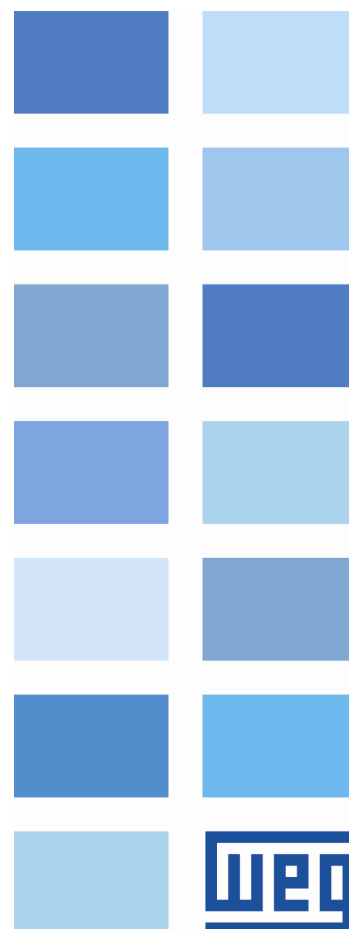


# Profibus DP

CFW-11

## Communication Manual

Language: English





# Profibus DP Communication Manual

Series: CFW-11

Language: English

Document Number: 10000736714 / 00

Publication Date: 01/2010

## Summary

<b>ABOUT THIS MANUAL.....</b>	<b>4</b>
ABBREVIATIONS AND DEFINITIONS.....	5
NUMERICAL REPRESENTATION .....	5
<b>1 ACCESSORY KIT .....</b>	<b>6</b>
1.1 PROFIBUSDP-01 KIT .....	6
1.1.1 Connector Pinout.....	6
1.1.2 Indications .....	6
1.1.3 DIP Switches.....	7
<b>2 INTRODUCTION TO THE PROFIBUS DP PROTOCOL.....</b>	<b>8</b>
2.1 PROFIBUS DP NETWORK .....	8
2.2 PROFIDRIVE SPECIFICATION .....	8
2.3 CFW-11 INSTALLATION IN THE PROFIBUS DP NETWORK .....	8
2.3.1 Baud Rates.....	8
2.3.2 Addressing .....	9
2.3.3 Cable .....	9
2.3.4 Connectors .....	9
2.3.5 Connection of the Drive to the Network.....	9
2.3.6 Termination Resistor.....	10
2.3.7 GSD File.....	10
<b>3 INVERTER PROGRAMMING.....</b>	<b>11</b>
3.1 SYMBOLS FOR THE DESCRIPTION OF THE PROPERTIES .....	11
P0105 – 1 <sup>ST</sup> /2 <sup>ND</sup> RAMP SELECTION .....	11
P0220 – LOCAL/REMOTE SELECTION SOURCE.....	11
P0221 – LOCAL REFERENCE SELECTION .....	11
P0222 – REMOTE REFERENCE SELECTION .....	11
P0223 – LOCAL FORWARD/REVERSE SELECTION.....	11
P0224 – LOCAL RUN/STOP SELECTION.....	11
P0225 – LOCAL JOG SELECTION.....	11
P0226 – REMOTE FORWARD/REVERSE SELECTION.....	11
P0227 – REMOTE RUN/STOP SELECTION .....	11
P0228 – REMOTE JOG SELECTION.....	11
P0313 – COMMUNICATION ERROR ACTION .....	11
P0680 – STATUS WORD .....	12
P0681 – MOTOR SPEED IN 13 BITS .....	13
P0684 – CANOPEN/DEVICENET/PROFIBUS DP CONTROL WORD.....	14
P0685 – CANOPEN/DEVICENET/PROFIBUS DP SPEED REFERENCE.....	15
P0695 – SETTINGS FOR THE DIGITAL OUTPUTS .....	15
P0696 – VALUE 1 FOR ANALOG OUTPUTS.....	16
P0697 – VALUE 2 FOR ANALOG OUTPUTS.....	16
P0698 – VALUE 3 FOR ANALOG OUTPUTS.....	16
P0699 – VALUE 4 FOR ANALOG OUTPUTS.....	16
P0740 – PROFIBUS DP COMMUNICATION STATUS .....	17
P0741 – PROFIBUS DATA PROFILE.....	18
P0742 – PROFIBUS READING #3.....	19
P0743 – PROFIBUS READING #4.....	19
P0744 – PROFIBUS READING #5.....	19
P0745 – PROFIBUS READING #6.....	19
P0746 – PROFIBUS READING #7.....	19
P0747 – PROFIBUS READING #8.....	19
P0748 – PROFIBUS READING #9.....	19
P0749 – PROFIBUS READING #10.....	19
P0750 – PROFIBUS WRITING #3.....	20
P0751 – PROFIBUS WRITING #4.....	20
P0752 – PROFIBUS WRITING #5.....	20

P0753 – PROFIBUS WRITING #6 .....	20
P0754 – PROFIBUS WRITING #7 .....	20
P0755 – PROFIBUS WRITING #8 .....	20
P0756 – PROFIBUS WRITING #9 .....	20
P0757 – PROFIBUS WRITING #10 .....	20
P0918 – PROFIBUS ADDRESS .....	20
P0922 – CONFIGURATION TELEGRAM SELECTION .....	21
P0944 – INVERTER FAULT COUNTER .....	21
P0947 – FAULT NUMBER .....	22
P0963 – PROFIBUS BAUD RATE .....	22
P0964 – DRIVE IDENTIFICATION .....	23
P0965 – PROFIDRIVE PROFILE IDENTIFICATION .....	23
P0967 – PROFIDRIVE CONTROL WORD .....	23
P0968 – PROFIDRIVE STATUS WORD .....	24
<b>4 PROFIBUS DP PROTOCOL SERVICES.....</b>	<b>26</b>
4.1 PROFIBUS DP-V0 .....	26
4.1.1 Cyclic Data .....	26
4.1.2 SYNC/FREEZE .....	26
4.2 PROFIBUS DP-V1 .....	27
4.2.1 Available Services for Acyclic Communication .....	27
4.2.2 Data Addressing .....	27
4.2.3 Reading/Writing DP-V1 Telegrams .....	28
4.2.4 Data Structure for Parameter Access – PROFIdrive .....	29
4.2.5 Parameter Acyclic Access Telegram Examples .....	31
4.2.6 Data Structure for Parameter Access – WEG .....	33
<b>5 FAULTS AND ALARMS RELATED TO THE PROFIBUS DP COMMUNICATION .....</b>	<b>34</b>
A138/F238 –PROFIBUS DP INTERFACE IN CLEAR MODE .....	34
A139/F239 – OFFLINE PROFIBUS DP INTERFACE .....	34
A140/F240 – PROFIBUS DP MODULE ACCESS ERROR .....	34

## About this Manual

This manual provides the necessary information for the operation of the CFW-11 frequency inverter using the Profibus DP Interface. This manual must be used together with the CFW-11 User's Guide.

## Abbreviations and Definitions

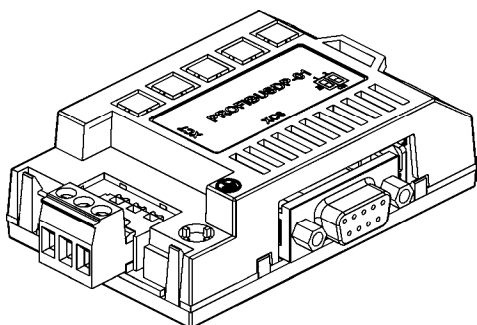
DP	Decentralized Periphery
CAN	Controller Area Network
CRC	Cycling Redundancy Check
EIA	Electronic Industries Alliance
I/O	Input/Output
SAP	Service Access Point

## Numerical Representation

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

# 1 Accessory Kit

## 1.1 PROFIBUSDP-01 Kit



- ✓ WEG part number: 11045488.
- ✓ Composed by the Profibus DP-V1 communication module, a fixing screw and an installation guide.
- ✓ Interface certified by the Profibus International.
- ✓ It supports DP-V1 (acyclic messages).



### NOTE!

The CFW-11 inverter also has a Profibus DP network communication option using the PROFIBUSDP-05 kit, with the Anybus-CC communication board. However, the parameters, configurations and indications are different, depending on the used communication kit. For more information on the PROFIBUSDP-05 kit, refer to the Anybus-CC communication manual.

