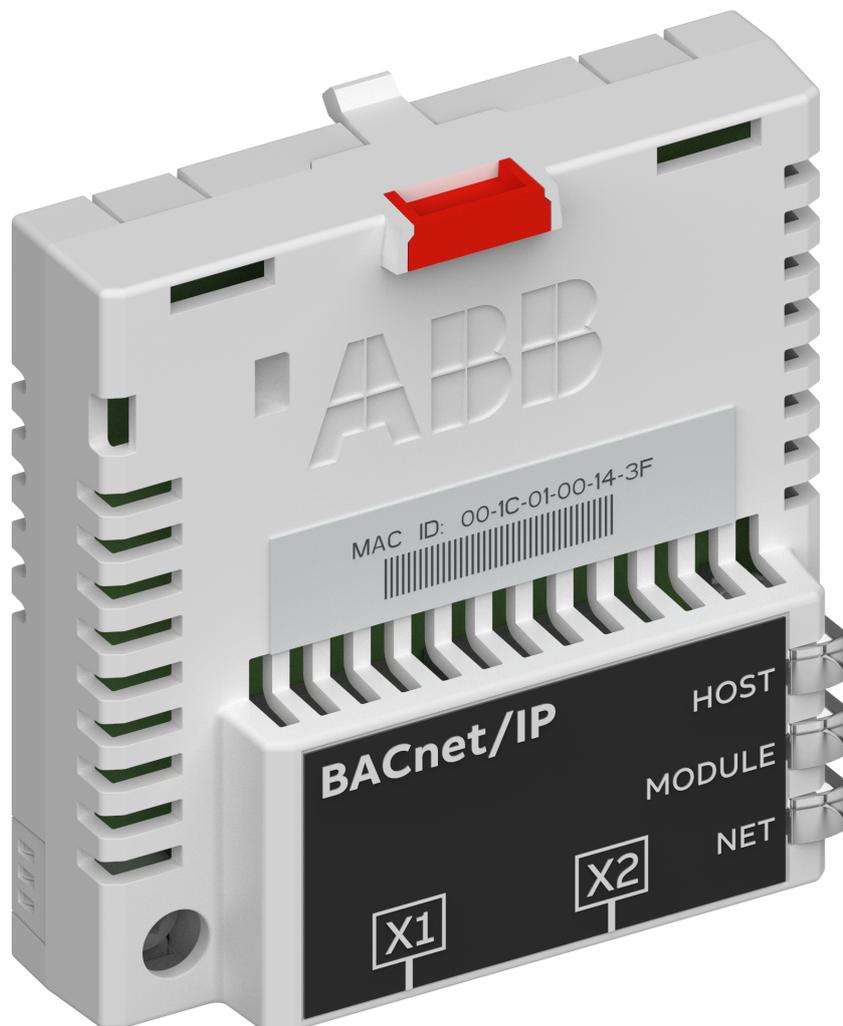OPTIONS FOR ABB DRIVES, CONVERTERS AND INVERTERS

FBIP-21 BACnet/IP adapter module
User's manual

FBIP-21 BACnet/IP adapter module

User's manual

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Further information

1

Safety instructions

Contents of this chapter

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

Use of warnings and notes

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. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

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

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

WARNING!
Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.

Safety in installation and maintenance

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning 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. Lock out and tag out.

- 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 voltage tester to make sure that there are no parts under voltage in reach. The impedance of the voltage tester must be at least 1 Mohm.

2

Introduction to the manual

Contents of this chapter

This chapter introduces this manual.

Applicability

This manual applies to the FBIP-21 BACnet/IP adapter module, SW version 2.0 and later.

Compatibility

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

Drives	ACH480, ACH580, ACH580 E-Clipse bypass
Protocols	• Ethernet standards IEEE 802.3 and IEEE 802.3u • All BACnet/IP clients that support protocol version 1, revision 14.

Target audience

This manual is intended for people who plan the installation, install, start up, use and service the module. Before you do work on the module, read this manual and the applicable drive manual that contains the hardware and safety information for the product in question. You are expected to know the fundamentals of electricity, wiring, electrical components, and electrical schematic symbols.

Purpose of the manual

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

Cybersecurity disclaimer

This product can be connected to and communicate information and data via a network interface. The HTTP protocol, which is used between the commissioning tool (Drive Composer) and the product, is an unsecured protocol. For independent and continuous operation of product such connection via network to commissioning tool is not necessary. However 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, prevention of physical access, 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.

Notwithstanding any other provision to the contrary and regardless of whether the contract is terminated or not, ABB and its affiliates are under no circumstances 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	Description
BACnet™	A network protocol (Building Automation and Control Networks)
BBDM	BACnet/IP broadcast management device
DIO	Digital input/output
Drive	Frequency converter for controlling AC motors
EMC	Electromagnetic compatibility
FBA	Fieldbus adapter
FBIP-21	BACnet/IP adapter module
Fieldbus adapter module	Device through which the drive is connected to an external communication network, that is, a fieldbus
Frame, frame size	Physical size of the drive or power module
FTP	File Transfer Protocol
MAC address	Media Access Control address
RCD	Residual current device
RO	Relay output
STO	Safe torque off (IEC/EN 61800-5-2)

Related manuals

Manual	Code
Drive hardware manuals and guides	
ACH480 HVAC control program firmware manual	3AXD50000247134
ACH580 HVAC control program firmware manual	3AXD50000027537
ACH480-04 manuals	9AKK107046A8101
ACQ580-01 manuals	9AKK106713A2709
ACH580-04 manuals	9AKK106930A9059
ACH580-07 manuals	9AKK106930A5241
Option manuals and guides	
FBIP-21 BACnet/IP adapter module user's manual	3AXD50000028468

The links above contain lists of documents.

You can find manuals on the Internet. See below for the relevant code/link. For more documentation, go to www.abb.com/drives/documents.

FBIP-21 manual

Fieldbus connectivity web page

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.

You can download the most recent version of the BACnet Protocol Implementation Conformance Statement (PICS) (3AXD10001248758 [English]) for the FBIP-21 from https://www.bacnetinternational.net/btl/.

■ BACnet supported network type with FBIP-21

The drive can be used with the following BACnet/IP network types:

BACnet/IP - This network 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.

Star topology
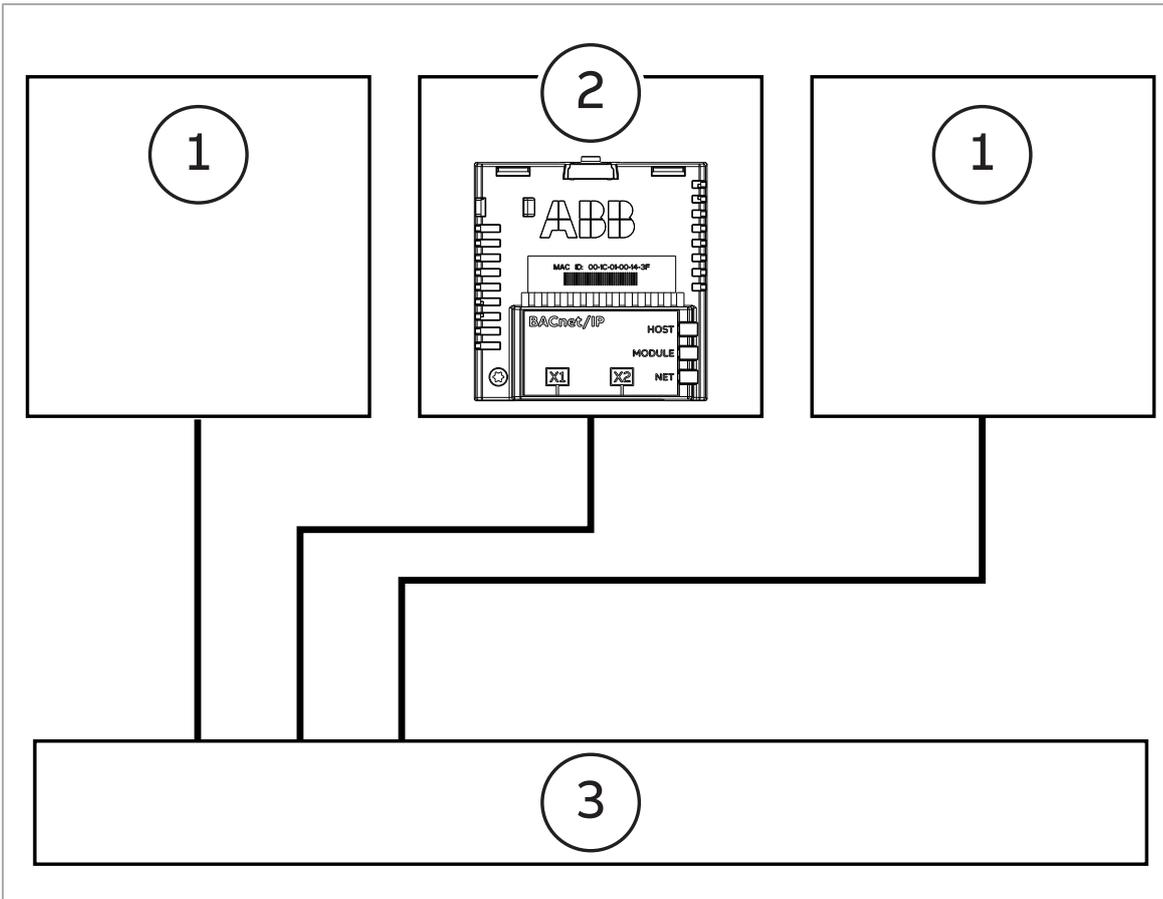
1	Other device
2	ABB drive
3	Switch or router

