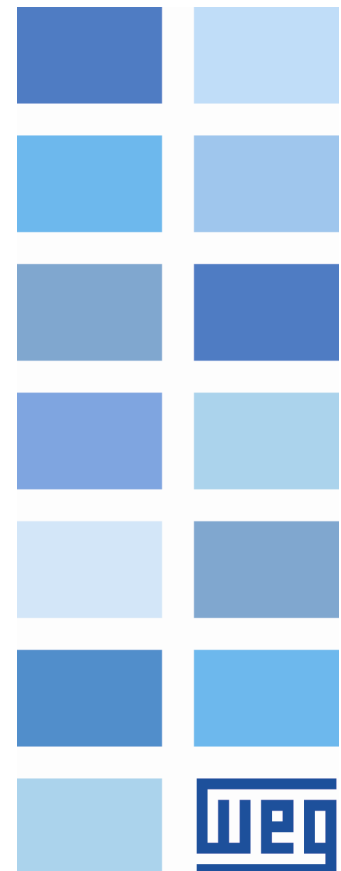


WEG CFW11 (PROFIBUS DP–5) communication with Siemens S7

Application Notes

Language: English
Document: 0





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Revision	Description	Chapter
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ABOUT THE MANUAL

This document provides information about the configuration and programming for the communication of the Siemens PLC S7 with the CFW11 Frequency Inverter equipped with PROFIBUS DP-05 module.

All presented operations assume the user is familiar with the programming of the Siemens PLC with the application Simatic Manager.

The equipment is subject to failures and the user must take safety measures for this condition.

ABBREVIATIONS AND DEFINITIONS

PLC	Programmable Logic Controller
RAM	Random Access Memory
USB	Universal Serial Bus
HMI	KEYPAD (HMI)
OP	Operation Mode
GSD	Gerät Sammlung Datei – Database file of the device.
DP	Decentralized Periphery

NUMERICAL REPRESENTATION

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

USED DOCUMENTS AND MANUALS

For a better understanding of the information provided hereby, the following manuals may be referred to:

MANUAL OF THE FREQUENCY INVERTER

Series: CFW-11

Language: English

Document number: 0899.5620/05

MANUAL OF THE ANYBUS-DC COMMUNICATION

Series: CFW-11

Language: English

Document number: 0899.5750/05

Simatic Manager

Software Application: V5.4 SP5 Rev. 5.4.5.0

Language: English

GSD FILE

HMSB1811.gsd

Manufacturer: WEG

HARDWARE

CFW11 Frequency Inverter

Firmware Version: 2.05

Manufacturer: WEG

PROFIBUS DP interface module

Model: PROFIBUSDP-5

Manufacturer: WEG

CPU 315-2 DP

Model: 6ES7 315 – 2AF01 – 0AB0

Manufacturer: Siemens

SAFETY INSTRUCTIONS



This manual was developed to be used by people with proper technical training or qualification to operate this kind of equipment.

SAFETY WARNINGS IN THE MANUAL

In this manual are used the following safety warnings:



DANGER!

The not following of the procedures recommended in this warning can lead to death, serious injuries and considerable material damages.



ATTENTION!

The not following of the procedures recommended in this warning can lead to material damages.



NOTE!

The text aims at providing important information for the full understanding and proper operation of the product.

PRELIMINARY RECOMMENDATIONS



DANGER!

Only duly qualified people must operate the INVERTER. Those people must first read the user manual. Executing unknown commands or not complying with the safety instructions may result in risk of life and/or damages to the machine.



ATTENTION!

In order to make the commands on the inverter HMI, you must not use pointed tools or instruments.

That could damage the keypad screen.

1. HARDWARE CONFIGURATION

All the configuration of the used hardware for communication is described in details below.

1. PLC 1 CONFIGURATION

1.1.1 Hardware architecture.

The minimum hardware configuration to perform the communication in Profibus DP network is described in the figure below. It is composed of a CPU with Profibus DP Master communication port and a MPI communication port for download/monitoring of the software.

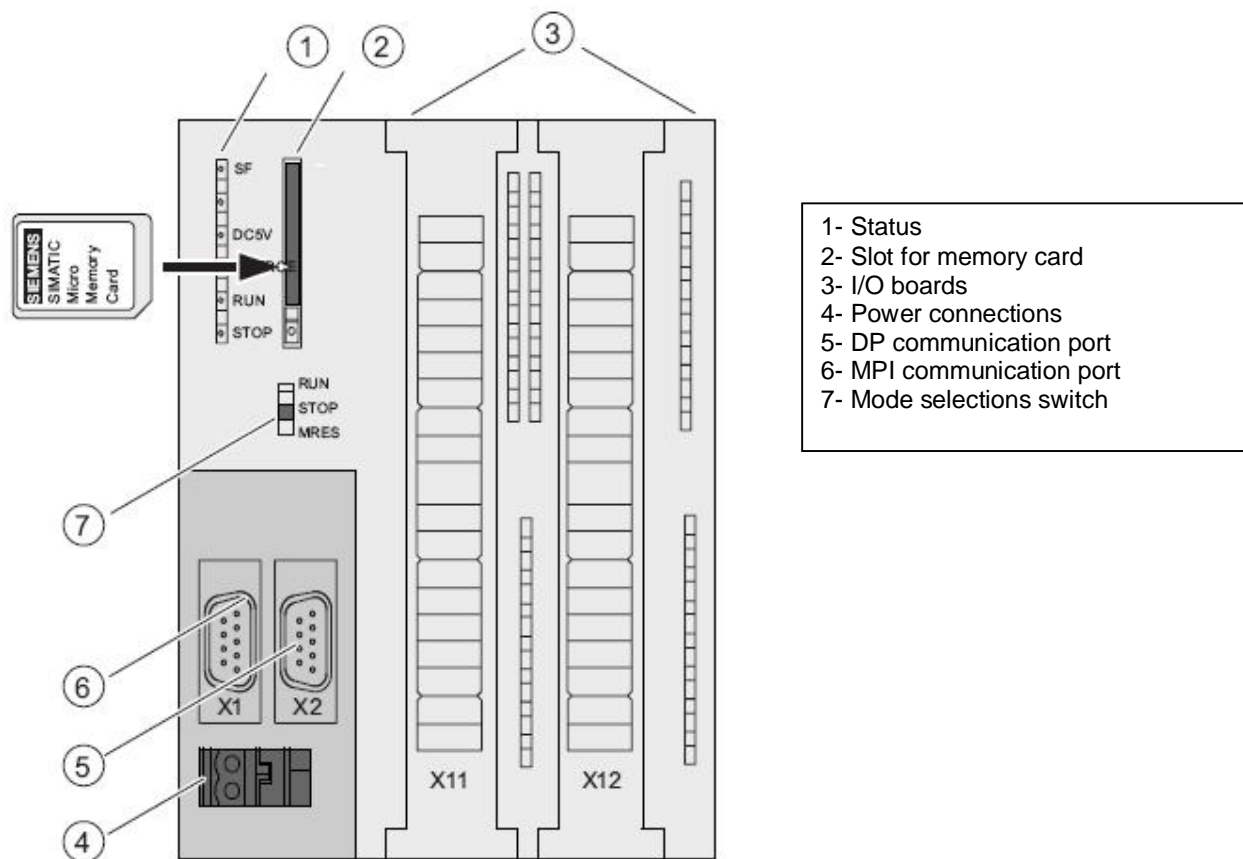


Figure 1.1.1 – Architecture of the PLC hardware

1.2 INVERTER CONFIGURATION



1.2.1 Hardware architecture

The minimum hardware configuration to perform the communication in Profibus DP network is described in the figure below. It is composed of a Frequency Inverter and a Profibus DP interface module. O Profibus interface module must be installed in slot four.

