



# iC7 Series BACnet/IP

## BACnet/IP OS7BI





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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, BACnet/IP technology, MyDrive® Insight, and the PC or PLC that is used as a master in the system.

Read the instructions before configuring BACnet/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](http://www.danfoss.com).
- Other supplemental publications, drawings, and guides are available at [www.danfoss.com](http://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.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



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

### WARNING



#### 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
AI	Analog input
AO	Analog output
AV	Analog value
B-AAC	BACnet advanced application controller
B-ASC	BACnet application-specific controller
BI	Binary input

**Table 1: Abbreviations - (continued)**

Abbreviation	Definition
BMS	Building management system
BO	Binary output
BV	Binary value
CO	Exception calendar
COS	Change of state
COV	Change of value
CSV	Character string value
CTW	Control word
EE	Event enrollment
EMC	Electromagnetic compatibility
FC	Frequency converter
I/O	Input/output
IP	Internet protocol
LAN	Local area network
LCP	Local control panel
LED	Light-emitting diode
Lsb	Least significant bit
MAV	Main actual value (actual output)
MRV	Main reference value
Msb	Most significant bit
MSV	Multi-state value
N/A	Not applicable
NC	Notification class
PC	Personal computer
PLC	Programmable logic controller
PNU	Parameter number
REF	Reference (=MRV)
RTC	Real-time clock
SO	Schedule object
STW	Status word
TL	Trend log
UTC	Universal time coordinated

## 1.7 Trademarks

BACnet™ is a registered trademark of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

## 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
AQ548636302177, version 0101	First release.

## 2 Overview

### 2.1 BACnet/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. Fieldbus protocols can be selected in the configurator when ordering a drive, or alternatively, they can be activated later. When ordering a drive with BACnet IP OS7BI, it is possible to switch between all available Ethernet-based protocols.

BACnet (Building Automation and Control Networks) is a communication protocol standard designed for building automation and control systems that enable the seamless integration of products from different manufacturers.

BACnet facilitates the integration of diverse building systems from various manufacturers, leading to enhanced energy efficiency, improved performance, and greater occupant comfort. Its scalable and reliable protocol makes it a user-friendly and economical choice for building automation. The primary application for BACnet is in Building Management Systems (BMS) to control and monitor a wide range of HVAC and other building automation devices, allowing facility managers and building owners to manage their systems efficiently from a unified platform.

### 2.2 BACnet Interoperability Building Blocks

#### 2.2.1 Overview

BACnet Interoperability Building Blocks (BIBBs) are collections of 1 or more BACnet services and fall into 5 principal areas:

- Data sharing
- Alarms and events
- Scheduling
- Trending
- Device management

Each of these areas has several interoperable functions, which are prescribed in terms of an A and a B device. Both devices are nodes on a BACnet internetwork. Usually, the A device acts as the user of data (client), and the B device is the provider of this data (server). iC7 drives support type B devices and the ASC profile.

#### 2.2.2 Supported BACnet Interoperability Building Blocks

Table 3: Supported Data Sharing BIBBs

BIBB	Abbreviation	Description
Data Sharing Read Property	DS-RP-B	Retrieve the value of a property from a device.
Data Sharing Read Property Multiple	DS-RPM-B	Retrieve the value of multiple properties from a device with in 1 request.
Data Sharing Write Property	DS-WP-B	Writes the value of a property to a device.
Data Sharing Write Property Multiple	DS-WPM-B	Write the value to multiple properties from a device with in 1 request.

Table 4: Supported Device Management BIBBs

BIBB	Abbreviation	Description
Device Management - Dynamic Device Binding B	DM-DDB-B	Responds to Who-Is with I-am. Based on the setting in the <i>BacnetIamService</i> parameter, during the power-up or every 60 s with I-am.
Device Management Dynamic Object Binding B	DM-DOB-B	Respond to Who-Have with I-Have.
Device Management Device Communication Control	DM-DCC-B	Supports Disable initialization and Enable with an optional password.
Device Management UTC Time Synchronization	DM-UTC-B	Supports UTC time synchronization with time offset and daylight saving with an optional password.
Device Management Reinitialize Device	DM-RD-B	Supports cold start, warm start, and Activate Changes with an optional password.

## 2.3 BACnet Segmentation

To provide for messages that are longer than the maximum length supported by a communications network, or by the sending or receiving device, BACnet provides a method to perform application layer segmentation. In BACnet, only Confirmed-Request and Complex ACK messages may be segmented.

Table 5: BACnet Message Specifications

Data	Value	Description
Maximum APDU Length	1476 bytes	Specifies the maximum length for application protocol data units.
Maximum Segments Accepted	16	Specifies the maximum number of segments transmitted in a Confirmed-Request or Complex ACK message.
Proposed Window Size	8	Specifies the maximum segmentation window size acceptable to a requester sending a segmented BACnet-Confirmed-Request-PDU.

## 2.4 BACnet Services

### 2.4.1 UTC Time Synchronization

The UTC Time Synchronization service is used by a requesting BACnet user to notify 1 or more remote devices of the correct Universal Time Coordinated (UTC). Its purpose is to notify recipients of the correct UTC so that devices synchronize their internal clocks with each other.

A device receiving a UTC Time Synchronization service indication updates its local representation of time and date by subtracting the value of the *UTC Offset* property of the Device Object from the *Time* parameter and taking the *Daylight Savings Status* property of the Device Object into account as appropriate to the locality. This change is reflected in the Local Time and Local Date properties of the Device Object.

The time zones to the west of the 0° meridian are positive values, and time zones to the east are negative values. The value of the UTC Offset property is subtracted from the UTC received in UTC Time Synchronization service requests to calculate the correct local standard time. UTC Offset is configurable and accepts any multiples of 15 minutes across the full range.

### 2.4.2 Reinitialize Device

#### 2.4.2.1 Overview

The Reinitialize Device service is used by a client BACnet user to instruct a remote device to reboot itself (cold start), reset itself to a predefined initial state (warm start), to activate network port object changes, or to control the backup or restore procedure.

Resetting or rebooting a device is primarily initiated by a human operator for diagnostic purposes. Use of this service during the backup or restore procedure is initiated on behalf of the user by the device controlling the backup or restore.

iC7 drives support the following options:

- [2.4.2.2 Warm Start](#)
- [2.4.2.3 Cold Start](#)
- [2.4.2.4 Activate Changes](#)
- [2.4.2.5 Discard Changes](#)

#### 2.4.2.2 Warm Start

Warm start performs the power cycle operation on the device without affecting the drive parameters. The warm start should reinitialize the device only when the device is in ready state (Drive Not Running) and irrespective of the device communication control.

When the BACnet client attempts a warm start on a device when the device is not ready state, the device does not execute a warm start and reports an error in the BACnet service.

#### 2.4.2.3 Cold Start

Cold start applies the restore operation to all settings (all application parameters and log history) to factory-set default values except the communication parameters followed by a power cycle. Warm start should reinitialize the device only when the device is in ready state (Drive Not Running) and irrespective of the device communication control.

When the BACnet client attempts a cold start for a device when the device is not ready state, the device does not execute the cold start and reports an error in the BACnet service.

The BACnet parameters which are excluded from the restore operation are listed in [Table 6](#).

Table 6: Excluded Parameters in BACnet/IP

Parameter index number	Parameter name
10.3.7.2.1	<i>BACnet Device Instance</i>
–	<i>X1X2Reqlpv4GatewayAddr</i>
–	<i>X1X2Reqlpv4GatewayAddr</i>
–	<i>X1X2DnsServer1</i>
–	<i>X1X2DnsServer2</i>
–	<i>X1X2LinkConfig1</i>
–	<i>X1X2LinkConfig1</i>

#### 2.4.2.4 Activate Changes

The Activate Changes service involves applying the new configuration via the device user interface or software, and often restarting the device for the settings to take effect. For more information, see [2.7.9 Network Port Object](#).

#### 2.4.2.5 Discard Changes

If the device supports the Discard changes command, the object reverts to the set of property values that were contained in the object when Changes\_Pending was last equal to FALSE.

### 2.4.3 Device Communication Control

The Device Communication Control (DCC) service is used by a client BACnet user to instruct a remote device to stop initiating BACnet services on the communication network or internetwork for a specified duration of time. This service is primarily used by a human operator for diagnostic purposes. A password may be required from the client BACnet user before executing the service.

The behavior of the Device Communication Control service varies:

- On power cycle: During power-up, the DCC is configured to the **Enable** state, allowing the device to initiate the I-Am service. On device startup, the DCC is automatically set to the **Enable** state, irrespective of the DCC state before the reboot.
- On warm start or cold start: According to the specification, whenever the device undergoes a warm start or a cold start, the DCC is set to the **Enable** state.

## 2.5 BACnet Broadcast Management Device

A Who-Is message/Who-Has sent by a BACnet device is relayed to the local network with a broadcast MAC address (FF:FF:FF:FF:FF:FF). All BACnet devices in this network receive the message and can respond accordingly. However, the message is not relayed by IP routers that communicate with other IP subnets. BBMD was introduced to resolve this issue. In a local network, only 1 device with BBMD functionality can be configured, which relays the IP broadcast messages to remote IP subnets via a broadcast distribution table (BDT).

