



iC7-Marine EtherNet/IP

EtherNet/IP OS7IP



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1 Introduction and Safety

1.1 Purpose of the Operating Guide

This operating guide provides information about configuring the system, controlling the drive or power converter, accessing parameters, programming, troubleshooting, and some typical application examples.

The operating guide is intended for use by qualified personnel, who are familiar with the iC7 drives and power converters, EtherNet/IP technology, and the PC or PLC that is used as a master in the system.

Read the instructions before configuring EtherNet/IP, and follow the procedures in this guide.

1.2 Additional Resources

Additional resources are available to help understand the features, and safely install and operate the iC7 series products:

- Safety guides, which provide important safety information related to installing iC7 series drives and power converters.
- Installation guides, which cover the mechanical and electrical installation of drives, power converters, or functional extension options.
- Design guides, which provide technical information to understand the capabilities of the iC7 series drives or power converters for integration into motor control and monitoring systems.
- Operating guides, which include instructions for control options, and other components for the drive.
- Application guides, which provide instructions on setting up the drive or power converter for a specific end use. Application guides for application software packages also provide an overview of the parameters and value ranges for operating the drives or power converters, configuration examples with recommended parameter settings, and troubleshooting steps.
- *Facts Worth Knowing about AC Drives*, available for download on www.danfoss.com.
- Other supplemental publications, drawings, and guides are available at www.danfoss.com.

Latest versions of Danfoss product guides are available for download at <https://www.danfoss.com/en/service-and-support/documentation/>.

1.3 Safety Symbols

The following symbols are used in Danfoss documentation and products.

 DANGER
Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE
Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

	ISO warning symbol for general warnings
	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electric shock
	Symbol for indicating the required discharge time of the capacitors in the product.
	ISO action symbol for referring to the instructions

1.4 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the product. Only qualified personnel are allowed to install and 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 guide.

1.5 Safety Precautions

DANGER



HIGH VOLTAGE

Drives and power converters contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, startup, and maintenance by qualified personnel can result in death or serious injury.

- Only qualified personnel are allowed to perform installation, startup, and maintenance.

WARNING

UNINTENDED START

When the drive or power converter is connected to the AC mains or connected on the DC terminals, the motor may start at any time, causing risk of death, serious injury, and equipment or property damage.

- Stop the drive or power converter before configuring parameters.
- Make sure that the drive or power converter cannot be started by an external switch, a fieldbus command, an input reference signal from the control panel, or after a cleared fault condition.
- Disconnect the drive or power converter from the mains whenever safety considerations make it necessary to avoid an unintended motor start.
- Check that the drive or power converter and any driven equipment are in operational readiness.

WARNING



DISCHARGE TIME

The drive or power converter contains DC-link capacitors, which can remain charged even when the drive or power converter is not powered. High voltage can be present even when the warning indicator lights are off. Failure to wait the specified time after power has been removed before performing service or repair work can result in death or serious injury.

- Stop the motor.
- Disconnect all power sources, including permanent magnet type motors.
- Wait for capacitors to discharge fully. The discharge time is specified on the drive or power converter product label.
- Measure the voltage level to verify full discharge.

WARNING

LEAKAGE CURRENT HAZARD

Leakage currents exceed 3.5 mA. Failure to ground the drive or power converter properly can result in death or serious injury.

- Ensure that the minimum size of the ground conductor complies with the local safety regulations for high touch current equipment.

WARNING

EQUIPMENT HAZARD

Contact with rotating shafts and electrical equipment can result in death or serious injury.

- Ensure that only trained and qualified personnel perform installation, start-up, and maintenance.
- Ensure that electrical work conforms to national and local electrical regulations.
- Follow the procedures in this guide.

CAUTION

INTERNAL FAILURE HAZARD

An internal failure in the drive or power converter can result in serious injury when the drive or power converter is not properly closed.

- Ensure that all safety covers are in place and securely fastened before applying power.

1.6 Abbreviations

Table 1: Abbreviations

Abbreviation	Definition
ACD	Address Conflict Detection
CIP	Common Industrial Protocol
CTW	Control word
DHCP	Dynamic host configuration protocol
DLR	Device Level Ring
DNS	Domain Name Server

Table 1: Abbreviations - (continued)

Abbreviation	Definition
EMC	Electromagnetic compatibility
EO	Exclusive Owner
I/O	Input/Output
IO	Input Only
IP	Internet protocol
IRT	Isochronous real time
CP	Control panel
LED	Light-emitting diode
LO	Listen Only
MAV	Main Actual Value
MRV	Main Reference Value
MS	Module Status (LED)
PC	Personal computer
PLC	Programmable logic controller
REF	Reference
RPM	Revolution Per Minute
SNMP	Simple Network Management Protocol
STW	Status word
TCP	Transmission Control Protocol
UCMM	Unconnected Message Manager

1.7 Version History

This guide is regularly reviewed and updated. All suggestions for improvement are welcome.

The original language of this guide is English.

Table 2: Version History

Version	Remarks
AQ528743884394, version 0101	First release.

2 Overview

2.1 EtherNet/IP Features and Technical Data

Fieldbus options for iC7 are integrated in the control board. Fieldbuses are enabled on communication interfaces X1 and X2 only. Modbus TCP is offered as standard, and other protocols such as PROFINET RT, and EtherNet/IP can be selected in the configurator when ordering a drive, or alternatively, they can be activated later by a proof-of-purchase token.

Table 3: EtherNet/IP Model Codes

Model code	Description
+BAIP	EtherNet/IP OS7IP

EtherNet/IP is an Ethernet-based automation standard that adapts the Common Industrial Protocol (CIP) to standard Ethernet technology. The EtherNet/IP and CIP technologies are managed by the ODVA organization.

The EtherNet/IP interface is designed to communicate with any system complying with the CIP EtherNet/IP standard. EtherNet/IP provides users with network tools to deploy standard Ethernet technology for manufacturing applications while enabling internet and enterprise connectivity.

Table 4: EtherNet/IP Features

Feature	Technical data
Minimum packet rate supported	1 ms
Connections	Class 1 I/O connection using TCP transport. The EtherNet/IP interface supports maximum 1 Class-1 connections, but several listen-only connections can be established if multicast is selected as the transport type.
	Class 3 Cyclic connection using UDP transport. Maximum 6 Class-3 connections are supported.
	UCMM Acyclic connection using TCP transport. This type of connection is used for explicit messaging.
Network management	DLR Device Level Ring Protocol for detecting and recovering from faults in ring-based networks.
	SNMP Simple Network Management Protocol

2.2 Communication Profiles and Objects

2.2.1 Overview

The iC7 drives support several communication profiles and mandatory objects. The supported profiles depend on the application software installed.

The fieldbus profile can be selected from the PLC configuration tool via a Profile Selector Assembly.

Communication profiles are selected in parameter **Fieldbus Profile** (1301).

Table 5: Communication Profiles and Supported Applications

Application software	Profile
Propulsion & Machinery	<ul style="list-style-type: none"> iC Generic iC Speed PROFIdrive
Active Front End	iC Active Front End

2.2.2 iC Generic

2.2.2.1 Overview

The iC Generic profile is used for motor control operation with iC7 application software.

2.2.2.2 Control Word

Table 6: iC Generic Profile Control Word Bits

Bit	Name	Description
0	Ramp Stop	0: The ramp stop request is inactive. The drive can be started. 1: The drive is ready to operate.
1	Coast Stop	0: A running drive coasts to a stop (modulation stops). 1: The coast request is inactive. The drive can be started.
2	Quick Stop	0: The drive stops with the Quick Stop function. 1: The Quick Stop request is inactive. The drive can be started.
3	Start	0: The drive stops operating with the method determined by the parameter <i>Missing Start Response</i> (4717). 1: The drive starts to operate on the rising edge of this signal.
4	–	Reserved
5	–	Reserved
6	–	Reserved
7	Event Reset	0: Event Reset Inactive. 1: Event Reset Active. A rising edge of this signal resets events (warnings, faults, and so on), which do not have active triggering conditions. After a fault the drive goes to a Switching On Inhibited state, which must be acknowledged with bit 0.
8	Reference Reverse	0: The speed reference remains normal. 1: The speed reference is reversed. The reference can also be reversed with a negative setpoint. Double negatives result in a forward reference.
9	–	Reserved
10	Data Valid	0: Ignores the current process data. Uses the previously processed data when the Data Valid bit was previously true. 1: Reads the current process data. For most of the control word commands to be acknowledged by the drive, fieldbus must be the commanding control place. See options in parameter group <i>Control Places</i> in parameter group <i>2 Parameters</i> .

Table 6: iC Generic Profile Control Word Bits - (continued)

Bit	Name	Description
11	Watchdog	0: Watchdog low. 1: Watchdog high. Continuous toggling 0–1 can be used as a sign of life between the drive and the fieldbus master. The value of this bit is also passed through the fieldbus status word as is.
12	Fieldbus Digital Input 1	0: Fieldbus Digital Input 1 inactive. 1: Fieldbus Digital Input 1 active. Select the value CTW B12 for any input parameter to use this signal for the activation of a selected function.
13	Fieldbus Digital Input 2	0: Fieldbus Digital Input 2 inactive. 1: Fieldbus Digital Input 2 active. Select the value CTW B13 for any input parameter to use this signal for the activation of a selected function.
14	Fieldbus Digital Input 3	0: Fieldbus Digital Input 3 inactive. 1: Fieldbus Digital Input 3 active. Select the value CTW B14 for any input parameter to use this signal for the activation of a selected function.
15	Fieldbus Digital Input 4	0: Fieldbus Digital Input 4 inactive. 1: Fieldbus Digital Input 4 active. Select the value CTW B15 for any input parameter to use this signal for the activation of a selected function

2.2.2.3 Status Word

Table 7: iC Generic Profile Status Word Bits

Bit	Name	Description
0	Ready To Switch On	0: The drive is not ready to receive a start command because of at least 1 of the following conditions is true: Fault Active, Ramp Stop Active, Coast Stop Active, or Quick Stop Active. 1: The drive is ready to accept a start command.
1	Power Unit Ready	0: The drive cannot be set running because the ready conditions of the power unit are not met. Check parameter Motor Control Start Ready Status Word (6207) for any conditions that are not met. 1: All power unit ready conditions are met.
2	Drive Running	0: The drive is not running. 1: The drive is running.
3	Fault Active	0: No active drive faults. 1: One or more drive faults are active. Switching on is inhibited.
4	–	Reserved
5	Quick Stop Active	0: The quick stop command is inactive. A new start command is required. 1: The quick stop command is active. This command can also be given from another control source than fieldbus.
6	–	Reserved

Table 7: iC Generic Profile Status Word Bits - (continued)

Bit	Name	Description
7	Warning Active	0: All drive warnings are inactive. 1: One or more drive warnings are active.
8	–	Reserved
9	Fieldbus Control Active	0: Fieldbus is not the active control place. 1: Fieldbus is the active control place.
10	–	Reserved
11	Run Enabled	0: The digital input signal <i>Run Enable Input</i> (103) is inactive, and modulation is disabled. 1: The digital input signal <i>Run Enable Input</i> (103) is active, and modulation is enabled.
12	–	Reserved
13	–	Reserved
14	–	Reserved
15	Watchdog Feedback	0: The watchdog signal that the drive has received is low. 1: The watchdog signal that the drive has received is high.

2.2.3 iC Speed Profile

2.2.3.1 Overview

The iC Speed profile is used with the iC7 series motor applications. The iC Speed profile differs from the PROFIdrive profile, because it does not have a state machine. It is only controlled by the actual state 1/0 of the control bits, not the sequence in which they are manipulated.

2.2.3.2 Control Word

Table 8: iC Speed Profile Control Word Bits

Bit number	Name	Description
0+1	Preset reference selector	00: Preset reference 1 01: Preset reference 2 10: Preset reference 3 11: Preset reference 4
2	Reserved	Reserved for future use. Any control words sent to the device should keep this bit at 0 to ensure compatibility with future extensions of the control word.
3	No coast/Coast	0: Causes the drive to immediately coast the motor. 1: No function.
4	No quick stop/Quick stop	0: Quick stops the drive and ramps down the motor speed to stop as defined with the quick stop ramp parameter. 1: No function.
5	No hold/Hold output frequency	0: Hold the present output frequency (in Hz). 1: No function.

