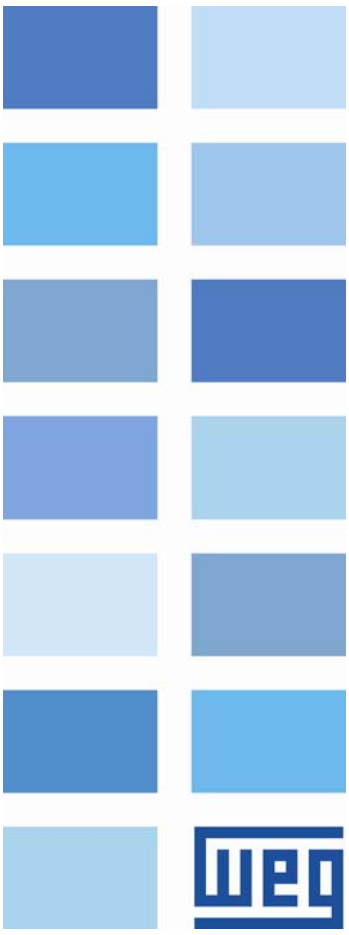
N2

CFW701

User's Manual



N2 User's Manual

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CONTENTS

ABOUT THE MANUAL

This manual provides the necessary information for the operation of the CFW701 frequency inverter using the N2 protocol. This manual must be used together with the CFW701 user manual.

ABBREVIATIONS AND DEFINITIONS

ASCII American Standard Code for Information Interchange
PLC Programmable Logic Controller
HMI Human-Machine Interface
ro Read-only
rw Read/write

NUMERICAL REPRESENTATION

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

DOCUMENTS

The N2 protocol for the CFW701 was developed based on the following specifications and documents:

Document	Version	Source
Metasys N2 Specification for Vendors	04-3402-22 REV A	Jhonson Controls, Inc

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 RS232 and RS485 interfaces.

The standards that specify the RS232 and RS485 interfaces, 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 N2 network using the RS485 interface as the physical layer to message exchange.

The characteristics of the RS485 serial interface available in the CFW701 frequency inverter, as well as the N2 protocol, will be presented next.

2 INTRODUCTION TO THE N2 COMMUNICATION

The N2 communication protocol was designed by Johnson Controls. The N2 uses the Master-Slave type communication configuration and it is possible to have up to 255 slaves in a network. All communication begins with the master sending a telegram to the slave and the slave answer the master what was requested.

The physical layer is RS-485 compatible, half duplex, shielded twisted pair. The communication rate is 9600 bits/sec with 1 start bit, 8 bits for data and 1 stop bit, without parity.

The N2 protocol is an interface for accessing the existing data in the device. Every device connection to the N2 network can be thought of as a small data manager. This data base presents data structure that represents the device objects.

An N2 object represents physical or virtual information of the device, with one digital or analog input or output, control variables and parameters. A virtual object, made of a collection of N2 objects, is the N2 device model as presented at Figure 2.1. The N2 specification is made up of:

Analog Inputs.
Binary Inputs.
Analog Outputs.
Binary Outputs.
Float Internal Values.
Integer Internal Values.
Byte Internal Value.

Each device can show 256 objects of each type maximum.

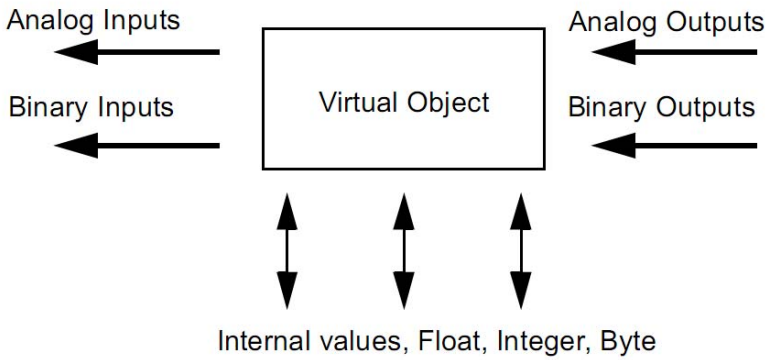

Figure 2.1: *Virtual object*

2.1 N2 MS/TP MESSAGES STRUCTURE

The Figure 2.2 shows the N2 data frame. The N2 data frame uses ASCII-hex characters.

>	ADDRESS	DATA	CHECKSUM	CR

Figure 2.2: *Frame N2*

- ">": character for message starting - 1 byte.
- Address: address range – from 1 to 255.
- Data: device message.
- Checksum: used to test the accuracy and validity of the message.
- "CR": end of message – 1 byte.

