ROBOTICS

Application manual

Scalable I/O

Trace back information:
Workspace Main version a513
Checked in 2023-05-29
Skribenta version 5.5.019

Application manual

Scalable I/O

RobotWare 6.15.03

Document ID: 3HAC059109-001

Revision: K

The information in this manual is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this manual.

Except as may be expressly stated anywhere in this manual, nothing herein shall be construed as any kind of guarantee or warranty by ABB for losses, damage to persons or property, fitness for a specific purpose or the like.

In no event shall ABB be liable for incidental or consequential damages arising from use of this manual and products described herein.

This manual and parts thereof must not be reproduced or copied without ABB's written permission.

Keep for future reference.

Additional copies of this manual may be obtained from ABB.

Original instructions.

Table of contents

This page is intentionally left blank

Overview of this manual

About this manual

This manual describes the scalable I/O devices and contains instructions for the configuration.

Usage

This manual should be used during installation and configuration of the scalable I/O devices.

Who should read this manual?

This manual is intended for

- Personnel responsible for installations and configurations of industrial network hardware/software
- Personnel responsible for I/O system configuration
- System integrators

Prerequisites

The reader should have the required knowledge of

- Mechanical installation work
- Electrical installation work
- System parameters and how to configure them
- RobotStudio

References

Document references

Reference	Document ID
Operating manual - RobotStudio	*3HAC032104-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Product manual - IRC5	*3HAC047136-001*
Technical reference manual - System parameters	*3HAC050948-001*
Technical reference manual - RAPID Instructions, Functions and Data types	*3HAC050917-001*
Application manual - Controller software IRC5	*3HAC050798-001*
Product specification - Controller IRC5	*3HAC047400-001*
Application manual - EtherNet/IP Scanner/Adapter	*3HAC050998-001*

Other references

Reference	Description
EtherNet/IP™ Specification, Edition 1.2	ODVA Specification comprises two volumes from the library: *Volume One: Common Industrial Protocol (CIP) Specification* and *Volume Two: EtherNet/IP Adaptation of CIP*.

Continues on next page

Revisions

Revision	Description
-	Released with RobotWare 6.05. • First edition.
A	Released with RobotWare 6.06. • EDS file is stored in the controller and location is mentioned. See *EDS file on page 45*.
B	Released with RobotWare 6.07. • The connector numbers are corrected in *DSQC1030 Digital base on page 27*, *DSQC1031 Digital add-on on page 30*, *DSQC1032 Analog add-on on page 32*, and *DSQC1033 Relay add-on on page 34* sections. • Updated the section *Firmware upgrade on page 59*.
C	Released with RobotWare 6.08. • *Renaming a Local I/O device* section removed from chapter *Software overview*.
D	Released with RobotWare 6.09. • Outer dimensions for local I/O units added in section *Introduction on page 15*. • Added clarification about labels X1/X2 on connector, see *Hardware overview on page 15*.
E	Released with RobotWare 6.09. • Minor corrections. •
F	Released with RobotWare 6.10.01. • Updated the section *Coil neutralization on page 44*.
G	Released with RobotWare 6.12. • Local I/O replaced by Scalable I/O in entire manual.
H	Released with RobotWare 6.13. • Information about node commissioning for other EtherNet/IP scanners added in sections *Introduction on page 13*, *Installing base devices on page 17*, and *Reset button on page 28*. • Section *Identifying an I/O device on page 55* updated with information that the MS LED also flashes during identification.
J	Released with RobotWare 6.14. • Minor corrections in entire manual.
K	Released with RobotWare 6.15.03. • Information about default hysteresis added in section *Analog inputs on page 43* and in *Analog input point object on page 63*.

Product documentation

Categories for user documentation from ABB Robotics

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

Tip

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

Product manuals

Manipulators, controllers, DressPack/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.
- Troubleshooting.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

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

Application manuals

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

An application manual generally contains information about:

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

Continues on next page

Continued

- Examples of how to use the application.

Operating manuals

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

Safety

Safety regulations

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

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

Network security

Network security

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

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

1 Introduction

General

ABB Scalable I/O is a modular, compact, and scalable I/O system that consists of a base device, which is the minimum configuration, and add-on devices.

Up to four add-on devices can be controlled by each base device with maintained performance, and any combination of add-on devices is supported.

Communication

The digital base device communicates over the EtherNet/IP communication protocol to the robot controller or to other EtherNet/IP scanners. Up to 20 devices in total can be connected to the robot controller over EtherNet/IP. This includes digital base devices and other third-party I/O devices.

Node commissioning for other EtherNet/IP scanners

For other EtherNet/IP scanners, node commissioning needs to be done either using a dhcp server on the scanner network or setting a static IP address in the device with the help of third-party software. An initial volatile address can be obtained using the reset button. The TCP/IP Object can then be accessed for the purpose of this.

Options

When using the standard *Plug & Produce* interface, no additional RobotWare options or hardware options are required to connect to the robot controller.

When using the RobotWare option *EtherNet/IP Scanner/Adapter*, more configuration possibilities are available.

Device interfaces

The add-on devices have an optical interface and must be attached to a digital base device. The additional Ethernet port on the base device can be used to daisy chain any Ethernet based equipment on the same network, for example additional digital base devices.

Mounting

The I/O devices are designed to be mounted vertically on a mounting rail in an IP20 protected environment with normal air convention. Forced air is needed if the devices are mounted horizontally.

Features

The important features of the ABB Scalable I/O devices are following:

- Easy to install.
- Easy to configure in RobotWare with support of the *Plug & Produce* interface.
- Compact and scalable.
- Can be mounted inside the controller and/or distributed outside.
- Supports standard DIN-rail mounting.
- Galvanically isolated add-on devices.
- Dual port switch for daisy chaining.

Continues on next page

Continued

- Fast signal setting with *Change of State*.

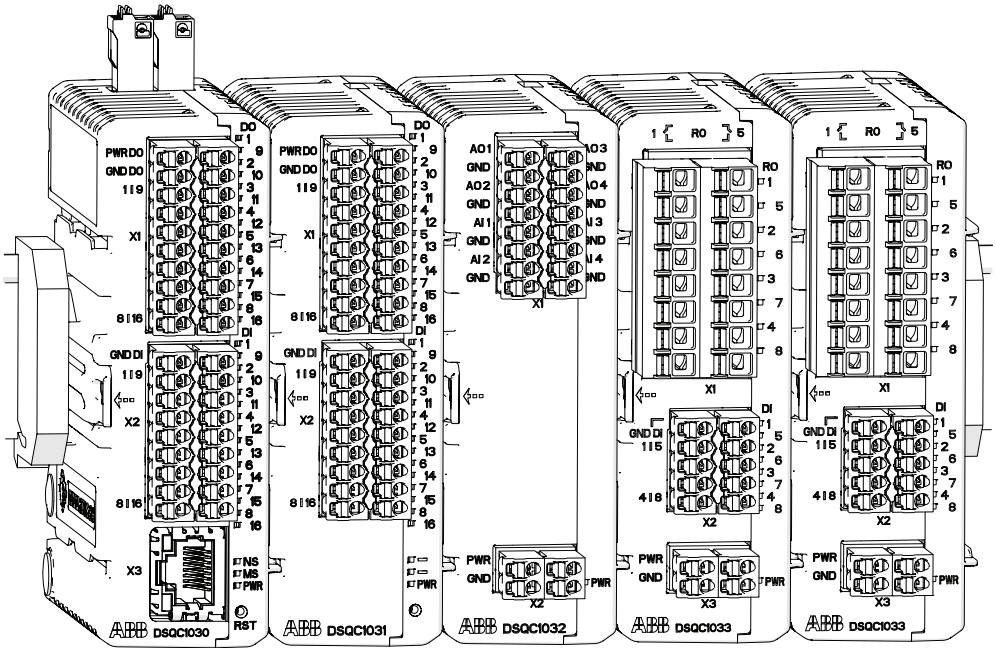
2 Hardware overview

2.1 Installing the I/O devices

2.1.1 Introduction

Scalable I/O devices

The illustration below shows the base device and connected add-on devices.



xx1600002032

Spare part no.	Description	Type
3HAC058663-001	Digital base, 16 digital inputs, 16 digital outputs	DSQC1030
3HAC058664-001	Digital add-on, 16 digital inputs, 16 digital outputs	DSQC1031
3HAC058665-001	Analog add-on, 4 analog inputs, 4 analog outputs	DSQC1032
3HAC058666-001	Relay add-on, 8 digital inputs, 8 relay outputs	DSQC1033

The main dimensions for the I/O devices are 75x36x101 (Length x Width x Height).

Additional parts

Spare part no.	Description
3HAC060919-001	Connectors digital base/add-on
3HAC060925-001	Connectors analog add-on
3HAC060926-001	Connectors relay add-on
3HAC062073-001	DIN bracket

Continues on next page

2.1.1 Introduction
Continued

Possible device combinations

The IRC5 controller has the capacity to handle the following combinations of I/O device base units and add-ons:

Base device units	Number of base units per controller	Number of add-ons per base unit
DSQC1030, Digital base	20	4

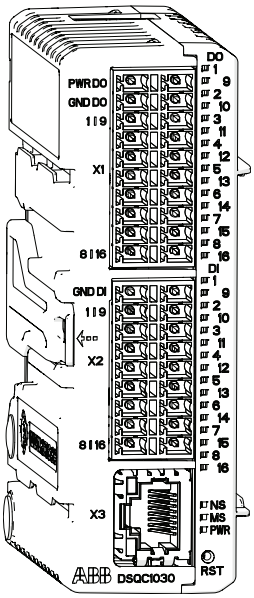
2.1.2 Installing base devices

General

The scalable I/O devices are designed to be mounted vertically on a mounting rail in an IP20 protected environment with normal air convention. Forced air is needed if the devices are mounted horizontally.

The base device communicates over the EtherNet/IP communication protocol to the robot controller or to other EtherNet/IP scanners. [1] Up to 20 devices in total can be connected to the robot controller over EtherNet/IP, this includes base devices and other third-party I/O devices.

When the base device is connected to logic power supply and Ethernet, it can be detected and configured by the robot controller. The process power supply powers the inputs, outputs, and the optical interface to the add-ons.



xx1600002033

Installing base devices

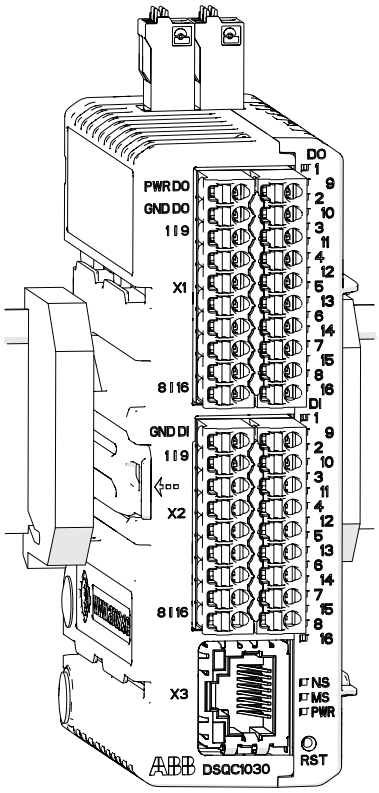
Use this procedure to install the base device. See also the product manual for the robot controller, listed in *References on page 7*.