Daisy chain topology
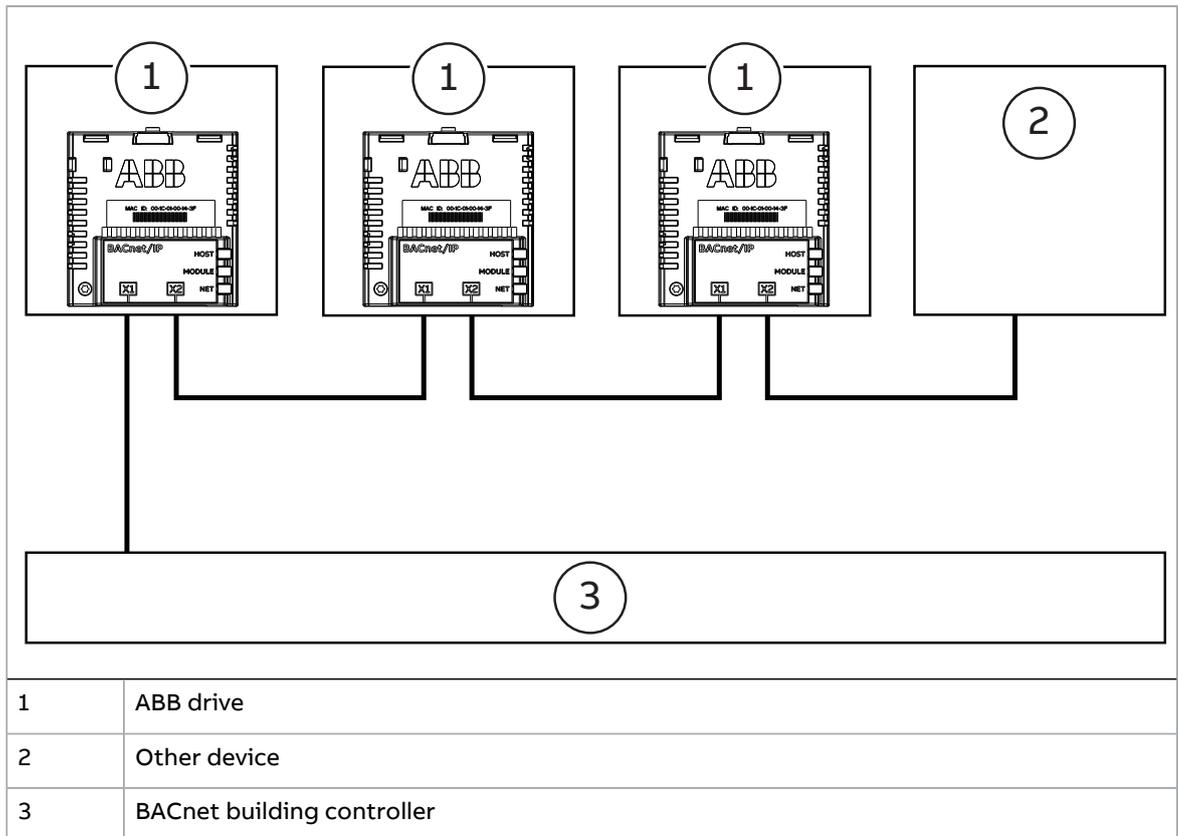
1	ABB drive
2	Other device
3	BACnet building controller

Note: If a device in the daisy chain is powered off or fails, the rest of the chain is disconnected from the network. If the drive power supply is not on and you want to keep the control unit energized, you must supply an external 24 V to the control unit. For ACH480 you need a BAPO-01 option module and for ACH580 a CMOD-01 or CMOD-02 option module. For more information, refer to the drive hardware manual.

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 ACH480 or 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
- connect to Drive Composer pro tool.

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
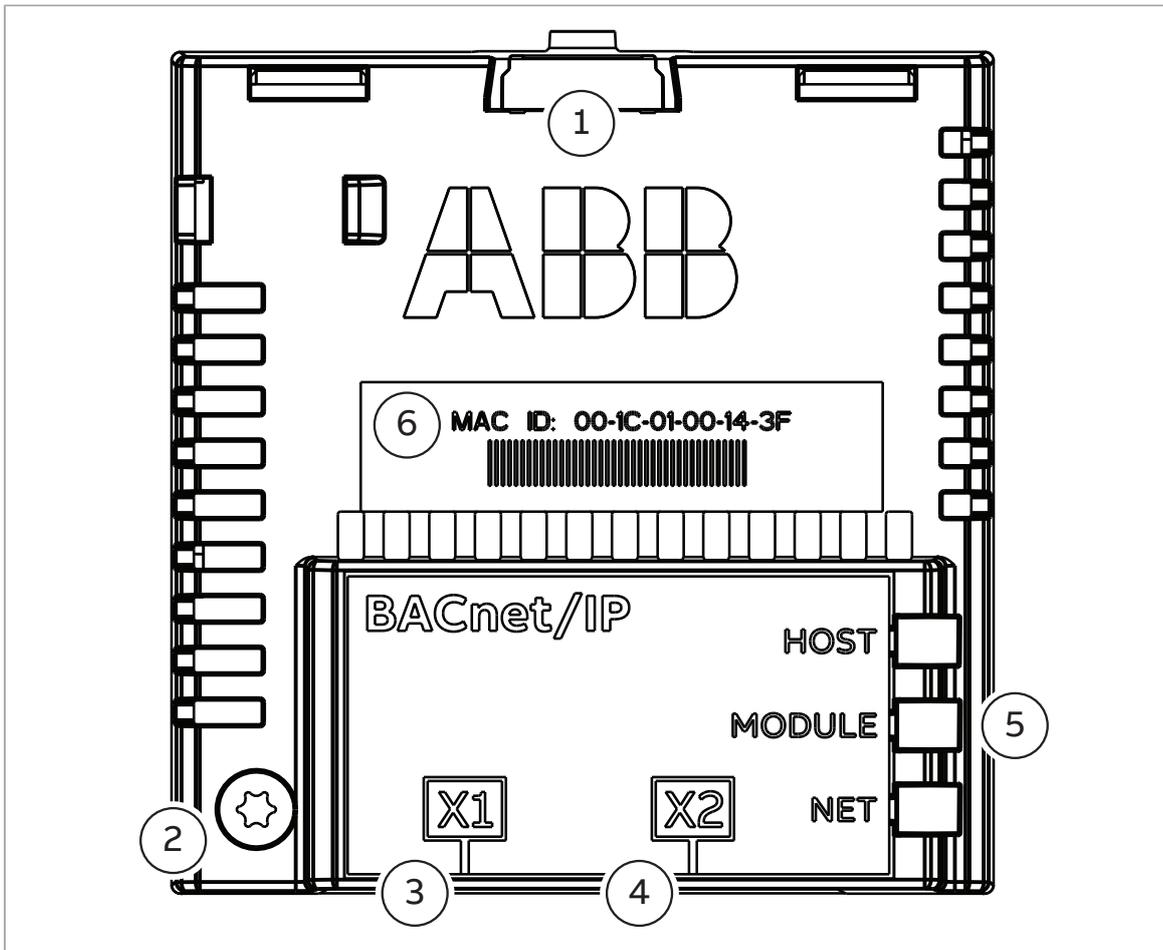
1	Lock
2	Mounting and grounding screw
3	X1 connector to Ethernet (RJ-45)
4	X2 connector for chaining another module (RJ-45)
5	Diagnostic LEDs
6	MAC address

4

Mechanical installation

Contents of this chapter

This chapter contains a delivery checklist and instructions on installing the module.