2.2 COMMANDS AND SUBCOMMANDS

The N2 device data are accessed by commands and subcommands. The first character of the data represents the command to be executed. Depending on the command it can present a subcommand, as shown in Table 2.1

Table 2.1: *N2 Commands and subcommands*

Command	Subcommand	Description	Note
0	0	Time Update Message	
0	1	Read Memory Diagnostics Message	Optional
0	4	Poll Message No ACK	
0	5	Poll Message with ACK	
0	8	Warm Start Message	Optional
0	9	Status Update Message	Optional
1	0 - FH	Read Field MSG	
2	0 - FH	Write Field MSG	
7	0 – FH	General Command Message	
8	1 – 3H	Upload Messages	Optional
9	1 – 3H	Download Message	Optional
F	-	MSG Identify Device	

The CFW701 inverter presents the commands and subcommands described in Table 2.2

Table 2.2: *N2 Commands and subcommands for the CFW701 inverter*

Command	Subcommand	Description	Note
0	0	Time Update Message	
0	4	Poll Message No ACK	
0	5	Poll Message with ACK	
1	0 - FH	Read Field MSG	
2	0 - FH	Write Field MSG	
7	2	General Command Message: Override	
7	3	General Command Message: Release	
F	-	MSG Identify Device	

2.3 POLLING MECHANISM

It is defined as an automatic communication mechanism performed by the master with the devices present in the N2 network. This allows the slaves to transmit the data that had their values changed from the last polling.

3 NETWORK CONNECTIONS

The CFW701 frequency inverter has a standard RS485 interface. Information about the connection and installation of the inverter to the network is presented bellow.

3.1 RS485

3.1.1 RS485 Interface Characteristics

- The interface follows the EIA-485 standard.
- It operates as a slave in the Modbus RTU, BACnet and N2 network.
- It allows communication baud rates from 9600 up to 57600 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 Connector pinout

The RS485 interface is available at the XC1 connector with the following connections:

Table 3.1: *RS485 connector pinout*

Pin	Name	Function
10	A-Line (-)	RxD/TxD negative
9	B-Line (+)	RxD/TxD positive
8	GND	0V isolated from the RS485 circuit

3.1.3 Terminating resistor

It is necessary to enable a terminating resistor at both ends of the main bus for each segment of the RS485 network. There are switches in the CFW701 frequency inverter that can be activated (by placing both switches S2 to ON) to enable the terminating resistor.

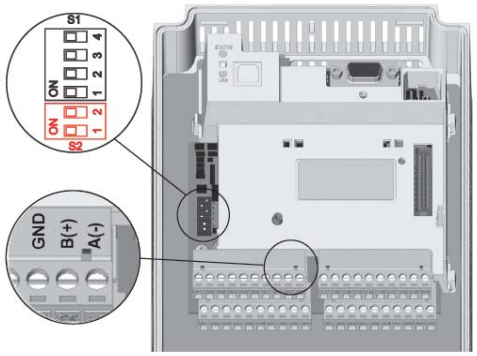

Figure 3.1: *Terminating Resistor and RS485 connector*

3.1.4 Connection with 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.

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

- Enable the termination resistors only at two points, at the extremes of the main bus, even if there are derivations from the bus.

4 INVERTER PROGRAMMING

Next, only the CFW701 frequency inverter parameters related to the N2 communication will be presented.

4.1 SYMBOLS FOR THE PROPERTIES DESCRIPTION

RO	Read-only parameter
CFG	Parameter that can be changed only with a stopped motor
Net	Parameter visible on the HMI if the inverter has the network interface installed – RS232, RS485, CAN, Anybus-CC, Profibus – or if the USB interface is connected
Serial	Parameter visible on the HMI if the inverter has the RS232 or RS485 interface installed

P0105 – 1ST/2ND RAMP SELECTION

P0220 – LOCAL/REMOTE SELECTION SOURCE

P0221 – SPEED REFERENCE SELECTION – LOCAL SITUATION

P0222 – SPEED REFERENCE SELECTION – REMOTE SITUATION

P0223 – FORWARD/REVERSE SELECTION – LOCAL SITUATION

P0224 – RUN/STOP SELECTION – LOCAL SITUATION

P0225 – JOG SELECTION – LOCAL SITUATION

P0226 – FORWARD/REVERSE SELECTION – REMOTE SITUATION

P0227 – RUN/STOP SELECTION – REMOTE SITUATION

P0228 – JOG SELECTION – REMOTE SITUATION

These parameters are used in the configuration of the command source for the CFW701 frequency inverter local and remote situations. In order that the device be controlled through the N2 interface, the options 'serial' available in these parameters, must be selected.

The detailed description of these parameters is found in the CFW701 programming manual.

P0308 – SERIAL ADDRESS

Range:	0 to 255	**Default:** 1
Properties:	CFG	
Access groups via HMI:	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.
- P0312 = 4 (N2) → Valid addresses: 1 to 255.