	Action	Note
1	**DANGER** Before commencing any work inside the cabinet make sure that the main power has been switched off.	

1 For more information about communication to other scanners, see *Node commissioning for other EtherNet/IP scanners on page 13*.

Continues on next page

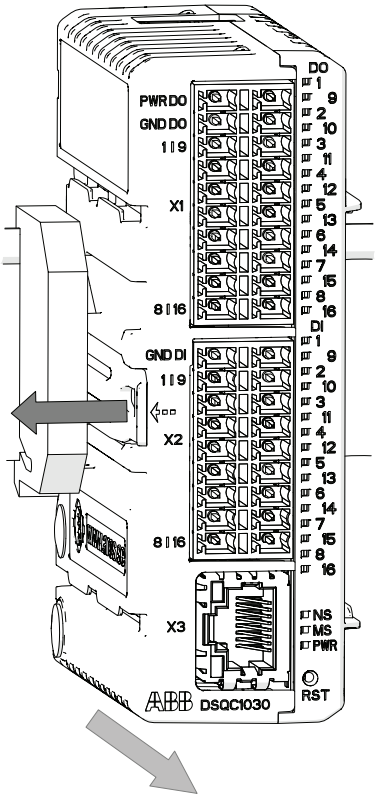
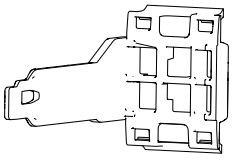
2.1.2 Installing base devices
Continued

	Action	Note
2	Fit the device by snapping it onto the mounting rail.	 xx1700000275
3	Connect the Ethernet cable from the robot controller, or the EtherNet/IP scanner, to any of the connectors X3 or X5.	
4	Connect the logic power supply to connector X4.	For information about the pinout see *Connectors on page 28*.
5	Connect process power supply and GND to the input and output connectors X1 and X2. **Note** The process power supply also powers the optical interface to the add-ons.	**CAUTION** The process power supply must be supplied separately. Connecting the process power supply through the logical power supply connector may damage the device.
6	Connect wires to the inputs and outputs as required.	
7	Configure the device, see *Configuring an I/O device on page 46*.	

Removing base devices

	Action	Note
1	**DANGER** Before commencing any work inside the cabinet make sure that the main power has been switched off.	

Continues on next page

	Action	Note
2	Disconnect all connectors.	
3	Press the DIN bracket gently to the left and pull the device straight out.	 xx1700000276
4	Snap off the DIN bracket and refit it to the removed device.	 xx1600002039

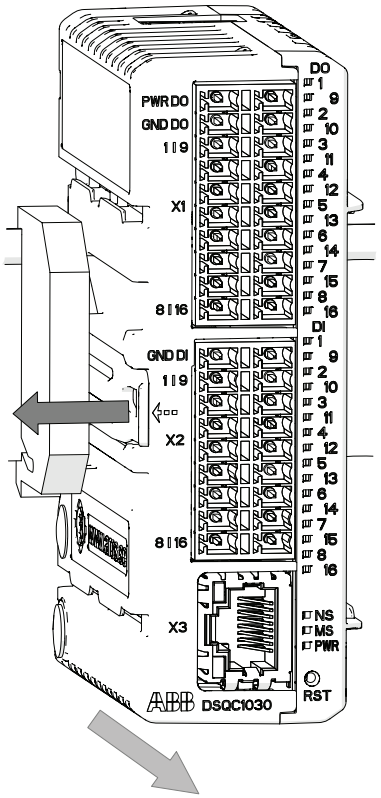
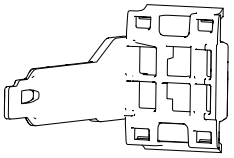
Replacing base devices

	Action	Note
1	**DANGER** Before commencing any work inside the cabinet make sure that the main power has been switched off.	
2	Disconnect all connectors.	

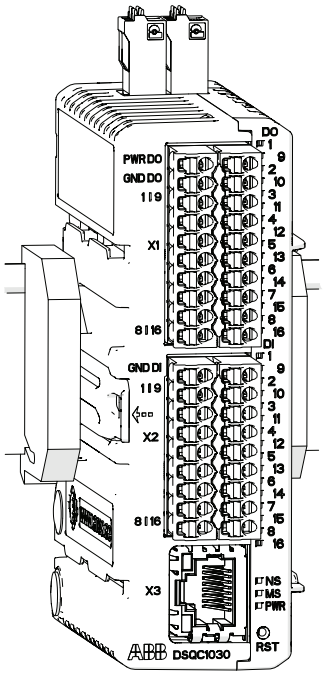
Continues on next page

2.1.2 Installing base devices

Continued

	Action	Note
3	Press the DIN bracket gently to the left and pull the device straight out. Leave the DIN bracket attached to the rail.	 xx1700000276
4	Remove the DIN bracket from the new device.	 xx1600002039

Continues on next page

	Action	Note
5	Fit the new device by snapping it onto the rail and the DIN bracket.	 xx1700000275
6	Reconnect all connectors.	
7	Fit the spare DIN bracket to the removed device.	
8	Configure the device, see *Replacing a broken I/O device on page 50*.	

Installing additional (external/remote) base devices

Additional base devices can be used as external/remote I/O devices, and assembled together in the same way as add-on devices, but they must be connected with separate Ethernet cables. The Ethernet cable can be connected to any of the connectors X3 or X5 on the previous base device.

The logical power supply, connector X4, of up to five base devices in total can be connected in parallel if the devices are placed inside the same controller cabinet, i.e. over short distances. For all other applications, the logical power must be supplied separately to each base device.

The process power supply must always be supplied separately to each base device.

CAUTION

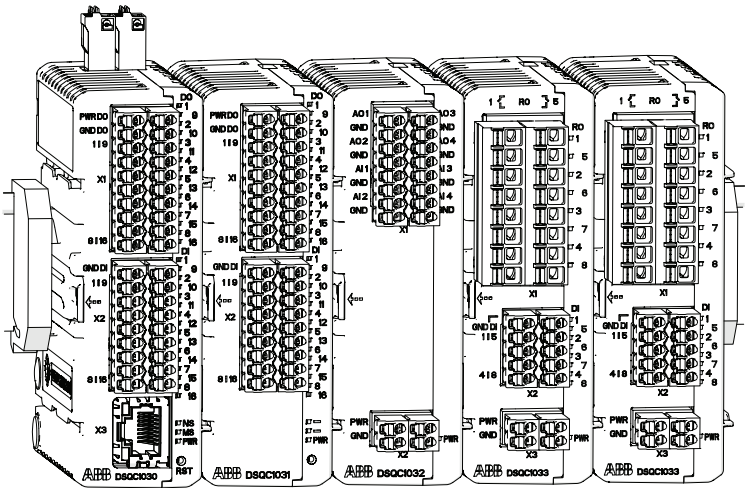
Connecting the process power supply in parallel or through the logical power supply connector may damage the device.

2.1.3 Installing add-on devices

General

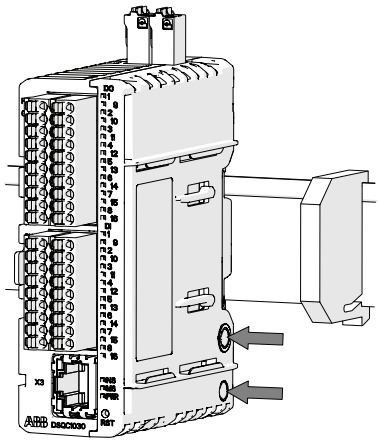
Add-on devices have an optical interface and must be powered and attached to a configured base device to be detected by the robot controller. Up to four add-on devices can be attached to the same base device with maintained performance.

The optical interface on the base device is powered by process power supply and must also be connected to detect the add-on device. Unpowered add-on devices shall be placed last, i.e. to the right, otherwise the optical link is broken.

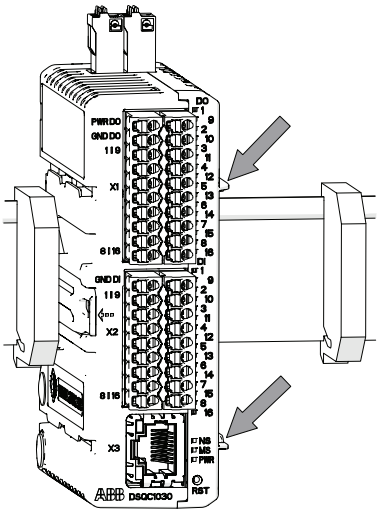
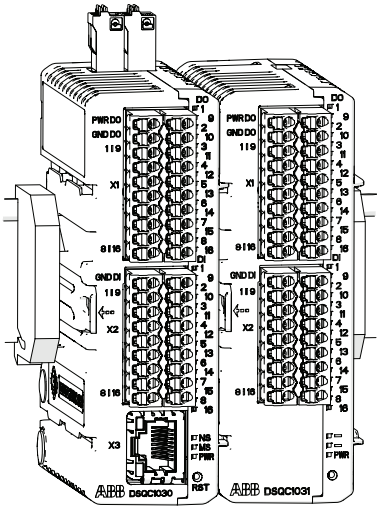


xx1600002032

Installing add-on devices

	Action	Note
1	**DANGER** Before commencing any work inside the cabinet make sure that the main power has been switched off.	
2	Clean the optical interface on both the base device and the add-on from dirt or dust using a soft cloth.	 xx1700000277

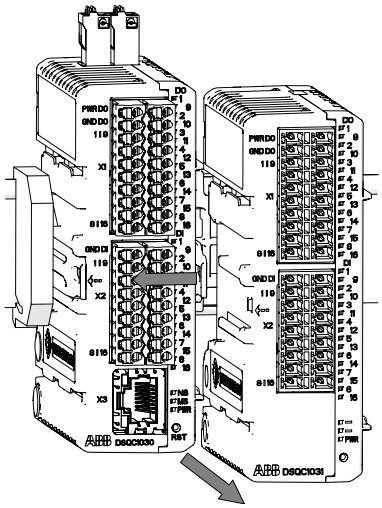
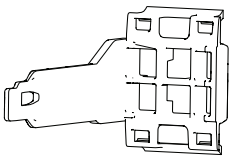
Continues on next page

	Action	Note
3	Fit the add-on device to the guide rails on the right side of the base device or the last device according to the arrows. Press the add-on device until it snaps onto the mounting rail.	 xx1700000278 **Note** If the device is not correctly inserted there is a risk that the optical communication between the devices does not work.
4	Connect the logic and process power supply. For information about the pinout see *I/O device descriptions on page 27*. **Note** The optical interface on the base device must also be powered by process power supply to detect add-on devices.	 xx1700000279 **CAUTION** Connecting the process power supply in parallel with another add-on may damage the devices.
5	Connect wires to the inputs and outputs as required.	
6	Configure the device, see *Configuring an I/O device on page 46*.	

