Operating Guide

iC7-Automation PROFINET

PROFINET RT OS7PR

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Contents

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, PROFINET technology, and the PC or PLC that is used as a master in the system.

Read the instructions before configuring PROFINET, 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
AR	Application relations
BMPA	Base mode parameter access
CAN	Controller area network
CiA	CAN in Automation
CTW	Control word
DAP	Device access point

Table 1: Abbreviations - (continued)

Abbreviation	Definition
DCP	Discovery and configuration protocol
DHCP	Dynamic host configuration protocol
DO	Drive object
DU	Drive unit
EMC	Electromagnetic compatibility
I/O	Input/Output
IP	Internet protocol
IRT	Isochronous real time
LED	Light-emitting diode
LLDP	Link layer discovery protocol
LSB	Least significant bit
MAP	Module access point
MAV	Main actual value
MRC	Media redundancy client
MRM	Media redundancy manager
MRP	Media redundancy protocol
MRV	Main reference value
MSB	Most significant bit
NAP	Network access point
PAP	Parameter access point
PC	Personal computer
PCD	Process channel data
PDEV	P-Device
PLC	Programmable logic controller
PNU	Parameter number
PPO	Process parameter object
REF	Reference
RFG	Ramp frequency generator
RT	Real time
SR	System redundancy
STW	Status word

1.7 Trademarks

PROFIBUS® and PROFINET® are registered trademarks of PROFIBUS and PROFINET International (PI).

PROFIdrive® is a registered trademark licensed by PROFIBUS and PROFINET International (PI).

1.8 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
AQ408626183394, version 0201	Updated to include the Active Front End application, S2 redundancy, and parameter access handling. Editorial changes.
AQ408626183394, version 0101	The information in this version applies to PROFINET RT OS7PR (+BAPR).

2 Product Overview

2.1 PROFINET Features and Technical Data

Fieldbus options for iC7 series drives and power converters 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 can be selected in the configurator when ordering a drive or power converter, or alternatively, they can be activated later by a proof-of-purchase token.

Table 3: PROFINET Model Codes

Model code	Description
+BAPR	PROFINET RT OS7PR

PROFINET is the Ethernet-based automation standard of PROFIBUS and PROFINET International (PI) for the implementation of an integrated and consistent automation solution based on Industrial Ethernet. PROFINET supports the integration of distributed field devices and time-critical applications in switched Ethernet networks. It also supports the integration of component-based distributed automation systems for vertical and horizontal integration of networks.

Table 4: PROFINET Features

Feature	Technical data
Cyclic response	1 ms update cycle
	PROFINET RT Conformance Class B (CC-B)
	Data consistency with submodule
Diagnostics	PROFINET Extended Diagnostics
	PROFINET Diagnostics (ALARM CR)
Connection	MRP (Media Redundancy Protocol)
	System Redundancy S2
	LLDP/SNMP
	Netload Class III, Advanced robustness against net load
	IPv4
	Addressing mode: DCP, STATIC, DHCP/BOOTP
	Number of communication application relations (AR): 2
System integration	GSDML files for iC7-Automation application software are available on www.danfoss.com/en/products/dds/low-voltage-drives/ic7-drives/ic7-automation/#tab-software. For information regarding the integration into 3rd party PROFINET-IO controller systems, see the application guides on https://www.danfoss.com.
PROFIenergy	Version 1.3

2.2 Communication Profiles and Objects

The iC7 series complies with PROFINET and PROFIdrive standards, mandatory PNU objects, PROFINET Extended Diagnostics, and a range of vendor-specific profiles for product-specific applications.

Table 5: Communication Profiles and Supported Applications

Profile	Industry	Motion	Active Front End
PROFIdrive Application Class 0	–	–	X
PROFIdrive Application Class 1	X	X	–

Table 5: Communication Profiles and Supported Applications - (continued)

Profile	Industry	Motion	Active Front End
PROFIenergy version 1.3	X	X	X
PROFIdrive standard PNUs	X	X	X
CiA402 CANopen Profile	X	X	–
iC Speed Profile	X	X	–
iC Motion Profile	–	X	–
iC Active Front End Profile	–	–	X

2.3 iC Speed

2.3.1 Overview

The iC Speed profile is used with the iC7 series. The iC Speed profile differs from the CiA 402 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.

2.3.2 Control Word

Table 6: 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.
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.

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

Bit number	Name	Description
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 *Parameter Descriptions* 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.

2.3.3 Status Word

Table 7: 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	Frequency converter ready	0 = The frequency converter is not ready for operation. This status does not involve faults and warnings as they are indicated in their respective bits elsewhere. 1 = The frequency converter is ready for operation.
2	Coast	0 = The frequency converter has an active coast signal and has released the motor. 1 = There are no active coast signals, and the motor can start when a start signal is given.
3	Fault	0 = There are no faults. 1 = A fault has occurred, and an acknowledge signal is required to re-establish operation.
4	Reserved	Reserved.
5	Reserved	Reserved.
6	Reserved	Reserved.
7	Warning	0 = There are no warnings. 1 = A warning is active.
8	Speed=reference	0 = The motor runs, but the current speed is different from the current speed reference, for example, while the speed ramps up or down during start or stop. 1 = The current motor speed matches the current speed reference within a given tolerance. The tolerance is product-specific.

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

Bit number	Name	Description
9	Bus control/Local operation	0 = The device does not react on commands from the fieldbus, for 1 of the following reasons: • CTW bit 10 = 0. • HMI is in local mode. • MyDrive® Insight has taken control. • Control places do not include fieldbus. 1 = The device is controlled and reacting to I/O and process data.
10	Frequency limit	0 = The output frequency has exceeded the defined motor limits. 1 = The output frequency is within the defined motor limits. The speed limits are set with the parameters in parameter group ***5.8.3 Speed Limits and Monitors***.
11	Operation	0 = There are no active start requests, and the process does not run. The motor is coasted and is not started. 1 = The process is running, and the motor can be running or start at any time.
12	Reserved	Reserved.
13	Reserved	Reserved.
14	User-defined	These bits are reserved for application-specific advanced control. For more information, refer to the *Parameter Descriptions* chapter in the application guide.
15	User-defined	

2.4 iC Motion

2.4.1 Overview

The iC Motion profile is used with the motion features of iC7-Automation and consists of:

- Motion-specific control word, speed reference, and position reference for controlling the drive.
- Motion-specific status word, actual speed, and actual position as status.

Table 8: Telegram Layout

	Word 1	Word 2	Word 3 and 4
Input to drive	Control word	Speed reference	Position reference
Output from drive	Status word	Actual speed	Actual position

Fieldbus reference is the default selection as the source for speed and position reference in the ***5.5 Control Places*** parameters but the references can be ignored if the ***Control Places*** settings are modified.

2.4.2 iC Motion Profile Control and Status Words

The iC Motion profile control and status words are based on the iC speed profile, with the addition of the most used signals for positioning and synchronizing. The Motion-specific signals require the selection of the appropriate operating mode, see parameter ***5.4.2.16 Operation Mode***.

Table 9: Control Word

Bit	Name	Description
0	Preset position reference Bit 0	000 = Preset Position Ref. 1 001 = Preset Position Ref. 2 010 = Preset Position Ref. 3 011 = Preset Position Ref. 4 100 = Preset Position Ref. 5 101 = Preset Position Ref. 6 110 = Preset Position Ref. 7 111 = Preset Position Ref. 8
1	Preset position reference Bit 1	
2	Preset position reference Bit 2	
3	No Coast	0: Causes the drive to immediately coast the motor. 1: No function.
4	Start Synchronizing	0 = Ramp down to standstill. 1 = Follower locked to synchronizing master.
5	Enable Reference	0 = No Function. 1 = New position reference enabled.
6	Start	0 = Stop the frequency converter and ramp down the motor speed as defined with the ramp down parameter. 1 = If the other starting conditions are fulfilled, this selection allows the frequency converter to start the motor.
7	Reset	0: No function. 0 ⇒ 1: Acknowledge faults.[1]
8	Enable Superimposed	0 = No function. 1 = Execute superimposed movement.
9	Relative Positioning	0 = Absolute positioning. 1 = Relative positioning.
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 (the iC Speed Profile for example) must be part of the signals list. 1 = Use process data (control by PLC). Use the previously processed data when the data valid bit was true (no control by PLC).
11	Enable Home	0 = Abort homing function. 1 = Execute homing function.
12	User-defined	These bits are reserved for application-specific advanced control. For more information, refer to the *Parameter Descriptions* chapter in the application guide.
13	User-defined	
14	User-defined	
15	User-defined	

1) Acknowledge is edge-triggered, when the logic is changed from 0 to 1. Faults can only be acknowledged is the triggering condition has been removed and any required acknowledgment has been done.

