Ethernet

CFW500-CETH2

User's Manual

User’s Manual

CFW500-CETH2

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The information below describes the reviews made in this manual.

Version	Revision	Description
V1.0X	R00	First edition.
V1.0X	R01	General review.
V1.1X	R02	General review.

CONTENTS

ABOUT THE MANUAL

This manual supplies the necessary information for the operation of the CFW500/MW500 G2 frequency inverter using the Ethernet interface. This manual must be used together with the CFW500/MW500 G2 user's manual and programming manual.

ABBREVIATIONS AND DEFINITIONS

ASCII American Standard Code for Information Interchange
CRC Cycling Redundancy Check
LSB Least Significant Bit/Byte
MSB Most Significant Bit/Byte
ro Read only
rw Read/write
cfg Configuration

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 - MODBUS TCP

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

Document	Version	Source
MODBUS Application Protocol Specification, December 28th 2006.	V1.1b	MODBUS.ORG
MODBUS Messaging On TCP/IP Implementation Guide, October 24th 2006.	V1.0b	MODBUS.ORG

In order to obtain this documentation, consult MODBUS.ORG, which is nowadays the organization that keeps, publishes and updates the information related to the Modbus protocol.

DOCUMENTS - ETHERNET/IP

The EtherNet/IP protocol was developed based on the following specifications and documents:

Document	Version	Source
Volume One - Common Industrial Protocol (CIP) Specification	3.32	ODVA
Volume Two - EtherNet/IP Adaptation of CIP	1.30	ODVA
Media Planning and Installation Manual - EtherNet/IP	PUB00148R0	ODVA
Guidelines for Using Device Level Ring with EtherNet/IP	PUB00316R2	ODVA

In order to obtain this documentation, consult ODVA, which is nowadays the organization that keeps, publishes and updates the information related to the EtherNet/IP 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

All other trademarks are the property of their respective holders.

1 MAIN CHARACTERISTICS

Below are the main characteristics for communication of the frequency inverter CFW500/MW500 G2 with CFW500-CETH2 accessory.

- The interface follows the Fast Ethernet 100BASE-TX standard.
- It allows communication using the 10 or 100 Mbps rates in half or full duplex mode.
- It has a built-in, two-port Ethernet switch.
- The Ethernet ports work with Auto-MDIX (automatic medium-dependent interface crossover), a technology which automatically detects the type of cable used and configures the connection accordingly, eliminating the need of cross-over cables.
- It has a built-in WEB server (HTTP), which provides access to configuration and parameterization of the equipment.

1.1 MODBUS TCP SPECIFIC CHARACTERISTICS

- Operates as Modbus TCP server.
- The server provides up to 4 simultaneous Modbus TCP connections.
- Allows data communication for equipment operation and parameterization, as well as markers and data used for CFW500/MW500 G2 ladder programming.

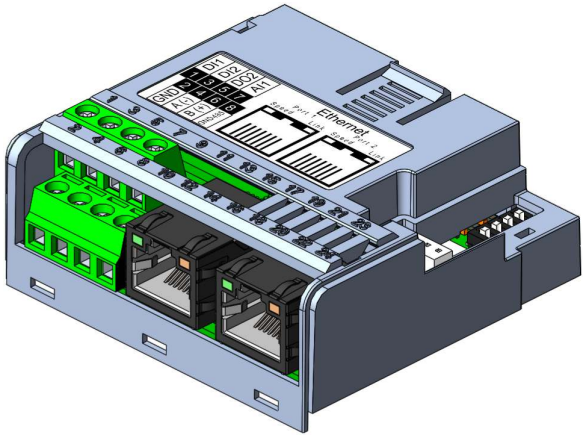
1.2 ETHERNET/IP SPECIFIC CHARACTERISTICS

- It is supplied with an EDS file for the network master configuration.
- Allows up to 14 input words and 14 output words for cyclic data communication.
- Supports ODVA (AC Drive) and manufacturer-specific profiles.
- Acyclic data available for parameterization.
- Up to 4 CIP Class 1 and Class 3 connections.
- Support to Unconnected Explicit Messages.
- Allow ring connection with support to Announce-based Device Level Ring (DLR).

2 INTERFACE DESCRIPTION

The CFW500/MW500 G2 uses an accessory to provide a Ethernet interface for communication. The characteristics of this interface are presented below.

2.1 ETHERNET ACCESSORY



CFW500-CETH2:

- Supplied items:
  - Installation guide.
  - Ethernet communication module.

NOTE!
This accessory is compatible from CFW500 3.9X and MW500 3.1X versions.

2.2 CONNECTORS

The accessory for Ethernet communication has two RJ45 connectors for network connection. The connector pin out follows the Fast Ethernet 100BASE-TX standard, using two pairs of cables for data transmission and reception.

The housings of the Ethernet connectors, which are normally connected to the cable shield, have connections between themselves and to the protective earth via a RC circuit.

2.3 INDICATION LEDS

The Ethernet accessory has a LED for speed indication and another for link/activity network indication, and two bicolor LEDs for status indication (MS and NS). These LEDs have the following functions and indications.

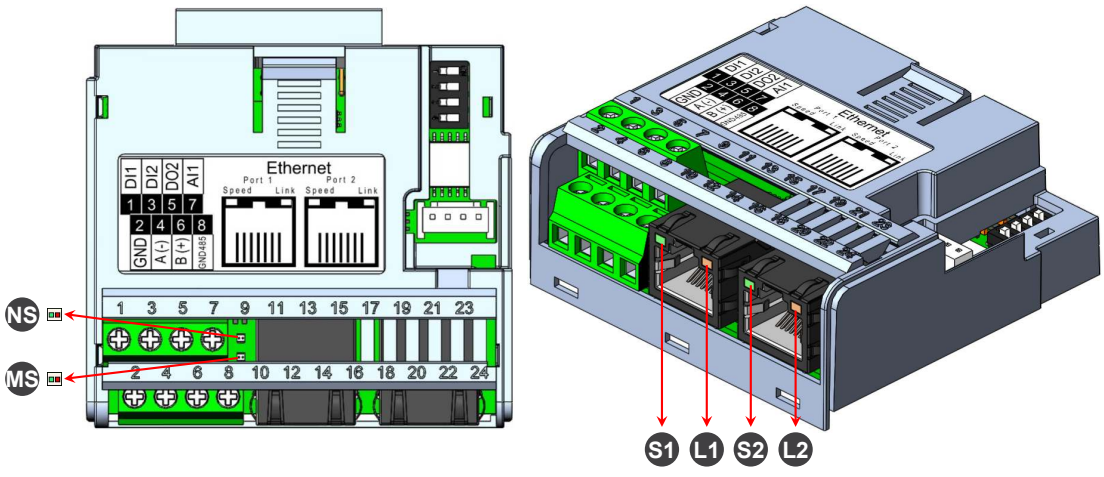


Table 2.1: *Speed LED (S1/S2)*

State	Description
Off	10 Mbps.
Green, solid	100 Mbps.

Table 2.2: *Link/Activity LED (L1/L2)*

State	Description
Off	No link or powered off.
Ambar, solid	Link up, no activity.
Ambar, flashing	Link up and activity.

Table 2.3: *Module Status LED (MS)*

Status	Description	Comments
Off	No power	-
Flashing green/red	Equipment performing self-diagnosis	It occurs during initialization.
Green, fast flashing (100ms ON / 100ms OFF)	DHCP enabled, waiting for receiving IP Address configuration.	-
Green, flashing (500ms ON / 500ms OFF)	Module enabled, waiting detection and connection between module and product.	-
Green, solid	Normal operation.	-
Red, flashing (500ms ON / 500ms OFF)	Recoverable error.	Indicates failure to exchange data between accessory and product.
Red, solid	Fatal error	Reinitializing the equipment is required.

Table 2.4: *Network Status LED (NS)*

Status	Description	Comments
Off	No power	-
Flashing green/red	Equipment performing self-diagnosis	It occurs during initialization.
Green, flashing (500ms ON / 500ms OFF)	Module enabled, waiting for connections.	-
Green, solid	At least one EtherNet/IP connection established.	-
Red, flashing (500ms ON / 500ms OFF)	EtherNet/IP connection timeout.	Indicates Exclusive Owner connection has timed out.

