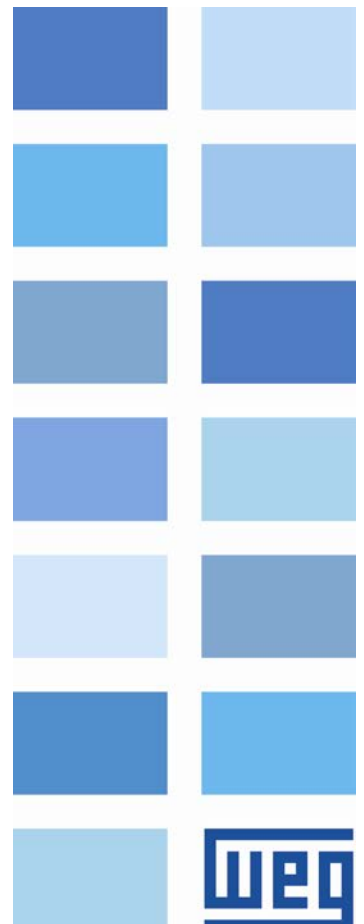


# SoftPLC

CFW100

## User Manual





# **SoftPLC User Manual**

Series: CFW100

Language: English

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## **ABOUT THE MANUAL**

This manual provides the required information for the operation of the CFW100 frequency inverter using the user's programming module, called SoftPLC. This manual must be used together with the user's manual of the CFW100 and WLP software.

### **ABBREVIATIONS AND DEFINITIONS**

|     |                                         |
|-----|-----------------------------------------|
| PLC | Programmable Logic Controller           |
| CRC | Cycling Redundancy Check                |
| RAM | Random Access Memory                    |
| WLP | Programming Software in Ladder Language |
| USB | Universal Serial Bus                    |

# 1 INTRODUCTION TO SOFTPLC

The SoftPLC is a resource that adds the functionalities of a PLC to the CFW100, making the product flexible and allowing the user to develop its own applications (user's programs).

The main SoftPLC characteristics are:

- Programming in "Ladder Language" using the WLP software.
- Access to all Parameters and I/Os of the CFW100.
- 50 configurable parameters for the user to set.
- PLC, Mathematical and Control Blocks
- On-line transfer and monitoring of the software application via Serial/USB interface.
- Transfer of the application software installed on the CFW100 to the PC with password restriction.
- Storage of the software application on the FLASH memory module.
- Execution directly on the RAM.

## 1.1 SYMBOL OF THE DATA TYPES

|     |                                                |
|-----|------------------------------------------------|
| %KW | word-type constants (16 bits)                  |
| %KF | float-type constants (32 bits, floating point) |
| %MX | bit markers                                    |
| %MW | word markers (16 bits)                         |
| %MF | float markers (32 bits, floating point)        |
| %SX | system bit markers                             |
| %SW | system word markers (16 bits)                  |
| %IX | digital Inputs                                 |
| %IW | analog inputs (16 bits)                        |
| %QX | digital outputs                                |
| %QW | analog outputs (16 bits)                       |
| %UW | user parameters (16 bits)                      |
| %UW | system parameters (16 bits)                    |
| %PD | drive parameter (16 bits)                      |

## 2 SOFTPLC MEMORY

The total size of the SoftPLC memory is 4712 bytes for programming memory and data memory.

### 2.1 MEMORY

- SoftPLC function: 4712 bytes
- SoftPLC User Parameter: 408 bytes

### 2.2 DATA MEMORY

The SoftPLC data memory area (user variables) is shared with the programming memory. Therefore, the total size of an application may vary as a function of the number of variables used by the user.

The bit, word and float markers are allocated according to the **LAST** address used on the application, that is, the longer the last address, the larger the allocated area. Therefore, it is recommended to use the markers in a **SEQUENTIAL** manner.

The word and float constants also use programming memory space.

#### 2.2.1 Constants

**Table 2.1:** Memory Map of the Constants

| Sym. | Description                         | Bytes                                                                                                                                                                                  |
|------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| %KW  | Word Constants<br>(16 bits)         | It depends on the number of different word constants.<br>E.g.: If it was used:<br>- %KW: 327 = 2 bytes<br>- %KW: 5; 67 = 4 bytes<br>- %KW: 13; 1000; 13; 4 = 6 bytes                   |
| %KF  | Float Constants<br>(32 bits – IEEE) | It depends on the number of different float constants. E.g.:<br>If it was used:<br>- %KF: -0.335 = 4 bytes<br>- %KF: 5.1; 114.2 = 8 bytes<br>- %KF: 0.0; 115.3; 0.0; 13.333 = 12 bytes |

#### 2.2.2 Physical Inputs and Outputs (Hardware)

**Table 2.2:** I/O Memory Map

| Sym. | Description             | Range   | Bytes |
|------|-------------------------|---------|-------|
| %IX  | Digital Inputs          | 1 ... 8 | 2     |
| %QX  | Digital Outputs         | 1 ... 3 | 2     |
| %IW  | Analog/Frequency Inputs | 1 ... 2 | 4     |
| %QW  | Analog Output           | 1       | 2     |



**NOTE!**

The %IW3 marker corresponds to the frequency input. In order to activate this input, it is necessary to set P246 to 1.



**NOTE!**

The values of the Analog/Frequency Inputs (%IW) and Analog Output (%QW) read and written via SoftPLC respect their gains (P232, P247: %IW1, %IW3 e P252: %QW1) and offsets (P234, P249: %IW1, %IW3).


**NOTE!**

The values read and written via SoftPLC obey the following rules, respecting the parameters related to the analog input and output signal types (P233: %IW1 and P253: %QW1):

- Option: 0 to 10 V / 20 mA
  - 0 V or 0 mA = 0
  - 10 V or 20 mA = 32767
- Option: 4 to 20 mA,
  - 4 mA = 0
  - 20 mA = 32767
- Option: 10 V / 20 mA to 0
  - 10 V or 20 mA = 0
  - 0 V or 0 mA = 32767
- Option: 20 to 4 mA,
  - 20 mA = 0
  - 4 mA = 32767

### 2.2.3 Volatile Markers (Variables)

They consist of variables that can be applied by the user to execute the logics of the application. They can be bit markers (1 bit), word markers (16 bit) or float markers (32 bit – IEEE).

**Table 2.3:** Volatile Marker Memory Map

| Sym. | Description   | Range         | Bytes                                                                                                                                                                                                                       |
|------|---------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| %MX  | Bit Markers   | 5000 ... 6099 | It depends on the last used marker. They are organized in byte pairs. E.g.:<br>- last marker: %MX5000 = 2 bytes<br>- last marker: %MX5014 = 2 bytes<br>- last marker: %MX5016 = 4 bytes<br>- last marker: %MX5039 = 6 bytes |
| %MW  | Word Markers  | 8000 ... 8199 | It depends on the last used marker. E.g.:<br>- last marker: %MX8000 = 2 bytes<br>- last marker: %MX8001 = 4 bytes<br>- last marker: %MX8007 = 16 bytes                                                                      |
| %MF  | Float Markers | 9000 ... 9199 | It depends on the last used marker. E.g.:<br>- last marker: %MX9000 = 4 bytes<br>- last marker: %MX9001 = 8 bytes<br>- last marker: %MX9007 = 32 bytes                                                                      |


**NOTE!**

In order to minimize the application size, use the markers in a sequential manner.  
E.g.:

- Bit markers: %MX5000, %MX5001, %MX5002, ...
- Word markers: %MW8000, %MW8001, %MW8002, ...
- Float markers: %MF9000, %MF9001, %MF9002, ...