Continues on next page

2.1.3 Installing add-on devices
Continued

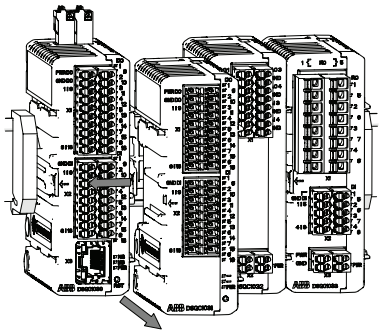
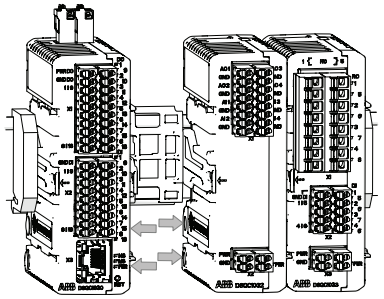
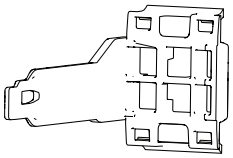
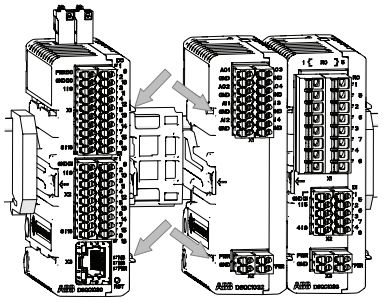
Removing add-on devices

	Action	Note
1	**DANGER** Before commencing any work inside the cabinet make sure that the main power has been switched off.	
2	Disconnect all connectors.	
3	Press the DIN bracket gently to the left and pull the device straight out.	 xx1700000274
4	Snap off the DIN bracket from the rail and refit it to the removed device.	 xx1600002039

Replacing add-on devices

	Action	Note
1	**DANGER** Before commencing any work inside the cabinet make sure that the main power has been switched off.	
2	Disconnect all connectors.	

Continues on next page

	Action	Note
3	Press the DIN bracket gently to the left and pull the device straight out. Leave the DIN bracket attached to the rail.	 xx1600002037
4	Clean all optical interfaces from dirt or dust using a soft cloth.	 xx1600002040
5	Remove the DIN bracket from the new device.	 xx1600002039
6	Fit the new device to the guide rails of the adjacent devices. Press the new device until it snaps onto the DIN bracket. **Note** The device must be updated if the order is changed, see *Updating an existing I/O device on page 48*.	 xx1600002038 **Note** If the device is not correctly inserted there is a risk that the optical communication between the devices does not work.
7	Reconnect all connectors.	
8	Fit the spare DIN bracket to the removed device.	

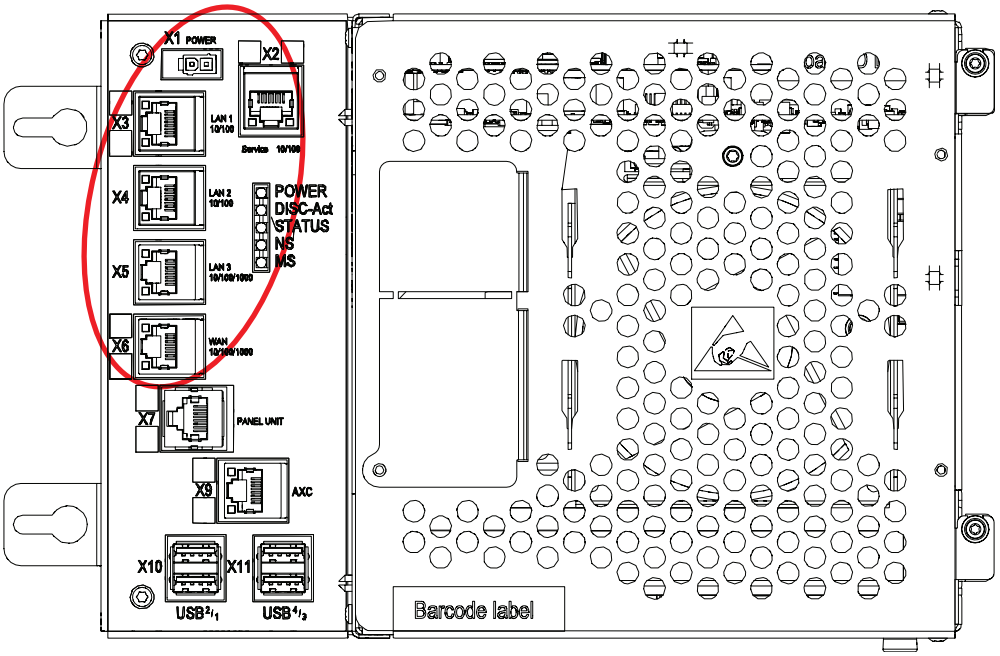
2.2 Connecting the EtherNet/IP network

Connection

The I/O devices are based on the EtherNet/IP communication protocol but does not require any additional RobotWare options or hardware options to be connected to the robot controller. In this standard configuration the devices must be connected to the Ethernet port LAN 2 on the main computer.

When using the RobotWare option *EtherNet/IP Scanner/Adapter* more configuration possibilities are available, and the I/O devices can be connected to any of the Ethernet ports WAN, LAN 2, or LAN 3 on the main computer. For more information see *Application manual - EtherNet/IP Scanner/Adapter*.

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



xx1500000391

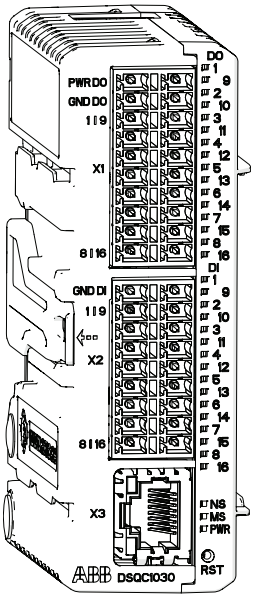
Connector	Label	Description
X2	Service	Port to the robot's private network. Intended to be left empty so that service personnel can use it to connect to the computer unit.
X3	LAN 1	Port to the robot's private network. Normally used to connect the FlexPendant.
X4	LAN 2	Port to the robot's private network.
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.

2.3 I/O device descriptions

2.3.1 DSQC1030 Digital base

Description

The DSQC1030 base device has 16 digital inputs and 16 digital outputs and can be combined with up to four additional add-on devices.



xx1600002033

Connector	Description
X1 [i]	Digital outputs, process power
X2 [i]	Digital inputs
X3	EtherNet
X4	Logic power
X5	EtherNet

i The numbers (printings) on the module only show the I/O numbers (digital input/output). It is not the pin position number for connector X1 or X2 (only I/O number).

Status LEDs

The DSQC1030 base device has the following status LEDs. For more information about the status LEDs, see *Status LED descriptions on page 36*.

LED label	Description
DO 1-16	Digital outputs
DI 1-16	Digital inputs
PWR	Power
NS	Network status
MS	Module status
	Ethernet

Continues on next page

2.3.1 DSQC1030 Digital base
Continued

Connectors

Location	Connector	Left side/description	Right side/description
Top	X4 Logic power	2 - PWR	4 - PWR
		1 - GND	3 - GND
Front	X1 Digital outputs, process power[i]	10 - PWR DO	20 - PWR DO
		9 - GND DO	19 - GND DO
		8 - DO01	18 - DO09
		7 - DO02	17 - DO10
		6 - DO03	16 - DO11
		5 - DO04	15 - DO12
		4 - DO05	14 - DO13
		3 - DO06	13 - DO14
		2 - DO07	12 - DO15
		1 - DO08	11 - DO16
	X2 Digital inputs[i]	9 - GND DI	18 - GND DI
		8 - DI01	17 - DI09
		7 - DI02	16 - DI10
		6 - DI03	15 - DI11
		5 - DI04	14 - DI12
		4 - DI05	13 - DI13
		3 - DI06	12 - DI14
		2 - DI07	11 - DI15
		1 - DI08	10 - DI16
	X3 EtherNet		
Down	X5 EtherNet		

i The numbers (printings) on the module only show the I/O numbers (digital input/output). It is not the pin position number for connector X1 or X2 (only I/O number).

Reset button

The DSQC1030 base device has a reset button located under the status LEDs. The reset button can be used in different ways to reset the device.

Function	Description	Indication
Pressed once (<3 sec)	Regular reset, same as toggling the power.	
Short press and hold (>3 sec)	Assigns volatile IP-settings of 192.168.125.254.	The Power LED flashes red once.
Long press and hold (>10 sec)	Factory reset.	The Power LED flashes red two times.

Continues on next page

CAUTION

Use a straightened out paper clip or a similar blunt object to carefully press the reset button. Using sharp objects or pressing with force may damage the reset button.

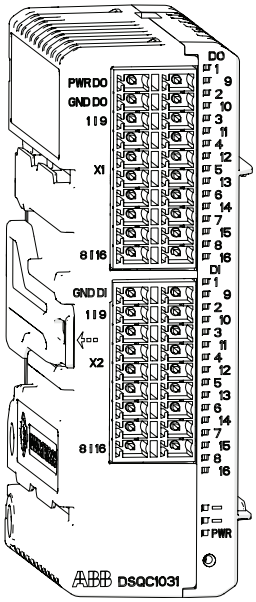
Note

Factory reset can also be made remotely via RobotStudio, see *Removing and resetting an I/O device configuration on page 53*.

2.3.2 DSQC1031 Digital add-on

Description

The DSQC1031 digital add-on device has 16 digital inputs and 16 digital outputs and must be used together with a DSQC1030 base device.



xx1600002034

Item	Description
X1	Digital outputs, logic and process power
X2	Digital inputs

Status LEDs

The DSQC1031 device has the following status LEDs. For more information about the status LEDs, see *Status LED descriptions on page 36*.

