# WEG CFW11 (DEVICENET–05) communication with Rockwell RSLogix 5000

Application Notes

Language: English
Document: 0
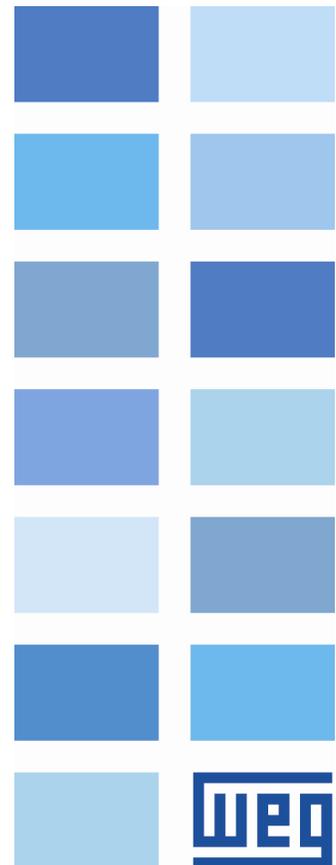
WEG CFW11 – (DEVICENET–05) communication with Rockwell RSLogix 5000

Summary of the Revisions

Revision	Description	Chapter
1	First Edition	-

INDEX

ABOUT THE MANUAL

This document provides information about the configuration and programming for the communication of the Rockwell ControlLogix PLC with the CFW11 Frequency Inverter equipped with DEVICENET-05 module.
All presented operations assume the user is familiar with the programming of the Rockwell PLC with the application RSLogix 5000.
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
EDS	Electronic Data Sheet – Data base file of the device.

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

RSLogix 5000
Software Application: V19.01.00 (CPR 9 SR 3)
Language: English

EDS FILE
DN_AB_CFW11_220-230V_2A-2A_V31X.eds
*(for models with different current, voltage and firmware, use the respective *.eds file)*
Manufacturer: WEG

HARDWARE

CFW11 Frequency Inverter
Firmware Version: 2.05
Manufacturer: WEG

DEVICENET interface module
Model: DEVICENET-05
Manufacturer: WEG

CPU ControlLogix
Model: 1756-L63 ControlLogix5563
Manufacturer: Rockwell

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 DeviceNet network is described in the figure below. It consists of a Rack/Frame with at least four slots, on CPU board (1756-L63) and a Scanner DeviceNet board (1756-DNB).
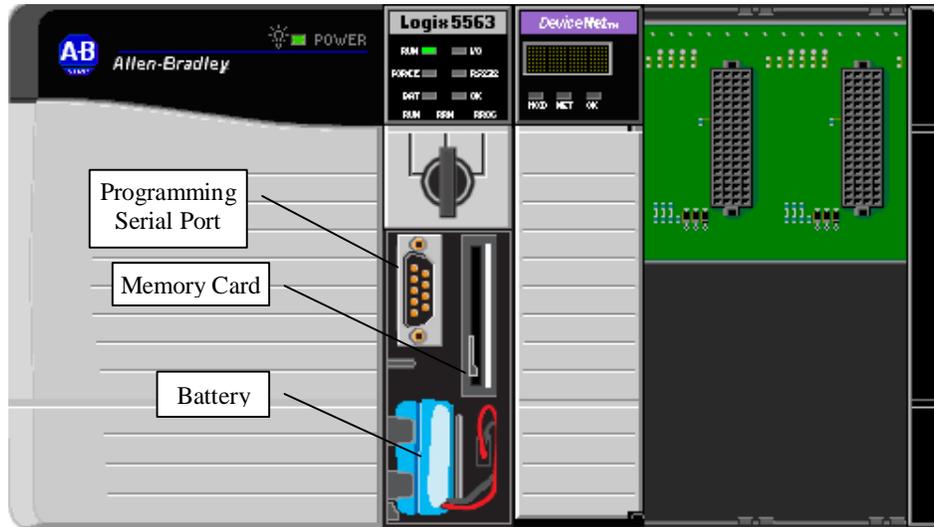
Figure 1.1.1 – Architecture of the PLC hardware

1.2 INVERTER CONFIGURATION

1.2.1 Hardware architecture

The minimum hardware configuration to perform the communication in DeviceNet network is described in the figure below. It consists of a Frequency Inverter and an Anybus DeviceNet interface module.
O DeviceNet interface module must be installed in slot four of the inverter.

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 DEVICENET NETWORK CONFIGURATION

1.3.1 DeviceNet Network Configuration

The figure below shows an example of the configuration of the DeviceNet network architecture.
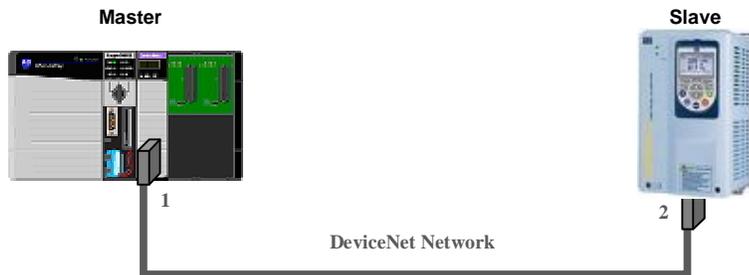
***Figure 1.3.1** – Architecture of the DeviceNet Network*

1.3.2 Connections and Terminations

The connectors of the DeviceNet network have five connection points: 24Vdc, CAN+, Loop, CAN- and 0Vdc.
The 24Vdc and 0Vdc points must have an external supply. The network topology, as well as the cable gauge and length, must be according to the standards defined by the norms for DeviceNet.

> **NOTE!**
> For the proper operation of the DeviceNet network, it is necessary that its ends have network termination resistors of 120Ω.

1.3.3 Addressing

In a DeviceNet network, each device has a unique address which varies from 1 to 63.
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 DEVICENET 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 local control is done via its own keypad and the remote references are programmed for the inverter to be controlled by the PLC via DeviceNet 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:	01 PARAMETER GROUPS	or	01 PARAMETER GROUPS	
	└ 31 Local Command		└ 32 Remote Command	

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:	01 PARAMETER GROUPS	
	└ 31 Local Command	

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.

P0223 – Selection of the Direction of Rotation – LOCAL Mode

Adjustable 0 to 16   **Value:** 2
Range:
Properties: CFG
Access groups via HMI: | 01 PARAMETER GROUPS |
                           └ | 31 Local 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 the Run/Stop Control – Local Mode

P0224 – Selection of the Run/Stop – LOCAL Mode

Adjustable 0 to 6   **Value:** 0
Range:
Properties: CFG
Access groups via HMI: | 01 PARAMETER GROUPS |
                           └ | 31 Local Command |

Description:

It defines the source for the inverter Run or Stop command in the LOCAL control mode.

In this example, the inverter will be programmed for **value 0 "I/O Key"**.

