ABB

ROBOTICS

# Application manual
PROFINET Controller/Device

# Application manual

# PROFINET Controller/Device

RobotWare 7.13

Document ID: 3HAC066558-001

Revision: M

# Table of contents

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# Overview of this manual

**About this manual**

This manual describes the following options and contains instructions on how to configure them in an OmniCore system.

- *PROFINET Controller*, option number 3020-1
- *PROFINET Device*, option number 3020-2
- *PROFIsafe Controller*, option number 3023-1
- *PROFIsafe Device*, option number 3023-2

> **ℹ️ Note**
>
> It is the responsibility of the integrator to provide safety and user guides for the robot system.

**Usage**

This manual should be used during installation and configuration of the PROFINET options.

> **ℹ️ Note**
>
> Before any work on or with the robot is performed, the safety information in the product manual for the controller and manipulator must be read.

**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 configuration
- OmniCore controller
- RobotStudio

**References**

ABB documents

| Reference | Document ID |
|---|---|
| *Application manual - I/O Engineering* | *3HAC082346-001* |
| *Technical reference manual - System parameters* | *3HAC065041-001* |
| *Product manual - OmniCore E10* | *3HAC079399-001* |

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| Reference | Document ID |
|---|---|
| *Product manual - OmniCore C30* | *3HAC060860-001* |
| *Product manual - OmniCore C90XT* | *3HAC073706-001* |
| *Product manual - OmniCore V250XT Type B* | *3HAC087112-001* |
| *Product manual - OmniCore V400XT* | *3HAC081697-001* |
| *Operating manual - Integrator's guide OmniCore* | *3HAC065037-001* |
| *Operating manual - OmniCore* | *3HAC065036-001* |
| *Operating manual - RobotStudio* | *3HAC032104-001* |

## 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. |
| International standard IEC 62443 | Industrial communication networks – Network and system security |
| PROFINET Cabling and Interconnection Technology | Installation Guideline for PROFINET |
| Commissioning PC Stations - Manual and Quick Start | Release 12/2006 C79000-G8976-C156-08 |
| ET200SP Distributed I/O System | Manual from Siemens |
| *www.profinet.com* | The web site of PROFINET International |

## Revisions

| Revision | Description |
|---|---|
| A | Released with RobotWare 7.0. |
| B | Released with RobotWare 7.0.1.<br>• Cfg name removed from entire manual. |
| C | Released with RobotWare 7.0.2.<br>• LLDP overview image corrected in section *PROFINET for OmniCore on page 14*. Image now shows that LAN3 is a private network port. |
| D | Released with RobotWare 7.1.<br>• Information regarding group signals added in section "Signal Editor" and "Editing signals".<br>• Configuration of internal device added in chapter *Configuring the internal device on page 51*.<br>• The following sections have been updated regarding PROFIsafe: *PROFINET for OmniCore on page 14*, *I/O devices on page 18*, *Information about the internal device on page 19*, "The I/O Engineering Tool user interface" and *Configuring the internal device on page 51*.<br>• New chapter: *Setting up your PROFINET system on page 23*.<br>• Information about a new flash pattern for PC-STAT added in section "Unidentified devices", in chapter *Troubleshooting scenarios on page 61*.<br>• Appendix regarding TIA portal removed.<br>• PROFINET parameters are described in the instructions instead of in a separate chapter. The section System Parameters is therefore removed. |

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

| Revision | Description |
|---|---|
| E | Released with RobotWare 7.2.<br>• Minor corrections in section "Network connections on the OmniCore".<br>• New section: *Creating safety integers on page 59*.<br>• Minor corrections in section "Connections on the main computer". |
| F | Released with RobotWare 7.3.<br>• Limitations for selection of LLDP mode added in sections *Specification overview, internal controller on page 14* and *Configuring the PROFINET network properties on page 27*.<br>• Information regarding the Parameterization Speedup parameter added in section *Poor performance using fast startup on page 62*.<br>• Information about MDI settings added in section *Using Fast Device Startup on page 46*. |
| G | Released with RobotWare 7.4.<br>• Information about certification added in section *PROFINET for Omni-Core on page 14*.<br>• Section "Network connections on OmniCore" replaced by "Ethernet networks on OmniCore".<br>• Updated sections due to removed connection between IOE and VSM: "The ribbon", "Symbols", *Configuration prerequisites on page 51* and *Saving the configuration on page 60*. |
| H | Released with RobotWare 7.5.<br>• Information about Media Redundancy Protocol (MRP) added in section *Manually adding devices to your network on page 37*.<br>• Information about temporary IP addresses added in section *Troubleshooting scenarios on page 61*. |
| J | Released with RobotWare 7.6.<br>• Minor corrections in section *PROFINET for OmniCore on page 14* and *Adding I/O modules on page 41*.<br>• Information about I/O-Network added in entire manual.<br>• Section "Ethernet networks on OmniCore" removed.<br>• Section *Configuring the network settings on page 25* updated and section "Configuring the IP settings for internal controller has been removed". |
| K | Released with RobotWare 7.7.<br>• Minor corrections in *PROFINET for OmniCore on page 14*.<br>• Reference to AM I/O Engineering added, and section "I/O Engineering user interface" removed.<br>• New section: *Scan Editor options on page 34*<br>• Update button for GSD files added in *Importing the GSD files on page 32*. |
| L | Released with RobotWare 7.10.<br>• Information about 3023-1 *PROFIsafe Controller* added in *What is PROFINET? on page 13*, *PROFINET for OmniCore on page 14*, *Information about the internal device on page 19*, *Information about the internal controller on page 21*, *Logging in with configuration grant on page 23*.<br>• New section: *Add safety I/O modules to internal controller (for option 3023-1 PROFIsafe Controller) on page 41*.<br>• GSD version for internal controller updated in section *PROFINET for OmniCore on page 14*.<br>• Information about calculation of **Faulty Telegrams** added in *Manually adding devices to your network on page 37*.<br>• Minor updates in *PROFINET for OmniCore on page 14*. |

| Revision | Description |
|---|---|
| | • Minor updates regarding submodules in *Configuring the internal controller and external devices on page 31*.<br>• New section: *Deleting an internal device on page 54*.<br>• Device SD-IO 8 bytes 4-bytes crc added in section *Input and output size on page 19*.<br>• Description of identification and maintenance fields added in *Configuring the internal device on page 51*.<br>• Information about **I/O Network** added in *Configure IP settings on page 25*. |
| M | Released with RobotWare 7.13.<br>• Information about support for PROFINET Device for E10 added.<br>• Information about naming standards for GSD files added in *Troubleshooting scenarios on page 61*.<br>• Information about muted event log messages added in *Muting I/O event messages for external devices on page 50*.<br>• Minor updates in *References on page 7*. |

# 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.

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# 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.

PROFIsafe is one of the PROFINET communication profiles. It 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).

## 1.2 PROFINET for OmniCore

**General**

The PROFINET network is running on the OmniCore main computer and does not require any additional hardware.

**Options**

There are two options available for PROFINET:

- 3020-1 *PROFINET Controller*
- 3020-2 *PROFINET Device*

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ℹ️ **Note**

In this manual, the 3020-2 *PROFINET Device* and the 3023-2 *PROFIsafe Device* are referred to as *internal device*.

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The following options are available for PROFIsafe:

- 3023-1 *PROFIsafe Controller*
- 3023-2 *PROFIsafe Device*

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ℹ️ **Note**

With option *3023-2 PROFIsafe Device*, it is possible to configure safe modules for the internal device.

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**Compatibility**

**PROFINET**

The PROFINET controller and device is certified by PROFINET International (PI) with conformance class B/ NetLoad Class II.

The PROFINET controller and device is certified for the PROFINET version 2.35.

**PROFIsafe**

The PROFIsafe controller and device were executed in accordance with the following documents:

PROFIsafe - Test Specification for F-Slaves, F-Devices, and F-Hosts, Version 2.3.

