AuCom

PROFINET

Contents

1 Important User Information

1.1 Safety

Observe all necessary safety precautions when controlling the soft starter remotely. Alert personnel that machinery may start without warning.

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

Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this guide carefully.

1.2 Product Design

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

Separate interfaces are available for Profinet, Modbus TCP and Ethernet/IP networks.

The Profinet Interface operates at the application layer. Lower levels are transparent to the user.

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

1.3 Compatibility

The Profinet Interface is compatible with the following AuCom soft starters:

- 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.
- MVS and MVX – all models

1.4 Disclaimer

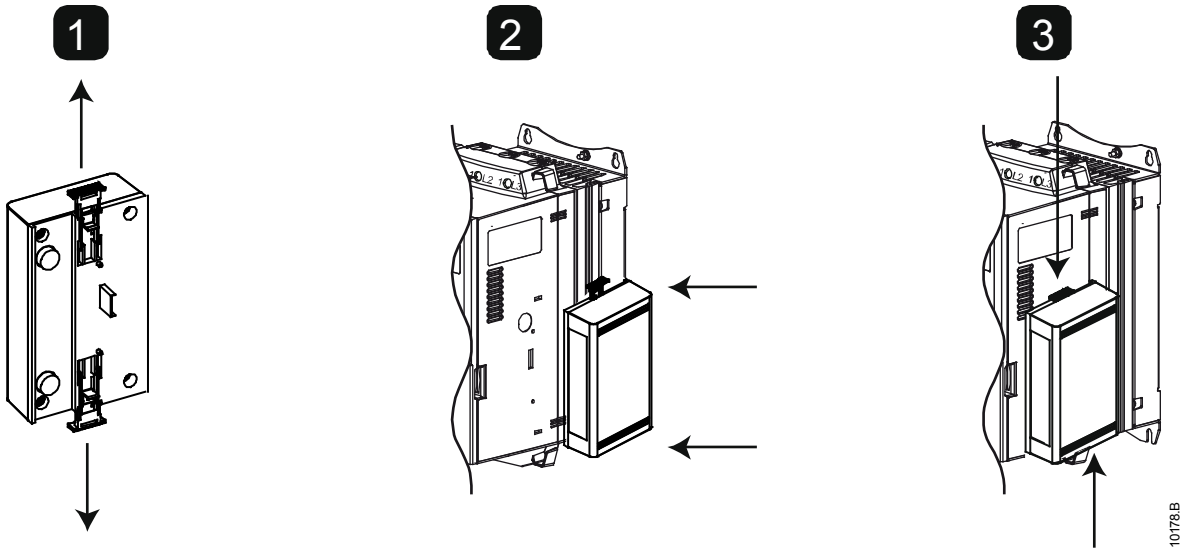
The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting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

2 Installation

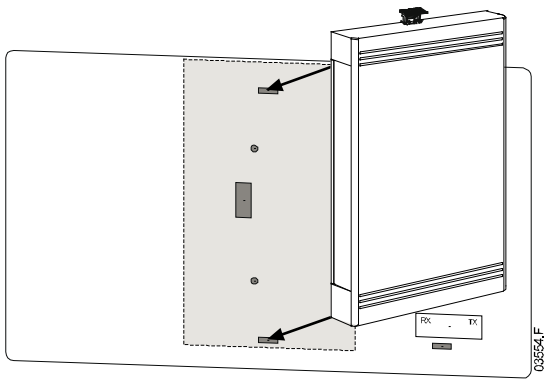
CAUTION
Remove mains and control voltage from the soft starter before attaching or removing accessories. Failure to do so may damage the equipment.

2.1 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.
3. Line up the interface with the comms port slot.
4. Push in the top and bottom retaining clips to secure the interface to the starter.
5. Insert the network connector.
6. Apply control power to the soft starter.

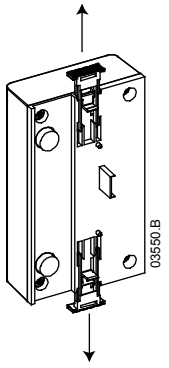


MVS and MVX:
Plug the interface onto the back of the controller.



