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# 1 Introduction

## 1.1 Introduction

### 1.1.1 About this Manual

First time users can obtain the most essential information for quick installation and set-up in these chapters:

- Introduction
- How to Install
- How to Configure the System
- Application Example

For more detailed information including the full range of set-up options and diagnosis tools please refer to the chapters:

- How to Control the Drive
- How to Access AF-600 FP Parameters
- Parameters
- Troubleshooting

### 1.1.2 Technical Overview

BACnet (Building Automation and Control Network) is an open data communications protocol, American National Standard (ANSI/ASHRAE 135-1995). BACnet provides a means by which computer-based control equipment from different manufacturers can work together. BACnet is designed to handle many types of building controls, including HVAC, lighting, security, fire, access control, maintenance and waste management. BACnet permits flexibility for expansion and different equipment combinations.

Conformance Classes, Function Groups and the PICS: Evaluating the capabilities of a BACnet device is potentially a formidable task, given the great choice of Objects, Properties and Services, which can be implemented, as well as the fact that it is not necessary for every BACnet device to have a full BACnet implementation in order to carry out its task. ASHRAE's BACnet Committee recognized this problem and responded with aids to evaluation in the form of "Conformance Classes," "Function Groups" and the "Protocol Implementation Conformance Statement" (PICS).

The BACnet protocol defines six levels of Conformance Classes, each of which specifies the minimum subset of Services implemented on the device. The lowest level, Conformance Class 1, requires only that the BACnet device contain a Device Object and that it be able to execute (respond to) a ReadProperty Service request. Each successive Conformance Class level adds Service Requests that must be executable by the device, as well as the Service Requests it must be able to initiate. Conformance Class 6 requires 21 types of Service Requests (of the 32 overall) to be implemented, of which 20 must be initi able and 17 executable. Conformance Class thus provides a measure of the device's ability to communicate.

Function Groups specify a combination of Objects and Services necessary to carry out certain building automation functions. They are specified independently of Conformance Class, though the implementation of some of the Function Groups automatically confers some Conformance Class higher than 1.



**Background information**

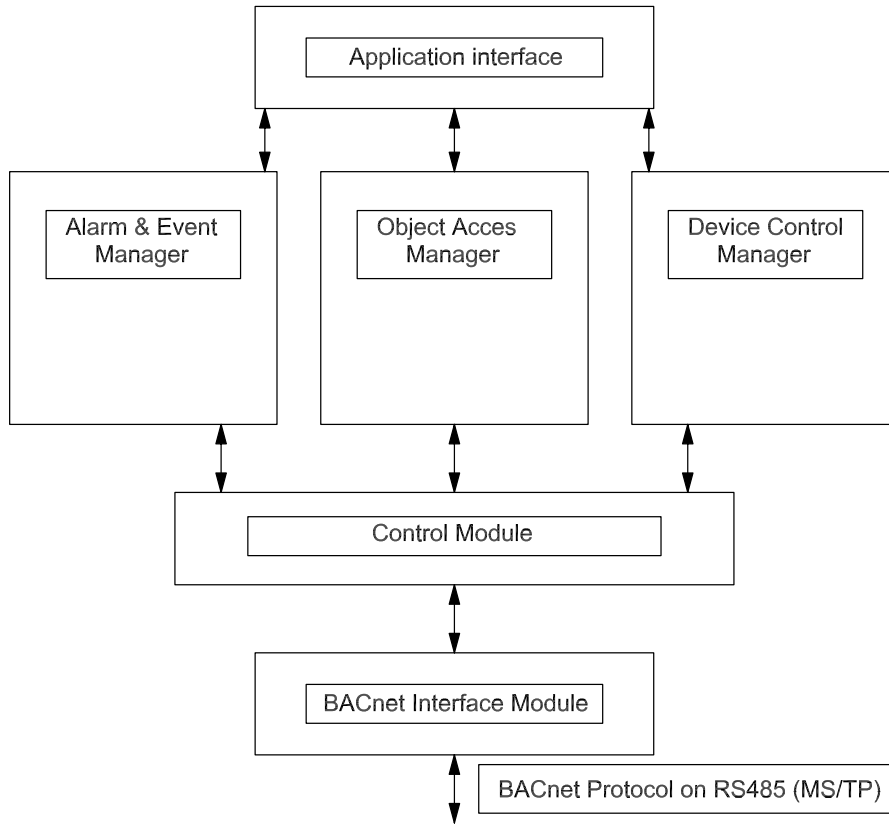
Protocol name:	BACnet
Technology developer:	ASHRAE
Year introduced:	1995
Governing standards:	ANSI/ASHRAE Standard 135-2004, ISO 16484-5
Openness:	Open specification

**Physical characteristics**

Network topology:	Bus
Physical media:	Shielded twisted pair
Max. Distance at low speed:	1200 meters

**Transport mechanism**

Communication methods:	Master/slave
Baud Rates Supported:	9600, 19200, 38400, 76800
Termination:	120 ohm



130BA669.10



### 1.1.3 Assumptions

This manual assumes you are using a GE BACnet Option Card in conjunction with a GE AF-600 FP seriesdrive. It is also assumed that your master is a BMS or PC equipped with a serial communication card supporting all the BACnet communication services required by your application, and that all requirements stipulated in the BACnet standard, as well as those pertaining to the Variable Speed Drive are strictly observed as well as all limitations therein fully respected.

### 1.1.4 Background Knowledge

The GE BACnet Option Card is designed to communicate with any master complying with the BACnet standard. Familiarity with the PC or PLC used as a master in the system is assumed. Issues regarding hardware or software produced by other manufacturers are beyond the scope of this manual and are not the responsibility of GE.

If you have questions regarding set-up of master-to-master communication or communication to a non-GE slave, please consult the appropriate manuals.

### 1.1.5 Available literature

- Operating Instructions provide the necessary information for getting the drive up and running.
- Design Guide entails all technical information about the drive and customer design and applications.
- Programming Guide provides information on how to program and includes complete parameter descriptions.

GE technical literature is available in print from your local GE Sales Office or online at: [www.geelectrical.com/drives](http://www.geelectrical.com/drives)

- AF-600 FP Built-in network manuals are available separately.



### 1.1.6 Abbreviations

**1**

ACI	Acyclical Control Interval	PCD	Process Data
AOC	Application Orientated Controller	PCA	Parameter Characteristics
BMS	Building Management System	PCV	Parameter-Characteristics-Value
CAN	Controller Area Network	PDU	Protocol Data Unit
CTW	Control Word	PLC	Programmable Logic Control
EEPROM	Electrical Erasable Programmable Read Only Memory	PNU	Parameter Number
EIA	Electronic Industries Association: Specifies of the EIA Standard RS 485-A	PVA	Parameter Value
EMC	Electromagnetic Compatibility	RC	Request/Response Characteristics
FDL	Network Data link Layer	STW	Status Word
FDT	Field Device Tool		
IND	Sub index		
I/O	Input/Output		
ISO	International Standards Organization		
LCD	Liquid Crystal Display		
LED	Light Emitting Diode		
MAV	Main Actual Value		
MOC	Motion Orientated Controller		
MRV	Main Reference Value		
PC	Personal Computer		



## 2 Safety

### 2.1 Safety

#### 2.1.1 Copyright, Limitation of Liability and Revision Rights

**2**

This publication contains information proprietary to GE. By accepting and using this manual the user agrees that the information contained herein will be used solely for operating equipment from GE or equipment from other vendors provided that such equipment is intended for communication with GE equipment over a serial communication link. This publication is protected under the Copyright laws of Denmark and most other countries.

GE does not warrant that a software program produced according to the guidelines provided in this manual will function properly in every physical, hardware or software environment.

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It has been assumed that all devices will be sitting behind a firewall that does packet filtering and the environment has well-implemented restrictions on the software that can run inside the firewall. All nodes are assumed to be "trusted" nodes.

## 2.1.2 Safety Precautions

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The voltage of the drive is dangerous whenever connected to mains. Incorrect installation of the motor, drive or network may cause damage to the equipment, serious personal injury or death. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

### Safety Regulations

1. The mains supply to the drive must be disconnected whenever repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains supply plugs.
2. The [OFF] button on the Keypad of the driver does not disconnect the mains supply and consequently it must not be used as a safety switch.
3. The equipment must be properly earthed, the user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage current exceeds 3,5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is desired, set par. F-10 *Electronic Overload* to data value Elec. OL trip 1 [4] or data value Elec. OL warning 1 [3].
6. Do not remove the plugs for the motor and mains supply while the drive is connected to mains. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains plugs.
7. Please note that the drive has more voltage sources than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) or external 24 V DC are installed. Check that all voltage sources have been disconnected and that the necessary time has elapsed before commencing repair work.

### Warning against unintended start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the drive is connected to mains. If personal safety considerations (e.g. risk of personal injury caused by contact with moving machine parts following an unintentional start) make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient. In such cases the mains supply must be disconnected.
2. The motor may start while setting the parameters. If this means that personal safety may be compromised (e.g. personal injury caused by contact with moving machine parts), motor starting must be prevented by disconnection of the motor connection.
3. A motor that has been stopped with the mains supply connected, may start if faults occur in the electronics of the drive, through temporary overload or if a fault in the power supply grid or motor connection is remedied. If unintended start must be prevented for personal safety reasons (e.g. risk of injury caused by contact with moving machine parts), the normal stop functions of the drive are not sufficient. In such cases the mains supply must be disconnected.
4. Control signals from, or internally within, the drive may in rare cases be activated in error, be delayed or fail to occur entirely. When used in situations where safety is critical, e.g. when controlling the electromagnetic brake function of a hoist application, these control signals must not be relied on exclusively.



Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back up.

Systems where frequency converters are installed must, if necessary, be equipped with additional monitoring and protective devices according to the valid safety regulations, e.g. law on mechanical tools, regulations for the prevention of accidents etc. Modifications on the frequency converters by means of the operating software are allowed.

### Protection Mode

Once a hardware limit on motor current or dc-link voltage is exceeded the drive will enter "Protection mode". "Protection mode" means a change of the PWM modulation strategy and a low switching frequency to minimize losses. This continues 10 sec after the last fault and increases the reliability and the robustness of the drive while re-establishing full control of the motor.

The "Protection mode" can be disabled by setting par. SP-26 *Trip Delay at Drive Fault* to zero which means that the drive will trip immediately if one of the hardware limits is exceeded.



