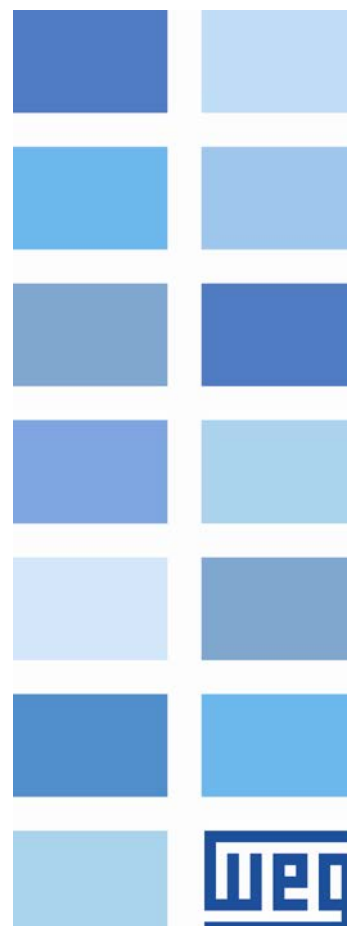


# Crane Vertical Motion

CFW-11

## Application Manual

Language: English  
Document: 10001257576 / 02







# **Crane Vertical Motion Application Manual**

Series: CFW-11

Language: English

Document Number: 10001257576 / 02

Publication Date: 01/2016

# CONTENTS

|  |           |
|--|-----------|
| <b>ABOUT THE MANUAL .....</b>  | <b>6</b>  |
| ABBREVIATIONS AND DEFINITIONS .....                                  | 6         |
| NUMERICAL REPRESENTATION .....                                       | 6         |
| <b>QUICK PARAMETER REFERENCE, FAULTS AND ALARMS .....</b>            | <b>7</b>  |
| <b>1 INTRODUCTION TO THE CRANE .....</b>                             | <b>10</b> |
| 1.1 CRANE VERTICAL MOTION .....                                      | 10        |
| 1.2 CRANE HORIZONTAL MOTION .....                                    | 10        |
| 1.3 FREQUENCY INVERTER USE ADVANTAGES .....                          | 11        |
| 1.4 PRECAUTIONS IN THE FREQUENCY INVERTER SELECTION .....            | 11        |
| 1.5 FREQUENCY INVERTER AND BRAKING RESISTOR SELECTION CRITERIA ..... | 12        |
| 1.5.1 Vertical Motion .....  | 12        |
| 1.5.2 Horizontal Motion .....  | 13        |
| 1.5.3 General Notes .....  | 14        |
| <b>2 CRANE VERTICAL MOTION .....</b>                                 | <b>15</b> |
| 2.1 CONTROL CONNECTIONS .....  | 15        |
| 2.1.1 Speed Reference via Electronic Potentiometer (EP) .....        | 16        |
| 2.1.2 Speed Reference via Digital Inputs .....                       | 17        |
| 2.1.3 Speed Reference via Analog Input AI1 .....                     | 18        |
| 2.1.4 Speed Reference via Communication Networks .....               | 19        |
| 2.2 BRAKE SYSTEM .....   | 20        |
| 2.2.1 Connection Diagram .....                                       | 20        |
| <b>3 PARAMETERS DESCRIPTION .....</b>                                | <b>22</b> |
| 3.1 ORIGIN OF THE COMMANDS .....                                     | 22        |
| 3.1.1 Configuration of the Commands .....                            | 23        |
| 3.2 RAMPS .....  | 24        |
| 3.3 SPEED LIMITS .....   | 25        |
| 3.4 DYNAMIC BRAKING .....  | 26        |
| 3.5 SPEED REFERENCES .....   | 26        |
| 3.6 CONTROL WORD .....   | 30        |
| 3.7 CONFIGURATION OF THE LIMIT SWITCHES .....                        | 30        |
| 3.8 DIGITAL INPUTS .....   | 31        |
| 3.9 DIGITAL OUTPUTS .....  | 36        |
| 3.10 ANALOG INPUT .....  | 37        |
| 3.11 LIGHTWEIGHT MODE .....  | 38        |
| 3.12 BRAKE CONTROL .....   | 41        |
| 3.13 OVERWEIGHT .....  | 46        |
| 3.14 SLACK CABLE .....   | 50        |
| 3.15 INVERTER IN TORQUE LIMIT DETECTION .....                        | 53        |
| 3.16 IMPROPER OPERATION .....  | 54        |
| 3.17 MOTOR UMBALANCED CURRENT .....                                  | 55        |
| 3.18 HMI MONITORING .....  | 55        |
| 3.19 READ-ONLY PARAMETERS .....                                      | 56        |
| 3.19.1 Alarm History .....   | 56        |
| 3.19.2 Status Word .....   | 57        |
| <b>4 CREATION AND DOWNLOAD THE APPLICATION .....</b>                 | <b>59</b> |
| <b>5 APPLICATION CONFIGURATION WIZARD .....</b>                      | <b>64</b> |
| <b>6 DOWNLOAD DIALOG BOXES .....</b>                                 | <b>75</b> |

|  |           |
|--|-----------|
| <b>7 MONITORING DIALOG BOXES .....</b>     | <b>76</b> |
| <b>8 TREND VARIABLES DIALOG BOXES.....</b> | <b>81</b> |
| <b>9 PARAMETER VALUE DIALOG .....</b>      | <b>82</b> |

# ABOUT THE MANUAL

This manual provides the necessary description for the crane vertical motion application configuration developed of the CFW-11 frequency inverter SoftPLC function. This manual must be used together with the CFW-11 user manual, the SoftPLC function manual and the WLP software manual.

## ABBREVIATIONS AND DEFINITIONS

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

## NUMERICAL REPRESENTATION

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

## QUICK PARAMETER REFERENCE, FAULTS AND ALARMS

| Parameter | Description  | Adjustable Range  | Factory Setting | User Setting | Properties | Groups | Page |
|-----------|--|---|-----------------|--------------|------------|--------|------|
| P1010     | Crane Vertical Motion Version                                | 0.00 to 10.00   |                 |              | ro         | 50     | 56   |
| P1011     | Last Alarm   | 0 to 999  |                 |              | ro         | 50     | 56   |
| P1012     | Last Alarm Date  | 01.01 to 31.12  |                 |              | ro         | 50     | 56   |
| P1013     | Last Alarm Time  | 00.00 to 23.59  |                 |              | ro         | 50     | 57   |
| P1014     | Second Alarm   | 0 to 999  |                 |              | ro         | 50     | 56   |
| P1015     | Second Alarm Date  | 01.01 to 31.12  |                 |              | ro         | 50     | 56   |
| P1016     | Second Alarm Time  | 00.00 to 23.59  |                 |              | ro         | 50     | 57   |
| P1017     | Third Alarm  | 0 to 999  |                 |              | ro         | 50     | 56   |
| P1018     | Third Alarm Date   | 01.01 to 31.12  |                 |              | ro         | 50     | 56   |
| P1019     | Third Alarm Time   | 00.00 to 23.59  |                 |              | ro         | 50     | 57   |
| P1020     | Crane Vertical Motion Status Word 1                          | Bit 0 = General Enabled<br>Bit 1 = Running (RUN)<br>Bit 2 = Rotation Direction<br>Bit 3 = LOC/REM<br>Bit 4 = Fault Condition<br>Bit 5 = Undervoltage<br>Bit 6 = Alarm Condition<br>Bit 7 = Hoisting Command<br>Bit 8 = Lowering Command<br>Bit 9 = Brake Release Command<br>Bit 10 to 15 = Reserved   |                 |              | ro         | 50     | 57   |
| P1021     | Crane Vertical Motion Status Word 2                          | Bit 0 = Lightweight Operation<br>Bit 1 = Coast to Stop<br>Bit 2 = Fast Stop<br>Bit 3 = Emergency Stop<br>Bit 4 = Stop by Simultaneous Commands<br>Bit 5 = Hoisting Slowdown<br>Bit 6 = Stop Hoisting<br>Bit 7 = Stop Lowering<br>Bit 8 = Reserved<br>Bit 9 = Overweight<br>Bit 10 = Slack Cable Alarm<br>Bit 11 = Slack Cable Fault<br>Bit 12 = Inverter in Torque Limit<br>Bit 13 = Improper Operation<br>Bit 14 = Reserved<br>Bit 15 = Reserved         |                 |              | ro         | 50     | 58   |
| P1022     | Communication Network Control Word                           | Bit 0 = Load Hoisting<br>Bit 1 = Load Lowering<br>Bit 2 to 15 = Reserved  | 0               |              | rw         | 50     | 30   |
| P1023     | Speed Reference Control Configuration                        | 0 = Speed Reference via Electronic Potentiometer (EP)<br>1 = One Speed Reference via Digital Input DI4<br>2 = Two Speed References via Digital Input DI4<br>3 = Three Speed References via Digital Input DI4 and DI5<br>4 = Four Speed References via Digital Input DI4 and DI5<br>5 = Five Speed References via Digital Input DI4, DI5 and DI6<br>6 = Speed Reference via Analog Input AI1 (Step Less)<br>7 = Speed Reference via Communication Networks | 2               |              | cfg        | 50     | 26   |
| P1024     | Enable use of a Filter in the Hoisting and Lowering Commands | 0 = Off<br>1 = On   | 0               |              |            | 50     | 23   |

| Parameter | Description   | Adjustable Range  | Factory Setting | User Setting | Properties | Groups | Page |
|-----------|---|---|-----------------|--------------|------------|--------|------|
| P1025     | Limit Switches Configuration  | 0 = Without Limit Switches<br>1 = Stop Hoisting via DI5<br>2 = Hoisting Slowdown via DI6<br>3 = Stop Hoisting via DI5 and Stop Lowering via DI6<br>4 = Hoisting Slowdown via DI3, Stop Hoisting via DI5 and Stop Lowering via DI6<br>5 = Hoisting Slowdown via DI4, Stop Hoisting via DI5 and Stop Lowering via DI6<br>6 = Hoisting Slowdown via DI9, Stop Hoisting via DI10 and Stop Lowering via DI11 | 0               |              | cfg        | 50     | 30   |
| P1026     | Motor Rotation Direction Inversion  | 0 = Off<br>1 = On   | 0               |              | cfg        | 50     | 23   |
| P1027     | Motor Demagnetization Time  | 0 to 65000 s  | 600 s           |              |            | 50     | 24   |
| P1028     | Speed Hysteresis for Inverter in Torque Limit Detection                       | 0.0 to 50.0 %   | 10.0 %          |              |            | 50     | 54   |
| P1029     | Inverter in Torque Limit Fault (F775) Delay Time                              | 0.00 to 650.00 s  | 0.75 s          |              |            | 50     | 54   |
| P1030     | Speed Reference via Communication Networks                                    | 0.0 to 1020.0 Hz  | 0.0 Hz          |              |            | 50     | 27   |
| P1031     | Speed Reference 1   | 0.0 to 1020.0 Hz  | 6.0 Hz          |              |            | 50     | 27   |
| P1032     | Speed Reference 2   | 0.0 to 1020.0 Hz  | 60.0 Hz         |              |            | 50     | 28   |
| P1033     | Speed Reference 3   | 0.0 to 1020.0 Hz  | 0.0 Hz          |              |            | 50     | 28   |
| P1034     | Speed Reference 4   | 0.0 to 1020.0 Hz  | 0.0 Hz          |              |            | 50     | 29   |
| P1035     | Speed Reference 5   | 0.0 to 1020.0 Hz  | 0.0 Hz          |              |            | 50     | 29   |
| P1036     | Dwell Time at Speed Reference 1   | 0.00 to 650.00 s  | 0.50 s          |              |            | 50     | 29   |
| P1037     | Hoisting Current Threshold for Lightweight Detection                          | 0.0 to 3000.0 A   | 14.0 A          |              |            | 50     | 38   |
| P1038     | Lowering Current Threshold for Lightweight Detection                          | 0.0 to 3000.0 A   | 10.0 A          |              |            | 50     | 38   |
| P1039     | Speed Threshold for Lightweight Detection Enabling                            | 0.0 to 1020.0 Hz  | 0.0 Hz          |              |            | 50     | 39   |
| P1041     | Brake Release Frequency Threshold   | 0.0 to 1020.0 Hz  | 4.0 Hz          |              |            | 50     | 41   |
| P1042     | Load Hoisting Current Threshold   | 0.0 to 3000.0 A   | 0.0 A           |              |            | 50     | 41   |
| P1043     | Load Lowering Current Threshold   | 0.0 to 3000.0 A   | 0.0 A           |              |            | 50     | 41   |
| P1044     | Load Hoisting Torque Threshold  | 0.0 to 350.0 %  | 50.0 %          |              |            | 50     | 41   |
| P1045     | Load Lowering Torque Threshold  | 0.0 to 350.0 %  | 30.0 %          |              |            | 50     | 41   |
| P1046     | Brake Response Time to Release  | 0.00 to 650.00 s  | 0.10 s          |              |            | 50     | 42   |
| P1047     | Inhibition of the Brake Closing during a Hoisting/Lowering Command Transition | 0 = Off<br>1 = On   | 0               |              |            | 50     | 42   |
| P1048     | Brake Closing Frequency Threshold   | 0.5 to 1020.0 Hz  | 2.5 Hz          |              |            | 50     | 42   |
| P1049     | Delay Time for Brake Closing  | 0.00 to 650.00 s  | 0.00 s          |              |            | 50     | 42   |
| P1050     | Time to Enable a new Command to Brake Release                                 | 0.10 to 650.00 s  | 0.50 s          |              |            | 50     | 43   |
| P1051     | Overweight Current Threshold in the Minimum Speed                             | 0.0 to 3000.0 A   | 50.0 A          |              |            | 50     | 46   |
| P1052     | Overweight Current Threshold in the Maximum Speed                             | 0.0 to 3000.0 A   | 40.0 A          |              |            | 50     | 47   |
| P1053     | Overweight Detection Delay Time   | 0.00 to 650.00 s  | 1.00 s          |              |            | 50     | 47   |
| P1054     | Overweight Alarm (A770) Delay Time  | 0.00 to 650.00 s  | 0.50 s          |              |            | 50     | 47   |
| P1055     | Load Detection Time   | 0.00 to 650.00 s  | 0.00 s          |              |            | 50     | 50   |
| P1056     | Slack Cable Alarm (A772) Delay Time   | 0.00 to 650.00 s  | 0.50 s          |              |            | 50     | 50   |
| P1057     | Slack Cable Fault (F773) Delay Time   | 0.00 to 650.00 s  | 0.00 s          |              |            | 50     | 51   |
| P1058     | Number of Consecutive Alarms for Improper Fault (F777)                        | 0 to 10   | 3               |              |            | 50     | 54   |
| P1059     | Period of Time for Improper Fault (F777)                                      | 0 to 65000 s  | 120 s           |              |            | 50     | 55   |



| Fault/Alarm                             | Description  | Possible causes  |
|---|--|--|
| A750:<br>Lightweight Operation          | The application is operating in the lightweight mode.  | The motor speed is greater than P1039 and the motor current is less than P1037 when a load hoisting command is being executed or less than P1038 when a load lowering command is being executed. |
| A752:<br>Coast to Stop                  | The general enable signal has been removed, releasing the motor to cast down.                                      | Digital input DI3 with logical level "0"   |
| A754:<br>Fast Stop                      | The fast stop command has been activated.  | Digital input DI3 with logical level "0"   |
| A756:<br>Emergency Stop                 | The emergency stop command has been activated.   | Digital input DI3 with logical level "0"   |
| A758:<br>Stop by Simultaneous Commands  | The application has been stopped because of the simultaneous activation of the hoisting and the lowering commands. | Digital inputs DI1 and DI2 with logical level "1"  |
| A760:<br>Hoisting Slowdown Limit Switch | The hoisting slowdown limit switch has been actuated.  | The digital input DI3, DI4, DI6 or DI9 is with logical level "0". The digital input for that function is defined by the parameter P1025.   |
| A762:<br>Stop Hoisting Limit Switch     | The stop hoisting limit switch has been actuated.  | The digital input DI5 or DI10 is with logical level "0". The digital input for that function is defined by the parameter P1025.  |
| A764:<br>Stop Lowering Limit Switch     | The stop lowering limit switch has been actuated.  | The digital input DI6 or DI11 is with logical level "0". The digital input for that function is defined by the parameter P1025.  |
| A770:<br>Detected Overweight            | An attempt to hoist a load heavier than the maximum operational capacity of the application has been detected      | The motor current during the hoisting stage is greater than or equal to the value adjusted in P1050.   |
| A772:<br>Detected Slack Cable           | During the lowering stage, the load stayed below the minimum operational capacity of the crane vertical motion.    | The load was not pulled down by its weight during the lowering stage, it was pushed down instead.  |
| F773:<br>Detected Slack Cable           | During the lowering stage, the load stayed below the minimum operational capacity of the crane vertical motion.    | The load was not pulled down by its weight during the lowering stage, it was pushed down instead.  |
| F775:<br>Inverter in Torque Limit       | The frequency inverter reached the adjusted torque limit because of excessive load or demanded force.              | The difference between the actual speed and the speed reference is greater than or equal to the hysteresis value adjusted in P1056.  |
| F777:<br>Improper Operation             | Several consecutive alarm messages occurred during a certain period, disabling the frequency inverter.             | The number of consecutive alarms generated during a certain period is greater than or equal to the value adjusted in P1058.  |

## 1 INTRODUCTION TO THE CRANE

The applicatives for crane developed for the CFW-11 SoftPLC function provides flexibility to the user in the system use and in its configuration. It uses the tools already developed for the WLP programming software, together with configuration wizards and monitoring dialog boxes.

**DANGER!**  
**Crushing Hazard**

In order to ensure safety in load lifting applications, electric and/or mechanical devices must be installed outside the inverter for protection against accidental fall of load.

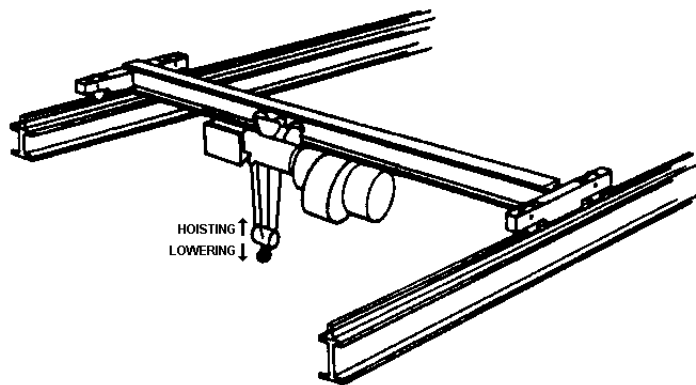
**DANGER!**

This product was not designed to be used as a safety element. Additional measures must be taken so as to avoid material and personal damages.

The product was manufactured under strict quality control, however, if installed in systems where its failure causes risks of material or personal damages, additional external safety devices must ensure a safety condition in case of a product failure, preventing accidents.

### 1.1 CRANE VERTICAL MOTION

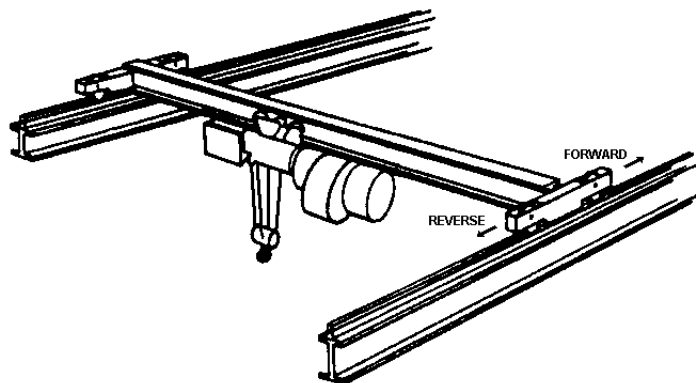
The crane vertical motion consists in moving the load vertically by executing commands to move it up and down. The load hoisting and its lowering are the vertical motions.



*Figure 1.1 – Crane vertical motion*

### 1.2 CRANE HORIZONTAL MOTION

The crane horizontal motion (or load translation) consists in moving the load in the horizontal direction by executing commands to forward and reverse the load. The long travel, the cross travel, and the boom rotation, among others, are horizontal motions.



*Figure 1.2 – Crane horizontal motion*

### 1.3 FREQUENCY INVERTER USE ADVANTAGES

We are able to evaluate the advantages of the variable frequency inverter use for crane vertical motion or for crane horizontal motion, under the following aspects:

- **Elimination of the electrical line disturbances:** with the use of the inverter, by maintaining the motor flux constant (varying both frequency and voltage), it is possible to have the motor rated torque in the entire speed range. Therefore, with the inverter it becomes possible to start high torque loads with currents that are close to motor rated current thus eliminating the high direct on line motor starting currents (up to  $7 \times I_n$ ). The frequency inverter eliminates those effects that cause voltage sags, the need of over sizing the switchgear, cables and transformers, avoiding nuisance trips, etc.;
- **Elimination of the mechanical stress:** frequency inverters allow the programming of soft acceleration and deceleration ramps, still giving out high torque, eliminating mechanical stress while starting, during speed changes (if compared to the commutations of slip ring motor resistances), and while stopping, since the mechanical brake does not longer engage for regular stopping (braking becomes electrical), being used only for parking and emergencies. In this way downtime due to maintenance, adjustment of brake shoes, due to broken coupling, bearings or gearboxes, is drastically reduced. Easier load positioning and better precision are also achieved. All the settings are programmable and can be easily changed according to the application requirements (acceleration and deceleration ramps, speeds, etc.);
- **Energy savings:** there is a reduction in the energy consumption because the motor power (kW) is determined by the driven load and by the operation speed, consuming only what the process requires, eliminating energy wastes (low efficiency, energy and heat dissipation at slip ring motor drive systems), etc. In production overhead cranes with high duty cycles, the use of active front end frequency inverters (regenerative) becomes feasible, making it possible, besides the above mentioned energy savings for the return to the line of the energy regenerated by lowering and braking the load (when the motor is being driven and operates as a generator);
- **System automation:** the frequency inverter makes the system automation possible by allowing the control through communication networks. By exchanging information with a higher hierarchy system (PLC, supervisory), it allows better process management through monitoring, report emission, etc. It also makes the adaptation to a remote radio control, with pushbuttons or joystick, easier;
- **Standardization:** it makes the use of standard induction motors possible, facilitating the plant motor standardization, for maintenance and spares availability;
- **Comfort:** the reduction of mechanical noises and vibrations improve operator and area personnel comfort, safety and productivity.

### 1.4 PRECAUTIONS IN THE FREQUENCY INVERTER SELECTION

For the great majority of loads (pumps, fans, compressors, etc. ) the frequency inverter selection is made through the electric motor rated current, using an inverter with equal or slightly higher rated current (for environmental conditions: temperature up to  $50^\circ\text{C}$  and altitude up to 1000 m).

This selection also considers 150 % overload during 60 s every 10 minutes for heavy duty (HD) loads, or 110 % overload during 60 seconds every 10 minutes for normal duty (ND) loads.

For crane applications, where there is need of starting heavy loads with relatively short acceleration times, it is certain that the inverter has to operate with overload to overcome the inertia during acceleration or deceleration, and normally the duty cycle is higher than the supported by the regular overload capability of frequency inverters. Therefore, in most of cases, it is necessary to take into account the worst-case duty cycle for a 10-minute operation period, calculating the rms current value for that period.

The chosen inverter will be for a current equal or higher than the calculated rms value. It must also be observed whether any overload current in the evaluated cycle is higher than 1.5 times the rated inverter current, where the inverter must be oversized in order to fulfill this requirement.