**Specification overview, internal controller**

| Item | Specification |
|---|---|
| PROFINET version | 2.35 |
| PROFIsafe version | 2.6.1 |
| GSD file versions supported | 2.20–2.42 |
| Number of I/O devices connected to controller | In total 50 I/O devices of which maximum 8 safe devices. |

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Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

| Item | Specification |
|---|---|
| LLDP mode | Legacy and Standard mode supported:<br>• *Legacy mode* supports communication to I/O devices according to PROFINET I/O specification up to version 2.2.<br>• *Standard mode* supports communication to I/O Devices according to PROFINET I/O specification after version 2.2.<br><br>ℹ **Note**<br><br>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 | 2.35 |
| PROFIsafe version | 2.6.1 |
| GSD version | 2.35 |
| Slot configuration | Slot 1-2: Digital input or output modules of variable size<br>Slot 3-4: Safe digital input or output modules of fixed 8 bytes size |
| Connection size | Maximum 256 input bytes and 256 output bytes, and maximum 8 safe input bytes and 8 safe output bytes. |

## Application protocols

For information about application protocols and port numbers, see section "OmniCore application protocols" in *Operating manual - Integrator's guide OmniCore*.

## Default gateway

There is one default gateway for the entire system. The default gateway must hence be configured so that it matches both the requirements for PROFINET traffic and non-PROFINET traffic.

## Interface ports

The PROFINET controller and device can be configured on both the **Public Network** (WAN) and the **I/O Network** (LAN). See *Selecting an interface port on page 28*.

## Link Layer Discovery Protocol (LLDP)

The OmniCore 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).

**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.

- The device cannot be configured with FSU (Fast Startup Unit). In that case Device replacement will not work.

# 2  Hardware overview

## 2.1  Ethernet switches

**Prerequisites**

It is recommended to use PROFINET certified switches.

## 2.2 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.

# 3  Software overview

## 3.1  Information about the internal device

**General**

To use the PROFINET internal device, the OmniCore controller must be installed with the option 3020-2 *PROFINET Device*. If safe modules shall be added, the option 3023-2 *PROFIsafe Device* must also be installed.

The PROFINET internal device can be used to:

- connect an OmniCore controller to a PLC.
- connect an OmniCore controller to another OmniCore 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 I/O Engineering to configure the PROFINET network for initial use. For example, by setting the correct network name and IP settings. The DCP protocol can also be used to set station name and IP-address when running as a device.

**Input and output size**

PROFINET has an internal device with maximum 2048 digital input signals and maximum 2048 digital output signals. Apart from this, if PROFIsafe is used, 64 safety digital input signals and 64 safety digital output signals can also be added.

The following table shows the possible modules that can be configured for the internal device:

| Slot | Possible modules | Comment |
|------|------------------|---------|
| 01 | DO 8 bytes<br>DO 16 bytes<br>DO 32 bytes<br>DO 64 bytes<br>DO 128 bytes<br>DO 256 bytes | |
| 02 | DI 8 bytes<br>DI 16 bytes<br>DI 32 bytes<br>DI 64 bytes<br>DI 128 bytes<br>DI 256 bytes | |

# 3 Software overview

## 3.1 Information about the internal device
*Continued*

| Slot | Possible modules | Comment |
|---|---|---|
| 03 | SDO 8 bytes<br>SD-IO 8 bytes<br>SDO 8 bytes/4-bytes crc<br>SD-IO 8 bytes/4-bytes crc | ℹ️ **Note**<br><br>The *SDO 8 bytes* and *SD-IO 8 bytes* modules are compatible with PROFINET version 2.4.<br>The *SDO 8 bytes/4-bytes crc* and *SD-IO 8 bytes/4-bytes crc* modules are compatible with PROFIsafe version 2.6.1.<br><br>ℹ️ **Note**<br><br>If the *SD-IO module* (both input and output) is selected, slot 04 will not be available for configuration. |
| 04 | SDI 8 bytes<br>SDI 8 bytes/4-bytes crc | ℹ️ **Note**<br><br>The *SDI 8 bytes* module is compatible with PROFINET version 2.4.<br>The *SDI 8 bytes/4-bytes crc* module is compatible with PROFIsafe version 2.6.1. |

💡 **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.

ℹ️ **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 OmniCore controller must be installed with the option 3020-1 *PROFINET Controller*. If third-party safe devices shall be used, the option 3023-1 *PROFIsafe Controller* must also be installed.

The PROFINET internal controller can be used to:

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

**GSD files**

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

For information regarding how to import a GSD file, see .

## 3.3 Software for configuring a device

**General**

The PROFINET internal device needs to be configured in I/O Engineering before it can be connected to a PLC/PROFINET controller. Furthermore, the connecting PLC/PROFINET controller might need a PC software tool to configure all connection parameters used to connect to the OmniCore system.

**GSD file for configuring the internal device for a PROFINET controller**

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

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

- **In the RobotWare installation folder in RobotStudio:**
  *...\DistributionPackages\ABB.RobotWare-x.x.x-xxx\RobotPackages\RobotControl_x.x.xxx\utility\service\GSDML\*

- **On the OmniCore Controller:**
  *...\products\RobotControl_x.x.x\utility\service\GSDML\*

> **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**.

# 4  Setting up your PROFINET system

## 4.1  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 options 3023-1 *PROFIsafe Controller* or 3023-2 *PROFIsafe Device*, and a configuration is to be written to a robot controller, log in as a safety user (a user with access to **Safety Services**). See *Operating manual - RobotStudio*, section *Managing the user authorization system*.

## 4.2 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**.

See *Application manual - I/O Engineering* for more information.

## 4.3 Configuring the network settings

**Configure IP settings**

IP settings for the PROFINET network used on the **Public Network** or **I/O Network** are defined in **Network Settings** in RobotStudio or on the FlexPendant. See *Operating manual - RobotStudio* and *Operating manual - Integrator's guide OmniCore*.

|   |   |
|---|---|
| ℹ | **Note** |

When using PROFINET on the **I/O Network**, make sure that DHCP server is not active on the **Public Network** (WAN). To disable DHCP for the **Public Network**, assign a static IP address.

**Configure firewall settings**

The Firewall Management function is used to configure the network firewall on the controller. Configuration is done in RobotStudio under **Configuration\Communication\Firewall Manager** where pre-configured Network Services can be enabled or disabled. See *Operating manual - RobotStudio* and *Operating manual - Integrator's guide OmniCore*.

## 4.4 Setting the station name

**Set station name**

The station name is used to identify the controller and/or the device on the respective network interfaces (**Public Network** and **I/O Network**).
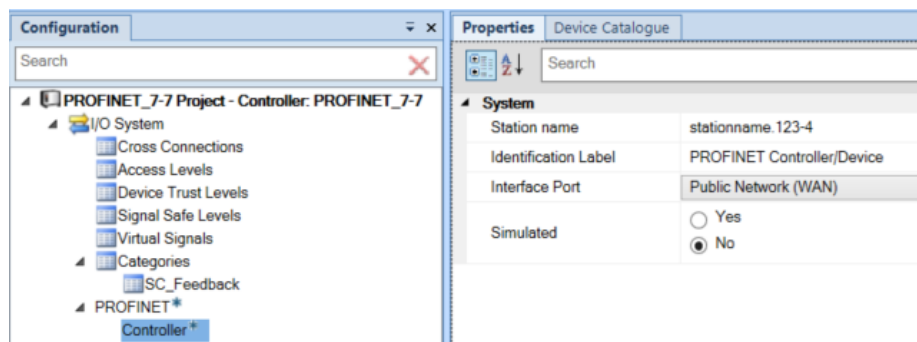
1 In the **Configuration** browser, expand **PROFINET** and select **Controller**.

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

> **ⓘ Note**
>
> This is the name of the internal device as it appears on the Public or I/O network. For example, detectable by a PLC.

PROFINET station name follows the PROFINET naming convention. It uses lower case alphabets for naming station name.