Necessary tools and instructions

You will need a Torx TX10 screwdriver to secure the FBIP-21 BACnet adapter module to the drive. See also the 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
    *   quick guide.

3. Make sure that there are no signs of damage.

Before you start

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

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

Installing option modules

> ⚠️⚠️ **WARNING!**
> Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

Pay attention to the free space required by the cabling or terminals coming to the option modules.

1. Repeat the steps described in the electrical safety precautions of the drive.

2. Pull out the lock (a).

3. Install the module to a free option module slot on the control unit.

4. Push in the lock (a).

5. Tighten the grounding screw (b) to a torque of 0.8 N·m (7 lbf·in).

   Note: The screw tightens the connections and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.

> ⚠️ **WARNING!**
> Do not use excessive force, or leave the screw too loose. Over-tightening can damage the screw or module. A loose screw can cause an operation failure.
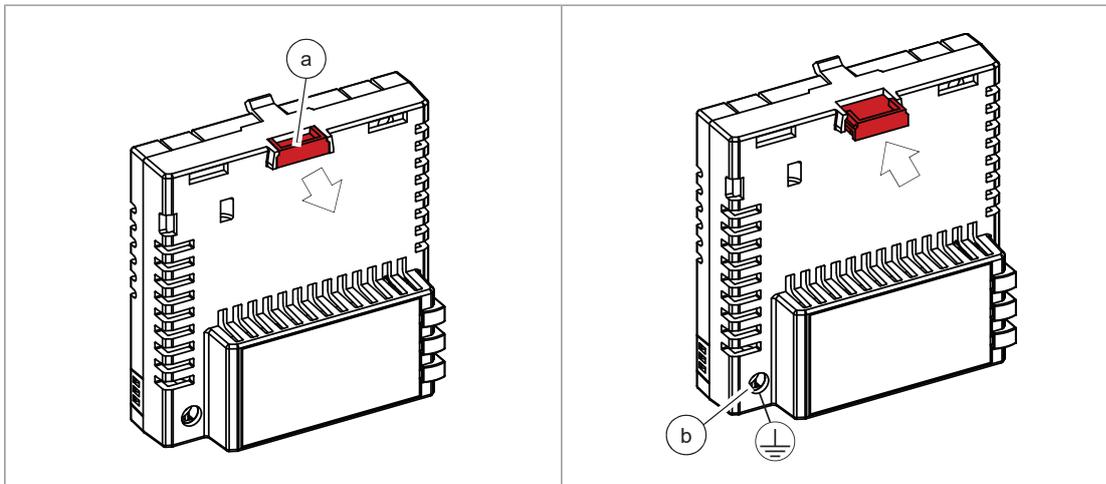
6. Connect the wiring to the module. Obey the instructions given in this manual.

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Electrical installation

Contents of this chapter

This chapter contains general cabling instructions and instructions on connecting the FBIP-21 adapter module to the BACnet/IP network.

Necessary tools and instructions

See the drive hardware manual.

General cabling instructions

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

Connecting the FBIP-21 to the BACnet/IP network

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

Choose correct cable for your application, CAT5e and CAT6 cables are recommended. ABB recommends to use double shielded twisted pair cables, eg. "SF/FTP".

◼ Connection procedure

1. Make a hole to a grommet at the drive cable entry, and pull the cable through the grommet inside the drive enclosure.

2. Connect the network cable to the RJ-45 connector (X1) on the adapter module.

3. 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 Daisy chain topology (page 17).

4. Mechanically attach the cables on the outside of the drive for strain relief.

Note: If a device in the daisy chain is powered off or fails, the rest of the chain is disconnected from the network. If the drive power supply is not on and you want to keep the control unit energized, you must supply an external 24 V to the control unit. For ACH480 you need a BAPO-01 option module and for ACH580 a CMOD-01 or CMOD-02 option module. For more information, refer to the drive hardware manual.

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

After the adapter module has been mechanically and electrically installed according to the instructions in chapters Mechanical installation (page 19) and Electrical installation (page 21), 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 Starting up BACnet/IP communication for ACH480 and ACH580 drives (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 the 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.	
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 05…08 define the four octets of the IP address.	0
	0…255	IP address	
…	…	…	…
08	IP address 4	See parameter 05 IP address 1.	0
	0…255	IP address	

No.	Name/Value	Description	Default
09	Subnet CIDR	Defines subnet masks for CIDR notation. 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. Subnet masks are typically represented in either dotted decimal notation or the more compact CIDR notation, as shown in the table below.	0

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		

No.	Name/Value	Description	Default
	1…31	Subnet mask in CIDR notation	
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	

No.	Name/Value	Description	Default
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.	
18	BACnet/IP port	Sets the UDP port used for the BACnet/IP communication. By default port 0xBAC0/47808 is used.	0xBAC0 (47808)
20	Timeout time	Sets the delay time for directing messages to the drive before a communication loss condition is declared. • 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.	

No.	Name/Value	Description			Default
22	Service configuration	Disable services that are not required. Each service is represented by a single bit. Bit 0, Lock configuration, can be used to prevent accidental changing of this parameter. By default, all services are enabled and configuration is unlocked. ABB recommends to disable all services that are not used after commissioning.			000000b
		Bit	**Name**	**Information**	
		0	Lock configuration	Changing this bit to one will lock service configuration and no bit can be changed. Only resetting the fieldbus configuration will unlock the parameter. To reset the fieldbus configuration, choose "Reset all fieldbus settings" or "Clear all" in parameter 96.06 Parameter restore.	
		1	Disable IP config tool	When this bit is set, access from ABB IP Configuration tool is prevented.	
		2	Disable ETH tool network	When this bit is set, access from Ethernet tool network (eg, ABB Drive Composer tool) is prevented.	
		3	Disable ping response	When this bit is set, response to ICMP (ping) message is prevented.	
		4	Unsecured ETH tool network	When this bit is set, access from Ethernet tool network is unsecured. **Note:** Drive Composer pro before V2.7 supports unsecured communication only.	
		5	Disable configuring web pages	When this bit is set, access to web pages is disabled.	
23 ... 26		Reserved			
27	FBA Par refresh	Validates any changed adapter module configuration parameter settings. After refreshing, the value reverts automatically to Done. This parameter cannot be changed while the drive is running.			**0** = Done
	0 = Done	Refreshing done			
	1 = Configure	Refreshing			
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

No.	Name/Value	Description	Default
	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.	
	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 **xxyy**, 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 **xxyy**, 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 ACH480/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.

Change only those parameter of the functions that you want to control through BACnet/IP.

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

■ Start/stop direction control

For Start/stop direction control through BACnet/IP, 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 ACH480/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 firmware 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 BACnet/IP 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 BACnet/IP 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 FBA A ref2 type	**0** = Speed or frequency **4** = Speed	References (1 or 2) type for scaling defined in parameter 46.02 Frequency scaling	AV16/AV17

■ **Miscellaneous drive control**

To use the BACnet/IP 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 field-bus	BV12
20.01 Ext1 commands/ 20.06 Ext2 commands	Fieldbus A	Fault reset by fieldbus	BV14
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 BACnet/IP:

- set the following drive parameters to select the source for the relay outputs
- set the drive for control through BACnet
- set the building 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 BACnet/IP, 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 firmware manual.

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 BACnet/IP, configure the following drive parameters and set the building 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 Feedback data storage	Storage parameter for process feedback value
AV42	40.92 Setpoint data storage	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 t out**.

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. • 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.
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 required 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 .

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
05.11 Inverter temperature	Estimated drive temperature in percent of fault limit	AV7
01.57 Inverter kWh counter (resettable)	Cumulative energy usage of the drive. This value can be reset.	AV8
01.20 Inverter kWh counter	Amount of energy that has passed through the drive (in either direction) in full kilowatthours. Whenever the counter rolls over, 01.19 Inverter MWh counter is incremented. The minimum value is zero.	AV9
40.97 Process PID feedback %	This object is the Process PID feedback signal.	AV10
40.99 Process PID deviation %	This object is the Process PID output signal's deviation from its setpoint.	AV11
-	External PID feedback percentage scaled	AV12
-	This object is the External PID output signal's deviation from its setpoint.	AV13
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

Drive parameter	Description	BACnet access point
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
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 diagnostics information, see the Diagnostics section in the drive firmware 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 BACnet/IP communication for ACH480 and ACH580 drives

Follow these steps to setup fieldbus communication in ACH480 or ACH580 drives. For example of appropriate values, see Parameter setting examples (page 36).

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. Configure the BACnet UPD port number with parameter **51.18 BACnet/IP Port** if necessary.

