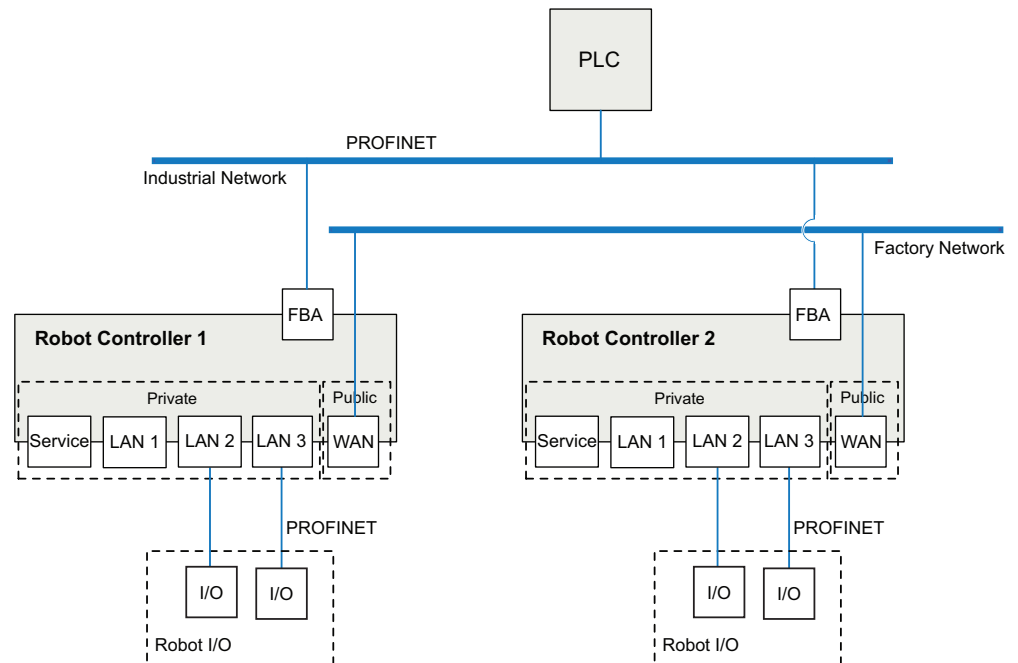
2.2 Ethernet switches

Prerequisites

It is recommended that switches used in the I/O network support Quality of Service (QoS).

I/O devices mark their packets with a priority value. The priority value is used in order to get better I/O data throughput and shorter delays on the network.

Switches and routers are then able to differentiate the device's critical from the other non-critical traffic. To do this, the switches and routers must support Quality of Service.

2.3 I/O devices

Limitations

It is possible to connect any type 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 IRC5 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, refer to *Application manual - Functional safety and SafeMove2* and *Application manual - I/O Configurator*.

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

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.

GSD file

In order to configure a PROFINET network with an external PROFINET configuration tool, a GSD file for each I/O device needs 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.

For information on where to find the GSD file for the IRC5 controller, see .

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*

> **ℹ 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**.

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. This event message informs the user of the present slot configuration of the internal device.

> **ℹ 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 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.

Location of GSD files

GSD files are stored under the *<system>/HOME/GSDML* catalog of the target system.

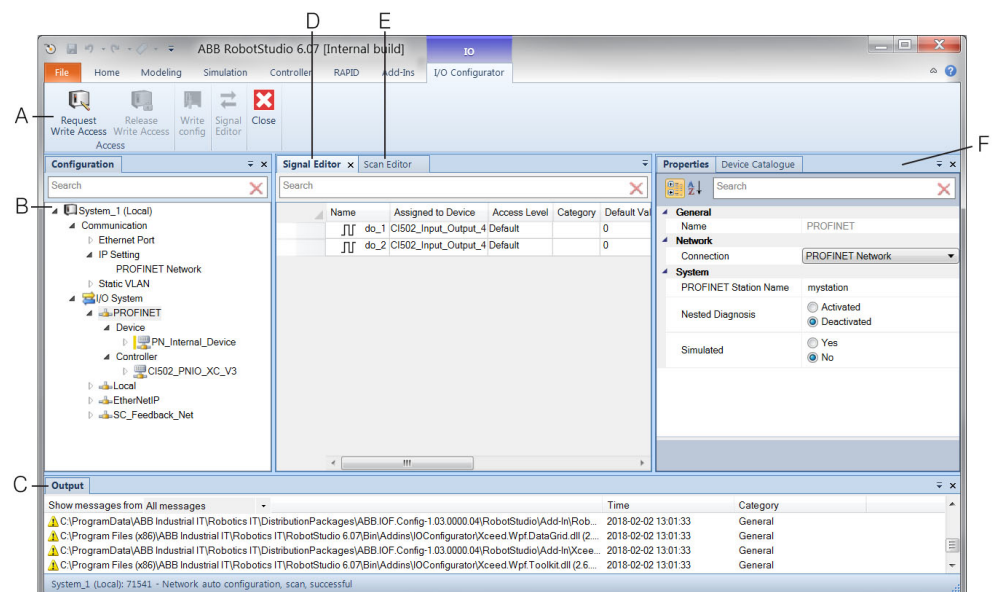# 4 The I/O Configurator user interface

4.1 The user interface

Start the IO Configurator

1 Start RobotStudio and connect to the robot system to configure.

2 In the ribbon of the **Controller** tab, click **Configuration** and select **I/O Configurator**.
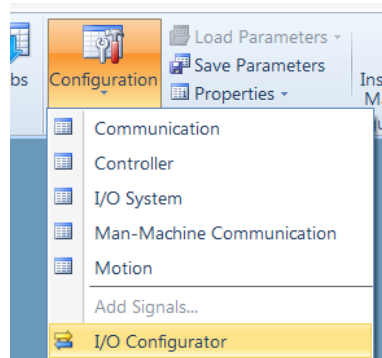
Overview of the user interface

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

	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	**Output** window	Displays the information about the events that occur in controller and I/O devices.

Continues on next page

4 The I/O Configurator user interface

4.1 The user interface
Continued

	Parts	Description
D	**Signal Editor**	Displays the signals assigned to the I/O device. Enables to add or delete signals of I/O device.
E	**Scan Editor**	Displays the information of the I/O devices that are found on the network.
F	**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.
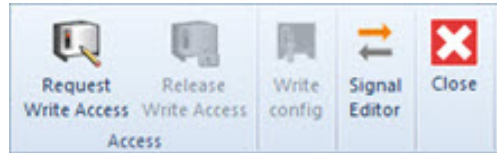
The ribbon contains following command buttons:

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.
Signal Editor	Displays the signals assigned to the I/O device.
Close	Closes the I/O Configurator view.

4.3 Configuration browser

Introduction

The Configuration browser displays hierarchical structure of controller and configuration elements in the **I/O Configurator** 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.
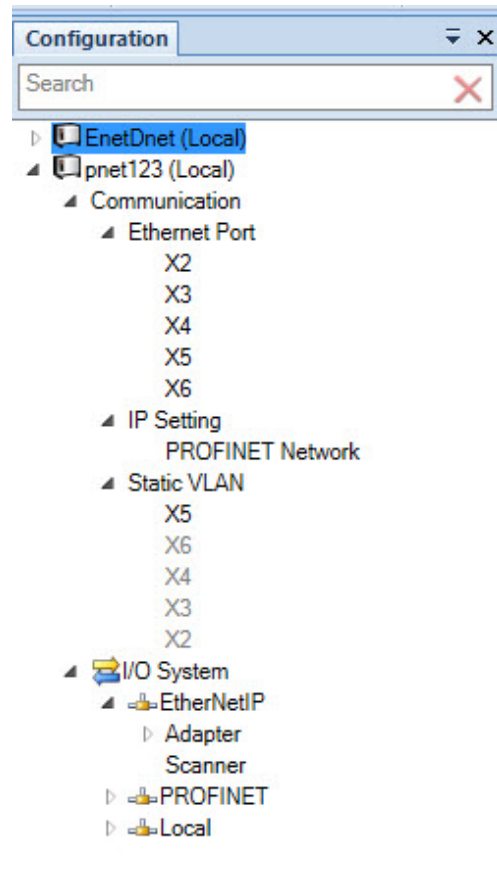
> **Note**
>
> Correct the validation error on each element in the Configuration browser before writing the configuration to the controller.

Communication node

The Communication node contains parameters for configuring the main computer's connectivity using Ethernet ports. For more information on parameters, refer to section *Communication* of *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.

Continues on next page

Element	Description
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.

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
⚠️ xx1700001175	Indicates incomplete information. You can enter the pending information in the **Properties** tab.
✳ xx1700001176	Indicates that there are unsaved changes.
▷ xx1800000147	Indicates a sub-module belonging to an I/O module. The sub-module is used configure some parameters for the I/O module (e.g. input delay).
Yellow line mark	Identifier for a safety I/O device.
🛡️ xx1800000406	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.