The basic commands such as ***Start*** and ***Coast*** are configured via ***5.5 Control Places***. By default, the commands are mapped to the corresponding control word bits, but that can change if the ***Control Places*** settings are modified. The Motion-specific commands are not available for configuration in ***Control Places***, but the logic when mapping these signals to digital inputs is "OR".

Table 10: Status Word

Bit	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 device is not ready for operation. This status does not involve faults and warnings as they are indicated in their respective bits elsewhere. 1 = The device is ready for operation.
2	No coast (Enabled)	0 = The frequency converter has an active coast signal and has released the motor. 1 = There are no active coast signals, and the motor can start when a start signal is given.
3	Fault	0 = There are no faults. 1 = A fault has occurred, and an acknowledge signal is required to re-establish operation.
4	Home Done	0 = Homing is not completed. 1 = Homing is completed.
5	In Sync	0 = Follower is not in sync with master. 1 = Follower is in sync with master within the tolerance specified by parameter ***5.15.2.2 Synchronization Window***.
6	Reserved	Reserved.
7	Warning	0 = There are no warnings. 1 = A warning is active.
8	Position error within tolerance	0 = Position error is greater than the tolerance specified by parameter ***5.13.5.1 Position Error Window***. 1 = Position error is within the tolerance specified by parameter ***5.13.5.1 Position Error Window***.
9	Bus control	0 = The device does not react on commands from the fieldbus, for 1 of the following reasons: • CTW bit 10 = 0. • HMI is in local mode. • MyDrive® Insight has taken control. • Control places do not include fieldbus. 1 = The device is controlled and reacting to I/O and process data.
10	Frequency limit OK	0 = The output frequency has exceeded the defined motor limits. 1 = The output frequency is within the defined motor limits. The speed limits are set with the parameters: • ***5.8.3.1 Positive Speed Limit*** • ***5.8.3.2 Negative Speed Limit*** • ***5.8.3.3 Minimum Speed Limit***
11	In operation	0 = There are no active start requests, and the process does not run. The motor is coasted and is not started. 1 = The process is running, and the motor can be running or start at any time.

Table 10: Status Word - (continued)

Bit	Name	Description
12	Target position reached	0 = Target position is not reached. 1 = Target position is reached within the window defined by parameter ***5.14.2.18 On-target Window*** around the position reference.
13	Superimposed target reached	0 = Superimposed movement is not completed. 1 = Superimposed movement is completed.
14	User-defined	These bits are reserved for application-specific advanced control. For more information, refer to the *Parameter Descriptions* chapter in the application guide.
15	User-defined	

2.4.3 Speed Reference and Actual Speed

The speed values are represented by the N2 format, a 16-bit normalized value defined in the PROFIdrive profile. They are represented in percent of nominal motor speed.

PROFIdrive profile definition of N2

N2 is a linear normalized value. 0% corresponds to 0 (0x0), 100% corresponds to 2^{14} (0x4000).

Table 11: Range of N2 values

Coding	Data type	Range of values	Resolution	Length
113	N2	$-200\% \leq I \leq (200\text{-}2^{-14})\%$	$2^{-14} = 0.006\ 1\%$	2 Octet

Coding:

- Representation in twos complement, the most significant bit (MSB) is the bit after the sign bit (SN) of the 1st octet.
- SN = 0: positive numbers including 0.
- SN = 1: negative numbers.

2.4.4 Position Reference and Actual Position

Position values are expressed in 32-bit signed position units. The units are scaled by parameters ***5.13.4.4 Position Unit Numerator*** and ***5.13.4.5 Position Unit Denominator***.

2.5 iC Active Front End

2.5.1 Overview

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

2.5.2 Control Word

Table 12: 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 ***Fieldbus Start Mode*** (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.
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 *Parameter Descriptions* chapter in the application guide.
13	User-defined	
14	User-defined	
15	User-defined	

2.5.3 Status Word

Table 13: 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
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 ***Run Enable Input*** (103)
12	--	Reserved
13	--	Reserved
14	--	Reserved
15	Watchdog	Outgoing fieldbus watchdog bit, mirroring control word bit Watchdog (bit 11).

2.6 PROFIdrive Application Class 1

2.6.1 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.

2.6.2 Control Word

Table 14: 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).
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 *Parameter Descriptions* 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.

2.6.3 Status Word

Table 15: 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).
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.*

2.6.4 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.

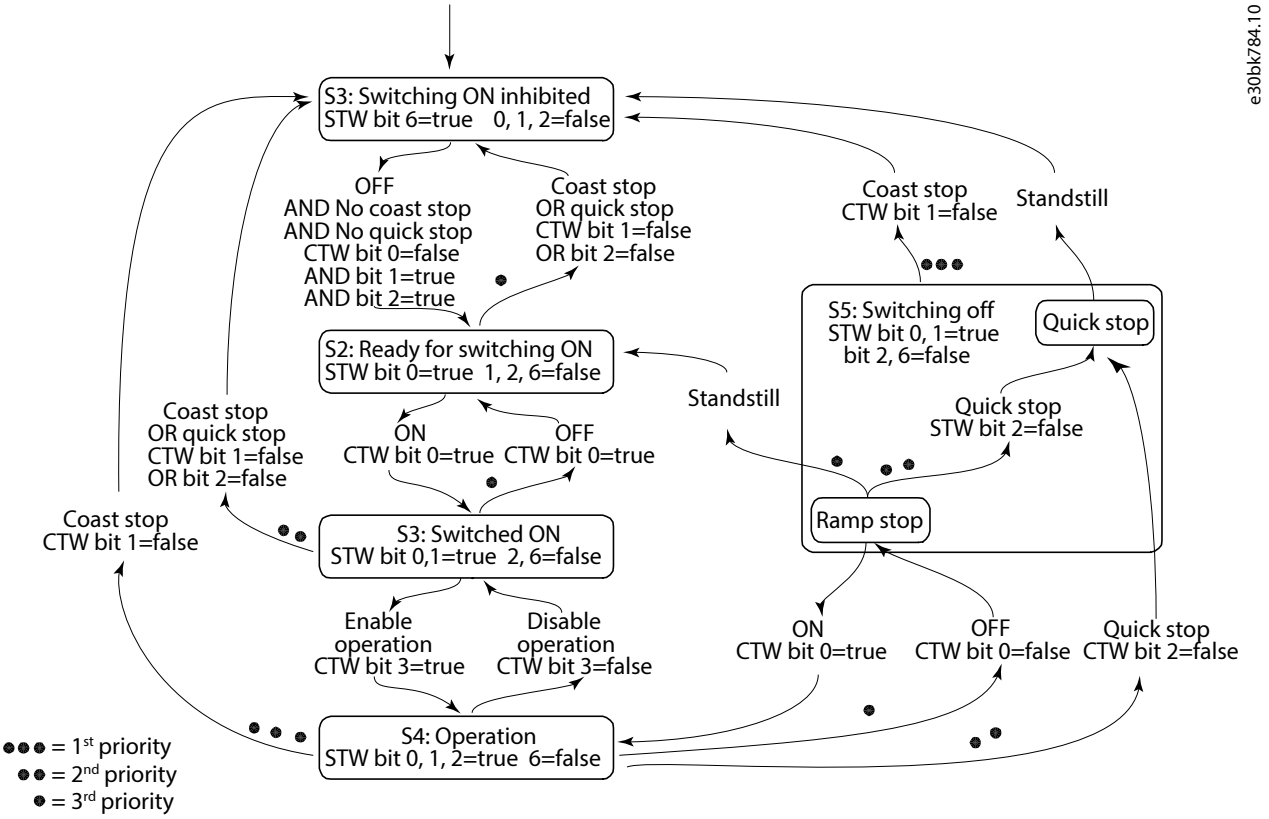

Figure 1: General State Diagram

2.7 Submodules

In iC7 series, the exchange of process data values is done through submodules:

- Profile signals
- Process data input and output signals. The available signal content can be browsed in the iC7-Automation device description files (see 4.7 GSDML File (Device Description File) for further information).