6. 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.

7. With parameter **96.07 Parameter save manually**, save the valid parameter values to permanent memory.

8. With parameter **51.27 FBA A par refresh**, validate the settings made in parameter group 51.

9. Set the relevant drive control parameters to control the drive according to the application.

■ Parameter setting examples

Frequency control

This table shows a parameter setting example for a frequency control application. The rest of parameters are in default values.

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.

Drive parameter	Settings	Description
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.
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

7

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 14 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-COV-B	Data Sharing – Change of Value
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
DM-TS-B	Device Management – Time Synchronization

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.

During the first boot, the FBIP-21 will build a BACnet object list based on the available functionalities in the connected drive. Note that the objects listed below are not available for all drives.

■ Analog input 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

■ Analog output 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

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

■ Analog value 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
AV8	Kilowatt-Hour-Meter-R	Cumulative energy usage of the drive. This value can be reset.	0, 1000	kWh	R
AV9	Kilowatt-Hour-Meter-NR	Cumulative energy usage of the drive. This value cannot be reset.	0, 999999	kWh	R
AV10	Process-PID-Feedback	This object is the Process PID feedback signal.	-100, 100	%	R
AV11	Process-PID-Deviation	This object is the Process PID output signal's deviation from its setpoint.	-100, 100	%	R
AV12	External-PID-Feedback	External PID feedback percentage scaled	-100, 100	%	R
AV13	External-PID-Deviation	This object is the External PID output signal's deviation from its setpoint.	-100, 100	%	R
AV14	Running-Hours	Drive's resettable run time (reset by writing 0).	0, 3.40282347e38	hours	R
AV15	Motor-Temp-Degrees-C	Motor temperature	-10, 200	°C	R
AV16	Input- Reference-1	Speed setpoint 1	-150, 150	%	C
AV17	Input- Reference-2	Speed setpoint 2	-150, 150	%	C

Object ID	Default object name	Description	Minimum/ Maximum present value (information, depends on the drive parameter)	Unit	Present value access type
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
AV25	Mbox-Param	Parameter number to be used by mailbox function.	-	No unit	W
AV26	Mbox-Data	Set (W) or indicate (R) of the data value of mailbox function	-	No unit	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
AV32	Output-Current-Range	Actual motor current	0, 200	%	R
AV33	Max-Current	Max motor current	0, nominal current	A	W
AV34	DC-Ripple	DC bus ripple voltage	0, 200	V	R
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

Object ID	Default object name	Description	Minimum/ Maximum present value (information, depends on the drive parameter)	Unit	Present value access type
AV54	LOOP-1-Integration-Time	Loop-1 integration time	0, 3600	s	W
AV55	LOOP-2-Feedback-Monitor	External loop controller feedback value after source selection, mathematical function and filtering (read-only)	0, 100	%	R
AV56	LOOP-2-Setpoint-Monitor	External loop controller setpoint value after source selection, mathematical function limitation and ramping (read-only)	0, 100	%	R
AV59	LOOP-2-Output	External loop controller output	0, 100	%	R
AV60	LOOP-2-Gain	External loop controller gain	0.1, 100	No unit	W
AV61	LOOP-2-Integration-Time	External loop controller integration time	0, 3600	s	W
AV64	LOOP-2-Deviation-Monitor	External loop controller deviation	0, 100	%	R
AV130	Kilowatt-Hour-This-Hour	Kilowatt hour this hour	0, 3.40282347e38	kWh	R
AV131	Kilowatt-Hour-Last-Hour	Kilowat 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

▪ Binary input object

Object ID	Default object name	Description	Default active/ Inactive text	Present value access type
BI0	RO1-Monitor	Status of Relay Output 1	ON / OFF	R
BI1	RO2-Monitor	Status of Relay Output 2	ON / OFF	R
BI2	RO3-Monitor	Status of Relay Output 3	ON / OFF	R
BI3	RO4-Monitor	Status of Relay Output 4	ON / OFF	R
BI4	RO5-Monitor	Status of Relay Output 5	ON / OFF	R
BI5	DO1-Monitor	Status of Digital Output 1	ON / OFF	R
BI6	DI1-Monitor	Status of Digital Input 1	ON / OFF	R
BI7	DI2-Monitor	Status of Digital Input 2	ON / OFF	R
BI8	DI3-Monitor	Status of Digital Input 3	ON / OFF	R
BI9	DI4-Monitor	Status of Digital Input 4	ON / OFF	R
BI10	DI5-Monitor	Status of Digital Input 5	ON / OFF	R
BI11	DI6-Monitor	Status of Digital Input 6	ON / OFF	R

▪ Binary output 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

■ **Binary value 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
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
BV17	Lock-Parameters	Actual status of parameter lock.	LOCK / UNLOCK	R
BV18	Control- Override-Command	Command the drive into BACnet Control Override. In this mode BACnet acquires drive control from its normal source. **Note:** The HAND mode of the panel has priority over BACnet Control Override.	ON / OFF	C

Object ID	Default object name	Description	Default active/ Inactive text	Present value access type
BV19	Control- Override- Monitor	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.	ON / OFF	R
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
BV25	Safe-Torque-Off-Monitor	Actual status of Safe Torque Off	Active / OK	R
BV26	Underload-Monitor	Underload status	UNDERLOAD / OK	R
BV27	Overload-Monitor	Overload status	OVERLOAD / OK	R
BV28	Motor-Heating-Command	Command to motor heating mode	ON / OFF	W
BV29	Motor-Heating-Monitor	Actual status of motor heating mode	ON / OFF	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
BV40	PID-Set-Select	Command to Process PID set1 or Process PID set2 selection	Set1 / Set2	W

■ **Multistate Value Object**

Object ID	Object Name	Description	State Text	Present Value Access Type
MSV0	HAND-AUTO-Reference	Indicates whether the drive is under Hand or Auto control, or if override mode is active.	Off, Hand, Auto, Override	R
MSV1	Active-Fault-1	Enumerated type of the most recent fault currently active	None, Comm-Error, Overcurrent, Overtemperature, Overspeed, Overvoltage, Undervoltage, Short-Circuit, Ground-Fault, Motor-Overload, Inverter-Overload, Motor-Underload, External-Fault, Operator-Interface-Error, Config-Error, Feedback-Failure, Output-Phase-Loss Motor-Stall, Power-Unit-Error, Input-Phase-Fault, Internal-Failure, STO-Active, Other	R
MSV2	Active-Fault-2	Enumerated type of the 2nd most recent fault currently active	None, Comm-Error, Overcurrent, Overtemperature, Overspeed, Overvoltage, Undervoltage, Short-Circuit, Ground-Fault, Motor-Overload, Inverter-Overload, Motor-Underload, External-Fault, Operator- Interface-Error, Config-Error, Feedback-Failure, Output-Phase-Loss Motor-Stall, Power-Unit-Error, Input-Phase-Fault, Internal-Failure, STO-Active, Other	R
MSV3	Active-Fault-3	Enumerated type of the 3rd most recent fault currently active	None, Comm-Error, Overcurrent, Overtemperature, Overspeed, Overvoltage, Undervoltage, Short-Circuit, Ground-Fault, Motor-Overload, Inverter-Overload, Motor-Underload, External-Fault, Operator- Interface-Error, Config-Error, Feedback-Failure, Output-Phase-Loss Motor-Stall, Power-Unit-Error, Input-Phase-Fault, Internal-Failure, STO-Active, Other	R

Object ID	Object Name	Description	State Text	Present Value Access Type
MSV4	Active-Warning-1	Enumerated type of the most recent warning currently active	None, Comm-Error, Current-Limit, Overtemperature, Start-Interlock-1, Start-Interlock-2, Start-Interlock-3, Start-Interlock-4, Run-Permissive, Internal-Warning, Start-Delay, Other	R
MSV5	Active-Warning-2	Enumerated type of the 2nd most recent warning currently active	None, Comm-Error, Current-Limit, Overtemperature, Start-Interlock-1, Start-Interlock-2, Start-Interlock-3, Start-Interlock-4, Run-Permissive, Internal-Warning, Start-Delay, Other	R
MSV6	Active-Warning-3	Enumerated type of the 3rd most recent warning currently active	None, Comm-Error, Current-Limit, Overtemperature, Start-Interlock-1, Start-Interlock-2, Start-Interlock-3, Start-Interlock-4, Run-Permissive, Internal-Warning, Start-Delay, Other	R

▪ Loop Object

Object ID	Object Name	Description	Manipulated Variable reference	Controlled variable reference	Setpoint Reference	Present Value Access Type
LOOP0	LOOP-Set1	Loop object for process PID set 1	AV44 Present Value	AV43 Present Value	AV42 Present Value	R
LOOP1	LOOP-Set2	Loop object for process PID set 2	AV44 Present Value	AV43 Present Value	AV42 Present Value	R

Mailbox function

The drive provides a Mailbox function to access parameters that have not been pre-defined by the protocol. Using mailbox, any drive parameter can be identified and read. Mailbox can also be used to adjust parameter settings by writing a value to any parameter identified. The following table shows the mailbox objects.

