**RIGHT FROM THE START**

**AuCom**
MOTOR CONTROL SPECIALISTS

# Contents

# Compatibility

This manual is suitable for:

- CSX – 24 VAC/VDC and 110/240 VAC control voltage.
  **The Profinet Interface is not suitable for use with CSX starters using 380/440 VAC control voltage.**
- EMX3 – all models
- MV – all models

The available features may vary according to the model and version of the starter.

This manual is suitable for use with PIM-PN-02. The part number is printed on a label on the front of the device. For PIM-PN-01, the manual is available from your local supplier.

# Disclaimer

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

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

# 1. Warnings

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

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

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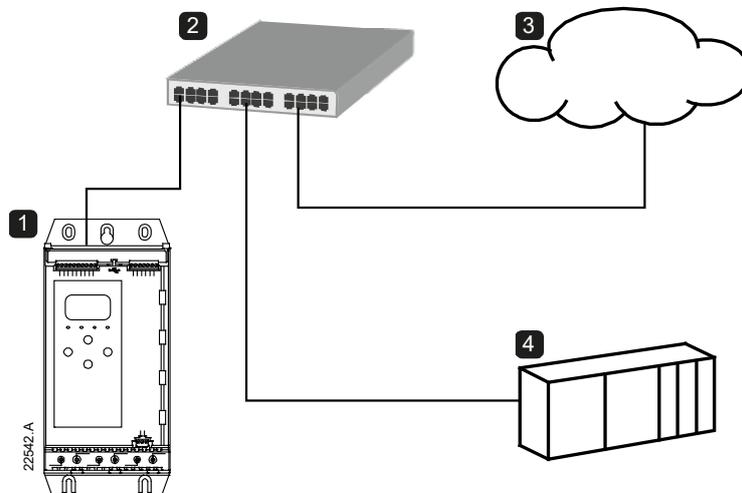
# 2. Introduction

## 2.1 Product design

The Profinet Interface allows the soft starter to connect to an Ethernet network and be controlled or monitored using an Ethernet communication model.

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

## 2.2 Communication protocols

The Profinet Interface supports the following protocols:

| Profinet | Industrial ethernet via Profinet |
|---|---|
| MQTT | Message Queue Telemetry Transport |
| OPC UA | Open Platform Communications Unified Architecture |



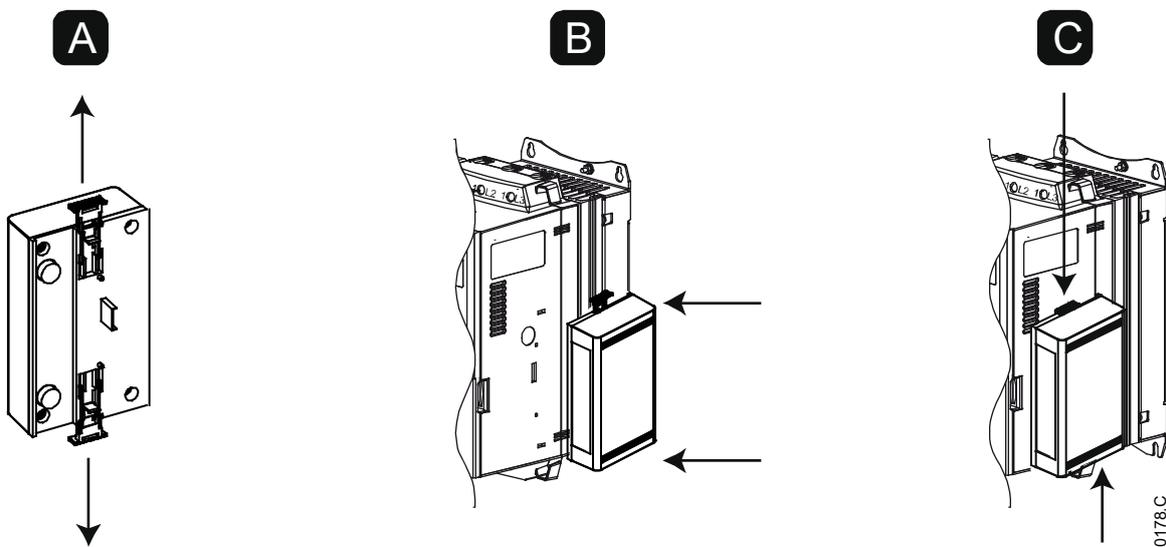| 1 | Soft starter |
|---|---|
| 2 | Network switch |
| 3 | IoT connection (MQTT/OPC UA) |
| 4 | Industrial ethernet connection to programmable logic controller |