Remove the interface using the following procedure:

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.
4. Pull the interface away from the soft starter.



3 Connection

3.1 Soft Starter Connection

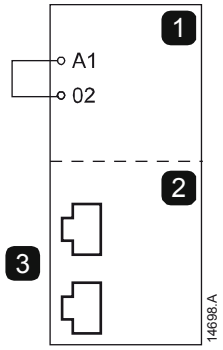
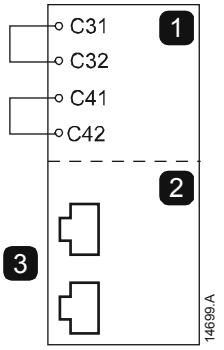
The Profinet Interface is powered from the soft starter.

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

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

EMX3 and MVS/MVX: 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.

NOTE
EMX3 and MVS/MVX: 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.

CSX	EMX3 or MVS/MVX
	

1	CSX A1, 02: Stop input	1	EMX3 or MVS/MVX (Remote mode) C31, C32: Stop input C41, C42: Reset input
2	Profinet Interface	2	Profinet Interface
3	RJ45 Ethernet ports	3	RJ45 Ethernet ports

3.2 Network Connection

Ethernet Ports

The Profinet Interface has two Ethernet ports. The ports are equal and interchangeable - if only one connection is required, either port can be used.

Cables

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

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°.

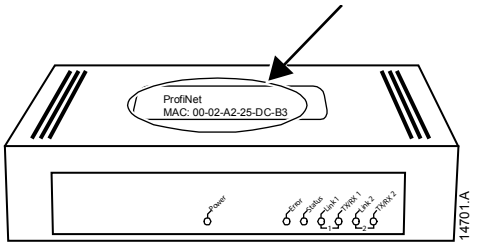
3.3 Network Establishment

The controller must establish communications directly with each interface before the interface can participate in the network. Once communications are established, the interface can participate in an existing network.

3.4 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 interface will receive a dynamic IP address (via DHCP) when it is connected to the network, or can be assigned a static IP address during configuration.
- 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 interface.



4 Device Configuration

To permanently configure attributes in the Profinet Interface, use the Ethernet Device Configuration Tool and untick "Store settings temporary".

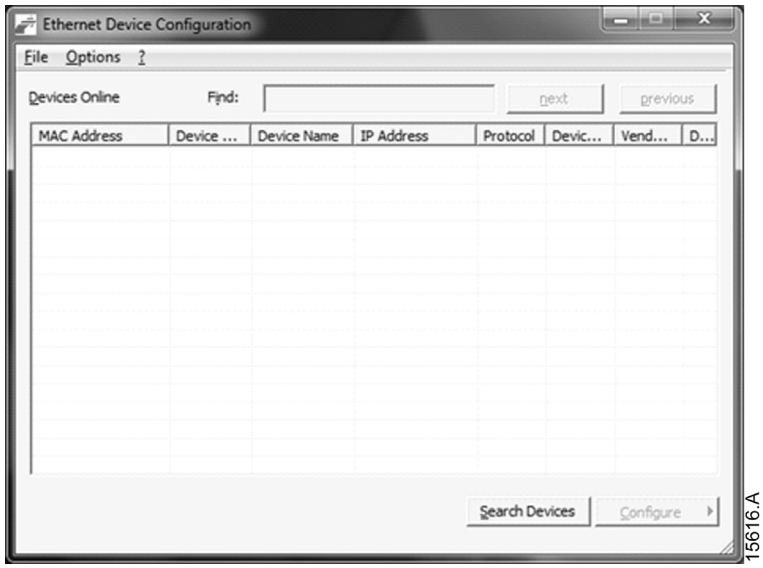
NOTE
The Error LED flashes whenever the interface is receiving power but is not connected to a network. The Error LED will flash throughout the configuration process.