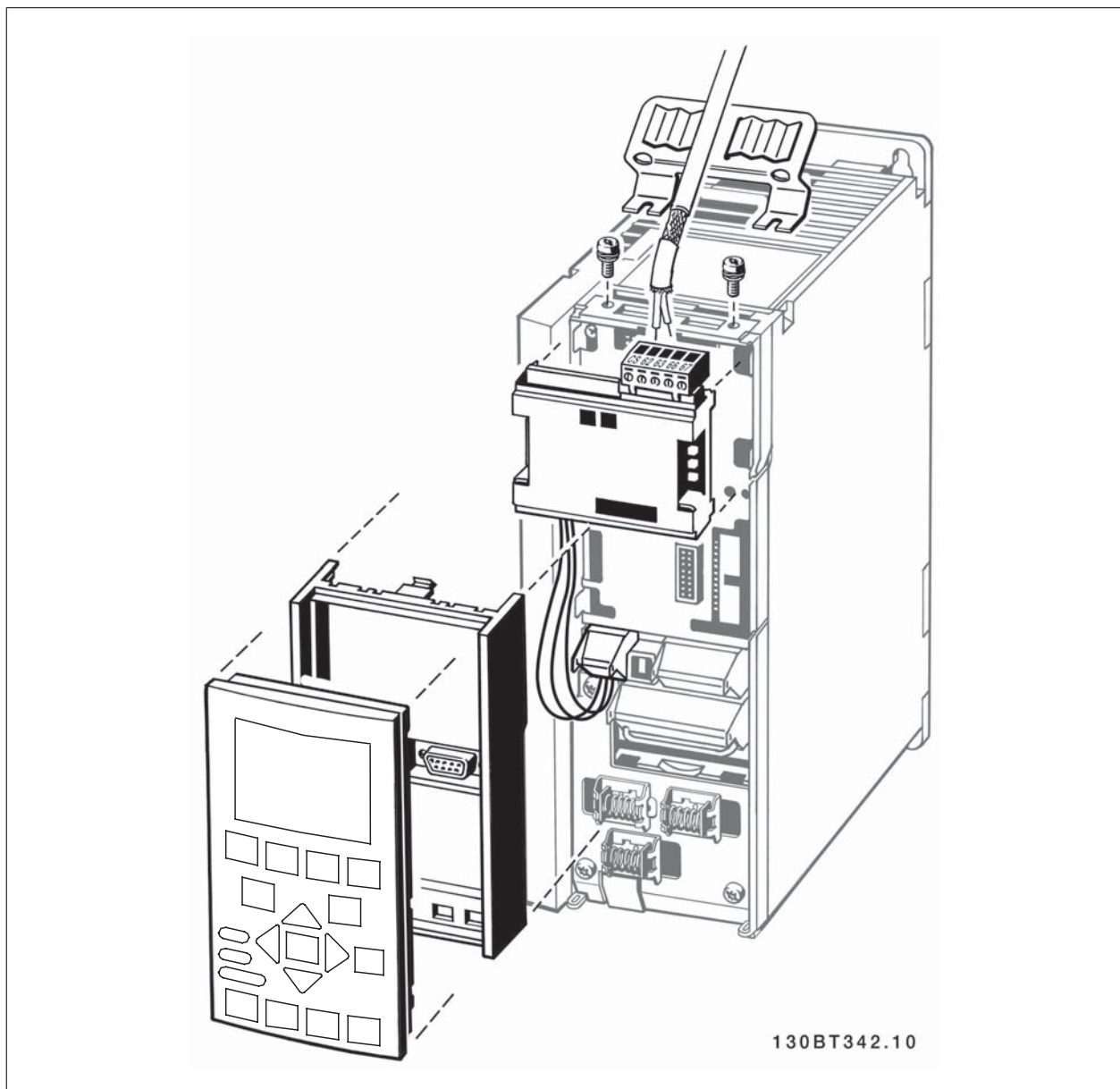
## 3 How to Install

### 3.1 The BACnet Option

#### 3.1.1 Installation of the Option

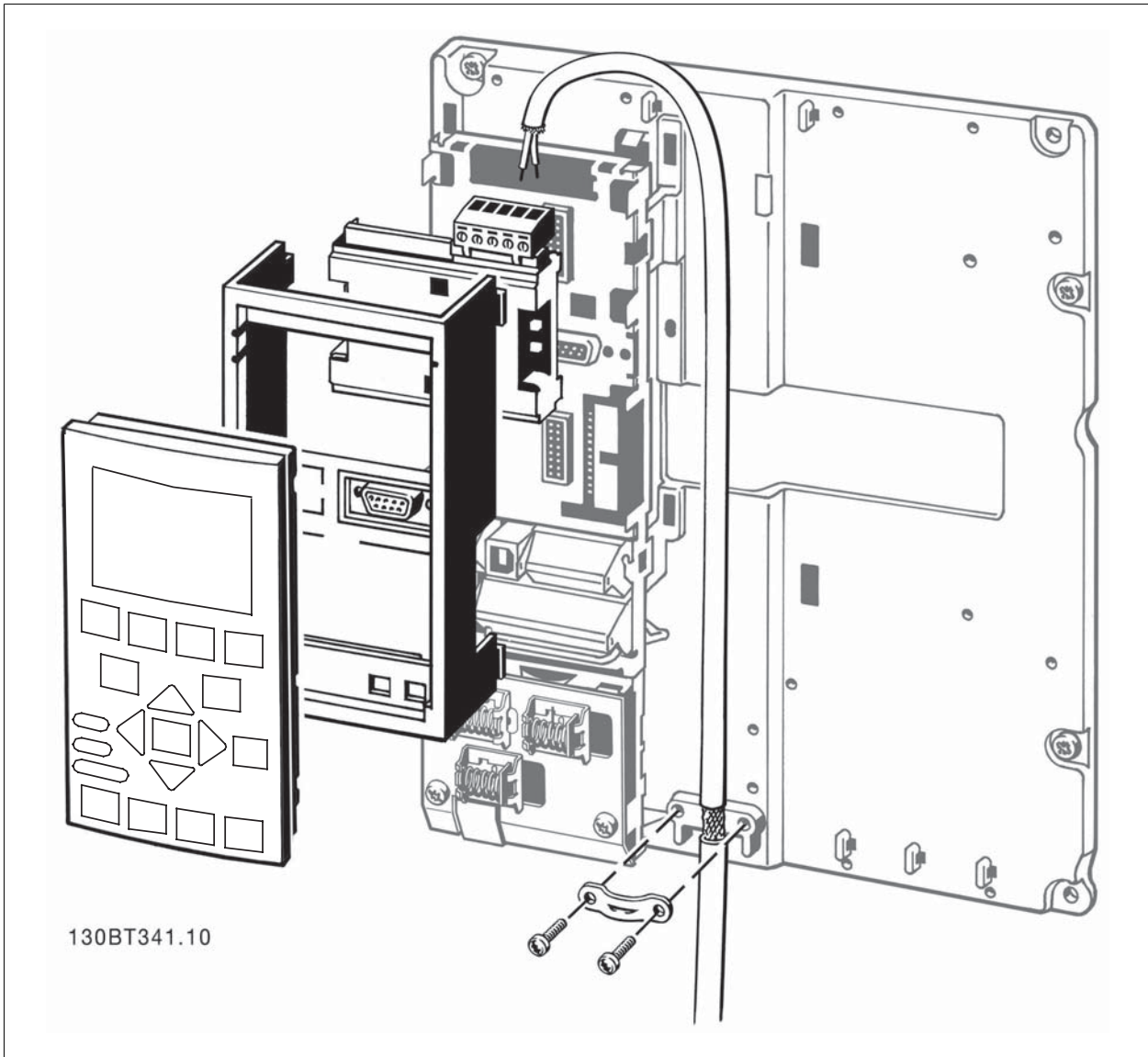
Items required to install a network option in the drive:

- The network option
- Network option adaptor frame for the drive. This frame is deeper than the standard frame, to allow space for the network option beneath.
- Cable holders



**Instructions:**

- Remove the Keypad from the drive.
- Remove the frame located beneath and discard.
- Push the option into place. Two positions are possible, with cable terminal facing either up or down. The cable up position is often most suitable when several frequency converters are installed side by side in a rack, as this position permits shorter cable lengths.
- Push the network option adaptor frame for the drive into place.
- Remove the Plug for the Drive Port and connect the Plug that is connected to the BACnet Option
- Replace the Keypad.
- Attach cable.
- Fasten the cable in place using cable holders. The drive top surface has pre-drilled threaded holes for attaching the cable holders to the unit.

**3**



### 3.1.2 Cabling

#### Cable lengths and number of nodes

The maximum cable length allowable in one segment is dependent on the transmission speed. The total cable length includes drop cables if any. A drop cable is the connection from the main bus cable to each node if a T-connection is used instead of permissible cable length and maximum number of nodes/Drives with 1, 2, 3 and 4 bus segments.

Drop cable connection (i.e. T-connection) beyond the cable lengths indicated is not recommended, due to the increased risk of reflection occurring. Instead, GE recommends direct connection of the drive.

Note that a repeater is a node in both of the two segments it connects. The number of frequency converters is based on a single master system. If there are two or more masters (e.g. PC tools, Routers), the number of frequency converters must be reduced correspondingly.

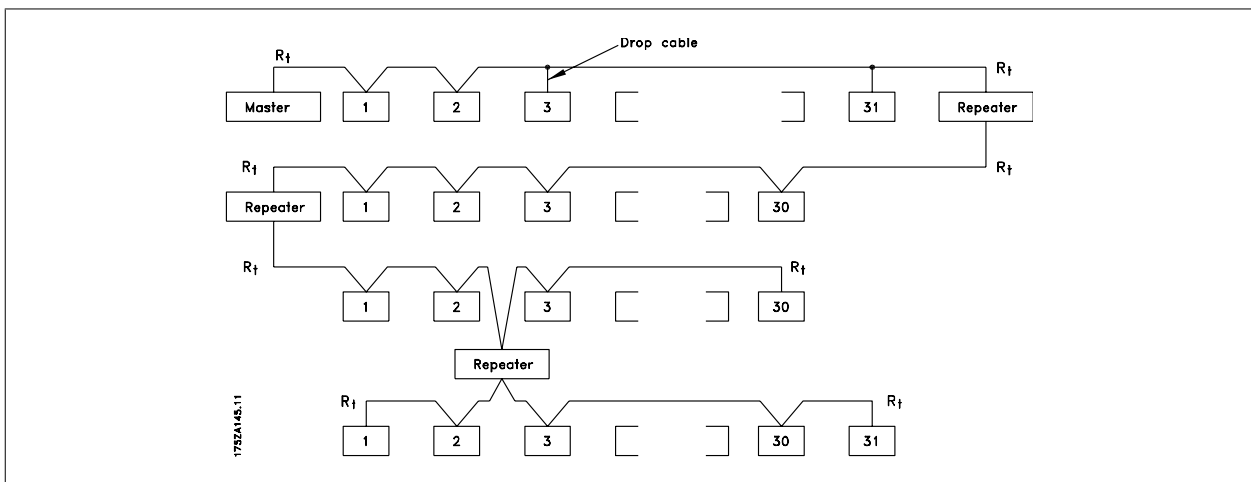


Network topology	Maximum cable length
Free topology without repeater	500 m
Free topology with one repeater	1000 m
Free topology maximum device-to-device	500 m
Bus topology single terminated	500 m
Bus topology double terminated without repeater	2700 m
Bus topology double terminated with one repeater	5400 m
Bus topology maximum stub length	3 m

The length statements in the tables above are valid for bus cable with the following properties:

- Impedance: 135 to 165 Ohm at a measuring frequency from 3 to 20 MHz
- Resistance: <110 Ohm/km
- Capacitance: <30 pF/m
- Damping: max. 9 dB over the whole wire length
- Cross section: max. 0.34 mm<sup>2</sup>, corresponding to AWG 22
- Cable type: twisted in pairs, 1 x 2, or 2 x 2, or 1 x 4 wires
- Shielding: Copper-braided screen or braided screen and foil screen

Use of the same cable type throughout the entire segment is recommended to avoid impedance mismatch.