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## 4.5 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:
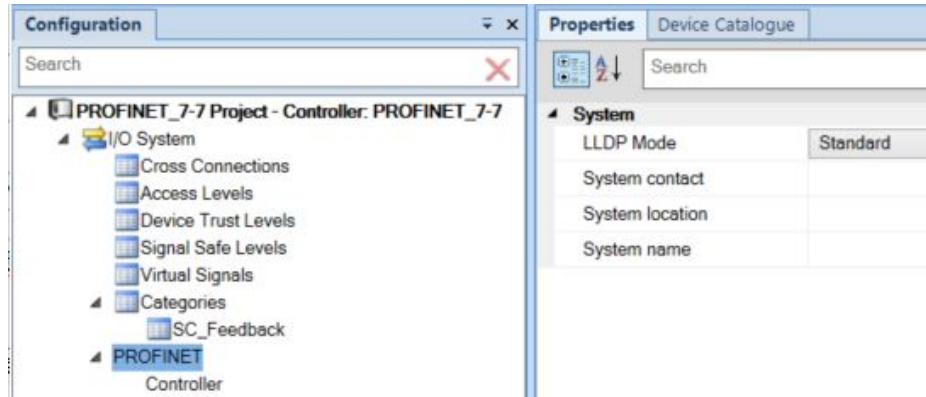


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| Parameter | Description |
|-----------|-------------|
| **LLDP Mode** | Select **Standard** or **Legacy**, indicating what Link Layer Discovery Protocol mode should be supported. |
| | ![i] **Note** |
| | The controller supports LLDP, but only on one port at a time. Any network connected to another port must have LLDP disabled (or use equipment not supporting LLDP). |
| | ![i] **Note** |
| | If one device in the configuration only supports legacy mode, all devices must run in legacy mode. |

## 4.6 Selecting an interface port

**Select an interface port**

The PROFINET controller and device can be configured on both the **Public Network (WAN)** and the **I/O Network (LAN)**:

1. In the **Configuration** browser, expand **PROFINET** and select the controller or the internal device.

2. In the **Properties** browser, select the **Interface Port** to be used for the controller:
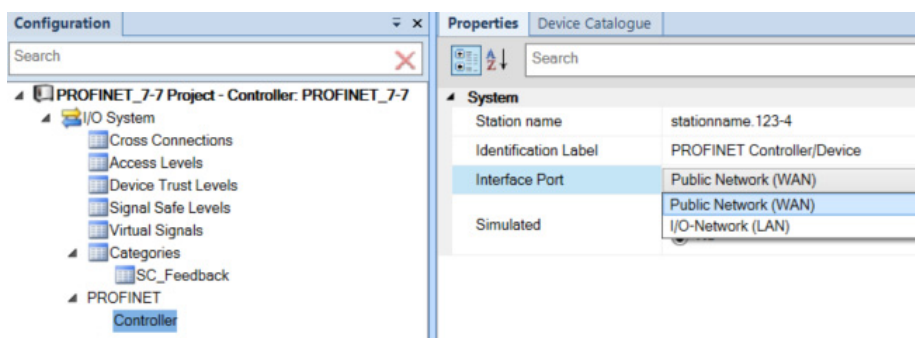


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Select between **Public Network (WAN)** and **I/O Network (LAN)**.

## 4.7 Working with functional safety (PROFIsafe)

### Log in as safety user

If working with safe I/O signals (option 3023-2 PROFIsafe Device), log in as a safety user (the user grant **Safety Services** is required). See *Operating manual - RobotStudio*, section *Managing user rights and write access on a controller*.

### Requirements for PROFIsafe address types

The following applies for the PROFIsafe address types:

- For PROFIsafe Device, **Address type 2** is supported.

### Communication error handling

When communication errors occur, signals that are mapped to PROFIsafe devices are set to fail-safe values (0) and one or more error log messages are generated.

In order to prevent unintentional restart of the communication, the operator is required to activate the **F-Host Operator Acknowledge** button on the FlexPendant (Settings\Safety Controller\Configuration).

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# 5  Configuring the internal controller and external devices

## 5.1  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 23*.
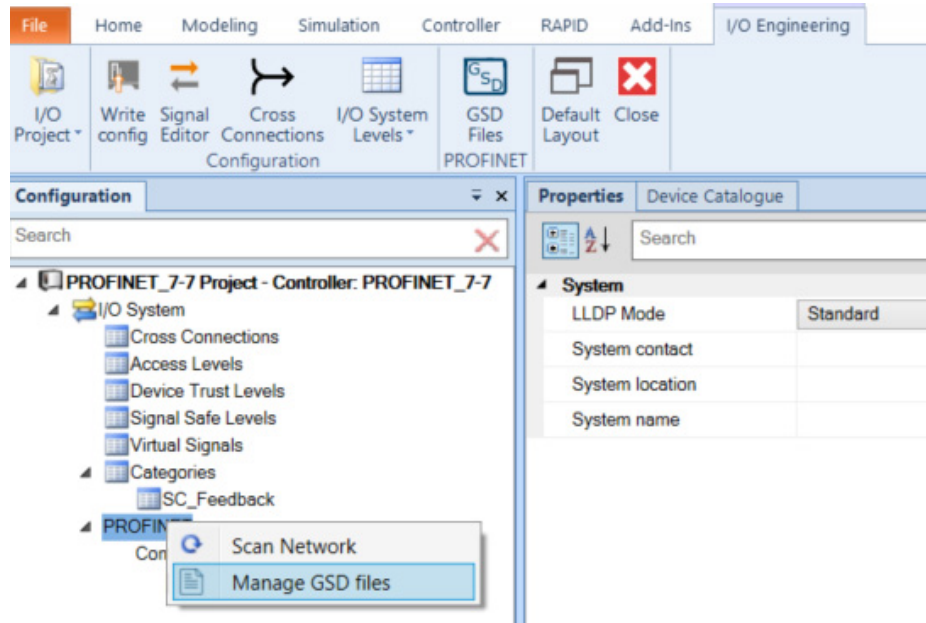
## 5.2 Importing the GSD files

**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 **I/O Engineering** tab, select **GSD Files**, or right-click on **PROFINET** (under I/O system) and select **Manage GSD files**.



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Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

2 The **GSD Files** window is displayed. Click **Import** and browse for a GSD file, or **Import, Folder** to import a complete folder with GSD files.
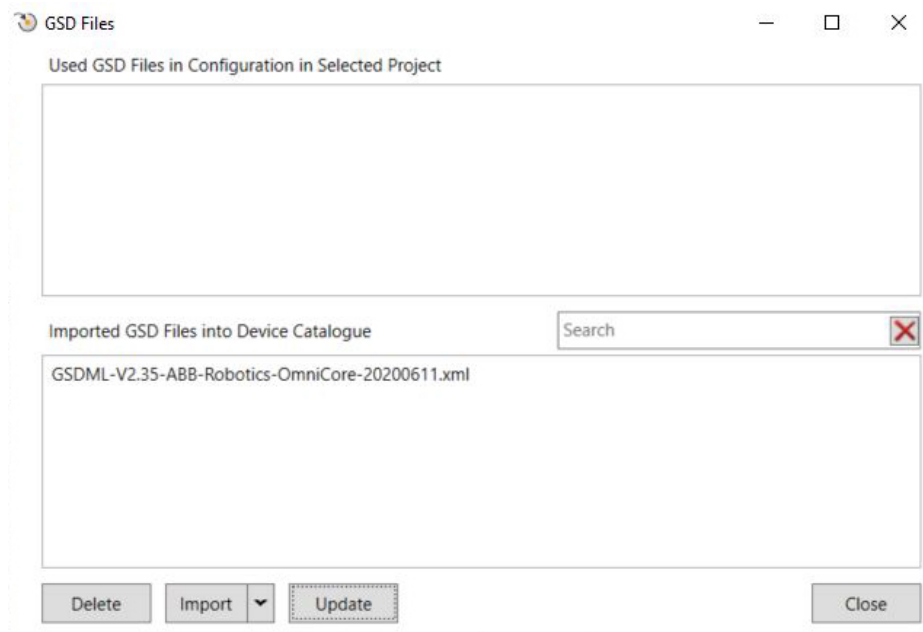


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> ℹ **Note**
>
> The **Used GSD Files...** window shows all GSD files that are used in the current I/O project.
>
> The **Imported GSD Files...** window shows all GSD files that are imported into the I/O project but are not used in the configuration.

> ℹ **Note**
>
> When a new I/O project is opened, only the used GSD files will be shown in the **Imported GSD Files...** window. Click **Update** to display all previously imported, but not used, GSD files.

## 5.3 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 the network properties. See *Configuring the network settings on page 25*.

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 37*.

