

Installation Guide

EtherNet/IP Module

VLT® Compact Starter MCD201/MCD 202 and VLT® Soft Starter MCD 500



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1 Safety

1.1 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. Responsibility or liability is never accepted for direct, indirect, or consequential damage resulting from the use or application of this equipment.

1.2 Warnings

W A R N I N G

SHOCK HAZARD

Attaching or removing accessories while the soft starter is connected to mains voltage may cause personal injury.

- Before attaching or removing accessories, isolate the soft starter from mains voltage.

W A R N I N G

RISK OF PERSONAL INJURY AND EQUIPMENT DAMAGE

Inserting foreign objects or touching the inside of the soft starter while the expansion port cover is open may endanger personnel and can damage the soft starter.

- Do not insert foreign objects in the soft starter with the port cover open.
- Do not touch the inside of the soft starter with the port cover open.

2 Introduction

2.1 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 arising from using this device with 3rd-party products, including PLCs, scanners, and commissioning tools, contact the relevant supplier.

2.2 Compatibility

The EtherNet/IP Module is compatible with the following Danfoss soft starters:

- MCD 200 - 24 V AC/V DC and 110/240 V AC control voltage.
- MCD 500 - all models.

2.3 Product Versions

The MCD EtherNet/IP module is available in 2 different versions. The part number is printed on the label on the side of the module.

- 175G9906 MCD EtherNet/IP module
 - Monitor and control the soft starter over an EtherNet/IP connection.
- 175G9907 MCD EtherNet/IP module
 - Monitor and control the soft starter over an EtherNet/IP connection.
 - Monitor and control the soft starter over a TCP connection using VLT® Motion Control Tool MCT 10, refer to the VLT® Motion Control Tool MCT 10 Operating Guide.
 - Monitor the soft starter over an IoT connection.

This installation guide is suitable for use with 175G9907. For the manual for 175G9906, contact the local supplier.

2.4 Network Connection

Table 1: Supported Protocols

Protocols	
EtherNet/IP	Industrial Ethernet via EtherNet/IP
TCP	Transmission control protocol to connect to port 4000 of a PC
MQTT	Message queue telemetry transport
OPC UA	Open platform communications unified architecture

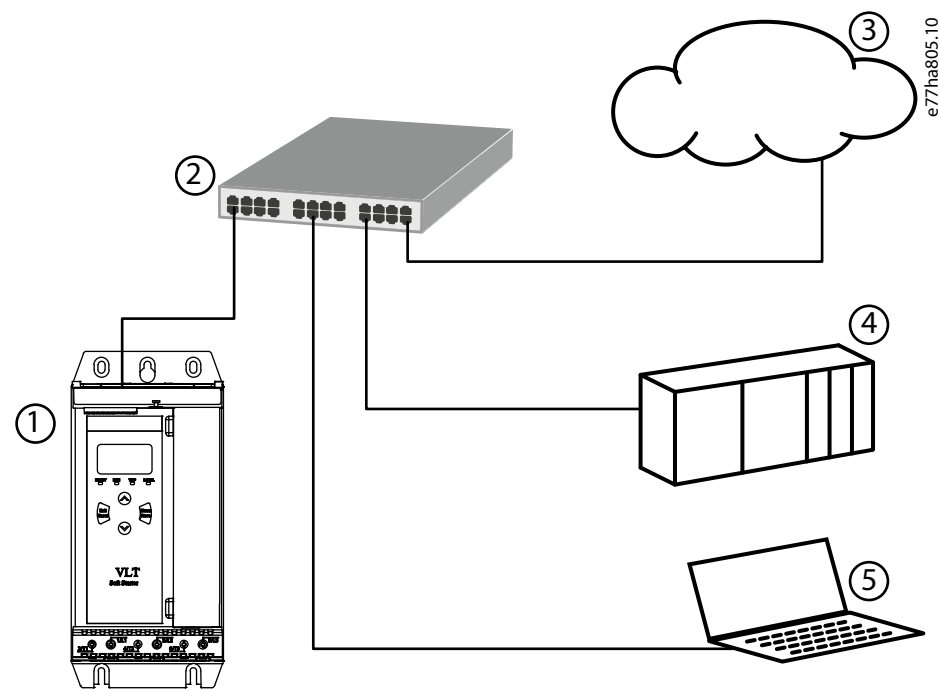


Illustration 1: Overview of Network Connections

1	Soft starter	4	Industrial Ethernet connection to programmable logic controller
2	Network switch	5	TCP connection to VLT® Motion Control Tool MCT 10. Refer to the VLT® Motion Control Tool MCT 10 Operating Guide for connection details.
3	IoT connection (MQTT/OPC UA)		

3 Installation

3.1 Installing the Communication Module

! C A U T I O N !