3 ETHERNET NETWORK INSTALLATION

This chapter presents recommendations related to equipment installation in an Ethernet network.

3.1 IP ADDRESS

Every equipment in an Ethernet network needs an IP address and subnet mask.

The IP addressing is unique in the network, and each equipment must have a different IP. The subnet mask is used to define which IP address range is valid in the network.

The CFW500/MW500 G2 frequency inverter allows the use of two methods for programming these features, programmable via :

- Parameters: uses the configurations of IP address, mask and gateway as programmed on equipment parameters.
- DHCP: enable the configuration of the CFW500/MW500 G2 via DHCP server. The DHCP can automatically assign IP addresses, subnet mask, etc. to the devices on the network. The configurations performed via parameters are disregarded.

3.2 COMMUNICATION RATE

The Ethernet interfaces of the CFW500/MW500 G2 frequency inverter can communicate using the 10 or 100 Mbps rates in half or full duplex mode.

NOTE!
It is important that, for each Ethernet connection made between two points, the baud rate and the duplex mode are set to the same option. If the option AUTO is used in one of the points, you must set the other point also to AUTO, or to half duplex mode.

3.3 CABLE

Recommended characteristics of the cable used in the installation:

- Standard Ethernet cable, 100Base-TX (FastEthernet), CAT 5e or higher.
- Shielded cable.
- Maximum length between devices: 100 m.

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

3.4 NETWORK TOPOLOGY

To connect CFW500/MW500 G2 frequency inverter in an Ethernet network, usually the star connection is made using an industrial switch.

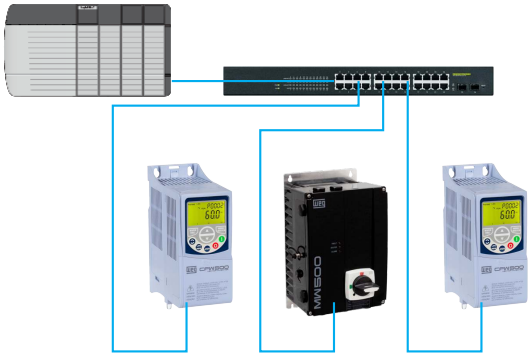


Figure 3.1: *Star topology*

It is also possible to make the connection in daisy chain and the connection in ring (Device Level Ring, DLR).

Figure 3.2: *Daisy chain topology*

Figure 3.3: *Ring topology*

NOTE!
When the equipment is turned off, the built-in switch is also deactivated, preventing communication with the subsequent equipment.

3.5 RECOMMENDATIONS FOR GROUNDING CONNECTION AND CABLE ROUTING

The correct connection with the ground decreases problems caused by interference in an industrial environment. The following are some recommendations about grounding and cable routing:

- Always use shielded twisted pair Ethernet cables and connectors with metallic housing.
- Connect the equipment grounding via grounding terminal. Avoid the cable connection on multiple grounding points, especially where there are grounds with different potentials.
- Pass signal cables and communication cables in dedicated pathways. Prevent laying these cables next to power cables.

4 PARAMETERS

4.1 COMMUNICATION STATES AND COMMANDS

Below are the parameters related to the states and commands through the communication networks available for the frequency inverter.

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 4.1: *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.

P0680 - Logical Status

Adjustable Range:	0 to FFFF (hexa) Bit 0 = STO 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 4.2 on page 4-3.

Table 4.2: *P0680 bits function*

Bit	Value/Description
Bit 0 STO	**0:** STO function inactive (inverter operational) **1:** STO function active (inverter locked A0160)
Bit 1 Run Command	**0:** there was no Run command **1:** there was Run command
Bit 2 Fire Mode	**0:** fire Mode function inactive **1:** fire Mode function active
Bit 3 Reserved	-
Bit 4 Quick Stop	**0:** quick stop inactive **1:** quick stop active
Bit 5 2nd Ramp	**0:** 1st acceleration and deceleration ramp by P0100 and P0101 **1:** 2nd acceleration and deceleration ramp by P0102 and P0103
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
Bit 7 Alarm	**0:** inverter is not in alarm state **1:** inverter is in alarm state
Bit 8 Running	**0:** motor is stopped **1:** motor is running according to reference and command
Bit 9 Enabled	**0:** inverter is disabled **1:** inverter is enabled and ready to run the motor
Bit 10 Forward	**0:** motor is running in the reverse direction **1:** motor is running in the forward direction
Bit 11 JOG	**0:** JOG function inactive **1:** JOG function active
Bit 12 Remote	**0:** inverter in Local mode **1:** inverter in Remote mode
Bit 13 Undervoltage	**0:** no undervoltage **1:** with undervoltage
Bit 14 Automatic PID	**0:** in manual mode (PID function) **1:** in automatic mode (PID function)
Bit 15 Fault	**0:** inverter is not in fault state **1:** some fault registered by the inverter

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).

P0684 - CO/DN/PB/Eth 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 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 4.3 on page 4-4. The value of P0684 is indicated in hexadecimal.

Table 4.3: *P0684 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
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
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)
Bit 3 JOG Enable	**0**: disable JOG function **1**: enable JOG function
Bit 4 Remote	**0**: inverter goes into Local mode **1**: inverter goes into Remote mode
Bit 5 2nd Ramp	**0**: acceleration and deceleration ramp by P0100 and P0101 **1**: acceleration and deceleration ramp by P0102 and P0103
Bit 6 Quick Stop	**0:** disable quick stop **1:** enable quick stop
Bit 7 Fault Reset	**0**: no function **1**: if in fault state, reset the fault
Bit 8 … 15 Reserved	-

P0685 - CO/DN/PB/Eth SpeedRef

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):

- 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 - P0684 bit 2 setting:

- Bit 2 = 1 and P0685 > 0: reference for forward direction
- Bit 2 = 1 and P0685 < 0: reference for reverse direction
- Bit 2 = 0 and P0685 > 0: reference for reverse direction
- Bit 2 = 0 and P0685 < 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”.

Table 4.4: *P0695 bits function*

Bit	Value/Description
Bit 0 DO1	**0**: DO1 output open. **1**: DO1 output closed.
Bit 1 DO2	**0**: DO2 output open. **1**: DO2 output closed.
Bit 2 DO3	**0**: DO3 output open. **1**: DO3 output closed.
Bit 3 DO4	**0**: DO4 output open. **1**: DO4 output closed.
Bit 4 DO5	**0**: DO5 output open. **1**: DO5 output closed.

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.

NOTE!
If the analog output is programmed for working from -10 V to 10 V, negative values for this parameter must be used to command the output with negative voltage values, i.e., -32768 to 32767 represent a variation from -10 V to 10 V at the analog output.

P0799 - Eth:Enable protocols

Adjustable Range:	0 to 1 (hexa) Bit 0 = Web Server	**Factory Setting:**	0
Properties:			
Access Groups:	NET		

Description:

It allows enabling and disabling functionalities of some protocols, limiting the exposure of the inverter via network.

Table 4.5: *P0799 bits function*

Bit	Value/Description
Bit 0 Web Server	**0**: Protocol disabled. **1**: Protocol enabled.

NOTE!
After changing this configuration, for the modification to be effective, the equipment must be turned off and then turned on again.

P0806 - Eth:ModbusTCP Timeout

Adjustable Range:	0 to 66	**Factory Setting:**	0
Properties:	cfg		
Access Groups:	NET		

Description:

It defines a timeout protection against fault in the Modbus TCP communication.

In case the product does not receive valid Modbus TCP telegrams for a period longer than the setting, a communication error will be indicated, alarm A0149 will be displayed on the Keypad, depending on the programming of P0313, and the action programmed will be executed.

Time will start counting from the first valid telegram received.

The value 0.0 disables this function.

P0810 - Eth:IP Address Config

Adjustable Range:	0 = Parameters 1 = DHCP 2 = DCP	**Factory Setting:**	1
Properties:	cfg		
Access Groups:	NET		

Description:

It defines how to set the IP address used by the Ethernet interfacee.