# 3. Installation

⚠️ **CAUTION**

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

## 3.1 Installation procedure

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

### CSX and EMX3



### MV

Plug the interface onto the back of the controller.
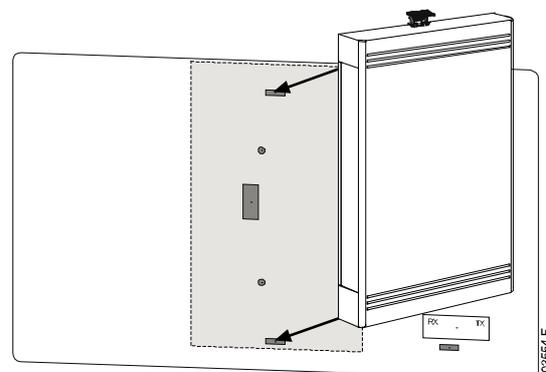
## 3.2   Remove the module

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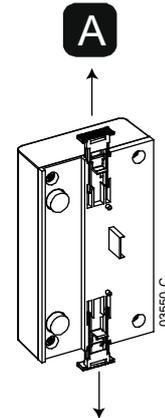2. Disconnect all external wiring from the interface.
3. Fully pull out the top and bottom retaining clips on the interface. [A]
4. Pull the interface away from the soft starter.



## 3.3   Soft starter connection

The device is powered from the soft starter.

**The Profinet Interface is not suitable for use with CSX starters using 380/440 VAC control voltage.**

| CSX | EMX3 or MV |
|---|---|
|  |  |

| 1 | Soft starter<br><br>A1, 02: Stop input | 1 | Soft starter (remote mode)<br><br>C31, C32: Stop input<br><br>C41, C42: Reset input |
|---|---|---|---|
| 2 | Profinet Interface | 2 | Profinet Interface |
| 3 | RJ45 Ethernet ports | 3 | RJ45 Ethernet ports |

## 3.4   Network connection

### Ethernet ports

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

### Cables

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

**EMC precautions**

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

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

## 3.5   Network establishment

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

## 3.6   Addressing

Each device in a network is addressed using a MAC address and a device name. 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 Configure the device name

Use the Ethernet Device Configuration Tool to configure the device name. The Ethernet Device Configuration Tool is available from your local supplier.

To identify the device using the Ethernet Device Configuration Tool:

1. Attach the 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 on Search Devices. The software will search for connected devices.
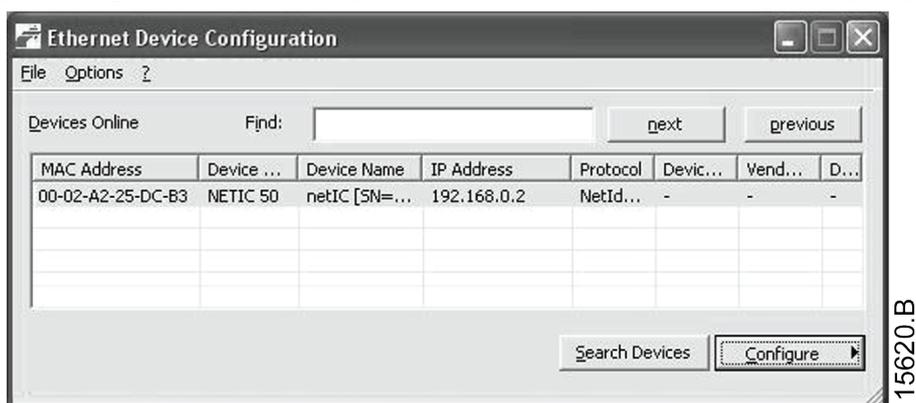


