Danfoss

Installation Guide

PROFINET Card

VLT® Soft Starter MCD 600

Contents

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 Card 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

This communication expansion card is suitable for use with VLT® Soft Starter MCD 600.

This Installation Guide is intended for use with version 3.x of the VLT® Soft Starter MCD 600 PROFINET Card. Earlier versions of the PROFINET Card do not support custom users, TCP connection, or IoT operation.

2.3 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

e77ha805.10

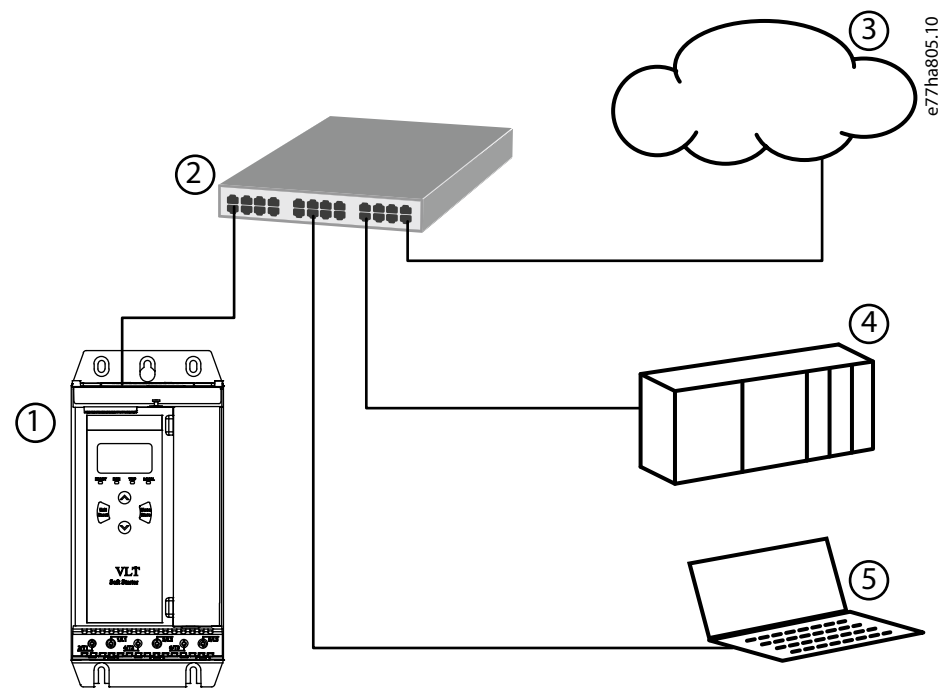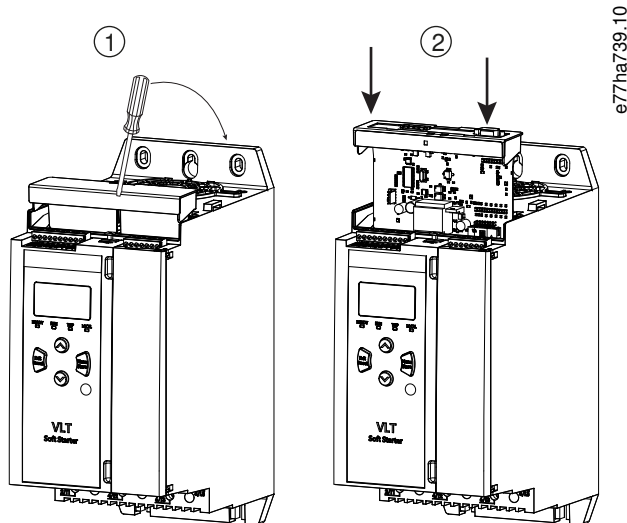**Illustration 1: Overview of Network Connections**

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 Expansion Card

Procedure

1. Push a small flat-bladed screwdriver into the slot in the center of the expansion port cover and ease the cover away from the soft starter.
2. Align the card with the expansion port. Gently push the card along the guide rails until it clicks into the soft starter.

3.2 Network Connections

3.2.1 Ethernet Ports

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

3.2.2 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

3.2.3 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°.

3.3 Network Establishment

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

3.4 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.

4 Device Configuration

4.1 Configuration of Device Name

Use the Ethernet Device Configuration Tool to configure the device. The tool can be downloaded from www.danfoss.com under *Service and support/Downloads*.

4.1.1 Identifying the Device with Ethernet Device Configuration Tool

N O T I C E
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.

