Ethernet/IP

Communications option for CSXi soft starters

User Guide

BENSHAW

Applied Motor Controls

710-21961-00B

Compatibility

This communications module is suitable for use with Benshaw CSX soft starters.

NOTE

The Ethernet/IP Module is not suitable for use with CSX soft starters using 380/440 VAC control voltage.

This manual is suitable for use with PIM-EI-02.

The part number is printed on a label on the front of the device. For PIM-EI-01, the manual is available from your local supplier.

For the latest manuals and software, please visit our website.

Contents

Disclaimer

The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting from the use or application of this equipment.

Failure to follow the information and instructions in this manual will void the warranty.

Warnings

It is the installer's responsibility to follow all instructions in this manual and to follow correct electrical practice.

WARNING
For your safety, isolate the soft starter completely from mains voltage before attaching or removing accessories.

WARNING
Observe all necessary safety precautions when controlling the soft starter remotely. Alert personnel that machinery may start without warning.

1 Introduction

1.1 Product design

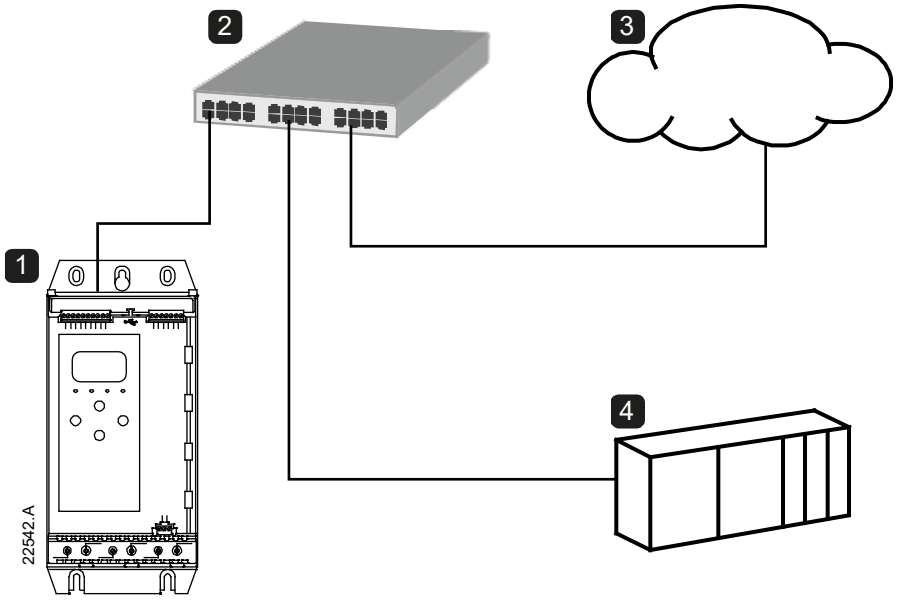
The Ethernet/IP Module allows the soft starter to connect to an Ethernet network and be controlled or monitored using an Ethernet communication model.

Familiarity with Ethernet protocols and networks is required to operate the device successfully. For difficulties using this device with third party products, including PLCs, scanners and commissioning tools, contact the relevant supplier.

1.2 Communication protocols

The Ethernet/IP Module supports the following protocols:

Ethernet/IP	Industrial ethernet via Ethernet/IP
MQTT	Message Queue Telemetry Transport
OPC UA	Open Platform Communications Unified Architecture



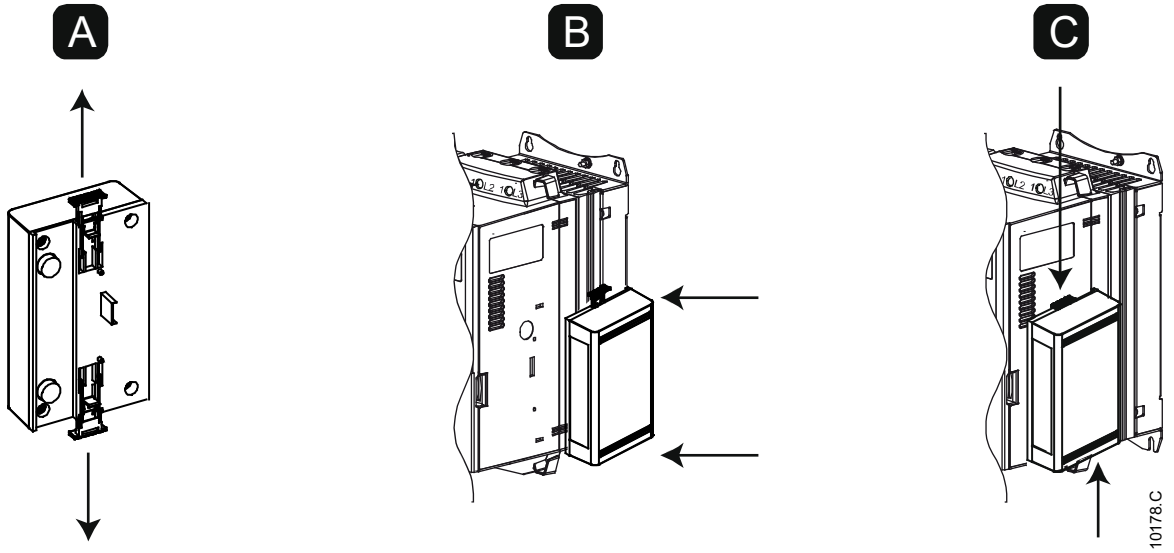
1	Soft starter
2	Network switch
3	IoT connection (MQTT/OPC UA)
4	Industrial ethernet connection to programmable logic controller

2 Installation

CAUTION
Remove mains and control voltage from the soft starter before attaching or removing accessories. Failure to do so may damage the equipment.