### 1.1.1 Connector Pinout

The Profibus DP-V1 communication module has two connectors to the Profibus network, each one with the following pinout:

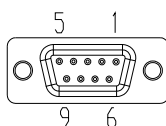


Table 1.1 – Profibus female DB9 connector pinout (XC6)

Pin	Name	Function
1	-	-
2	-	-
3	B-Line (+)	RxD/TxD positive
4	RTS	Request To Send
5	GND	0V isolated from the RS485 circuit
6	+5V	+5V isolated from the RS485 circuit
7	-	-
8	A-Line (-)	RxD/TxD negative
9	-	-



### NOTE!

The DB9 connector frame is connected to the inverter protective earth.



Table 1.2 – Profibus plug-in connector pinout (XC7)

Pin	Name	Function
1	A-Line (-)	RxD/TxD negative (green)
2	B-Line (+)	RxD/TxD positive (red)
3	Shield	Protective earth.

### 1.1.2 Indications

The alarms, faults and status indications are done through the inverter HMI and parameters. Refer to the section 5 to get more information.

### 1.1.3 DIP Switches



At each segment of the Profibus DP network, it is necessary to enable termination resistors at the extreme points of the main bus. For this purpose, the Profibus DP communication module has two DIP switches that can be activated (both switches to the ON position) to enable the resistor. The DIP switches should not be activated if the network connector already has the termination resistors.

## 2 Introduction to the Profibus DP Protocol

The Profibus DP network, such as several industrial communication networks, for being many times applied in aggressive environments with high exposure to electromagnetic interference, requires that certain precautions be taken in order to guarantee a low communication error rate during its operation. Characteristics of the Profibus DP network and also recommendations to perform the connection of the CFW-11 inverter in this network are presented next.

### 2.1 Profibus DP Network

The term Profibus is used to describe a digital communication system that can be used in several application areas. It is an open and standardized system, defined by the IEC 61158 and IEC 61784 standards, which comprises from the used physical medium to data profiles for certain sets of equipments. In this system, the DP communication protocol was developed with the purpose of allowing a fast, cyclic and deterministic communication between masters and slaves.

Among the several communication technologies that can be used in this system, the Profibus DP technology describes a solution that, typically, is composed by the DP protocol, RS485 transmission medium and application profiles, used mainly in applications and equipments with emphasis in manufacturing automation.

Nowadays, there is an organization named Profibus International, responsible for keeping, updating and publishing the Profibus technology among users and members. More information regarding the technology, as well as the complete protocol specification can be obtained with this organization or with one of the regional associations or competence centers associated to the Profibus International (<http://www.profibus.com>).

### 2.2 PROFIdrive Specification

Complementary to the Profibus protocol specification, the PROFIdrive specification, elaborated and kept by the *Profibus International*, basically describes a set of parameters and services common for the “drive” type equipments in a Profibus network. The purpose of this specification is to facilitate the integration of drives in a Profibus network.

The CFW-11 frequency inverter Profibus DP interface was developed in accordance with the PROFIdrive specification. Thus, several of the parameters, communication words and data access services of the CFW-11 are described in accordance with this specification.

### 2.3 CFW-11 Installation in the Profibus DP Network

#### 2.3.1 Baud Rates

The Profibus DP protocol defines several baud rates that can be used, from 9.6 kbit/s up to 12Mbit/s. The maximum allowed transmission line length depends on the used baud rate, and this correlation is showed on the Table 2.1.

Table 2.1 – Baud rate x Segment length

Baud rate (kbit/s)	Segment length (m)
9.6; 19.2; 45.45; 93.75	1200
187.5	1000
500	400
1500	200
3000, 6000, 12000	100

The CFW-11 Profibus DP interface has automatic baud rate detection, according to what has been configured for the network master, and therefore it is not necessary to configure this option. It is possible to observe the baud rate detected by the board at the parameter P0963.



### 2.3.2 Addressing

At the CFW-11 the address configuration is done through the parameter P0918. Addresses from 1 to 125 are allowed. Each network device must have a different address.

### 2.3.3 Cable

It is recommended that the installation be carried out with a type A cable, whose characteristics are described in the Table 2.2. The cable has a pair of wires that must be shielded and twisted, in order to guarantee higher immunity against electromagnetic interference.

*Table 2.2 – Type A cable properties*

Impedance	135 to 165 $\Omega$
Capacitance	30 pf/m
Loop resistance	110 $\Omega$ /km
Cable diameter	> 0.64 mm
Wire cross section	> 0.34 mm <sup>2</sup>

### 2.3.4 Connectors

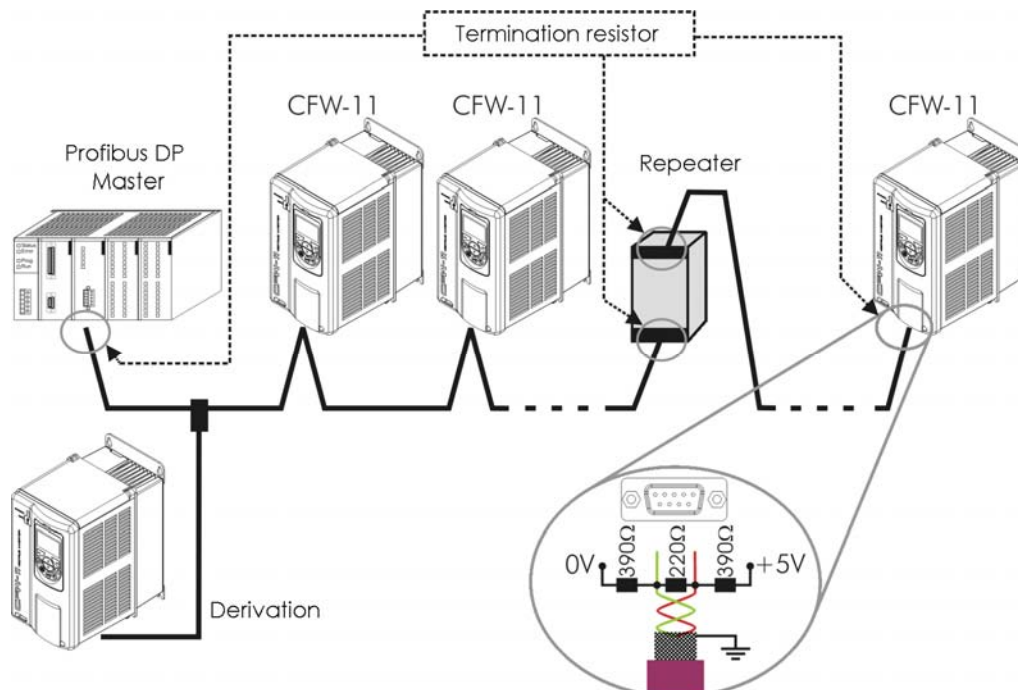
The Profibus DP communication board has two different connectors for Profibus network: a female DB9 connector and a plug-in connector. The signals available at each connector pin are described in the Table 1.1.

For connection with the female DB9 there are different connector models, which have been developed specifically for Profibus network applications. For the CFW-11, the use of connectors with axial cable entry is recommended, because connectors with cable entry in different angles can normally not be used due to the product mechanical characteristics.

### 2.3.5 Connection of the Drive to the Network

The Profibus DP protocol, by using the RS485 physical medium, allows the connection of up to 32 devices per segment without the use of repeaters. By using repeaters, up to 126 addressable equipments can be connected to the network. Each repeater must also be included as a device connected to the segment, even not occupying a network address.

It is recommended that the connection of all the devices present in the Profibus DP network be made coming from the main bus. Generally, the Profibus network connector itself has an input and an output for the cable, allowing the connection to be taken to the other network points. Derivations from the main bus are not recommended, especially for baud rates higher or equal to 1.5Mbits/s.



*Figure 2.1 – CFW-11 in a Profibus DP network*

The Profibus DP network cables must be laid separately (and far away if possible) from the power cables. All the drives must be properly grounded, preferably at the same ground point. The Profibus cable shield must also be grounded. The CFW-11 Profibus board DB9 connector itself already has a connection with the protective ground and, therefore, makes the connection of the shield to the ground when the Profibus cable is connected to the drive. However a better connection, implemented by clamps that connect the shield to a ground point, is also recommended.

### 2.3.6 Termination Resistor

At each segment of the Profibus DP network, it is necessary to enable a termination resistor at the extreme points of the main bus. The use of specific Profibus network connectors with a switch to enable the resistor is recommended, which must only be enabled (ON position) if the equipment is the first or the last element of the segment. The DIP switches present in the communication module also can be used to enable the termination resistors.