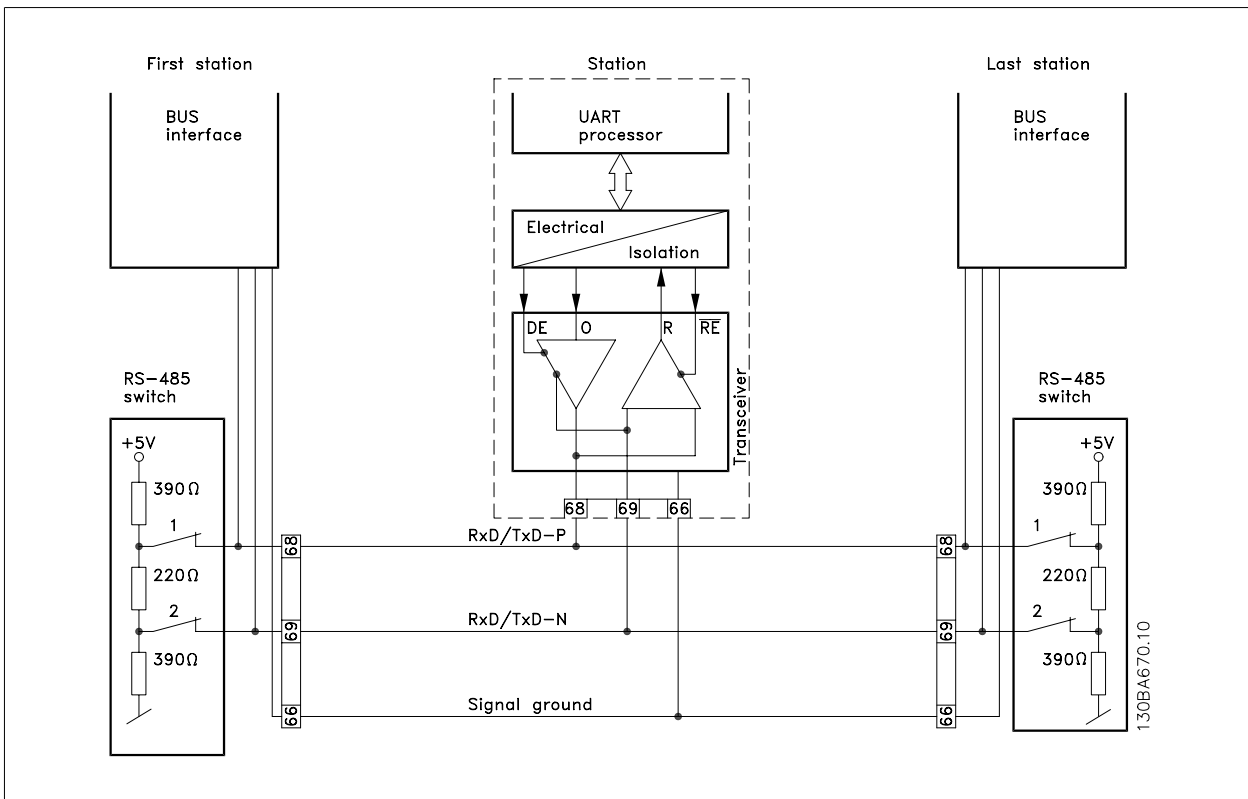
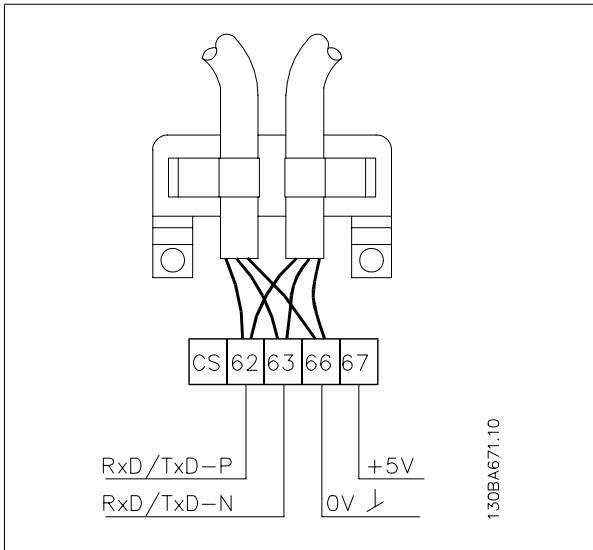


### 3.1.3 Network Termination

#### Connecting the Bus Line

Connect the BACnet Option Card to the network line via terminals 62, 63 and 66. Terminal 62 is Marked Red and Terminal 63 is marked Green. These two are the RS485 lines. Terminal 66 the signal Ground for the RS485 Transmitter.

3



#### Maximum Cable Lengths

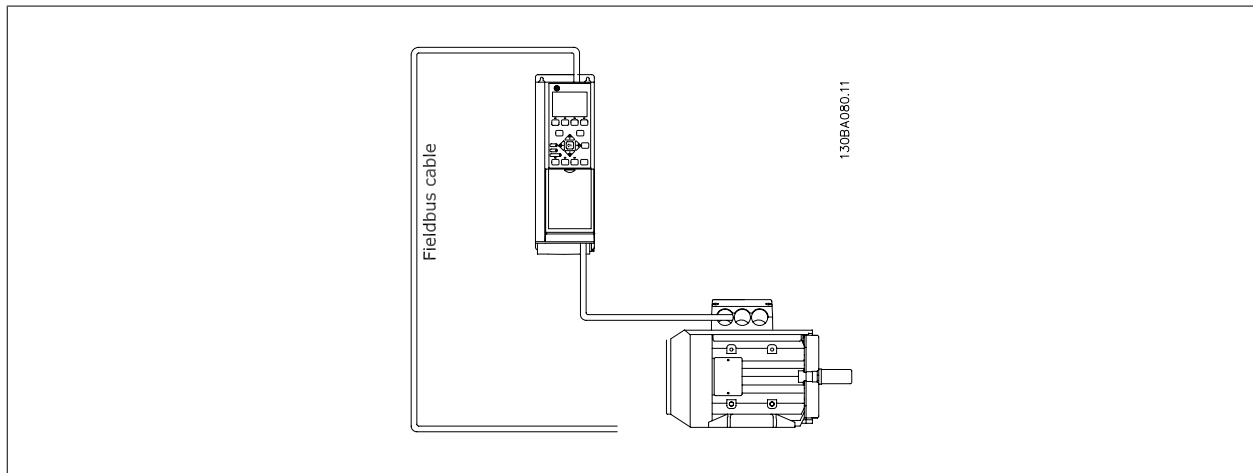
Maximum total network cable length: 4000Feet ~ 1200Meter



### 3.1.4 Cable Routing

The BACnet communication cable must be kept away from motor cables to avoid coupling of high frequency noise from one cable to the other. Normally a distance of 200 mm is sufficient, but maintaining the greatest possible distance between cables is generally recommended, especially where cables run in parallel over long distances.

When crossing is unavoidable, the BACnet cable must cross motor at an angle of 90 degrees.



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## 3.2 System Specifications

### 3.2.1 EMC Precautions

The following EMC precautions are recommended to achieve interference-free operation of the BACnet network. Additional EMC information is available in the *AF-600 FP Drive Design Guide*. Please also consult the BACnet master manual for further installation guidelines.

**NB!**

Ensure compliance with relevant national and local regulations, for example in protective earth connection.

### 3.2.2 Connection of the Cable Screen

It is recommended to connect the screen to ground in both end of the Bus Cable. This ensures the optimum resistance towards EMC noise. Screen of the BACnet cable must always be connected to ground at both ends, meaning the screen must be connected to ground in all stations connected to the BACnet network. It is very important to have a low impedance ground connection of the screen, also at high frequencies. This can be obtained by connecting the surface of the screen to ground, for example by means of a cable clamp or a conductive cable gland. The AF-600 FP Series has various clamps and brackets to enable a proper ground connection of the BACnet cable screen.

### 3.2.3 Earth Connection

It is important that all stations connected to the BACnet network are connected to the same earth potential. The earth connection must have low HF (high frequency) impedance. This can be achieved by connecting a large surface area of the cabinet to earth, for example by mounting the AF-600 FP series on a conductive rear plate. Particularly when there are long distances between the stations in a BACnet network, it can be necessary to use additional potential equalizing cables, connecting the individual stations to the same earth potential. The use of Repeaters with galvanic isolation or Fibre optic can improve the EMC performance and reduce Ground loop Current.





## 4 How to Configure the System

### 4.1 Configuring BACnet

#### 4.1.1 Initialization Procedure

The Initialization Procedure is explained by the flow chart given below:

##### Initialization Parameter

##### General Settings

Name	Parameter Number	Default Value	Setting for BACnet
Control Site	O-01	Digital and control word	Digital and control word
Control word source	O-02	Drive RS-485	Drive RS-485
ControlWord Timeout time	O-03	1.0 sec	1.0 sec
ControlWord Timeout Function	O-04	Off	Off
End of Timeout Function	O-05	Resume setup	Resume setup
Reset ControlWord Timeout	O-06	Do not reset	Do not reset
Diagnosis	O-07	Set up	Don't care
ControlWord Profile	O-10	Drive protocol	Drive protocol

##### Drive Port Settings

Name	Parameter Number	Default Value	Setting for BACnet
Protocol	O-30	Drive	Drive Option
Address	O-31	1	1
Baud Rate	O-32	9600 baud	9600 baud
Minimum Response Delay	O-35	10 ms	10 ms
Max Response Delay	O-36	5000 ms	5000 ms

Table 4.1: 1) Please see also section: Parameter Overview >Parameter List.

**Digital/Bus settings**

Name	Parameter Number	Default Value	Setting for BACnet
Coasting Select	O-50	Logic-or	Logic-or
Quick Stop Select	O-51	Logic-or	Logic-or
DC Brake Select	O-52	Logic-or	Logic-or
Start Select	O-53	Logic-or	Logic-or
Reversing Select	O-54	Logic-or	Logic-or
Set-up Select	O-55	Logic-or	Logic-or
Preset reference Select	O-56	Logic-or	Logic-or

**4****BACnet settings**

Name	Parameter Number	Default Value	Setting for BACnet
BACnet device Instance	BN-70	1	1
MS/TP Max Masters	BN-73	127	Depent on the Number of Masters in the system
"I am" Service	BN-74	At power up	At power up
Initialisation Password	BN-75	"admin"	"admin"

**4.1.2 Control Word Time-out Function**

par. O-03 *Control Word Timeout Time* and par. O-04 *Control Word Timeout Function* are not enabled in this version of the BACnet option.