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

2.1.5 Selection of the JOG Control – Local Mode

P0225 - Selection of JOG – LOCAL Mode

Adjustable 0 to 7   **Value:** 0
Range:
Properties: CFG
Access groups via HMI: | 01 PARAMETER GROUPS |
                           └ | 31 Local Command |

Description:

It defines the source for the inverter JOG command in the LOCAL control mode.
In this example, the inverter will be programmed for **value 0 "Inactive"**.

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

2.1.6 Selection of Speed Reference – REMOTE Mode

P0222 – Selection of Speed Reference – REMOTE Mode

Adjustable Range:	0 to 13		**Value:** 10
Properties:	CFG		
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.

2.1.7 Selection of the Direction of Rotation Control – Remote Mode

P0226 – Selection of the Direction of Rotation – REMOTE Mode

Adjustable Range:	0 to 16		**Value:** 7
Properties:	CFG		
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.

2.1.8 Selection of the Run/Stop Control – Remote Mode

P0227 – Selection of Run/Stop – REMOTE Mode

Adjustable Range:	0 to 6		**Value:** 3
Properties:	CFG		
Access groups via HMI:	01 PARAMETER GROUPS		
	└ 32 Remote Command		

Description:

It defines the source for the inverter Run or Stop command in the REMOTE control mode.
In this example, the inverter will be programmed for **value 3 "Anybus-DC"**.

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

2.1.9 Selection of the JOG Control – Remote Mode

P0228 - Selection of JOG – REMOTE Mode

Adjustable Range:	0 to 7	**Value:** 0
Properties:	CFG	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 32 Remote Command	

Description:

It defines the source for the inverter JOG command in the REMOTE control mode.
In this example, the inverter will be programmed for **value 0 "Inactive"**.

> **NOTE!**
> For further information about the parameter, refer to the Inverter Programming Manual.

2.2 CONFIGURATION OF THE DEVICENET-05 MODULE

2.2.1 Anybus Identification

P0723 – Anybus Identification

Adjustable Range:	0 to 25	**Value:** 17
Properties:	RO, Anybus	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 114 Anybus	

Description:
It identifies the DEVICENET-05 module connected to the CFW11.

If the DeviceNet interface module was recognized by the inverter, this parameter must be indicating the **value 17 "DeviceNet"**.

> **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:	1 to 63	**Value:** 2
Properties:	CFG, Anybus	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 114 Anybus	

Description:
It defines the address of the inverter on the network.
In this example, the inverter will be programmed for **value 2**.

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

2.2.3 Baud Rate

P0726 – Anybus Baud Rate

Adjustable Range:	0 to 3	Value: 0
Properties:	CFG, Anybus	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 114 Anybus	

Description:
It defines the network baud rate.
In this example, the inverter will be programmed for **value 0 "125kbps"**.

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

2.2.4 Quantity of I/O in the Communication

P0727 – Anybus I/O Words

Adjustable Range:	1 to 9	Value: 2
Properties:	CFG, Anybus	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 114 Anybus	

Description:
In parameter P0727, configure the quantity of words you wish to communicate with the network master.
This same value exactly must be set in the DeviceNet 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 IN THE RSLOGIX 5000

3.1 IMPORTING EDS FILE

- Open the RSNetWorx for DeviceNet
- Access the **"Tools"** Menu, **"EDS Wizard..."** option
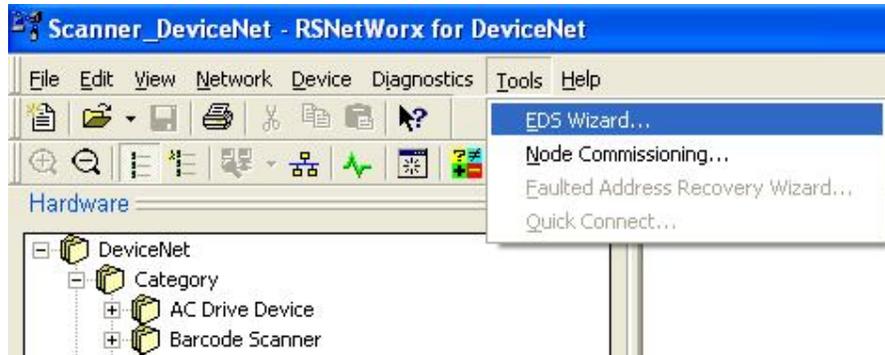
Figure 3.1 – *Importing EDS file*

- Click on **"Next >"**

Figure 3.1.1 – *Importing EDS file*

- Select the **"Register na EDS file(s)."** option
- Click on **"Next >"**

Figure 3.1.2 – Importing EDS file

- Select the desired file.
- Click on **"Next >"**
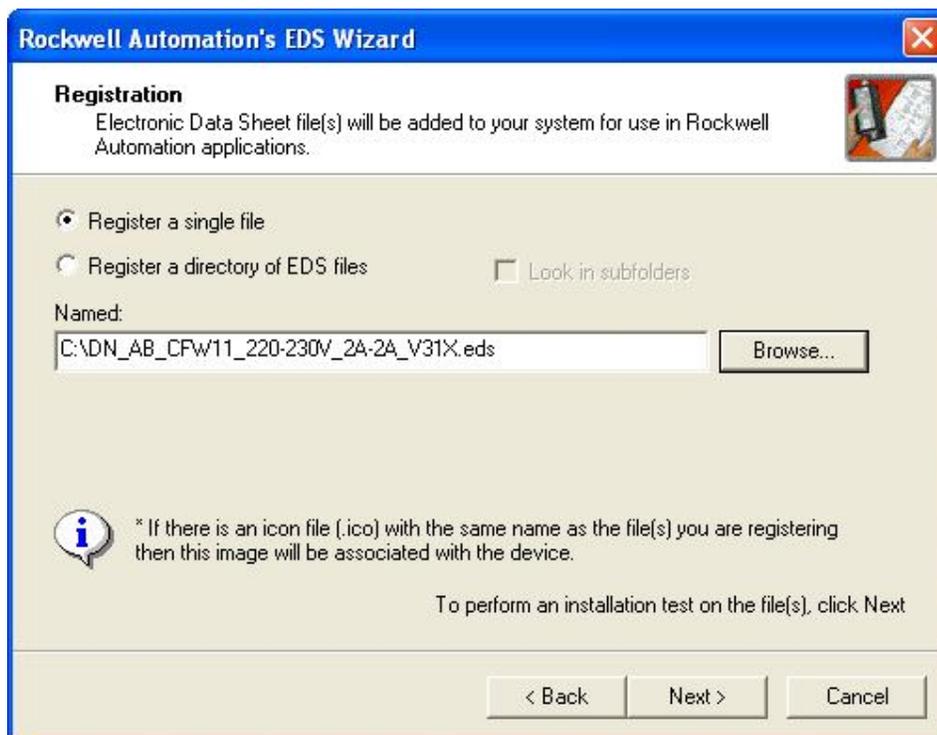
Figure 3.1.3 – Importing EDS file
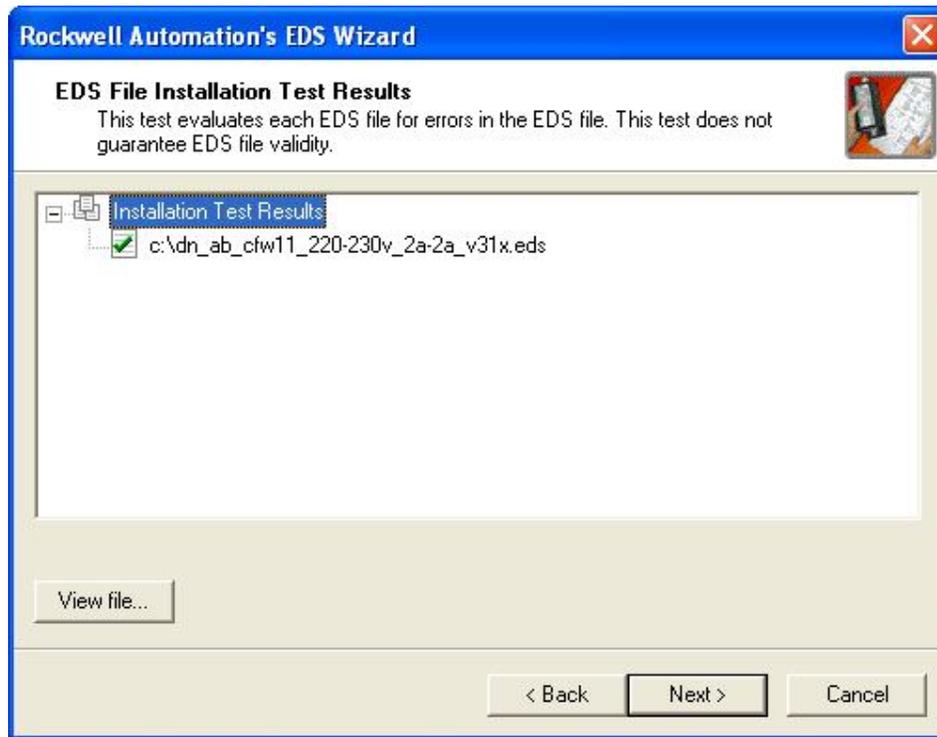
- Click on **"Next >"**