6. To configure a device name, click Configure then select Device Name.
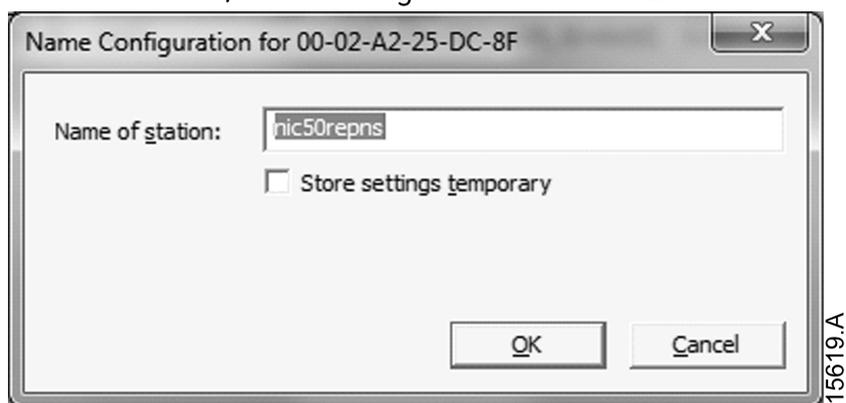


📄 **NOTE**
The Error LED is on if the device is not configured. If the device is configured but is not passing I/O data, the Error LED will flash. The Error LED will be active during the configuration process.

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

## 4.2 On-board web server

Other settings in the Profinet Interface can be configured via the device's web server.

### Connect to the device

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

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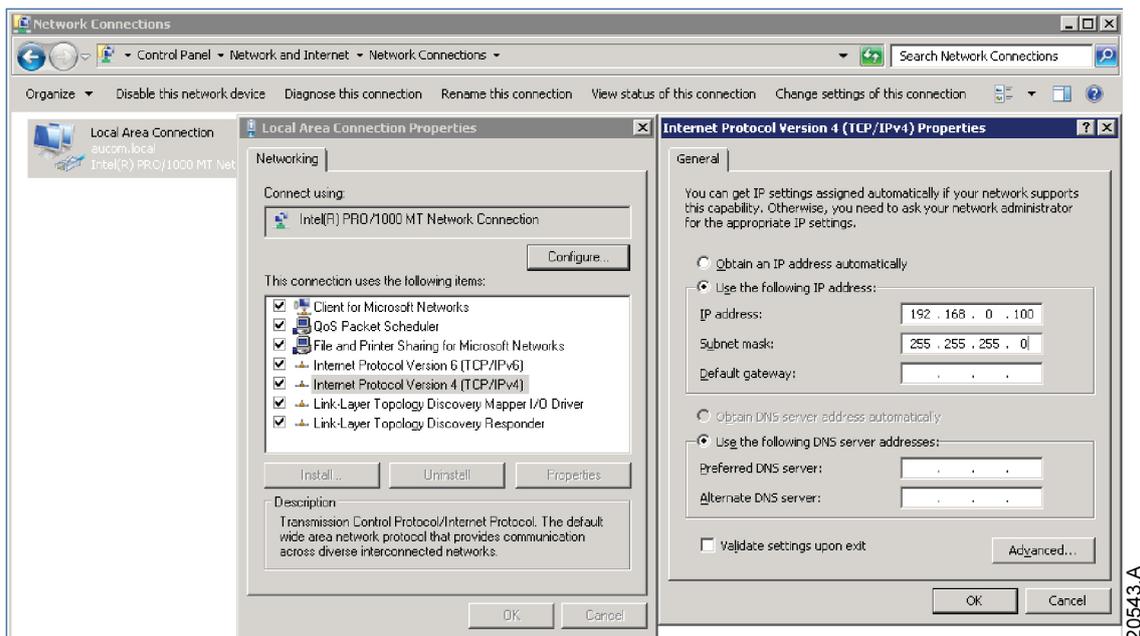


Once connected, the web server reports basic information about the device and the soft starter.
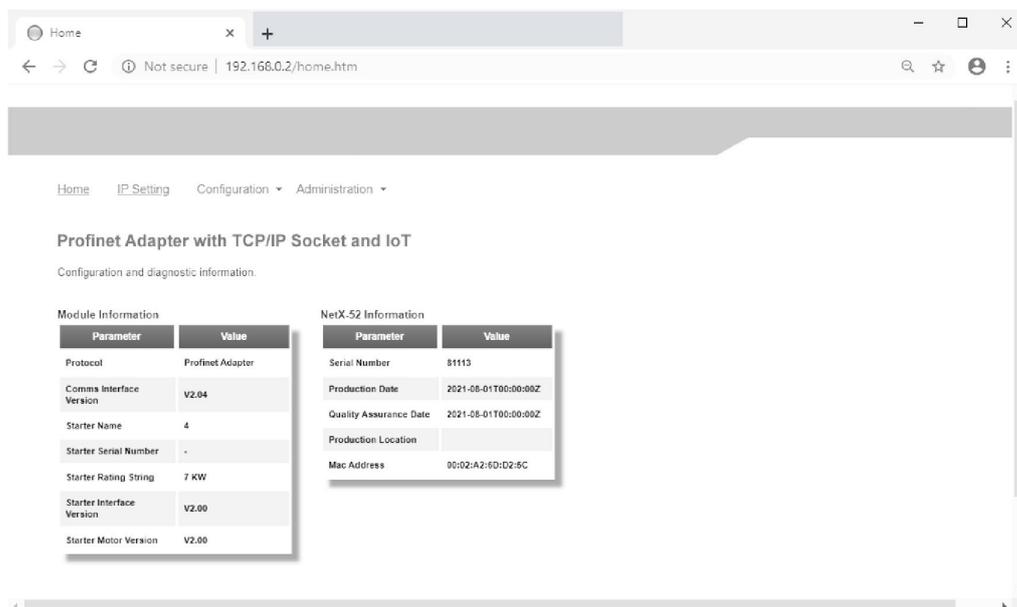
## Manage users and passwords