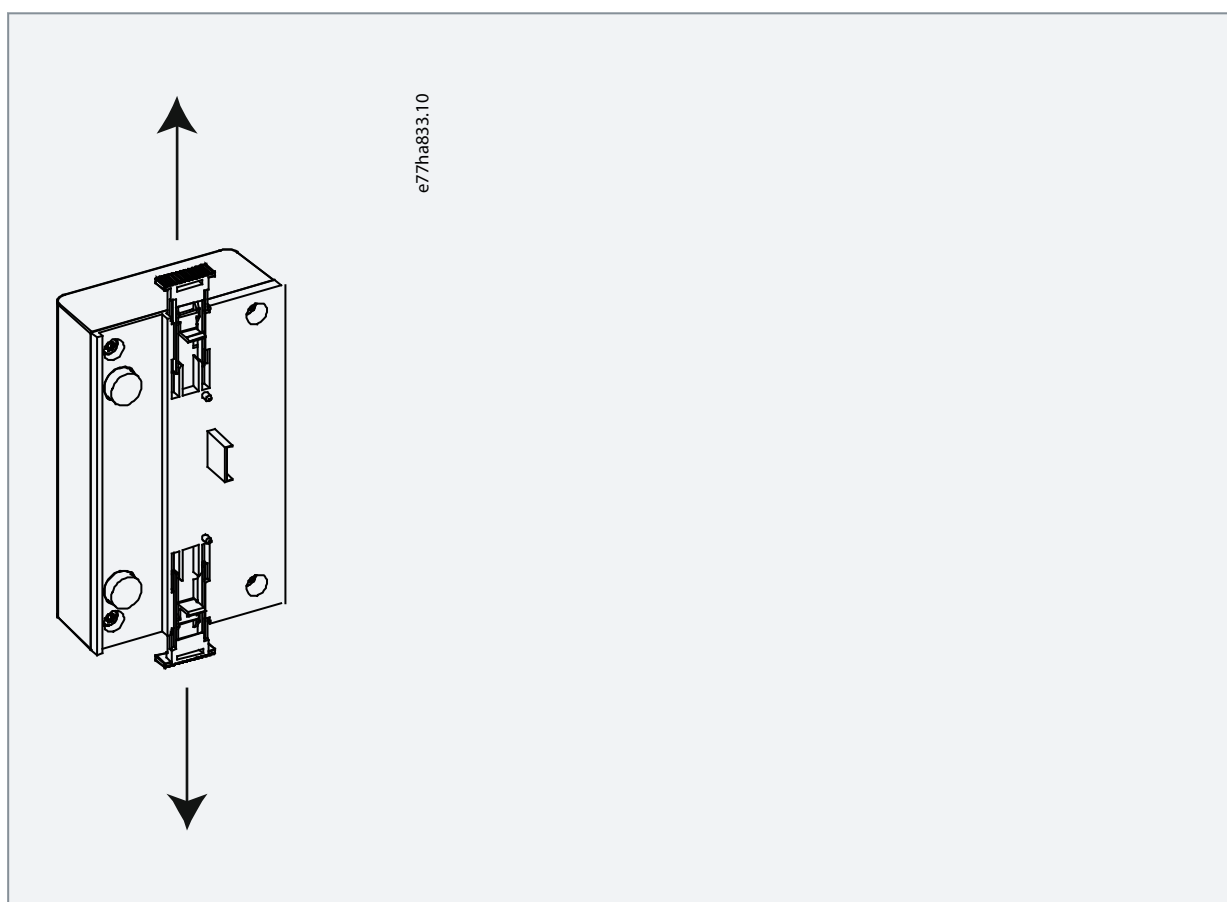
EQUIPMENT DAMAGE

If mains and control voltage are applied when installing or removing options/accessories, it may damage the equipment.

- Remove mains and control voltage from the soft starter before installing or removing options/accessories.

Procedure

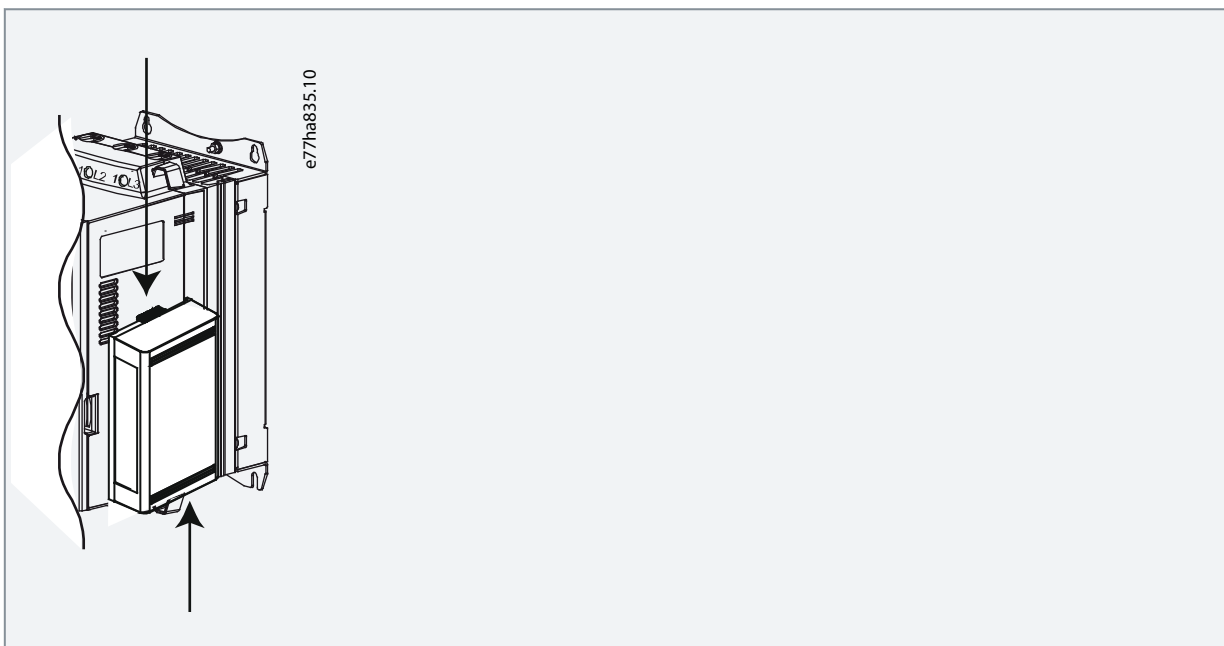
1. Remove control power and mains supply from the soft starter.
2. Fully pull the top and bottom retaining clips on the module.



3. Line up the module with the comms port slot.



4. Push in the top and bottom retaining clips to secure the module to the soft starter.



5. Connect Ethernet Port 1 or Port 2 on the EtherNet/IP module to the network.
6. Apply control power to the soft starter.

4 Connection

4.1 Soft Starter Connection

The EtherNet/IP module is powered from the soft starter.

NOTICE

The EtherNet/IP module is not suitable for use with MCD 200 soft starters using 380/440 V AC control voltage.

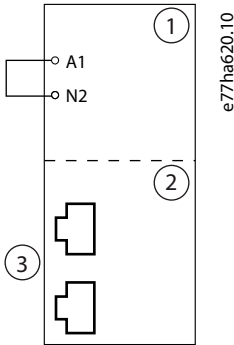


Illustration 2: Connecting MCD 200

1	Soft starter A1, N2: Stop input	3	RJ45 Ethernet ports
2	EtherNet/IP module		

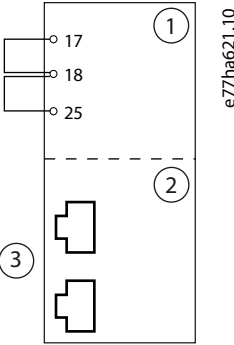


Illustration 3: Connecting MCD 500

1	Soft starter (remote mode) 17, 18: Stop input 25, 18: Reset input	3	RJ45 Ethernet ports
2	EtherNet/IP module		

4.2 Network Connection

4.2.1 Ethernet Ports

The device has 2 Ethernet ports. If only 1 connection is required, either port can be used.

