ENGINEERING TOMORROW

Installation Guide
PROFINET Module

VLT® Compact Starter MCD 201/MCD 202
VLT® Soft Starter MCD 500

vlt-drives.danfoss.com

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1 Introduction

1.1 Purpose of the Manual

This installation guide provides information for the installation of the PROFINET Module for VLT® Compact Starter MCD 201/MCD 202 and VLT® Soft Starter MCD 500. The installation guide is intended for use by qualified personnel.

Users are assumed to be familiar with:

- VLT® soft starters.

- Ethernet protocols.

- PC or PLC that is used as a master in the system.

Read the instructions before installation and ensure that the instructions for safe installation are observed.

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1.2 Additional Resources

Resources available for the soft starter and optional equipment:

- The *VLT® Compact Starter MCD 200 Operating Instructions* provide the necessary information for getting the soft starter up and running.

- The *VLT® Soft Starter MCD 500 Operating Guide* provides the necessary information for getting the soft starter up and running.

Supplementary publications and manuals are available from Danfoss. See *drives.danfoss.com/knowledge-center/technical-documentation/* for listings.

1.3 Product Overview

1.3.1 Intended Use

This installation guide relates to PROFINET Module for VLT® soft starters, ordering number 175G9905.

The PROFINET Module is intended for use with:

- VLT® Compact Starter MCD 201/MCD 202, 24 V AC/V DC and 110/240 V AC control voltage.

- VLT® Soft Starter MCD 500, all models.

NOTICE

The PROFINET Module is NOT suitable for use with the MCD 201/MCD 202 compact starters using 380/440 V AC control voltage.

The PROFINET Module allows a Danfoss 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. If there are difficulties when using this device with third-party products, including PLCs, scanners, and commissioning tools, contact the relevant supplier.

1.4 Approvals and Certifications

More approvals and certifications are available. For more information, contact a local Danfoss partner.

1.5 Disposal

	Do not dispose of equipment containing electrical components together with domestic waste. Collect it separately in accordance with local and currently valid legislation.

1.6 Symbols, Abbreviations, and Conventions

Abbreviation	Definition
DHCP	Dynamic host configuration protocol
EMC	Electromagnetic compatibility
IP	Internet protocol
LCP	Local control panel
LED	Light-emitting diode
LOP	Local operation panel
PC	Personal computer
PLC	Programmable logic controller

Table 1.1 Symbols and Abbreviations

Conventions
Numbered lists indicate procedures.
Bullet lists indicate other information and description of illustrations.

Italicized text indicates:

- Cross-reference.

- Link.

- Parameter name.

- Parameter group name.

- Parameter option.

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2 Safety

The following symbols are used in this manual:

⚠WARNING

Indicates a potentially hazardous situation that could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. It can also be used to alert against unsafe practices.

NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

2.1 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the soft starter. Only qualified personnel are allowed to install or operate this equipment.

Qualified personnel are defined as trained staff, who are authorized to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Also, the qualified personnel must be familiar with the instructions and safety measures described in this installation guide.

2.2 General Warnings

⚠WARNING

ELECTRICAL SHOCK HAZARD

VLT® Soft Starter MCD 500 contains dangerous voltages when connected to mains voltage. Only a qualified electrician should carry out the electrical installation. Improper installation of the motor or the soft starter can cause death, serious injury, or equipment failure. Follow the guidelines in this manual and local electrical safety codes.
Models MCD5-0360C ~ MCD5-1600C:
Treat the busbar and heat sink as live parts whenever the unit has mains voltage connected (including when the soft starter is tripped or waiting for a command).

⚠WARNING

PROPER GROUNDING

Disconnect the soft starter from mains voltage before carrying out repair work.
It is the responsibility of the person installing the soft starter to provide proper grounding and branch circuit protection according to local electrical safety codes.
Do not connect power factor correction capacitors to the output of the VLT® Soft Starter MCD 500. If static power factor correction is employed, it must be connected to the supply side of the soft starter.

⚠WARNING

IMMEDIATE START

In auto-on mode, the motor can be controlled remotely (via remote inputs) while the soft starter is connected to mains.
MCD5-0021B ~ MCD5-0961B:
Transportation, mechanical shock, or rough handling may cause the bypass contactor to latch into the On state.