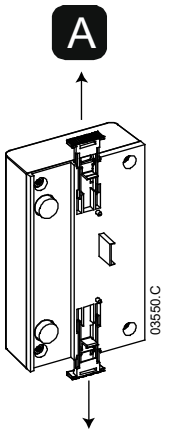
2.1 Installation procedure

1. Remove control power and mains supply from the soft starter.
2. Fully pull out the top and bottom retaining clips on the module. [A]
3. Line up the module with the comms port slot. [B]
4. Push in the top and bottom retaining clips to secure the module to the starter. [C]
5. Connect Ethernet Port 1 or Port 2 on the Ethernet/IP Module to the network.
6. Apply control power to the soft starter.



To remove the module:

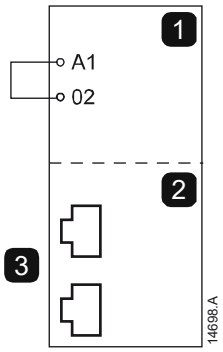
1. Remove control power and mains supply from the soft starter.
2. Disconnect all external wiring from the module.
3. Fully pull out the top and bottom retaining clips on the module. [A]
4. Pull the module away from the soft starter.



2.2 Soft starter connection

The device is powered from the soft starter.

The Ethernet/IP Module is not suitable for use with Compact Soft Starter starters using 380/440 VAC control voltage.



1	Soft starter A1, 02: Stop input
2	Ethernet/IP Module
3	RJ45 Ethernet ports

2.3 Network connection

Ethernet ports

The device has two Ethernet ports. If only one connection is required, either port can be used.

Cables

Use Category 5, 5e, 6 or 6e cable to connect to the device.

EMC precautions

To minimise electromagnetic interference, Ethernet cables should be separated from motor and mains cables by 200 mm.

If the Ethernet cable must cross motor or mains cables, the crossing should be at an angle of 90°.

2.4 Network establishment

The controller must establish communications directly with each device before the device can participate in the network.

2.5 Addressing

Each device in a network is addressed using a MAC address and an IP address.

- The device can be assigned a static IP address during configuration, or can be configured to accept a dynamic IP address (via DHCP).
- The MAC address is fixed within the device and is printed on a label on the front of the device.

3 Device configuration

3.1 Overview

NOTE
To avoid IP address conflicts and to ensure successful deployment, we recommend that the device is connected directly to a PC or laptop to configure the IP address, before connecting to the network.

NOTE
The Error LED flashes whenever the device is receiving power but is not connected to a network. The Error LED will flash occasionally during the configuration process.

3.2 Configuration methods

Ethernet attributes can be configured directly in the device using the on-board web server.

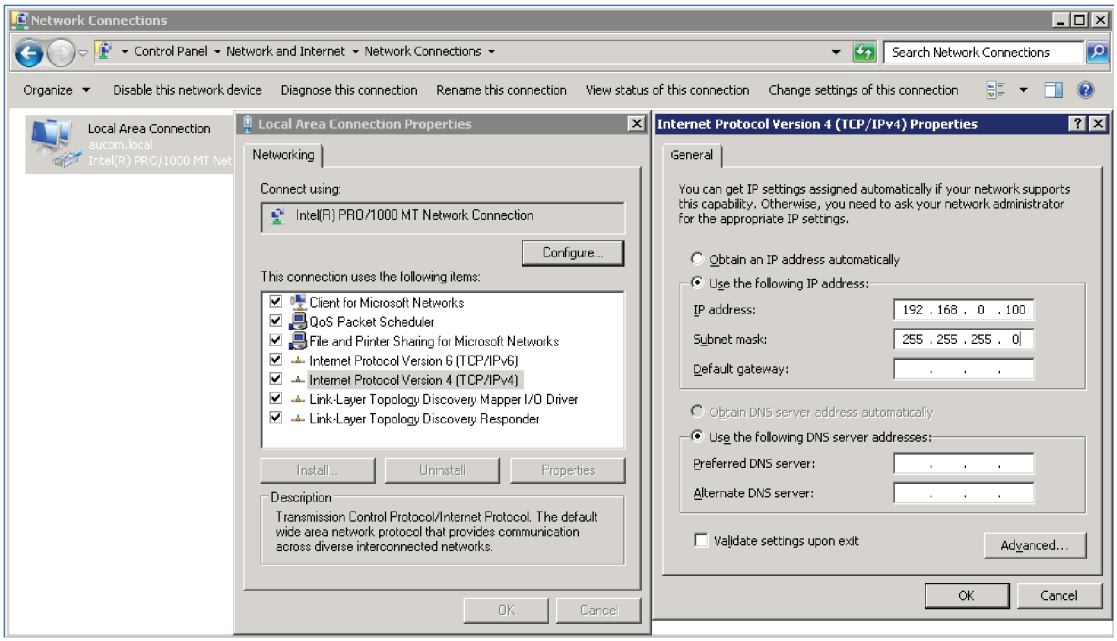
- The module is configured with a static IP address as default. A new address can be assigned during configuration, or the device can be configured to accept a dynamic IP address (via DHCP).
- The web server can configure the IP address and messaging settings for MQTT or OPC UA operation.
- If you cannot connect to the web server, use the Ethernet Device Configuration software to scan the network and identify the device.