## Introduction to the Crane

### 1.5 FREQUENCY INVERTER AND BRAKING RESISTOR SELECTION CRITERIA

Some criteria have been established for the selection of the frequency inverter and the braking resistor in a crane application, according to the type of motion to be executed:

#### 1.5.1 Vertical Motion

The inverter must be selected according to its heavy duty rated current ( $I_{HD}$ ) respecting the maximum ambient temperature specified for each model and altitude of 1000 m (3,300 ft), based on the following criteria:

■ For light or moderate duty operation (installations on maintenance shops, light assembly operations, testing laboratories, warehouses, pulp and paper industries, etc. where the load requests are on average less than 50% of rated capacity):

$$I_{HD} = 1.15 \times I_{Motor} \times \left( \frac{P_{Load}}{P_{Motor}} \right)$$

■ For heavy or severe duty operation (installations on heavy machine shops, foundries, heavy steel structures factories, handling steel coils, container handling, timber, storage, scrap, cement factory, sawmills, fertilizer plants, container handling, etc. Where the loading requests are on average more than 50% of the rated capacity):

$$I_{HD} = 1.30 \times I_{Motor} \times \left( \frac{P_{Load}}{P_{Motor}} \right)$$

Being:

$I_{HD}$  = frequency inverter rated heavy duty current (A);

$I_{Motor}$  = motor rated current considering the service factor (A);

$P_{Motor}$  = motor rated power considering the service fact (kW);

$P_{Load}$  = power required by the load (kW).



#### NOTE!

In case of doubt about the duty operation, use the biggest factor (1.30) to determine the heavy duty current ( $I_{HD}$ ) of the CFW-11 frequency inverter.



#### NOTE!

For temperatures higher than the specified as maximum (see table 1.1), limited to 10 °C above, the oversizing factor (1.15 or 1.30) to determine the heavy duty current ( $I_{HD}$ ) must be increased by 0.02 per °C.



#### NOTE!

For altitude above 1000 m (3,300 ft) to 4000 m (13,200 ft), oversizing factor (1.15 or 1.30) to determine the heavy duty current ( $I_{HD}$ ) must be increased by 0.01 to 100 m (330 ft) above 1000 m (3,300 ft).



#### NOTE!

For situations where the motor was oversized above the power required by the load, attention should be paid to the heavy duty current ( $I_{HD}$ ) of the CFW-11 inverter at least equal to the rated motor current with the service factor.



#### NOTE!

The oversizing factor (1.15 or 1.30) is based on the standard acceleration ramps of the application that are 3.0 seconds to accelerate and 2.0 seconds to decelerate. For smaller acceleration and deceleration times may need to increase these factors.

**Table 1.1** – Surrounding air temperature as CFW-11 inverter frame

| CFW-11 Inverter Frame          | Surrounding Air Temperature | Temperature (maximum) with Derating |
|--------------------------------|-----------------------------|-------------------------------------|
| A, B, C and D                  | -10 to 50 °C (14 to 122 °F) | 60 °C (140 °F)                      |
| E, F e G (except CFW110720...) | -10 to 45 °C (14 to 113 °F) | 55 °C (131 °F)                      |
| CFW110720...                   | -10 to 40 °C (14 to 104 °F) | 50 °C (122 °F)                      |
| IP54 1, 2 and 3                | -10 to 40 °C (14 to 104 °F) | 50 °C (122 °F)                      |

The braking resistor must be selected according to the equation:

$$P_{\text{Resistor}} = 0.70 \times P_{\text{Load}} \text{ with \%ED} = 100.0\%$$

Being:

$P_{\text{Resistor}}$  = braking resistor power (kW);

$P_{\text{Load}}$  = power required by the load (kW).

%ED = braking duty cycle.

**NOTE!**

Refer to the CFW-11 user's guide, table 3.3, to verify the ohmic value of the braking resistor to be used according to the frequency inverter model.

**NOTE!**

If the power required by the load is unknown use the motor rated power considering the service fact to the dimensioning of the braking resistor.

**1.5.2 Horizontal Motion**

The inverter must be selected according to its rated normal duty current ( $I_{ND}$ ):

$$I_{ND} = 1.00 \times I_{\text{Motor}}$$

Being:

$I_{ND}$  = frequency inverter rated normal duty current;

$I_{\text{Motor}}$  = motor rated current considering the service factor (A);

**NOTE!**

For temperatures higher than the specified as maximum (see table 1.1), limited to 10 °C above, the oversizing factor (1.00) to determine the normal duty current ( $I_{ND}$ ) must be increased by 0.02 per °C.

**NOTE!**

For altitude above 1000 m (3,300 ft) to 4000 m (13,200 ft), oversizing factor (1.00) to determine the normal duty current ( $I_{ND}$ ) must be increased by 0.01 to 100 m (330 ft) above 1000 m (3,300 ft).

The braking resistor must be selected according to the equation:

$$P_{\text{Resistor}} = 0.40 \times P_{\text{Load}} \text{ with \%ED} = 50.0\%$$

Being:

$P_{\text{Resistor}}$  = braking resistor power (kW);

$P_{\text{Load}}$  = power required by the load (kW).

%ED = braking duty cycle.

**NOTE!**

Refer to the CFW-11 user's guide, table 3.3, to verify the ohmic value of the braking resistor to be used according to the frequency inverter model.

**NOTE!**

If the power required by the load is unknown use the motor rated power considering the service factor to the dimensioning of the braking resistor.

### 1.5.3 General Notes

- The braking resistor selection can be optimized if the customer provides the power calculated for the load hoisting or for its horizontal motion. E.g., supposing that the power calculated for the hoisting of an overhead crane is 62 kW, the used motor would be a 75 kW (commercial value). In this case, the braking resistor can be obtained from the calculated power, in other words,  $0.7 \times 62 = 43.4$  kW;
- The installation condition, vibration and protection degree must be observed for the braking resistor specification;
- For the replacement of slip ring motors by standard motors, use a minimum factor of 1.2. The inverter selection criteria remain the same, adopting the current of the new motor. Another criterion that can be adopted is to use a motor whose frame is the same of the slip ring motor, provided that the ratio between the power of the new motor and the old one is close to 1.2. The slip ring motors used in cranes usually have bigger frame sizes than the same power range standard motors. The main advantage of adopting this criterion is the easy mechanical adaptation of the new motor.

## 2 CRANE VERTICAL MOTION

The crane vertical motion consists in moving a load vertically, executing commands for hoisting and lowering together with the mechanical brake control, which must assure that the load remains in the intended position when no hoisting or lowering commands exist.

The crane vertical motion control developed for the CFW-11 SoftPLC presents the following characteristics:

- Speed reference selection through electronic potentiometer (EP), logical combination of digital inputs (maximum of 5 references), analog input (step less) or communication networks;
- Commands for load hoisting and load lowering through digital inputs or through communication networks;
- Option of inverting the motor rotation direction adopted as standard for load hoisting and load lowering;
- Linear or “S” curve acceleration and deceleration ramps for crane vertical motion;
- Option of stopping command via digital input, which can be for coast to stop, fast stop or emergency stop with deceleration ramp;
- Minimum and maximum speed limits for crane vertical motion;
- Gain, offset and filter settings for control speed signal through analog input;
- Mechanical brake release logic controlled by motor frequency and/or motor current and/or motor torque, with independent settings for load hoisting and load lowering commands;
- Adjust of the brake response time to release avoids the increase of the motor frequency;
- Mechanical brake closing logic controlled only by motor frequency (total speed reference in Hz);
- Possibility of brake closing delay time;
- Adjust of the time to enable a new command to brake release after the command to brake closing preventing a new command to be generated without the brake being mechanically closed;
- Possibility of brake inhibition during the transition from hoisting to lowering and vice-versa (only with encoder);
- Digital inputs programmed for limit switches (over travel limits) functions to reduce the speed (slowdown) while hoisting, to stop hoisting and to stop lowering;
- Lightweight detection while hoisting or lowering the load;
- Overweight detection while hoisting the load, with subsequent alarm;
- Slack cable detection while lowering the load, with subsequent alarm or fault;
- Inverter in torque limitation detection while hoisting or lowering the load, with subsequent fault;
- Fault trip by improper use of the crane vertical motion;
- Fault trip due to motor current unbalance;
- Crane vertical motion alarm (the last three) and fault (the last ten) history;
- Possibility of applicative implementation or modification by the user through the WLP software.

### 2.1 CONTROL CONNECTIONS

The selection of the speed reference defines four different control connection types, because it can be through electronic potentiometer (EP), logical combination of digital inputs (maximum of 5 references), analog input (step less) or communication networks. The control connections (analog inputs/outputs and digital inputs/outputs) are made at the CFW-11 electronic control board CC11 terminal strip XC1.



**NOTE!**

Refer to the CFW-11 frequency inverter manual for more information on the connections.

The control connections (analog inputs/outputs and digital inputs/outputs) wired at the CFW-11 electronic control board CC11 terminal strip XC1, when the speed reference is through electronic potentiometer (EP), are presented next.

*Figure 2.1 – Signals at the XC1 terminal strip for crane vertical motion with speed reference via electronic potentiometer*



It is necessary to install the IOC-01 or IOC-02 accessory module in case the DI9, DI10 and DI11 digital inputs and/or the DO6, DO7 and DO8 digital outputs use is required. Refer to the CFW-11 frequency inverter manual for more information on accessory modules.



### 2.1.2 Speed Reference via Digital Inputs

The control connections (analog inputs/outputs and digital inputs/outputs) wired at the CFW-11 electronic control board CC11 terminal strip XC1, when the speed reference is through the logical combination of digital inputs for 5 references, are presented next.

| XC1 Terminal Strip |       | Default Function for Crane Vertical Motion via Digital Inputs |
|--------------------|-------|---|
| 1                  | REF+  | Positive reference for potentiometer                          |
| 2                  | AI1+  | Analog input # 1 (0 - 10 V): No function                      |
| 3                  | AI1-  |   |
| 4                  | REF-  | Negative reference for potentiometer                          |
| 5                  | AI2+  | Analog input # 2 (0 - 10 V): No function                      |
| 6                  | AI2-  |   |
| 7                  | AO1   | Analog output # 1: Motor speed                                |
| 8                  | AGND  |   |
| 9                  | AO2   | Analog output # 2: Motor current                              |
| 10                 | AGND  |   |
| 11                 | DGND  | Reference (0 V) for the 24 Vdc power supply                   |
| 12                 | COM   | Common point of the digital inputs                            |
| 13                 | 24VCC | 24 Vdc power supply   |
| 14                 | COM   | Common point of the digital inputs                            |
| 15                 | DI1   | Digital input # 1: Load hoisting command                      |
| 16                 | DI2   | Digital input # 2: Load lowering command                      |
| 17                 | DI3   | Digital input # 3: Emergency stop                             |
| 18                 | DI4   | Digital input # 4: 1st DI for speed reference                 |
| 19                 | DI5   | Digital input # 5: 2nd DI for speed reference                 |
| 20                 | DI6   | Digital input # 6: 3rd DI for speed reference                 |
| 21                 | NC1   | Digital output #1 DO1 (RL1): No fault                         |
| 22                 | C1    |   |
| 23                 | NO1   |   |
| 24                 | NC2   | Digital output #2 DO2 (RL2): Run                              |
| 25                 | C2    |   |
| 26                 | NO2   |   |
| 27                 | NC3   | Digital output #3 DO3 (RL3): Brake release                    |
| 28                 | C3    |   |
| 29                 | NO3   |   |

**Figure 2.2** – Signals at the XC1 terminal strip for crane vertical motion with speed reference via the logical combination of digital inputs

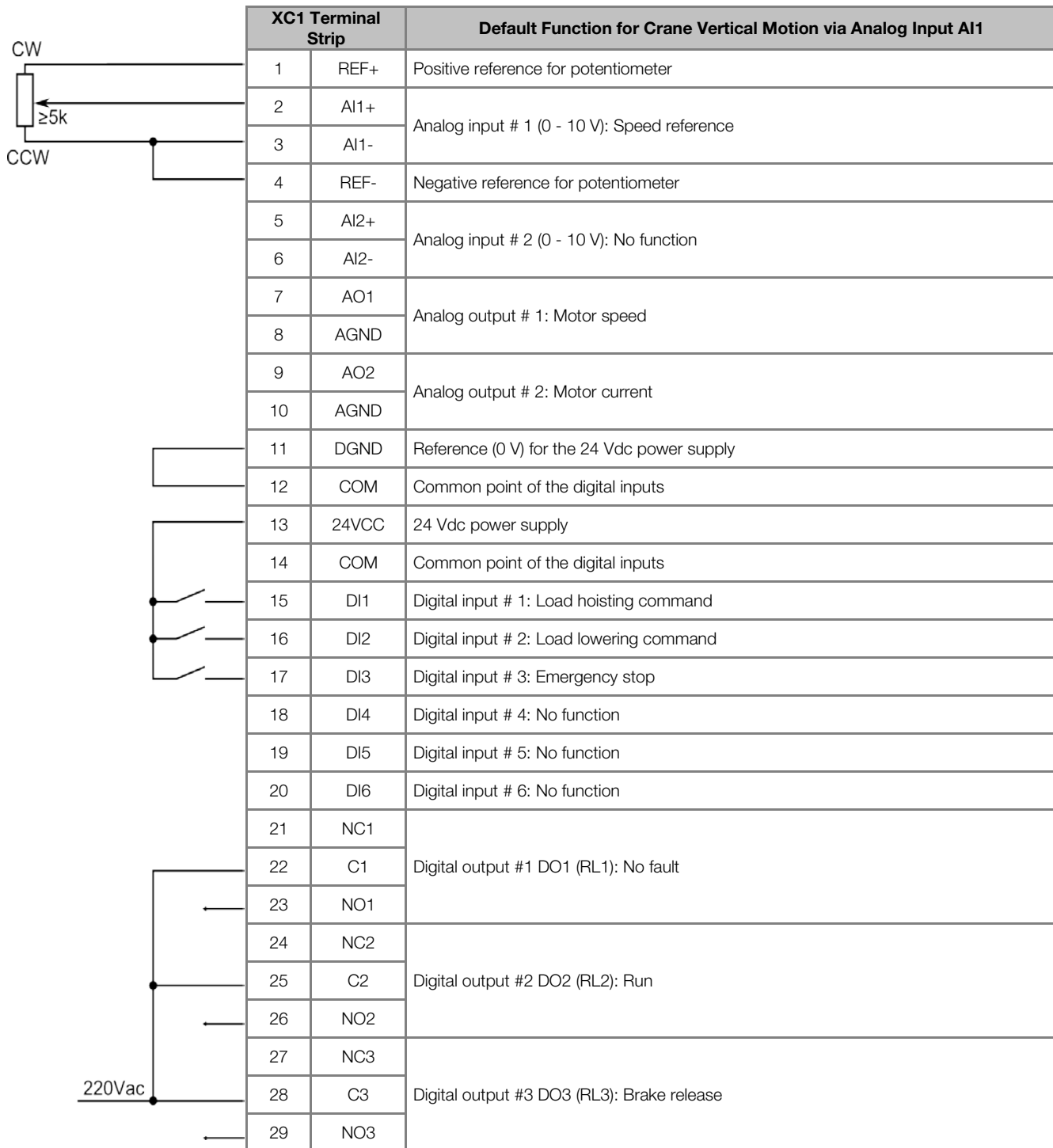


#### NOTE!

It is necessary to install the IOC-01 or IOC-02 accessory module in case the DI9, DI10 and DI11 digital inputs and/or the DO6, DO7 and DO8 digital outputs use is required. Refer to the CFW-11 frequency inverter manual for more information on accessory modules.

### 2.1.3 Speed Reference via Analog Input AI1

The control connections (analog inputs/outputs and digital inputs/outputs) wired at the CFW-11 electronic control board CC11 terminal strip XC1, when the speed reference is through the analog input AI1, are presented next.



**Figure 2.3** – Signals at the XC1 terminal strip for crane vertical motion with speed reference via the analog input AI1



**NOTE!**

It is necessary to install the IOC-01 or IOC-02 accessory module in case the DI9, DI10 and DI11 digital inputs and/or the DO6, DO7 and DO8 digital outputs use is required. Refer to the CFW-11 frequency inverter manual for more information on accessory modules.

## 2.1.4 Speed Reference via Communication Networks

The control connections (analog inputs/outputs and digital inputs/outputs) wired at the CFW-11 electronic control board CC11 terminal strip XC1, when the speed reference is through communication networks, are presented next.

| XC1 Terminal Strip |       | Default Function for Crane Vertical Motion via Communication Networks |
|--------------------|-------|---|
| 1                  | REF+  | Positive reference for potentiometer                                  |
| 2                  | AI1+  | Analog input # 1 (0 - 10 V): No function                              |
| 3                  | AI1-  |   |
| 4                  | REF-  | Negative reference for potentiometer                                  |
| 5                  | AI2+  | Analog input # 2 (0 - 10 V): No function                              |
| 6                  | AI2-  |   |
| 7                  | AO1   | Analog output # 1: Motor speed  |
| 8                  | AGND  |   |
| 9                  | AO2   | Analog output # 2: Motor current                                      |
| 10                 | AGND  |   |
| 11                 | DGND  | Reference (0 V) for the 24 Vdc power supply                           |
| 12                 | COM   | Common point of the digital inputs                                    |
| 13                 | 24VCC | 24 Vdc power supply   |
| 14                 | COM   | Common point of the digital inputs                                    |
| 15                 | DI1   | Digital input # 1: No function  |
| 16                 | DI2   | Digital input # 2: No function  |
| 17                 | DI3   | Digital input # 3: Emergency stop                                     |
| 18                 | DI4   | Digital input # 4: No function  |
| 19                 | DI5   | Digital input # 5: No function  |
| 20                 | DI6   | Digital input # 6: No function  |
| 21                 | NC1   | Digital output #1 DO1 (RL1): No fault                                 |
| 22                 | C1    |   |
| 23                 | NO1   |   |
| 24                 | NC2   | Digital output #2 DO2 (RL2): Run                                      |
| 25                 | C2    |   |
| 26                 | NO2   |   |
| 27                 | NC3   | Digital output #3 DO3 (RL3): Brake release                            |
| 28                 | C3    |   |
| 29                 | NO3   |   |

*Figure 2.4 – Signals at the XC1 terminal strip for Crane Vertical Motion with speed reference via communication networks*



### NOTE!

It is necessary to install the IOC-01 or IOC-02 accessory module in case the DI9, DI10 and DI11 digital inputs and/or the DO6, DO7 and DO8 digital outputs use is required. Refer to the CFW-11 frequency inverter manual for more information on accessory modules.

## Crane Vertical Motion

### 2.2 BRAKE SYSTEM

The brake is the element of the crane vertical motion responsible for hold the load when the motor is not running. Therefore it is very important that it be configured to operate in the safest way possible.

The electromagnet coil is powered by direct current (DC) which can be supplied by a DC voltage source or bridge rectifier which converts AC to DC current. The bridge rectifier consists of diodes and varistors that filter undesirable voltage spikes and enable fast current shutdown.



#### NOTE!

It is recommended always power the brake by direct current (DC) as it provides greater speed and reliable brake operation.

#### 2.2.1 Connection Diagram



#### NOTE!

The following connection diagrams shown are valid for WEG brake motors. The same must be suitable for other types of brake or brake motor.

##### 2.2.1.1 AC Power Supply

Usually brake motors admit two braking systems: normal and fast.

■ **Normal Braking:** the interruption of DC power to brake closing is done by removal of the AC power supply to terminals 1 and 2.

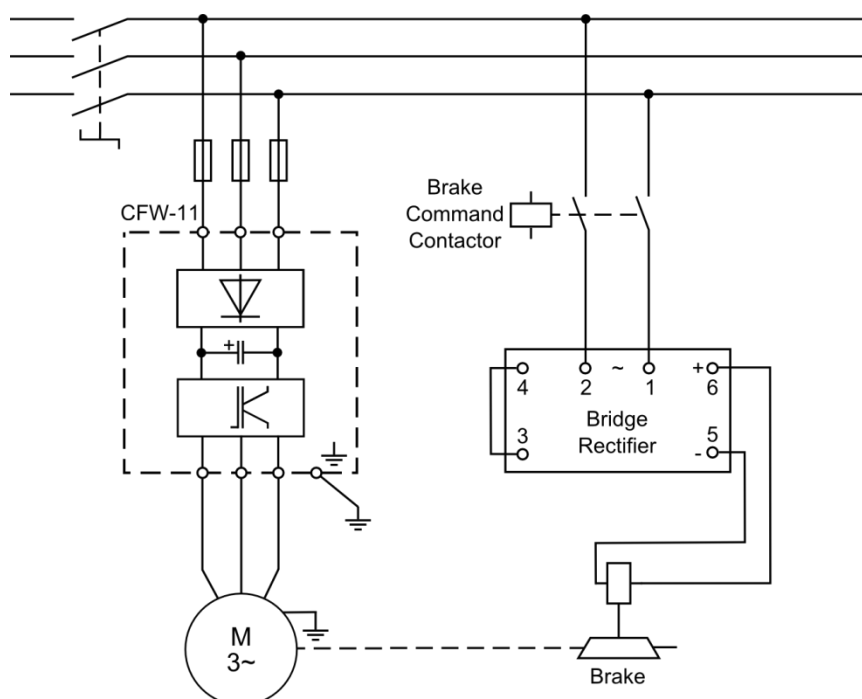
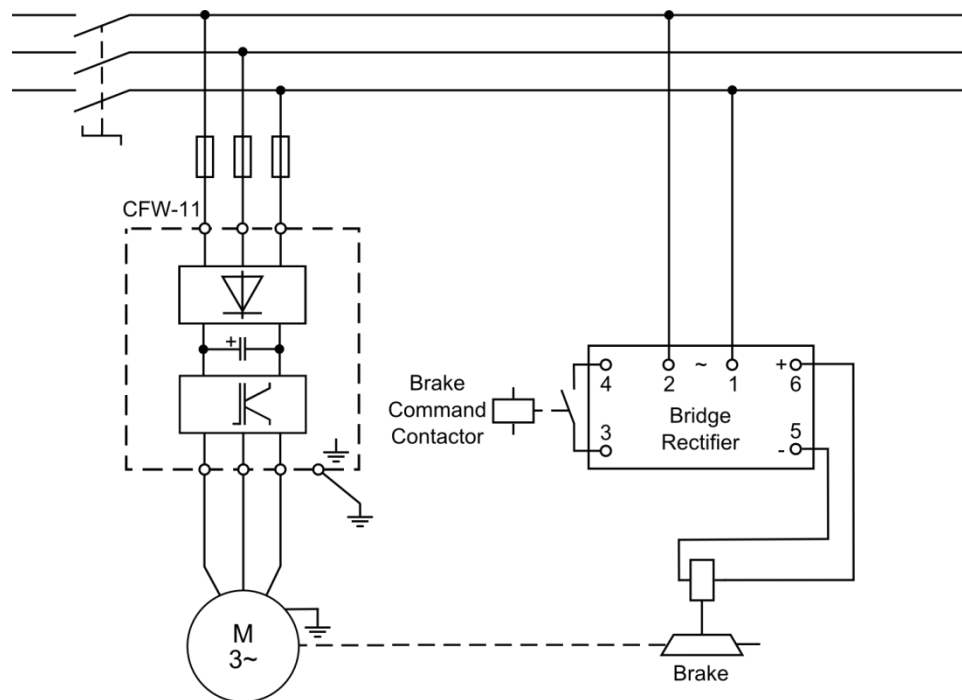


Figure 2.5 – Connection diagram of the bridge rectifier for normal braking

■ **Fast Braking:** the interruption of DC power to brake closing is done directly in the direct current source to terminals 3 and 04 keeping the terminals 1 and 2 on AC power supply.



*Figure 2.6 – Connection diagram of the bridge rectifier for fast braking*

### 2.2.1.2 DC Power Supply

The connection must be made directly on the brake terminals as the voltage on the brake power nameplate.

### 3 PARAMETERS DESCRIPTION

Next, the parameters of the crane vertical motion applicative, for both the CFW-11 frequency inverter and the SoftPLC, will be presented.