**4.2 BIBBs****4.2.1 Bibb's**

ReadProperty Service  
 ReadPropertyMultiple Service  
 WriteProperty Service  
 WritePropertyMultiple Service  
 ConfirmedEventNotification Service  
 UnconfirmedEventNotification Service  
 GetEventInformation Service  
 AcknowledgeAlarm Service  
 ReinitializeDevice Service  
 DeviceCommunicationControl Service  
 I-Have Service  
 Who-Has Service  
 Who-Is Service  
 I-am Service  
 TimeSynchronization





### 4.3 Example of a simple setup of BACnet

This example shows the necessary steps to set up the AF-600 FP BACnet interface with the following system requirements:

- MS/TP running at 38.400 Baud
- MAC address 20 for the AF-600 FP
- BACnet Device Instance 0 1025
- Highest number of a Master stack is 35
- Start/stop of Drive from BACnet only
- Reference from BACnet
- Read status of Drive (Actual speed)

Set the following parameters:

Name	Parameter number	Value
Protocol	O-30	Drive option [9]
Address	O-31	20
Drive Port Baud Rate	O-32	38,400 Baud [4]
Coasting Select	O-50	Bus [1]
BACnet device Instance	BN-70	1025
MS/TP Max Masters	BN-72	35

After the parameters have been set according to the table above, the drive has to be unpowered and repowered before the changes take effect. When the drive is detected by the BMS, the drive can be controlled by BV:1, which will start the motor if set to [1]. Setting AV:0 will set the speed reference of the drive. The actual speed can be monitored via AV:1. See also *Analog Input- and Output Objects* section.





## 5 How to Control the Drive

### 5.1.1 Reference Handling

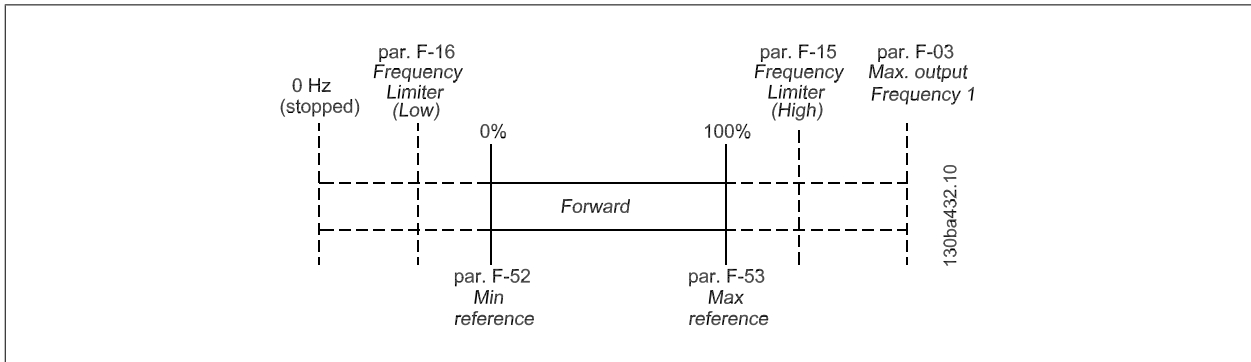
Select the drive configuration mode in par. H-40 *Configuration Mode*.

- [0] Open Loop
- [3] Closed Loop

#### Open Loop

For open loop operation, the reference represents the desired output speed of the drive.

The speed reference value:



#### Closed Loop

For closed loop operation, the reference represents the setpoint.

#### NB!

In closed loop operation, par. F-52 *Minimum Reference* and par. F-16 *Motor Speed Low Limit [Hz]* must be set to 0 Hz. Set the par. F-15 *Motor Speed High Limit [Hz]* to a value greater than the setting in par. F-53 *Maximum Reference*.



## 5.2 Network Drive Control Inputs and -Outputs

### 5.2.1 Analog Input- and Output Objects

Control the drive from the BACnet network using 'objects'. The various types of 'objects' and their descriptions are shown in the following tables.

Object ID	Object Name	Read/Write	Changeable Description	Non volatile ram Store	Drive Par.	Alarm notification	Triggers Bus time-out
AI:0	Analog Input 53	R	Yes	No	DR-62	Yes	NO
AI:1	Analog Input 54	R	Yes	No	DR-64	Yes	NO
AI:2	Analog In X30/11	R	Yes	No	DR-75	Yes	NO
AI:3	Analog In X30/12	R	Yes	No	DR-76	Yes	NO
AI:4	Analog Input X42/1	R	Yes	No	LG-30	Yes	NO
AI:5	Analog Input X42/3	R	Yes	No	LG-31	Yes	NO
AI:6	Analog Input X42/5	R	Yes	No	LG-32	Yes	NO

Table 5.1: Analog inputs

Object ID	Object Name	Read/Write	Changeable Description	Non volatile ram Store	Linked to AF-600 FPPParameter	Alarm notification	Triggers Bus Timeout
AO:0	Terminal 42 Output Bus Control	W/R	Yes	No	AN-53	No	Yes
AO:1	Pulse out #27 Bus Control	W/R	Yes	No	E-93	No	Yes
AO:2	Pulse out #29 Bus Control	W/R	Yes	No	E-95	No	Yes
AO:3	Analogue Out X30/8 [mA]	W/R	Yes	No	AN-63	No	Yes
AO:4	Analogue output X42/7[V]	W/R	Yes	No	AO-43	No	Yes
AO:5	Analogue output X42/9[V]	W/R	Yes	No	AO-53	No	Yes
AO:6	Analogue output X42/11[V]	W/R	Yes	No	AO-63	No	Yes

Table 5.2: Analog outputs



Object ID	Object Name	Read/Write	Changeable Description	Non volatile ram Store	AF-600 FPPa-rameter	Alarm notification	Triggers Bus Time-out
AV:0	Reference	W/R	Yes	No	MRV	No	Yes
AV:1	Speed Act. Value	W/R	Yes	No	MAV	Yes	Yes
AV:2	Bus Feedback1	W/R	Yes	No	O-94	No	Yes
AV:3	Bus Feedback2	W/R	Yes	No	O-95	No	Yes
AV:4	Bus Feedback3	W/R	Yes	No	O-96	No	Yes
AV:5	Motor Voltage	Read	Yes	No	DR-12	Yes	No
AV:6	Motor Current	Read	Yes	No	DR-14	Yes	No
AV:7	Motor Torque %	Read	Yes	No	DR-22	Yes	No
AV:8	DC Link Voltage	Read	Yes	No	DR-30	Yes	No
AV:9	Motor thermal	Read	Yes	No	DR-18	Yes	No
AV:10	Heat sink Temperature	Read	Yes	No	DR-12	Yes	No
AV:11	Inverter Thermal	Read	Yes	No	DR-35	Yes	No
AV:12	Operating Hours	Read	No	No	ID-00	No	No
AV:13	Running Hours	Read	No	No	ID-01	No	No
AV:14	KWh Counter	Read	No	No	ID-02	No	No
AV:15	Power [KW]	Read	No	No	DR-10	No	No
AV:16	PID Start Speed [Hz]	W/R	No	AF-600 FP	CL-83	No	No
AV:17	PID Proportional Gain	W/R	No	AF-600 FP	CL-93	No	No
AV:18	PID Integral Time (Sec)	W/R	No	AF-600 FP	CL-94	No	No
AV:19	PID Differential Time (Sec)	W/R	No	AF-600 FP	CL-95	No	No
AV:20	PID Dif. Gain Limit	W/R	No	AF-600 FP	CL-96	No	No
AV:21	On Reference Bandwith	W/R	No	AF-600 FP	CL-84	No	No
AV:22	Ext. 1 Setpoint	W/R	No	AF-600 FP	XC-15	No	No
AV:23	Ext. 1 Reference [Unit]	W/R	No	AF-600 FP	XC-17	No	No
AV:24	Ext. 1 Feedback [Unit]	W/R	No	AF-600 FP	XC-18	No	No
AV:25	Ext. 1 Propotional Gain	W/R	No	AF-600 FP	XC-21	No	No
AV:26	Reserved	W/R	No	Na			
AV:27	Ext. 1 Integral Time (Sec)	W/R	No	AF-600 FP	XC-22	No	No
AV:28	Ext. 1 Differential Time (Sec)	W/R	No	AF-600 FP	XC-23	No	No
AV:29	Ext. 1 Dif. Gain Limit	W/R	No	AF-600 FP	XC-24	No	No
AV:30	Reserved	W/R	No	Na			

Table 5.3: Analog values



Object ID	Object Name	Read/Write	Changeable Description	Non volatile ram Store	AF-600 FP Parameter	Alarm notification	Triggers Bus Timeout
AV:31	Ext. 2 Setpoint	W/R	No	AF-600 FP	XC-35	No	No
AV:32	Ext. 2 reference [Unit]	W/R	No	AF-600 FP	XC-37	No	No
AV:33	Ext. 2 Feedback [Unit]	W/R	No	AF-600 FP	XC-38	No	No
AV:34	Ext. 2 Proportional Gain	W/R	No	AF-600 FP	XC-41	No	No
AV:35	Ext. 2 Integral Time (Sec)	W/R	No	AF-600 FP	XC-42	No	No
AV:36	Ext. 2 Differential Time	W/R	No	AF-600 FP	XC-43	No	No
AV:37	Ext. 2 Dif. Gain	W/R	No	AF-600 FP	XC-44	No	No
AV:38	Ext. 3 Setpoint	W/R	No	AF-600 FP	XC-55	No	No
AV:39	Ext. 3 Reference [Unit]	W/R	No	AF-600 FP	XC-57	No	No
AV:40	Ext. 3 Feedback [Unit]	W/R	No	AF-600 FP	XC-58	No	No
AV:41	Ext. 3 Proportional Gain	W/R	No	AF-600 FP	XC-61	No	No
AV:42	Ext. 3 Integral Time (Sec)	W/R	No	AF-600 FP	XC-62	No	No
AV:43	Ext. 3 Differential Time (Sec)	W/R	No	AF-600 FP	XC-63	No	No
AV:44	Ext. 3 Dif. Gain Limit	W/R	No	AF-600 FP	XC-64	No	No

Table 5.4: Analog values cont.

### 5.2.2 Binary Input- and Output Objects

Object Id	Object Name	Read/Write	Changeable Description	Non volatile ram Store	Drive Par.	Alarm notification	Triggers Bus Timeout
Bl:0	Digital input 33	Read	No	No	DR-60/00	No	No
Bl:1	Digital input 32	Read	No	No	DR-60/01	No	No
Bl:2	Digital input 29	Read	No	No	DR-60/02	No	No
Bl:3	Digital input 27	Read	No	No	DR-60/03	No	No
Bl:4	Digital input 19	Read	No	No	DR-60/04	No	No
Bl:5	Digital input 18	Read	No	No	DR-60/05	No	No
Bl:6	Digital input 37	Read	No	No	DR-60/06	No	No
Bl:7	Digital input X30/2	Read	No	No	DR-60/07	No	No
Bl:8	Digital input X30/3	Read	No	No	DR-60/08	No	No
Bl:9	Digital input X30/4	Read	No	No	DR-60/09	No	No
Bl:10	Digital input DR-60/10*	Read	No	No	DR-60/10	No	No
Bl:11	Digital input DR-60/11*	Read	No	No	DR-60/11	No	No
Bl:12	Digital input DR-60/12*	Read	No	No	DR-60/12	No	No
Bl:13	Digital input DR-60/13*	Read	No	No	DR-60/13	No	No
Bl:14	Digital input DR-60/14*	Read	No	No	DR-60/14	No	No
Bl:15	Digital input DR-60/15*	Read	No	No	DR-60/15	No	No

Table 5.5: Binary inputs

Bl:7 - Bl:19 values are only available if the option is installed.

