Honeywell

BACnet Protocol
Installation and User's Manual

SmartVFD HVAC

**Variable Frequency Drives
for Constant and Variable
Torque Applications**

63-2697-07

TABLE OF CONTENTS

1.   SAFETY

This manual contains clearly marked cautions and warnings that are intended for your personal safety and to avoid any unintentional damage to the product or connected appliances.

Please read the information included in cautions and warnings carefully.

The cautions and warnings are marked as follows:

⚠️	**= DANGER! Dangerous voltage**
⚠️	**= WARNING or CAUTION**
⚠️	**= Caution! Hot surface**

1.1   Danger

⚠️	The **components of the power unit are live** when the drive is connected to mains potential. Coming into contact with this voltage is **extremely dangerous** and may cause death or severe injury.
⚠️	The **motor terminals U, V, W and the brake resistor terminals are live** when the AC drive is connected to mains, even if the motor is not running.
⚠️	**After disconnecting** the AC drive from the mains, **wait** until the indicators on the keypad go out (if no keypad is attached, see the indicators on the cover). Wait 5 more minutes before doing any work on the connections of the drive. Do not open the cover before this time has expired. After expiration of this time, use a measuring equipment to absolutely ensure that no voltage is present. **Always ensure absence of voltage before starting any electrical work!**
⚠️	The control I/O-terminals are isolated from the mains potential. However, the **relay outputs and other I/O-terminals may have a dangerous control voltage** present even when the AC drive is disconnected from mains.
⚠️	**Before connecting** the AC drive to mains make sure that the front and cable covers of the drive are closed.
⚠️	During a ramp stop (see the Application Manual), the motor is still generating voltage to the drive. Therefore, do not touch the components of the AC drive before the motor has completely stopped. Wait until the indicators on the keypad go out (if no keypad is attached, see the indicators on the cover). Wait additional 5 minutes before starting any work on the drive.

1.2   Warnings

⚠	The AC drive is meant for **fixed installations only**.
⚠	**Do not perform any measurements** when the AC drive is connected to the mains.
⚠	The **earth leakage current** of the AC drives exceeds 3.5mA AC. According to standard EN61800-5-1, **a reinforced protective ground connection** must be ensured. See Chapter 1.3.
⚠	If the AC drive is used as a part of a machine, the **machine manufacturer is responsible** for providing the machine with a **supply disconnecting device** (EN 60204-1).
⚠	Only **spare parts** delivered by the manufacturer can be used.
⚠	At power-up, power break or fault reset **the motor will start immediately** if the start signal is active, unless the pulse control for Start/Stop logic has been selected. Furthermore, the I/O functionalities (including start inputs) may change if parameters, applications or software are changed. Disconnect, therefore, the motor if an unexpected start can cause danger.
⚠	The **motor starts automatically** after automatic fault reset if the auto restart function is activated. See the Application Manual for more detailed information.
⚠	**Prior to measurements on the motor or the motor cable**, disconnect the motor cable from the AC drive.
⚠	**Do not touch the components on the circuit boards**. Static voltage discharge may damage the components.
⚠	Check that the **EMC level** of the AC drive corresponds to the requirements of your supply network.
⚠	Wear protective gloves when you do mounting, cabling or maintenance operations. There can be sharp edges in the AC drive that can cause cuts.

1.3 Earthing and earth fault protection

⚠️ **CAUTION!**

The AC drive must always be earthed with an earthing conductor connected to the earthing terminal marked with ⏚.

The earth leakage current of the drive exceeds 3.5mA AC. According to EN61800-5-1, one or more of the following conditions for the associated protective circuit must be satisfied:

0) The protective conductor must have a cross-sectional area of at least 10 mm2 Cu or 16 mm2 Al, through its total run.

a) Where the protective conductor has a cross-sectional area of less than 10 mm2 Cu or 16 mm2 Al, a second protective conductor of at least the same cross-sectional area must be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm2 Cu or 16 mm2 Al.

b) Automatic disconnection of the supply in case of loss of continuity of the protective conductor.

The cross-sectional area of every protective earthing conductor which does not form part of the supply cable or cable enclosure must, in any case, be not less than:

- 2.5mm² if mechanical protection is provided or
- 4mm² if mechanical protection is not provided.

The earth fault protection inside the AC drive protects only the drive itself against earth faults in the motor or the motor cable. It is not intended for personal safety.

Due to the high capacitive currents present in the AC drive, fault current protective switches may not function properly.

⚠️ **Do not perform any voltage withstand tests** on any part of the AC drive. There is a certain procedure according to which the tests must be performed. Ignoring this procedure may result in damaged product.

In North America:

NOTE! You can download the English and French product manuals with applicable safety, warning and caution information from **https://customer.honeywell.com/en-US/Pages/default.aspx**.

REMARQUE Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site **https://customer.honeywell.com/en-US/Pages/default.aspx**.

In Europe:

You can download the product manuals at **http://hwll.co/inverter**

2.   BACNET - GENERAL INFO

BACnet stands for 'Building Automation and Control Networks'. It is the common name for the communication standard ISO 16484-5 which defines the methods and the protocol for cooperating building automation devices to communicate. Devices can be designed to operate using BACnet communication protocol as well as utilising BACnet protocol to communicate between systems. BACnet is an internationally accepted protocol for building automation (e.g. lighting control, air conditioning and heating automation) and control over a communications network.

BACnet provides a method by which computer-based control equipment, from different manufacturers can work together, or 'interoperate'. For this to be achieved, components must be able to exchange and understand BACnet data messages.

Your SmartVFD HVAC/SmartDrive HVAC AC drive is equipped with BACnet support as standard.

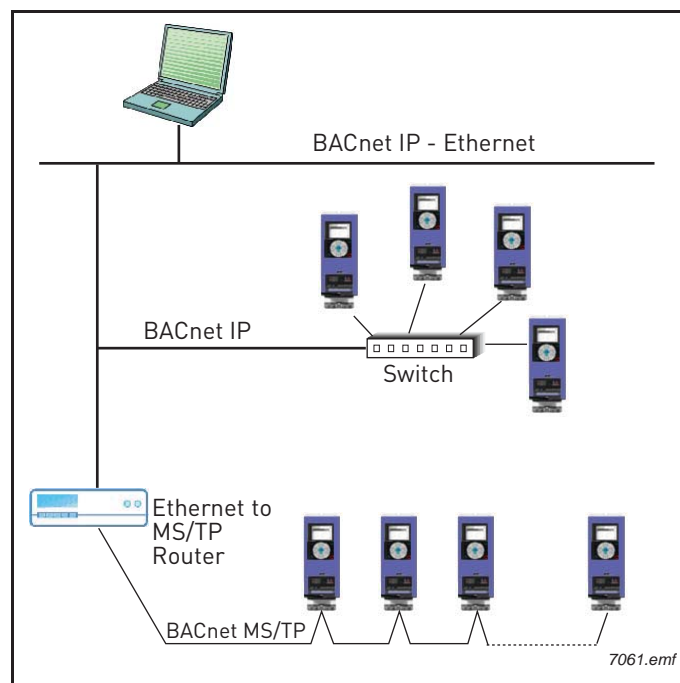*Figure 1. Principal example diagram of BACnet*

If you need to contact local support in problems related to BACnet, send a description of the problem together with the Drive Info File taken with PC tool to your local support. You can download the Service Information file with the PC tool. In BACnet/IP networks, also send a log file captured with the Wireshark tool that contains the error situation.

3.   BACNET TECHNICAL DATA

3.1   BACnet MS/TP protocol

Table 1.

	Interface	RS-485
	Data transfer method	RS-485 MS/TP, half-duplex
	Transfer cable	STP (Shielded Twisted Pair), type Belden 9841 or similar
	Connector	2.5 mm^2
	Electrical isolation	Functional
	BACnet MS/TP	As described in ANSI/ASHRAE Standards 135-2010 Ver.1 Rev.12
	Baud rate	9600, 19200, 38400 and 76800 baud(supports autobaud detection)

3.2   BACnet IP protocol

Table 2.

	Interface	100BaseTX, IEEE 802.3 compatible
	Data transfer method	Ethernet half/full -duplex
	Data transfer speed	10/100 MBit/s, autosensing
	Protocol	BACnet over UDP/IP
	Connector	Shielded RJ45 connector.
	Cable type	CAT5e STP
	BACnet IP	As described in ANSI/ASHRAE Standards 135-2010 Ver.1 Rev.12
	IP address mode	Selectable: Static or DHCP

3.3   ACD (Address Conflict Detection)

The SmartVFD HVAC/SmartDrive HVAC AC drives implement the ACD algorithm (IETF RFC 5227).

