ROBOTICS

Application manual

Discrete I/O

Trace back information:
Workspace 20A version a7
Checked in 2020-03-09
Skribenta version 5.3.033

Application manual

Discrete I/O

RobotWare 7.0.2

Document ID: 3HAC070208-001

Revision: C

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Original instructions.

Table of contents

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Overview of this manual

About this manual

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

Usage

This manual should be used during installation and configuration of the discrete 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 - OmniCore	*3HAC065036-001*
Product manual - OmniCore C30	*3HAC060860-001*
Technical reference manual - System parameters	*3HAC065041-001*
Technical reference manual - RAPID Instructions, Functions and Data types	*3HAC065038-001*
Application manual - Controller software OmniCore	*3HAC066554-001*
Product specification - OmniCore C line	*3HAC065034-001*
Application manual - EtherNet/IP Scanner/Adapter	*3HAC066565-001*

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*.

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Revisions

Revision	Description
A	Released with RobotWare 7.0.
B	Released with RobotWare 7.0.1. • Updated the section *Coil neutralization on page 40*.
C	Released with RobotWare 7.0.2. • Updated the section *Connecting the EtherNet/IP network on page 25*.

Product documentation

Categories for user documentation from ABB Robotics

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

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

Product manuals

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

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

Technical reference manuals

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

Application manuals

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

An application manual generally contains information about:

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

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Operating manuals

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

Safety

Safety regulations

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

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

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 damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

1 Introduction

General

Discrete 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. When the I/O device is installed inside the controller, then it is referred to as *Local I/O* or *Internal I/O*. When installed outside the controller, then it is referred to as *External I/O* or *Remote I/O*.

The 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 base devices and other third-party I/O devices.

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.

The add-on devices have an optical interface and must be attached to a 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 base devices.

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 Discrete I/O devices are following:

- Easy to install.
- Easy to configure in RobotWare with support of the new *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.

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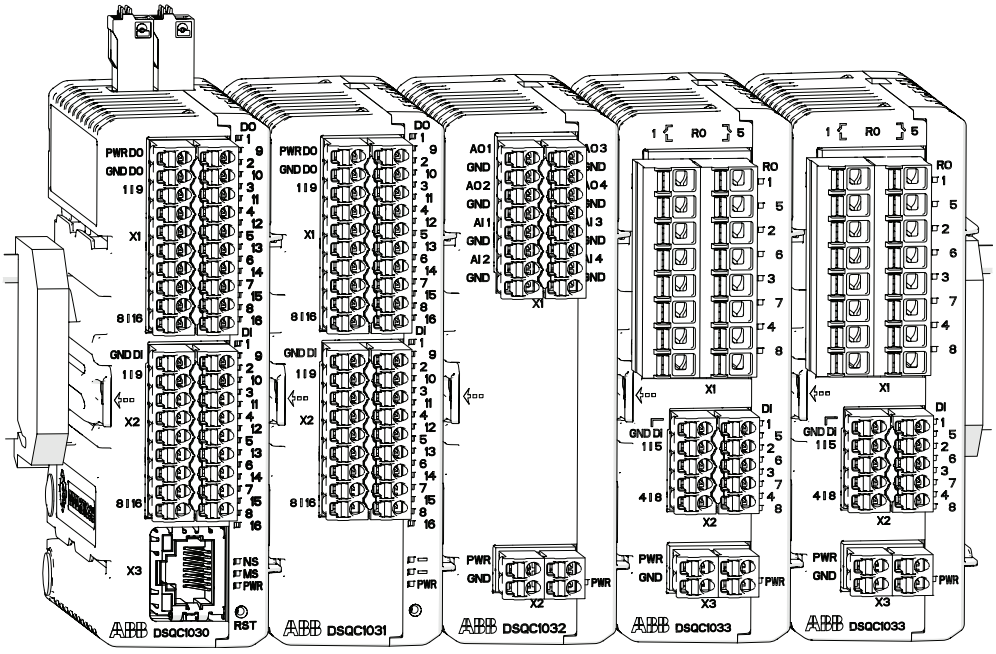
2 Hardware overview

2.1 Installing the I/O devices

2.1.1 Introduction

Local 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

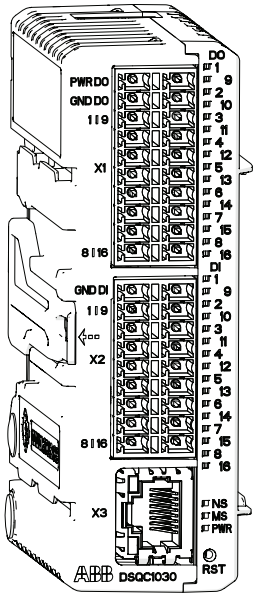
2.1.2 Installing base devices

General

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.

The 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 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.



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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.	

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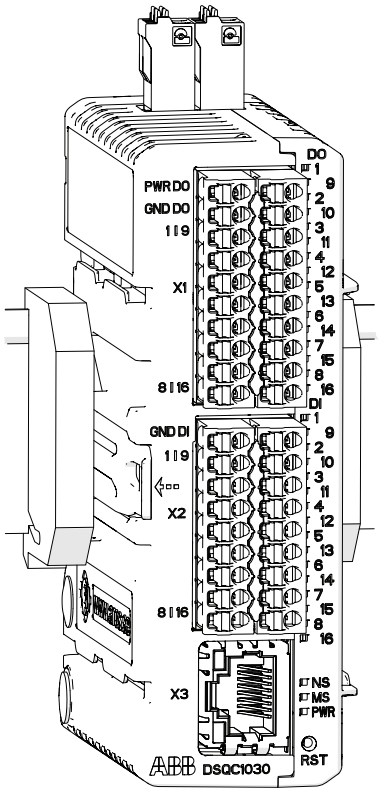
	Action	Note
2	Fit the device by snapping it onto the mounting rail.	 xx1700000275
3	Connect the Ethernet cable from the robot controller, or the EtherNet/IP scanner, to any of the connectors X3 or X5.	
4	Connect the logic power supply to connector X4.	For information about the pinout see *Connectors on page 27*.
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 *Using Discrete I/O devices on page 42*.	