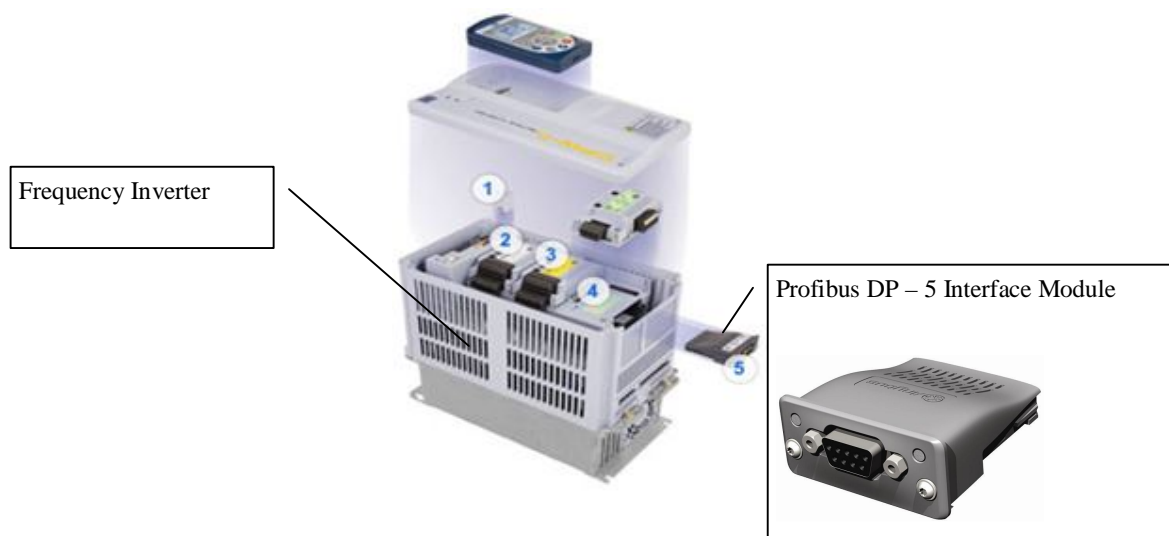


Figure 1.2.1 – Architecture of the Inverter hardware



NOTE!

- With the inverter off, install the module on connector XC44.
- Make sure it is properly installed and fastened by the screws.
- Power up the inverter.

1.2.2 Power-up.

The figure below shows the proper wiring for the correct power-up of the Frequency Inverter.



Figure 1.2.2 – Power-up of Inverter hardware

1.3 CONFIGURATION OF THE PROFIBUS NETWORK



1.3.1 Architecture of the Profibus DP Network

The figure below shows an example of the configuration of the Profibus DP network architecture.



Figure 1.3.1 – Architecture of the Profibus DP Network

1.3.2 Connections and Terminations

The connectors of the Profibus network have input and output connections, connection for the cable loop and network termination resistors. An output point of a connector must always be interconnected to an input point of another connector, except at the ends of the network, where the input points are used as active network termination resistor.



NOTE!

For the proper operation of the Profibus DP network, it is necessary that its ends have network termination resistors active and energized by the device connected!

1.3.3 Addressing

In a Profibus DP network, each device has a unique address which varies from 0 to 127. In this example, the master has address 1 and the slave address 2.

2. INVERTER PARAMETER SETTINGS

Below are the parameters that must be verified and configured in order to perform the communication in PROFIBUS DP network.

This parameter setting can be used as a basic example and uploaded directly to the inverter by means of the SuperDrive drive programming application, which can be downloaded at WEG's website.

Note: This parameter setting is available in the "Parameters" folder of this directory.

2.1 SELECTION OF THE INVERTER COMMAND REFERENCES

The Inverter control references (Local and Remote) must be programmed properly.

In this example, the local references are programmed so that the inverter control is done via its own keypad and the remote references are programmed for the inverter to be controlled by the PLC via Profibus DP network.

2.1.1 Selection of the Operation Control Mode – Local/Remote

P0220 – LOCAL/REMOTE Source Selection

Adjustable Range:	0 to 14	Value:	8
Properties:	CFG		
Access groups via HMI:	<div> <div>01 PARAMETER GROUPS</div> <div>or</div> <div>01 PARAMETER GROUPS</div> </div> <div> <div>31 Local Command</div> <div>31 Remote Command</div> </div>		

Description:

It defines the command origin source which will select between LOCAL control and REMOTE control. It also defines which control mode the inverter will adopt when it is powered up.

In this example, the inverter will be programmed for **value 8 "Anybus-CC Remote"**.



NOTE!

For further information about the parameter, refer to the Inverter Programming Manual.

2.1.2 Selection of Speed Reference – LOCAL Mode

P0221 – Selection of the Speed Reference – LOCAL Mode

Adjustable Range:	0 to 13	Value:	0
Properties:	CFG		
Access groups via HMI:	<div> <div>01 PARAMETER GROUPS</div> <div>or</div> <div>01 PARAMETER GROUPS</div> </div> <div> <div>31 Local Command</div> <div>31 Remote Command</div> </div>		

Description:

It defines the source of the inverter speed reference in the LOCAL control mode.

In this example, the inverter will be programmed for **value 0 "HMI"**.



NOTE!

For further information about the parameter, refer to the Inverter Programming Manual.

2.1.3 Selection of the Direction of Rotation Control – Remote Mode

P0223 – Selection of the Direction of Rotation – REMOTE Mode

Adjustable 0 to 16

Value: 2

Range:

Properties: CFG

Access groups via HMI: 01 PARAMETER GROUPS

└ 31 Remote Command

Description:

It defines the source for the inverter Direction of Rotation command in the LOCAL control mode. It also defines the direction of rotation the inverter will adopt when it is powered up.

In this example, the inverter will be programmed for **value 2 “Direction of Rotation Key (H)”**.



NOTE!

For further information about the parameter, refer to the Inverter Programming Manual.

2.1.4 Selection of Speed Reference – LOCAL Mode

P0222 – Selection of the Speed Reference – LOCAL Mode

Adjustable 0 to 13

Value: 10

Range:

Properties: CFG, V/f, VVW and Vector

Access groups via HMI: 01 PARAMETER GROUPS

└ 32 Remote Command

Description:

It defines the source of the inverter speed reference in the REMOTE control mode.

In this example, the inverter will be programmed for **value 10 “Anybus-DC”**.



NOTE!

For further information about the parameter, refer to the Inverter Programming Manual.

2.1.5 Selection of the Direction of Rotation – Remote Mode

P0226 – Selection of the Direction of Rotation – REMOTE Mode

Adjustable 0 to 16

Value: 7

Range:

Properties: CFG, V/f, VVW and Vector

Access groups via HMI: 01 PARAMETER GROUPS

└ 32 Remote Command

Description:

It defines the source for the inverter Direction of Rotation command in the REMOTE control mode. It also defines the direction of rotation the inverter will adopt when it is powered up.

In this example, the inverter will be programmed for **value 7 “Anybus-DC (H)”**.



NOTE!

For further information about the parameter, refer to the Inverter Programming Manual.

2.2 CONFIGURATION OF THE PROFIBUS DP-5 MODULE

P0723 – Anybus Identification

Adjustable Range:	0 to 25	Value: 16
Properties:	RO, Anybus	
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 49 Communication</div> <div>└ 114 Anybus</div>	

Description:

It identifies the PROFIBUS DP-5 module connected to the CFW11.

If the Profibus DP interface module was recognized by the inverter, this parameter must be indicating the **value 16** “Profibus DP”.



NOTE!

For further information about the parameter, refer to the Anybus-DC communication Manual!

2.2.2 Addressing on the network

P0725 – Anybus Address

Adjustable Range:	0 to 255	Value: 2
Properties:	CFG, Anybus	
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 49 Communication</div> <div>└ 114 Anybus</div>	

Description:

- Set the inverter address on the network in parameter P0725.
- Valid values: 1 to 126.



NOTE!

It is not necessary to set the module baud rate. Profibus uses autobaud and, therefore, this configuration is done on the network master.

2.2.3 Quantity of I/O in the Communication

P0727 – Anybus I/O Words

Adjustable	2 to 9	Value: 2
Range:		
Properties:	CFG, Anybus	
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 49 Communication</div> <div>└ 114 Anybus</div>	

Description:

In parameter P0727, configure the quantity of words you wish to communicate with the network master. This same value must be set in the Profibus master.