BBMD configurations can be achieved with the properties available in the network port object.

Table 7: Network Port Objects for BACnet Broadcast Management Device Configurations

Property	Access	Default
Changes_Pending	R	-
Command (Discard changes)	W	-
BACnet_IP_Mode	R	-
BACnet_IP_UDP_Port	W	-
BBMD_Broadcast_Distribution_Table	W	-
BBMD_Accept_FD_Registrations	W	-

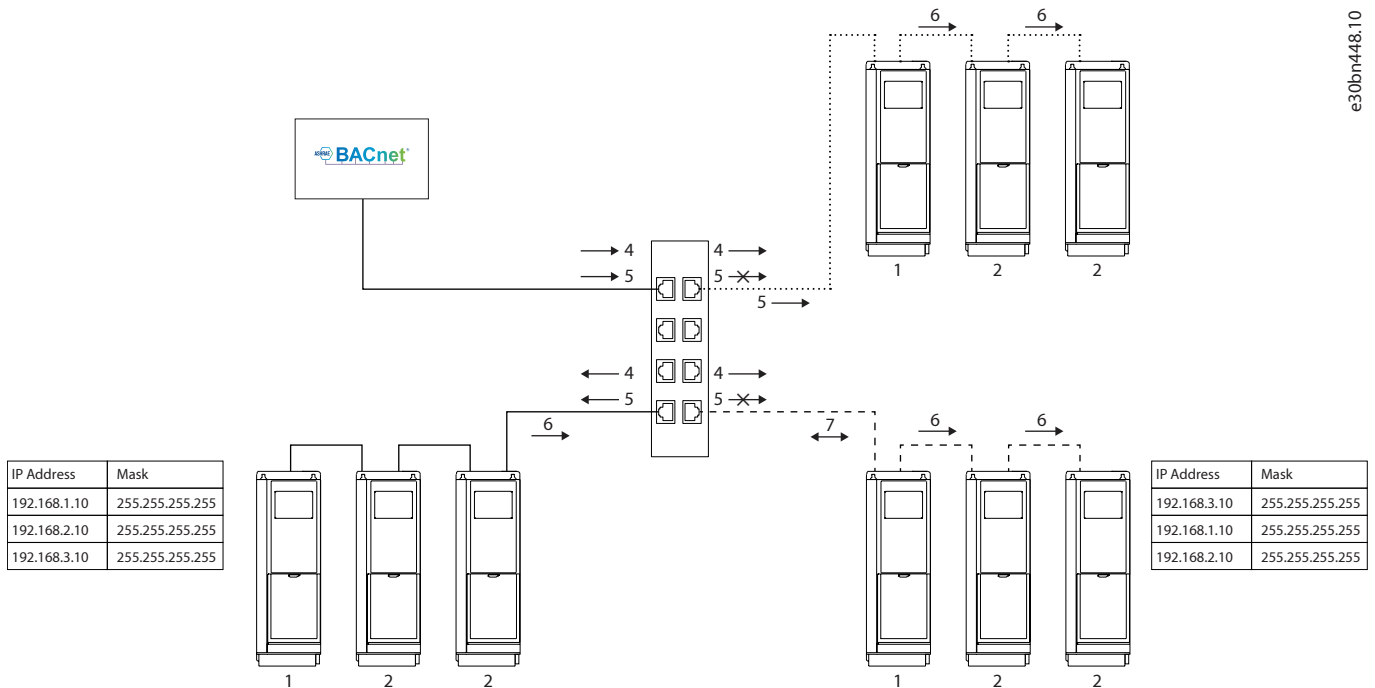


Figure 1: Example of a BACnet Broadcast Management Device with 3 Networks

## 2.6 Foreign Device

The foreign device procedure can be used to enable remote devices that dial in via an internet connection, for example, to link dynamically with a BACnet configuration. Special BACnet services exist, which BACnet/IP also supports, for generating an entry in the foreign device table (FDT). Like the BDT procedure, a BBMD IP broadcast relays messages to all FDT entries. In contrast to BDT, FDT entries have a limited lifetime. This means that the login has to be refreshed after a time interval (Time To Live) has elapsed.

Table 8: Network Port Objects for Foreign Devices

Property	Access	Default
Object_Identifier	R	-
Object_Name	W	-
Object_Type	R	-
Description	W	-
Status_Flags	R	-
Reliability	R	-
Out_Of_Service	R	-
Network_Type	R	-
Protocol_Level	R	-
Network_Number	R	-
Network_Number_Quality	R	-
Changes_Pending	R	-
Command (Discard_Changes)	W	-
MAC_Address	R	-
APDU_Length	R	-
BACnet_IP_Mode	R	-
BACnet_IP_UDP_Port	W	-
BBMD_Broadcast_Distribution_Table	W	-
BBMD_Foreign_Device_Table	R	-
BBMD_Accept_FD_Registrations	W	-
FD_BBMD_Address	W	-
FD_Subscription_Lifetime	W	-

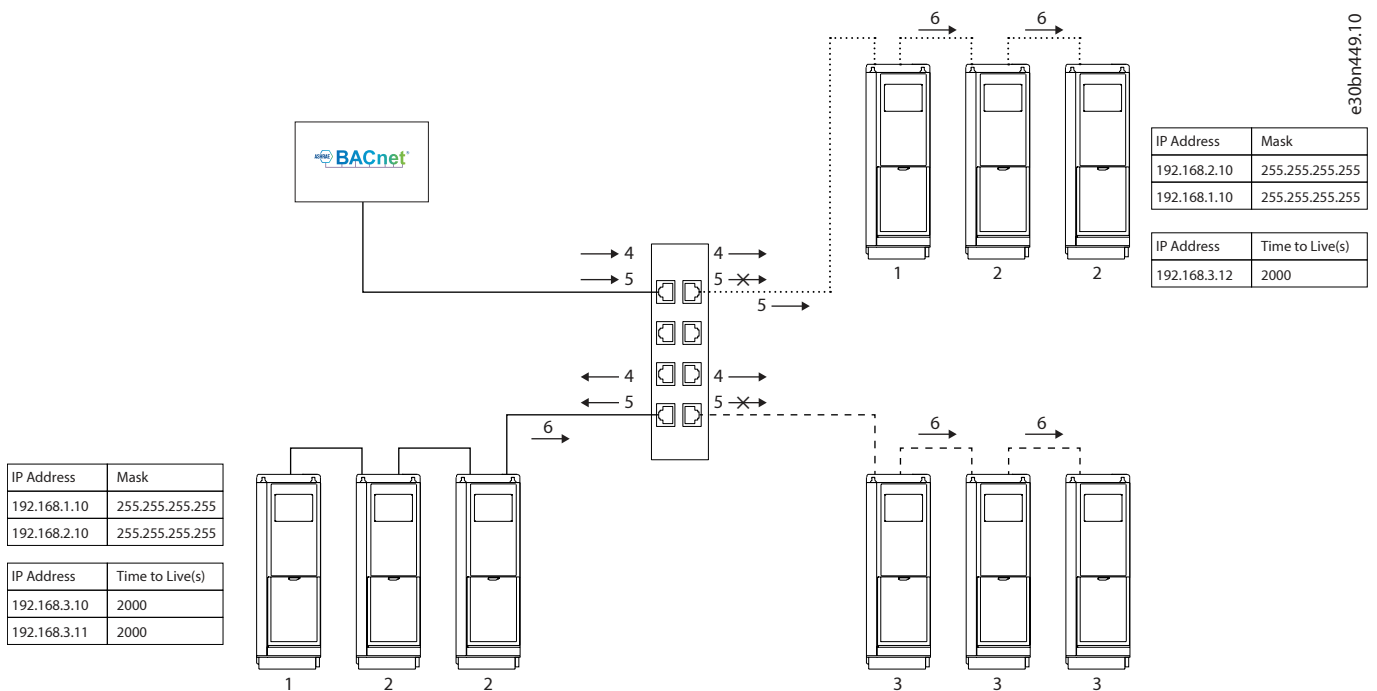


Figure 2: Example of a BACnet Broadcast Management Device/Foreign Device with 3 Networks

## 2.7 BACnet Objects

### 2.7.1 Overview

The following objects are supported in iC7 drives with BACnet:

- [2.7.8 Device Objects](#)
- [2.7.5 Binary Input Object](#)
- [2.7.6 Binary Output Object](#)
- [2.7.7 Binary Value Object](#)
- [2.7.2 Analog Input Object](#)
- [2.7.3 Analog Output Object](#)
- [2.7.4 Analog Value Object](#)
- [2.7.9 Network Port Object](#)

Temperature Measurement OC7T0 option is not supported in BACnet.