### 2.2.4 System Markers

They consist of special variables that allow the user to read and change inverter data that may or may not be available in the parameters. They may be: system bit markers (1 bit) or system word markers (16 bits).



**Table 2.4.a: Memory Map for the Odd System Bits – Writing/Command**

| Sym. | Description                  | Range                    | Bytes                                                                                                                                                                                                                                                                                                          |
|------|------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | System Bits                  | 3000 ... 3040            | 4 bytes                                                                                                                                                                                                                                                                                                        |
| %SX  | <i>Writing/Command (odd)</i> |                          |                                                                                                                                                                                                                                                                                                                |
|      | 3001                         | General Enable           | <b>0:</b> It disables the inverter completely, interrupting the motor supply.<br><b>1:</b> It enables the inverter, allowing the motor operation.                                                                                                                                                              |
|      | 3003                         | Run/Stop                 | <b>0:</b> Stops the motor by deceleration ramp.<br><b>1:</b> The motor runs according to the acceleration ramp until reaching the speed reference value.                                                                                                                                                       |
|      | 3005                         | Speed Direction          | <b>0:</b> The motor runs in the reverse direction.<br><b>1:</b> The motor runs in the forward direction.                                                                                                                                                                                                       |
|      | 3007                         | JOG                      | <b>0:</b> It disables the JOG function.<br><b>1:</b> It enables the JOG function.                                                                                                                                                                                                                              |
|      | 3009                         | LOC/REM                  | <b>0:</b> The inverter goes to the local situation.<br><b>1:</b> The inverter goes to the remote situation.                                                                                                                                                                                                    |
|      | 3011                         | Fault Reset              | <b>0:</b> No function.<br><b>1:</b> If in fault condition, it resets the inverter.<br><b>NOTE:</b> When this command is executed, the inverter and the SoftPLC Application are reinitialized. This is also true for reset via keypad.                                                                          |
|      | 3021                         | Activate the Second Ramp | <b>0:</b> The values for the motor acceleration and deceleration are those from the first Ramp (P100 and P101).<br><b>1:</b> The values for the motor acceleration and deceleration are those from the first Ramp (P102 and P103).<br><b>Note:</b> Set P105 to 6 in order to enable the selection via SoftPLC. |

**Table 2.4.b: Memory Map for the Even System Bit – Reading/State**

| Sym. | Description                 | Range                 | Bytes                                                                                                                                                                                                                                                                                                  |
|------|-----------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type | System Bits                 | 3000 ... 3020         | 4 bytes                                                                                                                                                                                                                                                                                                |
| %SX  | <i>Reading/State (Even)</i> |                       |                                                                                                                                                                                                                                                                                                        |
|      | 3000                        | General Enabling      | <b>0:</b> General enabling is not active.<br><b>1:</b> General enabling is active and the inverter is ready to run the motor.                                                                                                                                                                          |
|      | 3002                        | Motor Running (RUN)   | <b>0:</b> The motor is stopped.<br><b>1:</b> The inverter is driving the motor at the set point speed, or executing either the acceleration or the deceleration ramp.                                                                                                                                  |
|      | 3004                        | Speed Direction       | <b>0:</b> The motor is running reverse.<br><b>1:</b> The motor is running forward.                                                                                                                                                                                                                     |
|      | 3006                        | JOG                   | <b>0:</b> JOG function inactive.<br><b>1:</b> JOG function active.                                                                                                                                                                                                                                     |
|      | 3008                        | LOC/REM               | <b>0:</b> Inverter in local mode.<br><b>1:</b> Inverter in remote mode.                                                                                                                                                                                                                                |
|      | 3010                        | In Fault              | <b>0:</b> Inverter is not in fault state.<br><b>1:</b> Some fault registered by the inverter.<br><b>Note:</b> The number of the fault can be read through parameter P049 – Current Fault.                                                                                                              |
|      | 3012                        | Undervoltage          | <b>0:</b> No undervoltage.<br><b>1:</b> With undervoltage.                                                                                                                                                                                                                                             |
|      | 3016                        | Alarm Condition       | <b>0:</b> Inverter is not in an alarm condition.<br><b>1:</b> Inverter is in an alarm condition.<br><b>Note:</b> The number of the alarm can be read by means of parameter P048 – Current Alarm.                                                                                                       |
|      | 3018                        | In Configuration Mode | <b>0:</b> Inverter operating normally.<br><b>1:</b> Inverter in configuration state. It indicates a special condition when the inverter cannot be enabled:<br>- There is a parameter setting incompatibility.<br><b>Note:</b> Parameter P047 shows the cause of the parameter setting incompatibility. |
|      | 3020                        | Ramp Active           | <b>0:</b> It indicates that the first Ramp is active.<br><b>1:</b> It indicates that the second Ramp is active.                                                                                                                                                                                        |
|      | 3032                        | Start key (🟢)         | <b>0:</b> Not pressed.<br><b>1:</b> Pressed during 1 scan cycle.<br><b>Note:</b> Only use to visualize the key status with Run/Stop Selection via HMI keys (P224 = 0 or P227 = 0).                                                                                                                     |
|      | 3034                        | Stop key (🔴)          |                                                                                                                                                                                                                                                                                                        |
|      | 3046                        | Up key (⬆️)           |                                                                                                                                                                                                                                                                                                        |
|      | 3048                        | Down key (⬆️)         |                                                                                                                                                                                                                                                                                                        |

**Table 2.5: Memory Map for the Even System Word Markers**

| Sym. | Description                          | Range                                   | Bytes    |
|------|--------------------------------------|-----------------------------------------|----------|
| %SW  | System Words                         | 3300 ... 3324                           | 48 bytes |
|      | <i>Reading Markers/Status (Even)</i> |                                         |          |
|      | 3300                                 | Motor speed [13 bits]                   |          |
|      | 3302                                 | Motor synchronous speed [rpm]           |          |
|      | 3304                                 | Motor speed [rpm]                       |          |
|      | 3306                                 | Speed reference [rpm]                   |          |
|      | 3308                                 | Alarm                                   |          |
|      | 3310                                 | Fault                                   |          |
|      | 3320                                 | Inverter rated current [A x10]          |          |
|      | 3322                                 | Unfiltered motor current (P003) [A x10] |          |
|      | 3324                                 | Unfiltered motor torque [% x10]         |          |


**NOTE!**

The system word marker %SW3300 uses a 13-bit resolution (8192 → to 8191), which represents the motor synchronous speed. Thus, if the speed reference via “Reference” block (%SW3301) is 4096 for a VI pole motor (this means a synchronous speed of 1200 rpm), the motor will run at 600 rpm.


**NOTE!**

Equation for the calculation of the motor speed in rpm:

$$\text{Speed in rpm} = \frac{\text{synchronous speed in rpm} \times \text{speed in 13 bits}}{8192}$$


**NOTE!**

Equation for the calculation of the motor speed in Hz:

$$\text{Speed in Hz} = \frac{\text{synchronous frequency in Hz (P403)} \times \text{speed in 13 bits}}{8192}$$

## 2.2.5 Parameters

The parameters from P910 to P959 appear on the keypad of the CFW100 only when there is a valid application (user program) in the memory, i.e., when P900 > 0.

