

Installation Guide

# PROFINET Module

VLT® Compact Starter MCD 200 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 PROFINET 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 3<sup>rd</sup>-party products, including PLCs, scanners, and commissioning tools, contact the relevant supplier.

### 2.2 Compatibility

The PROFINET 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.

## N O T I C E

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

### 2.3 Product Versions

The PROFINET Module is available in 2 different versions. The part number is printed on the label on the side of the module.

- 175G9905 MCD PROFINET Module
  - Monitor and control the soft starter over a PROFINET connection.
- 175G9915 MCD PROFINET Module
  - Monitor and control the soft starter over a PROFINET 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.

This installation guide is suitable for use with 175G9915. For the manual for 175G9905, contact the local supplier.

### 2.4 Network Connection

**Table 1: Supported Protocols**

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

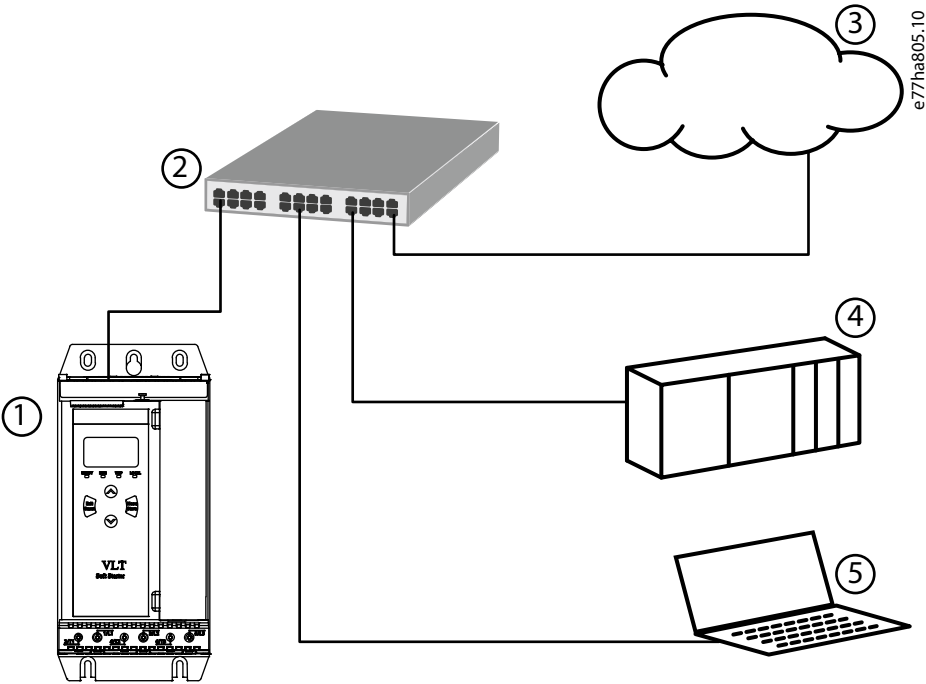


Illustration 1: Overview of Network Connections

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