### 2.7.2 Analog Input Object

Table 9: Analog Input Object

ID	Object name	Unit	Custom unit	R/W	Parameter	Index	Available from
AI:20	Analog Input (T33)	%	Y	R	1611	9.3.4 [101]	Integrated I/O
AI:21	Analog Input (T34)	%	Y	R	1612	9.3.5 [101]	Integrated I/O
AI:22	Analog Input (T2)	%	Y	R	1620	9.3.3 [201]	General Purpose I/O
AI:23	Analog Input (T3)	%	Y	R	1621	9.3.4 [201]	General Purpose I/O
AI:24	Temperature Input (T34)	°C	Y	R	1616	9.3.6 [101]	Integrated I/O

Table 9: Analog Input Object - (continued)

ID	Object name	Unit	Custom unit	R/W	Parameter	Index	Available from
AI:25	Temperature Input 1 (T2)	°C	Y	R	4966	9.3.6 [201]	General Purpose I/O or Temperature Measurement OC7T0
AI:26	Temperature Input 2 (T3)	°C	Y	R	4967	9.3.7 [201]	General Purpose I/O or Temperature Measurement OC7T0

### 2.7.3 Analog Output Object

Table 10: Analog Output Object

ID	Object name	Unit	Custom Unit	R/W	Parameter	Index	Remarks
AO:0	Analog Output 1 (T31)	%	-	R/W	1613	9.3.3 [101]	Integrated I/O
AO:3	Analog Output (T4)	%	-	R/W	1622	9.3.5 [201]	General Purpose I/O

### 2.7.4 Analog Value Object


**NOTE:**

- Properties *Reliability*, *Fault High Limit*, *Fault Low Limit*, and *Reliability Evaluation Inhibit* are not available for Analog Value instances AV 5, 6, 16, 17, 18, 19, 20, 21, 22, 23, 25, 51, 71, 76, and 77.
- Supported reliability values are NO\_FAULT\_DETECTED, UNDER\_RANGE, and OVER\_RANGE.
- The *Event State* property always shows the value as **Normal**.

Table 11: Analog Value Object

ID	Object name	Unit	Custom Unit	R/W	Parameter	Index	Remarks
AV:1	Fieldbus Speed Reference 1 (Input Reference 1)	%	-	R/W	1611	9.3.4 [101]	Integrated I/O
AV:3	Motor Speed (Motor Actual Speed)	%	-	R/W	1612	9.3.5 [101]	Integrated I/O
AV:5	Motor Current	A	-	R	1620	9.3.3 [201]	General Purpose I/O
AV:6	Output Power	kW	-	R	1621	9.3.4 [201]	General Purpose I/O
AV:7	Fieldbus Process Reference	%	-	R	1616	9.3.6 [101]	Integrated I/O
AV:15	Motor Thermal Overload (ETR)	%	-	R	2951	4.1.16	-
AV:16	Line-To-Line Voltage (RMS)	V	-	R	9040	1.1.2	-
AV:17	L1-L2 Line Voltage (RMS)	V	-	R	9048	1.1.3	-

**Table 11: Analog Value Object - (continued)**

ID	Object name	Unit	Custom Unit	R/W	Parameter	Index	Remarks
AV:18	L2-L3 Line Voltage (RMS)	V	-	R	9049	1.1.4	-
AV:19	L3-L1 Line Voltage (RMS)	V	-	R	9050	1.1.5	-
AV:20	Control Unit On Time	h	-	R	2000	6.5.1	-
AV:21	Power Unit On Time	h	-	R	2001	6.5.2	-
AV:22	Active Running Hours	h	-	R	2009	6.5.9	-
AV:23	Energy Consumption	kWh	-	R	2002	6.5.3	-
AV:24	Motor Voltage	V	-	R	9005	4.1.6	-
AV:25	Output Frequency	Hz	-	R	9015	5.8.1.3	-
AV:26	Torque	%	-	R	1708	4.1.12	-
AV:27	DC Link Voltage	V	-	R	9044	2.1.3	-
AV:28	Heat Sink Temperature	°C	-	R	2950	2.1.15	-
AV:30	Multi Zone Reference 1 (Setpoint 1)	%	-	R/W	6383	5.10.8.1	-
AV:32	Feedback 1	%	-	R	6080	5.10.1.6	-
AV:35	Multi Zone Reference 2 (Setpoint 2)	%	-	R/W	6384	5.10.8.2	-
AV:37	Feedback 2	%	-	R	6085	5.10.1.7	-
AV:40	Multi Zone Reference 3 (Setpoint 3)	%	-	R/W	6285	5.10.8.3	-
AV:42	Feedback 3	%	-	R	6104	5.10.1.8	-
AV:47	Control Unit Temperature	°C	-	R	2952	6.1.1.3	-
AV:49	Control Place Selection	#	-	R/W	114	5.5.2.1	-
AV:51	Occurrence Number	#	-	R	1610	6.1.1.1	Refer to the drive and profile.
AV:52	PID Start Speed	Hz	-	R/W	6056	5.10.3.24	-
AV:53	On Reference Bandwidth	%	-	R/W	6050	5.10.2.1	-
AV:54	PID Proportional Gain	#	-	R/W	6065	5.10.5.1	-
AV:55	PID Integral Time	s	-	R/W	6058	5.10.5.2	-
AV:56	PID Derivative Time	s	-	R/W	6068	5.10.5.5	-
AV:57	PID Derivative Gain	#	-	R/W	6069	5.10.5.6	-

Table 11: Analog Value Object - (continued)

ID	Object name	Unit	Custom Unit	R/W	Parameter	Index	Remarks
AV:59	Process Controller output (PID Output)	%	-	R/W	6075	5.10.1.2	-
AV:60	Reserved		-	R	6092	5.10.1.3	-
AV:61	Fault Status Word 1		-	R	6203	5.1.5	-
AV:66	Warning Word		-	R	6205	5.1.8	-
AV:70	Feedback	%	Y	R	6090	5.10.1.4	-
AV:71	Converted Signal 1	m <sup>3</sup> /h	Y	R	6700	-	-
AV:72	Converted Signal	m <sup>3</sup> /h	Y	R/W	6701	-	-
AV:77	Converted Signal 3	m <sup>3</sup> /h	Y	R	6702	-	-
AV:153	MPC Status		-	R	5367	5.31.2.1.1	-
AV:154	Number of Fixed-Speed Pumps Running	-	-	R	5331	5.31.2.1.2	-
AV:155	Fixed-Speed Pump 1 Status	-	-	R	5340	5.31.2.1.3	-
AV:156	Fixed-Speed Pump 2 Status	-	-	R	5341	5.31.2.1.4	-
AV:157	Fixed-Speed Pump 3 Status	-	-	R	5342	5.31.2.1.5	-
AV:158	Fixed-Speed Pump 4 Status	-	-	R	5343	5.31.2.1.6	-
AV:159	Fixed-Speed Pump 5 Status	-	-	R	5344	5.31.2.1.7	-
AV:163	Fixed-Speed Pump 1 Running Hours	h	-	R/W	5350	5.31.2.1.8	-
AV:164	Fixed-Speed Pump 2 Running Hours	h	-	R/W	5351	5.31.2.1.9	-
AV:165	Fixed-Speed Pump 3 Running Hours	h	-	R/W	5352	5.31.2.1.10	-
AV:166	Fixed-Speed Pump 4 Running Hours	h	-	R/W	5353	5.31.2.1.11	-
AV:167	Fixed-Speed Pump 5 Running Hours	h	-	R/W	5354	5.31.2.1.12	-
AV:171	Fixed-Speed Pump 1 Number of Starts	-	-	R	5357	5.31.2.1.13	-
AV:172	Fixed-Speed Pump 2 Number of Starts	-	-	R	5358	5.31.2.1.14	-
AV:173	Fixed-Speed Pump 3 Number of Starts	-	-	R	5359	5.31.2.1.15	-

**Table 11: Analog Value Object - (continued)**

ID	Object name	Unit	Custom Unit	R/W	Parameter	Index	Remarks
AV:174	Fixed-Speed Pump 4 Number of Starts	-	-	R	5360	5.31.2.1.16	-
AV:175	Fixed-Speed Pump 5 Number of Starts	-	-	R	5361	5.31.2.1.17	-

## 2.7.5 Binary Input Object

**Table 12: Binary Input Object**

ID	Object name	R/W	Parameter	Index	Remarks
BI:0	Digital input Term 13	R	1614	9.3.1 [101]	Integrated I/O
BI:1	Digital input Term 14	R	1614	9.3.1 [101]	Integrated I/O
BI:2	Digital input Term 15	R	1614	9.3.1 [101]	Integrated I/O
BI:3	Digital input Term 16	R	1614	9.3.1 [101]	Integrated I/O
BI:4	Digital input Term 17	R	1614	9.3.1 [101]	Integrated I/O
BI:5	Digital input Term 18	R	1614	9.3.1 [101]	Integrated I/O
BI:7	Digital input 1 (T11)	R	1614	9.3.1 [201]	General Purpose I/O
BI:8	Digital input 1 (T12)	R	1614	9.3.1 [201]	General Purpose I/O
BI:9	Digital input 1 (T13)	R	1614	9.3.1 [201]	General Purpose I/O