It is important to emphasize that in order to be possible to disconnect the element from the network without impairing the bus, it becomes interesting the use of active terminations, which are elements that have only the termination function. Therefore, any drive of the network can be disconnected from the bus without impairing the termination.

### 2.3.7 GSD File

Each element of the Profibus DP network has an associated configuration file with the GSD extension. This file describes the characteristics of each equipment, and it is used by the Profibus DP network master configuration tool. During the master configuration the GSD configuration file supplied with the equipment must be used.

### 3 Inverter Programming

Next, only the CFW-11 frequency inverter parameters related to the Profibus DP communication will be presented.

#### 3.1 Symbols for the Description of the Properties

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
DP	Parameter visible on the HMI if the inverter has a Profibus DP interface installed

#### P0105 – 1<sup>st</sup> /2<sup>nd</sup> Ramp Selection

#### P0220 – Local/Remote Selection Source

#### P0221 – Local Reference Selection

#### P0222 – Remote Reference Selection

#### P0223 – Local Forward/Reverse Selection

#### P0224 – Local Run/Stop Selection

#### P0225 – Local Jog Selection

#### P0226 – Remote Forward/Reverse Selection

#### P0227 – Remote Run/Stop Selection

#### P0228 – Remote Jog Selection

These parameters are used in the configuration of the source of commands for the local and remote modes of the inverter CFW-11. In order that the inverter is controlled through the Profibus DP interface, one of the 'CANopen/DeviceNet/Profibus DP' options available at the parameters must be selected.

The detailed description of these parameters is found in the CFW-11 Programming Manual.

#### P0313 – Communication Error Action

Range:	0 = Inactive 1 = Disable via Start/Stop 2 = Disable via General Enable 3 = Change to Local 4 = Change to Local keeping commands and reference 5 = Causes a Fault	Default: 0
--------	---	------------

Properties: CFG, Net

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 111 Status / Commands

#### Description:

This parameter allows the selection of the action to be executed by the inverter when a communication error is detected.

**Table 3 .3.1 – P0313 options**

Options	Description
0 = Inactive	No action is taken and the inverter remains in the existing status.
1 = Disable via Start/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 enabling command status and the speed reference value received via the network are kept in the local mode, provided that the inverter be programmed, in the local mode, to use HMI commands, or three-wire start/stop with HMI or Electronic Potentiometer speed reference.
5 = Causes a Fault	Instead of an alarm, a communication error causes a fault in the inverter, so that it becomes necessary to reset the inverter in order to restore normal operation.

For the Profibus DP interface, the following events are considered communication errors:

- ☑ Alarm A138/Fault F238: the inverter received a command to operate in *clear* mode;
- ☑ Alarm A139/Fault F239: the inverter went to the *offline* state;
- ☑ Alarm A140/Fault F240: Profibus interface access error.

The detailed description of these alarms/faults is done in the section 5.

The actions described in this parameter are performed by means of the automatic writing of the respective bits on the CANopen/DeviceNet/Profibus DP Control Word parameter – P0684. In order that the commands written in this parameter be executed, it is necessary that the inverter be programmed to be commanded via CANopen/DeviceNet/Profibus DP. This programming is done by means of parameters P0220 to P0228.

## P0680 – Status Word

**Range:** 0000h to FFFFh

**Default:** -

**Properties:** RO

**Access groups via HMI:**

01 PARAMETER GROUPS

L 49 Communication

L 111 Status / Commands

### Description:

It allows the monitoring of the inverter status. Each bit corresponds to one state:

Bits	15	14	13	12	11	10	9	8	7	6	5	4	3 to 0
Function	Fault condition	Manual/ Automatic	Undervoltage	LOC/REM	JOG	Speed Direction	General Enabling	Run/Stop	Alarm condition	Configuration Mode	Second Ramp	Fast Stop	Reserved

**Table 3.2 – Parameter P0680 bit functions**

Bits	Values
Bits 0 to 3	Reserved.
Bit 4	0: The inverter is not executing the fast stop command.
Fast Stop	1: The inverter is executing the fast stop command.

Bit 5 Second Ramp	0: The inverter is configured to use the first ramp as motor acceleration and deceleration ramp, programmed at the parameters P0100 and P0101. 1: The inverter is configured to use the second ramp as motor acceleration and deceleration ramp, programmed at the parameters P0102 and P0103.
Bit 6 Configuration Mode	0: The inverter is operating normally. 1: The inverter is in configuration mode. It indicates a special condition in which the inverter cannot be enabled: <input checked="" type="checkbox"/> Executing the self-tuning routine. <input checked="" type="checkbox"/> Executing the oriented start-up routine. <input checked="" type="checkbox"/> Executing the HMI Copy function. <input checked="" type="checkbox"/> Executing the flash memory card guided routine. <input checked="" type="checkbox"/> There is a parameter setting incompatibility. <input checked="" type="checkbox"/> Without supply at the inverter power section. <b>Note:</b> It is possible to obtain the exact description of the special operation mode at the parameter P0692.
Bit 7 Alarm Condition	0: The inverter is not in alarm condition. 1: The inverter is in alarm condition. <b>Note</b> The alarm number can be read by means of the parameter P0048 – Current Alarm.
Bit 8 Run/Stop	0: The motor is stopped. 1: The inverter is driving the motor at the set point speed, or executing either the acceleration or the deceleration ramp.
Bit 9 General Enabling	0: General Enabling is not active. 1: General enabling is active and the inverter is ready to run the motor.
Bit 10 Speed Direction	0: The motor is in Reverse speed direction. 1: The motor is in Forward speed direction.
Bit 11 JOG	0: JOG function inactive. 1: JOG function active.
Bit 12 LOC/REM	0: The inverter is in LOCAL situation. 1: The inverter is in REMOTE situation.
Bit 13 Under voltage	0: No Undervoltage. 1: With Undervoltage.
Bit 14 Manual/ Automatic	0: PID in manual mode. 1: PID in Automatic mode.
Bit 15 Fault Condition	0: The inverter is not in a fault condition. 1: The inverter is in a fault condition. <b>Note:</b> The fault number can be read by means of the parameter P0049 – Current Fault.

## P0681 – Motor Speed in 13 Bits

**Range:** - 32768 to 32768 **Default:** -

**Properties:** RO

**Access groups via HMI:**

01 PARAMETER GROUPS

└ 49 Communication

└ 111 Status / Commands

### Description:

It allows monitoring the motor speed. This word uses 13 bit resolution with sign to represent the motor nominal speed:

- ☒ P0681 = 0000h (0 decimal) → motor speed = 0 rpm
- ☒ 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, in order to obtain the speed in rpm one must calculate:

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

$$\text{Speed in rpm} = 450 \text{ rpm}$$

Negative values in this parameter indicate motor rotating in reverse speed direction.

## P0684 – CANopen/DeviceNet/Profibus DP Control Word

Range: 0000h to FFFFh

Default: 0000h

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS .

L 49 Communication .

L 111 Status / Commands .

### Description:

It is the inverter control word via Profibus DP interface. This parameter can only be changed via the Profibus DP interface. For the other sources (HMI, Serial, etc.) it behaves like a read-only parameter.

In order that the commands written in this parameter be executed, it is necessary that the inverter be programmed to be commanded via CANopen/DeviceNet/Profibus DP. This programming is done by means of parameters P0105 and P0220 to P0228.

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

Bits	15 to 8	7	6	5	4	3	2	1	0
Function	Reserved	Fault Reset	Fast Stop	Second Ramp	LOC/REM	JOG	Speed Direction	General Enabling	Run /Stop

Table 3.3 – Parameter P0684 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.
Bit 1 General Enabling	0: It disables the inverter, interrupting the supply for the motor. 1: It enables the inverter allowing the motor operation.
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.
Bit 3 JOG	0: It disables the JOG function. 1: It enables the JOG function.
Bit 4 LOC/REM	0: The inverter goes to the LOCAL situation. 1: The inverter goes to the REMOTE situation.
Bit 5 Second Ramp	0: The inverter uses the first ramp times as motor acceleration and deceleration ramps, programmed at the parameters P0100 and P0101. 1: The inverter uses the second ramp times as motor acceleration and deceleration ramps, programmed at the parameters P0102 and P0103.
Bits 6 Fast Stop	0: It does not execute the Fast Stop command. 1: It executes the Fast Stop command. <b>Note:</b> When the control type (P0202) is V/f or VVV, the use of this function is not recommended.
Bit 7 Fault Reset	0: No function. 1: If in a fault condition, then it executes the inverter reset.
Bits 8 to 15	Reserved.