Object ID	Default object name	Description	Present value access type
AV25	Mbox-Param	Parameter number to be used by mailbox function.	W
AV26	Mbox-Data	Set (W) or indicate (R) of the data value of mailbox function.	W

To use the Mailbox function, write the parameter address to the Mbox-Param object as a floating point value. The three lowest digits in the integer part are used for the parameter index within the parameter group.

Example: For parameter 47.01, write the address as 47001.00 to the Mbox-Param object. For parameter 47.999, write the address as 47999.00 to the Mbox-Param object.

Read or write the value to the Mbox-Data object as a floating point value. If the parameter is a decimal type parameter, its value is shown as a decimal number. The value of an integer type parameter is shown as an integer number.

Example: If parameter 47.01 has value 12.554 it is shown just as it is. If parameter 47.21 has value 125, it is shown just like that, without a decimal part.

8

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.
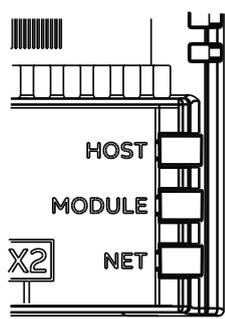
Fault and warning messages

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.
	Red	• 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 • 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).
NETWORK / 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.

Dimension drawing
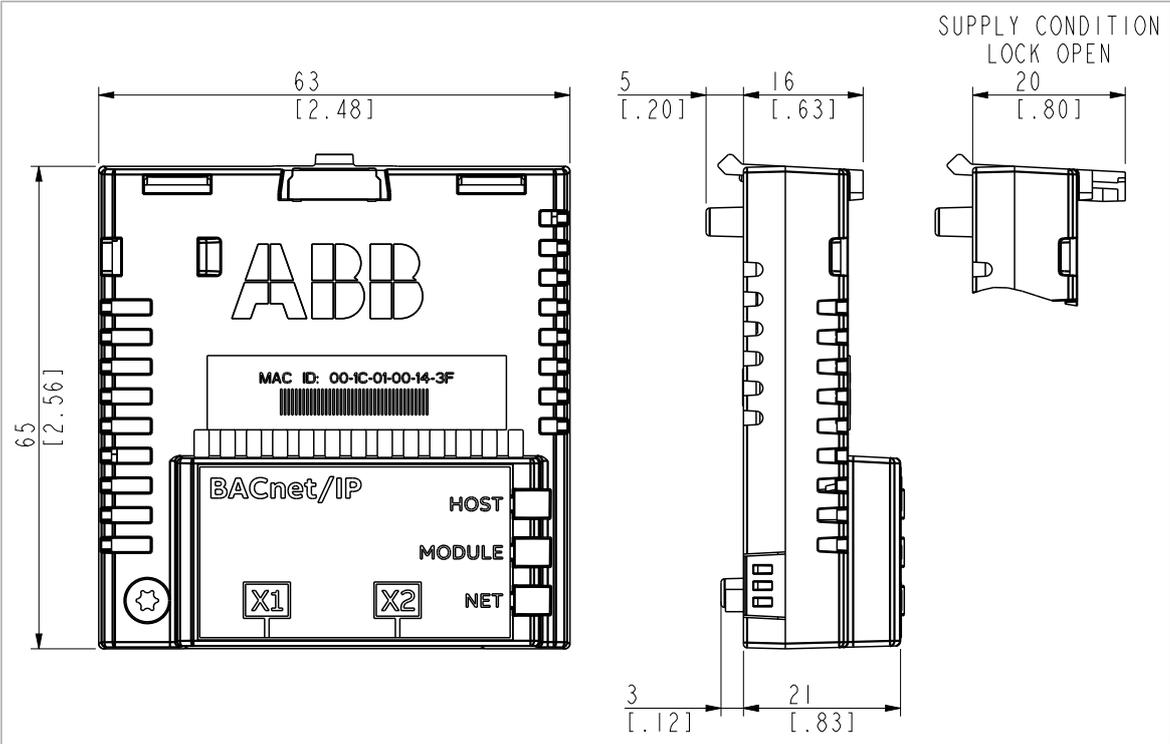
General conditions

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 ±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 Autonegotiation and Auto-MDIX (Auto-crossover) • 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 module. Some ports are protocol-specific and are not used when other protocols are selected.

Port	Service	Purpose
80 (TCP)	HTTP	Used for Ethernet tool communication. To disable, go to Service configuration page (page 68) via web interface.
68 (UDP)	DHCP	DHCP client **Note:** Used only when IP configuration method is selected as "Dyn IP DHCP".

Port	Service	Purpose
24576 (UDP)	ABB Netconfig	• Auto discovery protocol • Used by ControlBuilder plus (IP Configuration tool) and Drive composer pro and DriveWindow 2.40 PC tools • Discovers ABB-specific Ethernet devices in a local network segment, by listening to and responding to UDP broadcasts. To disable, go to **Service Configuration parameter 51.22** or to Service configuration web page.
123 (UDP)	SNTP	Simple Network Time Protocol. This service is disabled by default. To enable the service, go to Service configuration page (page 68) via web interface.
443 (TCP)	HTTPS	HTTPS protocol, used for access to FBIP-21's web page and for Ethernet tool Network (like Drive Composer pro).
47808 (UDP)	BACnet	BACnet IP protocol.

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Appendix A - ABB IP configuration tool

Contents of this chapter

This chapter shows how to use the ABB IP configuration tool to:

- find configured and unconfigured **FBIP-21** adapter modules in the network
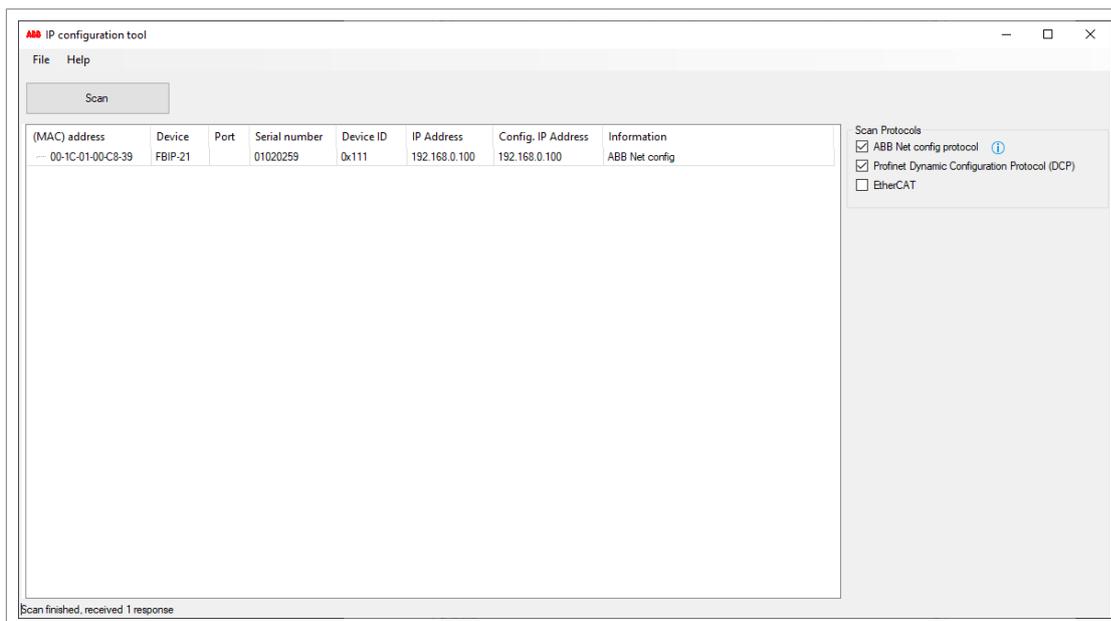- rewrite the IP configuration of the adapter modules.

Installation

The ABB IP configuration tool is part of the ABB Automation Builder software. No separate installation is needed.

## Finding adapter modules in the network

1. Open the ABB IP configuration tool.
2. Click the **Scan** button.

   The FBIP-21 adapter modules present in the network appear on the results list.

Rewriting the IP configuration of adapter modules

1. Scan the network for adapter modules.
   For instructions, see section Finding adapter modules in the network (page 57).