- Select the file and click on **"Change icon..."**
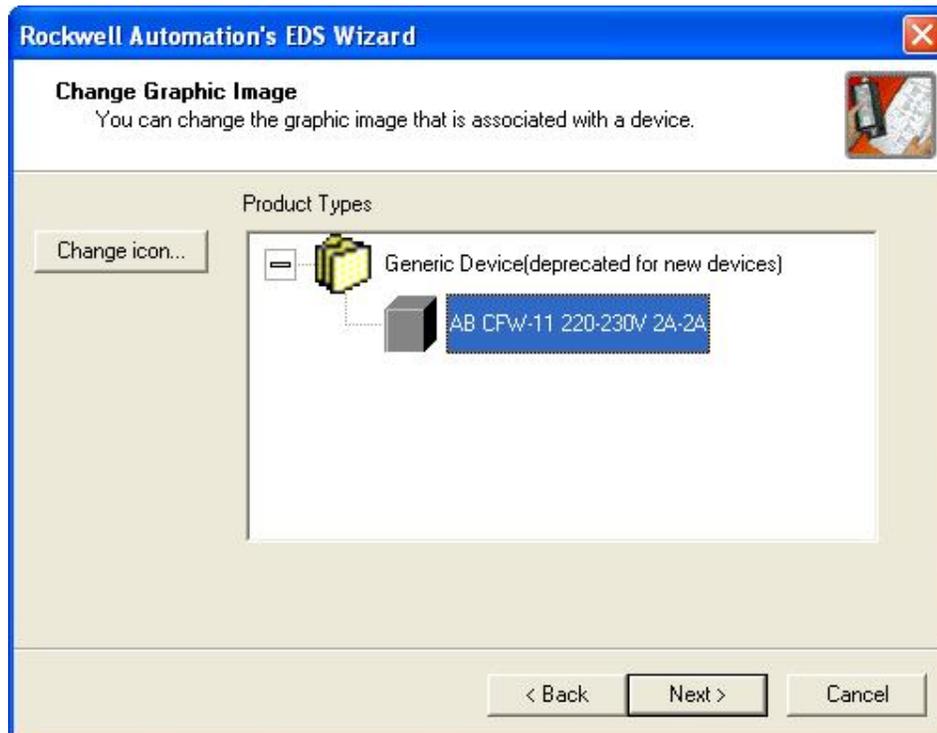
- Select the Icon file by clicking on **"Browse..."**

- Click on **"OK"**
- Click on **"Next >"**
- Click on **"Next >"**
- Click on **"Finish"**

3.2 ADDING THE DEVICENET-05 MODULE TO THE PROJECT

- Find the EDS file in the Hardware List
- Click and drag it up to the network on the right.
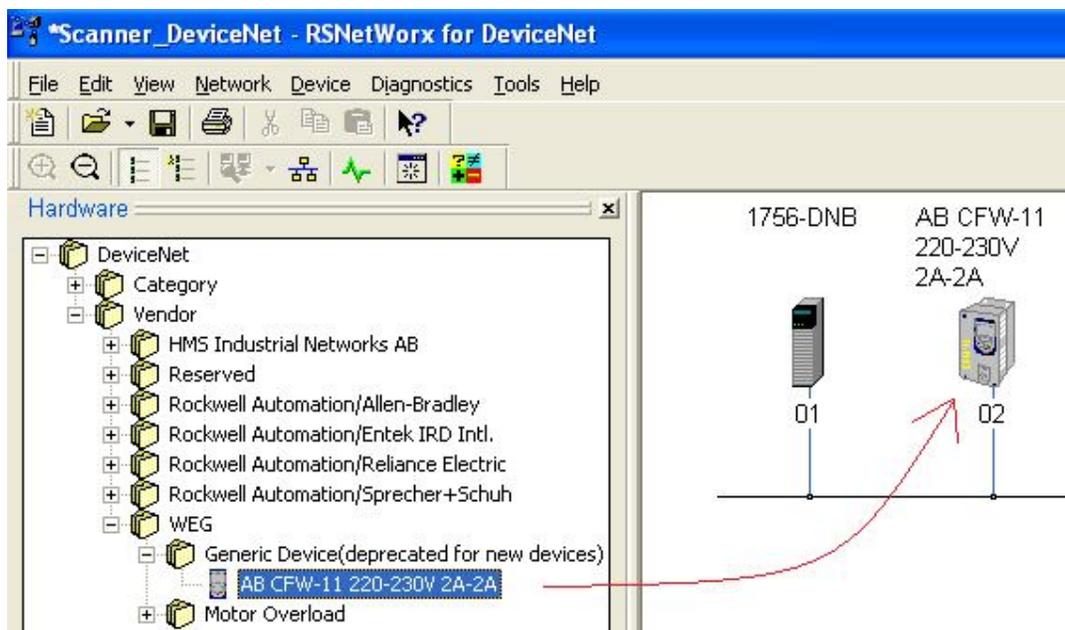
***Figure 3.2** – Adding the DEVICENET-05 module to the project*

