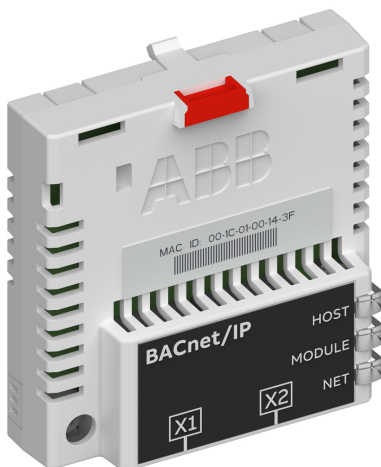


OPTION FOR ABB DRIVES, CONVERTERS AND INVERTERS

FBIP-21 BACnet/IP adapter module

User's manual



List of related manuals

Drive manuals and guides	Code (EN/Multilingual)
ACH580 HVAC control program firmware manual	3AXD50000027537
ACH580-01 manuals	9AKK10103A0587
ACH580-04 manuals	9AKK106930A9059
ACH580-07 manuals	9AKK106930A5241
ACQ580-01 manuals	9AKK106713A2709

Option manuals and guides

FBIP-21 BACnet/IP adapter module user's manual	3AXD50000028468
--	-----------------

You can find manuals and other product documents in PDF format on the Internet. See section Document library on the Internet on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

The code below opens an online listing of the manuals applicable to the product:



FBIP-21 manuals



Fieldbus connectivity webpage

User's manual

FBIP-21 BACnet/IP adapter module

Table of contents



1. Safety instructions



4. Mechanical installation



5. Electrical installation



6. Start-up



Table of contents

1. Safety instructions

Contents of this chapter	9
Use of warnings	9
Safety in installation	10

2. Introduction to the manual

Contents of this chapter	11
Purpose of the manual	11
Applicability	11
Compatibility	11
Target audience	12
Before you start	12
Contents	12
Cyber Security Disclaimer	13
Terms and abbreviations	14



3. Overview of the BACnet/IP network and the FBIP-21 module

Contents of this chapter	17
BACnet	17
BACnet supported network type with FBIP-21	17
Topology of the BACnet/IP network	18
Example 1	18
Example 2	18
FBIP-21 BACnet/IP adapter module	19
Layout of the FBIP-21 BACnet/IP adapter module	20

4. Mechanical installation

Contents of this chapter	21
Necessary tools and instructions	21
Unpacking and examining the delivery	21
Installing the adapter module	22

5. Electrical installation

Contents of this chapter	25
Warnings	25
Necessary tools and instructions	25
General cabling instructions	26
Connecting the adapter module to the BACnet/IP network	26
Connection procedure	26

6. Start-up

Contents of this chapter	27
Configuring the BACnet/IP connection	28
FBIP-21 configuration parameters – group A (group 1)	29
Activating drive control functions with ACH580	36
Drive control	36
Start/stop direction control	36
Input reference select	37
Frequency reference	37
Speed reference	38
Miscellaneous drive control	38
Relay output control	39
Data point connections	40
Analog output control	40
Data point connections	41
PID control	41
Data point connections	42
Communication fault	42
Drive feedback	43
Fault queue for drive diagnostics	45
Starting up fieldbus communication for ACH580 drives	46
Parameter setting examples	47
Frequency control	47

7. Communication protocol

Contents of this chapter	49
BACnet/IP	49
Prioritizing commands	49



BACnet interoperability building blocks	50
BACnet object list	51
AI object	51
AO object	51
AV object	52
BI object	56
BO object	57
BV object	57

8. Diagnostics

Contents of this chapter	61
Fault and warning messages	61
LEDs	62

9. Technical data

Contents of this chapter	65
Layout diagram	65
General conditions	66
BACnet link	66
TCP and UDP service ports	67
Open source licenses	67

Further information



8 *Table of contents*



1

Safety instructions

Contents of this chapter

The chapter contains the warning symbols used in this manual and the safety instructions which you must obey when you install or connect an optional module to a drive, converter or inverter. If you ignore the safety instructions, injury, death or damage can occur. Read this chapter before you start the installation.



Use of warnings

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. The manual uses these warning symbols:



Electricity warning tells you about hazards from electricity which can cause injury or death, or damage to the equipment.



General warning tells you about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.

Safety in installation

These instructions are for all who install or connect an optional module to a drive, converter or inverter and need to open its front cover or door to do the work.



WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- If you are not a qualified electrician, do not do installation or maintenance work.
- Disconnect the drive, converter or inverter from all possible power sources. After you have disconnected the drive, converter or inverter, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
- Disconnect all dangerous voltages connected to other control signal connectors in reach. For example, it is possible that 230 V AC is connected from outside to a relay output of the drive, converter or inverter.
- Always use a multimeter to make sure that there are no parts under voltage in reach. The impedance of the multimeter must be at least 1 Mohm.



2

Introduction to the manual

Contents of this chapter

This chapter contains general information on the manual and gives the compatibility information of the FBIP-21 adapter module.

Purpose of the manual

The manual provides information on installing, commissioning and using the FBIP-21 BACnet adapter module.

Applicability

This manual applies to the FBIP-21 BACnet/IP adapter module, SW version 0.41 and later.

Compatibility

The FBIP-21 adapter module is compatible with the following drives and protocols:

Drives	ACH580
Protocols	<ul style="list-style-type: none">• Ethernet standards IEEE 802.3 and IEEE 802.3u• All BACnet/IP clients that support protocol version 1, revision 12.

Target audience

This manual is intended for people who plan the installation, install, start up, use and service the adapter module.

The manual is written for readers worldwide. Both SI and imperial units are shown.

Before you start

Before you do work on the module, read this manual and the applicable drive/converter /inverter manual that contains the hardware and safety instructions for the product in question.

You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Contents

The manual consists of the following chapters:

- *Safety instructions* gives the safety instructions which you must obey when you install a fieldbus adapter module.
 - *Overview of the BACnet/IP network and the FBIP-21 module* contains a short description of the BACnet/IP network and the adapter module.
 - *Mechanical installation* contains a delivery checklist and instructions on installing the adapter module.
 - *Electrical installation* contains instructions on cabling and connecting the adapter module to the BACnet/IP network.
 - *Start-up* presents the steps to take during the start-up of the drive with the adapter module and gives information on configuring the BACnet/IP network.
 - *Communication protocol* describes the BACnet/IP communication protocol for the adapter module.
 - *Diagnostics* explains how to trace faults with the status LEDs on the adapter module.
 - *Technical data* contains the technical data of the adapter module and the Ethernet link.
-

Cyber Security Disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Terms and abbreviations

Term/ Abbreviation	Explanation
AI	Analog input
AO	Analog output
AV	Analog value
BBMD	BACnet Broadcast Management Device
BI	Binary input
BO	Binary output
BV	Binary value
C	Commandable property
DHCP	Dynamic Host Control Protocol. A protocol for automating the configuration of IP devices. DHCP can be used to automatically assign IP addresses and related network information.
DIO	Digital inputs/outputs of the drive
EMC	Electromagnetic compatibility
FBA	Fieldbus adapter
FBIP-21 BACnet adapter module	One of the optional fieldbus adapter modules available for ABB drives. FBIP-21 is a device through which an ABB drive is connected to a BACnet/IP network.
Fieldbus adapter module	Device through which the drive is connected to an external communication network, that is, a fieldbus. The communication with the module is activated with a drive parameter.
FTP	Foiled twisted pair
HVAC	Heating, ventilating, and air conditioning
LAN	Local area network
MAC ID	Every node on an Ethernet network has to have a unique identifier. This node number is called MAC ID (Media Access Control ID).
R	Readable property
RC	Resistor -capacitor

Term/ Abbreviation	Explanation
RO	Relay output
STP	Shielded twisted pair
UTP	Unshielded twisted pair
VLAN	Virtual LAN
W	Writable property
WAN	Wide area network

3

Overview of the BACnet/IP network and the FBIP-21 module

Contents of this chapter

This chapter contains a short description of the BACnet/IP network and the FBIP-21 adapter module.

