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BACnet

CFW503

User's Guide

User’s Guide

CFW503

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The information below describes the reviews made in this manual.

Version	Revision	Description
-	R00	First edition.

CONTENTS

ABOUT THE MANUAL

This manual supplies the necessary information for the operation of the CFW503 frequency inverter using the BACnet protocol. This manual must be used together with the CFW503 user's manual and programming manual.

ABBREVIATIONS AND DEFINITIONS

DP Decentralized Periphery
EIA Electronic Industries Alliance
I/O Input/Output
ro Read only
rw Read/write
SAP Service Access Point

NUMERICAL REPRESENTATION

Decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter 'h' after the number. Binary numbers are represented with the letter 'b' after the number.

DOCUMENTS

The BACnet protocol was developed based on the following specifications and documents:

Document	Version	Source
Standard 135-2004	1.0	ANSI/ASHRAE/ISO

In order to obtain this documentation, consult BACnet ORG, witch is the organization that currently maintains, publishes and updates the information regarding the BACnet network.

IMPORTANT NOTICE ABOUT CYBERSECURITY AND COMMUNICATIONS

This product/equipment can connect and exchange information through networks and communication protocols. It has been designed and subjected to tests to ensure correct operation with other automation systems using the protocols mentioned in this manual. Therefore, it is essential that the customer understands the responsibilities in connection with information and cybersecurity when using this equipment.

Consequently, it is the exclusive obligation of the customer to adopt in-depth defense strategies and implement policies and measures to ensure the security of the system as a whole, including with regard to communications sent and received by the equipment. Among such measures, we can point out the installation of firewalls, antivirus and malware protection applications, data encryption, authentication control and physical user access.

WEG and its affiliates take no liability for damages or losses arising from cybersecurity breaches, including, but not limited to, unauthorized access, intrusion, information, or data leak and/or theft, denial-of-service attacks, or any other form of security breach. Using this product under conditions for which it was not specifically designed is not recommended and may result in damage to the product, the network, and the automation system. Thus, it is essential that the customer understand that the external intervention by third-party software applications, such as sniffers or applications with similar actions, has the potential to cause interruptions or restrictions in the functionality of the equipment.

TRADEMARKS

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1 INTRODUCTION TO THE SERIAL COMMUNICATION

In a serial interface, the data bits are sent sequentially through a communication channel, or busbar. Several technologies use serial communication for data transfer, including the RS485 interface.

The standards that specify the RS485 interface, however, do specify neither the format nor the character sequence for data transmission and reception. In this sense, besides the interface, it is also necessary to identify the protocol used for the communication.

The BACnet MS/TP network defines the BACnet message exchange using the RS485 interface as the physical layer.

The characteristics of the RS485 serial interfaces available in the CFW503 frequency inverter, as well as the BACnet protocol, will be presented next.

2 INTRODUCTION TO THE BACNET PROTOCOL

2.1 BACNET NETWORK

BACnet, acronym for “Building Automation Control Network”, is a protocol defined by the ANSI/ASHRAE/ISO Standard 135-2004. The protocol defines a model for building-automation, describing the interaction between devices and systems. The protocol defines:

- Data and commands structured in an object-oriented model;
- Services that describe the access to data;
- A flexible network architecture.

The BACnet standard defines six types of communication networks for transporting BACnet messages, as showed in the Figure 2.1 on page 2-1. The type of network defines the physical and data link layers. The six types of networks are:

- BACnet ARCnet;
- BACnet Ethernet;
- BACnet Lontalk;
- BACnet MS/TP;
- BACnet Point-to-Point;
- BACnet IP.

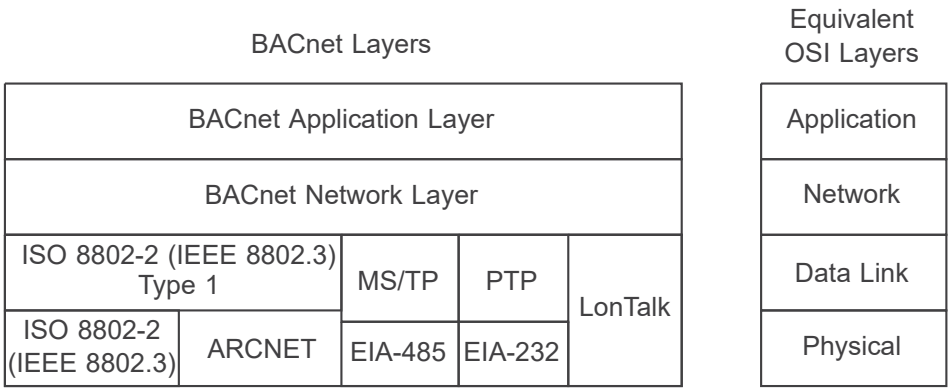

Figure 2.1: *BACnet protocol architecture*

A BACnet equipment contains an information collection defined as objects and properties.

A BACnet object represents physical or virtual information of the equipment, as a digital or analog input, control variables and parameters. The BACnet standard defines 25 types of objects. Each object is identified by a propriety called Object Identifier, which codifies the object instance type in a 32-bit binary number.

A BACnet property represents characteristics or information of a BACnet object. It is through the properties that other elements can access the equipment information. The property access can be defined as read-only or writing/reading. The BACnet specification defines services that are grouped in five categories:

- Object access;
- Device Management;
- Alarm and event;
- File transfer;
- Virtual terminal.

BACnet equipments can be classified in six different profiles according to the set of services made available:

- BACnet Operator Workstation (B-OWS);
- BACnet Building Controller (B-BC);
- BACnet Advanced Application Controller (B-AAC);
- BACnet Application Specific Controller (B-ASC);
- BACnet Smart Actuator (B-AS);

- BACnet Smart Sensor (B-SS).

2.2 BACNET MS/TP

In the CFW503, the BACnet protocol was developed using the RS485 standard for the physical and data link layers, called BACnet MS/TP (Master Slave/Token Passing). BACnet MS/TP nodes can be divided into two groups, master nodes and slave nodes, according to the node address range.

The access control to the communication mean is performed in two ways:

- **Master/Slave (MS):** It is used in the communication between a master node and a slave node;
- **Token passing (TP):** Communication only among master nodes. A logical ring is defined and the master that has the token can establish communication with slave nodes and other masters.

In a BACnet MS/TP network, the nodes are initialized and enter the IDLE state, waiting for the arrival of a telegram, which can be:

- Invalid frame: it remains in IDLE;
- Not desired frame: it remains in IDLE;
- Token: it enters the USE TOKEN state, executes the necessary communication (with slaves or other masters) and passes the token to the next node;
- Reception of a Poll of Master: it sends a telegram to the node with the address in the Source Address field;
- Reception of a DataNoReplay: it signalizes the reception to the higher layers;
- Reception of a DataNeedingReplay: it signalizes the reception to the higher layers and sends the requested response.

2.2.1 BACnet MS/TP Message Structure

The BACnet specification defines that the frame can have from 0 up to 501 bytes (octets), and that each byte is composed by 8 bits without parity, with start and stop bits, as showed in the Figure 2.2 on page 2-2.

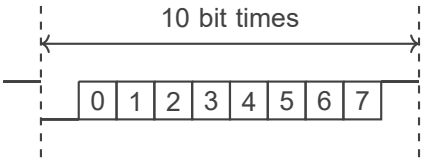

Figure 2.2: *Byte structure*

Reception (RX): The maximum time between bytes (Tframegap) is of 20-bit times, and the minimum time between frames (Tturnaround) after the last byte stop bit is of 40-bit times, according to the Figure 2.3 on page 2-2.

Transmission (TX): The RTS signal must be disabled after the end of the stop bit time (Tpostdrive), which is of 15-bit times.