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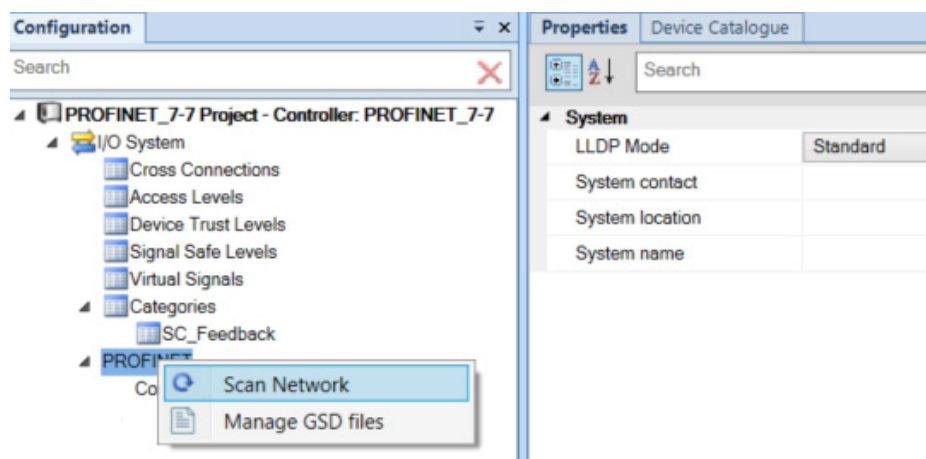


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Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

> 💡 **Tip**
>
> Use the **Blink** functionality to detect the correct unit when multiple devices are connected.
>
> When a device is identified, the PC-STAT LED on the device will flash green with a frequency of 1Hz.

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.

## 5.4 Configuring the controller properties

**Configure the controller properties**

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

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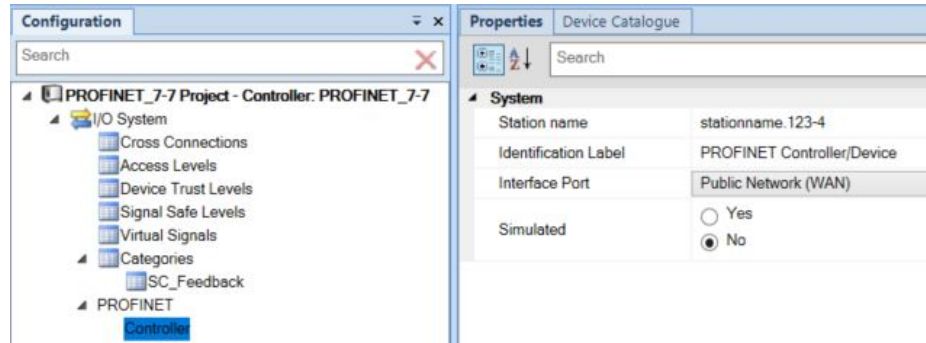


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| Parameter | Description |
|---|---|
| **Station name** | Define a station name to be used to identify the controller on the respective network interfaces (**Public Network** and **I/O-Network**). |
| **Identification Label** | Define a label to help the operator to identify the controller. |
| **Interface Port** | Select between **Public Network (WAN)** and **I/O-Network (LAN)** indicating the interface port to be used for the controller. |
| **Simulated** | Select **Yes** or **No**, indicating if the industrial network and all its connected I/O devices should be treated as simulated. |

## 5.5 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.



xx1900000886

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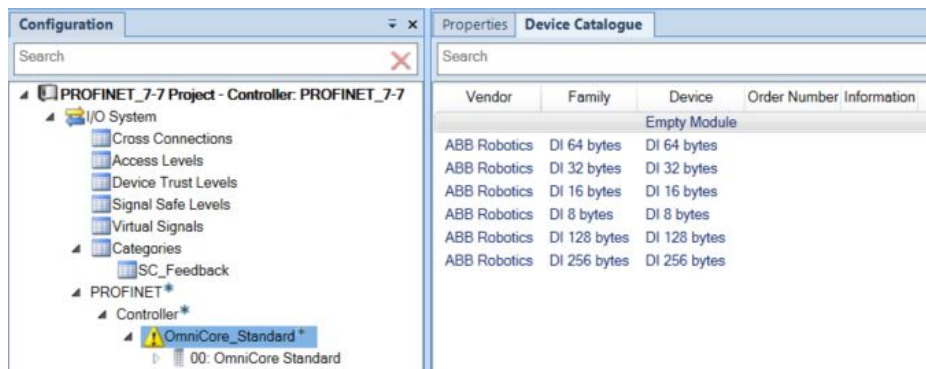


xx1900000887

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.

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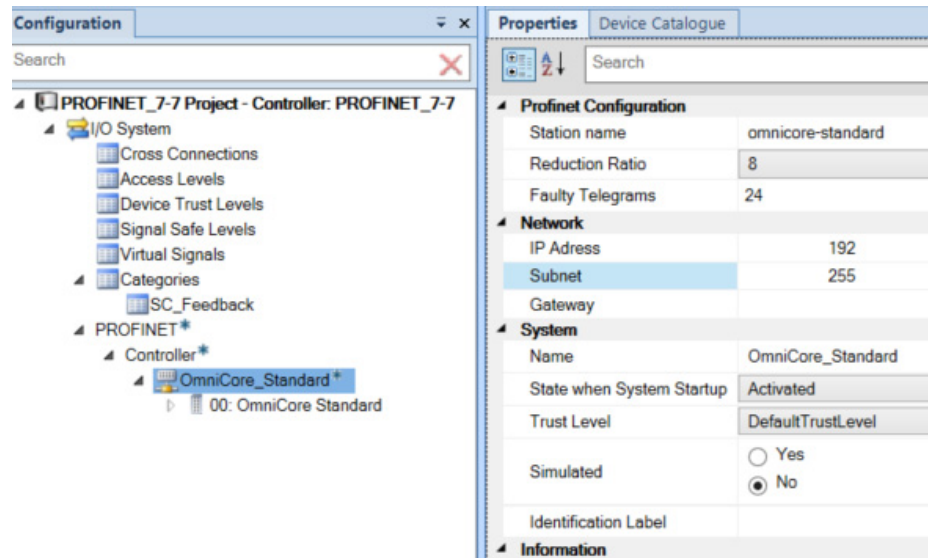


xx1900000888

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

| Parameter | Description | Allowed values |
|---|---|---|
| **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.<br>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.<br>**ℹ Note**<br>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. | |
| **Subnet** | Defines the subnet mask for the external device. | |

*Continues on next page*

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

| Parameter | Description | Allowed values |
|---|---|---|
| **Gateway** | Defines the gateway for the external device.<br><br>ℹ️ **Note**<br><br>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.<br>The string must follow the RAPID rules described in *Technical reference manual - RAPID Overview*.<br>The name must be unique among all named objects in the I/O system configuration.<br><br>ℹ️ **Note**<br><br>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:<br>• Establish communication (Activated)<br>• Don't establish communication (Deactivated)<br>• 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.<br>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.<br>A string with maximum 32 characters.<br>The string must follow the RAPID rules described in *Technical reference manual - RAPID Overview*.<br><br>ℹ️ **Note**<br><br>Names differing only in upper and lower case are considered to be equal. |
| **Simulated** | Select **Yes** or **No**, specifying if the industrial network and all its connected external devices should be treated as simulated. | |

*Continues on next page*

| Parameter | Description | Allowed values |
|---|---|---|
| **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. |
| **Media Redundancy Protocol** | Media Redundancy Protocol (MRP) is a data network protocol standardized by IEC 62439-2.<br><br>It is a redundancy protocol supported by all PROFINET capable devices that will allow a network to be configured in a ring topology to overcome any single failure on the network. | Select **Enabled** or **Disabled**, specifying if the MRP should be enabled or not.<br><br>![i] **Note**<br><br>The robot controller has no support for MRP. |