N O T I C E
If the PC has a firewall enabled, add the tool to the list of authorized programs.

Procedure

1.   Start the Ethernet Device Configuration Tool.
2.   Click *Search Devices*.
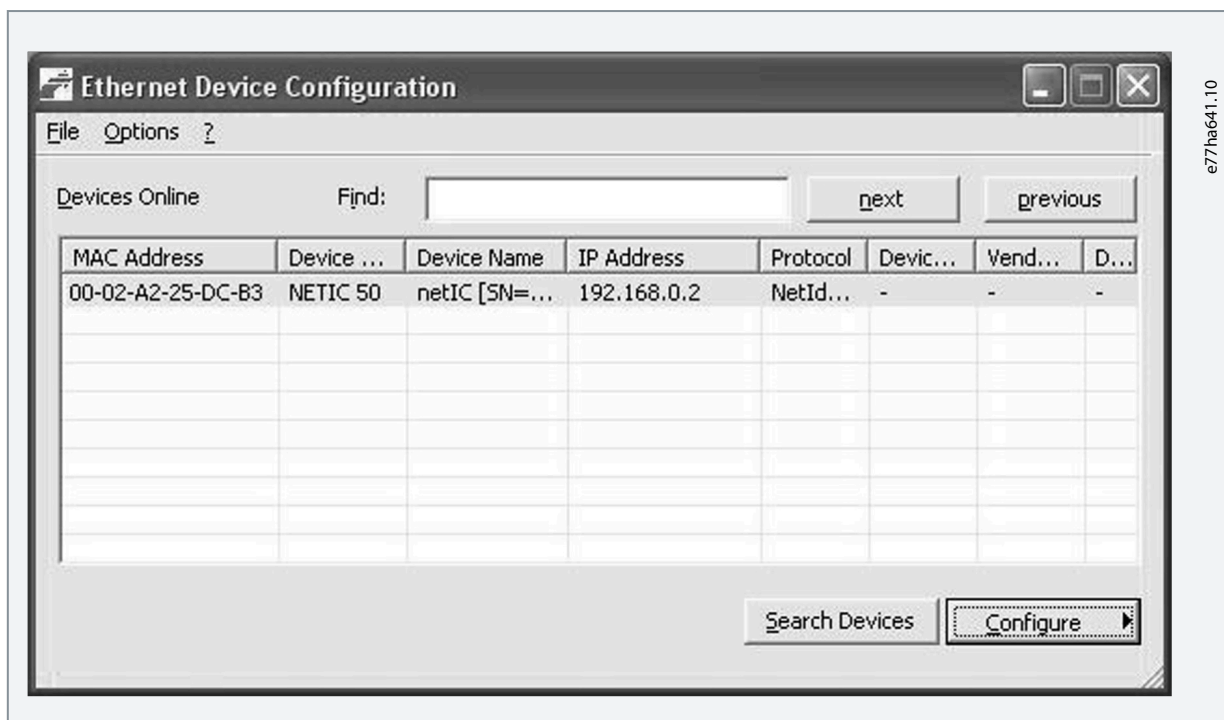
➜   The software searches for connected devices.

3.   To configure a device name, click *Configure* and select *Device Name*.
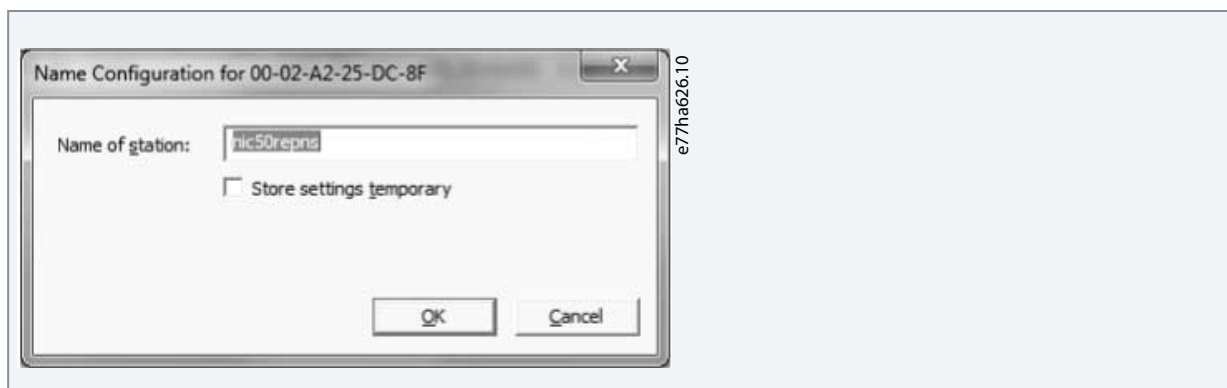
4.2 Enabling Network Control

> ### N O T I C E
>
> If the reset input is active, the soft starter does not operate. If a reset switch is not required, use *parameter 7-9* to set the reset input to normally open or fit a link across terminals RESET, COM+ on the soft starter.