#### NOTE!

The adjustable range of the CFW-11 parameters has been customized for the crane vertical motion application. Refer to the CFW-11 programming manual for more details on the parameters.

#### Symbols for the parameter properties:

|               |   |
|---------------|---|
| <b>RO</b>     | Read-only parameter   |
| <b>RW</b>     | Read and write parameter  |
| <b>CFG</b>    | Configuration parameter, value can be programmed only with motor stopped  |
| <b>Vector</b> | Available when a vector control mode is chosen  |
| <b>Net</b>    | Parameter visible on the HMI if the inverter has the network interface installed – RS232, RS485, CAN, Anybus-CC, Profibus – or if the USB interface is connected. |

#### 3.1 ORIGIN OF THE COMMANDS

This parameter group allows the user to configure the origin of the CFW-11 frequency inverter commands. For this application, the inverter control in LOCAL situation is done via HMI and in REMOTE situation via SoftPLC function.

#### LOCAL Situation:

It allows the user to command the motor of crane driven by the CFW-11 inverter disregarding the control logics.

#### REMOTE Situation:

It enables the crane vertical motion control logics, according to the programming performed by the user.

**P0220 – LOCAL/REMOTE Selection Source**

**P0221 – Speed Reference Selection - LOCAL Situation**

**P0222 – Speed Reference Selection - REMOTE Situation**

**P0223 – Forward Reverse Selection - LOCAL Situation**

**P0226 – Forward Reverse Selection - REMOTE Situation**

**P0224 – Run/Stop Selection - LOCAL Situation**

**P0227 – Run/Stop Selection - REMOTE Situation**

**P0225 – JOG Selection - LOCAL Situation**

**P0228 – JOG Selection - REMOTE Situation**



#### NOTE!

Refer to the CFW-11 programming manual for more information on the command origin parameters. Some parameter options have been removed from the configuration wizard.

## Parameters Description

### 3.1.1 Configuration of the Commands

This parameter group allows the user to configure some of the CFW-11 frequency inverter commands, necessary for the crane vertical motion applicative.

#### P0229 – Stop Mode Selection

|                               |                                 |                         |   |
|-------------------------------|---------------------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 = Ramp to Stop                | <b>Factory Setting:</b> | 0 |
| <b>Range:</b>                 | 1 = Coast to Stop               |                         |   |
|                               | 2 = Fast Stop                   |                         |   |
|                               | 3 = Ramp to Stop with Iq* reset |                         |   |
|                               | 4 = Fast Stop with Iq* reset    |                         |   |
| <b>Proprieties:</b>           |                                 |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS             |                         |   |
|                               | L 20 Ramps                      |                         |   |

#### Description:

This parameter defines the motor stop mode when the inverter receives the “Stop” command.



#### NOTE!

Options 3 and 4 operate only in vector mode with encoder. The difference in behavior, compared to the options 0 and 2, is in the torque current reference (Iq\*) reset. This reset occurs during the inverter state transition from Run to Ready, after executing a “Stop” command. The purpose of the options 3 and 4 is to avoid that a high current reference value is stored in the speed regulator when, for instance, using a mechanical brake to stop the motor shaft before its speed is null.



#### NOTE!

Refer to the CFW-11 programming manual for more information on the stop mode.

#### P1024 – Enable use of a Filter in the Hoisting and Lowering Commands

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 = Off             | <b>Factory Setting:</b> | 0 |
| <b>Range:</b>                 | 1 = On              |                         |   |
| <b>Proprieties:</b>           |                     |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter enables the use of a time of 100 ms as a filter to accept the load hoisting and load lowering commands via the digital inputs DI1 and DI2 to prevent too fast or false commands are accepted by the crane vertical motion.

With the option "0" (Off), there is no filter on the digital inputs DI1 and DI2.

With the option "1" (On), the filter 100 ms is applied to the digital inputs DI1 and DI2 in changing the logic state "0" to "1". The change from "1" to "0" there is no filter.

#### P1026 – Motor Rotation Direction Inversion

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 = Off             | <b>Factory Setting:</b> | 0 |
| <b>Range:</b>                 | 1 = On              |                         |   |
| <b>Proprieties:</b>           | CFG                 |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter inverts the motor rotation direction that is normally adopted for the load hoisting and load lowering commands.

## Parameters Description

With the option "0" (Disabled), the load hoisting command occurs with forward rotation direction and the load lowering command with reverse rotation direction.

With the option "1" (Enabled), the load hoisting command occurs with reverse rotation direction and the load lowering command with forward rotation direction.

### P1027 – Motor Demagnetization Time

|                               |  |                         |       |
|-------------------------------|--|-------------------------|-------|
| <b>Adjustable Range:</b>      | 0 to 65000 s   | <b>Factory Setting:</b> | 600 s |
| <b>Proprieties:</b>           |  |                         |       |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |       |

#### Description:

This parameter defines the period without hoisting or lowering commands that has to elapse before the inverter general enable command is removed, thus demagnetizing the motor. This measure prevents the motor from remaining energized during a period while the crane vertical motion is not being used.



#### NOTE!

Keeping the motor magnetized in the absence of hoisting or lowering commands allows a faster motor response when those commands are issued, expediting its operation.

## 3.2 RAMPS

This parameter group allows the user to configure the inverter ramps, so that the motor is accelerated or decelerated in a faster or in a slower manner.

### P0100 – Acceleration Time

|                               |  |                         |       |
|-------------------------------|--|-------------------------|-------|
| <b>Adjustable Range:</b>      | 0.0 to 999.9 s                                       | <b>Factory Setting:</b> | 3.0 s |
| <b>Proprieties:</b>           |  |                         |       |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 20 Ramps</div> |                         |       |

#### Description:

This parameter defines the time to accelerate linearly from 0 to the maximum speed (defined in P0134).

### P0101 – Deceleration Time

|                               |  |                         |       |
|-------------------------------|--|-------------------------|-------|
| <b>Adjustable Range:</b>      | 0.0 to 999.9 s                                       | <b>Factory Setting:</b> | 2.0 s |
| <b>Proprieties:</b>           |  |                         |       |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 20 Ramps</div> |                         |       |

#### Description:

This parameter defines the time to decelerate linearly from the maximum speed (defined at P0134) to zero, except in case of an emergency stop command execution.

### P0103 – Emergency Stop Time (2nd Ramp Deceleration)

|                               |  |                         |       |
|-------------------------------|--|-------------------------|-------|
| <b>Adjustable Range:</b>      | 0.0 to 999.9 s                                       | <b>Factory Setting:</b> | 0.3 s |
| <b>Proprieties:</b>           |  |                         |       |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 20 Ramps</div> |                         |       |



## Parameters Description

### Description:

This parameter defines the time to decelerate linearly from the maximum speed (defined at P0134) to zero, when an emergency stop command via the digital input DI3, the limit switch "Stop Hoisting", the overweight detection or the slack cable detection, is executed.

#### P0104 – S Ramp

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 = Off (linear)    | <b>Factory Setting:</b> | 0 |
| <b>Range:</b>                 | 1 = 50%             |                         |   |
|                               | 2 = 100%            |                         |   |
| <b>Proprieties:</b>           |                     |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 20 Ramps          |                         |   |

### Description:

This parameter allows that the acceleration and deceleration ramps have a nonlinear profile, similar to an "S" shape curve.

The "S" ramp reduces mechanical stress during accelerations and decelerations.

#### P0105 – 1st/2nd Ramp Selection

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 6 = SoftPLC         | <b>Factory Setting:</b> | 6 |
| <b>Range:</b>                 |                     |                         |   |
| <b>Proprieties:</b>           |                     |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 20 Ramps          |                         |   |

### Description:

This parameter defines the source of the command that will select between the 1st and the 2nd ramp, which is only SoftPLC for the crane vertical motion applicative.



#### NOTE!

Refer to the CFW-11 programming manual for more information on the ramp parameters.

## 3.3 SPEED LIMITS

This parameter group allows the user to configure the motor speed limits.

#### P0133 – Minimum Speed Reference Limit

|                               |                     |                         |                  |
|-------------------------------|---------------------|-------------------------|------------------|
| <b>Adjustable</b>             | 0 to 18000 rpm      | <b>Factory Setting:</b> | 120 rpm (4.0 Hz) |
| <b>Range:</b>                 |                     |                         |                  |
| <b>Proprieties:</b>           |                     |                         |                  |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |                  |
|                               | L 22 Speed Limits   |                         |                  |

### Description:

This parameter defines the minimum motor speed reference value when the inverter is enabled. It is the value used when the limit switch "Hoisting Slowdown" is activated.

#### P0134 – Maximum Speed Reference Limit

|                               |                     |                         |          |
|-------------------------------|---------------------|-------------------------|----------|
| <b>Adjustable</b>             | 0 to 18000 rpm      | <b>Factory Setting:</b> | 1800 rpm |
| <b>Range:</b>                 |                     |                         |          |
| <b>Proprieties:</b>           |                     |                         |          |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |          |
|                               | L 22 Speed Limits   |                         |          |

## Parameters Description

### Description:

This parameter defines the maximum motor speed reference value when the inverter is enabled. It is the value used when the crane is operating in the “Lightweight” mode.



#### NOTE!

Refer to the CFW-11 programming manual for more information on the speed limit parameters.

## 3.4 DYNAMIC BRAKING

This parameter group allows the user to configure the braking resistor to be used for dynamic braking.

### P0154 – Dynamic Braking Resistor

### P0155 – Dynamic Braking Resistor Power



#### NOTE!

Refer to the CFW-11 programming manual for more information on the dynamic braking parameters.

## 3.5 SPEED REFERENCES

This parameter group allows the user to configure the speed reference control for the crane vertical motion applicative.

### P1023 – Speed Reference Control Configuration

|                               |   |                           |
|-------------------------------|---|---------------------------|
| <b>Adjustable Range:</b>      | 0 = Speed Reference via Electronic Potentiometer (EP)<br>1 = One Speed Reference via Digital Input DI4<br>2 = Two Speed References via Digital Input DI4<br>3 = Three Speed References via Digital Input DI4 and DI5<br>4 = Four Speed References via Digital Input DI4 and DI5<br>5 = Five Speed References via Digital Input DI4, DI5 and DI6<br>6 = Speed Reference via Analog Input AI1<br>7 = Speed Reference via Communication Networks | <b>Factory Setting:</b> 2 |
| <b>Proprieties:</b>           | CFG   |                           |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 50 SoftPLC   |                           |

### Description:

This parameter defines how the control of the speed reference for the crane vertical motion applicative will be done.

*Table 3.1 – Speed reference control configuration*

| P1023 | Description  |
|-------|--|
| 0     | It defines that the speed reference will be controlled via the electronic potentiometer (EP) logic developed for the load hoisting, load lowering and load acceleration (increases the speed reference) commands.  |
| 1     | It defines that there will be one speed reference controlled through the logic combination of the load hoisting, load lowering and 1 <sup>st</sup> digital input for speed reference (DI4) commands.   |
| 2     | It defines that there will be two speed references controlled through the logic combination of the load hoisting, load lowering and 1 <sup>st</sup> digital input for speed reference (DI4) commands.  |
| 3     | It defines that there will be three speed references controlled through the logic combination of the load hoisting, load lowering, 1 <sup>st</sup> digital input for speed reference (DI4) and 2 <sup>nd</sup> digital input for speed reference (DI5) commands.   |
| 4     | It defines that there will be four speed references controlled through the logic combination of the load hoisting, load lowering, 1 <sup>st</sup> digital input for speed reference (DI4) and 2 <sup>nd</sup> digital input for speed reference (DI5) commands.  |
| 5     | It defines that there will be five speed references controlled through the logic combination of the load hoisting, load lowering, 1 <sup>st</sup> digital input for speed reference (DI4), 2 <sup>nd</sup> digital input for speed reference (DI5) and 3 <sup>rd</sup> digital input for speed reference (DI6) commands. |

## Parameters Description

|   |   |
|---|---|
| 6 | It defines that the speed reference will be controlled via the value read by the analog input AI1, combined with the load hoisting and load lowering commands.                                |
| 7 | It defines that the speed reference will be written via a communication network and that the load hoisting and load lowering commands will be given through the network control word (P1022). |

When the speed reference is selected through the logic combination of the DI4, DI5 and DI6 digital inputs, the following truth table must be applied to obtain the speed reference.

*Table 3.2 – Speed reference truth table with the logical combination of DI4, DI5 and DI6 digital inputs*

|                   | P1031 - Speed reference 1 | P1032 - Speed reference 2 | P1033 - Speed reference 3 | P1034 - Speed reference 4 | P1035 - Speed reference 5 |
|-------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Digital input DI4 | 0                         | 1                         | 0                         | 1                         | 0                         |
| Digital input DI5 | 0                         | 0                         | 1                         | 1                         | 0                         |
| Digital input DI6 | 0                         | 0                         | 0                         | 0                         | 1                         |

### P1030 – Speed Reference via Communication Networks

|                               |                                     |                         |  |
|-------------------------------|-------------------------------------|-------------------------|--|
| <b>Adjustable Range:</b>      | 0.0 to 1020.0 Hz                    | <b>Factory Setting:</b> | P1023 = 0: 0.0 Hz<br>P1023 = 1: 0.0 Hz<br>P1023 = 2: 0.0 Hz<br>P1023 = 3: 0.0 Hz<br>P1023 = 4: 0.0 Hz<br>P1023 = 5: 0.0 Hz<br>P1023 = 6: 0.0 Hz<br>P1023 = 7: 6.0 Hz |
| <b>Proprieties:</b>           |                                     |                         |  |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 50 SoftPLC |                         |  |

#### Description:

This parameter has different functions according to the speed reference control configuration:

- P1023 = 0, 1, 2, 3, 4, 5 or 6, the parameter does not have a specific function for the crane vertical motion applicative.
- P1023 = 7, it defines the speed reference value via communication networks for the crane vertical motion applicative.

### P1031 – Speed Reference 1

|                               |                                     |                         |   |
|-------------------------------|-------------------------------------|-------------------------|---|
| <b>Adjustable Range:</b>      | 0.0 to 1020.0 Hz                    | <b>Factory Setting:</b> | P1023 = 0: 6.0 Hz<br>P1023 = 1: 60.0 Hz<br>P1023 = 2: 6.0 Hz<br>P1023 = 3: 6.0 Hz<br>P1023 = 4: 6.0 Hz<br>P1023 = 5: 6.0 Hz<br>P1023 = 6: 6.0 Hz<br>P1023 = 7: 0.0 Hz |
| <b>Proprieties:</b>           |                                     |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 50 SoftPLC |                         |   |

#### Description:

This parameter has different functions according to the speed reference control configuration:

## Parameters Description

- P1023 = 0, it defines the minimum speed reference value for the crane vertical motion applicative. In other words, it is the initial speed reference value when the load hoisting or lowering command is executed. This value can be subsequently incremented through the “acceleration” command via the digital input DI4.
- P1023 = 1, 2, 3, 4 or 5, it defines the value of the 1st speed reference for the crane vertical motion applicative.
- P1023 = 6, it defines the minimum speed reference value for the crane vertical motion applicative. In other words, it is the initial speed reference value when the value read at the analog input is 0 V, 0 mA or 4 mA.
- P1023 = 7, the parameter does not have a specific function for the crane vertical motion applicative.

### P1032 – Speed Reference 2

|                               |  |                         |  |
|-------------------------------|--|-------------------------|--|
| <b>Adjustable Range:</b>      | 0.0 to 1020.0 Hz                                       | <b>Factory Setting:</b> | P1023 = 0: 60.0 Hz<br>P1023 = 1: 0.0 Hz<br>P1023 = 2: 60.0 Hz<br>P1023 = 3: 30.0 Hz<br>P1023 = 4: 20.0 Hz<br>P1023 = 5: 15.0 Hz<br>P1023 = 6: 60.0 Hz<br>P1023 = 7: 0.0 Hz |
| <b>Proprieties:</b>           |  |                         |  |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |  |

#### Description:

This parameter has different functions according to the speed reference control configuration:

- P1023 = 0, it defines the maximum speed reference value for the crane vertical motion applicative. In other words, this is the maximum value that the “acceleration” command via digital input DI4 can provide.
- P1023 = 1 or 7, the parameter does not have a specific function for the crane vertical motion applicative.
- P1023 = 2, 3, 4 or 5, it defines the value of the 2nd speed reference for the crane vertical motion applicative.
- P1023 = 6, it defines the maximum speed reference value for the crane vertical motion applicative. In other words, it is the maximum speed reference value when the value read at the analog input is 10 V or 20 mA.

### P1033 – Speed Reference 3

|                               |  |                         |   |
|-------------------------------|--|-------------------------|---|
| <b>Adjustable Range:</b>      | 0.0 to 1020.0 Hz                                       | <b>Factory Setting:</b> | P1023 = 0: 0.0 Hz<br>P1023 = 1: 0.0 Hz<br>P1023 = 2: 0.0 Hz<br>P1023 = 3: 60.0 Hz<br>P1023 = 4: 40.0 Hz<br>P1023 = 5: 30.0 Hz<br>P1023 = 6: 0.0 Hz<br>P1023 = 7: 0.0 Hz |
| <b>Proprieties:</b>           |  |                         |   |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |   |

#### Description:

This parameter has different functions according to the speed reference control configuration:

- P1023 = 0, 1, 2, 6 or 7, the parameter does not have a specific function for the crane vertical motion applicative.
- P1023 = 3, 4 or 5, it defines the value of the 3rd speed reference for the crane vertical motion applicative.

## Parameters Description

### P1034 – Speed Reference 4

|                               |                                     |                         |  |
|-------------------------------|-------------------------------------|-------------------------|--|
| <b>Adjustable Range:</b>      | 0.0 to 1020.0 Hz                    | <b>Factory Setting:</b> | P1023 = 0: 0.0 Hz<br>P1023 = 1: 0.0 Hz<br>P1023 = 2: 0.0 Hz<br>P1023 = 3: 0.0 Hz<br>P1023 = 4: 60.0 Hz<br>P1023 = 5: 45.0 Hz<br>P1023 = 6: 0.0 Hz<br>P1023 = 7: 0.0 Hz |
| <b>Proprieties:</b>           |                                     |                         |  |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 50 SoftPLC |                         |  |

#### Description:

This parameter has different functions according to the speed reference control configuration:

- P1023 = 0, 1, 2, 3, 6 or 7, the parameter does not have a specific function for the crane vertical motion applicative.
- P1023 = 4 or 5, it defines the value of the 4th speed reference for the crane vertical motion applicative.

### P1035 – Speed Reference 5

|                               |                                     |                         |   |
|-------------------------------|-------------------------------------|-------------------------|---|
| <b>Adjustable Range:</b>      | 0.0 to 1020.0 Hz                    | <b>Factory Setting:</b> | P1023 = 0: 0.0 Hz<br>P1023 = 1: 0.0 Hz<br>P1023 = 2: 0.0 Hz<br>P1023 = 3: 0.0 Hz<br>P1023 = 4: 0.0 Hz<br>P1023 = 5: 60.0 Hz<br>P1023 = 6: 0.0 Hz<br>P1023 = 7: 0.0 Hz |
| <b>Proprieties:</b>           |                                     |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 50 SoftPLC |                         |   |

#### Description:

This parameter has different functions according to the speed reference control configuration:

- P1023 = 0, 1, 2, 3, 4, 6 or 7, the parameter does not have a specific function for the crane vertical motion applicative.
- P1023 = 5, it defines the value of the 5th speed reference for the crane vertical motion applicative.

### P1036 – Dwell Time at Speed Reference 1

|                               |                                     |                         |        |
|-------------------------------|-------------------------------------|-------------------------|--------|
| <b>Adjustable Range:</b>      | 0.00 a 650.00 s                     | <b>Factory Setting:</b> | 0.50 s |
| <b>Proprieties:</b>           |                                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 50 SoftPLC |                         |        |

#### Description:

This parameter defines the crane dwell time with the speed reference 1 after the brake release. I.e., maintains the speed reference 1 for a while even if another speed has been selected by the user.

## Parameters Description

### 3.6 CONTROL WORD

#### P1022 – Communication Network Control Word

**Adjustable Range:** 0000h to FFFFh **Factory Setting:** 0000h

**Proprieties:**

**Access groups via HMI:** 01 PARAMETER GROUPS  
L 50 SoftPLC

#### Description:

This parameter defines the control word for the Crane Vertical Motion applicative when the speed reference control via communication networks has been selected (P1023 = 7).

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

*Table 3.3 – Description of the communication network control word*

| Bits     | 15 to 2  | 1             | 0             |
|----------|----------|---------------|---------------|
| Function | Reserved | Load Lowering | Load Hoisting |

| Bits                   | Values  |
|------------------------|---|
| Bit 0<br>Load Hoisting | 0: It removes the load hoisting command.<br>1: It executes the load hoisting command. |
| Bit 1<br>Load Lowering | 0: It removes the load lowering command.<br>1: It executes the load lowering command. |
| Bits 2 to 15           | Reserved.   |

### 3.7 CONFIGURATION OF THE LIMIT SWITCHES

#### P1025 – Limit Switches Configuration

**Adjustable Range:** 0 = Without Limit Switches  
1 = Stop Hoisting via DI5  
2 = Hoisting Slowdown via DI6  
3 = Stop Hoisting via DI5 and Stop Lowering via DI6  
4 = Hoisting Slowdown via DI3, Stop Hoisting via DI5 and Stop Lowering via DI6  
5 = Hoisting Slowdown via DI4, Stop Hoisting via DI5 and Stop Lowering via DI6  
6 = Hoisting Slowdown via DI9, Stop Hoisting via DI10 and Stop Lowering via DI11  
**Factory Setting:** 0

**Proprieties:** CFG

**Access groups via HMI:** 01 PARAMETER GROUPS  
L 50 SoftPLC

#### Description:

This parameter configures the manner an interlocking function of the Crane Vertical Motion applicative will be associated to a digital input. This interlocking is no more than limit switches installed in the hoisting and lowering travel course, which indicate operation conditions when activated.

■ Hoisting Slowdown (speed reduction): With an active hoisting command and activated sensor (logical level “0”), It decelerates the motor down to the minimum speed defined at P0133 respecting the ramp defined at P0101.

■ Stop Hoisting: With an active hoisting command and activated sensor (logical level “0”), it causes an emergency stop respecting the ramp defined at P0103.

## Parameters Description

- Stop Lowering: With an active lowering command and activated sensor (logical level “0”), it causes a normal stop respecting the ramp defined at P0101.



### NOTE!

Refer to the section 3.8 for more information on the functions of the digital inputs, bearing in mind that the parameters P1023 and P1025 operate together in the execution of the commands for the crane vertical motion applicative.

## 3.8 DIGITAL INPUTS

This parameter group allows the user to configure the command function of each digital input in the crane vertical motion applicative.

### P0263 – DI1 Function

|                               |                              |                         |                      |
|-------------------------------|------------------------------|-------------------------|----------------------|
| <b>Adjustable</b>             | 21 = Load Hoisting (PLC Use) | <b>Factory Setting:</b> | P1023 ≠ 7: 21        |
| <b>Range:</b>                 | 0 to 31                      |                         | P1023 = 7: 0         |
| <b>Proprieties:</b>           |                              |                         |                      |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS          | or                      | 07 I/O CONFIGURATION |
|                               | └ 40 Digital Inputs          |                         | └ 40 Digital Inputs  |

### Description:

This parameter defines that the function of the digital input DI1 will be the load hoisting command, which enables the motor to run in the forward rotation direction (or the reverse direction if P1026 is enabled (1)), except when P1023 = 7.

With logical level “0”, the crane vertical motion is disabled (except if there is a command for lowering the load).

With logical level “1”, the crane vertical motion is enabled for hoisting the load.



### NOTE!

When the speed reference control is programmed for communication networks (P1023 = 7), then the digital input DI1 does not have a specific function for the crane vertical motion applicative.