Important:

For this setting to be complete, it is necessary to program a value different from 0 for parameters P0728 to P0739 (see the Anybus DC manual, section P0727 – Anybus I/O Words)



NOTE!

Turn the CFW-11 off and then back on in order to effect the changes.

3. PARAMETER SETTINGS ON THE SIMATIC MANAGER

3.1 IMPORTING GSD FILE

Access the hardware options.

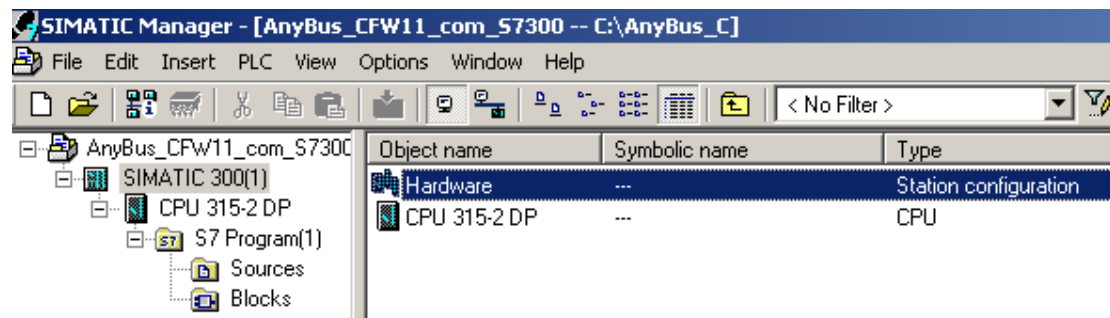


Figure 3.1 – Importing GSD file

Install the GSD file.

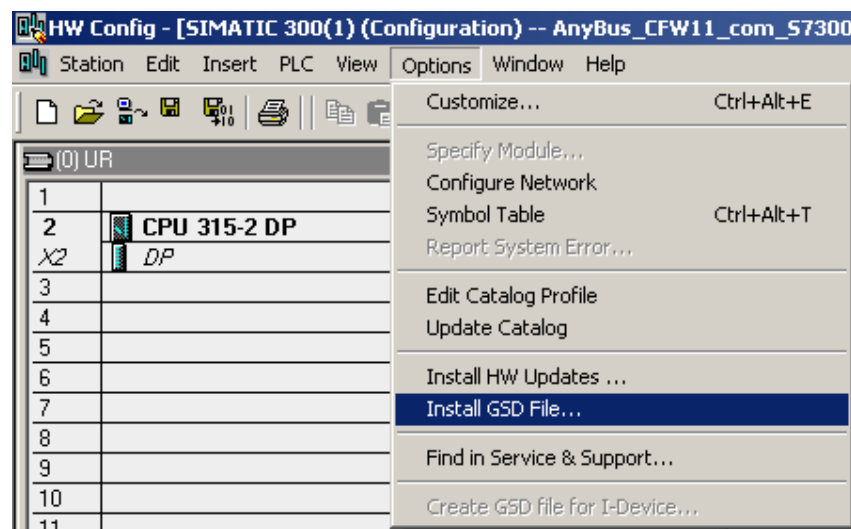


Figure 3.1.1 – Importing GSD file

Search the file in the directory and install it.

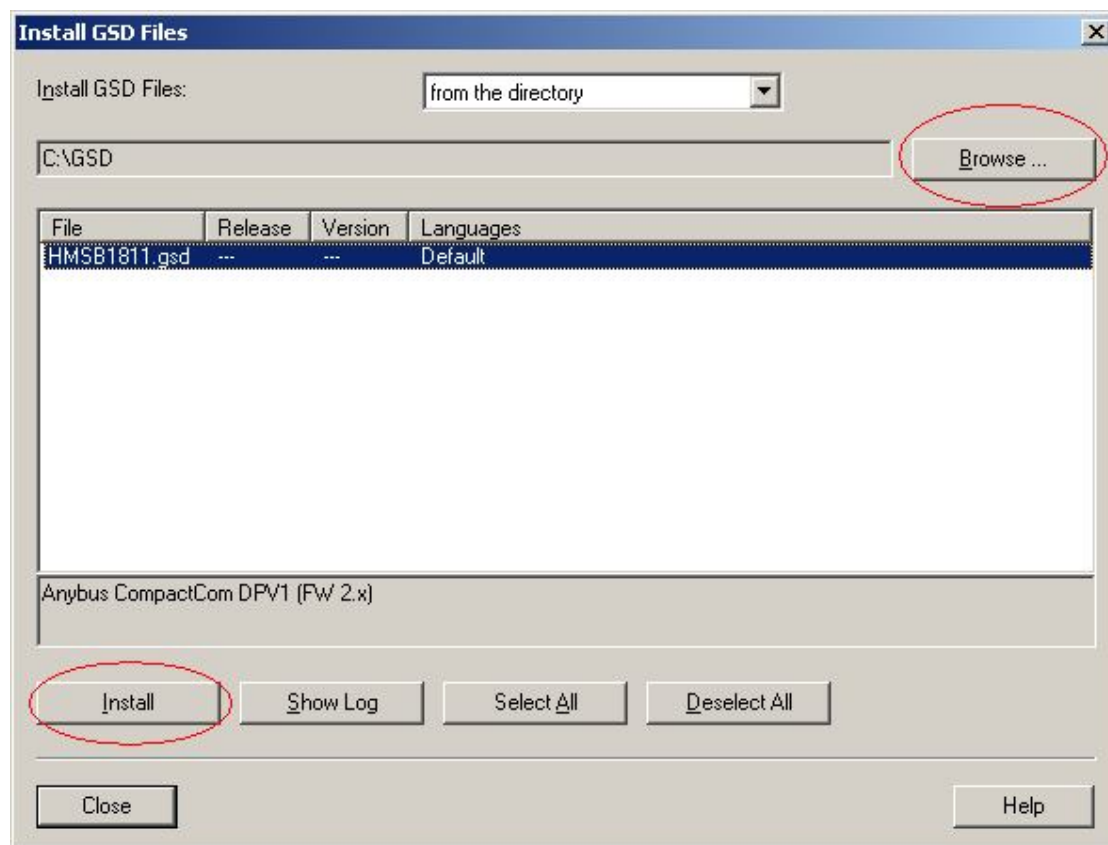


Figure 3.1.2 – Importing GSD file

Click on YES.



Figure 3.1.3 – Importing GSD file

3.2 ADDING THE PROFIBUS DP-5 MODULE TO THE PROJECT

Right click on the *DP* line, Add Master System

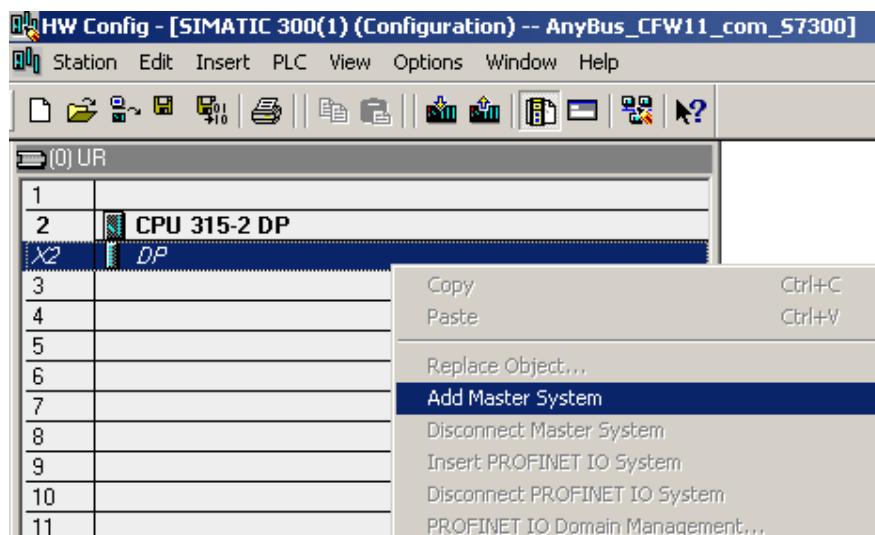


Figure 3.2 – Adding the PROFIBUS DP–5 module to the project

Right click and add it to the network.