#### ⚠ CAUTION ⚠

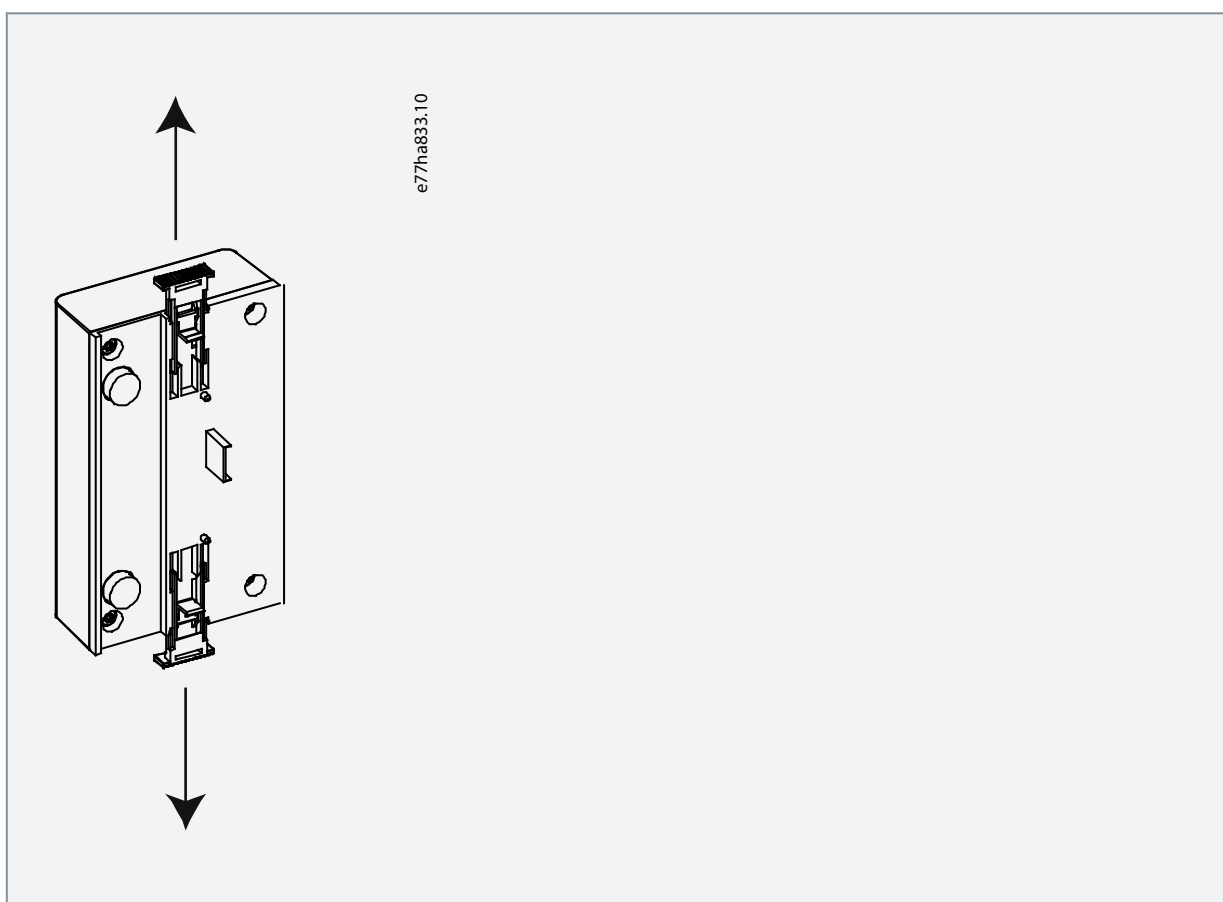
##### EQUIPMENT DAMAGE

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.

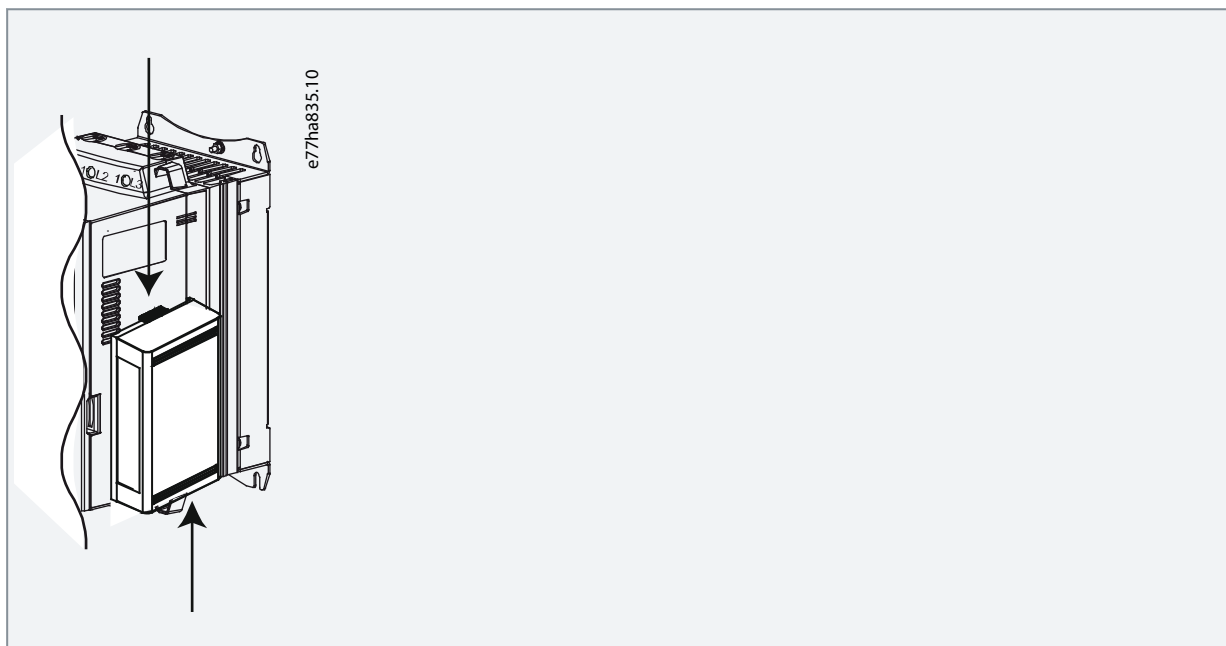




3. Line up the module with the comms port slot.



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 PROFINET Module to the network.
6. Apply control power to the soft starter.

## 4 Connection

### 4.1 Soft Starter Connection

The PROFINET Module is powered from the soft starter.

#### NOTICE

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

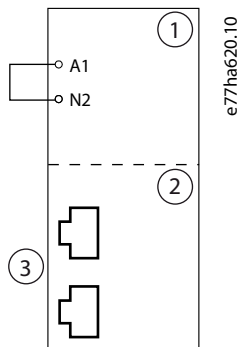


Illustration 2: Connecting MCD 200

1	Soft starter A1, N2: Stop input	3	RJ45 Ethernet ports
2	PROFINET Module		

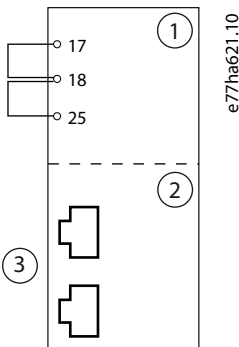


Illustration 3: Connecting MCD 500

1	Soft starter (remote mode) 17, 18: Stop input 25, 18: Reset input	3	RJ45 Ethernet ports
2	PROFINET 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 MAC address is fixed within the device and is printed on a label on the front of the device.

## 5 Device Configuration

### 5.1 Configuration of Device Name

Use the Ethernet Device Configuration Tool to configure the device name. The tool can be downloaded from [www.danfoss.com](http://www.danfoss.com) under *Service and support/Downloads*.