4.2.2 Cables

When connecting to the device, make sure that the cables are of 1 of the following categories:

- Category 5
- Category 5e
- Category 6
- Category 6e

4.2.3 EMC Precautions

To minimize electromagnetic interference, Ethernet cables should be separated from motor and mains cables by 200 mm (7.9 in). If the Ethernet cable must cross motor or mains cables, the crossing should be at an angle of 90°.

4.3 Network Establishment

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

4.4 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.

5 Device Configuration

5.1 Before Configuring the Device

NOTICE

To avoid IP address conflicts and to ensure successful deployment, connect the device directly to a PC or laptop to configure the IP address, before connecting to the network.

NOTICE

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.

5.2 Configuration Methods

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

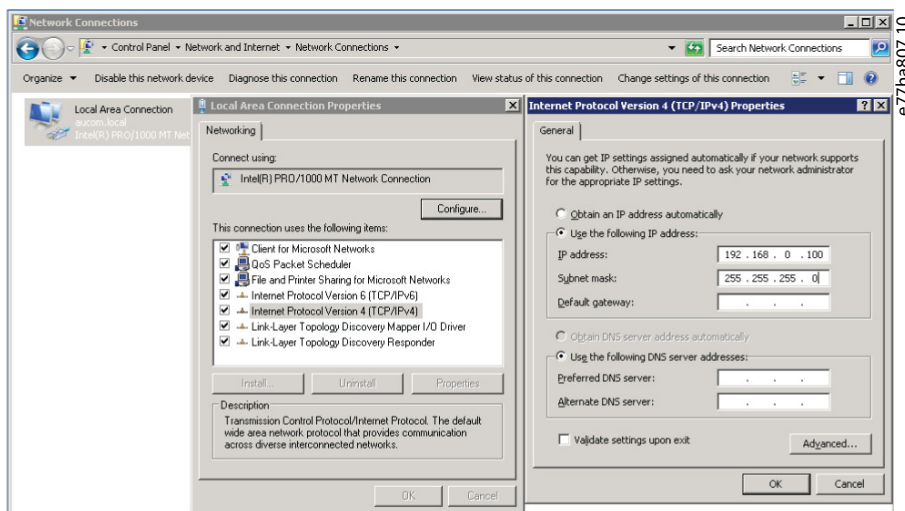
- The module is configured with a static IP address as default. A new address can be assigned during configuration, or the device can be configured to accept a dynamic IP address (via DHCP).
- The web server can configure the IP address and messaging settings for MQTT or OPC UA operation.
- If it is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

5.3 On-board Web Server

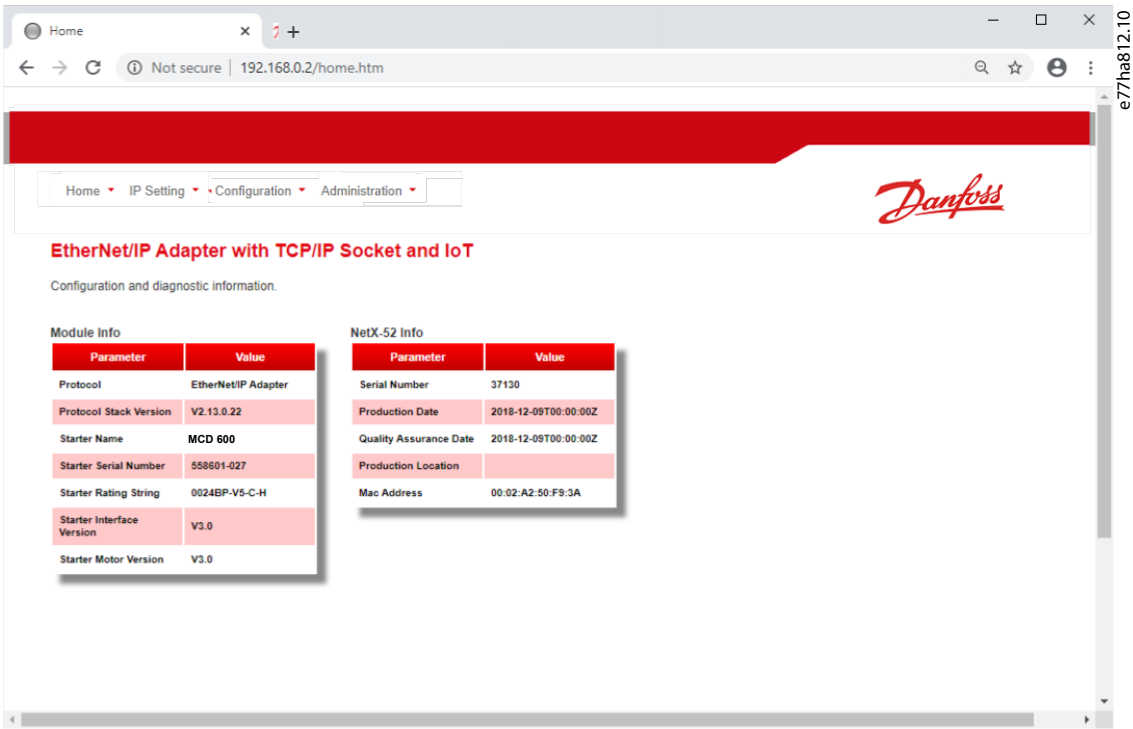
5.3.1 Connect to the Device

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

The computer must use a fixed IP address (not DHCP) and the same subnet mask as the device. The default IP address for a new EtherNet/IP module is 192.168.1.2. The default subnet mask is 255.255.255.0.