\*) Reserved for future options!



Object Id	Object Name	Read/Write	Changeable De- scription	Non volatile ram Store	Drive Par.	Alarm notifi- cation	Triggers Bus Time- out
BO:0	Digital output 27	W/R	No	No	E-90/00	No	Yes
BO:1	Digital output 29	W/R	No	No	E-90/01	No	Yes
BO:2	GPIO Output Term X30/6	W/R	No	No	E-90/02	No	Yes
BO:3	GPIO Output Term X30/7	W/R	No	No	E-90/03	No	Yes
BO:4	Relay 1 output	W/R	No	No	E-90/04	No	Yes
BO:5	Relay 2 output	W/R	No	No	E-90/05	No	Yes
BO:6	Option B Relay 1 output	W/R	No	No	E-90/06	No	Yes
BO:7	Option B Relay 2 output	W/R	No	No	E-90/07	No	Yes
BO:8	Option B Relay 3 output	W/R	No	No	E-90/08	No	Yes
BO:9	Reserved output E-90/9	W/R	No	No	E-90/09	No	Yes
BO:10	Reserved output E-90/10*	W/R	No	No	E-90/10	No	Yes
BO:11	Reserved output E-90/11*	W/R	No	No	E-90/11	No	Yes
BO:12	Reserved output E-90/12*	W/R	No	No	E-90/12	No	Yes
BO:13	Reserved output E-90/13*	W/R	No	No	E-90/13	No	Yes
BO:14	Reserved output E-90/14*	W/R	No	No	E-90/14	No	Yes
BO:15	Reserved output E-90/15*	W/R	No	No	E-90/15	No	Yes
BO:16	Option C Relay 1 output	W/R	No	No	E-90/16	No	Yes
BO:17	Option C Relay 2 output	W/R	No	No	E-90/17	No	Yes
BO:18	Option C Relay 3 output	W/R	No	No	E-90/18	No	Yes
BO:19	Option C Relay 4 output	W/R	No	No	E-90/19	No	Yes
BO:20	Option C Relay 5 output	W/R	No	No	E-90/20	No	Yes
BO:21	Option C Relay 6 output	W/R	No	No	E-90/21	No	Yes
BO:22	Option C Relay 7 output	W/R	No	No	E-90/22	No	Yes
BO:23	Option C Relay 8 output	W/R	No	No	E-90/23	No	Yes
BO:24	Reserved output E-90/24*	W/R	No	No	E-90/24	No	Yes
BO:25	Reserved output E-90/25*	W/R	No	No	E-90/25	No	Yes

Table 5.6: Binary outputs

\*) Reserved for future options!



Object Id	Object Name	Read/Write	Changeable Description	Non volatile ram Store	Drive Par.	Alarm notification	Triggers Bus Timeout
BO:30	Reserved output E-90/30*	W/R	No	No	E-90/30	No	Yes
BO:31	Reserved output E-90/31*	W/R	No	No	E-90/31	No	Yes
BO:36	Reserved output E-90/26*	W/R	No	No	E-90/26	No	Yes
BO:37	Reserved output E-90/27*	W/R	No	No	E-90/27	No	Yes
BO:38	Reserved output E-90/28*	W/R	No	No	E-90/28	No	Yes
BO:39	Reserved output E-90/29*	W/R	No	No	E-90/29	No	Yes

Table 5.7: Binary outputs cont.

\*) Reserved for future options!

Object ID	Object Name	Read / Write	Changeable Description	Non volatile ram Store	Drive Par.	Alarm notification	Triggers Bus Timeout
BV:0	Com. Fault	R	No	NA	BACnet option	Yes	No
BV:1	Start	W/R	No	No	CTW	No	Yes
BV:2	Coasting	W/R	No	No	CTW, Bit 3 =0	No	Yes
BV:3	CW/CCW	W/R	No	No	CTW bit 15=1	No	Yes
BV:4	Jog	W/R	No	No	CTW bit 0 =1	No	Yes
BV:5	Reset	W	No	No	CTW bit 07 = 1	No	Yes
BV:6	Reset Kwh Counter	W	No	No	ID-06	No	NO
BV:7	Reset Running Hours Counter	W	No	No	ID-07	No	NO
BV:10	Drive Ready	R	No	NA	STW Bit 01	No	No
BV:11	Reverse	R	No	NA	STW Bit 15	No	No
BV:12	Speed = reference	R	No	NA	STW Bit 08	No	No
BV:13	Bus control	R	No	NA	STW Bit 09	No	No
BV:14	Tripped	R	No	NA	STW Bit 03	Yes	No
BV:15	Triplock	R	No	NA	STW Bit 06	Yes	No
BV:16 -20	Reserved	R	No				

Table 5.8: Binary values





Object ID	Object Name	Read / Write	Changeable De- scription	Non volatile ram Store	Drive Par.	Alarm notifi- cation	Triggers Bus Timeout
BV:40	Brake check	R	No	NA	DR-90/00	Yes	
BV:41	Pwr. Card Temp	R	No	NA	DR-90/01	Yes	
BV:42	Earth Fault	R	No	NA	DR-90/02	Yes	
BV:43	Ctrl.Card Temp	R	No	NA	DR-90/03	Yes	
BV:44	Ctrl. Word TO	R	No	NA	DR-90/04	Yes	
BV:45	Over Current	R	No	NA	DR-90/05	Yes	
BV:46	Torque Limit	R	No	NA	DR-90/06	Yes	
BV:47	Motor TH Over	R	No	NA	DR-90/07	Yes	
BV:48	Motor TH Over	R	No	NA	DR-90/08	Yes	
BV:49	Inverter Overld.	R	No	NA	DR-90/09	Yes	
BV:50	DC under Volt	R	No	NA	DR-90/10	Yes	
BV:51	DC over Volt	R	No	NA	DR-90/11	Yes	
BV:52	Short Circuit	R	No	NA	DR-90/12	Yes	
BV:53	Inrush Fault	R	No	NA	DR-90/13	Yes	
BV:54	Mains Fault	R	No	NA	DR-90/14	Yes	
BV:55	Auto Tune Not OK	R	No	NA	DR-90/15	Yes	
BV:56	Live Zero Error	R	No	NA	DR-90/16	Yes	
BV:57	Internal Fault	R	No	NA	DR-90/17	Yes	
BV:58	Brake Overload	R	No	NA	DR-90/18	Yes	
BV:59	U Phase Loss	R	No	NA	DR-90/19	Yes	
BV:60	V Phase Loss	R	No	NA	DR-90/20	Yes	
BV:61	W Phase Loss	R	No	NA	DR-90/21	Yes	
BV:62	Network Fault	R	No	NA	DR-90/22	Yes	
BV:63	24 V Supply Low	R	No	NA	DR-90/23	Yes	
BV:64	Mains fault	R	No	NA	DR-90/24	Yes	
BV:65	1.8V supply low	R	No	NA	DR-90/25	Yes	
BV:66	Brake Failure	R	No	NA	DR-90/26	Yes	
BV:67	Brake IGBT	R	No	NA	DR-90/27	Yes	
BV:68	Option Changed	R	No	NA	DR-90/28	Yes	
BV:69	Drive Initialized	R	No	NA	DR-90/29	Yes	
BV:70	Safe Stop	R	No	NA	DR-90/30	Yes	
BV:71	Brake low	R	No	NA	DR-90/31	Yes	
BV:72	Service trip DR-91/0	R	No	NA	DR-91/00	Yes	
BV:73	Service trip DR-91/1	R	No	NA	DR-91/01	Yes	
BV:74	Service trip DR-91/2	R	No	NA	DR-91/02	Yes	
BV:75	Service trip DR-91/3	R	No	NA	DR-91/03	Yes	
BV:76	Service trip DR-91/4	R	No	NA	DR-91/04	Yes	
BV:77	No flow	R	No	NA	DR-91/05	Yes	
BV:78	Dry Pump	R	No	NA	DR-91/06	Yes	
BV:79	Curve end	R	No	NA	DR-91/07	Yes	

Table 5.9: Binary values cont.



Object ID	Object Name	Read / Write	Changeable De- scription	Non volatile ram Store	Drive Par.	Alarm notifi- cation	Triggers Bus Timeout
BV:80	Broken Belt	R	No	NA	DR-91/08	Yes	
BV:81	Discharge High	R	No	NA	DR-91/08	Yes	
BV:82	Start fault	R	No	NA	DR-91/10	Yes	
BV:83	Speed limit	R	No	NA	DR-91/11	Yes	
BV:84	State fault DR-91/12	R	No	NA	DR-91/12	Yes	
BV:85	State fault DR-91/13	R	No	NA	DR-91/13	Yes	
BV:86	State fault DR-91/14	R	No	NA	DR-91/14	Yes	
BV:87	State fault DR-91/15	R	No	NA	DR-91/15	Yes	
BV:88	KTY Temperature error	R	No	NA	DR-91/16	Yes	
BV:89	Drive Fan error	R	No	NA	DR-91/17	Yes	
BV:90	ECB error	R	No	NA	DR-91/18	Yes	
BV:91	Alarm 1692/19	R	No	NA	DR-91/19	Yes	
BV:92	Alarm 1692/20	R	No	NA	DR-91/20	Yes	
BV:93	Alarm 1692/21	R	No	NA	DR-91/21	Yes	
BV:94	Alarm 1692/22	R	No	NA	DR-91/22	Yes	
BV:95	Alarm 1692/23	R	No	NA	DR-91/23	Yes	
BV:96	Alarm 1692/24	R	No	NA	DR-91/24	Yes	
BV:97	Alarm 1692/25	R	No	NA	DR-91/25	Yes	
BV:98	Alarm 1692/26	R	No	NA	DR-91/26	Yes	
BV:99	Alarm 1692/27	R	No	NA	DR-91/27	Yes	
BV:100	Alarm 1692/28	R	No	NA	DR-91/28	Yes	
BV:101	Alarm 1692/29	R	No	NA	DR-91/29	Yes	
BV:102	Alarm 1692/30	R	No	NA	DR-91/30	Yes	
BV:103	Alarm 1692/31	R	No	NA	DR-91/31	Yes	
BV:104	Brake Check	R	No	NA	DR-92/00	Yes	
BV:105	Pwr. Card Temp	R	No	NA	DR-92/01	Yes	
BV:106	Earth Fault	R	No	NA	DR-92/02	Yes	
BV:107	Ctrl. Card Temp	R	No	NA	DR-92/03	Yes	
BV:108	Ctrl. Word TO	R	No	NA	DR-92/04	Yes	
BV:109	Over Current	R	No	NA	DR-92/05	Yes	
BV:110	Torque Limit	R	No	NA	DR-92/06	Yes	
BV:111	Motor Th Over	R	No	NA	DR-92/07	Yes	
BV:112	Motor Electronic Thermal Overload Over	R	No	NA	DR-92/08	Yes	
BV:113	Inverter overld.	R	No	NA	DR-92/09	Yes	
BV:114	DC under Volt	R	No	NA	DR-92/10	Yes	
BV:115	DC over Volt	R	No	NA	DR-92/11	Yes	
BV:116	DC Voltage Low	R	No	NA	DR-92/12	Yes	
BV:117	DC Voltage high	R	No	NA	DR-92/13	Yes	
BV:118	Mains Ph. Loss	R	No	NA	DR-92/14	Yes	
BV:119	No Motor	R	No	NA	DR-92/15	Yes	
BV:120	Live Zero Error	R	No	NA	DR-92/16	Yes	

Table 5.10: Binary values cont.