## 2.7.6 Binary Output Object

**Table 13: Binary Output Object**

ID	Object name	R/W	Parameter	Index	Available from
BO:0	Digital Output Term 15	R/W	1615	9.3.2 [101]	Integrated I/O
BO:1	Digital Output Term 15	R/W	1615	9.3.2 [101]	Integrated I/O
BO:2	Digital Output 1 (T7)	R/W	1615	9.3.2 [201]	General Purpose I/O
BO:3	Digital Output 2 (T8)	R/W	1615	9.3.2 [201]	General Purpose I/O
BO:4	Relay Output 1 (T5)	R/W	1615	9.3.2 [101]	Integrated I/O
BO:5	Relay Output 2 (T6)	R/W	1615	9.3.2 [101]	Integrated I/O
BO:6	Relay Output 1 X101	R/W	4909	9.3.1 [201]	Relay Option
BO:7	Relay Output 2 X102	R/W	4909	9.3.1 [201]	Relay Option
BO:8	Relay Output 3 X103	R/W	4909	9.3.1 [201]	Relay Option

## 2.7.7 Binary Value Object

**Table 14: Binary Value Object**

ID	Object name	R/W	Parameter	Index	Available from
BV:1	RUN/STOP Command	R/W	1335	5.27.1.42	-
BV:3	Fault Reset	R	1307	5.27.1.50	-

Table 14: Binary Value Object - (continued)

ID	Object name	R/W	Parameter	Index	Available from
BV:5	READY/FAULT Monitor	R	1307	5.27.1.50	–
BV:6	LOCAL/REMOTE	R	1307	5.27.1.50	–
BV:21	Warning	R	1307	5.27.1.50	–
BV:22	Trip	R	1307	5.27.1.50	–
BV:24	Coasting	R/W	1335	5.27.1.42	–
BV:25	Reversing (CW/CCW)	R/W	1335	5.27.1.42	–
BV:31	Speed = reference	R	1307	5.27.1.50	–
BV:32	Bus control	R	1307	5.27.1.50	–
BV:33	Running	R	1307	5.27.1.50	–
BV:34	Ramp 1/Ramp 2	R/W	1335	5.27.1.42	–
BV:41	Sleep Mode Status	–	–	–	–
BV:44	Interlock Status	–	–	–	–
BV:47	End of Curve	–	–	–	–
BV:49	No Flow	–	–	–	–
BV:50	Dry Run	–	–	–	–
BV:62	Fieldbus Status word 1, bit 14	R	1307	5.27.1.50	–
BV:63	Fieldbus Status word 1, bit 15	R	1307	5.27.1.50	–
BV:64	Fieldbus Status word 2, bit 0	R	1344	5.27.1.90	–
BV:65	Fieldbus Status word 2, bit 1	R	1344	5.27.1.90	–
BV:66	Fieldbus Status word 2, bit 2	R	1344	5.27.1.90	–
BV:67	Fieldbus Status word 2, bit 3	R	1344	5.27.1.90	–
BV:68	Fieldbus Status word 2, bit 4	R	1344	5.27.1.90	–
BV:69	Fieldbus Status word 2, bit 5	R	1344	5.27.1.90	–
BV:70	Fieldbus Status word 2, bit 6	R	1344	5.27.1.90	–
BV:71	Fieldbus Status word 2, bit 7	R	1344	5.27.1.90	–
BV:72	Fieldbus Status word 2, bit 8	R	1344	5.27.1.90	–
BV:73	Fieldbus Status word 2, bit 9	R	1344	5.27.1.90	–
BV:74	Fieldbus Status word 2, bit 10	R	1344	5.27.1.90	–
BV:75	Fieldbus Status word 2, bit 11	R	1344	5.27.1.90	–
BV:76	Fieldbus Status word 2, bit 12	R	1344	5.27.1.90	–
BV:77	Fieldbus Status word 2, bit 13	R	1344	5.27.1.90	–

**Table 14: Binary Value Object - (continued)**

ID	Object name	R/W	Parameter	Index	Available from
BV:78	Fieldbus Status word 2, bit 14	R	1344	5.27.1.90	–
BV:79	Fieldbus Status word 2, bit 15	R	1344	5.27.1.90	–
BV:80	Fieldbus Control Word 1, bit 12	R/W	1335	5.27.1.42	–
BV:81	Fieldbus Control Word 1, bit 13	R/W	1335	5.27.1.42	–
BV:82	Fieldbus Control Word 1, bit 14	R/W	1335	5.27.1.42	–
BV:83	Fieldbus Control Word 1, bit 15	R/W	1335	5.27.1.42	–
BV:84	Fieldbus Control Word 2, bit 0	R/W	1347	5.27.1.89	–
BV:85	Fieldbus Control Word 2, bit 1	R/W	1347	5.27.1.89	–
BV:86	Fieldbus Control Word 2, bit 2	R/W	1347	5.27.1.89	–
BV:87	Fieldbus Control Word 2, bit 3	R/W	1347	5.27.1.89	–
BV:88	Fieldbus Control Word 2, bit 4	R/W	1347	5.27.1.89	–
BV:89	Fieldbus Control Word 2, bit 5	R/W	1347	5.27.1.89	–
BV:90	Fieldbus Control Word 2, bit 6	R/W	1347	5.27.1.89	–
BV:91	Fieldbus Control Word 2, bit 7	R/W	1347	5.27.1.89	–
BV:92	Fieldbus Control Word 2, bit 8	R/W	1347	5.27.1.89	–
BV:93	Fieldbus Control Word 2, bit 9	R/W	1347	5.27.1.89	–
BV:94	Fieldbus Control Word 2, bit 10	R/W	1347	5.27.1.89	–
BV:95	Fieldbus Control Word 2, bit 11	R/W	1347	5.27.1.89	–
BV:96	Fieldbus Control Word 2, bit 12	R/W	1347	5.27.1.89	–
BV:97	Fieldbus Control Word 2, bit 13	R/W	1347	5.27.1.89	–

Table 14: Binary Value Object - (continued)

ID	Object name	R/W	Parameter	Index	Available from
BV:98	Fieldbus Control Word 2, bit 14	R/W	1347	5.27.1.89	–
BV:99	Fieldbus Control Word 2, bit 15	R/W	1347	5.27.1.89	–

## 2.7.8 Device Objects

The Device Object provides information about the device and its capabilities available to other devices on the networks. Before a BACnet device starts control-related communication with another device, it needs to obtain some of the information presented by the Device Object of the other device.

Table 15: Device Objects

Number	Property identifier	Property datatype	R/W status
1	Object_Identifier	BACnetObjectIdentifier	R
2	Object_Name	CharacterString	W
3	Object_Type	BACnetObjectType	R
4	System_Status	BACnetDeviceStatus	R
5	Vendor_Name	CharacterString	R
6	Vendor_Identifier	Unsigned16	R
7	Model_Name	CharacterString	R
8	Firmware_Revision	CharacterString	R
9	Application_Software_Version	CharacterString	R
10	Location	CharacterString	W
11	Description	CharacterString	W
12	Protocol_Version	Unsigned	R
13	Protocol_Revision	Unsigned	R
14	Protocol_Services_Supported	BACnetServicesSupported	R
15	Protocol_Object_Types_Supported	BACnetObjectTypesSupported	R
16	Object_List	BACnetARRAY[N] of BACnetObjectIdentifier	R
17	Max_APDU_Length_Accepted	Unsigned	R
18	Segmentation_Supported	BACnetSegmentation	R
19	Max_Segments_Accepted	Unsigned	R
20	Local_Time	Time	R
21	Local_Date	Date	R
22	UTC_Offset	INTEGER	W
23	Daylight_Savings_Status	BOOLEAN	R
24	APDU_Segment_Timeout	Unsigned	W
25	APDU_Timeout	Unsigned	W
26	Number_Of_APDU_Retries	Unsigned	W

**Table 15: Device Objects** - (continued)

Number	Property identifier	Property datatype	R/W status
27	Max_Manager	Unsigned(0..127)	W
28	Max_Info_Frames	Unsigned	W
29	Last_Restart_Reason	BACnetRestartReason	R
30	Database revision	Unsigned	R
31	Time_Of_Device_Restart	BACnetTimeStamp	R
32	Serial_Number	CharacterString	R
33	Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R
34	Device Address Binding	BACnetLIST of BACnetAddressBinding	R

## 2.7.9 Network Port Object

A BACnet network port object (NPO) represents a physical or logical network port on a BACnet device and provides access to its configuration and properties. It is used to manage communication settings for each port, including addressing, data rates, and other parameters specific to the network type.

The properties of NPO objects are writable through the BACnet/IP client and MyDrive® Insight.

In MyDrive® Insight, it is possible to write parameters on the fly and the changes are updated instantly. However, modifying the properties through BACnet requires additional steps to activate the changes.

After a successful write to the NPO properties, the event sets the Changes\_Pending property to TRUE. A value written to the property becomes effective when the device receives a Reinitialize Device service request with a reinitialized device state of ACTIVATE\_CHANGES or WARMSTART.