## P0685 – CANopen/DeviceNet/Profibus DP Speed Reference

Range: - 32768 to 32768

Default: 0

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 111 Status / Commands

### Description:

It allows the programming of the speed reference for the inverter via Profibus DP interface. This parameter can only be changed via Profibus DP interface. For the other sources (HMI, Serial, etc.) it behaves like a read-only parameter.

In order that the reference written in this parameter be used, it is necessary that the inverter be programmed for using the speed reference via CANopen/DeviceNet/Profibus DP. This programming is done by means of parameters P0221 and P0222.

This word uses a 13 bit resolution with sign to represent the motor synchronous speed:

- ☒ P0685 = 0000h (0 decimal) → speed reference = 0 rpm
- ☒ P0685 = 2000h (8192 decimal) → speed reference = synchronous speed

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

$$\begin{array}{rcl} 1800 \text{ rpm} & - & 8192 \\ 900 \text{ rpm} & - & 13 \text{ bit reference} \end{array} \quad 13 \text{ bit reference} = \frac{900 \times 8192}{1800}$$

$$13 \text{ bit reference} = 4096 \text{ (value corresponding to 900 rpm in a 13 bit scale)}$$

This parameter also accepts negative values to revert the motor speed direction. The reference speed direction, however, depends also on the control word bit 2 setting – P0684:

- ☒ Bit 2 = 1 and P0685 > 0: reference for the forward speed direction
- ☒ Bit 2 = 1 and P0685 < 0: reference for the reverse speed direction
- ☒ Bit 2 = 0 and P0685 > 0: reference for the reverse speed direction
- ☒ Bit 2 = 0 and P0685 < 0: reference for the forward speed direction

## P0695 – Settings for the Digital Outputs

Range: 0000h to FFFFh

Default: 0000h

Properties: Net

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 111 Status / Commands

### Description:

It makes possible the control of the digital outputs through the network interfaces (Serial, USB, CAN, Profibus DP, etc.). This parameter cannot be modified through the HMI.

Each bit of this parameter corresponds to the desired value for one digital output. In order that the corresponding digital output be controlled according to this content, it is necessary that its function be programmed to "P0695 Content" in the parameters P0275 to P0280.

Bits	15 to 5	4	3	2	1	0
Function	Reserved	Value for DO5	Value for DO4	Value for DO3 (RL3)	Value for DO2 (RL2)	Value for DO1 (RL1)

**Table 3.4** – Functions of the P0695 parameter bits

Bits	Values
Bit 0 Value for DO1 (RL1)	0: DO1 output open 1: DO1 output closed
Bit 1 Value for DO2 (RL2)	0: DO2 output open 1: DO2 output closed
Bit 2 Value for DO3 (RL3)	0: DO3 output open 1: DO3 output closed
Bit 3 Value for DO4	0: DO4 output open 1: DO4 output closed
Bit 4 Value for DO5	0: DO5 output open 1: DO5 output closed
Bits 5 to 15	Reserved.



**NOTE!**

The digital outputs DO4 and DO5 are only available with the use of a CFW-11 accessory.

### P0696 – Value 1 for Analog Outputs

### P0697 – Value 2 for Analog Outputs

### P0698 – Value 3 for Analog Outputs

### P0699 – Value 4 for Analog Outputs

**Range:** - 32768 to 32768 **Default:** 0

**Properties:** Net

**Access groups via HMI:**

01	PARAMETER GROUPS
L	49 Communication
L	111 Status / Commands

**Description:**

It makes possible the control of the analog outputs through the network interfaces (Serial, USB, CAN, Profibus DP, etc.). This parameter cannot be modified through the HMI.

The value written in these parameters is used as the analog output value, provided that the corresponding analog output function be programmed for "P0696/P0697/P0698 or P0699 Content", at the parameters P0251, P0254, P0257 or P0260.

The value must be written in a 15 bit scale ( $7FFFh = 32767$ )<sup>1</sup> to represent 100% of the desired value for the output, i.e.:

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

In this example the parameter P0696 was shown, but the same scale is used for the parameters P0697/P0698/P0699. For instance, one wants to control the value of the analog output 1 through the Profibus interface. In this case it is necessary to do the following programming:

<sup>1</sup> For the actual output resolution, refer to the CFW-11 manual.



- ☑ To choose one of the parameters from P0696 to P0699 to be the value used by the analog output 1. In this example we will choose P0696;
- ☑ To program at the analog output 1 function (P0254), the option "P0696 Content";
- ☑ To write the desired value for the analog output 1 in P0696 through the Profibus DP interface, between 0 and 100% according to the parameter scale.



#### NOTE!

If the analog output is programmed to operate from -10V to 10V, then negative values must be used at these parameters in order to generate negative voltage values, i.e., -32768 to 32767 represent a variation from -10V to 10V at the analog output.

## P0740 – Profibus DP Communication Status

<b>Range:</b>	0 = Inactive 1 = Profibus interface initialization error 2 = <i>Offline</i> 3 = Configuration data error 4 = Parameterization data error 5 = <i>Clear mode</i> 6 = <i>Online</i>	<b>Default:</b> -
---------------	--	-------------------

**Properties:** RO

### Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

### Description:

It allows identifying if the Profibus DP interface board is properly installed, besides indicating the status of the communication with the network master.

**Table 3.5 – Parameter P0740 values**

Options	Description
0 = Inactive	The Profibus interface is not installed in the CFW-11.
1 = Profibus interface initialization error	A problem was identified during the Profibus interface initialization.
2 = <i>Offline</i>	The Profibus interface is installed and properly configured, but no data has been received from the network master.
3 = Configuration data error	Data received in the I/O configuration telegram are not in accordance with the CFW-11 configurations done through the parameter P0922.
4 = Parameterization data error	Data received in the parameterization telegram does not have the format/values valid for the CFW-11.
5 = <i>Clear mode</i>	During data exchange with the master, the inverter received a command to enter the <i>clear mode</i> .
6 = <i>Online</i>	I/O data exchange between the CFW-11 and the Profibus network master is being successfully executed.

## P0741 – Profibus Data Profile

Range: 0 = PROFIdrive  
1 = Manufacturer

Default: 1

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

### Description:

It allows selecting the data profile for the control, speed reference, status and motor speed words during the I/O data exchange with the network master.

Table 3.6 – Parameter P0741 values

Options	Description
0 = PROFIdrive	The control, status, speed reference and motor speed words have values and functions according to what is described by the PROFIdrive specification. The description of each word is done in the following parameters: <input checked="" type="checkbox"/> P0967: PROFIdrive control word. <input checked="" type="checkbox"/> P0968: PROFIdrive status word. The speed reference and motor speed words for this profile are described next.
1 = Manufacturer	The control, status, speed reference and motor speed words have CFW-11 specific values and functions. The description of each word is done in the following parameters: <input checked="" type="checkbox"/> P0680: Status word <input checked="" type="checkbox"/> P0681: Motor Speed in 13 Bits <input checked="" type="checkbox"/> P0684: Control word <input checked="" type="checkbox"/> P0685: Speed reference.

### Speed for the PROFIdrive profile:

If the used profile is the PROFIdrive, both the speed reference and the motor speed must be indicated as a value proportional to the inverter maximum speed, programmed through P0134:

- ☒ Value via Profibus = 0000h (0 decimal) → Speed = 0 rpm
- ☒ Value via Profibus = 4000h (16384 decimal) → Speed = maximum speed (P0134)

Intermediary speed values in rpm can be obtained using this scale. For instance, if P0134 is programmed for 1800 rpm and the motor speed value read via Profibus is 2048 (0800 h), in order to obtain the value in rpm the following calculation must be done:

$$\frac{16384 - 1800 \text{ rpm}}{2048 - \text{speed in rpm}} \quad \text{Speed in rpm} = \frac{1800 \times 2048}{16384}$$

$$\text{Speed in rpm} = 225 \text{ rpm}$$

The same calculation applies for the transmission of speed reference values. Negative speed values indicate reverse speed direction.