Object ID	Object Name	Read / Write	Changeable De- scription	Non volatile ram Store	Drive Par.	Alarm notifi- cation	Triggers Bus Timeout
BV:121	10V low	R	No	NA	DR-92/17	Yes	
BV:122	Brake Overload	R	No	NA	DR-92/18	Yes	
BV:123	Brake Resistor	R	No	NA	DR-92/19	Yes	
BV:124	Brake IGBT	R	No	NA	DR-92/20	Yes	
BV:125	Speed Limit	R	No	NA	DR-92/21	Yes	
BV:126	Network Fault	R	No	NA	DR-92/22	Yes	
BV:127	24V Supply Low	R	No	NA	DR-92/23	Yes	
BV:128	Mains Failure	R	No	NA	DR-92/24	Yes	
BV:129	Current Limit	R	No	NA	DR-92/25	Yes	
BV:130	Low Temp	R	No	NA	DR-92/26	Yes	
BV:131	Voltage Limit	R	No	NA	DR-92/27	Yes	
BV:132	Encoder loss	R	No	NA	DR-92/28	Yes	
BV:133	Output Freq. limit	R	No	NA	DR-92/29	Yes	
BV:134	Safe stop	R	No	NA	DR-92/30	Yes	
BV:135	Ext. Status	R	No	NA	DR-92/31	Yes	
BV:136	Start delayed	R	No	NA	DR-93/00	Yes	
BV:137	Stop delayed	R	No	NA	DR-93/01	Yes	
BV:138	Clock failure	R	No	NA	DR-93/02	Yes	
BV:139	Fire mode was active	R	No	NA	DR-93/03	Yes	
BV:140	Reserved, P1693/04	R	No	NA	DR-93/04	Yes	
BV:141	No Flow	R	No	NA	DR-93/05	Yes	
BV:142	Dry Pump	R	No	NA	DR-93/06	Yes	
BV:143	End of Curve	R	No	NA	DR-93/07	Yes	
BV:144	Belt Broken	R	No	NA	DR-93/08	Yes	
BV:145	Discharge High	R	No	NA	DR-93/09	Yes	
BV:146	Reserved, DR-93/10	R	No	NA	DR-93/10	Yes	
BV:147	Reserved, DR-93/11	R	No	NA	DR-93/11	Yes	
BV:148	Reserved, DR-93/12	R	No	NA	DR-93/12	Yes	
BV:149	Reserved, DR-93/13	R	No	NA	DR-93/13	Yes	
BV:150	Reserved, DR-93/14	R	No	NA	DR-93/14	Yes	
BV:151	Reserved, DR-93/15	R	No	NA	DR-93/15	Yes	
BV:152	Reserved, DR-93/16	R	No	NA	DR-93/16	Yes	
BV:153	KTY Temperature	R	No	NA	DR-93/17	Yes	
BV:154	Drive Fan failure	R	No	NA	DR-93/18	Yes	
BV:155	ECB failure	R	No	NA	DR-93/19	Yes	

Table 5.11: Binary values cont.



Object ID	Object Name	Read / Write	Changeable De- scription	Non volatile ram Store	Drive Par.	Alarm notifi- cation	Triggers Bus Timeout
BV:156	Reserved, DR-93/20	R	No	NA	DR-93/20	Yes	
BV:157	Reserved, DR-93/21	R	No	NA	DR-93/21	Yes	
BV:158	Reserved, DR-93/22	R	No	NA	DR-93/22	Yes	
BV:159	Reserved, DR-93/23	R	No	NA	DR-93/23	Yes	
BV:160	Reserved, DR-93/24	R	No	NA	DR-93/24	Yes	
BV:161	Reserved, DR-93/25	R	No	NA	DR-93/25	Yes	
BV:162	Reserved, DR-93/26	R	No	NA	DR-93/26	Yes	
BV:163	Reserved, DR-93/27	R	No	NA	DR-93/27	Yes	
BV:164	Reserved, DR-93/28	R	No	NA	DR-93/28	Yes	
BV:165	Reserved, DR-93/29	R	No	NA	DR-93/29	Yes	
BV:166	PTC Temperature	R	No	NA	DR-93/30	Yes	
BV:167	Reserved, DR-93/31	R	No	NA	DR-93/31	Yes	
BV:168	Ramping active	R	No	NA	DR-94/00	No	
BV:169	Auto Tune Running	R	No	NA	DR-94/01	No	
BV:170	Start CW/CCW	R	No	NA	DR-94/02	No	
BV:171	Slowdown	R	No	NA	DR-94/03	No	
BV:172	Catch up	R	No	NA	DR-94/04	No	
BV:173	Feedback High	R	No	NA	DR-94/05	No	
BV:174	Feedback Low	R	No	NA	DR-94/06	No	
BV:175	Output Current High	R	No	NA	DR-94/07	No	
BV:176	Output Current Low	R	No	NA	DR-94/08	No	
BV:177	Output Freq High	R	No	NA	DR-94/09	No	
BV:178	Output Freq low	R	No	NA	DR-94/10	No	
BV:178	Brake Check OK	R	No	NA	DR-94/11	No	
BV:180	Brake Max	R	No	NA	DR-94/12	No	

Table 5.12: Binary values cont.

Object ID	Object Name	Read / Write	Changeable De- scription	Non volatile ram Store	Drive Par.	Alarm notifi- cation	Triggers Bus Timeout
BV:181	Braking	R	No	NA	DR-94/13	No	
BV:182	Out of Speed range	R	No	NA	DR-94/14	No	
BV:183	OVC Active	R	No	NA	DR-94/15	No	
BV:184	AC Brake	R	No	NA	DR-94/16	No	
BV:185	Password Timelock	R	No	NA	DR-94/17	No	
BV:186	Password status	R	No	NA	DR-94/18	No	
BV:187	Reference high	R	No	NA	DR-94/19	No	
BV:188	Reference low	R	No	NA	DR-94/20	No	
BV:189	Reference site	R	No	NA	DR-94/21	No	
BV:190	Reserved, DR-94/22	R	No	NA	DR-94/22	No	
BV:191	Reserved, DR-94/23	R	No	NA	DR-94/23	No	
BV:192	Reserved, DR-94/24	R	No	NA	DR-94/24	No	
BV:193	Reserved, DR-94/25	R	No	NA	DR-94/25	No	
BV:194	Reserved, DR-94/26	R	No	NA	DR-94/26	No	
BV:195	Reserved, DR-94/27	R	No	NA	DR-94/27	No	
BV:196	Reserved, DR-94/28	R	No	NA	DR-94/28	No	
BV:197	Reserved, DR-94/29	R	No	NA	DR-94/29	No	
BV:198	Reserved, DR-94/30	R	No	NA	DR-94/30	No	
BV:199	Reserved, DR-94/31	R	No	NA	DR-94/31	No	

Table 5.13: Binary values cont.



### 5.2.3 Multi-state Input- and Output Objects

#### Multi-state Variable

Object Id	Object Name	Read/Write	Changeable Description	Non volatile ram Store	Drive Par.	Alarm notification	Triggers Bus Timeout
MSV:0	LC Controller State	R	No	Non	DR-38	No	No
MSV:1	Setup selection	W/R	No	Non	Bit13&14 in CTW	No	No

#### Mailbox variable

Object Id	Object Name	Read/Write	Changeable Description	Non volatile ram Store	Drive Par.	Alarm notification	Triggers Bus Timeout
MBV:0	Mailbox Write	W/R	No	Non	PCV part of the send Drive telegram	No	No
MBV:1	Mailbox Read	R	No	Non	PCV part of the receive Drive telegram	No	No

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### 5.2.4 Real Time Clock Variable

The drive has a built-in real-time clock. The standard real-time clock has no battery back-up function, which will lead to a time stop if the Drive is unpowered. Some BACnet Master's can be programmed to send out the date and time as a Broadcast Telegram on a regular basis. The BACnet will update the real-time clock of the Drive if it receives this type of telegram: "Telegram".

## 5.3 Drive Feedback to Network

The BACnet option provides several output variables (nvo's) to the network, containing important drive -, motor- and I/O feedback data. The BACnet option transmits bound network variables only and sends feedback data when there is a change in value.

Influence of the digital input terminals upon the Drive Control Mode, par. O-50 *Coasting Select* to par. O-56 *Preset Reference Select*

The influence of the digital input terminals upon control of the drive can be programmed in par. O-50 *Coasting Select* to par. O-56 *Preset Reference Select*.

#### NB!

par. O-01 *Control Site* overrules the settings in *parameters O-50 to O-56*.

Each of the digital input signals can be programmed to logic AND, logic OR, or to have no relation to the corresponding bit in the control word. In this way a specific control command i.e. stop / coast, can be initiated by the network only, network AND Digital Input, or Ether Network OR Digital input terminal.



In order to control the drive via BACnet, par. O-50 *Coasting Select* must be set to either Bus [1], or to Logic AND [2] and par. O-01 *Control Site* must be set to Digital and ctrl. word [0] or Controlword only [2].

More detailed information and examples of logical relationship options are provided in the *Troubleshooting* chapter.