LED label	Description
DO 1-16	Digital outputs
DI 1-16	Digital inputs
PWR	Power

Continues on next page

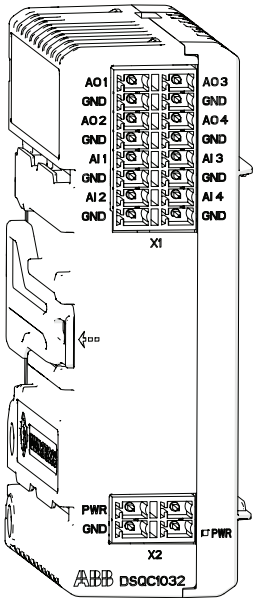
Connectors

Location	Designation	Left	Right
Front	X1 Digital outputs, logic and process power	10 - PWR DO	20 - PWR DO
		9 - GND DO	19 - GND DO
		8 - DO01	18 - DO09
		7 - DO02	17 - DO10
		6 - DO03	16 - DO11
		5 - DO04	15 - DO12
		4 - DO05	14 - DO13
		3 - DO06	13 - DO14
		2 - DO07	12 - DO15
		1 - DO08	11 - DO16
	X2 Digital inputs	9 - GND DI	18 - GND DI
		8 - DI01	17 - DI09
		7 - DI02	16 - DI10
		6 - DI03	15 - DI11
		5 - DI04	14 - DI12
		4 - DI05	13 - DI13
		3 - DI06	12 - DI14
		2 - DI07	11 - DI15
		1 - DI08	10 - DI16

2.3.3 DSQC1032 Analog add-on

Description

The DSQC1032 analog add-on device has 4 analog inputs and 4 analog outputs and must be used together with a DSQC1030 base device.



xx1600002035

Item	Description
X1	Analog inputs and outputs
X2	Logic and process power

Status LEDs

The DSQC1032 device has the following status LEDs. For more information about the status LEDs, see *Status LED descriptions on page 36*.

LED label	Description
PWR	Power

Continues on next page

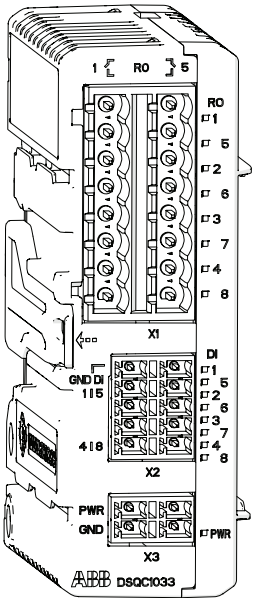
Connectors

Location	Designation	Left	Right
Front	X1 Analog inputs and outputs	8 - AO1	16 - AO3
		7 - GND	15 - GND
		6 - AO2	14 - AO4
		5 - GND	13 - GND
		4 - AI1	12 - AI3
		3 - GND	11 - GND
		2 - AI2	10 - AI4
		1 - GND	9 - GND
	X2 Logic and process power	2 - PWR	4 - PWR
		1 - GND	3 - GND

2.3.4 DSQC1033 Relay add-on

Description

The DSQC1033 relay add-on device has 8 digital inputs and 8 relay outputs and must be used together with a DSQC1030 base device.



xx1600002036

Item	Description
X1	Relay outputs
X2	Digital inputs
X3	Logic and process power

Status LEDs

The DSQC1031 device has the following status LEDs. For more information about the status LEDs, see *Status LED descriptions on page 36*.

LED label	Description
RO 1-8	Relay outputs
DI 1-8	Digital inputs
PWR	Power

Continues on next page

Connectors

Location	Designation	Left	Right
Front	X1 Relay outputs	8 - RLY1	16 - RLY5
		7 - RLY1	15 - RLY5
		6 - RLY2	14 - RLY6
		5 - RLY2	13 - RLY6
		4 - RLY3	12 - RLY7
		3 - RLY3	11 - RLY7
		2 - RLY4	10 - RLY8
		1 - RLY4	9 - RLY8
	X2 Digital inputs	5 - GND DI	10 - GND DI
		4 - DI1	9 - DI5
		3 - DI2	8 - DI6
		2 - DI3	7 - DI7
		1 - DI4	6 - DI8
	X3 Logic and process power	2 - PWR	4 - PWR
		1 - GND	3 - GND

2.4 Status LED descriptions

Introduction

The I/O devices have LED indicators which indicate the condition of the device and the function of the network communication.

Continues on next page

2.4.1 Digital base LEDs

Power LED

The bicolor (green/red) LED indicates the status of the power. The LED is controlled by software. The following table shows the different states of the Power LED.

LED color	Description	Remedy/cause
OFF	The device has no power or is not online. The device has not completed the startup.	Check power supply.
GREEN steady	The device is online and has connection in the established state.	If no light, check other LED modes.
GREEN flashing	Device is online, but has no connections in the established state.	Check that other nodes in the network are operative. Check parameter to see whether module has correct ID.
RED flashing	One or more I/O connections are in the time-out state.	Check system messages.
RED steady	Failed communication device. The device has detected an error rendering it incapable of communicating on the network. (Duplicate MAC_ID, or Bus-off).	Check system messages and parameters.

MS - Module status LED

The bicolor (green/red) LED indicates the status of the device. It indicates whether or not the device has power and is operating properly. The LED is controlled by software. The following table shows the different states of the MS LED.

LED color	Description	Remedy/cause
OFF	The device has no power. The device has not completed the startup.	Check power supply.
GREEN steady	Device is operating in a normal condition.	If no light, check other LED modes.
GREEN flashing	Device needs commissioning due to missing, incomplete or incorrect configuration. The device may be in the stand-by state.	Check system parameters. Check messages.
RED flashing	Recoverable minor fault.	Check messages.
RED steady	The device has an unrecoverable fault.	Device may need replacing.
RED/GREEN flashing	The device is running startup self test.	If flashing for more than a few seconds, check hardware.

Continues on next page

2.4.1 Digital base LEDs
Continued

NS - Network status LED

The bicolor (green/red) LED indicates the status of the communication link. The LED is controlled by software. The following table shows the different states of the NS LED.

LED color	Description	Remedy/cause
OFF	The device has no power or is not online. The device has not completed the startup.	Check status of MS LED. Check power supply.
GREEN steady	The device is online and has connection in the established state.	If no light, check other LED modes.
GREEN flashing	Device is online, but has no connections in the established state.	Check that other nodes in the network are operative. Check parameter to see whether module has correct ID.
RED flashing	One or more I/O connections are in the time-out state.	Check system messages.
RED steady	Failed communication device. The device has detected an error rendering it incapable of communicating on the network. (Duplicate MAC_ID, or Bus-off).	Check system messages and parameters.

Ethernet LEDs

The Ethernet LEDs are located on the Ethernet connectors and shows the status of Ethernet communication.

Speed

LED color	Description	Remedy/cause
OFF	Operating at 10 Mbps.	
YELLOW steady	Operating at 100 Mbps.	

Link/activity

LED color	Description	Remedy/cause
OFF	No link is established.	
GREEN steady	Link is established.	
GREEN flashing	There is activity on this port.	

Status LEDs at power-up

The system performs a test of the MS and NS LEDs during startup. The purpose of this test is to check that all LEDs are working properly. The test runs as follows:

Order	LED action
1	NS LED is switched Off.
2	MS LED is switched On green for approx. 0.25 seconds.
3	MS LED is switched On red for approx. 0.25 seconds.
4	MS LED is switched On green.

Continues on next page

Order	LED action
5	NS LED is switched On green for approx. 0.25 seconds.
6	NS LED is switched On red for approx. 0.25 seconds.
7	NS LED is switched On green.

2.4.2 Add-on module LEDs

Power LED

All add-on modules have a Power LED displaying the state of the module. The modules using digital inputs and outputs also have a separate LED for each input and output.

LED color	Description
GREEN steady	Addressed.
GREEN flashing	Not addressed.
RED flashing	Boot.

2.4.3 Input and Output LEDs

Input and Output LEDs

Each digital input, digital output, and relay output has a green LED indicating if the signal is active. The LEDs are controlled by software.

LED color	Description
OFF	Signal LOW
GREEN steady	Signal HIGH

2.5 Technical data

Technical data

Supply voltage

Description	Data	Note
Voltage range	20.4 – 28.8 VDC	
Input current, Digital base, 24V SYS	100 mA (TBC)	DSQC1030
Input current, Digital base, 24V Process	8 A	DSQC1030
Input current, Digital add-on, 24V Process	8 A	DSQC1031
Input current, Analog add-on, 24V Process	100 mA (TBC)	DSQC1032
Input current, Relay add-on, 24V Process	100 mA (TBC)	DSQC1033
Plug-in current	<2 A @ 1ms	
Surge protected	Yes	
Reverse polarity protected	Yes	

Digital outputs

Description	Data	Note
Rated current	500 mA	
Max current	600 mA	
Typical short circuit current	1200 mA	
Leakage current	< 100 uA	
Rated voltage	24 VDC	
Max voltage	30 VDC	
Max voltage drop	0.5V at 500 mA	
Max inductive load	1000 mH	(max switching repetition rate: 10 sec)
Max capacitive load	10 mF	
Recommended cable area	1 mm^2	
Surge protected	Yes	
Thermal protection	Yes	
Max delay time	0.5 ms	

Digital inputs

Description	Data	Note
Input voltage level Lo	-30 - 5 V	
Input voltage level Hi	15 - 30 V	
Type switch voltage	10 V	

Continues on next page

Description	Data	Note
Input current level Lo	<0.5 mA	
Input current level Hi	>2 mA	typically 4 mA
Max voltage	30 V	
Reverse polarity protected	Yes	
Surge protected	Yes	
Internal delay time	0.5 ms	
Filter time	0 – 65 ms	Programmable. Default value 5.5 ms

Analog inputs

Description	Data	Note
Input range	0 – 10 V	
Resolution	12 bits, 2.44 mV	
Hysteresis	4	The default value can be changed, see *Analog input point object on page 63*.
Inaccuracy	0.5% + 25 mV	
Input impedance	100 kOhm	typically
Reverse polarity protected	Yes	
Surge protected	Yes	
Delay time	2ms	

Analog outputs

Description	Data	Note
Output range	0 – 10 V	
Resolution	12 bits, 2.44 mV	
Inaccuracy	0.5% + 25 mV	
Min load impedance	1 kOhm	
Surge protected	Yes	
Short circuit protection	Yes	
Delay time	2 ms	

Relay outputs

Description	Data	Note
Max switching voltage	230 VAC	
Max switching current	2 A	
Isolation	Reinforced	

2.6 Coil neutralization

External devices

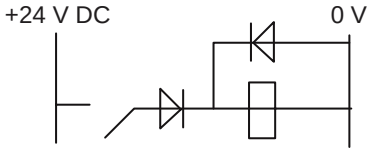
External relay coils, solenoids, and other devices that are connected to the I/O devices must be neutralized and protected with external diodes for reverse protection. The following sections describe how this can be done.

Note

The turn-off time for DC relays increases after neutralization, especially if a diode is connected across the coil. Varistors give shorter turn-off times. Neutralizing the coils lengthens the life of the switches that control them.

Clamping with a diode

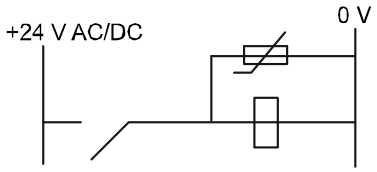
The diode should be dimensioned for the same current as the relay coil, and a voltage of twice the supply voltage.



xx0100000163

Clamping with a varistor

The varistor should be dimensioned for the same current as the relay coil, and a voltage of twice the supply voltage.