The Profinet Interface supports multiple users and levels of privilege.

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

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

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

To add a new user:

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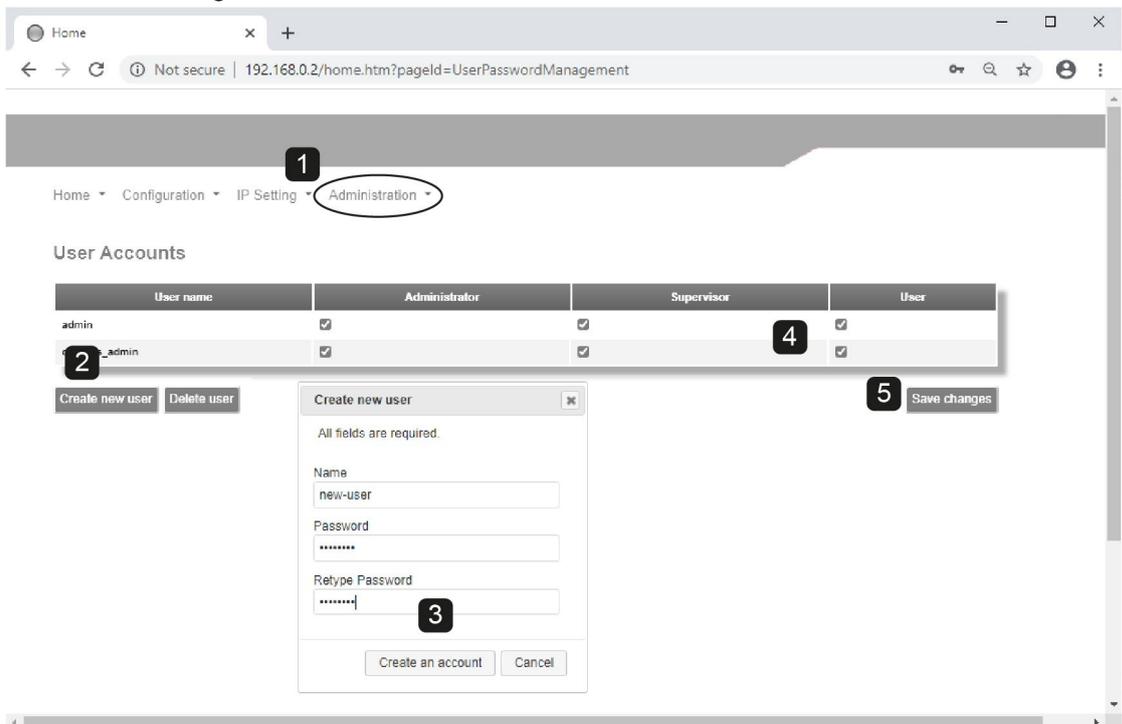


To delete a user:

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

## Configure IoT settings

The Profinet Interface supports soft starter status monitoring over IoT. The device cannot control or program the soft starter.