The ACD algorithm tries to actively detect if the IP address configured to this device is been used by another device in the same network. To accomplish this, ACD sends four ARP request packets when the device's Ethernet interface goes up or when its IP address changes. ACD prevents the use of the Ethernet interface until the ARP probing finishes. This delays the start-up of fieldbus protocols about one second. During the delay or after it, the ACD passively checks incoming ARP messages for use of the device's IP address.

If another device with the same IP address is detected, the ACD will try to defend its IP address with a single ARP message. If the other device with the same IP address also supports ACD, it should stop using the address. If not, the ACD will close the Ethernet connection and indicate the situation with an Alarm. This is done according the "DefendWithPolicyB". Acknowledging of the Alarm is not possible if the problem is active. ACD opens Ethernet connection if the other device with the same IP address disappears from the network. Alarm can be acknowledged after this. Other policies are not supported. If the fieldbus protocol has been active, a fieldbus fault may be activated (depends on the fieldbus and drive application configuration).

4.   PROGRAMMING

You will find basic information on how to use the control keypad in the Application Manual of your SmartVFD HVAC/SmartDrive HVAC AC drive.

Below you will find some examples of navigation paths to the fieldbus parameters.

1. First ensure that the right fieldbus protocol is selected.
Activating BACnet MSTP (P5.8.1.1) Main Menu > I/O and Hardware > RS-485 > Common settings > Protocol > **BACnet MSTP** < Activating BACnet IP (P5.9.3.1.4) Main Menu > I/O and Hardware > Ethernet > Bacnet IP > Settings > Protocol in use > **Yes** <
2. Select *'Fieldbus control'* as the *Remote Control Place*.
Control Place (P3.2.1) Main Menu > Parameters > Start/Stop Setup > Rem Control Place > **FieldbusCTRL** <
3. Activate Remote control.
Local/Remote (P3.2.2) Main Menu > Parameters > Start/Stop Setup > Local/Remote > **Remote** <
4. Select controlling fieldbus
Controlling Fieldbus (P5.13.1) Main Menu > I/O and Hardware > Fieldbus General > Controlling Fieldbus > **Automatic/BACnet IP/RS-485** <
5. Set up Protocol Parameters.
BACnet MS/TP parameters see Chapter 4.1 BACnet IP parameters see Chapter 4.2

4.1   BACnet MS/TP parameters and monitoring values

Table 3. Parameters related with BACnet used through MS/TP

Code	Parameter	Min	Max	Default	ID	Description
P5.8.3.1.1	Baud rate	9600	76800	9600	2392	Communication speed 1 = 9600 2 = 19200 3 = 38400 4 = 76800 5 = Autobaud
P5.8.3.1.2	MAC Address	1	127	1	2331	BACnet device MAC address
P5.8.3.1.3	Instance number	0	4194304	automatic	2332	Device Object's instance number. 0 = Automatically generated from the last 22 bit from Ethernet MAC address.
P5.8.3.1.4	MaxMaster	1	127	127	2561	Max Master parameter of device object. This can be used to reduce poll for master cycles.
P5.8.3.1.5	Communication time-out	0	65535	10	2333	Defines the number of seconds after which a communication timeout is indicated after a communication break. Value 0 disables this feature.
P5.8.3.1.6	MaxAPDUcycle	0	65535	0	2554	Defines the number of seconds after which the next application level message is shown after a communication break. Value 0 disables this feature.

Table 4. Monitoring values

Code	Parameter	Min	Max	ID	Description
V5.8.3.2.1	Fieldbus protocol status	INITIALIZING	INACTIVE	2393	See Table 9
V5.8.3.2.2	Communication status	0.0	99.999	2394	Counter for failed and good messages failed msg's <-> good msg's
V5.8.3.2.3	Actual instance	0	4194304	2395	Actual instance in use. If the instance parameter is 0, the generated instance number shows here.
V5.8.3.2.4	Last fault	See fault codes (table Table 8)		2396	Information about the latest fault detected.
V5.8.3.2.5	UartDBG	0.0.0	32767. 32767. 32767	2559	Uart error counters in the following order: framing errors. overrun errors. parity errors.
V5.8.3.2.6	ActiveCOVcount	0	20	2558	Number of active COV subscriptions
V5.8.3.2.7	Control Word	0	FFFFFFFF	2397	Control word monitor value
V5.8.3.2.8	Status Word	0	FFFFFFFF	2398	Status word monitor value

4.2   BACnet IP parameters and monitoring values

4.2.1   Ethernet common settings

Table 5. Common Ethernet Settings

Code	Parameter	Rante	Default	ID	Description
P5.9.1.1	IP address mode	Fixed (1), DHCP(2)	DHCP (2)	2482	IP Mode
P5.9.1.2	Duplicate IP Detection	Disabled (0), Enabled (1)	enabled	2569	When disabled drive does not check for or react to address conflict situation. See details of ACD functionality in Chapter 3.3.
P5.9.1.3.1	IP address	1.0.0.0 - 223.255.255.255	192.168.0.10	2529	Fixed IP address
P5.9.1.3.2	Subnet mask	0.0.0.0- 255.255.255.255	255.255.0.0	2530	Fixed Subnet mask
P5.9.1.3.3	Default gateway	0.0.0.0- 255.255.255.255	192.168.0.1	2531	Fixed default gateway
P5.9.1.4	Active IP address	-	-	2483	Shows current active IP address. It is same as fixed value if IP mode is "Fixed".
P5.9.1.5	Active subnet mask	-	-	2484	Shows current active subnet mask. It is same as fixed value if IP mode is "Fixed".
P5.9.1.6	Active default gateway	-	-	2485	Shows current active default gateway. It is same as fixed value if IP mode is "Fixed".
P5.9.1.7	MAC address	-	-	2486	Drive MAC address

4.2.2   BACnet IP settings

Table 6. Parameters related with BACnet used through Ethernet

Code	Parameter	Min	Max	Default	ID	Description
P5.9.3.1.1	Instance number	0	4194304	automatic	2406	Device Object's instance 0 = Automatically generated from the last 22 bit from the Ethernet MAC address.
P5.9.3.1.2	BACnet Port Number	47808	47823	47808	2538	UDP port for BACnet IP communication.
P5.9.3.1.3	Communication time-out	0	65535	10	2407	Defines the number of seconds after which a communication timeout is indicated after a communication break. Value 0 disables this feature.
P5.9.3.1.4	Protocol in use	0	1	0	2408	Activates BACnet IP protocol
P5.9.3.1.5	ForeignDevice	Sub menu for Foreign Device setting				
P5.9.3.1.5.1	ForeignDevice	No	Yes	No	2555	Activates foreign device registration
P5.9.3.1.5.2	BBMD IP			192.168.0.1	2409	IP address of BBMD device to send registration
P5.9.3.1.5.3	BBMD Port	47808	47823	47808	2410	BBMD port number

Table 6. Parameters related with BACnet used through Ethernet

Code	Parameter	Min	Max	Default	ID	Description
P5.9.3.1.5.4	RegistrationInterval	1	65535	10	2411	Registration interval to keep a live connection to BBMD. **NOTE!** Registration message TTL is twice as long as this time.

Table 7. Monitoring values

Code	Parameter	Min	Max	ID	Description
V5.9.3.2.1	Fieldbus protocol status	INITIALIZING	INACTIVE	2412	See Table 9
V5.9.3.2.2	Communication status	0.0	99.999	2413	Counter for failed and good messages failed msg's <-> good msg's
V5.9.3.2.3	Actual instance	0	4194304	2414	Actual instance is use. In case instance parameter is zero you can see here generated instance number
V5.9.3.2.4	Last fault	See fault codes (Table 8)		2556	The fault code of the latest fault detected.
V5.9.3.2.5	ActiveCOVcount	0	20	2557	Number of active COV subscriptions
V5.9.3.2.6	Control Word	0	FFFFFFFF	2397	Control word monitor value
V5.9.3.2.7	Status Word	0	FFFFFFFF	2398	Status word monitor value

Table 8. Fault Code values

Fault Number	Fault Text	Description
0	No fault	No fault detected since the last power-up.
1	Connection timeout	Timeout occurred in communication.
2	MAC address	Duplicate MAC address detected.
3	Autobaud Error	Error during baudrate detection.
4	Ethernet link lost	Ethernet cable disconnected during communication.