3.3 On-board web server

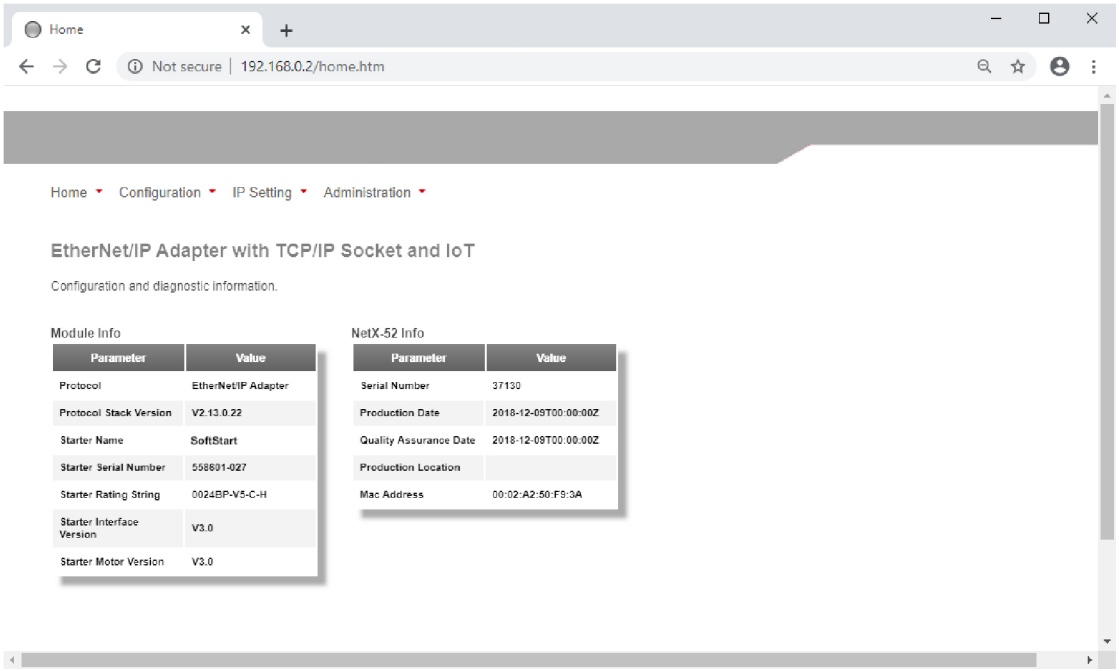
Connect to the device

To configure settings using the on-board web server, the device must be installed on a soft starter, control power must be available, and the device and computer must be connected to each other or to the same Ethernet network.

The computer must use a fixed IP address (not DHCP) and the same subnet mask as the device. The default address for a new Ethernet/IP Module is 192.168.0.2. The default subnet mask is 255.255.255.0.



Once connected, the web server reports basic information about the device and the soft starter.



Manage users and passwords

The Ethernet/IP Module supports multiple users and levels of privilege.

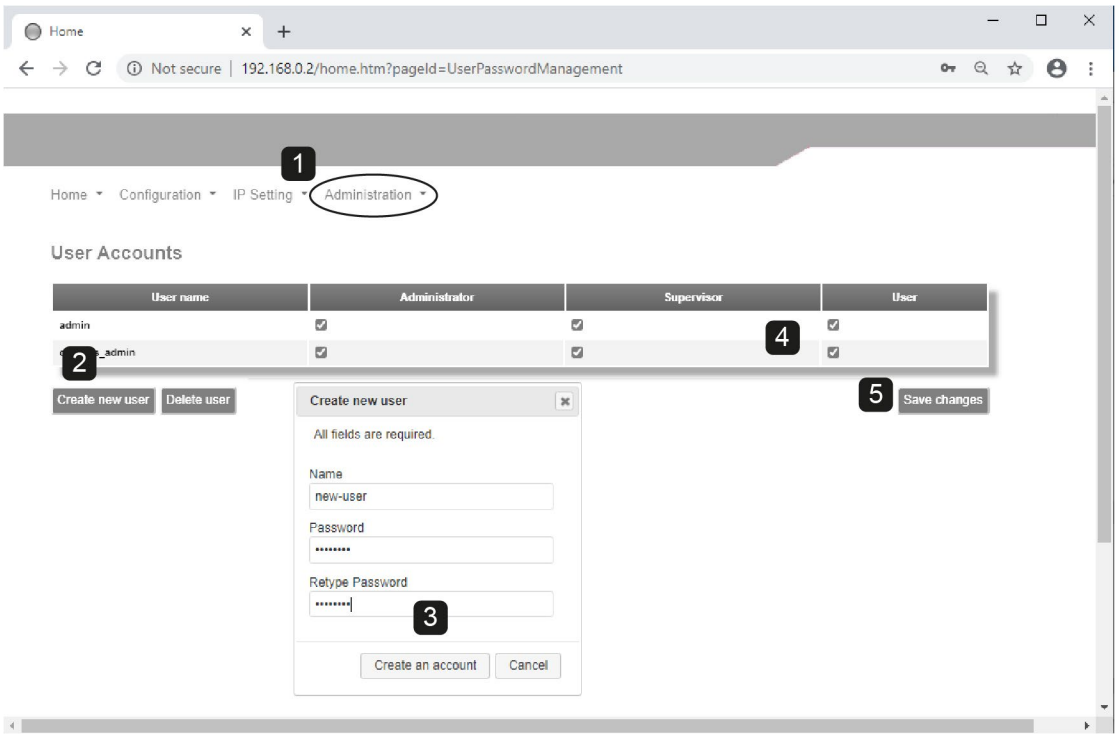
- Users can view the home screen and IP address settings
- Supervisors can view the home screen and IP settings and can change configuration settings
- Administrators can view the home screen, change configuration settings and add or delete users