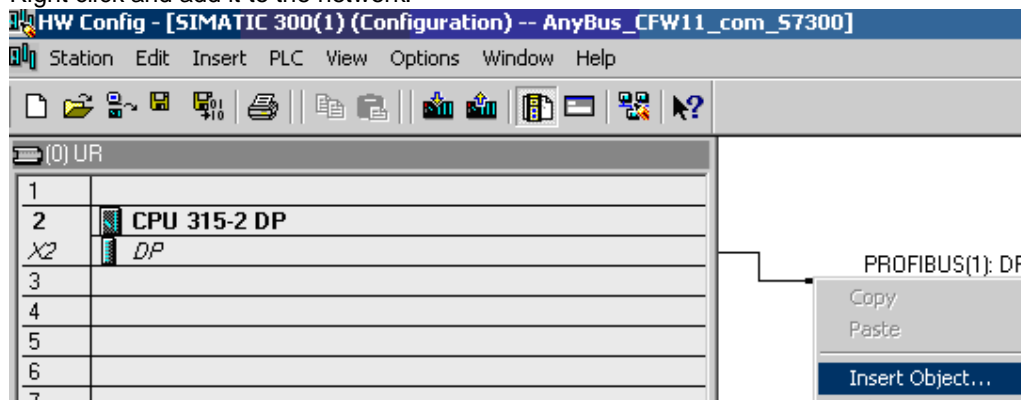


Figure 3.2.1 – Adding the PROFIBUS DP-5 module to the project

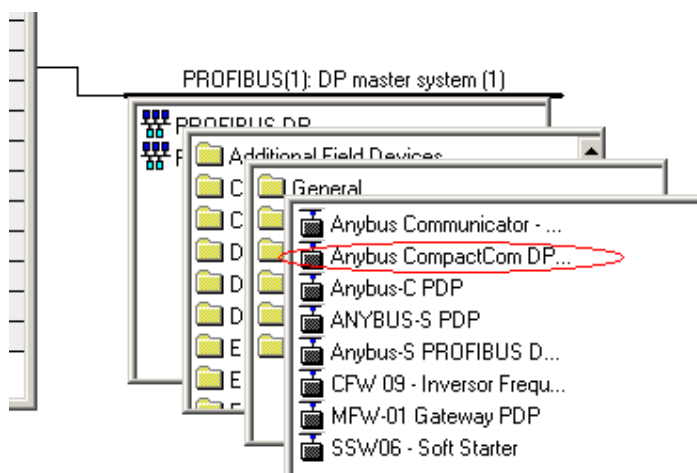


Figure 3.2.2 – Adding the PROFIBUS DP–5 module to the project

Define the address and click on OK.

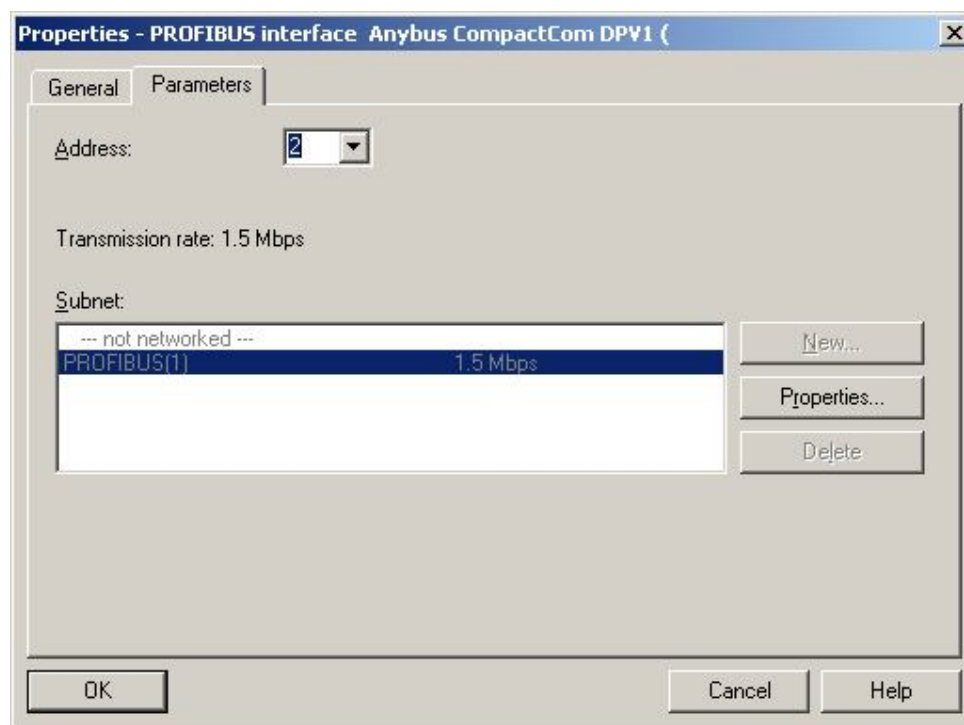


Figure 3.2.3 – Adding the PROFIBUS DP–5 module to the project

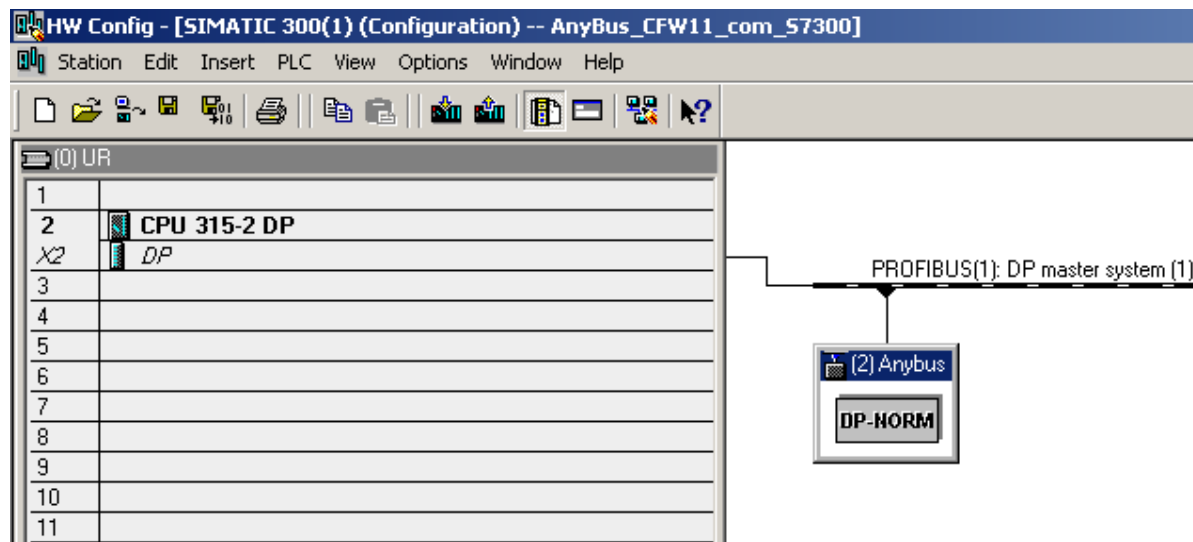


Figure 3.2.4 – Adding the PROFIBUS DP–5 module to the project

3.3 ADDING THE I/O MODULES

Add the Word modules as set in P0727 of the inverter.

E.g.: For P0727=4, there will be four input words and four output words.

Double click or drag the object to the Slot.