- Right click on the scanner and select the **"Properties..."** option.
- On the **"Scanlist"** tab, select the inverter in the list on the left and click on **">"** in order to add the inverter to the Scanlist.
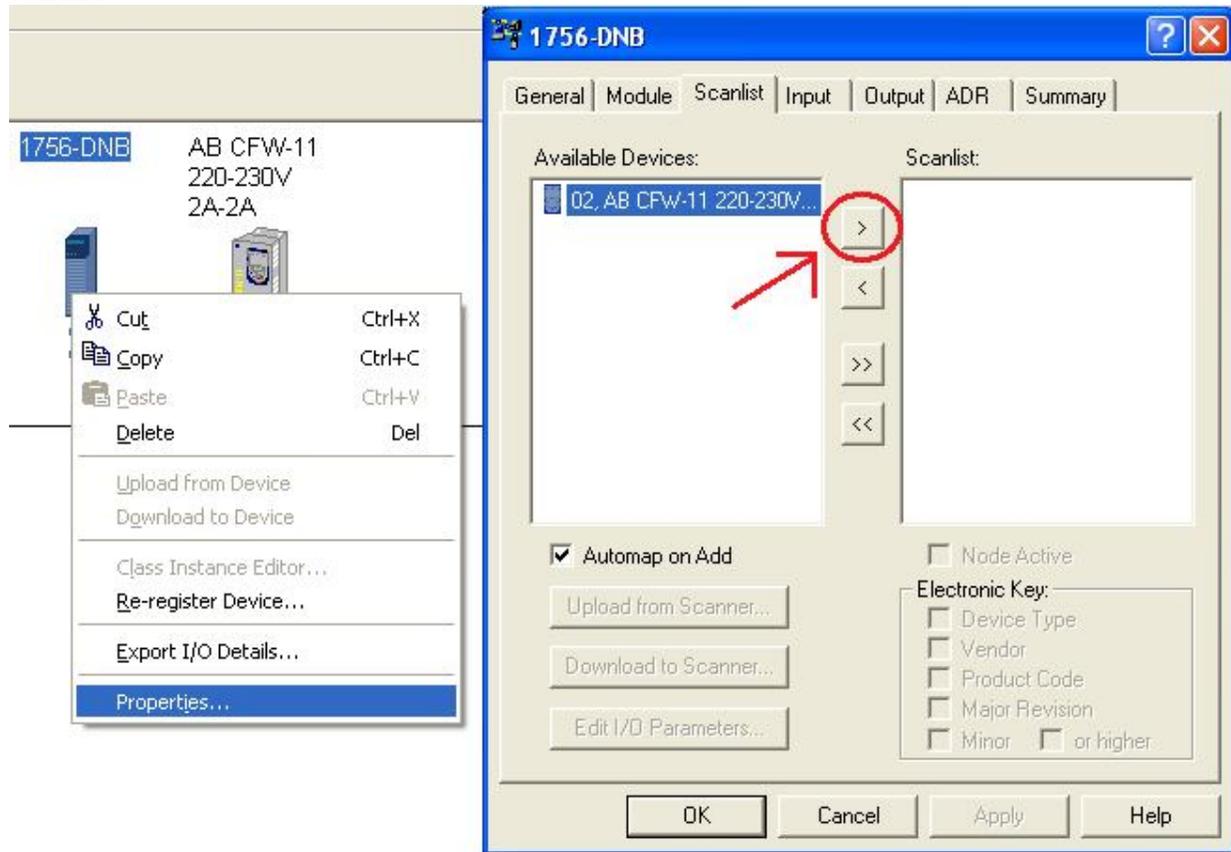

Figure 3.2.1 – Adding the DEVICENET-05 module to the project

- Click on **"Edit I/O Parameters..."** and configure the quantity of communication I/O bytes.
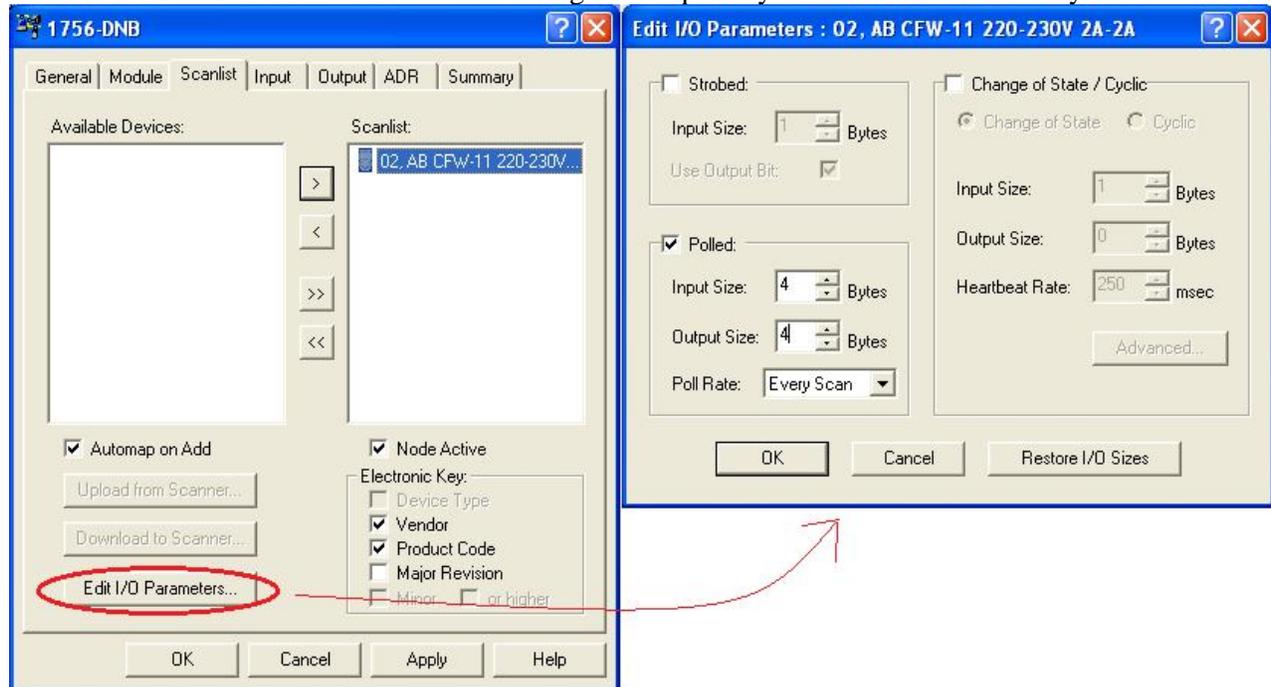
Figure 3.2.2 – Adding the DEVICENET–05 module to the project