Table 8: iC Speed Profile Control Word Bits - (continued)

Bit number	Name	Description
6	Start/No start	0: Stops the drive and ramps down the motor speed as defined with the ramp-down parameter. 1: If the other starting conditions are fulfilled, this selection allows the drive to start the motor.
7	Reset	0: No function. 0 ⇒ 1: Reset faults. ⁽¹⁾
8	Jog/No jog	0: No function. 1: Sets the output frequency to the jog speed defined with the jog speed parameter.
9	Ramp select	0: Ramp 1 is active. 1: Ramp 2 is active.
10	Data valid	0: Ignore the current process data. This is linked to the submodule where the CTW is present. If signals are to be covered, the CTW/STW profile (for example, the iC Speed profile) must be part of the signals list. 1: Use process data (controlled by PLC). Use the previously processed data when the data valid bit was true (no control by PLC).
11	Reserved	Reserved for future use.
12	User-defined	These bits are reserved for application-specific advanced control. Select the value CTW bit x for any input parameter to use this signal for the activation of a selected function. For more information, refer to the <i>Parameter Descriptions</i> chapter in the application guide.
13	User-defined	
14	User-defined	
15	User-defined	

1) Edge-triggered from 0 to 1 to reset the fault.

2.2.3.3 Status Word

Table 9: iC Speed Profile Status Word Bits

Bit number	Name	Description
0	Control Ready	0: The device controls are not ready and do not react to process data. 1: The device controls are ready and react to process data.
1	Drive Ready	0: The drive is not ready for operation. 1: The drive is ready for operation.
2	Coast	0: There is an active coast stop command and the drive is in a coast stop state. 1: There are no active coast signals. The drive can be started.
3	Fault	0: There are no active faults. 1: There is at least 1 active fault. The drive cannot be started before the fault condition is cleared and the fault is reset.
4	–	Reserved
5	–	Reserved
6	–	Reserved

Table 9: iC Speed Profile Status Word Bits - (continued)

Bit number	Name	Description
7	Warning	0: There are no active warnings. 1: There is at least 1 active warning. The cause of the warning should be investigated and mitigated.
8	Speed Reference	0: Speed not at reference. The motor speed differs from the given speed reference, for example, due to ramping. 1: Speed at reference. The motor speed matches the given speed reference.
9	Fieldbus Control	0: Fieldbus control inactive. None of the basic command functions of the drive are affected by fieldbus commands. 1: Fieldbus control active. Fieldbus is the active control place, or configured as part of the advanced control place.
10	Limiter	0: Limiter inactive. All limiters (regulators) are inactive. 1: Limiter active. One or more limiters (regulator) are actively limiting the drive current, torque, and so on. See parameter <i>Motor Regulator Status Word</i> (1715) for further details.
11	Operation	0: The drive is not modulating (operating). 1: The drive is modulating (operating).
12	–	Reserved
13	–	Reserved
14	–	Reserved
15	–	Reserved

2.2.4 PROFIdrive – Standard Telegram 1

2.2.4.1 Overview

Standard telegram 1 is implemented according to PROFIdrive Application Class 1 profile as defined in the PROFIdrive standard and state machine diagram. It can be used with iC7 series motor applications.

2.2.4.2 Control Word

Table 10: Control Word Bits in PROFIdrive Standard Telegram 1

Bit number	Name	Description
0	On-Off	0: Off. 1: On.
1	Coast stop	0: Coast stop. 1: No coast stop.
2	Quick stop	0: Quick stop. 1: No quick stop.
3	Operation	0: Disable operation. 1: Enable operation.
4	Ramp generator	0: Reset ramp generator. The output of the RFG is set to 0. The drive decelerates along the current limit or along the voltage limit of the DC link. 1: Enable ramp generator (RFG).

Table 10: Control Word Bits in PROFIdrive Standard Telegram 1 - (continued)

Bit number	Name	Description
5	Freeze	0: Freeze ramp generator. Freezes the present output frequency (in Hz). 1: Unfreeze ramp generator.
6	Enable setpoint	0: Disable setpoint. 1: Enable setpoint.
7	Fault acknowledge	0: No function. 0 ⇒ 1: Acknowledge faults. ⁽¹⁾
8	Jog 1	0: Jog 1 off. 1: Jog 1 on. Operation is enabled, drive is at standstill, and STW1 bit 4, 5, 6: 0. The drive runs up along the ramp to jogging setpoint 1.
9	Jog 2	0: Jog 2 off. 1: Jog 2 on. Operation is enabled, drive is at standstill, and STW1 bit 4, 5, 6: 0. The drive runs up along the ramp to jogging setpoint 2.
10	Control by PLC	0: Ignores the current process data. This is linked to a submodule where the CTW is present. If signals are to be covered, the CTW/STW profile (for example, the iC Speed Profile) must be part of the signals list. 1: Uses process data (controlled by PLC).
11	–	Reserved
12	User-defined	These bits are reserved for application-specific advanced control. For more information, refer to the <i>Parameter Descriptions</i> chapter in the application guide.
13	User-defined	
14	User-defined	
15	User-defined	

1) Acknowledging is edge-triggered, when changing from logic 0 to logic 1.

2.2.4.3 Status Word

Table 11: Status Word Bits in PROFIdrive Standard Telegram 1

Bit number	Name	Description
0	Ready to switch on	0: Not ready to switch on. 1: Ready to switch on.
1	Ready to operate	0: Not ready to operate. 1: Ready to operate.
2	Operation enabled	0: Operation disabled. 1: Operation enabled.
3	Operation fault	0: No fault. 1: Fault present.
4	Coast stop	0: Coast stop activated (OFF2). 1: Coast stop not activated (No OFF2).
5	Quick stop	0: Quick stop activated (OFF3). 1: Quick stop not activated (No OFF3).

Table 11: Status Word Bits in PROFIdrive Standard Telegram 1 - (continued)

Bit number	Name	Description
6	Switching on inhibited	0: Switching on not inhibited. 1: Switching on inhibited.
7	Warning	0: There are no warnings. 1: A warning has occurred.
8	Speed error within/out of tolerance range	0: The motor runs, but the present speed is more than 1% different from the reference. It could, for example, be the case while the speed ramps up/down during start/stop. 1: The present motor speed matches the present speed reference within 1% of motor nominal speed.
9	Fieldbus control active/inactive	0: The device does not react on commands from fieldbus. ⁽¹⁾ 1: The device is controlled and reacting to I/O and process data.
10	Speed reached/Speed not reached	0: The actual speed is below the comparison value set with parameter Limit Supervision 1 Threshold (5253). 1: The actual speed is above the comparison value set with parameter Limit Supervision 1 Threshold (5253).
11	Reserved	Reserved
12	Reserved	Reserved
13	Reserved	Reserved
14	Reserved	Reserved
15	Reserved	Reserved

1) The reason why the device does not react to commands can be:

- Fieldbus is not the active control place.
- Fieldbus signals are not configured to be part of the Advanced Control Place.

2.2.4.4 PROFIdrive State Machine

In the PROFIdrive control profile, the control bits perform different functions:

- 0–3 perform the basic startup and power-down functions.
- 4–10 perform application-oriented control.
- 12–15 can be configured for different purposes.

See [Figure 1](#) for the basic state transition diagram, where control bits 0–3 control the transitions and the corresponding status bit indicates the actual state. The black dots indicate the priority of the control signals. Fewer dots indicate lower priority, and more dots indicate higher priority.

The general state diagram is defined in the PROFIdrive standard.

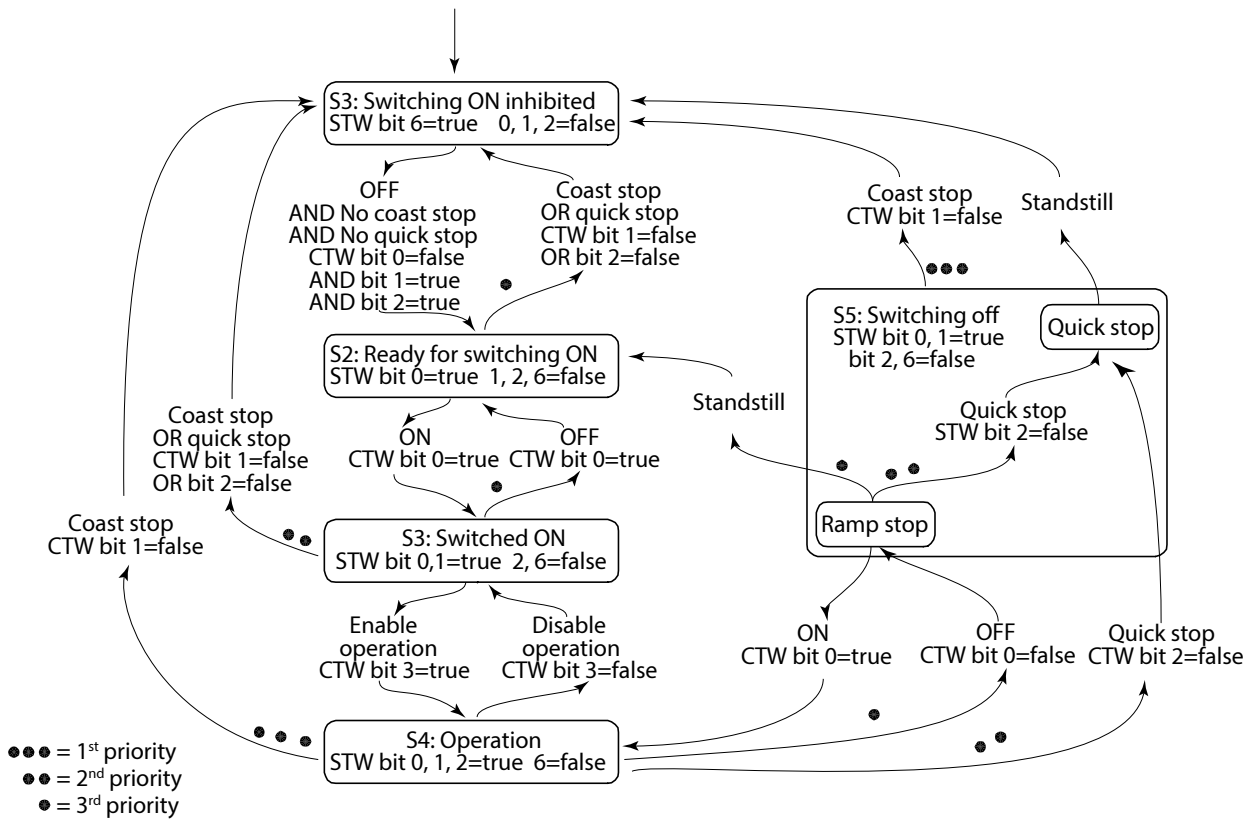


Figure 1: General State Diagram

2.2.5 iC Active Front End

2.2.5.1 Overview

The iC Active Front End profile is used in the iC7 series with the Active Front End application.

2.2.5.2 Status Word

Table 12: iC Active Front End Profile Status Word Bits

Bit number	Name	Description
0	Ready to Switch On	0: The unit is not ready to run. 1: The unit is ready to run. This bit indicates that the unit is ready to start the startup sequence, that is, pre-charging and/or MCB closure, if controlled by the application. There are no active faults and the Switch on Enabled bit is active.
1	Converter Ready	0: The unit is not ready to run. 1: The unit is ready to run. When this bit is true, it indicates that the unit can be successfully started with the Start bit (bit 3) of the control word.
2	Running	0: The unit is not running (modulating). 1: The unit is running (modulating).
3	Fault	0: No faults active. 1: One or more faults active.
4	--	Reserved

Table 12: iC Active Front End Profile Status Word Bits - (continued)

Bit number	Name	Description
5	Quick Stop Inverse	0: Quick stop is active. 1: Quick stop not active.
6	--	Reserved
7	Warning	0: No active warnings. 1: One or more warnings are active.
8	--	Reserved
9	Control by PLC	0: Fieldbus is not the active control place. 1: Fieldbus is the active control place.
10	--	Reserved
11	Run Enabled	0: Run enable from a dedicated input signal is missing. 1: Run enable from a dedicated input signal is present. This bit indicates the state of parameter <i>Run Enable Input</i> (103)
12	--	Reserved
13	--	Reserved
14	--	Reserved
15	Watchdog	Outgoing fieldbus watchdog bit, mirroring control word bit Watchdog (bit 11).