2. On the results list, click to select the adapter module whose IP configuration you want to modify.
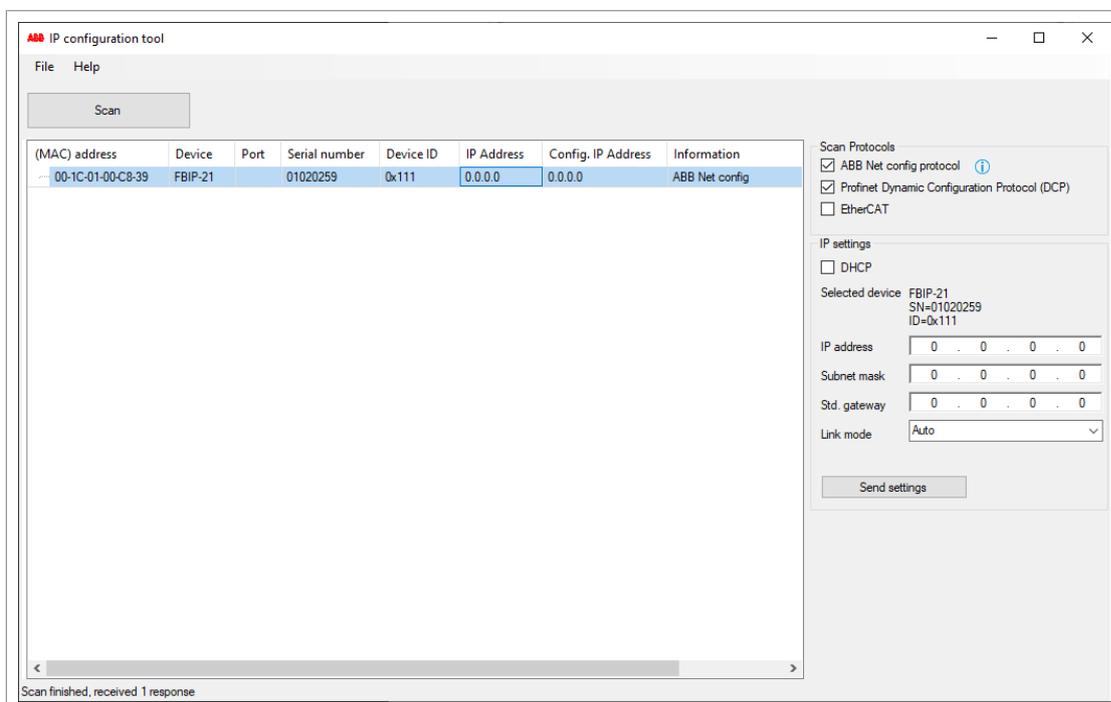
3. Below **IP settings**, define the IP configuration settings according to your network configuration.

4. To apply the new settings, click the **Send settings** button.

   The new current IP address and configured IP address appear on the results list.

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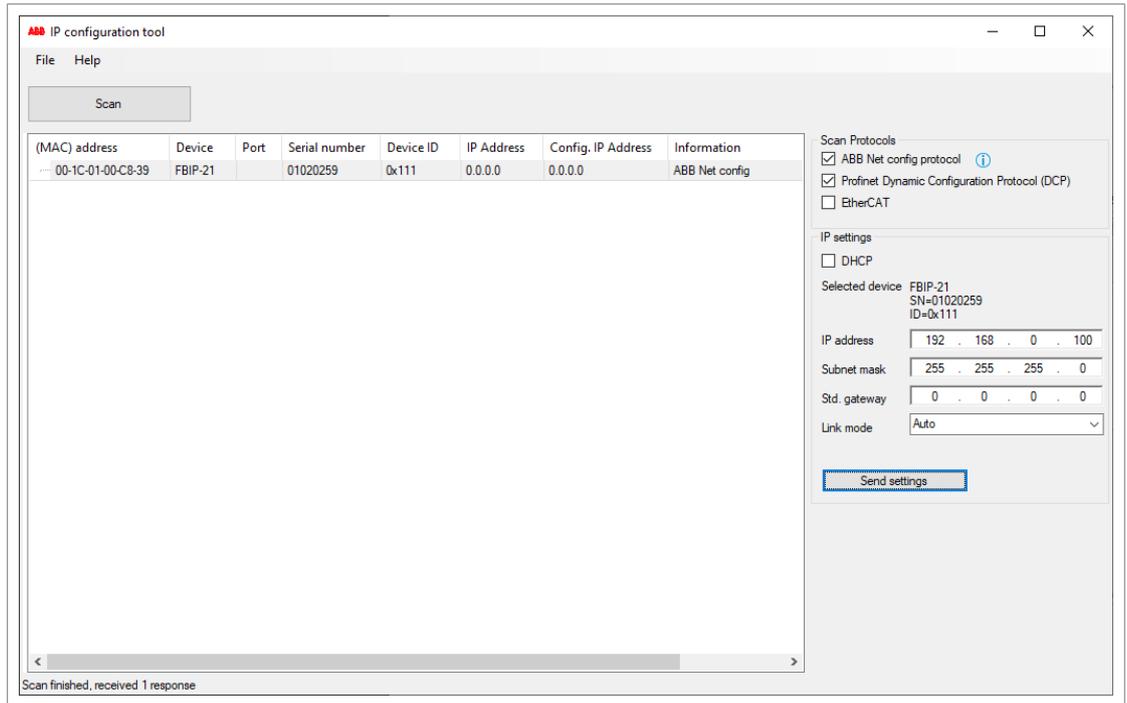
Appendix B - Module configuration backup

Contents of this chapter

This chapter presents the settings for FBIP-21 configuration backup.

Compatibility

FBIP-21 settings are stored in the drive parameters and also in the configuration files. FBIP-21 adapter module supports backup of all settings to the drive. These settings are now also included in any backups made of the drive using the Drive composer PC tool or the control panel.

Settings for backup

Consider the following points:

- Backup is not slot-specific. For example, backup of FBIP-21 in FBA A, slot 1 can be restored to FBIP-21 FBA A, slot 2.
- Backup depends on the fieldbus channel. For example, backup of FBIP-21 in FBA A is not restored to FBIP-21 in FBA B.
- FBIP-21 configuration parameters are included in the backup when drive parameters are saved.

■ Configuration backup for all protocols in FBIP-21

Backup includes the following configuration for BACnet/IP in FBIP-21:

Configuration	Description
Ethernet service configuration	Enables different Ethernet services. See Service configuration page (page 68). When set, backup will automatically include this configuration.
Web page password	Login password for accessing FBIP-21 configuration web pages. See Password page. Backup will automatically include the set password. **Note:** Backup will include the default password.
SNTP configuration	Enables SNTP, request interval, UTC offset, and server addresses. See Service configuration page (page 68). When set, backup will automatically include this configuration.

The settings are saved to the drive after 10 seconds. If a Refresh command is given to FBIP-21 using parameter 51.27, the pending backup is transferred to drive immediately and FBIP-21 is rebooted after the transfer is completed.

Note: The new setting is not saved to drive if the drive was powered off or the adapter was disconnected from the drive within 10 seconds of changing a setting.

▪ Using the restored backup

The use cases in the below table show how FBIP-21 settings are used after you restored a backup or after you powered up or enabled the module. The matching status box colours indicate matching configurations.

No.	Configuration status	
	Before restore	**After restore**
1	Restoring a backup to drive with Drive composer or panel. Drive with any configuration → FB adapter with any configuration ⇒ Drive with configuration from backup → FB with configuration from backup	
	Drive and fieldbus adapter can have any configuration.	Configuration from backup is used in drive and in FBIP-21
2	Replacing a new fieldbus adapter of the same type. Drive with backup → FB adapter with no configuration ⇒ Drive with backup → FB with configuration from drive backup	
	Drive has a backup of FBIP-21 configuration and a new FBIP-21 with no configuration is installed.	Drive backup is used in FBIP-21.