- Check **"Input"** and **"Output"** tabs to see in which memory area the I/O bytes were allocated.
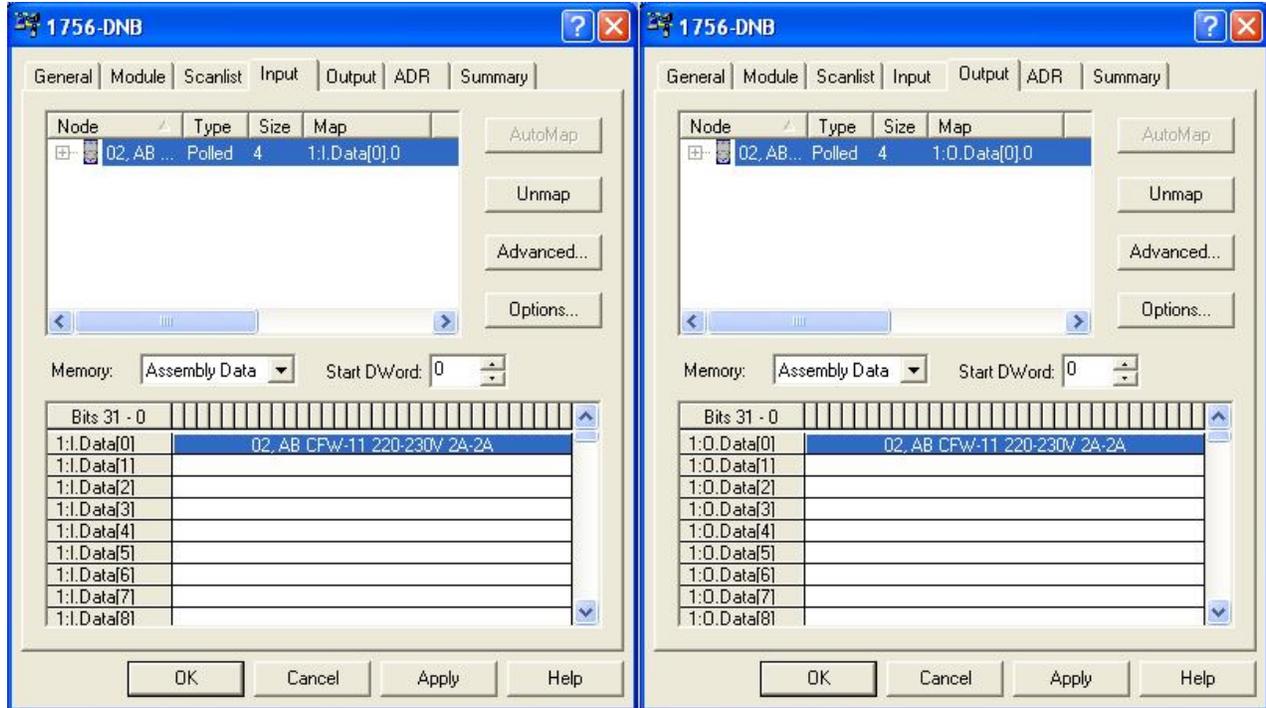
***Figure 3.2.3** – Adding the DEVICENET–05 module to the project*

NOTE!

As configured on the Inverter in parameter P0727 "Quantity of Anybus I/O" = 2 words, the PLC was configured with the same quantity, but represented in bytes, 4 bytes.
For different values, both must be configured again.

3.3 TRANSFERRING THE HARDWARE PROJECT

- Go to the **"Network"** Menu, **"Online"** option in order to establish the connection with the DeviceNet board.
- On the **"Browse for Network"** window, select the desired DeviceNet network and click on **"Ok".**
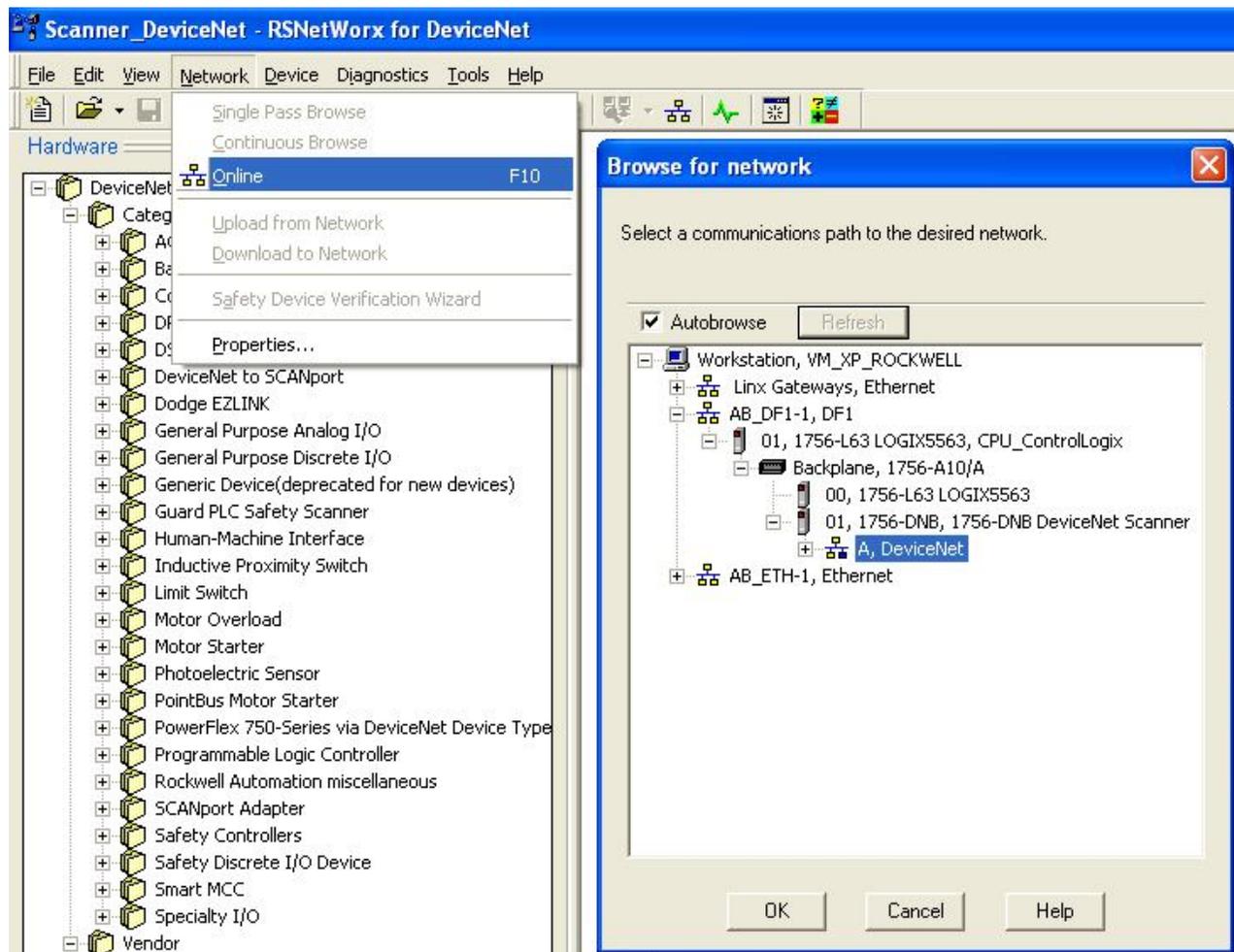
Figure 3.5 *– Transferring the hardware project*