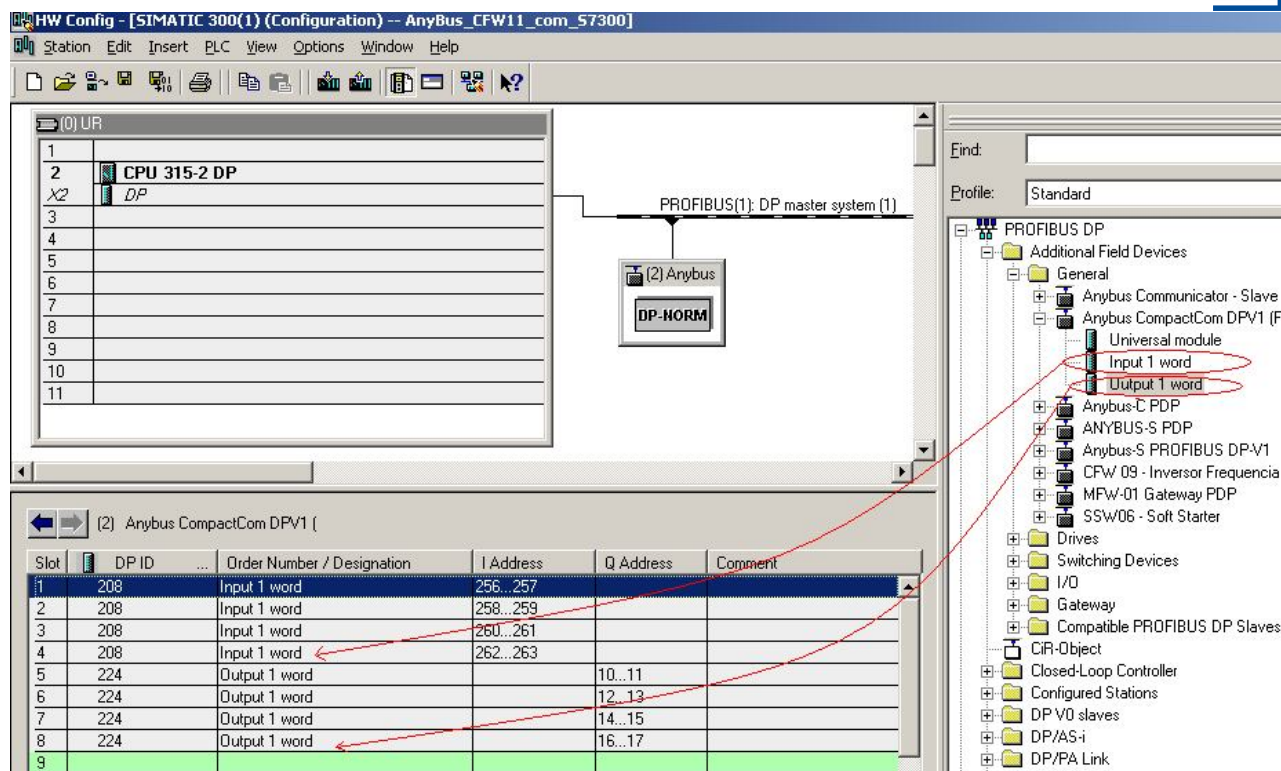


Figure 3.3 – Adding the I/O modules

3.4 ADDRESSING

In order to define the I/O address, right click on the desired slot and go to Object Properties.

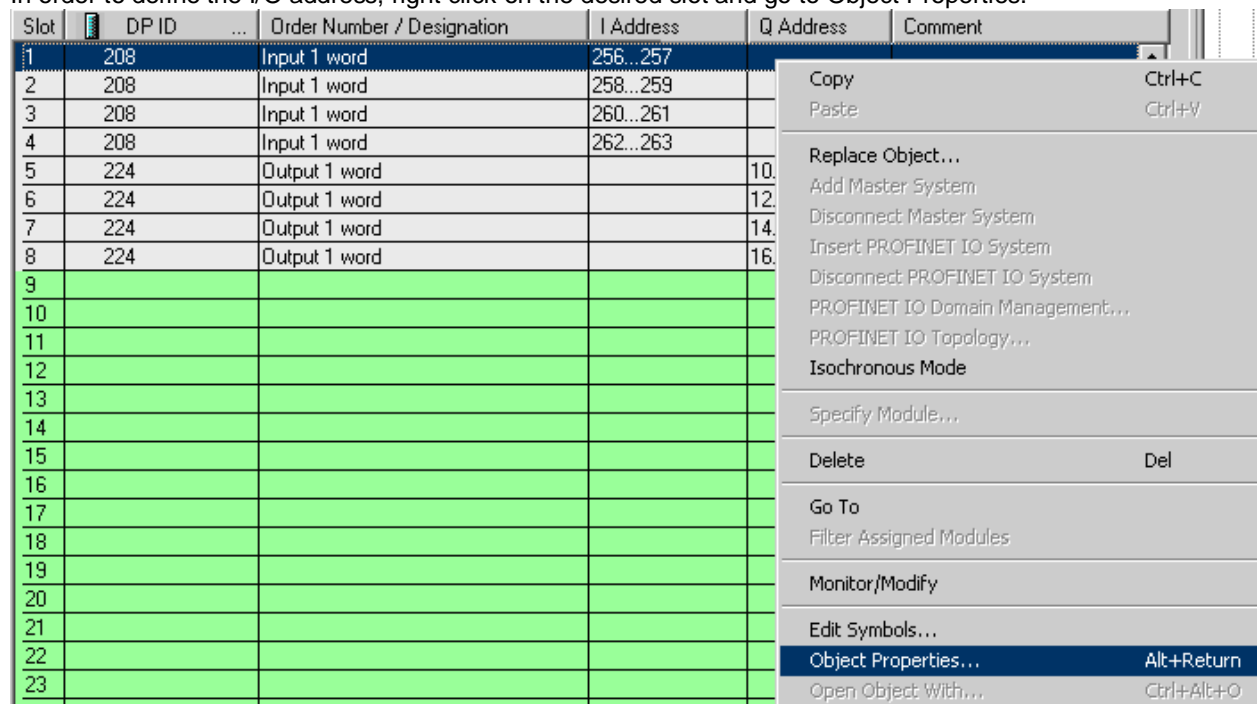


Figure 3.4.1 – Addressing

Insert the address and click on OK.

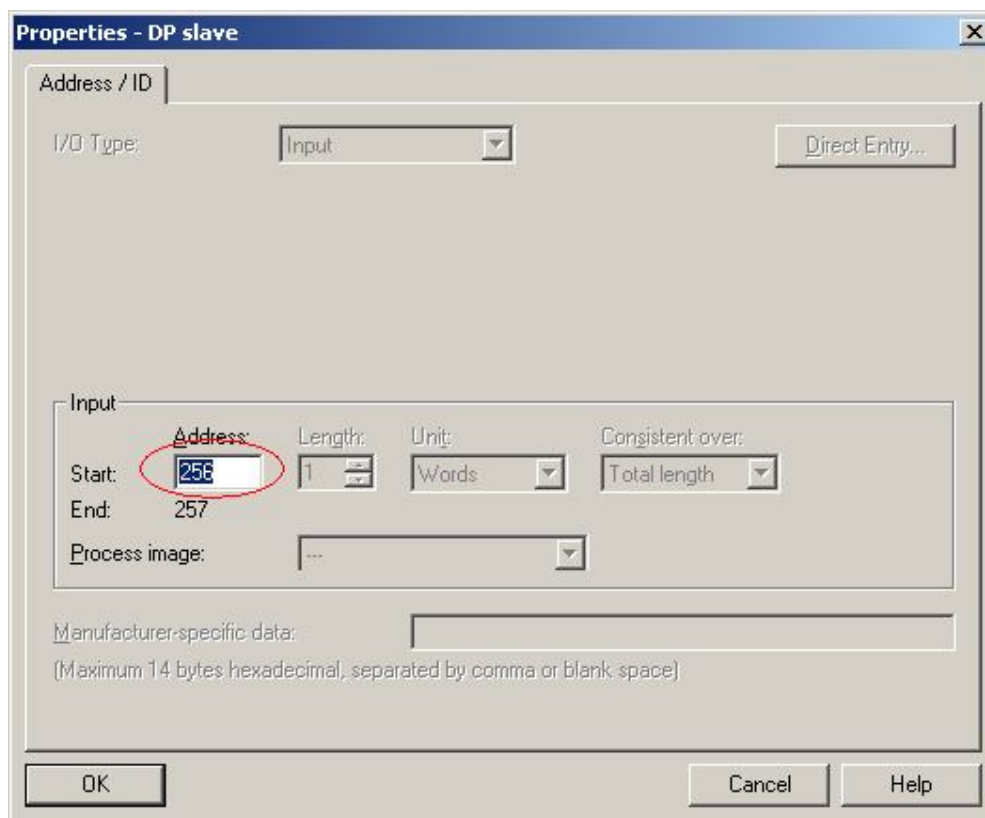


Figure 3.4.2 – Addressing

3.5 TRANSFERRING THE HARDWARE PROJECT

After the hardware configuration is set, download the project. If everything is correctly configured and the PLC is in RUN, the OP LED of the module will turn on solid green. It is in this condition that data exchange effectively occurs between the drive and the network master.