**Table 2.6: Parameter Memory Map**

| Sym. | Description                                         | Range                                                                                                      | Bytes     |
|------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------|
| %PD  | System Parameters<br>(refer to the CFW100 manual)   | 0... 999                                                                                                   |           |
| %PW  | SoftPLC Parameters                                  | 900 ... 959                                                                                                | 6 bytes   |
|      | P900: SoftPLC Status<br>[Read-only parameter]       | 0: No application<br>1: Install. Applic.<br>2: Applic. Incomp.<br>3: Applic. Stopped<br>4: Applic. Running |           |
|      | P901: SoftPLC Command                               | 0: Stop Program<br>1: Run Program<br>2: Delete Program                                                     |           |
|      | P902: Scan Cycle Time [ms]<br>[Read-only parameter] |                                                                                                            |           |
| %UW  | User Parameters                                     | 910 ... 959                                                                                                | 100 bytes |

## 2.3 MODBUS

### 2.3.1 Modbus protocol SoftPLC addresses

*Table 2.7: SoftPLC x Modbus Address Range*

| Sym. | Description             | SoftPLC | MODBUS      |
|------|-------------------------|---------|-------------|
| %IX  | Digital Inputs          | 1 ... 8 | 2201...2208 |
| %QX  | Digital Outputs         | 1 ... 3 | 2401...2403 |
| %IW  | Analog/Frequency Inputs | 1 ... 2 | 2601...2602 |
| %QW  | Analog Output           | 1       | 2801        |



**NOTE!**

The %IW3 marker corresponds to the frequency input. In order to activate this input, it is necessary to set P246 to 1.



**NOTE!**

All the other data types have the user addresses (SoftPLC) equal to the Modbus addresses. E.g.: %PD0100 = Modbus address 100; %MX5000 = Modbus address 5000; %SW3308 = Modbus address 3308.

### 2.3.2 Protocol

Refer to the Modbus RTU (CFW100) User Manual, Modbus Protocol chapter.

### 3 RESUME OF THE FUNCTION BLOCKS

This chapter contains a summary of the function blocks that are available for the user programming.

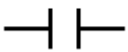
#### 3.1 CONTACTS

They send to the stack the content of a programmed data (0 or 1), which can be of the following type:

- %MX: Bit Marker
- %IX: Digital Input
- %QX: Digital Output
- %UW: User Parameter
- %SX: System Bit Marker – Reading

##### 3.1.1 Normally Open Contact – NO CONTACT

%MX5000

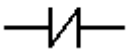


**Menu:** Insert-Contacts-NO CONTACT.

E.g.: It sends the content of bit marker 5000 to the stack.

##### 3.1.2 Normally Closed Contact – NC CONTACT

%QX1



**Menu:** Insert-Contacts-NC CONTACT.

E.g.: It sends the negated content of digital output 1 to the stack.

##### 3.1.3 “AND” Logic with Contacts

When the contacts are in series, an “AND” logic is executed among them, storing the result in the stack. Examples:

| Example                                        | Truth Table |      |       |
|------------------------------------------------|-------------|------|-------|
| <p>%IX1      %IX2</p> <p>%IX1.%IX2</p>         | %IX1        | %IX2 | Stack |
|                                                | 0           | 0    | 0     |
|                                                | 0           | 1    | 0     |
|                                                | 1           | 0    | 0     |
|                                                | 1           | 1    | 1     |
| <p>%UW910      %QX1</p> <p>%UW910. (~%QX1)</p> | %UW910      | %QX1 | Stack |
|                                                | 0           | 0    | 0     |
|                                                | 0           | 1    | 0     |
|                                                | 1           | 0    | 1     |
|                                                | 1           | 1    | 0     |

##### 3.1.4 “OR” Logic with Contacts

When the contacts are in parallel, an “OR” logic is executed among them, storing the result in the stack. Examples:

| Example                   | Operation        | Truth Table |      |       |
|---------------------------|------------------|-------------|------|-------|
| <p>%IX1</p> <p>%IX2</p>   | %IX1 + %IX2      | %IX1        | %IX2 | Stack |
|                           |                  | 0           | 0    | 0     |
|                           |                  | 0           | 1    | 1     |
|                           |                  | 1           | 0    | 1     |
|                           |                  | 1           | 1    | 1     |
| <p>%UW910</p> <p>%QX1</p> | %UW910 + (~%QX1) | %UW910      | %QX1 | Stack |
|                           |                  | 0           | 0    | 1     |
|                           |                  | 0           | 1    | 0     |
|                           |                  | 1           | 0    | 1     |
|                           |                  | 1           | 1    | 1     |

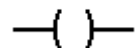
## 3.2 COILS

They save the content of the stack in the programmed data (0 or 1), which can be of the following type:

- %MX: Bit Marker
- %QX: Digital Output
- %UW: User Parameter
- %SX: System Bit Marker – Writing

It is allowed to add coils in parallel in the last column.

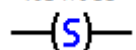
### 3.2.1 Normal Coil - COIL

**%MX5001**  
 **Menu:** *Insert-Coils-COIL*  
 E.g.: It sets the bit marker 5001 with the stack content

### 3.2.2 Negated Coil – NEG COIL

**%QX2**  
 **Menu:** *Insert-Coils-NEG COIL*  
 E.g.: It sets the digital output 2 with the negated content of the stack

### 3.2.3 Set Coil – SET COIL

**%UW911**  
 **Menu:** *Insert-Coils-SET COIL*  
 E.g.: It sets the user parameter 911, provided that the content of the stack is not 0

### 3.2.4 Reset Coil – RESET COIL

**%UW911**  
 **Menu:** *Insert-Coils-RESET COIL*  
 E.g.: It resets the user parameter 911, provided that the content of the stack is not 0

### 3.2.5 Positive Transition Coil – PTS COIL

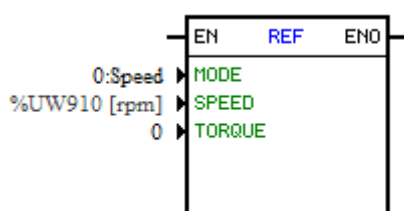
**%MX5002**  
 **Menu:** *Insert-Coils-PTS COIL*  
 E.g.: It sets the bit marker 5002 during 1 scan cycle, provided that a transition from 0 to 1 in the stack is detected.

### 3.2.6 Negative Transition Coil – NTS COIL

**%SX3011**  
 **Menu:** *Insert-Coils-NTS COIL*  
 E.g.: It sets the system bit marker 3011 during 1 scan cycle, provided that a transition from 1 to 0 in the stack is detected.

## 3.3 MOVEMENT BLOCKS

### 3.3.1 Speed and/or Torque Reference – REF



**Menu:** *Insert-Function Blocks-Movement-REF*

#### Input:

EN: Enables the block

#### Output:

ENO: Goes to 1 when EN ≠ 0 and without error

#### Properties:

MODE: 0=Speed Mode

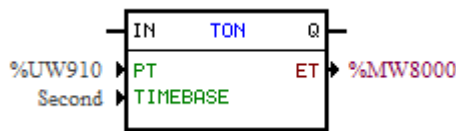
SPEED: Speed reference [RPM, 13 Bits, Hz (x10)]

TORQUE: Not available

In the example above, if the EN is active, and the digital input 1 is off, then the block will generate a speed reference according to the user parameter 910 in the rpm unit. If there is no error (example: disabled inverter), the ENO output goes to 1.

### 3.4 PLC BLOCKS

#### 3.4.1 Timer – TON



**Menu:** *Insert-Function Blocks-PLC-TON*

**Input:**

IN: Enables the block

**Output:**

Q: Goes to 1 when  $IN \neq 0$  and  $ET \geq PT$

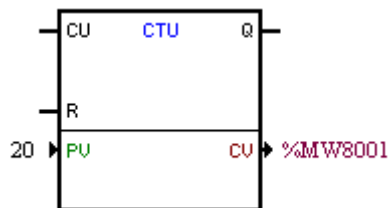
**Properties:**

PT: Preset time

ET: Elapsed Time

In the example above, if the IN input is active and the content of the word marker 8000 is greater than or equal to the content of the user parameter 910, the output Q goes to set 1.