- Download to the network. On the **"Network"** Menu, **"Download to Network"** option.
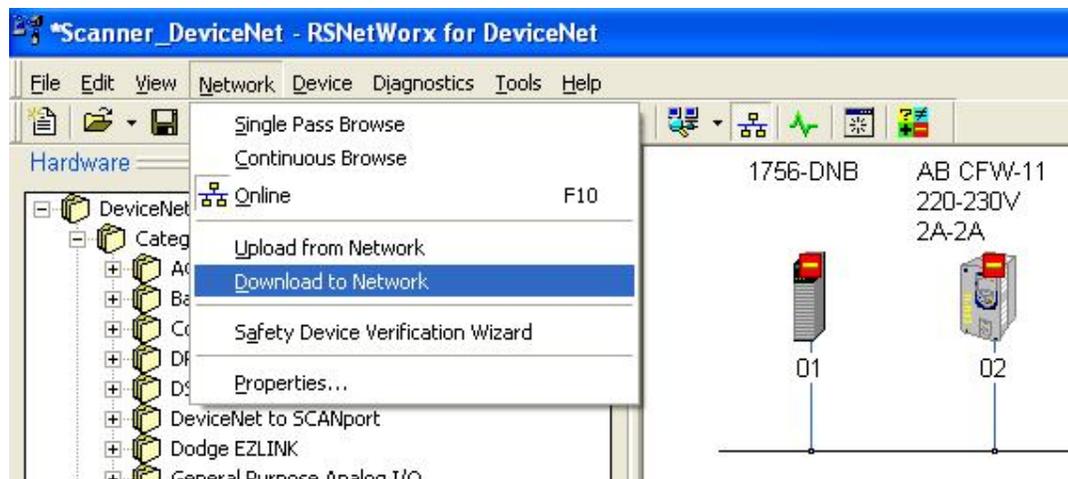
- Download the Scanlist to the board in the **"Device"** Menu, **"Download to Device"** option.
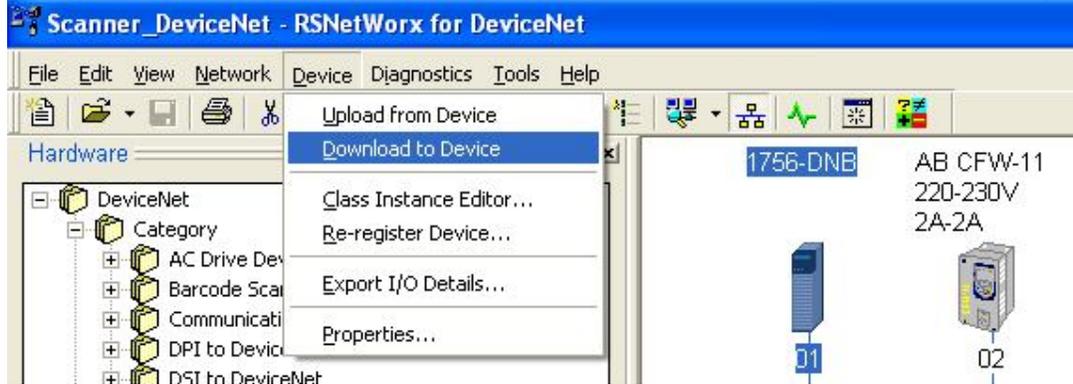
- Activate the Run command of the DeviceNet board by means of the writing variables on the Controller Tags.

4. CYCLIC DATA COMMUNICATION

4.1 READING WORDS

The CFW11 inverter can read up to eight words via DEVICENET-05 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:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 111 Status/Commands	

Description:

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

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 to 32767	Factory Setting: 0
Properties:	RO	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 111 Status/Commands	

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   speed in rpm = <u>1800 x 2048</u>

Speed in rpm = 450 rpm

4.2 EXAMPLES OF READINGS ON THE PLC

4.2.1 First reading Word (fixed).

	Name	≡⊟ △	Value	←	Force Mask	←	Style	Data Type	Description
	+ MWI_CFW11_LogicStatus		2#0000_0110_0000_0000				Binary	INT	Logic Status Word
	MXI_CFW11_2ndRamp		0				Decimal	BOOL	Status - 2nd Ramp
	MXI_CFW11_Alarm		0				Decimal	BOOL	Status - Alarm
	MXI_CFW11_AutomaticPID		0				Decimal	BOOL	Status - Automatic PID
	MXI_CFW11_Clockwise		1				Decimal	BOOL	Status - Clockwise Rotati...
	MXI_CFW11_Enabled		1				Decimal	BOOL	Status - Enabled
	MXI_CFW11_Fault		0				Decimal	BOOL	Status - Fault
	MXI_CFW11_JOG		0				Decimal	BOOL	Status - JOG
	MXI_CFW11_Remote		0				Decimal	BOOL	Status - Remote Mode
	MXI_CFW11_Running		0				Decimal	BOOL	Status - Running
	MXI_CFW11_Setup		0				Decimal	BOOL	Status - Setup Mode
	MXI_CFW11_UnderVoltage		0				Decimal	BOOL	Status - UnderVoltage

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

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 Logic below was created to transform the value read in 13 bit into rpm. The calculations were done according to the formula in item 4.1.2.
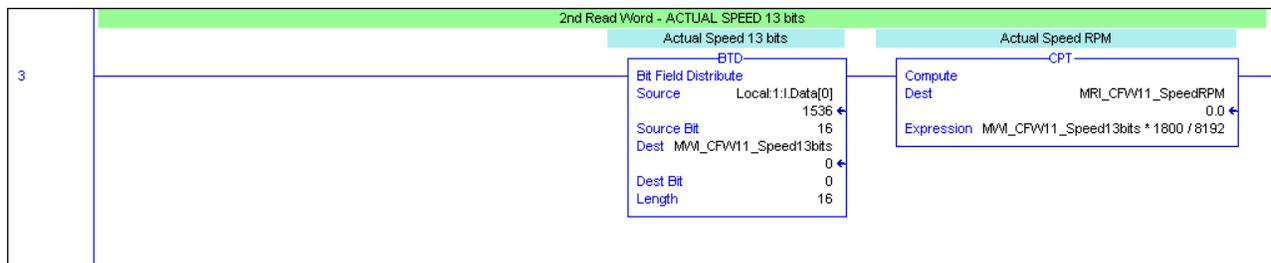
Figure 4.2.2 – Second reading Word (fixed).

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.

NOTE!

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

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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: 01 PARAMETER GROUPS
└ 49 Communication
└ 111 Status/Commands

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.