Table 4.6: *P0810 options*

Indication	Description
0 = Parameters	The programming of the IP address, configurations of the subnet mask and gateway must be done through parameters P0811 to P0819.
1 = DHCP	Enables the DHCP function. The IP address and other network configurations are received from a DHCP server via network.
2 = DCP	The IP address and other network configurations are received via DCP (PROFINET).

P0811 - Eth:IP Address 1

Adjustable Range:	0 to 255	**Factory Setting:**	192
Properties:	cfg		
Access Groups:	NET		

P0812 - Eth:IP Address 2

Adjustable Range:	0 to 255	**Factory Setting:**	168
Properties:	cfg		
Access Groups:	NET		

P0813 - Eth:IP Address 3

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

P0814 - Eth:IP Address 4

Adjustable Range:	0 to 255	**Factory Setting:**	14
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the IP address used by the Ethernet interface. It is valid only if P0810 = Parameters.

Each parameter programs one octet of the IP address, where the P0811 is the most significant octet. The programmed IP address, then, has the format “P0811.P0812.P0813.P0814”.

P0815 - Eth:CIDR Sub-net

Adjustable Range:	0 = Reserved 1 = 128.0.0.0 2 = 192.0.0.0 3 = 224.0.0.0 4 = 240.0.0.0 5 = 248.0.0.0 6 = 252.0.0.0 7 = 254.0.0.0 8 = 255.0.0.0 9 = 255.128.0.0 10 = 255.192.0.0 11 = 255.224.0.0 12 = 255.240.0.0 13 = 255.248.0.0 14 = 255.252.0.0 15 = 255.254.0.0 16 = 255.255.0.0 17 = 255.255.128.0 18 = 255.255.192.0 19 = 255.255.224.0 20 = 255.255.240.0 21 = 255.255.248.0 22 = 255.255.252.0 23 = 255.255.254.0 24 = 255.255.255.0 25 = 255.255.255.128 26 = 255.255.255.192 27 = 255.255.255.224 28 = 255.255.255.240 29 = 255.255.255.248 30 = 255.255.255.252 31 = 255.255.255.254	**Factory Setting:**	24
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the subnet mask used by the Ethernet interface. It is valid only if P0810 = Parameters.

The following table shows the allowed values for the CIDR notation and equivalent dot notation for the subnet mask:

Table 4.7: *P0815 options*

Indication	Description
0 = Reserved	Reserved.
1 = 128.0.0.0	Subnet mask.
2 = 192.0.0.0	Subnet mask.
3 = 224.0.0.0	Subnet mask.
4 = 240.0.0.0	Subnet mask.
5 = 248.0.0.0	Subnet mask.
6 = 252.0.0.0	Subnet mask.
7 = 254.0.0.0	Subnet mask.
8 = 255.0.0.0	Subnet mask.
9 = 255.128.0.0	Subnet mask.
10 = 255.192.0.0	Subnet mask.
11 = 255.224.0.0	Subnet mask.
12 = 255.240.0.0	Subnet mask.
13 = 255.248.0.0	Subnet mask.
14 = 255.252.0.0	Subnet mask.
15 = 255.254.0.0	Subnet mask.
16 = 255.255.0.0	Subnet mask.
17 = 255.255.128.0	Subnet mask.
18 = 255.255.192.0	Subnet mask.
19 = 255.255.224.0	Subnet mask.
20 = 255.255.240.0	Subnet mask.
21 = 255.255.248.0	Subnet mask.
22 = 255.255.252.0	Subnet mask.
23 = 255.255.254.0	Subnet mask.
24 = 255.255.255.0	Subnet mask. Factory setting.
25 = 255.255.255.128	Subnet mask.
26 = 255.255.255.192	Subnet mask.
27 = 255.255.255.224	Subnet mask.
28 = 255.255.255.240	Subnet mask.
29 = 255.255.255.248	Subnet mask.
30 = 255.255.255.252	Subnet mask.
31 = 255.255.255.254	Subnet mask.

P0816 - Eth:Gateway 1

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

P0817 - Eth:Gateway 2

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

P0818 - Eth:Gateway 3

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

P0819 - Eth:Gateway 4

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

Description:

It defines the IP address of the default gateway used by the Ethernet interface. It is valid only if P0810 = Parameters.

Each parameter programs one octet of the gateway address, where the P0816 is the most significant octet. The programmed gateway IP address, then, has the format “P0816.P0817.P0818.P0819”.

P0820 - Eth:Read Word #3

P0821 - Eth:Read Word #4

P0822 - Eth:Read Word #5

P0823 - Eth:Read Word #6

P0824 - Eth:Read Word #7

P0825 - Eth:Read Word #8

P0826 - Eth:Read Word #9

P0827 - Eth:Read Word #10

P0828 - Eth:Read Word #11

P0829 - Eth:Read Word #12

P0830 - Eth:Read Word #13

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

Description:

It defines the content of read words 3 to 14 (slave sends to the master). Using these parameters, it is possible to

program the number of other parameter whose content shall be made available in the input area of the network master.

For instance, in case it is necessary to read the motor current in amperes from the inverter, the value 3 must be programmed in some of these parameters, since the parameter P0003 is the parameter that contains this information. Note that the reading value of any parameter is represented with a 16-bit word. Even if the parameter has a decimal resolution value, the value is transferred with no decimal indication. For instance, if the parameter P0003 has the value 4.7, the value transferred via network will be 47.

These parameters are only used if the equipment is programmed in parameter P0871 to use options 4, 5 or 8, which have fixed words plus configurable I/Os.

The first parameter of this list programmed with the value 0 (zero) disables the reading of this word and the subsequent ones. The total number of words that must be programmed for reading in the network master then depends on how many parameters values other than 0 have been programmed in sequence.

P0831 - Eth:Read Word #14

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

Description:

It defines the content of read words 3 to 14 (slave sends to the master). Using these parameters, it is possible to program the number of other parameter whose content shall be made available in the input area of the network master.

For instance, in case it is necessary to read the motor current in amperes from the inverter, the value 3 must be programmed in some of these parameters, since the parameter P0003 is the parameter that contains this information. Note that the reading value of any parameter is represented with a 16-bit word. Even if the parameter has a decimal resolution value, the value is transferred with no decimal indication. For instance, if the parameter P0003 has the value 4.7, the value transferred via network will be 47.

These parameters are only used if the equipment is programmed in parameter P0871 to use options 4, 5 or 8, which have fixed words plus configurable I/Os.

The first parameter of this list programmed with the value 0 (zero) disables the reading of this word and the subsequent ones. The total number of words that must be programmed for reading in the network master then depends on how many parameters values other than 0 have been programmed in sequence.

P0835 - Eth:Write Word #3

P0836 - Eth:Write Word #4

P0837 - Eth:Write Word #5

P0838 - Eth:Write Word #6

P0839 - Eth:Write Word #7

P0840 - Eth:Write Word #8

P0841 - Eth:Write Word #9

P0842 - Eth:Write Word #10

P0843 - Eth:Write Word #11

P0844 - Eth:Write Word #12

P0845 - Eth:Write Word #13

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

Description:

It defines the content of write words 3 to 14 (masters sends to the slave). Using these parameters, it is possible to program the number of other parameter whose content shall be made available in the output area of the network master.

For instance, in case it is necessary to write the acceleration in the device, the value 100 must be programmed in some of these parameters, since the parameter P0100 is the parameter where this information is programmed. Note that the written value of any parameter is represented with a 16-bit word. Even if the parameter has a decimal resolution value, the value is transferred with no decimal indication. For instance, if you want to set the parameter P0100 with the value 5.0s, the value 50 should be written via network.

These parameters are only used if the equipment is programmed in parameter P0871 to use options 4, 5 or 8, which have fixed words plus configurable I/Os.

The first parameter of this list programmed with the value 0 (zero) disables the writing of this word and the subsequent ones. The total number of words that must be programmed for writing in the network master then depends on how many parameters values other than 0 have been programmed in sequence.

P0846 - Eth:Write Word #14

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

Description:

It defines the content of write words 3 to 14 (masters sends to the slave). Using these parameters, it is possible to program the number of other parameter whose content shall be made available in the output area of the network master.