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



5.3.2 Manage Users and Passwords

NOTICE

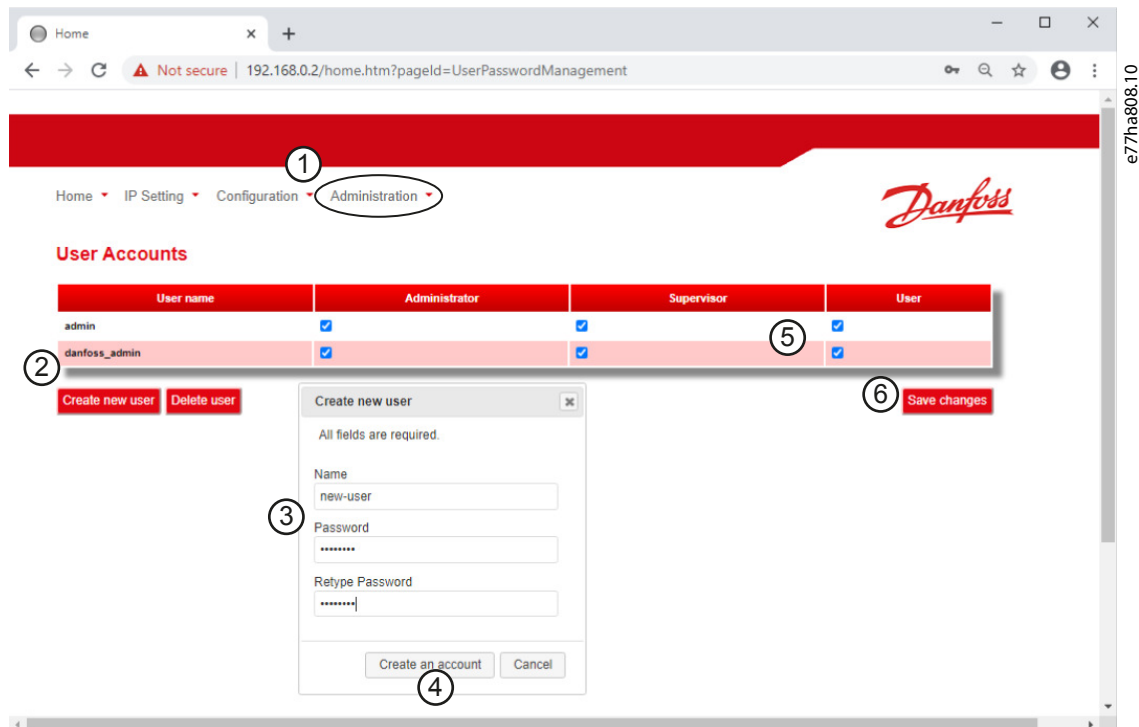
For security reasons, define a custom administrator ID and password. The default username and password are:

- Username: danfoss
- Password: danfoss

The EtherNet/IP module supports multiple users and levels of privilege.

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

5.3.2.1 Adding a User



Procedure

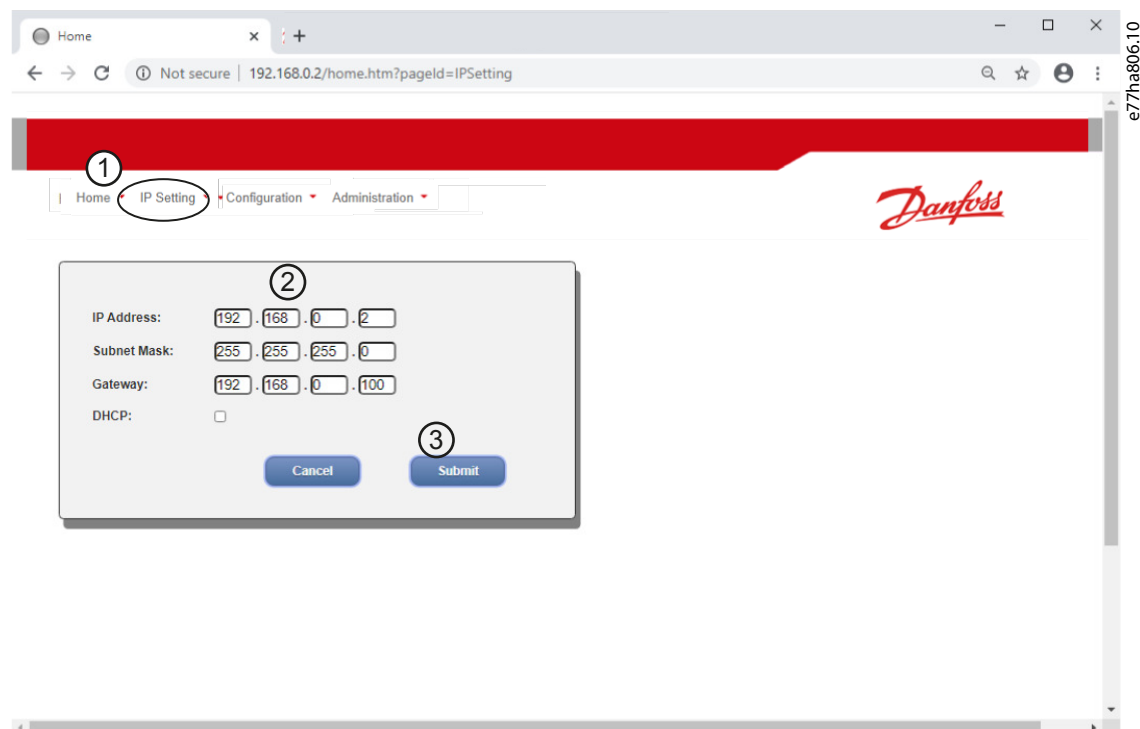
1. Connect to the web server and click *Administration*.
2. Click *Create new user*.
3. Enter the new username and password.
4. Click *Create an account*.
5. Set privileges (user, supervisor, administrator) as appropriate.
6. Click *Save changes*.