Removing base devices

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

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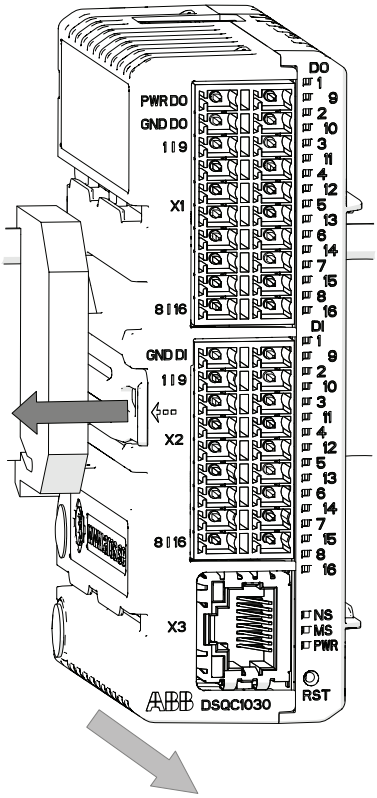
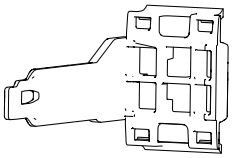
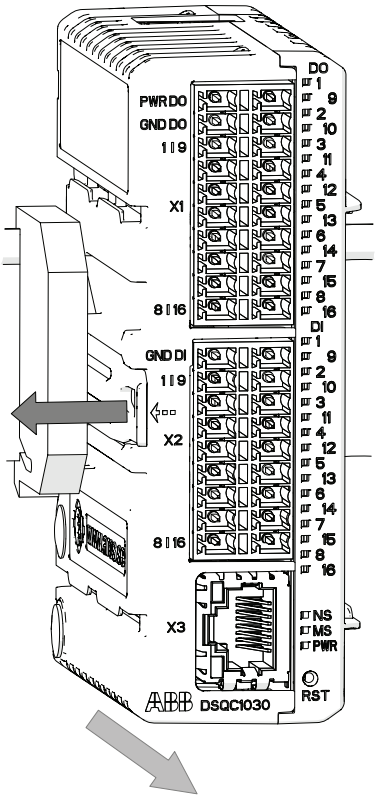
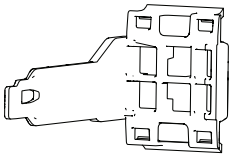
2.1.2 Installing base devices
Continued

	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

	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

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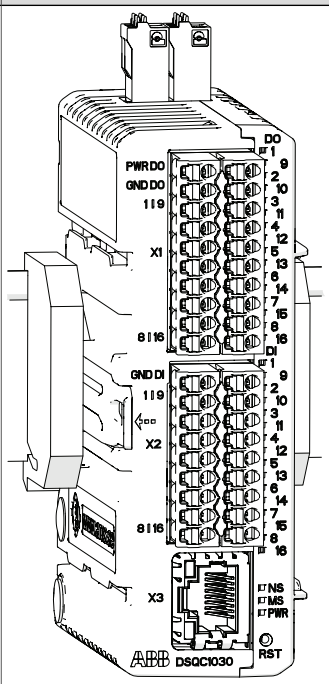
2.1.2 Installing base devices
Continued

	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 Discrete I/O device on page 46*.	

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

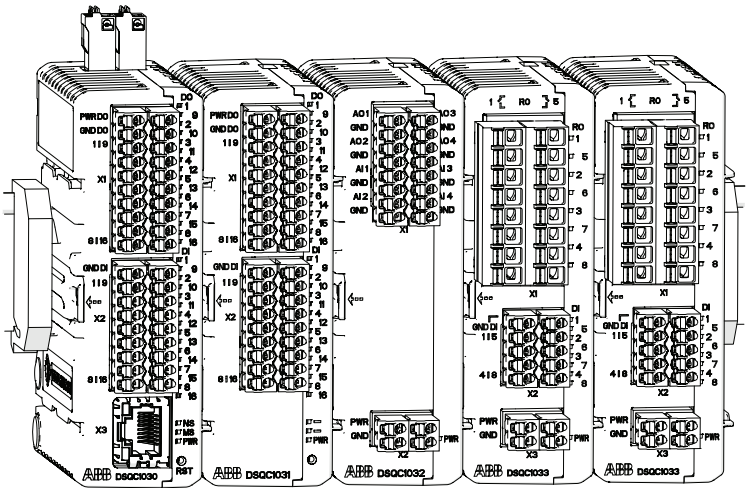
Connecting the process power supply in parallel or through the logical power supply connector may damage the device.

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.



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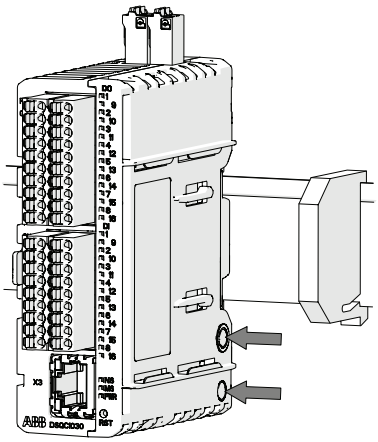
Installing add-on devices

	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

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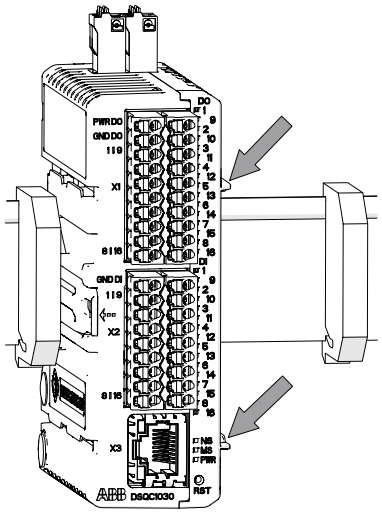
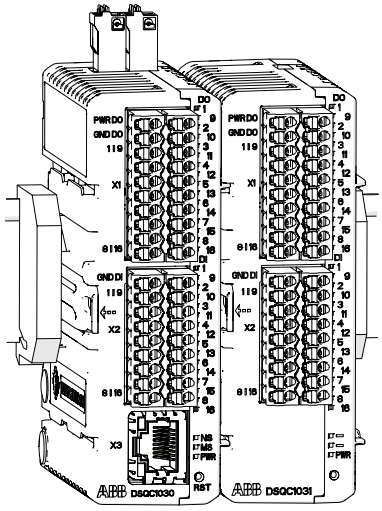
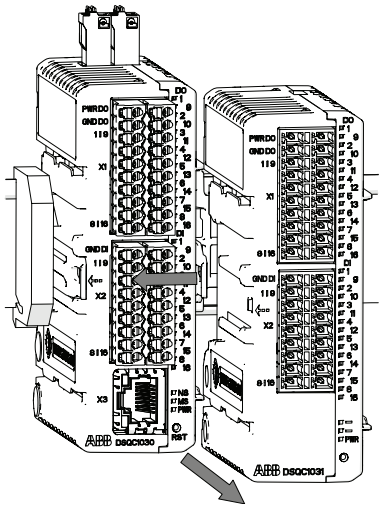
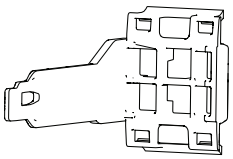
2.1.3 Installing add-on devices

Continued

	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 26*. **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 *Using Discrete I/O devices on page 42*.	