Continues on next page

Symbol	Explanation
🔒 xx1800000404	Indicates that a signal is defined as protected basic configuration by the safety module. See *Application manual - Functional safety and SafeMove2*.
❓ xx1800000407	Identifies an unknown device which is not mapped to a GSD definition.
ⓘ xx1800000141	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.

> **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 device or module to show a shortcut menu with various operations (not all are available for all devices):

Setting	Description
Delete	Removes the device from the Configuration browser tree 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 Communication parameters, see section *Communication* in the *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 assigned to the I/O device. It is used to view the signals and to add new signals to the I/O device. For more information about attributes of signal, refer to *Technical reference manual - System parameters*.

4.6 Scan Editor

Overview

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 .

> ℹ️ **Note**
>
> PROFINET station name follows the PROFINET naming convention. It uses lower case alphabets for naming station name.

Right-click menu

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

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

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

Setting	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.

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5 Configuring internal controller and external device using IO Configurator

5.1 Configuring with IO Configurator

Log in as safety user

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

Start the IO Configurator

1 Start RobotStudio and connect to the robot system to configure.

2 In the ribbon of the **Controller** tab, click **Configuration** and select **I/O Configurator**.
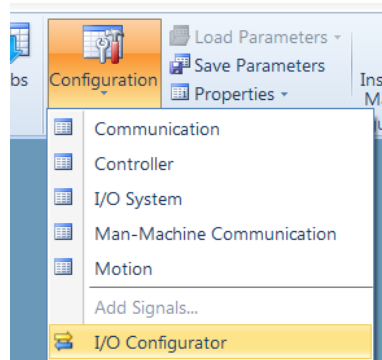
3 In the ribbon, click **Request Write Access** to be allowed to configure the controller.

Configure IP settings

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

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 cause a validation error.
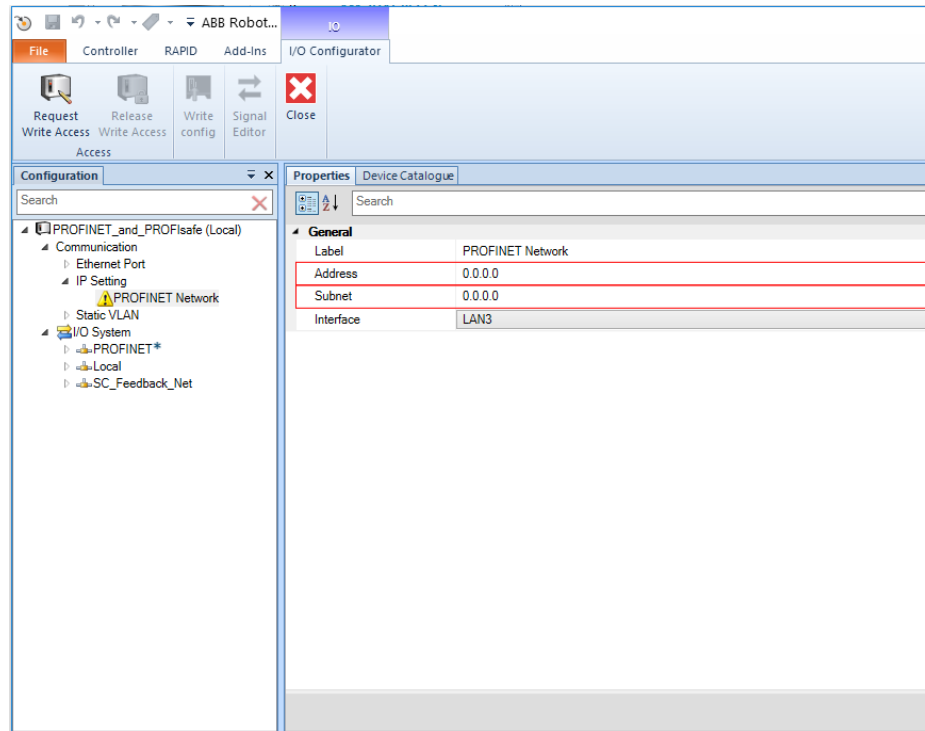
xx1700002228

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

- **IP**: The IP address for the IRC5 controller on the PROFINET network.
- **Subnet**: The subnet mask.
- **Interface**: Where the network is connected to the IRC5 controller, see *Connections on page 19*.

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 appear on the PROFINET network. E.g. detectable by a PLC.
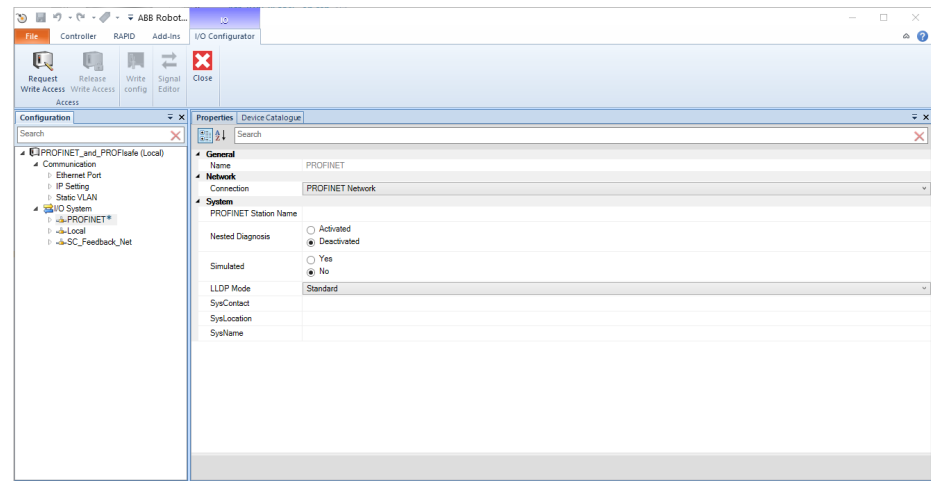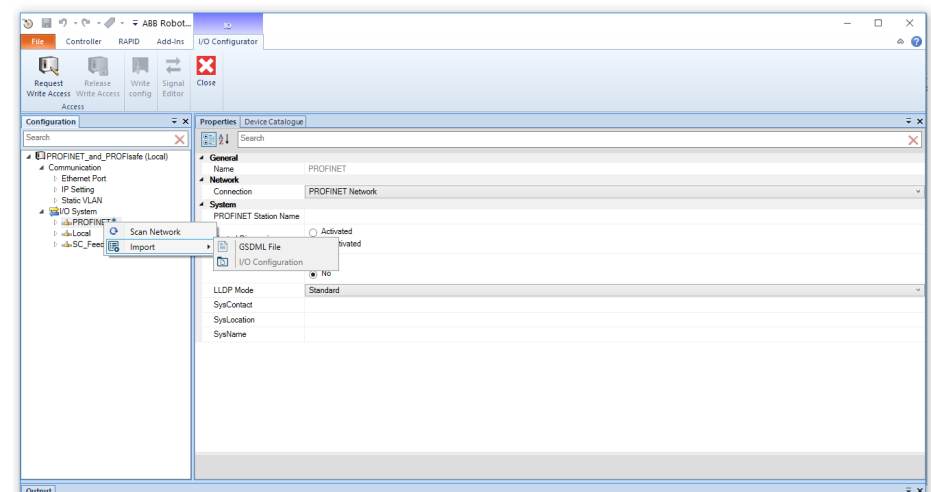

xx1700002231

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.

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 *Configure IP settings on page 43*.
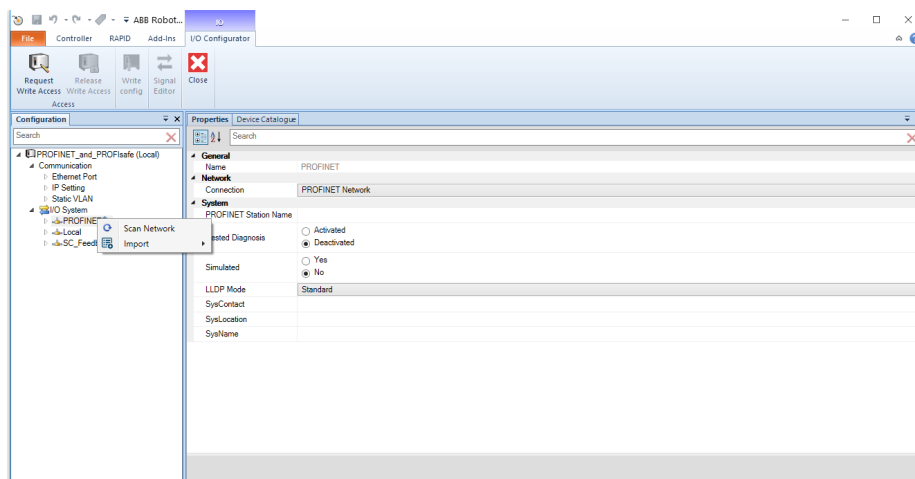
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If you want to configure the network before the physical network is in place, follow the instruction .