### NOTE!

- ☒ For the internal reference writing in the inverter, the values are converted and written in the parameter P0685.
- ☒ The reference writing does also depend on the bit 6 of the PROFIdrive control word (P0967).

### P0742 – Profibus Reading #3

### P0743 – Profibus Reading #4

### P0744 – Profibus Reading #5

### P0745 – Profibus Reading #6

### P0746 – Profibus Reading #7

### P0747 – Profibus Reading #8

### P0748 – Profibus Reading #9

### P0749 – Profibus Reading #10

Range: 0 to 1199 Default: 0 (disabled)

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

#### Description:

The parameters P0742 to P0749 permit programming the content of the input words 3 to 10 (input: inverter sends to the master). By using these parameters it is possible to program the number of another parameter whose content must be made available at the network master input area.

If, for instance, one wants to read from the CFW-11inverter the motor current in Amps, one must program the value 3 in one of these parameters, because the parameter P0003 is the one that contains this information. It is worthwhile to remind that the value read from any parameter is represented with a 16 bit word. Even if the parameter has decimal resolution, the value is transmitted without the indication of the decimal places. E.g., if the parameter P0003 has the value 4.7A, the value supplied via the network will be 47.

These parameters are used only if the inverter is programmed at the parameter P0922 to use the options 2 to 9 (configuration telegrams 100 to 107). Up to 10 words to be read by the network master can be made available, according to the selected option.

The first two input words are fixed and represent the status and the motor speed.



#### NOTE!

The value 0 (zero) disables the writing in the word.

### P0750 – Profibus Writing #3

### P0751 – Profibus Writing #4

### P0752 – Profibus Writing #5

### P0753 – Profibus Writing #6

### P0754 – Profibus Writing #7

### P0755 – Profibus Writing #8

### P0756 – Profibus Writing #9

### P0757 – Profibus Writing #10

Range: 0 to 1199 Default: 0 (disabled)

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

#### Description:

The parameters P0750 to P0757 permit programming the content of the output words 3 to 10 (output: master sends to the inverter). Using these parameters, it is possible to program the number of another parameter whose content must be made available at the network master output area.

If, for instance, one wants to write the acceleration ramp value in the CFW-11 inverter, one must program the value 100 in one of these parameters, because the parameter P0100 is the one where this information is programmed. It is worthwhile to remind that the value written in any parameter is represented with a 16 bit word. Even if the parameter has decimal resolution, the value is transmitted without the indication of the decimal places. E.g., if one wishes to program the parameter P0100 with the value 5.0s, the value programmed via the network must be 50.

These parameters are used only if the inverter is programmed at the parameter P0922 to use the options 2 up to 9 (configuration telegrams 100 up to 107). Up to 10 words to be written by the network master can be made available, according to the selected option.

The first two output words are fixed and represent the control and the speed reference.



#### NOTE!

The value 0 (zero) disables the writing in the word.

### P0918 – Profibus Address

Range: 1 to 125 Default: 1

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

#### Description:

It allows programming the inverter address in the Profibus DP network. It is necessary that each of the equipments in the network has an address different from the others.



#### NOTE!

☒ In order that the modification of this parameter becomes valid, it is necessary to cycle the power of the inverter.

## P0922 – Configuration Telegram Selection

<b>Range:</b>	1 = Standard Telegram 1 (2 I/O words) 2 = Telegram 100 (3 I/O words) 3 = Telegram 101 (4 I/O words) 4 = Telegram 102 (5 I/O words) 5 = Telegram 103 (6 I/O words) 6 = Telegram 104 (7 I/O words) 7 = Telegram 105 (8 I/O words) 8 = Telegram 106 (9 I/O words) 9 = Telegram 107 (10 I/O words)	<b>Default:</b> 1
---------------	--	-------------------

**Properties:** DP

**Access groups via HMI:**

01 PARAMETER GROUPS
L 49 Communication
L 115 Profibus DP

### Description:

It allows selecting which configuration telegram is used by the inverter during the Profibus DP network initialization. This telegram defines the format and quantity of input/output data exchanged with the network master.

During the network master configuration, by using the GSD file, it is possible to select the desired data module for the exchange of cyclic data between the master and the inverter. It is possible to exchange from 2 to 10 input/output (I/O) words (16 bits each), depending on the selected option. The value programmed in this parameter must coincide with the module selected by the network master programming tool.

The content of the first two input/output words is pre-defined. The other words are programmable through the parameters P0742 to P0757:

	Input (CFW-11 → master)	Word	Output (master → CFW-11)	
Fixed	Status Word	#1	Control Word	2 I/O
	Motor Speed	#2	Speed Reference	
Programmable	Reading Profibus #3	#3	Writing Profibus #3	3 I/O
	Reading Profibus #4	#4	Writing Profibus #4	
	Reading Profibus #5	#5	Writing Profibus #5	4 I/O
	Reading Profibus #6	#6	Writing Profibus #6	
	Reading Profibus #7	#7	Writing Profibus #7	5 I/O
	Reading Profibus #8	#8	Writing Profibus #8	
	Reading Profibus #9	#9	Writing Profibus #9	6 I/O
	Reading Profibus #10	#10	Writing Profibus #10	
				7 I/O
				8 I/O
				9 I/O
				10 I/O



### NOTE!

The format of the control, status, speed reference and motor speed words depends on the parameter P0741 programming.

## P0944 – Inverter Fault Counter

<b>Range:</b>	0 to 1	<b>Default:</b> -
---------------	--------	-------------------

**Properties:** RO, DP

**Access groups via HMI:**

01 PARAMETER GROUPS
L 49 Communication
L 115 Profibus DP

**Description:**

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, to indicate the number of faults occurred in the CFW-11 inverter. If any fault indication occurs at the equipment, this counter will be incremented. For the CFW-11 only one fault at a time is registered, thus, this counter has a maximum value of 1. The value 0 (zero) indicates that the inverter is not in fault status. The parameter content is reset together with the inverter reset.

### P0947 – Fault Number

**Range:** 0 to 999 **Default:** -

**Properties:** RO, DP

**Access groups via HMI:**

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

**Description:**

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, to indicate the fault occurred in the CFW-11 inverter. If any fault occurs in the equipment, this parameter will have the code of the occurred fault. The value 0 (zero) indicates that the inverter is not in fault status.

### P0963 – Profibus Baud Rate

**Range:**

0 = 9.6 kbit/s	<b>Default:</b> 1
1 = 19.2 kbit/s	
2 = 93.75kbit/s	
3 = 187.5 kbit/s	
4 = 500 kbit/s	
5 = Not detected	
6 = 1500 kbit/s	
7 = 3000 kbit/s	
8 = 6000 kbit/s	
9 = 12000 kbit/s	
10 = Reserved	
11 = 45.45 kbit/s	

**Properties:** RO, DP

**Access groups via HMI:**

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

**Description:**

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, to indicate the baud rate detected by the Profibus DP interface.

## P0964 – Drive Identification

Range: 0 to 65535

Default: -

Properties: RO, DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

### Description:

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, to indicate information about the inverter. This parameter has 5 sub-indices with information on the inverter, but the sub-indices 1 to 4 are accessible only using the acyclic access to parameters defined by the PROFIdrive profile. Other interfaces access only the sub-index 0.

- ☒ Sub-index 0: Manufacturer = 367
- ☒ Sub-index 1: Drive Unit Type = 4
- ☒ Sub-index 2: Version (software) = Equipment firmware version (P0023)
- ☒ Sub-index 3: Firmware Date (year) = Firmware elaboration year, in yyyy format
- ☒ Sub-index 4: Firmware Date (day/month) = Firmware elaboration day and month, in ddmm format

## P0965 – PROFIdrive Profile Identification

Range: 0 to 65535

Default: -

Properties: RO, DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

### Description:

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, to indicate the profile and profile version used by the inverter. For the CFW-11, this parameter has a fixed value that can be divided in two bytes (high portion and low portion of the 16 bit word), where each byte has the following value:

- ☒ Byte 1 (high portion): profile number = 3 (PROFIdrive)
- ☒ Byte 2 (low portion): profile version = 41 (PROFIdrive Profile Version 4.1)

The value showed in the parameter is 809, which represents the decimal value concatenating the two bytes.

## P0967 – PROFIdrive Control Word

Range: 0000h to FFFFh

Default: 0000h

Properties: DP

Access groups via HMI:

01 PARAMETER GROUPS

L 49 Communication

L 115 Profibus DP

### Description:

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, with the inverter control word via the Profibus DP interface when the PROFIdrive data profile is selected at P0741. This parameter can only be changed via Profibus DP interface. For the other sources (HMI, Anybus C, etc.) it behaves like a read-only parameter.