## 5.6 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**.
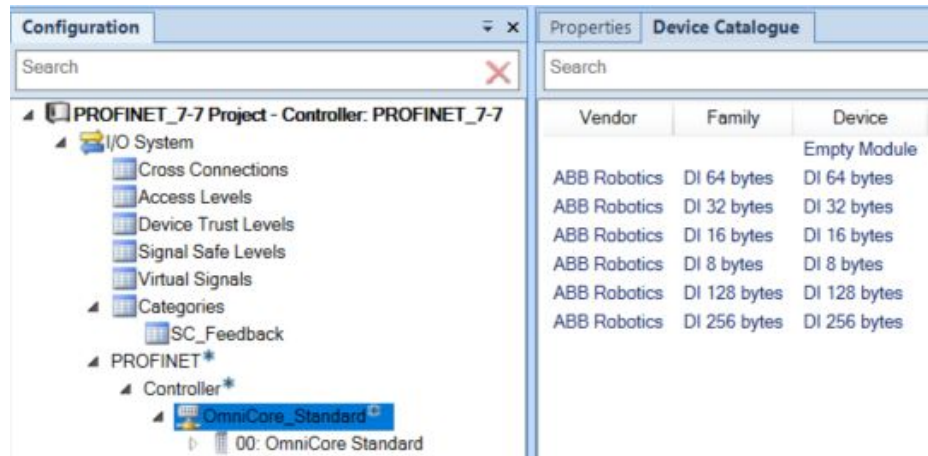


xx1900000889

2 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.
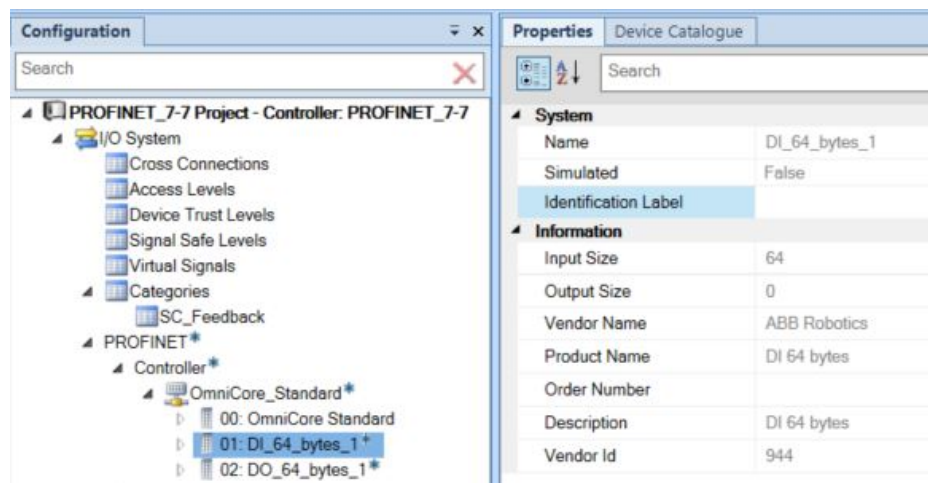


xx1900000890

**Add safety I/O modules to internal controller (for option 3023-1 *PROFIsafe Controller*)**

1 In the **Configuration** browser, expand **Controller** and select the device for which safe I/O modules should be added.
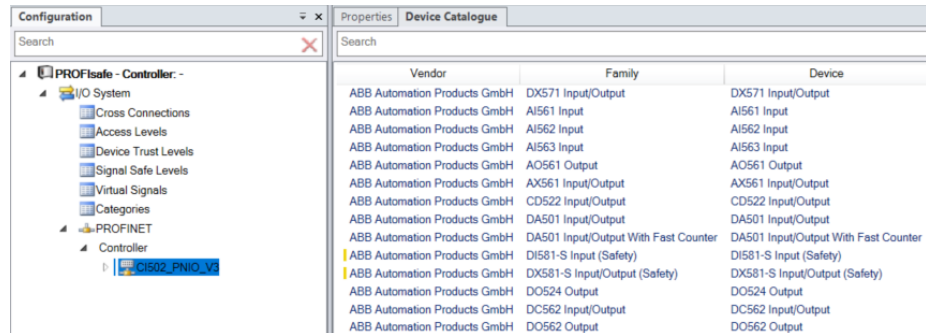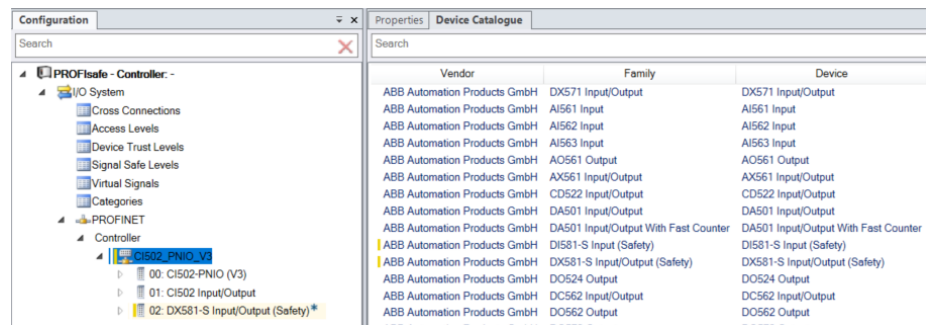
2  Select **Device Catalogue** to view a list of available safe I/O modules.



xx2200001023

3  Double-click the safe I/O modules (output and/or input) in the list to be added to the internal controller.



xx2200001024

---

**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.
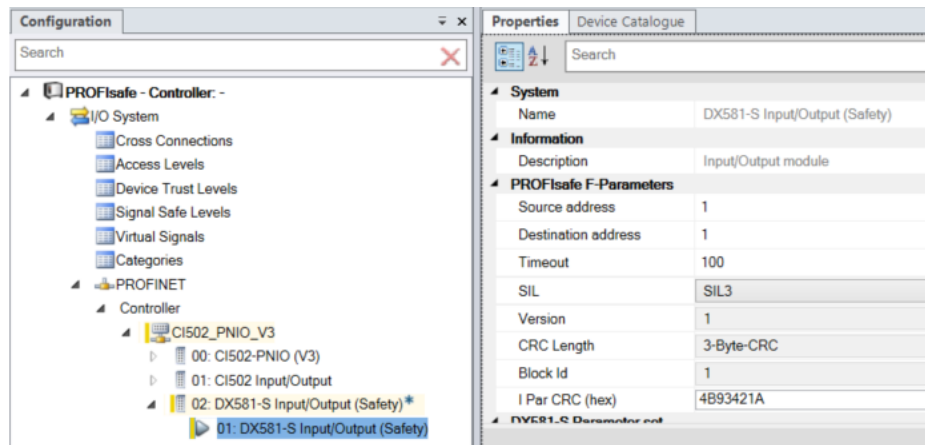
---

**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.

---

*Continues on next page*

4    Select the safe I/O submodule in the **Configuration** browser and configure
the **PROFIsafe F-Parameters**:



xx2200001025

| PROFIsafe F-Para-meter | Description |
|---|---|
| Source address | The PROFIsafe **Source address** combined with the **Destination address** uniquely identifies the module. Both addresses are decimal values. |
| Destination ad-dress | The PROFIsafe **Destination address** combined with the **Source address** uniquely identifies the module. Both addresses are decimal values. |
| Timeout | The monitoring time (WD_Timeout), in milli seconds, within which a valid current safety message frame must arrive. |
| SIL | The Safety Integrity Level (SIL) of a submodule. |
| Version | Indicates the version number of the F-parameter. Always 1. |
| CRC Length | Indicates the length of the CRC2 signature. Can be 3-Byte-CRC or 4-Byte-CRC. |
| Block Id | Indicates the parameter block type:<br>• 0: No I-parameters defined.<br>• 1: Field **I Par CRC (hex)** must be completed. |
| Passivation | Indicates the level of passivation that is supported. Can be Device/Module or Channel.<br><br>ℹ **Note**<br><br>Mandatory if **CRC Seed** is defined. |
| CRC Seed | Only displayed if **CRC Seed** is set to CRC-Seed32. Indicates how the MonitoringNumber for CRC2 is generated.<br><br>ℹ **Note**<br><br>If **CRC Seed** is defined, **Passivation** must also be completed.<br><br>ℹ **Note**<br><br>For PROFIsafe version 2.6, **CRC Seed** must be set to CRC-Seed32. |

*Continues on next page*

| PROFIsafe F-Para-meter | Description |
|---|---|
| **I Par CRC (hex)** | Only displayed if **Block Id** is set to 1.<br>Enter the IParCrc value for the safe module, calculated using a **Vendor Tool**. |

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

---

**ℹ Note**

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

---

**ℹ Note**

The **Vendor Tool** is provided by the device manufacturer.

---

## 5.7 Working with signals
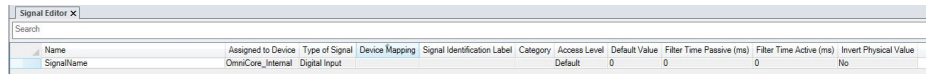
## 5.7.1 Creating I/O signals

**Overview**

I/O signals can be added to I/O devices in a project, either on module level or submodule level.

For detailed descriptions of all signal parameters, see *Technical reference manual - System parameters*.