To prevent the motor from starting immediately on first commissioning or operation after transportation:
- Always ensure that the control supply is applied before the power.

- Applying control supply before power ensures that the contactor state is initialized.

⚠WARNING

UNINTENDED START

When the soft starter is connected to AC mains, DC supply, or load sharing, the motor can start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The motor can start with an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 Set-up Software, or after a cleared fault condition.

To prevent unintended motor start:
- Press [Off]/[Reset] on the LCP before programming parameters.

- Disconnect the soft starter from mains.

- Completely wire and assemble the soft starter, motor, and any driven equipment before connecting the soft starter to AC mains, DC supply, or load sharing.

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⚠WARNING

SAFETY OF PERSONNEL

The soft starter is not a safety device and does not provide electrical isolation or disconnection from the supply.

- **If isolation is required, the soft starter must be installed with a main contactor.**

- **Do not rely on the start and stop functions for safety of personnel. Faults occurring in the mains supply, the motor connection, or the electronics of the soft starter can cause unintended motor starts or stops.**

- **If faults occur in the electronics of the soft starter, a stopped motor may start. A temporary fault in the supply mains or loss of motor connection can also cause a stopped motor to start.**

To provide safety of personnel and equipment, control the isolation device through an external safety system.

NOTICE

Before changing any parameter settings, save the current parameter to a file using MCD PC Software or the *Save User Set* function.

NOTICE

Use the *autostart* feature with caution. Read all the notes related to *autostart* before operation.

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.

3 Installation

3.1 Installation Procedure

⚠CAUTION

EQUIPMENT DAMAGE

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

To avoid damage:
- **Remove mains and control voltage from the soft starter before attaching or removing options/accessories.**

Installing the PROFINET Module:
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 communication port slot (B).

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

5. Connect Ethernet port 1 or port 2 on the PROFINET Module to the network.

6. Apply control power to the soft starter.
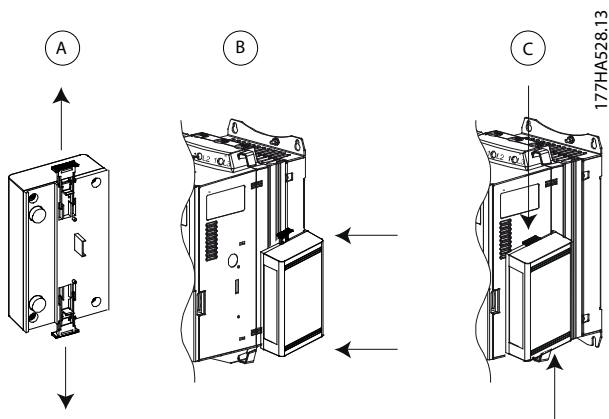

Illustration 3.1 Installing the PROFINET Module

Remove the module from the soft starter:
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).

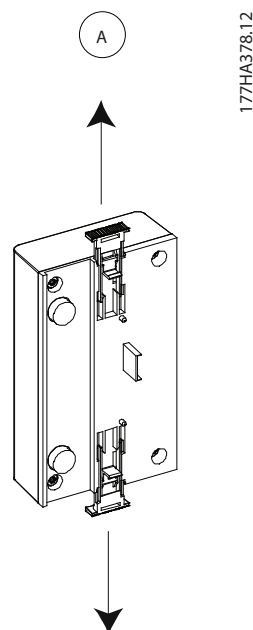4. Pull the module away from the soft starter.

Illustration 3.2 Removing the PROFINET Module

4 Connection

4.1 Soft Starter Connection

The device is powered from the soft starter.

VLT® Compact Starter MCD 201/MCD 202
For the PROFINET Module to accept fieldbus commands, fit a link across terminals A1–N2 on the soft starter.

VLT® Soft Starter MCD 500
If the MCD 500 has to be operated in auto-on mode, input links are required across terminals 17 and 25 to terminal 18. In hand-on mode, links are not required.