Figure 4.3.1 – Logical Control

> 👉 NOTE
> For details on the functions of each bit, refer to the Anybus-DC Communication Manual, section 4 – table 4.3.

4.3.2 Speed Control in 13 bits

P0687 – Speed in 13 bits

Adjustable Range:	-32768 to 32767	**Factory Setting:** 0

Properties: RO

**Access groups via HMI:** 01 PARAMETER GROUPS
└ 49 Communication
└ 111 Status/Commands

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

Example 1:

Calculation to transform a value of 1200 rpm into speed in 13 bits, see formula in section 4.1.2.


```
                          2nd Write Word - SPEED REFERENCE 13 bits
                                  Speed Reference 13
                                        Bits
                          ─CPT─                          ─BTD─
      6          Compute                        Bit Field Distribute
                 Dest                           Source  MWQ_CFW11_Reference13Bits
                        MWQ_CFW11_Reference13Bits                          5461 ←
                                        5461 ←   Source Bit                    0
                 Expression  MRQ_CFW11_ReferenceRPM * 8192 / 1800   Dest   Local:1:O.Data[0]
                                                                          357892111 ←
                                                 Dest Bit                     16
                                                 Length                       16
```
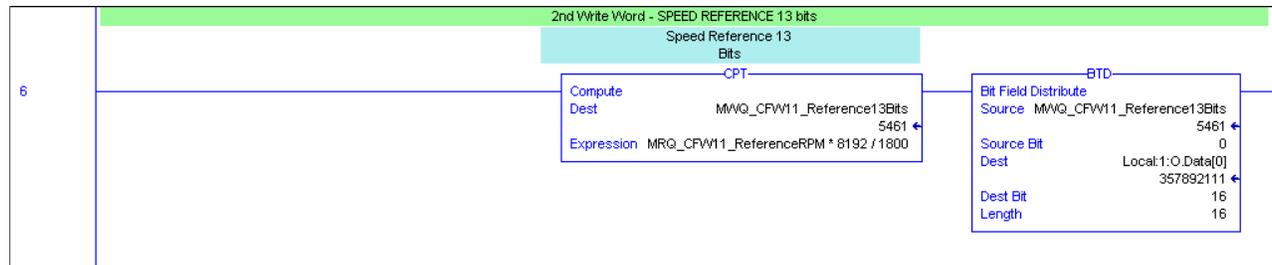
In order to change the direction of rotation, you must insert a negative value at the speed reference input.

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 writing parameter according to the parameter you wish to write, 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:


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

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5. ACYCLIC DATA COMMUNICATION

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

After the registration of the EDS file in the RSNetWorx, the user will have access to the full parameter list of the equipment, which can be accessed via explicit messages. In order to view them just access the **"Parameters"** tab in **"Properties..."** in the inverter.
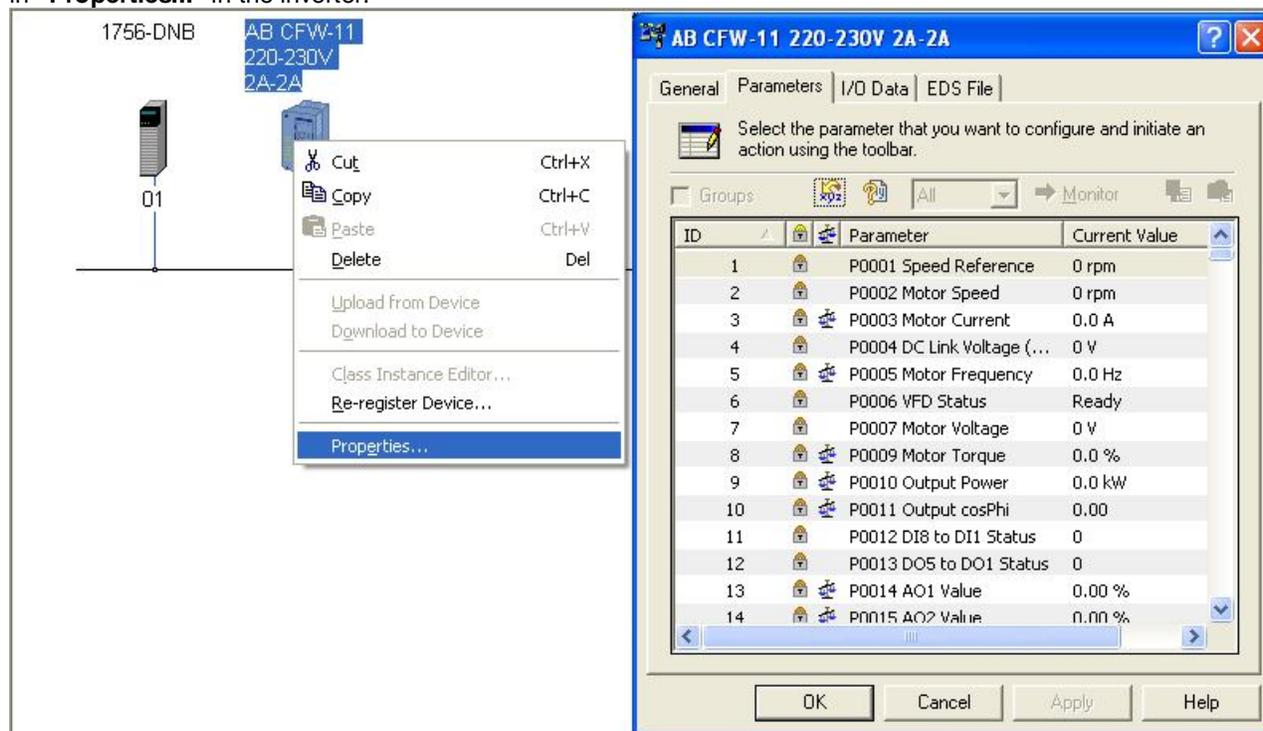
Each parameter is accessed using an addressing based on class, instance and attribute. According to the table below:

| Parameter	Class	Instance	Attribute
P0001	Class 162 (A2 hex)	1	5
P0002	Class 162 (A2 hex)	2	5
P0003	Class 162 (A2 hex)	3	5
...	...	...	...
P0400	Class 162 (A2 hex)	400	5
...	...	...	...

> **NOTE!**
> For further information, refer to the Inverter Anybus-DC Communication Manual.