### NOTE!

It is possible to enable a filter 100ms (P1024 = 1) in the load hoisting command to prevent too fast or false commands are accepted by the crane vertical motion.

### P0264 – DI2 Function

|                               |                              |                         |                      |
|-------------------------------|------------------------------|-------------------------|----------------------|
| <b>Adjustable</b>             | 21 = Load Lowering (PLC Use) | <b>Factory Setting:</b> | P1023 ≠ 7: 21        |
| <b>Range:</b>                 | 0 to 31                      |                         | P1023 = 7: 0         |
| <b>Proprieties:</b>           |                              |                         |                      |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS          | or                      | 07 I/O CONFIGURATION |
|                               | └ 40 Digital Inputs          |                         | └ 40 Digital Inputs  |

### Description:

This parameter defines that the function of the digital input DI2 will be the load lowering command, which enables the motor to run in the reverse rotation direction (or the forward direction if P1026 is enabled (1)), except when P1023 = 7.

With logical level “0”, the crane vertical motion is disabled (except if there is a command for hoisting the load).

With logical level “1”, the crane vertical motion is enabled for lowering the load.

## Parameters Description



### NOTE!

When the speed reference control is programmed for communication networks (P1023 = 7), then the digital input DI2 does not have a specific function for the crane vertical motion applicative



### NOTE!

It is possible to enable a filter 100ms (P1024 = 1) in the load lowering command to prevent too fast or false commands are accepted by the crane vertical motion.

## P0265 – DI3 Function

|                               |  |   |
|-------------------------------|--|---|
| <b>Adjustable Range:</b>      | 0 = Not Used<br>2 = Coast to Stop<br>3 = Fast Stop<br>21 = Emergency Stop (PLC Use) (for P1025 ≠ 4)<br>21 = Hoisting Slowdown Limit Switch (PLC Use) (for P1025 = 4) | <b>Factory Setting:</b> 21                        |
| <b>Proprieties:</b>           |  |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 40 Digital Inputs   | or<br>07 I/O CONFIGURATION<br>L 40 Digital Inputs |

### Description:

This parameter defines that the function of the digital input DI3 will be stopping the operation of the crane vertical motion (except when P1025 = 4).

- Not Used: It defines that no operation stopping command for the crane vertical motion will be executed.
- Coast to Stop (General Enable): It defines that the crane vertical motion operation stopping will be by motor coasting (the motor is demagnetized).

With logical level "0", it executes the stopping command by coasting, not exercising any control to decelerate the crane vertical motion motor, so that the motor coasts to stop and remains demagnetized. The alarm "A752, Coast to Stop" is generated until the digital input DI3 is activated with level "1".

With logical level "1", it indicates that the crane vertical motion is enabled, so that a command for hoisting or lowering the load can be executed.

- Fast stop: It defines that the stopping operation will be carried out with a null deceleration ramp, so that the motor is decelerated down to zero rpm in the shortest possible time.

With logical level "0", it executes the fast stop command with null deceleration ramp, so that the crane vertical motion motor stops in the shortest possible time. The alarm "A754: Fast Stop" is generated until the digital input DI3 is activated with level "1".

With logical level "1", it indicates that the crane vertical motion is enabled, so that a command for hoisting or lowering the load can be executed.

- Emergency Stop: It defines that the stopping operation will occur according to the deceleration ramp that has been programmed in P0103.

With logical level "0", it executes the emergency stop command by decelerating the crane vertical motion motor according to the deceleration ramp that has been programmed in P0103. The alarm "A756: Emergency Stop" is generated until the digital input DI3 is activated with level "1".

With logical level "1", it indicates that the crane vertical motion is enabled, so that a command for hoisting or lowering the load can be executed.



### NOTE!

This command overrides the load hoisting or lowering command, stopping the crane vertical motion and preventing the execution of a new command. Refer to the section 3.12 in this application manual for more information on the brake control logic.



## Parameters Description

- P1025 = 4: It defines that the digital input DI3 function will be “Hoisting Slowdown Limit Switch”.

With logical level “0” (sensor actuated) and with a hoisting command present, it decelerates the motor down to the minimum speed defined in P0133.

With logical level “1” (sensor not actuated), it allows commands for hoisting or lowering the load.

### P0266 – DI4 Function

|                               |   |                         |                      |
|-------------------------------|---|-------------------------|----------------------|
| <b>Adjustable Range:</b>      | 21 = Acceleration (PLC Use)                             | <b>Factory Setting:</b> | P1023 = 0: 21        |
|                               | 21 = 1st Speed Reference Digital Input (PLC Use)        |                         | P1023 = 1: 21        |
|                               | 21 = 1st Speed Reference Digital Input (PLC Use)        |                         | P1023 = 2: 21        |
|                               | 21 = 1st Speed Reference Digital Input (PLC Use)        |                         | P1023 = 3: 21        |
|                               | 21 = 1st Speed Reference Digital Input (PLC Use)        |                         | P1023 = 4: 21        |
|                               | 21 = 1st Speed Reference Digital Input (PLC Use)        |                         | P1023 = 5: 21        |
|                               | 0 to 31 / 21 = Hoisting Slowdown Limit Switch (PLC Use) |                         | P1023 = 6: 0         |
|                               | 0 to 31 / 21 = Hoisting Slowdown Limit Switch (PLC Use) |                         | P1023 = 7: 0         |
| <b>Proprieties:</b>           |   |                         |                      |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS                                     | or                      | 07 I/O CONFIGURATION |
|                               | └ 40 Digital Inputs                                     |                         | └ 40 Digital Inputs  |

### Description:

This parameter has different functions according to the speed reference control configuration:

- P1023 = 0 defines that the function of the digital input DI4 will be to execute the command to accelerate (increase) the speed reference for the crane vertical motion. It operates together with the load hoisting or lowering command.

With logical level “0”, it freezes the current speed reference value for the crane vertical motion, in case the load hoisting (DI1) or lowering (DI12) command is still active.

With logical level “1”, it accelerates (increases) the speed reference for the crane vertical motion according to the acceleration ramp defined in P0100, up to the maximum value defined in P1032.

When a load hoisting or a load lowering command is executed, the motor is accelerated to the value programmed in P1031. Then, if an acceleration command is given, the motor is accelerated from the P1031 value up to the maximum programmed in P1032. If the acceleration command is removed before reaching that maximum speed, then the actual speed value is kept (frozen) as the crane vertical motion speed reference. When the load hoisting or lowering command is removed, then the motor decelerates to 0 rpm.

- P1023 = 1, 2, 3, 4 or 5: These options define that the function of the DI4 is to be the 1st digital input for the selection of the crane vertical motion speed reference via the logical combination of digital inputs, as described in the section 3. 5.

- P1023 = 6 or 7 and P1025 = 0, 1, 2, 3, 4 or 6: These options define that the digital input DI4 has no specific function for the crane vertical motion.

- P1023 = 6 or 7 and P1025 = 5: These options define that the function of the DI4 is “Hoisting Slowdown Limit Switch”.

With logical level “0” (sensor actuated) and with a hoisting command present, it decelerates the motor down to the minimum speed defined in P0133.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.

## Parameters Description

### P0267 – DI5 Function

|                               |   |                         |                      |
|-------------------------------|---|-------------------------|----------------------|
| <b>Adjustable Range:</b>      | 0 to 31 / 21 = Stop Hoisting Limit Switch (PLC Use) | <b>Factory Setting:</b> | P1023 = 0: 0         |
|                               | 0 to 31 / 21 = Stop Hoisting Limit Switch (PLC Use) |                         | P1023 = 1: 0         |
|                               | 0 to 31 / 21 = Stop Hoisting Limit Switch (PLC Use) |                         | P1023 = 2: 0         |
|                               | 21 = 2nd Speed Reference Digital Input (PLC Use)    |                         | P1023 = 3: 21        |
|                               | 21 = 2nd Speed Reference Digital Input (PLC Use)    |                         | P1023 = 4: 21        |
|                               | 21 = 2nd Speed Reference Digital Input (PLC Use)    |                         | P1023 = 5: 21        |
|                               | 0 to 31 / 21 = Stop Hoisting Limit Switch (PLC Use) |                         | P1023 = 6: 0         |
|                               | 0 to 31 / 21 = Stop Hoisting Limit Switch (PLC Use) |                         | P1023 = 7: 0         |
| <b>Proprieties:</b>           |   |                         |                      |
| <b>Access groups via HMI:</b> |   |                         |                      |
|                               | 01 PARAMETER GROUPS                                 | or                      | 07 I/O CONFIGURATION |
|                               | └ 40 Digital Inputs                                 |                         | └ 40 Digital Inputs  |

#### Description:

This parameter has different functions according to the speed reference control configuration:

■ P1023 = 0, 1, 2, 6 or 7 and P1025 = 0, 2 or 6: These options define that the digital input DI5 has no specific function for the crane vertical motion.

■ P1023 = 0, 1, 2, 6 or 7 and P1025 = 1, 3, 4 or 5: These options define that the function of the DI5 is “Stop Hoisting Limit Switch”.

With logical level “0” (sensor actuated) and with a hoisting command present, it performs an emergency stop respecting the ramp defined in P0103.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.

■ P1023 = 3, 4 or 5: These options define that the function of the DI5 is to be the 2nd digital input for the selection of the crane vertical motion speed reference via the logical combination of digital inputs, as described in the section 3. 5.

### P0268 – DI6 Function

|                               |  |                         |                      |
|-------------------------------|--|-------------------------|----------------------|
| <b>Adjustable Range:</b>      | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering           | <b>Factory Setting:</b> | P1023 = 0: 0         |
|                               | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering (PLC Use) |                         | P1023 = 1: 0         |
|                               | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering (PLC Use) |                         | P1023 = 2: 0         |
|                               | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering (PLC Use) |                         | P1023 = 3: 0         |
|                               | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering (PLC Use) |                         | P1023 = 4: 0         |
|                               | 21 = 3rd Speed Reference Digital Input (PLC Use)           |                         | P1023 = 5: 21        |
|                               | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering (PLC Use) |                         | P1023 = 6: 0         |
|                               | 0 to 31 / 21 = Hoisting Slowdown / Stop Lowering (PLC Use) |                         | P1023 = 7: 0         |
| <b>Proprieties:</b>           |  |                         |                      |
| <b>Access groups via HMI:</b> |  |                         |                      |
|                               | 01 PARAMETER GROUPS  | or                      | 07 I/O CONFIGURATION |
|                               | └ 40 Digital Inputs  |                         | └ 40 Digital Inputs  |

#### Description:

This parameter has different functions according to the speed reference control configuration:

■ P1023 = 0, 1, 2, 3, 4, 6 or 7 and P1025 = 0, 1 or 6: These options define that the digital input DI6 has no specific function for the crane vertical motion.

■ P1023 = 0, 1, 2, 3, 4, 6 or 7 and P1025 = 2: These options define that the function of the DI6 is “Hoisting Slowdown Limit Switch”.

With logical level “0” (sensor actuated) and with a hoisting command present, it decelerates the motor down to the minimum speed defined in P0133.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.

## Parameters Description

■ P1023 = 0, 1, 2, 3, 4, 6 or 7 and P1025 = 3, 4 or 5: These options define that the function of the DI6 is “Stop Lowering Limit”.

With logical level “0” (sensor actuated) and with a lowering command present, it performs a normal stop respecting the ramp defined in P0101.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.

■ P1023 = 5: These options define that the function of the DI6 is to be the 3rd digital input for the selection of the crane vertical motion speed reference via the logical combination of digital inputs, as described in the section 3. 5.



### NOTE!

Refer to the CFW-11 programming manual for more information on the digital input parameters. Some parameter options have been removed from the configuration wizard.

## DI9 Function

### Description:

It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P1025 = 0, 1, 2, 3, 4 or 5: These options define that the digital input DI9 has no specific function for the crane vertical motion.

■ P1025 = 6: This option defines that the function of the DI9 is “Hoisting Slowdown Limit Switch”.

With logical level “0” (sensor actuated) and with a hoisting command present, it decelerates the motor down to the minimum speed defined in P0133.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.

## DI10 Function

### Description:

It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P1025 = 0, 1, 2, 3, 4 or 5: These options define that the digital input DI10 has no specific function for the crane vertical motion.

■ P1025 = 6: This option defines that the function of the DI10 is “Stop Hoisting Limit Switch”.

With logical level “0” (sensor actuated) and with a hoisting command present, it performs an emergency stop respecting the ramp defined in P0103.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.

## DI11 Function

### Description:

It is an IOC-01 or IOC-02 accessory module digital input with exclusive SoftPLC function use, not presenting a parameter for configuring its function.

■ P1025 = 0, 1, 2, 3, 4 or 5: These options define that the digital input DI10 has no specific function for the crane vertical motion.

■ P1025 = 6: This option defines that the function of the DI11 is “Stop Lowering Limit Switch”.

## Parameters Description

With logical level “0” (sensor actuated) and with a lowering command present, it performs a normal stop respecting the ramp defined in P0101.

With logical level “1” (sensor not actuated), it allows commands for load hoisting or lowering.



### NOTE!

Refer to the IOC-01 or IOC-02 accessory module installation, configuration and operation guide for more information on the DI9, DI10 and DI11 digital inputs.

## 3.9 DIGITAL OUTPUTS

This parameter group allows the user to configure the command function of each digital output in the crane vertical motion applicative.

### P0275 – DO1 Function (RL1)

### P0276 – DO2 Function (RL2)

### P0277 – DO3 Function (RL3)

|                               |   |                         |  |
|-------------------------------|---|-------------------------|--|
| <b>Adjustable Range:</b>      | 0 to 36 / 28 = Brake Release (SoftPLC)      | <b>Factory Setting:</b> | P0275 = 13<br>P0276 = 11<br>P0277 = 28       |
| <b>Proprieties:</b>           |   |                         |  |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS<br>L 41 Digital Outputs | or                      | 07 I/O CONFIGURATION<br>L 41 Digital Outputs |

### Description:

These parameters define the functions of the DO1, DO2 and DO3 digital outputs. If the option “28 = Brake Release (SoftPLC)” has been selected, the output assumes the function of commanding the crane vertical motion brake. As presented in the section 2.1, the NO relay contact of DO1, DO2 and DO3 digital outputs must be used.



### NOTE!

Refer to the section 3.12 in this application manual for more information on the brake control logic.



### NOTE!

Refer to the CFW-11 programming manual for more information on the digital output parameters. Some parameter options have been removed from the configuration wizard.

## DO6 Function

### Description:

It is an IOC-01 or IOC-02 accessory module digital output with exclusive SoftPLC function use, not presenting a parameter for its configuration. It has the function of indicating the alarm “A770: Detected Overweight”.



### NOTE!

Refer to the section 3.13 in this application manual for more information on the overweight detection logic.

## DO7 Function

### Description:

It is an IOC-01 or IOC-02 accessory module digital output with exclusive SoftPLC function use, not presenting a parameter for its configuration. It has the function of indicating the alarm “A772: Detected Slack Cable”, or the fault “F773: Detected Slack Cable”.

## Parameters Description



### NOTE!

Refer to the section 3.14 in this application manual for more information on the slack cable detection logic.

## DO8 Function

### Description:

It is an IOC-01 or IOC-02 accessory module digital output with exclusive SoftPLC function use, not presenting a parameter for its configuration. It has the function of indicating the fault "F775: Inverter in Torque Limit".



### NOTE!

Refer to the section 3.15 in this application manual for more information on the inverter torque limit detection logic.



### NOTE!

Refer to the IOC-01 or IOC-02 accessory module installation, configuration and operation guide for more information on the DO6, DO7 and DO8 digital outputs.

## 3.10 ANALOG INPUT

This parameter group allows the user to configure the analog input AI1 for the speed reference control of the crane vertical motion.



### NOTE!

It is configured only when the parameter P1023 (speed reference control configuration) is programmed with the option 6.

## P0231 – AI1 Signal Function

|                               |                               |                         |                      |
|-------------------------------|-------------------------------|-------------------------|----------------------|
| <b>Adjustable</b>             | 7 = Speed Reference (PLC Use) | <b>Factory Setting:</b> | 7                    |
| <b>Range:</b>                 |                               |                         |                      |
| <b>Proprieties:</b>           |                               |                         |                      |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS           | or                      | 07 I/O CONFIGURATION |
|                               | L 38 Analog Inputs            |                         | L 38 Analog Inputs   |

### Description:

This parameter defines that the function of the analog input AI1 will be the crane vertical motion speed reference.

## P0233 – AI1 Signal Type

|                               |                       |                         |                      |
|-------------------------------|-----------------------|-------------------------|----------------------|
| <b>Adjustable</b>             | 0 = 0 to 10 V / 20 mA | <b>Factory Setting:</b> | 0                    |
| <b>Range:</b>                 | 1 = 4 to 20 mA        |                         |                      |
| <b>Proprieties:</b>           |                       |                         |                      |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS   | or                      | 07 I/O CONFIGURATION |
|                               | L 38 Analog Inputs    |                         | L 38 Analog Inputs   |

### Description:

This parameter configures the type of signal (voltage or current) that will be read by the analog input AI1. Adjust the CFW-11 control board DIP switch S1.4 according to the selected option.

## Parameters Description

### P0232 – AI1 Gain

**Adjustable Range:** 0.000 to 9.999 **Factory Setting:** 1.000

**Proprieties:**

**Access groups via HMI:** 01 PARAMETER GROUPS or 07 I/O CONFIGURATION  
 L 38 Analog Inputs L 38 Analog Inputs

**Description:**

This parameter applies a gain to the value read at the analog input AI1, i.e., the value obtained at the input is multiplied by the gain, thus allowing adjustments in the measured variable.

### P0234 – AI1 Offset

**Adjustable Range:** -100.00 % to +100.00 % **Factory Setting:** 0.00 %

**Proprieties:**

**Access groups via HMI:** 01 PARAMETER GROUPS or 07 I/O CONFIGURATION  
 L 38 Analog Inputs L 38 Analog Inputs

**Description:**

This parameter adds to the measured quantity a value, in percentage, in order to adjust the read variable.

### P0235 – AI1 Filter

**Adjustable Range:** 0.00 to 16.00 s **Factory Setting:** 0.25 s

**Proprieties:**

**Access groups via HMI:** 01 PARAMETER GROUPS or 07 I/O CONFIGURATION  
 L 38 Analog Inputs L 38 Analog Inputs

**Description:**

This parameter configures the 1<sup>st</sup> order filter time constant that will be applied to the analog input AI1.



**NOTE!**

Refer to the CFW-11 programming manual for more information on the analog input parameters. Some parameter options have been removed from the configuration wizard.

## 3.11 LIGHTWEIGHT MODE

This parameter group allows the user to adjust the lightweight mode operation conditions.

**Lightweight** is an operation status of the crane vertical motion in which the motor current is monitored after a certain speed, in order to determine whether it is at a low value, which would indicate lightweight. This allows an increase to the control speed reference, therefore expediting the operation of the crane vertical motion.



**NOTE!**

While in lightweight operation mode, the motor speed reference will be the maximum value programmed in parameter P0134.

### P1037 – Hoisting Current Threshold for Lightweight Detection

### P1038 – Lowering Current Threshold for Lightweight Detection

**Adjustable Range:** 0.0 to 3000.0 A **Factory Setting:** P1037 = 14.0 A

**Range:** P1038 = 10.0 A

**Proprieties:**

**Access groups via HMI:** 01 PARAMETER GROUPS  
 L 50 SoftPLC

## Parameters Description

### Description:

These parameters configure the motor current threshold for lightweight detection with hoisting (P1037) or lowering (P1038) commands. In other words, when the actual motor current is below the adjusted value, this indicates that it is with lightweight.

### P1039 – Speed Threshold for Lightweight Detection Enabling

|                               |  |                         |        |
|-------------------------------|--|-------------------------|--------|
| <b>Adjustable</b>             | 0.0 to 1020.0 Hz                                       | <b>Factory Setting:</b> | 0.0 Hz |
| <b>Range:</b>                 |  |                         |        |
| <b>Proprieties:</b>           |  |                         |        |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |        |

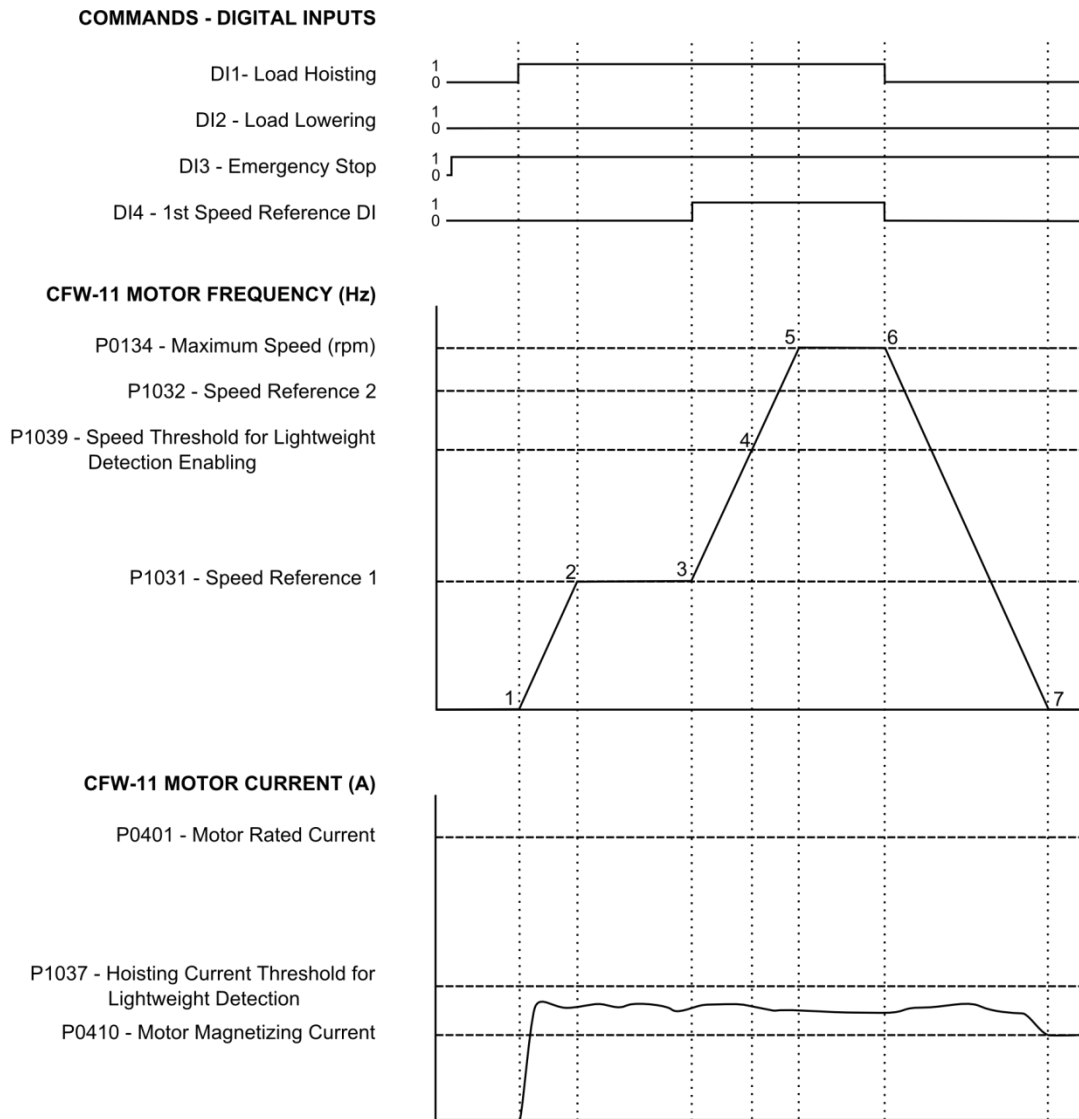
### Description:

This parameter configures the speed threshold for lightweight detection. In other words, when the actual motor speed is higher than or equal to the reference value, it enables the lightweight detection through the motor current monitoring.