Table 9. Fieldbus Protocol Status

Value	Text	Description
1	INITIALIZING	Protocol is starting
2	STOPPED	Protocol is stopped
3	OPERATIONAL	Communicating
4	FAULTED	Timeout/APDU time expired
5	INACTIVE	No communication

4.3   BACnet MS/TP parameter descriptions

4.3.1   BACnet MS/TP Parameters

P5.8.3.1.1   BAUD RATE

Select the communication speed for the network. The default value is 9600 baud. If Autobauding is selected, the node will detect the baudrate. There must be at least one device in the bus to select the baud rate and to start token transmitting. When the baudrate is detected, it is saved into this parameter.

NOTE! Autobauding is disabled after baudrate is detected.

P5.8.3.1.2   MAC ADDRESS

The parameters of every device must be set before connecting to the bus. Especially the parameters *MAC address* and *Baud rate* must be the same as in the master's configuration.

The first parameter, BACnet MAC (Medium Access Control) address, must be unique on the network to which it is connected. The same MAC address may be used on a device on another network within the internetwork.

Addresses 128-254 are reserved for slaves. Addresses 1-127 are valid for both masters and slaves. The portion of the address space that is actually used for masters in a particular installation is determined by the value of the Max_Master property of the Device object.

It is recommended that MAC address 0 be reserved for use by the MS/TP router. 255 is reserved for broadcasts.

P5.8.3.1.3   INSTANCE NUMBER

The Device Object's Instance number must be unique across the entire BACnet internetwork because it is used to uniquely identify the BACnet devices. It may be used to conveniently identify the BACnet device from other devices during installation.

If 0 (default) is selected, the Device Instance number is generated from the last 22 bit of the Ethernet MAC address. This unique number is then shown in the Monitor menu (actual instance).

P5.8.3.1.4   MAXMASTER

This parameter defines the last possible master on the network segment. Each master node is responsible for searching new devices from network using the 'poll for master' messages. The nodes are searched up to MAC address defined by MaxMaster parameter.

This parameter affects the cycle time of the token. We recommend to use the highest MAC address value in the network for this parameter.

P5.8.3.1.5   COMMUNICATION TIMEOUT

The BACnet MS/TP indicates timeout error if the node is not receiving a token within time defined by this parameter. It can be used to detect communication loss to other nodes. Time unit is seconds.

NOTE! Application parameter P3.9.1.6 (ID 733) can be use to define action for communication timeout.

P5.8.3.1.6   *MAXAPDUCYCLE*

This parameter defines the maximum time in seconds between APDU messages addressed to this node. The APDU messages are Application layer messages, for example, 'ReadParameter' and 'Write Parameter' messages. This can be used to detect communication loss to the controlling node.

NOTE! The application parameter P3.9.1.6 (ID 733) can be used to define the action for communication timeout.

4.3.2   BACnet MS/TP monitoring values

V5.8.3.2.1   *FIELDBUS PROTOCOL STATUS*

Fieldbus Protocol Status tells the status of the protocol.

V5.8.3.2.2   *COMMUNICATION STATUS*

The *Communication status* shows how many error and how many good messages the AC drive has received. The Communication status includes a common error counter that counts CRC and parity errors and a counter for good messages.

Only messages to the current slave in use are counted in the good messages, not MS/TP token packages.

Good messages	
0…999	Number of messages received without errors
Bad Frames	
0…99	Number of messages received with errors

V5.8.3.2.3   *ACTUAL INSTANCE NUMBER*

Shows the actual instance number.

V5.8.3.2.4   *LAST FAULT*

This monitor value consist of text string that gives extra information about the fault condition. Can be used to track the reason for communication timeout. See Table 8.

V5.8.3.2.5   *UARTDBG*

This is advanced debug information from RS-485 uart module. It shows parity, framing and overrun errors occurred while receiving the MSTP messages.

V5.8.3.2.6   *ACTIVECOVCOUNT*

This shows the number of active COV subscriptions on the device.

V5.8.3.2.7   CONTROL WORD

Shows control word that is written by BACnet MS/TP into drive application. This is shown in panel as hexadecimal format.

V5.8.3.2.8 STATUS WORD

Shows control word that is written by BACnet MS/TP into drive application. This is shown in panel as hexadecimal format.

4.4   BACnet IP parameter descriptions

4.4.1   Ethernet common settings

P5.9.1.1   IP ADDRESS MODE

The IP address mode determines how the drive IP settings are set.

If " DHCP with AutoIP" is set as IP mode, then the drive will try to retrieve its IP settings from the DHCP server connected to the local network. If the drive is unable to retrieve its IP settings, it will set a link-local address as the current IP address after about one minute (for example 169.x.x.x).

If "Fixed IP" is set as IP mode, the settings from submenu "P5.9.1.3 Fixed IP" are used.

P5.9.1.2   DUPLICATE IP DETECTION

See Chapter 3.3.

P5.9.1.3   FIXED IP

If "Fixed IP" is set as IP mode, the settings from submenu "P5.9.1.3 Fixed IP" are used. The default Fixed IP is shown below.

IP: 192.168.0.10

Subnet mask: 255.255.0.0

Default gateway: 0.0.0.0

NOTE: Default gateway address is IP address of the network point which acts as an entrance to another network. This needs to be defined if the device communicates with nodes on different networks, for example, in case where **'Foreign Device'** functionality is active.

P5.9.1.4   IP ADDRESS

P5.9.1.5   SUBNET MASK

P5.9.1.6   DEFAULT GATEWAY

5.9.1.4 IP address, P5.9.1.5 Subnet mask and P5.9.1.6 Default gateway are monitoring values and cannot be changed.

If IP mode is "Fixed IP" then these values will display same values as defined in Fixed IP address.

If IP mode is "DHCP with AutoIP", the values are 0.0.0.0 when DHCP is retrieving IP settings. If IP setting can be retrieved then the values shows currently active IP settings. If IP settings cannot be retrieved then the current IP address is set after about one minute (for example 169.x.x.x).

P5.9.1.7   MAC ADDRESS

The MAC address of the control board. MAC address (Media Access Control) is a unique address given to each network host. It is not editable.

4.4.2   BACnet IP settings

P5.9.3.1.1   INSTANCE NUMBER

Similar to BACnet MS/TP device object instance number (see Chapter 4.3.1).

P5.9.3.1.2   BACNET PORT NUMBER

The UDP port for the BACnet IP communication.

P5.9.3.1.3   COMMUNICATION TIME-OUT

Defines the number of seconds after a timeout is indicated after a communication break or disconnected ethernet link. Value 0 disables communication and link supervision.

NOTE! The Application parameter P3.9.1.6 (ID 733) can be used to define the action for communication timeout.

P5.9.3.1.4   PROTOCOL IN USE

BACnet/IP protocol can be enabled and disabled with this parameter. When the parameter value is set to "**1**" the BACnet/IP protocol is enabled and disabled when set to "**0**".

P5.9.3.1.5   FOREIGNDEVICE

The foreign device settings are located under this submenu. The foreign device feature is used when the device is located in a different network than the BBMD. A normal router does not send broadcast messages between different networks. The 'Foreign device' feature solves this problem by establishing a connection to the BBMD with unicast messages. All broadcast messages are forwarded to a BBMD device that takes care of receiving and transmitting broadcast messages in both directions for all foreign devices.

P5.9.3.1.5.1   FOREIGNDEVICE

If this parameter is set to value 'Yes', the foreign device registration becomes active.

P5.9.3.1.5.2   BBMD IP

The IP address of the BACnet IP Broadcast Management Device.

P5.9.3.1.5.3   BBMD PORT

The BBMD Port number.

P5.9.3.1.5.4   REGISTRATIONINTERVAL

The registration interval to keep a live connection to the BBMD. Unit is seconds.

NOTE! The Registration TTL is twice as long as this time.

4.4.3   BACnet IP monitoring values

V5.9.3.2.1   FIELDBUS PROTOCOL STATUS

Fieldbus Protocol Status tells the status of the protocol.

V5.9.3.2.2   COMMUNICATION STATUS

The Communication status shows how many error and how many good messages the AC drive has received. The Communication status includes a common error counter that counts CRC and parity errors and a counter for good messages.

Good messages	
0…999	Number of messages received without errors
Bad Frames	
0…99	Number of messages received with errors

V5.9.3.2.3   ACTUAL INSTANCE NUMBER

The Device Object's actual instance number. This monitoring value is needed when value 0 is written to parameter P5.8.3.1.1.

V5.9.3.2.4   LAST FAULT

This monitor value contains a text string that gives extra information about the fault condition. Can be used to track reason for communication timeout. See Table 8.