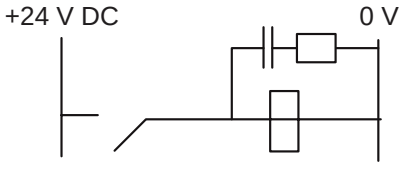


xx0100000164

Clamping with an RC circuit

R 100 ohm, 1W C 0.1 - 1 mF

>500 V max. voltage, 125 V nominal voltage.



xx0100000165

3 Software overview

3.1 Information about ABB Scalable I/O devices

General

To use the Scalable I/O devices, plug in the base device and the add-on devices to the controller through the Ethernet cable. Then configure the I/O devices using RobotStudio or the FlexPendant. For more information about I/O device configuration, see *Using ABB Scalable I/O devices on page 46*.

Industrial network

EtherNet/IP is the industrial network that is used for communication between the I/O devices and the robot and controller.

EDS file

Electronic Data Sheet (EDS) files are required when configuring I/O devices with other scanners. The EDS file, which identifies the devices during the configuration in the network, is stored in the following controller location:

<SystemName>\PRODUCTS\ <RobotWare_xx.xx.xxxx>\utility\service\EDS

Behavior

ABB Scalable I/O devices support both *Cyclic* and *Change of State* (COS) I/O connection. It is possible to set output signals with a *Change of State* connection.

Note

Change of State is used together with production inhibit timer, which is calculated as Request Packet Interval (RPI) divided by 4. RPI/4 is the highest frequency for which a signal change can occur with *Change of State*.

3.2 Using ABB Scalable I/O devices

3.2.1 Configuring Scalable I/O devices using RobotStudio

General

This section describes the recommended working procedure when installing and configuring ABB Scalable I/O devices in RobotStudio.

For information about configuration using the FlexPendant, see *Configuring Scalable I/O devices using the FlexPendant on page 56*.

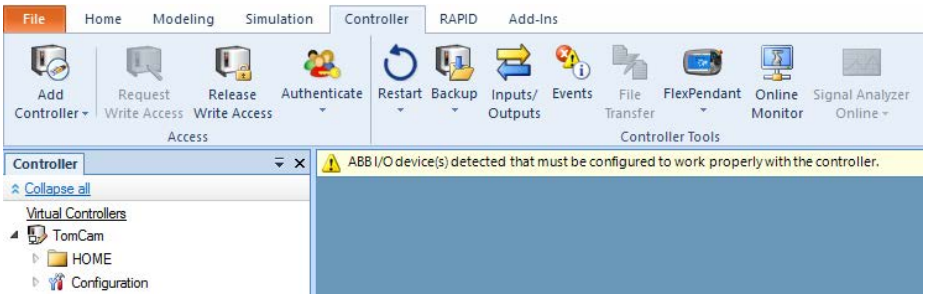
When the I/O device is configured using *Plug & Produce* interface, it requires minimal user interaction. Follow the working procedures to configure a new I/O device, update an existing I/O device and to replace an I/O device with another.

Configuring an I/O device

When a base I/O device and an add-on I/O device are connected to the controller, they must be configured.

This procedure describes how to configure the base I/O device and add-on I/O device at the same time. However, if more add-on I/O devices should be attached after the first configuration of the base I/O device, use the *Updating an existing I/O device on page 48* procedure to update the configuration of the base I/O device.

1. Start RobotStudio and connect to the IRC5 controller. Request write access.
2. The I/O device that has not yet been configured is connected to the private network. The name of the detected I/O device appears.



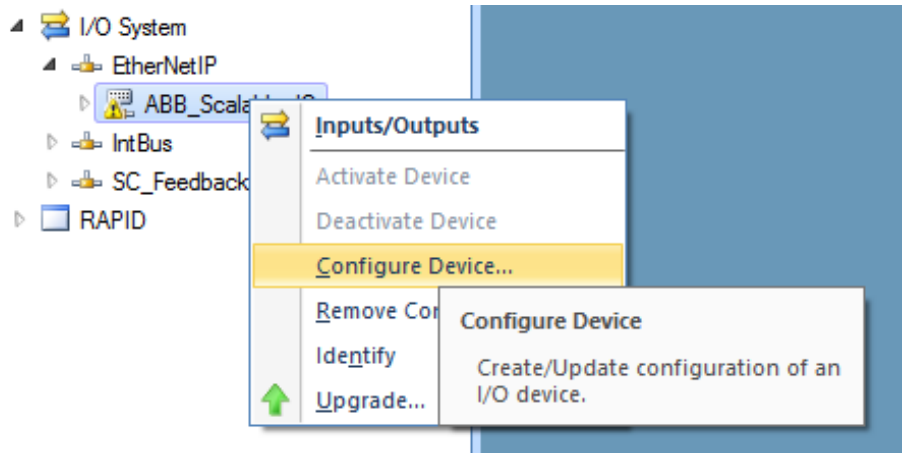
xx2100000064

3. Right-click the detected I/O device and select **Configure**.

   Or

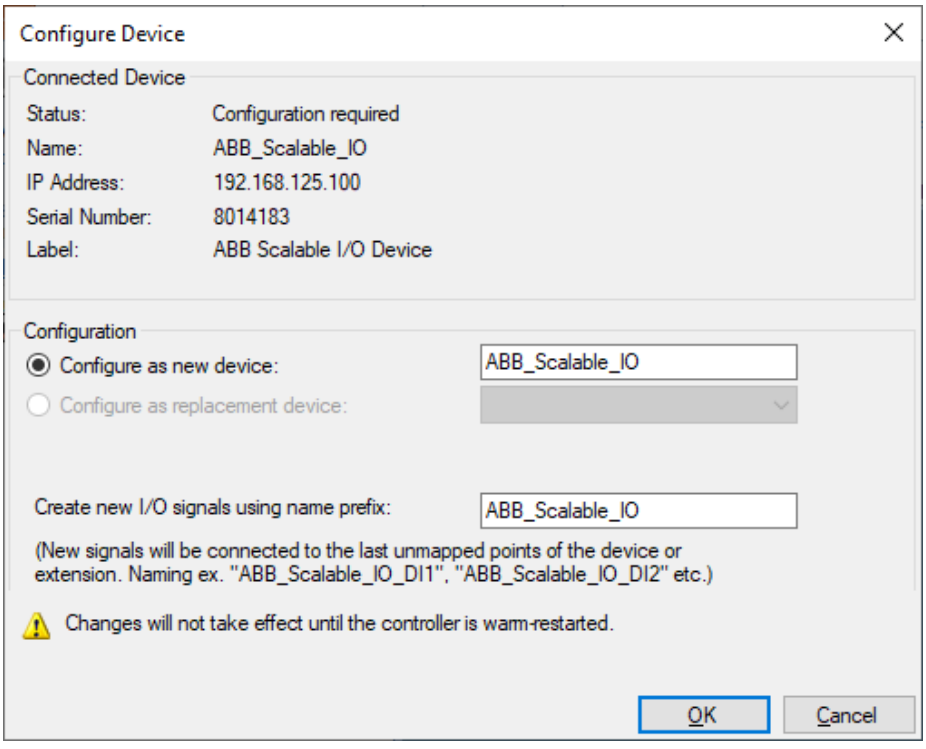
Continues on next page

In the **I/O System** tree, right-click the I/O device and select **Configure Device**.



xx2100000063

4 The **Configure Device** dialog is displayed.



xx2100000065

Complete the following fields:

- **Configure as new device**: Enter the name of the I/O device.

> **Note**
>
> The name will be stored in the I/O device and will be used for identification and addressing.

Continues on next page

3.2.1 Configuring Scalable I/O devices using RobotStudio
Continued

- **Create new I/O signals using name prefix**: Enter the signal prefix to be used in signal names. Not mandatory.

> **Note**
>
> If this field is left empty, no signals will be added to the configuration.

Select **OK**. The I/O device, and its signals, are added.

5 Restart the controller.

Updating an existing I/O device

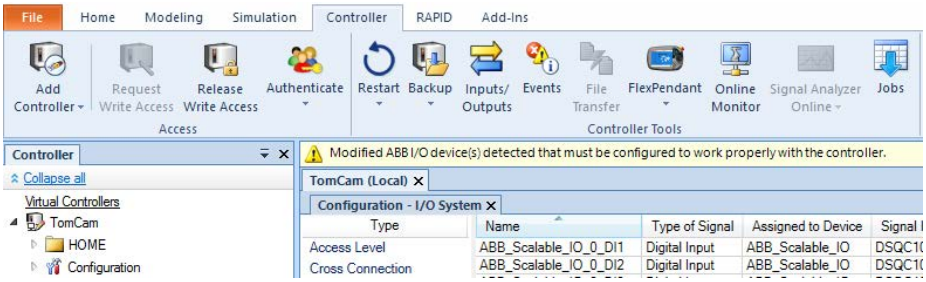
When an add-on I/O device has been attached or removed, the I/O configuration of the base I/O device must be updated.

> **Note**
>
> Always attach or remove I/O devices from the right side of the base I/O device, otherwise the optical link is broken.

The update function can also be used for the generation of default signals on a device.