**Create I/O signals**

1  In the ribbon of the **I/O Engineering** tab, select **Signal Editor**.

2  In the **Configuration** browser, select the I/O device (module or sub-module) for which signals are to be created and complete the fields.

| Name | Assigned to Device | Type of Signal | Device Mapping | Signal Identification Label | Category | Access Level | Default Value | Filter Time Passive (ms) | Filter Time Active (ms) | Invert Physical Value |
|---|---|---|---|---|---|---|---|---|---|---|
| SignalName | OmniCore_Internal | Digital Input | | | | Default | 0 | 0 | 0 | No |

xx1900000891

For detailed descriptions of all signal parameters, see *Technical reference manual - System parameters*.

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

## 5.8  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 62*.

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 48* and *Configuring port speed for external devices on page 49*.
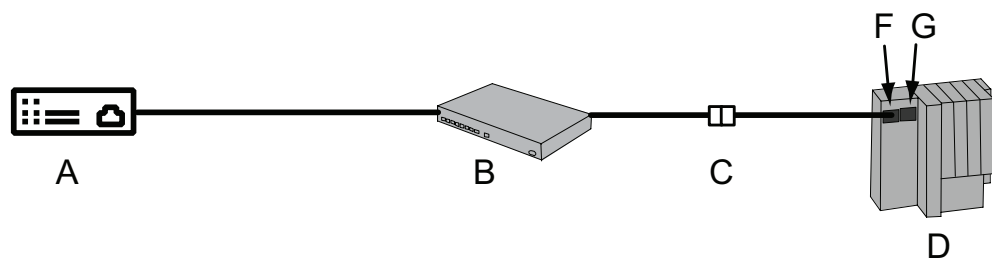
---

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

---

**Three alternative connections**
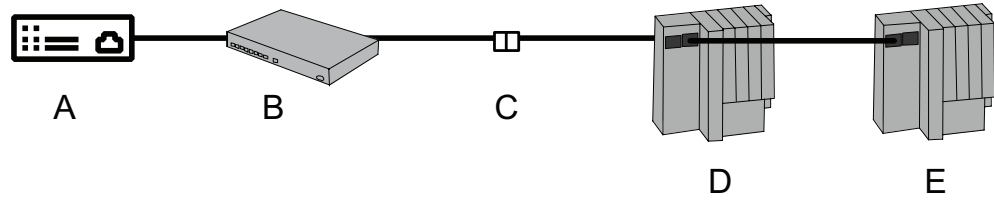
I/O device connected via a switch



xx1100000093

| A | OmniCore 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.

*Continues on next page*

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

**Two I/O devices connected in serial via a switch**



xx1100000094

| A | OmniCore 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 | OmniCore 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.

**MDI settings for fixed port speed**

When fixed port speed is used, the interface WAN on the robot controller has the Medium-dependent interface set as **MDI**.

Thus, Auto MDI-X functionality is disabled, and the user must be aware of the link-partners setting and what type of cable to use in order to achieve a link.

The following table displays the cable requirements for the Ethernet link:

|  | MDI | MDI-X | Auto MDI-X |
|---|---|---|---|
| **MDI** | crossover | straight | any |
| **MDI-X** | straight | crossover | any |
| **Auto MDI-X** | any | any | any |

## 5.8.1  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**.



| Properties | Device Catalogue | Diagnostics |
| --- | --- | --- |
| Search | | |
| ▲ **Profinet Configuration** | | |
| PROFINET Station Name | im-155-6-pn-st-s-v1-0 | |
| Reduction Ratio | 8 | |
| Faulty Telegrams | 24 | |
| Fast Startup | Enabled | |
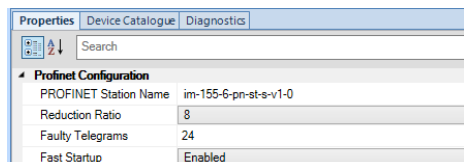
xx1800003277

## 5.8.2 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**.
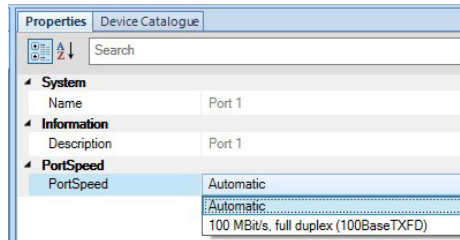


xx1900000905

| ℹ | **Note** |
|---|---|
| | The GSD file defines what port speeds are allowed for the external device. |

## 5.8.3  Muting I/O event messages for external devices

I/O Event Messages from an external device can be muted using the RAPID instruction `IODeviceMute`.

Devices are unmuted by default, but using this instruction all event log messages from a specified device can be muted. The device will remain muted until the setting is changed or until the controller is restarted.

For information about how to use the instruction `IODeviceMute`, see *Technical reference manual - RAPID Instructions, Functions and Data types*.

# 6 Configuring the internal device

## 6.1 Configuration prerequisites

**Prerequisites**

Before configuring the internal device, make sure to set up your system according to *Setting up your PROFINET system on page 23*.
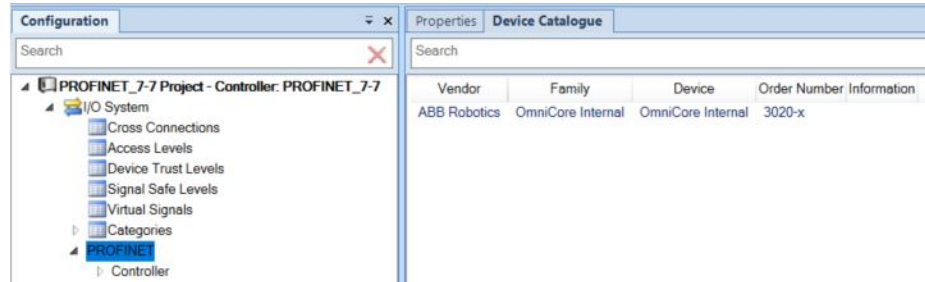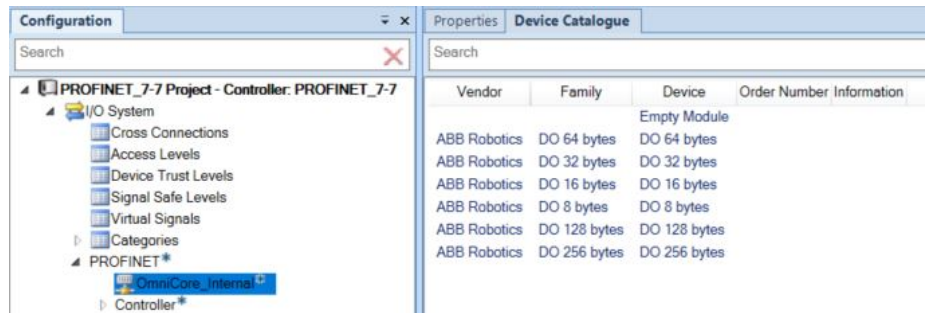
## 6.2 Adding an internal device

**Add internal device**

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

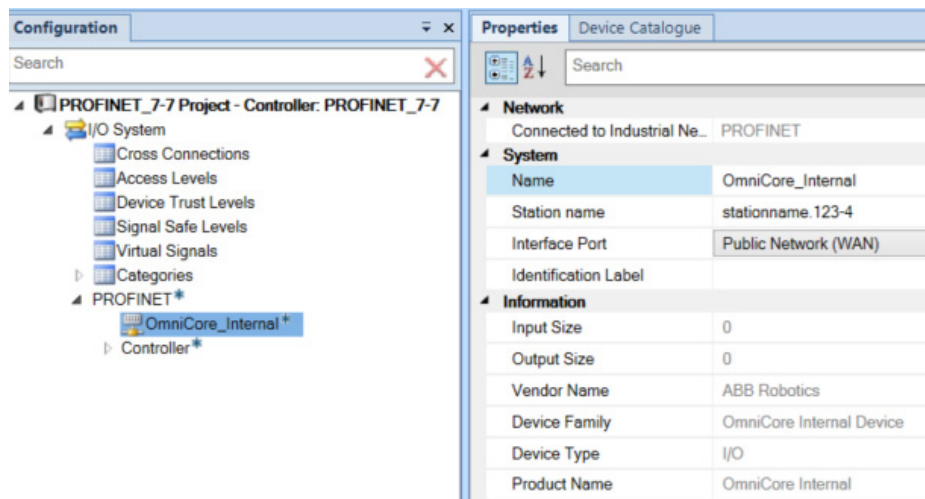2   Select **Device Catalogue** to view a list of available devices.