**NOTE!**  
A setting of “0.0 Hz” disables the lightweight detection.

The lightweight detection operation diagram, considering that the crane vertical motion has been configured for two speed references obtained from the digital input logic, is presented next. The brake control logic has not been considered.



*Figure 3.1 – Lightweight detection operation mode*

Description of the identified moments:

- 1** – The load hoisting command is given through the digital input DI1. The motor becomes magnetized, and voltage and frequency are applied to it
- 2** – The motor is accelerated to the speed reference 1 value set in P1031.
- 3** – The speed reference 2, programmed in P1032, is selected through the digital input DI4 and the load is then accelerated to that speed. Note that the motor current remains below the lightweight threshold set in P1037.
- 4** – At that moment, the motor frequency crosses the speed threshold for lightweight detection adjusted in P1039 and because the motor current remains below the current threshold set in P1037, lightweight, generating the alarm A750, is detected. The motor is then accelerated up to the maximum speed adjusted in P0134.
- 5** – The motor reaches the programmed maximum speed.
- 6** – The load hoisting command is removed from the digital input DI1 (and consequential removal of the selection done via the digital input DI4). The motor deceleration begins.
- 7** – The motor reaches 0 rpm and remains magnetized (If within the period programmed in P1027 a new hoisting or lowering command does not occur, the motor will be demagnetized).



## Parameters Description

### 3.12 BRAKE CONTROL

This parameter group allows the user to configure the crane vertical motion brake operation, which can be performed through the digital output DO1, DO2 and/or DO3, as described in the section 3.9.

#### P1041 – Brake Release Frequency Threshold

|                               |  |                         |        |
|-------------------------------|--|-------------------------|--------|
| <b>Adjustable</b>             | 0.0 to 1020.0 Hz                                       | <b>Factory Setting:</b> | 4.0 Hz |
| <b>Range:</b>                 |  |                         |        |
| <b>Proprieties:</b>           |  |                         |        |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |        |

#### Description:

This parameter defines the motor frequency threshold to release the brake with load hoisting or load lowering commands. In other words, if the total speed reference (as motor frequency) after the ramp is higher than or equal to the adjusted value, then the brake release command is permitted. It is also necessary that the other conditions be satisfied for effectively commanding the brake release.



#### NOTE!

A setting of “0.0 Hz” disables the motor frequency verification for the brake control.

#### P1042 – Load Hoisting Current Threshold

#### P1043 – Load Lowering Current Threshold

|                               |  |                         |                                |
|-------------------------------|--|-------------------------|--------------------------------|
| <b>Adjustable</b>             | 0.0 to 3000.0 A  | <b>Factory Setting:</b> | P1042 = 0.0 A<br>P1043 = 0.0 A |
| <b>Range:</b>                 |  |                         |                                |
| <b>Proprieties:</b>           |  |                         |                                |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |                                |

#### Description:

These parameters define the motor current thresholds to release the brake with hoisting (P1042) or lowering (P1043) commands. In other words, if the actual motor current is higher than or equal to the adjusted value, then the brake release command is permitted. It is also necessary that the other conditions be satisfied for effectively commanding the brake release.



#### NOTE!

A setting of “0.0 A” disables the motor current verification for the brake control.

#### P1044 – Load Hoisting Torque Threshold

#### P1045 – Load Lowering Torque Threshold

|                               |  |                         |                                  |
|-------------------------------|--|-------------------------|----------------------------------|
| <b>Adjustable</b>             | 0.0 to 350.0 %   | <b>Factory Setting:</b> | P1044 = 50.0 %<br>P1045 = 30.0 % |
| <b>Range:</b>                 |  |                         |                                  |
| <b>Proprieties:</b>           |  |                         |                                  |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |                                  |

#### Description:

These parameters define the motor torque thresholds to release the brake with hoisting (P1044) or lowering (P1045) commands. In other words, if the actual motor torque is higher than or equal to the adjusted value, then the brake release command is permitted. It is also necessary that the other conditions be satisfied for effectively commanding the brake release.

## Parameters Description



### NOTE!

A setting of "0.0 %" disables the motor torque verification for the brake control.

### P1046 – Brake Response Time to Release

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable</b>             | 0.00 to 650.00 s    | <b>Factory Setting:</b> | 0.10 s |
| <b>Range:</b>                 |                     |                         |        |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines the brake response time to release, or how long the brake takes to release after receiving the command from the digital output of the CFW-11, and thus be mechanically released.



### NOTE!

In time for the brake release, the speed reference is kept in the brake release frequency threshold if it is enabled (P1041  $\neq$  0). This avoids the increase of the motor frequency with the brake closing can thus minimize motor current spikes.

### P1047 – Inhibition of the Brake Closing during a Hoisting/Lowering Command Transition

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 = Off             | <b>Factory Setting:</b> | 0 |
| <b>Range:</b>                 | 1 = On              |                         |   |
| <b>Proprieties:</b>           |                     |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter inhibits the brake closing during the transition from hoisting to lowering and vice versa.



### NOTE!

Available when a vector with encoder control mode is chosen (P0202 = 4 or 6).

### P1048 – Brake Closing Frequency Threshold

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable</b>             | 0.5 to 1020.0 Hz    | <b>Factory Setting:</b> | 2.5 Hz |
| <b>Range:</b>                 |                     |                         |        |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines the motor frequency threshold to close the brake. In other words, if the total speed reference after the ramp is less than or equal to that threshold, a command for brake closing is issued.

### P1049 – Delay Time for Brake Closing

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable</b>             | 0.00 to 650.00 s    | <b>Factory Setting:</b> | 0.00 s |
| <b>Range:</b>                 |                     |                         |        |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines a delay after the frequency threshold condition to close the brake is fulfilled, before effectively issuing the brake closing command.

## Parameters Description



### NOTE!

The delay time to close the brake does not apply in the event of a fault, coast to stop, fast stop or emergency stop.

## P1050 – Time to Enable a new Command to Brake Release

**Adjustable** 0.10 to 650.00 s **Factory Setting:** 0.50 s

**Range:**

**Proprieties:**

**Access groups via HMI:**

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

This parameter defines a time after the command to brake closing has been executed via the digital output of the CFW-11, so that a new command to load hoisting or load lowering is accepted and thus the brake can be released again thus preventing a new command to be generated without the brake being closed mechanically.



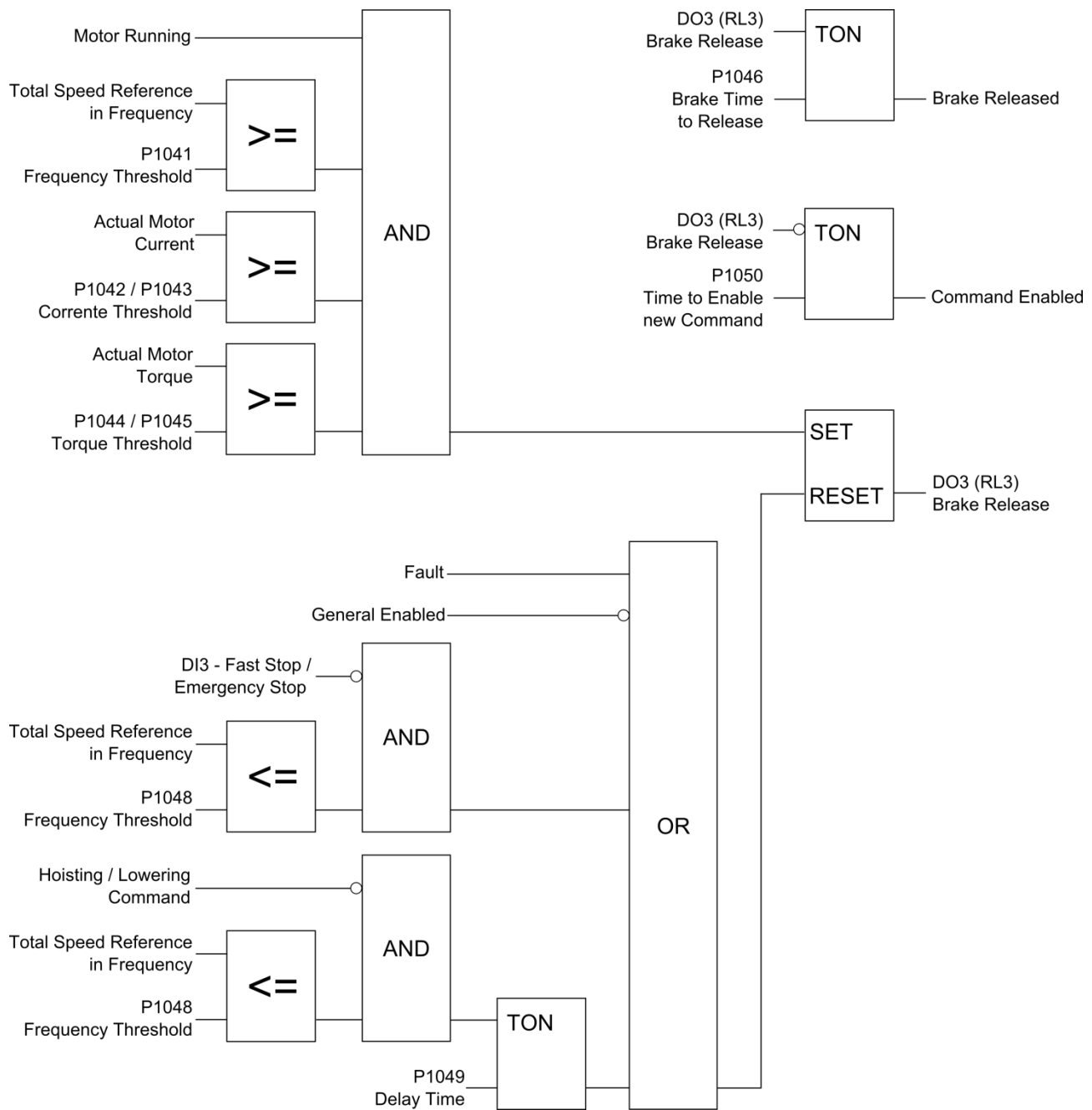
### NOTE!

The value of the set time should be sufficient to ensure that a new command to load hoisting or load lowering performs with the brake closed, but that does not generate a very large delay in the crane vertical motion operation.



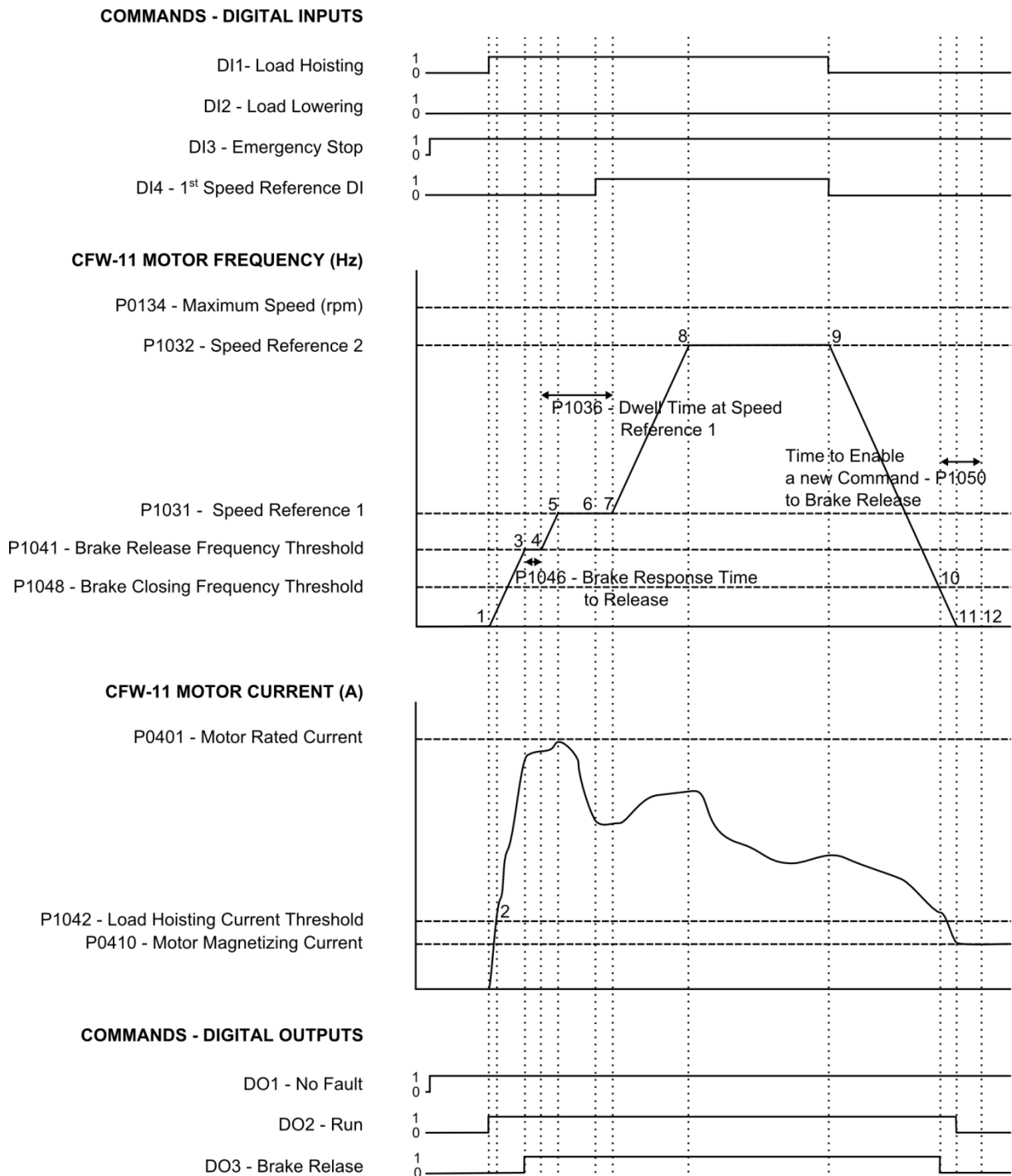
### NOTE!

Refer to the section 2.2 in this application manual for more information on the connection diagram and brake power supply.



**Figure 3.2** Logic block diagram for the mechanical brake control through the digital output DO3

The brake control operation diagram considering that the crane vertical motion has been configured for two speed references obtained from the digital input logic, and that the evaluations of motor frequency and current for the control of the mechanical brake are enabled, is presented next.



*Figure 3.3 – Brake control operation*

Description of the identified moments:

- 1** – The load hoisting command is given through the digital input DI1. The motor becomes magnetized, and voltage and frequency are applied to it. The brake remains closed.
- 2** – The motor current reaches the P1042 threshold, the brake, however, remains closed because the motor frequency is below the frequency threshold adjusted in P1041.
- 3** – The motor current remains greater than or equal to the P1042 threshold, and since the motor frequency reaches the P1041 threshold, the command to release the mechanical brake through the digital output DO3 is executed; in this instant starts elapsing the brake response time to release (P1046) and the speed reference remains at the value set in P1041.

## Parameters Description

- 4** – The brake response time to release (P1046) has elapsed, i.e., the brake is released and the load hoisting with the speed reference 1 adjusted in P1031 begins; in this instant starts elapsing the dwell time at speed reference 1 (P1036).
- 5** – With the brake released, the load hoisting remains with the speed reference 1 adjusted in P1031 and dwell time at speed reference 1 (P1036) continues to count.
- 6** – The speed reference 2, programmed in P1032, is selected through the digital input DI4. Due to the dwell time at speed reference 1 (P1036) has not yet elapsed, the load remains at speed reference 1.
- 7** – The dwell time at speed reference 1 (P1036) has elapsed. The load is then accelerated to that speed reference 2 selected through the digital input DI4. Note that the motor current increases, but overweight is not detected while hoisting the load.
- 8** – The motor reaches the speed reference 2 and keeps hoisting the load at that speed.
- 9** – The load hoisting command is removed from the digital input DI1 (and consequential removal of the selection done via the digital input DI4). The motor deceleration begins. The brake remains release.
- 10** – The motor frequency becomes less than or equal to the threshold adjusted in P1048, and the command to close the mechanical brake is executed through the removal of the digital output DO3 command; in this instant starts elapsing the time to enable a new command to brake release (P1050).
- 11** – The motor is decelerated down to 0 rpm and remains magnetized (If within the period programmed in P1027 a new hoisting or lowering command does not occur, the motor will be demagnetized). Due to time to to enable a new command to brake release (P1050) has not yet elapsed, a new command to load hoisting or load lowering will not be accepted.
- 12** – The time to enable a new command to brake release (P1050) has elapsed, and from this moment a new command to load hoisting or load lowering will be accepted. The load remains stopped, being held by the mechanical brake.

### 3.13 OVERWEIGHT

This parameter group allows the user to adjust the conditions for the crane vertical motion overweight detection during the load hoisting stage.

**Overweight** is an abnormal condition detected during the hoisting stage of the crane vertical motion operation. It indicates that the load weight is greater than the maximum established for normal operation.



#### NOTE!

A direct load weight measurement is not performed, i.e., the weight determination is based on the motor current measured by the CFW-11 frequency inverter.

### P1051 – Overweight Current Threshold in the Minimum Speed

|                               |  |                         |        |
|-------------------------------|--|-------------------------|--------|
| <b>Adjustable Range:</b>      | 0.0 to 3000.0 A  | <b>Factory Setting:</b> | 50.0 A |
| <b>Proprieties:</b>           |  |                         |        |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |        |

#### Description:

This parameter defines the overweight current threshold, so that the overweight condition can be detected during the hoisting stage in the minumim speed (P0133).



#### NOTE!

A setting of “0.0 A” disables the overweight detection.

## Parameters Description

### P1052 – Overweight Current Threshold in the Maximum Speed

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable</b>             | 0.0 to 3000.0 A     | <b>Factory Setting:</b> | 40.0 A |
| <b>Range:</b>                 |                     |                         |        |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines the overweight current threshold, so that the overweight condition can be detected during the hoisting stage in the maximum speed (P0134).

Through the overweight currents and as the operating speed you can generate an overweight curve thus allowing a higher current at low speeds than at high, as shown below:

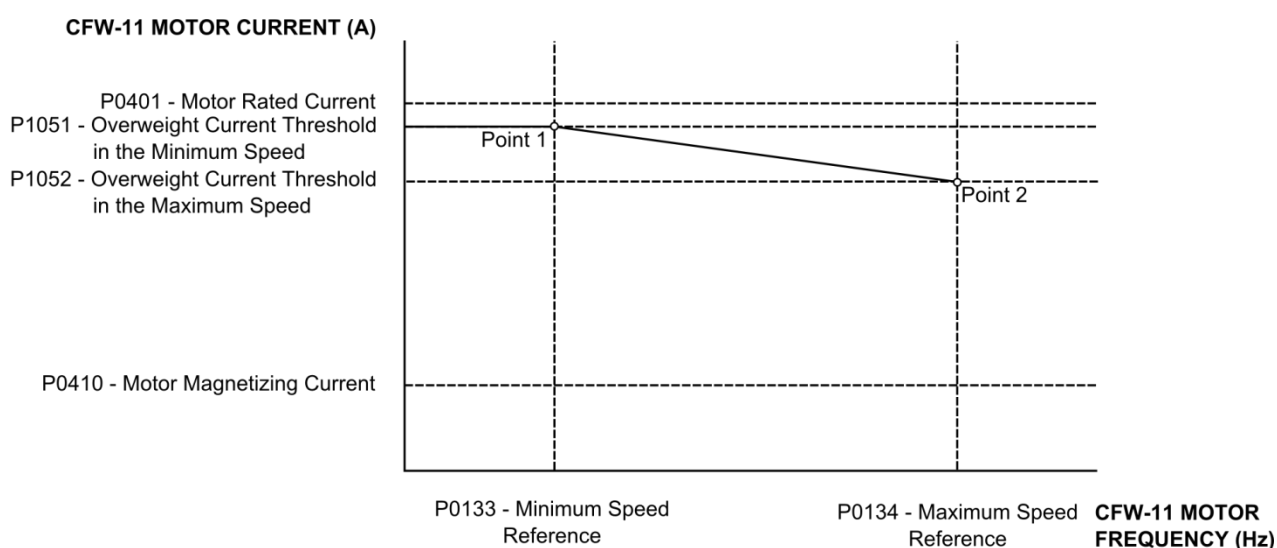


Figure 3.4 – Overweight curve

### P1053 –Overweight Detection Delay Time

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable</b>             | 0.00 to 650.00 s    | <b>Factory Setting:</b> | 1.00 s |
| <b>Range:</b>                 |                     |                         |        |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines a delay time after the hoisting command has been given, before initiating the overweight monitoring according to the overweight curve defined in P1051 and P1052.

### P1054 – Overweight Alarm (A770) Delay Time

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable</b>             | 0.00 to 650.00 s    | <b>Factory Setting:</b> | 0.50 s |
| <b>Range:</b>                 |                     |                         |        |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines a delay time after the motor current becomes greater than or equal to the overweight curve defined in P1051 and P1052, during a hoisting command, before the alarm “A770: Detected Overweight”, is generated.

## Parameters Description



### NOTE!

With the overweight detection, an emergency stop is executed respecting the ramp defined in P0103.



### NOTE!

The alarm is reset when a load lowering command is given for at least 100 ms.

The overweight detection operation diagram, considering that the crane vertical motion has been configured for two speed references obtained from the digital input logic, is presented next. Only the motor frequency has been considered in the brake control logic. The digital output DO6 is used to indicate the overweight alarm.