Continues on next page

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

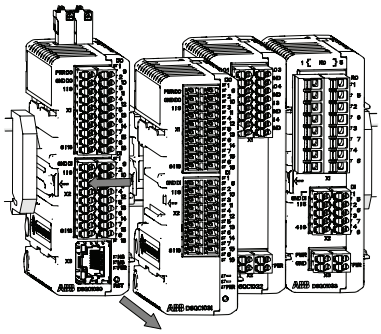
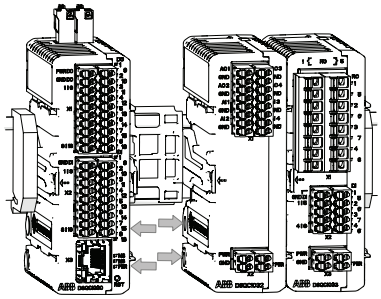
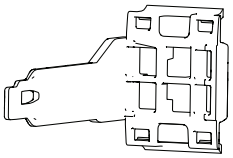
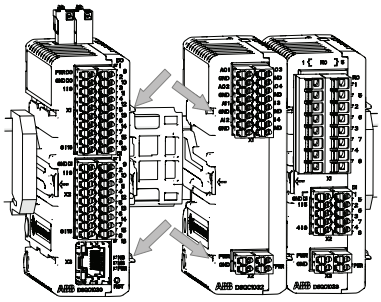
Replacing add-on devices

	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

2.1.3 Installing add-on 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.	 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 the existing Discrete I/O device on page 44*.	 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

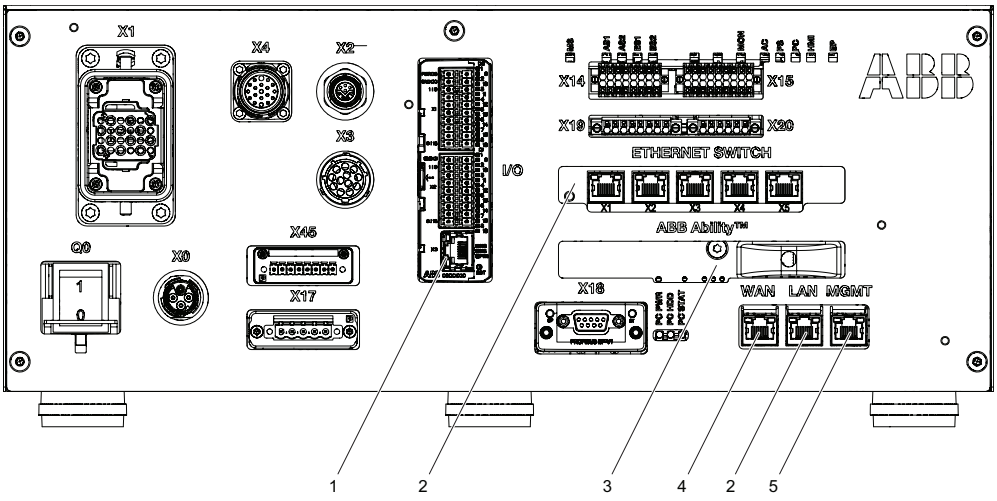
Connecting the EtherNet/IP network

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 should be connected to the private network (I/O or LAN + ETHERNET SWITCH) to gain the advantages with plug-n-produce.

When using the RobotWare options *3024-1 EtherNet/IP Scanner* or *3024-2 EtherNet/IP Adapter* more configuration possibilities are available. For more information see *Application manual - EtherNet/IP Scanner/Adapter*.

A factory wide I/O network should be connected to the Ethernet port WAN on the controller.

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



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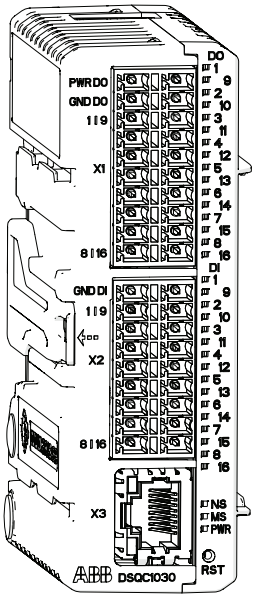
	Label	Description
1	I/O	Port to the robot's private network. Intended for connecting I/O units.
2	LAN + ETHERNET SWITCH	Port to the robot's private network. Intended for connecting network based process equipment to the controller.
3	ABB Ability™	This port only exists if the wired variant of the Connected Services Gateway is used. Intended for connecting to the robot's Ability™ network.
4	WAN	WAN port that can be used to host a public industrial network.
5	MGMT (Management)	Port to the robot's private network. Intended to be used by service personnel to connect to the computer, that is, not for other connections.

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.



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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 35*.

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

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)	Resets the IP-settings to ABB default values.	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

2.3.1 DSQC1030 Digital base
Continued

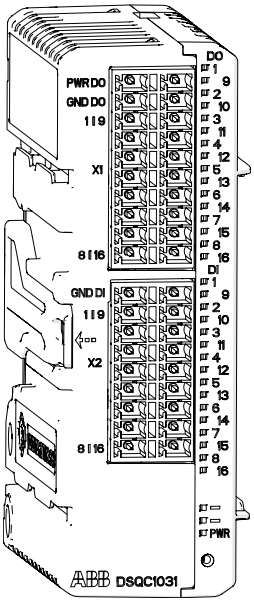
CAUTION

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.

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 35*.

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

Continues on next page

2.3.2 DSQC1031 Digital add-on
Continued

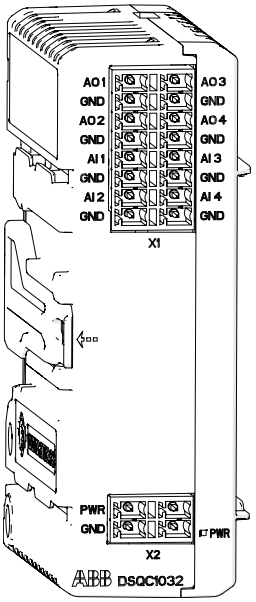
Connectors

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 35*.