Table 16: Submodule Sizes

Application	Cyclic input data	Cyclic output data
PROFIdrive Standard telegram 1	[STW] [MAV]	[CTW] [REF]
iC Speed Profile	[STW] [MAV]	[CTW] [REF]
iC Active Front End Profile	[STW] [MAV]	[CTW] [REF]
CTW2/STW2	[STW2]	[CTW2]

Table 17: Signal Module Sizes

Application	Cyclic input data	Cyclic output data
Industry	4 signals (16 bytes) 8 signals (32 bytes) 12 signals (48 bytes) 16 signals (64 bytes) 20 signals (80 bytes)	4 signals (16 bytes) 8 signals (32 bytes) 12 signals (48 bytes) 16 signals (64 bytes) 20 signals (80 bytes)
Motion	4 signals (16 bytes) 8 signals (32 bytes) 12 signals (48 bytes) 16 signals (64 bytes) 20 signals (80 bytes)	4 signals (16 bytes) 8 signals (32 bytes) 12 signals (48 bytes) 16 signals (64 bytes) 20 signals (80 bytes)
Active Front End	4 signals (16 bytes) 8 signals (32 bytes) 12 signals (48 bytes) 16 signals (64 bytes) 20 signals (80 bytes)	–

Each of the selections in a signal module can comprise the following data types:

- Boolean
- Unsigned 8/16/32
- Signed 8/16/32
- Float 32

The buffer size adapts to the data type of the selected signals. If a Boolean type is mapped, only bit 0 is used in the selected signal address, and the remaining 7 bits are not used. The actual interpretation of the value that is read or written depends on the data type and representation. For example, motor current is a real-type 32-bit value that is represented as float, and publishing the motor current as an actual value does not need any scaling and factoring.

2.8 Functional Extension Options

Each functional extension option is defined by its own PROFINET device model with a module and submodule(s)

Slot 1 contains the application and the subsequent slots contain the installed options. Each option supports a module access point (MAP), and other submodules contain the process data.

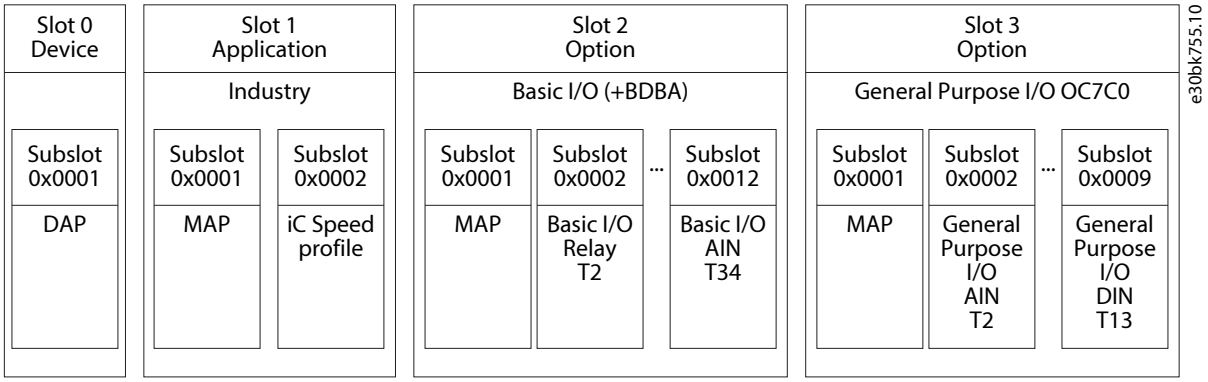

Figure 2: Example of a PROFINET Device Model with Functional Extension Options Installed in an iC7-Automation Drive

IMPORTANT: The Encoder/Resolver Option OC7M0 must be installed in option slot A. This means that data access to the encoder/resolver option is done via slot 2, if the Basic I/O option is not installed, or slot 3, if the Basic I/O option is installed. For more information on option slot locations, refer to the product-specific design guide.

2.9 Network Topologies

2.9.1 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

2.9.2 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.

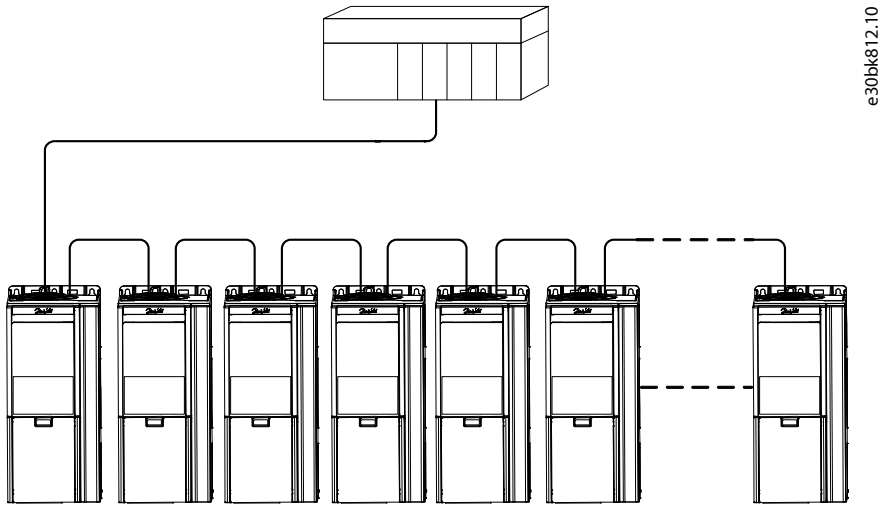

Figure 3: Example of Line Topology

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.

2.9.3 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.

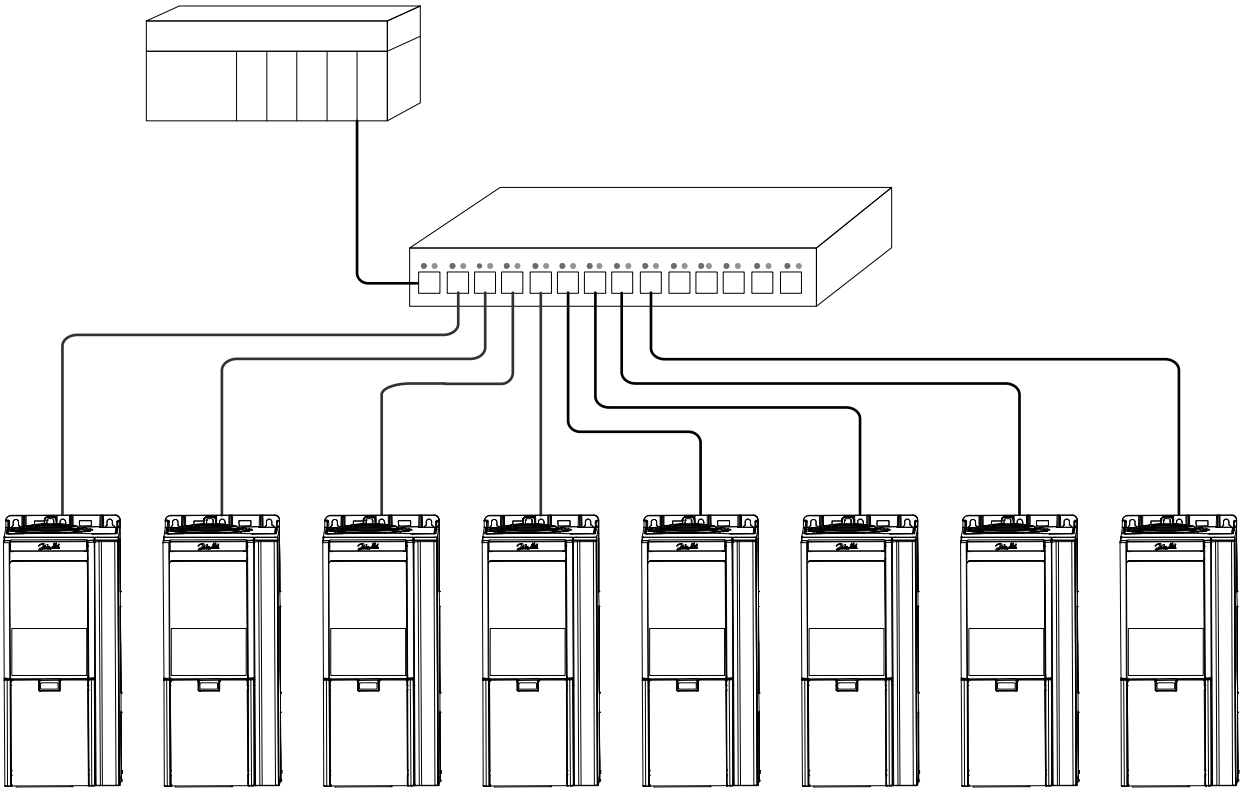

Figure 4: Example of Star Topology

2.9.4 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 PROFINET, the Media Redundancy Protocol (MRP) is used. The MRP is designed to react deterministically on a cable failure. One of the nodes in the network has the role of Media Redundancy Manager (MRM), which observes and controls the ring topology to react to network faults. Usually this device is a PLC or network switch.