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

xx1700002230

> 💡 **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.

Manually add devices to your network

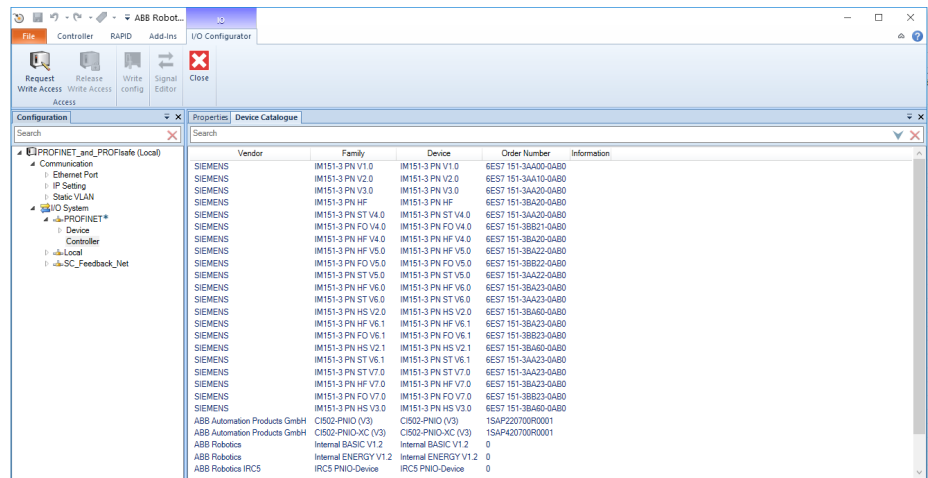1   In the **Configuration** browser, expand **PROFINET** and select **Controller**.

Continues on next page

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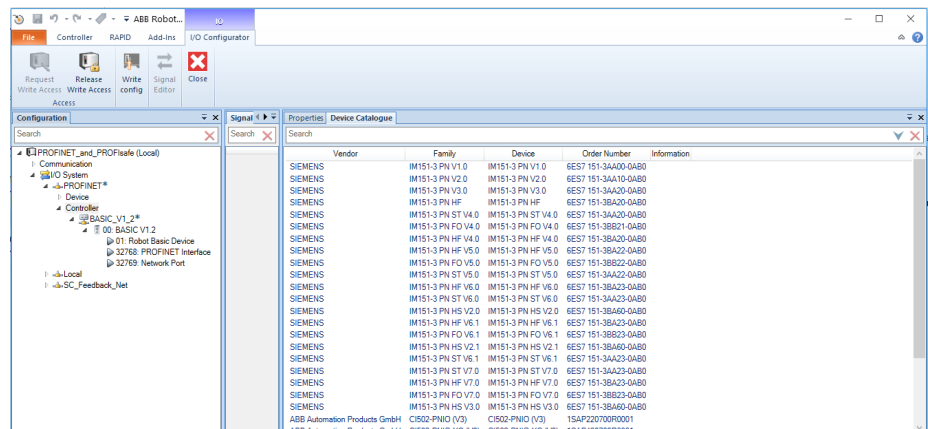
2 Click on the tab **Device Catalogue** to show a list of available communication modules.

xx1700002233

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

xx1700002234

The added communication module is automatically selected. If the communication module contains an internal I/O module (physically included on the communication module), it is added as the first I/O module under the communication module.
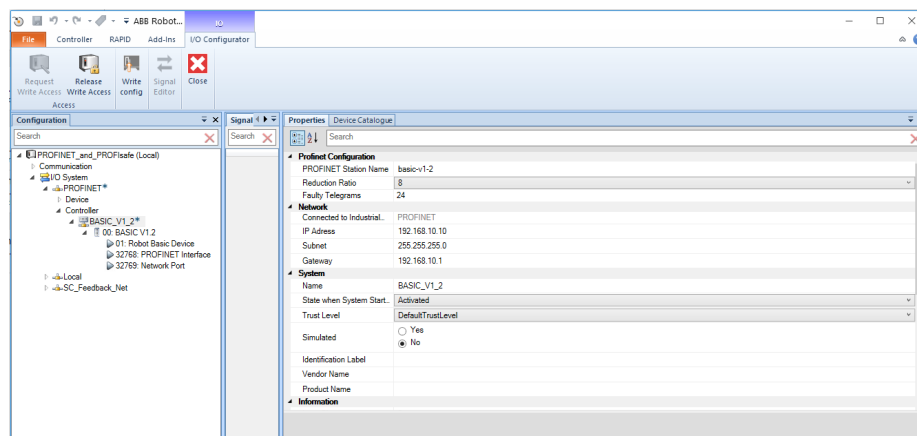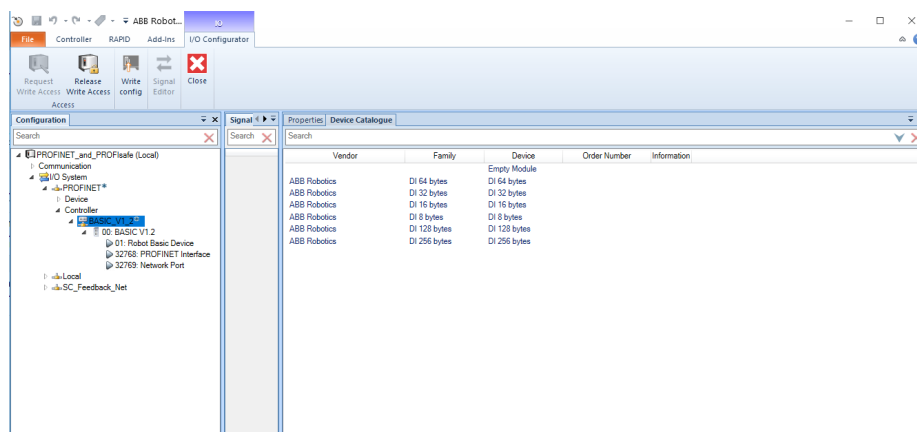
4   In the **Properties** tab, specify the properties for the communication module. The ones with a red frame around must be specified (current value is invalid).

xx1700002315

Adding I/O modules

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

xx1700002235

Figure 5.1:

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).

Continues on next page

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Setting	Description
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 <u>hexadecimal</u> value into the Safe IO Configurator.

> **ℹ Note**
>
> Note that the IParCrc checksum must be recalculated if the module configuration is changed, i.e. channel configuration, delay filter, etc.
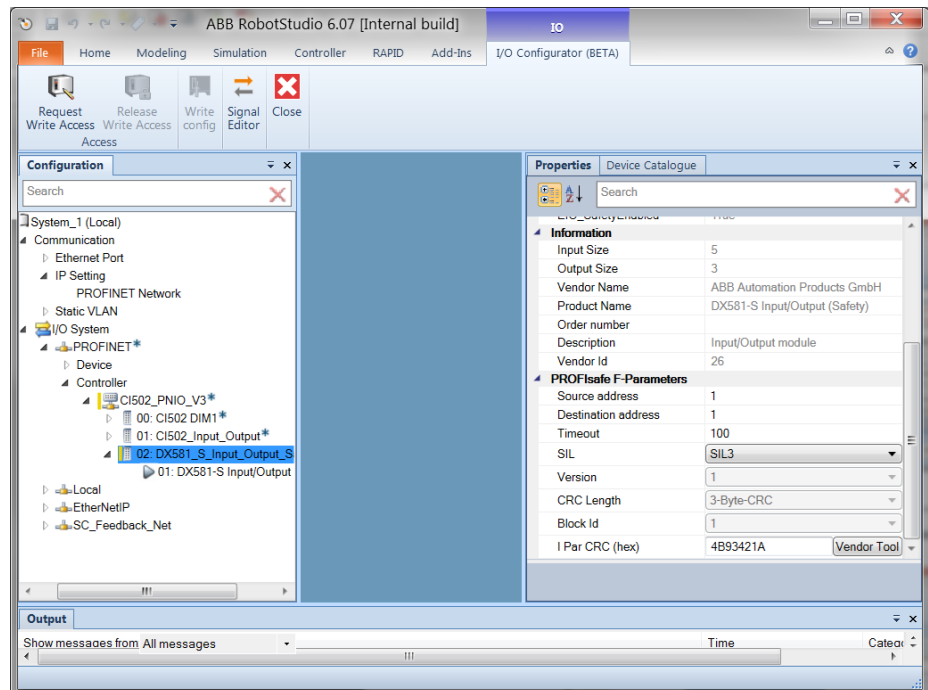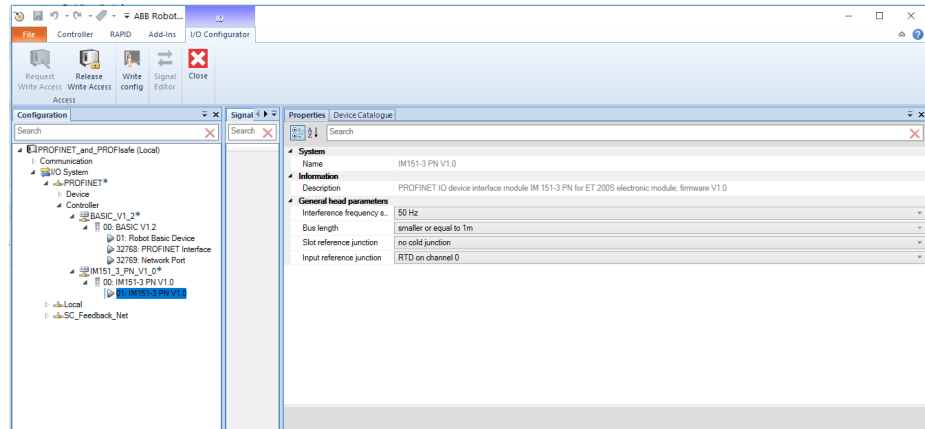
3   Select the sub-module in the **Configuration** browser and configure the module settings in the **Properties** browser. These properties are extracted from the GSD file for the I/O module.