5.4.1 Object / Property Support Matrix

The following table summarises the Object Types and Properties supported:

Property	Device	Binary input	Binary output	Binary value	Analog input	Analog output	Analog value	Multistage value	File	Event notification class
Object identifier	X	X	X	X	X	X	X	X	X	X
Object Name	X	X	X	X	X	X	X	X	X	X
Object Type	X	X	X	X	X	X	X	X	X	X
System Status	X									
Vendor Name	X									
Vendor Identifier	X									
Model Name	X									
Firmware Revision	X									
Appl. Software Revision	X									
Location	X									
Description	X	X	X	X	X	X	X	X	X	X
Protocol Version	X									
Protocol Revision	X									
Services Supported	X									
Object Types Supported	X									
Object List	X									
Max. APDU Length	X									
Segmentation Support	X									
Local Time	X									
Local Date	X									
APDU Timeout	X									
Number APDU Retries	X									
Max Master	X									
Max Info Frames	X									
Device Address Binding	X									
Database Revision Present Value	X	X	X	X	X	X	X	X	X	X



**Object / Property Support Matrix, continued..**

Property	Device	Binary input	Binary output	Binary value	Analog input	Analog output	Analog value	Multistage value	File	Event notification class
Status Flags		X	X	X	X	X	X			
Event State		X	X	X	X	X	X			
Reliability		X	X	X	X	X	X			
Out-of-Service		X	X	X	X	X	X			
Number of States								X		
State Text								X		
Units					X	X	X			
Time Delay					X		X			
Notification Class					X		X			
High Limit					X		X			
Low Limit					X		X			
Deadband					X		X			
Limit Enable					X		X			
Event Enable					X		X			
Acked Transitions					X		X			
Notify Type					X		X			
Event Time Stamp					X		X			
Priority Array			X	X*		X	??	X		
Priority										X
ACK Required										X
Recipient List										X
# of Notification Class										X
Relinquish Default			X	X*		X	??	X		
Polarity		X	X							
Active Text		X	X	X						
Inactive Text		X	X	X						
File type									X	
File size									X	
Modification Date									X	
Archive									X	
Read Only									X	
File Access Method									X	

\*For commandable values only







## 6 Parameters

### 6.1 Parameter Overview

#### 6.1.1 Parameter List

Nr.	Title	Default value	Range	Conversion index	Data type
O-01	Control Site	Dig. and ctrl. word [0]	[0 - 2]	-	5
O-02	Control Source	Drive RS485 [0]	[0 - 4]	-	5
O-03	Control Timeout Time	1 s	0.1 - 18000	- 1	7
O-04	Control Timeout Function	Off [0]	[0 - 10]	-	5
O-05	End-of-timeout Function	Hold set-up [0]	[0 - 1]	-	5
O-06	Reset Control Timeout	Do not reset [0]	[0 - 1]	-	5
O-07	Diagnosis Trigger	Disable [0]	[0 - 3]	-	5
O-10	Control Profile	Drive profile protocol [0]	[0 - x]	-	5
O-30	Protocol	Drive			
O-31	Address	1	[0 - 255]		
O-32	Baudrate	9600	[0 - 7]		
O-33	Parity/Stop Bits	No Parity, 1 Stop Bit			
O-35	Minimum Response Delay	10ms			
O-36	Max Response Delay	5000mS			
O-37	Max Inter-Char Delay	25.00mS			
O-50	Coasting Select	Logic OR [3]	[0 - 3]	-	5
O-52	DC Brake Select	Logic OR [3]	[0 - 3]	-	5
O-53	Start Select	Logic OR [3]	[0 - 3]	-	5
O-54	Reversing Select	Logic OR [3]	[0 - 3]	-	5
O-55	Setup Select	Logic OR [3]	[0 - 3]	-	5
O-56	Preset Reference Select	Logic OR [3]	[0 - 3]	-	5
BN-70	BACnet Device Instance	1	[1-4194304]	-	
BN-72	MS/TP Max Masters	127	[1-127]	-	
BN-73	MS/TP Max Info Frames				
BN-74	"I am" Service	Once at powerup [0]	[0-1]	-	
BN-75	Initialisation Password	"admin"	String[19]		

Table 6.1: BACnet specific parameter list

Please refer to the *AF-600FP Drive Operating Instructions* for a comprehensive parameter list or to the *AF-600FP Drive Programming Guide* for detailed descriptions of parameters.



## 6.2 Parameter Description

### 6.2.1 O-## Options / Comms

Parameter group for configuring communications and options.

O-01 Control Site		
Option:		Function:
		The setting in this parameter overrides the settings in par. O-50 <i>Coasting Select</i> to par. O-56 <i>Preset Reference Select</i> .

[0] *	Digital and ctrl.word	Control by using both digital input and control word.
-------	-----------------------	---

[1]	Digital only	Control by using digital inputs only.
-----	--------------	---------------------------------------

[2]	Controlword only	Control by using control word only.
-----	------------------	-------------------------------------

O-02 Control Word Source		
Option:		Function:
		Select the source of the control word: one of two serial interfaces or four installed options. During initial power-up, the drive automatically sets this parameter to <i>Option A</i> [3] if it detects a valid network option installed in slot A. If the option is removed, the drive detects a change in the configuration, sets par. O-02 <i>Control Word Source</i> back to default setting <i>Drive Port</i> , and the drive then trips. If an option is installed after initial power-up, the setting of par. O-02 <i>Control Word Source</i> will not change but the drive will trip and display: <i>Alarm 67 Option Changed</i> .

[0]	None
-----	------

[1]	Drive Port
-----	------------

[2]	USB Port
-----	----------

[3] *	Option A
-------	----------

[4]	Option B
-----	----------

[5]	Option C0
-----	-----------

[6]	Option C1
-----	-----------

[30]	External Can
------	--------------

#### NB!

This parameter cannot be adjusted while the motor is running.

O-03 Control Word Timeout Time		
Range:		Function:
60.0 s*	[1.0 - 18000.0 s]	Enter the maximum time expected to pass between the reception of two consecutive messages. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in par. O-04 <i>Control Word Timeout Function Control Time-out Function</i> will then be carried out.  In LonWorks the following variables will trigger the Control Word Time parameter:
		nviStartStop
		nviReset Fault
		nviControlWord
		nviDrvSpeedStpt
		nviRefPcnt
		nviRefHz

**O-04 Control Word Timeout Function****Option:****Function:**

Select the time-out function. The time-out function is activated when the control word fails to be updated within the time period specified in par. O-03 *Control Word Timeout Time*. Choice [20] only appears after setting the N2 protocol.

[0] *	Off
[1]	Freeze output
[2]	Stop
[3]	Jogging
[4]	Max. speed
[5]	Stop and trip
[7]	Select setup 1
[8]	Select setup 2
[9]	Select setup 3
[10]	Select setup 4
[20]	N2 Override Release

In LonWorks, the time-out function is also activated when the following SNVT's fail to be updated within the time period specified in par. O-03 *Control Word Timeout Time*:

nviStartStop	nviDrvSpeedStpt
nviReset Fault	nviRefPcnt
nviControlWord	nviRefHz

**O-05 End-of-Timeout Function****Option:****Function:**

Select the action after receiving a valid control word following a time-out. This parameter is active only when par. O-04 *Control Word Timeout Function* is set to [Set-up 1-4].

[0]	Hold set-up	Retains the set-up selected in par. O-04 <i>Control Word Timeout Function</i> and displays a warning, until par. O-06 <i>Reset Control Word Timeout</i> toggles. Then the drive resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up active prior to the time-out.

**O-06 Reset Control Word Timeout****Option:****Function:**

This parameter is active only when the choice *Hold set-up* [0] has been selected in par. O-05 *End-of-Timeout Function*.

[0] *	Do not reset	Retains the set-up specified in par. O-04 <i>Control Word Timeout Function</i> , [Select setup 1-4] following a control time-out.
[1]	Do reset	Returns the drive to the original set-up following a control word time-out. When the value is set to <i>Do reset</i> [1], the drive performs the reset and then immediately reverts to the <i>Do not reset</i> [0] setting.

**O-07 Diagnosis Trigger****Option:****Function:**

This parameter has no function for LonWorks.

[0] *	Disable
[1]	Trigger on alarms
[2]	Trigger alarm/warn.

**O-10 Control Word Profile**

Option:	Function:
	Select the interpretation of the control and status words corresponding to the installed network. Only the selections valid for the network installed in slot A will be visible in the Keypad display.
[0] *	Drive Profile
[1]	PROFIdrive profile
[5]	ODVA
[7]	CANopen DSP 402

**O-30 Protocol**

Option:	Function:
	Protocol selection for the integrated Drive (standard) Port (RS485) on the control card. Parameter group BN-7# is only visible when Drive Option [9] is chosen.
[0] *	Drive Communication according to the Drive Protocol as described in the <i>AF-600 FP Design Guide, RS-485 Installation and Set-up</i> .
[1]	Drive MC Same as <i>Drive</i> [0] but to be used when downloading SW to the drive or uploading dll file (covering information regarding parameters available in the drive and their inter-dependencies) to Drive Control Tool DCT10.
[2]	Modbus RTU Communication according to the Modbus RTU protocol as described in the <i>AF-600 FP Design Guide, RS-485 Installation and Set-up</i> .
[3]	Metasys N2 Communication according to the Metasys N2 Protocol.
[4]	FLN
[9]	Drive Option To be used when a gateway is connected to the integrated RS-485 port, e.g. the BACnet gateway. Following changes will take place: -Address for the Drive port will be set to 1 and par. O-31 Address, is now used to set the address for the gateway on the network, e.g. BACnet. -Baud rate for the Drive port will be set to a fixed value (115.200 Baud) and par. O-32 Baud Rate, is now used to set the baud rate for the network port (e.g. BACnet) on the gateway.

**O-31 Address**

Range:	Function:
1. * [1. - 126.]	Enter the address for the Drive (standard) port. Valid range: 1 - 126.

**O-32 Drive Port Baud Rate**

Option:	Function:
	Baud rate selection depends on Protocol selection in par. O-30 <i>Protocol</i> .
[0]	2400 Baud
[1]	4800 Baud
[2] *	9600 Baud
[3]	19200 Baud
[4]	38400 Baud
[5]	57600 Baud
[6]	76800 Baud
[7]	115200 Baud

Default refers to the Drive Protocol.

**O-33 Drive Port Parity****Option:****Function:**

Parity and Stop Bits for the protocol par. O-30 *Protocol* using the Drive Port. For some of the protocols, not all options will be visible. Default depends on the protocol selected.

- [0] \* Even Parity, 1 Stop Bit
- [1] Odd Parity, 1 Stop Bit
- [2] No Parity, 1 Stop Bit
- [3] No Parity, 2 Stop Bits

**O-35 Minimum Response Delay****Range:****Function:**

10. ms\* [5. - 10000. ms]

Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

**O-36 Maximum Response Delay****Range:****Function:**

10001. ms\* [11. - 10001. ms]

Specify the maximum permissible delay time between transmitting a request and receiving a response. Exceeding this delay time will cause control word time-out.

**O-37 Maximum Inter-Char Delay****Range:****Function:**

25.00 ms\* [0.00 - 35.00 ms]

Specify the maximum permissible time interval between receipt of two bytes. This parameter activates time-out if transmission is interrupted.

**O-50 Coasting Select****Option:****Function:**

Select control of the coasting function via the terminals (digital input) and/or via the network.

- [0] Digit Input Activates Start command via a digital input.
- [1] Bus Activates Start command via the serial communication port or network option module.
- [2] Logic AND Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
- [3] \* Logic OR Activates Start command via the network/serial communication port OR via one of the digital inputs.

**NB!**

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

**O-52 DC Brake Select****Option:****Function:**

Select control of the DC brake via the terminals (digital input) and/or via the network.

- [0] Digit Input Activates Start command via a digital input.
- [1] Bus Activates Start command via the serial communication port or network option module.
- [2] Logic AND Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
- [3] \* Logic OR Activates Start command via the network/serial communication port OR via one of the digital inputs.

**NB!**

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

**O-53 Start Select**

Option:	Function:
	Select control of the drive start function via the terminals (digital input) and/or via the network.
[0] Digit Input	Activates Start command via a digital input.
[1] Bus	Activates Start command via the serial communication port or network option module.
[2] Logic AND	Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] * Logic OR	Activates Start command via the network/serial communication port OR via one of the digital inputs.