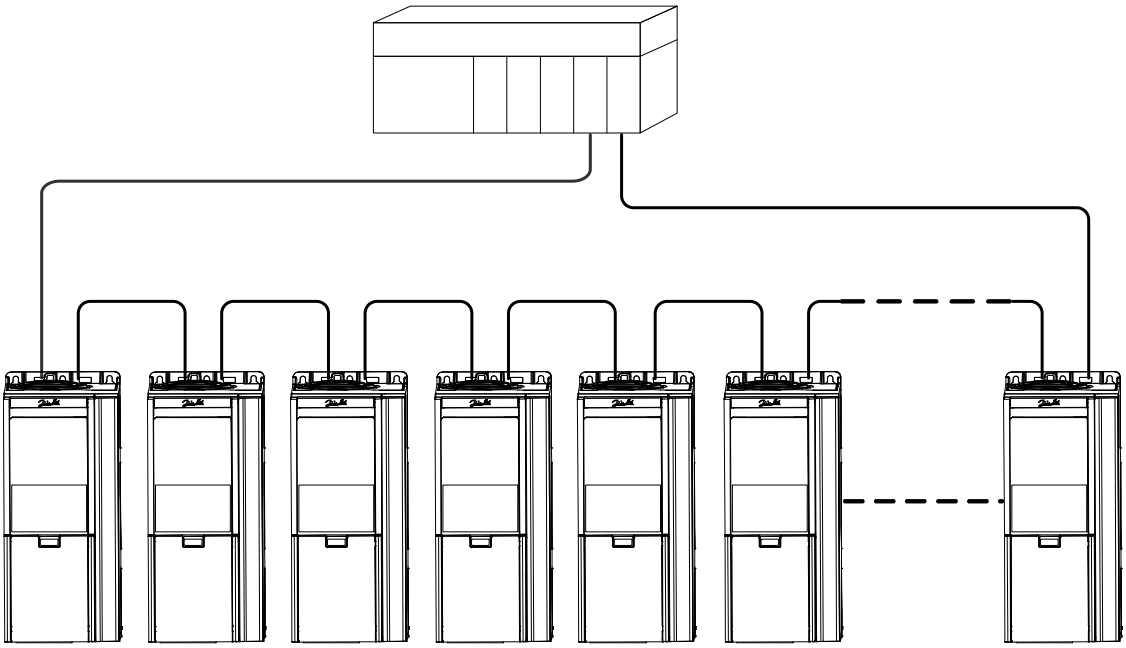

Figure 5: Example of Ring Topology

2.10 System Redundancy

To maximize operational continuity and minimize potential downtime in critical infrastructure, PROFINET incorporates advanced redundancy paradigms. S2 redundancy is a central methodology, and is designed to strengthen overall system reliability and ensure uninterrupted process availability. **S2** stands for a single NAP with 2 ARs.

S2 redundancy architecture

PROFINET S2 redundancy, as defined in the PROFINET standard, is a system architecture where 2 automation IO-Controllers, denoted as Primary and Backup, are simultaneously networked to a single field device (IO-Device). Both controllers establish parallel, sustained communication links with the IO-Device. However, only the Primary controller actively governs process operations under normal circumstances. The Backup controller continuously monitors the system and maintains a passive, synchronized state. If the Primary IO-Controller fails or loses communication, the Backup controller takes control instantaneously.

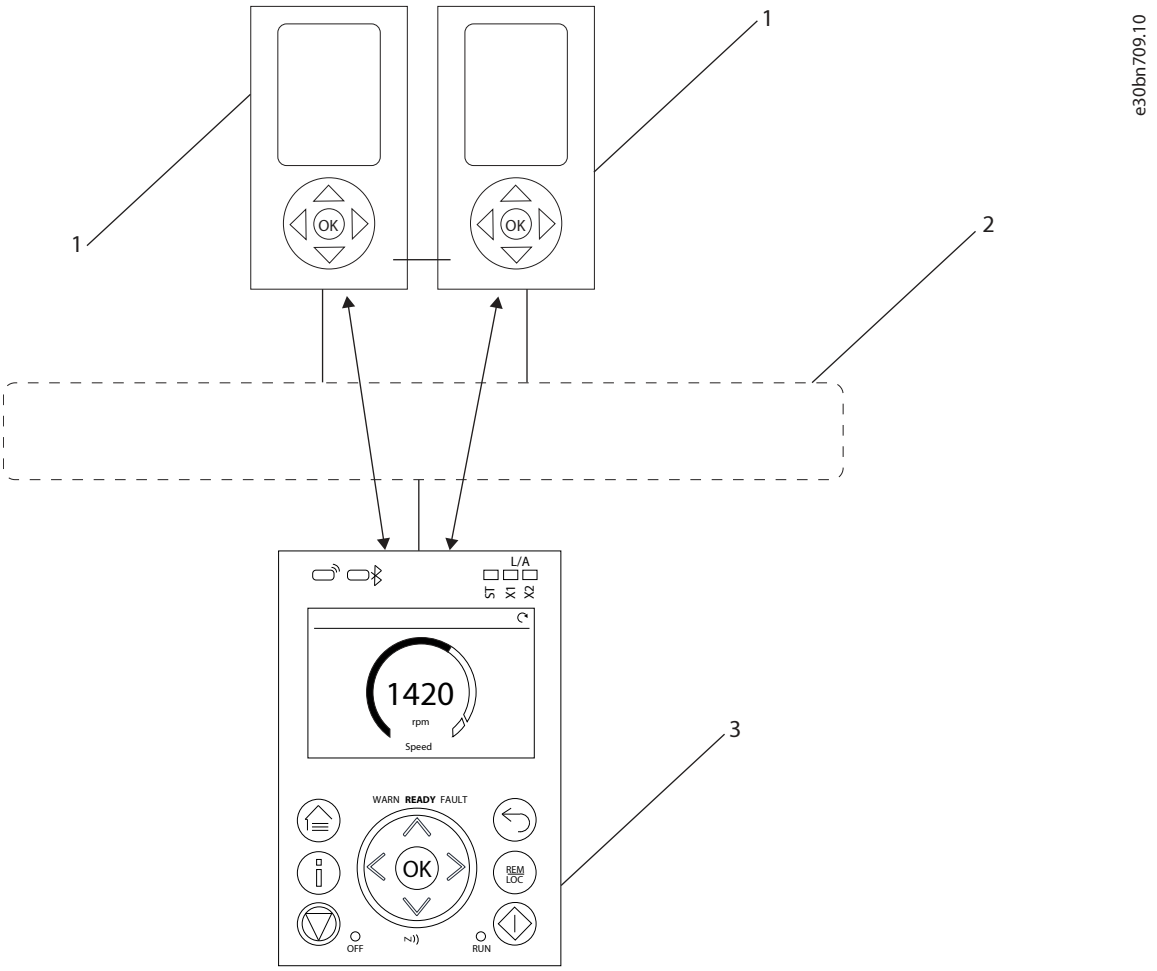

Figure 6: S2 Redundancy

1	IO-Controller	2	PROFINET network
3	IO-Device		

iC7 supports PROFINET S2 with the use of a single PROFINET interface (NAP) and 2 SR-ARs: 1 connection to each PROFINET IO-Controller. Redundant PROFINET IO-Controllers have parallel access to the iC7 SR-PROFINET device.

Operational principles

In an S2-redundant configuration, the IO-Device is engineered to support concurrent logical connections with both Primary and Backup controllers. Real-time exchange of process data and device status is maintained with both controllers, guaranteeing that the Backup remains fully synchronized with the latest process state.

If the Primary controller fails, switching to the Backup controller occurs autonomously and with minor latency. Operational integrity and continuity are sustained without manual intervention. This redundancy mechanism is useful in sectors with strict reliability requirements, such as chemical processing, power generation, and other mission-critical industrial domains.

The key features of S2 redundancy are:

- Dual controller connectivity: The IO-Device maintains persistent, simultaneous connections with both Primary and Backup controllers, ensuring continuous redundancy coverage.
- Autonomous seamless switchover: If the Primary controller fails, the system architecture facilitates the immediate and automatic transition of process control to the Backup controller and eliminates operational disruptions.

- Controller-level redundancy: S2 redundancy exclusively addresses controller redundancy, without needing redundant network topologies. S2 redundancy streamlines system design and deployment compared to alternative redundancy classes such as R1 or R2, which require additional hardware support.
- Continuous data synchronization: The Backup controller receives uninterrupted updates of process data and device status, which guarantees readiness for takeover.