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

P0310 – SERIAL BAUD RATE

Range:	0 = 9600 bits/s 1 = 19200 bits/s 2 = 38400 bits/s 3 = 57600 bits/s	**Default:** 1
Properties:	CFG	
Access groups via HMI:	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.

NOTE!
The option 0 must be selected for the N2 protocol.

P0311 – SERIAL INTERFACE BYTE CONFIGURATION

Range:	0 = 8 data bits, no parity, 1 stop bit 1 = 8 data bits, even parity, 1 stop bit 2 = 8 data bits, odd parity, 1 stop bit 3 = 8 data bits, no parity, 2 stop bits 4 = 8 data bits, even parity, 2 stop bits 5 = 8 data bits, odd parity, 2 stop bits	**Default:** 0
Properties:	CFG	
Access groups via HMI:	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.

NOTE!
The option 0 must be selected for the BACnet and N2 protocol.

P0312 – SERIAL PROTOCOL

Range:	2 = Modbus RTU 3 = BACnet MS/TP 4 = N2	**Default:** 2
Properties:	CFG	
Access groups via HMI:	NET	

Description:
It allows selecting the desired protocol for the serial interface.

The detailed description of the N2 protocol appears in the section 2 of this manual.

P0313 – COMMUNICATION ERROR ACTION

Range: 0 = Inactive **Default:** 0
1 = Disable via Run/Stop
2 = Disable via General Enable
3 = Change to Local
4 = Change to Local keeping commands and reference
5 = Causes a Fault
Properties: CFG
Access groups via HMI: 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.

Table 4.1: *P0313 options*

Options	Description
0 = Inactive	No action is taken and the inverter remains in the existing status.
1 = Disable via Run/Stop	A stop command with deceleration ramp is executed and the motor stops according to the programmed deceleration ramp.
2 = Disable via General Enable	The inverter is disabled by removing the General Enabling and the motor coasts to stop.
3 = Change to Local	The inverter commands change to Local.
4 = Change to Local keeping commands and reference	The inverter commands change to Local, but the status of the enabling and speed reference commands received via network are kept, providing that the inverter has been programmed to use in Local mode the commands via HMI and speed reference via either HMI.
5 = Causes a Fault	Instead of an alarm, the communication error causes an inverter fault, so that an inverter fault reset becomes necessary in order to restore normal operation.

The following events are considered communication errors:

Serial communication (RS485):
- A128 alarm/F228 fault: Serial communication timeout

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 written in this parameter be 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.

P0314 – SERIAL WATCHDOG

Range: 0.0 to 999.0s **Default:** 0.0
Properties: CFG
Access groups via HMI: NET

Description:
It allows programming a time limit for the detection of serial interface communication error. If the 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 A128 will be showed on the HMI and the option programmed in P0313 will be executed.

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

P0316 – SERIAL INTERFACE STATUS

Range:	0 = Inactive 1 = Active 2 = Watchdog error	**Default:** -
Properties:	RO	
Access groups via HMI:	NET	

Description:
It allows identifying whether the RS485 serial interface board is properly installed, and whether the serial communication presents errors.

Table 4.2: *P0316 options*

Options	Description
0 = Inactive	Inactive serial interface. It occurs when the device does not have the RS485 board installed. Not used for CFW701.
1 = Active	Installed and acknowledged RS485 interface board.
2 = Watchdog error	The serial interface is active, but a serial communication error has been detected - A128 alarm/F228 fault.

P0680 – STATUS WORD

Range:	0000h to FFFFh	**Default:** -
Properties:	RO	
Access groups via HMI:	NET	

Description:
It allows the device status monitoring. Each bit represents a specific status:

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1 to 0
Function	Fault condition	(PID) Automatic	Undervoltage	LOC/REM	JOG	Speed direction	Active General Enable	Motor Running	Alarm condition	In configuration mode	Second ramp	Active quick stop	Bypass	Fire Mode	Reserved

Table 4.3: *P0680 parameter bit functions*

Bits	Values
Bits 0 to 1	Reserved.
Bit 2 Fire Mode	0: Drive is not in Fire Mode. 1: Drive is in Fire Mode. This bit is mapped in the BIN1 object
Bit 3 Bypass	0: Drive is not in Bypass mode. 1: Drive is in Bypass mode. This bit is mapped in the BIN2 object