- **Configure MQTT settings**

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



- **Configure OPC UA settings**

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

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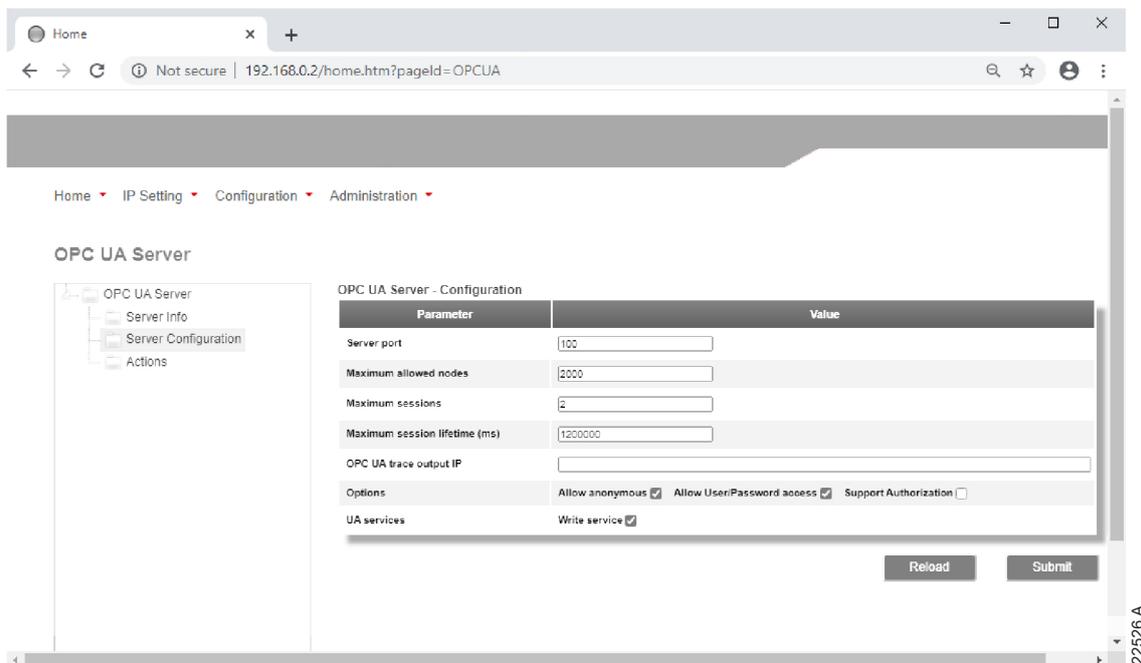
# 5. Master configuration

Import the latest GSDML file into your Master configuration tool. This file is available from your supplier.

If your Master uses on-screen icons, two graphic bitmap files are available from the website. SSPM_N.bmp indicates normal mode. SSPM_D.bmp indicates diagnostic mode.

# 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 document.

## 6.1 Device classification

The Profinet Interface is a Profinet IO-Device and must be managed by an IO-Controller over Ethernet.

## 6.2 Enabling network control

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

EMX3 and MV: Input links are required across the stop and reset inputs if the soft starter is being operated in Remote mode. In Local 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 6R *Comms in Remote*). Refer to the soft starter user manual for parameter details.

## 6.3 Ensuring safe and successful control

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

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

## 6.4 Feedback LEDs
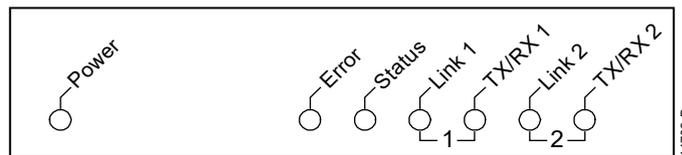


| LED name | LED state | Description |
| --- | --- | --- |
| Power | Off | Device is not powered up. |
| | On | Device is receiving power. |
| Error | Off | No error. |
| | Flashing | Connection not established. |
| | On | No physical link or slow physical link. No configuration. |
| Status | Off | No 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. |

# 7. Packet structures

📄 **NOTE**
Some soft starters do not support some functions.

## 7.1 Control commands (controller to device)

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

| Byte | Bits | Details |
|------|------|---------|
| 0 | 0 to 1 | *Reserved* |
| | 2 to 3 | 0 = Use soft starter remote input to select motor set<br>1 = Use primary motor set when starting<br>2 = Use secondary motor set when starting<br>3 = *Reserved* |
| | 4 | 0 = stop action will be as selected in the soft starter<br>1 = stop action will be a coast to stop |
| | 5 to 7 | *Reserved* |
| 1 | 0 | 0 = Stop<br>1 = Start |
| | 1 to 2 | *Reserved* |
| | 3 | 1 = Reset |
| | 4 to 7 | *Reserved* |
| 2 to 5 | | Parameter management (refer to *Parameter management* on page 16) |

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

## 7.2 Status information (device to controller)

Starter status information is always available when the device is active.