#### 5.1.1 Identifying the Device with Ethernet Device Configuration Tool

#### NOTICE

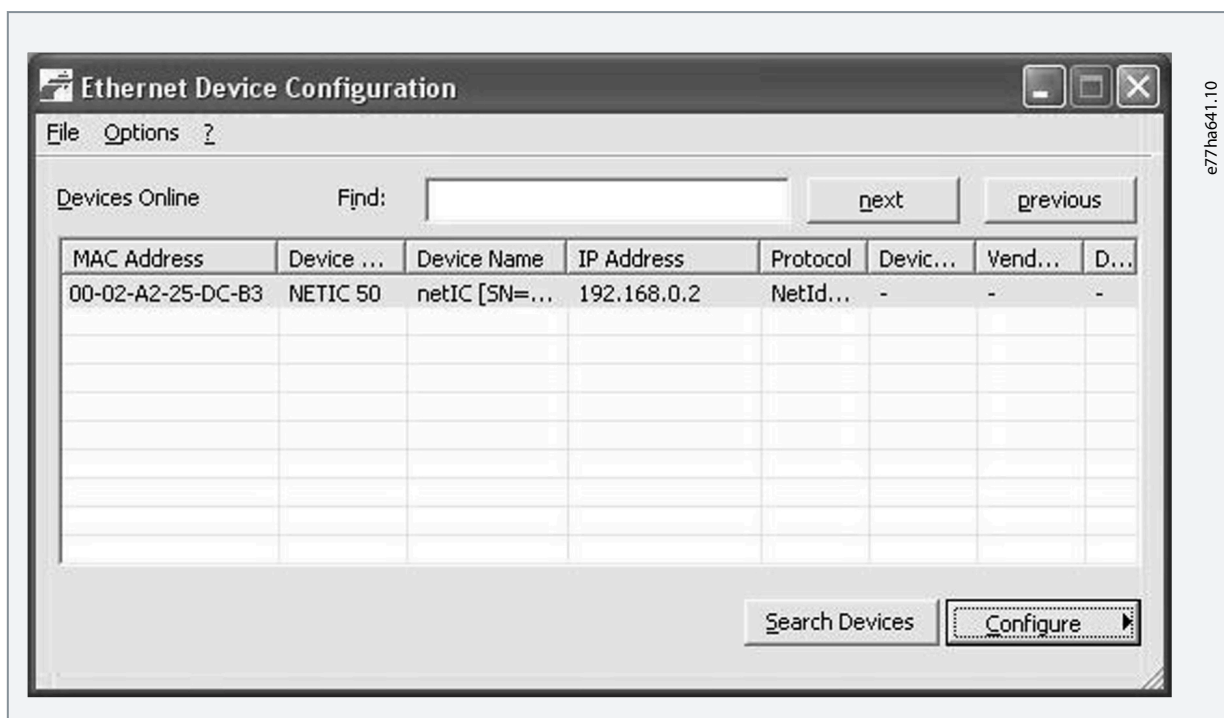
The Error LED flashes whenever the device is receiving power but is not connected to a network.  
The Error LED will flash occasionally during the configuration process.

#### NOTICE

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

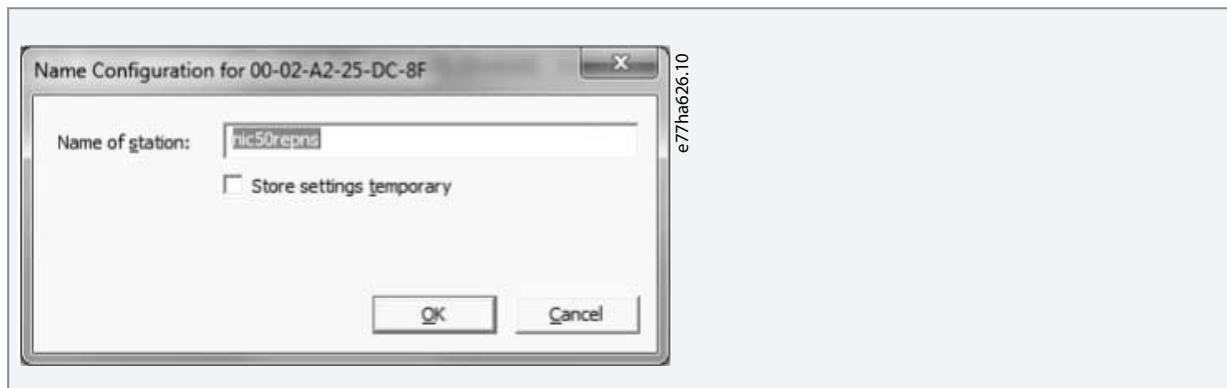
#### Procedure

1. Attach the PROFINET Module to the soft starter.
2. Connect Ethernet Port 1 or Port 2 on the PROFINET Module to the network.
3. Apply control power to the soft starter.
4. Start the Ethernet Device Configuration Tool.
5. Click *Search Devices*.



➡ The software searches for connected devices.