Bit 4 Active Quick Stop	0: Drive is not executing the fast stop command. 1: Drive is executing the fast stop command. This bit is mapped in the BIN3 object
Bit 5 Second ramp	0: The drive is configured to use the first ramp values, programmed in P0100 and P0101, as the motor acceleration and deceleration ramp times. 1: The drive is configured to use the second ramp values, programmed in P0102 and P0103, as the motor acceleration and deceleration ramp times. This bit is mapped in the BI4 object
Bit 6 In configuration mode	0: The drive is operating normally. 1: The drive is in the configuration mode. It indicates a special condition during which the drive cannot be enabled: ▪ Executing the self-tuning routine ▪ Executing the oriented start-up routine ▪ Executing the HMI copy function ▪ Executing the flash memory card self-guided routine ▪ There is a parameter setting incompatibility ▪ There is no power at the drive power section This bit is mapped in the BI5 object
Bit 7 Alarm condition	0: The drive is not in alarm condition. 1: The drive is in alarm condition. Note: The alarm number can be read by means of the parameter P0048 – Present Alarm. This bit is mapped in the BI6 object
Bit 8 Motor Running	0: The motor is stopped. 1: The drive is running the motor at the set point speed, or executing either the acceleration or the deceleration ramp. This bit is mapped in the BI7 object
Bit 9 Active General Enable	0: General Enable is not active. 1: General Enable is active and the drive is ready to run the motor. This bit is mapped in the BI8 object
Bit 10 Speed direction	0: The motor is running in the reverse direction. 1: The motor is running in the forward direction. This bit is mapped in the BI9 object
Bit 11 JOG	0: Inactive JOG function. 1: Active JOG function. This bit is mapped in the BI10 object
Bit 12 LOC/REM	0: Drive in Local mode. 1: Drive in Remote mode. This bit is mapped in the BI11 object
Bit 13 Undervoltage	0: No Undervoltage. 1: With Undervoltage. This bit is mapped in the BI12 object
Bit 14	Reserved
Bit 15 Fault condition	0: The drive is not in a fault condition. 1: The drive has detected a fault. Note: The fault number can be read by means of the parameter P0049 – Present Fault. This bit is mapped in the BI14 object

P0681 – MOTOR SPEED IN 13 BITS

Range: - 32768 to 32767 **Default:** -
Properties: RO
Access groups via HMI: NET

Description:
It allows monitoring the motor speed. This word uses 13-bit resolution with signal to represent the motor synchronous speed:

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

Intermediate or higher speed values in rpm can be obtained by using this scale. E.g. for a 4 pole 1800 rpm synchronous speed motor, if the value read is 2048 (0800h), then, to obtain the speed in rpm one must calculate:

8192 => 1800 rpm
2048 => Speed in rpm

$$\text{Speed in rpm} = \frac{1800 \times 2048}{8192}$$

Speed in rpm = 450 rpm

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

This parameter is mapped in the AI18 object.

P0682 – SERIAL CONTROL WORD

Range: 0000h a FFFFh **Default:** 0000h
Properties: -
Access groups via HMI: NET

Description:
It is the device N2 interface control word. This parameter can only be changed via serial interface. For the other sources (HMI, etc.) it behaves like a read-only parameter.

In order to have those commands executed, it is necessary to program the equipment to be controlled via serial. This programming is achieved by means of parameters P0105 and P0220 to P0228.

Each bit of this word represents a command that can be executed.

Bits	15	14	13	13 to 8	7	6	5	4	3	2	1	0
Function	External PID controller 2	External PID controller 1	Main PID controller	Reserved	Fault reset	Quick stop	Second ramp	LOC/REM	JOG	Speed direction	General enable	Run/Stop

Table 4.4: *P0682 parameter bit functions*

Bits	Values
Bit 0 Run/Stop	0: It stops the motor with deceleration ramp. 1: The motor runs according to the acceleration ramp until reaching the speed reference value. This bit is mapped in the object BO1
Bit 1 General enable	0: It disables the drive, interrupting the supply for the motor. 1: It enables the drive allowing the motor operation. This bit is mapped in the object BO2
Bit 2 Speed direction	0: To run the motor in a direction opposed to the speed reference. 1: To run the motor in the direction indicated by the speed reference. This bit is mapped in the object BO3
Bit 3 JOG	0: It disables the JOG function. 1: It enables the JOG function. This bit is mapped in the object BO4

Bit 4 LOC/REM	0: The drive goes to the Local mode. 1: The drive goes to the Remote mode. This bit is mapped in the object BO5
Bit 5 Second ramp	0: The drive uses the first ramp values, programmed in P0100 and P0101, as the motor acceleration and deceleration ramp times. 1: The drive is configured to use the second ramp values, programmed in P0102 and P0103, as the motor acceleration and deceleration ramp times. This bit is mapped in the object BO6
Bit 6 Quick stop	0: It does not execute the quick stop command. 1: It executes the quick stop command. Note: This function is not allowed with control types (P0202) V/f or VVW. This bit is mapped in the object BO7
Bit 7 Fault reset	0: No function. 1: If in a fault condition, then it executes the reset. This bit is mapped in the object BO8
Bits 8 to 12	Reserved.
Bit 13 Main PID controller	0: Automatic. 1: Manual This bit is mapped in the object BO14
Bit 14 External PID controller 1	0:.Automatic 1: Manual. This bit is mapped in the object BO15
Bit 15 External PID controller 2	0: Automatic. 1:.Manual This bit is mapped in the object BO16

P0683 – SERIAL SPEED REFERENCE

Range: -32768 a 32767 **Default:** 0
Properties: -
Access groups via HMI: NET

Description:
It allows programming the motor speed reference via the N2 interface. This parameter can only be changed via serial interface. For the other sources (HMI, etc.) it behaves like a read-only parameter.