For models EMX3-0053B and smaller, current reported via communications is 10 times greater than the actual value (displayed on the keypad).

**Bytes 0-1: Control status**

| Bits | Details |
|------|---------|
| 0 to 5 | Current (% motor FLC) |
| 6 | Local/Remote<br>0 = Remote control (Network)<br>1 = Local control (Keypad, Digital Input) |
| 7 | 1 = Ramping (starting or stopping) |
| 8 | 1 = Ready |
| 9 | 1 = Starting, running or stopping |
| 10 | 1 = Tripped |

| Bits | Details |
|---|---|
| 11 | 1 = Warning |
| 12 to 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.

### Bytes 2-3: Starter state

| Bits | Details |
|---|---|
| 0 to 3 | The decimal value of bits 0~3 indicates the starter's state: <br> 0 = Communication error between device and soft starter <br> 1 = Ready <br> 2 = Starting <br> 3 = Running <br> 4 = Stopping <br> 5 = Not ready (restart delay, restart temperature check, run simulation) <br> 6 = Tripped <br> 7 = Menu open (cannot start) <br> 8 = Jog forward <br> 9 = Jog reverse |
| 4 | 0 = Negative phase sequence <br> 1 = Positive phase sequence |
| 5 | 1 = Current exceeds FLC |
| 6 | 0 = Uninitialised <br> 1 = Initialised |
| 7 | 1 = Communication error between device and soft starter |
| 8 to 15 | *Reserved* |

### Bytes 4-5: Trip code

| Bits | Details |
|---|---|
| 0 to 15 | Refer to Trip codes on page 17 |

### Bytes 6-7: Motor current

| Bits | Details |
|---|---|
| 0 to 15 | Average rms current across all three phases |

### Bytes 8-9: Motor temperature

| Bits | Details |
|---|---|
| 0 to 15 | Motor 1 thermal model (%) |

## Bytes 10-117: Extended information

Bytes 10~117 report information from the soft starter's internal registers.

| Byte | Description | Bits | Details |
|---|---|---|---|
| 10-11 | Version | 0 to 5 | *Reserved* |
| | | 6 to 8 | Product parameter list version |
| | | 9 to 15 | Product type code:<br>4 = CSX<br>6 = EMX3<br>11 = MV |
| 12-13 | Device details | 0 to 7 | *Reserved* |
| | | 8 to 15 | Soft starter model ID |
| 14-15 | *Reserved* | | |
| 16-17 | *Reserved* | | |
| 18-19 | Starter state | 0 to 4 | 0 = *Reserved*<br>1 = Ready<br>2 = Starting<br>3 = Running<br>4 = Stopping<br>5 = Not ready (restart delay, restart temperature check, run simulation)<br>6 = Tripped<br>7 = Programming mode<br>8 = Jog forward<br>9 = Jog reverse |
| | | 5 | 1 = Warning |
| | | 6 | 0 = Uninitialised<br>1 = Initialised |
| | | 7 | 0 = Remote control (Network)<br>1 = Local control (Keypad, Digital Input) |
| | | 8 | *Reserved* |
| | | 9 | 0 = Negative phase sequence<br>1 = Positive phase sequence |
| | | 10 to 15 | Refer to Trip codes on page 17 |
| 20-21 | Current | 0 to 13 | Average rms current across all three phases |
| | | 14 to 15 | *Reserved* |
| 22-23 | Current | 0 to 9 | Current (% motor FLC) |
| | | 10 to 15 | *Reserved* |
| 24-25 | Motor temperature | 0 to 7 | Motor 1 thermal model (%) |
| | | 8 to 15 | *Reserved* |