5.3.2.2 Deleting a User

Procedure

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

5.3.3 Configuring the IP Address



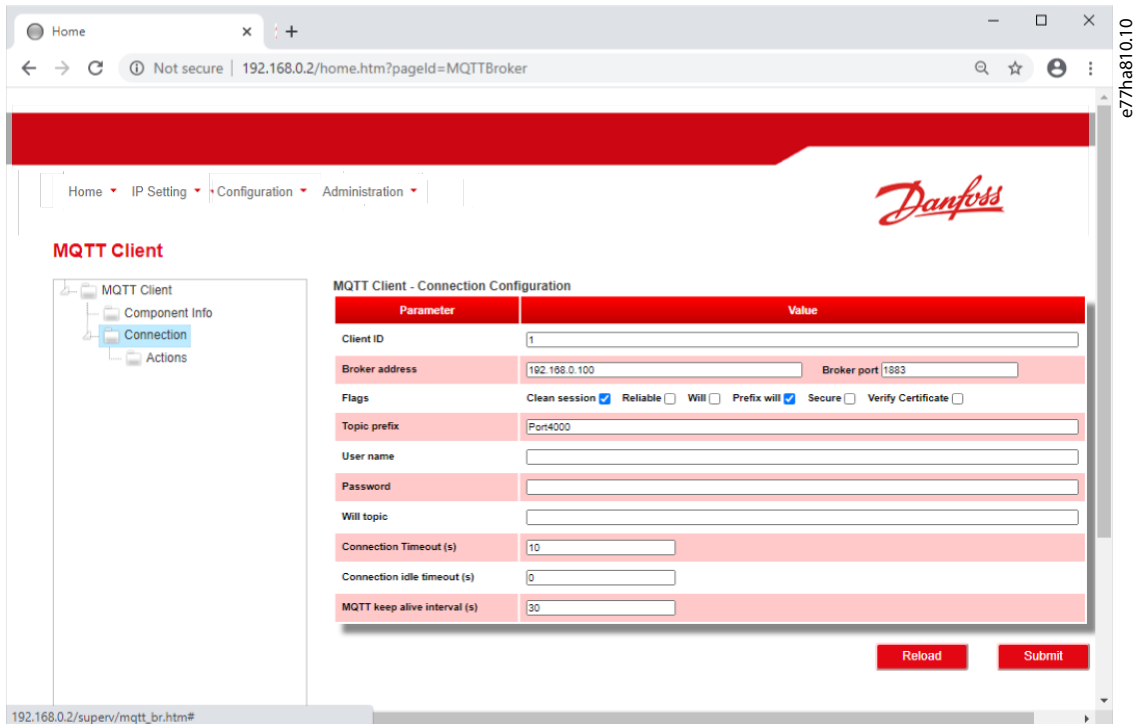
Procedure

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

5.3.4 Configure IoT Settings

The EtherNet/IP module supports soft starter status monitoring via IoT. The device cannot control or program the soft starter.

5.3.4.1 Configuring MQTT Settings



Parameter	Value
Client ID	1
Broker address	192.168.0.100
Broker port	1883
Flags	Clean session ☒ Reliable ☐ Will ☐ Prefix will ☒ Secure ☐ Verify Certificate ☐
Topic prefix	Port4000
User name	
Password	
Will topic	
Connection Timeout (s)	10
Connection idle timeout (s)	0
MQTT keep alive interval (s)	30

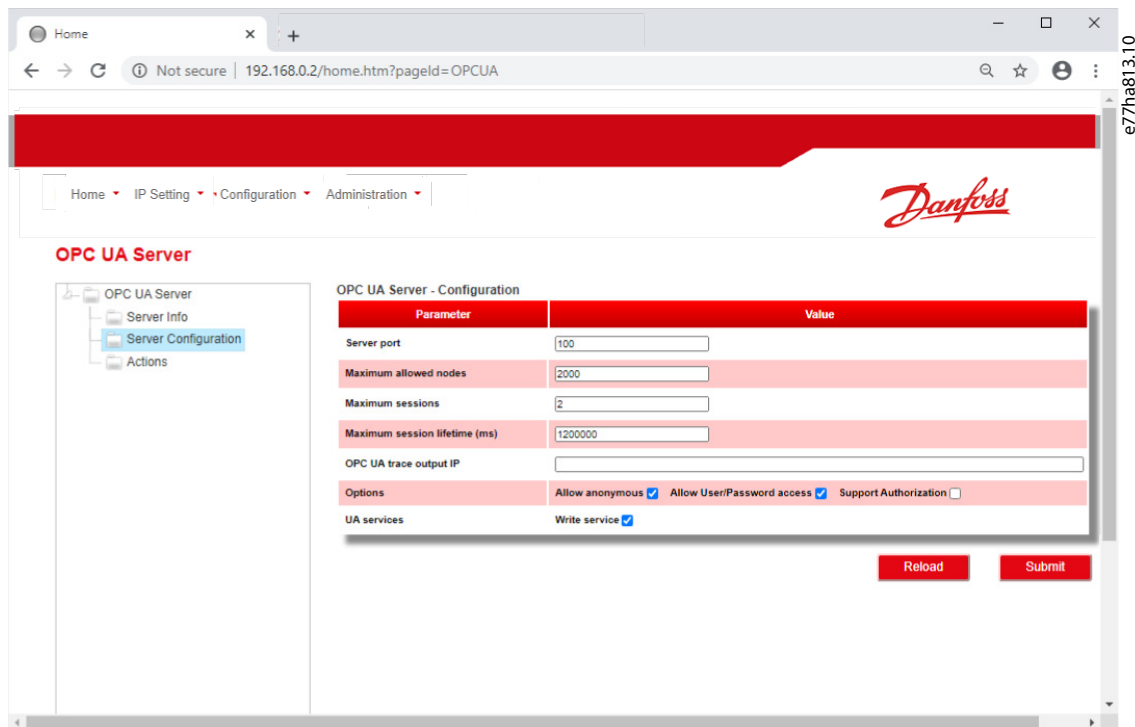
Procedure

1. Connect to the web server and click *Configuration*.
2. Select *MQTT Client*.
3. Tick the *Enable* checkbox to enable MQTT client operation.

The MQTT client is enabled by default.

4. Click *Connection* and configure the settings as required.
5. Click *Connections*⇒*Actions* to select which information the device should publish.
6. Click *Submit* to save all settings in the device.

5.3.4.2 Configuring OPC UA Settings



Parameter	Value
Server port	100
Maximum allowed nodes	2000
Maximum sessions	2
Maximum session lifetime (ms)	1200000
OPC UA trace output IP	
Options	Allow anonymous ☒ Allow User/Password access ☒ Support Authorization ☐
UA services	Write service ☒

Procedure

1. Connect to the web server and click *Configuration*.
2. Select *OPC UA Server*.
3. Tick the *Enable* checkbox to enable OPC UA client operation.

The OPC UA client is enabled by default.

4. Click *Server Configuration* and configure the settings as required.
5. Select *Actions* to select the actions for different object instances.
6. Click *Submit* to save all settings in the device.

5.4 Scanning the Network

If there is no connection to the web server and the soft starter cannot be accessed physically, use the Ethernet Device Configuration Tool to scan the network and identify the device. Changes made via the Ethernet Device Configuration Tool cannot be stored permanently in the device and will be lost when the control power is cycled.

Download the Ethernet Device Configuration Tool from www.danfoss.com under the sections *Service and Support/Downloads*.