In order that the reference written in this parameter be used, it is necessary that the drive be programmed to use the speed reference via serial. This programming is achieved by means of parameters P0221 and P0222.

This word uses a 13-bit resolution with signal to represent the motor synchronous speed.

- P0683 = 0000h (0 decimal) → speed reference = 0
- P0683 = 2000h (8192 decimal) → speed reference = synchronous speed

Intermediate or higher reference values can be programmed by using this scale. E.g. for a 4 pole 1800 rpm synchronous speed motor, to obtain a speed reference of 900 rpm one must calculate:

1800 rpm => 8192
900 rpm => 13 bit reference

$$13\ bit\ reference = \frac{900 \times 8192}{1800}$$

13 bit reference = 4096 => Value corresponding to 900 rpm 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

This parameter is mapped in the AO3 object.

P0695 – DIGITAL OUTPUT SETTING

Range:	0000h to 001Fh	**Default:** 0000h
Properties:	Net	
Access groups via HMI:	NET	

Description:
It allows the control of the digital outputs by means of the network interfaces. This parameter cannot be changed via HMI.

Each bit of this parameter corresponds to the desired value for one digital output. In order to have the correspondent digital output controlled according to this content, it is necessary that its function be programmed for "P0695 Content" at parameters P0275 to P0279.

P0696 – VALUE 1 FOR ANALOG OUTPUTS

P0697 – VALUE 2 FOR ANALOG OUTPUTS

Range:	-32768 to 32767	**Default:** 0
Properties:	RW	
Access groups via HMI:	NET	

Description:
They allow the control of the analog outputs by means of network interfaces 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 value", at the parameters P0251, P0254.

The value must be written in a 15-bit scale (7FFFh = 32767)[2] 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. For instance, to control the analog output 1 via serial, the following programming must be done:

- Choose a parameter from P0696, P0697 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.

N2 objects of the ANALOG OUTPUT type mold the analog outputs, where:
- AO4 - P0696.
- AO5 - P0697.

[2] Refer to the CFW700 manual for the product actual output resolution.

NOTE!
If the analog output is programmed for working from -10V to 10V, 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 -10V to 10V at the analog output.

5 N2 OBJECTS MODELING

An N2 object represents physical or virtual information of the equipment, such as a digital input or parameters. The CFW701 inverter presents the following object types:

- ANALOG INPUT.
- ANALOG OUTPUT.
- BINARY INPUT.
- BINARY OUTPUT.

5.1 N2 OBJECTS FOR THE CFW701

Table 5.1 shows the actions supported by each kind of object N2.

Table 5.1: *Action for the objects N2*

Action	Analog Input	Binary Input	Analog Output	Binary Output
Write	X	X	X	X
Read	X	X	X	X
Override			X	X
Release			X	X

The CFW701 inverter parameters are mapped by N2 objects which are described below.

NOTE!
Refer to the product manual for more details about the parameters.

5.1.1 ANALOG INPUT (AI) Object

It represents an analog input by which its value can be read by the network controller. The ANALOG INPUT object types for the CFW701 are described at Table 5.2.

Table 5.2: *ANALOG INPUT Object*

Object	Eng. Unit	Parameter	Description	Adjustable Range	Access
AI1	RPM	P0002	Motor speed	0 – 18000	R
AI2	A	P0003	Motor current	0.0 – 4500.0	R
AI3	V	P0004	DC Link voltage	0 – 2000	R
AI4	Hz	P0005	Motor frequency	0.0 – 1020.0	R
AI5	V	P0007	Output voltage	0 – 2000	R
AI6	%	P0009	Motor torque	-1000.0 – 1000.0	R
AI7	kW	P0010	Output power	0.0 – 6553.5	R
AI8	%	P0018	AI 1 value	-100.00 – 100.00	R
AI9	%	P0019	AI 2 value	-100.00 – 100.00	R
AI10	%	P0020	AI 3 value	-100.00 – 100.00	R
AI11	°C	P0030	IGBTs temperature	-20.0 – 150.0	R
AI12	°C	P0034	Internal air temperature	-20.0 – 150.0	R
AI13	h	P0042	Time powered	0 – 65535	R
AI14	h	P0043	Time enabled	0.0 – 6553.5	R
AI15	kWh	P0044	kWh output energy	0 – 65535	R
AI16	-	P0048	Current alarm	0 – 999	R
AI17	-	P0049	Current fault	0 – 999	R
AI18	-	P0681	13 bits speed	-32768 – 32767	R
AI19	bar	P1015	Main PID feedback	-32768 – 32767	R
AI20	%	P1016	Main PID output	0.0 – 100.0	R
AI21	°C	P1062	External PID feedback 1	-32768 – 32767	R
AI22	%	P1063	External PID output 1	0.0 – 100.0	R
AI23	%	P1082	External PID feedback 2	-32768 – 32767	R
AI24	%	P1083	External PID output 2	0.0 – 100.0	R