2.2.5.3 Control Word

Table 13: iC Active Front End Profile Control Word Bits

Bit number	Name	Description
0	Switch On Enabled	0: DC-link pre-charging, MCB closure, and running are prevented/interrupted. MCB is opened if closed. 1: DC-link pre-charging, MCB closure, and running are not prevented/interrupted. MCB is not opened if closed.
1	MCB Close Enabled	0: If pre-charging is completed, the MCB is not allowed to close. Running is also prevented or interrupted. MCB is opened if closed. 1: If pre-charging is completed, the MCB is allowed to close.
2	Quick Stop Inverse	0: Initiate quick stop. 1: Do not initiate quick stop.
3	Start	0: Stop the unit if it is running, or stop the pre-charging sequence if it is not completed. 1: Start running if already precharged. Otherwise initiate pre-charging and then start running. Use the parameter <i>Fieldbus Start Mode</i> (5114) to configure whether a new start command is required after the unit has been stopped, or whether the unit starts running immediately after all stopping conditions (quick stop, faults, and so on) are cleared.
4	Pre-charge	0: Stop the DC-link pre-charging, if ongoing. 1: Start/continue the DC-link pre-charging. Only used when the DC-link pre-charging is not controlled externally.

Table 13: iC Active Front End Profile Control Word Bits - (continued)

Bit number	Name	Description
5	–	Reserved
6	–	Reserved
7	Fault Reset	0: Do not reset faults. 1: Reset active faults. A rising edge (a transition from false to true) on this bit issues a fault reset request.
8	–	Reserved
9	–	Reserved
10	Data Valid	0: Ignore the current incoming process data values, instead use the last processed value when Data Valid bit was true.1: Use the current incoming process data values.
11	Watchdog	Incoming fieldbus watchdog bit. used for monitoring the fieldbus connection.
12	User-defined	These bits are reserved for application-specific advanced control. Select the value CTW bit x for any input parameter to use this signal for the activation of a selected function. For more information, refer to the <i>Parameter Descriptions</i> chapter in the application guide.
13	User-defined	
14	User-defined	
15	User-defined	

2.3 Network Topologies

2.3.1 Overview

Communication interface X1/X2 is used for fieldbus connection.

The communication interface in the iC7 drives and power converters has 2 Ethernet ports (X1 and X2) and an embedded switch with 2 Ethernet RJ45 connectors. It has 1 MAC and IP address, and is considered a single device in the network. The communication interface supports 3 network topologies:

- Line topology
- Star topology
- Ring topology

2.3.2 Line Topology

In many applications, line topology enables simpler cabling and the use of fewer Ethernet switches. Observe network performance and the number of devices in a line topology. Too many devices in a line may exceed network update time limits.

NOTICE

When line topology is used, take precautions to avoid timeout in the PLC when more than 8 drives or power converters are installed in series. Each drive or power converter in the network adds a small delay to the communication due to the built-in Ethernet switch. When the update time is too short, the delay can lead to a timeout in the PLC.

- Set the update time as shown in the table. The numbers given are typical values and can vary from installation to installation.

Number of units connected in series	Minimum update time [ms]
<8	2
8–16	4
16–32	8
33–50	16
>50	Not recommended



NOTE: Using tools such as MyDrive® Insight may influence system performance in a line topology.

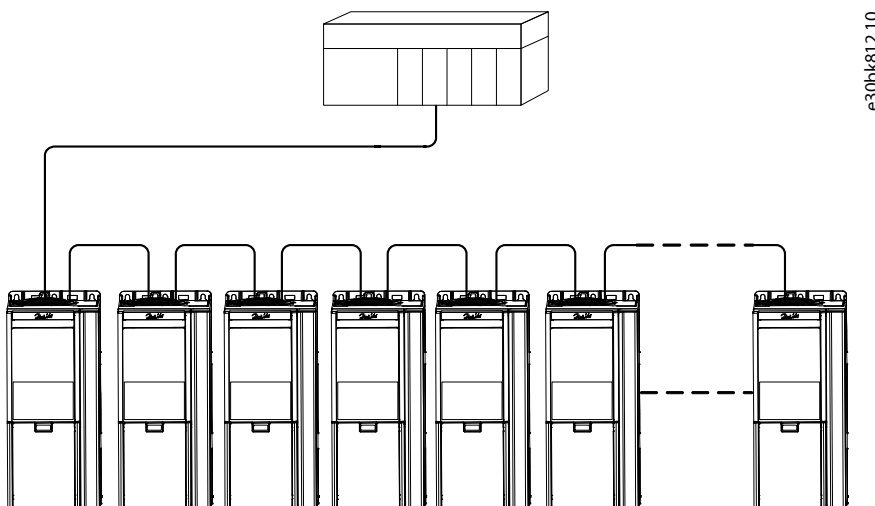


Figure 2: Example of Line Topology

NOTICE

Installing drives or power converters of different current ratings in line topology may result in unwanted fieldbus timeout messages in the event log.

- Mount the drives or power converters with the longest discharge time first in the line topology. In normal operation, the drives or power converters with bigger current ratings have a longer discharge time.

2.3.3 Star Topology

In a star network, all devices are connected to the same switch or switches. Star topology reduces the damage caused by a single cable failure. In a star topology, a single cable failure affects a single device instead of all devices in the network. In many applications, this topology enables simpler cabling depending on the location and distance of the device.

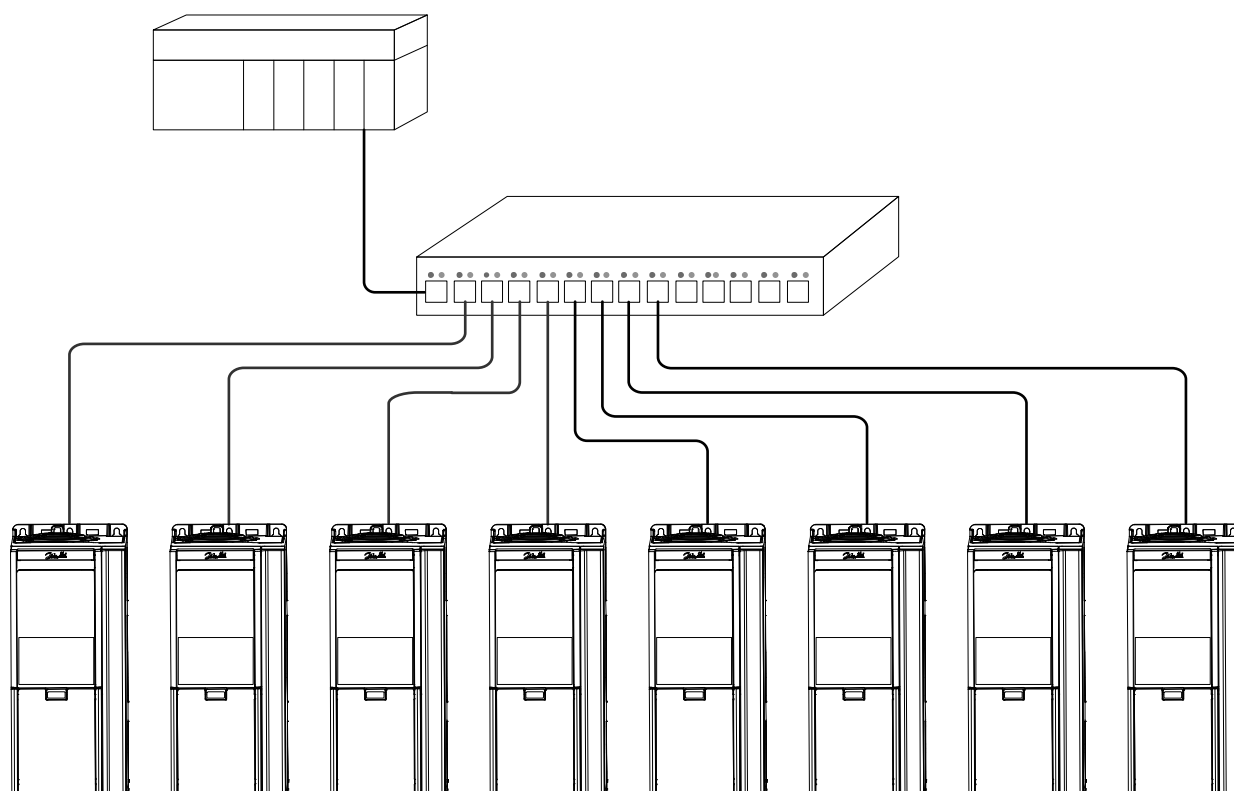


Figure 3: Example of Star Topology

2.3.4 Ring Topology

Ring topology enables the same simpler cabling and reduced cabling costs as line topology, but also reduces the damage caused by a single cable failure in a similar manner as star topology.

NOTICE

When ring topology is used, take precautions to avoid timeout in the PLC when more than 8 drives or power converters are installed in series. Each drive or power converter in the network adds a small delay to the communication due to the built-in Ethernet switch. When the update time is too short, the delay can lead to a timeout in the PLC.

- Set the update time as shown in the table. The numbers given are typical values and can vary from installation to installation.

Number of units connected in series	Minimum update time [ms]
<8	2
8–16	4
16–32	8
33–50	16
>50	Not recommended

The ring topology protocol depends on the protocol in use.

For EtherNet/IP, the device level ring (DLR) is used. A DLR network consists of an active ring supervisor and any number of ring nodes. The iC7 drive acts as a ring node with its 2 Ethernet ports X1/X2. The ring supervisor is typically a PLC and it is responsible for generating a beacon at regular intervals. The DLR protocol contains several fault detection and ring recovery mechanisms. The ring supervisor can block traffic on 1 port to avoid loops, faults are detected when beacon traffic is interrupted, and/or link/ node failure is detected by adjacent nodes. Any DLR-related settings are handled via the ring supervisor.

! IMPORTANT: Do not use non-DLR compliant devices throughout the DLR domain.

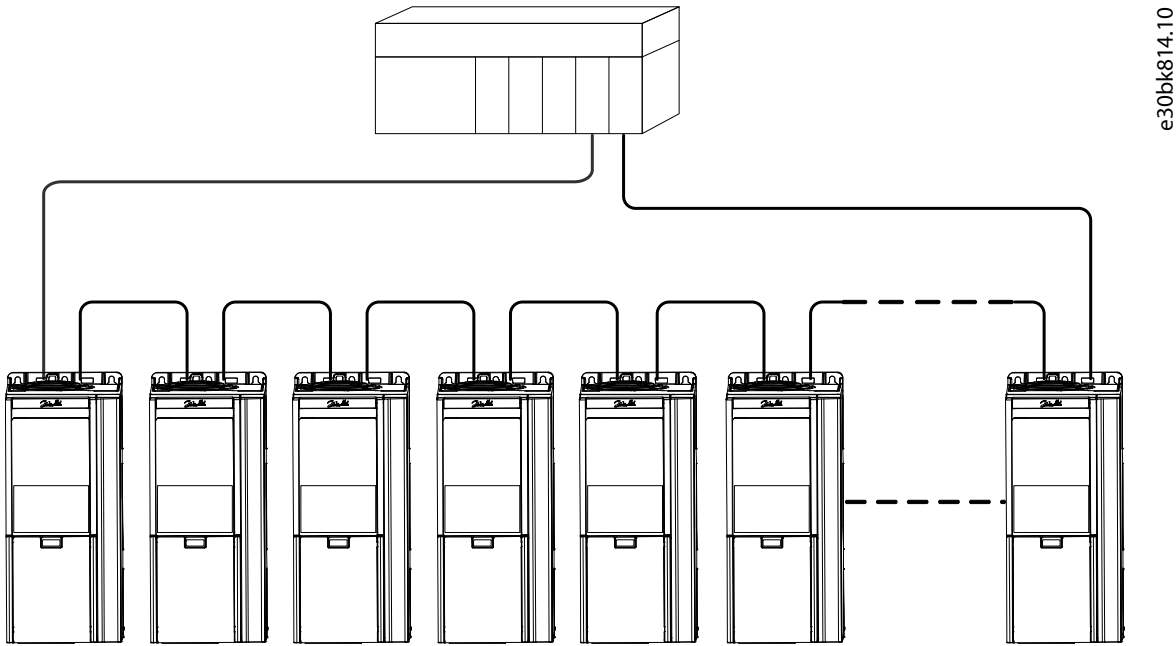


Figure 4: Example of Ring Topology

3 Fieldbus Cable Connections

3.1 Prerequisites for Installation

Communication interfaces are integrated in the control board in iC7 drives and power converters.