xx1800000013

> **ℹ 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.

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.
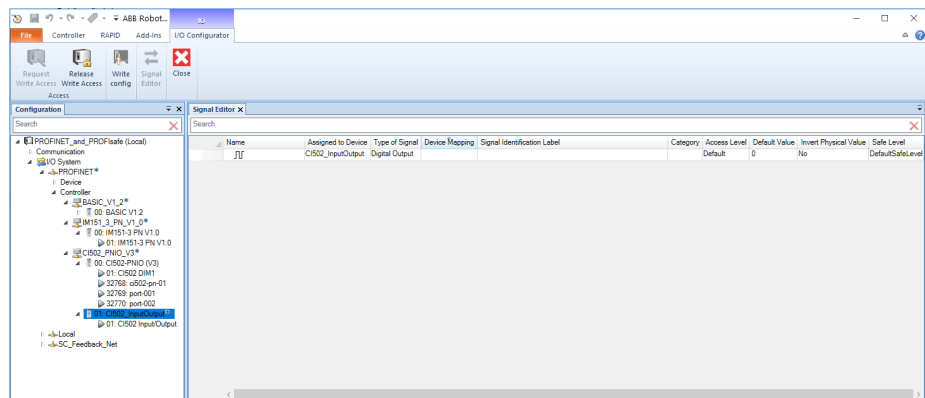
xx1700002316

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.

Continues on next page

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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.

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

> **ℹ 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**.
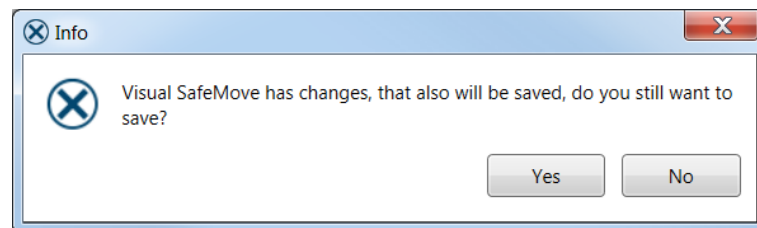
Message about removing device

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.
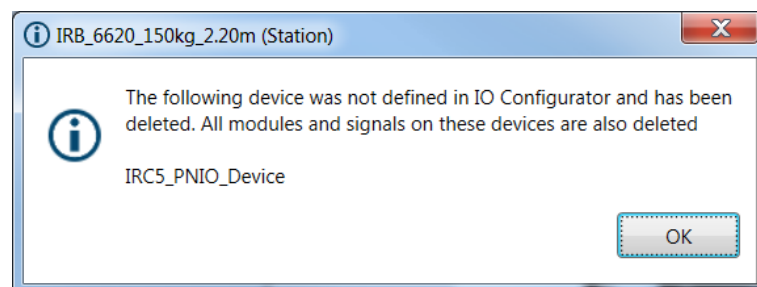
5.2 Using Fast Device Startup

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 78*.

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 54* and *Configuring port speed for external devices on page 55*.

> **Note**
>
> The system parameter *Mode when System Startup* and the RAPID instruction `IOEventMessage` define if I/O event messages should be sent from the device.
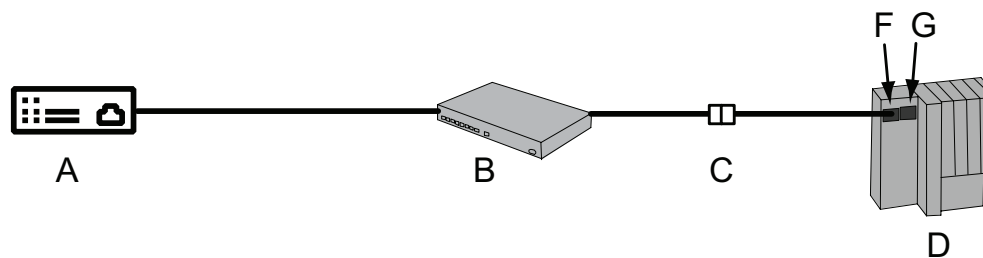
> **Note**
>
> The I/O device with FSU functionality is connected with the IRC5 controller. When the power of the I/O device is switched off and switched on again, the IRC5 controller establishes contact with the I/O device using the fast startup sequence.

Three alternative connections

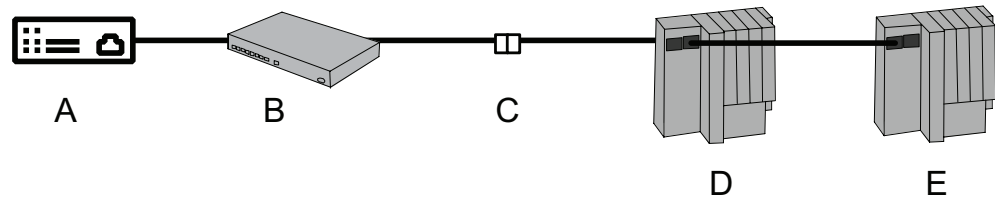I/O device connected via a switch

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

Continues on next page

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.

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.

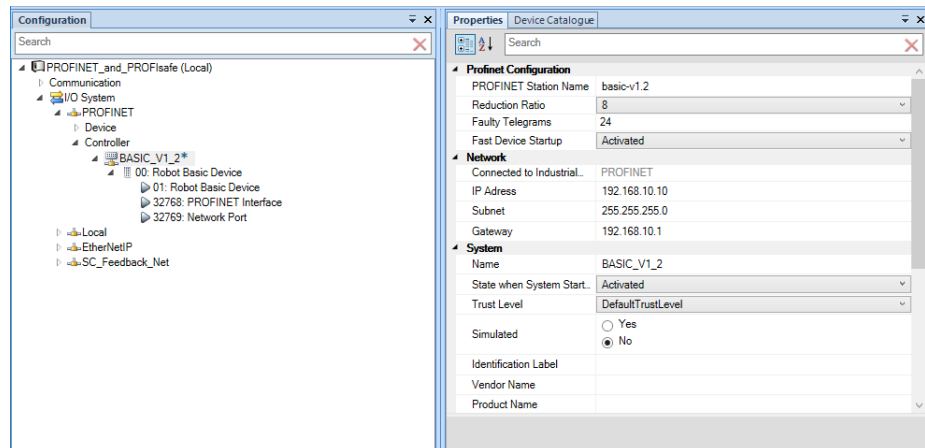## 5.2.1 Activating Fast Device Startup for external devices

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 Device Startup** to **Activated**.