#### 3.4.2 Incremental Counter – CTU



**Menu:** *Insert-Function Blocks-PLC-CTU*

**Inputs:**

CU: Captures the transitions from 0 to 1 at this input (*Counter Up*)

R: Resets CV

**Output:**

Q: Goes to 1 when  $CV \geq PV$

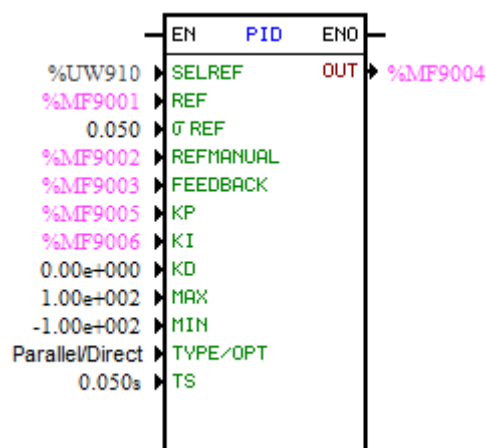
**Properties:**

PV: Preset value

CV: Counter Value

In the example above, if the content of the word marker 8001 is greater than or equal to 20, the output Q goes to 1.

#### 3.4.3 Proportional-Integral-Derivative Controller – PID



**Menu:** *Insert-Function Blocks-PLC-PID*

**Inputs:**

EN: Enables the block

**Output:**

ENO: EN input image

**Properties:**

TS: Sampling period

SELREF: Automatic/manual reference

REF: Automatic reference

δREF: Time constant of the automatic reference filter

REFMANUAL: Manual reference

FEEDBACK: Process feedback

KP: Proportional gain

KI: Integral gain

KD: Derivative gain

MAX: Maximum output value

MIN: Minimum output value

TYPE: Academic/parallel

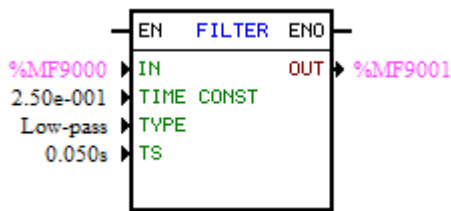
OPT: Direct/reverse

OUT: Controller output

In the example above, if the input EN is active, the controller starts its operation. The content of the user parameter 910 selects the reference that is active, that is, whether it is the float marker 9001 (automatic reference) or 9002 (manual reference). There is a 0.05s filter for the automatic reference. Since the derivative

gain is fixed in 0, this indicates that the PID was converted into a PI. The value of the control output OUT, represented by the float marker 9004, has the maximum and minimum limits of 100 and -100 and the sampling time of 0.050s.

### 3.4.4 Low-pass or High-pass Filter – FILTER



**Menu:** Insert-Function Blocks-PLC-FILTER

**Inputs:**

EN: Enables the block

**Output:**

ENO: EN input image

**Properties:**

TS: Sampling period

IN: Input data

TIMECONST: Filter time constant

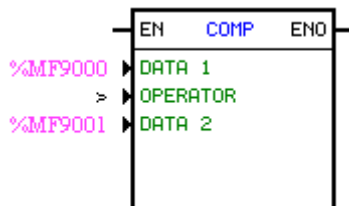
**TYPE:** Low-pass/High-pass

OUT: Input data filtered value

In the example above, if the EN input is active, the content of the float marker 9000 will be filtered with a time constant of 0.25s by a low-pass filter and it will be transferred to the float marker 9001.

## 3.5 CALCULATION BLOCKS

### 3.5.1 Comparator – COMP



**Menu:** Insert-Function Blocks-Calculation-COMP

**Input:**

EN: Enables the block

**Output:**

ENO: Goes to 1 when the comparison condition is fulfilled

**Properties:**

FORMAT: Integer or floating point

DATA 1: Comparison data 1

OPERATOR: Comparison operator

DATA 2: Comparison data 2

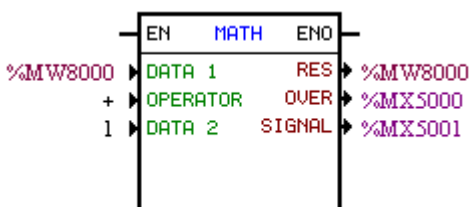
In the example above, if the EN input is active and the content of the float marker 9000 is greater than the float marker 9001, then the output ENO goes to 1.



**NOTE!**

If FORMAT is integer, all the numerical data are considered words of 15 bits + signal (-32768 to 32767).

### 3.5.2 Math Operation – MATH



**Menu:** Insert-Function Blocks-Calculation-MATH

**Input:**

EN: Enables the block

**Output:**

ENO: Indicates if the calculation has been executed

**Properties:**

FORMAT: Integer or floating point

DATA1: Calculation Data 1. It may also appear as DATA1H and DATA1L (representing the high and low parts of data 1)

OPERATOR: Mathematic operator (+, -, \*, etc.)

DATA2: Calculation Data 2. It may also appear as DATA2H and DATA2L (representing the high and low parts of data 2)

|         |                                                                                                                                                                                              |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RES:    | Calculation result. It may also appear as RESH and RESL (representing the high and low parts of the result) and also as QUOC and REM (representing the quotient and remainder of a division) |
| OVER:   | Indicates if the result exceeded its limit.                                                                                                                                                  |
| SIGNAL: | Result signal                                                                                                                                                                                |

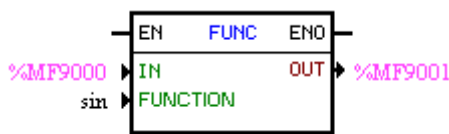
In the example above, when the input EN is active, the value of the word marker 8000 is incremented at each scan cycle. When the bit marker 5000 goes to 1, it indicates overflow and the word marker 8000 remains in 32767.



### NOTE!

If FORMAT is integer, all the numerical data are considered words of 15 bits + signal (-32768 to 32767).

### 3.5.3 Math Function – FUNC



**Menu:** Insert-Function Blocks-Calculation-FUNC

#### Input:

EN: Enables the block

#### Output:

ENO: Indicates if the calculation was executed

#### Properties:

FORMAT: Integer or floating point

IN: Data to be calculated

FUNCTION: Mathematic function (sin, cos, etc.)

OUT: Calculation result

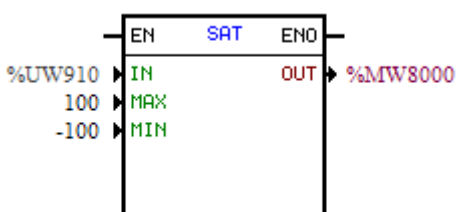
In the example above, when the EN input is active, the float marker 9001 presents the result of the float marker 9000 sine calculation.



### NOTE!

If FORMAT is integer, all the numerical data are considered words of 15 bits + signal (-32768 to 32767).

### 3.5.4 Saturator – SAT



**Menu:** Insert-Function Blocks-Calculation-SAT

#### Input:

EN: Enables the block

#### Output:

ENO: Indicates if saturation has occurred, provided that EN ≠ 0

#### Properties:

FORMAT: Integer or floating point

IN: Input data

MAX: Maximum allowed value

MIN: Minimum allowed value

OUT: Output data

In the example above, when the EN input is active, the word marker 8000 contains the user parameter 910 value, but limited between the maximum of 100 and the minimum of -100.



### NOTE!

If FORMAT is integer, all the numerical data are considered words of 15 bits + signal (-32768 to 32767).



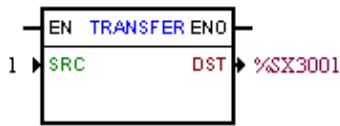
### NOTE!