**NB!**

This parameter is active only when par. O-01 Control Site is set to [0] *Digital and control word*.

**O-54 Reversing Select**

Option:	Function:
	Select control of the drive reverse function via the terminals (digital input) and/or via the fieldbus.
[0] * Digit Input	Activates Reverse command via a digital input.
[1] Bus	Activates Reverse command via the serial communication port or fieldbus option.
[2] Logic AND	Activates Reverse command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] Logic OR	Activates Reverse command via the fieldbus/serial communication port OR via one of the digital inputs.

**NB!**

This parameter is active only when par. O-01 Control Site is set to [0] *Digital and control word*.

**O-55 Set-up Select**

Option:	Function:
	Select control of the drive set-up selection via the terminals (digital input) and/or via the network.
[0] Digit Input	Activates the set-up selection via a digital input.
[1] Bus	Activates the set-up selection via the serial communication port or network option module.
[2] Logic AND	Activates the set-up selection via the network/serial communication port, AND additionally via one of the digital inputs.
[3] * Logic OR	Activate the set-up selection via the network/serial communication port OR via one of the digital inputs.

**NB!**

This parameter is active only when par. O-01 Control Site is set to [0] *Digital and control word*.

**O-56 Preset Reference Select****Option:****Function:**

Select control of the drive Preset Reference selection via the terminals (digital input) and/or via the network.

[0] Digit Input

Activates Preset Reference selection via a digital input.

[1] Bus

Activates Preset Reference selection via the serial communication port or network option module.

[2] Logic AND

Activates Preset Reference selection via the network/serial communication port, AND additionally via one of the digital inputs.

[3] \* Logic OR

Activates the Preset Reference selection via the network/serial communication port OR via one of the digital inputs.

**NB!**

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

**BN-70 BACnet Device Instance****Range:****Function:**

1 \* [0 - 4194304]

Enter a unique ID number for the BACnet device.

**NB!**

This parameter is active only when par. O-30 *Protocol* is set to [9] *Drive Option*.

**BN-72 MS/TP Max Masters****Range:****Function:**

127 \* [0 - 127]

Define the address of the master which holds the highest address in this network. Decreasing this value optimises polling for the token.

**NB!**

This parameter is active only when par. O-30 *Protocol* is set to [9] *Drive Option*.

**BN-73 MS/TP Max Info Frames****Range:****Function:**

1 \* [1 - 65534]

Define how many info/data frames the device is allowed to send while holding the token.

**NB!**

This parameter is active only when par. O-30 *Protocol* is set to [9] *Drive Option*.

**BN-74 "I-Am" Service****Option:****Function:**

[0] \* Send at power-up

[1] Continuously

Choose whether the device should send the "I-Am" service message only at power-up or continuously with an interval of approx. 1 min.

**NB!**

This parameter is active only when par. O-30 *Protocol* is set to [9] *Drive Option*.

**BN-75 Initialization Password****Range:**

0 \* [0 - 0]

**Function:**

Enter the password needed for execution of Drive Re-initialisation from BACnet.

**NB!**This parameter is active only when par. 0-30 *Protocol* is set to [9] *Drive Option*.





## 7 Troubleshooting

### 7.1 Alarm-, Warning and Extended Status Word

#### 7.1.1 Alarm and warning messages

##### General

There is a clear distinction between alarms and warnings. In the event of an alarm, the drive will enter a fault condition. After the cause for the alarm has been cleared, the master must acknowledge the alarm message in order to start operation of the drive again. A warning, on the other hand, may appear when a warning condition arises, then disappear when conditions return to normal without interfering with the process.

Alarm Word and Warning Word are shown on the display in Hex format. If there is more than one warning or alarm, a sum of all warnings or alarms will be shown. Warning Word and Alarm Word are displayed in par. DR-90 to DR-95. For more information on the individual alarms and warnings, please refer to: *AF-600 FP Drive Design Guide*.

##### Warnings

All warnings within the drive are represented by a single bit within a Warning Word. A Warning Word is always an action parameter. Bit status FALSE [0] means no warning, while bit status TRUE [1] means warning. Each bit status has a corresponding text string message. In addition to the Warning Word message the master will also be notified via a change to bit 7 in the status word.

##### Alarms

Following an alarm message the drive will enter a fault condition. Only after the fault has been rectified and the master has acknowledged the alarm message by setting bit 3 in the Control Word, can the Drive resume operation. All alarms within the Drive are represented by a single bit within an Alarm Word. An Alarm Word is always an action parameter. Bit status FALSE [0] means no alarm, while bit status TRUE [1] means alarm.



## 7.1.2 Alarm words

Alarm word, par. DR-90 Alarm Word

Bit (Hex)	Alarm Word (par. DR-90 Alarm Word)
00000001	Brake check
00000002	Power card over temperature
00000004	Earth fault
00000008	Ctrl. card over temperature
00000010	Control word timeout
00000020	Over current
00000040	Torque limit
00000080	Motor thermistor over temp.
00000100	Motor Electronic Thermal Overload over temperature
00000200	Inverter overloaded
00000400	DC link under voltage
00000800	DC link over voltage
00001000	Short circuit
00002000	Inrush fault
00004000	Mains phase loss
00008000	Auto Tune not OK
00010000	Live zero error
00020000	Internal fault
00040000	Brake overload
00080000	Motor phase U is missing
00100000	Motor phase V is missing
00200000	Motor phase W is missing
00400000	Network fault
00800000	24V supply fault
01000000	Mains failure
02000000	1.8V supply fault
04000000	Brake resistor short circuit
08000000	Brake chopper fault
10000000	Option change
20000000	Drive initialized
40000000	Safe Stop
80000000	Not used

Alarm word 2, par. DR-91 Alarm Word 2

Bit (Hex)	Alarm Word 2 (par. DR-91 Alarm Word 2)
00000001	Service Trip, read / Write
00000002	Reserved
00000004	Service Trip, Typecode / Sparepart
00000008	Reserved
00000010	Reserved
00000020	No Flow
00000040	Dry Pump
00000080	End of Curve
00000100	Broken Belt
00000200	Not used
00000400	Not used
00000800	Reserved
00001000	Reserved
00002000	Reserved
00004000	Reserved
00008000	Reserved
00010000	Reserved
00020000	Not used
00040000	Fans error
00080000	ECB error
00100000	Reserved
00200000	Reserved
00400000	Reserved
00800000	Reserved
01000000	Reserved
02000000	Reserved
04000000	Reserved
08000000	Reserved
10000000	Reserved
20000000	Reserved
40000000	Reserved
80000000	Reserved



### 7.1.3 Warning words

Warning word , par. DR-92 *Warning Word*

Bit (Hex)	Warning Word (par. DR-92 <i>Warning Word</i> )
00000001	Brake check
00000002	Power card over temperature
00000004	Earth fault
00000008	Ctrl. card over temperature
00000010	Control word timeout
00000020	Over current
00000040	Torque limit
00000080	Motor thermistor over temp.
00000100	Motor Electronic Thermal Overload over temperature
00000200	Inverter overloaded
00000400	DC link under voltage
00000800	DC link over voltage
00001000	DC link voltage low
00002000	DC link voltage high
00004000	Mains phase loss
00008000	No motor
00010000	Live zero error
00020000	10V low
00040000	Brake resistor power limit
00080000	Brake resistor short circuit
00100000	Brake chopper fault
00200000	Speed limit
00400000	Network comm. fault
00800000	24V supply fault
01000000	Mains failure
02000000	Current limit
04000000	Low temperature
08000000	Voltage limit
10000000	Encoder loss
20000000	Output frequency limit
40000000	Not used
80000000	Not used

Warning word 2, par. DR-93 *Warning Word 2*

Bit (Hex)	Warning Word 2 (par. DR-93 <i>Warning Word 2</i> )
00000001	Start Delayed
00000002	Stop Delayed
00000004	Clock Failure
00000008	Reserved
00000010	Reserved
00000020	No Flow
00000040	Dry Pump
00000080	End of Curve
00000100	Broken Belt
00000200	Not used
00000400	Reserved
00000800	Reserved
00001000	Reserved
00002000	Reserved
00004000	Reserved
00008000	Reserved
00010000	Reserved
00020000	Not used
00040000	Fans warning
00080000	ECB warning
00100000	Reserved
00200000	Reserved
00400000	Reserved
00800000	Reserved
01000000	Reserved
02000000	Reserved
04000000	Reserved
08000000	Reserved
10000000	Reserved
20000000	Reserved
40000000	Reserved
80000000	Reserved



## 7.1.4 Extended status words

Extended status word, par. DR-94 Ext. Status Word

Bit (Hex)	Extended Status Word (par. DR-94 Ext. Status Word)
00000001	Ramping
00000002	Auto Tune tuning
00000004	Start CW/CCW
00000008	Not used
00000010	Not used
00000020	Feedback high
00000040	Feedback low
00000080	Output current high
00000100	Output current low
00000200	Output frequency high
00000400	Output frequency low
00000800	Brake check OK
00001000	Braking max
00002000	Braking
00004000	Out of speed range
00008000	OVC active
00010000	AC brake
00020000	Password Timelock
00040000	Password Protection
00080000	Reference high
00100000	Reference low
00200000	Local Ref./Remote Ref.
00400000	Reserved
00800000	Reserved
01000000	Reserved
02000000	Reserved
04000000	Reserved
08000000	Reserved
10000000	Reserved
20000000	Reserved
40000000	Reserved
80000000	Reserved

Extended status word 2, par. DR-95 Ext. Status Word 2

Bit (Hex)	Extended Status Word 2 (par. DR-95 Ext. Status Word 2)
00000001	Off
00000002	Hand / Auto
00000004	Not used
00000008	Not used
00000010	Not used
00000020	Relay 123 active
00000040	Start Prevented
00000080	Control ready
00000100	Drive ready
00000200	Quick Stop
00000400	DC Brake
00000800	Stop
00001000	Standby
00002000	Freeze Output Request
00004000	Freeze Output
00008000	Jog Request
00010000	Jog
00020000	Start Request
00040000	Start
00080000	Start Applied
00100000	Start Delay
00200000	Sleep
00400000	Sleep Boost
00800000	Running
01000000	Bypass
02000000	Fire Mode
04000000	Reserved
08000000	Reserved
10000000	Reserved
20000000	Reserved
40000000	Reserved
80000000	Reserved



## 7.2 LED Status

Check the LEDs. The two bi-colour LEDs on the BACnet card indicate the status of BACnet communication.

### LED 1: Net Status

Phases	Status	Bi-colour LED
Power On.	Hardware Not OK	Red
	Self test	Green
Running	Module OK	Green
	Recoverable fault	Red
Data exchange	Device communicating.	Green

### LED 2 : Module Status

Phases	Status	Bi-colour LED
Power On.	Unrecoverable fault Drive is not responding on internal bus	Red
	Self test configuration takes place	Green
Running	Module OK	Green
	Recoverable fault <ul style="list-style-type: none"> <li>• Configuration not OK e.g, P830</li> <li>• Drive tripped</li> </ul>	Red