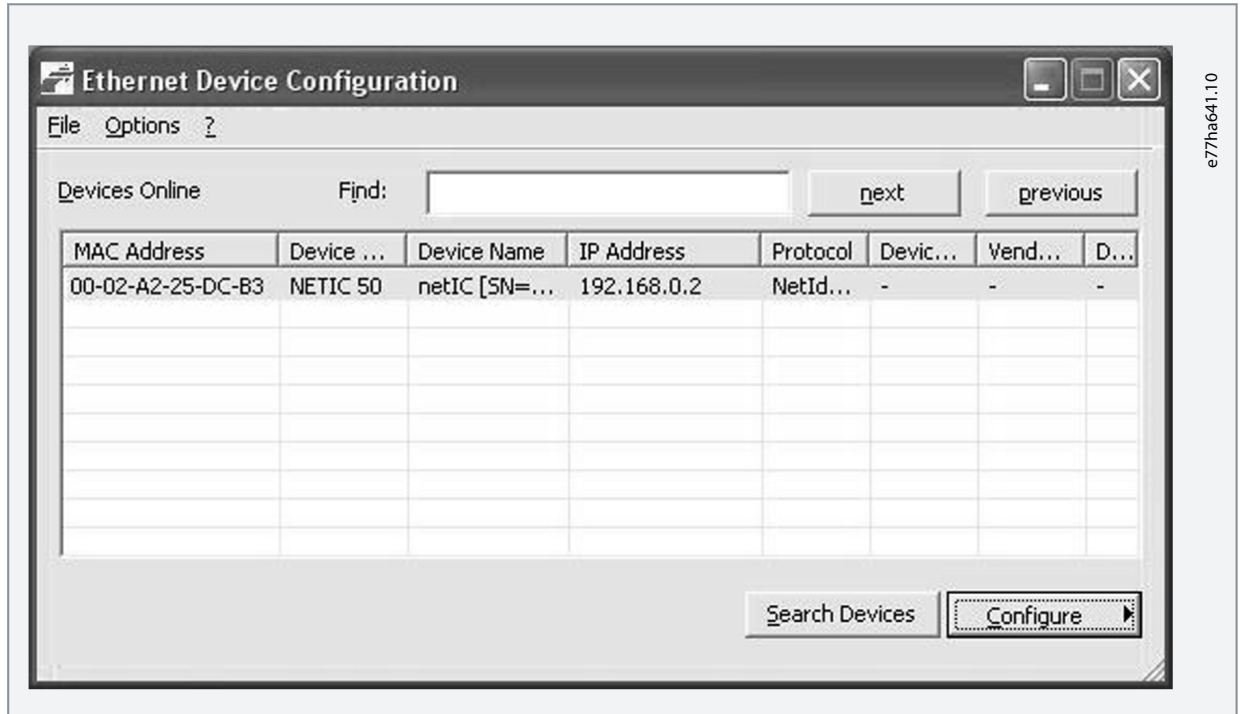
NOTICE

If the PC has a firewall enabled, add the tool to the list of authorized programs.

5.4.1 Identifying the Device with Ethernet Device Configuration Tool

Procedure

1. Start the Ethernet Device Configuration Tool.
2. Click *Search Devices*.



➡ The software searches for connected devices.

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

6 Scanner Configuration

6.1 EDS File

An EDS file is available from the website. The EDS file contains all required attributes of the EtherNet/IP module.

- For 175G9906, use EDS file SSEM10xxxx.eds.
- For 175G9907, use EDS file SSEM11xxxx.eds.

Once the EDS file has been loaded, the individual EtherNet/IP module must be defined.

6.2 Assembly Objects

Table 2: Supported Assembly Objects

Description	Class	Instance	Type	Maximum size
Output (Originator⇒Target)	04d (0x04)	104d (0x68)	Integer	2 (4 bytes)
Input (Target⇒Originator)	04d (0x04)	154d (0x9A)	Integer	6 (12 bytes)

7 Operation

7.1 Requirements for Successful 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 manual.

7.2 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.

7.3 Enabling Network Control

MCD 200

For the soft starter to accept the fieldbus commands, a link must be fitted across terminals A1–N2 on the soft starter.

MCD 500

Input links are required across terminals 17 and 25–18 if the soft starter is being operated in auto-on mode. In hand-on mode, links are not required.

Control via the fieldbus communication network is always enabled in local control mode and can be enabled or disabled in remote control mode (*parameter 3-2 Comms in Remote*). See the VLT® Soft Starter MCD 500 Operating Guide for parameter details.

7.4 Ensuring Safe and Successful Control

Data written to the device remains in its registers until the data is overwritten or the device is reinitialized. The EtherNet/IP module will not transfer successive duplicate commands to the soft starter.

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

7.5 Feedback LEDs

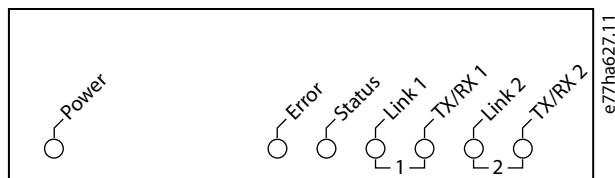


Table 3: LED Descriptions

LED name	LED state	Description
Power	Off	The device is not powered up.
	On	The device is receiving power.
Error	Off	The device is not powered up or the the device is powered up and has received an IP address.
	Flashing	Connection timeout.
	On	Duplicate IP address.
Status	Off	The device is not powered up or the the device is powered up and has received an IP address.
	Flashing	The device has obtained an IP address but has not established any network connections.
	On	Communication has been established.

LED name	LED state	Description
Link x	Off	No network connection.
	On	Connected to a network.
TX/RX x	Flashing	Transmitting or receiving data.

8 Packet Structures

8.1 Important Information

NOTICE

The following functions are only available with VLT® Soft Starter MCD 500: Parameter management, dual motor control, digital inputs, jog, current measurement in amperes, power information, warnings.

VLT® Compact Starter MCD 201 open-loop soft starters do not support motor current and motor temperature information.

8.2 Implicit Messaging (Cyclic Operation)

This section lists the 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.

8.2.1 Assembly Objects

Table 4: Supported Assembly Objects

Description	Class	Instance	Type	Maximum size
Output (Originator⇒Target)	04d (0x04)	104d (0x68)	Integer	2 (4 bytes)
Input (Target⇒Originator)	04d (0x04)	154d (0x9A)	Integer	6 (12 bytes)

8.2.2 Control Commands (Assembly Instance 104d)

To send control data from the scanner to the soft starter, use assembly class 04d (0x04), assembly instance 104d (0x68), attribute 03d (0x03).

8.2.2.1 Bytes 0–1: Command

Bits	Function	Details
0–5	Reserved	Must be 0.
6	Run	0 = Stop command 1 = Start command
7	Reset	Changing this bit from 0 to 1 resets a trip.
8–12	Reserved	Must be 0.
13	Motor set select	0 = Use primary motor set when starting. 1 = Use secondary motor set when starting.
14–15	Reserved	Must be 0.