BACnet

BACnet is a standard data communication protocol that enables interoperability between different building systems (e.g. fire, security, lighting, HVAC, elevator, etc.) and devices in building automation and control applications. It enables data sharing among different types of devices from a broad set of suppliers.

■ BACnet supported network type with FBIP-21

The ACH580 drive can be used with the following BACnet/IP network types for transporting BACnet messages. A BACnet router is used to connect the various network types.

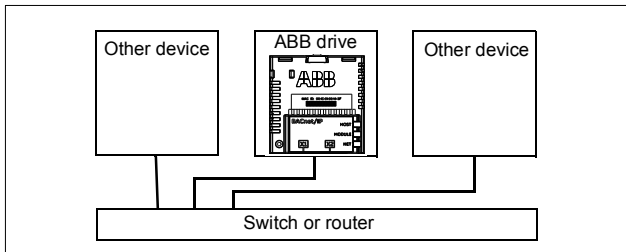
BACnet/IP - This type is used with the existing Ethernet infrastructure, VLAN and WAN networks. It uses the UDP/IP for compatibility with existing IP infrastructure. When it is used with multiple IP subnets, an additional device BACnet Broadcast

Management Devices (BBMDs) is required to manage inter-subnet BACnet broadcast messages. Each subnet requires one BBMD.

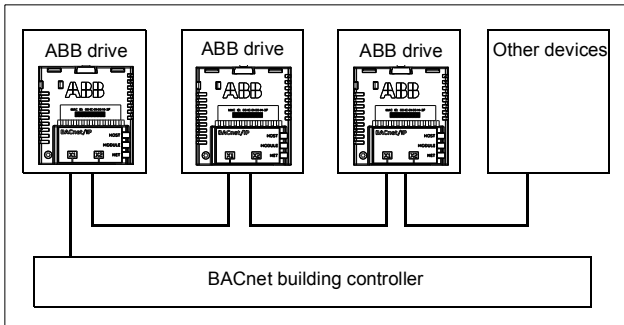
■ Topology of the BACnet/IP network

The below examples show the allowable topologies for a BACnet/IP network with FBIP-21 module.

Example 1



Example 2



FBIP-21 BACnet/IP adapter module

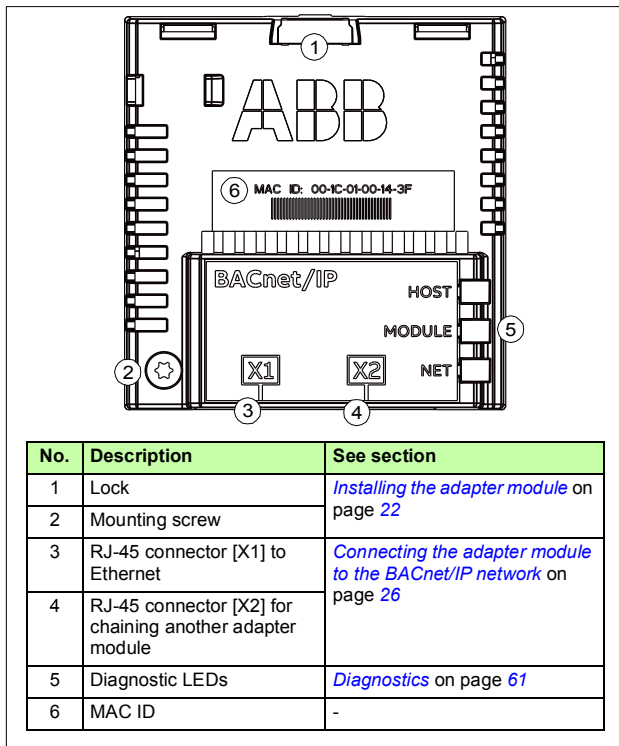
The FBIP-21 BACnet/IP adapter module is an optional device for ABB drives which enables the connection of the drive to a BACnet/IP network. For example, the FBIP-21 BACnet/IP adapter module connects the ACH580 drive designed for HVAC and refrigeration applications.

Through the adapter module you can:

- give control commands to the drive (for example, Start, Stop, Run permissive)
- give a motor speed or torque reference to the drive
- give a process actual value or a process setpoint to the PID controller of the drive
- read status information and actual values from the drive
- reset a drive fault
- read and command analog and digital I/Os of the drive.

The adapter module is installed into an option slot on the drive control unit. See the drive manuals for module placement options.

Layout of the FBIP-21 BACnet/IP adapter module



4

Mechanical installation

Contents of this chapter

This chapter contains a delivery checklist and instructions to install the adapter module.

Necessary tools and instructions

You will need a Torx TX10 screwdriver to secure the BACnet adapter module to the drive. See also, the applicable drive hardware manual.



Unpacking and examining the delivery

1. Open the option package.
 2. Make sure that the package contains:
 - BACnet adapter module, type FBIP-21 and
 - this manual.
 3. Make sure that there are no signs of damage.
-

Installing the adapter module



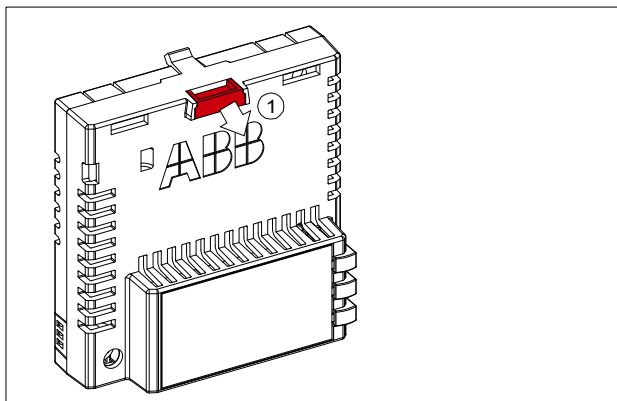
WARNING! Obey the safety instructions. See chapter [Safety instructions](#) on page 9. If you ignore the safety instructions, injury or death can occur.

The adapter module has a specific position in the drive. Plastic pins, a lock and one screw to hold the adapter module in place. The screw also makes an electrical connection between the module and drive frame for cable shield termination.