4.1 Ethernet Device Configuration Tool

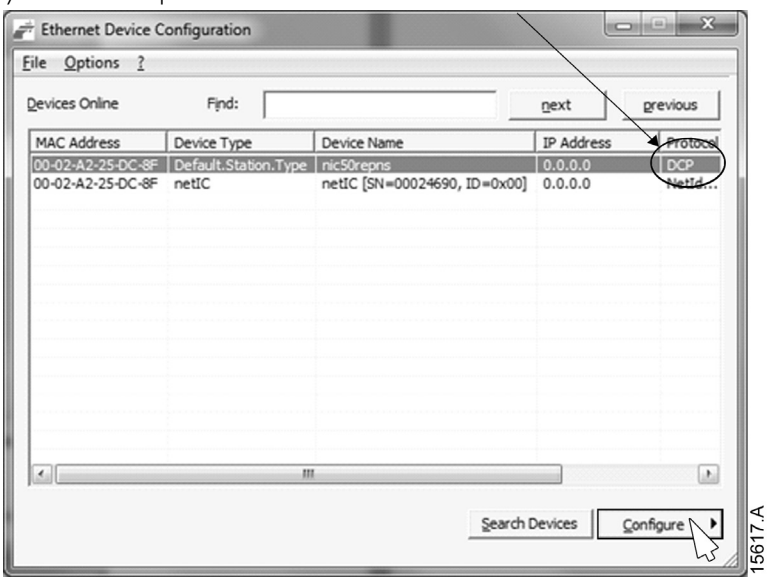
The Ethernet Device Configuration Tool can be downloaded from www.aucom.com.

To configure the device using the Ethernet Device Configuration Tool:

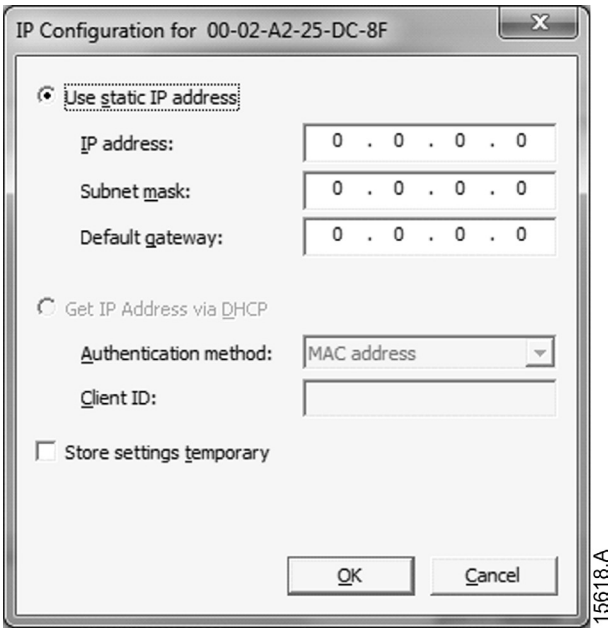
1. Attach the interface to a soft starter.
2. Connect one Ethernet port on the interface to the Ethernet port of the PC.
3. Apply control power to the soft starter.
4. Start the Ethernet Device Configuration Tool.



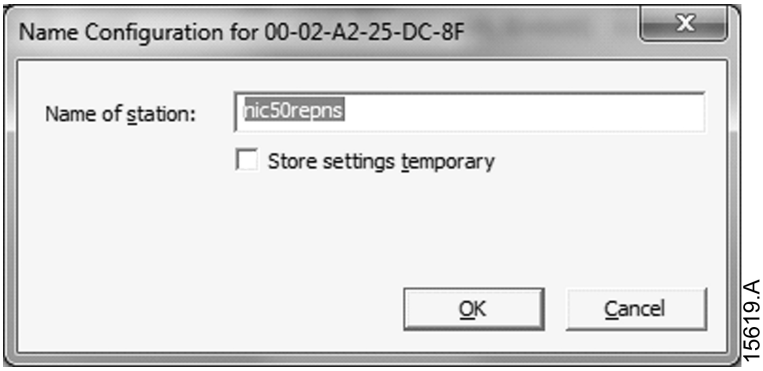
5. Click on Search Devices. The software will search for connected devices.
6. The search results will contain two entries for each connected device. Select the DCP Protocol entry for the required device.