If the value of MIN is greater than the MAX, the outputs OUT and ENO are reset to zero.



## 3.6 TRANSFER BLOCKS

### 3.6.1 Data Transfer – TRANSFER



**Menu:** Insert-Function Blocks-Transfer-TRANSFER

**Input:**

EN: Enables the block

**Output:**

ENO: Indicates that the transfer has been done

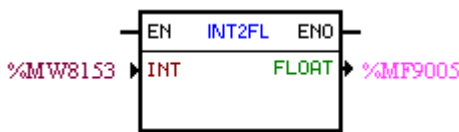
**Properties:**

SRC: Source data

DST: Destine data

In the example above, if the EN input is active, the word constant 1 is transferred to the system bit marker 3001 (general enable).

### 3.6.2 Conversion from Integer (16 bits) to Floating Point – INT2FL



**Menu:** Insert-Function Blocks-Transfer-INT2FL

**Input:**

EN: Enables the block

**Output:**

ENO: Indicates that the transfer has been done

**Properties:**

INT: Integer data

FLOAT: Data converted into floating point

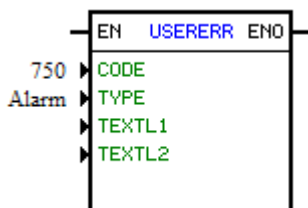
In the example above, if the EN input is active, the content of word marker 8153 (taking into account its signal) is converted to floating point to the float marker 9005.



**NOTE!**

INT is treated as word of 15 bits + signal (-32768 to 32767).

### 3.6.3 User Fault or Alarm Generator - USERERR



**Menu:** Insert-Function Blocks-Transfer-USERERR

**Input:**

EN: Enables the block

**Output:**

ENO: It indicates 1 when EN = 1 and the alarm or error has been effectively generated.

**Properties:**

CODE: Fault or alarm code.

TYPE: 0: Generates alarm, 1: Generates fault

TEXTL1: HMI line 1 text (Not available)

TEXTL2: HMI line 2 text (Not available)

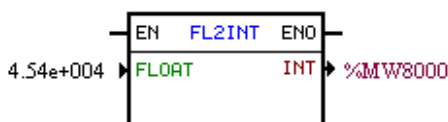
In the example above, if the EN input is active, A750 will appear.



**NOTE!**

If this block is configured as Fault, it is necessary to reset the drive so as to enable it again.

### 3.6.4 Convert from Floating Point to Integer (16 bits) – FL2INT



**Menu:** Insert-Function Blocks-Transfer-FL2INT

**Input:**

EN: Enables the block

**Output:**

ENO: Indicates that the transfer has been done

**Properties:**

FLOAT: Floating point data

INT: Data converted into integer

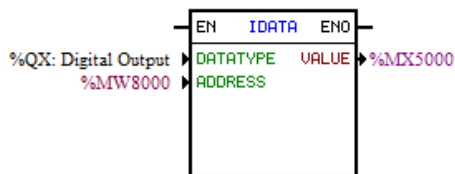
In the example above, if the EN input is active, the float constant  $4.54 \times 10^4$  is converted into an integer with signal via word marker 8000. However, after the conversion, the word marker 8000 will remain with the value 32767, because this is the positive limit for a Word.



**NOTE!**

INT is treated as word of 15 bits + signal (-32768 to 32767).

### 3.6.5 Indirect Data Transfer – IDATA



**Menu:** *Insert-Function Blocks-Transfer-IDATA*

**Input:**

EN: Enables the block

**Output:**

ENO: Indicates that the transfer has been done

**Properties:**

CMD: Read/Write command

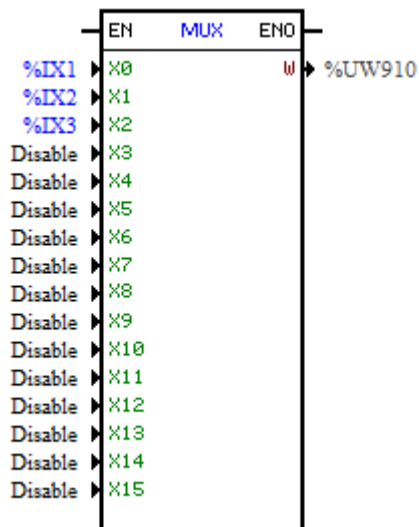
DATATYPE: Data type

ADDRESS: User address

VALUE: Read content/Value to be written

In the example above, if the EN input is active, the content of the bit marker 5000 is written to the digital output whose address is the content of the word marker 8000.

### 3.6.6 Multiplexer – MUX



**Menu:** *Insert-Function Blocks -Transfer-MUX*

**Input:**

EN: Enables the mathematic operation

**Output:**

ENO: Indicates that the transfer has been done

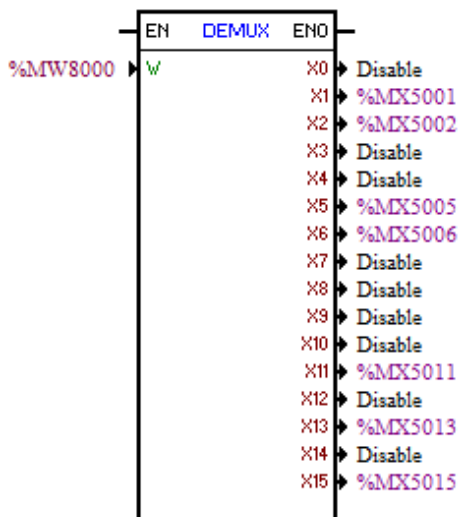
**Properties:**

X0-X15: Binary data vector

W: Resulting word

In the example above, when the EN input is active, the digital inputs 1, 2 and 3 transfer their content to the bits 0, 1 and 2 of the user parameter P910.

## 3.6.7 Demultiplexer – DMUX



**Menu:** *Insert-Function Blocks-Transfer-DMUX*

**Input:**

EN: Enables the mathematic operation

**Output:**

ENO: Indicates that the transfer has been done

**Properties:**

W: Source word

X0-X15: Resulting binary data vector

In the above example, when the EN input is active, the bits 1, 2, 5, 6, 11, 13 and 15 of the word marker 8000 are transferred respectively to the bit markers 5001, 5002, 5005, 5006, 5011, 5013 and 5015.

## 4 INVERTER PARAMETER SETTINGS

Below, only the parameters of the CFW100 frequency inverter that are related to the SoftPLC will be presented.

### 4.1 SYMBOLS FOR PROPERTY DESCRIPTION

|            |                                                         |
|------------|---------------------------------------------------------|
| <b>ro</b>  | Read only parameter                                     |
| <b>cfg</b> | Parameter that can be changed only with a stopped motor |

### 4.2 CFW100 CONFIGURATION PARAMETERS

|                                                                      |
|----------------------------------------------------------------------|
| <b>P100 – Acceleration Time</b>                                      |
| <b>P101 – Deceleration Time</b>                                      |
| <b>P220 – Selection of the LOCAL/REMOTE Source</b>                   |
| <b>P221 – Selection of the Speed Reference – LOCAL Status</b>        |
| <b>P222 – Selection of the Speed Reference – REMOTE Status</b>       |
| <b>P223 – Selection of the Direction of Rotation – LOCAL Status</b>  |
| <b>P224 – Selection of Run/Stop (Local Status)</b>                   |
| <b>P225 – Selection of JOG – LOCAL Status</b>                        |
| <b>P226 – Selection of the Direction of Rotation – REMOTE Status</b> |
| <b>P227 – Selection of Run/Stop (Remote Status)</b>                  |
| <b>P228 – Selection of JOG – REMOTE Status</b>                       |
| <b>P246 – Frequency Input FI</b>                                     |
| <b>P251 – Analog Output AO1 Function</b>                             |
| <b>P263 – Digital Input DI1 Function</b>                             |
| <b>P264 – Digital Input DI2 Function</b>                             |
| <b>P265 – Digital Input DI3 Function</b>                             |
| <b>P266 – Digital Input DI4 Function</b>                             |
| <b>P267 – Digital Input DI5 Function</b>                             |
| <b>P268 – Digital Input DI6 Function</b>                             |
| <b>P269 – Digital Input DI7 Function</b>                             |
| <b>P270 – Digital Input DI8 Function</b>                             |
| <b>P271 – Digital Input Signal</b>                                   |
| <b>P275 – DO1 Output Function (RL1)</b>                              |
| <b>P276 – DO2 Output Function (RL2)</b>                              |

## P277 – DO3 Output Function (RL3)



### NOTE!

The resources of available inputs and outputs depend on the used accessory.  
For further information, please, refer to the CFW100 Programming Manual.