LED label	Description
PWR	Power

Continues on next page

2.3.3 DSQC1032 Analog add-on
Continued

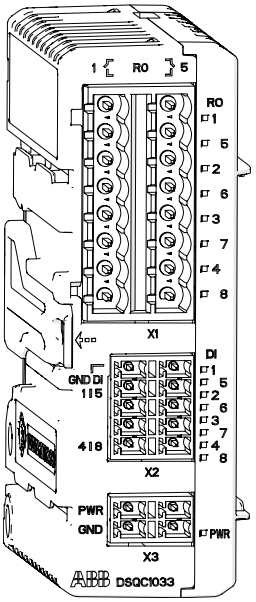
Connectors

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 35*.

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

Continues on next page

2.3.4 DSQC1033 Relay add-on
Continued

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 has LED indicators which indicate the condition of the device and the function of the network communication.

I/O signal 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.

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.

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.	

Continues on next page

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.

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.

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.

Continues on next page

Order	LED action
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.
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.

2.5 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	
Typ 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 4mA
Max voltage	30 V	
Reverse polarity protected	Yes	
Surge protected	Yes	
Delay time	0.5 – 65 ms	programmable

Analog inputs

Description	Data	Note
Input range	0 – 10 V	
Resolution	12 bits, 2.44 mV	
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

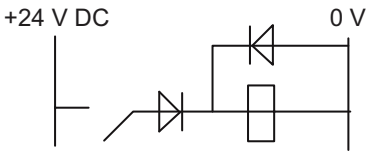
External relay coils, solenoids, and other devices that are connected to the I/O devices must be neutralized and protected with external diodes for reverse protection. The following sections describe how this can be done.

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.



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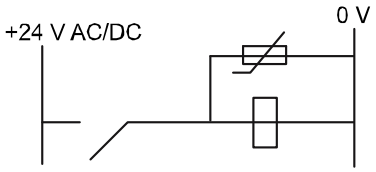
Clamping with a varistor

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

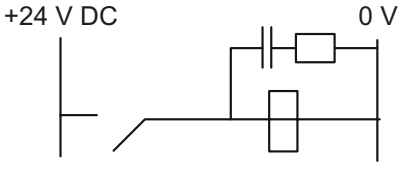


xx0100000164

Clamping with an RC circuit

R 100 ohm, 1W C 0.1 - 1 mF

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



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3 Software overview

3.1 Information about I/O devices

General

To use the ABB 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 device by using RobotStudio or FlexPendant. For more information on configuring the I/O device, see *Using Discrete I/O devices on page 42*.

Industrial network

The EtherNet/IP is the industrial network for the I/O devices to communicate with the robot and the controller.

EDS file

An EDS file is required only when configuring the I/O device with other scanners. An Electronic Data Sheet file, EDS file, is available for the I/O device to identify the devices when configured in the network. The EDS file for the I/O device is stored in the controller and location is:

...\RobotWare\RobotControl_x.x.x-xxx\utility\service\ioconfig\EDS

Behavior

ABB 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 Discrete I/O devices

3.2.1 Configuring ABB I/O device using RobotStudio

General

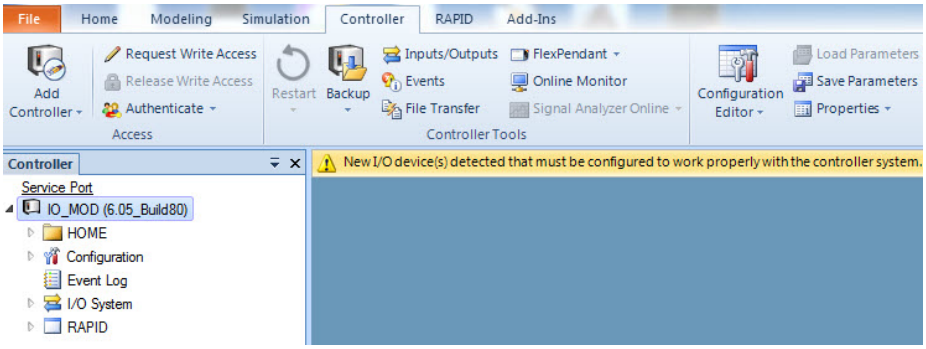
This section describes the recommended working procedure when installing and configuring the ABB I/O devices in RobotStudio. Configuration is also possible by using the FlexPendant, for more information refer to *Configuring ABB I/O device using the FlexPendant on page 49*.

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

Configuring a Discrete I/O device

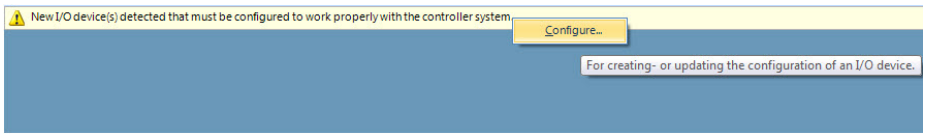
When a base I/O device and an add-on I/O device is connected to the robot controller, it should be configured using RobotStudio or FlexPendant. Follow this procedure to configure the base I/O device and add-on I/O device at the same time. However, if more add-on I/O devices are attached after configuring the base I/O device the first time, use the *Updating the existing Discrete I/O device on page 44* procedure to update the configuration of the base I/O device.

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



xx1700000263

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

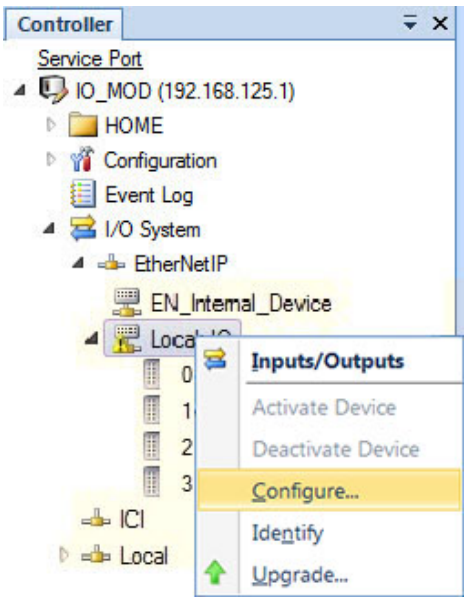


xx1700000475

Or

Continues on next page

In the I/O System tree, right-click the discrete I/O device and select **Configure**. The **Configure I/O Device** dialog box appears.