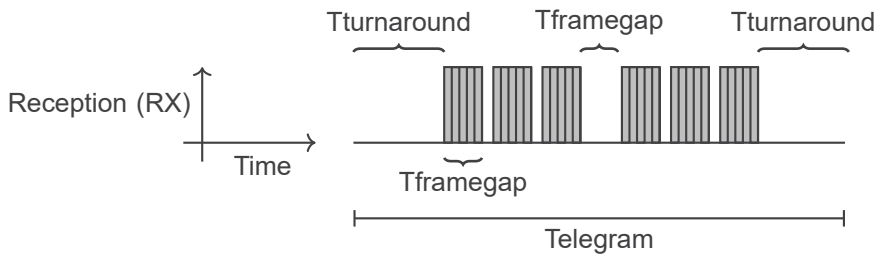

Figure 2.3: *BACnet data reception*

Header and data, as Table 2.1 on page 2-3 illustrates, form the BACnet data frame.

Table 2.1: *BACnet Frame*

HEADER								DATA		
0x55	0xFF	Frame type	Destination address	Source address	Length	Length	CRC	Data	CRC	CRC

Preamble: It is formed by two bytes with the 55h and FFh values respectively.

Frame type: The BACnet specification defines eight frame types, from 0 to 7. Frame Types 8 through 127 are reserved for the specification improvement, and from 128 through 255 are reserved for each vendor specific frames. The defined types are:

- 0 Token;
- 1 Poll for master;
- 2 Reply to poll for master;
- 3 Test request;
- 4 Test response;
- 5 BACnet data expecting reply;
- 6 BACnet data not expecting reply;
- 7 Reply postponed.

Only master nodes must acknowledge frame types 0, 1 and 2, the slave nodes must ignore them.

Token (0) frame type: it is used in the relationship between master nodes. It does not present data. The master node that has the token can initiate the communication. After sending the maximum number of data frames (Nmax_info_frames) and waiting any expected replies, it must pass the token to the next master.

Poll for Master (1) frame type: It is transmitted periodically during the configuration. It is used to discover the presence of other masters in the network and to determine the token sequence. Master nodes must respond and slave nodes must ignore it. It does not present data.

Reply to Poll for Master (2) frame type: It is the response of the master nodes to the Poll for Master (frame type 1). It does not present data.

Test Request (3) frame type: It is used to start the communication in the MS/TP network. It is applied to send a particular piece of information to a node.

Test Response (4) frame type: It is the response to a Test Request.

BACnet Data Expecting Reply (5) frame type: It is used by master nodes to convey the data parameter of a DL_UNITDATA.request that presents destination address, data, priority and message code, waiting for a response from the destination node.

BACnet Data not Expecting Reply (6) frame type: It is used by master nodes to convey the data parameter of a DL_UNITDATA.request that presents destination address, data, priority and message code. It does not wait for a response from the destination node.

Reply Postponed (7) frame type: It is used by master nodes to indicate that the response to a Data Expecting Reply frame will be sent later. It does not present data.

Destination and source addresses: It is formed by two bytes, destination and source, respectively.

Length: It is formed by two bytes that inform the number of data bytes in the message.

Header CRC: The last part of the header is the fields for checking header transmission errors. The used method is the CRC-8 (Cycling Redundancy Check).

Data: It may present from 0 to 501 bytes, according to the BACnet specification. Data in the CFW503 can present up to 59 bytes.

Data CRC: The last part of the telegram is the field for checking data transmission errors. The used method is the CRC-16 (Cycling Redundancy Check).

2.3 ADDRESS

It presents an address range from 0 to 254, where:

- The range from 0 to 127 is reserved for master or slave nodes;
- The range from 128 to 254 is used only by slave nodes.

The broadcast telegram must have FFh (255) in the destination address field.
The serial address is set using parameter P0308 in the CFW503.

2.4 BACNET PROFILE

The BACnet profile developed for the CFW503 is the B-ASC, with communication management services and data sharing that presents the following BIBBs (BACnet interoperability Building Blocks):

- DATA SHARING:
  - DS-RP-B: ReadProperty;
  - DS-WP-B: WriteProperty.
- DEVICE and NETWORK MGMT:
  - DM-DDB-B: WHO IS / I AM;
  - DM-DCC-B: Device Communication Control;
  - DM-DOB-B: Device Management Dynamic Object Binding B;
  - DM-RD-B: Device Management-Reinitialize Device-B.

2.4.1 ReadProperty (DS-RP-B)

A BACnet client (node performing a request to a server node) uses the ReadProperty service to obtain a BACnet object property value. This service allows reading access to the properties that have the R (reading) access type.

2.4.2 WriteProperty (DS-WP-B)

A BACnet client uses the WriteProperty service to modify the value of a specific BACnet object property. This service allows writing access to the properties that have the W (write) or C (commandable) access type.

2.4.3 WHO IS / I AM (DM-DDB-B)

The WHO IS / I AM service is used to identify the devices connected to the network. The WHO IS message is sent by the BACnet controller, and the nodes respond with an I AM message, informing their Object Identifier and address. The I AM message is transmitted in broadcast, and can be transmitted during initialization or continuous, according to the parameter P0764.

2.4.4 Device Management-Reinitialize Device-B (DM-RD-B)

The Reinitialize Device service is used to remotely reinitialize the equipment and uses a password to validate the service execution.
The BACnet standard defines that the password is a string (set of ASCII characters) with up to 20 positions. The password used for the CFW503 remote reinitialization is the same one used to allow the access for parameter content modifications, informed in the parameter P0000. This password can be a number between 0000 and 9999.
The BACnet password for the CFW503 is a 4-character string. Therefore, the BACnet password can be a number between 0000 and 9999.

E.g., considering that the CFW503 default password is 5, the remote reinitialization service will only be executed if the received password is “0005”.

3 INTERFACE DESCRIPTION

The interfaces for serial communication RS485 available for the CFW503 frequency inverter depend on the selected communication module for the product. Following are presented information about the connection and installation of the equipment, using different communication modules.

3.1 RS485 INTERFACE

3.1.1 RS485 Interface Characteristics

- The interface follows the EIA/TIA-485 standard.
- It allows communication baud rates from 9600 up to 38400 Kbit/s.
- The interface is electrically isolated and with differential signal, which grants more robustness against electromagnetic interference.
- It allows the connection of up to 32 devices to the same segment. More devices can be connected by using repeaters[1].
- A maximum bus length of 1000 meters.

3.1.2 Terminating resistor

It is necessary to enable a terminating resistor at both ends of the main bus for each segment of the RS485 network. If the equipment located at both ends of the bus does not have termination resistors, use active terminating to enable these resistors.

3.1.3 Indications

Details on the alarms, communications failures and communication states are made through the keypad (HMI) and product parameters.

3.1.4 Connection to the RS485 Network

The following points must be observed for the connection of the device using the RS485 interface:

- It is recommended the use of a shielded cable with a twisted pair of wires.
- It is also recommended that the cable has one more wire for the connection of the reference signal (GND). In case the cable does not have the additional wire, then the GND signal must be left disconnected.
- The cable must be laid separately (and far away if possible) from the power cables.
- All the network devices must be properly grounded, preferably at the same ground connection. The cable shield must also be grounded.
- Enable the termination resistors only at two points, at the extremes of the main bus, even if there are derivations from the bus.

[1] The limit of devices that can be connected on the network depends on the protocol used.

3.2 PLUG-IN MODULES WITH RS485 INTERFACE

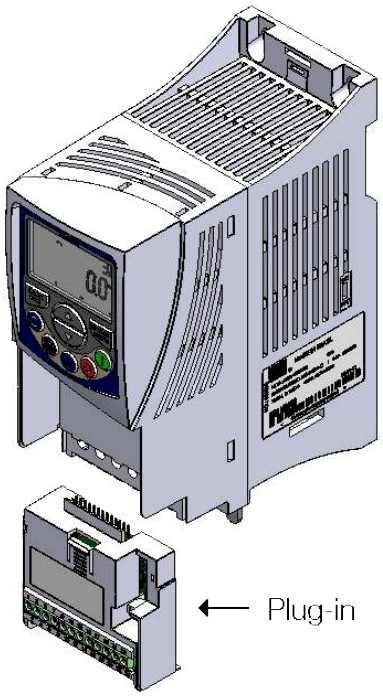

Figure 3.1: *Example of CFW503 plug-in module*

All plug-in modules for frequency inverter CFW503 have at least one standard RS485 interface, identified as Serial (1). This standard RS485 interface has two functions:

- Point to Point Connection with remote keypad.
- Connection via RS485 for network operation.