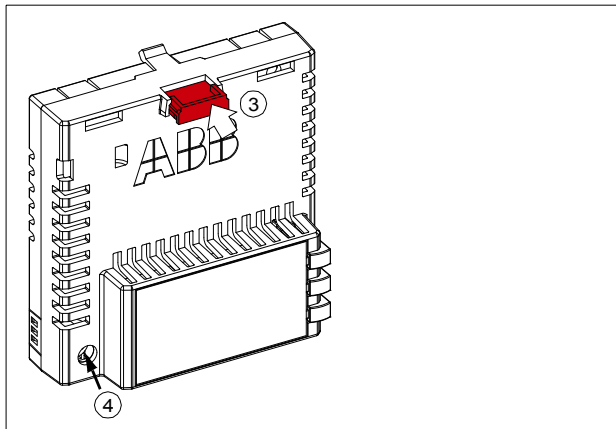
When the adapter module is installed, it makes the signal and power connection to the drive through a 20-pin connector.

When you install or remove the adapter module from the control unit:

1. Pull out the lock.



- Put the adapter module carefully into its position on the drive.
- Push in the lock.



- Tighten the screw to torque 0.8 N·m using a Torx TX10 screwdriver.



WARNING! Do not use excessive force, or leave the screw too loose. Over-tightening can damage the screw or module. A loose screw decreases the EMC performance, and can even cause an operation failure.

See the applicable drive manual for further instructions on how to install the adapter module to the drive.



5

Electrical installation

Contents of this chapter

This chapter contains:

- general cabling instructions
- instructions on connecting the adapter module to the BACnet/IP network.

Warnings



WARNING! Obey the safety instructions. See chapter [Safety instructions](#) on page 9. If you ignore the safety instructions, injury or death can occur. If you are not a qualified electrician, do not do electrical work.

Necessary tools and instructions

See the applicable drive hardware manual.



General cabling instructions

- Arrange the bus cables as far away from the motor cables as possible.
- Avoid parallel runs.
- Use bushings at cable entries.

Connecting the adapter module to the BACnet/IP network

The network cable can be CAT5 or higher, and type unshielded twisted pair (UTP), foiled twisted pair (FTP) or shielded twisted pair (STP).

When FTP or STP is used, the cable shield is connected to the drive frame through a resistor-capacitor (RC) circuit.

■ Connection procedure

1. Connect the network cable to the RJ-45 connector (X1) on the adapter module.
2. If you want to create a daisy chain with FBIP-21 adapter modules, connect the X2 connector of the first adapter module to X1 on the next adapter module, and so on. See BACnet/IP network topology [Example 2](#) on page 18.



6

Start-up

Contents of this chapter

This chapter contains:

- information on configuring the drive for operation with the adapter module
- drive-specific instructions on starting up the drive with the adapter module
- information on configuring the client for communication with the adapter module.



Configuring the BACnet/IP connection



WARNING! Obey the safety instructions given in this manual and the drive documentation.

After the adapter module has been mechanically and electrically installed according to the instructions in chapters *Mechanical installation* and *Electrical installation*, you must prepare the drive for communication with the module.

The detailed procedure for activating the module for BACnet/IP communication with the drive depends on the drive type. Normally, you must adjust a parameter to activate the communication. See the drive-specific start-up sections starting on page 36.

Once communication between the drive and the adapter module has been established, several configuration parameters are copied to the adapter module. These parameters are shown in the tables below and must be checked first and adjusted where necessary. You can adjust the parameters via a drive control panel or a PC tool.

Note: The new parameter settings take effect only when you power up the module the next time or when you activate the fieldbus adapter refresh parameter.



■ FBIP-21 configuration parameters – group A (group 1)

Group A (group 1) corresponds to parameter group 51 in ACH580 drive.

No.	Name/Value	Description	Default
01	FBA type	Shows the fieldbus adapter type as detected by the drive. You cannot adjust this value. This parameter is read-only.	47808 = BACnet
	0 = None	Communication between the drive and the module is not established.	
	47808 = BACnet	BACnet	
02	Reserved	This parameter is not used by the adapter module.	-
03	Commrate	Sets the bit rate of the communication and determines if the communication can be simultaneously two-way (full duplex) or only one way (half duplex).	0 = Auto
	0 = Auto	Auto-negotiate	
	1 = 100 Mbps FD	100 Mbps, full duplex	
	2 = 100 Mbps HD	100 Mbps, half duplex	
	3 = 10 Mbps FD	10 Mbps, full duplex	
	4 = 10 Mbps HD	10 Mbps, half duplex	
04	IP configuration	Sets the method for configuring the IP address, subnet mask and gateway address for the Ethernet interface.	1 = Dyn IP DHCP
	0 = Static IP	Configuration will be obtained from parameters 05...13 .	
	1 = Dyn IP DHCP	Configuration is obtained via DHCP.	



No.	Name/Value	Description	Default
05	IP address 1	An IP address is assigned to each IP node on a network. An IP address is a 32-bit number that is typically represented in "dotted decimal" notation consisting of four decimal integers, in the range 0...255, separated by periods. Each integer represents the value of one octet (8-bits) in the IP address. Parameters <i>05...08</i> define the four octets of the IP address.	0
	0...255	IP address	
...
08	IP address 4	See parameter <i>05 IP address 1</i> .	0
	0...255	IP address	



No.	Name/Value	Description	Default																																																																				
09	Subnet CIDR	<p>Defines subnet masks for CIDR notation.</p> <p>Subnet masks are used for splitting networks into smaller networks called subnets. A subnet mask is a 32-bit binary number that splits the IP address into a network address and host address.</p> <p>Subnet masks are typically represented in either dotted decimal notation or the more compact CIDR notation, as shown in the table below.</p> <table border="1" data-bbox="242 518 858 1109"> <thead> <tr> <th>Dotted decimal</th> <th>CIDR</th> <th>Dotted decimal</th> <th>CIDR</th> </tr> </thead> <tbody> <tr><td>255.255.255.254</td><td>31</td><td>255.254.0.0</td><td>15</td></tr> <tr><td>255.255.255.252</td><td>30</td><td>255.252.0.0</td><td>14</td></tr> <tr><td>255.255.255.248</td><td>29</td><td>255.248.0.0</td><td>13</td></tr> <tr><td>255.255.255.240</td><td>28</td><td>255.240.0.0</td><td>12</td></tr> <tr><td>255.255.255.224</td><td>27</td><td>255.224.0.0</td><td>11</td></tr> <tr><td>255.255.255.192</td><td>26</td><td>255.224.0.0</td><td>10</td></tr> <tr><td>255.255.255.128</td><td>25</td><td>255.128.0.0</td><td>9</td></tr> <tr><td>255.255.255.0</td><td>24</td><td>255.0.0.0</td><td>8</td></tr> <tr><td>255.255.254.0</td><td>23</td><td>254.0.0.0</td><td>7</td></tr> <tr><td>255.255.252.0</td><td>22</td><td>252.0.0.0</td><td>6</td></tr> <tr><td>255.255.248.0</td><td>21</td><td>248.0.0.0</td><td>5</td></tr> <tr><td>255.255.240.0</td><td>20</td><td>240.0.0.0</td><td>4</td></tr> <tr><td>255.255.224.0</td><td>19</td><td>224.0.0.0</td><td>3</td></tr> <tr><td>255.255.192.0</td><td>18</td><td>192.0.0.0</td><td>2</td></tr> <tr><td>255.255.128.0</td><td>17</td><td>128.0.0.0</td><td>1</td></tr> <tr><td>255.255.0.0</td><td>16</td><td></td><td></td></tr> </tbody> </table>	Dotted decimal	CIDR	Dotted decimal	CIDR	255.255.255.254	31	255.254.0.0	15	255.255.255.252	30	255.252.0.0	14	255.255.255.248	29	255.248.0.0	13	255.255.255.240	28	255.240.0.0	12	255.255.255.224	27	255.224.0.0	11	255.255.255.192	26	255.224.0.0	10	255.255.255.128	25	255.128.0.0	9	255.255.255.0	24	255.0.0.0	8	255.255.254.0	23	254.0.0.0	7	255.255.252.0	22	252.0.0.0	6	255.255.248.0	21	248.0.0.0	5	255.255.240.0	20	240.0.0.0	4	255.255.224.0	19	224.0.0.0	3	255.255.192.0	18	192.0.0.0	2	255.255.128.0	17	128.0.0.0	1	255.255.0.0	16			0
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255.255.192.0	18	192.0.0.0	2																																																																				
255.255.128.0	17	128.0.0.0	1																																																																				
255.255.0.0	16																																																																						
1...31	Subnet mask in CIDR notation																																																																						