No.	Configuration status	
	Before restore	**After restore**
3	Replacing a fieldbus adapter with another adapter of the same type. But the new adapter was used with some other drive previously.	
	Drive with backup → FB adapter with previous configuration ⇒ Drive with backup → FB with configuration from drive backup	
	Drive has a backup of FBIP-21 configuration and a new FBIP-21 with existing configuration is attached.	Drive backup is used in FBIP-21.
4	A new drive and fieldbus adapter are used.	
	Drive with no backup or backup of another FB adapter FB adapter with default configuration ⇒ Drive with new backup from FB ⇐ FB with default configuration	
	Drive has no backup or a backup of some other type of fieldbus adapter other than FBIP-21 exists. FBIP-21 with no configuration is attached.	FBIP-21 generates a new backup with its default settings and copies it to drive.
5	Replacing drive with a new drive and reusing the old Fieldbus adapter.	
	Drive with no backup or backup to another FB adapter Used FB adapter with previous configuration ⇒ Drive with new backup from FB ⇐ FB with previous configuration	
	Drive has no backup or a backup of some other type of fieldbus adapter other than FBIP-21 exists. FBIP-21 with an existing configuration is attached.	FBIP-21 copies its backup to drive.
6	Clearing fieldbus configuration from drive and module to defaults.	
	Drive with a backup FB from drive backup ⇒ Drive with no backup FB adapter default configuration	
	You can clear the fieldbus configuration from drive and module to defaults with parameter 96.06 Parameter restore using the selection Reset all fieldbus settings.	Clears the fieldbus parameters and backup files for FBA A and FBA B on the drive side. If a FBIP-21 module is connected, its configurations are reset to defaults.

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Appendix C - FBIP-21 configuration web pages

Contents of this chapter

This chapter presents the FBIP-21 configuration web pages.

Note: ABB recommends to disable the web pages after the commissioning to reduce cyber security risks. See the Service configuration page (page 68).

Browser requirements

Any web browser can be used.

Compatibility

The web pages support all drives compatible with the FBIP-21 adapter module.

For the compatibility table, see section Compatibility (page 11).

Logging in

1. Open a web browser and type the IP address of the adapter module in the address field. The IP address is visible in the FBIP-21 configuration parameters, group A, parameter 5...8.

   Example: https://192.168.0.100/
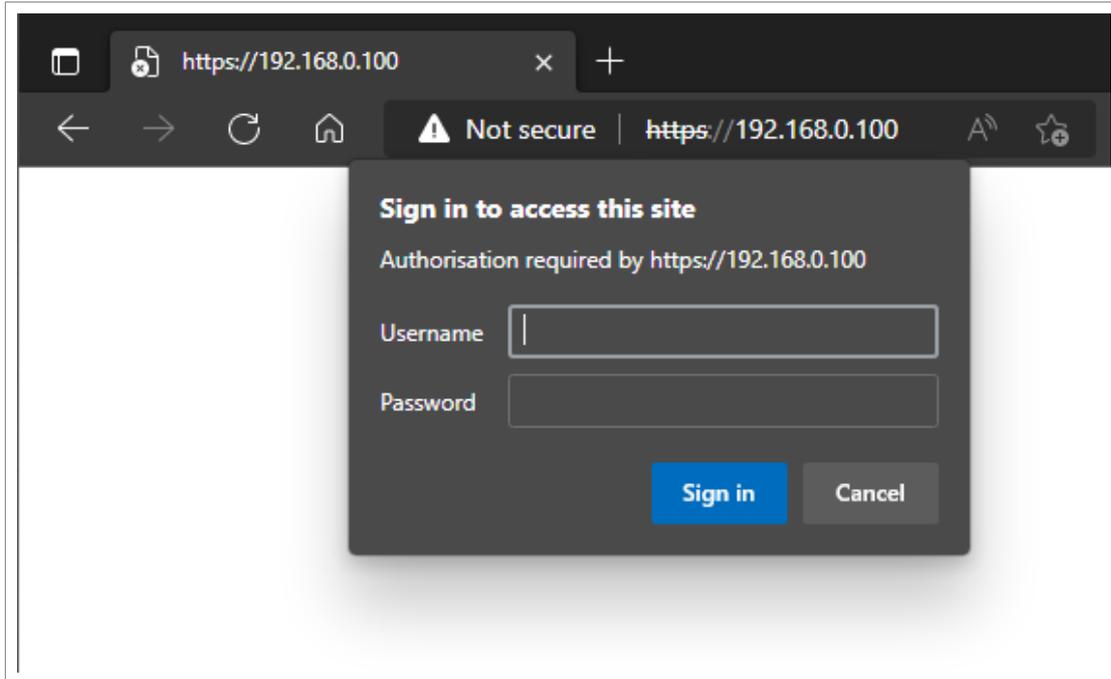
2. Log in with a user name and a password.
    Default user name: admin
    Password: The last six digits of the MAC address of the adapter module, in upper case, without hyphens.
    The MAC ID is visible on the cover of the adapter module and in the ABB IP configuration tool, see Appendix A - ABB IP configuration tool (page 57).

    Example: If the MAC address of the adapter module is 00-1C-01-00-2F-73, the password is 002F73.
    The browser opens the user interface.

3. After successful login, you will be prompted to change the password for security reasons. It is recommended to change the default password.
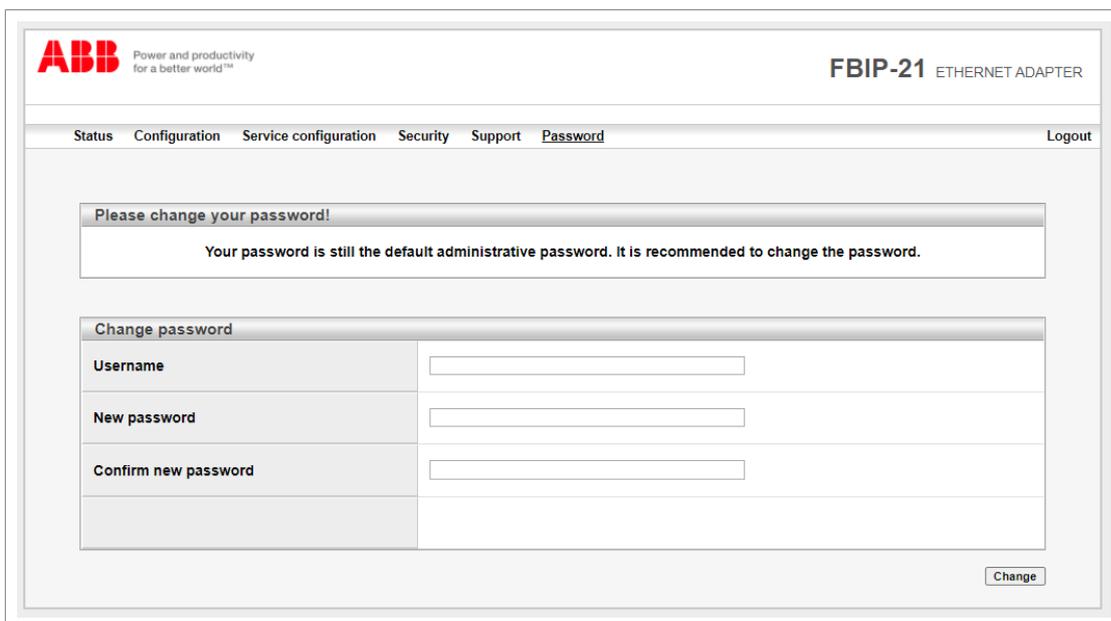
Menu overview

To navigate on the web pages, use the menu items available:

- Status
- Configuration
- Service configuration
- Security
- Support
- Password.

■ Status page

The Status page shows version information, as well as the serial number and MAC address (MAC ID) of the adapter module.

■ Configuration page

On the Configuration page, you can modify parameter settings in the configuration parameter group A.

After you have changed any setting in any of the groups, you must click Save and reboot at the bottom of Group A to validate the settings.

▪ Service configuration page

On the Service configuration page, you can enable or disable certain Ethernet services. All services except Simple Network Time Protocol (SNTP) are enabled by default. You can disable the following services on this page:

- access to FBIP-21 configuration web page
- allow to change IP settings remotely via ABB IP configuration tool
- remote access drive with Drive composer tool via Ethernet tool network
- Ping response
- configure SNTP

The new settings take effect after reboot of the module. You can click Save and reboot, to validate the new settings immediately or click Save without rebooting if you want to do other settings also and then reboot.

Note: These settings are available only through web pages. When you select to disable the web page, a warning appears to confirm before you can save the selection.

To enable the web page again, see Enable web page access after it was disabled (page 72).

ABB recommends to disable all services that are not used after commissioning.