1. When NPO updates are done using the Activate Changes service, it is not required to be updated in the last restart reason in the Device Object property.
2. When executing a power cycle or the Discard changes service when the Changes\_Pending property is TRUE, the changes are discarded.
3. NPO supports a single non-hierarchical network port object for the BACnet port.
4. The NPO Reliability property only supports the value NO\_FAULT\_DETECTED.

**Table 16: Network Port Object**

Property	Access
Object_Identifier	R
Object_Name	W
Object_Type	R
Description	W
Status_Flags	R
Reliability	R
Out_Of_Service	R
Network_Type	R
Protocol_Level	R
Network_Number	R
Network_Number_Quality	R

**Table 16: Network Port Object - (continued)**

Property	Access
Changes_Pending	R
Command (Discard_Changes)	W
MAC_Address	R
APDU_Length	R
BACnet_IP_Mode	R
BACnet_IP_UDP_Port	W
BBMD_Broadcast_Distribution_Table	W
BBMD_Foreign_Device_Table	R
BBMD_Accept_FD_Registrations	W
FD_BBMD_Address	W
FD_Subscription_Lifetime	W
Property_List	R
IP_Address	W
IP_Subnet_Mask	W
IP_Default_Gateway	W
IP_DNS_Server	W
IP_DHCP_Enable	W
IP_DHCP_Server	R

## 2.8 Engineering Units

### 2.8.1 Standard Engineering Units

BACnet uses a standardized set of engineering units to represent physical quantities. These units are defined in the BACnet standard and are used to ensure consistent data exchange between different devices and systems.

In iC7 drives with BACnet, it is possible to change the units to compatible units through the BACnet client.

Unit group	Unit	Enum.
Rotational speed and frequency	RPM	104
	Hz	27
Electric current	mA	2
	A (default)	3
Electric potential or voltage	V (default)	5
	kV	6
	mV	124
Energy	Wh	18
	kWh (default)	19
	MWh	146

Unit group	Unit	Enum.
Power	W	47
	kW (default)	48
	MW	49
	hp	51
	mW	132
Pressure	Pa (default)	53
	kPa	54
	bar	55
	psi	56
	hPa	133
	mbar	134
Temperature	°C (default)	62
	°F	64
Time	h (default)	71
	s	72
Volumetric flow rate	m <sup>3</sup> /s (default)	85
	l/s	87
	m <sup>3</sup> /h	135
Fraction of 100	%	98
No unit	-	95



NOTE: The assigned engineering unit must retain its latest value when a power cycle or a warm start occurs in the drive. The cold start service resets the engineering unit to the default value. For more information, see [2.4.2.2 Warm Start](#) and [2.4.2.3 Cold Start](#).

## 2.8.2 Custom Units

In certain applications, BACnet objects handle different engineering units where the actual value should not change but the engineering units should be modified with compatible engineering conversions.

iC7 drives have custom units to handle this functionality. For more information on custom objects, see [BACnet Objects](#).

## 2.9 BACnet Control Word and Status Word

### 2.9.1 Control Word

Table 17: Control Word Bits in BACnet

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 (should be kept 0)	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 frequency converter immediately to coast the motor. 1 = No function.
4	Reserved (should be kept 0)	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.
5	Reserved (should be kept 0)	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.
6	Start/No Start	0 = Stops the frequency converter and the motor speed ramps down to stop via the selected ramp-down parameter. 1 = Allows the frequency converter to start the motor if the other starting conditions have been fulfilled.
7	Fault Acknowledge	0 = No function. 0 → 1 = Acknowledge faults. Acknowledge is triggered by the edge when changing from logic 0 to logic 1. Faults can only be acknowledged if the trigger condition has been removed and any required acknowledge has been done.
8	Reserved (should be kept 0)	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.
9	Ramp select	0 = Ramp 1 is active. 1 = Ramp 2 is active.
10	Reserved (should be kept 0)	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.
11	Reverse	0 = Normal running. 1 = Reversing.

**Table 17: Control Word Bits in BACnet** - (continued)

Bit number	Name	Description
12	User-defined	These bits enable mapping the application functionality of the drive to the control word. Mapping is done through parameters. For details, refer to the application guide.
13		
14		
15		

## 2.9.2 Status Word

**Table 18: Status Word Bits in BACnet**

Bit number	Name	Description
0	Control ready/Control not ready	0 = The device controls are not ready and do not react to process data. 1 = The device controls are ready and reacts to process data.
1	Frequency converter ready/Frequency converter not ready	0 = The frequency converter is not ready for operation. This does not involve Faults and warnings as they are indicated in their respective bits elsewhere. 1 = The frequency converter is ready for operation.
2	Coasting/No Coast	0 = The frequency converter has an active Coast signal and has released the motor. 1 = There are no active coast signals. (can start when the start signal is given).
3	Fault/No Fault	0 = The frequency converter is not in fault mode. 1 = The frequency converter is faulted, and an acknowledge signal is required to re-establish operation.
4	Reserved	Reserved.
5	Reserved	Reserved.
6	Reserved	Reserved.
7	Warning/No warning	0 = There are no warnings. 1 = A warning has occurred.
8	Speed=reference/Speed<>reference	0 = The motor runs, but the present speed is different from the present speed 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 a given tolerance. The tolerance is product specific.
9	Bus control/Local operation	0 = The HMI has taken over the control and the device is right now not reacting to control requests coming from the process data and/or I/Os. 1 = The device is controlled and reacting to I/O and process data.
10	SpeedMonitorActive	0 = The speed monitor is not active (for example, the motor speed is within the defined warning limits). 1 = The speed monitor is active (for example, the motor speed exceeds the defined warning limits).

Table 18: Status Word Bits in BACnet - (continued)

Bit number	Name	Description
11	In operation/No operation	0 = There are no active start requests and the process does not run. The motor is in a coasted state and the motor is not started. 1 = The process is running and the motor could be running or starting at any time.
12	Reserved	Reserved for intermittent problem.
13	Reserved	Reserved.
14	Vendor-specific 2.	Vendor-specific 2.
15	Vendor-specific 1.	Vendor-specific 1.

## 2.10 Network Topologies

### 2.10.1 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

### 2.10.2 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

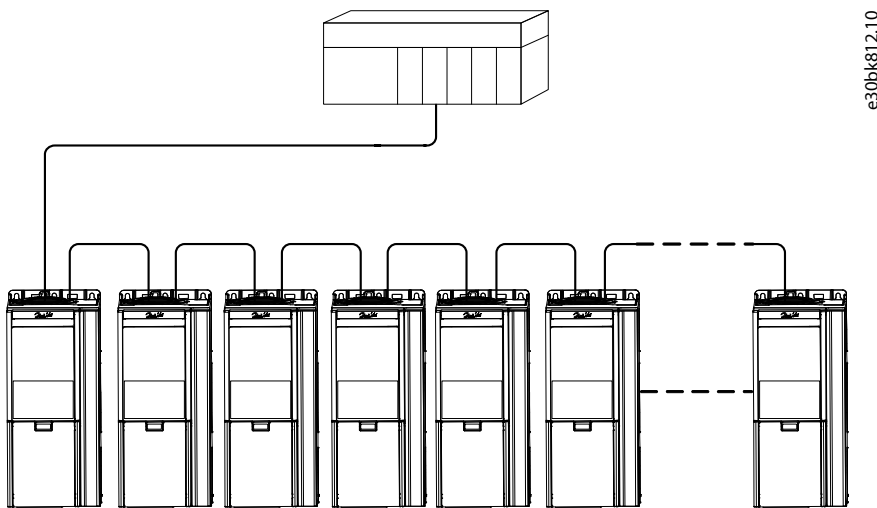
When line topology is used, take precautions to avoid timeout in the PLC when more than 8 drives or power converters are installed in series. Each drive or power converter in the network adds a small delay to the communication due to the built-in Ethernet switch. When the update time is too short, the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