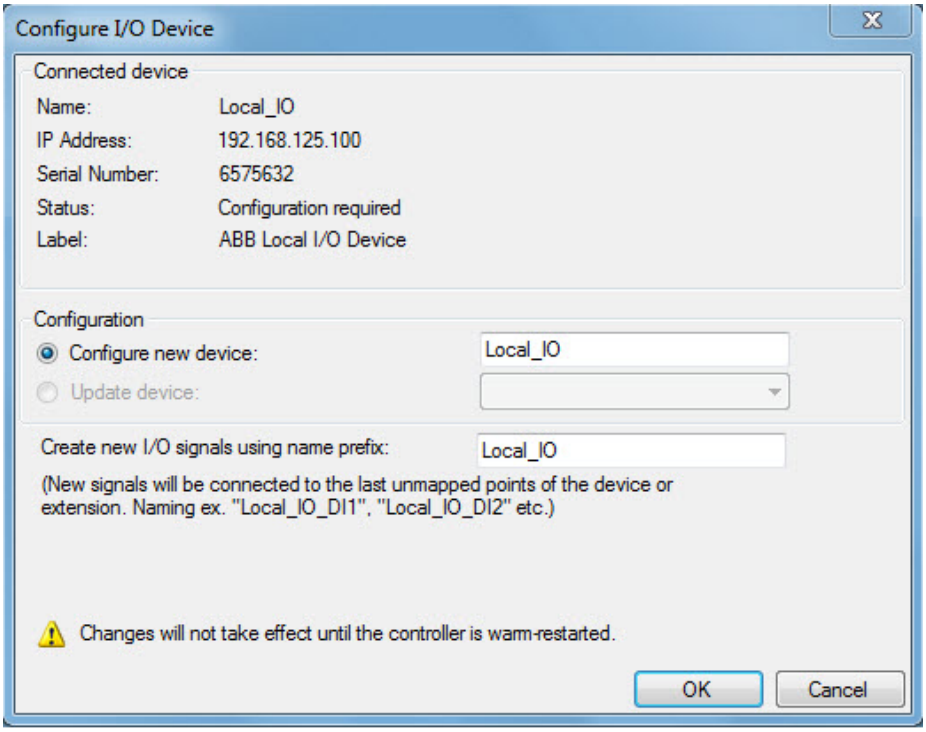
xx1700000264

4 In the **Configure I/O Device** dialog box:
   - Enter the I/O device name in the **Configure new device** field.
   - Enter the signal name if desired.
   - Click **Ok**. The I/O device is added with signals.

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

Continues on next page

3.2.1 Configuring ABB I/O device using RobotStudio
Continued



xx1700000265

5 Restart the controller.

Updating the existing Discrete I/O device

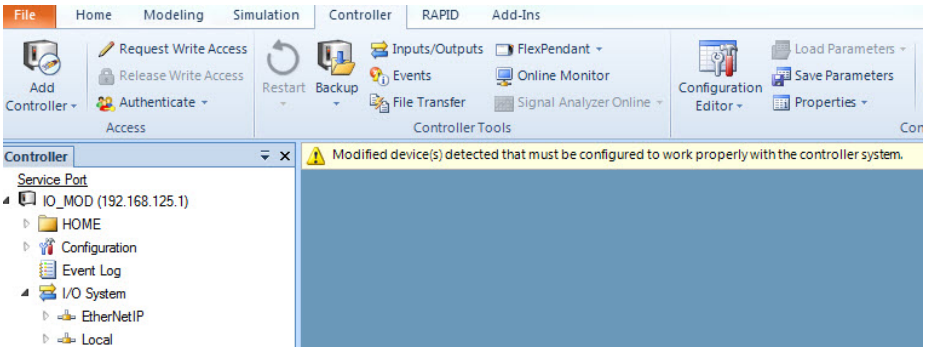
It is required to update the I/O configuration of the base I/O device when an add-on I/O device is attached or removed.

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.

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

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



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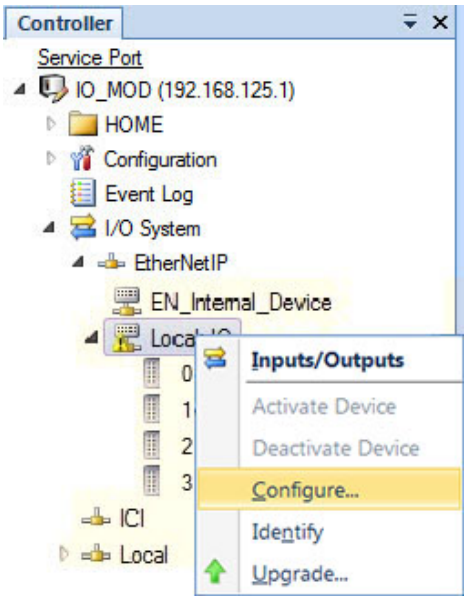
Continues on next page

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

Or

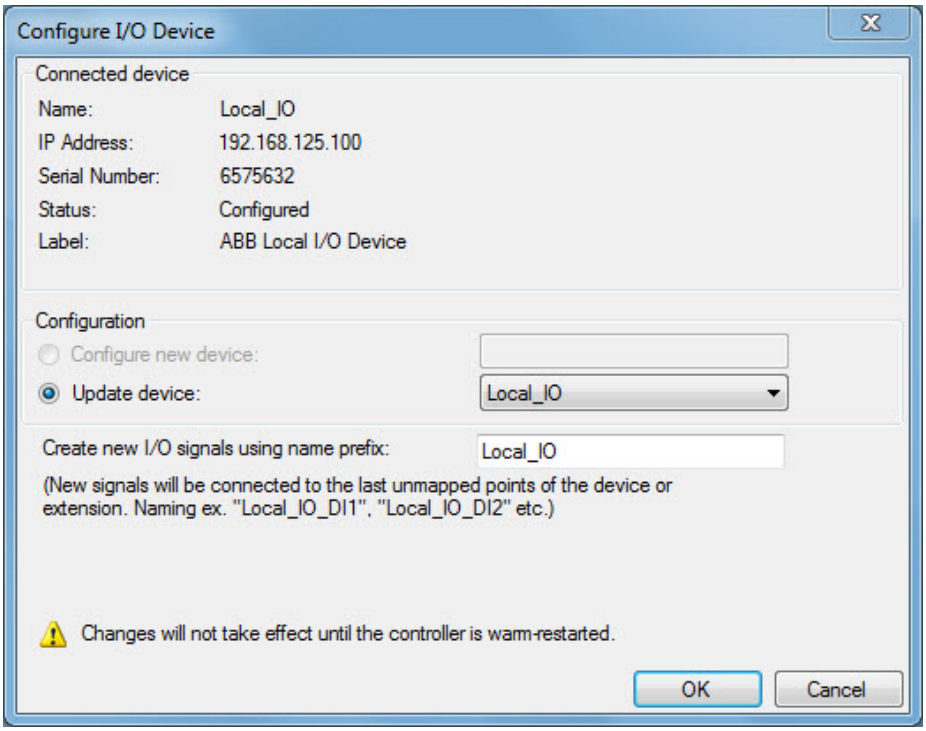
In the I/O System tree, right-click the I/O device to be updated and select **Configure.**



xx1700000264

The **Configure I/O Device** dialog box appears.