5.1.2 ANALOG OUTPUT (AO) Object

It represents an analog output by which its value can be read by the network controller. The ANALOG OUTPUT object types for the CFW701 are described at Table 5.3.

Table 5.3: *ANALOG OUTPUT Object*

Object	Eng. Unit	Parameter	Description	Adjustable range	Access
AO1	s	P0100	Acceleration time	0.0 – 999.0	R/W
AO2	s	P0101	Deceleration time	0.0 – 999.0	R/W
AO3	-	P0683	13 bits speed reference	-32768 – 32767	R/W
AO4	-	P0696	AOx value 1	-32768 – 32767	R/W
AO5	-	P0697	AOx value 2	-32768 – 32767	R/W
AO6	-	P1012	SoftPLC parameter	0 – 65535	R/W
AO7	-	P1013	SoftPLC parameter	0 – 65535	R/W
AO8	-	P1025	SoftPLC parameter	0 – 65535	R/W
AO9	bar	P1011	Main PID automatic setpoint	-32768 – 32767	R/W
AO10	%	P1014	Main PID manual setpoint	0.0 – 100.0	R/W
AO11	°C	P1060	External PID automatic setpoint 1	-32768 – 32767	R/W
AO12	%	P1061	External PID manual setpoint 1	0.0 – 100.0	R/W
AO13	%	P1080	External PID automatic setpoint 2	-32768 – 32767	R/W
AO14	%	P1081	External PID manual setpoint 2	0.0 – 100.0	R/W

5.1.3 BINARY INPUT (BI) Object

It represents a physical digital input by which its status can be read by the network controller. The BINARY INPUT object types for the CFW701 are described at Table 5.4.

Table 5.4: *BINARY INPUT Object*

Object	Eng. Unit	Parameter	Bit	Description	Adjustable range	Access
BI1	-	P0680	0	Reserved	-	-
BI2	-	P0680	1	Reserved	-	-
BI3	-	P0680	2	Fire Mode	0 - Drive is not in Fire Mode. 1 - Drive is in Fire Mode.	R
BI4	-	P0680	3	Bypass	0 - Drive is not in Bypass mode. 1 - Drive is in Bypass mode.	R
BI5	-	P0680	4	Quick Stop	0: Drive is not executing the fast stop command. 1: Drive is executing the fast stop command.	R
BI6	-	P0680	5	Second Ramp	0 – Refer to P0100 and P0101 1 – Refer to P0102 and P0103	R
BI7	-	P0680	6	Configuration mode	0 – Regular operation 1 – Configuration mode	R
BI8	-	P0680	7	Alarm	0 – Inverter without alarm 1 – Inverter with alarm	R
BI9	-	P0680	8	Enable Ramp (RUN)	0 – Motor stopped 1 – Motor running	R
BI10	-	P0680	9	General Enable	0 – Inverter disabled 1 – Inverter enabled	R
BI11	-	P0680	10	Direction of rotation	0 – Reverse 1 – Forward	R
BI12	-	P0680	11	JOG	0 – JOG disabled 1 – JOG enabled	R
BI13	-	P0680	12	LOC/REM	0 – Local mode 1 – Remote mode	R
BI14	-	P0680	13	Undervoltage	0 – No undervoltage 1 – Undervoltage	R
BI15	-	P0680	14	Reserved	-	-
BI16	-	P0680	15	Fault	0 – No fault 1 – Fault	R
BI17	-	P0012	0	DI 1 status	0 - 1	R
BI18	-	P0012	1	DI 2 status	0 - 1	R
BI19	-	P0012	2	DI 3 status	0 - 1	R
BI20	-	P0012	3	DI 4 status	0 - 1	R
BI21	-	P0012	4	DI 5 status	0 - 1	R
BI22	-	P0012	5	DI 6 status	0 - 1	R
BI23	-	P0012	6	DI 7 status	0 - 1	R
BI24	-	P0012	7	DI 8 status	0 - 1	R

5.1.4 BINARY OUTPUT (BO) Object

It represents a physical digital output by which its status can be read by the network controller. The BINARY OUTPUT object types for the CFW701 are described at Table 5.5.