7. To set a static IP address, click Configure then select Set IP address.



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



5 Operation

The Profinet Interface 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.

5.1 Device Classification

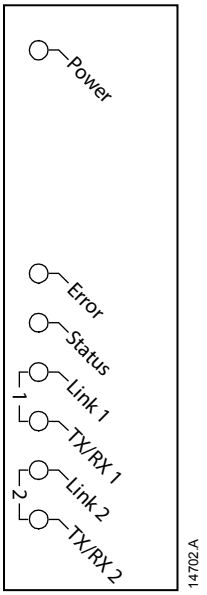
The Profinet Interface is a Profinet IO-Device and must be managed by an IO-Controller over Ethernet.

5.2 Master Configuration

Import the latest GSDML file into your Master configuration tool. This file is available from www.aucom.com.

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.

5.3 LEDs



LED name	LED Status	Description
Power	Off	Interface is not powered up.
	On	Interface is receiving 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 data.

6 Packet Structures

NOTE
Some soft starters do not support some functions.

6.1 Ensuring Safe and Successful Control

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

NOTE
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.

In order to operate safely and successfully in an environment where 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.

6.2 Control Commands (Write Only)

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

Byte 0							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	*Reserved*	*Reserved*	Quick stop (coast to stop)	Motor set		*Reserved*	*Reserved*
Byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	*Reserved*	*Reserved*	*Reserved*	Reset	*Reserved*	*Reserved*	Forward run

Motor Set Bits

Selects which parameter set to use when starting:
0 = selected from soft starter remote input (programmable input must be set to 'Motor Set Select')
1 = soft starter primary motor set (ensure soft starter programmable input is not set to 'Motor Set Select')
2 = soft starter secondary motor set (ensure soft starter programmable input is not set to 'Motor Set Select')
3 = *Reserved*

Quick Stop Bit

When Fwd run bit changes from 1 to 0:
0 = stop action will be a soft stop (as selected on the soft starter).
1 = stop action will be a quick stop (ie coast to stop).

NOTE
The Quick stop bit must be set to 0 before the soft starter can perform a start.

Forward Run

When Forward run changes from 0 to 1, the soft starter will start according to the Motor set setting.

When Forward run changes from 1 to 0, the soft starter will stop according to the Quick stop setting.

6.3 Status Commands (Read Only)

Starter status information is always available when the interface is connected to a soft starter, in the following format:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
Control status (low byte)/(high byte)		Starter state (low byte)/(high byte)		Trip code (low byte)/(high byte)		Motor current (low byte)/(high byte)		Motor temperature (low byte)/(high byte)	

Control status

Byte 0							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Ramping	Local mode	Motor current (% FLC) [1]					
Byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	*Reserved*	*Reserved*	*Reserved*	Warning	Fault	On	Ready

[1] 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. For models EMX3-0053B and smaller this value will be 10 times greater than the value displayed on the keypad.

Ready is set when the soft starter is ready to start the motor.
On is set when the soft starter is starting, running or soft stopping the motor.
Warning is set when the soft starter detects a warning condition.
Fault is set when the soft starter has tripped.
Ramping is set when the soft starter is starting or soft stopping the motor.
Local is set when the soft starter is set to Local mode.