e30bk812.10

Figure 3: Example of Line Topology

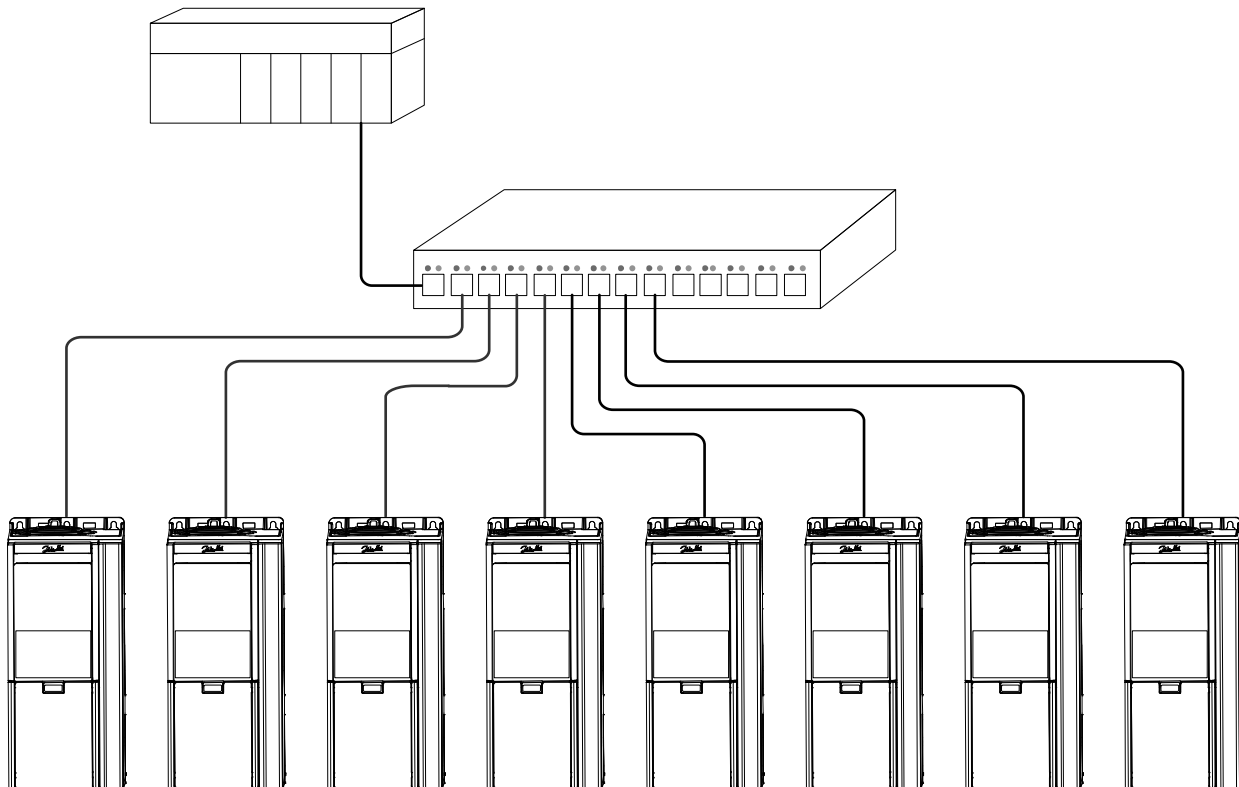
**NOTICE**

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.

### 2.10.3 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.



e30bk813.10

Figure 4: Example of Star 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.

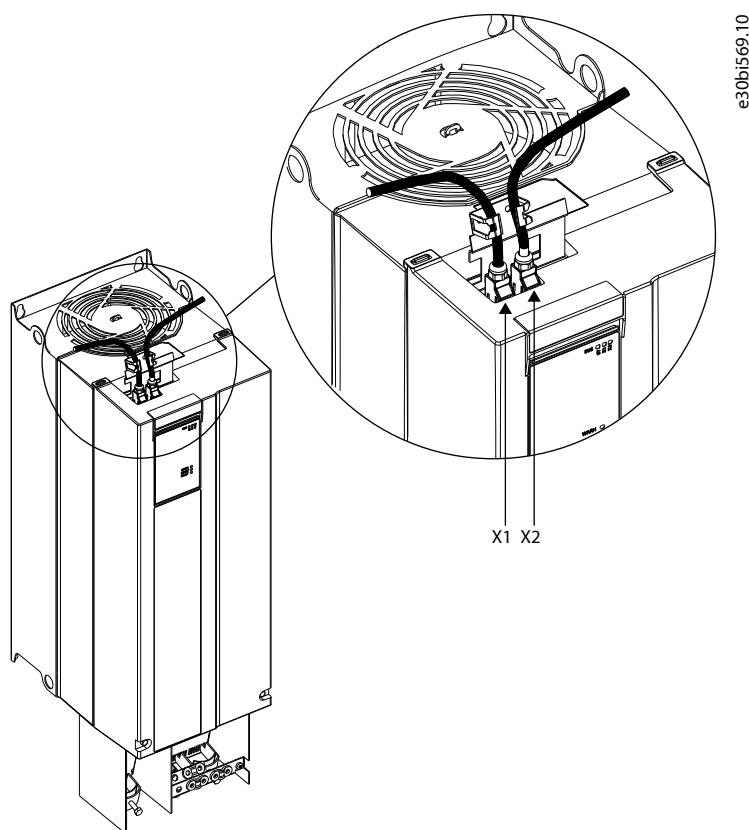


Figure 5: Location of the Communication Interface, X1/X2 in FA02-FA12 Frames (with the Optional EMC Plate)

#### 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](#).

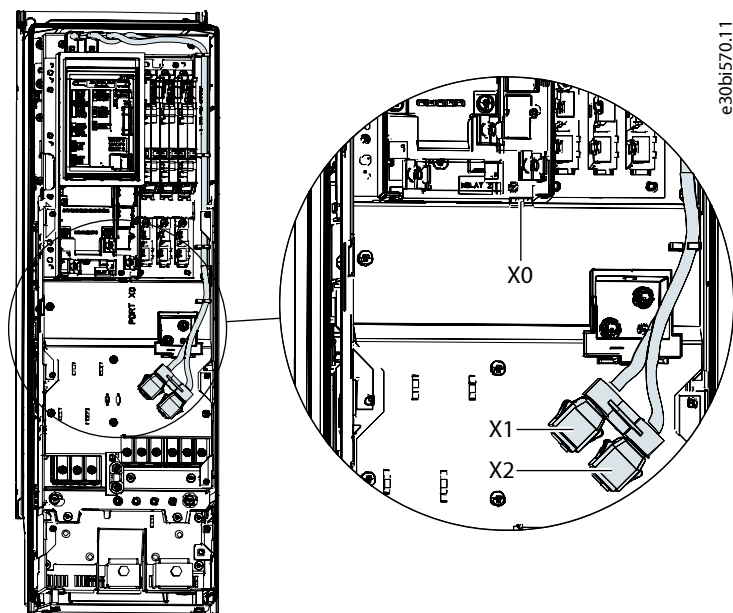


Figure 6: Communication Port X0, X1, and X2 Locations in FK06–FK08 Frames

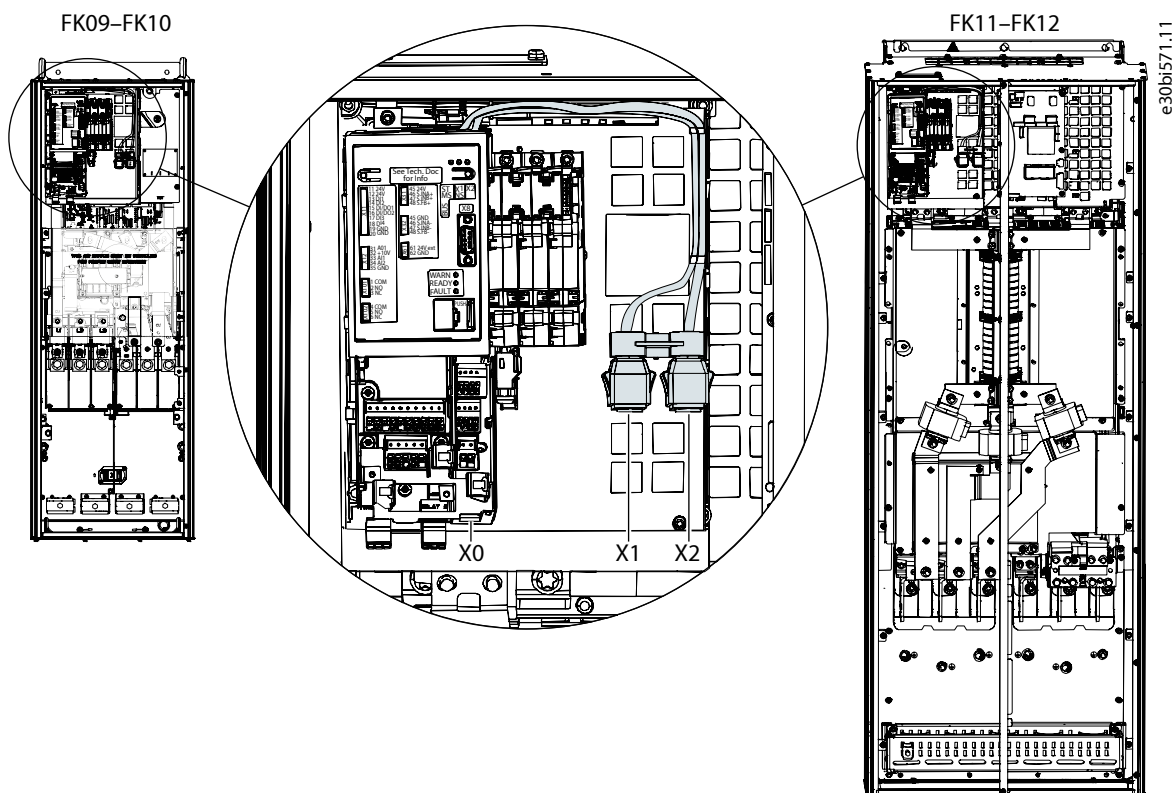


Figure 7: Communication Port X0, X1, and X2 Locations in FB09–FB12/FK09–FK12 Frames