The position of the connections differs based on the control board concept and frame, for example. For more information on the location of the connections, cabling, and shielding, refer to the product-specific design guide.

3.2 Installation in Frequency Converters

3.2.1 Communication Interface X1/X2 in Frames FA02–FA12

The communication interface is on the top of the frequency converter as shown in [Figure 5](#). Industrial-grade RJ45 connectors are recommended for optimal connection. A combined shield/fixing plate, the Fieldbus EMC plate, is available as an accessory to strengthen the mechanical fixation of the cables. For information on ordering the EMC plate, refer to the product-specific design guide.

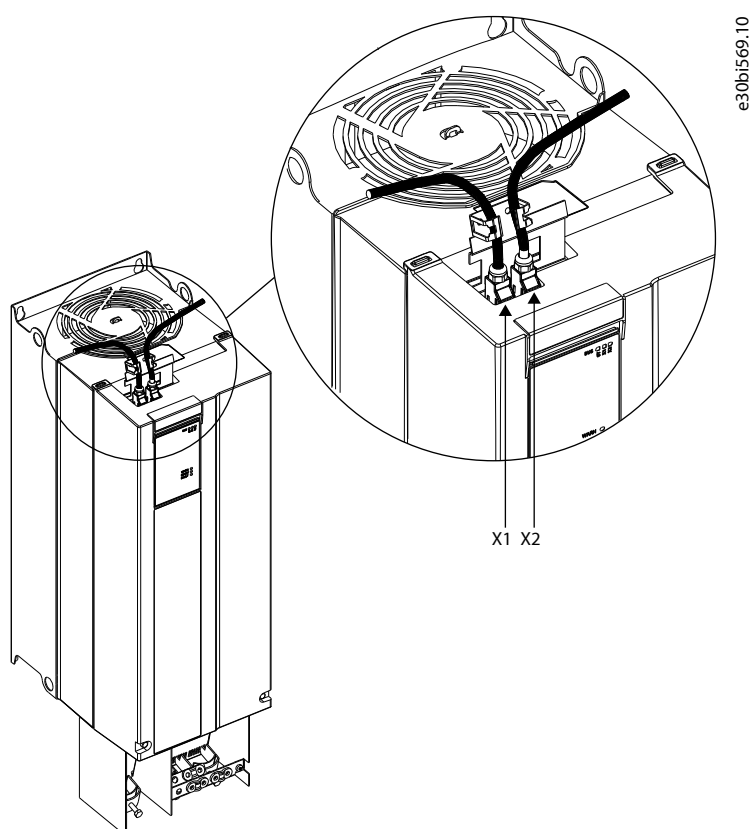


Figure 5: Location of the Communication Interface, X1/X2 in FA02-FA12 Frames (with the Optional EMC Plate)

3.2.2 Communication Interface X1/X2 in Frames FB09–FB12/FK06–FK12

The communication interface ports are located inside the frequency converter. The position of the ports and the recommended wiring path are shown in [Figure 6](#) and [Figure 7](#).

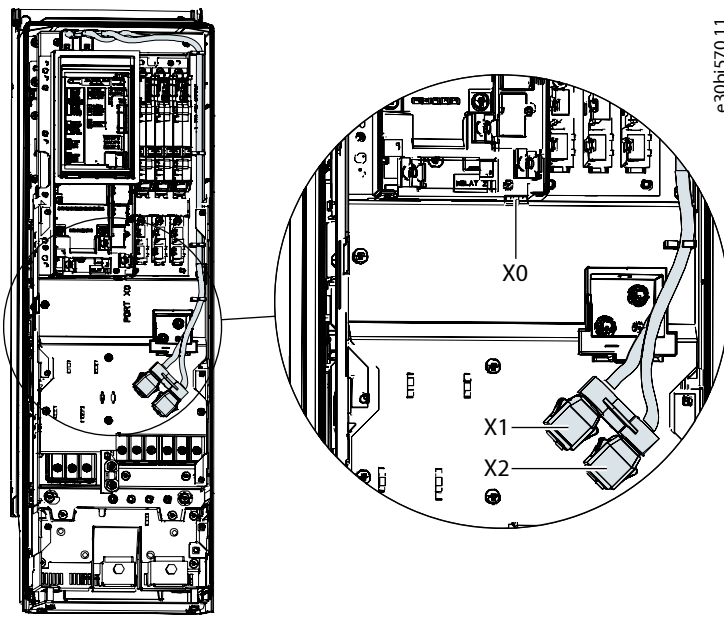


Figure 6: Communication Port X0, X1, and X2 Locations in FK06–FK08 Frames

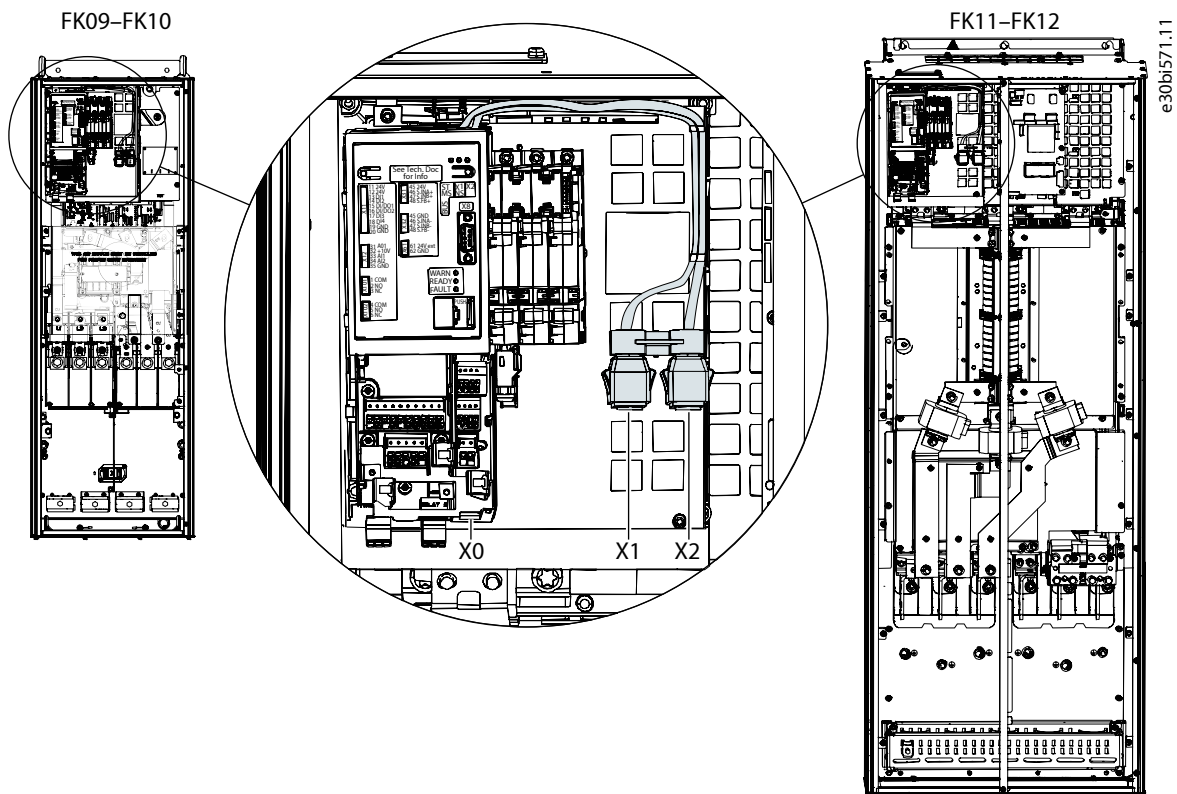


Figure 7: Communication Port X0, X1, and X2 Locations in FB09–FB12/FK09–FK12 Frames

3.3 Installation in System Modules

3.3.1 Communication Interface X1/X2 in System Modules

For systems that use system modules, the communication interface ports are located at the bottom facing side of the modular control unit as shown in [Figure 8](#).

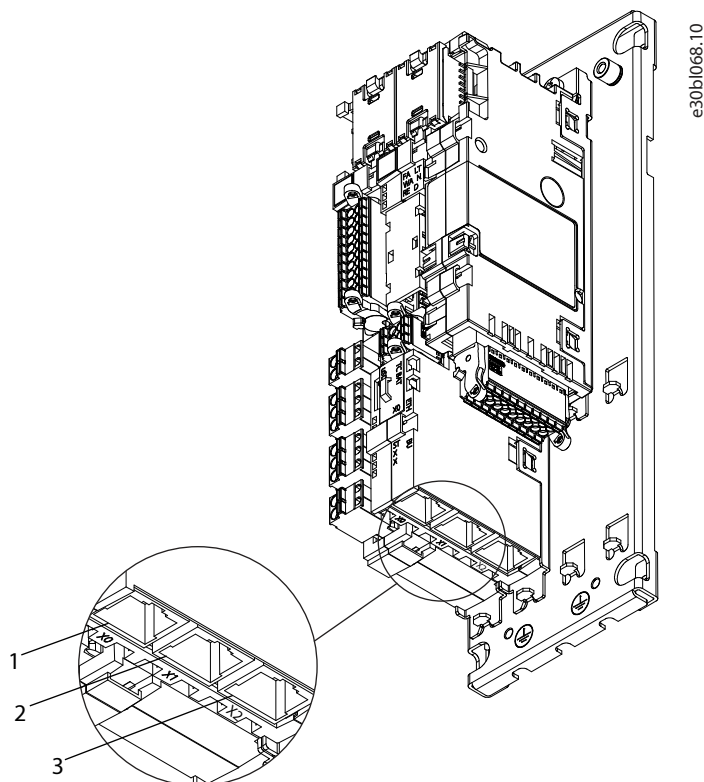


Figure 8: Communication Port X0, X1, and X2 Locations in the Modular Control Unit

1	Ethernet port (X0)	2	Ethernet port (X1)
3	Ethernet port (X2)		

3.4 EMC-compliant Installation

3.4.1 Overview

To obtain an EMC-compliant installation, follow the instructions provided in the product-specific design guide and the installation guide included in the shipment.

3.4.2 Grounding

- Ensure that all stations connected to the fieldbus network are connected to the same ground potential. When distances between the stations in a fieldbus network are long, connect the individual station to the same ground potential. Install equalizing cables between the system components.
- Establish a grounding connection with low HF impedance, for example, by mounting the unit on a conductive backplate.
- Keep the ground wire connections as short as possible.

3.4.3 Cable Routing

For more information on cabling, refer to the product-specific design guide and installation guide included in the shipment.

NOTICE

EMC INTERFERENCE

Failure to isolate fieldbus communication, motor, and brake resistor cables can result in unintended behavior or reduced performance.

- Use shielded cables for motor and control wiring, and separate cables for fieldbus communication, motor wiring, and brake resistor.
- A minimum of 200 mm (7.9 in) clearance between power, motor, and control cables is required. For power sizes above 315 kW (450 hp), increase the minimum distance to 500 mm (20 in).

NOTICE

CABLE ROUTING

- When the fieldbus cable intersects with a motor cable or a brake resistor cable, ensure that the cables intersect at an angle of 90°.