The selection of the function that will be used for the product is made using parameter P0312.

3.2.1 CFW500-IOS

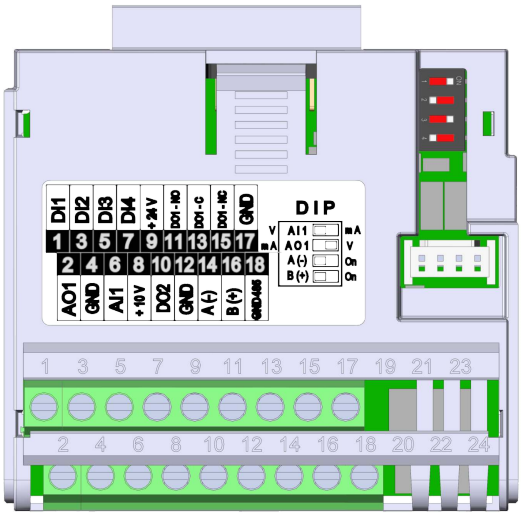

Figure 3.2: *Standard plug-in module (CFW500-IOS).*

For the standard plug-in module, the connection to the RS485 interface is available via the control terminal.

RS485 connector for the module (CFW500-IOS)

The connection for the RS485 interface is available through the terminals using the following pinout:

Table 3.1: RS485 connector pinout for the module (CFW500-IOS)

Pin	Name	Function
14	RS485 – A (-)	RS485 (Terminal A)
16	RS485 – B (+)	RS485 (Terminal B)
18	GND	0V Reference

3.3 PLUG-IN MODULES WITH RS485 AND ADDITIONAL INTERFACE

Depending on the installed plug-in module, frequency inverter CFW503 has up to two serial interfaces simultaneously, but only one can be the source of commands or references, the other is remote keypad or Modbus RTU slave using the same rate, parity and address settings as the selection of P0312.

The Serial (1) Interface is the standard interface frequency inverter CFW503 and is present in all plug-in modules via the terminals of the standard RS485 port. The Serial (2) interface is present only in the plug-in modules described below:

NOTE!
It is not possible use the serial interfaces for communication with two different networks. The only allowed simultaneous operation is using Serial (1) connected to the remote keypad, and another programmed protocol to Serial (2).

3.3.1 CFW500-CRS485-B

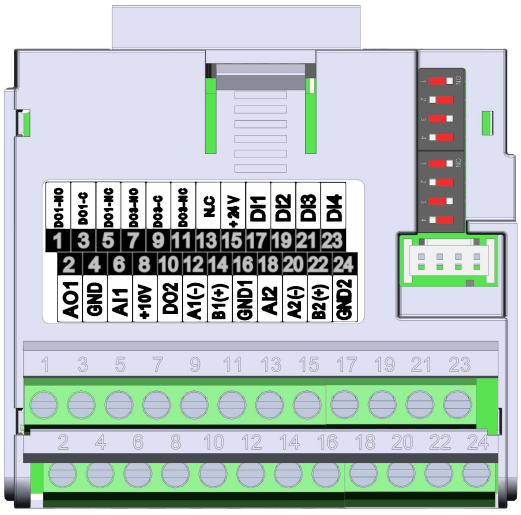

Figure 3.3: Module with RS485 connection.

For this plug-in module, in addition to the standard RS485 interface, a second RS485 interface is available. This accessory allows the simultaneous connection of a remote HMI on the standard RS485 interface and a programmable serial interface.

4 BACNET NETWORK INSTALLATION

For the connection of the frequency inverter CFW503 using the RS485 interface, the following points must be observed:

4.1 COMMUNICATION RATE

The RS485 interfaces of the CFW503 frequency inverter can communicate using the rates defined on the Table 4.1 on page 4-1.

Table 4.1: *Supported baud rates*

Baud Rate
9600 bit/s
19200 bit/s
38400 bit/s

All network equipment must be programmed to use the same communication baud rate.

4.2 ADDRESS IN THE BACNET NETWORK

Each BACnet network device must have an address, and may range from 0 to 254. This address must be unique for each equipment.

4.3 TERMINATING RESISTOR

The use of termination resistors at the ends of the bus is essential to avoid line reflection, which can impair the signal and cause communication errors. Termination resistors of 120 Ω | 0.25 W must be connected between the signals +B and -A at the ends of the main bus.

It worth to mention that, in order to allow the disconnection of the element from the network without damaging the bus, it is interesting to put active terminations, which are elements that only play the role of the termination. Thus, any equipment in the network can be disconnected from the bus without damaging the termination.

4.4 CABLES

Recommended characteristics of the cable used in the installation:

- It is recommended the use of a shielded cable with a twisted pair for the signals +B and -A, 24 AWG minimum.
- It is also recommended that the cable has one more wire for the interconnection of the 0V reference signal.
- Maximum length for connection between devices: 1000 m.

To perform the installation, it is recommended the use of shielded cables specific for use in industrial environment.

4.5 CONNECTION IN THE NETWORK

In order to interconnect the several network nodes, it is recommended to connect the equipment directly to the main line without using derivations. During the cable installation the passage near to power cables must be avoided, because, due to electromagnetic interference, this makes the occurrence of transmission errors possible.

Figure 4.1: *BACnet network installation example*

In order to avoid problems with current circulation caused by difference of potential among ground connections, it is necessary that all devices be connected to the same ground point.

The maximum number of devices connected to a single segment of the network is limited to 32. Repeaters can be used for connecting a bigger number of devices.

4.6 RECOMMENDATIONS FOR GROUNDING AND CABLE PASSAGE

The correct connection to ground reduces problems caused by interference in an industrial environment. Below are some recommendations regarding grounding and cable passage:

- It is recommended the use of equipment suitable for the industrial environment.
- The cable must be laid separately (and far away if possible) from the power cables.
- All the network devices must be properly grounded, preferably at the same ground connection.
- Always use shielded cables, as well as connectors with metal housing.
- Use fastening clamps in the main grounding point, allowing a greater contact area between the cable shield and the grounding.
- Avoid connection of the cable in multiple grounding points, especially where groundings of different potentials are present.

5 PARAMETERS

Next, the frequency inverter CFW503 parameters related to the BACnet communication will be presented.

P0220 - LOC/REM Selection Src

Adjustable Range:	0 = Always LOC 1 = Always REM 2 = HMI Key LOC 3 = HMI Key REM 4 = DIx 5 = Serial/USB LOC 6 = Serial/USB REM 7 to 8 = Not Used 9 = CO/DN/PB/Eth LOC 10 = CO/DN/PB/Eth REM 11 = SoftPLC	**Factory Setting:**	2
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the command source which will select between Local situation and Remote.

Table 5.1: *P0220 options*

Indication	Description
0 = Always LOC	Always in Local command mode.
1 = Always REM	Always in Remote command mode.
2 = HMI Key LOC	REM/LOC mode change via HMI key.
3 = HMI Key REM	REM/LOC mode change via HMI key.
4 = DIx	REM/LOC mode change via digital input command, as programmed in P0263 to P0270.
5 = Serial/USB LOC	REM/LOC mode change via serial control word - P0682.
6 = Serial/USB REM	REM/LOC mode change via serial control word - P0682.
7 ... 8 = Not Used	Reserved.
9 = CO/DN/PB/Eth LOC	REM/LOC mode change via CO/DN/PB/Eth control word - P0684.
10 = CO/DN/PB/Eth REM	REM/LOC mode change via CO/DN/PB/Eth control word - P0684.
11 = SoftPLC	Change via SoftPLC command.

P0221 - LOC Reference Sel.

P0222 - REM Reference Sel.