### 3.3 EMC-compliant Installation

#### 3.3.1 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.

### 3.3.2 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.

### 3.3.3 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°.

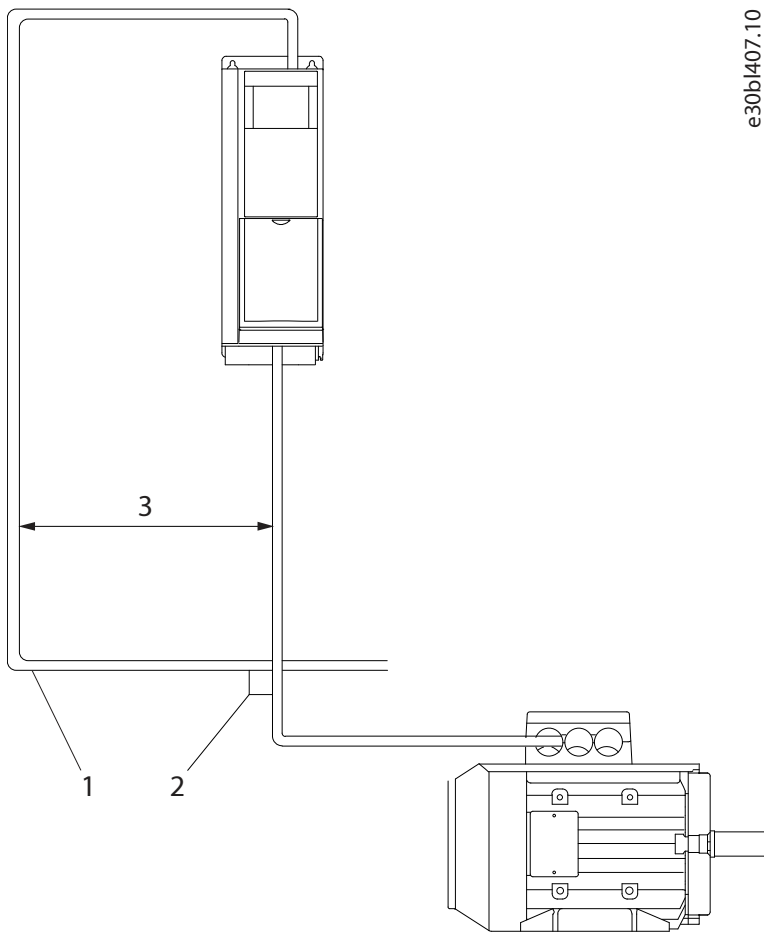


Figure 8: Cable Routing

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 Checking the License

Before starting the configuration, check that the BACnet license is installed in the drive.

1. Verify that the BACnet/IP (+BABI) license is installed in the drive.
  - In MyDrive® Insight, go to *Device Info*.
  - In the control panel, go to *About this device*.

Table 19: BACnet MSTP License

Protocol	Model code	Description
BACnet/IP	+BABI	Enables standard BACnet/IP protocol support, allowing the device to communicate with BACnet/IP clients such as SCADA or PLC systems over Ethernet.

### 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 20: 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 <b>Automatic</b> 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.

**Table 20: IPv4 Settings - (continued)**

Function	Value	Description
Enable ACD	Enable	Request to enable or disable Address Conflict Detection for the interface.
	Disable (default)	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.
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 21: Ethernet Port Configuration (X1/X2)**

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

### 4.3 Configuring BACnet/IP Communication

1. Configure the BACnet/IP settings.
  - In MyDrive®Insight, go to *Setup and Service > Parameter > Live > Connectivity > Protocols > BACnet > Configuration*.
  - In the control panel, navigate to parameter group **10.3.7.2 Configuration**.

**Table 22: BACnet Interface Parameters**

Parameter index	Parameter name	Default value	Minimum value	Maximum value	Description
10.3.7.2.1	<i>Device Instance</i>	1	1	4194303	Device Instance for BACnet.
10.3.7.2.6	<i>APDU Segment Timeout</i>	5000 ms	3000 ms	10000 ms	Set the wait time for a device to acknowledge the transmitted segment.
10.3.7.2.7	<i>APDU Timeout</i>	6000 ms	5000 ms	65535 ms	Set the time to wait for a device to receive a response after a message is sent.

2. Configure the parameters for enabling the drive to respond to commands from the BACnet/IP client.
  - In MyDrive®Insight, go to *Setup and Service > Parameter > Live > Application > Control Places*.
  - In the control panel, navigate to parameter group **5.5 Control Places**.

Table 23: BACnet/IP Response Parameters

Parameter index	Parameter name	Default value	Setting for BACnet
5.5.2.1	<b>Control Place Selection</b>	Advanced Control	Advanced Control/Fieldbus Control
5.5.2.7	<b>Fieldbus Speed Reference Source</b>	Fieldbus Reference, None	Fieldbus Reference, None
5.5.4.1.2	<b>Fieldbus Speed Reference Logic</b>	Source 1	Source 1
5.5.6.1.1	<b>Advanced Start Input</b>	Fieldbus Start, Integrated I/O T13 Digital Input	Fieldbus Start
5.5.6.1.2	<b>Advanced Start Logic</b>	OR	Source 1
5.5.6.1.3	<b>Advanced Start Backward Input</b>	False, False	False, False
5.5.6.1.4	<b>Advanced Start Backward Logic</b>	Source 1	Source 1
5.5.6.1.5	<b>Advanced Stop Inverse Input</b>	Fieldbus stop, True	Fieldbus stop, True
5.5.6.1.6	<b>Advanced Stop Inverse Logic</b>	Source 1	Source 1
5.5.6.1.7	<b>Advanced Coast Inverse Input</b>	Fieldbus coast, True	Fieldbus coast, True
5.5.6.1.8	<b>Advanced Coast Inverse Logic</b>	Source 1	Source 1
5.5.6.1.9	<b>Advanced Reversing Input</b>	Fieldbus reverse, False	Fieldbus reverse, False
5.5.6.1.10	<b>Advanced Reverse Logic</b>	OR	OR
5.5.6.1.11	<b>Advanced Reset Input</b>	Fieldbus reset, Integrated I/O T17 Digital Input	Fieldbus reset, Integrated I/O T17 Digital Input
5.5.6.1.13	<b>Advanced Start Mode</b>	State High Start	State High Start
5.5.6.1.15	<b>Fieldbus CTW Feature Bits</b>	Enabled	Enabled
5.5.6.2.1	<b>Adv. Speed Reference Source</b>	Fieldbus reference, Reference 1 input	Fieldbus reference
5.5.6.2.2	<b>Adv. Speed Reference Logic</b>	Sum	Source 1
5.5.6.2.3	<b>Adv. Speed Reference Toggle Input</b>	False	False

➔ The device is detected by the BMS. Start Logic and Stop Logic are assigned automatically as **Fieldbus Start** and **Fieldbus Stop** if **Fieldbus Control** is selected as the control place.

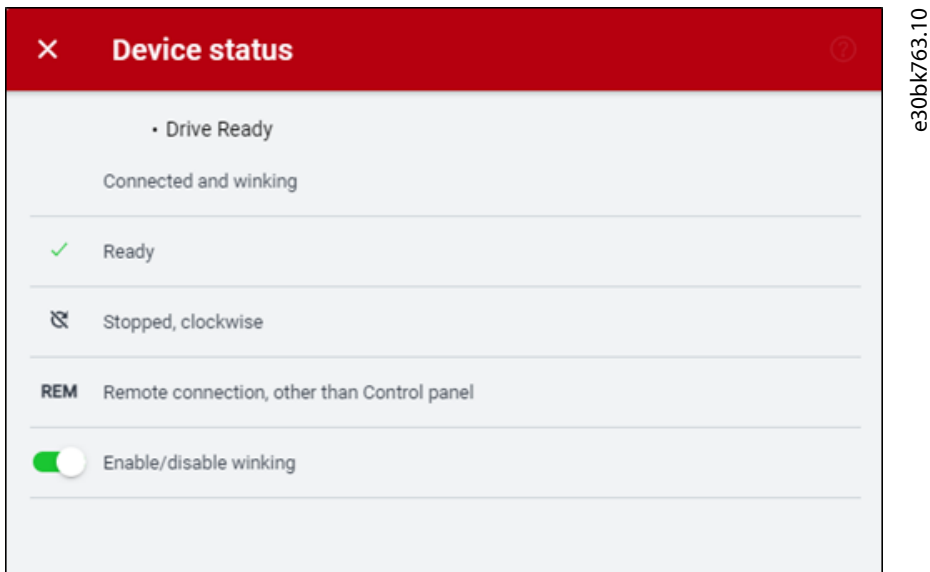
If there is a problem in establishing the communication between the device and the BACnet/IP client, see [Troubleshooting](#).

## 5 Troubleshooting

### 5.1 Identifying a Unit

The winking function makes the fieldbus indicator LEDs 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.