The advantages of implementing S2 redundancy include:

- Maximized system availability enables prompt and automatic failover between controllers, significantly reducing the risk of process downtime and production losses.
- The cost-optimized redundancy achieves high system resilience and redundancy without the requirement for additional network infrastructure, contributing to economical deployment.
- The broad applicability and scalability of S2 redundancy offer a robust and scalable solution for diverse industrial environments where uninterrupted controller operation is required.

S2 redundancy, as specified in the PROFINET standard, provides a rigorous, efficient, and cost-effective approach for enhancing system dependability in industrial automation. By enabling dual-controller management of a single IO-Device and supporting seamless failover processes, S2 redundancy ensures that critical operations continue without interruption, even if a fault occurs in the controller. As such, S2 redundancy is a fundamental consideration in the design of high-availability, safety-critical automation infrastructures.

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 7. 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.

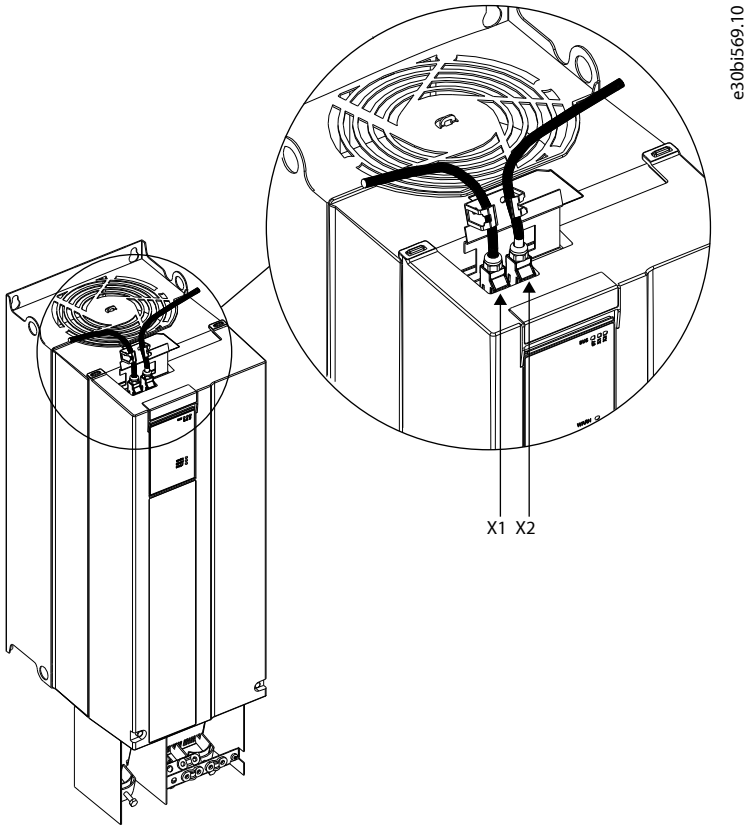

Figure 7: Location of the Communication Interface, X1/X2 in FA02-FA12 Frames (with the Optional EMC Plate)

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 8 and Figure 9.

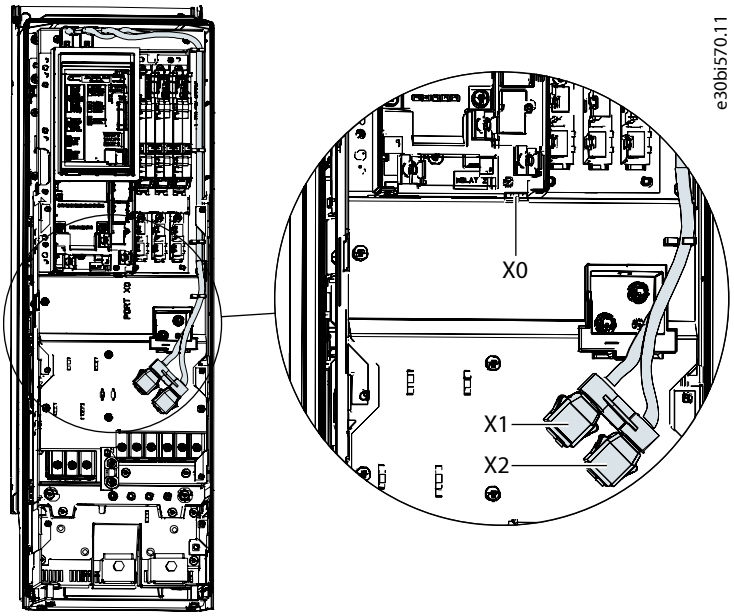

Figure 8: Communication Port X0, X1, and X2 Locations in FK06–FK08 Frames

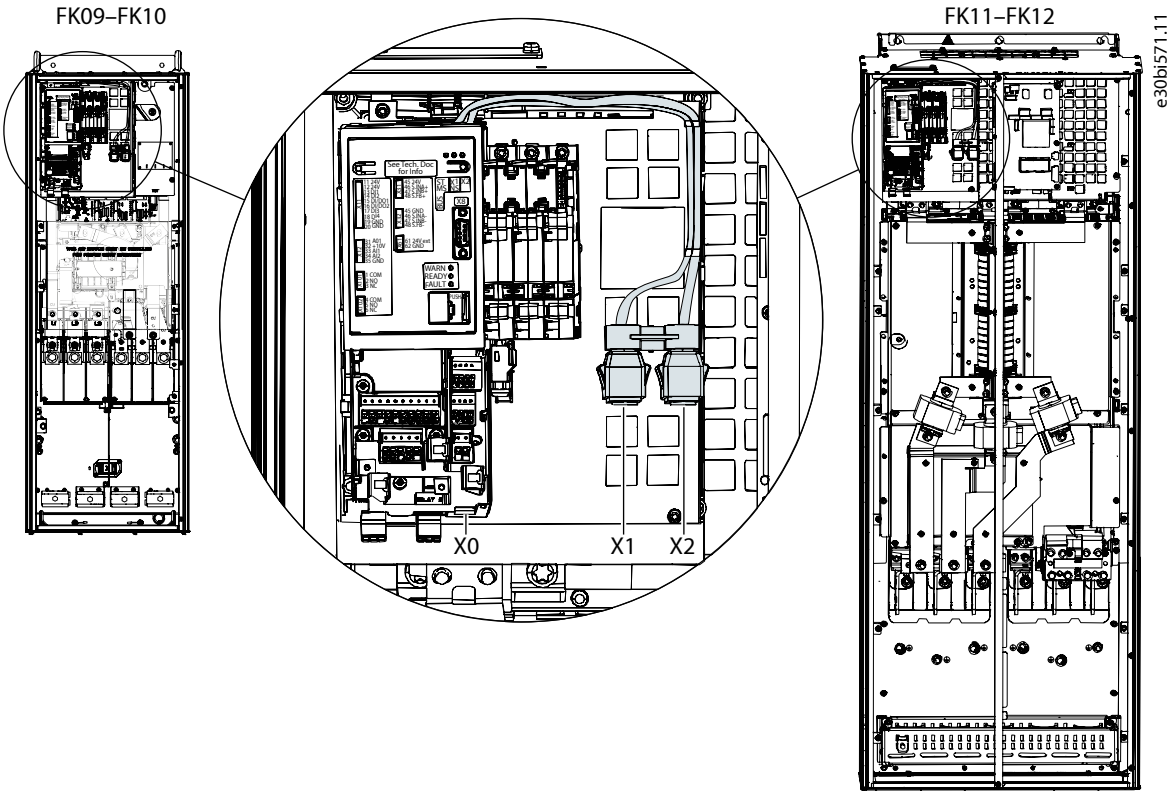

Figure 9: Communication Port X0, X1, and X2 Locations in FB09–FB12/FK09–FK12 Frames

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 10.