V5.9.3.2.5   ACTIVECOVCOUNT

This shows the number of active COV subscriptions on the device.
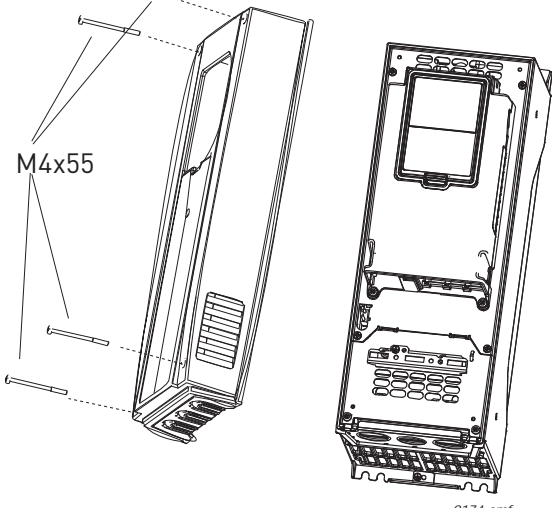
V5.9.3.2.6   CONTROL WORD

Shows control word that is written by BACnet IP into drive application. This is shown in panel as hexadecimal format.

V5.9.3.2.7   STATUS WORD

Shows status word that is written by drive application to BACnet IP. This is shown in panel as hexadecimal format.
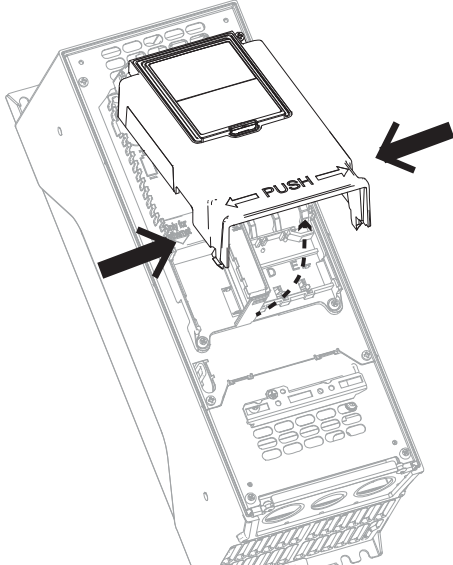
5.   INSTALLATION
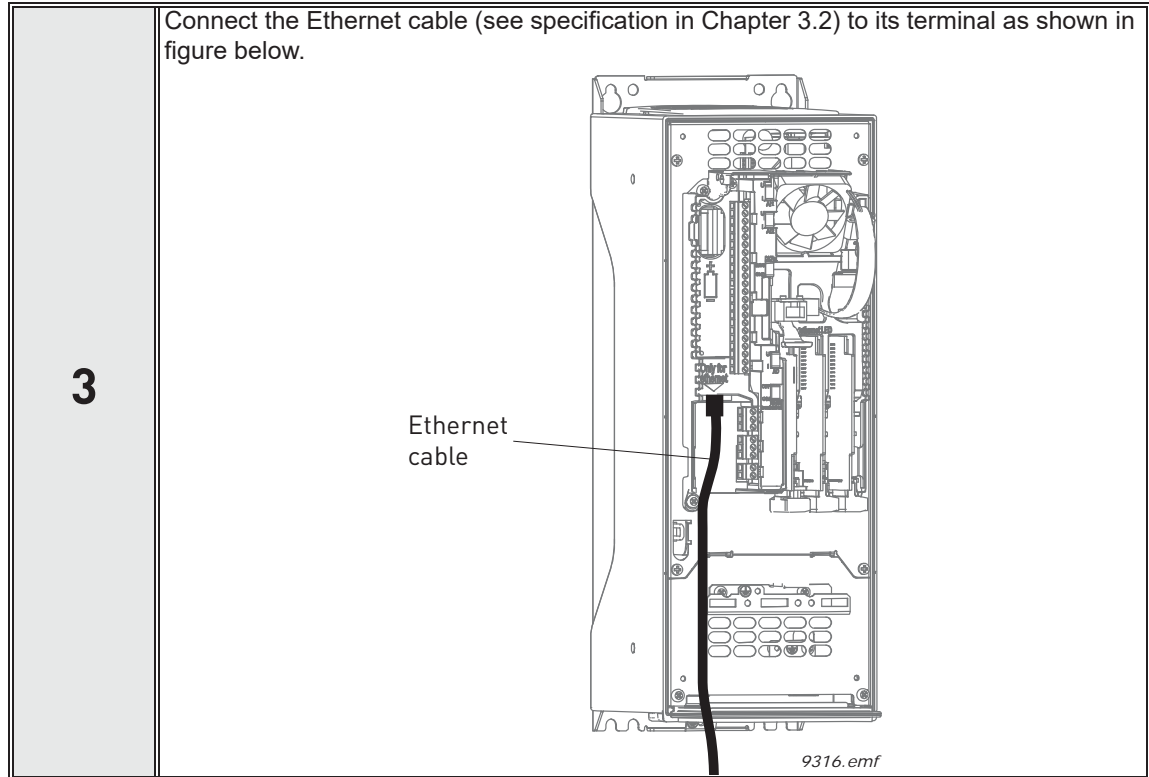
5.1   SmartVFD HVAC/SmartDrive HVAC AC drive

1	Open the cover of the AC drive. M4x55 9174.emf
⚡	The relay outputs and other I/O-terminals may have a dangerous control voltage present even when the AC drive is disconnected from mains.

2	Open the inner cover of the drive. PUSH

5.1.1   Prepare for use through Ethernet

3	Connect the Ethernet cable (see specification in Chapter 3.2) to its terminal as shown in figure below. Ethernet cable *9316.emf*

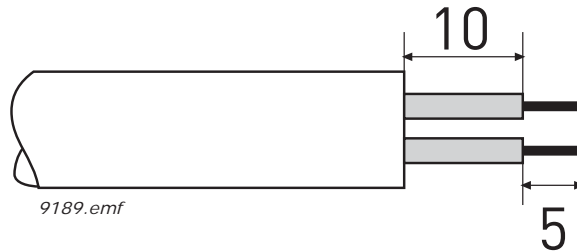|	
4	**Protection class IP21:** Cut free the opening on the AC drive cover for the Ether-net cable. **Protection class IP54:** Cut the rubber grommets open to slide the cables through. Should the grommets fold in while inserting the cable, just draw the cable back a bit to straighten the grommets up. Do not cut the grommet open-ings wider than what is nec-essary for the cables you are using. **NOTE!** To meet the requirements of the enclosure class IP54, the connection between the grommet and the cable must be tight. Therefore, lead the first bit of the cable out of the grommet **straight** before letting it bend. If this is not possible, the tightness of the connection must be ensured with insulation tape or a cable tie. 9068.emf

|	
5	Remount the AC drive cover. **NOTE!** When planning the cable runs, remember to keep the distance between the Ethernet cable and the motor cable at a **minimum of 30 cm**. Ethernet cable IP21 IP54 9265.emf