Procedure

1. Set *parameter 1-1 Command Source* to Network for the soft starter to accept commands from the PROFINET Card.

4.3 On-board Web Server

4.3.1 Connect to the Device

To configure settings using the on-board web server, the PROFINET Card must be installed in a soft starter, control power must be available, and the card 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 card. The default IP address for the card is 192.168.0.2. The default subnet mask is 255.255.255.0.
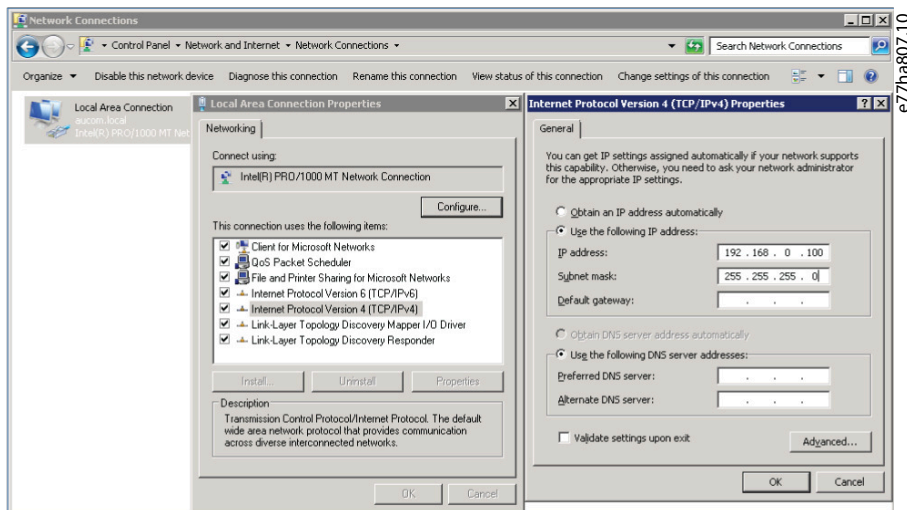
Once connected, the web server reports basic information about the card and the soft starter.
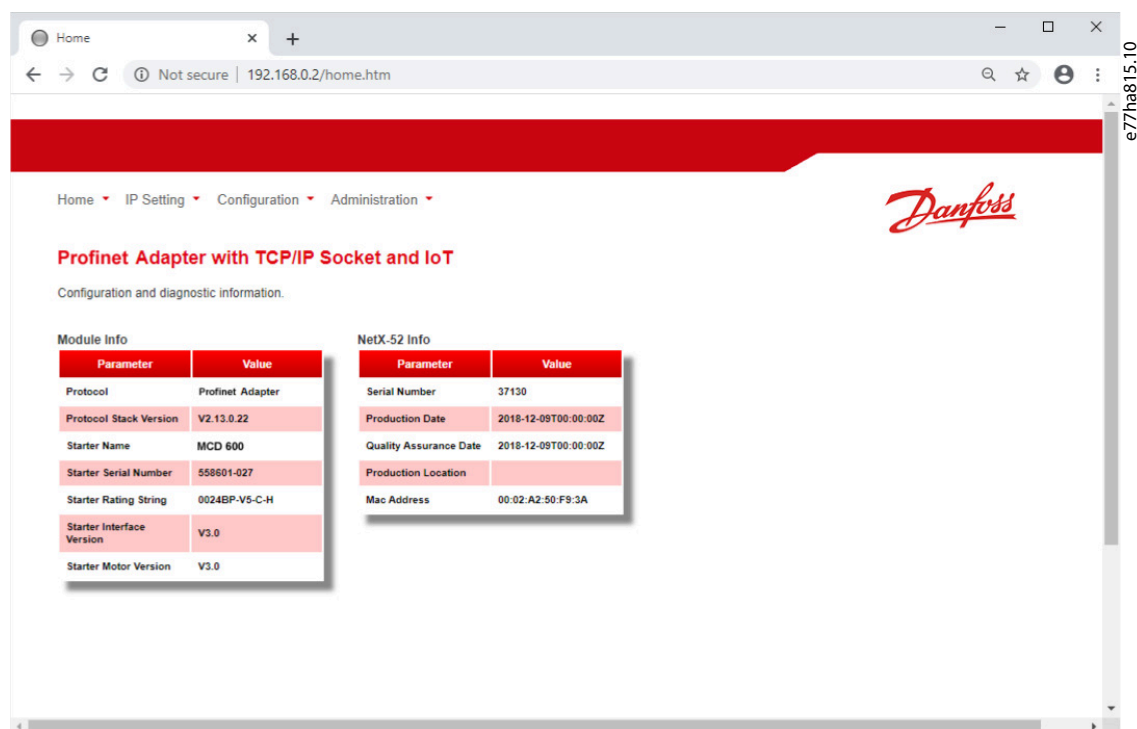
4.3.2 Manage Users and Passwords