6. To configure a device name, click *Configure* and select *Device Name*.

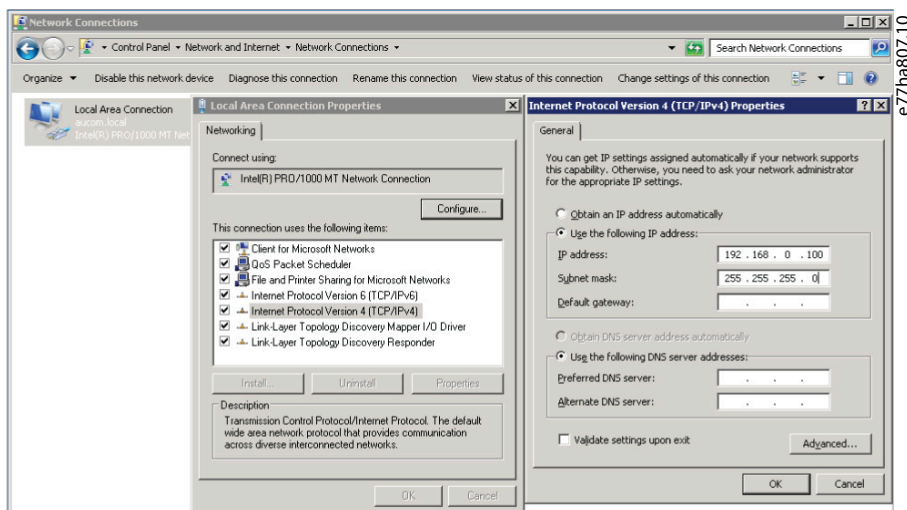


## 5.2 On-board Web Server

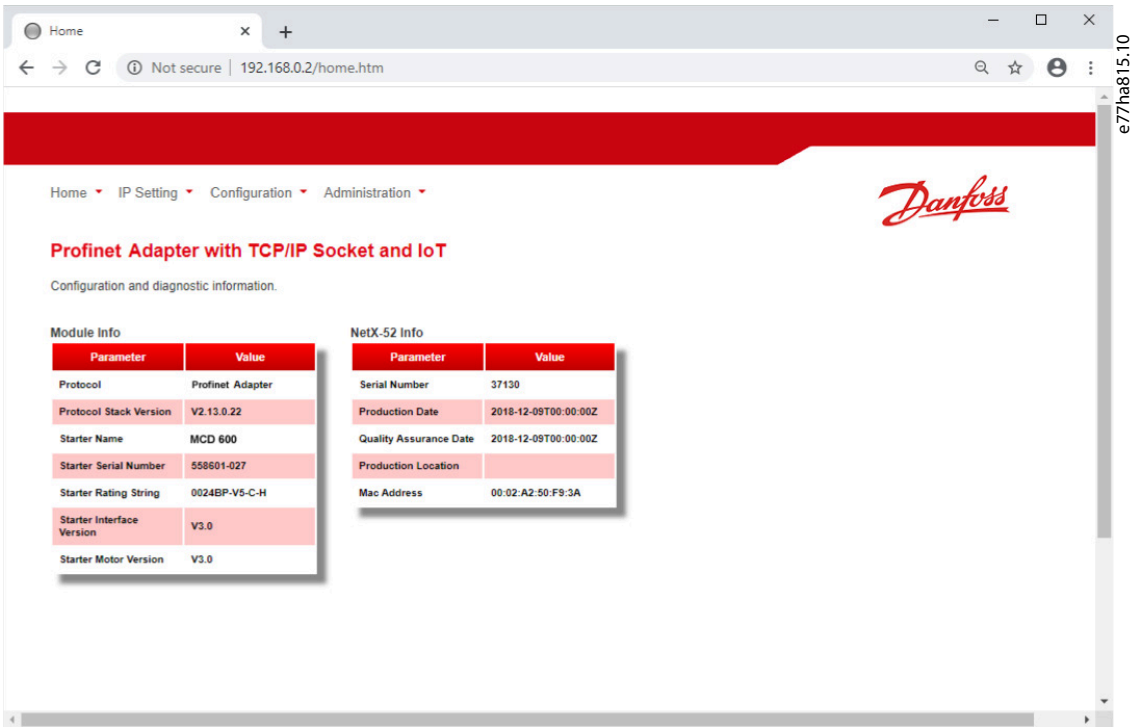
### 5.2.1 Connect to the Device

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 PROFINET 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.



### 5.2.2 Manage Users and Passwords

#### NOTICE

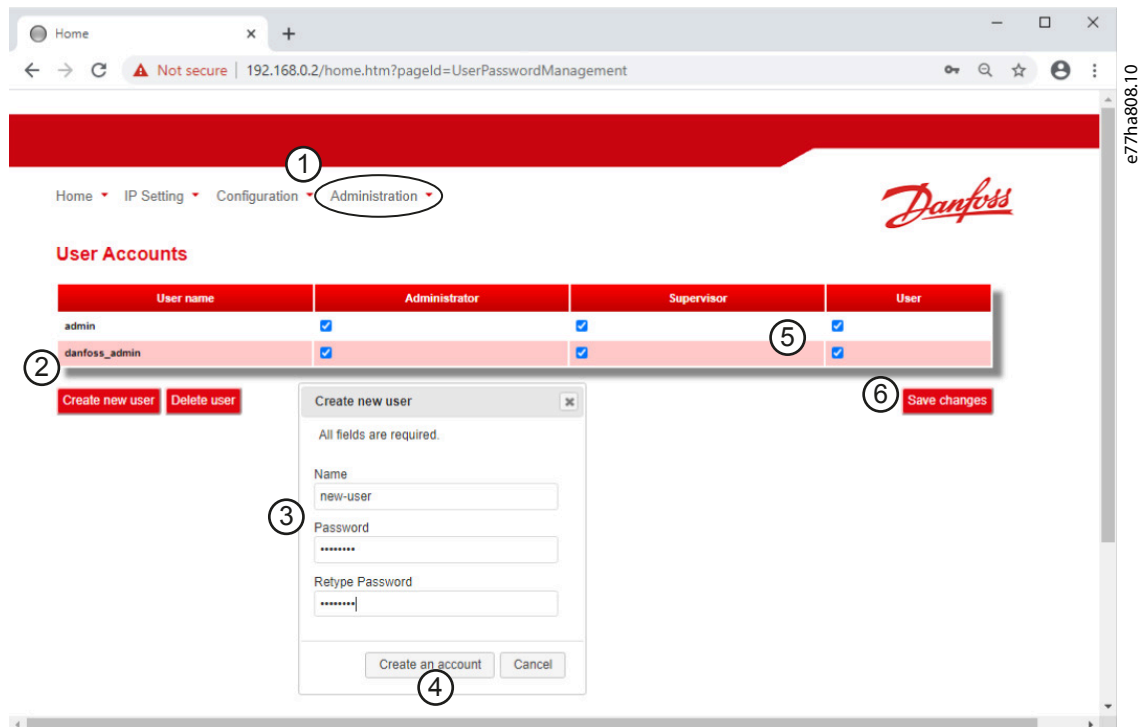
For security reasons, define a custom administrator ID and password. The default username and password are:

- Username: danfoss
- Password: danfoss

The PROFINET 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.

### 5.2.2.1 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*.

### 5.2.2.2 Deleting a User

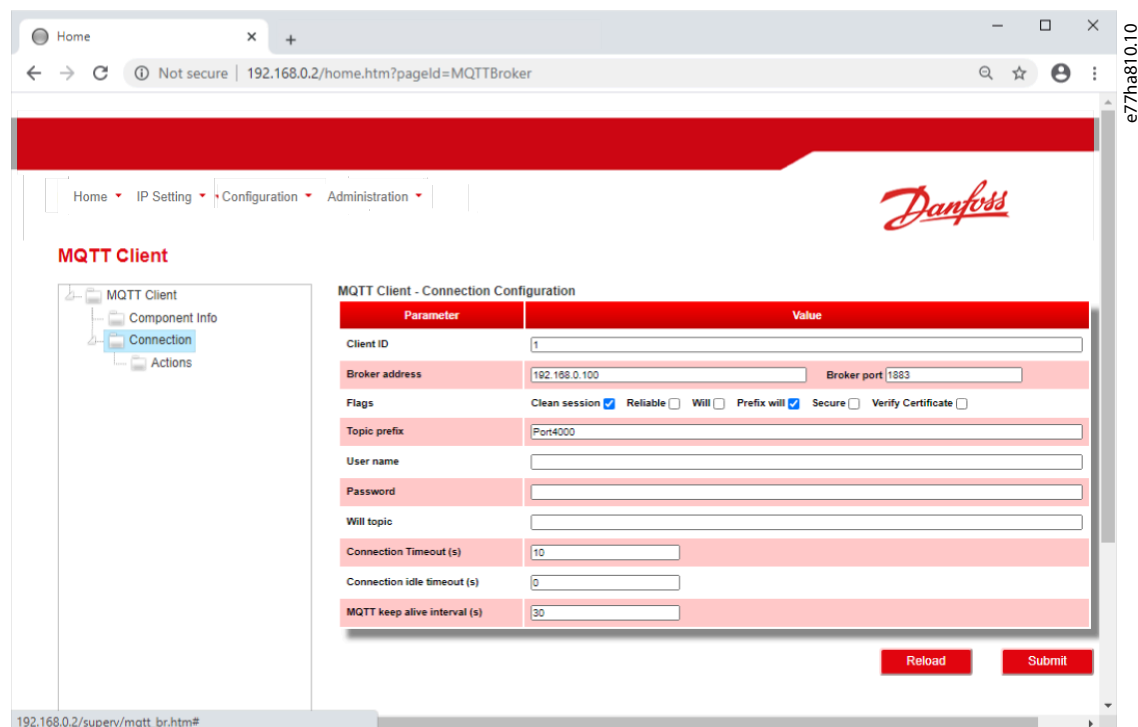
#### Procedure

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.

### 5.2.3 Configure IoT Settings

The PROFINET Module supports soft starter status monitoring via IoT. The device cannot control or program the soft starter.