## 4.3 EXCLUSIVE SOFTPLC PARAMETERS

### P900 – SoftPLC Status

|                   |                      |                           |
|-------------------|----------------------|---------------------------|
| <b>Adjustable</b> | 0 = No Application   | <b>Factory Setting:</b> 0 |
| <b>Range:</b>     | 1 = Install. Applic. |                           |
|                   | 2 = Applic. Incomp.  |                           |
|                   | 3 = Applic. Stopped  |                           |
|                   | 4 = Applic. Running  |                           |

**Properties:** ro

#### Description:

It allows the user to view the SoftPLC status. If there are no applications installed, the parameters P910 to P959 will not be shown on the keypad.

If this parameter presents the option 2 ("Incomp. Applic."), it indicates that the version that has been loaded in the flash memory module is not compatible with the current CFW100 firmware.

In this case, the user needs to recompile its project in the WLP, considering the new CFW100 version and download it. If that is not possible, the upload of this application can be done with the WLP, provided that the application password is known or is not enabled.

### P901 – SoftPLC Command

|                   |                    |                           |
|-------------------|--------------------|---------------------------|
| <b>Adjustable</b> | 0 = Stop Applic.   | <b>Factory Setting:</b> 0 |
| <b>Range:</b>     | 1 = Run Applic     |                           |
|                   | 2 = Delete Applic. |                           |

**Properties:** cfg

#### Description:

It allows stopping, running or excluding an installed application, but the motor must be disabled in order to do so.

### P902 – Scan Cycle Time

|                    |                 |                                        |
|--------------------|-----------------|----------------------------------------|
| <b>Adjustable</b>  | 0.00 to 9.999 s | <b>Factory Setting:</b> Not applicable |
| <b>Range:</b>      |                 |                                        |
| <b>Properties:</b> | ro              |                                        |

#### Description:

It consists of the application scanning time. The larger the application, the longer the scanning time.

### P910 to P959 – SoftPLC User Parameters

|                    |               |                           |
|--------------------|---------------|---------------------------|
| <b>Adjustable</b>  | -9999 to 9999 | <b>Factory Setting:</b> 0 |
| <b>Range:</b>      |               |                           |
| <b>Properties:</b> | -             |                           |

#### Description:

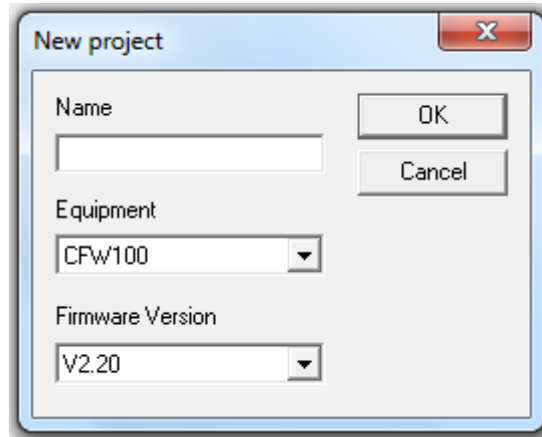
They consist of use parameters defined by the user via WLP software, as described in item 5.5.

## 5 SUMMARY OF THE WLP MAIN FUNCTIONS

This chapter brings basic information about the operations done with the WLP software for the use of the CFW100 inverter. More information can be obtained in the help of the WLP software

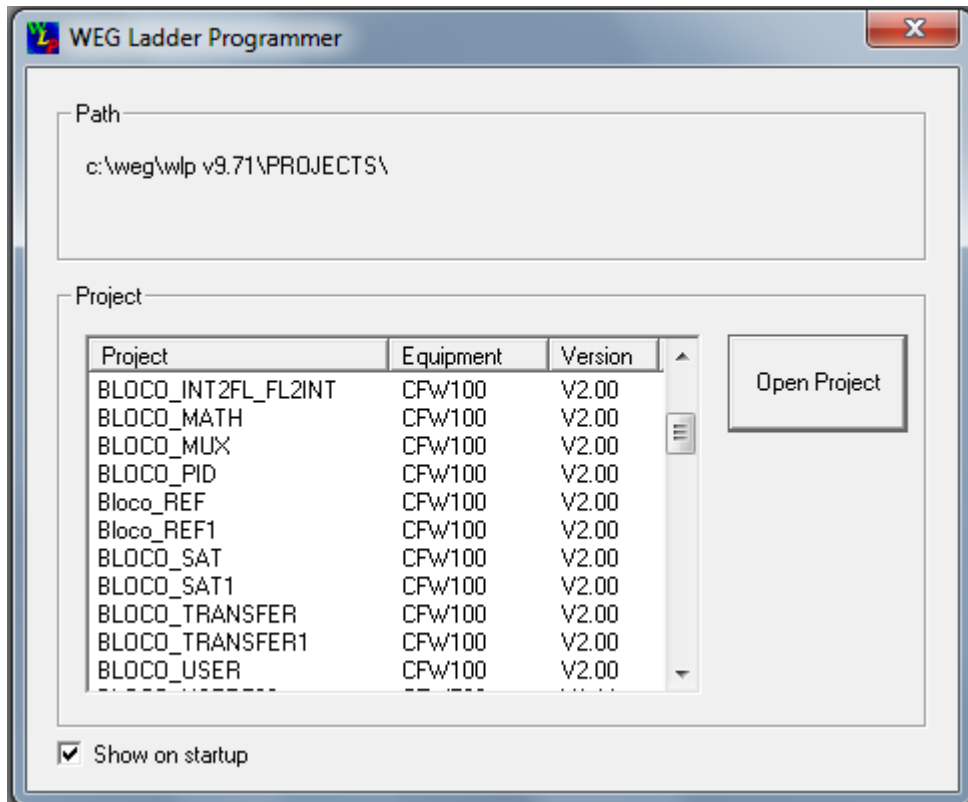
### 5.1 PROJECT – NEW

It creates a new project. Besides defining the project name, it is also necessary to configure the equipment and the respective firmware version.