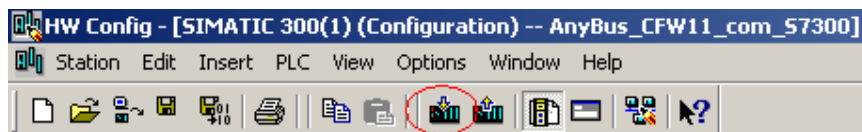


Figure 3.5 – Transferring the hardware project

4. CYCLIC DATA COMMUNICATION

4.1 READING WORDS

The CFW11 inverter can read up to eight words via PROFIBUS DP-5 module, seeing that two are fixed referring to parameters P0680 and P0681.

4.1.1 Parameter P0680 - Inverter

P0680 – Logical Status

Adjustable Range:	0000h - FFFFh	Factory Setting:	-
Properties:	RO		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 49 Communication</div> <div>└ 111 Status/Commands</div>		

Description:

It allows the user to identify the status of the drive.

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 active	Ramp enabled	In Alarm condition	In configuration mode	Second Ramp	Quick Stop Activated	Reserved

The actions described in this parameter are executed by means of the automatic writing of the respective bits in the control parameter via Anybus-DC – P0686.



NOTE!

For further information about the parameter, refer to the Anybus-DC communication Manual.

4.1.2 Parameter P0681 - Inverter

P0681 – Speed in 13 bits

Adjustable Range:	-32768 _ 32767	Factory Setting:	0
Properties:	RO		
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 49 Communication</div> <div>└ 111 Status/Commands</div>		

Description:

It allows the user to view the motor speed with a binary representation of 13 bits.

P0681 = 0000h (0 decimal) → motor speed = 0 rpm

P0680 = 2000h (8192 decimal) → motor speed = synchronous rotation

Intermediate or higher speed values in RPM can be obtained by using this scale. For example, for a 4-pole motor and 1800 rpm of synchronous rotation, in case the read value is 2048 (0800h), in order to obtain the value in RPM, you must calculate:

8192 – 1800 rpm
 2048 – speed in rpm

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



Speed in rpm = 450 rpm

4.2 EXAMPLES OF READINGS ON THE PLC

4.2.1 First reading Word (fixed).

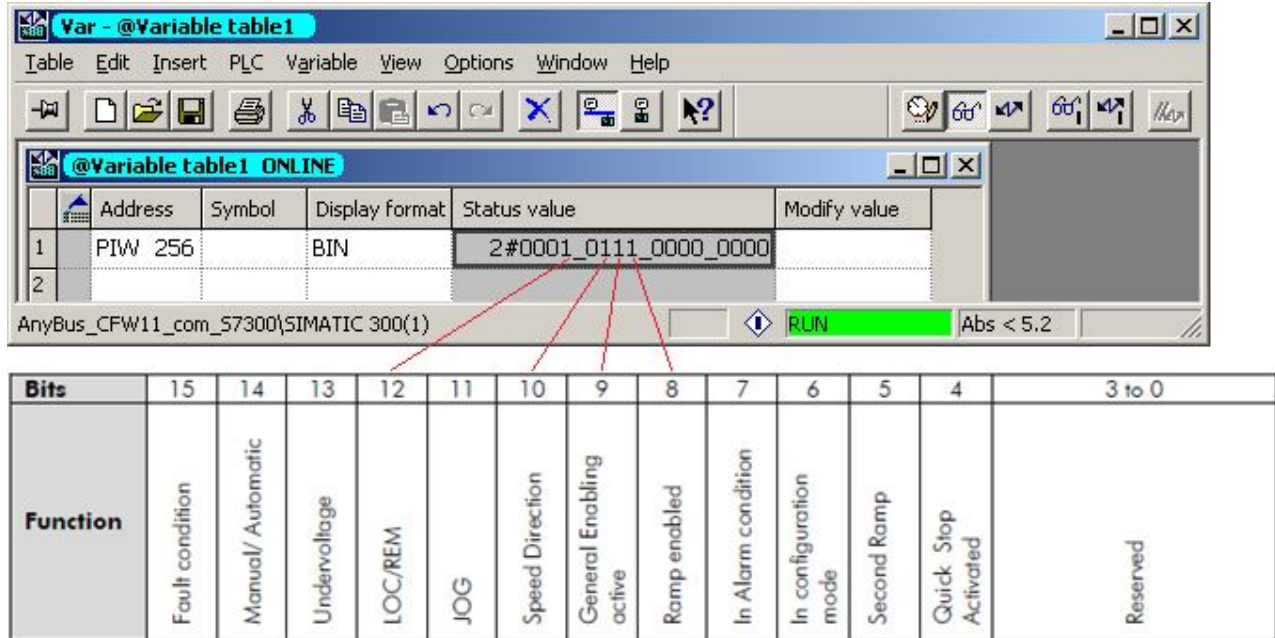


Figure 4.2.1 – First reading Word (fixed)

Description: The image above shows the list of each bit referring to reading Word, P0680 – Logical status of the inverter.

4.2.2 Second reading Word (fixed).

The Block below was created to transform the value read in 13 bit into rpm. The calculations on block FC201 were done according to the formula in item 4.1.2.

PROFIBUS READ CICLIC WORDS - 2nd Read Word
 Speed 13bits Word

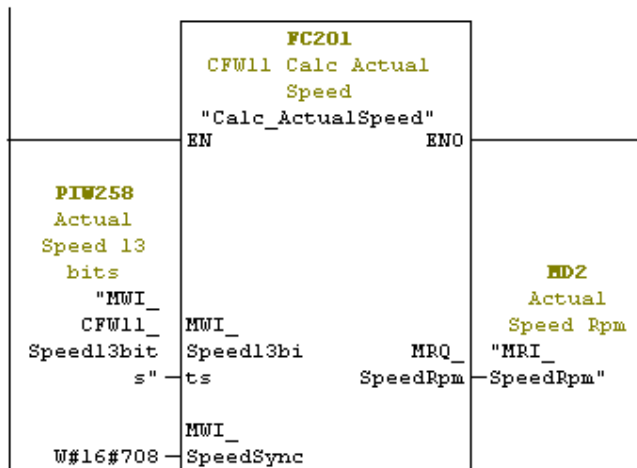


Figure 4.2.2 – Second reading Word (fixed)

Important:

The multiplication factor of the calculation must be equal to the value set in parameter P0208. In the example, a motor of four poles/1800 rpm was used.

4.2.3 Reading an inverter parameter

In order to read an inverter parameter on the PLC, it is necessary to set the value of a reading parameter according to the parameter you wish to read, for example: in order to verify the CFW11 last fault (P0050), you must set P0728 (third reading Word) to value 50.

On the PLC, the input 3 Word must take the value of P0050.

PROFIBUS READ CICLIC WORDS - 3rd/4th Read Word
Read Parameter

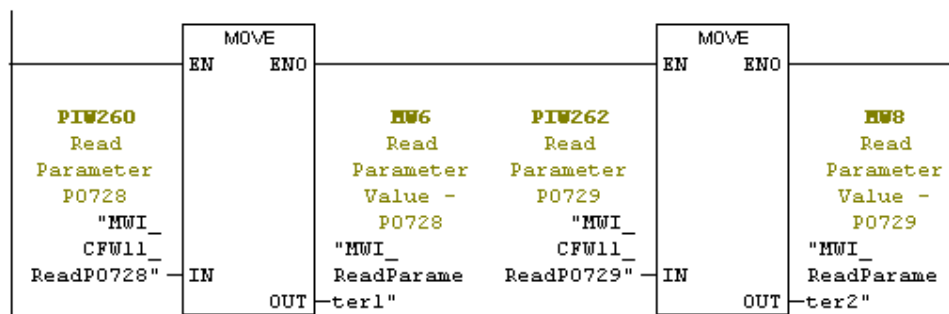


Figure 4.2.3 – Reading and inverter parameter

In the example above, it is observed that the last inverter fault was F021, undervoltage fault.