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5.2.2 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**.
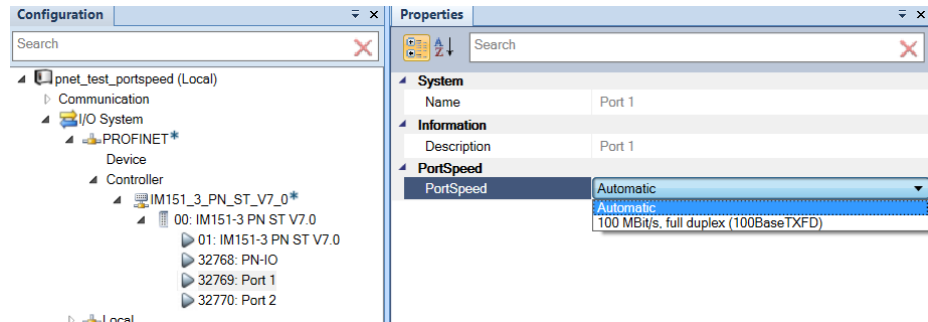
xx1800003278

Note

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

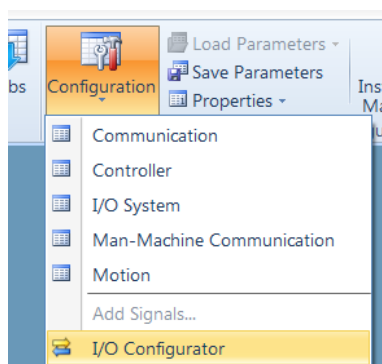This page is intentionally left blank

6 Configuring the internal device using IO Configurator (for option 997-2 PROFIsafe Controller/Device)

Log in as safety user

> If working with safe I/O signals, log in as a safety user (the user grant **Safety Services** is required). See *Operating manual - RobotStudio*, section *Managing the user authorization system*.

Start the IO Configurator

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

> 3 In the ribbon, click **Request Write Access** to be allowed to configure the controller.

View the internal device

> 1 In the **Configuration** browser, expand **PROFINET**, then **Device**, and then **PN_Internal_Device**.
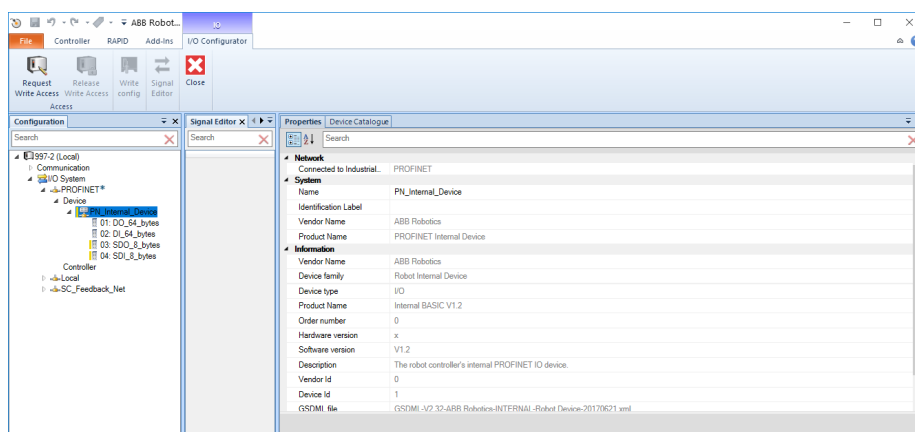
xx1800000052

> The default internal device is of type *Internal Basic*. If you want to replace this, see *Change type of internal device on page 58*.

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 58*.

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.
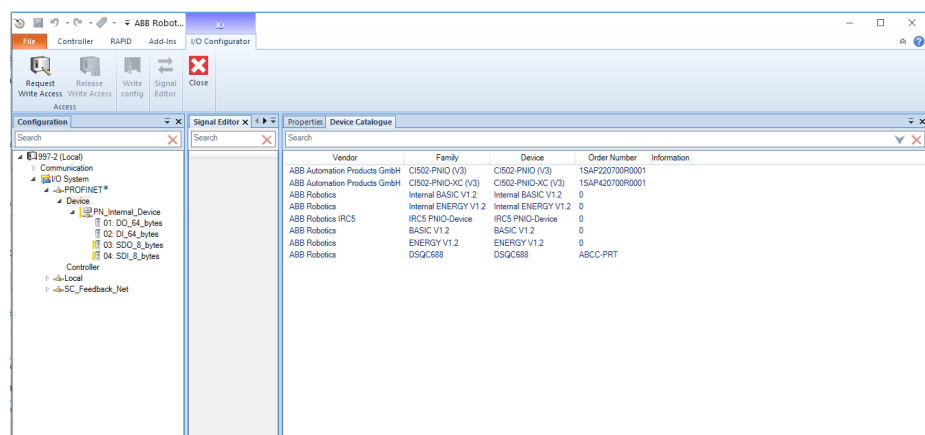
xx1800000053

4   Double-click on the internal device type you want.

The ones that can be selected are:

   •   **Internal BASIC** (standard internal device)

   •   **Internal ENERGY** (internal device for energy saving PROFINET)

### 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**.

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3 Click on the tab **Device Catalogue** to show a list of available I/O modules.
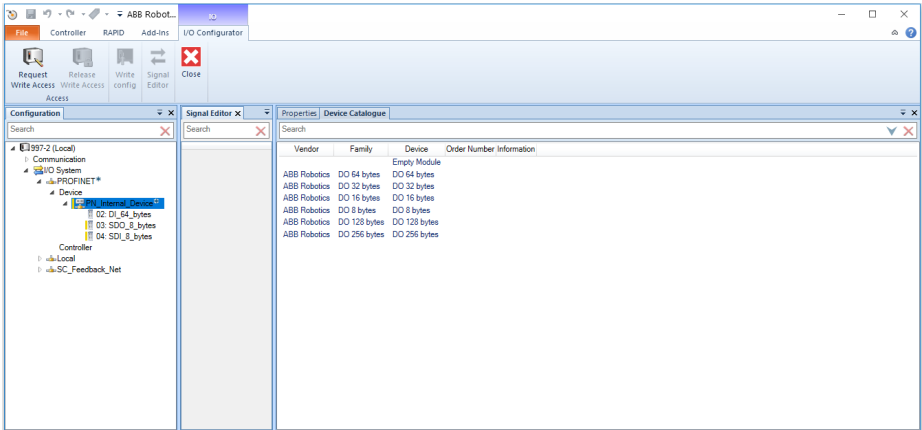
xx1800000054

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.

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.
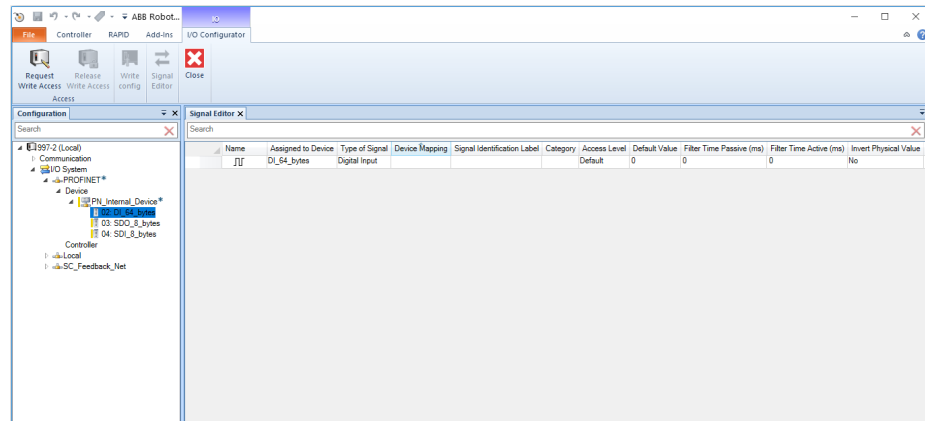

Edit signals

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.

xx1800000055

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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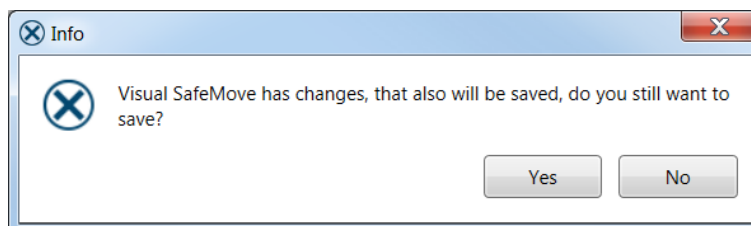
7 Configuring the internal device using IO Configurator (for option 997-1 PROFIsafe Device)

Log in as safety user

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

Start the IO Configurator

1 Start RobotStudio and connect to the robot system to configure.

2 In the ribbon of the **Controller** tab, click **Configuration** and select **I/O Configurator**.

3 In the ribbon, click **Request Write Access** to be allowed to configure the controller.

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 .

Continues on next page

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.

xx1800003347

4   Double-click on the internal device type you want.

The ones that can be selected are:

•   **Internal BASIC** (standard internal device)

•   **Internal ENERGY** (internal device for energy saving PROFINET)

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.

8 System parameters

8.1 Introduction

About the system parameters

There are both PROFINET specific parameters and more general parameters. This chapter describes all PROFINET specific system parameters. The parameters are divided into the type they belong to. For information about other parameters, see *Technical reference manual - System parameters*.