xx2000001653

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



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4   Select the internal device in the **Configuration** browser and configure the **Properties**:



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*Continues on next page*

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

| Parameter | Description | Allowed values |
|---|---|---|
| **Name** | The name of the internal device is used as a reference to the specific internal device when configuring the I/O signals. | |
| **Station Name** | This parameter is used to identify a PROFINET device on the network. The name must be unique on the network. | |
| **Interface Port** | The interface port to be used for the controller. | Public Network (WAN) or I/O-Network (LAN) |
| **Identification Label** | This parameter is an optional way to provide a label that will help the operator to identify the internal device. | A string with maximum 80 characters. |
| **IM1 Function** (Identification and maintenance) | Information that describes the function of the internal device. Used to help the operator to identify the internal device. | A string with maximum 32 characters. |
| **IM1 Location** (Identification and maintenance) | The location of the internal device. | A string with maximum 22 characters. |
| **IM2 Installation Date** (Identification and maintenance) | Information about when the internal device was installed. | Format YYYY-MM-DD |
| **IM3 Description** (Identification and maintenance) | Additional information for the internal device. Used to help the operator to identify the internal device. | A string with maximum 54 characters. |

5 Continue by adding I/O modules to the internal device. See *Adding I/O modules to the internal device on page 55*.

## 6.3 Deleting an internal device
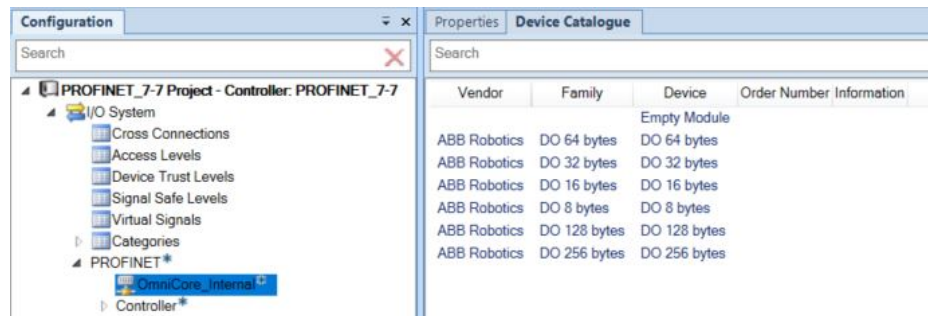
**Delete internal device**

> **Note**
>
> When an internal device is deleted, all associated signals are also removed.

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

2 The selected internal device is now removed from the configuration.

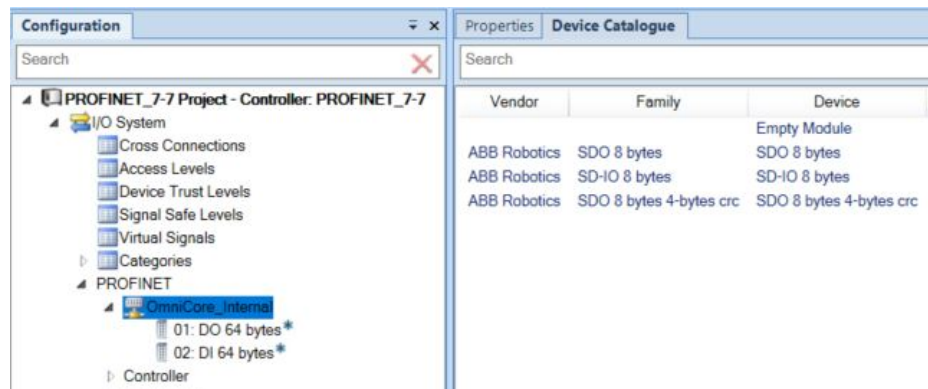## 6.4 Adding I/O modules to the internal device

**Add I/O modules to internal device**

1  In the **Configuration** browser, expand **PROFINET** and select the internal device for which I/O modules should be added.

2  Select **Device Catalogue** to view a list of available I/O modules.



xx2000001654

3  Double-click the I/O modules (output and input) in the list to be added to the internal device.



xx2000001655

> **i** **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.

> **i** **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.

**Add safety I/O modules to internal device (for option *3023-2 PROFIsafe Device*)**

1  In the **Configuration** browser, expand **PROFINET** and select the internal device for which safe I/O modules should be added.
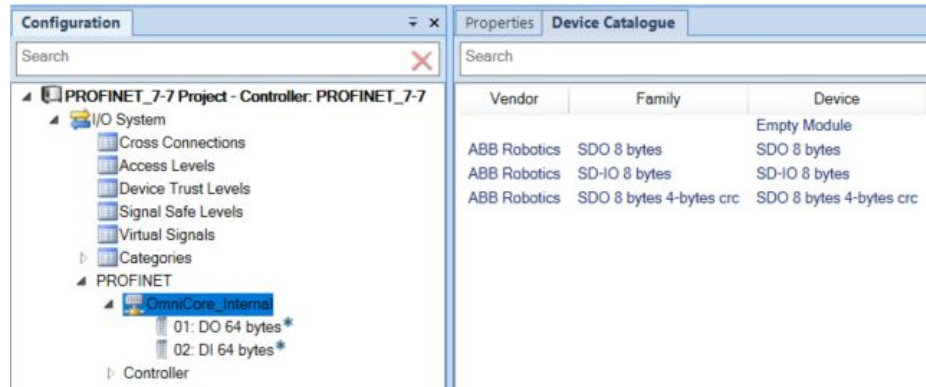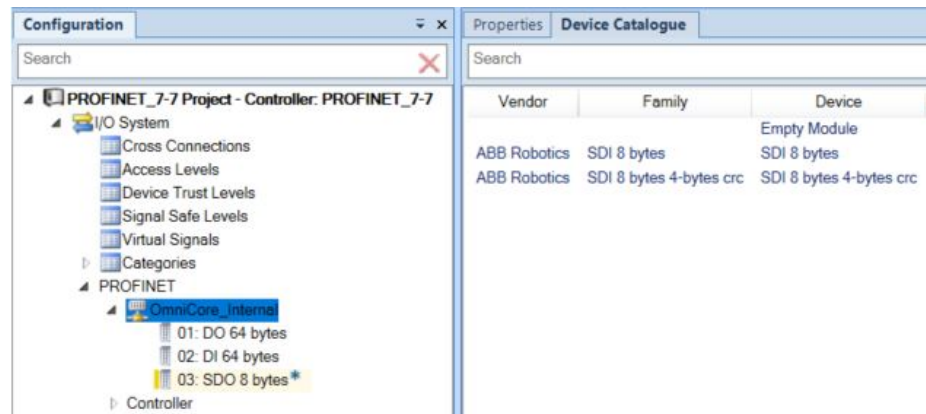
2 Select **Device Catalogue** to view a list of available safe I/O modules.



xx2000001655

3 Double-click the safe I/O modules (output and input) in the list to be added to the internal device.



xx2000001933

| ℹ️ | **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.

| ℹ️ | **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.
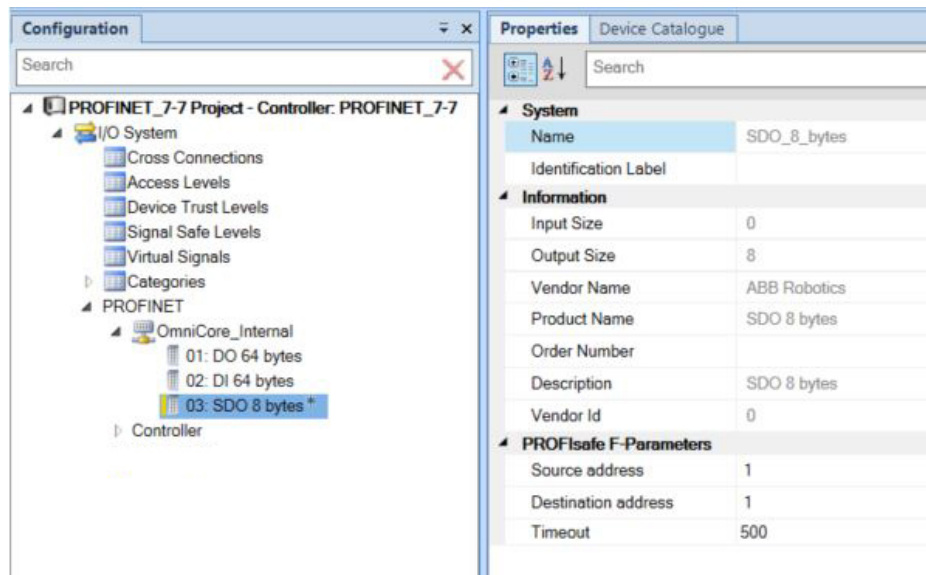
| ℹ️ | **Note** |
|---|---|

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.