NOTE!

For further information, refer to the Anybus-DC Communication Manual, section 4.

4.3 WRITING WORDS

The CFW11 Inverter can write up to eight words via network, seeing that the first and second ones are fixed. They correspond respectively to parameters P0686 and P0687.

4.3.1 Logical Control

P0686 – Logical Control

Adjustable Range:	0000h - FFFFh	Factory Setting: -
Properties:	RO	
Access groups via HMI:	<div>01 PARAMETER GROUPS</div> <div>└ 49 Communication</div> <div>└ 111 Status/Commands</div>	

For the commands written on this parameter to be executed, it is necessary that the drive be programmed to be controlled via Anybus-DC. This programming is done via parameters P0105 and P0220 up to P0228. Each bit of this word represents a command that can be executed on the inverter.

Bits	15 to 8	7	6	5	4	3	2	1	0
Function	Reserved	Fault reset	Quick Stop	Second Ramp Use	LOC/REM	JOG	Direction of Rotation	General Enabling	Run/Stop



For details on the functions of each bit, refer to the Anybus-DC Communication Manual, section 4 – table

P0687 – Speed in 13 bits

Factory Setting: 0

Properties:	RO
-------------	----

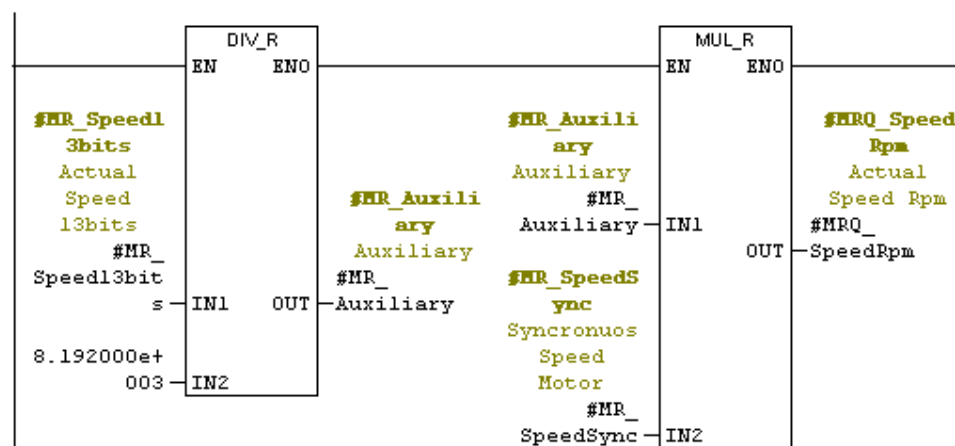
Access groups via HMI:	01 PARAMETER GROUPS
-------------------------------	---------------------

L 49 Communication

111 Status/Commands

This word uses 13-bit resolution with signal to represent the motor synchronous rotation:

Calc Actual Speed Rpm



CFW 11 (PROFIBUS DP – 5) x Siemens S7 - 24

The other words, both the reading and writing ones, can be used for other applications, according to the needs of the project.

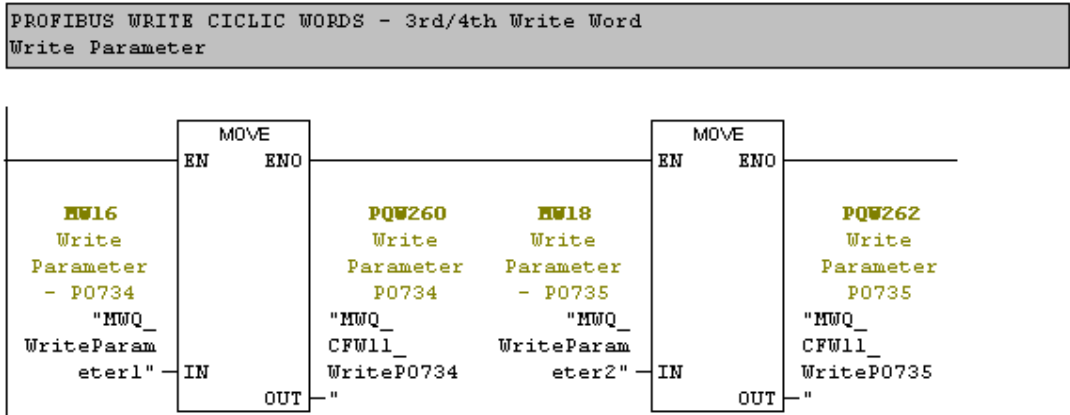


NOTE!
For the direction of rotation, you can use the most significant bit as reference or bit “10” of logical status.

4.3.3 Writing parameter on the inverter

In order to do so, it is necessary to set the value of a reading parameter according to the parameter you wish to read, for example: in order to write an acceleration ramp value (P0100), you must set P0734 (third writing Word) to value 100.

Thus, on the PLC, the output Word 3 will determine the desired value in P0100.
In order to send the value, it is necessary to multiply by ten to consider the decimal place after the point, as in the example below:



In this case, parameter P0100 would go to 5.4 s.

Figure 4.3.3 – Writing parameter on the inverter



NOTE!
The multiplication by ten is necessary, since the inverter consider on decimal place after the point.

5. ACYCLIC DATA COMMUNICATION

Additionally to the services defined by the first version of the Profibus DP specification (DP-V0), where it is mainly defined how to exchange cyclic data for control and monitoring of the equipment, the CFW-11 with the PROFIBUS DP-5 communication accessory also supports the DP-V1 additional services for acyclic communication. By using these services, it is possible to read/write on parameters through the DPV1 acyclic functions, both by the network master, and by a commissioning tool.



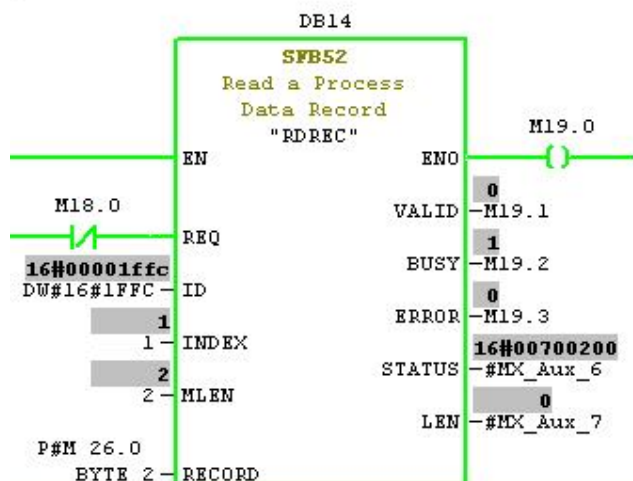
NOTE!

Some CPU models do not support the DPV1 communication through the SFB52 and 53 blocks; refer to the hardware manual.

5.1 ACYCLIC READING

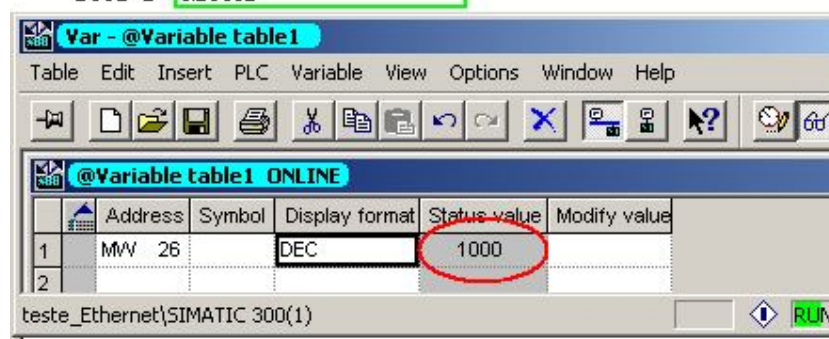
5.1.1 Example of reading

In the example below, it was verified the value of parameter P0002 referring to the current speed in rpm of the motor.