PROFINET system parameters

Industrial Network

These parameters belong to the type *Industrial Network* in the topic *I/O System*.

Parameter	For more information, see
Name	*Technical reference manual - System parameters*
Identification Label	*Technical reference manual - System parameters*
Connection	*Connection on page 65*
PROFINET Station Name	*PROFINET Station Name on page 66*
Nested Diagnosis [i]	*Nested Diagnosis on page 67*

[i]   This parameter is only used in RobotWare versions prior to 6.08.01.

PROFINET Device

These parameters belong to the type *PROFINET Device* in the topic *I/O System*.

Parameter	For more information, see
Name	*Technical reference manual - System parameters*
PROFINET Station Name	*PROFINET Station Name on page 68*
Connected to Industrial Network	*Technical reference manual - System parameters*
State at System Restart	*Technical reference manual - System parameters*
Identification Label	*Technical reference manual - System parameters*
Trust Level	*Technical reference manual - System parameters*
Simulated	*Technical reference manual - System parameters*
Vendor Name	*Technical reference manual - System parameters*
Recovery Time	*Technical reference manual - System parameters*
Energy Saving	*Energy Saving on page 69*

Signal

These parameters belong to the type *Signal* in the topic *I/O System*.

Parameter	For more information, see
Name	*Technical reference manual - System parameters*
Type of Signal	*Technical reference manual - System parameters*
Assigned to Device	*Technical reference manual - System parameters*

8 System parameters

Parameter	For more information, see
Signal Identification Label	*Technical reference manual - System parameters*
Device Mapping	*Technical reference manual - System parameters*
Category	*Technical reference manual - System parameters*
Access Level	*Technical reference manual - System parameters*
Default Value	*Technical reference manual - System parameters*
Filter Time Passive (ms)	*Technical reference manual - System parameters*
Filter Time Active (ms)	*Technical reference manual - System parameters*
Invert Physical Value	*Technical reference manual - System parameters*
Analog Encoding Type	*Technical reference manual - System parameters*
Maximum Logical Value	*Technical reference manual - System parameters*
Maximum Physical Value	*Technical reference manual - System parameters*
Maximum Physical Value Limit	*Technical reference manual - System parameters*
Maximum Bit Value	*Technical reference manual - System parameters*
Minimum Logical Value	*Technical reference manual - System parameters*
Minimum Physical Value	*Technical reference manual - System parameters*
Minimum Physical Value Limit	*Technical reference manual - System parameters*
Minimum Bit Value	*Technical reference manual - System parameters*
Transfer To Device	*Transfer To Device on page 70*
Output Offset On Destination Device	*Output Offset on Destination Device on page 71*
Transfer From Device	*Transfer From Device on page 72*
Input Offset On Source Device	*Input Offset on Source Device on page 73*

PROFINET Internal Device

These parameters belong to the type *PROFINET Internal Device* in the topic *I/O System*.

Parameter	For more information, see ...
Name	*Technical reference manual - System parameters*
Connected to Industrial Network	*Technical reference manual - System parameters*
Simulated	*Technical reference manual - System parameters*
Vendor Name	*Technical reference manual - System parameters*
Product Name	*Technical reference manual - System parameters*
Identification Label	*Technical reference manual - System parameters*
Input Size	*Input Size on page 74*
Output Size	*Output Size on page 75*

8.2 Type Industrial Network

8.2.1 Connection

Parent

Connection belongs to the type *Industrial Network*, in the topic *I/O System*.

Description

The parameter *Connection* specifies the *IP Setting* that the PROFINET industrial network shall use.

Default value

PROFINET Network

Allowed values

Valid instances of *IP Setting*

Additional information

The Public Network or the Private Network cannot be edited by external controllers or tool, such as NetNames+.

8.2.2 PROFINET Station Name

Parent

PROFINET Station Name belongs to the type *Industrial Network*, in the topic *I/O System*.

Description

PROFINET Station Name specifies the PROFINET station name on the network of the IRC5 controller.

Usage

The parameter *PROFINET Station Name* is used to identify a PROFINET device on the network. The name must be unique on the network.

The parameter *PROFINET Station Name* can also be changed with an external PROFINET configuration tool or a connecting PROFINET controller.

Prerequisites

The option *PROFINET Controller/Device* or *PROFINET Device* must be installed.

Default value

The default value is an empty string.

Allowed values

A string with maximum 80 characters.

Allowed characters:

- 0-9 (numerical)
- A-Z (uppercase letters)
- a-z (lowercase letters)
- - (hyphen)
- . (full stop)

8.2.3 Nested Diagnosis

Parent

Nested Diagnosis belongs to the type *Industrial Network*, in the topic *I/O System*.

Description

The parameter *Nested Diagnosis* specifies diagnosis in hierarchical plants and enables the end-users to evaluate the status of the PROFINET network from a central PLC or external tool.

Usage

If the parameter *Nested Diagnosis* is activated, alarms will be forwarded from a controller if its internal device has a connected controller.

Prerequisites

The option *PROFINET Controller/Device* or *PROFINET Device* must be installed.

This parameter is only used in RobotWare versions prior to 6.08.01.

Default value

The default value is *Deactivated*.

Allowed values

Activated

Deactivated

8.3 Type PROFINET Device

8.3.1 PROFINET Station Name

Parent

PROFINET Station Name belongs to the type *PROFINET Device*, in the topic *I/O System*.

Description

PROFINET Station Name specifies the PROFINET station name on the network of the external I/O device.

Usage

The parameter *PROFINET Station Name* is used to identify a PROFINET device on the network. The name must be unique on the network.

Prerequisites

The option *PROFINET Controller/Device* or *PROFINET Device* must be installed.

Default value

The default value is an empty string.

Allowed values

The station name follows the PROFINET naming convention for IO devices.

8.3.2 Energy Saving

Parent

Energy Saving belongs to the type *PROFINET Device*, in the topic *I/O System*.

Description

The parameter *Energy Saving* specifies if the I/O device should respond to energy saving command or not.

Usage

The parameter *Energy Saving* is used mainly to activate energy saving mode.

Prerequisites

The option *PROFINET Controller/Device* and *PROFIenergy* must be installed.

Default value

The default value is *Activated*.

Allowed values

- *Activated*
- *Deactivated*

8.4 Type Signal

8.4.1 Transfer To Device

Parent

Transfer To Device belongs to the type *Signal*, in the topic *I/O System*.

Description

The parameter *Transfer To Device* specifies that the signal shall be transferred to the internal device starting at the offset specified in the parameter *Output Offset On Destination Device*.

Prerequisites

The option *PROFINET Controller/Device* must be installed.

Limitations

Only signals of type Digital Output/ Digital Input/ Group Output/ Group Input can be transferred. The destination I/O device can only be the PROFINET internal device.

Allowed values

The allowed value is the PROFINET internal device.

8.4.2 Output Offset on Destination Device

Parent

Output Offset On Destination Device belongs to the type *Signal*, in the topic *I/O System*.

Description

The parameter *Output Offset On Destination Device* specifies the output start bit on the PROFINET internal device set by the transfer signal.

Prerequisites

The option *PROFINET Controller/Device* must be installed.

Limitations

The destination I/O device can only be the PROFINET internal device.

Default value

The default value is -1. This means that no *Output Offset On Destination Device* is defined.

Allowed values

The values are in the range of -1 to 65535.

Additional information

The parameter *Output Offset On Destination Device* specifies the start bit on the internal device. And, for bits specified in a group are transferred starting with the first bit.

8.4.3 Transfer From Device

Parent

Transfer From Device belongs to the type *Signal*, in the topic *I/O System*.

Description

The parameter *Transfer From Device* specifies that the bit value for the internal device (starting at the offset specified in the parameter *Input Offset On Destination Device*) shall be transferred to the signal.

Prerequisites

The option *PROFINET Controller/Device* must be installed.

Limitations

Only the input bits from the PROFINET internal device can be transferred to the signals of type digital output and group output.

Allowed values

The allowed value is the PROFINET internal device.

8.4.4 Input Offset on Source Device

Parent

Input Offset on Source Device belongs to the type *Signal*, in the topic *I/O System*.

Description

The parameter *Input Offset on Source Device* specifies the input start bit PROFINET internal device that will be transferred to the defined signal.

Prerequisites

The option *PROFINET Controller/Device* must be installed.

Limitations

The transfer is possible only to the signals of type digital output and group output. For all cases, it is possible to transfer information from the internal device to signals defined on other PROFINET I/O devices only.

Default value

The default value is -1. This means that *Input Offset on Source Device* is not defined.

Allowed values

The values are in the range of -1 to 65535.

Additional information

The parameter *Input Offset On Destination Device* specifies the start bit on the internal device. The bits specified in a group are transferred starting with the first bit.