5.1.2   Prepare for use through RS485

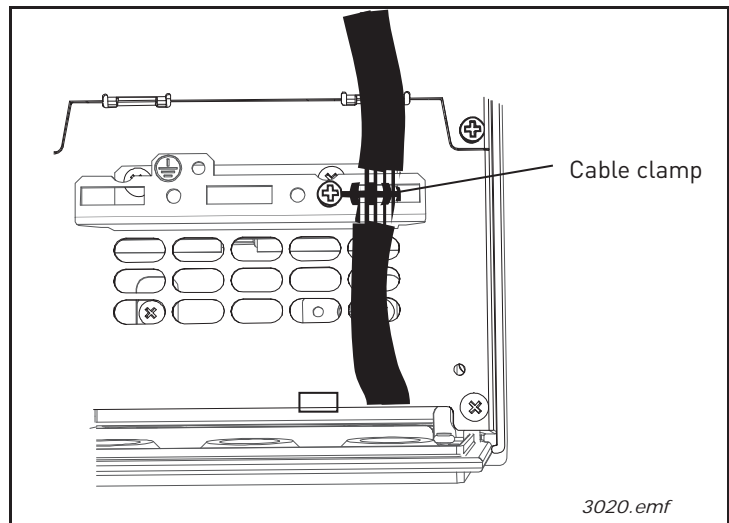|	
1	Strip about 15 mm of the RS485 cable (see specification in Chapter 3.1) and cut off the grey cable shield. Remember to do this for both bus cables (except for the last device). Leave no more than 10 mm of the cable outside the terminal block and strip the cables at about 5 mm to fit in the terminals. See picture below. *9189.emf* Also strip the cable now at such a distance from the terminal that you can fix it to the frame with the grounding clamp. Strip the cable at a maximum length of 15 mm. **Do not strip the aluminum cable shield!** *9188.emf*
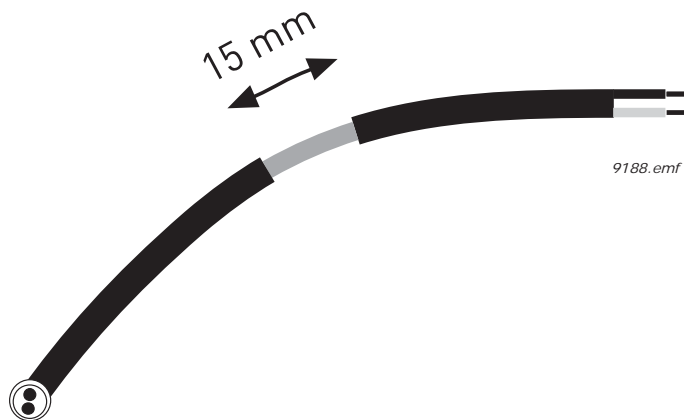
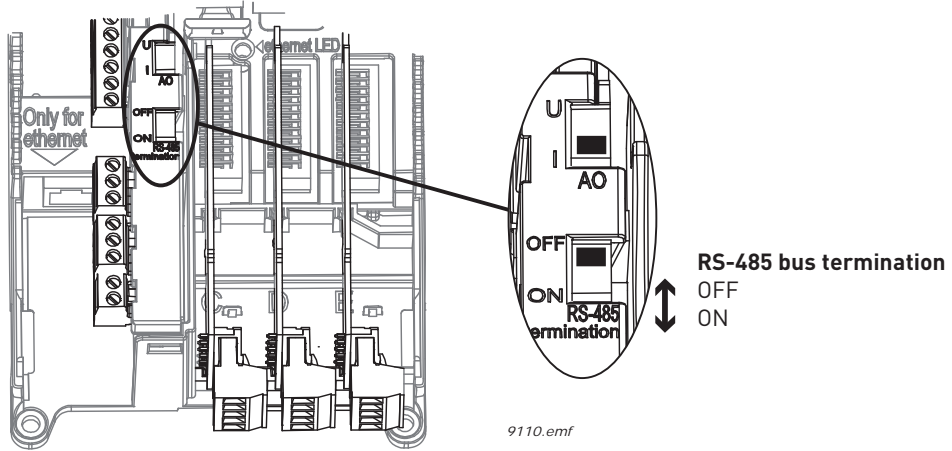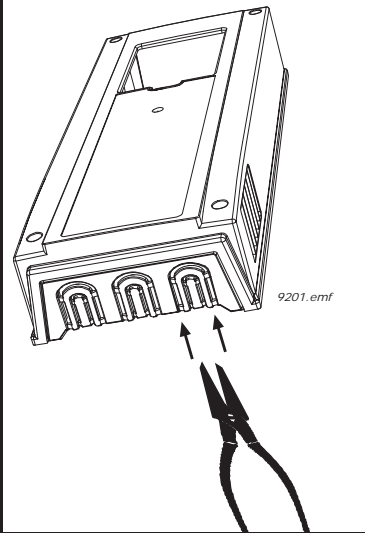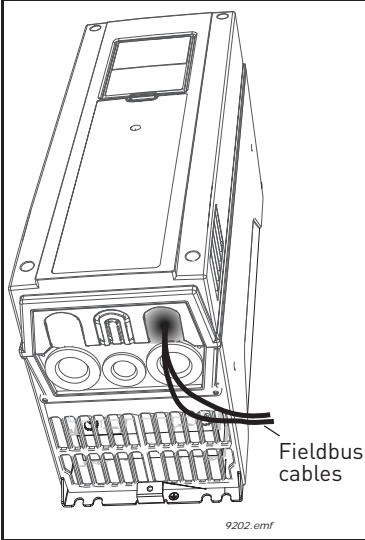| 2	Then connect the cable to its appropriate terminals on SmartVFD HVAC/SmartDrive HVAC AC drive standard terminal block, terminals **A and B** (A = negative, B = positive). See figure below.

7074.emf
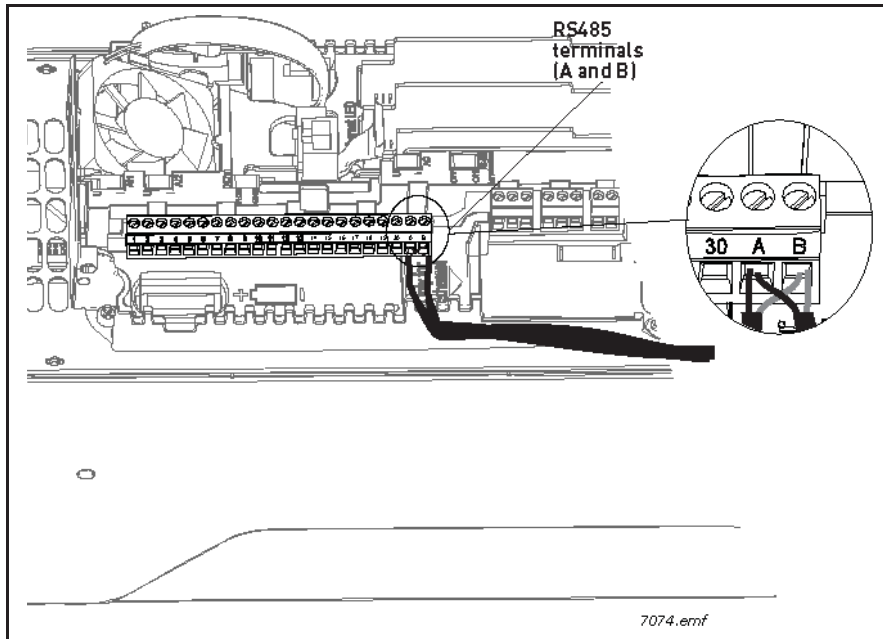
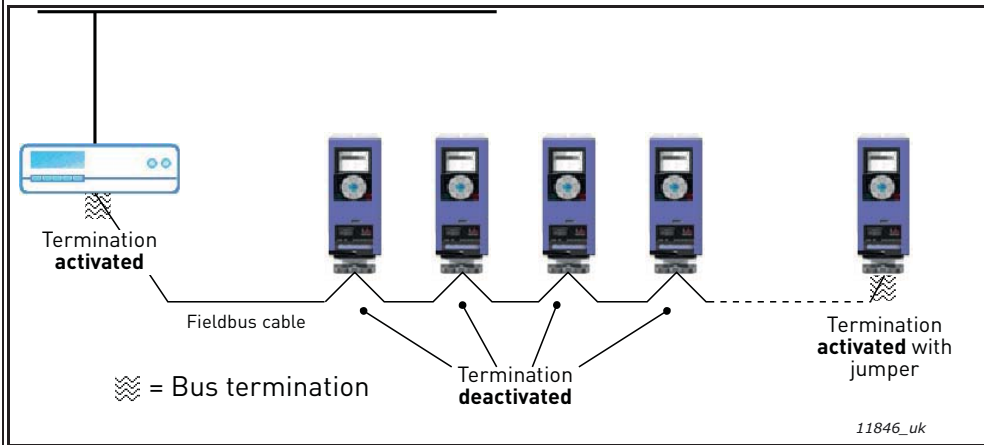| 3	Using the cable clamp included in the delivery of the drive, ground the shield of the RS485 cable to the frame of the AC drive. **NOTE!** This can be done in all drives if there is no difference in PE potentialbetween the drives. However, if there is PE potential difference then the shieldshould be connected to PE only at one point in the system. The shields of thecables shall be joint but not connected to several PE points with different poten-tial. **NOTE!** This is only a principle drawing and the actual drive may look different.

Cable clamp

3020.emf

4	**If SmartVFD HVAC/SmartDrive HVAC AC drive is the last device on the bus**, the bus termination must be set. Locate the DIP switches to the right of the control keypad of the drive and turn the switch for the RS485 bus termination resistor to position ON. Biasing is built in the termination resistor. See also step 6 on page 25. *9110.emf* **RS-485 bus termination** OFF ON
5	Unless already done for the other control cables, cut free the opening on the AC drive cover for the RS485 cable (protection class IP21). **NOTE!** This is only a principle drawing and the actual drive may look different. *9201.emf*
6	Remount the AC drive cover and run the RS485 cables as shown in picture. **NOTE!** When planning the cable runs, remember to keep the distance between the fieldbus cable and the motor cable at a **minimum of 30 cm**. Fieldbus cables *9202.emf*

7	The bus termination must be set for the first and the last device of the fieldbus line. See picture below. See also step 3 on page 24. Termination **activated** Fieldbus cable ≋ = Bus termination Termination **deactivated** Termination **activated** with jumper *11846_uk*

6.   COMMUNICATIONS

6.1   Device Object

Device object provides information about device and its configuration. Note that the Device Object "Object_Name" property corresponds to the AC drive's "Drive name" (P6.7).