PROFINET Module connections

NOTICE

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

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MCD 201/202		MCD 500	
1	A1, N2: Stop input	1	(Auto-on mode)
			17, 18: Stop input
			25, 18: Reset input
2	PROFINET Module	2	PROFINET Module
3	RJ45 Ethernet ports	3	RJ45 Ethernet ports

Table 4.1 Connection Diagrams

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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.
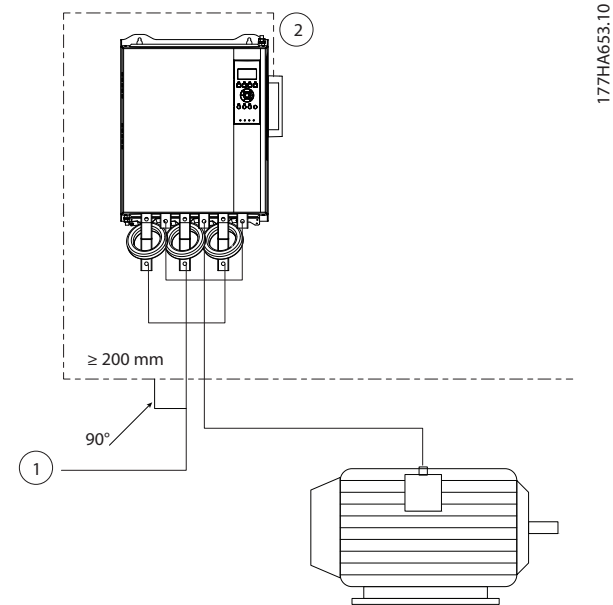
4.2.2 Cables

Suitable cables for PROFINET Module connection:
- 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).

The Ethernet cable must cross the motor and mains cables at an angle of 90°.

| 1 | 3-phase supply |
| 2 | Ethernet cable |

Illustration 4.1 Correct Running of Ethernet Cables

4.2.4 Network Establishment

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

4.3 Communication Protocols

LC-RPC	Connectionless remote procedure call
DCP	Discovery and configuration protocol
LLDP	Link layer discovery protocol
MRP	Media redundancy protocol
RTC	Real-time cyclic protocol; Class 1 and 2 (unsynchronized), Class 3 (synchronized)
SNMP	Simple network management protocol

Table 4.2 PROFINET-supported Protocols

| DHCP	Dynamic host configuration protocol
MCR	Multicast communication relation
RTA	Real-time acyclic protocol
Flexible RT_CLASS_2	Real-time cyclic protocol; Class 2 synchronized
RT_CLASS_UDP	Unsynchronized cross-subnet communication between different subnets

Table 4.3 Protocols not Supported by PROFINET

The maximum data length for input and output data is 256 bytes each.

4.4 Addressing

Each device in a network is addressed using a MAC address and an IP address and can be assigned a symbolic name associated with the MAC address.

- The module must be assigned a static IP address (see *chapter 5.1 Ethernet Device Configuration Tool*) or can be assigned an IP address by the master via DCP. The PROFINET Module does not support DHCP addressing.

- The symbolic name is optional and must be configured within the device.

- The MAC address is fixed within the device and is printed on a label on the front of the module.
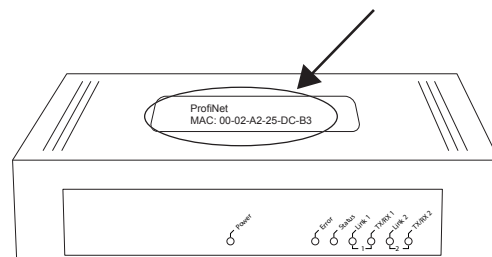
Illustration 4.2 MAC ID Location

5 Device Configuration

To configure attributes permanently in the PROFINET Module, use the Ethernet Device Configuration Tool and untick *Store settings temporary*.

NOTICE

The Error LED flashes whenever the device is receiving power but is not connected to a network. The Error LED flashes throughout the configuration process.

5.1 Ethernet Device Configuration Tool

Downloading the tool:

1. Go to *drives.danfoss.com/downloads/pc-tools/* to find the tool.

2. Make sure to have administrator privileges on the PC before starting the installation.

3. Accept the End-User License Agreement.

4. Click *Yes* on the User account control dialog box.

Configuring the device using the Ethernet Device Configuration Tool:

1. Attach the module to a soft starter.

2. Connect Ethernet port 1 or port 2 on the module to the network.

3. Apply control power to the soft starter.

4. Start the Ethernet Device Configuration Tool.

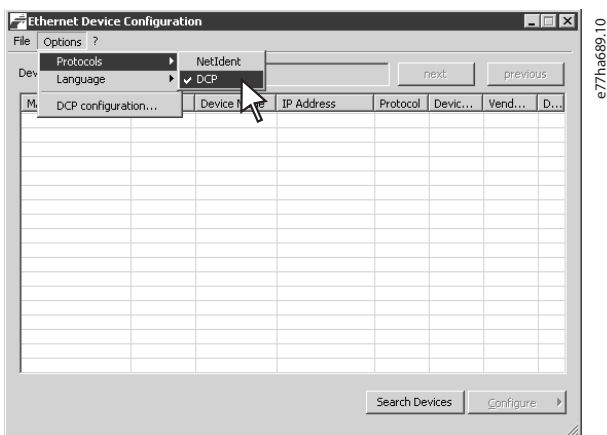5. In *Options* ⇒ *Protocols*, select *DCP* and deselect *NetIdent*.

Illustration 5.1 Starting the Tool

6. Click *Search Devices*.

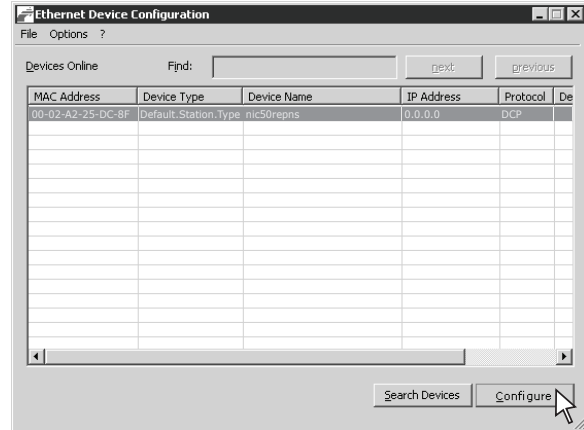   6a   The software searches for connected devices.

Illustration 5.2 The Tool Shows the Connected Devices

7. To set a static IP address, click *Configure* and select *Set IP Address*.

NOTICE

To configure attributes permanently, untick *Store settings temporary*.
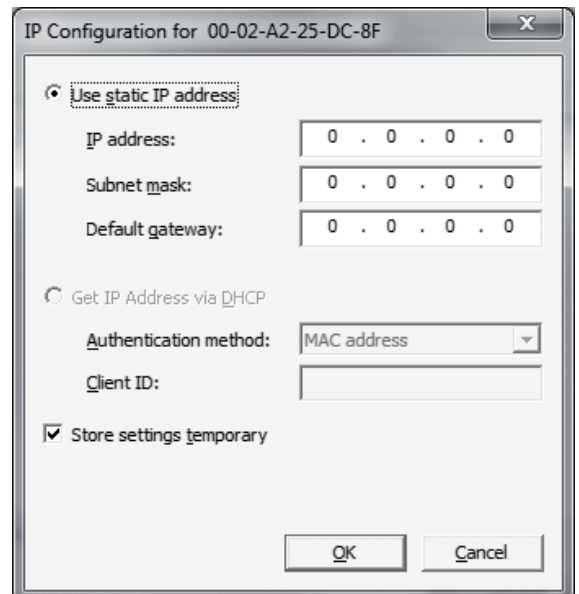

Illustration 5.3 Setting a Static IP Address

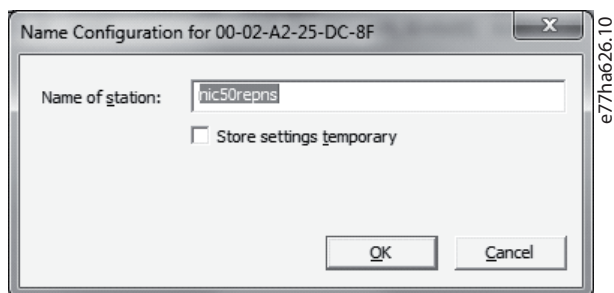8.   To configure a device name, click *Configure*, then select *Device Name*.

Illustration 5.4 Configuring a Device Name

6 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.

6.1 Device Classification

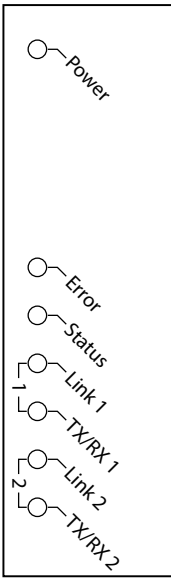The PROFINET Module is a PROFINET IO device managed by an IO controller over Ethernet.