N O T I C E
For security reasons, define a custom administrator ID and password. The default username and password are: –   Username: danfoss_admin –   Password: danfoss_admin

N O T I C E
Version 2.x of the PROFINET Card does not support custom users.

The PROFINET Card 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.

4.3.2.1 Adding a User
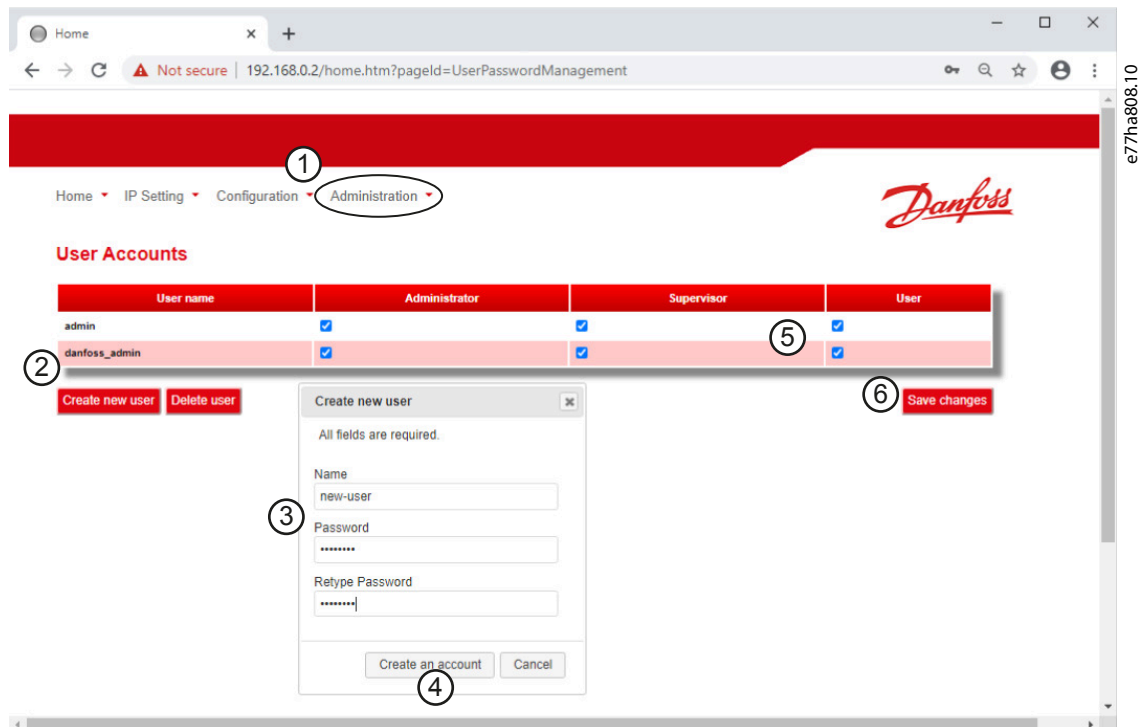
Procedure

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.*

4.3.2.2 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.
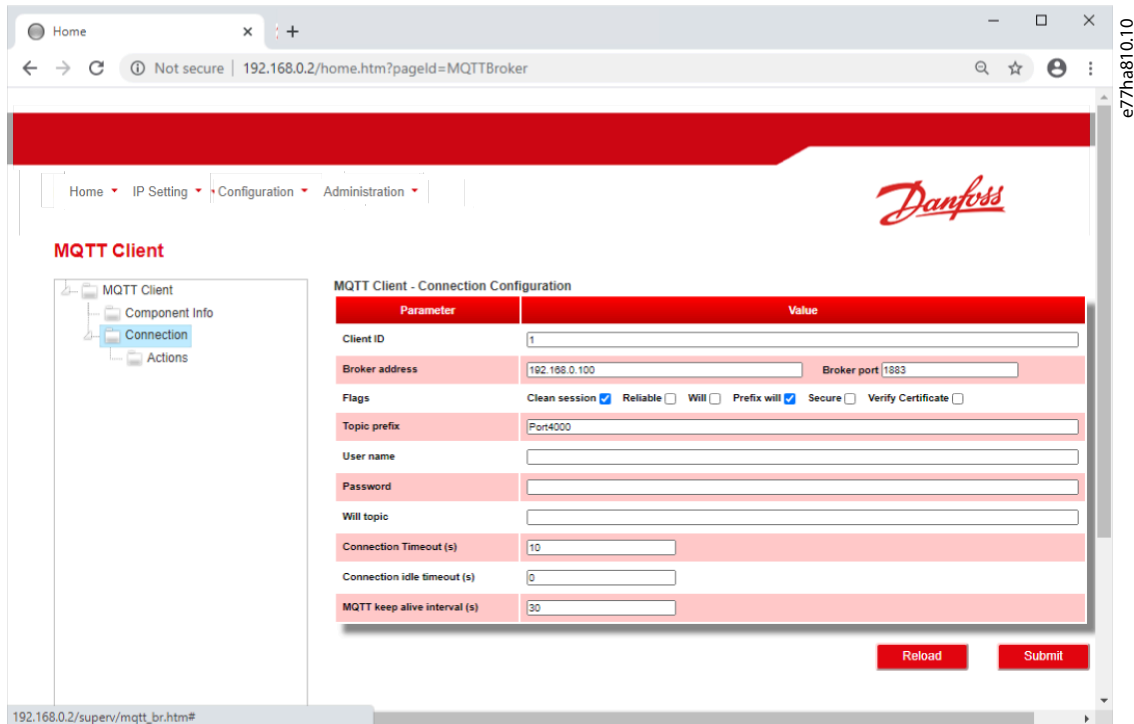
4.3.3 Configure IoT Settings

The PROFINET Card supports soft starter status monitoring via IoT. The card cannot control or program the soft starter.

> ### N O T I C E
> Version 2.x of the PROFINET Card does not support IoT operation.