4 In the **Configure I/O Device** dialog box:



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- Click **Update device** option.

Continues on next page

3.2.1 Configuring ABB I/O device using RobotStudio
Continued

- Select the I/O device from the drop-down list that needs to be updated.
- Update the signals if required.

5 Click **OK**.

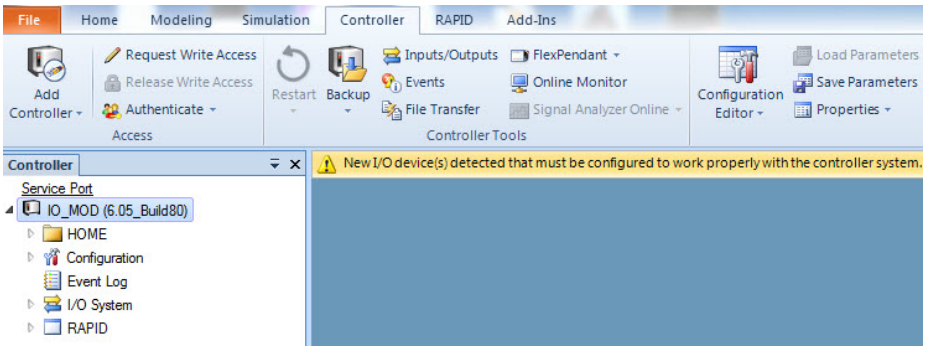
6 Restart the controller.

Replacing a Discrete I/O device

When a base I/O device is damaged, broken or faulty, then replace the base I/O device.

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

2 A new discrete I/O device is connected to the private network using *Plug & Produce* interface. The detected I/O device appears.



xx1700000263

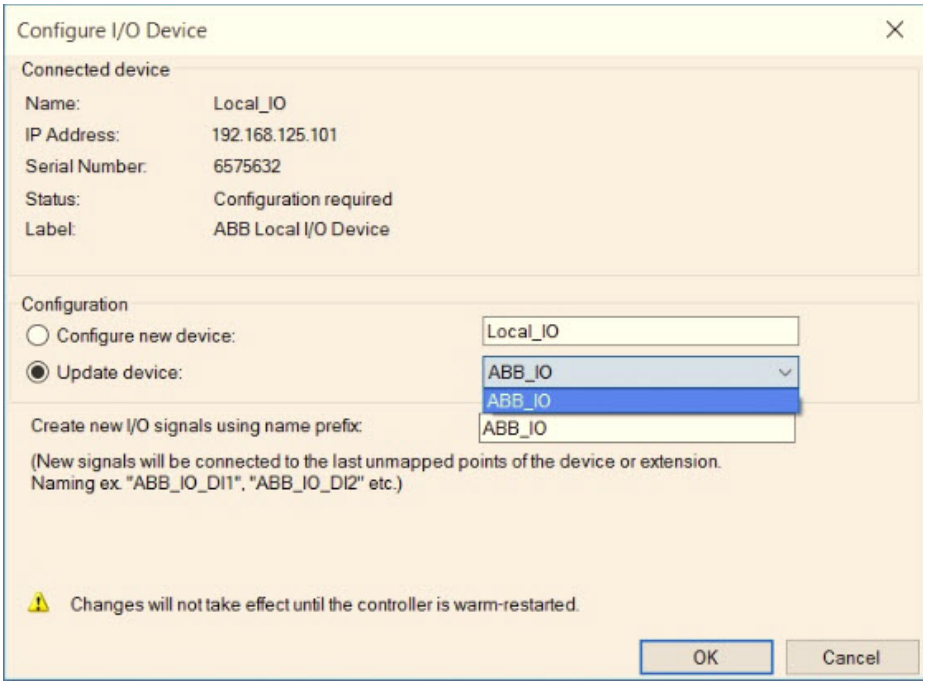
3 In the **Configure I/O Device** dialog box:

- Click **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*.

- Update the signals if required.

Continues on next page



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4 Click **OK**.

5 Restart the controller.

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.

Identifying a Discrete I/O device

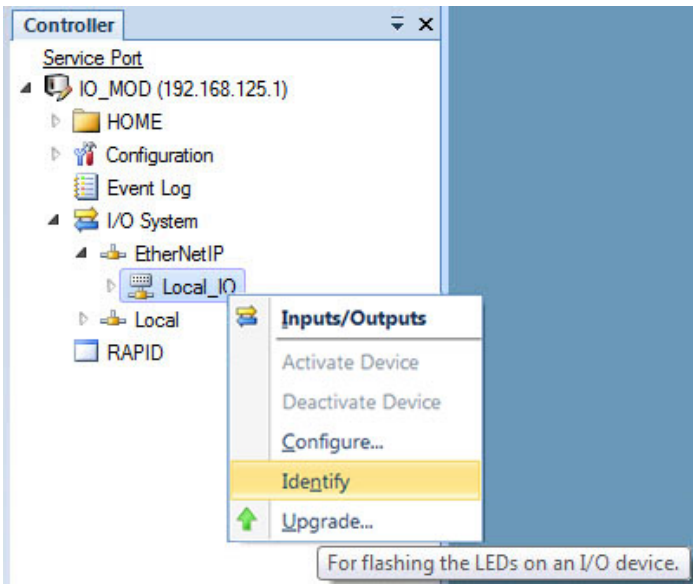
When there are multiple I/O devices in the controller, it is important to identify the physical I/O device for any device update, signal connection or troubleshooting.

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

Continues on next page

3.2.1 Configuring ABB I/O device using RobotStudio
Continued

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



xx1700000646

3 The PWR (Power) 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 ABB I/O device using the FlexPendant

General

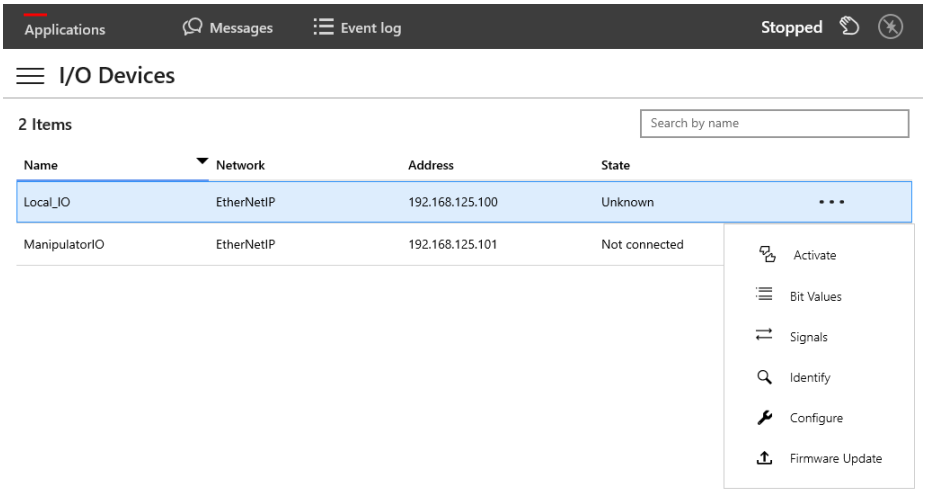
This section describes the recommended working procedure when installing and configuring the ABB I/O devices in FlexPendant. For information on configuring I/O devices using RobotStudio, see *Configuring ABB I/O device using RobotStudio on page 42*.