## COMMANDS - DIGITAL INPUTS

### DI1- Load Hoisting

## DI2 - Load Lowering

### DI3 - Emergency Stop

DI4 - 1st Speed Reference DI

## CFW-11 MOTOR FREQUENCY (Hz)

P0134 - Maximum Speed (rpm)

### P1032 - Speed Reference 2

### P1031 - Speed Reference 1

### P1041 - Brake Release Frequency Threshold

## CFW-11 MOTOR CURRENT (A)

P0401 - Motor Rated Current

P1051 - Overweight Current Threshold  
in Minimum Speed

### P1052 - Overweight Current Threshold in Maximum Speed

### P0410 - Motor Magnetizing Current

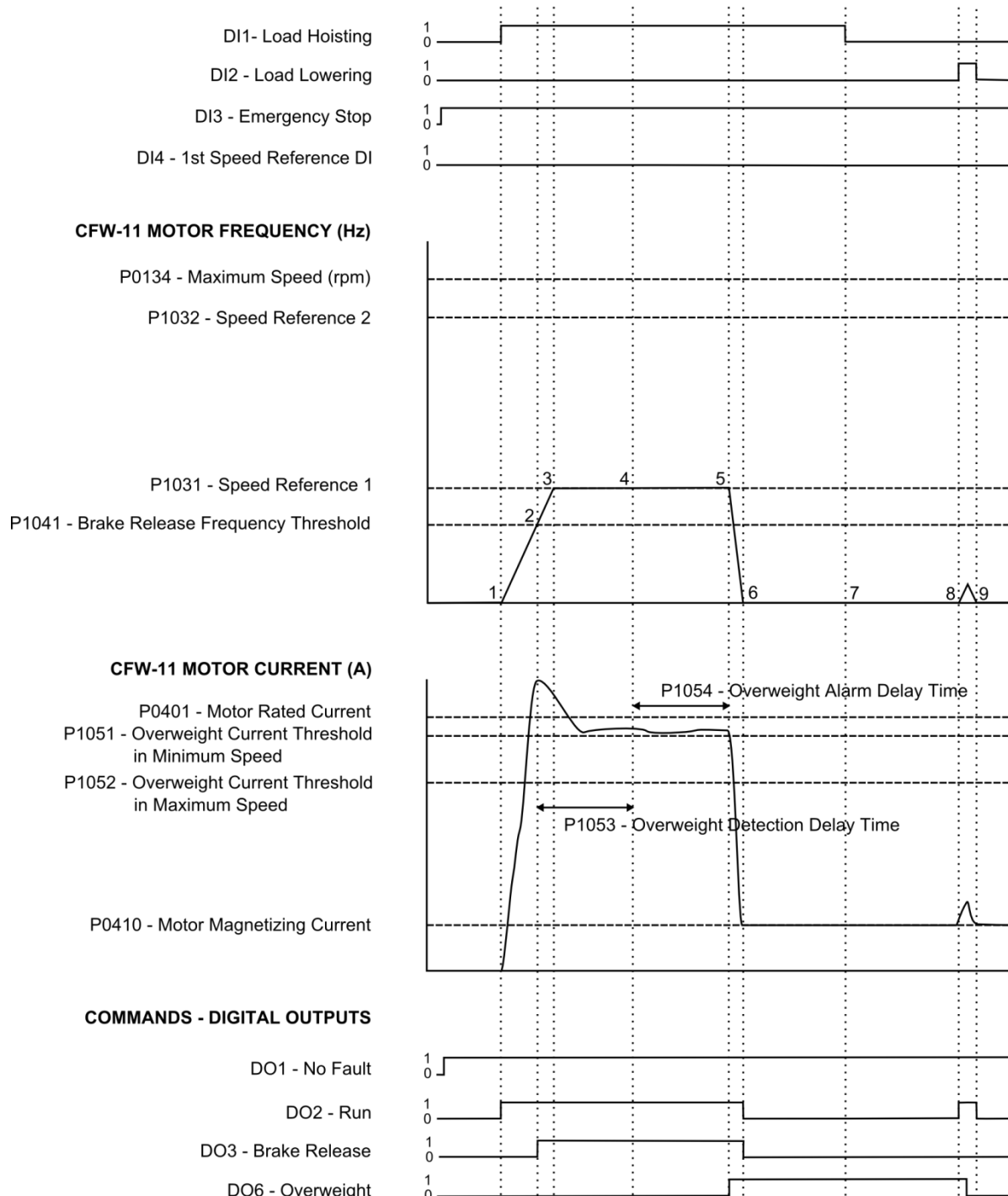
## COMMANDS - DIGITAL OUTPUTS

DO1 - No Fault

DO2 - Run

DO3 - Brake Release

DO6 - Overweight



*Figure 3.5 – Overweight detection operation*

Description of the identified moments:

1 – The load hoisting command is given through the digital input DI1. The motor becomes magnetized, and voltage and frequency are applied to it. The brake remains closed.

**2** – The motor frequency reaches the threshold adjusted in P1041 and the command to release the mechanical brake through the digital output DO3 is executed. Overweight detection delay time, programmed in P1053, starts elapsing because the load hoisting and brake release commands are presented.

**3** – With the brake release, the load hoisting with the speed reference 1 adjusted in P1031 begins.

## Parameters Description

**4** – The overweight detection delay time has elapsed. Since the motor current is greater than the overweight curve defined in P1051 and P1052, the overweight alarm delay timer begins counting the time programmed in P1054.

**5** – The overweight alarm delay time has elapsed and the alarm A770, Detected Overweight, is generated. The crane vertical motion is then decelerated according to the ramp programmed in P0103 and the digital output DO6 is activated indicating the overweight condition.

**6** – The command for brake closing is executed through the digital output DO3, the motor is decelerated down to 0 rpm and remains magnetized.

**7** – The load hoisting command is removed from the digital input DI1.

**8** – The load lowering command is given through the digital input DI2. This action resets the overweight alarm (after 100 ms), enabling the crane vertical motion to receive a new load hoisting command.

**9** – The load lowering command is removed from the digital input DI2 and the motor remains magnetized (If within the period programmed in P1027 a new hoisting or lowering command does not occur, the motor will be demagnetized). The load remains stopped, being held by the mechanical brake.

### 3.14 SLACK CABLE

This parameter group allows the user to adjust the conditions for the crane vertical motion slack cable detection during the load lowering stage.

**Slack cable** is an abnormal condition detected during the lowering stage of the crane vertical motion, by the verification of load existence.



#### NOTE!

The weight of the load is not measured directly, in other words, the load is detected observing the behavior of the motor controlled by the CFW-11 frequency inverter. It is known that while being lowered, the load is usually braked by the motor, which regenerates energy to the inverter. If instead of braking the load, the motor is actually driving the hoist down, this would indicate load absence.

### P1055 – Load Detection Time

|                               |  |                         |        |
|-------------------------------|--|-------------------------|--------|
| <b>Adjustable Range:</b>      | 0.00 to 650.00 s                                       | <b>Factory Setting:</b> | 0.00 s |
| <b>Proprieties:</b>           |  |                         |        |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |        |

#### Description:

This parameter defines a period with the motor regenerating energy after the lowering command has been given, before initiating the slack cable monitoring.



#### NOTE!

A setting of "0.00 s" disables the load detection and slack cable alarm or fault.

### P1056 – Slack Cable Alarm (A772) Delay Time

|                               |  |                         |        |
|-------------------------------|--|-------------------------|--------|
| <b>Adjustable Range:</b>      | 0.00 to 650.00 s                                       | <b>Factory Setting:</b> | 0.50 s |
| <b>Proprieties:</b>           |  |                         |        |
| <b>Access groups via HMI:</b> | <div>01 PARAMETER GROUPS</div> <div>L 50 SoftPLC</div> |                         |        |

## Parameters Description

### Description:

This parameter defines a delay time after it has been detected that the motor is being driven by the inverter, instead of being braked by it, before generating the alarm “A772: Detected Slack Cable”.



#### NOTE!

The alarm is reset when a load hoisting command is given for at least 100 ms.

### P1057 – Slack Cable Fault (F773) Delay Time

**Adjustable** 0.00 to 650.00 s **Factory Setting:** 0.00 s

#### Range:

#### Proprieties:

#### Access groups via HMI:

01 PARAMETER GROUPS

L 50 SoftPLC

### Description:

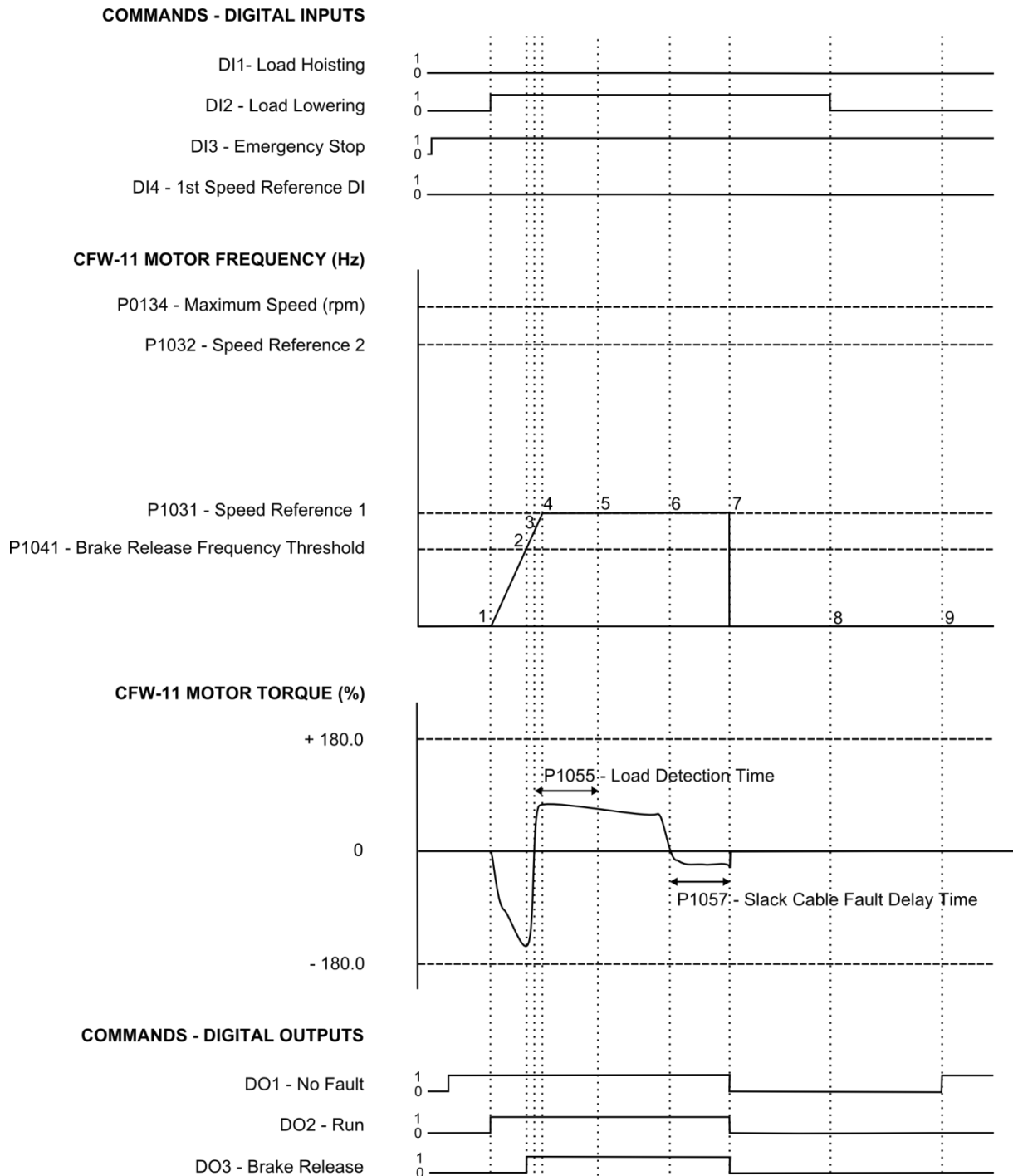
This parameter defines a delay time after it has been detected that the motor is being driven by the inverter while lowering, instead of being braked by it, before generating the fault “F773: Detected Slack Cable”.



#### NOTE!

A setting of “0.00 s” disables the slack cable fault detection, and values different from zero disable the slack cable alarm generation. It is necessary to use the sensorless vector or vector with encoder control mode for the slack cable detection.

The slack cable detection operation diagram, considering that the crane vertical motion has been configured for two speed references obtained from the digital input logic, is presented next. Only the motor frequency has been considered in the brake control logic.



**Figure 3.6** – Slack cable detection operation

Description of the identified moments:

- 1** – The load lowering command is given through the digital input DI2. The motor becomes magnetized, and voltage and frequency are applied to it. The brake remains closed.
- 2** – The motor frequency reaches the threshold adjusted in P1041 and the command to release the mechanical brake through the digital output DO3 is executed.
- 3** – The motor begins to regenerate energy supplied by the load and the load detection time while lowering the load, programmed in P1055 starts elapsing.
- 4** – With the brake release, the load lowering with the speed reference 1 adjusted in P1031 begins.

## Parameters Description

- 5** – The load detection time has elapsed, enabling at that moment the slack cable detection.
- 6** – The load stops lowering because of an external cause, the motor no longer regenerates energy, but it is driven by the inverter. Because the load has been previously detected, at that moment the slack cable fault delay time starts elapsing, according to the value adjusted in P1057.
- 7** – The delay time to generate the fault has elapsed and the fault message "F773: Detected Slack Cable" is generated. At that moment, the command for closing the brake is executed through the digital output DO3 and the motor is demagnetized (general disabled).
- 8** – The load lowering command is removed from the digital input DI2.
- 9** – The command to reset the inverter is executed through the CFW-11 HMI reset key. At that moment, the drive status changes to "ready", becoming prepared to receive a new command. The motor remains demagnetized and the load remains stopped, being held by the mechanical brake.

### 3.15 INVERTER IN TORQUE LIMIT DETECTION

This parameter group allows the user to adjust the conditions for the crane vertical motion torque limit detection during the load hoisting or lowering stages.

**Inverter in Torque Limit** is an abnormal condition detected in the crane vertical motion operation, when the CFW-11 frequency inverter is not able to execute the vertical motion in the desired manner (with controlled speed), i.e., operating in a torque limit condition.



#### NOTE!

The inverter in torque limit detection is based on the CFW-11 frequency inverter speed control, after the command to release the brake, i.e., the torque limit detection is not performed with the brake closed. It is necessary to use sensorless vector or vector with encoder control mode for inverter in torque limit detection.

#### P0169 – Maximum Positive Torque Current

#### P0170 – Maximum Negative Torque Current

|                               |                           |                         |         |
|-------------------------------|---------------------------|-------------------------|---------|
| <b>Adjustable Range:</b>      | 0.0 to 350.0 %            | <b>Factory Setting:</b> | 200.0 % |
| <b>Proprieties:</b>           |                           |                         |         |
| <b>Access groups via HMI:</b> |                           |                         |         |
|                               | 01 PARAMETER GROUPS       |                         |         |
|                               | └ 29 Vector Control       |                         |         |
|                               | └ 95 Torque Current Limit |                         |         |

#### Description:

These parameters limit the motor current component that produces positive (P0169) or the negative (P0170) torque. The adjustment is expressed as a percentage of the rated motor torque current.



#### NOTE!

In this crane vertical motion application, because of the default definition that the hoisting command is forward, the lowering command is reverse, and with P1026 disabled, when a hoisting command is executed the torque polarity is positive, and during a lowering command it is also positive because of the load braking (the system sends energy to the inverter). The excess of braking energy is dissipated on the braking resistor. The torque current limit parameters to operate the motor in the field-weakening region, P0171 and P0172, are disabled via ladder application where P0171 = P0169 and P0172 = P0170.

## Parameters Description

### P1028 – Speed Hysteresis for Inverter in Torque Limit Detection

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable Range:</b>      | 0.0 to 50.0 %       | <b>Factory Setting:</b> | 10.0 % |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> |                     |                         |        |
|                               | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines the percentage of the motor synchronous speed that will be the hysteresis used to detect inverter torque limits during the execution of load hoisting or lowering commands in the crane vertical motion application. In other words, if the motor speed is less than (hoisting) or greater than (lowering) the hysteresis value when compared to the speed reference, then the inverter torque limit condition is detected.



#### NOTE!

A setting of "0.0 %" disables the fault.

### P1029 – Inverter in Torque Limit Fault (F775) Delay Time

|                               |                     |                         |        |
|-------------------------------|---------------------|-------------------------|--------|
| <b>Adjustable Range:</b>      | 0.00 to 650.00 s    | <b>Factory Setting:</b> | 0.75 s |
| <b>Proprieties:</b>           |                     |                         |        |
| <b>Access groups via HMI:</b> |                     |                         |        |
|                               | 01 PARAMETER GROUPS |                         |        |
|                               | L 50 SoftPLC        |                         |        |

#### Description:

This parameter defines a delay time after the inverter in torque limit condition has been detected, before the fault "F775: Inverter in Torque Limit", is generated.

## 3.16 IMPROPER OPERATION

This parameter group allows to the user to adjust the conditions to supervise the use of the crane vertical motion verifying whether it is being operated properly.

### P1058 – Number of Consecutive Alarms for Improper Operation Fault (F777)

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable Range:</b>      | 0 to 10             | <b>Factory Setting:</b> | 3 |
| <b>Proprieties:</b>           |                     |                         |   |
| <b>Access groups via HMI:</b> |                     |                         |   |
|                               | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter defines the number of consecutive alarms during the period programmed in P1059 to generate the fault "F777: Improper Operation". The practical result of this fault is not allowing the user to continue the crane vertical motion operation in case of consecutive alarm messages.



#### NOTE!

The alarms A750, A760, A762 and A764 are not computed in the consecutive alarm counter, because they just indicate an operation status of the crane vertical motion.



#### NOTE!

A setting of "0" disables the fault.

## Parameters Description

### P1059 – Period of Time for Improper Operation Fault (F777)

|                               |                     |                         |       |
|-------------------------------|---------------------|-------------------------|-------|
| <b>Adjustable</b>             | 0 to 65000 s        | <b>Factory Setting:</b> | 120 s |
| <b>Range:</b>                 |                     |                         |       |
| <b>Proprieties:</b>           |                     |                         |       |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |       |
|                               | L 50 SoftPLC        |                         |       |

#### Description:

This parameter defines the period of time during which the number of consecutive alarms programmed in P1058 must occur, in order to generate the fault “F777: Improper Operation”.

### 3.17 MOTOR UMBALANCED CURRENT

#### P0342 – Motor Unbalanced Current Detection

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 = Off             | <b>Factory Setting:</b> | 0 |
| <b>Range:</b>                 | 1 = On              |                         |   |
| <b>Proprieties:</b>           | CFG                 |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 45 Protections    |                         |   |

#### Description:

This parameter enables the motor unbalanced current detection, which will be responsible for the F076 fault generation. This function will be enabled to trip when the conditions below were fulfilled simultaneously for longer than 2 seconds:

1. P0342 = On;
2. Enabled inverter;
3. Speed reference higher than 3 %;
4.  $|I_u - I_v|$  or  $|I_u - I_w|$  or  $|I_v - I_w| > 0.125 \times P0401$ .



#### NOTE!

Refer to the CFW-11 programming manual for more information on the protection parameters.

### 3.18 HMI MONITORING

This parameter group allows the user to configure which parameters will be shown on the HMI display in the monitoring mode.

#### P0205 – Reading Parameter Selection 1

#### P0206 – Reading Parameter Selection 2

#### P0207 – Reading Parameter Selection 3



#### NOTE!

Refer to the CFW-11 programming manual for more information on the HMI parameters. Some parameter options have been removed from the configuration wizard.

## Parameters Description

### 3.19 READ-ONLY PARAMETERS

#### P1010 – Crane Vertical Motion Version

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0.00 to 10.00       | <b>Factory Setting:</b> | - |
| <b>Range:</b>                 |                     |                         |   |
| <b>Proprieties:</b>           | RO                  |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter indicates the version of the applicative developed for the crane vertical motion.

#### 3.19.1 Alarm History

This parameter group allows to the user to visualize the last three alarms that have occurred in the inverter, together with their time and date information.

#### P1011 – Last Alarm

#### P1014 – Second Alarm

#### P1017 – Third Alarm

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 0 to 999            | <b>Factory Setting:</b> | - |
| <b>Range:</b>                 |                     |                         |   |
| <b>Proprieties:</b>           | RO                  |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

These parameters indicate the last three alarm codes.

The recording systematic is the following:

Axxx → P1011 → P1014 → P1017

#### P1012 – Last Alarm Date

#### P1015 – Second Alarm Date

#### P1018 – Third Alarm Date

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable</b>             | 01.01 to 31.12      | <b>Factory Setting:</b> | - |
| <b>Range:</b>                 |                     |                         |   |
| <b>Proprieties:</b>           | RO                  |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

These parameters indicate the occurrence date (day and month) of the last to the third alarm in the DD.MM format.



## Parameters Description

### P1013 – Last Alarm Time

### P1016 – Second Alarm Time

### P1019 – Third Alarm Time

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable Range:</b>      | 00.00 to 23.59      | <b>Factory Setting:</b> | - |
| <b>Proprieties:</b>           | RO                  |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

These parameters indicate the occurrence time (hour and minute) of the last to the third alarm in the HH.MM format.

### 3.19.2 Status Word

This parameter group allows the user to visualize the status of the crane vertical motion.

### P1020 – Crane Vertical Motion Status Word 1

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable Range:</b>      | 0000h to FFFFh      | <b>Factory Setting:</b> | - |
| <b>Proprieties:</b>           | RO                  |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter allows the status monitoring of the CFW-11 frequency inverter and of the crane vertical motion commands. Each bit represents a specific status.

*Table 3.4 – Status word 1 description*

| Bits     | 15 to 10 | 9                     | 8                | 7                | 6               | 5            | 4               | 3         | 2                  | 1       | 0               |
|----------|----------|-----------------------|------------------|------------------|-----------------|--------------|-----------------|-----------|--------------------|---------|-----------------|
| Function | Reserved | Brake Release Command | Lowering Command | Hoisting Command | Alarm Condition | Undervoltage | Fault Condition | LOC / REM | Rotation Direction | Running | General Enabled |

| Bits                        | Values  |
|-----------------------------|---|
| Bit 0<br>General Enabled    | 0: The inverter is general disabled.<br>1: The inverter is general enabled and ready to run the motor.  |
| Bit 1<br>Running            | 0: Stopped motor<br>1: The inverter is driving the motor at the set point speed, or executing either the acceleration or the deceleration ramp.                                     |
| Bit 2<br>Rotation Direction | 0: Motor in reverse speed direction<br>1: Motor in forward speed direction  |
| Bit 3<br>LOC / REM          | 0: Inverter in local mode<br>1: Inverter in remote mode   |
| Bit 4<br>Fault Condition    | 0: The inverter is not in a fault condition.<br>1: The inverter has detected a fault.<br><b>Note:</b> The fault number can be read by means of the parameter P0049 – Present Fault. |
| Bit 5<br>Undervoltage       | 0: No undervoltage<br>1: Undervoltage   |
| Bit 6<br>Alarm Condition    | 0: The inverter is not in alarm condition.<br>1: The inverter is in alarm condition.<br><b>Note:</b> The alarm number can be read by means of the parameter P0048 – Present Alarm.  |
| Bit 7<br>Hoisting Command   | 0: No load hoisting command<br>1: It indicates that a load hoisting command is being executed.  |
| Bit 8<br>Lowering Command   | 0: No load lowering command<br>1: It indicates that a load lowering command is being executed.  |

## Parameters Description

|                                |  |
|--------------------------------|--|
| Bit 9<br>Brake Release Command | 0: It indicates that a brake closing command is being executed.<br>1: It indicates that a brake release command is being executed. |
| Bits 10 to 15                  | Reserved   |

### P1021 – Crane Vertical Motion Status Word 2

|                               |                     |                         |   |
|-------------------------------|---------------------|-------------------------|---|
| <b>Adjustable Range:</b>      | 0000h to FFFFh      | <b>Factory Setting:</b> | - |
| <b>Proprieties:</b>           | RO                  |                         |   |
| <b>Access groups via HMI:</b> | 01 PARAMETER GROUPS |                         |   |
|                               | L 50 SoftPLC        |                         |   |

#### Description:

This parameter allows the monitoring of the present alarm and fault condition in the crane vertical motion application. Each bit represents one specific status.