4.3.3.1 Configuring MQTT Settings
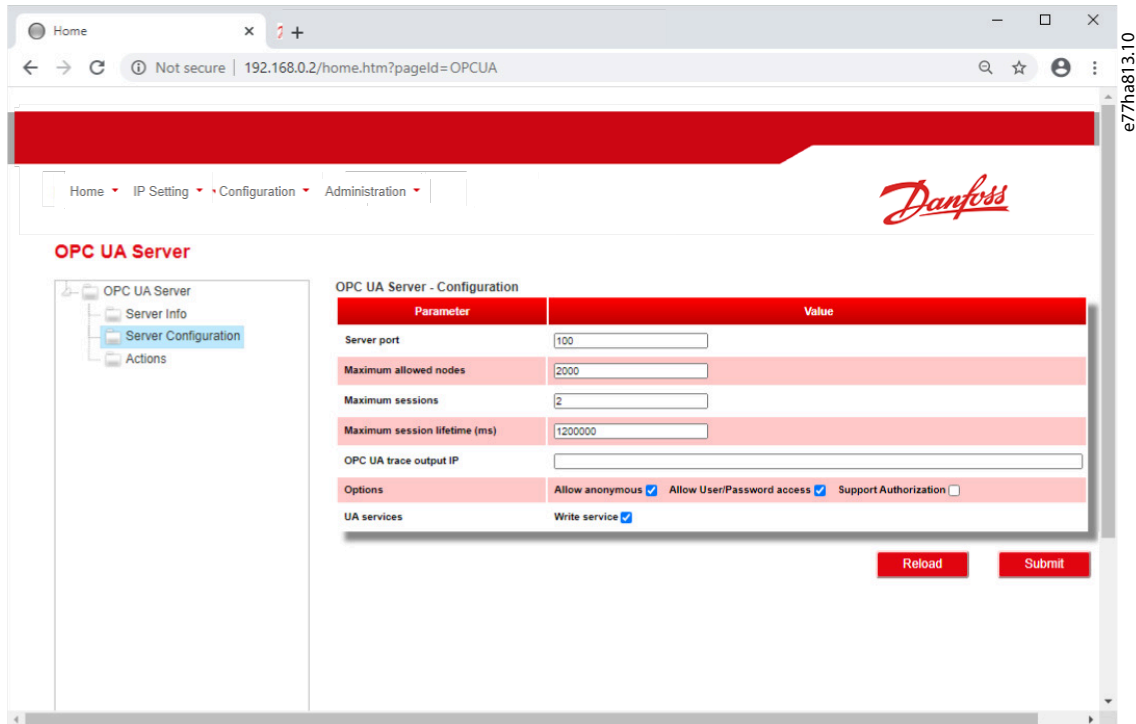
Procedure

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 card should publish.

6. Click *Submit* to save all settings in the card.

4.3.3.2 Configuring OPC UA Settings

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 card.

4.4 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.bnp indicates diagnostic mode.

5 Operation

5.1 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.

5.2 Device Classification

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

5.3 Ensuring Safe and Successful Control

Data written to the device remains in its registers until the data is overwritten or the device is reinitialized. If the soft starter is controlled via *parameter 7-1 Command Override* or is disabled via the reset input (terminals RESET, COM+), fieldbus commands should be cleared from the registers. If a command is not cleared, it is re-sent to the soft starter once fieldbus control resumes.

5.4 Feedback LEDs
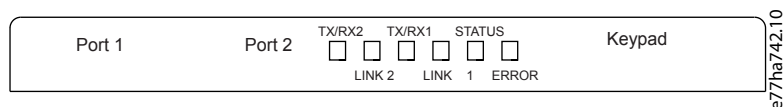
Table 2: LED Descriptions

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 initiated via the bus.
Link x	Off	No network connection.
	On	Connected to a network.
TX/RX x	Flashing	Transmitting or receiving data.

6 Packet Structures

6.1 Important Information

N O T I C E
The available features and parameter details may vary according to the model and software version of the soft starter. Refer to the VLT® Soft Starter MCD 600 Operating Guide for details of parameters and supported features.

6.2 Control Commands (Controller to Device)

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

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.

6.3 Status Information (Device to Controller)

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

N O T I C E
For models MCD6-0063B and smaller, current reported via communications is 10 times greater than the actual value (shown on the LCP).

6.3.1 Bytes 0–1: Control Status