Adjustable Range:	0 = HMI Keys 1 = AI1 2 = AI2 3 = AI3 4 = FI 5 = AI1 + AI2 > 0 6 = AI1 + AI2 7 = E.P. 8 = Multispeed 9 = Serial/USB 10 = Not Used 11 = CO/DN/PB/Eth 12 = SoftPLC 13 = Not Used 14 = AI1 > 0 15 = AI2 > 0 16 = AI3 > 0 17 = FI > 0	**Factory Setting:**	0
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the source of the frequency reference in the Local situation and Remote situation.

Table 5.2: *P0221 options*

Indication	Description
0 = HMI Keys	Reference via speed reference parameter HMI (P0121).
1 = AI1	Reference via analog input 1.
2 = AI2	Reference via analog input 2.
3 = AI3	Reference via analog input 3.
4 = FI	Reference via frequency input.
5 = AI1 + AI2 > 0	Combination of reference AI1 + AI2 when greater than 0.
6 = AI1 + AI2	Combination of reference AI1 + AI2.
7 = E.P.	Reference via electronic potentiometer.
8 = Multispeed	Configuration for predefined speeds.
9 = Serial/USB	Reference via serial - P0683.
10 = Not Used	Reserved.
11 = CO/DN/PB/Eth	Reference via CO/DN/PB/Eth - P0685.
12 = SoftPLC	Reference via SoftPLC.
13 = Not Used	Reserved.
14 = AI1 > 0	Condition for reference AI1 greater than 0.
15 = AI2 > 0	Condition for reference AI2 greater than 0.
16 = AI3 > 0	Condition for reference AI3 greater than 0.
17 = FI > 0	Condition for reference FI greater than 0.

P0223 - LOC Rotation Sel.

P0226 - REM Rotation Sel.

Adjustable Range:	0 = Clockwise 1 = Countclockwise 2 = HMI Key (FWD) 3 = HMI Key (REV) 4 = DIx 5 = Serial/USB (F) 6 = Serial/USB (R) 7 to 8 = Not Used 9 = CO/DN/PB/Et(F) 10 = CO/DN/PB/Et(R) 11 = Not Used 12 = SoftPLC	**Factory Setting:**	2
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the source of the “Direction of Rotation” command in the Local and Remote situation.

Table 5.3: *P0223 options*

Indication	Description
0 = Clockwise	Direction of rotation in clockwise (H).
1 = Countclockwise	Direction of rotation in counterclockwise (AH).
2 = HMI Key (FWD)	Clockwise direction of rotation via HMI key.
3 = HMI Key (REV)	Counterclockwise direction of rotation via HMI key.
4 = DIx	Direction of rotation controlled by digital input, as programmed in P0263 to P0270.
5 = Serial/USB (F)	Clockwise direction of rotation via serial control word - P0682.
6 = Serial/USB (R)	Counterclockwise direction of rotation via serial control word - P0682.
7 ... 8 = Not Used	Reserved.
9 = CO/DN/PB/Et(F)	Clockwise direction of rotation via CO/DN/PB/Eth control word - P0684.
10 = CO/DN/PB/Et(R)	Counterclockwise direction of rotation via CO/DN/PB/Eth control word - P0684.
11 = Not Used	Reserved.
12 = SoftPLC	Direction of rotation controlled by SoftPLC.

P0224 - LOC Run/Stop Sel.

P0227 - REM Run/Stop Sel.

Adjustable Range:	0 = HMI Keys 1 = DIx 2 = Serial/USB 3 = Not Used 4 = CO/DN/PB/Eth 5 = SoftPLC	**Factory Setting:**	0
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the source of the “Run/Stop” command in the Local and Remote situation. This command corresponds to the functions implemented in any of the command sources able to enable the motor movement, that is, General Enable, Ramp Enable, Forward Run, Reverse Run, Start, etc.

Table 5.4: P0224 options

Indication	Description
0 = HMI Keys	Reference via HMI key.
1 = DIx	Reference controlled by digital input, as programmed in P0263 to P0270.
2 = Serial/USB	Reference via serial control word - P0682
3 = Not Used	Reserved.
4 = CO/DN/PB/Eth	Reference via CO/DN/PB/Eth control word - P0684.
5 = SoftPLC	Reference controlled by SoftPLC.

P0225 - LOC JOG Selection

P0228 - REM JOG Selection

Adjustable Range:	0 = Disable 1 = HMI Keys 2 = DIx 3 = Serial/USB 4 = Not Used 5 = CO/DN/PB/Eth 6 = SoftPLC	**Factory Setting:**	1
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the source of the JOG function in the Local and Remote situation. The JOG function means a Run/Stop command added to the reference defined by P0122. See the programming manual.

Table 5.5: P0225 options

Indication	Description
0 = Disable	Disabled.
1 = HMI Keys	Control via HMI key.
2 = DIx	Control via digital input, as programmed in P0263 to P0270.
3 = Serial/USB	Control via serial control word - P0682.
4 = Not Used	Reserved.
5 = CO/DN/PB/Eth	Control via CO/DN/PB/Eth control word - P0684.
6 = SoftPLC	Control via SoftPLC.

P0308 - Serial Address

Adjustable Range:	0 to 255	**Factory Setting:**	1
Properties:			
Access Groups:	NET		

Description:

It allows programming the address used for the inverter serial communication. It is necessary that each device in the network has an address different from all the others. The valid addresses for this parameter depend on the protocol programmed in P0312:

- P0312 = 2 (Modbus RTU) -> valid addresses: 1 to 247.
- P0312 = 3 (BACnet MS/TP) -> valid addresses: 0 to 254.

NOTE!
The equipment must be initialized when the serial address is changed.

P0310 - Serial Baud Rate

Adjustable Range:	0 = 9600 bits/s 1 = 19200 bits/s 2 = 38400 bits/s	**Factory Setting:**	1
Properties:			
Access Groups:	NET		

Description:

It allows programming the baud rate for the serial communication interface, in bits per second. This baud rate must be the same for all the devices connected to the network.

Table 5.6: *P0310 options*

Indication	Description
0 = 9600 bits/s	9600 bit per second.
1 = 19200 bits/s	19200 bit per second.
2 = 38400 bits/s	38400 bit per second.

NOTE!
To use the RS485 interface with the remote HMI, it is not necessary to program the communication rate. This rate is only used with the other serial protocols, both through the standard interface and through additional interfaces.

P0311 - Serial Bytes Config.

Adjustable Range:	0 = 8 bits, no, 1 1 = 8 bits, even,1 2 = 8 bits, odd, 1 3 = 8 bits, no, 2 4 = 8 bits, even,2 5 = 8 bits, odd, 2	**Factory Setting:**	1
Properties:			
Access Groups:	NET		

Description:

It allows programming the number of data bits, parity and stop bits of the serial interface bytes. This configuration must be identical for all the devices connected to the network.

Table 5.7: *P0311 options*

Indication	Description
0 = 8 bits, no, 1	8-bit, no parity, 1 stop bit.
1 = 8 bits, even,1	8 bits, with even parity, 1 stop bit.
2 = 8 bits, odd, 1	8-bit, with odd parity, 1 stop bit.
3 = 8 bits, no, 2	8-bit, no parity, 2 stop bit.
4 = 8 bits, even,2	8-bit, with even parity, 2 stop bit.
5 = 8 bits, odd, 2	8-bit, with odd parity, 2 stop bit.

NOTE!
The option 0 must be selected for the BACnet protocol.

NOTE!
To use the RS485 interface with the remote HMI, it is not necessary to program the communication rate. This rate is only used with the other serial protocols, both through the standard interface and through additional interfaces.

P0312 - Serial Protocol (1/2)

Adjustable Range:	0 = HMI-1 1 = SymbiNet-1 2 = Modbus RTU-1 3 = BACnet-1 4 = Reserved 5 = Master RTU-1 6 = HMI-1/Mbus-2 7 = Modbus RTU-2 8 = HMI-1/BACnet-2 9 = BACnet-2 10 to 11 = Reserved 12 = HMI-1/MBMast-2 13 = RTU Master-2 14 = HMI-1/SymNet-2 15 = SymbiNet-2	**Factory Setting:**	2
Properties:	cfg		
Access Groups:	NET		

Description:
Selects serial port protocol.