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

Configuring a Discrete I/O device

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

1. Start the FlexPendant and connect to the OmniCore controller.
2. On the start screen, tap **I/O**, and then select **I/O Devices** from the menu.
3. Select the I/O device and and tap **Configure**.



xx1900000918

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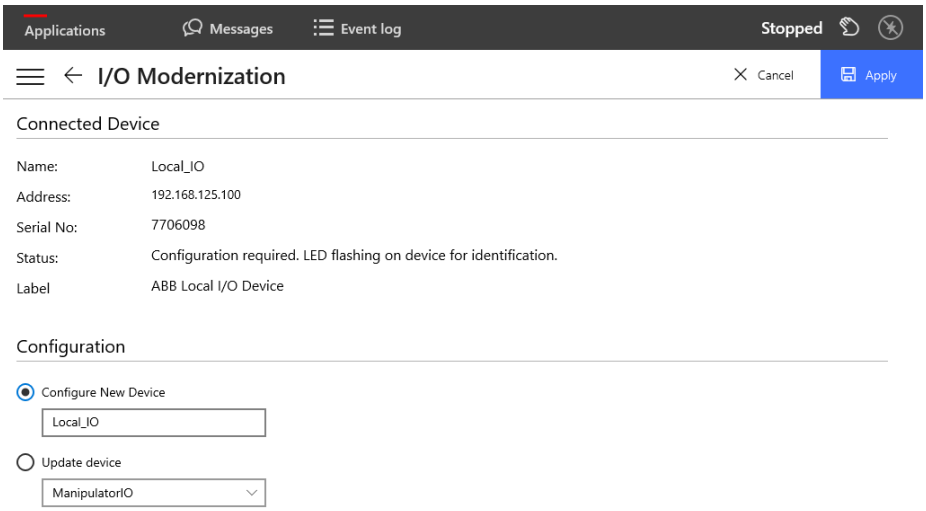
3.2.2 Configuring ABB I/O device using the FlexPendant
Continued

4 The **I/O Modernization** window is displayed.



xx1900000919

Enter the device name in the **Configure New Device** option, and then tap **Apply**.

5 Tap **OK** to the question **The changes will not take effect until the controller is restarted. Do you want to restart now?**.

Updating the existing Discrete 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

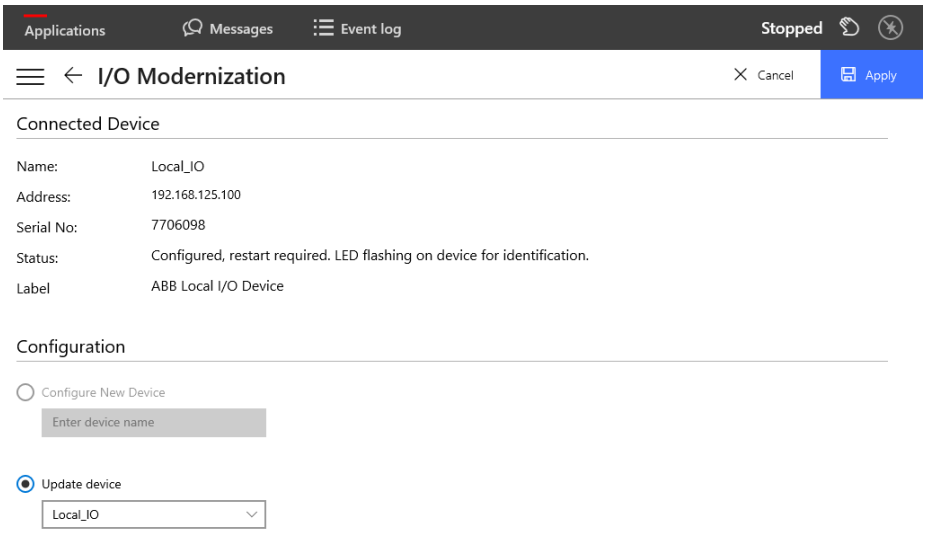
Attach or remove the add-on I/O device from the last, that is to the right-side of the base I/O device or the last add-on I/O device.

1 On the start screen, tap **I/O**, and then select **I/O Devices** from the menu.

2 Select the I/O device to be updated and and tap **Configure**.

Continues on next page

3 The **I/O Modernization** window is displayed.



xx1900000920

Enter the device name in the **Update device** option, and then tap **Apply**.