For instance, in case it is necessary to write the acceleration in the device, the value 100 must be programmed in some of these parameters, since the parameter P0100 is the parameter where this information is programmed. Note that the written value of any parameter is represented with a 16-bit word. Even if the parameter has a decimal resolution value, the value is transferred with no decimal indication. For instance, if you want to set the parameter P0100 with the value 5.0s, the value 50 should be written via network.

These parameters are only used if the equipment is programmed in parameter P0871 to use options 4, 5 or 8, which have fixed words plus configurable I/Os.

The first parameter of this list programmed with the value 0 (zero) disables the writing of this word and the subsequent ones. The total number of words that must be programmed for writing in the network master then depends on how many parameters values other than 0 have been programmed in sequence.

P0856 - Eth:Actual IP Addr. 1

P0857 - Eth:Actual IP Addr. 2

P0858 - Eth:Actual IP Addr. 3

P0859 - Eth:Actual IP Addr. 4

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

Description:

It allows viewing the IP address in use by the CFW500-CETH2 accessory.

P0860 - MBTCP: Communication Status

Adjustable Range:	0 = Disabled 1 = No connection 2 = Connected 3 = Timeout Error	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It indicates Modbus TCP communication status.

Table 4.8: *P0860 options*

Indication	Description
0 = Disabled	Communication disabled, no accessory.
1 = No connection	Communication enabled, but no active Modbus TCP connection.
2 = Connected	At least one active Modbus TCP connection.
3 = Timeout Error	Device detected timeout at Modbus TCP communication, programmed through P0806.

P0863 - MBTCP: Active Connections

Adjustable Range:	0 to 4	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It indicates the number of active Modbus TCP connections.

The equipment allows up to 4 simultaneous Modbus TCP connections. If a connection is inactive for approximately 1 minute, the connection is closed automatically by the server.

P0865 - MBTCP: TCP Port

Adjustable Range:	0 to 9999	**Factory Setting:**	502
Properties:	cfg		
Access Groups:	NET		

Description:

It defines the TCP port for Modbus TCP connections.

Port 502 is the default TCP port for Modbus TCP connections, and is always available. If it is required to have any additional port to establish Modbus TCP connections, you can program the number of another TCP port in this parameter.

NOTE!
For the changes in this parameter be effective, the equipment must be powered off and on again.

P0869 - EIP: Master Status

Adjustable Range:	0 = Run 1 = Idle	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It indicates the EtherNet/IP network master status. It may be in operation mode (Run) or in configuration mode (Idle).

Table 4.9: *P0869 options*

Indication	Description
0 = Run	Reading and writing telegrams are processed normally and updated by the master.
1 = Idle	Only the reading telegrams from the slaves are updated by the master. Writing, in this case, remains disabled.

P0870 - EIP: Communication Status

Adjustable Range:	0 = Disabled 1 = No connection 2 = Connected 3 = Timeout in I/O Connection 4 = Duplicated IP	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It indicates EtherNet/IP communication status.

Table 4.10: P0870 options

Indication	Description
0 = Disabled	No interface, interface disabled or with no IP address configured.
1 = No connection	Communication enabled, but no I/O connections are established with network master.
2 = Connected	Communication enabled and I/O connection established with network master. At this state, device effectively perform data exchange through network.
3 = Timeout in I/O Connection	I/O connection has timed out.
4 = Duplicated IP	Reserved.

P0871 - EIP: Data Profile

Adjustable Range:	0 to 3 = Reserved 4 = 120/170: CIP Basic Speed + I/O 5 = 121/171: CIP Extended Speed + I/O 6 to 7 = Reserved 8 = 100/150: Manufac. Speed + I/O 9 to 10 = Reserved	**Factory Setting:**	8
Properties:	cfg		
Access Groups:	NET		

Description:

It allows to select which instance of the Assembly class is used when exchanging I/O data with the network master.

The defined Assembly class instance defines the format of the cyclic data (I / O) communicated with the device.

Table 4.11: P0871 options

Indication	Description
0 ... 3 = Reserved	Reserved.
4 = 120/170: CIP Basic Speed + I/O	Program I/O instances 120/170, with 2 read words + 2 write words predefined according to ODVA AC/DC Drive profile Basic Speed, plus configurable I/O words using parameters.
5 = 121/171: CIP Extended Speed + I/O	Program I/O instances 121/171, with 2 read words + 2 write words predefined according to ODVA AC/DC Drive profile Extended Speed, plus configurable I/O words using parameters.
6 ... 7 = Reserved	Reserved.
8 = 100/150: Manufac. Speed + I/O	Program I/O instances 100/150, with 2 read words + 2 write words predefined according to manufactures specific profile, plus configurable I/O words using parameters.
9 ... 10 = Reserved	Reserved.

P0884 - Eth: SW Version

Adjustable Range:	0 to 655	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

Indicates the software version of the CFW500-CETH2 plug-in module.

P0885 - Eth: SW Revision

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

Description:

This parameter is a counter that indicates the software revision of the CFW500-CETH2 plug-in module. It is automatically generated by the machine that generated the firmware.

P0886 - EIP: DLR Topology

Adjustable Range:	0 = Linear 1 = Ring	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

Indicates the network topology.

Table 4.12: *P0886 options*

Indication	Description
0 = Linear	Indicates linear topology.
1 = Ring	Indicates ring topology.

P0887 - EIP: DLR Status

Adjustable Range:	0 = Idle State 1 = Normal State 2 = Fault State	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

Indicates the status of the network.

Table 4.13: *P0887 options*

Indication	Description
0 = Idle State	Ring Node is in Idle state.
1 = Normal State	Ring Node is in Normal state.
2 = Fault State	Ring Node is in Fault state.

P0889 - Eth: Interface Status

Adjustable Range:	0 to 3 (hexa) Bit 0 = Link 1 Bit 1 = Link 2	**Factory Setting:**	-
Properties:	ro		
Access Groups:	NET		

Description:

It indicates the status of Ethernet interface.

Table 4.14: *P0889 bits function*

Bit	Value/Description
Bit 0 Link 1	**0:** No link at port 1. **1:** Link active at port 1.
Bit 1 Link 2	**0:** No link at port 2. **1:** Link active at port 2.

P0890 - Eth: Interface Control

Adjustable Range:	0 to 3F (hexa) Bit 0 = Auto Negotiate Link 1 Bit 1 = Speed Link 1 Bit 2 = Forced Duplex Link 1 Bit 3 = Auto Negotiate Link 2 Bit 4 = Speed Link 2 Bit 5 = Forced Duplex Link 2	**Factory Setting:**	9
Properties:			
Access Groups:	NET		

Description:

Configures the Ethernet network interface. Each bit represents a setting.

Table 4.15: *P0890 bits function*

Bit	Value/Description
Bit 0 Auto Negotiate Link 1	**0:** Auto-negotiation inactive in port 1. **1:** Auto-negotiation active in port 1.
Bit 1 Speed Link 1	**0:** 10 Mbps in port 1, if auto-negotiation inactive. **1:** 100 Mbps in port 1, if auto-negotiation inactive.
Bit 2 Forced Duplex Link 1	**0:** Half-duplex in port 1, if auto-negotiation inactive. **1:** Full-duplex in port 1, if auto-negotiation inactive.
Bit 3 Auto Negotiate Link 2	**0:** Auto-negotiation inactive in port 2. **1:** Auto-negotiation active in port 2.
Bit 4 Speed Link 2	**0:** 10 Mbps in port 2, if auto-negotiation inactive. **1:** 100 Mbps in port 2, if auto-negotiation inactive.
Bit 5 Forced Duplex Link 2	**0:** Half-duplex in port 2, if auto-negotiation inactive. **1:** Full-duplex in port 2, if auto-negotiation inactive.