Bits	Details
0–5	Current (% of motor FLC)
6	Command source 0 = Network, timer 1 = Remote LCP, digital input, clock
7	1 = Ramping (starting or stopping)
8	1 = Ready

Bits	Details
9	1 = Starting, running, or stopping
10	1 = Tripped
11	1 = Warning
12–15	Reserved

6.3.2 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, run simulation, reset input is open). 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.

6.3.3 Bytes 4–5: Trip Code

Bits	Details
0–15	See the chapter *Trip Codes*.

6.3.4 Bytes 6–7: Motor Current

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

6.3.5 Bytes 8–9: Motor Temperature

Bits	Details
0–15	Motor thermal model (%)

6.3.6 Bytes 10–63: Extended Information

Table 4: Information from Internal Registers of the Soft Starter

Byte	Description	Bits	Details
10–11	Version	0–8	Reserved.
		9–15	Product type code: 15 = MCD 600.
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, run simulation, reset input is open). 6 = Tripped. 7 = Programming mode. 8 = Jog forward. 9 = Jog reverse.
		5	1 = Warning.
		6	0 = Uninitialized. 1 = Initialized.
		7	Command source: 0 = Network, timer. 1 = Remote LCP, digital input, clock.
		8	Reserved.
		9	0 = Negative phase sequence. 1 = Positive phase sequence.
		10–15	Reserved.
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	Reserved		

Byte	Description	Bits	Details
28–29	% Power factor	0–7	100% = power factor of 1.
		8–15	Reserved.
30–31	Voltage	0–13	Average rms voltage across all 3 phases.
		14–15	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	Voltage	0–13	Phase 1 voltage (rms).
		14–15	Reserved.
40–41	Voltage	0–13	Phase 2 voltage (rms).
		14–15	Reserved.
42–43	Voltage	0–13	Phase 3 voltage (rms).
		14–15	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/stop.
		1	Reserved.
		2	Reset[0].
		3	Input A.
		4	Input B.
		5–15	Reserved.
48–49	Trip code	0–15	See the chapter *Trip Codes*.
50–59	Reserved		
60–63	Parameter management		See the chapter *Parameter Management*.