In order that the commands written in this parameter be executed, it is necessary that the inverter be programmed to be commanded via CANopen/DeviceNet/Profibus DP. This programming is done by means of parameters P0105 and P0220 to P0228.

The specific functions in this word follow the defined by the PROFIdrive specification. Each bit of this word corresponds to a command that can be executed by the inverter:

Bits	15 to 11	10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Control By PLC	Reserved	JOG 1 ON	Fault Acknowledged	Enable Setpoint	Reserved	Enable Ramp Generator	Enable Operation	No Quick Stop	No Coast Stop	ON

**Table 3.7 – Parameter P0967 bit functions**

Bits	Values
Bit 0 ON / OFF	0: OFF -> If enabled, it stops and disables the inverter. 1: ON -> It allows the inverter enabling.
Bit 1 No Coast Stop / Coast Stop	0: Coast Stop -> It disables the inverter. 1: No coast Stop -> It allows the inverter enabling.
Bit 2 No Quick Stop / Quick Stop	0: If enabled, it executes the Fast Stop command and disables the inverter. 1: It allows the inverter enabling. <b>Note:</b> When the control type (P0202) is V/f or VVV, the use of this function is not recommended.
Bit 3 Enable Operation	0: It disables the inverter. 1: It enables the inverter.
Bit 4 Enable Ramp Generator	0: It disables the inverter via deceleration ramp. 1: It enables the speed ramp for the inverter.
Bit 5	Reserved
Bit 6 Enable Setpoint	0: It resets the speed reference. 1: It uses the speed reference received via the Profibus DP network.
Bit 7 Fault Acknowledge	0: No function. 1: If in a fault condition, it executes the inverter reset.
Bit 8 JOG 1 ON	0: It disables the JOG function. 1: It enables the JOG function.
Bit 9	Reserved
Bit 10 Control By PLC	0: The inverter goes to the LOCAL situation. 1: The inverter goes to the REMOTE situation. <b>Note:</b> The local and remote command sources depend on the options programmed at the parameters P0220 to P0228.
Bits 11 to 15	Reserved.



**NOTE!**

The speed direction reversion can be done by sending a negative value to the speed reference.

## P0968 – PROFIdrive Status Word

Range: 0000h to FFFFh

Default: 0000h

Properties: RO, DP

Access groups via HMI:

01 PARAMETER GROUPS

└ 49 Communication

└ 115 Profibus DP

**Description:**

It is a Profibus DP communication specific parameter, defined by the PROFIdrive standard, with the inverter status word via the Profibus DP interface when the PROFIdrive data profile is selected at P0741.



The specific functions in this word follow the defined by the PROFIdrive specification. Each bit of this word corresponds to one state:

Bits	15 to 10	9	8	7	6	5	4	3	2	1	0
Function	Reserved	Control Request	Reserved	Warning Present	Switching On Inhibited	Quick Stop Not Active	Coast Stop Not Active	Fault Present	Operation Enabled	Ready to Operate	Ready to Switch On

**Table 3.8** – Parameter P0968 bit functions

Bits	Values
Bit 0 Ready To Switch On	0: The inverter cannot be enabled. 1: Commands received from the master allow enabling the inverter.
Bit 1 Ready To Operate	0: No commands received from the master to operate the equipment. 1: Commands received from the master allow enabling the inverter.
Bit 2 Operation Enabled	0: The inverter is disabled. 1: Inverter enabled, and able to receive the command to release the ramp.
Bit 3 Fault Present	0: The inverter is not in a fault condition. 1: The inverter is in a fault condition.
Bit 4 Coast Stop Not Active	0: The inverter is disabled. 1: The inverter is enabled.
Bit 5 Quick Stop Not Active	0: The inverter is with a Fast Stop command active. 1: Fast Stop command is not active at the inverter.
Bit 6 Switching On Inhibited	0: The inverter enabling is allowed. 1: The inverter operation is blocked, indicating a special condition that prevents the equipment operation.
Bit 7 Warning Present	0: No alarm. 1: The inverter has an active alarm.
Bit 8	Reservado
Bit 9 Control By PLC	0: The inverter is operating in local mode. 1: The inverter is operating in remote mode.
Bits 10 to 15	Reserved.

## 4 Profibus DP Protocol Services

The Profibus DP protocol defines a series of functions for exchanging data between master and slave. The set of functions can be divided in different functional levels, in the following versions:

- ☑ DP-V0: It is the first version of the protocol, which mainly defines functions to perform cyclic data exchange between master and slave.
- ☑ DP-V1: It is an extension of the functions defined in the first version; it defines particularly how to perform the exchange of acyclic data between master and slave, besides the cyclic data.
- ☑ DP-V2: It defines a set of advanced functions such as communication between slaves and isochronous communication mode.

Three different types of equipment are specified in a Profibus network:

- ☑ Slaves: They are passive stations in the network, which only answer to the requests made by the master.
- ☑ Class 1 Master: It is responsible for the cyclic data exchange. Typically represented by the PLC, or process or plant control software.
- ☑ Class 2 Master: It allows the communication in the Profibus DP network through acyclic messages. Typically represented by an engineering or configuration tool used for network commissioning or maintenance.

The CFW-11 operates as a slave in the Profibus DP network, and supports the services of the DP-V0 and DP-V1 versions.

### 4.1 Profibus DP-V0

#### 4.1.1 Cyclic Data

The communication via cyclic data allows the data transfer in two directions:

- ☑ Input data: Data transmitted from the slave to the master, for monitoring the status and the variables of each slave.
- ☑ Output data: Data transmitted from the master to the slave, for control and transmission of operation data to the equipment.

These data are transmitted in regular time periods, defined by the baud rate, number of slaves in the network and the amount of data exchanged with each slave.

The number of input/output (I/O) words available for the CFW-11 depends on the format of the configuration telegram, programmed through the parameter P0922. It is possible to communicate from 2 to 10 input words and the same number of output words. The contents of these words depend on the setting of the parameters P0741 to P0757.

The same programming done at the parameter P0922 must also be configured at the network master, using a master configuration tool and the CFW-11 GSD file, selecting one of the available modules described in the GSD file.

#### 4.1.2 SYNC/FREEZE

The CFW-11 supports the SYNC/UNSYNC and FREEZE/UNFREEZE commands. These are global commands that the master can send to all the network slaves, allowing simultaneous update of I/O data in the network equipments.

The SYNC/UNSYNC commands act on the master output data. When receiving a SYNC command, the command and speed reference values received by each slave are frozen. Values received later by the slave are stored, but will only be updated after the reception of a new SYNC command, or after the UNSYNC command, which cancels this function.

The FREEZE/UNFREEZE commands act in a similar form as the SYNC, but their action is associated to the master input data. When receiving a FREEZE command, variable and status values of each slave are frozen. These values remain fixed until a new FREEZE command be received, or after the UNFREEZE command, which cancels this function.

## 4.2 Profibus DP-V1

In addition to the services defined by the first version of the Profibus DP specification (DP-V0), where it is mainly defined how to perform the exchange of cyclic data for equipment control and monitoring, the CFW-11 with the Profibus DP communication accessory also supports the DP-V1 additional services, both by the network master (class 1 master) and by a commissioning tool (class 2 master).