NOTE
For security reasons, we recommend that you define a custom administrator ID and password.

The default username and password are:
username: admin
password: 1978

To add a new user:

1. Connect to the web server then click Administration.
2. Click Create new user.
3. Enter the new username and password then click Create an account.
4. Set privileges (user, supervisor, administrator) as appropriate.
5. Click Save changes.

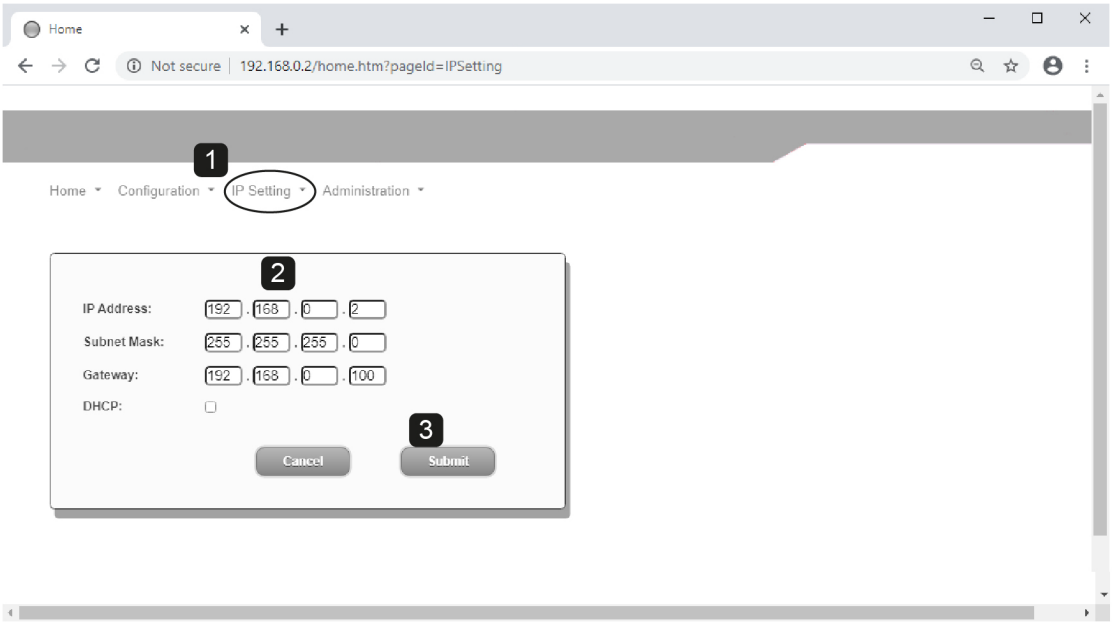


To delete a user:

1. Connect to the web server then click Administration.
2. Click the required entry in the user list then click Delete user. Click Delete again to confirm the action.

Configure the IP address

1. Connect to the web server then click IP Setting.
2. Edit the settings as required. To enable DHCP addressing, tick the DHCP checkbox.
3. Click Submit to send the new settings to the device.