8.5 Type PROFINET Internal Device

8.5.1 Input Size

Parent

Input Size belongs to the type *PROFINET Internal Device*, in the topic *I/O System*.

Description

The parameter *Input Size* is used to configure the input slot configuration of the PROFINET internal device.

Usage

It will configure the input slot size for the PROFINET internal device. This size must match the connecting PLC's or other PROFINET controller's defined output slot size. For more information, see *Input and output size on page 30*.

Prerequisites

The option *PROFINET Controller/Device* or *PROFINET Device* must be installed.

Default value

The default value is 64 bytes (512 signal bits).

Allowed values

8, 16, 32, 64, 128 or 256 bytes (64, 128, 512, 1024 or 2048 signal bits).

8.5.2 Output Size

Parent

Output Size belongs to the type *PROFINET Internal Device*, in the topic *I/O System*.

Description

The parameter *Output Size* is used to configure the output slot configuration of the PROFINET internal device.

Usage

The parameter *Output Size* is only valid for the PN_Internal_Device. It will configure the output slot size for the PROFINET internal device. This size must match the connecting PLC's or other PROFINET controller's defined input slot size. For more information, see *Input and output size on page 30*.

Prerequisites

The option *PROFINET Controller/Device* or *PROFINET Device* must be installed.

Default value

The default value is 64 bytes (512 signal bits).

Allowed values

8, 16, 32, 64, 128 or 256 bytes (64, 128, 512, 1024 or 2048 signal bits).

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9 Troubleshooting

9.1 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.
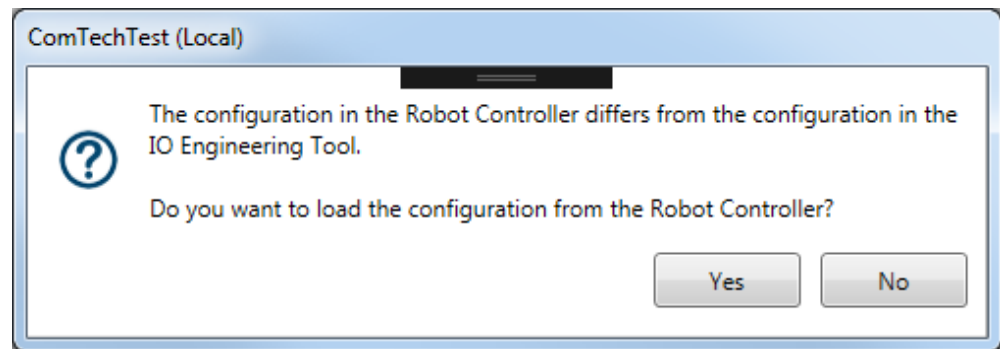
xx1800000014

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.

9 Troubleshooting

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 IO 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 specific tool or through the network configuration tool. According to 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.

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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).**
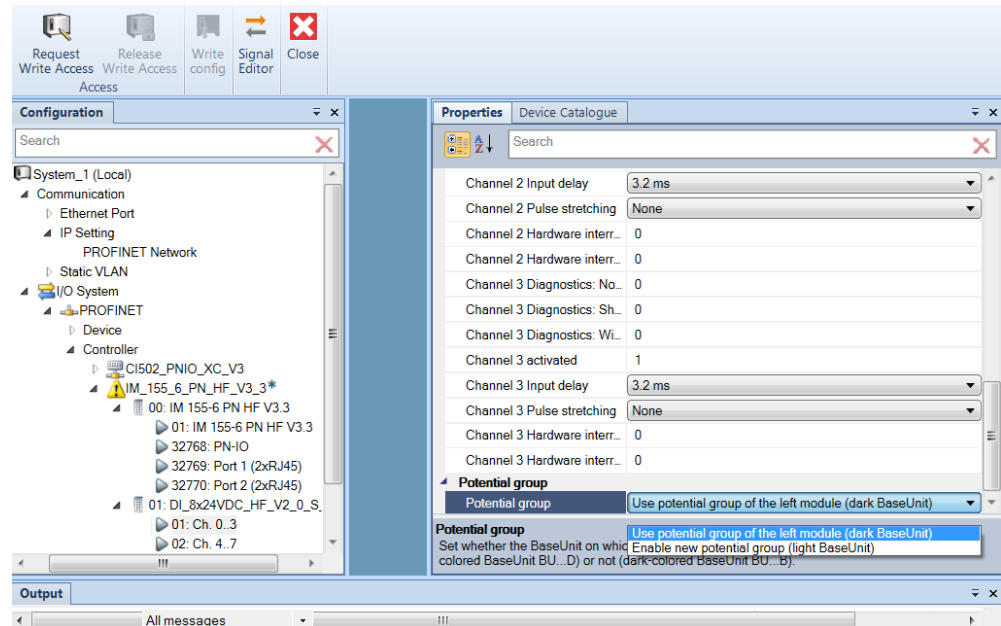
Duplicated module id in GSD file

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.
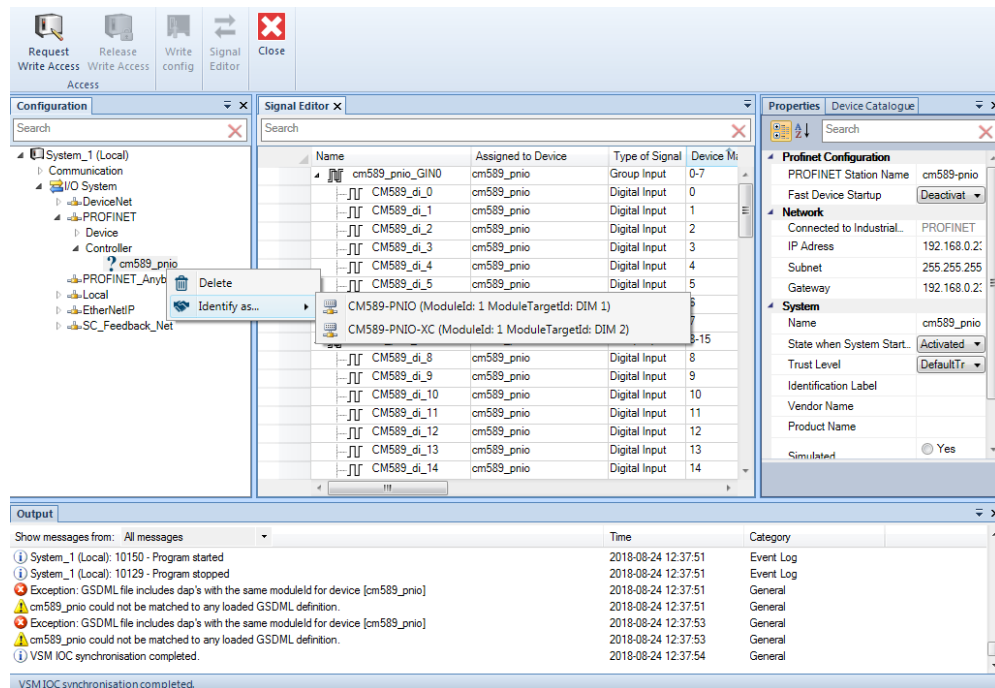
xx1800001534

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 80*.

- If the message "Exception: GSD file includes dap's with the same moduleId for device ..." is not shown, load the GSD definitions. See *Import GSD files on page 45*.
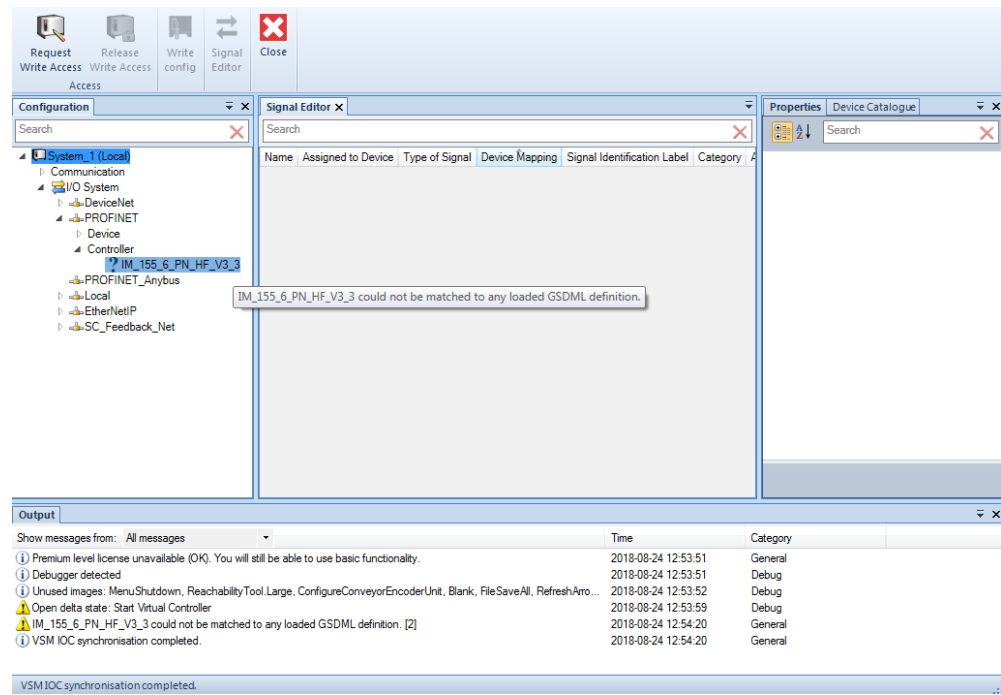
xx1800001535

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

If an old configuration is restored into IO Configurator, 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.