Table 5.5: *BINARY OUTPUT Objects*

Object	Eng. Unit	Parameter	Bit	Description	Adjustable range	Access
BO1	-	P0682	0	Start/Stop	0 – Motor stopped 1 – Motor running	R/W
BO2	-	P0682	1	General enable	0 – Inverter disabled 1 – Inverter enabled	R/W
BO3	-	P0682	2	Direction of rotation	0 – Reverse 1 – Forward	R/W
BO4	-	P0682	3	JOG	0 – JOG disabled 1 – JOG enabled	R/W
BO5	-	P0682	4	LOC/REM	0 – Local mode 1 – Remote mode	R/W
BO6	-	P0682	5	Second ramp	0 – Refer to P0100 and P0101 1 – Refer to P0102 and P0103	R/W
BO7	-	P0682	6	Fast stop	0 – Without function 1 – Stop the motor	R/W
BO8	-	P0682	7	Fault reset	0 – Without function 1 – Resets the inverter under fault condition	R/W
BO9	-	P0682	8	Reserved	-	-
BO10	-	P0682	9	Reserved	-	-
BO11	-	P0682	10	Reserved	-	-
BO12	-	P0682	11	Reserved	-	-
BO13	-	P0682	12	Reserved	-	-
BO14	-	P0682	13	Internal PID controller	0 – Automatic 1 – Manual	R/W-
BO15	-	P0682	14	External PID controller 1	0 – Automatic 1 – Manual	R/W
BO16	-	P0682	15	External PID controller 2	0 – Automatic 1 – Manual	R/W
BO17	-	P0695	0	DO1	0 -1	R/W
BO18	-	P0695	1	DO2	0 -1	R/W
BO19	-	P0695	2	DO3	0 -1	R/W
BO20	-	P0695	3	DO4	0 -1	R/W
BO21	-	P0695	4	DO5	0 -1	R/W

NOTE!
In order to run the commands of BO1 and BO21 objects, it is necessary to set the inverter to be controlled via serial interface. This setting is done at P0105 and from P0220 to P0228 parameters.

5.1.5 Control System Model DDL

```
**********************************************************
* WEG , CFW701 Variable Frequency Drive
**********************************************************
CSMODEL "CFW701","VND"
AITITLE "Analog Inputs"
BITITLE "Binary Inputs"
AOTITLE "Analog Outputs"
BOTITLE "Binary Outputs"

CSAI "AI1",N,N,"MOTOR SPEED","RPM"
CSAI "AI2",N,N,"MOTOR CURRENT","A"
CSAI "AI3",N,N,"LINK VOLTAGE CC","V"
CSAI "AI4",N,N,"MOTOR FREQUENCY","Hz"
CSAI "AI5",N,N,"OUTPUT VOLTAGE","V"
CSAI "AI6",N,N,"MOTOR TORQUE","%"
CSAI "AI7",N,N,"OUTPUT POWER","kW"
CSAI "AI8",N,N,"AI1 VALUE","%"
CSAI "AI9",N,N,"AI2 VALUE","%"
CSAI "AI10",N,N,"AI3 VALUE","%"
CSAI "AI11",N,N,"IGBTs TEMP","C"
CSAI "AI12",N,N,"INTERNAL TEMP","C"
CSAI "AI13",N,N,"ENER HOUR","h"
```

CSAI "AI14",N,N,"ENABLE HOUR","h"
CSAI "AI15",N,N,"kWh COUNTER","kWh"
CSAI "AI16",N,N,"WARNING","CODE"
CSAI "AI17",N,N,"ERROR","CODE"
CSAI "AI18",N,N,"SPEED 13BITS","-"
CSAI "AI19",N,N,"FBACK MAIN PID - P1015","BAR"
CSAI "AI20",N,N,"MAIN PID OUT - P1016","%"
CSAI "AI21",N,N, “FBACK PID 1 - P1062","°C"
CSAI "AI22",N,N, “OUT PID 1 - P1063","%"
CSAI "AI23",N,N, “FBACK PID 2 - P1082","%"
CSAI "AI24",N,N, “OUT PID 2 - P1083","%"