6.2 Master Configuration

Import the latest GSDML file into the master configuration tool. The file is available from *drives.danfoss.com/services/pc-tools*.

If the master uses on-screen icons, 2 graphic bitmaps files are available from the website. SSPM_N.bmp indicates normal mode. SSPM_D.bmp indicates diagnostic mode.

6.3 LEDs

	LED name	LED status	Description
	Power	Off	The module is not powered up.
		On	The module receives power.
	Error	Off	No error.
		Flashing	No data exchange.
		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	Invalid controller.
		On	Transmitting or receiving data.

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Power
Error
Status
Link 1
TX/RX 1
Link 2
TX/RX 2

Table 6.1 Feedback LEDs

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7 Packet Structures

7.1 Ensuring Safe and Successful Control

Data written to the PROFINET Module remains in its register until the data is overwritten or the module is reinitialized. The PROFINET Module does not transfer successive duplicate commands to the soft starter.

- If the soft starter is started via fieldbus communication 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 is controlled via the LCP or the remote inputs (and via fieldbus communications), a control command should be immediately followed by a status query to confirm that the command has been actioned.

NOTICE

Functions available only in VLT® Soft Starter MCD 500:

- **Parameter management.**
- **Dual motor control.**
- **Digital inputs.**
- **Jog.**
- **Current measurement in amperes.**
- **Power information.**
- **Warnings.**

NOTICE

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

7.2 Control Commands (Write Only)

Use the following structures to send a control command to the soft starter:

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.
		4 = *Reserved.*
	4	0 = Stop action is a soft stop (as selected on the soft starter).
		1 = Stop action is a quick stop (coast to stop).
	5–7	*Reserved.*
1	0	0 = Stop
		1 = Start
	1–2	*Reserved.*
	3	1 = Reset.
	4–7	*Reserved.*

Table 7.1 Control I/O Data Structure

7.3 Status Commands (Read Only)

Soft starter status information is always available when the device is connected to a soft starter.

NOTICE

For models MCD5-0053B and smaller (soft starter model ID 1–4), the current reported via communication registers is 10 times greater than the actual value.

7.3.1 Bytes 0–1: Control Status

Bits	Details
0–5	Motor current (%FLC).
6	Command source
	0 = Hand On.
	1 = Auto On.
7	1 = Ramping (starting or stopping).
8	1 = Ready.
9	1 = Starting, running, or stopping.
10	1 = Tripped.
11	1 = Warning.
12–15	*Reserved.*

Table 7.2 Description of Bytes 0–1

7.3.2 Bytes 2–3: Starter State

Bits	Details
0–3	The decimal value of bits 0–3 indicates the soft starter's state: 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.

Table 7.3 Description of Bytes 2–3

7.3.3 Bytes 4–5: Trip Code

Bits	Details
0–15	See chapter 7.5 Trip Codes.

Table 7.4 Description of Bytes 4–5

7.3.4 Bytes 6–7: Motor Current

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

Table 7.5 Motor Current

7.3.5 Bytes 8–9: Motor Temperature

Bits	Details
0–15	Motor 1 thermal model (%).

Table 7.6 Description of Bytes 8–9

7.3.6 Bytes 10–59: Extended Information

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	Device details		

Byte	Description	Bits	Details
14–15	Reserved		
16–17	Reserved		
18–19	Soft 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 = Hand On. 1 = Auto On.
		8	Reserved.
		9	0 = Negative phase sequence. 1 = Positive phase sequence.
		10–15	See chapter 7.5 Trip Codes.
20–21	Current	0–13	Average current across all 3 phases.
		14–15	Reserved.
22–23	Current	0–9	Current (% of FLC).
		10–15	Reserved.
24–25	Motor temperature	0–7	Motor 1 thermal mode (%).
		8–15	Motor 2 thermal mode (%).
26–27	Power[1]	0–11	Power.
		12–13	Power scale.
		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	0–15	For all inputs, 0 = open, 1 = closed (short-circuited). 0 = Start. 1 = Stop. 2 = Reset. 3 = Input A. 4–15 = Reserved.
48–49	Trip code	0–15	See chapter 7.5 Trip Codes.