No.	Name/Value	Description	Default
10	GW address 1	Defines the four octets of the gateway address. IP gateways connect individual physical IP subnets into a unified IP network. An IP node on one subnet communicates with an IP node on another subnet by sending data to the IP gateway for forwarding. Parameters 10...13 define the four octets of the gateway address.	0
	0...255	GW address	
...
13	GW address 4	See parameter 10 GW address 1 .	0
	0...255	GW address	
14	Device obj ID lo	Defines the device object ID for BACnet devices. The Device Object ID needs to be unique across all BACnet devices in the building network. Valid values are 0...4194303. For values 0...9999, this parameter sets the values directly. For values greater than 9999, the ID is calculated with this formula: Device ID = (10000 * par. 15) + par. 14.	0
	0...9999	Device ID	
15	Device obj ID hi	Defines the device object ID for BACnet devices.	0
	0...419	Device ID	
16	Max APDU retries	Defines the number of retries to send when no response is seen to confirmed requests.	3
	0...10	Number of retries.	
17	APDU timeout	Defines the time a client waits for response from a BACnet device.	6 s
	6...60 s	Waiting time.	



No.	Name/Value	Description	Default
20	Timeout time	Sets the delay time for directing messages to the drive before a communication loss condition is declared. <ul style="list-style-type: none"> • If value is zero, the feature is disabled. • If value is non zero, the timeout is in units of 100ms. For example, a value of 300 is 30.0 seconds. 	300 (30.0 s)
	0...65535	Delay time	
21	Timeout mode	Defines the message type that resets the timeout counter for detecting communication loss between the drive and the master.	1 = Any packet
	1 = Any packet	Any message directed to the drive resets the timeout.	
	2 = Control RW	A write to control or reference resets the timeout.	
22 ... 26	Reserved		
27	FBA Par refresh	Validates any changed adapter module configuration parameter settings. After refreshing, the value reverts automatically to Done. Note: This parameter cannot be changed while the drive is running.	0 = Done
	0 = Done	Refreshing done	
	1 = Configure	Refreshing	



No.	Name/Value	Description	Default
28	FBA Par table ver	Displays the parameter table revision of the fieldbus adapter module mapping file stored in the memory of the drive. In format xyz , where x = major revision number y = minor revision number z = correction number This parameter is read-only.	0 hex
	0..0xFFFF	Parameter table revision	
29	FBA Drive type code	Displays the drive type code of the fieldbus adapter module mapping file stored in the memory of the drive. This parameter is read-only.	0
	0...65535	Drive type code of the fieldbus adapter module mapping file	
30	FBA Mapping file ver	Displays the fieldbus adapter module mapping file revision stored in the memory of the drive in decimal format. This parameter is read-only.	0
	0...65535	Mapping file revision	
31	D2FBA comm status	Displays the status of the fieldbus adapter module communication. This parameter is read-only. Note: The value names may vary by drive.	0 = Idle
	0 = Idle	Adapter is not configured.	
	1 = Exec.init	Adapter is initializing.	
	2 = Time out	A timeout has occurred in the communication between the adapter and the drive.	
	3 = Conf.err	Adapter configuration error	
	4 = Off-line	Adapter is off-line.	
	5 = On-line	Adapter is on-line.	



No.	Name/Value	Description	Default
	6 = Reset	Adapter is performing a hardware reset.	
32	FBA comm SW ver	Read-only. Displays the firmware patch and build number of the adapter module in format xyy , where: xx = patch number yy = build number. Example: C80D ≥ 200.13 or 0 ≥ 0.0	0 hex
	0..0xFFFF	Firmware patch and build number of the adapter module	
33	FBA appl SW ver	Read-only. Displays the firmware version of the adapter module in format xyy , where: xx = major revision number yy = minor revision number. Example: 0041h = 0.41 Version number is in the form: <major>,<minor>,<patch>,<build> Example: 0.41.200.6 or 0.41.0.0	0 hex
	0..0xFFFF	Firmware version of the adapter module	



Activating drive control functions with ACH580

■ Drive control

To enable fieldbus control of various drive functions through BACnet/IP, do the following:

- configure the drive to accept fieldbus control of the function.
- define a fieldbus input for any drive data required for fieldbus control.
- define a fieldbus output for any control data required by the drive.


See the individual control functions described in below sections with details of configuration.

Note: Change only those parameter of the functions that you want to control through BACnet/IP. All other parameters should remain as factory default values.

For a complete parameter list, see the relevant drives manual.

■ Start/stop direction control

For Start/stop direction control through fieldbus, configure the following drive parameters and set the fieldbus controller supplied command(s) in the appropriate location:



Drive parameter	Value	Description	BACnet access point
20.01 Ext1 commands	Fieldbus A	Start/stop by fieldbus with Ext1 selected	BV10
20.06 Ext2 commands	Fieldbus A	Start/stop by fieldbus with Ext2 selected	BV10
20.21 Direction	Request	Direction by fieldbus, if required	BV11

■ Input reference select

The tables below show how to use the fieldbus to select the drive input references for frequency and speed control modes.

- For frequency control, set parameter **99.04 Motor control mode** = Scalar (1) (default value for ACH580).
- For speed control, set parameter **99.04 Motor control mode** = Vector (0)

Vector control has better accuracy than the scalar control, but vector control cannot be used in all situations. For information on control modes and reference scaling, see the drive manual.