### 4.2.1 Available Services for Acyclic Communication

The CFW-11 supports the following services for acyclic communication in the Profibus DP network:

- ☑ Communication between class 1 master and slave (MS1):
  - Data acyclic reading (DS\_Read)
  - Data acyclic writing (DS\_Write)
- ☑ Communication between class 2 master and slave (MS2):
  - Initiates the connection (Initiate)
  - Data acyclic reading (DS\_Read)
  - Data acyclic writing (DS\_Write)
  - Aborts the connection (Abort)

DP-V1 requests use an SD2 type Profibus DP telegram – with variable size of data length. This type of telegram has the following fields:

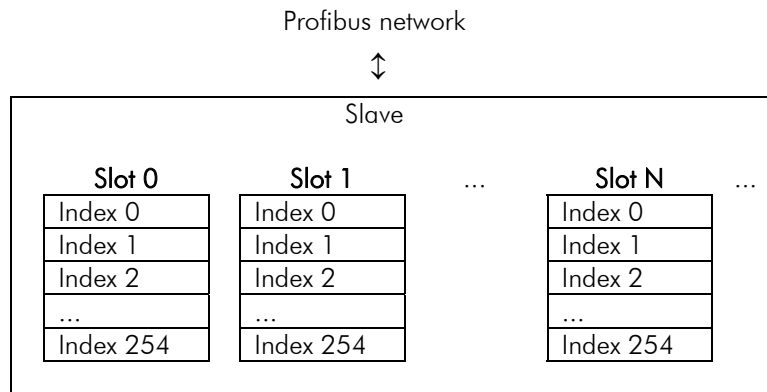
Telegram header									Data unit	Telegram end	
SD	LE	LEr	SD	DA	SA	FC	DSAP	SSAP	DU	FCS	ED
68h	xx	xx	68h	xx	xx	xx	xx	xx	xx ...	xx	16h

SD	Telegram start delimiter (Start Delimiter)
LE	Telegram length, from the DA field to the DU (Length)
LEr	Telegram length repetition (Length repeat)
DA	Destination Address
SA	Source Address
FC	Function Code
DSAP	Destination Service Access Point
SSAP	Source Service Access Point
DU	Data unit, size 1 to 244 (Data Unit for DP services)
FCS	Telegram checking byte (Frame Checking Sequence)
ED	Telegram end delimiter (End Delimiter)

In this telegram it matters to describe the data structure in the DU field, where the form to access the inverter parameters is defined. The other fields follow the defined by the Profibus specification and, normally, are controlled by the network master.

### 4.2.2 Data Addressing

In the functions for reading and writing via acyclic data, these data are addressed with a numbering indicating which slot and index are being accessed. The slots can be used to address different physical segments of an equipment (a modular equipment for instance) or even logical segments inside a single equipment. The index indicates which data inside the segment is being accessed.



**Figure 4.1 – Acyclic Data Addressing**

### 4.2.3 Reading/Writing DP-V1 Telegrams

In the Profibus DP protocol, the writing (DS\_Write) and reading (DS\_Read) DP-V1 telegrams used to access the parameters have the following structure:

Writing Telegram (DS\_Write):

Request (master -> slave)	Header	Data Unit (DU)					End
	Function 5Fh	Slot 0	Index 47	Size n	Request data (n bytes)		

Positive Response (slave -> master)	Header	Data Unit (DU)				End
	Function 5Fh	Slot 0	Index 47	Size 0		

Negative Response (slave -> master)	Header	Data Unit (DU)				End
	Function DFh	Error Decode 128	Error Code 1 xx	Error Code 2 xx		

Reading Telegram (DS\_Read):

Request (master -> slave)	Header	Data Unit (DU)				End
	Function 5Eh	Slot 0	Index 47	Size 240		

Positive Response (slave -> master)	Header	Data Unit (DU)					End
	Function 5Eh	Slot 0	Index 47	Size n	Response data (n bytes)		

Negative Response (slave -> master)	Header	Data Unit (DU)				End
	Function DEh	Error Decode 128	Error Code 1 xx	Error Code 2 xx		

Each telegram field can assume the following values:

<b>Function</b>	5Fh – Writing request, positive response for writing 5Eh – Reading request, positive response for reading DFh – Negative response for writing DEh – Negative response for reading
<b>Slot</b>	0 (It is the standard slot for accessing the CFW-11 parameters, according to PROFIdrive)
<b>Index</b>	47 (It is the standard index for accessing the CFW-11 parameters, according to PROFIdrive)

<b>Size</b>	Number of bytes for reading and writing. <input checked="" type="checkbox"/> Writing request: 'n' bytes, according to the number of bytes in the request telegram. <input checked="" type="checkbox"/> Positive response for writing: 0 bytes <input checked="" type="checkbox"/> Reading request: 240 bytes (It requests the maximum number of reading bytes, because the size of the slave response is variable). <input checked="" type="checkbox"/> Positive response for reading: 'n' bytes, according to the number of bytes in the response telegram.
<b>Error Decode</b>	128
<b>Error Code 1</b>	Error code, according to the problem found in the request: B0h: access error – invalid slot B2h: access error – invalid index B5h: access error – modification not allowed for the parameter B6h: access error – modification in read-only parameter B7h: access error – incorrect values for parameter access B8h: access error – invalid parameter number C3h: Resource error – Response not available for the reading request
<b>Error Code 2</b>	0
<b>Request data</b>	Variable size field of the writing request (DS_Write), which contains the data for accessing the inverter parameters.
<b>Response data</b>	Variable size field of the reading response (DS_Read), which contains the result of the access to the inverter parameters.

#### 4.2.4 Data Structure for Parameter Access – PROFIdrive

The CFW-11 makes available the access to the inverter entire parameter list through the acyclic data, according to the PROFIdrive specification. According to the specification, the access to the global parameters is achieved through the following addressing:

- ☒ Slot 0
- ☒ Index 47

Through this slot and index, one must use the structure to access the parameters defined in the PROFIdrive specification, in order to perform readings and modifications of the CFW-11 inverter parameters. This access uses the following mechanism:

1. Either the reading or the modification of parameters must begin with a writing DP-V1 telegram (DS\_Write) at the slot 0 index 47, with the request of the parameter to the inverter.
2. When receiving the telegram, the CFW-11 will test the data consistency in order to know if the request is valid. If errors in the request format are not found, it will respond positively to the request telegram and initiate the data treatment.
3. After receiving writing telegram positive response, reading DP-V1 telegrams (DS\_Read) must be sent in order to obtain the response to the request performed previously. If the request has not been processed yet, the inverter will respond a reading error. This reading must be repeated until the inverter responds with valid data.

The fields with the request and response data contain the structure where the parameters accessed at the inverter are defined. In this access, as defined by the PROFIdrive, the request and response data have the following structure:

**Table 4.1 – Request data structure**

Request data header	Request Reference	Request ID
	DO-ID	Nr. of Parameters (n)
Parameter Address	Attribute	Nr. of Elements
	Parameter Number	
	Sub-index	
	:	
Parameter value (only for parameter modification requests)	Format	Number of values
	Value 1	
	Value 2...	
	:	

Repeated 'n' times, according to the number of accessed parameters

Repeated 'n' times, according to the number of parameters in the header

<b>Request Reference</b>	A number between 1 and 255 that will be retransmitted in the response telegram.
<b>Request ID</b>	It represents the type of request made to the slave: 1 = Parameter reading 2 = Parameter modification
<b>DO-ID</b>	0
<b>Nr. of Parameters</b>	The number of parameters accessed in the request
<b>Attribute</b>	10h (request of the parameter value)
<b>Nr. of Elements</b>	For parameters of the array type, it represents the number of elements accessed in the parameter. For the CFW-11 only a few parameters specified by the PROFIdrive specification have this format, the other parameters are always formed by a single value, and therefore this field must be set in 0 or 1.
<b>Parameter number</b>	The number of an inverter valid parameter (the most significant byte is transmitted first).
<b>Sub-index</b>	For parameters of the array type, it represents the array element starting from which the access will be made (the most significant byte is transmitted first). For parameters formed by a single item, this field must be set in 0.
<b>Format</b>	It defines the format for the writing parameter. For the inverter parameters the value 42h (16 bit word) must be used.
<b>Number of values</b>	The number of values to be written (defined in the number of elements).
<b>Value</b>	Value to write in the parameter (the most significant byte is transmitted first).

**Table 4.2 – Response data structure**

Response data header	Request Reference mirror	Response ID
	DO-ID mirror	Nr. of Parameters (n)
Parameter value (only for parameter reading responses, or in case of error)	Format	Number of values
	Value 1 or error code	
	Value 2 or error code ...	
	:	

Repeated 'n' times, according to the number of accessed parameters

<b>Request Reference mirror</b>	A mirror of the value received in the request telegram.
<b>Response ID</b>	It represents the type of response sent by the slave: 1 = Successful parameter reading 2 = Successful parameter modification 129 = Parameter reading with error 130 = Parameter modification with error
<b>DO-Id Mirror</b>	Mirror of the value received in the request telegram.
<b>Nr. of Parameters (n)</b>	The number of parameters accessed in the request
<b>Format</b>	It defines the format of the accessed parameter: 42h = 16 bit word 44h = Parameter access error

<b>Number of values</b>	The number of values read from the parameter, or the number of error codes from the parameter access.
<b>Value</b>	Value read from the parameter (the most significant byte is transmitted first).
<b>Error code</b>	<p>In case of parameter illegal access (error in reading or writing of any of the parameters, the code of the type of found error will be indicated:</p> <p>0000h = parameter does not exist  0001h = modification of read-only parameter  0002h = parameter value out of the limits  0003h = indicated sub-index does not exist  0004h = parameter not of the array type  0005h = incorrect format for the parameter  0009h = description not available (only value)  000Fh = text not available (only value)  0016h = incorrect access to the parameter  0017h = unknown format  0018h = incorrect number of values</p>

#### 4.2.5 Parameter Acyclic Access Telegram Examples

Examples of sequences to get access to inverter parameters will be presented next. As said previously, every access to the parameters is performed first with a writing telegram with the request, and then with a reading telegram in order to obtain the result of the request.