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Byte	Description	Bits	Details
50–59	*Reserved*		

Table 7.7 Description of Bytes 10–59

1) Power scale functions as follows:

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.

7.4 Parameter Management (Read/Write)

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

The device references parameters according to their position in the soft starter's parameter list.

- Parameter number 1 corresponds to *parameter 1-1 Motor Full Load Current*.

- The VLT® Soft Starter MCD 500 has 112 parameters. Parameter 112 corresponds to *parameter 20-6 Pedestal Detect*.

⚠CAUTION

UNPREDICTABLE BEHAVIOR

Changing the values in *parameter group 20- Factory Parameters* may cause unpredictable behavior in the soft starter.**

- **Do not change the default values of the parameters in *parameter group 20-** Factory Parameters*.**

7.4.1 Output

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

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 soft starter/zero data values for read.
5	0–7	High byte parameter value to write to soft starter/ zero data values for read.

Table 7.8 Structure of Master to Slave Output Bytes

7.4.2 Input

Parameter management data from the soft starter is reported in input bytes 60–53.

Byte	Bits	Details
60	0–7	Echo parameter number.
61	0	1 = Invalid parameter number.
	1	1 = Invalid parameter value.
	2–7	*Reserved.*
62	0–7	Low byte parameter value read from the soft starter.
63	0–7	High byte parameter value read from the soft starter.

Table 7.9 Structure of Master to Slave Input Bytes

7.5 Trip Codes

Trip codes are reported in registers 30241 and 30254 (*standard mode*) and register 40604 (*legacy mode*).

Trip code	Description	MCD 201	MCD 202	MCD 500
0	No trip	✓	✓	✓
1	Excess start time		✓	✓
2	Motor overload		✓	✓
3	Motor thermistor		✓	✓
4	Current imbalance		✓	✓
5	Frequency	✓	✓	✓
6	Phase sequence		✓	✓
7	Instantaneous 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	Soft starter communication (between device and soft starter)	✓	✓	✓
16	Network communication (between device and soft starter)	✓	✓	✓
17	Internal fault x (where x is the fault code detailed in *Table 7.11*)			✓
23	Parameter out of range			✓
25	Bypass fail (bypass contactor)			✓
26	L1 phase loss			✓
27	L2 phase loss			✓
28	L3 phase loss			✓
29	L1-T1 short-circuited			✓

Trip code	Description	MCD 201	MCD 202	MCD 500
30	L2-T2 short-circuited			✓
31	L3-T3 short-circuited			✓
33[1)]	Time-overcurrent (bypass overload)		✓	✓
35	Battery/clock			✓
36	Thermistor circuit			✓

Table 7.10 Trip Codes

1) For MCD 500, time-overcurrent protection is only available on internally bypassed models.

7.5.1 Internal Fault X

Internal fault	Message shown on the LCP
70–72	Current Read Err Lx
73	ATTENTION! Remove Mains Volts
74–76	Motor Connection Tx
77–79	Firing Fail Px
80–82	VZC Fail Px
83	Low Control Volts
84–98	Internal fault x Contact the local supplier with the fault code (X).

Table 7.11 Internal Fault Code Associated with Trip Code 17

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8 Network Design

The device supports star, line, and ring topologies.

8.1 Star Topology

In a star network, all controllers and devices connect to a central network switch.
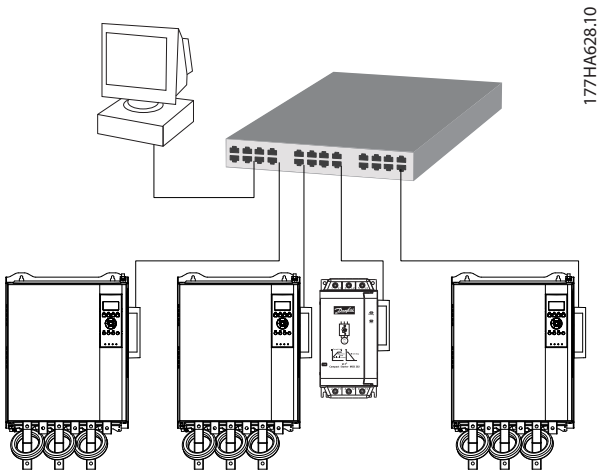
Illustration 8.1 Star Network Topology