| Byte | Description | Bits | Details |
|------|-------------|------|---------|
| 26-27 | Power | 0 to 11 | Power |
| | | 12 to 13 | Power scale<br>0 = Multiply power by 10 to get W<br>1 = Multiply power by 100 to get W<br>2 = Power (kW)<br>3 = Multiply power by 10 to get kW |
| | | 14 to 15 | *Reserved* |
| 28-29 | % Power factor | 0 to 7 | 100% = power factor of 1 |
| | | 8 to 15 | *Reserved* |
| 30-31 | Voltage | 0 to 13 | Average rms voltage across all three phases (medium voltage products only) |
| | | 14 to 15 | *Reserved* |
| 32-33 | Current | 0 to 13 | Phase 1 current (rms) |
| | | 14 to 15 | *Reserved* |
| 34-35 | Current | 0 to 13 | Phase 2 current (rms) |
| | | 14 to 15 | *Reserved* |
| 36-37 | Current | 0 to 13 | Phase 3 current (rms) |
| | | 14 to 15 | *Reserved* |
| 38-39 | Voltage | 0 to 13 | Phase 1 voltage (rms) (medium voltage products only) |
| | | 14 to 15 | *Reserved* |
| 40-41 | Voltage | 0 to 13 | Phase 2 voltage (rms) (medium voltage products only) |
| | | 14 to 15 | *Reserved* |
| 42-43 | Voltage | 0 to 13 | Phase 3 voltage (rms) (medium voltage products only) |
| | | 14 to 15 | *Reserved* |
| 44-45 | Parameter list version number | 0 to 7 | Parameter list minor revision |
| | | 8 to 15 | Parameter list major version |
| 46-47 | Digital input state | | For all inputs, 0 = open, 1 = closed (shorted) |
| | | 0 | Start |
| | | 1 | Stop |
| | | 2 | Reset (Refer to note) |
| | | 3 | Input A |
| | | 4 to 15 | *Reserved* |
| 48-49 | Trip code | 0 to 15 | Refer to Trip codes on page 17 |
| 50-59 | *Reserved* | | |
| 60-63 | Parameter management | | Refer to Parameter management on page 16 |

📄 NOTE
The reset input is normally closed by default. If parameter 6M *Remote Reset Logic* is set to normally open, the reported state will be inverted (0 = closed, 1 = open).

## 7.3 Parameter management

The Profinet Interface can read parameter values from and write parameter values to the soft starter. The interface handles one parameter at a time.

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

⚠️ CAUTION
Changing the values of the Factory parameters (parameter group 20) may cause unpredictable behaviour in the soft starter. Consult your local supplier before adjusting the Factory parameters.

### Output

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

Controller > device output bytes are structured as follows.

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

### Input

Parameter data from the starter is reported in input bytes 60-63.

Device > controller input bytes are structured as follows.

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

## 7.4 Trip codes

| Trip code | Description |
|---|---|
| 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 | Heatsink overtemperature |
| 11 | Motor connection |
| 12 | Input A trip |
| 13 | FLC too high |
| 14 | Unsupported option (function not available in inside delta) |
| 15 | Starter communication (between device and soft starter) |
| 16 | Network communication (between device and network) |
| 17 | Internal fault |
| 20 | Ground fault |
| 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 |
| 32 | Motor 2 overload |
| 33 | Time-overcurrent / Bypass overload |
| 34 | SCR overtemperature |
| 35 | Battery/clock |
| 36 | Thermistor circuit |
| 37 | RTD/PT100 A |
| 38 | RTD/PT100 B |
| 39 | RTD/PT100 C |
| 40 | RTD/PT100 D |
| 41 | RTD/PT100 E |
| 42 | RTD/PT100 F |
| 43 | RTD/PT100 G |
| 45 | RTD/PT100 X Circt |
| 46 | Analog input trip |
| 255 | No trip |

## 7.5 Examples

### Control commands (controller to device)

| 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 | | | | | | |

| 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 | | | | | | |

| 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 | | | | | | |

| Quick stop the motor | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
| 16 | 0 | | | | | | |

| Reset a trip | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
| ≤ 28 | 8 | | | | | | |

### Status information (device to controller)

| Read control status - Ready | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
| 0 | 1 | | | | | | |

| Read control status - Running | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
| | | 3 | 0 | | | | |

| Read control status - Tripped, 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 | | |

### Parameter management

| Read parameter from EMX3: parameter number 12, 2H *Stop Mode* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
| | | 12 | 2 | 0 | 0 | | |

| Parameter read response: parameter 2H *Stop Mode* = 1 (TVR Soft Stop) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Byte 56 | Byte 57 | Byte 58 | Byte 59 | Byte 60 | Byte 61 | Byte 62 | Byte 63 |
| | | | | 12 | 0 | 1 | 0 |