Device object 'Object_Name' property value should be unique in the BACnet network. You can change the 'Drive Name' using PC tool. The new "Drive Name" becomes active when the drive/protocol is restarted.

6.2   Object types and properties supported

Property	Object Type		
	Device	Binary Value	Analogue Value
Object_Identifier	X	X	X
Object_Name	X	X	X
Object_Type	X	X	X
System_Status	X		
Vendor_Name	X		
Vendor_Identifier	X		
Model_Name	X		
Firmware_Revision	X		
Application_Software_Version	X		
Description			
Protocol_Version	X		
Protocol_Revision	X		
Protocol_Services_Supported	X		
Protocol_Object_Types_Supported	X		
Object_List	X		
Max_APDU_Length_Accepted	X		
Segmentation_Supported	X		
Max_Segments_Accepted	X		
Local_Time	X		
Local_Date	X		
UTC_Offset	X		
Daylight_Savings_Status	X		
APDU_Segment_Timeout	X		
APDU_Timeout	X		
Number_Of_APDU_Retries	X		
Max_Master	X		
Max_Info_Frames	X		
Device_Address_Binding	X		
Database_Revision	X		
Active_COV_Subscriptions	X		
Event_State		X	X

Out_Of_Service		X	X
Present_Value		X	X
Priority_Array		X *	X *
Relinquish_Default		X *	X *
Status_Flags		X	X
COV_Increment			X
Units			X

*. Only with commandable values

6.2.1 Binary Value Object

Instance ID	Object Name	Description	Inactive / Active	Present Value Access Type
BV0	Ready State	Indicates whether the drive is ready or not	Not Ready / Ready	R
BV1	Run/Stop State	Indicates whether the drive is running or stopped	Stop / Run	R
BV2	Fwd/Rev State	Indicates the rotation direction of the motor	Fwd / Rev	R
BV3	Fault State	Indicates if a fault is active	OK / Fault	R
BV4	Alarm State	Indicates if an alarm is active	OK / Alarm	R
BV5	At Setpoint	Ref. Frequency reached	False / True	R
BV6	At Zero Speed	Motor Running at zero speed	False / True	R
BV7	fb_ProcessdataOut_01 Bit_0	ProcessDataOut1 bit 0	0 / 1	R
BV8	fb_ProcessdataOut_01 Bit_1	ProcessDataOut1 bit 1	0 / 1	R
BV9	fb_ProcessdataOut_01 Bit_2	ProcessDataOut1 bit 2	0 / 1	R
BV10	fb_ProcessdataOut_01 Bit_3	ProcessDataOut1 bit 3	0 / 1	R
BV11	fb_ProcessdataOut_01 Bit_4	ProcessDataOut1 bit 4	0 / 1	R
BV12	fb_ProcessdataOut_01 Bit_5	ProcessDataOut1 bit 5	0 / 1	R
BV13	fb_ProcessdataOut_01 Bit_6	ProcessDataOut1 bit 6	0 / 1	R
BV14	fb_ProcessdataOut_01 Bit_7	ProcessDataOut1 bit 7	0 / 1	R
BV15	Run/Stop CMD	Command to start drive (FB control is active)	Stop / Run	C
	Fwd/Rev CMD	Command to run forward/reverse	Fwd/Rev	C
BV17	Reset Fault	Command to reset Active Fault from drive	0 / Reset	C
BV18	Stop By Coast	Stop Drive by coast	0 / 1	C
BV19	Stop By Ramp	Stop Drive by ramp	0 / 1	C

BV20	Quick Stop	Quick Stop	0 / 1	C
BV21	Zero Ramp	Stop by zero ramp	0 / 1	C
BV22	Hold Ramp	Hold ramp	0 / 1	C
BV23	BusCtrl	Activate Bus control	0 / 1	C
BV24	BusRef	Activate Bus reference	0 / 1	C
BV25	fb_control_word Bit_10	fb_control_word bit 10	0 / 1	C
BV26	fb_control_word Bit_11	fb_control_word bit 11	0 / 1	C
BV27	fb_control_word Bit_12	fb_control_word bit 12	0 / 1	C
BV28	fb_control_word Bit_13	fb_control_word bit 13	0 / 1	C
BV29	fb_control_word Bit_14	fb_control_word bit 14	0 / 1	C
BV30	fb_control_word Bit_15	fb_control_word bit 15	0 / 1	C

NOTE! Present Value Access Types: **R** = Read-only, **W** = Writeable, **C** = Commandable. Commandable values support priority arrays & relinquish defaults.

6.2.2   Analogue Value Object

Table 10.

Instance ID	Object Name	Description	Units	Present Value Access Type
AV0	Frequency Setpoint	Frequency Setpoint	Hz	R
AV1	Output Frequency	Output Frequency	Hz	R
AV2	Motor Speed	Motor Speed	rpm	R
AV3	Load (power)	Motor Shaft Power	%	R
AV4	Kilowatt Hours total	Kilowatt Hour Counter (Total)	kWh	R
AV5	Motor Current	Motor Current	A	R
AV6	DC link Voltage	DC link Voltage	V	R
AV7	Motor Voltage	Motor Voltage	V	R
AV8	Unit Temperature	Heatsink Temperature	°C	R
AV9	Motor Torque	In % of motor nominal Torque	%	R
AV10	Operating Days	Operating Days (resettable)	Day	R
AV11	Operating Hours	Operating Hours (resettable)	Hour	R
AV12	Kilowatt Hours	Kilowatt Hours (resettable)	kWh	R
AV13	Torque Reference	Torque Reference	%	R

Table 10.

AV14	Temperature Rise	Calculated motor temperature 100.0% = nominal temperature of motor	%	R
AV15	fb_ProcessdataOut_01	Application specific [2]		R
AV16	fb_ProcessdataOut_02	Application specific [2]		R
AV17	fb_ProcessdataOut_03	Application specific [2]		R
AV18	fb_ProcessdataOut_04	Application specific [2]		R
AV19	fb_ProcessdataOut_05	Application specific [2]		R
AV20	fb_ProcessdataOut_06	Application specific [2]		R
AV21	fb_ProcessdataOut_07	Application specific [2]		R
AV22	fb_ProcessdataOut_08	Application specific [2]		R
AV23	Active Fault Code	Active Fault Code	-	R
AV24	Speed Reference	Speed Reference, percentage of nominal speed	%	C
AV25	Current Limit	Current Limit	A	W
AV26	Min Frequency	Minimum Frequency	Hz	W
AV27	Maximum Frequency	Maximum Frequency	Hz	W
AV28	Accel Time	Acceleration Time	s	W
AV29	Decel Time	Deceleration Time	s	W
AV30	fb_ProcessdataIn_01	Application specific [2]		C
AV31	fb_ProcessdataIn_02	Application specific [2]		C
AV32	fb_ProcessdataIn_03	Application specific [2]		C
AV33	fb_ProcessdataIn_04	Application specific [2]		C
AV34	AnyParam ID	ID number that is used in AV35	0 to 65535 resolution 1	W
AV35	AnyParam Value	Value of ID defined by AV34	32 bits Value	W
AV36 [1]	Fb_Control_Word Lo16	Fixed Control Word First 16 bits 0-15	range 65535 - 0	C
AV37 [1]	Fb_Control_Word Hi16	Fixed Control Word Last 16 bits 16-31	range 65535 - 0	C
AV38	Fb_Status_Word Lo16	Fixed Status Word First 16 bits 0-15	range 65535 - 0	R
AV39	Fb_Status_Word Hi16	Fixed Status Word Last 16 bits 16-31	range 65535 - 0	R

1) ANSI/IEEE-754 floating point. Binary coding can be done only if the value has no decimals.
2) Map only analog data to these objects. If binary coded data is mapped into these objects, the data may be invalid because of ANSI/IEEE-754 floating point to 32bit integer conversion.

NOTE! Present Value Access Types: **R** = Read-only, **W** = Writeable, **C** = Commandable. Commandable values support priority arrays & relinquish defaults.

High and Low limits for the objects are defined in the application. See corresponding application for exact limits.