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 IO Configurator and Visual SafeMove, a dialog will be shown where the
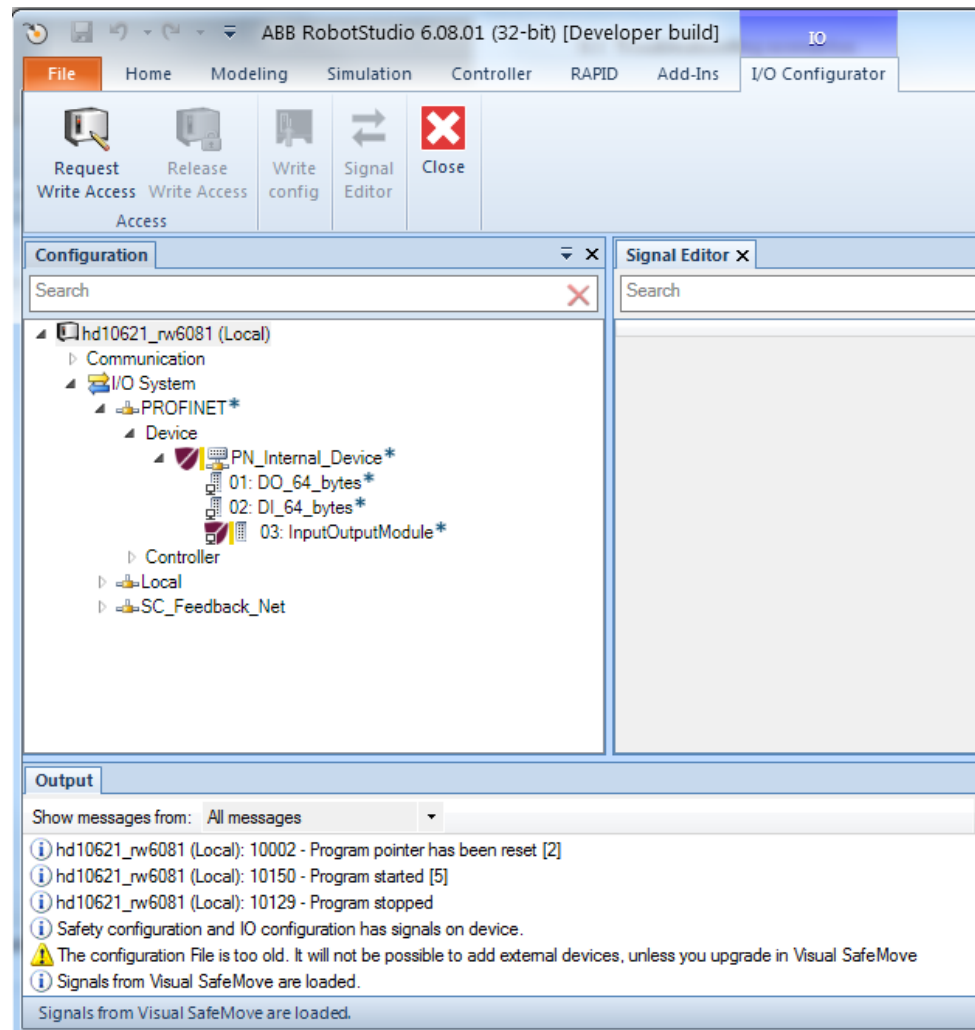
Continues on next page

user can select which names to use. These names can be changed at a later stage in IO Configurator.

> **Note**
>
> It is possible to have an internal device in the IO Configurator that shows virtual modules. The small monitor icon displayed next to a module indicates that the module is virtual:
>
>
>
> xx1800003373
>
> 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.

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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 IO Configurator 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 IO Configurator. If this is the case, a dialog will be displayed where the user is asked to select the configuration to be used.
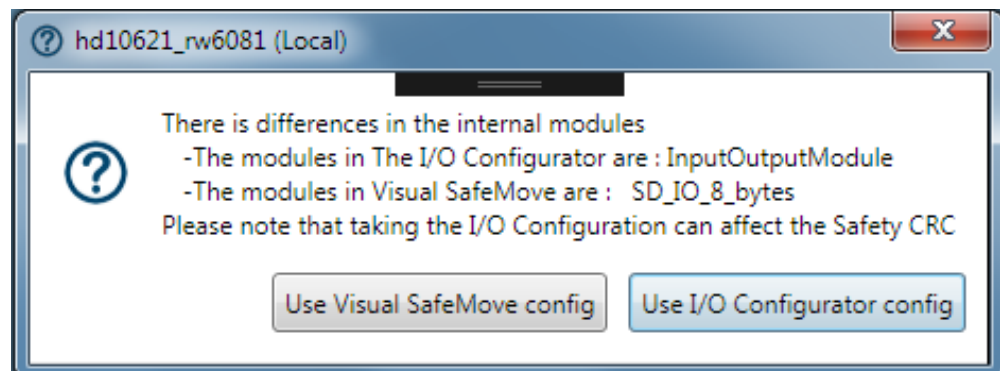
xx1800003374

The selected configuration can be changed at a later stage in IO Configurator.

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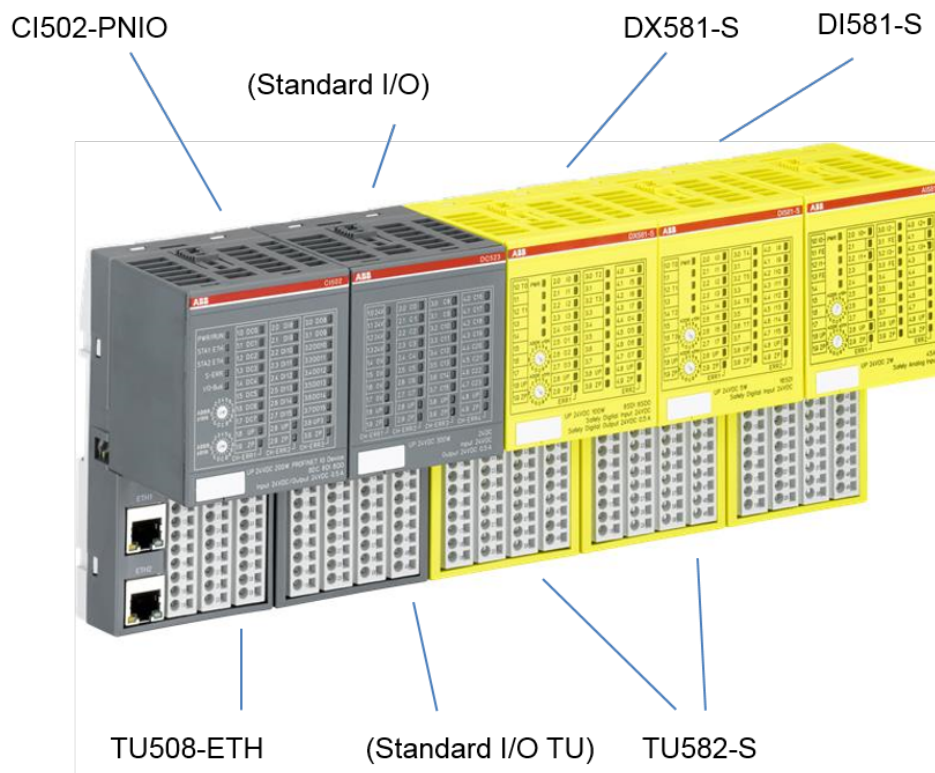
A RobotWare license with the options *PROFINET Controller/Device* and *Prepared for ABB CI502* or *PROFIsafe F-Host and Device* is required to host ABB safe I/O devices on the IRC5 controller.

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

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.

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 IO Configurator

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 Configurator 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.

Continues on next page

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

> ℹ️ **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 87*.

> ℹ️ **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.

> ℹ️ **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 IO Configurator.

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.

> ℹ️ **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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