Configuring SNTP

Simple Network Time Protocol (SNTP) can be used to synchronize drive time with a network time server. When SNTP is enabled, FBIP-21 will request the time from configured server at a given interval. To receive this time synchronization, you must set parameter 96.20 Time sync primary source to Fieldbus A. The table below shows the settings for SNTP:

Settings	Description	Value
SNTP update interval	Interval to request time from server.	Default: 30 seconds Minimum: 30 seconds
SNTP time offset to UTC	Time offset to the time received from SNTP. **Note:** SNTP time offset change does not need a reboot.	-1440...1440 minutes

Settings	Description	Value
SNTP server address 1	Primary server address for requesting time. Format: IP address followed by optional port number, eg: 192.168.0.1:123 **Note:** If port number is missing, the default NTP port number "123" is used.	-
SNTP server address 2	Secondary server address used if the request to server 1 fails.	-

■ Security page

On the Security page, you can upload a private key and certificates for FBIP-21 to use instead of the self-signed certificate that FBIP-21 uses as a default. You can upload and manage Drive Composer certificate files on Security page under "Drive Composer certificate settings". Up to four certificates are supported at a time.

FBIP-21 uses secure HTTPS (TLS 1.2) communication for the web page server. By default, FBIP-21 does not require client authentication for the PC tool communication. You can use client authentication to improve the system security.

If unsecured communication is required, you can enable it from Service configuration page or by setting parameter 51.22 Service configuration bit 4. When unsecured communication is enabled, the PC tool communication is not encrypted or authenticated.

For more details, refer to Drive composer start-up and maintenance PC tool user's manual (3AUA0000094606 [English]).

**Note:** Secure PC tool communication is possible with Drive Composer Pro version 2.7 or later.

◼ Support page

On the Support page, you can access documentation related to the adapter module.

The latest files corresponding to the drive firmware are available through the hyperlinks listed under "WWW documentation and downloads". You can find more information about each parameter under "Click here for more information about fieldbus parameters".
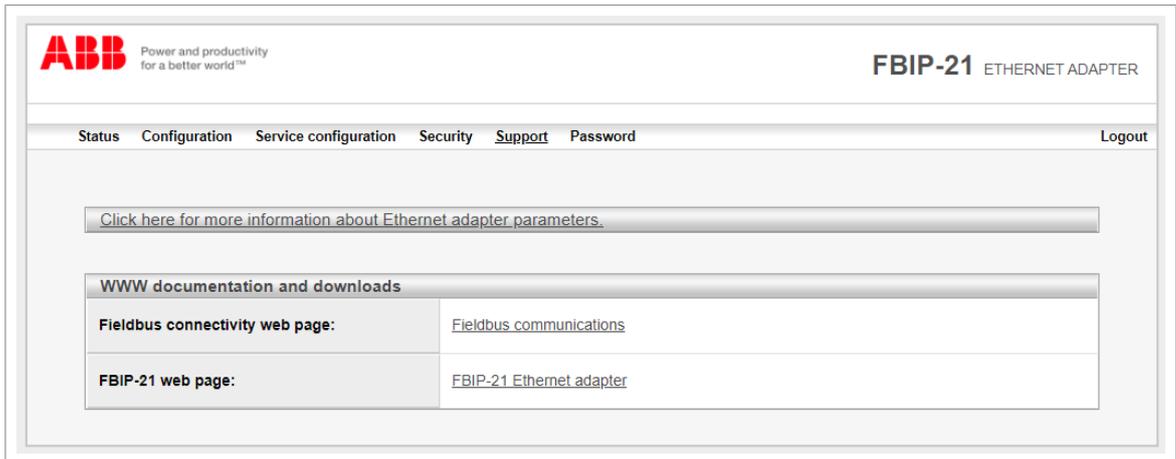
◼ Password page

On the Password page, you can change password. FBIP-21 supports only one user access level.
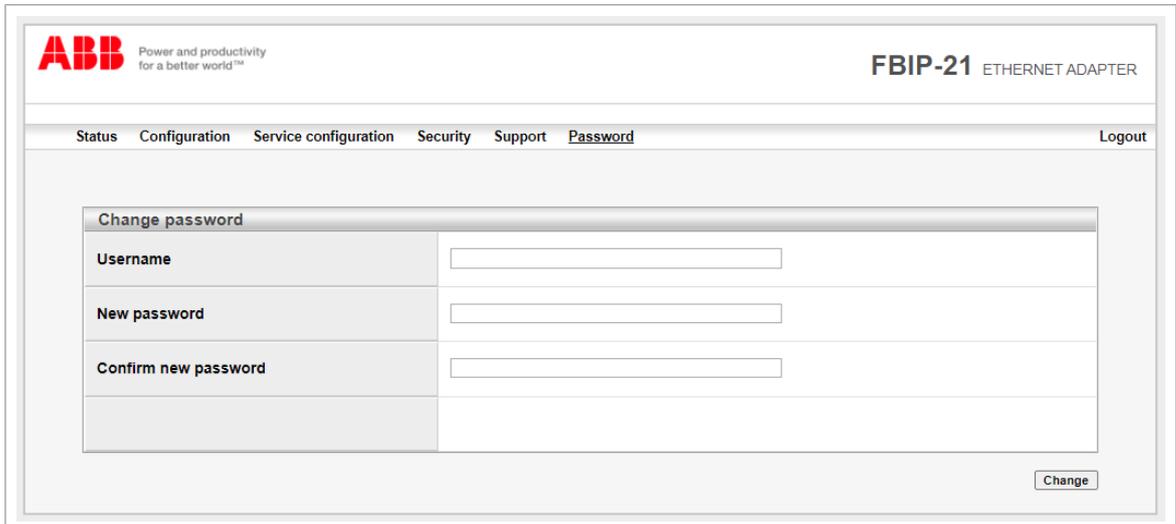
Reset FBIP-21 web page password to default

You can reset the FBIP-21 web page password to factory default.

Note: The password can be reset only with local access to the drive.

1. Disconnect all cable connections to FBIP-21.
   The NET led should switch off.
2. Write 0 (zero) to the parameter 26 under Group A (e.g. 51.26).
3. Refresh the settings by selecting Refresh in parameter 27 (e.g. 51.27).
4. Write 17989 to parameter 26 under Group A.
5. Refresh the settings by selecting Refresh in parameter 27.
6. Write 20033 to parameter 26 under Group A.
7. Refresh the settings by selecting Refresh in parameter 27.
8. Write 0 to parameter 26 under Group A.

FBIP-21 password is now reset to the default password. For information of default password, see section Logging in (page 65).

Enable web page access after it was disabled

You can enable the access to web pages with drive parameters.

1. Disconnect all cable connections to FBIP-21.
   The NET led should switch off.
2. Write 0 (zero) to the parameter 26 under Group A (e.g. 51.26).
3. Refresh the settings by selecting Refresh in parameter 27 (e.g. 51.27).
4. Write 87 to parameter 26 under Group A.
5. Refresh the settings by selecting Refresh in parameter 27.
6. Write 17730 to parameter 26 under Group A.
7. Refresh the settings by selecting Refresh in parameter 27.
8. Write 0 to parameter 26 under Group A.
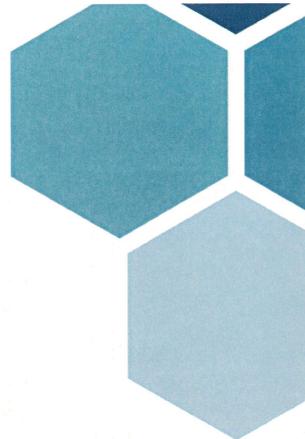
Access to web pages is now enabled.

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Appendix D - BACnet conformance certificate

BACnet CONFORMANCE CERTIFICATE

No. BTL-30952

WSPCert attests the conformance of the following BACnet implementation to the BACnet standard ISO 16484-5 protocol revision 1.14. The attested conformance refers to the BACnet Interoperability Building Blocks (BIBBs) listed on the BTL Listing bearing the above-mentioned BTL-number.

The BACnet implementation has fulfilled the requirements according to the test standard ISO 16484-6, the BTL Test Plan 18.1 and the BTL Testing Policies, see Test Report number VG 2021_1010241 of MBS.

Product name (B-ASC)
BACnet/IP option module
Model(s) FBIP-21
Firmware version
2.0
Vendor
ABB Inc.
16250 W Glendale Dr
New Berlin, WI 53151, USA

This certificate is valid until **31-Mar-2027**.

09-Dec-2022
Date of Initial Certification

Dipl.-Ing. G. Weinmann
Head of Certification Body

Issued on behalf of BACnet International
2900 Delk Road, Suite 700, PMB 321
Marietta, GA 30067, USA

Certification by WSPCert
Dr.-Ing. Frank Bitter
Kapuzinerweg 7, 70374 Stuttgart, Germany
Phone: +49 (0)711 9539220, email: info@wspcert.de

You can download the most recent version of the BACnet conformance certificate for the FBIP-21 from https://www.bacnetinternational.net/btl/.

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 www.abb.com/searchchannels.

Product training

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

Providing feedback on ABB manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at www.abb.com/drives/documents.

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