8.2.2.2 Bytes 2–3: Reserved

Bits	Function	Details
0–15	Reserved	Must be 0.

8.2.2.3 Command Examples

Byte	Value	Description
0	0b01000000 (64d, 0x40)	Command: Start the soft starter.
1	0b00000000 (00d, 0x00) or 0b00100000 (32d, 0x20)	Command: Select primary or secondary motor settings when starting.
0	0b10000000 (128d, 0x80)	Command: Reset the soft starter. The reset only occurs when the previous reset bit is 0, otherwise the value of 1 is ignored.
0	0b11000000 (192d, 0xC0)	Command: Reset and start the soft starter.
0	0bX0000000 (00d, 0x00)	Command: Stop the soft starter.

8.2.3 Status Information (Assembly Instance 154d)

To retrieve status data from the soft starter, use assembly class 04d (0x04), assembly instance 154d (0x9A), attribute 03d (0x03).

8.2.3.1 Bytes 0–1: Starter State

Bits	Function	Details
0	Ready	0 = Not ready 1 = Ready to start
1	Operating mode	0 = Program mode 1 = Operating mode
2	Running	0 = Not ready, ready to start, or tripped 1 = Starting, Running, Stopping, or Jogging
3	Trip	0 = Not tripped 1 = Tripped
4	Jog forward	1 = Jog forward
5	Jog reverse	1 = Jog reverse
6	Reserved	
7	Warning	0 = No warning 1 = Warning
8	Ramping	1 = Running (full voltage at the motor)
9	Local/remote	0 = Hand on 1 = Auto on
10	Reserved	
11	Reserved	
12	Reserved	

Bits	Function	Details
13	Reserved	
14	Reserved	
15	Temperature limit	0 = Motor operating within thermal capacity (thermal model) 1 = Motor operating above thermal capacity (thermal model)

8.2.3.2 Bytes 2–3: Reserved

Bits	Function	Details
0–15	Reserved	

8.2.3.3 Bytes 4–7: Motor Current

Bits	Function	Details
0–31	Motor current	Average rms current across all 3 phases. Measured current is shown as a 32-bit value to 2 decimal places. 10d (0x0A) = 0.10 A 3450d (0xD7A) = 34.50 A 68930d (0x10D42) = 689.30 A

8.2.3.4 Bytes 8–9: Trip Code

Bits	Function	Details
0–15	Trip code	See the chapter <i>Trip Codes</i> .

8.2.3.5 Bytes 10–11: Reserved

Bits	Function	Details
0–15	Reserved	

8.3 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.

8.3.1 Identity Object (Class 0x01)

Table 5: Supported 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

8.3.2 Vendor-specific Objects

The EtherNet/IP module supports vendor-specific classes 100, 101, 102, 103, and 104.

8.3.2.1 Class 100 ~ 102 Objects (Read/Write)

Class 100 ~ 102 objects allow parameter values to be read from and written to the soft starter.

- Class 100d (0x64): Parameters 1–99
- Class 101d (0x65): Parameters 100–199
- Class 102d (0x66): Parameters 200–299

NOTICE

Parameter lists vary according to the model and version of the soft starter. See the relevant soft starter operating guide for a complete parameter list.

NOTICE

When writing parameter values, the EtherNet/IP module will update all parameter values in the soft starter. Always enter a valid value for every parameter.

NOTICE

Changing the values of the Factory parameters (*parameter group 20-***) may cause unpredictable behavior in the soft starter. Consult a local supplier before adjusting the Factory parameters.

8.3.2.2 Class 103 Objects (Read Only)

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

Table 6: Objects 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
Changed parameter number	103	105	100
Number of parameters	103	106	100
Changed parameter value	103	107	100
Reserved	103	108	100
Soft starter state 1 = Ready 2 = Starting 3 = Running 4 = Stopping (including braking) 5 = Restart delay (including temperature check) 6 = Tripped 7 = Programming mode 8 = Jog forward	103	109	100

Object name	Class	Instance	Attribute
9 = Jog reverse			
Warning 0 = No warning 1 = Warning	103	110	100
Initialized 1 = Phase sequence is valid	103	111	100
Phase sequence (1 = Positive phase sequence, only valid if Initialized = 1)	103	112	100
Reserved	103	113	100
Reserved	103	114	100
Trip/Warning code (see the chapter <i>Trip Codes</i>)	103	115	100
Average rms current across all 3 phases	103	116	100
Current (% motor FLC)	103	117	100
Motor temperature	103	118	100
Reserved	103	119	100
Power	103	120	100
Power scale 0 = Multiply power by 10 to get W 1 = Multiply power by 100 to get W 2 = Power (kW) 3 = Multiply power by 10 to get kW	103	121	100
% Power factor	103	122	100
Reserved	103	123	100
Phase 1 current	103	124	100
Phase 2 current	103	125	100
Phase 3 current	103	126	100
Reserved	103	127	100
Reserved	103	128	100
Reserved	103	129	100
Parameter list minor version	103	130	100
Parameter list major version	103	131	100
Digital input state For all inputs, 0 = open, 1 = closed (short-circuited) Start/stop input = 01h, reset = 04h, programmable input A = 08h	103	132	100
Trip code	103	133	100

N O T I C E

The reset input is normally closed by default. If *parameter 3-8 Remote Reset Logic* is set to normally open, the reported state is inverted (0 = closed, 1 = open).

N O T I C E

For models MCD5-0053B and smaller, current reported via communications is 10 times greater than the actual value (shown on the LCP).

8.3.2.3 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
Major software version - Remote LCP (if installed)	104	105	100
Minor software version - Remote LCP (if installed)	104	106	100
Major software version - Expansion card (if installed)	104	107	100
Minor software version -. Expansion card (if installed)	104	108	100
Model rating	104	109	100
Control variant	104	110	100
Backplane variant	104	111	100
Actual motor current	104	112	100
Variant high byte	104	113	100
Customer	104	114	100

8.3.3 Supported Services for Vendor-specific Objects

This section describes the operational instructions to carry out acyclic services on class objects 100, 101, 102, 103, and 104.

8.3.3.1 Service Codes for Acyclic Operation

Table 7: Supported 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

8.3.3.2 Status Codes for Acyclic Services

Table 8: Status Codes Returned in Response to Get/Set Attribute Single

Status code	Status name	Details
00d (0x00)	Success	This code is returned when: - the register mapped for "Get Attribute Single" is successfully read. - the register mapped for "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 of 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.