# 8.  Network design

The device supports star, line and ring topologies.
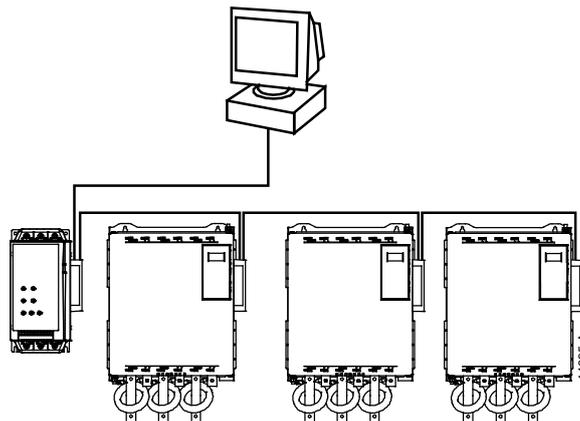
## 8.1  Star topology

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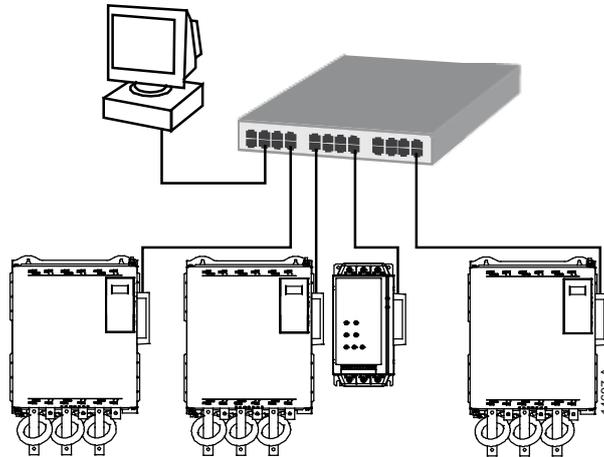


## 8.2  Line topology

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



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

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

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

## 8.3   Ring topology

In a ring topology network, the controller connects to the first interface, via a network switch. The second Ethernet port of the interface 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.
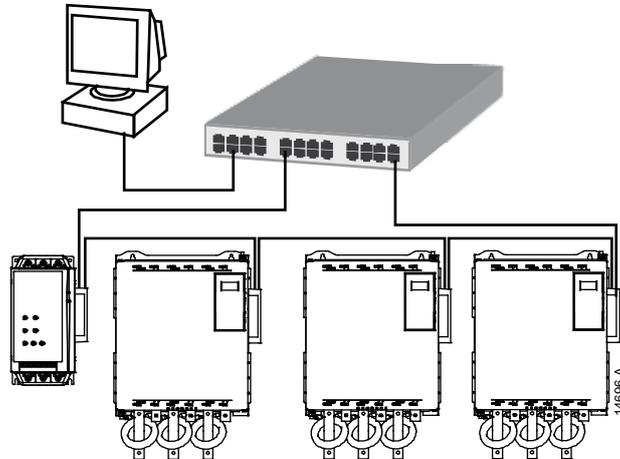


## 8.4   Combined topologies

A single network can include both star and line components.
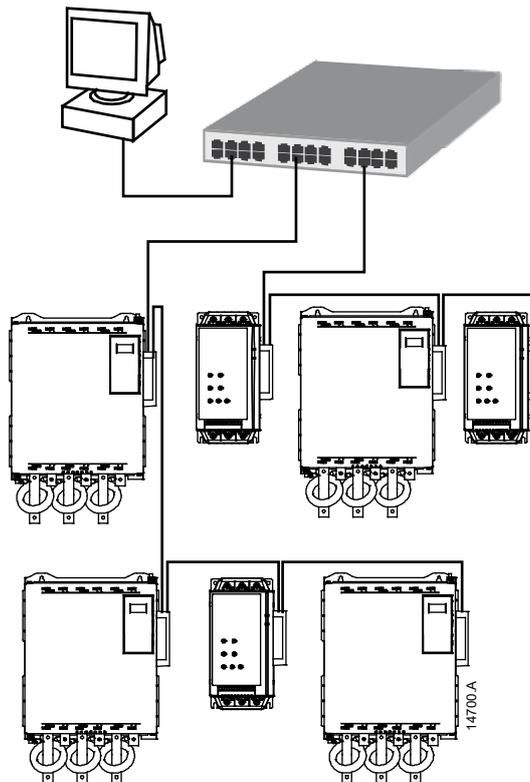
# 9. Specifications

- **Enclosure**

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

- **Mounting**

  Spring-action plastic mounting clips (x 2)

- **Connections**

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

- **Settings**

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

- **Network**

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

- **Power**

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

- **Certification**

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

  Profibus & Profinet International ...................................................