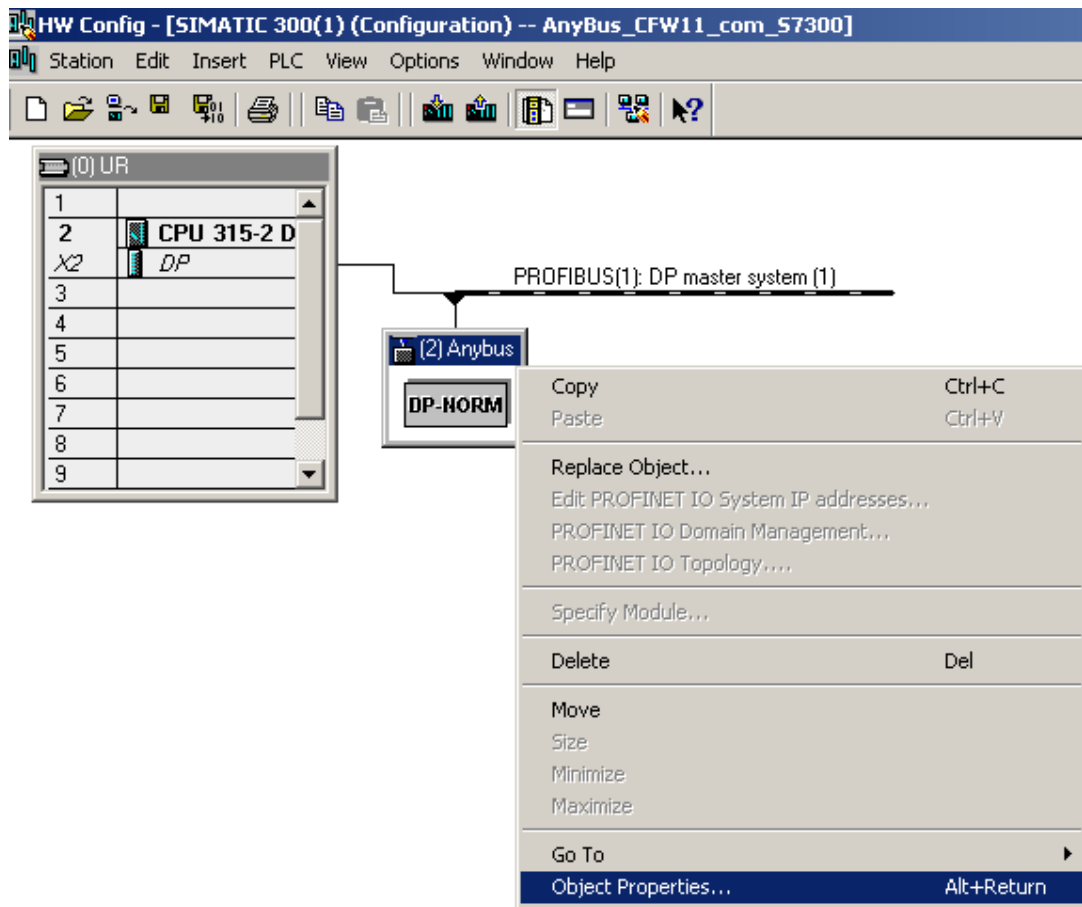


Where:

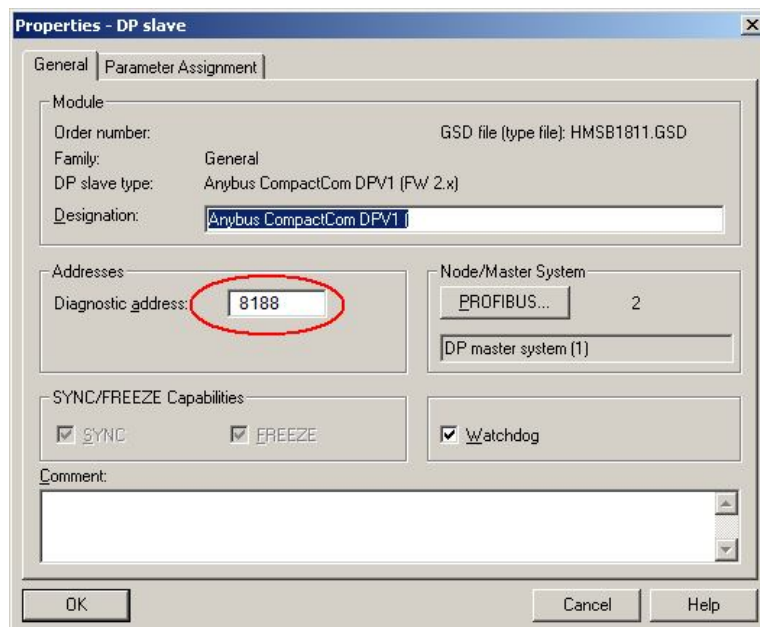
REQ: Enable data transfer
ID: Slave diagnosis address
INDEX: (n-1), where n is the parameter number
MLEN: Number of bytes you wish to read
RECORD: Area for data registration



In order to obtain the diagnosis address, right click on the device and select Object Properties.



The following box will open

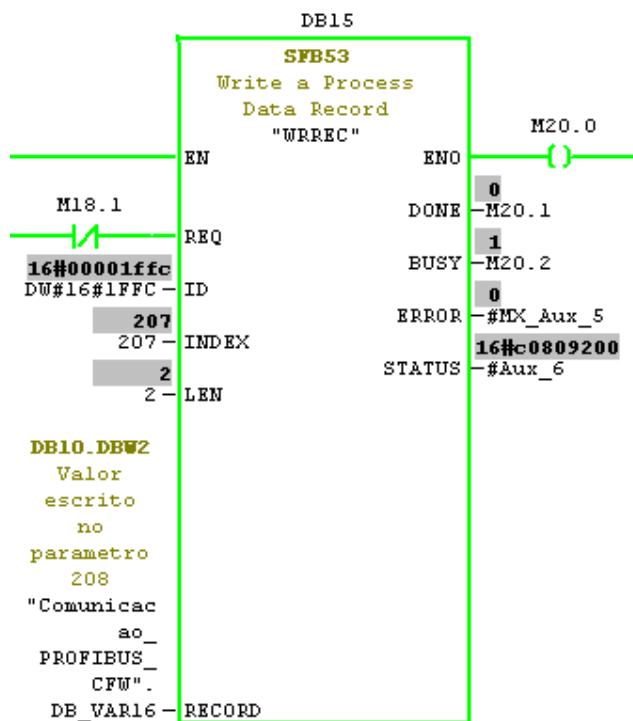


In the example, the Slave diagnosis address is 8188 decimal or 1FFC in Hexadecimal

5.2 ACYCLIC WRITING

5.2.1 Example of writing

Faz a escrita aciclica do parametro definido no indice, no exemplo e escrito o valor do DB



NOTE!

For further information regarding blocks DP_RDREC and DP_ID, refer to the S7300 application manual, Section 8.

6. FAULT AND ALARM MESSAGES

Possible fault and alarm message that may occur during the communication:

Fault / Alarm	Description	Possible Causes
A129: Anybus Offline	Alarm that indicates interruption in the communication Anybus-DC.	<ul style="list-style-type: none"> - PLC went to the idle status. - Programming error. Number of I/O words programmed on the slave differs from the setting on the master. - Loss of communication with the master (broken cable, connector disconnected, etc.)
A130: Anybus Access Error	Alarm that indicates error in the access to the DP-5 PROFIBUS communication module.	<ul style="list-style-type: none"> -PROFIBUS DP-5 module defective, not recognized or incorrectly installed. -Conflict with WEG optional module.

Table 6.1 – Description of the Fault and Alarm Messages