Starter state

Byte 2							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Communi-cation failure between interface and starter	Initialised (set after first start once phase sequence has been confirmed)	Current exceeds FLC	Positive phase sequence	The decimal value of bits 0~3 indicates the starter's state: 0 = Unknown (communication error between interface and soft starter) 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check, run simulation) 6 = Tripped 7= Menu open (cannot start) 8 = Jog forward 9 = Jog reverse			
Byte 3							
Reserved							

Trip Codes

Trip Code	Description	CSX	CSXi	EMX3	MVS/MVX
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 (starter) 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 interface and soft starter)	●	●	●	●
16	Network communication (between interface and network)	●	●	●	●
17	Internal fault x (where x is the fault code detailed in the table below)			●	●
20[1]	Ground fault			●	●
23	Parameter out of Range			●	●
24	Input B trip			●	●
25	Bypass fail (bypass contactor)			●	●
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[2]	Time-overcurrent (Bypass overload)		●	●	
34	SCR overtemperature				●
35	Battery/clock			●	●
36	Thermistor circuit			●	
37	RTD/PT100 A			●	
38[1]	RTD/PT100 B			●	
39[1]	RTD/PT100 C			●	
40[1]	RTD/PT100 D			●	
41[1]	RTD/PT100 E			●	
42[1]	RTD/PT100 F			●	
43[1]	RTD/PT100 G			●	
45	RTD circuit fail			●	
46	Analog input trip			●	●

[1] Available with EMX3 only if the appropriate option card is fitted.

[2] For EMX3, time-overcurrent protection is only available on internally bypassed models.

- **Internal Fault x**

The table below details the internal fault code associated with trip code 17.

Internal fault	Message displayed on the keypad
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 your local supplier with the fault code (X).

Motor current

Bytes 6 and 7 report motor current in amperes. For models EMX3-0053B and smaller this value will be 10 times greater than the value displayed on the keypad.

Motor temperature

Bytes 8 and 9 report motor temperature as a percentage of the motor service factor (calculated by the soft starter's thermal model).

Extended information

Bytes 10~73 report information from the soft starter's internal registers.

Byte	Register Address	Description	Bits	Details
10-11	0	Version	0 to 5 6 to 8 9 to 15	Binary protocol version number Product parameter list version Product type code [1]
12-13	1	Device details		
14-15	2 [2]	Changed parameter number	0 to 7 8 to 15	0 = no parameters have changed 1~255 = index number of the last parameter changed Total number of parameters available in the starter
16-17	3 [2]	Changed parameter value	0 to 13	Value of the last parameter that was changed, as indicated in register 2
			14 to 15	*Reserved*

Byte	Register Address	Description	Bits	Details
18-19	4	Starter state	0 to 4	0 = *Reserved* 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check, run simulation) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
			5	1 = Warning
			6	0 = Unintialised 1 = Initialised
			7	0 = Local control 1 = Remote control
			8	0 = Parameter(s) have changed since last parameter read 1 = no parameters have changed [2]
			9	0 = Negative phase sequence 1 = Positive phase sequence
			10 to 15	Refer to Trip Codes on page 12 [3]
20-21	5	Current	0 to 13	Average rms current across all three phases [4]
			14 to 15	*Reserved*
22-23	6	Current	0 to 9	Current (% motor FLC)
			10 to 15	*Reserved*
24-25	7	Motor temperature	0 to 7	Motor 1 thermal model (%)
26-27	8 [5]	Power	0 to 11	Power
			12 to 13	Power scale
			14 to 15	*Reserved*
28-29	9	% Power factor	0 to 7	100% = power factor of 1
			8 to 15	*Reserved*
30-31	10	Voltage	0 to 13	Average rms voltage across all three phases
			14 to 15	*Reserved*
32-33	11 [4]	Current	0 to 13	Phase 1 current (rms)
			14 to 15	*Reserved*
34-35	12 [4]	Current	0 to 13	Phase 2 current (rms)
			14 to 15	*Reserved*
36-37	13 [4]	Current	0 to 13	Phase 3 current (rms)
			14 to 15	*Reserved*
38-39	14	Voltage	0 to 13	Phase 1 voltage (rms)
			14 to 15	*Reserved*
40-41	15	Voltage	0 to 13	Phase 2 voltage (rms)
			14 to 15	*Reserved*
42-43	16	Voltage	0 to 13	Phase 3 voltage (rms)
			14 to 15	*Reserved*