6.4 Parameter Management

The PROFINET Card 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 600 Operating Guide for details of the soft starter parameters.

⚠ C A U T I O N ⚠

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.

6.4.1 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

6.4.2 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 = Invalied parameter value
	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

6.5 Trip Codes

Code	Description
255	No trip
1	Excess start time
2	Motor overload
3	Motor thermistor
4	Current imbalance

Code	Description
5	Frequency
6	Phase sequence
7	Overcurrent
8	Power loss
9	Undercurrent
10	Heat sink overtemperature
11	Motor connection
12	Input A trip
13	FLC too high
14	Unsupported option (function not available in inside delta)
15	Communications card fault
16	Network communication
18	Overvoltage
19	Undervoltage
23	Parameter out of range
24	Input B trip
26	L1 phase loss
27	L2 phase loss
28	L3 phase loss
29	L1-T1 shorted
30	L2-T2 shorted
31	L3-T3 shorted
33	Time-overcurrent (bypass overload)
34	SCR overtemperature
35	Battery/clock
36	Thermistor circuit
47	Overpower
48	Underpower
56	LCP disconnected
57	Zero speed detect
58	SCR Itsm
59	Instantaneous overcurrent

Code	Description
60	Rating capacity
70	Current Read Err L1
71	Current Read Err L2
72	Current Read Err L3
74	Motor connection T1
75	Motor connection T2
76	Motor connection T3
77	Firing fail P1
78	Firing fail P2
79	Firing fail P3
80	VZC fail P1
81	VZC fail P2
82	VZC fail P3
83	Low control volts
84–96	Internal fault x. Contact the local supplier with the fault code (x).

6.6 Examples

6.6.1 Control Commands (Controller to Device)

Table 7: Start the Motor Using Parameter Set 1

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
4	1						

Table 8: Start the Motor, Select via Remote Input

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0	1						

Table 9: Stop the Motor Using the Programmed Soft Stop for Motor Set 2

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
8	0						

Table 10: Quick Stop the Motor

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
16	0						

Table 11: Reset a Trip

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
≤28	8						

6.6.2 Status Information (Device to Controller)

Table 12: Read Control Status - Ready

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0	1						

Table 13: Read Control Status - Running

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		3	0				

Table 14: Read Control Status - Trip Code 4 (Current Imbalance)

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		6	0	4	0		

6.6.3 Parameter Management

Table 15: Write Parameter to Soft Starter: Parameter Number 2, 1-2 Motor Full Load Current = 55

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		2	4	55	0		

Table 16: Parameter Write Response

Byte 56	Byte 57	Byte 58	Byte 59	Byte 60	Byte 61	Byte 62	Byte 63
				2	0	55	0

Table 17: Read Parameter Number 16, 2-9 Stop Mode

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		16	2	0	0		

Table 18: Parameter Read Response: Parameter 2-9 Stop Mode = 1 (TVR Soft Stop)

Byte 56	Byte 57	Byte 58	Byte 59	Byte 60	Byte 61	Byte 62	Byte 63
				16	0	1	0

7 Network Design

7.1 Star Topology

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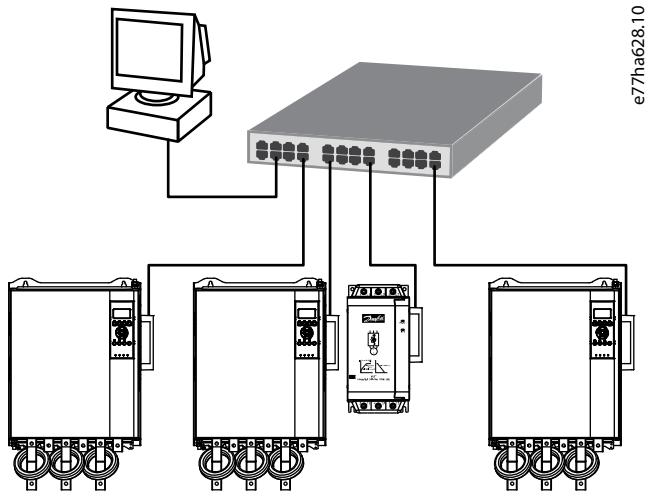