The actual output values of the drive can be read from AV0...AV6, AV31 and AV32. For example, AV0 is output speed in rpm, AV1 is output frequency in Hz and AV31 is output speed in %.

Frequency reference

For using the fieldbus to provide input frequency references to the drive, configure the following drive parameters and set the fieldbus controller supplied reference word(s) in the appropriate location:

Drive parameter	Value	Description	BACnet access point
19.11 Ext1/Ext2 selection	2 = FBA A MCW bit	Reference set selection by fieldbus	BV13
28.11 Ext1 frequency ref1	3 = FBA ref1 ¹⁾	Frequency reference source 1	AV16
28.15 Ext2 frequency ref1	5 = FBA ref2 ¹⁾	Frequency reference source 2	AV17
46.02 Frequency scaling	50.00 Hz ¹⁾	16-bit scaling of frequency-related parameters	AV16/AV17
50.04 FBA A ref1 type/50.05 FBA A ref2 type	0 = Speed or frequency 5 = Frequency	References (1 or 2) type for scaling defined in parameter 46.02 Frequency scaling	AV16/AV17

¹⁾ As example

Speed reference

For using the fieldbus to provide input speed references to the drive, configure the following drive parameters and set the fieldbus controller supplied reference word(s) in the appropriate location:

Drive parameter	Value	Description	BACnet access point
19.11 Ext1/Ext2 selection	2 = FBA A MCW bit	Reference set selection by fieldbus	BV13
22.11 Ext1 speed ref1	3 =FBA ref1 ¹⁾	Speed reference source 1	AV16
22.18 Ext2 speed ref1	5 =FBA ref2 ¹⁾	Speed reference source 2	AV17
46.01 Speed scaling	1500 rpm ¹⁾	16-bit scaling of speed-related parameters	AV16/AV17
50.04 FBA A ref1 type/50.05 FBAA ref2 type	0 = Speed or frequency 4 = Speed	References (1 or 2) type for scaling defined in parameter 46.02 Frequency scaling	AV16/AV17

¹⁾ As example

Miscellaneous drive control



To use the fieldbus for different drive control functions, configure the following drive parameters and set the fieldbus controller supplied command(s) in the appropriate location:

Drive parameter	Value	Description	BACnet access point
20.40 Run permissive	Fieldbus adapter	Run permission by fieldbus	BV12
20.01 Ext1 commands/ 20.06 Ext2 commands	Fieldbus A	Fault reset by fieldbus	BV14

Drive parameter	Value	Description	BACnet access point
20.41 Start interlock 1	Fieldbus adapter	Source for start interlock 1 is fieldbus	BV20
20.42 Start interlock 2	Fieldbus adapter	Source for start interlock 2 is fieldbus	BV21

■ Relay output control

For relay output control through fieldbus,

- set the following drive parameters to select the source for the ROs
- program the drive for control through BACnet
- set the fieldbus controller supplied binary coded relay command(s) in the appropriate location.

Drive parameter	Value	Description	BACnet access point
10.24 RO1 source	RO/DIO control word bit0	Relay output 1 controlled by fieldbus	BO0
10.27 RO2 source	RO/DIO control word bit1	Relay output 2 controlled by fieldbus	BO1
10.30 RO3 source	RO/DIO control word bit2	Relay output 3 controlled by fieldbus	BO2
15.07 RO4 source	RO/DIO control word bit3	Relay output 4 controlled by fieldbus	BO3
15.10 RO5 source	RO/DIO control word bit4	Relay output 5 controlled by fieldbus	BO4
15.23 DO1 source	RO/DIO control word bit8	Digital output 1 controlled by fieldbus	BO5



Data point connections

The BACnet access points of the above relay output control parameters are in turn linked to the following parameters:

BACnet access point	Drive parameter	Description
BO0...BO5	10.99 RO/DIO control word	Storage parameter for relay output and digital outputs

■ Analog output control

For analog output control through fieldbus, configure the following drive parameters and set the fieldbus controller supplied analog value(s) in the appropriate location.

For more information on scaling of analog outputs and inputs, see the *ACH580 HVAC control program firmware manual* (3AXD50000027537[English]).

Drive parameter	Value	Description	BACnet access point
13.12 AO1 source	AO1 data storage	Analog output 1 controlled by fieldbus	AO0
13.22 AO2 source	AO2 data storage	Analog output 2 controlled by fieldbus	AO1
13.17 AO1 source min	0.0	Minimum value of signal selected by parameter 13.12 AO1 source	AO0
13.18 AO1 source max	100.0	Maximum value of signal selected by parameter 13.12 AO1 source	AO0
13.27 AO2 source min	0.0	Minimum value of signal selected by parameter 13.22 AO2 source	AO1
13.28 AO2 source max	100.0	Maximum value of signal selected by parameter 13.22 AO2 source	AO1

Data point connections

The BACnet access points in the above drive parameter connections are linked to the following data points:

BACnet access point	Drive parameter	Description
AO0	13.91 AO1 data storage	Storage parameter for AO1
AO1	13.92 AO2 data storage	Storage parameter for AO2

PID control

For PID control through fieldbus, configure the following drive parameters and set the fieldbus controller supplied PID value(s) in the appropriate location:

Drive parameter	Value	Description	BACnet access point
40.08 Set 1 feedback 1 source	Feedback storage	Feedback 1 source data storage	AV43
40.09 Set 1 feedback 2 source	Feedback storage	Feedback 2 source data storage	AV43
40.16 Set 1 setpoint 1 source	Setpoint data storage	Setpoint 1 source data storage	AV42
40.17 Set 1 setpoint 2 source	Setpoint data storage	Setpoint 2 source data storage	AV42



Data point connections

The BACnet access points in the above drive parameter connections are linked to the following data points:

BACnet access point	Drive parameter	Description
AV43	40.91 <i>Feedback data storage</i>	Storage parameter for process feedback value
AV42	40.92 <i>Setpoint data storage</i>	Storage parameter for process setpoint value

■ Communication fault

BACnet has no built-in feature to detect communication timeout, because it is not a synchronous protocol. If communication timeouts are needed, you can use the following parameters to detect timeouts based on different packets and specifying the drive action.

Full timeout time is the sum of parameters **51.20 Timeout time** and **50.03 FBA A comm loss tout**.

Drive parameter	Value	Description
51.21 Timeout mode	1 = Any packet 2 = Control RW	Defines the message type that resets the timeout counter for detecting communication loss between the drive and the master.
51.20 Timeout time	0...65535	Sets the delay time for directing messages to the drive before a communication loss condition is declared. <ul style="list-style-type: none"> • If value is zero, the feature is disabled. • If value is non-zero, the time is in units of 100 ms. For example, a value of 300 is 30.0 seconds.



Drive parameter	Value	Description
50.02 FBA A comm loss func	0 = No action 1 = Fault 2 = Last speed 3 = Speed ref safe 4 = Fault always 5 = Warning	Selects how the drive reacts upon a fieldbus communication break. The time delay is defined by parameter 50.03 FBA A comm loss t out.
50.03 FBA A comm loss t out	0.3...6553.5 s	Defines the time delay before the action defined by parameter 50.02 FBA A comm loss func is taken.