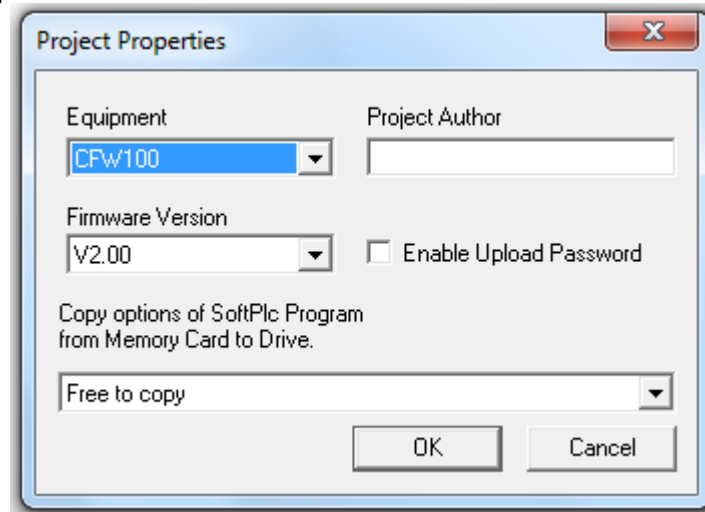
### 5.2 PROJECT – OPEN

It opens the selected project.



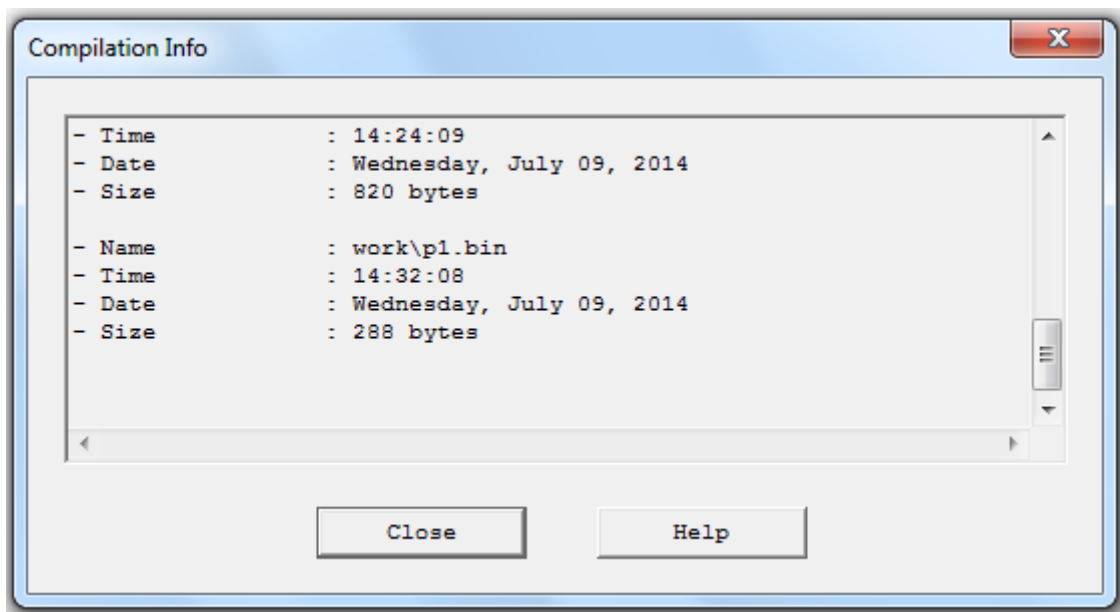
## 5.3 PROJECT – PROPERTIES

It allows the user to define the equipment and firmware version. In this box, it is also configured whether the project will have upload password or not.



## 5.4 VIEW – COMPILATION INFORMATION

It allows the user to know the size in bytes of the compiled application (<projectname>.bin) to be sent to the equipment.



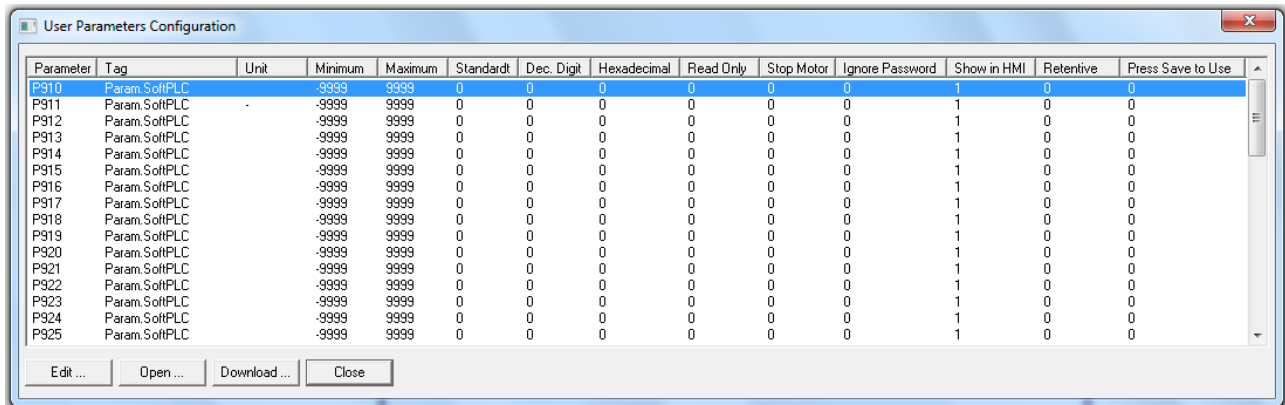
## 5.5 VIEW – USER PARAMETER CONFIGURATION

It opens an attribute visualization window for all the user parameters. With a double click on the selected parameter, it is permitted the configuration of these attributes, which includes:

- Parameter descriptive text (up to 21 characters);
- Unit selection;
- Minimum and maximum limit;
- Default value;
- Number of decimal positions;
- Hexadecimal or regular format;
- Reading or writing only;
- Modification only with a stopped motor or online;
- Ignore the password (allow modification regardless of the inverter password (P000)) or normal;

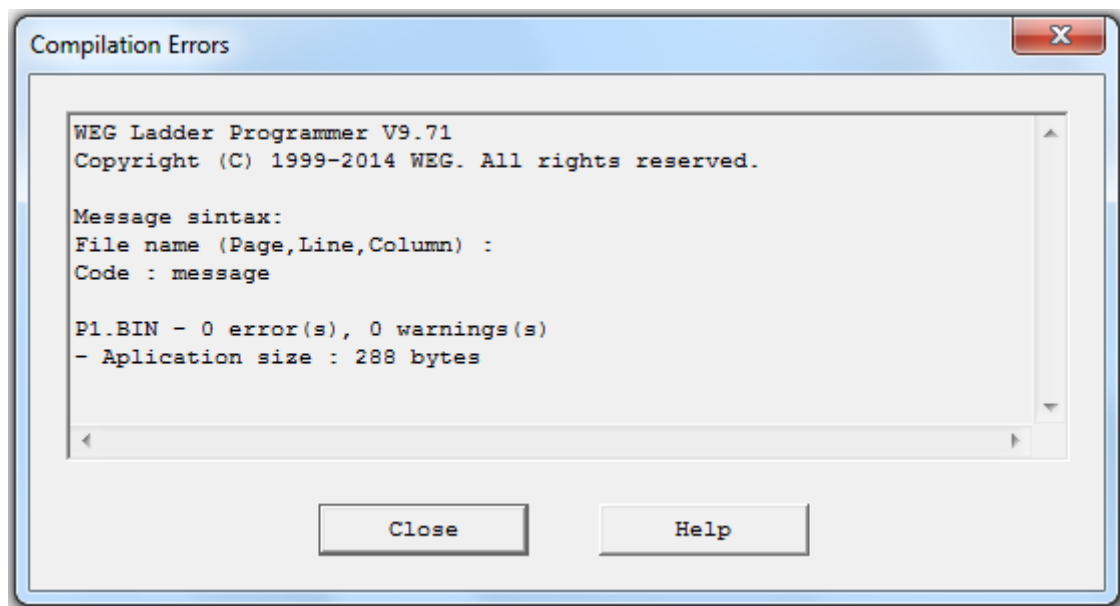
- Display or hide the parameter;
- Allow saving the parameter value (retentive), when it is used in some blocks (PLC, Calculations and Transfers) on power down;
- Configuration parameter which allows modification with the motor running.