5 OPERATION IN THE MODBUS TCP NETWORK – SERVER MODE

5.1 AVAILABLE FUNCTIONS

In the Modbus specification are defined the functions used to access different types of data. In the CFW500/MW500 G2, in order to access those data the following services (or functions) have been made available:

Table 5.1: *Supported Modbus Functions*

Code	Name	Description
01	Read Coils	Reading of bit blocks of the coil type.
02	Read Discrete Inputs	Reading of bit blocks of the discrete input type.
03	Read Holding Registers	Reading of register blocks of the holding register type.
04	Read Input Registers	Reading of register blocks of the input register type.
05	Write Single Coil	Writing in a single bit of the coil type.
06	Write Single Register	Writing in a single register of the holding type.
15	Write Multiple Coils	Writing in bit blocks of the coil type.
16	Write Multiple Registers	Writing in register blocks of the holding register type.
43	Read Device Identification	Identification of the device model.

5.2 MEMORY MAP

The frequency inverter CFW500/MW500 G2 has different types of data accessible through the Modbus communication. These data are mapped at data addresses and access functions as described in the following items.

5.2.1 Parameters

The CFW500/MW500 G2 Modbus communication is based on the reading/writing of the equipment parameters. All the drive parameters list is made available as 16-bit holding registers type. The data addressing is done with the offset equal to zero, which means that the parameter number corresponds to the register number. The Table 5.2 on page 5-1 illustrates the parameters addressing, which can be accessed as holding register.

Table 5.2: *Parameters Access - Holding Registers*

Parameter	Modbus data address (decimal)
P0000	0
P0001	1
⋮	⋮
P0100	100
⋮	⋮

It is necessary to know the device list of parameters to be able to operate the equipment. Thus, it is possible to identify what data are needed for the status monitoring and the control of the functions. The main parameters are:

Monitoring (reading):

- P0680 (holding register address 680): Status word
- P0681 (holding register address 681): Motor speed

Command (writing):

- P0684 (holding register address 684): Command word
- P0685 (holding register address 685): Speed reference

Refer to the Programming Manual for a complete parameter list of the equipment.

NOTE!

- All the parameters are treated as holding registers. Depending on the master that is used, those registers are referenced starting from the base address 40000 or 4x. In this case, the address that must be programmed in the master for a parameter is the address showed in the Table 5.2 on page 5-1 added to the base address. Refer to the master documentation to find out how to access holding registers.
- It should be noted that read-only parameters can only be read from the equipment, while other parameters can be read and written through the network.

5.2.2 Memory Markers

Besides the parameters, other types of data as bit markers, word or float, can also be accessed using the Modbus protocol. Those markers are used mainly by the SoftPLC function, available for the CFW500/MW500 G2. Refer to the SoftPLC documentation for the description of those markers, as well as for the addresses via Modbus.

5.3 COMMUNICATION ERRORS

Communication errors may occur in the transmission of telegrams, as well as in the contents of the transmitted telegrams.

In the event of a successful reception, during the treatment of the telegram, the server may detect problems and send an error message, indicating the kind of problem found:

Table 5.3: *Error codes for Modbus*

Error Code	Description
1	Invalid function: the requested function is not implemented for the equipment.
2	Invalid data address: the data address (register or bit) does not exist.
3	Invalid data value: ■ Value out of the allowed range. ■ Writing on data that cannot be changed (read only register or bit).

NOTE!

It is important that it be possible to identify at the client what type of error occurred, in order to be able to diagnose problems during the communication.

6 OPERATION IN THE ETHERNET/IP NETWORK

6.1 I/O DATA

The I/O data for control and monitoring of the equipment is programmed through parameters P0820 to P0846, and P0871. Using these parameters it is possible to define the I/O words format and the number of words to communicate with the master.

Monitoring (Read)

Table 6.1: *Programming of the I/O words*

	Instance	16 bits word	Function	Option of P0871 + P0820 ... P0831
Const		#1	Status word	2
		#2	Motor speed	3
Programable		#3	Ethernet Read Word #3	4
	150, 170, 171	#4	Ethernet Read Word #4	5
		#5	Ethernet Read Word #5	
		⋮	⋮	14
		#14	Ethernet Read Word #14	

Control (Write)

Table 6.2: *Programming of the I/O words*

	Instance	16 bits word	Function	Option of P0871 + P0835 ... P0846
Const		#1	Control word	2
		#2	Speed reference	3
Programable		#3	Ethernet Write Word #3	4
	100, 120, 121	#4	Ethernet Write Word #4	5
		#5	Ethernet Write Word #5	
		⋮	⋮	14
		#14	Ethernet Write Word #14	

According to the selected instance, the first two reading words (status and motor speed) and the first two writing words (control and speed reference) may have a different format depending on the profile defined for the instance. Programmable words using parameters P0820 ... P0831 and P0835 ... P0846 have similar operation regardless of the selected instance.

6.1.1 Instances 100/150: Manufacturer Specific

Data for control and monitoring of equipment using manufacturer specific profile.

In this profile, the first two predefined reading and writing words use the equipment control and monitoring parameters as indicated below:

Instance 150 - Monitoring

- P0680 - Status word.
- P0681 - Motor speed.

Instance 100 - Control

- P0684 - Control word.
- P0685 - Speed reference.

6.1.2 Instances 120/170: ODVA Basic Speed

Data for control and monitoring of equipment using profile AC/DC Drive - Basic Speed.

In this profile, the first two predefined read and write words follow the format defined by the CIP specification according to instances 20/70:

Instance 170 - Monitoring

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
170	0						Running1		Faulted
	1	-							
	2	Speed Actual rpm (low byte)							
	3	Speed Actual rpm (high byte)							

Bit	Value/Description
Bit 0 Faulted	**0**: frequency inverter is not in a fault state **1**: Some fault registered by the frequency inverter. Note: The number of the fault can be read through parameter P0049 – Current Fault.
Bit 1	Reserved.
Bit 2 Running1 (Fwd)	**0**: The motor is not running forward. **1**: The motor is running forward.
Bits 3 to 7	Reserved.

- Byte 1: reserved.
- Bytes 2 and 3: represent the motor speed in RPM.

Instance 120 - Control

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
120	0						Fault Reset		Run Fwd
	1	-							
	2	Speed Reference rpm (low byte)							
	3	Speed Reference rpm (high byte)							

Bit	Value/Description
Bit 0 Run Fwd	**0**: Stop motor **1**: The motor runs in the forward direction.
Bit 1	Reserved.
Bit 2 Fault Reset	**0**: Not used. **1**: If in a fault condition, it resets the frequency inverter.
Bits 3 to 7	Reserved.

- Byte 1: reserved.
- Bytes 2 and 3: represent the speed reference of the motor in RPM.

NOTE!
For this profile, the values read and written via net in these words are internally converted into equivalent values for the product control and monitoring words described in Section 6.1.1 Instances 100/150: Manufacturer Specific on page 6-1.

6.1.3 Instances 121/171: ODVA Extended Speed

Data for control and monitoring of equipment using profile AC/DC Drive - Extended Speed.

In this profile, the first two predefined read and write words follow the format defined by the CIP specification according to instances 21/71:

Instance 171 - Monitoring

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
171	0	At Reference	Ref. from Net	Ctrl from Net	Ready	Running2 (Rev)	Running1 (Fwd)	Warning	Faulted
	1	Drive State							
	2	Speed Actual rpm (low byte)							
	3	Speed Actual rpm (high byte)							

Bit	Value/Description
Bit 0 Faulted	**0**: frequency inverter is not in a fault state **1**: Some fault registered by the frequency inverter. Note: The number of the fault can be read through parameter P0049 – Current Fault.
Bit 1 Warning	**0**: frequency inverter is not in an alarm state. **1**: Some alarm registered by the frequency inverter. The number of the alarm can be read by means of parameter P0048 – Current Alarm.
Bit 2 Running1 (Fwd)	**0**: The motor is not running forward. **1**: The motor is running forward.
Bit 3 Running2 (Rev)	**0**: The motor is not running in the reverse direction. **1**: The motor is running in the reverse direction.
Bit 4 Ready	**0**: frequency inverter not ready to operate. **1**: frequency inverter ready to operate (Ready, Enabled or Stopping states).
Bit 5 Ctrl from Net	**0**: Drive locally controlled. **1**: Drive remotely controlled.
Bit 6 Ref. from Net	**0**: Speed reference is not being sent via EtherNet/IP. **1**: Indicates speed reference being sent via EtherNet/IP.
Bit 7 At Reference	**0**: frequency inverter has not reached the programmed speed yet. **1**: frequency inverter has reached the programmed speed.