1 Start RobotStudio and connect to the IRC5 controller. Request write access.

2 The add-on I/O device is attached or removed from the base module. The modified I/O device appears.



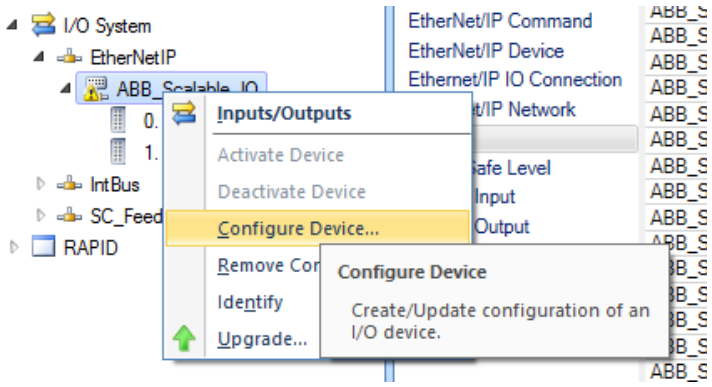
xx2100000078

3 Right-click the modified I/O device and select **Configure**.

Or

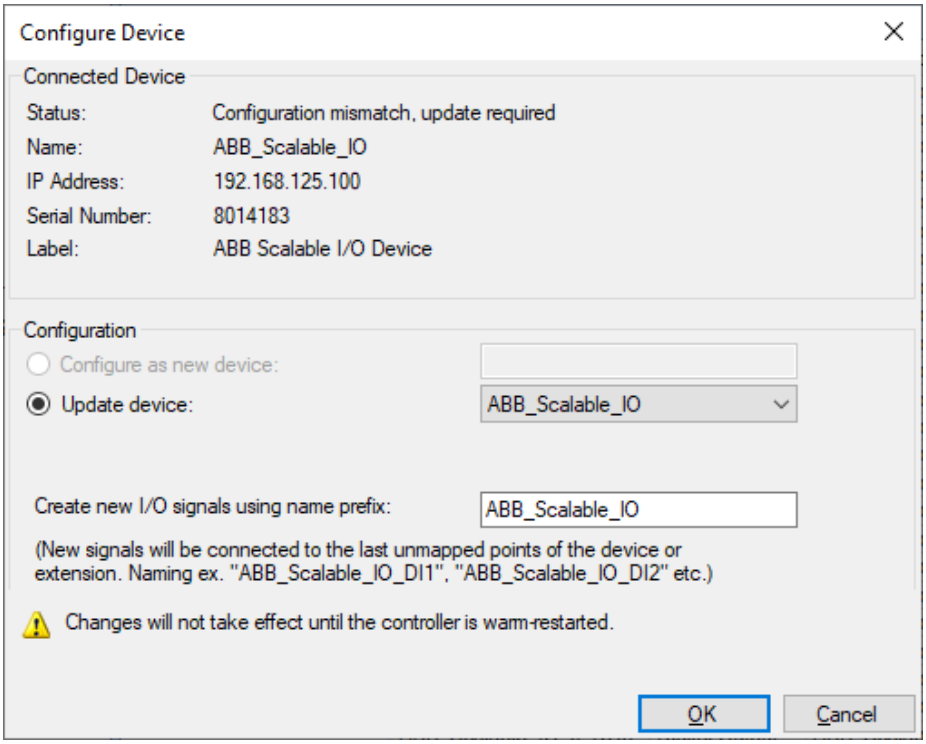
Continues on next page

In the **I/O System** tree, right-click the I/O device to be updated and select **Configure Device**.



xx2100000079

4 The **Configure Device** dialog is displayed.



xx2100000081

Complete the following fields:

- **Update device**: Select the I/O device that is to be updated.
- **Create new I/O signals using name prefix**: Enter the signal prefix to be used in signal names. Not mandatory.

> **Note**
>
> If this field is left empty, no signals will be added to the configuration.

Select **OK**. The I/O device is updated.

Continues on next page

3.2.1 Configuring Scalable I/O devices using RobotStudio
Continued

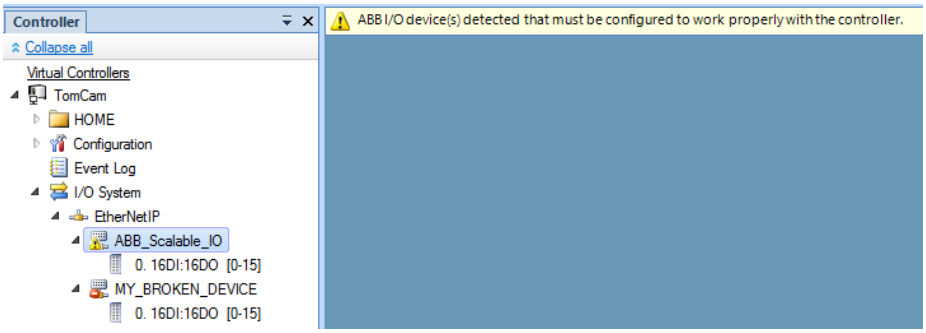
5 Restart the controller.

Replacing a broken I/O device

When a base I/O device is damaged, broken or faulty, it should be replaced.

> **Note**
>
> If a faulty add-on I/O device is replaced with another add-on I/O device of the same type, there is no need to update the configuration of the base I/O device.

1 Start RobotStudio and connect to the IRC5 controller. Request write access.
2 A new I/O device is connected to the private network. The detected I/O device appears.



xx2100000082

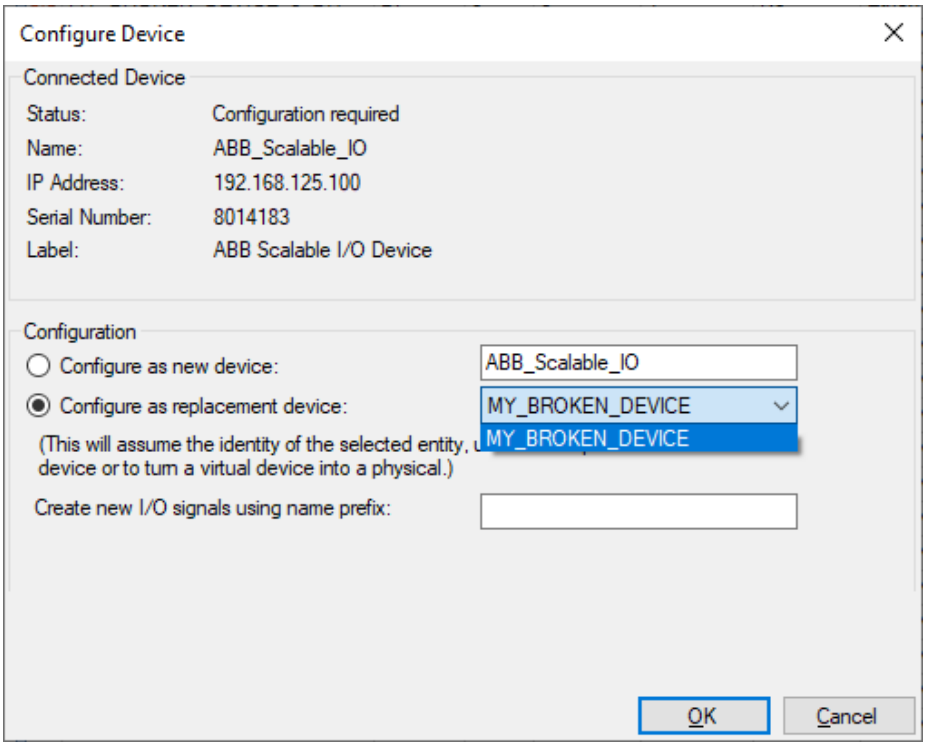
3 Right-click the new I/O device and select **Configure**.

Or

In the **I/O System** tree, right-click the new I/O device and select **Configure Device**.

Continues on next page

4 The **Configure Device** dialog is displayed.



xx2100000083

Complete the following fields:

- **Configure as new device**: Shows the new I/O device that will replace the faulty one.
- **Configure as replacement device**: Select the faulty I/O device that needs to be replaced.

> **Note**
>
> In this example, *ABB_Scalable_IO* is the new I/O device to replace the faulty I/O device, *MY_BROKEN_DEVICE*.

- **Create new I/O signals using name prefix**: Enter the signal prefix to be used in signal names. Not mandatory.

> **Note**
>
> If this field is left empty, no signals will be added to the configuration.

Select **OK**. The I/O device is updated.

5 Restart the controller.

> **Note**
>
> If a faulty add-on I/O device is replaced with another add-on I/O device of the same type, there is no need to update the configuration of the base I/O device.

Continues on next page

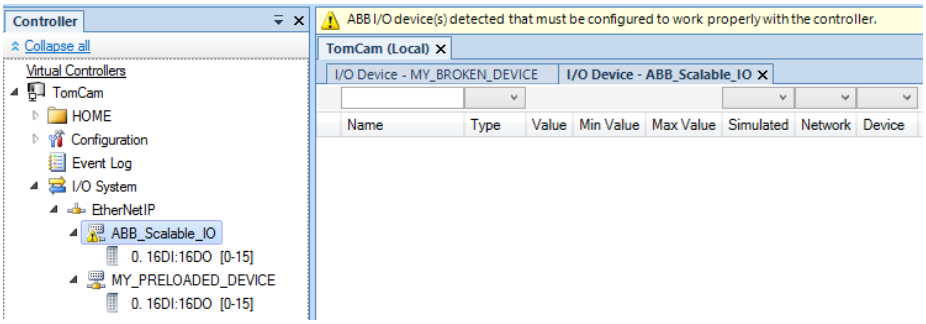
3.2.1 Configuring Scalable I/O devices using RobotStudio
Continued

Replacing an existing I/O device configuration

Existing ABB Scalable I/O configurations found on the controller can be inherited by new ABB Scalable I/O devices. This means that devices can be created in the controller ahead of time without access to the physical device. This also extends to simulated devices that also can be turned into physical devices by configuring a new ABB Scalable I/O device using the simulated device configuration.

1 Start RobotStudio and connect to the IRC5 controller. Request write access.

2 A new I/O device is connected to the private network. The detected I/O device appears.



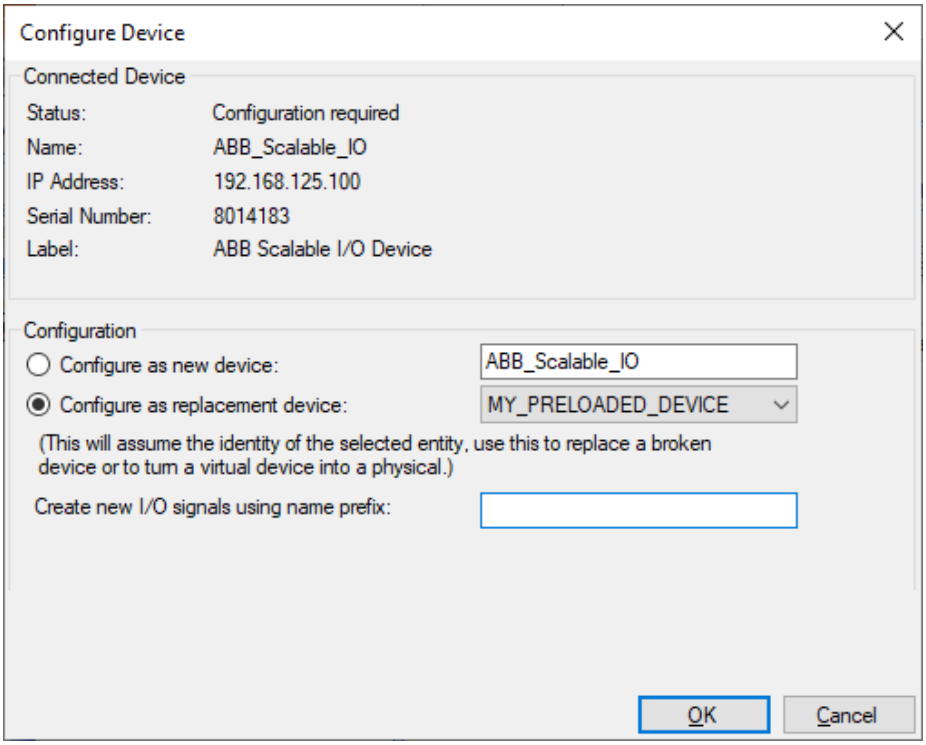
xx2100000084

3 Right-click the new I/O device and select **Configure**.

Or

In the **I/O System** tree, right-click the new I/O device and select **Configure Device**.

4 The **Configure Device** dialog is displayed.



xx2100000085

Continues on next page

Complete the following fields:

- **Configure as new device**: Shows the new I/O device that will replace the existing and inherit its configuration.
- **Configure as replacement device**: Select the existing I/O device to be replaced.