### 5.2.3.1 Configuring MQTT Settings



#### Procedure

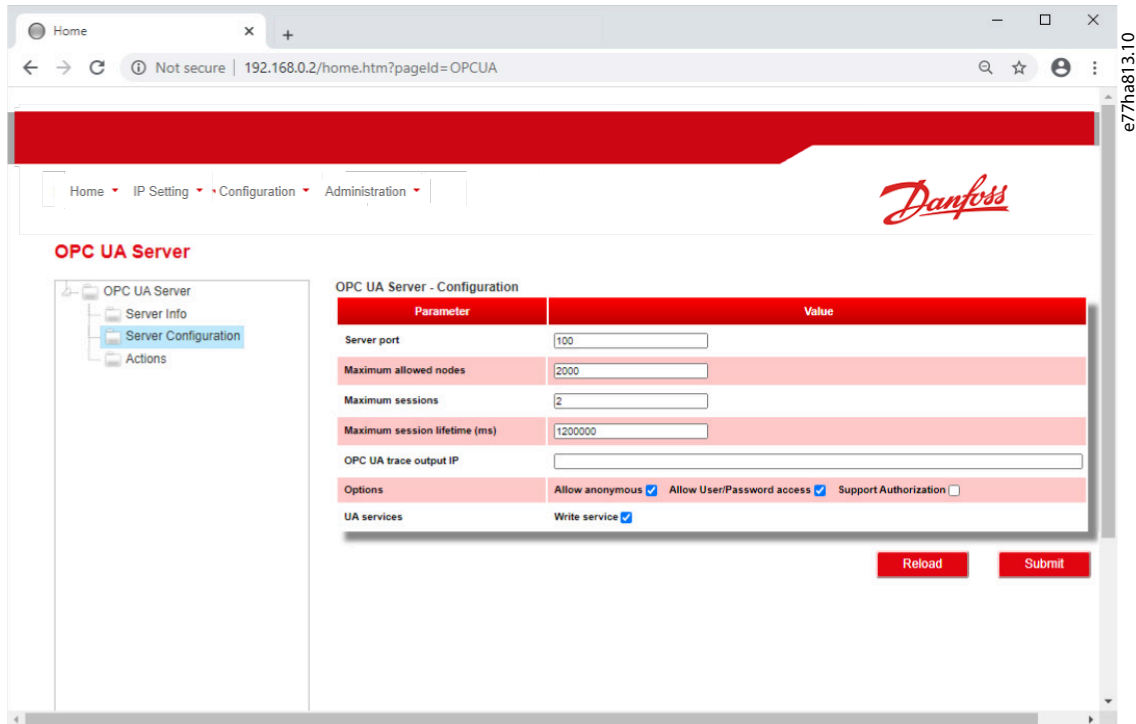
1. Connect to the web server and click *Configuration*.
2. Select *MQTT Client*.
3. Tick the *Enable* checkbox to enable MQTT client operation.

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.



### 5.2.3.2 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 <input checked="" type="checkbox"/> Allow User/Password access <input checked="" type="checkbox"/> Support Authorization <input type="checkbox"/>
UA services	Write service <input checked="" type="checkbox"/>

Reload Submit

#### 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.

## 6 Operation

### 6.1 Requirements for Successful Operation

The device has been designed for use in a system complying with the PROFINET standard. For successful operation, the controller must also support all functions and interfaces described in this manual.

### 6.2 Device Classification

The PROFINET Module is a PROFINET I/O-device and must be managed by an I/O-controller over Ethernet.

### 6.3 Master Configuration

Import the latest GDSML file into the Master configuration tool. This file is available from the website. SSPM\_N.bmp indicates normal mode. SSPM\_D.bmp indicates diagnostic mode.

### 6.4 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.

### 6.5 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 PROFINET 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.

### 6.6 Feedback LEDs

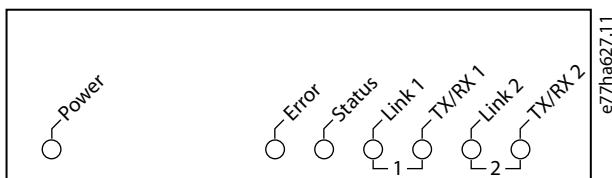


Table 2: LED Descriptions

LED name	LED state	Description
Power	Off	The device is not powered up.
	On	The device is receiving power.
Error	Off	No error.
	Flashing	Connection not established.
	On	No physical link or slow physical link. No configuration.
Status	Off	No error.
	Flashing	DCP signal service initiate via the bus.

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

## 7 Packet Structures

### 7.1 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.

### 7.2 Control Commands (Controller to Device)

Use output bytes 0–1 to send a control command to the soft starter.

#### NOTICE

Bit 4 of byte 0 must be set to 0 before the soft starter can perform a start.

Table 3: Control Command Bits

Byte	Bits	Details
0	0–1	Reserved.
	2–3	0 = Use soft starter remote input to select motor set. 1 = Use primary motor set when starting. 2 = Use secondary motor set when starting. 3 = Reserved.
	4	0 = Stop action as selected in the soft starter. 1 = Stop action will be a coast to stop.
	5–7	Reserved.
1	0	0 = Stop. 1 = Start.
	1–2	Reserved.
	3	1 = Reset.
	4–7	Reserved.
2–5		Parameter management.

### 7.3 Status Information (Device to Controller)

Soft starter status information is always available when the device is active.

#### NOTICE

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

#### 7.3.1 Bytes 0–1: Control Status

Bits	Details
0–5	Current (% of motor FLC).
6	Local/Remote.

Bits	Details
	0 = Auto on (Network). 1 = Hand on (LCP, Digital Input).
7	1 = Ramping (starting or stopping).
8	1 = Ready.
9	1 = Starting, running, or stopping.
10	1 = Tripped.
11	1 = Warning.
12–15	Reserved.

Motor current (% FLC) represents current as a percentage of the set motor full load current. A maximum value of 63 represents 200% full load current. To convert this value to a readable percentage, divide by 0.315.

### 7.3.2 Bytes 2–3: Starter State

Bits	Details
0–3	The decimal value of bits 0–3 indicates the state of the soft starter: 0 = Communication error between device and soft starter. 1 = Ready. 2 = Starting. 3 = Running. 4 = Stopping. 5 = Not ready (restart delay, restart temperature check). 6 = Tripped. 7 = Menu open (cannot start). 8 = Jog forward. 9 = Jog reverse.
4	0 = Negative phase sequence. 1 = Positive phase sequence.
5	1 = Current exceeds FLC.
6	0 = Uninitialized. 1 = Initialized.
7	1 = Communication error between device and soft starter.
8–15	Reserved.

### 7.3.3 Bytes 4–5: Trip Code

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

### 7.3.4 Bytes 6–7: Motor Current

Bits	Details
0–15	Average rms current across all 3 phases.