Table 5.8: P0312 options

Indication	Description
0 = HMI-1	For the standard serial interface (1), this option selects the remote HMI communication protocol.
1 = SymbiNet-1	For the standard serial interface (1), this option selects SymbiNet as the communication protocol.
2 = Modbus RTU-1	For the standard serial interface (1), this option selects Modbus RTU slave as the communication protocol.
3 = BACnet-1	For the standard serial interface (1), this option selects BACnet as the communication protocol.
4 = Reserved	Reserved.
5 = Master RTU-1	For the interface modules with more than one serial interface, this option allows to use the standard interface (1) as master Modbus RTU, and simultaneously to use the additional interface as slave Modbus RTU.
6 = HMI-1/Mbus-2	For the interface modules with more than one serial interface (example: CFW500-CUSB, etc.), this option allows to use the remote HMI connected to standard interface (1), and simultaneously, to use Modbus RTU slave protocol at the additional serial interface (2).
7 = Modbus RTU-2	For the additional serial interface (2), this option selects Modbus RTU slave communication protocol. The standard serial interface (1) remains disabled.
8 = HMI-1/BACnet-2	For the interface modules with more than one serial interface, this option allows to use the remote HMI connected to standard interface (1), and simultaneously to use the additional interface (2) as BACnet.
9 = BACnet-2	For the additional serial interface (2), this option selects BACnet communication protocol. The standard serial interface (1) remains disabled.
10 ... 11 = Reserved	Reserved.
12 = HMI-1/MBMast-2	For the interface modules with more than one serial interface, this option allows to use the remote HMI connected to standard interface (1), and simultaneously to use the drive as Master Modbus RTU at the additional serial interface (2).
13 = RTU Master-2	For the interface modules with more than one serial interface, this option allows to use the standard interface (1) as slave Modbus RTU, and simultaneously to use the drive as Master Modbus RTU at the additional serial interface (2).
14 = HMI-1/SymNet-2	For the interface modules with more than one serial interface, this option allows to use the remote HMI connected to standard interface (1), and simultaneously to use the additional interface (2) as SymbiNet.
15 = SymbiNet-2	For the additional serial interface (2), this option selects SymbiNet communication protocol. The standard serial interface (1) remains disabled.

NOTE!
For further details about Modbus RTU Master, refer to the help menu of the WLP or WPS software and the SoftPLC manual (document number 10001499063).

P0313 - Comm. Error Action

Adjustable Range:	0 = Inactive 1 = Ramp Stop 2 = General Disab. 3 = Go to LOC 4 = LOC Keep Enab. 5 = Cause Fault	**Factory Setting:**	1
Properties:			
Access Groups:	NET		

Description:

It allows the selection of the action to be executed by the device, if it is controlled via network and a communication error is detected.

The actions described in this parameter are executed by means of the automatic writing of the selected actions in the respective bits of the interface control words. Therefore, in order that the commands are effective, it is necessary that the device be programmed to be controlled via the used network interface (with exception of

option “Causes a Fault”, which blocks the equipment even if it is not controlled by network). This programming is achieved by means of parameters P0220 to P0228.

Table 5.9: *P0313 options*

Indication	Description
0 = Inactive	No action is taken and the drive remains in the existing status.
1 = Ramp Stop	A stop command with deceleration ramp is executed and the motor stops according to the programmed deceleration ramp.
2 = General Disab.	The drive is disabled by removing the General Enabling and the motor coasts to stop.
3 = Go to LOC	The drive commands change to Local.
4 = LOC Keep Enab.	The drive commands change to Local, but the status of the enabling and speed reference commands received via network are kept, providing that the drive has been programmed to use in Local mode the commands via HMI, or 3-wire start/stop and speed reference via either HMI or electronic potentiometer.
5 = Cause Fault	Instead of an alarm, the communication error causes a drive fault, so that a drive fault reset becomes necessary in order to restore normal operation.

P0313 - Comm. Error Action

Adjustable Range:	0 = Inactive 1 = Ramp Stop 2 = General Disab. 3 = Go to LOC 4 = LOC Keep Enab. 5 = Cause Fault	**Factory Setting:**	1
Properties:			
Access Groups:	NET		

Description:

It allows the selection of the action to be executed by the device, if it is controlled via network and a communication error is detected.

The actions described in this parameter are executed by means of the automatic writing of the selected actions in the respective bits of the interface control words. Therefore, in order that the commands are effective, it is necessary that the device be programmed to be controlled via the used network interface (with exception of option “Causes a Fault”, which blocks the equipment even if it is not controlled by network). This programming is achieved by means of parameters P0220 to P0228.

Table 5.10: *P0313 options*

Indication	Description
0 = Inactive	No action is taken and the drive remains in the existing status.
1 = Ramp Stop	A stop command with deceleration ramp is executed and the motor stops according to the programmed deceleration ramp.
2 = General Disab.	The drive is disabled by removing the General Enabling and the motor coasts to stop.
3 = Go to LOC	The drive commands change to Local.
4 = LOC Keep Enab.	The drive commands change to Local, but the status of the enabling and speed reference commands received via network are kept, providing that the drive has been programmed to use in Local mode the commands via HMI, or 3-wire start/stop and speed reference via either HMI or electronic potentiometer.
5 = Cause Fault	Instead of an alarm, the communication error causes a drive fault, so that a drive fault reset becomes necessary in order to restore normal operation.

P0314 - Serial Watchdog

Adjustable Range:	0 to 999	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:

Defines a time limit for the detection of serial interface communication error. If the frequency inverter remains without receiving valid telegrams longer than the time programmed in this parameter, it will be considered that a communication error has occurred, the alarm A0128 will be showed on the HMI and the option programmed in P0313 will be executed.

After being powered up, the frequency inverter starts counting this time from the first received valid telegram. The value 0.0 disables this function.

P0316 - Serial Interf. Status

Adjustable Range:	0 = Inactive 1 = Active 2 = Watchdog Error	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It allows identifying whether the serial communication presents errors.

Table 5.11: *P0316 options*

Indication	Description
0 = Inactive	Serial interface without valid data traffic.
1 = Active	Serial interface with valid data traffic.
2 = Watchdog Error	The serial interface is active, but a serial communication error has been detected - A0128 alarm/ F0228 fault.

P0680 - Logical Status

Adjustable Range:	0 to FFFF (hexa) Bit 0 = Reserved Bit 1 = Run Command Bit 2 = Fire Mode Bit 3 = Reserved Bit 4 = Quick Stop Bit 5 = 2nd Ramp Bit 6 = Config. Mode Bit 7 = Alarm Bit 8 = Running Bit 9 = Enabled Bit 10 = Forward Bit 11 = JOG Bit 12 = Remote Bit 13 = Undervoltage Bit 14 = Automatic PID Bit 15 = Fault	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

The inverter status word is unique for all the sources and can only be accessed for reading. It indicates all the relevant operating status and modes of the inverter. The value of P0680 is indicated in hexadecimal. The function of each bit of P0680 is described in Table 5.12 on page 5-11.