CSBI "BI1",N,N,"RESERVED”,"OFF","ON"
CSBI "BI2",N,N,"RESERVED”,"OFF","ON"
CSBI "BI3",N,N,"FIRE MODE”,"OFF","ON"
CSBI "BI4",N,N,"BYPASS”,"OFF","ON"
CSBI "BI5",N,N,"QUICK STOP”,"OFF","ON"
CSBI "BI6",N,N,"SECOND RAMP”,"P100","P102"
CSBI "BI7",N,N,"CONF MODE”,"NORMAL","CONF"
CSBI "BI8",N,N,"WARNING”,"NO","YES"
CSBI "BI9",N,N,"ENABLE RAMP”,"STOP","START"
CSBI "BI10",N,N,"GENERAL ENABLE”,"OFF","ON"
CSBI "BI11",N,N,"DIRECTION”,"REVERSE","DIRECT"
CSBI "BI12",N,N,"JOG”,"OFF","ON"
CSBI "BI13",N,N,"LOC/REM”,"LOC","REM"
CSBI "BI14",N,N,"UNDERVOLTAGE”,"NO","YES"
CSBI "BI15",N,N,"RESERVED”,"OFF","ON"
CSBI "BI16",N,N,"ERROR”,"NO","YES"
CSBI "BI17",N,N,"DI1","OFF","ON"
CSBI "BI18",N,N,"DI2","OFF","ON"
CSBI "BI19",N,N,"DI3","OFF","ON"
CSBI "BI20",N,N,"DI4","OFF","ON"
CSBI "BI21",N,N,"DI5”,"OFF","ON"
CSBI "BI22",N,N,"DI6”,"OFF","ON"
CSBI "BI23",N,N,"DI7”,"OFF","ON"
CSBI "BI24",N,N,"DI8”,"OFF","ON"

CSAO "AO1",Y,Y,"ACEL TIME","S"
CSAO "AO2",Y,Y,"DESACEL TIME","S"
CSAO "AO3",Y,Y,"13 BITS SPEED REF”,"CODE"
CSAO "AO4",Y,Y,"AOX VALUE 1”,"-"
CSAO "AO5",Y,Y,"AOX VALUE 2”,"-"
CSAO "AO6",Y,Y,"SOFTPLC 1012”,"-"
CSAO "AO7",Y,Y,"SOFTPLC 1013”,"-"
CSAO "AO8",Y,Y,"SOFTPLC 1025”,"-"
CSAO "AO9",Y,Y,"AUTO SETPOINT MAIN PID - P1011”,"BAR"
CSAO "AO10",Y,Y,"MAN SETPOINT MAIN PID - P1014”,"%"
CSAO "AO11",Y,Y," AUTO SETPOINT PID 1 - P1060”,"°C"
CSAO "AO12",Y,Y," MAN SETPOINT PID 1 - P1061”,"%"
CSAO "AO13",Y,Y," AUTO SETPOINT PID 2 - P1080”,"%"
CSAO "AO14",Y,Y," MAN SETPOINT PID 2 - P1081”,"%"

CSBO "BO1",Y,Y,"START/STOP","STOP" ,"START"
CSBO "BO2",Y,Y,"GENERAL ENABLE”,"OFF","ON"
CSBO "BO3",Y,Y,"DIRECTION OF ROTATION”,"REVERSE","DIRECT"
CSBO "BO4",Y,Y,"JOG”,"OFF","ON"
CSBO "BO5",Y,Y,"LOC/REM”,"OFF","ON"
CSBO "BO6",Y,Y,"SECOND RAMP USE”,"OFF","ON"
CSBO "BO7",Y,Y, "QUICK STOP”,"OFF","ON"
CSBO "BO8",Y,Y, "FAULT RESET”,"OFF","ON"
CSBO "BO14",Y,Y, "MAN/AUTO INTERNAL PID”,"OFF","ON"

CSBO "BO15",Y,Y, " MAN/AUTO EXTERNAL D 1","OFF","ON"
CSBO "BO16",Y,Y, " MAN/AUTO EXTERNAL PID 2","OFF","ON"

6 FAULTS AND ALARMS RELATED TO THE SERIAL COMMUNICATION

A128/F228 – TIMEOUT FOR SERIAL COMMUNICATION

Description:
It is the only alarm/fault related to the serial communication indicates that the equipment stopped receiving valid serial telegrams for a period longer than the one programmed in P0314.

Operation:
The parameter P0314 allows programming a period of time during which the equipment must receive at least one valid telegram via the RS485 serial interface – with address and error-checking field correct – otherwise, it will be considered that there was any problem in the serial communication. The time counting initiates after the reception of the first valid telegram. This function can be used by any serial protocol supported by the equipment.

After the serial communication timeout has been identified, the A128 alarm or F228 fault message will be showed on the HMI, depending on the P0313 programming. For alarms, if the communication is reestablished and new valid telegrams are received, the alarm indication will be removed from the HMI.

Possible Causes/Correction:
- Verify factors that could cause failures in the communication (cables, installation, and grounding).
- Make sure that the master sends telegrams to the equipment in intervals shorter than the programmed in P0314.
- Disable this function at P0314.