### 7.3.5 Bytes 8–9: Motor Temperature

Bits	Details
0–15	Motor thermal model (%).

### 7.3.6 Bytes 10–63: Extended Information

Table 4: Information from Internal Registers of the Soft Starter

Byte	Description	Bits	Details
10–11	Version	0–5	Reserved.
		6–8	Product parameter list version.
		9–15	Product type code: 4 = MCD 200. 7 = MCD 500.
12–13	Model number	0–7	Reserved.
		8–15	Soft starter model ID.
14–15	Reserved		
16–17	Reserved		
18–19	Starter state	0–4	0 = Reserved. 1 = Ready. 2 = Starting. 3 = Running. 4 = Stopping. 5 = Not ready (restart delay, restart temperature check). 6 = Tripped. 7 = Programming mode. 8 = Jog forward. 9 = Jog reverse.
		5	1 = Warning.
		6	0 = Uninitialized. 1 = Initialized.
		7	0 = Auto on (Network). 1 = Hand on (LCP, Digital Input).
		8	Reserved.
		9	0 = Negative phase sequence. 1 = Positive phase sequence.
		10–15	See the chapter <i>Trip Codes</i> .

Byte	Description	Bits	Details
20–21	Current	0–13	Average rms current across all 3 phases.
		14–15	Reserved.
22–23	Current	0–9	Current (% motor FLC).
		10–15	Reserved.
24–25	Motor temperature	0–7	Motor thermal model (%).
		8–15	Reserved.
26–27	Power	0–11	Power.
	Power scale	12–13	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.
		14–15	Reserved.
28–29	% Power factor	0–7	100% = power factor of 1.
		8–15	Reserved.
30–31	Reserved		
32–33	Current	0–13	Phase 1 current (rms).
		14–15	Reserved.
34–35	Current	0–13	Phase 2 current (rms).
		14–15	Reserved.
36–37	Current	0–13	Phase 3 current (rms).
		14–15	Reserved.
38–39	Reserved		
40–41	Reserved		
42–43	Reserved		
44–45	Parameter list version number	0–7	Parameter list minor version.
		8–15	Parameter list major version.
46–47	Digital input state		For all inputs, 0 = open, 1 = closed (shorted).
		0	Start.
		1	Stop.
		2	Reset <sup>(1)</sup> .
		3	Input A.
		4–15	Reserved.

Byte	Description	Bits	Details
48–49	Trip code	0–15	See the chapter <i>Trip Codes</i> .
50–59	Reserved		
60–63	Parameter management		See the chapter <i>Parameter Management</i> .

<sup>1</sup> The reset input is normally closed by default. If *parameter 7-9 Reset/Enable Logic* is set to *Normally open*, the reported state will be inverted (0 = closed, 1 = open).

## 7.4 Parameter Management

The PROFINET Module can read parameter values from and write parameter values to the soft starter. The card handles 1 parameter at a time.

The device references parameters according to their position in the soft starter parameter list. Parameter number 1 corresponds to *parameter 1-1 Command Source*. Refer to the VLT® Soft Starter MCD 500 Operating Guide for details of the soft starter parameters.

### ⚠ CAUTION ⚠

#### UNPREDICTABLE BEHAVIOR

Changing the values of the parameters in *parameter group 20 Advanced Parameters* may cause unpredictable behavior in the soft starter.

- Consult the local supplier before adjusting the Advanced Parameters.

### 7.4.1 Output

Use output bytes 2–5 to read or write a parameter to the soft starter.

Controller⇒Device output bytes are structured as follows:

Table 5: Output Byte Details

Byte	Bits	Details
2	0–7	Parameter number to read/write
3	0	Reserved
	1	1 = Read parameter
	2	1 = Write parameter
	3–7	Reserved
4	0–7	Low byte parameter value to write to the soft starter/0 data values for read
5	0–7	High byte parameter value to write to the soft starter/0 data values for read

### 7.4.2 Input

Parameter data from the soft starter is reported in bytes 60–63.

Device⇒Controller input bytes are structured as follows.

Table 6: Input Byte Details

Byte	Bits	Details
60	0–7	Echo parameter number
61	0	1 = Invalid parameter number
	1	1 = Invalid parameter value



Byte	Bits	Details
	2–7	Reserved
62	0–7	Low byte parameter value read from soft starter
63	0–7	High byte parameter value read from soft starter

## 7.5 Trip Codes

Code	Description	MCD 201	MCD 202	MCD 500
0	No trip	x	x	x
1	Excess start time		x	x
2	Motor overload		x	x
3	Motor thermistor		x	x
4	Current imbalance		x	x
5	Frequency	x	x	x
6	Phase sequence		x	x
7	Instantaneous overcurrent			x
8	Power loss	x	x	x
9	Undercurrent			x
10	Heat sink overtemperature			x
11	Motor connection			x
12	Input A trip			x
13	FLC too high			x
14	Unsupported option (function not available in inside delta)			x
15	Starter communication (between device and soft starter)	x	x	x
16	Network communication (between device and soft starter)	x	x	x
17	Internal fault			x
23	Parameter out of range			x
25	Bypass fail (bypass contactor)			x
26	L1 phase loss			x
27	L2 phase loss			x
28	L3 phase loss			x
29	L1-T1 shorted			x
30	L2-T2 shorted			x
31	L3-T3 shorted			x

Code	Description	MCD 201	MCD 202	MCD 500
33	Time-overcurrent (bypass overload)		x	x
35	Battery/clock			x
36	Thermistor circuit			x