Illustration 2: Example of Star Topology

7.2 Line Topology

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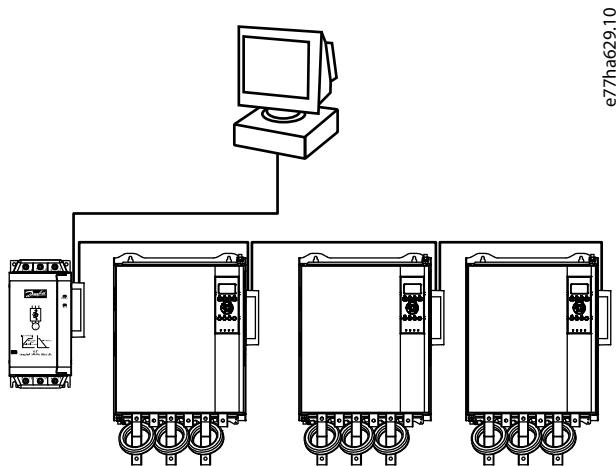

Illustration 3: Example of Line Topology

N O T I C E

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.

N O T I C E

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

<div style="border:1px solid #000; padding:10px;">

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.

</div>

7.3 Ring Topology

In a ring topology network, the controller connects to the 1st card via a network switch. The 2nd Ethernet port of the card connects to another device, which in turn connects to another device until all devices are connected. The final device connects back to the switch.
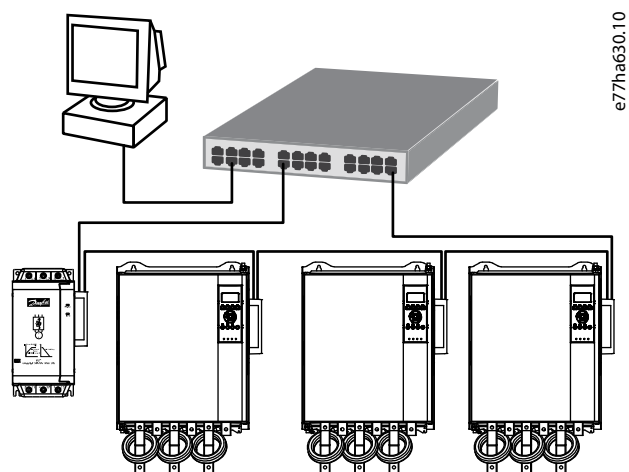
The device supports beacon-based ring node configuration.

Illustration 4: Example of Ring Topology

<div style="border:1px solid #000; padding:10px;">

N O T I C E

The network switch must support loss of line detection.

</div>

7.4 Combined Topologies

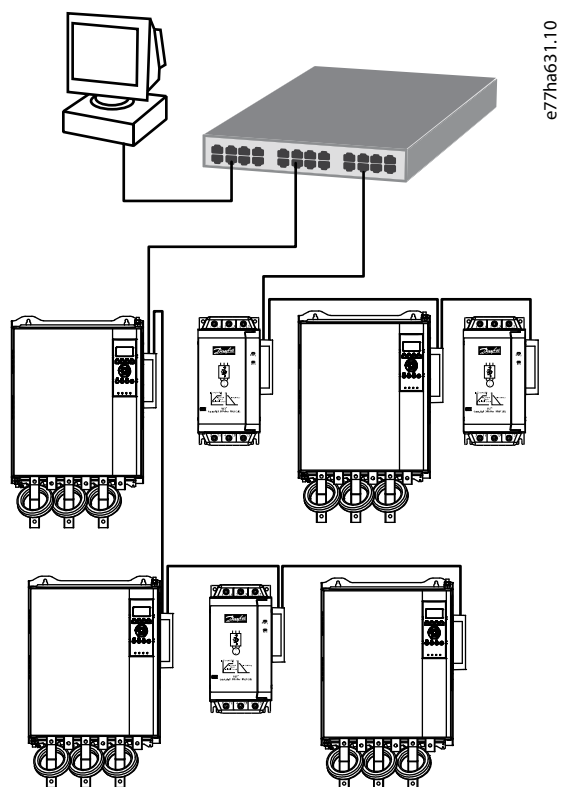A single network can include both star and line components.

Illustration 5: Example of Combined Topologies

8 Specifications

8.1 Connections

Soft starter	16-way pin assembly
Contacts	Gold flash
Network	RJ45

8.2 Settings

IP address	Automatically assigned
Device name	Automatically assigned, configurable

8.3 Network

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

8.4 Power

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

8.5 Certification

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

ENGINEERING
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