Byte	Register Address	Description	Bits	Details
44-45	17	Parameter list version number	0 to 7	Parameter list minor revision
			8 to 15	Parameter list major version
46-47	18	Digital Input state	0 to 15	For all inputs, 0 = open, 1 = closed (shorted) 0 = Start 1 = Stop 2 = Reset 3 = Input A 4 = Input B 5 = Input C, if fitted 6 = Input D, if fitted 7 to 15 = *Reserved*
48-73	19 to 31	*Reserved*		

[1] Product type code:

4 = CSX Series
5 = MVS (two-line controller)
6 = EMX3
10 = MVX
11 = MVS (four-line controller)

[2] Reading register 3 (Changed parameter value) will reset registers 2 (Changed parameter number) and 4 (Parameters have changed). Always read registers 2 and 4 before reading register 3.

[3] Bits 10~15 of register 4 report the soft starter's trip or warning code. If the value of bits 0~4 is 6, the soft starter has tripped. If bit 5 = 1, a warning has activated and the starter is continuing to operate.

[4] For models EMX3-0053B and smaller this value will be 10 times greater than the value displayed on the keypad.

[5] Powerscale functions as follows:

0 = multiply Power by 10 to get W
1 = multiply Power by 100 to get W
2 = Power is represented in kW
3 = multiply Power by 10 to get kW

6.4 Parameter Management (Read/write)

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

- Parameter number 1 corresponds to parameter 1A *Motor Full Load Current*
- The EMX3 has 159 parameters. Parameter number 159 corresponds to parameter 16X *Low Control Volts*.
- The MVS/MVX has 141 parameters. Parameter number 141 corresponds to parameter 16W *Overvoltage*.

Master > Slave output bytes are structured as follows.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 2	Parameter number to read/write							
Byte 3	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	Write parameter	Read parameter	*Reserved*
Byte 4	Low byte parameter value to write to soft starter/ zero data values for read							
Byte 5	High byte parameter value to write to soft starter/ zero data values for read							

Slave > Master input bytes are structured as follows.

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 114	Echo parameter number							
Byte 115	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	*Reserved*	Invalid parameter value	Invalid parameter number
Byte 116	Low byte parameter value read from soft starter							
Byte 117	High byte parameter value read from soft starter							

6.5 Examples

Control Commands

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 Commands

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

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

Read starter 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 Read/Write

Write parameter to starter: parameter number 1, 1A *Motor Full Load Current* = 55							
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
		1	4	55	0		

Acknowledge parameter write							
Byte 112	Byte 113	Byte 114	Byte 115	Byte 116	Byte 117	Byte 118	Byte 119
		1	0	55	0		

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		

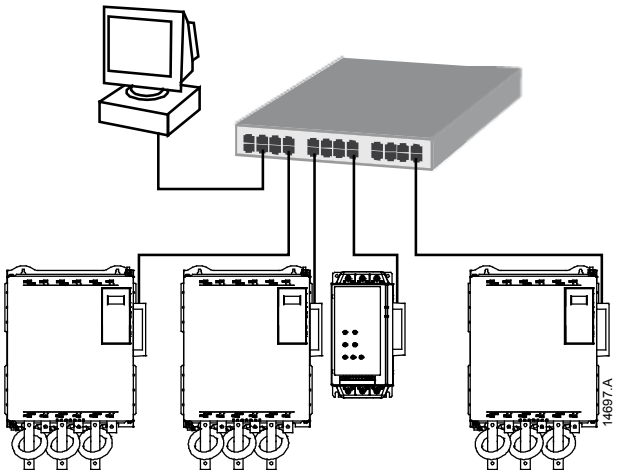
Parameter read response: parameter 2H *Stop Mode* = 1 (TVR Soft Stop)							
Byte 112	Byte 113	Byte 114	Byte 115	Byte 116	Byte 117	Byte 118	Byte 119
		12	0	1	0		

7 Network Design

The Profinet Interface supports star, line and ring topologies.