Table 5.12: *P0680 bits function*

Bit	Value/Description
Bit 0 Reserved	Reserved.
Bit 1 Run Command	**0:** there was no Run command **1:** there was Run command This bit is mapped in the BV1 object.
Bit 2 Fire Mode	**0:** fire Mode function inactive **1:** fire Mode function active This bit is mapped in the BV2 object.
Bit 3 Reserved	Reserved.
Bit 4 Quick Stop	**0:** quick stop inactive **1:** quick stop active This bit is mapped in the BV4 object.
Bit 5 2nd Ramp	**0:** 1st acceleration and deceleration ramp by P0100 and P0101 **1:** 2nd acceleration and deceleration ramp by P0102 and P0103 This bit is mapped in the BV5 object.
Bit 6 Config. Mode	**0:** inverter operating in normal conditions **1:** inverter in configuration state. It indicates a special condition in which the inverter cannot be enabled, because it has parameterization incompatibility This bit is mapped in the BV6 object.
Bit 7 Alarm	**0:** inverter is not in alarm state **1:** inverter is in alarm state This bit is mapped in the BV7 object.
Bit 8 Running	**0:** motor is stopped **1:** motor is running according to reference and command This bit is mapped in the BV8 object.
Bit 9 Enabled	**0:** inverter is disabled **1:** inverter is enabled and ready to run the motor This bit is mapped in the BV9 object.
Bit 10 Forward	**0:** motor is running in the reverse direction **1:** motor is running in the forward direction This bit is mapped in the BV10 object.
Bit 11 JOG	**0:** JOG function inactive **1:** JOG function active This bit is mapped in the BV11 object.
Bit 12 Remote	**0:** inverter in Local mode **1:** inverter in Remote mode This bit is mapped in the BV12 object.
Bit 13 Undervoltage	**0:** no undervoltage **1:** with undervoltage This bit is mapped in the BV13 object.
Bit 14 Automatic PID	**0:** in manual mode (PID function) **1:** in automatic mode (PID function) This bit is mapped in the BV14 object.
Bit 15 Fault	**0:** inverter is not in fault state **1:** some fault registered by the inverter This bit is mapped in the BV15 object.

P0681 - Speed at 13 bits

Adjustable Range:	-32768 to 32767	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It defines the 13-bit speed reference. The 13-bit Frequency Reference is a scale based on the motor rated speed (P0402) or on the motor rated frequency (P0403). In the inverter, parameter P0403 is taken as the base to determine the frequency reference.

Thus, the 13-bit frequency value has a range of 16 bits with signal, that is, -32768 to 32767; however, the rated frequency in P0403 is equivalent to the value 8192. Therefore, the maximum value in the range 32767 is equivalent to four times P0403:

- P0681 = 0000h (0 decimal) → motor speed = 0
- P0681 = 2000h (8192 decimal) → motor speed = rated frequency

Intermediate or higher frequency values can be obtained by using this scale. E.g., for a 60Hz rated frequency motor, if the value read is 2048 (0800h), then, to obtain the value in Hz one must calculate:

8192 => 60 Hz
2048 => Frequency

$$\text{Frequency} = \frac{2048 \times 60}{8192}$$

Frequency = 15 Hz

Negative values in this parameter indicate that the motor is running in the reverse direction.

NOTE!
The values transmitted over the network have a scale limitation, allowing a maximum of 4 times the rated frequency of the motor, with saturation in 32767 (or -32768).

P0682 - Serial/USB Control

Adjustable Range:	0 to FFFF (hexa) Bit 0 = Run/Stop Bit 1 = General Enable Bit 2 = Run Forward Bit 3 = JOG Enable Bit 4 = Remote Bit 5 = 2nd Ramp Bit 6 = Quick Stop Bit 7 = Fault Reset Bit 8 to 12 = Reserved Bit 13 = Internal PID Bit 14 = External PID Bit 15 = Reserved	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

The inverter control word has read and write access only via network interface, but read only access is permitted for the other sources (keypad, SoftPLC). Each bit function is described as per Table 5.13 on page 5-13. The value of P0682 is indicated in hexadecimal.

Table 5.13: *P0682 bits function*

Bit	Value/Description
Bit 0 Run/Stop	**0**: stops the motor by deceleration ramp **1**: run the motor according to the acceleration ramp until reaching the speed reference value This bit is mapped in the BV16 object.
Bit 1 General Enable	**0**: disables the inverter, interrupting the power supply to the motor **1**: enables the inverter, allowing the operation of the motor This bit is mapped in the BV17 object.
Bit 2 Run Forward	**0**: run the motor in the opposite direction of the reference signal (reverse) **1**: run the motor in the direction of the reference signal (forward) This bit is mapped in the BV18 object.
Bit 3 JOG Enable	**0**: disable JOG function **1**: enable JOG function This bit is mapped in the BV19 object.
Bit 4 Remote	**0**: inverter goes into Local mode **1**: inverter goes into Remote mode This bit is mapped in the BV20 object.
Bit 5 2nd Ramp	**0**: acceleration and deceleration ramp by P0100 and P0101 **1**: acceleration and deceleration ramp by P0102 and P0103 This bit is mapped in the BV21 object.
Bit 6 Quick Stop	**0:** disable quick stop **1:** enable quick stop This bit is mapped in the BV22 object.
Bit 7 Fault Reset	**0**: no function **1**: if in fault state, reset the fault This bit is mapped in the BV23 object.
Bit 8 … 12 Reserved	Reserved.
Bit 13 Internal PID	**0:** automatic **1:** manual This bit is mapped in the BV29 object.
Bit 14 External PID	**0:** automatic **1:** manual This bit is mapped in the BV30 object.
Bit 15 Reserved	Reserved.

P0683 - Serial/USB Speed Ref.

Adjustable Range:	-32768 to 32767	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It allows programming the motor speed reference via communication interfaces only. For other sources (HMI, etc.), it behaves as a read-only parameter.

To enable the use of the reference written in this parameter, the product must be programmed to use the speed reference via communication network. This is programming is done using parameters P0221 and P0222.

This word uses a 13-bit resolution with signal to represent the motor rated frequency (P0403):

- P0683 = 0000h (0 decimal) → speed reference = 0.
  P0683 = 2000h (8192 decimal) → speed reference = rated frequency (P0403).
- P0685 = 0000h (0 decimal) → speed reference = 0.
  P0685 = 2000h (8192 decimal) → speed reference = rated frequency (P0403).

Intermediate or higher reference values can be programmed by using this scale. E.g. 60Hz rated frequency, to obtain a speed reference of 30 Hz one must calculate:

60 Hz => 8192
30 Hz => 13 bits reference

$$\text{13 bits reference} = \frac{30 \times 8192}{60}$$

13 bits reference = 4096 => Value corresponding to 30 Hz in a 13 bit scale

This parameter also accepts negative values to revert the motor speed direction. The reference speed direction, however, depends also on the control word - P0682 bit 2 setting:

- Bit 2 = 1 and P0683 > 0: reference for forward direction
- Bit 2 = 1 and P0683 < 0: reference for reverse direction
- Bit 2 = 0 and P0683 > 0: reference for reverse direction
- Bit 2 = 0 and P0683 < 0: reference for forward direction

NOTE!
The values transmitted over the network have a scale limitation, allowing a maximum of 4 times the rated frequency of the motor, with saturation in 32767 (or -32768).

P0695 - DOx Value

Adjustable Range:	0 to 1F (hexa) Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:

It provides access for monitoring and controlling the inverter by using the communication interfaces. Each bit represents the value for a digital output. The value written in this parameter is used as the digital output value, providing that the function for the desired digital output be programmed for “P0695 value” at parameters P0275 to P0279.

Table 5.14: P0695 bits function

Bit	Value/Description
Bit 0 DO1	**0**: DO1 output open. **1**: DO1 output closed. This bit is mapped in the BOUT0 object.
Bit 1 DO2	**0**: DO2 output open. **1**: DO2 output closed. This bit is mapped in the BOUT1 object.
Bit 2 DO3	**0**: DO3 output open. **1**: DO3 output closed. This bit is mapped in the BOUT2 object.
Bit 3 DO4	**0**: DO4 output open. **1**: DO4 output closed. This bit is mapped in the BOUT3 object.
Bit 4 DO5	**0**: DO5 output open. **1**: DO5 output closed. This bit is mapped in the BOUT4 object.

NOTE!
Some of the digital outputs may not be available depending on the plug-in module.

P0696 - AOx Value 1

P0697 - AOx Value 2

P0698 - AOx Value 3

Adjustable Range:	-32768 to 32767	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:

It provides access for monitoring and controlling the inverter by using the communication interfaces.

They allow the control of the analog outputs by means of network interfaces (Serial, CAN, etc.). These parameters cannot be changed via HMI.

The value written in these parameters is used as the analog output value, providing that the function for the desired analog output be programmed for “P0696 / P0697 / P0698 value”, at the parameters P0251, P0254.