Those configurations can be transferred to the CFW100 with the “Download” button.



### 5.6 CONSTRUCT – COMPILE

It analyzes the application and generates the compiled code for the specified equipment.



### 5.7 COMMUNICATION – CONFIGURATION

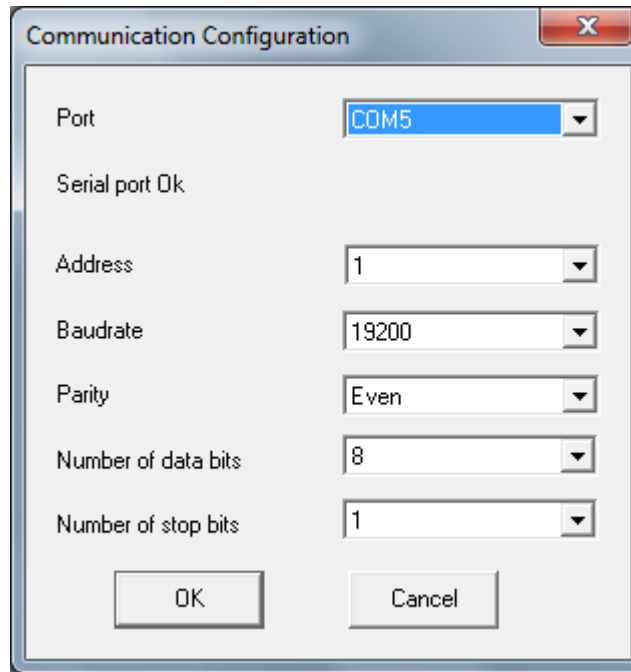
The Serial port is used for the CFW100.



#### NOTE!

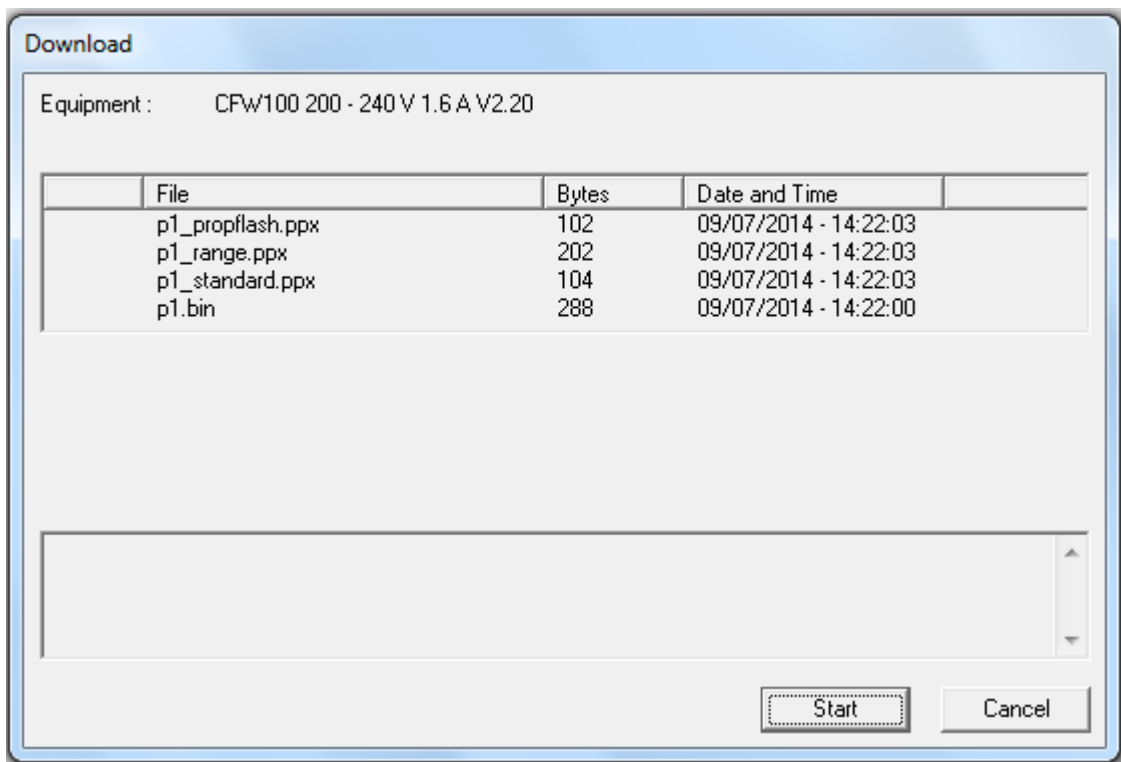
It is recommended to use the CFW100-CRS485 and CFW100-CUSB accessories to establish the communication of the CFW100 with the WLP.





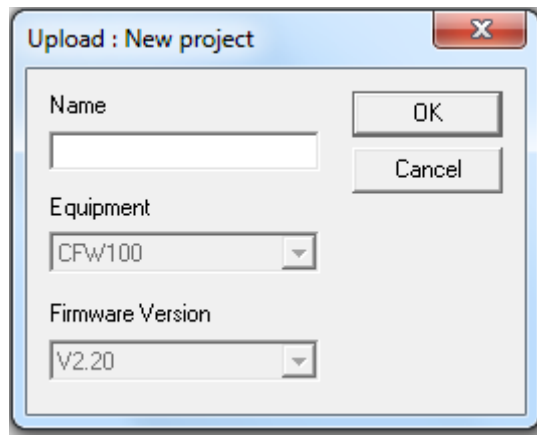
### 5.8 COMMUNICATION – DOWNLOAD

This command allows downloading the application and/or user parameter configurations to the CFW100.



### 5.9 COMMUNICATION – UPLOAD

This command makes it possible to upload and open the application installed on the CFW100, provided that the password is valid.



## 6 ALARMS, FAULTS AND POSSIBLE CAUSES

**Table 6.1:** "Alarms", "Faults" and possible causes

| Fault/Alarm                                           | Description                                                                                          | Possible Causes                                                                                                                                                                                                                   |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A702:<br>Inverter Disabled                            | It occurs when a SoftPLC movement block (REF Block) is not active.                                   | <ul style="list-style-type: none"> <li>Check if the drive general enable command is active.</li> </ul>                                                                                                                            |
| A704:<br>Two Movem. Enabled                           | It occurs when 2 or more movement blocks (REF Block) are enabled simultaneously.                     | <ul style="list-style-type: none"> <li>Check the user program logic.</li> </ul>                                                                                                                                                   |
| A706:<br>SPLC Ref. Not Prog.                          | It occurs when a movement block is enabled and the speed reference is not programmed for the SoftPLC | <ul style="list-style-type: none"> <li>Check the programming of the references in the local and/or remote modes (P221 and P222).</li> </ul>                                                                                       |
| F711:<br>The upload of the SoftPLC application failed | The upload or the SoftPLC application failed.                                                        | <ul style="list-style-type: none"> <li>Fault in the SoftPLC boot by the CPU.</li> <li>Loaded application incompatible (P900=2) and Command for Application (P901=0);</li> </ul>                                                   |
| A712:<br>SoftPLC protected against copy               | It occurs when there is an attempt to copy the SoftPLC application protected against copies.         | <ul style="list-style-type: none"> <li>Attempt to copy WLP application protected against copies ("never permit to copy").</li> <li>Attempt to copy the WLP from a protected copy ("never permit to copy from a copy");</li> </ul> |