6.3   Control word bits

Table 11. Control Word bits

Bit	Name	Value = 1	Value = 0	Description
B0	Start/Stop	Start request	Stop request	Start/Stop command to application
B1	Fwd/Rev	Reverse direction	Forward direction	Controls the direction of motor axis rotation
B2	Fault reset	Reset faults	No action	Command to reset fault
B3-B15	Not used			

6.4   Status word bits

Table 12. Status Word bits

Bit	Name	Value = 1	Value = 0	Description
B0	Ready	Ready	Not ready	Indicates whether the drive is ready or not
B1	Run	Running	Stop	Indicates whether the drive is running or stopped
B2	Direction	Counterclockwise	Clockwise	Indicates the rotation direction of the motor
B3	Fault	Faulted	Not faulted	Indicates if a fault is active
B4	Alarm	Alarm	No alarm	Indicates if an alarm is active
B5	AtReference	True	False	Reference frequency reached
B6	ZeroSpeed	True	False	Motor running at zero speed
B7-B15	Not used			

6.5   COV functionality

It is possible to subscribe to up to 20 objects for COV monitoring. When the change occurs, the subscribed object COV indication is sent with new object value.

When you subscribe to objects for COV monitoring, the object are added into background monitoring list that has 150ms update cycle per item. So, the update rate for COV indication is depending on the amoount of subscribed objects. The maximum amount of COV items to subscribe to is 20. This means that the update rate is 150ms – 3000ms for the whole list.

6.6   Processdata mapping in drive application

The drive application allows you to choose freely which data is mapped into processdata out objects. See the drive appllication 'Fieldbus DataMap' parameters (P3.6).

Some of the drive processdata values are available in BACnet analog value object and some are available via binary value objects.

fb_ProcessdataOut_01   BV7 - BV14 and AV15

fb_ProcessdataOut_02 - 08   AV16 - AV22

If binary coded data needs to be produced over BACnet, we recommend to use 'fb_ProcessdataOut_01' which is available via BV objects. Note that 'fb_ProcessdataOut_01' is also available via AV15 object but we recommend to use it only when an analog value is mapped into 'fb_ProcessdataOut_01'. Follow the same principle with 'fb_ProcessdataOut_01' – 'fb_ProcessdataOut_08' which are available in AV objects 16-22.

7.   FAULT TRACING

When an unusual operating condition is detected by the AC drive control diagnostics, the drive initiates a notification visible, for example, on the keypad. The keypad will show the ordinal number of the fault, the fault code and a short fault description.

The fault can be reset with the Reset button on the control keypad or via the I/O terminal. The faults are stored in the Fault history menu, which can be browsed. The different fault codes you will find in the table below. This fault table presents only the faults related to the fieldbus in use.

NOTE! If you need support in problems related to BACnet, send a description of the problem together with the Drive Info File taken with PC tool to your local support. In case of BACnet IP protocol please send also a "Wireshark" log from the situation if applicable.

7.1   Typical fault conditions

Fault condition	Possible cause	Remedy
Termination resistor	Missing or excessive termination resistor.	Install termination resistors at both ends of the fieldbus line.
Cabling	• Supply or motor cables are located too close to the fieldbus cable • Wrong type of fieldbus cable • Too long cabling	
Grounding	Inadequate grounding.	Ensure grounding in all points on the net
Connections	Faulty connections: • Excessive stripping of cables • Conductors in wrong terminals • Too loose connections of conductors	
Parameter	• Faulty address • Overlapping slave addresses • Wrong baud rate • Wrong control place selected	

7.2   Other fault conditions

The following fault tracing diagram will help you to locate and fix some of the most usual problems. If the problem persists contact your local distributor.
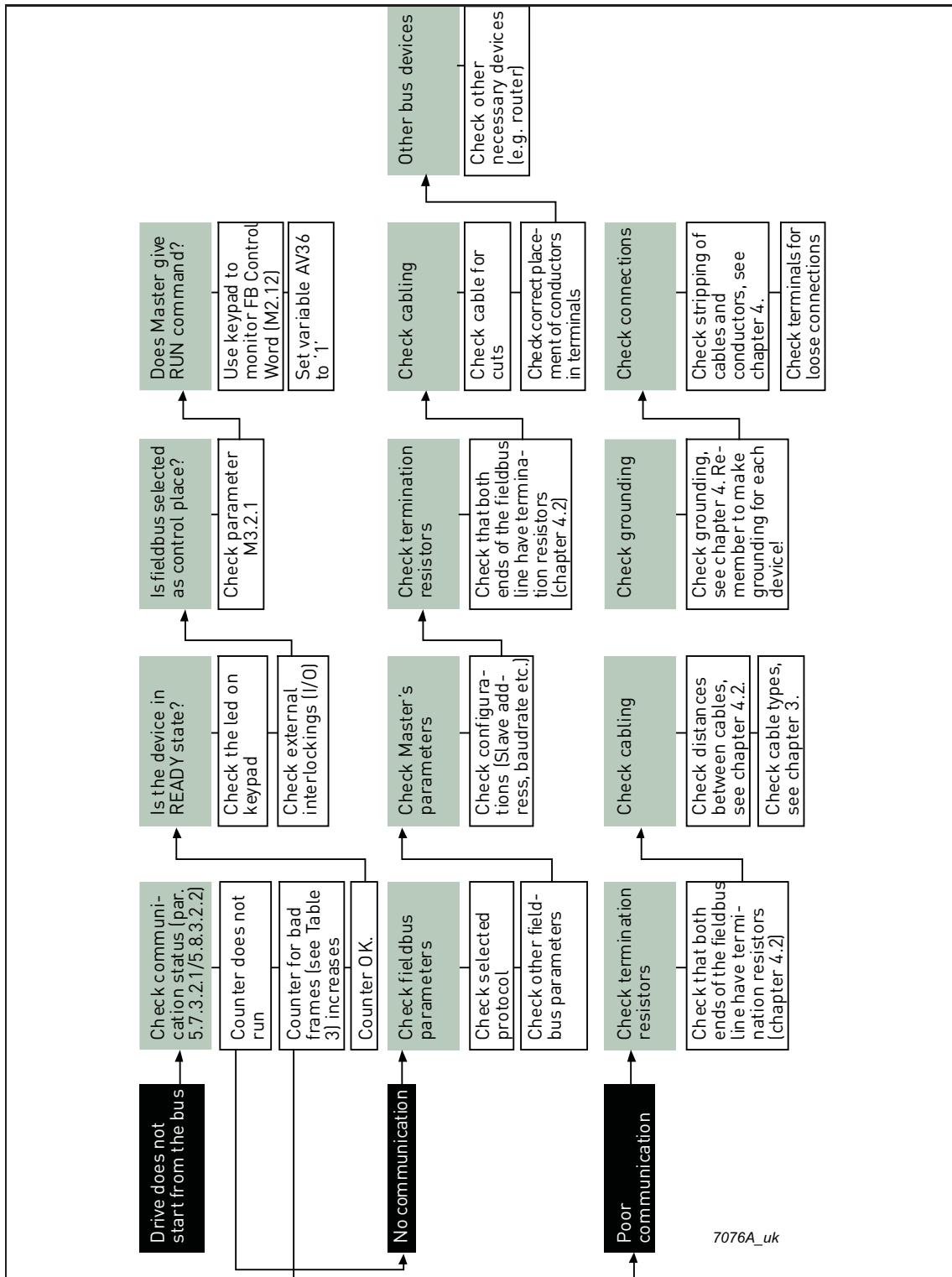

Figure 2. Fault tracing diagram for BACnet MS/TP

Drive does not start from the bus

Check communication status (par. P5.9.3.2.2)
- Counter does not run
- Counter for bad frames (see Table 3) increases
- Counter OK.

Is the device in READY state?
- Check the led on keypad
- Check external interlockings (I/O)

Is fieldbus selected as control place?
- Check parameter M1.15 or P3.2.1

Does Master give RUN command?
- Use keypad to monitor FB Control Word (M2.12)
- Set variable AV36 to '1'

No communication

Check fieldbus parameters
- Check BACnet IP 'protocol in use' parameter (P5.9.3.1.4)
- Check other fieldbus parameters

Check Master's parameters
- Check IP address, gateway etc.

Check cabling
- Check cable for cuts
- Check correct placement of conductors in terminals

Other bus devices
- Check other necessary devices (e.g. switches)

Poor communication

Check cabling
- Check distances between cables, see chapter 4.2.
- Check cable types, see chapter 3.