## 8 Network Design

### 8.1 Star Topology

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

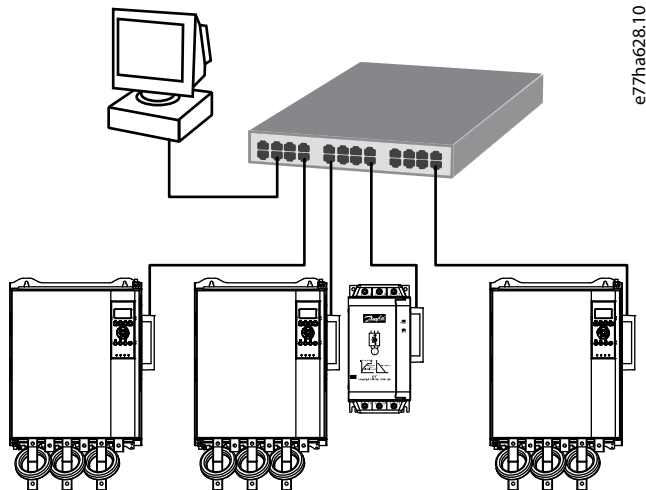


Illustration 4: Example of Star Topology

### 8.2 Line Topology

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

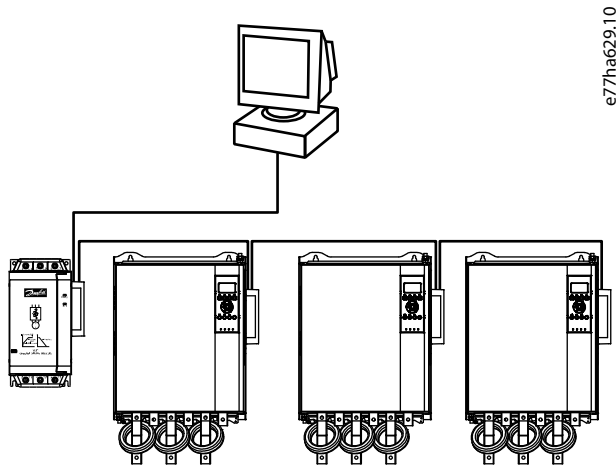


Illustration 5: Example of Line Topology

#### 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.

## N O T I C E

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.

### 8.3 Ring Topology

In a ring topology network, the controller connects to the 1<sup>st</sup> module via a network switch. The 2<sup>nd</sup> 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.

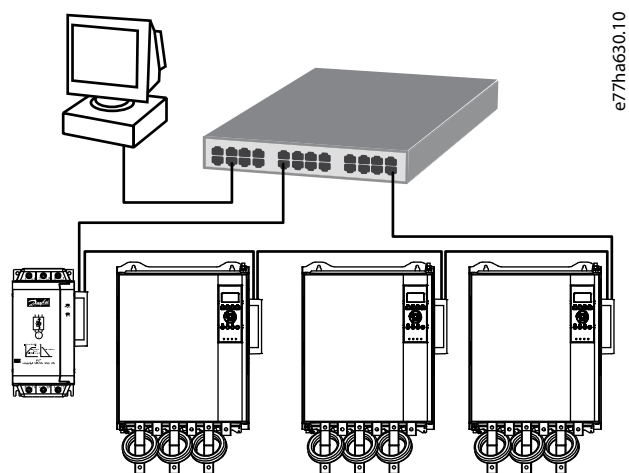


Illustration 6: Example of Ring Topology

## N O T I C E

The network switch must support loss of line detection.

### 8.4 Combined Topologies

A single network can include both star and line components.

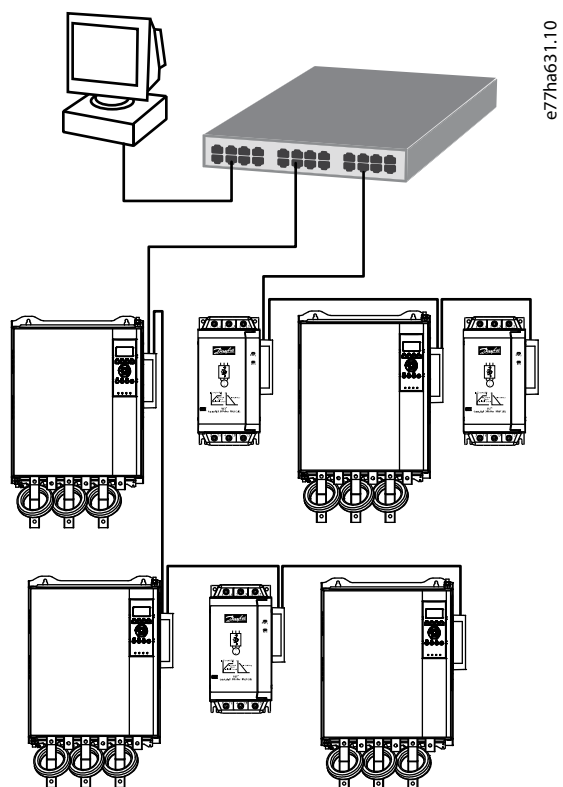


Illustration 7: Example of Combined Topologies

## 9 Specifications

### 9.1 Enclosure

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

### 9.2 Mounting

Spring-action plastic mounting clips (x2)

### 9.3 Connections

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

### 9.4 Settings

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

### 9.5 Network

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

### 9.6 Power

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

### 9.7 Certification

RCM	IEC 60947-4-2
CE	EN 60947-4-2
PROFIBUS & PROFINET International	





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