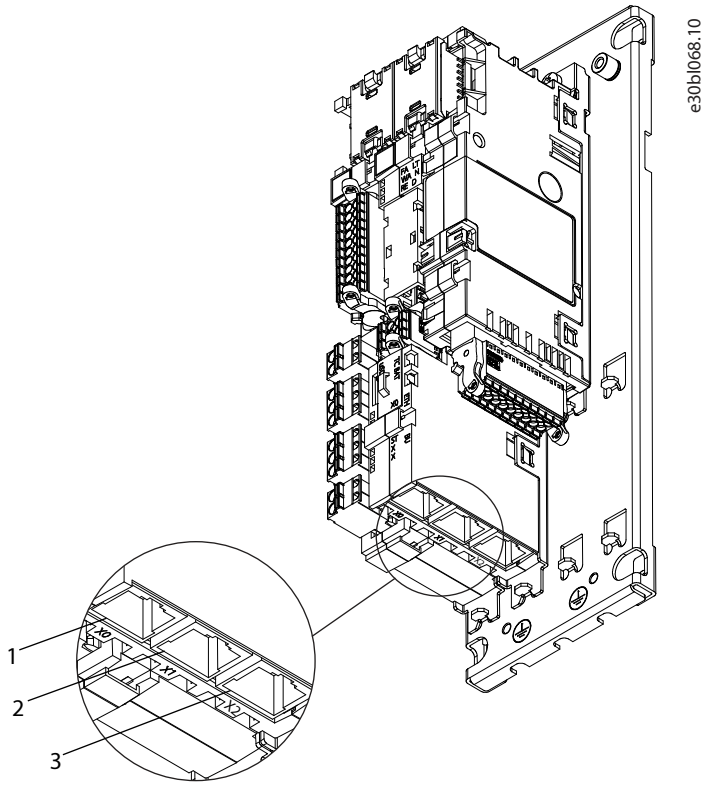

Figure 10: Communication Port X0, X1, and X2 Locations in the Modular Control Unit

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°.

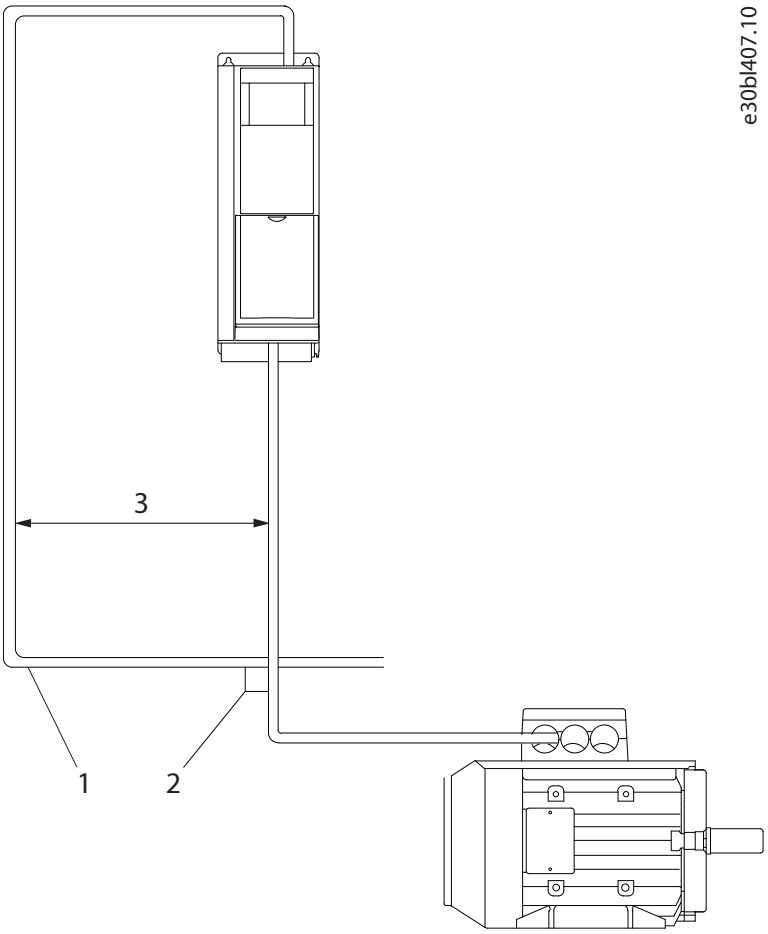

Figure 11: Cable Routing

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***.

Table 18: 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.
	DCP (default)	DCP is used with PROFINET where a PLC assigns the IP address, subnet mask, and other relevant parameters.
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. The recommended setting for PROFINET is ***Disable***.
	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).

4.3 Configuring Fieldbus Protection Settings for the Industry Application

1. Navigate to ***Connectivity*** > ***Protocols*** > ***General Settings***.
2. Configure fieldbus protection settings.

Table 19: Fieldbus Protection Setting Parameters for the Industry Application

Parameter	Parameter number	Value	Description
Fieldbus Fault Response	1303	• Info (default) • Warning • Fault, ramp to coast • Fault See Table 20 for descriptions of the events.	Select the behavior when a fieldbus fault, for example loss of I/O connection occurs.
No Fieldbus Connection Response	1327	• Info (default) • Warning • Fault, ramp to coast • Fault See Table 20 for descriptions of the events.	Select the response in case there is no fieldbus connection.
Process Data Timeout Time	1340	0.05–18000 s (Default value: 1.00 s)	Set the timeout time. If process data is not received within the time set, a process data timeout is triggered.
Process Data Timeout Response	1341	• Info (default) • Warning • Warning - Change Control Place • Warning - Change Control Place - Persistent • Fault, Ramp to Coast • Fault, coast See Table 20 for descriptions of the events.	Select the response to a process data timeout.
Process Data Timeout Control Place	112	• Local control • Fieldbus control • I/O control • Advanced control	Select the alternative control place to be used in case of fieldbus timeout. This is only valid if there is a timeout warning or info.

Table 20: Event Descriptions for the Industry Application

Value	Description
Info	The event is logged in the event log.
Warning	The drive issues a warning. The motor can still be controlled, but with limited performance.

Table 20: Event Descriptions for the Industry Application - (continued)

Value	Description
Warning - Change Control Place	The drive issues a warning, and the control place changes to the selected alternative while the timeout warning is active. The control place changes back to the original one when the fieldbus process data returns.
Warning - Change Control Place - Persistent	The drive issues a warning, and the control place changes to the selected alternative while the timeout warning is active. The control place requires a reset command to change back to the original one after the fieldbus process data returns.
Fault, ramp to coast	The drive issues a fault, ramps down, and coasts. Motor control is no longer possible.
Fault	The drive issues a fault and coasts the motor. Motor control is no longer possible.

4.4 Configuring Fieldbus Protection Settings for the Motion Application

1. Navigate to ***Connectivity*** > ***Protocols*** > ***General Settings***.
2. Configure fieldbus protection settings.

Table 21: Fieldbus Protection Setting Parameters for the Motion Application

Parameter	Parameter number	Value	Description
Fieldbus Fault Response	1303	• Info (default) • Warning • Fault, ramp to coast • Fault See Table 20 for descriptions of the events.	Select the behavior when a fieldbus fault, for example loss of I/O connection occurs.
No Fieldbus Connection Response	1327	• Info (default) • Warning • Fault, ramp to coast • Fault See Table 20 for descriptions of the events.	Select the response in case there is no fieldbus connection.
Process Data Timeout Time	1340	0.05–18000 s (Default value: 1.00 s)	Set the timeout time. If process data is not received within the time set, a process data timeout is triggered.

Table 21: Fieldbus Protection Setting Parameters for the Motion Application - (continued)

Parameter	Parameter number	Value	Description
Process Data Timeout Response	1341	• Info (default) • Warning • Warning - Change Control Place • Warning - Change Control Place - Persistent • Fault, Ramp to Coast • Fault, coast See Table 20 for descriptions of the events.	Select the response to a process data timeout.
Process Data Timeout Control Place	112	• Local control • Fieldbus control • I/O control • Advanced control	Select the alternative control place to be used in case of fieldbus timeout. This is only valid if there is a timeout warning or info.

Table 22: Event Descriptions for the Motion Application

Value	Description
Info	The event is logged in the event log.
Warning	The drive issues a warning. The motor can still be controlled, but with limited performance.
Warning - Change Control Place	The drive issues a warning, and the control place changes to the selected alternative while the timeout warning is active. The control place changes back to the original one when the fieldbus process data returns.
Warning - Change Control Place - Persistent	The drive issues a warning, and the control place changes to the selected alternative while the timeout warning is active. The control place requires a reset command to change back to the original one after the fieldbus process data returns.
Fault, ramp to coast	The drive issues a fault, ramps down, and coasts. Motor control is no longer possible.
Fault	The drive issues a fault and coasts the motor. Motor control is no longer possible.