8.4 Trip Codes

Code	Description
0	No trip
11	Input A trip
20	Motor overload
21	Heat sink overtemperature
23	L1 phase loss
24	L2 phase loss
25	L3 phase loss
26	Current imbalance
28	Instantaneous overcurrent
29	Undercurrent
50	Power loss
54	Phase sequence
55	Frequency
60	Unsupported option (function not available in inside delta)
61	FLC too high
62	Parameter out of range
70	Miscellaneous

Code	Description
75	Motor thermistor
101	Excess start time
102	Motor connection
104	Internal fault
113	Starter communication
114	Network communication
115	L1-T1 shorted
116	L2-T2 shorted
117	L3-T3 shorted
118	Motor 2 overload
119	Time-overcurrent (bypass overload)
121	Battery/clock
122	Thermistor circuit

9 Network Design

9.1 Star Topology

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

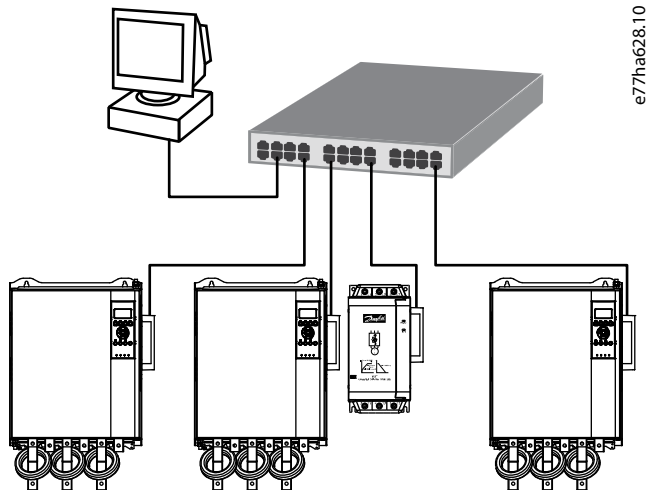


Illustration 4: Example of Star Topology

9.2 Line Topology

In a line network, the controller connects directly to 1 port of the 1st device. The 2nd Ethernet port connects to another device, which in turn connects to another device until all devices are connected.

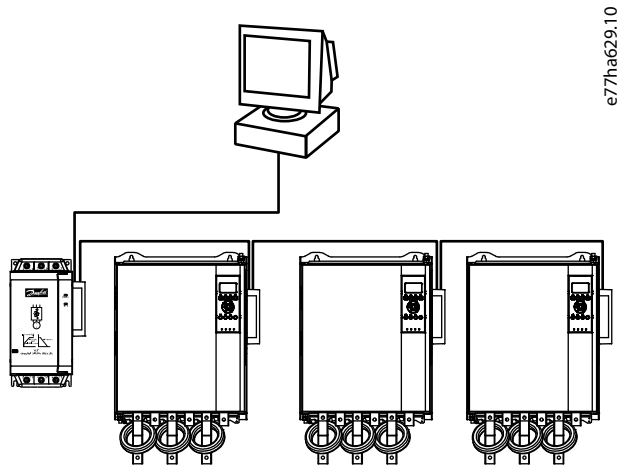


Illustration 5: Example of Line Topology

NOTICE

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.

NOTICE

If the connection between 2 devices is interrupted, the controller cannot communicate with devices after the interruption point.

NOTICE

Each connection adds a delay to the 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 1st module via a network switch. The 2nd 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.

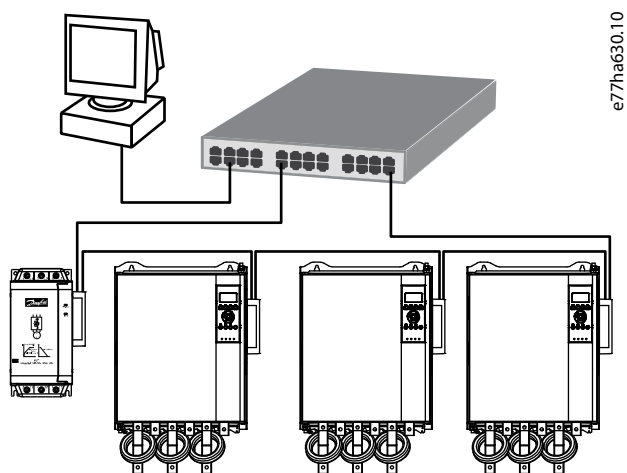


Illustration 6: Example of Ring Topology

9.4 Combined Topologies

A single network can include both star and line components.

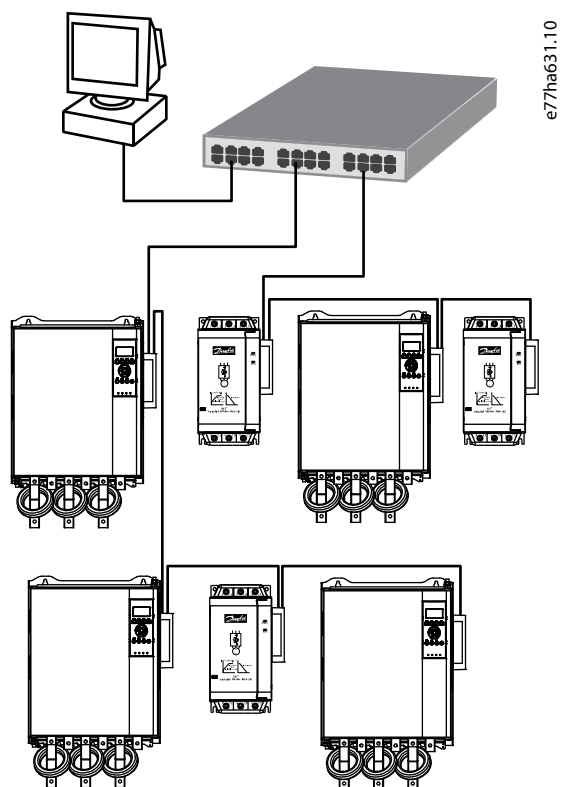


Illustration 7: Example of Combined Topologies

10 Specifications

10.1 Enclosure

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

10.2 Mounting

Spring-action plastic mounting clips (x2)

10.3 Connections

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

10.4 Network

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

10.5 Power

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

10.6 Certification

RCM	IEC 60947-4-2
CE	EN 60947-4-2
ODVA	



Illustration 8: ODVA

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