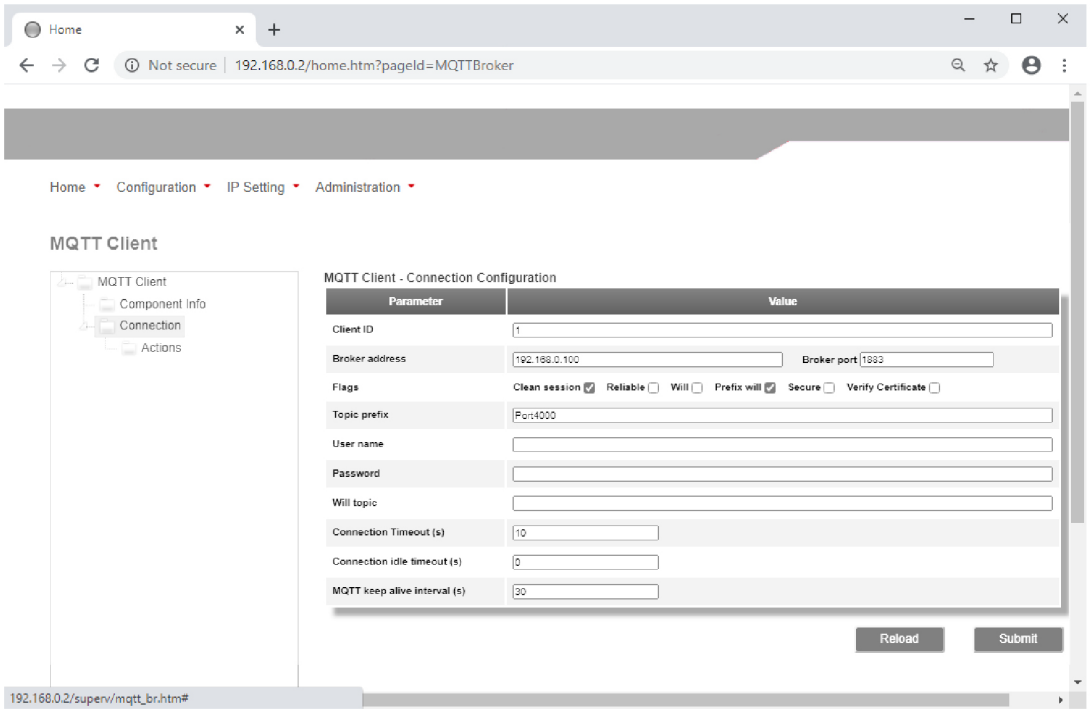


Configure IoT settings

The Ethernet/IP Module supports soft starter status monitoring over IoT. The device cannot control or program the soft starter.

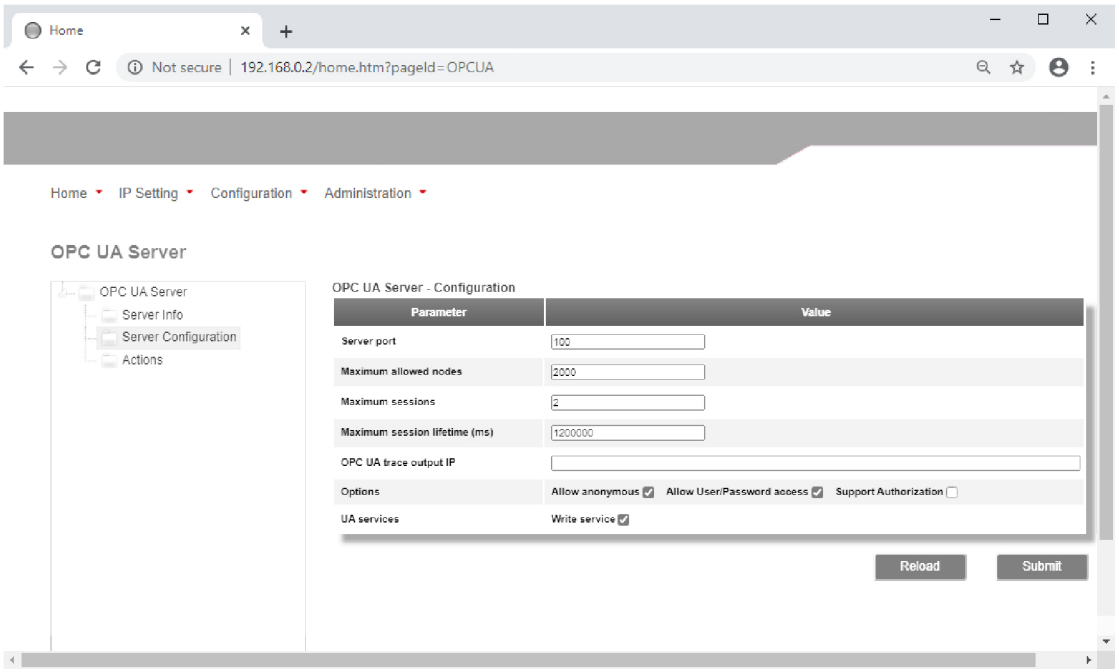
- **Configure MQTT settings**

1. Connect to the web server then click Configuration > MQTT Client.
2. Tick the Enable checkbox to enable MQTT client operation. The MQTT client is enabled by default.
3. Click Connection then configure the settings as required.
4. Use Connection > Actions to select which information the device will publish.
5. Click Submit to save all settings in the device.



- **Configure OPC UA settings**

1. Connect to the web server then click Configuration > OPC UA Server.
2. Tick the Enable checkbox to enable OPC UA client operation. The OPC UA client is enabled by default.
3. Click Server Configuration then configure the settings as required.
4. Use Actions to select the actions for different object instances.
5. Click Submit to save all settings in the device.



3.4 Scanning the network

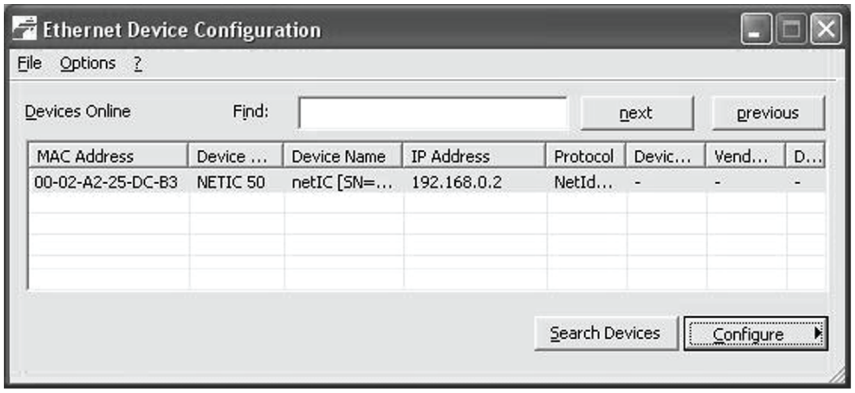
If you cannot connect to the web server, use the Ethernet Device Configuration software to scan the network and identify the device. Changes made via the software cannot be stored permanently in the device and will be lost when control power is cycled.