*Table 3.5 – Status word 2 description*

| Bits     | 15       | 14       | 13                        | 12                           | 11                       | 10                       | 9                 | 8        | 7                    | 6                    | 5                        | 4                                    | 3                     | 2                | 1                    | 0                            |
|----------|----------|----------|---------------------------|------------------------------|--------------------------|--------------------------|-------------------|----------|----------------------|----------------------|--------------------------|--------------------------------------|-----------------------|------------------|----------------------|------------------------------|
| Function | Reserved | Reserved | Improper Operation (F777) | Inverter Torque Limit (F775) | Slack Cable Fault (F773) | Slack Cable Alarm (A772) | Overweight (A770) | Reserved | Stop Lowering (A764) | Stop Hoisting (A762) | Hoisting Slowdown (A760) | Stop by Simultaneous Commands (A758) | Emergency Stop (A756) | Fast Stop (A754) | Coast to Stop (A752) | Lightweight Operation (A750) |

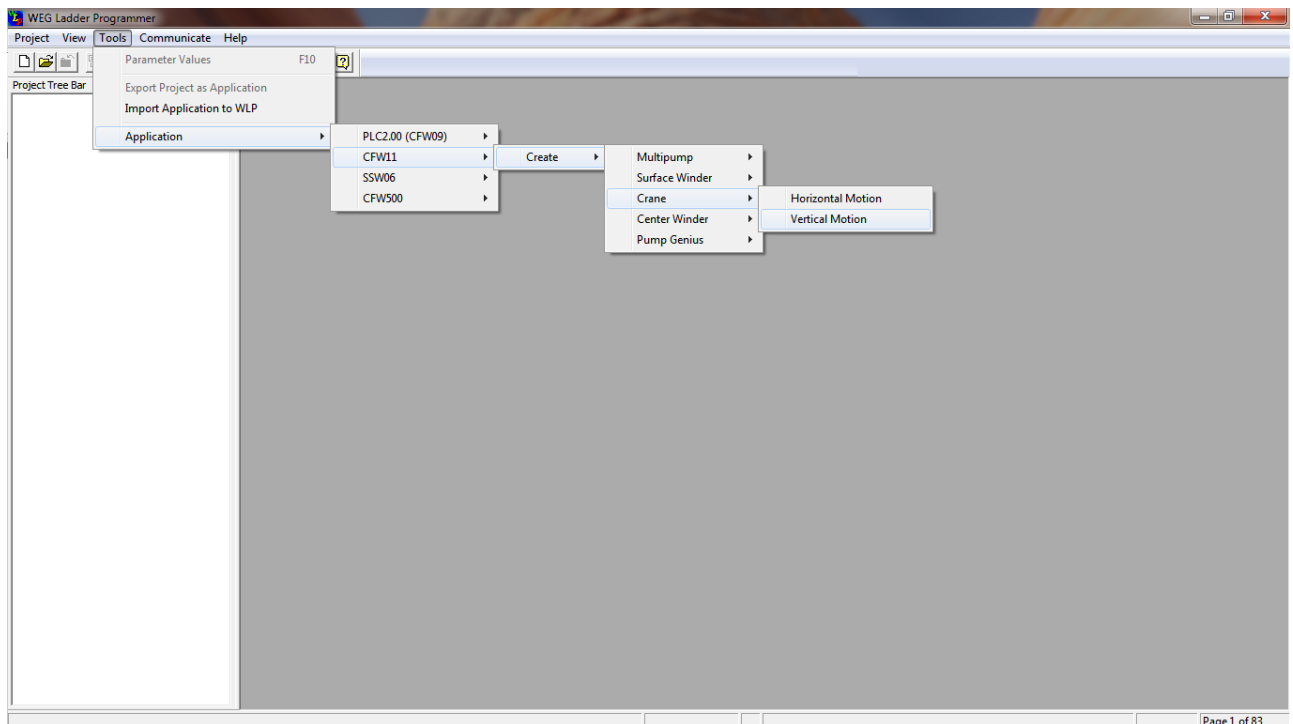
| Bits                                   | Values  |
|--|---|
| Bit 0<br>Lightweight Operation         | 0: No alarm indication<br>1: It indicates that the crane vertical motion is in the lightweight operation mode (A750).         |
| Bit 1<br>Coast to Stop                 | 0: No alarm indication<br>1: The general enable signal has been removed from the DI3 causing the motor to cast down (A752).   |
| Bit 2<br>Fast Stop                     | 0: No alarm indication<br>1: It indicates that a fast stop via digital input DI3 has been executed (A754).                    |
| Bit 3<br>Emergency Stop                | 0: No alarm indication<br>1: It indicates that an emergency stop via digital input DI3 has been executed (A756).              |
| Bit 4<br>Stop by Simultaneous Commands | 0: No alarm indication<br>1: It indicates that a stop occurred because of simultaneous hoisting and lowering commands (A758). |
| Bit 5<br>Hoisting Slowdown             | 0: No alarm indication<br>1: It indicates that the hoisting slowdown limit switch has been actuated (A760).                   |
| Bit 6<br>Stop Hoisting                 | 0: No alarm indication<br>1: It indicates that the stop hoisting limit switch has been actuated (A762).                       |
| Bit 7<br>Stop Lowering                 | 0: No alarm indication<br>1: It indicates that the stop lowering limit switch has been actuated (A764).                       |
| Bit 8                                  | Reserved.   |
| Bit 9<br>Overweight                    | 0: No alarm indication<br>1: It indicates that the overweight condition has been detected during the hoisting stage (A770).   |
| Bit 10<br>Slack Cable Alarm            | 0: No alarm indication<br>1: It indicates that the slack cable condition has been detected during the hoisting stage (A772).  |
| Bit 11<br>Slack Cable Fault            | 0: No fault indication<br>1: It indicates that the slack cable condition has been detected during the hoisting stage (F773).  |
| Bit 12<br>Inverter in Torque Limit     | 0: No fault indication<br>1: It indicates that the inverter in torque limit condition has been detected (F775).               |
| Bit 13<br>Improper Operation           | 0: No fault indication<br>1: It indicates that the improper operation condition has been detected (F777).                     |
| Bit 14                                 | Reserved  |
| Bit 15                                 | Reserved  |

## 4 CREATION AND DOWNLOAD THE APPLICATION

In order to configure the CFW-11 inverter for Crane Vertical Motion application, it is necessary to create the ladder application on the WLP and then download it to the SoftPLC function of the CFW-11 inverter, as well as the parameter values configured on the configuration wizard.

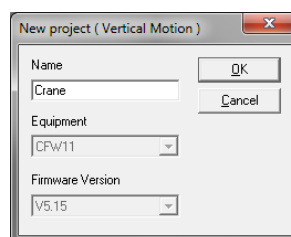
The following steps show how to create and configure the Crane Vertical Motion application in the WLP and how to transfer it to the CFW-11 inverter.

**1<sup>st</sup> Step:** Create a new project on the WLP based on the Crane Vertical Motion ladder standard application. For this, select Tools, Application, CFW-11, Create, Crane and finally click Vertical Motion;



*Figure 4.1 – Create the Crane Vertical Motion application in the WLP*

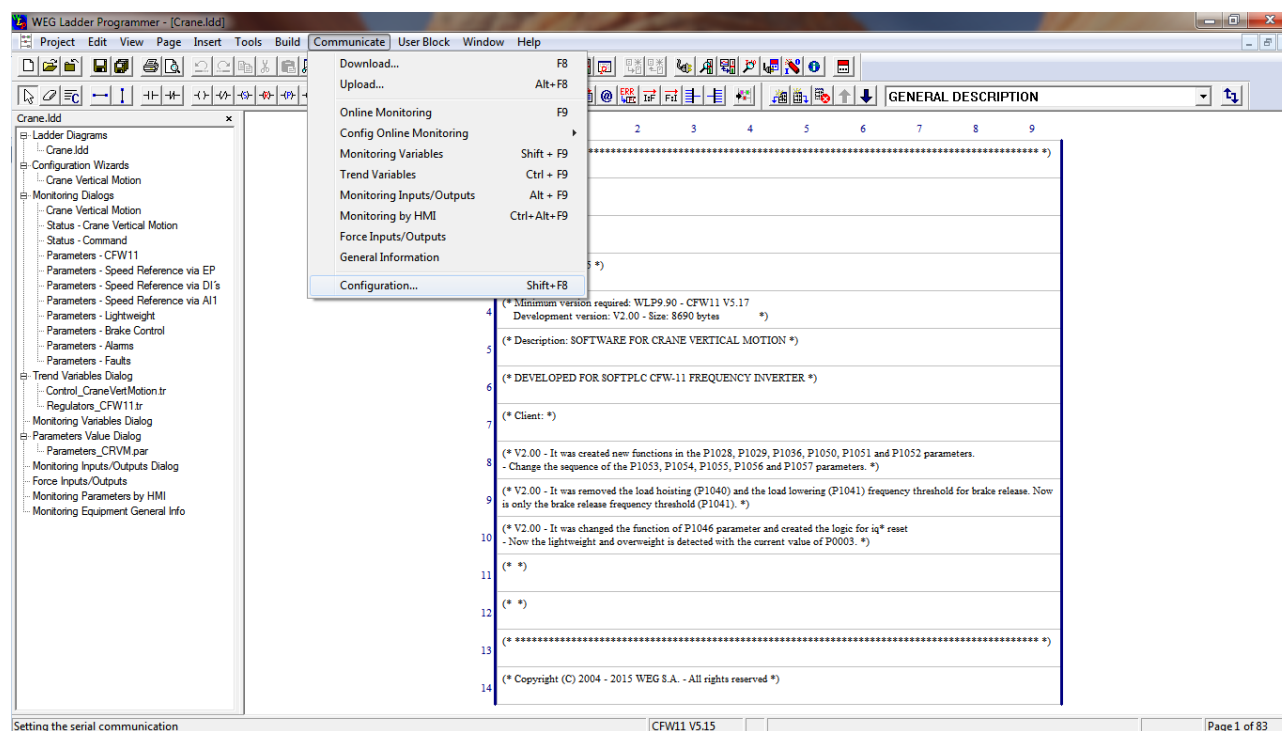
**2<sup>nd</sup> Step:** Name the new project created;



*Figure 4.2 – Dialog to name the new project*

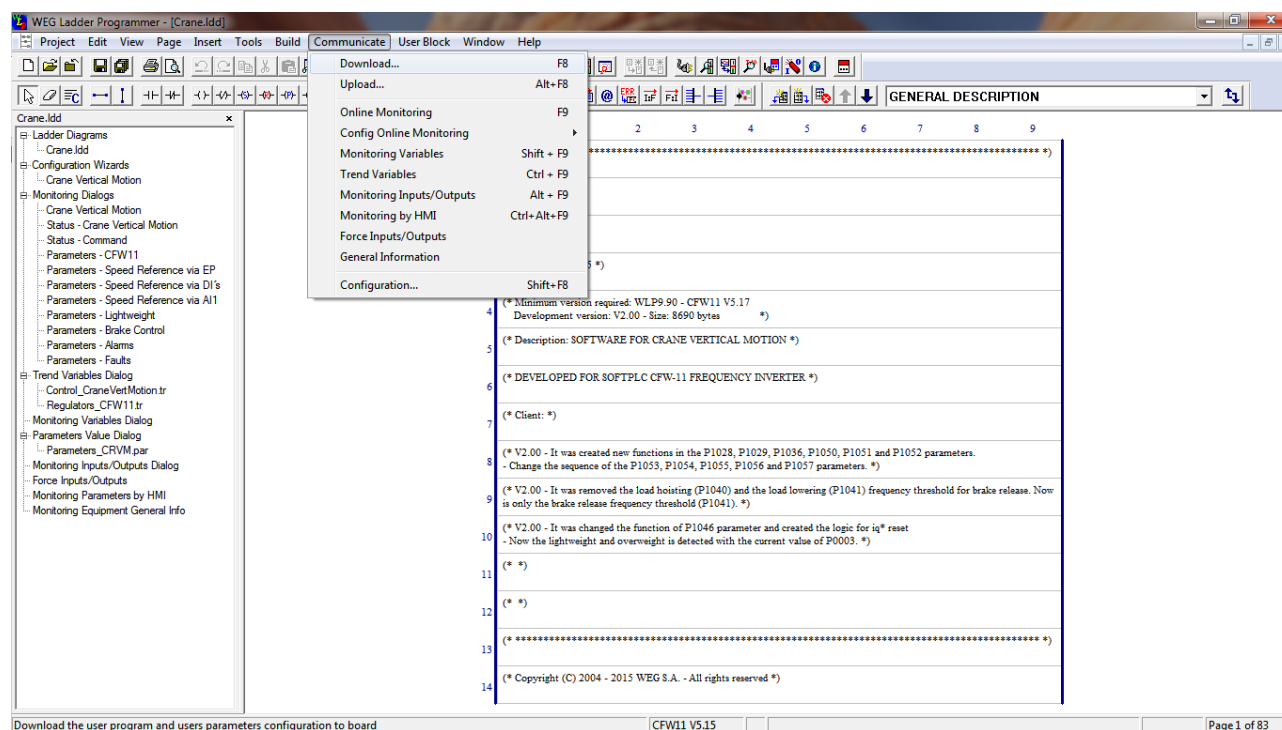
## Creation and Download the Application

**3<sup>rd</sup> Step:** Adjust the configuration of the WLP communication interface with the equipment, can be via USB or serial port (COM1..COM8). For this, select Communicate and then click Configuration (Shift + F8);



*Figure 4.3 – Adjust the communication interface in the new project*

**4<sup>th</sup> Step:** Download the ladder application and user's parameter. For this, select Communicate and then click Download (F8);



*Figure 4.4 – Download the new project*

## Creation and Download the Application

**5<sup>th</sup> Step:** Select “User Program” and “Users Parameters Configuration” in the download dialog. Then click “Ok” to start the transfer to the CFW-11 inverter;

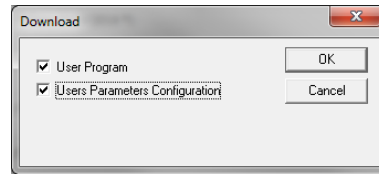


Figure 4.5 – Ladder application download dialog

**6<sup>th</sup> Step:** Download the ladder application to the CFW-11 inverter. For this, after the project is compiled and the CFW-11 inverter is identified, click “Yes” to start the download;

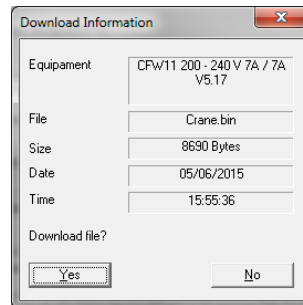


Figure 4.6 – User program download dialog

**7<sup>th</sup> Step:** Enable the execution of the SoftPLC user program after the download of the ladder application to the CFW-11 inverter. Click “Yes” to enable the execution of the SoftPLC user program.

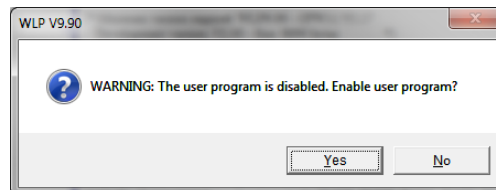


Figure 4.7 – Enabling dialog of the SoftPLC user's program

**8<sup>th</sup> Step:** Download the user's parameters configuration of the ladder application to the CFW-11 inverter. For this, click “Download” in the user parameters configuration dialog; and then, click “Yes” to start the download;

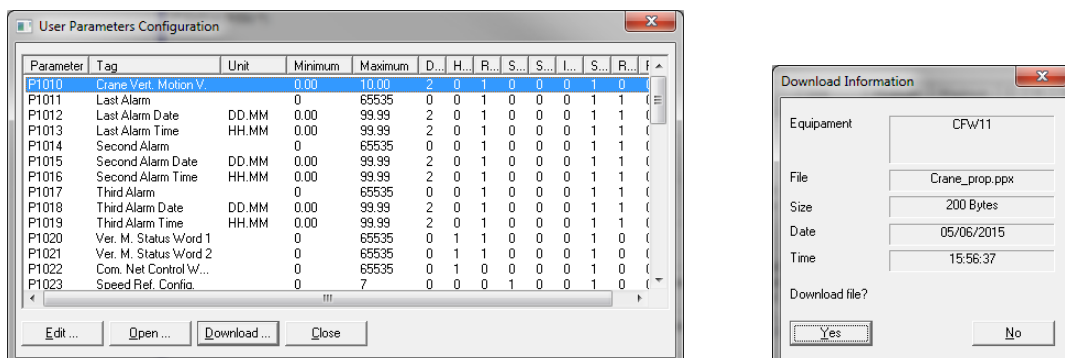


Figure 4.8 – User parameters download dialogs

## Creation and Download the Application

**9<sup>th</sup> Step:** Start the configuration wizard setup for Crane Vertical Motion application. For this, click the Configuration Wizard "Crane Vertical Motion" in the project tree bar according to the pump operation mode for and follow the steps described in chapter 5;

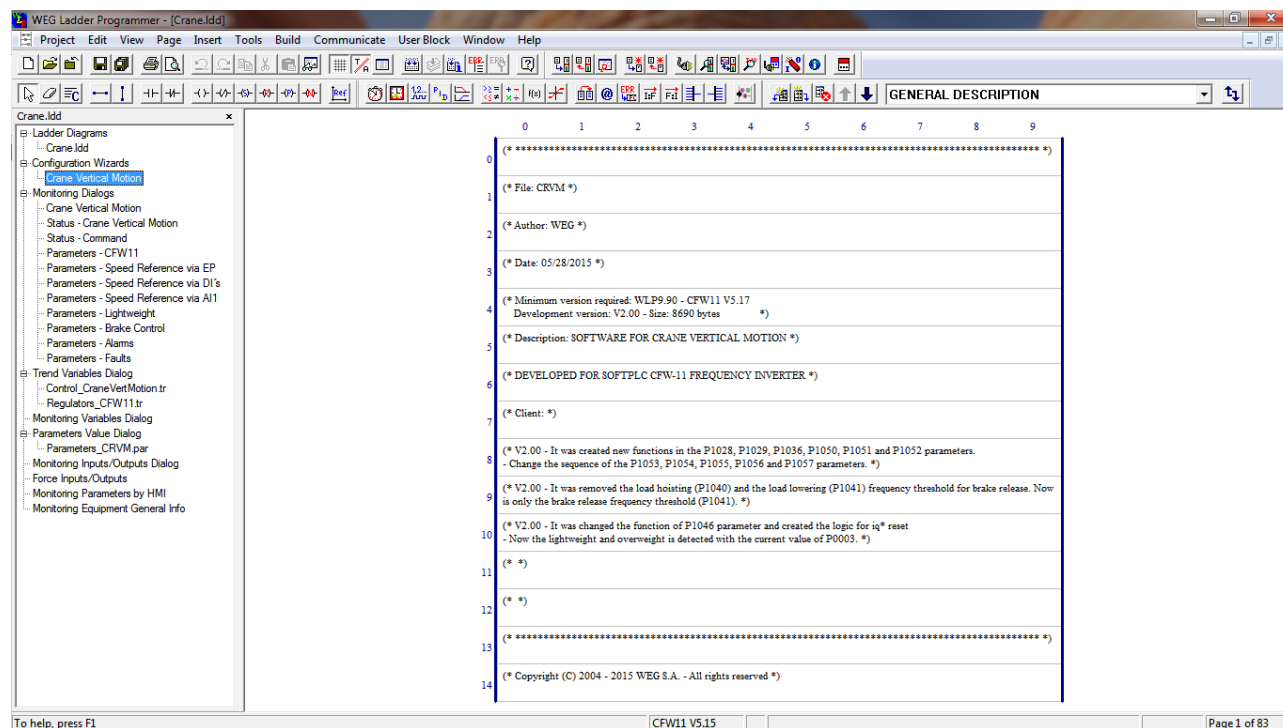


Figure 4.9 – Select the configuration wizard for Crane Vertical Motion application

**10<sup>th</sup> Step:** Click "Finish" in the summary of Crane Vertical Motion configuration;

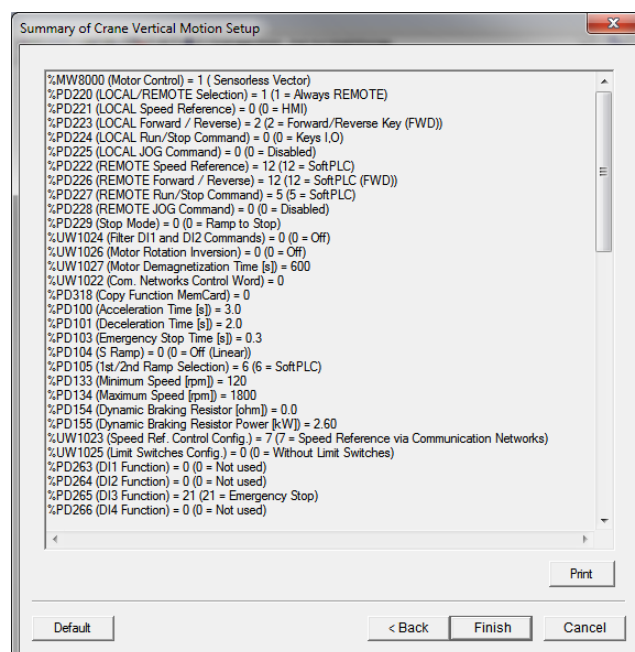
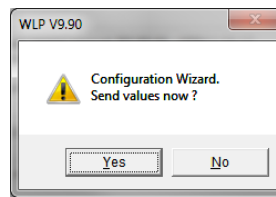


Figure 4.10 – Summary of Crane Vertical Motion configuration

**11<sup>th</sup> Step:** Send the values of the parameters configured in the configuration wizard of Crane Vertical Motion for the CFW-11 inverter. For this, click "Yes" to start sending the values.



*Figure 4.11 – Dialog for download the values of configuration wizard*



**NOTE!**

After performing these steps, the CFW-11 inverter is configured for Crane Vertical Motion application.

## 5 APPLICATION CONFIGURATION WIZARD

The Crane Vertical Motion application can be configured with the WLP (WEG Ladder Programmer) software. The configuration of the application is done with the “Crane Vertical Motion” configuration wizard, which consists of an oriented step by step guide for the configuration of the parameters regarding the application.

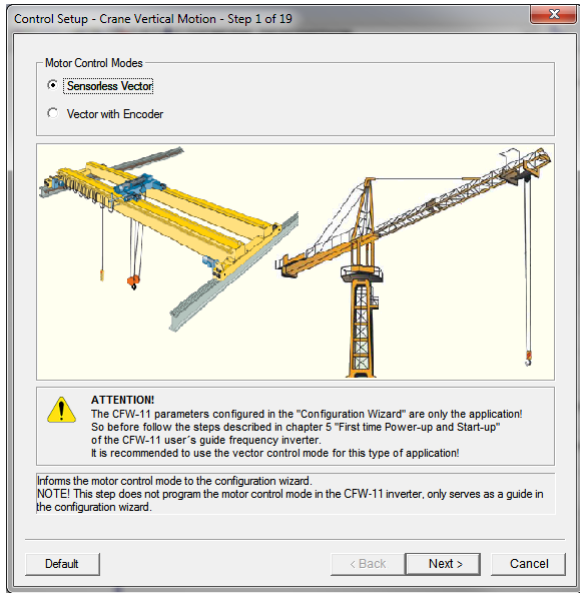
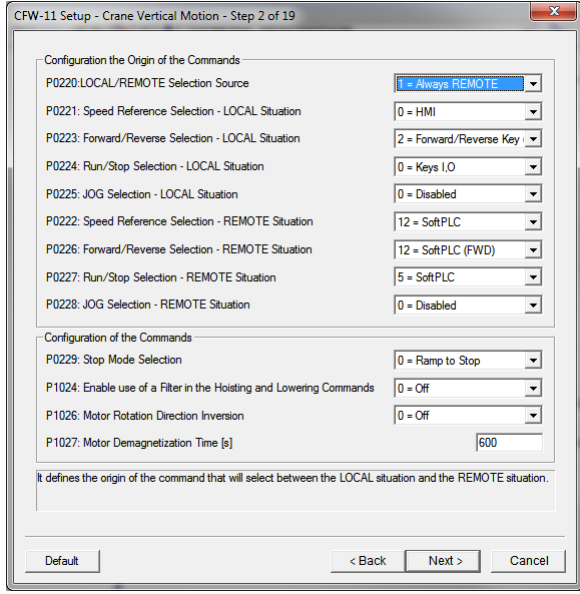


### NOTE!

When powering up the inverter for the first time follow the steps described in the chapter 5 “First Time Power-up and Start-up” of the CFW-11 frequency inverter manual.

It is recommended to use the sensorless vector or the vector with encoder control mode for this kind of application.