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

4   Select the safe I/O module in the **Configuration** browser and configure the
    **PROFIsafe F-Parameters**:



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| Parameter | Description | Allowed values |
|-----------|-------------|----------------|
| **Source address** | The PROFIsafe address **Source address** combined with the **Destination address** uniquely identifies the module. Both addresses are decimal values.<br><br>ℹ️ **Note**<br><br>Both address values must match the information sent from the controller. | Valid range is 0 to 65535. |
| **Destination address** | The PROFIsafe address **Destination address** combined with the **Source address** uniquely identifies the module. Both addresses are decimal values.<br><br>ℹ️ **Note**<br><br>Both address values must match the information sent from the controller. | Valid range is 0 to 65535. |
| **Timeout** | A valid current safety message frame must arrive within the monitoring time, defined in milli seconds. | |

## 6.5 Editing signals

**Edit signals**

1 In the ribbon, select **Signal Editor**.

2 In the **Configuration** browser, select the I/O module for which signals are to be configured.

3 In the column **Name**, type the name of the signal.
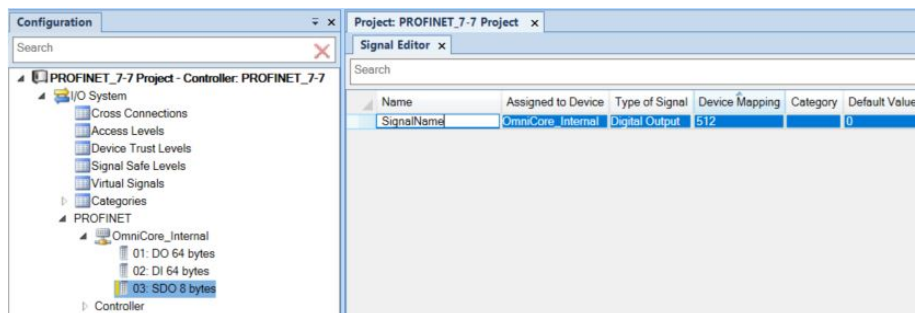
xx2000001656

## 6.6 Creating safety integers

**Create safety integers**

When creating safety integers, the signal should be 32-bit long and the device mapping should have the most significant byte first.

1  In the ribbon, select **Signal Editor**.

2  In the **Configuration** browser, select the I/O module for which the signal is to be created.

3  In the column **Name**, type the name of the signal.



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4  In the column **Type of Signal**, select **Group Output** or **Group Input**.

5  In the column **Device Mapping**, enter the device mapping values. If the offset is 64, type the mapping using the format: 88-95,80-87,72-79,64-71. This will create a safety integer mapped 0-31.

6  Press **Enter** to create the signal.

## 6.7 Saving the configuration

**Save configuration**

See *Application manual - I/O Engineering* for more information.

# 7 Troubleshooting

## 7.1 Troubleshooting scenarios

**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.

**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 34*.

- 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 OmniCore 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 Controller 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.

# 7 Troubleshooting

**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 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.

**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).**

*Continues on next page*

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

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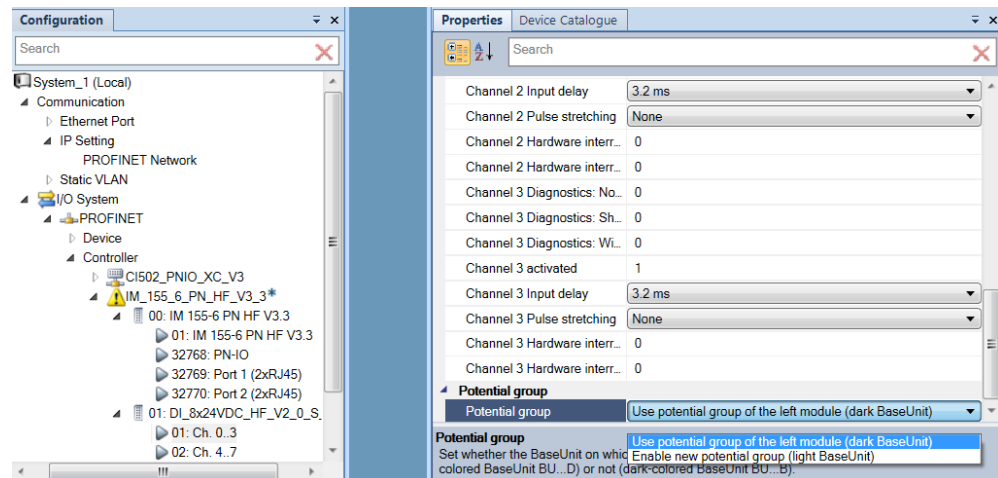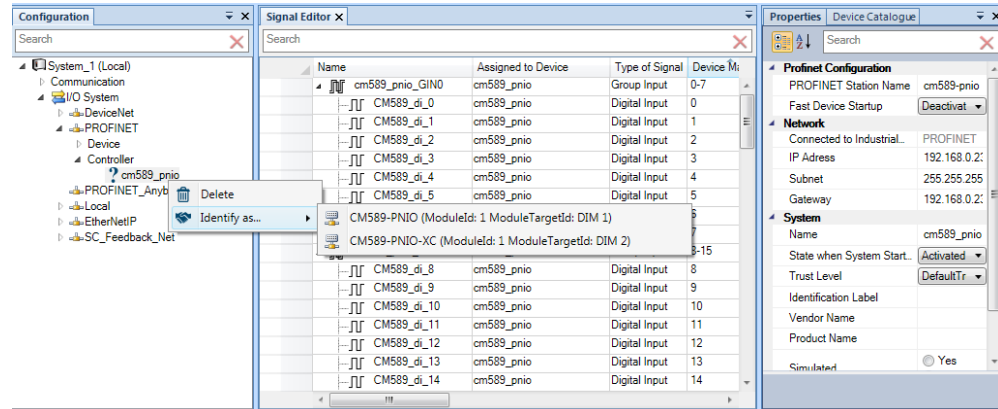


xx1800000146

### 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:
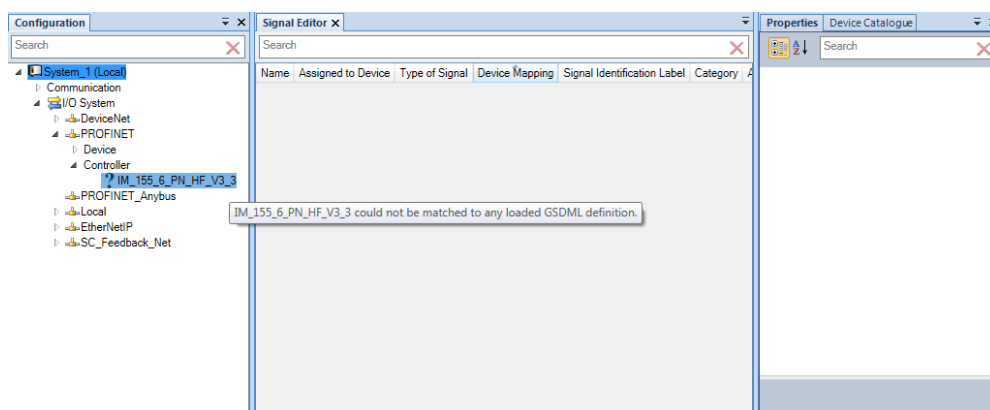
- If the message "Exception: GSD file includes dap's with the same moduleId for device ..." is also shown, see *Duplicated module id in GSD file on page 63*.

- 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 32*.

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**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.

Application manual - PROFINET Controller/Device
3HAC066558-001 Revision: M

# Index

**ABB AB**
**Robotics & Discrete Automation**
S-721 68 VÄSTERÅS, Sweden
Telephone +46 10-732 50 00

**ABB AS**
**Robotics & Discrete Automation**
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

**ABB Engineering (Shanghai) Ltd.**
Robotics & Discrete Automation
No. 4528 Kangxin Highway
PuDong New District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

**ABB Inc.**
**Robotics & Discrete Automation**
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

**abb.com/robotics**