Example 1: Reading of the speed (P0002) and motor current (P0003) parameters.

Request (done by the master using the DS\_Write telegram):

Byte Nr.	Field	Value	Description
1	Request Reference	1	
2	Request ID	1	Reading request
3	DO-ID	0	
4	Nr. of Parameters	2	Reading of 2 parameters
5	Attribute	10h	Parameter value reading
6	Nr. of elements	1	Reading of only 1 value
7	Parameter number (most significant byte)	0	Number of the first read parameter = P0002
8	Parameter number (least significant byte)	2	
9	Sub-index (high portion)	0	Parameter does not have sub-index
10	Sub-index (low portion)	0	
11	Attribute	10h	Parameter value reading
12	Nr. of elements	1	Reading of only 1 value
13	Parameter number (most significant byte)	0	Number of the second read parameter = P0003
14	Parameter number (least significant byte)	3	
15	Sub-index (most significant byte)	0	Parameter does not have sub-index
16	Sub-index (least significant byte)	0	

Positive response (sent by the slave in the DS\_Read telegram response)

Assuming P0002 = 100 rpm and P0003 = 5,0 A

Byte Nr.	Field	Value	Description
1	Request Reference	1	Copied from the request telegram
2	Request ID	1	Positive reading request
3	DO-ID	0	
4	Nr. of Parameters	2	Reading of 2 parameters

5	Format	42h	Word type value (16 bits)
6	Number of values	1	Reading of only 1 value
7	Parameter value (most significant byte)	0	P0002 = 100 rpm
8	Parameter value (least significant byte)	100	
11	Format	42h	Word type value (16 bits)
12	Number of values	1	Reading of only 1 value
13	Parameter value (most significant byte)	0	P0003 = 5,0 A
14	Parameter value (least significant byte)	50	

Negative response (sent by the slave in the DS\_Read telegram response)

Assuming error in the second parameter reading

Byte Nr.	Field	Value	Description
1	Request Reference	1	Copied from the request telegram
2	Request ID	129	Negative reading request
3	DO-ID	0	
4	Nr. of Parameters	2	Reading of 2 parameters
5	Format	42h	Word type value (16 bits)
6	Number of values	1	Reading of only 1 value
7	Parameter value (most significant byte)	0	P0002 = 100 rpm
8	Parameter value (least significant byte)	100	
11	Format	44h	Reading error
12	Number of values	1	Only 1 value made available
13	Error code (most significant byte)	0	Error 0000h (assuming that the requested parameter did not exist).
14	Error code (least significant byte)	0	

Example 2: Acceleration ramp parameter (P0100) modification.

Request (done by the master using the DS\_Write telegram)

Assuming that the desired modification for P0100 = 8.5s.

Byte Nr.	Field	Value	Description
1	Request Reference	1	
2	Request ID	2	Modification request
3	DO-ID	0	
4	Nr. of Parameters	1	Modification of 1 parameter
5	Attribute	10h	Parameter value modification
6	Nr. of elements	1	Modification of only 1 value
7	Parameter number (most significant byte)	0	Number of the modified parameter = P0100
8	Parameter number (least significant byte)	100	
9	Sub-index (high portion)	0	Parameter does not have sub-index
10	Sub-index (low portion)	0	
11	Format	42h	Word type value (16 bits)
12	Number of values	1	Only 1 modified value
13	Parameter value (most significant byte)	0	P0100 = 8,5 s
14	Parameter value (least significant byte)	85	

Positive response (sent by the slave in the DS\_Read telegram response):



Byte Nr.	Field	Value	Description
1	Request Reference	1	Copied from the request telegram
2	Request ID	2	Positive modification request
3	DO-ID	0	
4	Nr. of Parameters	1	Modification of 1 parameter

Negative response, assuming error in the modification (sent by the slave in the DS\_Read telegram response):

Byte Nr.	Field	Value	Description
1	Request Reference	1	Copied from the request telegram
2	Request ID	130	Negative modification request
3	DO-ID	0	
4	Nr. of Parameters	2	Modification of 1 parameter
5	Format	44h	Modification error
6	Number of values	1	Only 1 value made available
7	Error code (most significant byte)	0	Error 0002h (assuming that the value for the parameter were out of the limits).
8	Error code (least significant byte)	2	

#### 4.2.6 Data Structure for Parameter Access – WEG

Besides the structure for the access to the parameters according to the PROFIdrive specification, it is also possible to use a simplified structure for the access to the parameters through the following addressing:

- ☒ Slot 0
- ☒ Index 48.

With the telegrams described in the section 4.2.3, it is possible to get access to the parameters using the following mechanism:

- ☒ Parameter modification: the modification of parameters is performed with a writing telegram (DS\_Write), with 4 data bytes, where the two first represent the parameter number and the two last represent the parameter content, always with the most significant byte transmitted first. The response to the writing telegram indicates whether or not the modification was successful.
- ☒ Parameter reading: for the reading of parameters, first a writing telegram (DS\_Write) with 2 data bytes representing the parameter number must be sent. After this telegram has been successfully sent, a reading telegram (DS\_Read) must be sent, and the response will have 2 data bytes with the parameter content.

The reading telegrams as well as the writing telegrams are able to report errors in the parameter requests, according to the codes described for the *Error Code 1* field.

## 5 Faults and Alarms Related to the Profibus DP Communication

### A138/F238 –Profibus DP Interface in Clear Mode

#### Description:

It indicates that the inverter has received from the network master the command to enter the *Clear* mode.

#### Actuation:

The indication occurs if during the cyclic communication the Profibus DP network master sends to the network a global telegram telling the slaves that they must leave the operation mode and enter the *Clear* mode. The conditions for the transmission of this command depend on the network master, but it normally indicates a special operation condition, such as during the programming of the master.

The message of alarm A138 or fault F238 will in this case be signaled through the HMI, depending on the P0313 programming. In case of alarm, the indication will automatically disappear if a new telegram to leave this mode is received.

#### Possible Causes/Correction:

- ☒ Verify the network master status, making sure it is in execution (RUN) mode.

### A139/F239 – Offline Profibus DP Interface

#### Description:

It indicates an interruption in the communication between the Profibus DP network master and the inverter. The Profibus communication interface went to the offline state.

#### Actuation:

It acts when for any reason an interruption in the communication between the CFW-11 and the Profibus DP network master occurs after the cyclic communication has been initiated. The time programmed for this detection is received through the parameterization telegram sent by the master.

The message of alarm A139 or fault F239 will in this case be signaled through the HMI, depending on the P0313 programming. In case of alarm, the indication will automatically disappear at the moment when the cyclic communication is reestablished.



#### NOTE!

When energizing the equipment, the Profibus DP interface will be initialized in the offline state. The error indication, however, will be done only if a transition from online to offline occurs.

#### Possible Causes/Correction:

- ☒ Verify whether the network master is configured correctly and operating normally.
- ☒ Search for short-circuit or bad contact in the communication cables.
- ☒ Make sure the cables are not changed or inverted.
- ☒ Verify whether termination resistors with correct values were installed only at the extremes of the main bus.
- ☒ Verify the entire network installation – cable passage, grounding.

### A140/F240 – Profibus DP Module Access Error

#### Description:

It indicates error in the access to the Profibus communication module data.

#### Actuation:

It acts when the CFW-11 control board is not able to read information from the Profibus DP communication module.

The message of alarm A140 or fault F240 will in this case be signalized through the HMI, depending on the P0313 programming. It is necessary to cycle the power of the inverter so that a new attempt to access the Profibus DP module is done.

**Possible Causes/Correction:**

- ☒ Verify whether the Profibus DP module is fitted properly in the slot 3.