> **Note**
>
> In this example, *ABB_Scalable_IO* is the new I/O device to replace the existing I/O device, *MY_PRELOADED_DEVICE*.

- **Create new I/O signals using name prefix**: Enter the signal prefix to be used in signal names. Not mandatory.

> **Note**
>
> If this field is left empty, no signals will be added to the configuration.

Select **OK**. The new I/O device will inherit the configuration of the selected device.

5 Restart the controller.

Removing and resetting an I/O device configuration

Use this function to remove a configuration and reset the device to factory default.

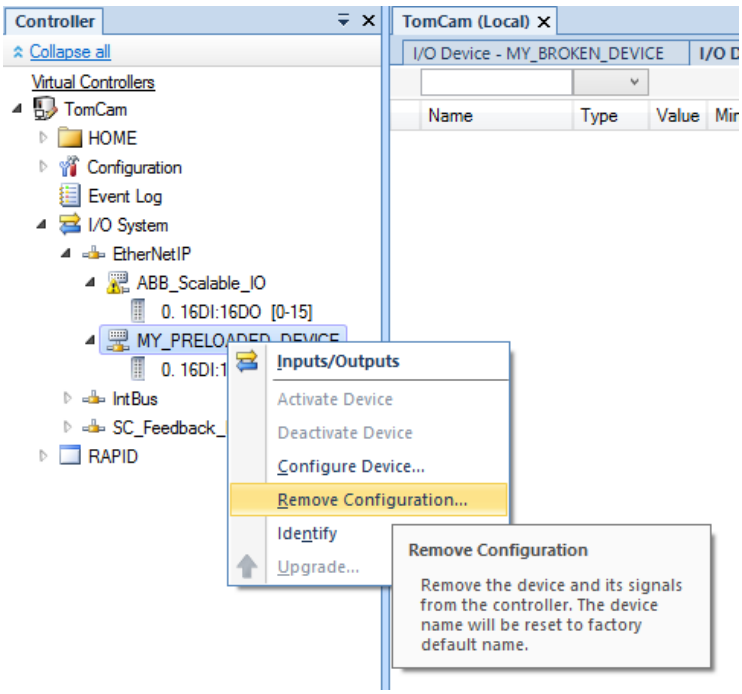
> **Note**
>
> Prerequisites for removing and resetting an I/O device configuration:
> - Connect as Local Client
> - Manual mode
> - The unit must be deactivated
> - Write access

1 Start RobotStudio and connect to the IRC5 controller. Request write access.

Continues on next page

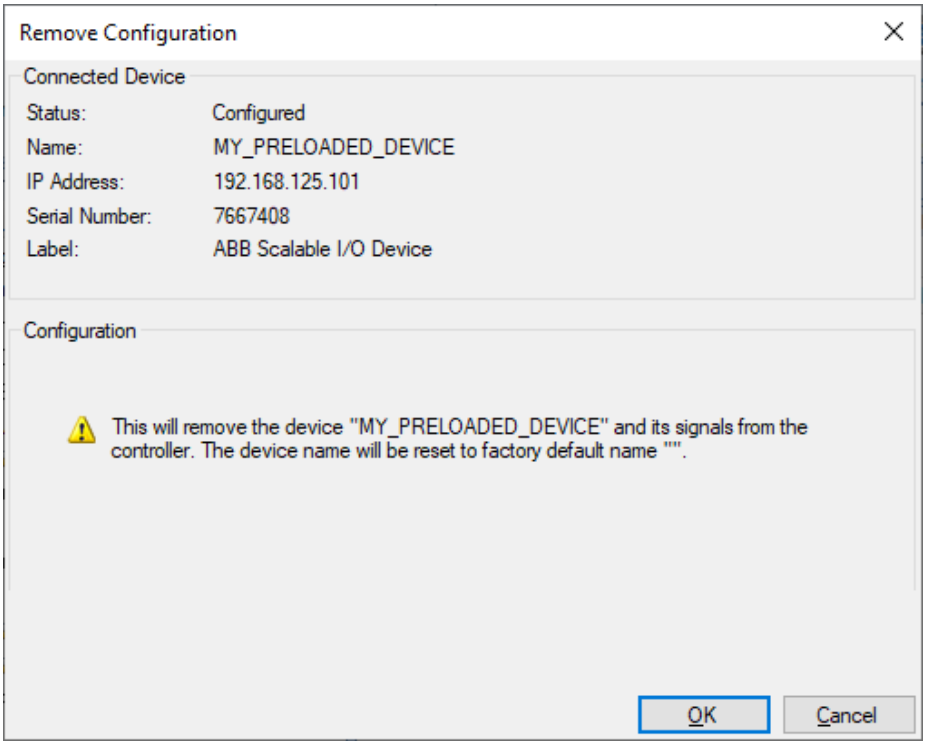
3.2.1 Configuring Scalable I/O devices using RobotStudio
Continued

2 In the **I/O System** tree, right-click the I/O device to be removed and select **Remove Configuration**.



xx2100000086

3 The **Remove Configuration** dialog is displayed.



xx2100000087

Select **OK**. The I/O device is removed.

Continues on next page

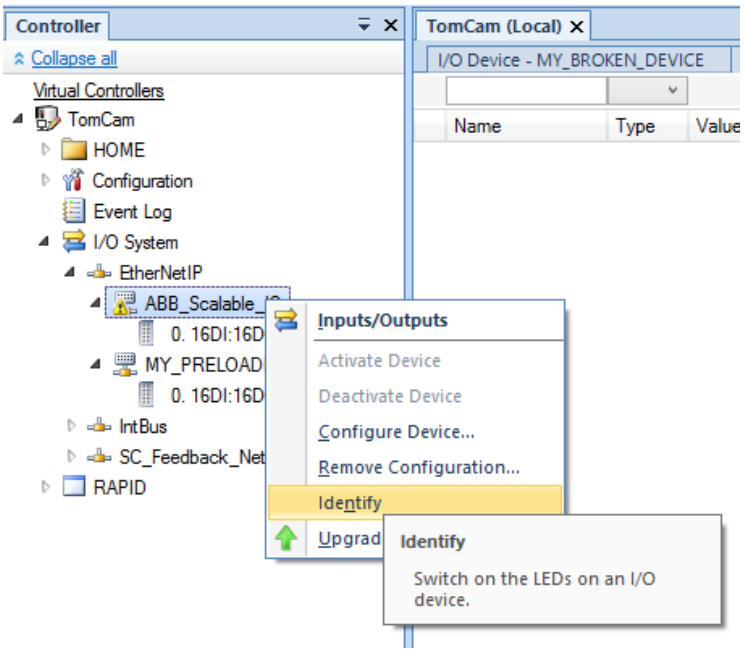
4 Restart the controller.

Identifying an I/O device

When there are multiple I/O devices in the controller, it is important to identify the physical I/O device for any device update, signal connection or troubleshooting.

1 Start RobotStudio and connect to the IRC5 controller. Request write access.

2 In the **I/O System** tree, right-click the target I/O device to be identified and select **Identify**.



xx2100000077

3 The PWR (Power), MS (Module status) and NS (Network Status) LED of the physical base I/O device flashes to identify the I/O device in the controller.

3.2.2 Configuring Scalable I/O devices using the FlexPendant

General

This section describes the recommended working procedure when installing and configuring ABB Scalable I/O devices using the FlexPendant.

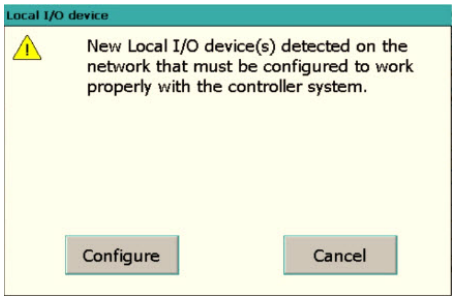
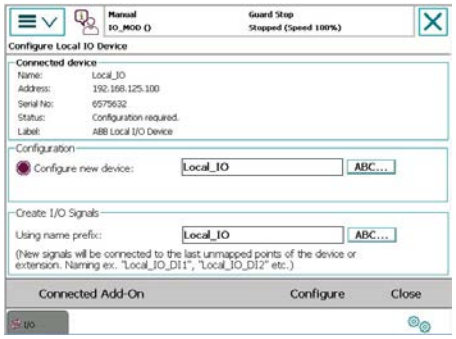
For information about configuration using RobotStudio, see *Configuring Scalable I/O devices using RobotStudio on page 46*.

Note

The system should be in manual mode while configuring or updating the I/O device using the FlexPendant.

Configuring an I/O device

Use this procedure to configure a new I/O device on the FlexPendant.

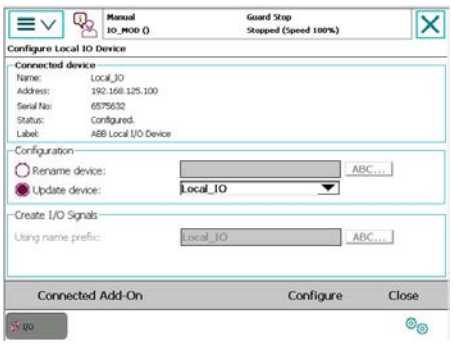
	Action	Note
1	Start the FlexPendant and connect to the IRC5 controller.	
2	The I/O device not yet configured is connected to the private network. The detected I/O device name appears.	 xx1700000591
3	Tap **Configure**. The **Configure Local IO Device** window opens.	
4	Enter the device name in the **Configure new device** option.	 xx1700000592
5	Tap **Configure**.	
6	Tap **Yes** to the question **The changes will not take effect until the controller is restarted. Do you want to restart now?**.	

Continues on next page

Updating an existing I/O device

Use this procedure to update the I/O configuration of the base I/O device on the FlexPendant, when an add-on I/O device is attached or removed.

> **Note**
>
> Attach or remove the add-on I/O device from the last, that is to the right-side of the base I/O device or the last add-on I/O device.

	Action	Note
1	On the **ABB** menu tap **Inputs and Outputs**.	
2	In the **View** menu, tap **I/O Devices**.	
3	Select the I/O device to be updated and tap **Actions**.	
4	Select **Configure**. The **Configure Local IO Device** window opens.	
5	Select the I/O device in the **Update device** option.	 xx1700000593
6	Tap **Configure**.	
7	Tap **Yes** to the question **The changes will not take effect until the controller is restarted. Do you want to restart now?**.	