■ Drive feedback

The inputs to the controller (drive outputs) have pre-defined meanings established by the protocol. This feedback does not require drive configuration.

The following table lists a sample of the feedback data. For a complete listing, see the input word/point/object listings in the chapter [Communication protocol](#) on page 49.

Drive parameter	Description	BACnet access point
01.01 Motor speed used	Estimated motor speed in RPM	AV0
01.06 Output frequency	Estimated drive output frequency in Hz	AV1
01.11 DC voltage	DC bus voltage	AV2
01.13 Output voltage	Calculated motor voltage in V AC	AV3
01.07 Motor current	Measured (absolute) motor current in A	AV4
01.10 Motor torque	Motor torque in percent of the nominal motor torque	AV5
01.14 Output power	Drive output power	AV6



Drive parameter	Description	BACnet access point
05.11 Inverter temperature	Estimated drive temperature in percent of fault limit	AV7
01.20 Inverter kWh counter	Amount of energy that has passed through the drive (in either direction) in full kilowatt-hours. Whenever the counter rolls over, 01.19 Inverter MWh counter is incremented. The minimum value is zero.	AV9
35.01 Motor estimated temperature	Displays the motor temperature as estimated by the internal motor thermal protection model	AV15
01.03 Motor speed %	Motor speed in percent of the synchronous motor speed.	AV31
01.50 Current hour kWh	Current hour energy consumption. This is the energy of the last 60 minutes (not necessarily continuous) the drive has been running, not the energy of a calendar hour. The value is set to the value before the power cycle when the drive is again up and running.	AV130
01.51 Previous hour kWh	Previous hour energy consumption. The value 01.50 Current hour kWh is stored here when its values has been cumulated for 60 minutes. The value is set to the value before the power cycle when the drive is again up and running.	AV131
01.52 Current day kWh	Current day energy consumption. The value 01.51 Previous hour kWh is stored here when its value has been cumulated for 24 hours. The value is set to the value before the power cycle when the drive is again up and running.	AV132



Drive parameter	Description	BACnet access point
01.53 Previous day kWh	Previous day energy consumption. The value 01.52 Current day kWh is stored here when its value has been cumulated for 24 hours. The value is set to the value before the power cycle when the drive is again up and running	AV133

■ Fault queue for drive diagnostics

Faults specific to fieldbus control are listed below:

For general ACH580 diagnostics information, see the *Diagnostics* section in the ACH580 User's manual.

Drive parameter	Description	BACnet access point
04.01 Tripping fault	Fault that caused the current trip	AV18
04.11 Latest fault	Code of the first stored (non-active) fault	AV19
04.12 2nd last fault	Code of the second stored (non-active) fault	AV20



Starting up fieldbus communication for ACH580 drives

Follow these steps to setup fieldbus communication in ACH580 drives. For example of appropriate values, see [Parameter setting examples](#) (page 47).

1. Power up the drive.
2. Enable communication between the adapter module and the drive with parameter **50.01 FBA A enable**.
3. Configure network settings with parameters **51.03...51.13**.
4. Define the device object instance value with parameters **51.14 Device obj ID lo** and **51.15 Device obj ID hi**.

Note: The object instance value should be unique and in the range 1...4194303.

5. Define communication loss function to monitor the communication between fieldbus master and adapter module and between adapter module and drive:
 - With parameters **51.20** and **51.21**, set the timeout time and timeout mode.
 - With parameter **50.03 FBA A comm loss t out**, define the communication break reaction time.
 - With parameter **50.02 FBA A comm loss func**, select how the drive reacts to a fieldbus communication break.
6. With parameter **96.07 Parameter save manually**, save the valid parameter values to permanent memory.
7. With parameter **51.27 FBA A par refresh**, validate the settings made in parameter group 51.
8. Set the relevant drive control parameters to control the drive according to the application.



Parameter setting examples

Frequency control

The table below shows an example of how to configure a basic frequency control application. Assume the rest of parameters are in default values.

ACH580 Drive parameter	Settings	Description
50.01 FBA A enable	1 = Enable	Enables communication between the drive and fieldbus adapter A, and specifies the slot the adapter is installed into.
51.01 FBA A type	47808 = BACnet ¹⁾	Shows the fieldbus adapter type as detected by the drive.
51.03 Commrate	0 = Auto ²⁾	BACnet communication rate is negotiated automatically by the device.
51.04 IP configuration	1 = Static IP	Configuration is obtained through parameter 51.05...51.13.
51.05 IP address 1	192 ²⁾	First part of the IP address
51.06 IP address 2	168 ²⁾	Second part of the IP address
51.07 IP address 3	0 ²⁾	Third part of the IP address
51.08 IP address 4	16 ²⁾	Last part of the IP address
51.09 Subnet CIDR	24 ²⁾	Sets the network mask as 255.255.255.0, allowing access only to the last subnet.
51.14 Device obj ID lo	51 ²⁾	Configures device object ID.
51.20 Comm loss time	300 ²⁾	Sets the communication timeout as 30 seconds.



ACH580 Drive parameter	Settings	Description
51.21 Comm loss mode	1 = Any message ²⁾	The timeout feature monitors the updating of the Control word and Reference 1.
51.27 FBA A par refresh	1 = Configure	Validates the FBIP-21 configuration parameter settings.
20.01 Ext1 commands	12 = Fieldbus A	Selects the Fieldbus A interface as the source of start and stop commands for external control location 1.
28.11 Ext1 frequency ref1	4 = FB A ref1	Selects fieldbus reference 1 as the source for frequency reference 1.

¹⁾ Read-only or automatically detected/set

²⁾ Example





Communication protocol

Contents of this chapter

This chapter describes the BACnet/IP communication protocol for the adapter module.

BACnet/IP

BACnet/IP is a standard data communication protocol intended for supervision and control of building automation equipment.

The FBIP-21 adapter module supports the BACnet protocol version 1, revision 12 according to the ISO 16484-5:2014 standard.

BACnet/IP uses objects to abstract and represent information. An object is a collection of data elements called properties. The type of the object determines which properties are present. This information is accessed through standardized services, which can also be used to command BACnet devices.

The FBIP-21 adapter module acts as a server providing object data access for BACnet clients.

Prioritizing commands

Commandable objects consist of priority array property, which is used to store the command priority. If you do not define priority with a command (example, write service request), the priority defaults to the least important command.

If the client no longer needs to control an object, it can relinquish the control by writing the priority property value as NULL. For more details, see the BACnet ISO standard 16484-5:2014.

Note: Priority arrays are not stored over the power cycle.