4 The I/O device is configured and a restart is required. Tap **OK**.

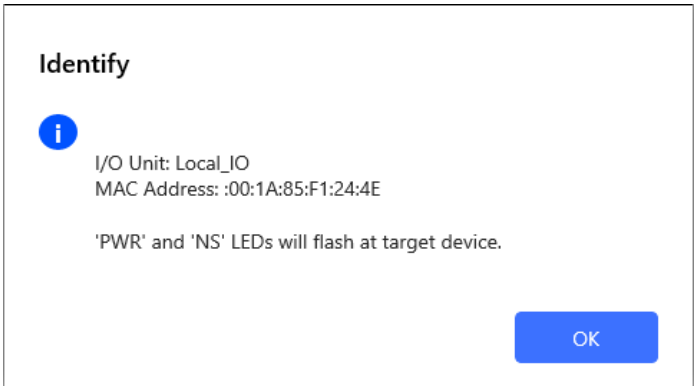
Identifying a Discrete I/O device

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

1 On the start screen, tap **I/O**, and then select **I/O Devices** from the menu.

2 Select the I/O device to be identified and and tap **Identify**.

3 The **Identify** window is displayed. Tap **OK**.

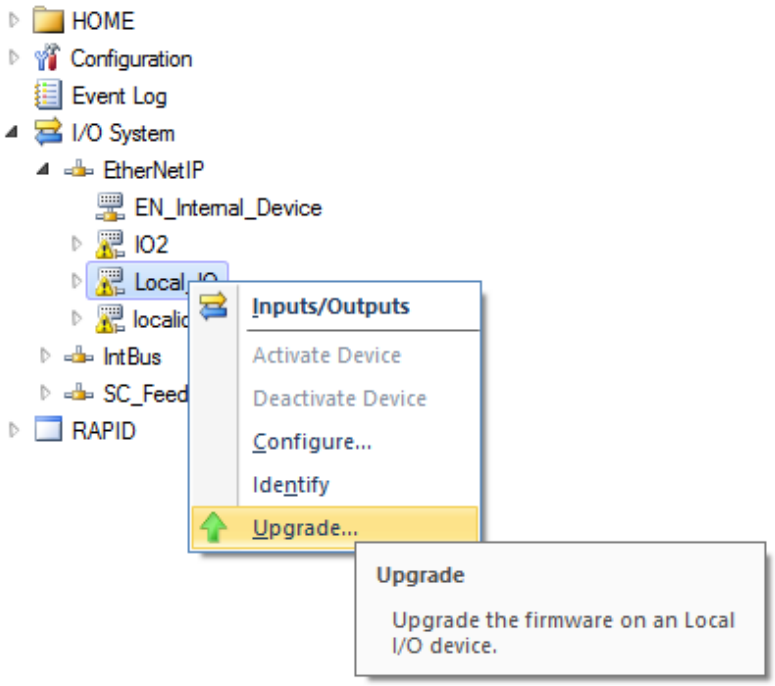


xx1900000921

3.3 Firmware upgrade

Upgrade firmware from RobotStudio

1. Set the OmniCore controller in manual mode.
2. If the device is in the running state, deactivate Discrete I/O on the FlexPendant:
   a. On the start screen, tap **I/O**, and then select **I/O Devices** from the menu.
   b. Select the device and and tap **Deactivate**.
3. Start RobotStudio and connect to the OmniCore controller.
4. Request write access.
5. In the I/O System tree, right-click the target I/O device and select **Upgrade**.

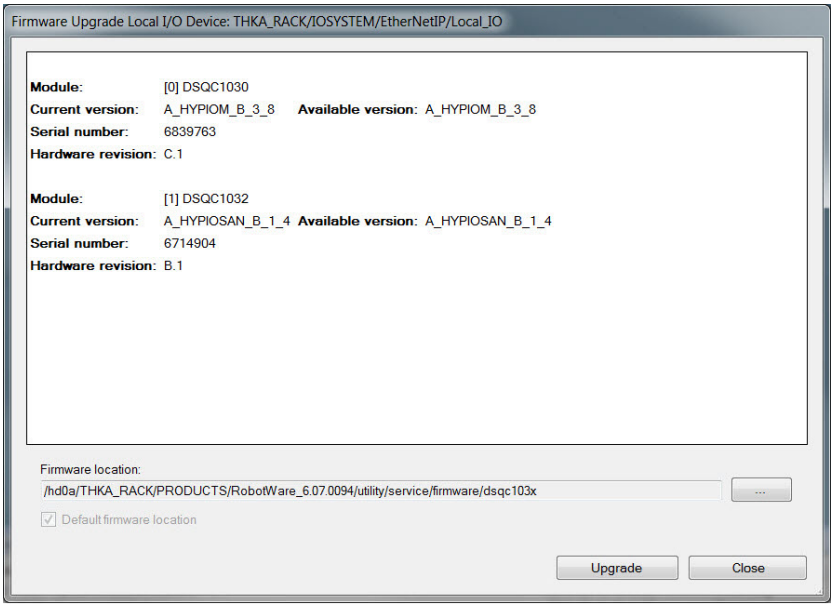


xx1900001181

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 to the folder with the new firmware file.

Continues on next page



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

1 Set the OmniCore controller in manual mode.

2 On the start screen, tap **I/O**, and then select **I/O Devices** from the menu.

3 If the I/O device is in the running state, select the device and and tap **Deactivate**.

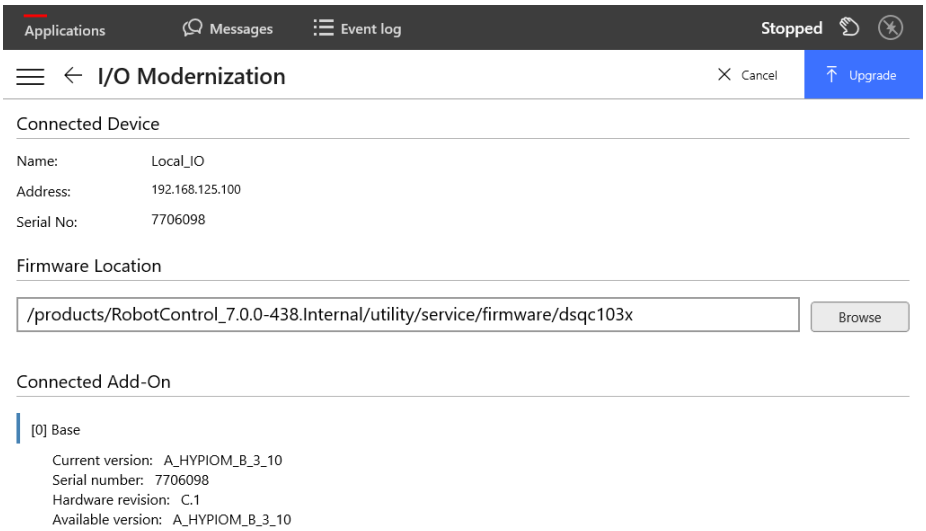
4 Select the I/O device and and tap **Firmware Update**.

Note

Firmware upgrade is not possible if the state of the selected I/O device is **Running**.

Continues on next page

5 The **I/O Modernization** window is displayed.



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Note

The **Firmware Location** field displays the default firmware file. To select a new firmware file, tap **Browse**.

6 Tap **Upgrade**.

The firmware is upgraded and a message is displayed.

Note

The **Upgrade** button is enabled only if a new version is detected either in the default firmware path or in a browsed path.

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ABB AB, Robotics
Robotics and Motion
S-721 68 VÄSTERÅS, Sweden
Telephone +46 (0) 21 344 400

ABB AS, Robotics
Robotics and Motion
Nordlysvegen 7, N-4340 BRYNE, Norway
Box 265, N-4349 BRYNE, Norway
Telephone: +47 22 87 2000

ABB Engineering (Shanghai) Ltd.
Robotics and Motion
No. 4528 Kangxin Highway
PuDong District
SHANGHAI 201319, China
Telephone: +86 21 6105 6666

ABB Inc.
Robotics and Motion
1250 Brown Road
Auburn Hills, MI 48326
USA
Telephone: +1 248 391 9000

abb.com/robotics

3HAC070208-001, Rev C, en