8.2 Line Topology

In a line network, the controller connects directly to 1 port of the 1st module. The 2nd Ethernet port connects to another module, which in turn connects to another device until all devices are connected.
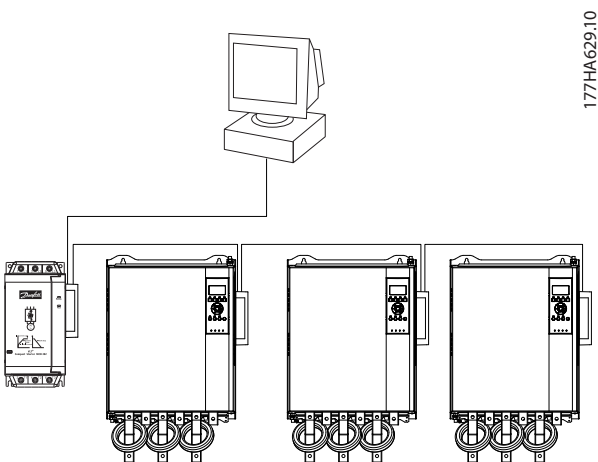
Illustration 8.2 Line Network Topology

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 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 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.
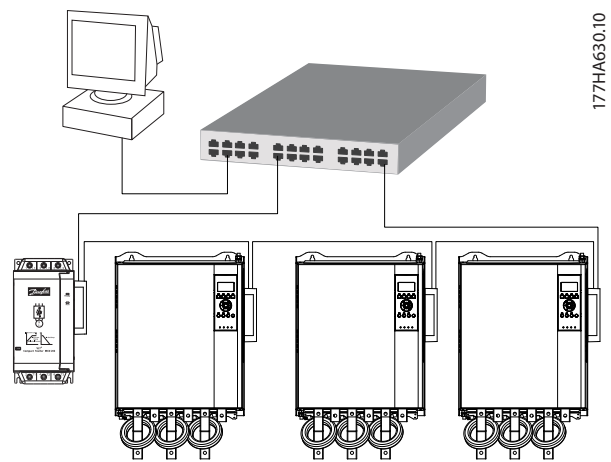
Illustration 8.3 Ring Network Topology

NOTICE

The network switch must support loss of line detection.

8.4 Combined Topologies

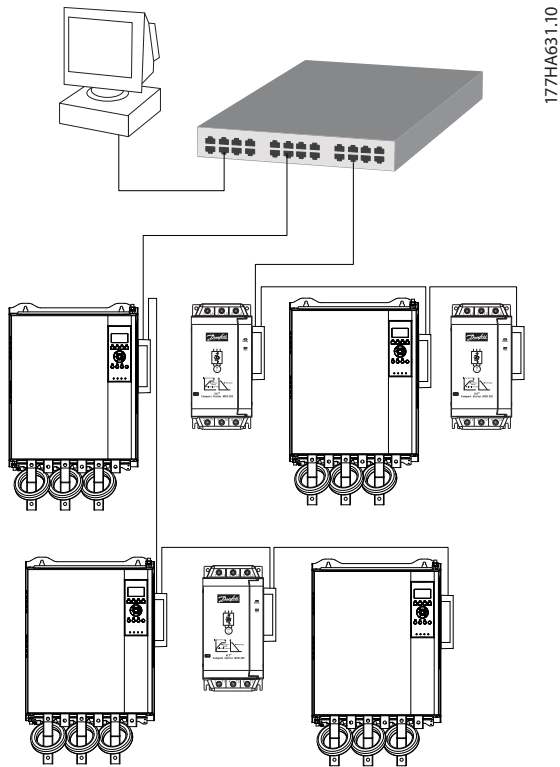A single network can include both star and line components.

Illustration 8.4 Combined Star/Line Network Topology

9 Specifications

Enclosure	
Dimensions, W x H x D [mm (in)]	40 x 166 x 90 (1.6 x 6.5 x 3.5)
Weight	250 g (8.8 Oz)
Protection	IP20

Mounting	
Spring-action plastic mounting clips	2

Connections	
Soft starter	6-way pin assembly
Contacts	Gold flash
Networks	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 at 24 V DC
Reverse polarity protected	
Galvanically isolated	

Certification	
CE	IEC 60947-4-2
RCM	IEC 60947-4-2

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