The Ethernet Device Configuration Tool is available from your local supplier.

NOTE
If your PC has a firewall enabled, you must add the tool to the list of authorised programs.

To identify the device using the Ethernet Device Configuration Tool:

1. Start the Ethernet Device Configuration Tool.
2. Click on Search Devices. The software will search for connected devices.



3. Use the IP address to connect to the device via the web server.

4 Scanner configuration

4.1 EDS file

An EDS file that contains all required attributes of the device is available from your supplier.

Once the EDS file has been loaded, the individual device must be defined.

4.2 Assembly objects

The device supports two assembly objects.

Description	Class	Instance	Type	Maximum size
Output (Originator -> Target)	04d (0x04)	100d (0x64)	Integer	2 (4 bytes)
Input (Target -> Originator)	04d (0x04)	101d (0x65)	Integer	6 (12 bytes)

5 Operation

The Ethernet/IP Module is conformance tested to ODVA. For successful operation, the scanner must also support all functions and interfaces described in this document.

NOTE
The available features and parameter details may vary according to the model and software version of the starter. Refer to the soft starter user manual for details of parameters and supported features.

5.1 Device classification

The Ethernet/IP Module is an I/O Adapter and must be managed by an I/O Scanner over Ethernet.

The Ethernet/IP Module supports both implicit (cyclic) and explicit (acyclic) messaging.

5.2 Enabling network control

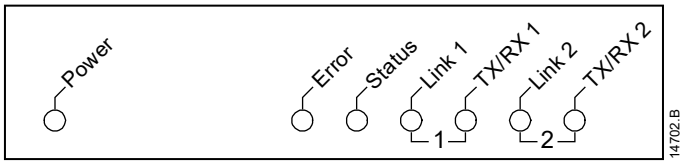
For the soft starter to accept fieldbus commands, a link must be fitted across terminals A1-02 on the starter.

5.3 Ensuring safe and successful control

Data written to the device will remain in its registers until the data is overwritten or the device is reinitialised. The device will not transfer successive duplicate commands to the soft starter.

- If the soft starter is started via fieldbus communications but stopped via the remote input, an identical start command cannot be used to restart the starter.
- If the soft starter may also be controlled via the remote inputs (as well as via fieldbus communications), a control command should be immediately followed by a status query to confirm the command has been actioned.

5.4 Feedback LEDs



LED name	LED state	Description
Power	Off	Device is not powered up.
	On	Device is receiving power.
Error	Off	Device is not powered up or has received an IP address.
	Flashing	Connection timeout.
	On	Duplicate IP address.
Status	Off	Device is not powered up or has received an IP address.
	Flashing	Device has obtained an IP address but has not established any network connections.
	On	Communication has been established.
Link x	Off	No network connection.
	On	Connected to a network.
TX/RX x	Flashing	Transmitting or receiving data.

6 Implicit messaging (cyclic operation)

This section lists requirements related to cyclic (implicit messaging) services for the Ethernet/IP Module.

The minimum cyclic interval is 1 ms.

All data is in little endian format.

6.1 Assembly objects

The device supports two assembly objects.

Description	Class	Instance	Type	Maximum size
Output (Originator -> Target)	04d (0x04)	100d (0x64)	Integer	2 (4 bytes)
Input (Target -> Originator)	04d (0x04)	101d (0x65)	Integer	6 (12 bytes)

6.2 Control commands (assembly instance 100d)

To send control data from the scanner to the starter, use assembly class 04d (0x04), assembly instance 100d (0x64), attribute 03d (0x03).

Bytes 0-1: Command

Bits	Function	Details
0 to 5	*Reserved*	Must be zero
6	Run	0 = Stop command 1 = Start command
7	Reset	Changing this bit from 0 to 1 will reset a trip.
8 to 15	*Reserved*	Must be zero

Bytes 2-3: Reserved

Bits	Function	Details
0 to 15	*Reserved*	Must be zero

Command examples

Byte	Value	Description
0	0b01000000 (64d, 0x40)	Start the soft starter
0	0b10000000 (128d, 0x80)	Reset the soft starter The reset only occurs when the previous reset bit is zero, otherwise the value of 1 will be ignored.
0	0b11000000 (192d, 0xC0)	Reset and start the soft starter
0	0bX0000000 (00d, 0x00)	Stop the soft starter

6.3 Status information (assembly instance 101d)

To retrieve status data from the starter, use assembly class 04d (0x04), assembly instance 101d (0x65), attribute 03d (0x03).

Bytes 0-1: Starter state

Bits	Function	Details
0	Ready	0 = Not ready 1 = Ready to start
1	*Reserved*	
2	Running	0 = Not ready, Ready to start or Tripped 1 = Starting, Running, Stopping
3	Trip	0 = Not tripped 1 = Tripped
4 to 7	*Reserved*	
8	Ramping	1 = Running (full voltage at the motor)
9 to 15	*Reserved*	

Bytes 2-3: Reserved

Bits	Function	Details
0 to 15	*Reserved*	

Bytes 4-7: Motor current

Bits	Function	Details
0 to 31	Motor current	Average rms current across all three phases. Measured current is represented as a 32-bit value to 2 decimal places. 10d (0x0A) = 0.10 A 3450d (0xD7A) = 34.50 A 68930d (0x10D42) = 689.30 A

Bytes 8-9: Trip code

Bits	Function	Details
0 to 15	Trip code	See *Trip codes* on page 14

Bytes 10-11: Reserved

Bits	Function	Details
0 to 15	*Reserved*	

7 Explicit messaging (acyclic operation)

This section provides information on objects, instances, attributes and services for acyclic operation (explicit messaging).