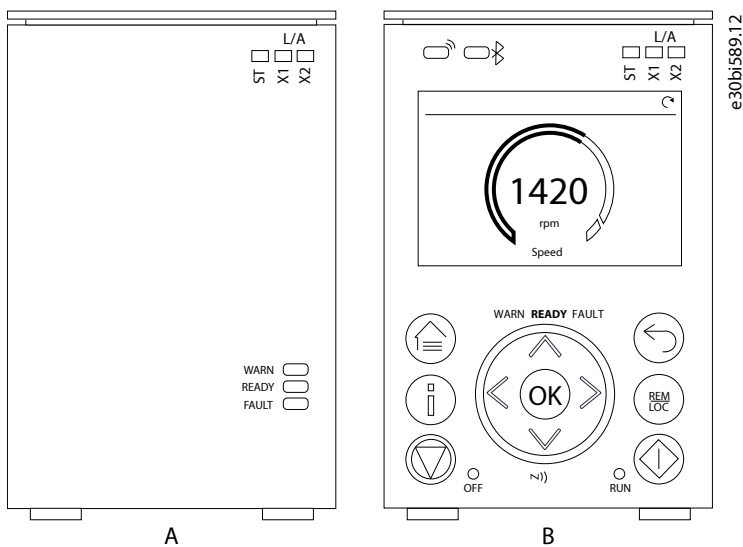


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See [5.2 Fieldbus Indicator LEDs](#) for more information on interpreting the LED signals and where the LEDs are located.

### 5.2 Fieldbus Indicator LEDs

There are 2 LEDs (X1/X2 and ST) on the top right corner of the control panel. The LED labeled X1/X2 shows the network status and the LED labeled ST shows the BACnet protocol related status.



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Figure 9: Fieldbus Indicator LEDs on Control Panel

Table 24: Fieldbus Indicator LED Functions

LED indication		Description
Network status (X1/X2)	BACnet protocol status (ST)	
Off	Off	No cable connected.
Green blink	Off	Cable is connected at the drive end.
Green	Off	Cable is connected at the drive and PLC end.
Red	Red blink	Address conflict
Green	Green blink	The master is not polling at the specified rate.
Green	Green	The device is communicating successfully.

### 5.3 Occurrences

An occurrence refers to a specific event or condition detected or reported by the device that is communicated across the fieldbus network to other devices or systems. Occurrences are often associated with faults or warnings.

The active faults and warnings are shown on the control panel and in MyDrive® Insight. Warnings are reset automatically when the cause for the warning is cleared. Faults stop the motor and require a manual reset. Once the issue is fixed, use the control panel, MyDrive® Insight, fieldbus, or a digital input to reset the fault.

The occurrences for iC7 BACnet devices are listed in [Table 25](#).

Table 25: Occurrences in iC7 drives with BACnet/IP

Number	Occurrence	Configurable	Value
1	BACnet Timeout	Yes	<ul style="list-style-type: none"> <li>• <b>No Response:</b> The event is ignored.</li> <li>• <b>Info:</b> The event is logged in the event log.</li> <li>• <b>Warning:</b> The drive issues a warning.</li> <li>• <b>Warning - Change Control Place:</b> 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 control place when the fieldbus process data returns.</li> <li>• <b>Warning - Change Control Place – Persistent:</b> 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 control place after the fieldbus process data returns.</li> <li>• <b>Fault, ramp to coast:</b> The drive issues a fault, ramps down, and coasts.</li> <li>• <b>Fault:</b> The drive issues a fault and coasts the motor.</li> </ul>

Table 26: BACnet Timeout Function Parameters

Parameter index	Parameter name	Default value	Minimum value	Maximum value	Description
10.3.7.2.14	<b>BACnet Connection Timeout</b>	60.00 s	10.00 s	18000.00 s	Set the BACnet timeout value.
10.3.7.2.15	<b>BACnet Timeout Control Place</b>	1	1	4	Select the alternative control place to be used in case of a BACnet timeout. <ol style="list-style-type: none"> <li>1. Local control</li> <li>2. Fieldbus control</li> <li>3. I/O control</li> <li>4. Advanced control</li> </ol>
10.3.7.2.16	<b>BACnet Timeout Response</b>	0	0	6	Select the response to BACnet data timeout. <ol style="list-style-type: none"> <li>1. Info</li> <li>2. Warning</li> <li>3. Warning - Change Control Place</li> <li>4. Warning - Change Control Place – Persistent</li> <li>5. Fault, ramp to coast</li> <li>6. Fault</li> </ol>

## 5.4 Error Codes

For BACnet to function, set the MAC address, the device instance, baud rate, and data format to match the bus parameters. If there are errors in establishing communication, see [5.5 Diagnostic Counters](#).

[Table 27](#) provides more information for troubleshooting the BACnet error responses.

BACnet communication also fails if bus termination is not done properly. Ensure that the ends are properly terminated.

Table 27: BACnet Error Codes

Number	BACnet error code	Error class category	Error code reason
1.	UNKNOWN_OBJECT	Object Class Error Code	Specified objects do not exist in the database.
2.	INVALID_ARRAY_INDEX	Property Class Error Code	Array index is out of range.
3.	INVALID_DATATYPE	Property Class Error Code	Property value datatype does not match the expected type.
4.	PROPERTY_IS_NOT_AN_ARRAY	Property Class Error Code	Attempt to access a property as an array, but it is not an array.
5.	UNKNOWN_PROPERTY	Property Class Error Code	Property identifier is unknown or unsupported.
6.	VALUE_OUT_OF_RANGE	Property Class Error Code	Value outside the valid range for the property.
7.	WRITE_ACCESS_DENIED	Property Class Error Code	Write access denied for the property.
8.	OUT_OF_MEMORY	Resource Class Error Code	Failed to allocate memory during internal operations.
9.	PASSWORD_FAILURE	Security Class Error Code	The operator's name and password did not match correctly.

Table 27: BACnet Error Codes - (continued)

Number	BACnet error code	Error class category	Error code reason
10.	CONFIGURATION_IN_PROGRESS	Device Class Error Code	Device is being configured; requests temporarily declined.
11.	OPTIONAL_FUNCTIONALITY_NOT_SUPPORTED	Object Class Error Code, Property Class Error Code, Service Class Error Code	Optional functionality required is not supported.
12.	NO_SPACE_TO_WRITE_PROPERTY	Resource Class Error Code	Not enough memory space to write the property.
13.	MISSING_REQUIRED_PARAMETER	Service Class Error Code, Reject Reason Error Code	Missing required parameter for the execution of the service request.
14.	PARAMETER_OUT_OF_RANGE	Service Class Error Code, Reject Reason Error Code	Parameter value is outside the allowable range for the service.
15.	ABORT_APPLICATION_EXCEEDED_REPLY_TIME	Abort Reason Error Code	Device failed to respond within the APDU Timeout period.
16.	ABORT_BUFFER_OVERFLOW	Communication Class Error Code, Abort Reason Error Code	Input buffer exceeded capacity either locally or remotely.
17.	ABORT_SEGMENTATION_NOT_SUPPORTED	Communication Class Error Code	Abort due to unsupported segmentation in PDU.
18.	ABORT_WINDOW_SIZE_OUT_OF_RANGE	Communication Class Error Code	Window size in segmented request exceeds the acceptable range.
19.	REJECT_UNDEFINED_ENUMERATION	Communication Class Error Code	Reject due to an undefined enumeration in the remote device.
20.	CHARACTER_SET_NOT_SUPPORTED	Property Class Error Code, Service Class Error Code	Unsupported character string encountered.
21.	DATATYPE_NOT_SUPPORTED	Property Class Error Code	Data contains an unsupported datatype.
22.	INVALID_TAG	Service Class Error Code, Reject Reason Error Code, Communication Class Error Code	Syntax error encountered in the service request.
23.	ABORT_INVALID_APDU_IN_THIS_STATE	Communication Class Error Code	APDU is not expected in the current transaction state.
24.	ABORT_PREEMPTED_BY_HIGHER_PRIORITY_TASK	Abort Reason Error Code	Transaction aborted to allow higher priority tasks to process.
25.	OTHER	All Class Error Code	This error code is returned for a reason other than any of those previously enumerated for this Error Class.

## 5.5 Diagnostic Counters

BACnet diagnostic counters are used to monitor and diagnose BACnet communication.

If the counter exceeds the limit, it restarts from 0. No information about the counter that has completed a cycle is recorded, and no notifications are sent.

The counters are reset when the drive restarts, or a warm start or a cold start is executed.

Table 28: BACnet Diagnostic Counters

Parameter index number	Parameter name	Minimum value	Maximum value	Description
10.3.7.1.1	<b>Total Messages</b>	0	4.29E+09	Total count of all messages processed (Rx + Tx). This counter increases by 1 for every message, whether it is transmitted or received.
10.3.7.1.2	<b>Transmitted Messages</b>	0	4.29E+09	Total count of all transmitted messages. This counter increases by 1 for every transmitted message.
10.3.7.1.3	<b>Received Messages</b>	0	4.29E+09	Total count of all received messages. This counter increases by 1 for every received message.
10.3.7.1.4	<b>Valid Received Messages</b>	0	4.29E+09	Count of received messages that passed validation. This counter increases if the received message is valid.
10.3.7.1.5	<b>Invalid Received Messages</b>	0	4.29E+09	Count of received messages that failed validation. This counter increases by 1 if the received message is invalid.



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