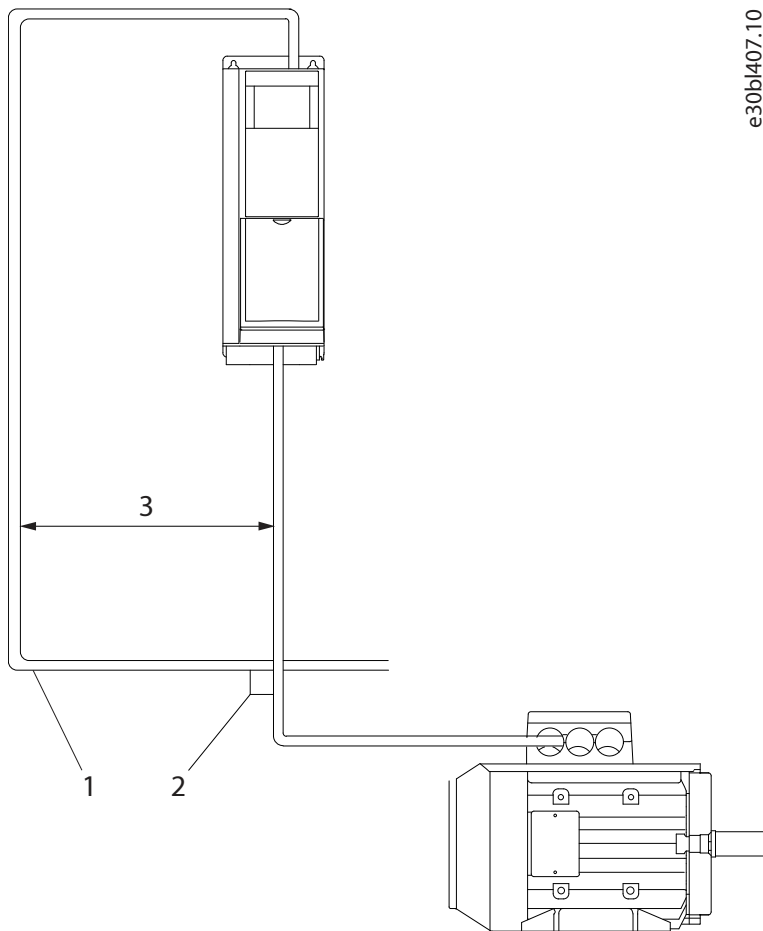


Figure 9: Cable Routing

1	Fieldbus cable	2	90° intersection
3	≥200 mm (7.9 in) (≥ 500 mm (20 in) for power sizes >315 kW (450 hp))		

4 Configuration

4.1 Selecting the Fieldbus Profile

For more information about the available profiles for the application in use, see [Communication Profiles and Objects](#).

1. Navigate to **Parameters > Control Places > Fieldbus Control > Fieldbus Profile**.
2. Select the fieldbus profile.

The selection affects the interpretation of the control word and status word. Selecting a profile may also automatically set specific values for certain parameters or affect control schemes. For details, refer to the application guide.

4.2 Configuring the Ethernet Interface

The X1 and X2 interfaces are internally connected with an Ethernet switch and share the same physical MAC layer, and the same IP settings apply to both interfaces. IPv4 settings are configured in MyDrive® Insight or in the control panel.

1. Configure IPv4 settings.
 - In MyDrive® Insight, go to **Setup and Service > Interface configuration > Interface X1/X2 > IPv4 settings**.
 - In the control panel, navigate to parameter group **Communication Interfaces**.


 **IMPORTANT:** To ensure that outgoing IP packets are routed correctly, configure the IP addresses of the X1/X2 interfaces to a different subnet than the IP address of the X0 interface.

Table 14: IPv4 Settings

Function	Value	Description
Interface X1/X2 MAC address	00:1B:08: xx:xx:xx	The MAC address of interface X1/X2. The value is read-only.
IPv4 addressing method	Disable	Only link-local IP address in the 169.254.xxx.xxx range is active.
	Static IP	A static IP address is entered manually.
	Automatic	IP address is assigned via a DHCP or BOOTP server.
Requested IPv4 address	xxx.xxx.xxx.xxx	If Automatic is selected as the IPv4 addressing method and no DHCP/BOOTP server is present, the X1/X2 interface automatically configures an IP address and subnet mask in the 169.254.xxx.xxx range.
Requested IPv4 subnet mask	xxx.xxx.xxx.xxx	The requested IPv4 subnet mask for the interface.
Requested IPv4 gateway address	xxx.xxx.xxx.xxx	Requested IPv4 gateway address for the interface.
Enable ACD	Enable	Request to enable or disable Address Conflict Detection for the interface. The change does not take effect before a power cycle is performed. If no conflicts are detected, ACD activity shows 0. If an address conflict occurs, the ACD activity shows 1, and the IPv4 interface reverts to an automatically assigned IP address in the 169.254.xxx.xxx range.
	Disable (default)	
DNS server 1, 2	xxx.xxx.xxx.xxx	The user-requested Domain Name Server 1 for the interface (for manual IP addressing mode only).

Table 15: Ethernet Port Configuration (X1/X2)

Parameter name	Parameter number	Selections	Description
<i>Link Configuration X1</i>	7048	<ul style="list-style-type: none"> • Auto negotiation • 10 Mbps full duplex • 10 Mbps half duplex • 100 Mbps full duplex • 100 Mbps half duplex 	Configures the Ethernet link parameter
<i>Link Configuration X2</i>	7049		

4.3 Configuring Fieldbus Protection Settings for the Propulsion & Machinery Application

1. Navigate to parameter group *Parameters > Protections and Responses > Fieldbus Protections*.
2. Configure fieldbus protection settings.

Table 16: Fieldbus Protection Setting Parameters for the Propulsion & Machinery Application

Parameter	Parameter number	Value	Description
<i>Fieldbus Fault Response</i>	1303	<ul style="list-style-type: none"> • No response • Info (default) • Warning • Fault, ramp to coast • Fault, coast See Table 17 for descriptions of the events.	Select the behavior when a fieldbus fault, for example, loss of I/O connection occurs.
<i>Process Data Timeout Response</i>	5291	<ul style="list-style-type: none"> • No response • Info (default) • Warning • Fault, ramp to coast • Fault, coast See Table 17 for descriptions of the events.	Select the response to a process data timeout.
<i>Process Data Timeout Delay</i>	1340	0.05–18000 s (Default value: 1.00 s)	Set a delay for the triggering of the Process Data Timeout event. If process data has not been updated within this delay time, the event is triggered.
<i>Fieldbus Watchdog Response</i>	5244	<ul style="list-style-type: none"> • No response (default) • Info • Warning • Fault, ramp to coast • Fault, coast See Table 17 for descriptions of the events.	Select the drive response for the fieldbus watchdog event.
<i>Fieldbus Watchdog Delay</i>	5245	0.0–3000.0 s (Default value: 5.00 s)	Set a delay for activating the fieldbus watchdog event.

Table 16: Fieldbus Protection Setting Parameters for the Propulsion & Machinery Application - (continued)

Parameter	Parameter number	Value	Description
Fieldbus Watchdog Start Delay	5246	0.0–3000.0 s (Default value: 30.00 s)	Set the startup delay time for activating the fieldbus watchdog event. The counter starts when drive wakes up.
FB Monitoring Control Place Dependency	1338	<ul style="list-style-type: none"> Disabled Enabled (default) 	Set the control place dependency for fieldbus monitoring functions (Fieldbus Fault, Process Data Timeout, and Fieldbus Watchdog). When enabled, the monitoring functions are active only in the fieldbus control place. When disabled, the functions are active regardless of the control place.

Table 17: Event Descriptions in the Propulsion & Machinery Application

Value	Description
No response	–
Info	The event is logged in the event log.
Warning	The drive or power converter issues a warning.
Fault, ramp to coast	The drive or power converter issues a fault, and ramps the motor speed to zero before stopping modulation.
Fault, coast	The drive or power converter issues a fault and stops modulation immediately.

4.4 Configuring Fieldbus Protection Settings for the Active Front End Application

When using the iC7 series Active Front End application, the fieldbus profile is selected automatically.

1. Navigate to parameter group **Parameters > Protections and Responses > Fieldbus Protections**.
2. Configure fieldbus protection settings.

Table 18: Fieldbus Protection Setting Parameters for the Active Front End Application

Parameter	Parameter number	Value	Description
<i>Fieldbus Fault Response</i>	1304	<ul style="list-style-type: none"> • No response • Info • Warning • Fault (default) • Fault, open MCB See Table 19 for descriptions of the events.	Select the behavior when a fieldbus fault, for example, loss of I/O connection occurs.
<i>No Fieldbus Connection Response</i>	1305	<ul style="list-style-type: none"> • No response (default) • Info • Warning • Fault • Fault, open MCB See Table 19 for descriptions of the events.	Select the response if there is no fieldbus connection.
<i>Process Data Timeout Response</i>	1306	<ul style="list-style-type: none"> • No response • Info (default) • Warning • Fault • Fault, open MCB See Table 19 for descriptions of the events.	Select the response to a process data timeout.
<i>Process Data Timeout Delay</i>	1340	0.05–18000 s (Default value: 1.00 s)	Set a delay for the triggering of the Process Data Timeout event. If process data has not been updated within this delay time the event is triggered.
<i>Fieldbus Watchdog Response</i>	5244	<ul style="list-style-type: none"> • No response • Info • Warning (default) • Fault • Fault, open MCB See Table 19 for descriptions of the events.	Select the converter response for the fieldbus watchdog event.
<i>Fieldbus Watchdog Delay</i>	5245	0.0–3000.0 s (Default value: 5.00 s)	Set a delay for activating the fieldbus watchdog event.
<i>Fieldbus Watchdog Start Delay</i>	5246	0.0–3000.0 s (Default value: 30.00 s)	Set a startup delay time for activating the fieldbus watchdog event. The counter starts when the converter wakes up.

Table 19: Event Descriptions

Value	Description
No response	–
Info	The event is logged in the event log.
Warning	The drive or power converter issues a warning.
Fault	The drive or power converter issues a fault and stops modulation.
Fault, open MCB	The drive or power converter issues a fault, stops modulation, and opens the main circuit breaker.

4.5 Configuring EtherNet/IP Scanner

Danfoss provides an electronic data sheet (EDS), which contains the necessary information for the offline configuration of EtherNet/IP communication.

1. Download the EDS files from <https://www.danfoss.com/en/products/dds/system-modules/ic7-system-modules/ic7-marine/#tab-software>.

Each iC7 series application requires its own EDS file. Check that the EDS file version is compatible with the firmware version.

2. To configure a drive with EtherNet/IP for operation with a PLC system, install the EDS file.

4.6 Configuring Rockwell Scanner

To configure a Rockwell (Allen-Bradley) scanner to operate with an EtherNet/IP device, install the EDS file using the EDS hardware installation tool.