BACnet interoperability building blocks

The following BACnet interoperability building blocks that is collection of one or more services, are supported by FBIP-21:

Building block (short name)	Description
DS-RP-B	Data Sharing – Read Property – B (Provider / Server)
DS-RPM-B	Data Sharing – Read Property Multiple – B (Provider / Server)
DS-WP-B	Data Sharing – Write Property – B (Provider / Server)
DS-WPM-B	Data Sharing – Write Property Multiple – B (Provider / Server)
DM-DDB-B	Device Management – Dynamic Device Binding – B (Provider / Server)
DM-DOB-B	Device Management – Dynamic Object Binding – B (Provider / Server)
DM-DCC-B	Device Management– Device Communication Control – B (Provider / Server), password is not required
DM-RD-B	Device Management– Reinitialize Device B (Provider/Server), password is not required

BACnet object list

The adapter module supports the BACnet objects listed below. The present value property of the object can be readable (R), writable (W) or commandable (C), i.e. writable with priority.

■ AI object

Object ID	Default object name	Description	Minimum/Maximum preset value	Unit	Present value access type
AI0	AI1-Monitor	Indicates the input level of analog input 1.	0,100	%	R
AI1	AI2-Monitor	Indicates the input level of analog input 2.	0,100	%	R

■ AO object

Object ID	Default object name	Description	Minimum/Maximum preset value	Unit	Present value access type
AO0	AO1-command	Controls analog output 1 (drive must be configured for BACnet control).	0,100	%	C
AO1	AO2-command	Controls analog output 2 (drive must be configured for BACnet control).	0,100	%	C

■ AV object

Object ID	Default object name	Description	Minimum/ Maximum present value (information, depends on the drive parameter)	Unit	Present value access type
AV0	Output-RPM	Motor speed	0, nominal speed	rpm	R
AV1	Output-Freq	Output frequency	-500, 500	Hz	R
AV2	DC-Voltage	DC bus voltage	0, 2000	V	R
AV3	Output-Voltage	AC output voltage	0, 2000	V	R
AV4	Output-Current	Output current of drive	0, nominal current	A	R
AV5	Output-Torque	Output torque of motor as a percentage of nominal torque	-1600, 1600	%	R
AV6	Output-Power	Output power in kW	nominal power (+/-)	kW	R
AV7	Operating-Temp-Range	Heatsink temperature	-40, 160	%	R
AV9	Kilowatt-Hour-Meter-NR	Cumulative energy usage of the drive. This value cannot be reset.	0, 65535999999	kWh	R
AV15	Motor-Temp-Degrees-C	Motor temperature	-10, 200	°C	R

Object ID	Default object name	Description	Minimum/ Maximum present value (information, depends on the drive parameter)	Unit	Present value access type
AV16	Input-Reference -1	Speed setpoint 1	-150, 150	%	C
AV17	Input-Reference -2	Speed setpoint 2	-150, 150	%	C
AV18	Active-Fault	Active fault	-	No unit	R
AV19	Previous-Fault-1	Previous fault-1	-	No unit	R
AV20	Previous-Fault-2	Previous fault-2	-	No unit	R
AV21	AO1-Monitor	Output level of Analog Output 1	0, 100	%	R
AV22	AO2-Monitor	Output level of Analog Output 2	0, 100	%	R
AV23	Accel-1-Seconds	For frequency reference chain	0, 1800	s	W
AV24	Decel-1-Seconds	For frequency reference chain	0, 1800	s	W
AV29	Min-Speed	Minimum speed	-500, 500	Hz	W
AV30	Max-Speed	Maximum speed	-500, 500	Hz	W
AV31	Output-Speed	Actual motor speed	-200, 200	%	R

Object ID	Default object name	Description	Minimum/ Maximum present value (information, depends on the drive parameter)	Unit	Present value access type
AV32	Output-Current-Range	Actual motor current	0, 200	%	R
AV33	Max-Current	Max motor current	0, nominal current	A	W
AV40	LOOP-Feedback-Monitor	Loop controller feedback	0, 100	%	R
AV41	LOOP-Setpoint-Monitor	Loop setpoint monitor	0, 100	%	R
AV42	LOOP-Setpoint	Loop setpoint	0, 100	%	C
AV43	LOOP-Feedback	Loop feedback	0, 100	%	W
AV44	LOOP-Output	Loop output	0, 100	%	R
AV45	LOOP-Gain	Loop gain	0.1, 100	No unit	W
AV46	LOOP-Integration-Time	Loop integration time	0, 3600	s	W
AV49	LOOP-Deviation-Monitor	Loop controller deviation	0, 100	%	
AV53	LOOP-1-Gain	Loop-1 gain	0.1, 100	No unit	W
AV54	LOOP-1-Integration-Time	Loop-1 integration time	0, 3600	s	W

Object ID	Default object name	Description	Minimum/ Maximum present value (information, depends on the drive parameter)	Unit	Present value access type
AV130	Kilowatt-Hour-This-Hour	Kilowatt hour this hour	0, 3.40282347e38	kWh	R
AV131	Kilowatt-Hour-Last-Hour	Kilowatt hour during last hour	0, 3.40282347e38	kWh	R
AV132	Kilowatt-Hour-This-Day	Kilowatt hour today	0, 3.40282347e38	kWh	R
AV133	Kilowatt-Hour-Last-Day	Kilowatt hour last day	0, 3.40282347e38	kWh	R

■ BI object

Object ID	Default object name	Description	Default active/ Inactive text	Present value access type
B10	RO1-Monitor	Status of Relay Output 1	ON / OFF	R
B11	RO2-Monitor	Status of Relay Output 2	ON / OFF	R
B12	RO3-Monitor	Status of Relay Output 3	ON / OFF	R
B13	RO4-Monitor	Status of Relay Output 4	ON / OFF	R
B14	RO5-Monitor	Status of Relay Output 5	ON / OFF	R
B15	DO1-Monitor	Status of Digital Output 1	ON / OFF	R
B16	DI1-Monitor	Status of Digital Input 1	ON / OFF	R
B17	DI2-Monitor	Status of Digital Input 2	ON / OFF	R
B18	DI3-Monitor	Status of Digital Input 3	ON / OFF	R
B19	DI4-Monitor	Status of Digital Input 4	ON / OFF	R
B110	DI5-Monitor	Status of Digital Input 5	ON / OFF	R
B111	DI6-Monitor	Status of Digital Input 6	ON / OFF	R

■ BO object

Object ID	Default object name	Description	Default active/ Inactive text	Present value access type
BO0	RO1-Command	Output state of Relay 1	ON / OFF	C
BO1	RO2-Command	Output state of Relay 2	ON / OFF	C
BO2	RO3-Command	Output state of Relay 3	ON / OFF	C
BO3	RO4-Command	Output state of Relay 4	ON / OFF	C
BO4	RO5-Command	Output state of Relay 5	ON / OFF	C
BO5	DO1-Command	Output state of Digital Output 1	ON / OFF	C

■ BV object

Object ID	Default object name	Description	Default active/ Inactive text	Present value access type
BV0	RUN-STOP-Monitor	Run status of drive	RUN / STOP	R
BV1	Direction-Monitor	Rotational direction of the motor	REVERSE / FORWARD	R
BV2	OK-FAULT-Monitor	Actual fault status of drive	FAULT / OK	R
BV3	EXT1-EXT2-Monitor	Actual control source	EXT2 / EXT1	R
BV4	HAND-AUTO-Monitor	Actual operating mode	HAND / AUTO	R
BV5	Warning-Monitor	Actual warning status	WARNING / OK	R
BV7	Ready-Monitor	Actual ready status	READY / NOT-READY	R