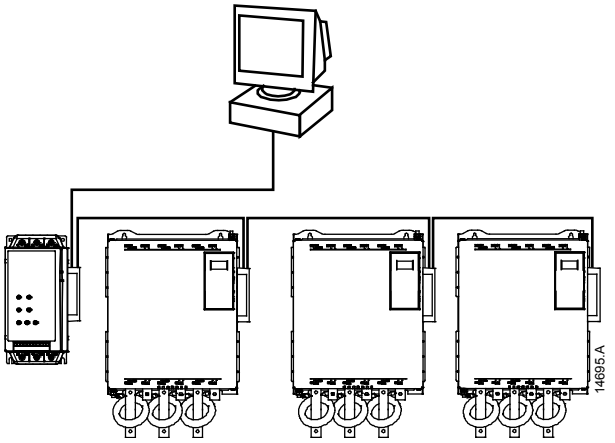
7.1 Star Topology

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



7.2 Line Topology

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



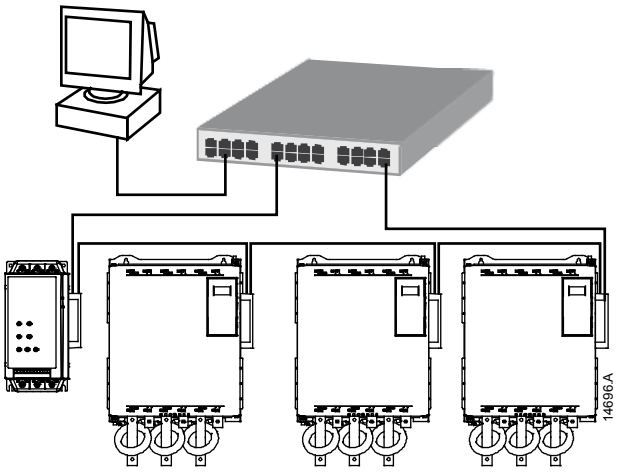
NOTE
The Profinet Interface has an integrated switch to allow data to pass through in line topology. The Profinet Interface must be receiving control power from the soft starter for the switch to operate.

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 interface.
The maximum number of devices in a line network is 32. Exceeding this number may reduce the reliability of the network.

7.3 Ring Topology

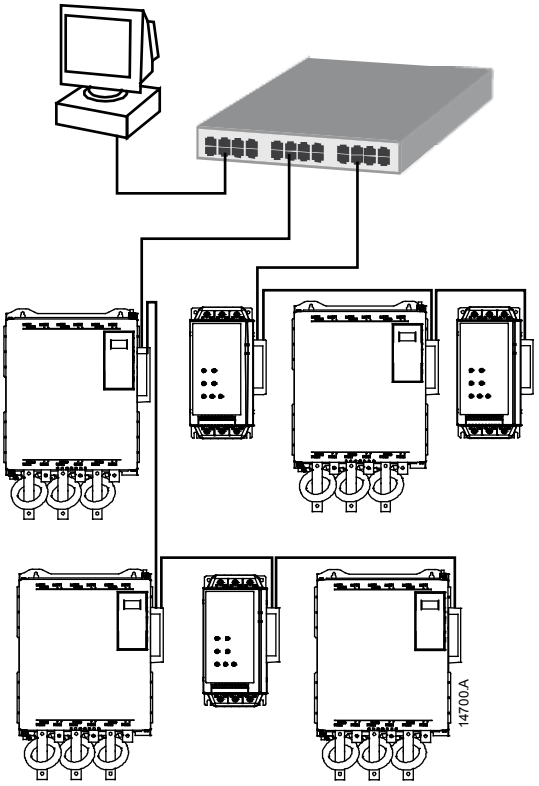
In a ring topology network, the controller connects to the first Profinet Interface, via a network switch. The second Ethernet port of the Profinet Interface connects to another interface, which in turn connects to another interface until all devices are connected. The final interface connects back to the switch.



NOTE
The network switch must support loss of line detection.

7.4 Combined Topologies

A single network can include both star and line components.



8 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, 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 VDC
Reverse polarity protected	
Galvanically isolated	
Certification	
C✓	IEC 60947-4-2
CE	IEC 60947-4-2
Profibus & Profinet International	