1. In *Rockwell EDS Hardware Installation Tool*, go to *Tools > EDS Hardware Installation Tool*.

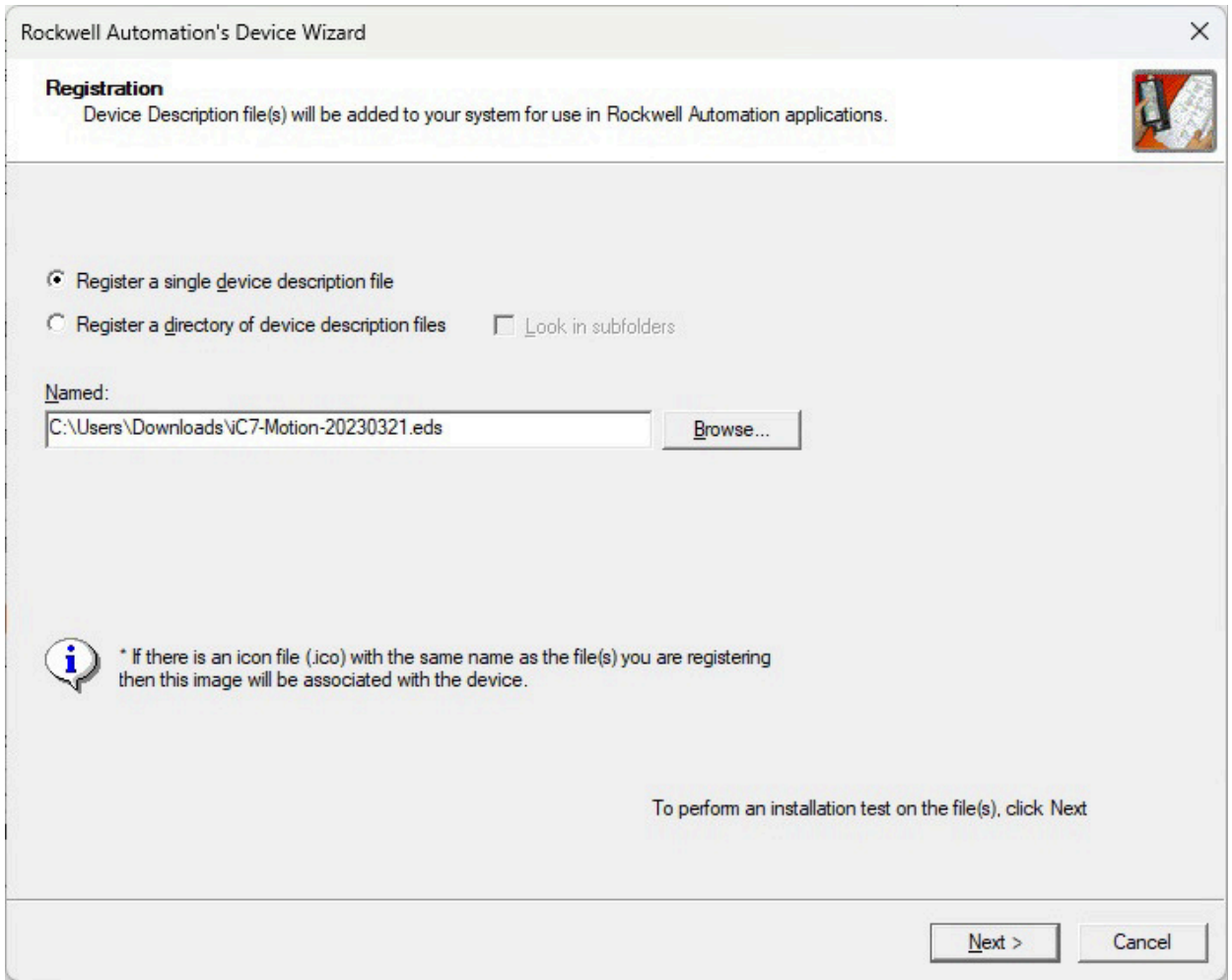


Figure 10: Example of EDS File Registration

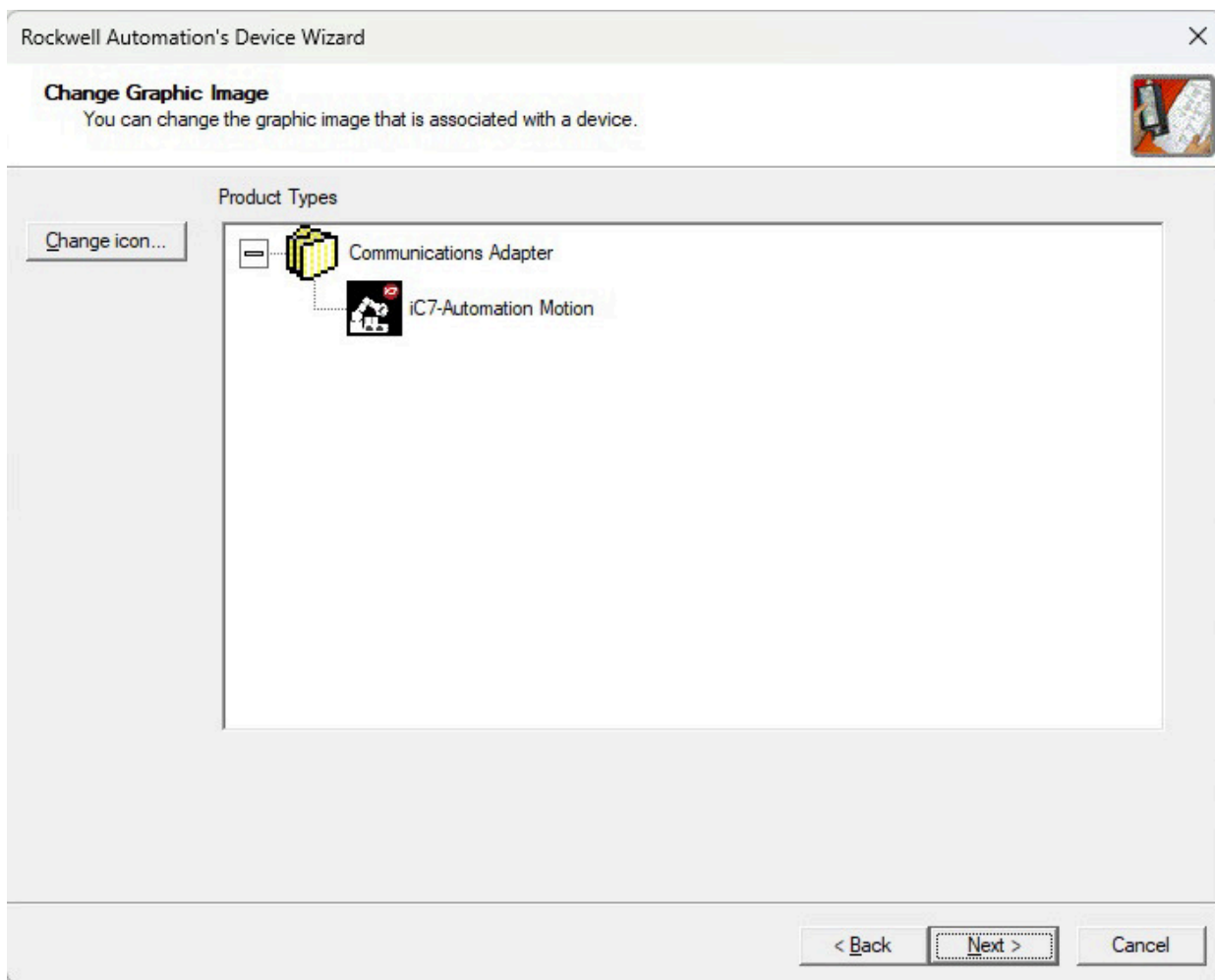
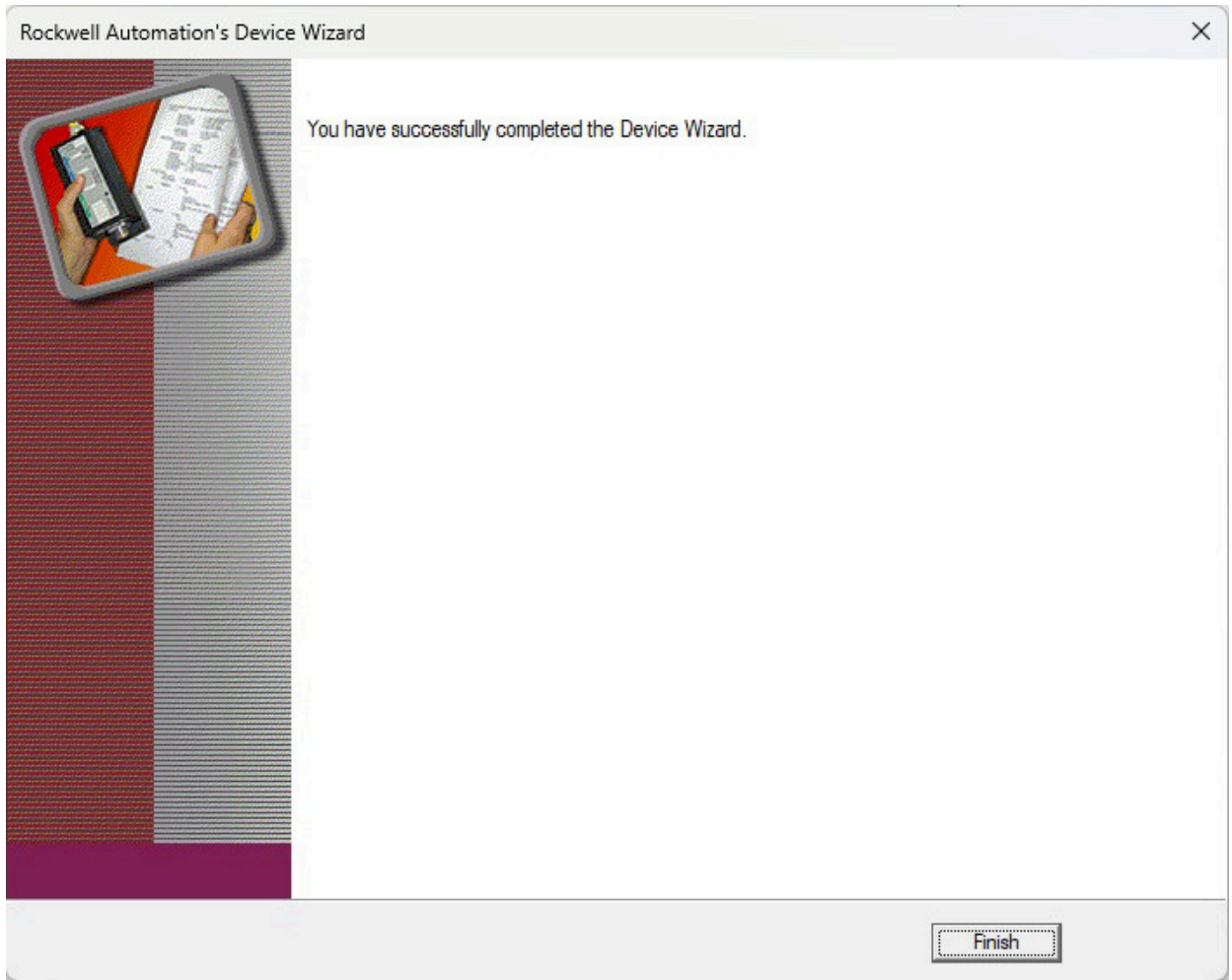


Figure 11: Example of Changing the Graphic Image



e30b1218.10

Figure 12: Example of Completion of EDS Registration

4.7 Configuring EtherNet/IP Connections

1. Configure I/O connection settings.

Table 20: I/O Connection Settings between Rockwell Scanner and the Drive

Name	Value
IP address	192.168.6.120
Connection	EO 130/180
Parameter	<ul style="list-style-type: none"> • Fieldbus Status Word (STW) • Fieldbus Speed Main Actual Value (MAV) • Heat Sink Temperature • DC-link Voltage

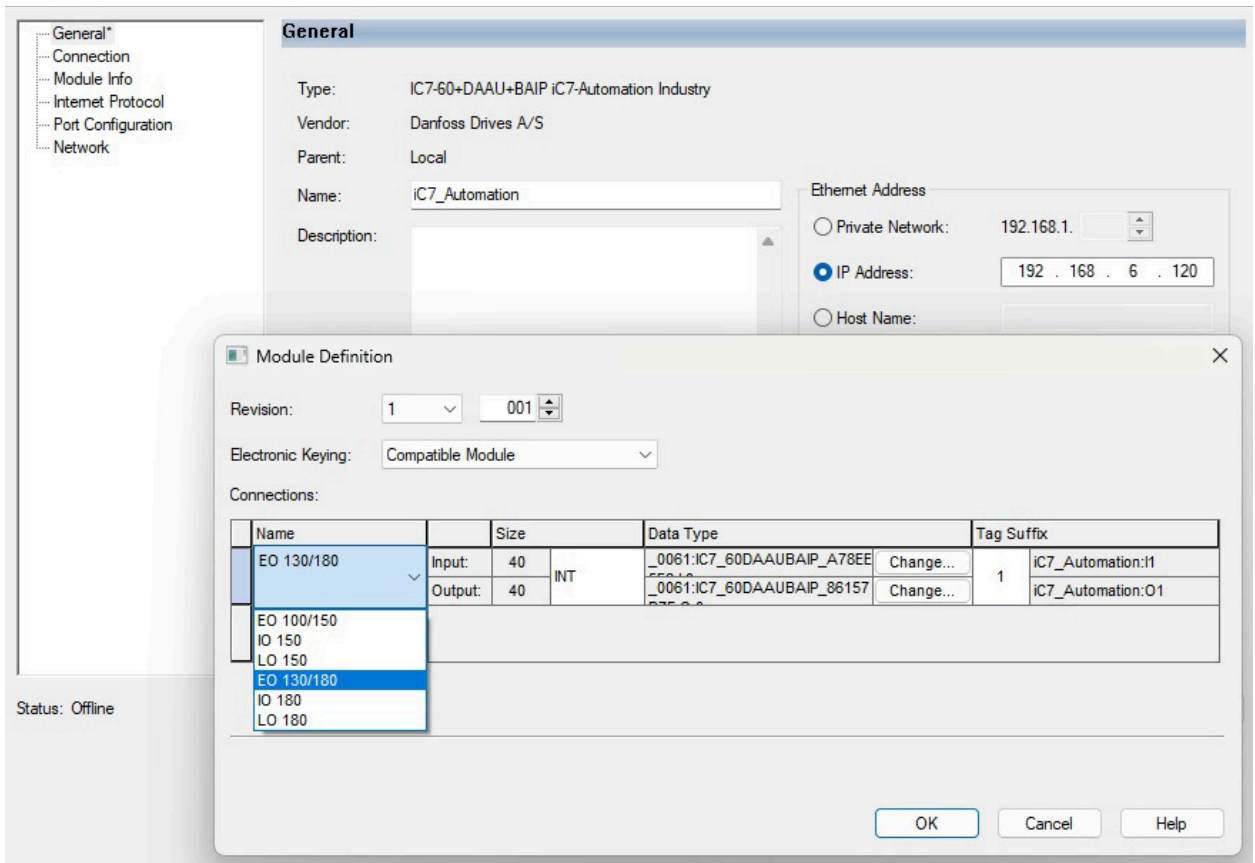


Figure 13: Example of I/O Connection Settings between the Rockwell Scanner and the Drive