- Byte 1 indicates the state of the drive:
  - 0 = Non Existent
  - 1 = Startup
  - 2 = Not Ready
  - 3 = Ready[1]
  - 4 = Enabled[1]
  - 5 = Stopping
  - 6 = Fault Stop
  - 7 = Faulted[1]
- Bytes 2 and 3: represent the motor speed in RPM.

Instance 121 - Control

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
121	0		NetRef	NetCtrl			Fault Reset	Run Rev	Run Fwd
	1	-							
	2	Speed Reference rpm (low byte)							
	3	Speed Reference rpm (high byte)							

[1] Only these states are presented by the product.

Bit	Value/Description
Bit 0 Run Fwd	**0**: Stop motor **1**: The motor runs in the forward direction.
Bit 1 Run Rev	**0**: Stop motor **1**: The motor runs in the reverse direction.
Bit 2 Fault Reset	**0**: Not used. **1**: If in a fault condition, it resets the frequency inverter.
Bits 3 e 4	Reserved.
Bit 5 NetCtrl	**0**: frequency inverter selects the local mode. **1**: frequency inverter selects the remote mode.
Bit 6 NetRef	**0**: Speed reference via network is disregarded. **1**: Using Speed reference received via network.
Bits 7	Reserved.

- Byte 1: reserved.
- Bytes 2 and 3: represent the speed reference in RPM.

NOTE!
For this profile, the values read and written via net in these words are internally converted into equivalent values for the product control and monitoring words described in Section 6.1.1 Instances 100/150: Manufacturer Specific on page 6-1.

6.1.4 Programmable Parameters

Besides the firs two predefined read and write words, for the cyclic communicagtion, it is possible to program up to 12 other parameters for reading and up to 12 other parameters for writing via network, through parameters P0820 ... P0831 (read) and P0835 ... P0846 (write).

The detailed description of how to program them is present in the description of these parameters.

6.2 ACYCLIC DATA

In addition to the cyclic data, the interface also provides acyclic data via *explicit messaging*. Using this type of communication, you can access any equipment parameter. Access to this type of data is commonly done using instructions for reading or writing data, which should indicate the class, instance and attribute to the desired parameter. The Section 6.4.12 Manufacturer Specific Class (64h) on page 6-10 describes how to address the parameters for CFW500/MW500 G2 frequency inverter.

6.3 EDS FILE

Each device on an EtherNet/IP network has an EDS configuration file, which contains information about the device functions on the network. This file is used by a master or configuration software to program devices present at EtherNet/IP network.

The EDS file is available from WEG website (http://www.weg.net). It is important to note if the EDS configuration file is compatible with the firmware version of the CFW500/MW500 G2 frequency inverter.

6.4 SUPPORTED OBJECT CLASSES

Every EtherNet/IP equipment is modeled as a set of objects. The objects are responsible for defining the function that each device will have.

The following sections present detailed information about these object classes.

6.4.1 Identity Class (01h)

This class provides general information about the device identity such as VendorID, Product Name, Serial Number, etc.. The following attributes are implemented:

Table 6.3: *Identity Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Identity Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.4: *Identity Class instance attributes (Instance #1)*

Attribute	Method	Name	Default	Description
1	GET	Vendor ID	355h	Manufacturer identifier.
2	GET	Device Type	2Bh	Product Type.
3	GET	Product Code	1A00h	Product Code.
4	GET	Revision	-	Firmware revision.
5	GET	Status	-	Device status.
6	GET	Serial Number	-	Serial Number.
7	GET	Product Name	CFW500/MW500 G2	Product name.

6.4.2 Message Router Class (02h)

This class provides information on the explicit message router object. The following attributes are implemented:

Table 6.5: *Message Router Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Message Router Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
4	GET	Opcional Attribute List	1 - 65535	List of optional attributes used.
5	GET	Opcional Service List	1 - 65535	List of optional services used.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.6: *Message Router Class instance attributes (Instance #1)*

Attribute	Method	Name	Default	Description
1	GET	Object List	-	List of supported objects.
2	GET	Number Available	-	Maximum number of connections supported.
3	GET	Number Active	-	Number of active connections.

6.4.3 Assembly Class (04h)

This class is responsible for grouping several attributes in only one connection. The following attributes are implemented:

Table 6.7: *Assembly Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Assembly Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
4	GET	Opcional Attribute List	1 - 65535	List of optional attributes used.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.8: *Assembly Class instance attributes (Instance #1)*

Atribute	Method	Name	Description
3	GET	Data	Instance data.
4	GET	Size	Number of bytes of Data.

The Assembly class contains the following instances in the CFW500/MW500 G2:

Table 6.9: *Assembly class instances*

Output instance	Input instance	Size	Description
100	150	up to 100 bytes	Consuming and Producing Instances.
120	170	up to 100 bytes	Consuming and Producing Instances.
121	171	up to 100 bytes	Consuming and Producing Instances.

6.4.4 Connection Manager Class (06h)

This class allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections.

Table 6.10: *Connection Manager Class attributes (Instance #0)*

Attribute	Method	Name	min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Connection Manager Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
4	GET	Opcional Attribute List	1 - 65535	List of optional attributes used.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.11: *Connection Manager Class instance attributes (Instance #1)*

Atribute	Method	Name	Description
1	GET	Open Requests	Number of Forward_Open service requests received.
2	GET	Open Format Rejects	Number of Forward_Open service requests which were rejected due to bad format.
3	GET	Open Resource Rejects	Number of Forward_Open service requests which were rejected due to lack of resources.
4	GET	Open Other Rejects	Number of Forward_Open service requests which were rejected for reasons other than bad format or lack of resources.
5	GET	Close Requests	Number of Forward_Close service requests received.
6	GET	Close Format Requests	Number of Forward_Close service requests which were rejected due to bad format.
7	GET	Close Other Requests	Number of Forward_Close service requests which were rejected for reasons other than bad format.
8	GET	Connection Timeouts	Total number of connection timeouts.

6.4.5 Device Level Ring Class (47h)

This class provides the status information for the DLR protocol. The following attributes have been implemented:

Table 6.12: *Device Level Ring Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Device Level Ring Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.13: *Device Level Ring Class instance attributes (Instance #1)*

Attribute	Method	Name	Min/Max	Default	Description
1	GET	Network Topology	0 - 1	0	0 = Linear. 1 = Ring.
2	GET	Network Status	0 - 4	0	0 = Normal. 1 = Ring Fault. 2 = Unexpected Loop Detected. 3 = Partial Network Fault. 4 = Rapid Fault/Restore Cycle.
10	GET	Active Supervisor Address	-	-	IP and/or MAC address of the active ring supervisor.
12	GET	Capability Flags	-	81h	Announce-based Ring Node, supports the Flush_Tables frame.

6.4.6 QoS Class (48h)

This class provides a means to configure Quality of Service (QoS) on EtherNet/IP devices. The following attributes have been implemented:

Table 6.14: *QoS Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the QoS Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.15: *QoS Class instance attributes (Instance #1)*

Attribute	Method	Name	Min/Max	Default	Description
4	SET	DSCP Urgent	0 - 63	55	CIP transport class 1 messages with priority Urgent.
5	SET	DSCP Scheduled	0 - 63	47	CIP transport class 1 messages with priority Scheduled.
6	SET	DSCP High	0 - 63	43	CIP transport class 1 messages with priority High.
7	SET	DSCP Low	0 - 63	31	CIP transport class 1 messages with priority Low.
8	SET	DSCP Explicit	0 - 63	27	CIP UCMM and CIP class 3.

6.4.7 SNMP Class (52h)

This class provides a means to configure of the SNMP Agent in the device. The following attributes have been implemented:

Table 6.16: *SNMP Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the SNMP Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.17: *SNMP Class instance attributes (Instance #1)*

Attribute	Method	Name	Min/Max	Default	Description
1	GET/SET	SnmpAgent	0 - 1	1	0 = Disabled. 1 = Enabled.
2	GET	SnmpAgentVersion	1 - 31	1	1 = SNMPv1. 3 = SNMPv3. 31 = SNMPv1+v3.
3	GET/SET	PrimaryNetworkManagmentIdentifier	-	0.0.0.0	Primary SNMP manager IP address.
4	GET/SET	SecondaryNetworkManagmentIdentifier	-	0.0.0.0	Secondary SNMP manager IP address.
5	GET/SET	Notifications	0 - 1	1	0 = Disabled. 1 = Enabled.
6	GET	TrapType	1 - 2	1	1 = TrapV1Pdu. 2 = TrapV2Pdu.