Check connections
- Check stripping of cables and conductors, see chapter 4.
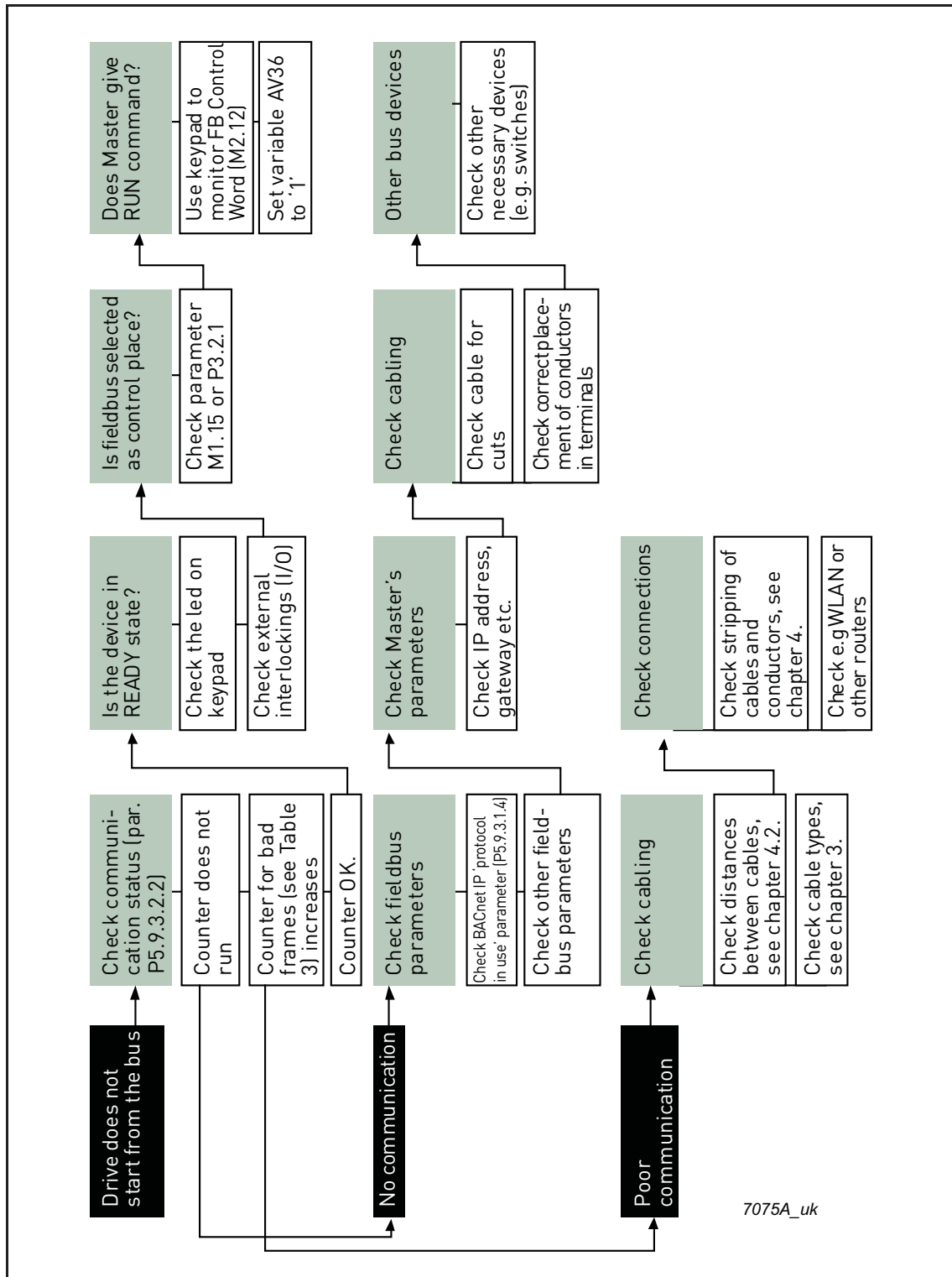- Check e.g WLAN or other routers

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Figure 3. Fault tracing diagram for BACnet IP

8.   QUICK SETUP

Following these instructions, you can easily and fast set up your BACnet bus for use.

1	Parametrize BACnet functionality as described in Chapter 4.
2	Make these settings in the master software. A. Set *Control Word* to **'0'** (AV36 Fb_Control_Word_Lo16). B. Set *Control Word* to **'1'** (AV36 Fb_Control_Word_Lo16). C. AC drive status is RUN. D. Set Reference value to **'50'** (50.00%) (AV24 Speed Reference). E. *Frequency setpoint* is **25.00 Hz** (if MinFreq is 0.00 Hz and MaxFreq is 50.00 Hz) F. Set *Control Word* to ´**0'** (AV36 Fb_Control_Word_Lo16). G. AC drive status is STOP.

9.   ANNEX - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT

PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)

(This annex is part of this Standard and is required for its use.)

BACnet Protocol Implementation Conformance Statement

Date: January 1, 2018

Vendor Name: Honeywell

Product Name: Honeywell SmartVFD

Product Model Number: Honeywell SmartVFD

Applications Software Version: 1.0

Firmware Revision: 1.0

BACnet Protocol Revision: 12

Product Description: Honeywell SmartVFD HVAC/SmartDrive HVAC variable frequency drive

BACnet Standardized Device Profile (Annex L): BACnet Application Specific Controller (B-ASC)

List all BACnet Interoperability Building Blocks Supported (Annex K): DS-RP-B, DS-RPM-B, DS-WP-B, DS-WPM-B, DS-COV-B, DM-TS-B, DM-UTC-B, DM-RD-B, DM-DDB-B, DM-DOB-B, DM-DCC-B.

Segmentation Capability:

☒ Segmented requests supportedWindow Size 8

☒ Segmented responses supportedWindow Size 8

Standard Object Types Supported:

Honeywell SmartVFD HVAC/SmartDrive HVAC product family supports:

- Device Object
- Analog Value Object
- Binary Value Object

The Analog Values that are *commandable* contain the *priority array* and *relinquish default* properties. All Analog Values that are not *commandable* become writable when the *out of service* property is set to true.

The Binary Values that are *commandable* contain the *priority array* and *relinquish default* properties. All Binary Values that are not *commandable* become writable when *out of service* property is set to true.

Device Object

Object property	Readable	Writable
object-identifier	x	
object-name	x	
object-type	x	
system-status	x	
vendor-name	x	
vendor-identifier	x	
model-name	x	
firmware-revision	x	
application-software-version	x	
description	x	
protocol-version	x	
protocol-revision	x	
protocol-services-supported	x	
protocol-object-types-supported	x	
object-list	x	
max-apdu-length-accepted	x	
segmentation-supported	x	
max-segments-accepted	x	
local-time	x	
local-date	x	
apdu-segment-timeout	x	
apdu-timeout	x	
number-of-apdu-retries	x	
max-master	x	
max-info-frames	x	
device-address-binding	x	
database-revision	x	
active-cov-subscriptions	x	

Analog Value Object

Analog Value Object - Commandable			
Object property	**Readable**	**Writable**	**Commandable**
object-identifier	x		
object-name	x		
object-type	x		
present-value	x		x
status-flags	x		
event-state	x		
out-of-service	x	x	
units	x		
priority-array	x		
relinquish-default	x	x	
cov-increment	x	x	

Analog Value Object - writable when out-of-service is set true		
Object property	**Readable**	**Writable**
object-identifier	x	
object-name	x	
object-type	x	
present-value	x	* x Normally 'read only' but becomes writable when out-of-service set to true
status-flags	x	
event-state	x	
out-of-service	x	x
units	x	
cov-increment	x	x

Binary Value Object

Binary Value Object - Commandable			
Object property	**Readable**	**Writable**	**Commandable**
object-identifier	x		
object-name	x		
object-type	x		
present-value	x		x
status-flags	x		
event-state	x		
out-of-service	x	x	
priority-array	x		

Binary Value Object - Commandable			
Object property	**Readable**	**Writable**	**Commandable**
relinquish-default	x	x	

Binary Value Object - writable when out-of-service is set true		
Object property	**Readable**	**Writable**
object-identifier	x	
object-name	x	
object-type	x	
present-value	x	* x Normally 'read only' but becomes writable when out-of-service set to true
status-flags	x	
event-state	x	
out-of-service	x	x
priority-array	x	
relinquish-default	x	x

Data Link Layer Options:

MS/TP master (Clause 9), baud rate(s): 9600,19200,34800, 76800 (supports autobaud detection)

BACnet IP, (Annex J), Foreign Device

Device Address Binding:

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes   ■No

Networking Options:

☐Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcast Management Device (BBMD)

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☒ ISO 10646 (UTF-8) ☐ IBM^{TM} /Microsoft^{TM} DBCS ☐ ISO 8859-1

☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4)   ☐ JIS X 0208

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