Object ID	Default object name	Description	Default active/Inactive text	Present value access type
BV8	At-Setpoint-Monitor	Actual at setpoint status	YES / NO	R
BV9	Enabled-Monitor	Actual run enabled status	ENABLE / DISABLE	R
BV10	RUN-STOP-Command	Command to start drive	RUN / STOP	C
BV11	Direction-Command	Command to rotational direction	REVERSE / FORWARD	C
BV12	Run-Permissive-Command	Command to Run Permissive command	ENABLE / DISABLE	C
BV13	EXT1-EXT2-Command	Command to External 1 or External 2	EXT2 / EXT1	C
BV14	Fault-Reset-Command	Command to fault reset	RESET / NO	W
BV18	Control-Override-Command	<p>Command the drive into BACnet Control Override. In this mode BACnet acquires drive control from its normal source.</p> <p>Note: The HAND mode of the panel has priority over BACnet Control Override.</p>	ON / OFF	C
BV19	Control-Override-Monitor	<p>Indicates if drive is placed in BACnet Control Override by commanding BV18. In this mode BACnet acquires drive control from its normal source. Note that HAND mode of the panel has priority over BACnet Control Override.</p>	ON / OFF	R

Object ID	Default object name	Description	Default active/Inactive text	Present value access type
BV20	Start-Interlock-1-Command	Command to start interlock 1	ENABLE / DISABLE	C
BV21	Start-Interlock-2-Command	Command to start interlock 2	ENABLE / DISABLE	C
BV24	Started-Monitor	Actual start status	STARTED / NOT-STARTED	R
BV26	Underload-Monitor	Underload status	UNDERLOAD / OK	R
BV27	Overload-Monitor	Overload status	OVERLOAD / OK	R
BV30	User0-Monitor	User 0 status	ON / OFF	R
BV31	User1-Monitor	User 1 status	ON / OFF	R
BV32	User2-Monitor	User 2 status	ON / OFF	R
BV33	User3-Monitor	User 3 status	ON / OFF	R
BV34	User0-Command	User 0 command	ON / OFF	C
BV35	User1-Command	User 1 command	ON / OFF	C
BV36	User2-Command	User 2 command	ON / OFF	C
BV37	User3-Command	User 3 command	ON / OFF	C
BV39	Parameter-Save-Command	Parameter save command	SAVE / NO	W



Diagnostics

Contents of this chapter

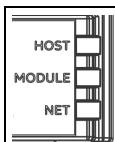
This chapter explains how to trace faults with the status LEDs on the adapter module when the module is used for BACnet communication.

Fault and warning messages

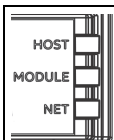
For the fault and warning messages concerning the adapter module, see the drive firmware manual.

LEDs

The adapter module is equipped with three bicolor diagnostic LEDs. The LEDs are described below.



Name	Color	Function
HOST	Blinking green	Establishing communication to host
	Green	Connection to host OK
	Blinking red	Communication to host lost temporarily
	Flashing orange, alternating with the MODULE flashing orange	Internal file system error. The error may be cleared by cycling drive power. If the error persists, contact your local ABB representative.
MODULE	Off	There is no power applied to the device.
	Flashing orange	Device is attempting to obtain IP configuration from the DHCP server.
	Orange	Device is executing Duplicate Address Detection.
	Flashing green	Device is waiting for a BACnet request.
	Green	Device has received a BACnet request within the timeout period.
	Flashing red	Ethernet link is down.



Name	Color	Function
	Red	<ul style="list-style-type: none"> • Ethernet interface is disabled. • Duplicate Address Detection may have detected a duplicate address. Check the IP configuration and either initiate a Fieldbus Adapter parameter refresh or cycle power to the drive. or <ul style="list-style-type: none"> • Drive is not supported by FBIP-21.
	Flashing orange, alternating with the HOST flashing orange	Internal file system error. The error may be cleared by cycling drive power. If the error persists, contact your local ABB representative.
	Flashing red/green	Device is in boot mode, ready for firmware update (HOST led is Off).
NET	Off	BACnet link is down.
	Flashing green	BACnet link is up at 100 Mbps. Flashing indicates activity on interface.
	Flashing orange	BACnet link is up at 10 Mbps. Flashing indicates activity on interface.

9

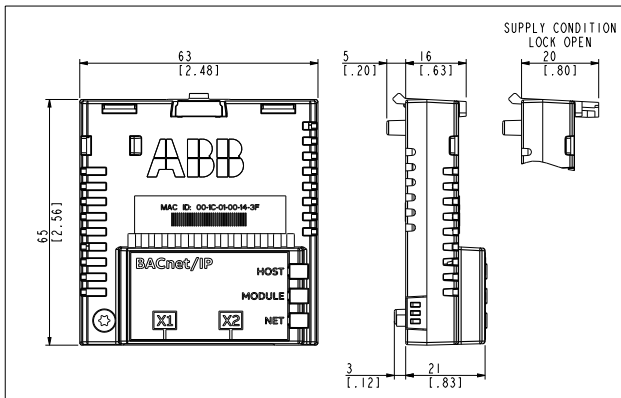
Technical data

Contents of this chapter

This chapter contains the technical specifications of the adapter module and the BACnet link.

Layout diagram

The figure below shows the enclosure of the FBIP-21 BACnet/IP adapter module from the front and side.



General conditions

Installation	Into an option slot on the drive control unit
Degree of protection	IP20
Ambient conditions	The ambient conditions specified for the drive in its manuals are applicable.
Package	Cardboard. Plastic wrapping: Antistatic air bubble sheet (PE).
Indicators	Three bicolor LEDs (HOST, MODULE, NETWORK/NET)
Connectors	A 20-pin connector to the drive RJ-45 connector to Ethernet (X1) RJ-45 connector for chaining another adapter module (X2)
Power supply	+3.3 V \pm 5% max. 400 mA (supplied by the drive)
Compliance	Complies with EMC standard EN 61800-3:2004 Printed circuit board conformal coated

BACnet link

Compatible devices	Ethernet Standard IEEE 802.3 and IEEE 802.3u devices
Medium	10BASE-TX or 100Base-TX with Auto-negotiation and Auto-MDIX (Auto-crossover) <ul style="list-style-type: none"> • Wiring: CAT5/6 UTP, CAT5/6 FTP, CAT5/6 STP • Connector: RJ-45 • Termination: Internal • Maximum segment length: 100 m / 328 ft
Topology	Bus or star. Max. 50 nodes allowed for FBIP-21 in a daisy chain topology.
Transfer rate	10 Mbps or 100 Mbps
Serial communication type	Half or full duplex
Protocol	BACnet/IP

TCP and UDP service ports

There are multiple in-bound and out-bound network services running on the FBIP-21.

Port	Service	Purpose
68 (UDP)	DHCP	DHCP client. Note: Used only when IP configuration method is selected as Dyn IP HFCP.
47808 (UDP)	BACnet	BACnet IP protocol.

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Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

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