6.4.8 Port Class (F4h)

This class describes the communication interfaces that are present on the device and visible to CIP.

Table 6.18: *Port Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Port Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.
8	GET	Entry Port	1 - 65535	Returns the instance of the Port Object that describes the port through which this request entered the device.
9	GET	Port Instance Info	1 - 65535	Informations of the attributes each instance.

Table 6.19: *Port Class instance attributes (Instance #1)*

Attribute	Method	Name	Default	Description
1	GET	Port Type	-	Type of port.
2	GET	Port Number	-	CIP port number associated with this port.
3	GET	Logical Link Object	-	-
4	GET	Port Name	-	String which names the communications interface.
5	GET	Node Address	-	-
6	GET	Port Routing Capabilities	-	-

6.4.9 TCP/IP Interface Class (F5h)

This class provides the mechanism to configure a device's TCP/IP network interface. The following attributes have been implemented:

Table 6.20: *TCP/IP Interface Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the TCP/IP Interface Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
4	GET	Opcional Attribute List	1 - 65535	List of optional attributes used.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.21: *TCP/IP Interface Class instance attributes (Instance #1)*

Attribute	Method	Name	Min/Max	Default	Description
1	GET	Status	-	-	Indicates the status of the TCP/IP network interface.
2	GET	Configuration Capability	-	-	Indicates the device's support for optional network configuration capability.
3	GET/SET	Configuration Control	-	-	Control network configuration options.
4	GET	Physical Link Object	-	-	Identifies the object associated with the underlying physical communications interface (e.g., an 802.3 interface).
5	GET/SET	Interface Configuration	-	-	Contains the configuration parameters required for a device to operate as a TCP/IP node.
6	GET/SET	Host Name	-	-	Contains the device's host name, which can be used for informational purposes.
13	GET	Encapsulation Inactivity Timeout	-	-	Used to enable TCP socket cleanup (closing) when the defined number of seconds have elapsed with no Encapsulation activity.

6.4.10 Ethernet Link Class (F6h)

This class maintains link-specific counters and status information for an IEEE802.3 communications interface. The following attributes have been implemented:

Table 6.22: *Ethernet Link Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the Ethernet Link Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
4	GET	Opcional Attribute List	1 - 65535	List of optional attributes used.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.23: *Ethernet Link Class instance attributes (Instance #1)*

Attribute	Method	Name	Min/Max	Default	Description
1	GET	Interface Speed	-	-	Indicate the speed at which the interface is currently running (e.g., 10 Mbps, 100 Mbps, 1 Gbps, etc.).
2	GET	Interface Flags	-	-	Contains status and configuration information about the physical interface.
3	GET	Physical Address	-	-	Contains the interface's MAC address.
4	GET	Interface Counters	-	-	Contains counters to the receipt of packets on the interface.
5	GET	Media Counters	-	-	Contains specific counters for the Ethernet interface.
6	GET/SET	Interface Control	-	-	Physical interface configuration.
11	GET	Interface Capability	-	-	Indicate the set of capabilities for the interface.

6.4.11 LLDP Management Class (109h)

This class contains information for the LLDP protocol for the EtherNet/IP. The following attributes have been implemented:

Table 6.24: *LLDP Management Class attributes (Instance #0)*

Attribute	Method	Name	Min/Max	Description
1	GET	Revision	1 - 65535	Revision of the definition of the LLDP Management Class Object upon which the implementation was based.
2	GET	Max Instance	1 - 65535	Maximum number of instances.
3	GET	Number of Instances	1 - 65535	Number of ports instantiated.
6	GET	Max Number Class Attributes	1 - 65535	Number of the last implemented class attribute on the device.
7	GET	Max Number Instance Attributes	1 - 65535	Number of the last implemented instance attribute on the device.

Table 6.25: *LLDP Class instance attributes (Instance #1)*

Attribute	Method	Name	Min/Max	Default	Description
1	GET/SET	LLDP Enable	0 - 1	1	Enabled or disabled the transmission of LLDP telegrams.
2	GET/SET	msgTxInterval	1 - 3600	30	Message Transmission Interval for LLDP frames.
3	GET/SET	msgTxHold	1 - 100	4	Message Transmission Multiplier for LLDP frames.
4	GET	LLDP Datastore	-	2	Bit: 1 = LLDP Data Table Object 2 = SNMP 3 = NETCONF YANG 4 = RESTCONF YANG 4-15 = Reserved
5	GET	Last Change	-	-	Time in seconds since the last time an entry in the LLDP database was changed.

6.4.12 Manufacturer Specific Class (64h)

For CFW500/MW500 G2 frequency inverter, the manufacturer specific classes are used for mapping all device parameters. These classes allow the user to read from and write to any parameter through the network. For this, EtherNet/IP CIP Class 3 messages or Unconnected Explicit messages can be used.

CFW500/MW500 G2 uses class 100 for parameter access, and the parameter number is defined according to instance and attribute, as shown in Table 6.26 on page 6-11:

Table 6.26: *Manufacturer Specific Class*

Class	Instance	Attributes	Accessed Parameters
Classe 100 (64h) (Vendor Specific)	1	100 ... 199	Parameters with Net ID 0 - 99
Classe 100 (64h) (Vendor Specific)	2	100 ... 199	Parameters with Net ID 100 - 199
Classe 100 (64h) (Vendor Specific)	3	100 ... 199	Parameters with Net ID 200 - 299
Classe 100 (64h) (Vendor Specific)	4	100 ... 199	Parameters with Net ID 300 - 399
Classe 100 (64h) (Vendor Specific)	5	100 ... 199	Parameters with Net ID 400 - 499
Classe 100 (64h) (Vendor Specific)	6	100 ... 199	Parameters with Net ID 500 - 599
⋮	⋮	⋮	⋮
Classe 100 (64h) (Vendor Specific)	10	100 ... 199	Parameters with Net ID 900 - 999
Classe 100 (64h) (Vendor Specific)	11	100 ... 199	Parameters with Net ID 1000 - 1099
⋮	⋮	⋮	⋮

For this list, status and diagnostics objects typically allow read-only access, while configuration objects allow read/write access:

- For read access (Get Attribute Single), the request must contain 1 byte with the size in bytes of the data read.
- For write access (Set Attribute Single), the request must contain the number of bytes written according to the size of the data accessed.

Examples:

- Parameter 23: class 64h, instance 1, attribute 123. This path gives access to P0023.
- Parameter 100: class 64h, instance 2, attribute 100. This path gives access to P0100.
- Parameter 202: class 64h, instance 3, attribute 102. This path gives access to P0202.

NOTE!
- Invalid or unavailable parameter mapping return zero value.
- The data is transmitted as an integer value, without the indication of the decimal places.

7 WEB SERVER

Ethernet interface also provides a WEB server with a simple page to access CFW500/MW500 G2 frequency inverter data. You can use a web browser by typing the IP address in the browser address bar, and it will present a web page with links to interface settings and device data.

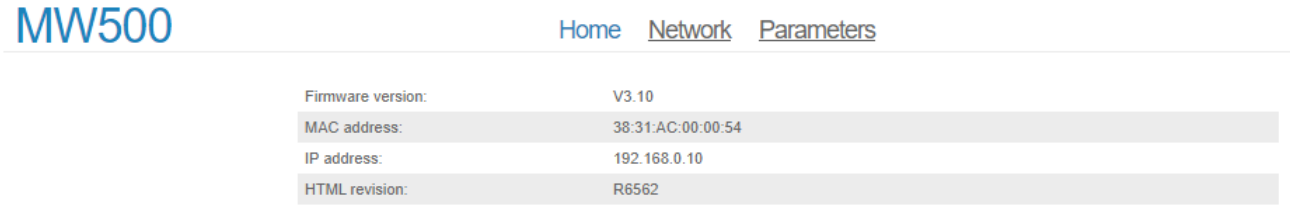


Figure 7.1: *WEB Page*

In the interface settings, it presents several fields for programming the IP address, subnet, DHCP, among others. The parameter list of the equipment can also be accessed through the WEB browser via ”Parameters” link.