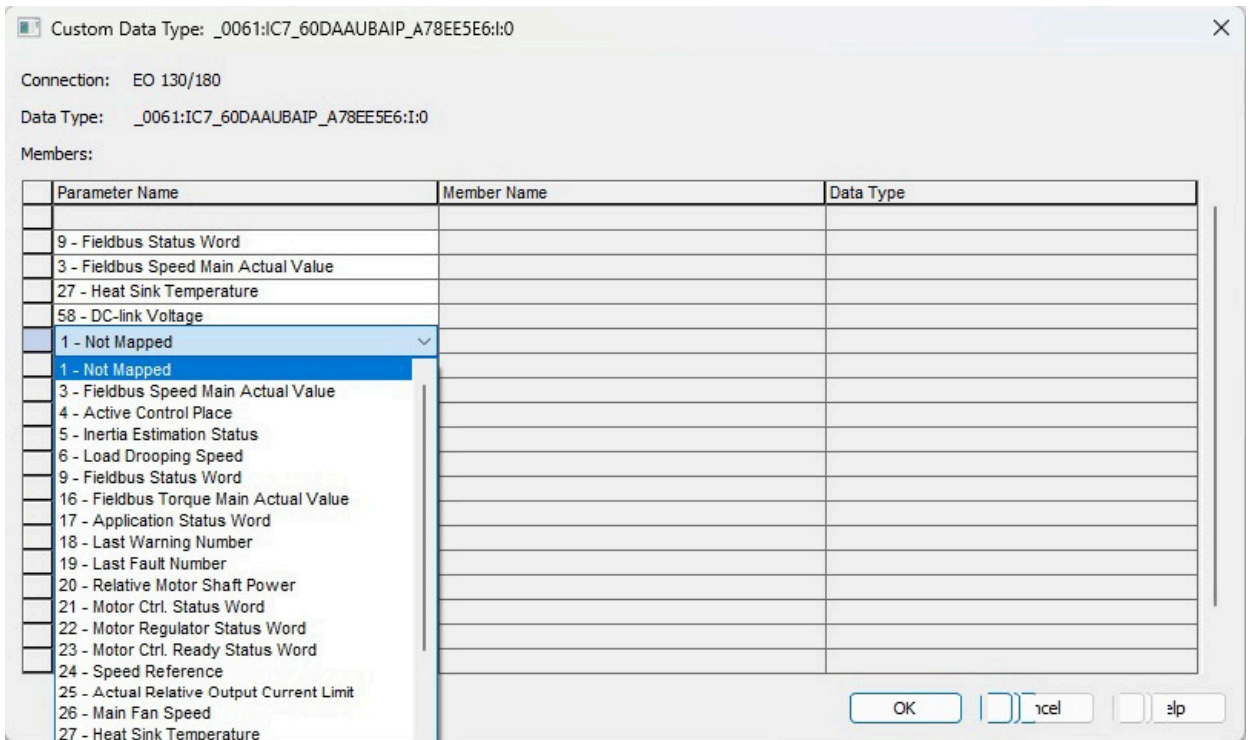


Figure 14: Example of Parameters for I/O Connections between Rockwell Scanner and the Drive

2. Configure Class-1 connection settings.

The class-1 connection is a cyclic I/O connection using TCP transport. The EtherNet/IP interface supports 1 Class-1 connection, but several listen-only connections can be established if multicast is selected as the transport type. The connection is established with a forward open command. See [Table 21](#) for more information.

I/O assembly instances are defined process control objects with defined content comprising control and status information.

Table 21: Assembly Instance Options

Instance	Direction	Size	Data
100	Originator → Target	4 bytes	<ul style="list-style-type: none"> Control word Reference
110 ⁽¹⁾	Originator → Target	6 bytes	<ul style="list-style-type: none"> Control word DC link reference %
130	Originator → Target	80 bytes	Freely selectable
150	Target → Originator	4 bytes	<ul style="list-style-type: none"> Status word Main actual value
160 ⁽¹⁾	Target → Originator	6 bytes	<ul style="list-style-type: none"> Status word DC link actual value %
180	Target → Originator	80 bytes	Freely selectable

1) Available only in the Active Front End application.

Table 22: Supported Connections

Connection point	Type	Description
EO 100/150	Exclusive Owner	The device is controlled by 1 scanner in this assembly.
EO 110/160 ⁽¹⁾		
EO 130/180		
IO 100	Input Only	The scanner receives input data from the device. The data is not sent to the device.
IO 130		
LO 150	Listen Only	A Listen Only connection can be attached to an existing Exclusive Owner or Input Only connection.
LO 180		

1) Available only in the Active Front End application.

Table 23: Supported Transport Types

Direction	Transport type
Originator → Target	Point-to-point
Target → Originator	<ul style="list-style-type: none"> Point-to-point Multicast
Trigger	Cyclic
Packet rate	1 ms minimum supported

3. Configure Class-3 connection settings.

Class-3 Connection is a cyclic connection using UDP transport. The EtherNet/IP interface supports a maximum of 6 Class-3 connections. This type of connection is used for explicit messaging. The connection is established with a forward open-command.

Table 24: Class-3 Connection Parameters

Connection name	Message parameters
Given name for the connection	Service code
	Class
	Instance
	Attribute
	Member
	Request data

4. Configure UCMM settings.

The Unconnected Messages, UCMM is an acyclic connection using TCP transport. This connection is used for explicit messaging. The connection is established on-the-fly and does not require a forward open-command.

Table 25: UCMM Connection Parameters

Connection name	Message parameters
Unconnected messages, UCMM	Service code
	Class
	Instance
	Attribute
	Member
	Request data

For information on accessing CIP objects explicitly, see [6.1.1 Overview](#).

4.8 Reference and Main Actual Handling

4.8.1 Propulsion & Machinery Application

In the Propulsion & Machinery application, the Main Reference [REF] and the Main Actual Value [MAV] are tied to the motor speed. These variables are interfaced as signed 16-bit integer values and are both scaled linearly based on the signal and scale parameter pairs given in [Table 26](#).

Table 26: Reference Scaling Parameters

Parameter	Parameter number	Unit	Range	Data type
<i>Fieldbus Speed Signal Max</i>	6312	–	-32768–32767	Signed 16
<i>Fieldbus Speed Signal Min</i>	6313	–	-32768–32767	Signed 16
<i>Fieldbus Speed Scale Max</i>	6310	[Hz]	-1000–1000	Float 32
<i>Fieldbus Speed Scale Min</i>	6311	[Hz]	-1000–1000	Float 32

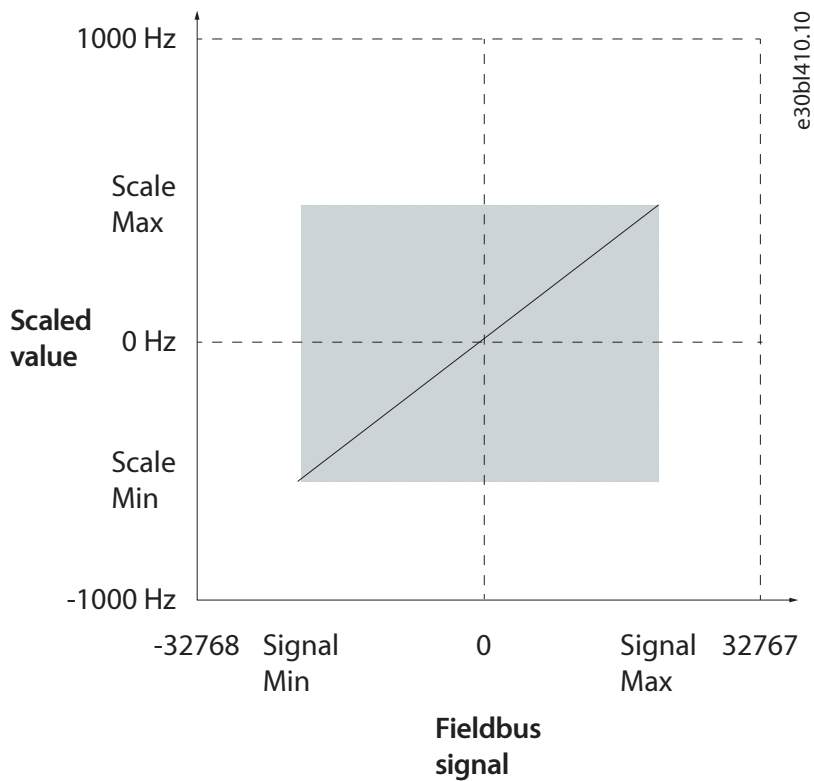


Figure 15: Example of Fieldbus Speed Reference

When the PROFIdrive Standard Telegram 1 profile is selected (parameter number 1301), these parameters are automatically set so that the following reference handling scheme is implemented:

- Signal Max = +32767 = 0x7FFF ↔ Scale Max = +199.99% of motor nominal speed (parameter number 402).
- Signal Min = -32768 = 0x8000 ↔ Scale Min = -200.00% of motor nominal speed (parameter number 402).

4.8.2 Active Front End Application

For the Active Front End application, the Main Reference [REF] and Main Actual Value [MAV] are tied to the DC-link voltage of the converter. Both of these signals are interfaced as 32-bit floating-point values. They are expressed in % of the **Grid Nominal Voltage** parameter (parameter number 6537).

5 Troubleshooting

5.1 Configuring Port Mirroring Settings

Enable or disable the port mirroring function for network troubleshooting with a network analyzer tool.

1. In MyDrive® Insight, go to **Setup and Service > Interface Configuration > Port Mirroring Settings**.

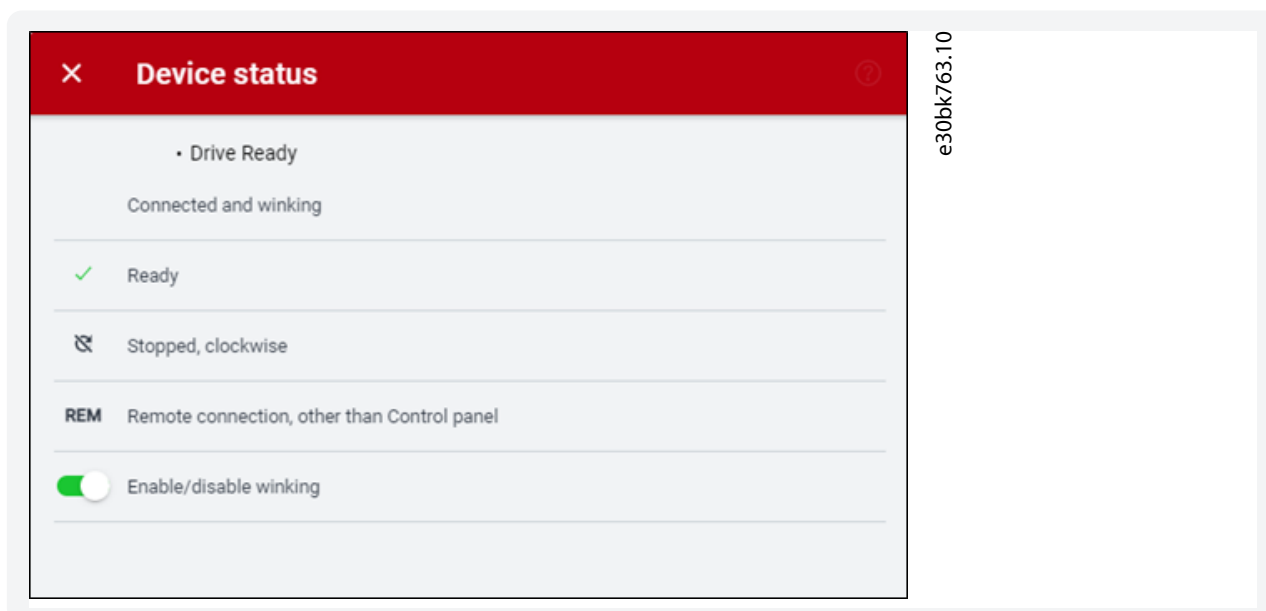
Table 27: Port Mirroring Settings

Function	Selections	Description
Source port	<ul style="list-style-type: none"> • X1 • X2 	Frames are mirrored from this port.
Destination port	<ul style="list-style-type: none"> • X1 • X2 	Frames are mirrored to this port.
Block RX from destination port	Enable/Disable	Device does not receive any frames from Destination Port when enabled.
Enable port mirroring	Enable/Disable	Enables the Port Mirroring feature.