All data is in little endian format.

7.1 Identity object (class 0x01)

The Ethernet/IP Module supports the following attributes for identity objects:

Attribute	Function	Value
1	Vendor	204d (0xCC)
2	Device type	12d (0x0C)
3	Product code	269d (0x10D)
4	Revision: Major, Minor	EDS file version
5	Status	Supported
6	Serial number	Supported
7	Product name	Supported

7.2 Vendor-specific objects

The Ethernet/IP Module supports vendor-specific classes 103 and 104.

Class 103 objects (read only)

Class 103d (0x67) allows starter state information to be read from the soft starter.

Object name	Class	Instance	Attribute
Binary protocol version	103	100	100
Product type code	103	101	100
Reserved	103	102	100
Reserved	103	103	100
Soft starter model	103	104	100
Reserved	103	105	100
Reserved	103	106	100
Reserved	103	107	100
Reserved	103	108	100
Starter state 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = *Reserved* 6 = Tripped	103	109	100
Reserved	103	110	100
Initialised 1 = Phase sequence is valid	103	111	100
Phase sequence (1 = Positive phase sequence, only valid if Initialised =1)	103	112	100
Reserved	103	113	100

Object name	Class	Instance	Attribute
Reserved	103	114	100
Trip code (See *Trip codes* on page 14)	103	115	100
Average rms current across all three phases	103	116	100
Current (% motor FLC)	103	117	100
Motor temperature	103	118	100
Reserved	103	119	100
Reserved	103	120	100
Reserved	103	121	100
Reserved	103	122	100
Reserved	103	123	100
Reserved	103	124	100
Reserved	103	125	100
Reserved	103	126	100
Reserved	103	127	100
Reserved	103	128	100
Reserved	103	129	100
Reserved	103	130	100
Reserved	103	131	100
Digital input state For all inputs, 0 = open, 1 = closed (shorted) xxxx0001 = Start input xxxx0010 = Stop input	103	132	100
Trip code	103	133	100

Class 104 objects (read only)

Class 104d (0x68) allows extended information to be read from the soft starter.

Object name	Class	Instance	Attribute
Major Software Version – User interface	104	101	100
Minor Software Version – User interface	104	102	100
Major Software Version – Motor control	104	103	100
Minor Software Version – Motor control	104	104	100

7.3 Supported services for vendor-specific objects

This section describes the operational instructions to carry out acyclic services on vendor-specific class objects.

Service codes for acyclic operation

The device supports the following services for vendor-specific objects:

Service code	Function	Description
01d (0x01)	Get Attribute All	Only supported for class 0x01 identity object
10d (0x10)	Set Attribute Single	Supported
15d (0x0E)	Get Attribute Single	Supported

Status codes for acyclic services

The device will return the following status codes in response to Get/Set Attribute Single:

Status code	Status name	Details
00d (0x00)	Success	This code is returned when: • the register mapped for service 'Get Attribute Single' is successfully read • the register mapped for service 'Set Attribute Single' is successfully set
03d (0x03)	Invalid parameter value	
05d (0x05)	Path destination unknown	The mapped register does not exist.
08d (0x08)	Service not supported	The requested service is not available for this Object Class/Instance.
09d (0x09)	Invalid attribute value	This code only applies to the service 'Set Attribute Single'. It is returned if the value is out of range for the mapped register.
15d (0x0E)	Attribute not settable	This code only applies to the service 'Set Attribute Single'. It is returned if the mapped register is read-only.
20d (0x14)	Attribute not supported	The attribute specified in the request is not supported.
22d (0x16)	Object does not exist	The object specified does not exist in the device.

8 Trip codes

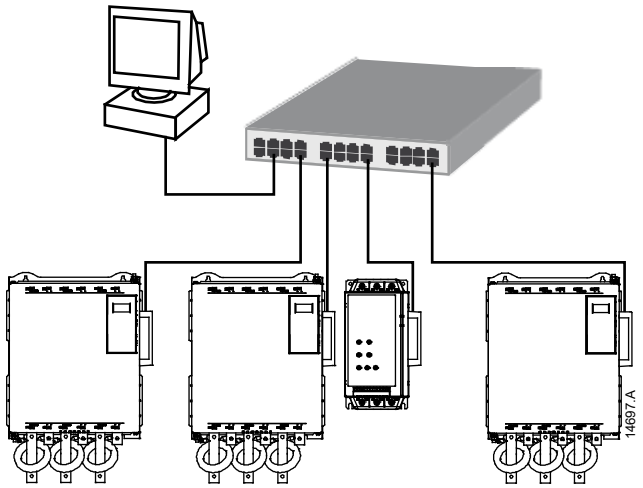
Trip code	Description
0	No trip
20	Motor overload
26	Current imbalance
50	Power circuit
54	Phase sequence
55	Frequency
75	Motor thermistor
101	Excess start time
113	Starter communication (between device and soft starter)
114	Network communication (between device and network)
119	Bypass overload

9 Network design

The device supports star, line and ring topologies.