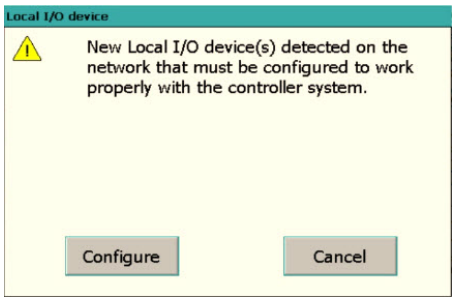
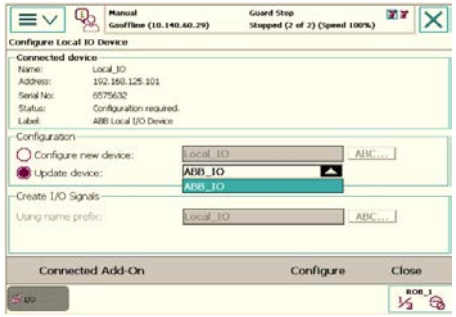
Replacing an I/O device

Use this procedure to replace a damaged or faulty base I/O device with a new I/O device on the FlexPendant.

> **Note**
>
> If a faulty add-on I/O device is replaced with another add-on I/O device of same type, there is no need to update configuration of the base I/O device.

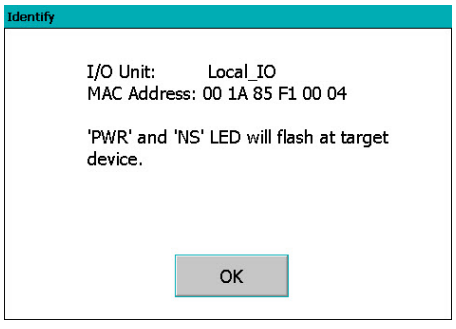
Continues on next page

3.2.2 Configuring Scalable I/O devices using the FlexPendant
Continued

	Action	Note
1	A new I/O device is connected to the private network using *Plug & Produce* interface. The detected I/O device appears.	 xx1700000591
2	Tap **Configure**. The **Configure Local IO Device** window opens.	
3	In the **Update device** option, select the faulty I/O device from the drop-down list that needs to be replaced. **Note** In this example, Local_IO is the new I/O device to replace the faulty I/O device, ABB_IO.	 xx1700000594
4	Tap **Configure**.	
5	Tap **Yes** to the question **The changes will not take effect until the controller is restarted. Do you want to restart now?**.	

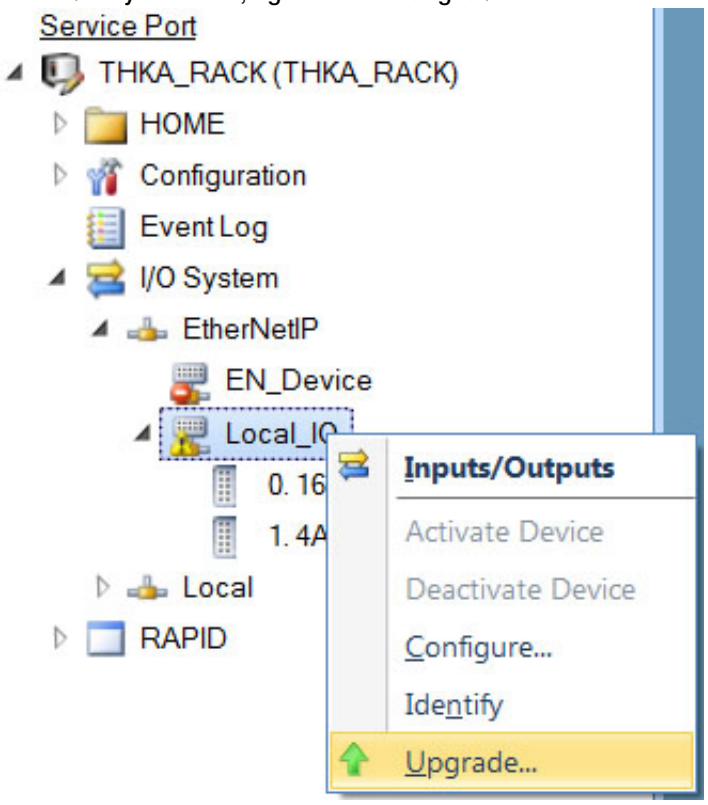
Identifying an I/O device

Use this procedure to identify the physical I/O device in the controller using the FlexPendant.

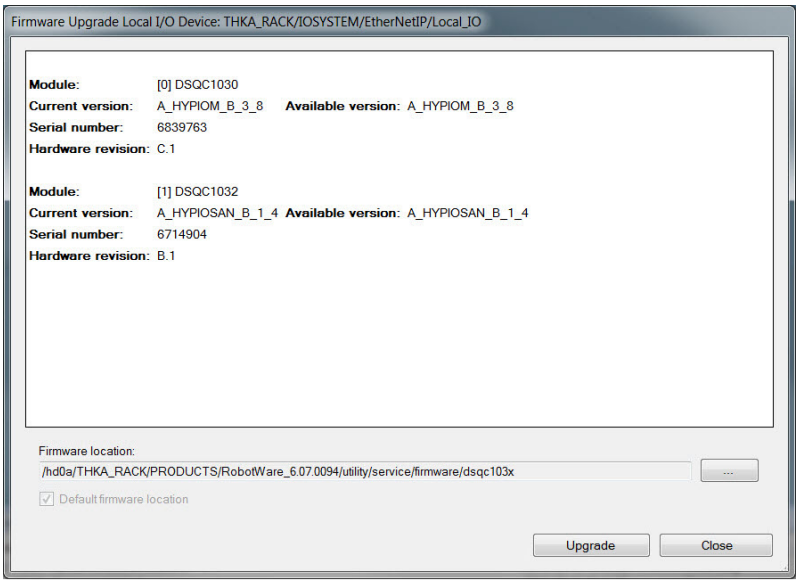
	Action	Note
1	On the **ABB** menu tap **Inputs and Outputs**.	
2	In the **View** menu, tap **I/O Devices**.	
3	Select the target I/O device to be identified and tap **Actions**.	
4	Select **Identify**. The **Identify** window opens.	 xx1700000647

3.3 Firmware upgrade

Upgrade firmware from RobotStudio

Step	Action
1	Set the IRC5 controller in manual mode.
2	If the device is in the running state, deactivate Local_IO on the FlexPendant. **Note** To deactivate the Local_IO on the FlexPendant, on the **ABB** menu, tap **Inputs and Outputs** > **View** > **I/O Devices**, select the target **Local_IO device**, and tap **Deactivate**.
3	Start RobotStudio and connect to the IRC5 controller.
4	Request write access.
5	In the I/O System tree, right-click the target I/O device and select **Upgrade**.  xx1800000142

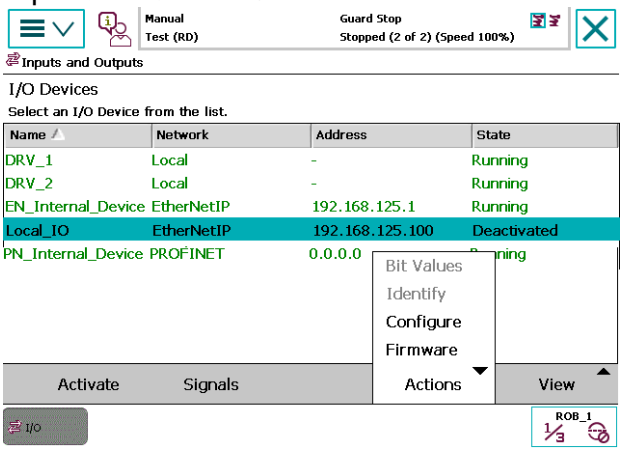
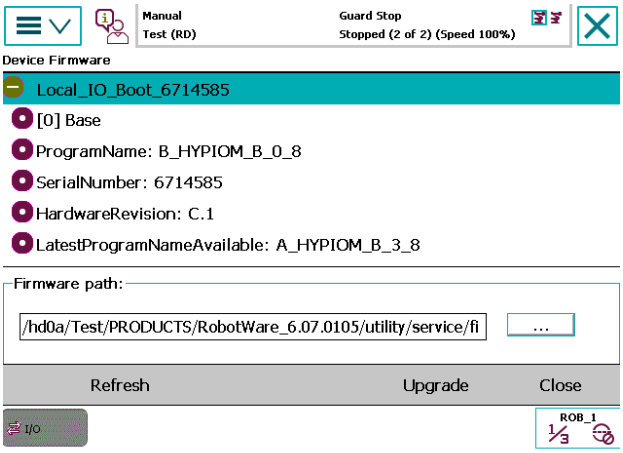
Continues on next page

Step	Action
6	The **Firmware Upgrade Local I/O Device** window is displayed. **Note** The Firmware location field displays the default firmware file. To select a new firmware file, click the **...** button and browse and to the folder that has the new firmware file.  xx1800000143 **Note** The **Upgrade** button is enabled only if a new version is detected either in the default firmware path or in a browsed path.
7	Click **Upgrade**. The firmware is upgraded and a message is displayed.

Upgrade firmware from the FlexPendant

Step	Action
1	Set the IRC5 controller in manual mode.
2	If the device is in the running state, deactivate the Local_IO. **Note** To deactivate the Local_IO on the FlexPendant, on the **ABB** menu, tap **Inputs and Outputs** > **View** > **I/O Devices**, select the target **Local_IO device**, and tap **Deactivate**.

Continues on next page

Step	Action
3	Tap **Actions** and select **Firmware**.  xx1800000144 **Note** Firmware upgrade is not possible if the state of the selected I/O device is **Running**.
4	The **Device Firmware** window is displayed. **Note** The **Firmware path** field displays the default firmware file. To select a new firmware file, click the **...** button and browse and to the folder that has the new firmware file.  xx1800000145 **Note** The **Upgrade** button is enabled only if a new version is detected either in the default firmware path or in a browsed path.
5	Tap **Upgrade**. The firmware is upgraded and a message is displayed.

This page is intentionally left blank

4 Reference material

4.1 Analog input point object

Analog Input Point Object (Class Code: 0Ahex)

The Analog Input Point Object contains information of the analog inputs of the Scalable I/O system.

Inputs cause the base module to produce data on the network. Each analog input point uses a low pass filter and a hysteresis which can both be configured. The sampled value is first passed through the low pass filter and then through the hysteresis. After this, the value is stored to attribute 3 (Value).

Class attributes

Attribute ID (hex)	Access rule	NV	Attribute name	Data type	Default value	Description
1	Get	NV	Revision	U16	2	

Instance attributes

Attribute ID (hex)	Access rule	NV	Attribute name	Data type	Default value	Description
3	Get	V	Value	U16		0 to 4095
32	Set	V	Low Pass Filter Order	U16	3	0 The Low Pass Filter Order exponent can be set to 0 – 16 and the sample time is 1 ms.
33	Set	V	Hysteresis	U16	4	The hysteresis of each analog input point can be set between 0 and 4095. New values (after filtering) must be outside the hysteresis window in order for it to be transferred to attribute 3 (Value).

Services

Service code (hex)	Implemented		Service name	Description
	Class	Instance		
0E	YES	YES	Get Attribute Single	
10	NO	YES	Set Attribute Single	

This page is intentionally left blank

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

3HAC059109-001, Rev K, en