4.5 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 23: Fieldbus Protection Setting Parameters for the Active Front End Application

Parameter	Parameter number	Value	Description
Fieldbus Fault Response	1304	• No response • Info • Warning • Fault (default) • Fault, open MCB See Table 24 for descriptions of the events.	Select the behavior when a fieldbus fault, for example, loss of I/O connection occurs.
No Fieldbus Connection Response	1305	• No response (default) • Info • Warning • Fault • Fault, open MCB See Table 24 for descriptions of the events.	Select the response if there is no fieldbus connection.
Process Data Timeout Response	1306	• No response • Info (default) • Warning • Fault • Fault, open MCB See Table 24 for descriptions of the events.	Select the response to a process data timeout.
Process Data Timeout Delay	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.
Fieldbus Watchdog Response	5244	• No response • Info • Warning (default) • Fault • Fault, open MCB See Table 24 for descriptions of the events.	Select the converter response for the fieldbus watchdog event.
Fieldbus Watchdog Delay	5245	0.0–3000.0 s (Default value: 5.00 s)	Set a delay for activating the fieldbus watchdog event.
Fieldbus Watchdog Start Delay	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 24: 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.

4.6 Configuring Name of Station

1. Navigate to parameter ***Name of Station (7080)***.

Parameter name	Parameter number	Value	Additional information
Name of Station	7080	Accepted characters: • Lower case letters (a–z) • Numbers (0–9) • Special characters: dash (–), full stop (.) The value can be up to 127 characters or digits in total. The maximum length for each component separated by a full stop or dash is 63 characters or digits. Spaces are not allowed.	Each PROFINET device has a unique Name of Station.

4.7 GSDML File (Device Description File)

To configure a PROFINET controller, the configuration tool needs a GSDML file for each type of device in the network. The GSDML file is a PROFINET xml file containing the necessary communication setup data for a device. Each product in the iC7 series has a unique GSDML file.

Download the GSDML files for the iC7 series from https://www.danfoss.com/en/service-and-support/downloads/dds/fieldbus-configuration-files/. Check that the GSDML file version is compatible with the firmware version.

4.8 Reference Handling

4.8.1 Industry and Motion Applications

The speed reference is scaled as a normalized relative value in percent (N2). The value is transmitted in hexadecimal:

- 0% = 0 hex
- 100% = 4000 hex
- -100% = C000 hex

Table 25: Reference Handling Parameters

Parameter	Parameter number	Unit	Range
Nominal Speed	402	[RPM]	0–100000
Positive Speed Limit	1729	[RPM]	0–35400
Negative Speed Limit	1728	[RPM]	-35400–0

For some applications, reversing is not wanted.

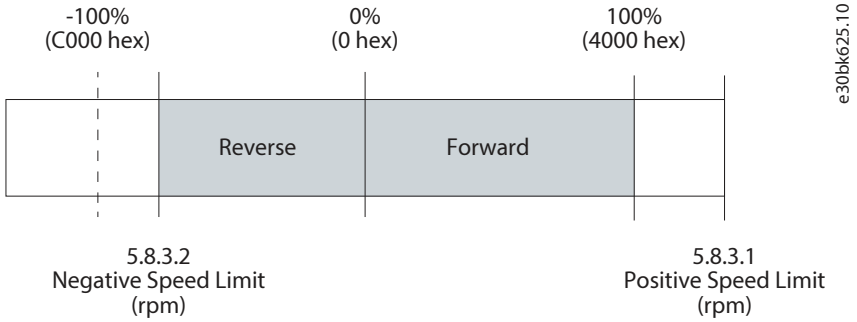

Figure 12: Example of Fieldbus Speed Reference in iC7-Automation

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 Parameter Access

5.1 Overview

iC7 series supports access to parameters via Base Mode Parameter Access. The data mechanism transmits requests and replies acyclically. The requests and replies are transmitted by the Acyclic Data Exchange mechanism.

For detailed instructions on how to access parameters, refer to the documentation provided by the PLC manufacturer.

5.2 Parameter Access Handling

All parameters are structured based on where the information is located.

Application-related parameters are in 1 specific slot of the PROFINET configuration, where functional options are located in different slot configurations (see 2.8 Functional Extension Options). This means that for every slot number the parameter request ID must match the location of the current parameter. There are 2 ways to address the slot number in the drive system:

- Local
- Global

The differences in handling these requests are based on how the object ID in the BMPA access ways is handled.

Example of local slot assignment (ObjectID 0xB02E)

An iC7 drive is configured with the Industry application and a basic I/O option is installed in the drive. Parameter 2952 (***6.1.1.3 Control Unit Temperature***) is accessed via the slot for application module access point, slot 1.

Parameter 1617 (***9.5.3.8 T34 Temperature Sensor Type***) is a parameter in the basic I/O option. This parameter is accessed via the first available Option Module Access Point after the slot used for the application, slot 2. The access of the MAP ID to these 2 parameters is different and must be addressed accordingly when a BMPA request is executed.

Example of global slot assignment (ObjectID 0xB02F)

An iC7 drive is configured with the Industry application and a basic I/O option is installed in the drive. Parameter 2952 (***6.1.1.3 Control Unit Temperature***) is accessed via the slot for application module access point, slot 1.

Parameter 1617 (***9.5.3.8 T34 Temperature Sensor Type***) is a parameter located in the basic I/O option. This parameter is accessed via the 1st available Option Module Access Point after the slot used for the application, slot 2. The MAP ID to access these 2 parameters is identical. Typically the head module ID of the MAP is used. Even if the MAP ID is identical, the slot number location of each parameter still must be addressed in the request. Accessing a parameter located in a different slot does not lead to any error message on a request. It is therefore up to the user to verify that the correct slot number is accessed where the parameter is located.

5.3 PROFIdrive Parameter Numbers

PROFIdrive specifies a list of standard PNUs and maps them to the areas defined in Table 26. For more details on PROFIdrive PNUs, refer to the latest version of the PROFIdrive standard.

The iC7 series supports all mandatory PNU objects and some optional and the device-specific parameter access range. The PROFIdrive parameters are not accessible via MyDrive® Insight or the control panel.

Table 26: Supported PNUs

PNU	Description
922	Telegram selection
923	List of all parameters for signals
944	Fault message counter
947	Fault number
950	Scaling of the fault buffer

Table 26: Supported PNUs - (continued)

PNU	Description
964	Drive unit identification
965	Profile identification number
972	Drive reset
974	Base mode parameter access service identification
975	Drive object identification
976	Load device parameter set
977	Transfer in non-volatile memory (global)
980–989	Number list of defined parameters
60000	Velocity reference value
61000	NameOfStation (read only)
61001	IpOfStation (read only)
61002	MacOfStation (read only)
61003	DefaultGatewayOfStation (read only)
61004	SubnetMaskOfStation (read only)

6 Troubleshooting

6.1 Diagnostics

The iC7 series supports diagnostic event messaging for control systems by using faults and warnings. The faults and warnings are enabled by default. Whenever one occurs, it is indicated on the display of a control system. If diagnosis interrupt is used by the control system, it is possible to read out the fault or warning event within the PLC program and to react accordingly.

Table 27: Diagnostics Parameters

Parameter name	Parameter number	Value	Description
Diagnostics Fault	7081	• Enabled (default) • Disabled	Enables diagnostic fault. When disabled, the device does not send any PROFINET diagnosis message with severity ***Fault*** when a fault is present on the device.
Diagnostics Warning	7083	• Enabled (default) • Disabled	Enables diagnostic warning. When disabled, the device does not send any PROFINET diagnosis message with severity ***Maintenance required*** when a warning is present on the device.

6.2 PROFINET Report

The PROFINET report is available in MyDrive® Insight. The report shows:

- Connections
- Configuration
- Mapped signals and their values

The report is a snapshot of the values from the time the report was created. It is not possible to see live data in the report.