5.1.1 Example of reading

In order to perform the acyclic reading on the software, just use the Message block. Below, the example shows how to configure it.
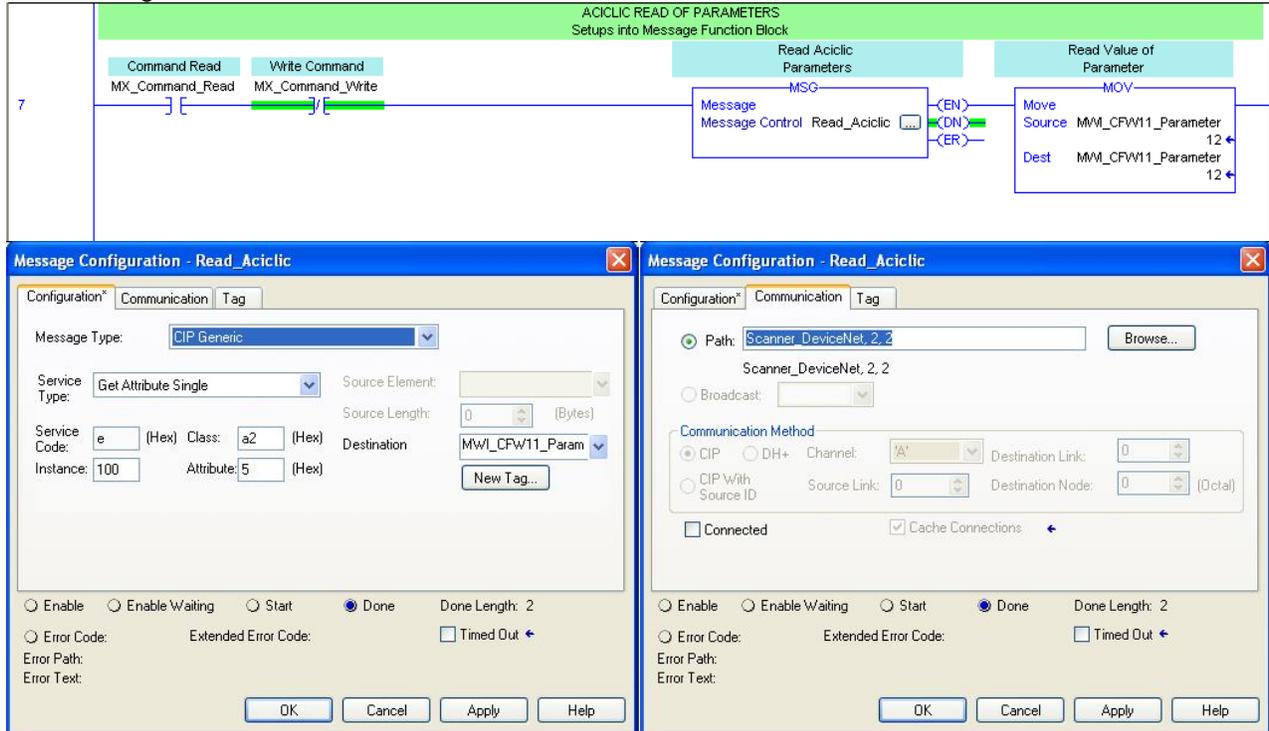
In the example above, the reading of the inverter parameter P0100 was done.
In the Message block, just make the following configurations

"Configuration" tab**:**
- Message Type: CIP Generic
- Service Type: Get Attribute Single
- Instance: Parameter instance = 100
- Class: Parameter class = a2 Hexadecimal
- Attribute: Parameter attribute = 5 Hexadecimal
- Destination: Tag that will receive the read value

"Communication" tab:
- Path: Indicate the DeviceNet board and the Inverter in the following format
   DeviceNet board address, DeviceNet board Slot + 1, Inverter DeviceNet Address.

	NOTE!
	Execute a message block at a time in the PLC scan cycle.

5.2 ACYCLIC WRITING

In order to perform acyclic reading on the software, just use the Message block. Below, the example shows how to configure it.
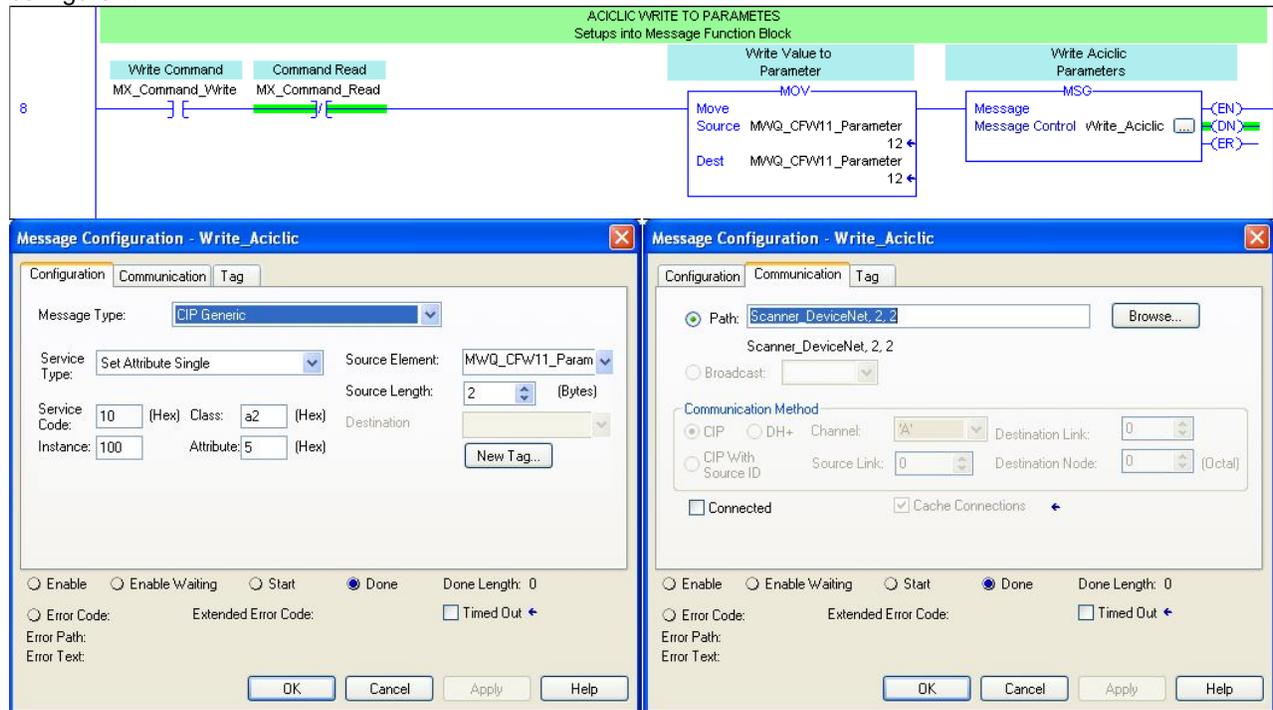
In the example above, the writing of the inverter parameter P0100 was done.
In the Message block, just make the following configurations

"Configuration" tab:
- Message Type: CIP Generic
- Service Type: Set Attribute Single
- Instance: Parameter instance = 100
- Class: Parameter class = a2 Hexadecimal
- Attribute: Parameter attribute = 5 Hexadecimal
- Source Element: Tag with the value to be written
- Source Length: Size in bytes of the value = 2 bytes

"Communication" tab:
- Path: Indicate the DeviceNet board and the Inverter in the following format
    DeviceNet board address, DeviceNet board Slot + 1, Inverter DeviceNet Address.

NOTE!
Execute a message block at a time in the PLC scan cycle.

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.	- 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.	-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*