5.2 Identifying a Unit

The winking function makes the fieldbus indicator LEDs ST, X1, and X2 flash yellow to make it easy to identify a unit. The function is enabled in MyDrive® Insight.

1. In MyDrive® Insight, click the device name in live mode.
2. Select *Device Status*.
3. To activate or deactivate the feature, click the toggle switch.



See [5.3 Fieldbus Indicator LEDs](#) for more information on interpreting the LED signals and where the LEDs are located.

Table 28: Fieldbus Indicator LED Functions

LED label	Status	LED pattern	Description
ST	Standby	Flashing green	Device needs commissioning.
	Operational	Solid green	Device is operational.
	Recoverable fault	Flashing red	Device has detected a recoverable fault (MAR).
	Unrecoverable fault	Solid red	Device has detected an unrecoverable fault (MAU).
	Flash LED	Flashing red/green	Flash LED service
X1/X2	No link/no IP	LED off	Unknown status
	No connections	Flashing green	No established EtherNet/IP connections
	Connected	Solid green	EtherNet/IP connection
	Connection timeout	Flashing red	One or more EtherNet/IP connection timeouts.
	Duplicate IP	Solid red	IP address assigned to the device is already in use.
	Flash LED	Flashing red/green	Flash LED service

6 EtherNet/IP Features

6.1 Supported CIP Objects

6.1.1 Overview

As in all implementations of CIP, EtherNet/IP shares the common object model. Objects are a common method to describe the specific application implemented in a device.

Data is structured in classes, instances, and attributes:

- A class is a group of objects with the same structure. These groups of objects within a class are called instances.
- Every instance provides the same data elements called attributes.
- Each class provides services to access data or to change the state of an object.

6.1.2 Class ID 0x01 Identity Object

Table 29: Instance Attributes for Class ID 0x01 Identity Object

Attribute	Access	Name	Data type	Description
1	Get	Vendor ID	UINT (97)	Danfoss Drives
2	Get	Device type	UINT (2)	Variable frequency drive
3	Get	Product code	UINT	CIP product code
4	Get	Revision	STRUCT	CIP revision
5	Get	Status	WORD	EtherNet/IP status word
6	Get	Serial number	UDINT	Serial number
7	Get	Product name	STRING	Name of iC7 application
8	Get	State	UINT	0 = N/A 1 = Device self-testing 2 = Standby 3 = Operational 4 = Major recoverable fault 5 = Major unrecoverable fault 6–254 = Reserved 255 = Default for <i>get_attribute_all</i>

6.1.3 Supported Services in Class ID 0x01

Table 30: Supported Services in Class ID 0x01

Service	Value
Reset Service Parameter	0 = Emulated Power Cycle 1 = Factory Reset
Flash LED Service Parameter	Duration in seconds. Flashing red/green/off

6.1.4 Class ID 0x04 Assembly Objects

Table 31: Instance Attributes for Class ID 0x04 Assembly Objects in the Propulsion & Machinery Application

Instance	Access	Name	Size	Description
100	Set	[CTW], [REF]	4 bytes	Consuming assembly 100
130	Set	Free configurable	80 bytes	Consuming assembly 130
150	Get	[STW], [MAV]	4 bytes	Producing assembly 150
180	Get	Free configurable	80 bytes	Producing assembly 180
768	Set	Configuration	4 bytes	Configuration assembly 768 (for instance 100, 150)
769	Set	Configuration	80 bytes	Configuration assembly 769 (for instance 130, 180)

Table 32: Instance Attributes for Class ID 0x04 Assembly Objects in the Active Front End Application

Instance	Access	Name	Size	Description
110	Set	[CTW], [REF]	4 bytes	Consuming assembly 110
130	Set	Free configurable	80 bytes	Consuming assembly 130
160	Get	[STW], [MAV]	4 bytes	Producing assembly 160
180	Get	Free configurable	80 bytes	Producing assembly 180
768	Set	Configuration	4 bytes	Configuration assembly 768 (for instance 100, 150)
769	Set	Configuration	80 bytes	Configuration assembly 769 (for instance 130, 180)

6.1.5 Class ID 0x06 Connection Manager

Table 33: Instance Attributes for Class ID 0x06 Connection Manager

Attribute	Access	Name	Data type	Description
1	Get	Open requests	UINT	Number of forward open requests received.
2	Get	Open format rejects	UINT	Number of forward open requests rejected due to bad format.
3	Get	Open resource rejects	UINT	Number of forward open requests rejected due to lack of resources.
4	Get	Open other rejects	UINT	Number of forward open requests rejected due to other reasons.
5	Get	Close requests	UINT	Number of forward close requests received.
6	Get	Close format requests	UINT	Number of forward close requests rejected due to bad format.
7	Get	Close other requests	UINT	Number of forward close requests rejected due to other reasons.
8	Get	Connection timeouts	UINT	Number of connection timeouts.

6.1.6 Class ID 0x47 DLR (Device Level Ring)

Table 34: Instance Attributes for Class ID 0x47 DLR (Device Level Ring)

Attribute	Access	Name	Data type	Description
1	Get	Network topology	USINT	Current network topology mode: 0 = Linear 1 = Ring
2	Get	Network status	USINT	Status of network: 0 = Normal 1 = Ring fault 2 = Unexpected loop detected 3 = Partial network fault 4 = Rapid fault/restore cycle
10	Get	Active supervisor address	Struct of:	–
		Supervisor IP address	UDINT	A Value of 0 indicates that no IP Address has been configured for the device.
		Supervisor MAC address	Array of 6 USINTs	Ethernet MAC address
12	Get	Capability flags	DWORD	DLR capabilities of the device. iC7series drives are beacon-based nodes.

6.1.7 Class ID 0x48 Quality of Service Object

Table 35: Instance Attributes for Class ID 0x48 Quality of Service Object

Attribute	Access	Name	Data type	Description
1	Get/Set	802.1Q tag enable	USINT	Enables or disables sending 802.1Q frames on CIP and IEEE 1588 messages. A value of 0 indicates tagged frames disabled. A value of 1 indicates tagged frames enabled.
4	Get/Set	DCSP urgent	USINT	DSCP value for CIP transport class 0/1 urgent priority messages.
5	Get/Set	DCSP scheduled	USINT	DSCP value for CIP transport class 0/1 scheduled priority messages.
6	Get/Set	DCSP high	USINT	DSCP value for CIP transport class 0/1 high priority messages.
7	Get/Set	DCSP low	USINT	DSCP value for CIP transport class 0/1 low-priority messages.
8	Get/Set	DCSP explicit	USINT	DSCP value for CIP explicit messages (transport class 2/3 and UCMM) and all other EtherNet/IP encapsulation messages.

6.1.8 Class ID 0xF5 TCP/IP Interface Object

Table 36: Instance Attributes for Class ID 0xF5 TCP/IP Interface Object

Attribute	Access	Name	Data type	Description
1	Get	Status	DWORD	Interface status
2	Get	Config. capability	DWORD	Interface capability flags
3	Get/Set	Config control	DWORD	Interface control flags
4	Get	Physical link object	Struct of:	–
		Path size	UINT	Size of path
		Path	Padded EPATH	Logical segments identifying the physical link object.
5	Get/Set	Interface config:	Struct of:	TCP/IP network interface configuration
		IP address	UDINT	The device IP address
		Network mask	UDINT	The device network mask
		Gateway address	UDINT	Default gateway address
		Name server	UDINT	Primary name server
		Name server 2	UDINT	Secondary name server
		Domain name	STRING	Default domain name
6	Get/Set	Host name	STRING	Host name
8	Get/Set	TTL value	USINT	Time-to-Live value for IP multicast packets. The default value is 1.
9	Get/Set	Multicast config	Struct of:	–
		Num Mcast	UINT	Number of IP multicast addresses to allocate for EtherNet/IP.
		Multicast start address	UDINT	Starting multicast address from which to begin allocation, A block of Num Mcast addresses is allocated starting with this address.
10	Get/Set	Select ACD	BOOL	Enable ACD: 0 = Disabled (default) 1 = Enabled
11	Get	Last conflict detected	Struct of:	–
		ACD activity	USINT	State of ACD activity when the last conflict was detected.
		Remote MAC	Array of 6 USINT	MAC address of a remote node from the ARP PDU in which a conflict was detected.
		ArpPdu	Array of 28 USINT	Copy of the raw ARP PDU in which a conflict was detected.
13	Get/Set	Encap. inactivity timeout		Number of seconds of inactivity before the TCP connection is closed.

6.1.9 Class ID 0xF6 Link Object

3 instances of the link object are implemented:

- Instance 1 relates to the internal interface of the option after the built-in switch.
- Instance 2 relates to Ethernet port X1.
- Instance 3 relates to Ethernet port X2.

Table 37: Instance Attributes for Class ID 0xF6 Link Object

Attribute	Access	Name	Data type	Description
1	Get	Interface speed	UDINT	Interface speed in Mbps
2	Get	Interface flags	DWORD	Interface status flags
3	Get	Physical address	ARRAY of 6 USINTs	MAC layer address
4	Get	Interface counters	Struct of:	–
		In octets	UDINT	Octets received on the interface.
		In Ucast packets	UDINT	Unicast packets received on the interface.
		In NUcast packets	UDINT	Non-unicast packets received on the interface.
		In discards	UDINT	Inbound packets are received on the interface but discarded.
		In errors	UDINT	Inbound packets that contain errors (does not include In Discards).
		In unknown protos	UDINT	Inbound packets with unknown protocol.
		Out octets	UDINT	Octets sent on the interface.
		Out Ucast packets	UDINT	Unicast packets sent on the interface.
		Out NUcast packets	UDINT	Non-unicast packets sent on the interface.
		Out discards	UDINT	Outbound packets discarded.
Out errors	UDINT	Outbound packets that contain errors.		

Table 37: Instance Attributes for Class ID 0xF6 Link Object - (continued)

Attribute	Access	Name	Data type	Description
5	Get	Media counters	Struct of:	–
		Alignment errors	UDINT	Frames received that are not an integral number of octets in length.
		FCS errors	UDINT	Frames received that do not pass the FCS check.
		Single collisions	UDINT	Successfully transmitted frames which experienced exactly 1 collision.
		Multiple collisions	UDINT	Successfully transmitted frames which experienced more than 1 collision.
		SQE test errors	UDINT	Number of times an SQE test error message is generated.
		Deferred transmissions	UDINT	Frames for which the 1st transmission attempt is delayed because the medium is busy.
		Late collisions	UDINT	Number of times a collision is detected later than 512 bit times into the transmission of a packet.
		Excessive collisions	UDINT	Frames for which transmission fails due to excessive collisions.
		MAC transmit errors	UDINT	Frames for which transmission fails due to an internal MAC sub layer transmit error.
		Carrier sense errors	UDINT	Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame.
		Frame too long	UDINT	Frames received that exceed the maximum allowed frame size.
MAC receive errors	UDINT	Frames for which reception on an interface fails due to an internal MAC sub layer receive error.		
6	Set	Interface control	Struct of:	–
		Control bits	WORD	Interface control bits
		Forces interface speed	UINT	The speed at which the interface is forced to operate (speed in Mbps).
7	Get	Interface type	SHORT_STRING	Type of interface: 1 = internal 2 = twisted pair
8	Get	Interface state	USINT	Current state of the interface: 0 = Unknown state 1 = Operational 2 = Disabled

Table 37: Instance Attributes for Class ID 0xF6 Link Object - (continued)

Attribute	Access	Name	Data type	Description
9	Get/Set	Admin state		Administrative state: 1 = Enable 2 = Disable
10	Get	Interface label	SHORT_STRING	Human readable identification
11	Get	Interface capabilities	Struct of:	Interface speed and Duplex mode



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