PROFINET Status

Name: **ic7**

IP: **192.168.3.2**

Connections

AR	State	Type	Count	Controller	Controller IP
1	Connected	Single	8	pn-io-simu-20	192.168.3.99
2	Not connected	-	0		0.0.0.0
3	Not connected	-	0		0.0.0.0
4	Not connected	-	0		0.0.0.0

Module Configuration

Slot	Module	Subslot	Submodule	IOPS	IOCS
1	Industry Application	1	Module Access Point	GOOD	GOOD
1	Industry Application	2	iC speed profile	GOOD	GOOD
2	Basic I/O	1	Module Access Point	GOOD	GOOD
2	Basic I/O	2	Basic I/O Relay Terminal 2	-	-
2	Basic I/O	3	Basic I/O Relay Terminal 5	-	-
2	Basic I/O	4	Basic I/O Digital Input Status Word	GOOD	GOOD
2	Basic I/O	11	Basic I/O Analog Input Terminal 33 Voltage	GOOD	GOOD
3	General Purpose I/O OC7C0	1	Module Access Point	GOOD	GOOD
3	General Purpose I/O OC7C0	5	General Purpose I/O Digital Output T7	GOOD	GOOD
3	General Purpose I/O OC7C0	6	General Purpose I/O Digital Output T8	GOOD	GOOD
4	Relay OC7R0	1	Module Access Point	GOOD	GOOD
4	Relay OC7R0	2	Relay Terminal 2	GOOD	GOOD
4	Relay OC7R0	3	Relay Terminal 5	GOOD	GOOD
4	Relay OC7R0	4	Relay Terminal 8	GOOD	GOOD
5	Temperature Measurement OC7T0	1	Module Access Point	-	-
5	Temperature Measurement OC7T0	2	Temperature Input T4	-	-
0	Device Access Point	1	Device Access Point	GOOD	GOOD
0	Device Access Point	32768	Interface X1/X2	GOOD	GOOD
0	Device Access Point	32769	Port X1	GOOD	GOOD
0	Device Access Point	32770	Port X2	GOOD	GOOD

AR 1

Industry Application/iC speed profile Outputs

Signal	Name	Unit	Value	Value as hex
1335	Fieldbus Control Word	-	0x047C	0x047C
1339	Fieldbus Speed Reference 1	-	8192	0x2000

Industry Application/iC speed profile Inputs

Signal	Name	Unit	Value	Value as hex
1307	Fieldbus Status Word	-	0x0E07	0x0E07
1308	Fieldbus Speed Main Actual Value	-	7826	0x1E92

Basic I/O/Basic I/O Digital Input Status Word Inputs

Signal	Name	Unit	Value	Value as hex
1614	Digital Input Status	-	0x0002	0x0002

Basic I/O/Basic I/O Analog Input Terminal 33 Voltage Inputs

Signal	Name	Unit	Value	Value as hex
16110	Basic I/O T33	-	0	0x0000

General Purpose I/O OC7C0/General Purpose I/O Digital Output T7 Outputs

Signal	Name	Unit	Value	Value as hex
16124	General Purpose I/O T7	-	false	0x00

General Purpose I/O OC7C0/General Purpose I/O Digital Output T8 Outputs

Signal	Name	Unit	Value	Value as hex
16125	General Purpose I/O T8	-	false	0x00

Relay OC7R0/Relay Terminal 2 Outputs

Signal	Name	Unit	Value	Value as hex
16100	Relay T2	-	false	0x00

Relay OC7R0/Relay Terminal 5 Outputs

Signal	Name	Unit	Value	Value as hex
16101	Relay T5	-	false	0x00

Relay OC7R0/Relay Terminal 8 Outputs

Signal	Name	Unit	Value	Value as hex
16102	Relay T8	-	false	0x00

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Figure 13: Example of a PROFINET Report

6.3 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***.

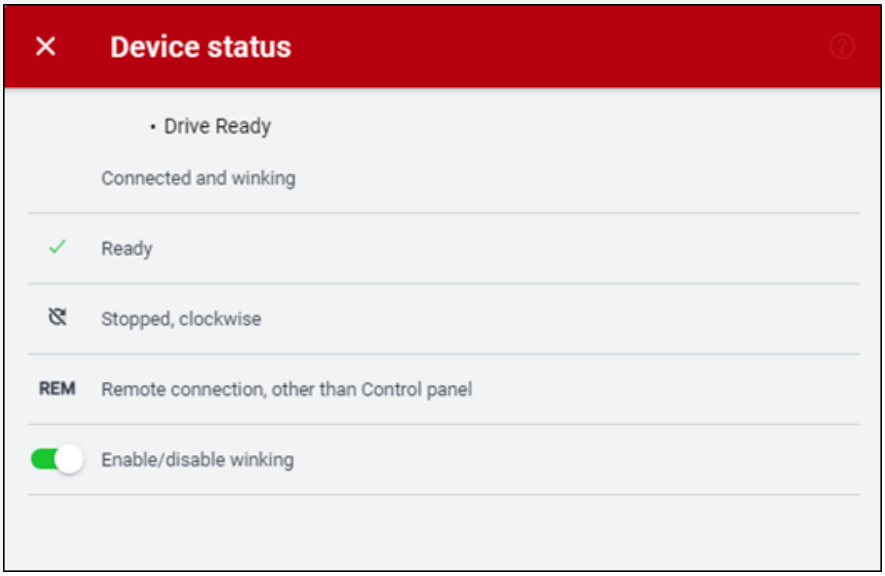
Table 28: Port Mirroring Settings

Function	Selections	Description
Source port	• X1 • X2	Frames are mirrored from this port.
Destination port	• 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.

6.4 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.



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See 6.5 Fieldbus Indicator LEDs for more information on interpreting the LED signals and where the LEDs are located.

6.5 Fieldbus Indicator LEDs

The fieldbus indicator LEDs are in the top right corner of the control panel and the bottom part of the front-facing side of the modular control unit.

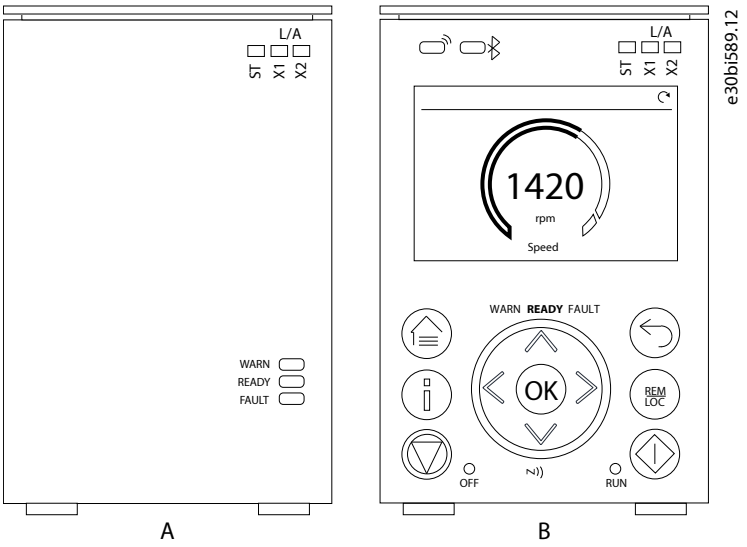
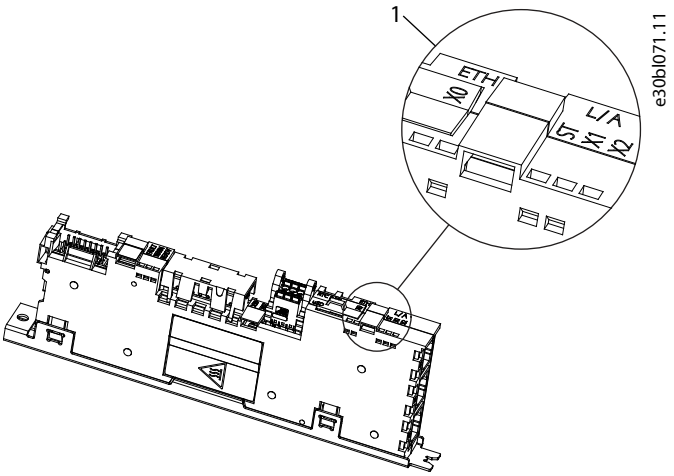


Figure 14: Fieldbus Indicator LEDs on Control Panel



1	Fieldbus indicator LEDs (ST, X1, and X2)

Figure 15: Fieldbus Indicator LEDs on Modular Control Board

- The LED labeled ST shows the module status.
- The LED labeled X1 shows the network status on Ethernet port X1.
- The LED labeled X2 shows the network status on Ethernet port X2.

Table 29: Fieldbus Indicator LED Functions

LED label	Status	LED pattern	Description
ST	DCP blink	Flashing yellow	PROFINET discovery protocol active, 3 s flashing.
	Not configured	Off	PROFINET not configured.
	I/O connection faulted	Steady red	A PROFINET I/O connection has faulted.
	Configuration mismatch	Flashing red	PROFINET configuration mismatch.
	Configured/No I/O connection	Flashing green	Device is configured from PLC master but no I/O connection has been established.
	All I/O connections OK	Solid green	PROFINET I/O connection to device established.

Table 29: Fieldbus Indicator LED Functions - (continued)

LED label	Status	LED pattern	Description
X1/X2	DCP blink	Flashing yellow	PROFINET discovery protocol active, 3 s flashing.
	Link down	Off	–
	Invalid configuration/Duplicated IP address	Solid red	IP configuration error
	Link up	Solid green	The Ethernet link is active.

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