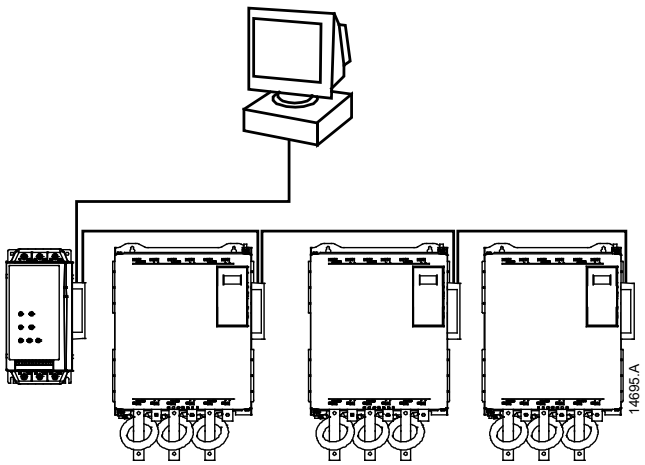
9.1 Star topology

In a star network, all controllers and devices connect to a central network switch.



9.2 Line topology

In a line network, the controller connects directly to one port of the first device. The second Ethernet port connects to another device, which in turn connects to another device until all devices are connected.



NOTE
The device has an integrated switch to allow data to pass through in line topology. The device must be receiving control power from the soft starter for the switch to operate.

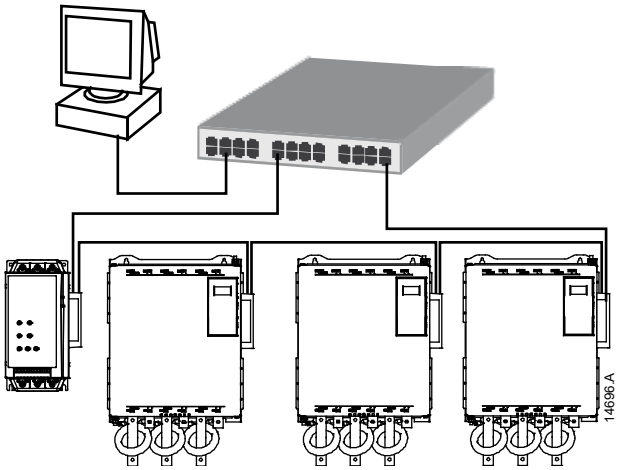
NOTE
If the connection between two devices is interrupted, the controller cannot communicate with devices after the interruption point.

NOTE
Each connection adds a delay to communication with the next device.
The maximum number of devices in a line network is 32. Exceeding this number may reduce the reliability of the network.

9.3 Ring topology

In a ring topology network, the controller connects to the first module, via a network switch. The second Ethernet port of the module connects to another device, which in turn connects to another device until all devices are connected. The final device connects back to the switch.

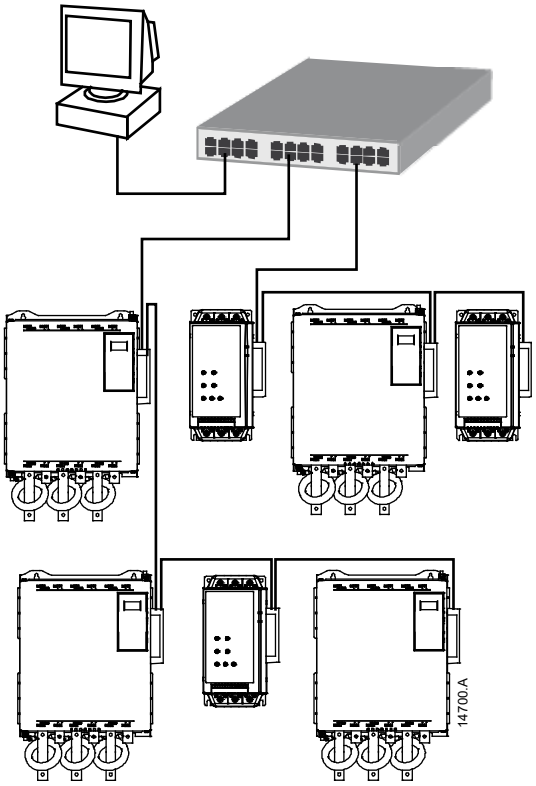
The device supports beacon based ring node configuration.



NOTE
The network switch must support loss of line detection.

9.4 Combined topologies

A single network can include both star and line components.



10 Specifications

- **Enclosure**

Dimensions ..... 40 mm (W) x 166 mm (H) x 90 mm (D)
Weight ..... 250 g
Protection IP20

- **Mounting**

Spring-action plastic mounting clips (x 2)

- **Connections**

Soft starter ..... 6-way pin assembly
Contacts ..... Gold flash
Network RJ45

- **Settings**

IP address ..... Automatically assigned, configurable
Device name ..... Automatically assigned, configurable

- **Network**

Link speed ..... 10 Mbps, 100 Mbps (auto-detect)
Full duplex
Auto crossover

- **Power**

Consumption (steady state, maximum) ..... 35 mA @ 24 VDC
Reverse polarity protected
Galvanically isolated

- **Certification**

CE ..... EN 60947-4-2

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