NOTE!
For security reasons, access to the WEB server is disabled by default and it can be enabled using the parameter P0799.

8 STARTUP GUIDE - MODBUS TCP COMMUNICATION

The main steps to start up the CFW500/MW500 G2 frequency inverter in Modbus TCP network are described below. These steps represent an example of use. Check out the specific chapters for details on the indicated steps.

8.1 INSTALLING THE ACCESSORY

1. Install the communication accessory, as indicated in the installation guide supplied with the accessory.
2. With the module installed, during the recognition stage, the Status LED test routine will be performed.
3. Observe the content of parameter P0027. Check if the module was recognized. The detection is done automatically and does not require the user's intervention.
4. Connect the cables, considering the recommended instructions in network installation, as described in Section 3 ETHERNET NETWORK INSTALLATION on page 3-1:
   - Use shielded cable.
   - Properly ground network equipment.
   - Avoid laying communication cables next to power cables.

8.2 CONFIGURING THE EQUIPMENT

1. Follow the recommendations described in the user manual to program the device parameters related to the motor parameterization, desired functions for the I/O signals, etc.
2. Program the command sources as desired for the application (P0220 ... P0228).
3. Configure communication parameters, such as DHCP, IP address, communication rate, etc. (P0810 ... P0819).
4. Configure the timeout for the Modbus TCP communication in P0806.
5. Program the desired action for the equipment in case of communication fault in P0313.
6. Define which data will be read and written at frequency inverter CFW500/MW500 G2, based on its parameter list. It is not necessary to define I/O words. The Modbus TCP protocol enables direct access to any device parameter, and does not distinguish between cyclic and acyclic data. Among the main parameters that can be used to control the device, we can mention:
   - P0680 - Status word (read)
   - P0681 - Motor speed (read)
   - P0684 - Control word (write)
   - P0685 - Speed reference (write)

8.3 CONFIGURING THE MASTER (CLIENT)

The way the network configuration is done depends greatly on the used client and the configuration tool. It is essential to know the tools used to perform this activity. In general, the following steps are necessary to perform the network configuration.

1. Configure the client to access the holding registers, based on the defined equipment parameters to read and write. The register address is based on the parameter number, as shown in Table 5.2 on page 5-1.
2. It is recommended that reading and writing are done in a cyclic manner, allowing detection of communication errors by timeout. The period of data update must be in accordance with the value programmed in parameter P0806.

8.4 COMMUNICATION STATUS

Once the network is assembled and the client programmed, it is possible to use the LEDs and parameters of the equipment to identify some status related to the communication.

- The Status and Link LEDs provide information about the status of the interface and communication.
- The parameter P0860 indicates the status of communication between the device and the network client.

The client of the network must also supply information about the communication with the server.

9 STARTUP GUIDE - ETHERNET/IP COMMUNICATION

The main steps to start up the CFW500/MW500 G2 frequency inverter in EtherNet/IP network are described below. These steps represent an example of use. Check out the specific chapters for details on the indicated steps.

9.1 INSTALLING THE ACCESSORY

1. Install the communication accessory, as indicated in the installation guide supplied with the accessory.
2. With the module installed, during the recognition stage, the LED test routine will be performed.
3. Observe the content of parameter P0027. Check if the module was recognized. The detection is done automatically and does not require the user's intervention.
4. Connect the cables, considering the recommended instructions in network installation, as described in Section 3 ETHERNET NETWORK INSTALLATION on page 3-1:
   - Use shielded cable.
   - Properly ground network equipment.
   - Avoid laying communication cables next to power cables.

9.2 CONFIGURING THE EQUIPMENT

1. Follow the recommendations described in the user manual to program the device parameters related to the motor parameterization, desired functions for the I/O signals, etc.
2. Program the command sources as desired for the application (P0220 ... P0228).
3. Configure communication parameters, such as DHCP, IP address, communication rate, etc. (P0810 ... P0819).
4. Program the desired action for the equipment in case of communication fault in P0313.
5. Define which I/O instance is used through the parameter P0871.
6. Define additional read/write I/O data in parameters P0820 ... P0831 and P0835 ... P0846.

9.3 CONFIGURING THE MASTER

The way the network configuration is done depends greatly on the used client and the configuration tool. It is essential to know the tools used to perform this activity. In general, the following steps are necessary to perform the network configuration.

1. Load the EDS file[2] to the list of devices in the network configuration tool.
2. Select CFW500/MW500 G2 frequency inverter from the available list of devices on the network configuration tool. This can be done manually or automatically, if allowed by the tool.
3. For the master configuration, in addition to the IP address used by the EtherNet/IP module, you must indicate the number of instances of I/O and the amount of data exchanged with the master in each instance. For the communication module for EtherNet/IP, the following values must be programmed:
   - Input instances: 150, 170 or 171, according to the value of P0871. The number of words read by the network master also depends on the programming of parameters P0820 ... P0831.
   - Output Instance: 100, 120, or 121, according to the value of P0871. The number of words written by the network master also depends on the programming of parameters P0835 ... P0846.

Once configured, the status LED will be on in green. It is in this condition that cyclic data exchange effectively occurs between the slave and the master of the network.

[2]The EDS file is available from WEG website (http://www.weg.net). It is important to note if the EDS configuration file is compatible with the firmware version of the CFW500/MW500 G2 frequency inverter.

9.4 COMMUNICATION STATUS

Once the network is assembled and the master programmed, it is possible to use the LEDs and parameters of the equipment to identify some status related to the communication.

- The Status and Link LEDs provide information about the status of the interface and communication.
- The parameter P0870 indicates the status of communication between the device and the network master.
- The parameter P0869 indicates if network master is in *IDLE* or *RUN* mode.

The master of the network must also supply information about the communication with the slave.

9.5 OPERATION USING PROCESS DATA

Once the communication is established, the data mapped in the I/O area is automatically updated between master and slave. Among the main parameters that can be used to control the device, we can mention:

- P0680 - Status word.
- P0681 - Motor speed.
- P0684 - Control word.
- P0685 - Speed reference.

It is important to know these parameters to program the master as desired for the application.

9.6 ACCESS TO PARAMETERS – ACYCLIC MESSAGES

Besides the I/O data (cyclic) communication, the EtherNet/IP protocol also defines a kind of acyclic telegram (*explicit messages*), used especially in asynchronous tasks, such as parameter setting and configuration of the equipment.

The Section 6.2 ACYCLIC DATA on page 6-4 describes how to address the parameters of the frequency inverter CFW500/MW500 G2 via acyclic messages.

10 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.
A0147/ F0247: EtherNet/IP Offline	It indicates interruption in the cyclic communication with EtherNet/IP master. It occurs when, for any reason, after the cyclic communication of the master with the product is started, this communication is interrupted.	■ Check the status of the network master. ■ Check the network installation, broken cable or failed/bad contact in the network connections.
A0148/ F0248: Access Error Ethernet	It indicates failure in data exchange between frequency inverter CFW500/MW500 G2 and accessory CFW500-CETH2.	■ Check the firmware version of the device that supports the CFW500-CETH2 accessory. ■ Hardware errors arising, for example, from incorrect handling or installation of the accessory can cause this error. If possible, perform tests by replacing the communication accessory.
A0149/ F0249: Ethernet Offline	It indicates that the device stopped receiving valid telegrams for a period longer than the setting in P0806. The time counting starts as soon as it receives the first valid telegram.	■ Check network installation, broken cable or fault/poor contact on the connections with the network, grounding. ■ Ensure the Modbus TCP client always sends telegrams to the equipment in a time shorter than the setting in P0806. ■ Disable this function in P0806.

Fault and alarm operation:

- Faults operate by indicating their occurrence on the HMI, in the frequency inverter status word (P0006), in the present fault parameter (P0049) 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 (P0048). They are automatically reset when the alarm condition ceases existing.

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