The value must be written in a 15-bit scale (7FFFh = 32767) to represent 100 % of the output desired value, i.e.:

- P0696 = 0000h (0 decimal) → analog output value = 0 %
- P0696 = 7FFFh (32767 decimal) → analog output value = 100 %

The showed example was for P0696, but the same scale is also used for the parameters P0697 and P0698. For instance, to control the analog output 1 via serial, the following programming must be done:

- Choose a parameter from P0696, P0697, P0698 to be the value used by the analog output 1. For this example, we are going to select P0696.
- Program the option “P0696 value” as the function for the analog output 1 in P0254.
- Using the network interface, write in P0696 the desired value for the analog output 1, between 0 and 100 %, according to the parameter scale.

BACnet objects of the ANALOG OUTPUT type mold the analog outputs, where:

- ANO0 - P0696.
- ANO1 - P0697.
- ANO2 - P0698.

NOTE!
For CFW503 frequency inverter, the analog output 3 represents the frequency output (FO).

P0760 - BN:Inst Hi Equip

Adjustable Range:	0 to 419	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:
It defines the high part of the BACnet equipment instance.

NOTE!
Refer to the parameter P0761 description for more details.

P0761 - BN:Dev Inst Lo

Adjustable Range:	0 to 9999	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:
It defines the low part of the BACnet equipment instance.

The BACnet standard defines that the equipment instance must be unique in the network and it must present a value between 0 and 4194304. The BACnet instance will compose the Object Identifier property of the DEVICE object, which defines the equipment characteristics in the network.

The BACnet instance can be defined automatically or manually.

Automatically:
If the values of parameters P0760 and P0761 are set 0 (default value), the inverter will automatically create the BACnet instance based on the vendor BACnet ID (WEG BACnet ID = 359) and the serial address. For this configuration, the user must only inform the serial address at the parameter P0308.

BACnet instance = BACnet ID + Serial address

Example 1: serial address = 102

Instance = 359102

Example 2: serial address = 15

Instance = 359015

NOTE!
The instance created automatically is not showed at the parameters P0760 and P0761, which remain with the value 0.

Manual:
The BACnet instance is defined by using the parameters P0760 and P0761. The P0760 parameter content is multiplied by 10000 and added to the P0761 parameter content.

Example 1:

Instance = 542786
542786 / 10000 = 54.2786
P0760 = 54 (whole part)
P0761 = 2786 (fractional part)

Example 2:

Instance = 66789
66789 / 10000 = 6.6789
P0760 = 6 (whole part)
P0761 = 6789 (fractional part)

Example 3:

Instance = 35478
35478 / 10000 = 3.5478
P0760 = 3 (whole part)
P0761 = 5478 (fractional part)

NOTE!
The parameters P0760 and P0761 allow adjusting a maximum value of 4199999. However, the maximum instance value will be 4194304.

NOTE!
The equipment must be initialized when the contents of parameters P0760 and P0761 are changed.

P0762 - BN:Master Max Number

Adjustable Range:	0 to 127	**Factory Setting:**	127
Properties:			
Access Groups:	NET		

Description:
It allows programming the longest address used by a master in the BACnet network, optimizing the communication. All the network devices must be set with the same value in this parameter.

With the standard value (127) for this parameter, any address set for the device can participate in the communication. However, that will make the devices in the network send requests searching for devices in all the address range, hindering the data exchange cycle and the entrance of new devices in the network. By limiting the longest address accepted, addresses above this value are ignored, preventing the search for unnecessary addresses and optimizing the communications.

It is recommended that the devices on the network be addressed in sequence from address 1 on, and that this parameter be set with the same value as the last address of the network.

NOTE!
The equipment must be initialized when the content of the parameter P0762 is changed.

P0763 - BN:MS/TP Max Fram Num

Adjustable Range:	1 to 65535	**Factory Setting:**	1
Properties:			
Access Groups:	NET		

Description:

It defines the number of telegrams that the node can transmit when it receives the token. Then it must transmit the token to the next node.

NOTE!
The equipment must be initialized when the content of the parameter P0763 is changed.

P0764 - BN:I-AM Msg Transm

Adjustable Range:	0 = Power Up 1 = Continuous	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:

The I AM telegram is used to identify the node in the BACnet network

NOTE!
The equipment must be initialized when the content of the parameter P0764 is changed.

Table 5.15: *P0764 options*

Indication	Description
0 = Power Up	When the option 0, power up, is selected, then a I AM telegram is sent in the Power up just.
1 = Continuous	When the option 1, periodically, is selected, then an I AM telegram is sent every 200 ms.

P0765 - BN:Token RX Qty

Adjustable Range:	0 to 65535	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It is the counter of the number of tokens received from other BACnet nodes. It allows the serial communication verification.

6 BACNET OBJECT MODELING

A BACnet object represents physical or virtual equipment information, as a digital input or parameters. The CFW503 frequency inverter presents the following object types:

- ANALOG INPUT;
- ANALOG OUTPUT;
- ANALOG VALUE;
- BINARY INPUT;
- BINARY OUTPUT;
- BINARY VALUE;
- DEVICE OBJECT.

Each object type defines a data structure composed by properties that allow the access to the object information. The Table 6.1 on page 6-1 shows the implemented properties for each CFW503 object type.

Table 6.1: *Properties of the BACnet objects*

Property	DEVICE	ANALOG INPUT	ANALOG OUTPUT	ANALOG VALUE	BINARY INPUT	BINARY OUTPUT	BINARY VALUE
Object Identifier	X	X	X	X	X	X	X
Object Name	X	X	X	X	X	X	X
Object Type	X	X	X	X	X	X	X
System Status	X						
Vendor Name	X						
Vendor Identifier	X						
Model Name	X						
Firmware Revision	X						
Application Software Version	X						
Description	X	X	X	X	X	X	X
Protocol Version	X						
Protocol Revision	X						
Protocol service supported	X						
Protocol object types Supported	X						
Object List	X						
Max APDU Len Accepted	X						
Segmentation Supported	X						
APDU timeout	X						
Number of APDU retries	X						
Max Master	X						
Max info frames	X						
Device Address Binding	X						
Database revision	X						
Present Value		X	X	X	X	X	X
Status Flags		X	X	X	X	X	X
Event State		X	X	X	X	X	X
Out of Service		X	X	X	X	X	X
Units		X	X	X	X	X	X
Priority Array			X	X		X	X
Relinquish Default			X	X		X	X
Polarity					X	X	

* The Priority Array and Relinquish Default properties are available for objects with type C (Commandable) access.

Each object presents an identifier unique in the network, called Object Identifier. The Object Identifier property is composed by two parts:

Object Type – 10 bits	Object instance – 22 bits

The Object Type values are defined by the BACnet specification, and object instance is defined by the manufacturer for each object available for communication.

Regarding the Present Value property, each object can present one of the following access types:

R Read-only
C Commandable – uses priority array.
W Write-only
R/W Read/Write – without priority array.

The Commandable (C) access type presents a 16-level priority array, where priority 1 is the highest and 16 the lowest. If all the priorities are disabled (NULL), the value of the Relinquish Default property is given to the Present Value property.

6.1 BACNET OBJECTS

The parameters of CFW503 frequency inverter are mapped through BACnet objects which are described below.

NOTE!
Check the product manual for parameters details.

6.1.1 ANALOG INPUT OBJECT

It represents an analog input that can have its value read by the controller. CFW503 ANALOG INPUT type objects are described in the Table 6.2 on page 6-2. The ANALOG INPUT objects are of the REAL type.

Table 6.2: *ANALOG INPUT objects*

Object Identifier	Object name	Related Parameter	Unit	Access type
AI0	AI1 Value	P018	%	R
AI1	AI2 Value	P019	%	R
AI2	AI3 Value	P020	%	R

6.1.2 ANALOG OUTPUT OBJECT

It represents an analog output that can have its value written by the controller. CFW503 ANALOG OUTPUT type objects are described in the Table 6.3 on page 6-2. The ANALOG OUTPUT objects are of the REAL type.

Table 6.3: *ANALOG OUTPUT objects*

Object Identifier	Object name	Related Parameter	Unit	Access type
AO0	AOx Value 1	P696		C
AO1	AOx Value 2	P697		C
AO2	AOx Value 3	P698		C

6.1.3 ANALOG VALUE OBJECT

They represent system control parameters that can be read, written or commanded by the controller. CFW503 ANALOG VALUE type objects are described in the Table 6.4 on page 6-3. The ANALOG VALUE objects are of the REAL type.

Table 6.4: ANALOG VALUE objects

Object Identifier	Object name	Related Parameter	Unit	Access type
AV0	Motor Speed	P0002	rpm	R
AV1	Motor Current	P0003	A	R
AV2	DC Link Voltage (Ud)	P0004	V	R
AV3	Motor Frequency	P0005	Hz	R
AV4	Motor Voltage	P0007	V	R
AV5	Motor Torque	P0009	%	R
AV6	Output Power	P0010	°C	R
AV7	Heatsink Temperature	P0030	h	R
AV9	Time Powered	P0042	h	C
AV10	Time Enabled	P0043	kWh	C
AV11	kWh Output Energy	P0044		R
AV12	Present Alarm	P0048		C
AV13	Present Fault	P0049		C
AV14	Acceleration Time	P0100	s	C
AV15	Deceleration Time	P0101	s	C
AV16	Speed in 13 bits	P0681		C
AV17	Serial/USB Speed Ref.	P0683		C
AV18	SoftPLC Parameter 3	P1012		C
AV19	SoftPLC Parameter 4	P1013		C
AV20	SoftPLC Parameter 16	P1025		C
AV21	Main PID Aut. Setpoint	P1011		C
AV22	Main PID Man. Setpoint	P1014	%	C
AV23	Main PID Feedback	P1015		C
AV24	Main PID Output	P1016	%	C
AV25	External PID Auto Setpoint	P1060		C
AV26	External PID Man. Setpoint	P1061	%	C
AV27	External PID Feedback	P1062		C
AV28	External PID Output	P1063	%	C
AV100	Mailbox: param. number	-		R/W
AV101	Mailbox: param. value	-		R/W

The CFW503 programming manual presents the detailed description of each parameter.

6.1.4 BINARY INPUT OBJECT

It represents a physical digital input that can have its status read by the controller. CFW503 BINARY INPUT type objects are described in the Table 6.5 on page 6-3.

Table 6.5: BINARY INPUT objects

Object Identifier	Object name	Related Parameter	State (1 / 0)	Access type
BI0	DI1	P012 – Bit 0	On/Off	R
BI1	DI2	P012 – Bit 1	On/Off	R
BI2	DI3	P012 – Bit 2	On/Off	R
BI3	DI4	P012 – Bit 3	On/Off	R
BI4	DI5	P012 – Bit 4	On/Off	R
BI5	DI6	P012 – Bit 5	On/Off	R
BI6	DI7	P012 – Bit 6	On/Off	R
BI7	DI8	P012 – Bit 7	On/Off	R

6.1.5 BINARY OUTPUT OBJECT

It represents a physical digital output that can have its status changed by the controller. CFW503 BINARY OUTPUT type objects are described in the Table 6.6 on page 6-4.

Table 6.6: BINARY OUTPUT objects

Object Identifier	Object name	Related Parameter	State (1 / 0)	Access type
BO0	DO1	P695 – Bit 0	On/Off	C
BO1	DO2	P695 – Bit 1	On/Off	C
BO2	DO3	P695 – Bit 2	On/Off	C
BO3	DO4	P695 – Bit 3	On/Off	C
BO4	DO5	P695 – Bit 4	On/Off	C

6.1.6 BINARY VALUE OBJECT

They represent system control parameter bits that can be read, written or commanded by the controller. CFW503 BINARY VALUE type objects are described in the Table 6.7 on page 6-4.

Table 6.7: BINARY VALUE objects

Object Identifier	Object name	Related Parameter	State (1 / 0)	Access type
BV0	Reserved	P680 Bit 0		
BV1	Run Command	P680 Bit 1		
BV2	Fire mode	P680 Bit 2	On/Off	R
BV3	Reserved	P680 Bit 3		
BV4	Quick Stop	P680 Bit 4	Active/Inactive	R
BV5	2nd Ramp	P680 Bit 5	On/Off	R
BV6	Config. Mode	P680 Bit 6	Config/Normal	R
BV7	Alarm	P680 Bit 7	Alarm/No Alarm	R
BV8	Running	P680 Bit 8	Running/Stopped	R
BV9	Enabled	P680 Bit 9	Enabled/Disabled	R
BV10	Forward	P680 Bit 10	Forward/Reverse	R
BV11	JOG	P680 Bit 11	On/Off	R
BV12	Remote	P680 Bit 12	Remote/Local	R
BV13	Undervoltage	P680 Bit 13	Undervoltage/No	R
BV14	Automatic PID	P680 Bit 14	Manual/Auto	R
BV15	Fault	P680 Bit 15	Fault/No Fault	R
BV16	Run/Stop	P682 Bit 0	Run/Stop	C
BV17	General Enable	P682 Bit 1	Enable/Disable	C
BV18	Run Forward	P682 Bit 2	Forward/Reverse	C
BV19	JOG Enable	P682 Bit 3	On/Off	C
BV20	Remote	P682 Bit 4	Reset/Off	C
BV21	2nd Ramp	P682 Bit 5	On/Off	C
BV22	Quick Stop	P682 Bit 6	On/Off	C
BV23	Fault Reset	P682 Bit 7	Reset/Off	C
BV29	Intern PID	P682 Bit 13	Manual/Auto	C
BV30	Extern PID	P682 Bit 14	Manual/Auto	C
BV100	Mailbox: exec. read	-	On/Off	R/W
BV101	Mailbox: exec. write	-	On/Off	R/W

NOTE!
In order to have those commands executed, it is necessary that the inverter be programmed to be controlled via serial. This programming is achieved by means of parameters P0220 to P0228.

6.1.7 DEVICE OBJECT

The DEVICE object informs the BACnet equipment characteristics. Its properties represent those characteristics and they are described in the Table 6.1 on page 6-1. There must be only one DEVICE object at each BACnet equipment.

6.1.8 Mailbox

It is a structure that allows reading and writing CFW503 parameters. The following objects compose this structure:

Table 6.8: *Mailbox objects*

Object Identifier	Object name	Description	Access type
AV100	Mailbox: param. number	Informs the parameter number	R/W
AV101	Mailbox: param. value	Informs the datum read from or written into the parameter	R/W
BV100	Mailbox: exec. read	Parameter reading command	R/W
BV101	Mailbox: exec. write	Parameter writing command	R/W

Procedure for reading a parameter via Mailbox:

1. Write the parameter number in the AV100 object Present Value property;
2. Write 1 in the BV100 object Present Value property;
3. Read the parameter value in the AV101 object Present Value property.

Procedure for writing a parameter via Mailbox:

1. Write the parameter number in the AV100 object Present Value property;
2. Write the value to the parameter in the AV101 object Present Value property;
3. Write 1 in the BV101 object Present Value property.

7 QUICK REFERENCE OF ALARMS AND FAULTS

Fault / Alarm	Description	Possible Causes
F0031: Plug-in Comm Lost	Main control cannot establish the communication link with the communication acccessory.	■ Accessory damaged. ■ Poor connection of the accessory. ■ Problem in the identification of the accessory; refer to P0027.
A0128/ F0228: Serial Comm Timeout	Alarma que indica falla en la comunicación serial. Indica que el equipamiento paró de recibir telegramas seriales válidos por un período mayor que el programado en el P0314.	- Check network installation, broken cable or fault/poor contact on the connections with the network, grounding. - Ensure the master always sends telegrams to the equipment in a time shorter than the setting in P0314. - Disable this function by setting P0314 = 0.

Fault and alarm operation:

- Faults operate by indicating their occurrence on the HMI, in the frequency inverter status word (P006), in the present fault parameter (P049) and disabling the motor. They can only be reset with a reset command or de-energizing the frequency inverter.
- Alarms operate by indicating their occurrence on the HMI and in the present alarm parameter (P048). They are automatically reset when the alarm condition ceases existing.

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