*Table 5.1 – Crane vertical motion configuration wizard*

| Step | Description  | WLP Configuration Wizard   |
|------|--|--|
| 1    | General presentation of the crane vertical motion applicative configuration wizard where the user enters which the motor control mode.   |   |
| 2    | It presents the parameters for the configuration of the CFW-11 source of commands and for the crane vertical motion applicative commands:<br>P0220: Local/Remote Selection Source<br>P0221: Speed Reference Selection - Local Situation<br>P0223: Forward Reverse Selection - Local Situation<br>P0224: Run/Stop Selection - Local Situation<br>P0225: JOG Selection - Local Situation<br>P0222: Speed Reference Selection - Remote Situation<br>P0226: Forward Reverse Selection - Remote Situation<br>P0227: Run/Stop Selection - Remote Situation<br>P0228: JOG Selection - Remote Situation<br>P0229: Stop Mode Selection<br>P1024: Enable use of a Filter in the Hoisting and Lowering Commands<br>P1026: Motor Rotation Direction Inversion<br>P1027: Motor Demagnetization Time |  |



|   |  |  |
|---|--|--|
| 3 | <p>It presents the parameters for the configuration of the CFW-11 ramps:</p> <p>P0100: Acceleration Time</p> <p>P0101: Deceleration Time</p> <p>P0103: Emergency Stop Time (2nd Ramp Deceleration)</p> <p>P0104: S Ramp</p> <p>P0105: 1st/2nd Ramp Selection</p> |  |
| 4 | <p>It presents the parameters for the configuration of the CFW-11 speed limits:</p> <p>P0133: Minimum Speed Reference Limit</p> <p>P0134: Maximum Speed Reference Limit</p>  |  |
| 5 | <p>It presents the parameters for the configuration of the CFW-11 dynamic braking:</p> <p>P0154: Dynamic Braking Resistor</p> <p>P0155: Dynamic Braking Resistor Power</p>   |  |

|       |   |  |
|-------|---|--|
| 6     | <p>It presents the parameter for the configuration of the crane vertical motion speed reference control:</p> <p>P1023: Speed Reference Control Configuration</p>  |  |
| 7     | <p>It presents the parameter for the control configuration of the crane vertical motion limit switches:</p> <p>P1025: Limit Switches Configuration</p>  |  |
| 8 - 0 | <p>It presents the parameters for the configuration of the command functions through digital inputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory (only with P1025=6), when the electronic potentiometer (EP) speed reference has been selected:</p> <p>P0263: DI1 Function</p> <p>P0264: DI2 Function</p> <p>P0265: DI3 Function</p> <p>P0266: DI4 Function</p> <p>P0267: DI5 Function</p> <p>P0268: DI6 Function</p> <p>DI9 Function</p> <p>DI10 Function</p> <p>DI11 Function</p> |  |

|              |  |  |
|--------------|--|--|
| <p>8 - 1</p> | <p>It presents the parameters for the configuration of the command functions through digital inputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory (only with P1025=6), when one or two speed references through digital input DI4 have been selected:</p> <p>P0263: DI1 Function<br/>P0264: DI2 Function<br/>P0265: DI3 Function<br/>P0266: DI4 Function<br/>P0267: DI5 Function<br/>P0268: DI6 Function<br/>DI9 Function<br/>DI10 Function<br/>DI11 Function</p>             |  |
| <p>8 - 2</p> | <p>It presents the parameters for the configuration of the command functions through digital inputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory (only with P1025=6), when three or four speed references through digital inputs DI4 and DI5 have been selected:</p> <p>P0263: DI1 Function<br/>P0264: DI2 Function<br/>P0265: DI3 Function<br/>P0266: DI4 Function<br/>P0267: DI5 Function<br/>P0268: DI6 Function<br/>DI9 Function<br/>DI10 Function<br/>DI11 Function</p> |  |
| <p>8 - 3</p> | <p>It presents the parameters for the configuration of the command functions through digital inputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory (only with P1025=6), when five speed references through digital inputs DI4, DI5 and DI6 have been selected:</p> <p>P0263: DI1 Function<br/>P0264: DI2 Function<br/>P0265: DI3 Function<br/>P0266: DI4 Function<br/>P0267: DI5 Function<br/>P0268: DI6 Function<br/>DI9 Function<br/>DI10 Function<br/>DI11 Function</p>     |  |

|              |  |  |
|--------------|--|--|
| <p>8 - 4</p> | <p>It presents the parameters for the configuration of the command functions through digital inputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory (only with P1025=6), when speed reference via analog input AI1 has been selected:</p> <p>P0263: DI1 Function<br/>P0264: DI2 Function<br/>P0265: DI3 Function<br/>P0266: DI4 Function<br/>P0267: DI5 Function<br/>P0268: DI6 Function<br/>DI9 Function<br/>DI10 Function<br/>DI11 Function</p>       |  |
| <p>8 - 5</p> | <p>It presents the parameters for the configuration of the command functions through digital inputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory (only with P1025=6), when speed reference via communication networks has been selected:</p> <p>P0263: DI1 Function<br/>P0264: DI2 Function<br/>P0265: DI3 Function<br/>P0266: DI4 Function<br/>P0267: DI5 Function<br/>P0268: DI6 Function<br/>DI9 Function<br/>DI10 Function<br/>DI11 Function</p> |  |
| <p>9</p>     | <p>It presents the parameters for the configuration of the command functions through digital outputs of the CFW-11 control board and the IOC-01 or IOC-02 accessory module:</p> <p>P0275: DO1 Function (RL1)<br/>P0276: DO2 Function (RL2)<br/>P0277: DO3 Function (RL3)<br/>DO6 Function<br/>DO7 Function<br/>DO8 Function</p>  |  |

| 10 - 0 | <p>It presents the parameters for the configuration of the speed, when the electronic potentiometer (EP) speed reference has been selected:</p> <p>P1031: Minimum Speed Reference 1</p> <p>P1032: Maximum Speed Reference 2</p> <p>P1036: Dwell Time at Speed Reference 1</p> | <div><div>Speed Setup - Crane Vertical Motion - Step 10 of 19</div><div><div>Speed Reference via Electronic Potentiometer (EP)</div><div>P1031: Minimum Speed Reference 1 [Hz]<div>6.0</div></div><div>P1032: Maximum Speed Reference 2 [Hz]<div>60.0</div></div><div>P1036: Dwell Time at Speed Reference 1 [s]<div>0.50</div></div></div><div><div>Block Diagram</div><div><div>Acceleration</div><div>Hoisting</div><div>Lowering</div><div>OR</div><div>AND</div><div>P1032 Hz</div><div>P1031 Hz</div><div>Ref. Hz</div></div></div><div><div>It defines the value of the minimum speed reference for the crane vertical motion.</div><div>Adjustable Range: 0.0 to 1020.0 Hz</div></div><div><div>Default</div><div>&lt; Back</div><div>Next &gt;</div><div>Cancel</div></div></div> |                       |                       |                       |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
|--------|---|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----|---|---|---|---|---|-----|---|---|---|---|---|-----|---|---|---|---|---|
| 10 - 1 | <p>It presents the parameter for the configuration of the speed, when one speed reference through digital input DI4 has been selected:</p> <p>P1031: Speed Reference 1</p>  | <div><div>Speed Setup - Crane Vertical Motion - Step 10 of 19</div><div><div>One Speed Reference via Digital Input DI4</div><div>P1031: Speed Reference 1 [Hz]<div>60.0</div></div></div><div><div>Speed Reference Truth Table</div><table><tr><th></th><th>P1031<br/>Ref. 1<br/>Hz</th><th>P1032<br/>Ref. 2<br/>Hz</th><th>P1033<br/>Ref. 3<br/>Hz</th><th>P1034<br/>Ref. 4<br/>Hz</th><th>P1035<br/>Ref. 5<br/>Hz</th></tr><tr><td>DI4</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>DI5</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>DI6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr></table><div>⇒ Sp. Ref. Hz</div></div></div>   |                       | P1031<br>Ref. 1<br>Hz | P1032<br>Ref. 2<br>Hz | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz | DI4 | 0 | 1 | 0 | 1 | 0 | DI5 | 0 | 0 | 1 | 1 | 0 | DI6 | 0 | 0 | 0 | 0 | 1 |
|        | P1031<br>Ref. 1<br>Hz   | P1032<br>Ref. 2<br>Hz  | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI4    | 0   | 1  | 0                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI5    | 0   | 0  | 1                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI6    | 0   | 0  | 0                     | 0                     | 1                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |

It defines the value of the 1st speed reference for the crane vertical motion.

Adjustable Range: 0.0 to 1020.0 Hz

Default

< Back

Next >

Cancel

| 10 - 2 | It presents the parameters for the configuration of the speed, when two speed references through digital input DI4 have been selected:  P1031: Speed Reference 1  P1032: Speed Reference 2  P1036: Dwell Time at Speed Reference 1 | Speed Setup - Crane Vertical Motion - Step 10 of 19  Two Speed References via Digital Input DI4  P1031: Speed Reference 1 [Hz] 6.0  P1032: Speed Reference 2 [Hz] 60.0  P1036: Dwell Time at Speed Reference 1 [s] 0.50  Speed Reference Truth Table   |     | P1031<br>Ref. 1<br>Hz | P1032<br>Ref. 2<br>Hz | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz | |-----|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------| | DI4 | 0                     | 1                     | 0                     | 1                     | 0                     | | DI5 | 0                     | 0                     | 1                     | 1                     | 0                     | | DI6 | 0                     | 0                     | 0                     | 0                     | 1                     |   ⇒ Sp. Ref. Hz  It defines the value of the 1st speed reference for the crane vertical motion.  Adjustable Range: 0.0 to 1020.0 Hz  Default  < Back  Next >  Cancel |

| 10 - 3 | <p>It presents the parameters for the configuration of the speed, when three speed references through digital inputs DI4 and DI5 have been selected:</p> <p>P1031: Speed Reference 1</p> <p>P1032: Speed Reference 2</p> <p>P1033: Speed Reference 3</p> <p>P1036: Dwell Time at Speed Reference 1</p>   | <p>Speed Setup - Crane Vertical Motion - Step 10 of 19</p> <p>Three Speed References via Digital Inputs DI4 and DI5</p> <p>P1031: Speed Reference 1 [Hz] 6.0</p> <p>P1032: Speed Reference 2 [Hz] 30.0</p> <p>P1033: Speed Reference 3 [Hz] 60.0</p> <p>P1036: Dwell Time at Speed Reference 1 [s] 0.50</p> <p>Speed Reference Truth Table</p> <table><thead><tr><th></th><th>P1031<br/>Ref. 1<br/>Hz</th><th>P1032<br/>Ref. 2<br/>Hz</th><th>P1033<br/>Ref. 3<br/>Hz</th><th>P1034<br/>Ref. 4<br/>Hz</th><th>P1035<br/>Ref. 5<br/>Hz</th></tr></thead><tbody><tr><td>DI4</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>DI5</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>DI6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr></tbody></table> <p>It defines the value of the 1st speed reference for the crane vertical motion.<br/>Adjustable Range: 0.0 to 1020.0 Hz</p> <p>Default &lt; Back Next &gt; Cancel</p>   |                       | P1031<br>Ref. 1<br>Hz | P1032<br>Ref. 2<br>Hz | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz | DI4 | 0 | 1 | 0 | 1 | 0 | DI5 | 0 | 0 | 1 | 1 | 0 | DI6 | 0 | 0 | 0 | 0 | 1 |
|--------|--|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----|---|---|---|---|---|-----|---|---|---|---|---|-----|---|---|---|---|---|
|        | P1031<br>Ref. 1<br>Hz  | P1032<br>Ref. 2<br>Hz  | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI4    | 0  | 1  | 0                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI5    | 0  | 0  | 1                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI6    | 0  | 0  | 0                     | 0                     | 1                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| 10 - 4 | <p>It presents the parameters for the configuration of the speed, when four speed references through digital inputs DI4 and DI5 have been selected:</p> <p>P1031: Speed Reference 1</p> <p>P1032: Speed Reference 2</p> <p>P1033: Speed Reference 3</p> <p>P1034: Speed Reference 4</p> <p>P1036: Dwell Time at Speed Reference 1</p>                                      | <p>Speed Setup - Crane Vertical Motion - Step 10 of 19</p> <p>Four Speed References via Digital Inputs DI4 and DI5</p> <p>P1031: Speed Reference 1 [Hz] 6.0</p> <p>P1032: Speed Reference 2 [Hz] 20.0</p> <p>P1033: Speed Reference 3 [Hz] 40.0</p> <p>P1034: Speed Reference 4 [Hz] 60.0</p> <p>P1036: Dwell Time at Speed Reference 1 [s] 0.50</p> <p>Speed Reference Truth Table</p> <table><thead><tr><th></th><th>P1031<br/>Ref. 1<br/>Hz</th><th>P1032<br/>Ref. 2<br/>Hz</th><th>P1033<br/>Ref. 3<br/>Hz</th><th>P1034<br/>Ref. 4<br/>Hz</th><th>P1035<br/>Ref. 5<br/>Hz</th></tr></thead><tbody><tr><td>DI4</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>DI5</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>DI6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr></tbody></table> <p>It defines the value of the 1st speed reference for the crane vertical motion.<br/>Adjustable Range: 0.0 to 1020.0 Hz</p> <p>Default &lt; Back Next &gt; Cancel</p>  |                       | P1031<br>Ref. 1<br>Hz | P1032<br>Ref. 2<br>Hz | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz | DI4 | 0 | 1 | 0 | 1 | 0 | DI5 | 0 | 0 | 1 | 1 | 0 | DI6 | 0 | 0 | 0 | 0 | 1 |
|        | P1031<br>Ref. 1<br>Hz  | P1032<br>Ref. 2<br>Hz  | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI4    | 0  | 1  | 0                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI5    | 0  | 0  | 1                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI6    | 0  | 0  | 0                     | 0                     | 1                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| 10 - 5 | <p>It presents the parameters for the configuration of the speed, when five speed references through digital inputs DI4, DI5 and DI6 have been selected:</p> <p>P1031: Speed Reference 1</p> <p>P1032: Speed Reference 2</p> <p>P1033: Speed Reference 3</p> <p>P1034: Speed Reference 4</p> <p>P1035: Speed Reference 5</p> <p>P1036: Dwell Time at Speed Reference 1</p> | <p>Speed Setup - Crane Vertical Motion - Step 10 of 19</p> <p>Five Speed References via Digital Inputs DI4, DI5 and DI6</p> <p>P1031: Speed Reference 1 [Hz] 6.0</p> <p>P1032: Speed Reference 2 [Hz] 15.0</p> <p>P1033: Speed Reference 3 [Hz] 30.0</p> <p>P1034: Speed Reference 4 [Hz] 45.0</p> <p>P1035: Speed Reference 5 [Hz] 60.0</p> <p>P1036: Dwell Time at Speed Reference 1 [s] 0.50</p> <p>Speed Reference Truth Table</p> <table><thead><tr><th></th><th>P1031<br/>Ref. 1<br/>Hz</th><th>P1032<br/>Ref. 2<br/>Hz</th><th>P1033<br/>Ref. 3<br/>Hz</th><th>P1034<br/>Ref. 4<br/>Hz</th><th>P1035<br/>Ref. 5<br/>Hz</th></tr></thead><tbody><tr><td>DI4</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>DI5</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>DI6</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr></tbody></table> <p>It defines the value of the 1st speed reference for the crane vertical motion.<br/>Adjustable Range: 0.0 to 1020.0 Hz</p> <p>Default &lt; Back Next &gt; Cancel</p> |                       | P1031<br>Ref. 1<br>Hz | P1032<br>Ref. 2<br>Hz | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz | DI4 | 0 | 1 | 0 | 1 | 0 | DI5 | 0 | 0 | 1 | 1 | 0 | DI6 | 0 | 0 | 0 | 0 | 1 |
|        | P1031<br>Ref. 1<br>Hz  | P1032<br>Ref. 2<br>Hz  | P1033<br>Ref. 3<br>Hz | P1034<br>Ref. 4<br>Hz | P1035<br>Ref. 5<br>Hz |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI4    | 0  | 1  | 0                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI5    | 0  | 0  | 1                     | 1                     | 0                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |
| DI6    | 0  | 0  | 0                     | 0                     | 1                     |                       |                       |                       |     |   |   |   |   |   |     |   |   |   |   |   |     |   |   |   |   |   |

|               |   |  |
|---------------|---|--|
| <p>10 - 6</p> | <p>It presents the parameters for the configuration of the speed, when speed reference via analog input AI1 (Step Less) has been selected:</p> <p>P0231: AI1 Signal Function</p> <p>P0233: AI1 Signal Type</p> <p>P0232: AI1 Gain</p> <p>P0234: AI1 Offset</p> <p>P0235: AI1 Filter</p> <p>P1031: Minimum Speed Reference 1</p> <p>P1032: Maximum Speed Reference 2</p> <p>P1036: Dwell Time at Speed Reference 1</p> |  |
| <p>10 - 7</p> | <p>It presents the parameter for the configuration of the speed, when speed reference via communication networks has been selected:</p> <p>P1030: Speed Reference</p> <p>P1031: Minimum Speed Reference 1</p> <p>P1032: Maximum Speed Reference 2</p> <p>P1036: Dwell Time at Speed Reference 1</p>   |  |
| <p>11</p>     | <p>It presents the parameters for the configuration of the lightweight detection:</p> <p>P1037: Hoisting Current Threshold for Lightweight Detection</p> <p>P1038: Lowering Current Threshold for Lightweight Detection</p> <p>P1039: Speed Threshold for Lightweight Detection Enabling</p>  |  |

|    |  |  |
|----|--|--|
| 12 | <p>It presents the parameters for the configuration of the brake release command when load hoisting or load lowering:</p> <p>P1041: Brake Release Frequency Threshold</p> <p>P1042: Load Hoisting Current Threshold</p> <p>P1043: Load Lowering Current Threshold</p> <p>P1044: Load Hoisting Torque Threshold</p> <p>P1045: Load Lowering Torque Threshold</p> <p>P1046: Brake Response Time to Release</p> |  |
| 13 | <p>It presents the parameters for the configuration of the brake closing command:</p> <p>P1047: Inhibition of the Brake Closing during a Hoisting/Lowering Transition</p> <p>P1048: Brake Closing Frequency Threshold</p> <p>P1049: Brake Closing Delay Time</p> <p>P1050: Time to Enable a new Command to Brake Release</p>   |  |
| 14 | <p>It presents the parameters for the configuration of the overweight detection at the load hoisting:</p> <p>P1051: Overweight Current Threshold in the Minimum Speed</p> <p>P1052: Overweight Current Threshold in the Maximum Speed</p> <p>P1053: Overweight Detection Delay Time</p> <p>P1054: Overweight Alarm (A770) Delay Time</p>   |  |



|    |   |  |
|----|---|--|
| 15 | <p>It presents the parameters for the configuration of the slack cable detection at the load lowering:</p> <p>P1055: Load Detection Time</p> <p>P1056: Slack Cable Alarm (A772) Delay Time</p> <p>P1057: Slack Cable Fault (F773) Delay Time</p>  |  |
| 16 | <p>It presents the parameters for the configuration of inverter in torque limitation detection at the load hoisting or lowering:</p> <p>P0169: Maximum Positive Torque Current</p> <p>P0170: Maximum Negative Torque Current</p> <p>P1028: Speed Hysteresis for Inverter in Torque Limit Detection</p> <p>P1029: Inverter in Torque Limit Fault (F775) Delay Time</p> |  |
| 17 | <p>It presents the parameters for the configuration of the improper operation fault:</p> <p>P1058: Number of Consecutive Alarms for Improper Operation Fault (F777)</p> <p>P1059: Period of Time for Improper Operation Fault (F777)</p>  |  |

|    |  |  |
|----|--|--|
| 18 | <p>It presents the parameter for the configuration of the motor unbalanced current fault:</p> <p>P0342: Motor Unbalanced Current Detection</p>   |  |
| 19 | <p>It presents the parameters that define which variables will be displayed on the HMI in the monitoring mode:</p> <p>P0205: Reading Parameter Selection 1</p> <p>P0206: Reading Parameter Selection 2</p> <p>P0207: Reading Parameter Selection 3</p> |  |
|    | <p>It presents a summary with all the parameters configured by the crane vertical motion applicative configuration wizard.</p>   |  |

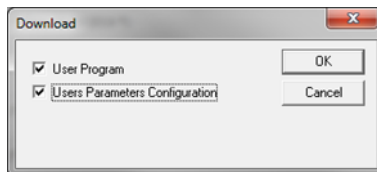
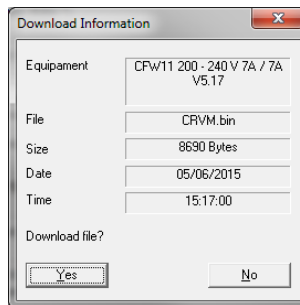
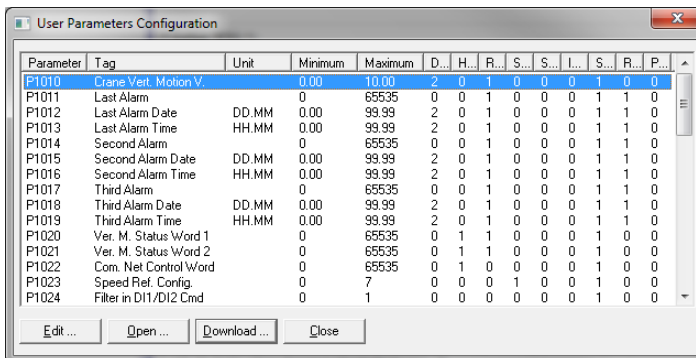
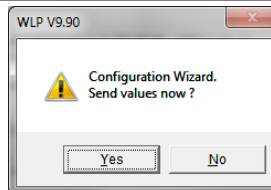
## 6 DOWNLOAD DIALOG BOXES

Through the WLP it is possible to download the user's ladder program, the configuration of user's parameters and the values configured in the configuration wizard. Below is a presentation of the main download dialogs to the CFW-11 inverter.


**NOTE!**

Refer to the help topics in the WLP programming software for more details on the download.

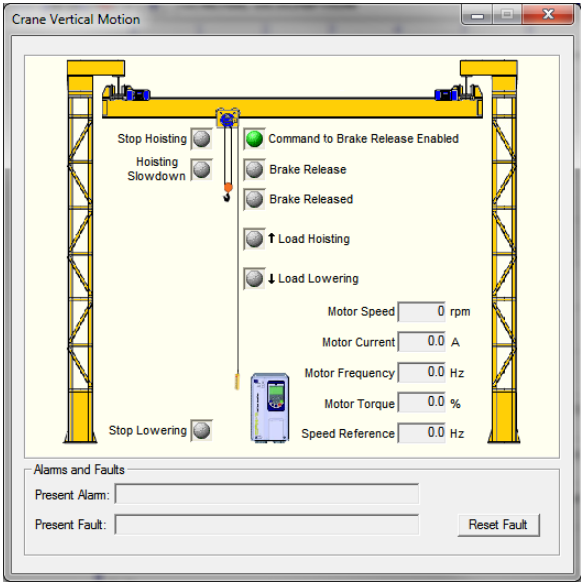
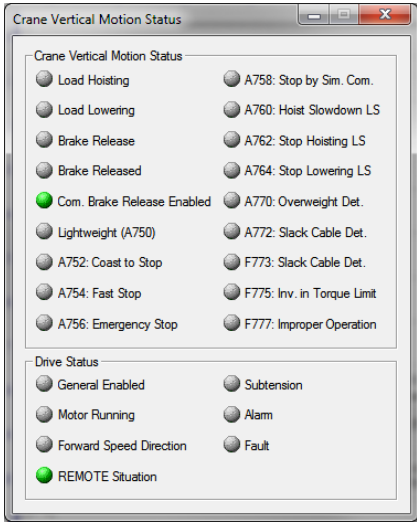
*Table 6.1 – Download dialog box for the Crane Vertical Motion application*

| Description  | WLP Download Dialog Box  |
|--|--|
| Download dialog box of the applicative developed with the WLP containing the following options: <ul style="list-style-type: none"> <li>■ User Program;</li> <li>■ Configuration of the User Parameters;</li> </ul>   |    |
| User program download dialog box containing: <ul style="list-style-type: none"> <li>■ Characteristics of the connected equipment;</li> <li>■ Name of the file to be downloaded;</li> <li>■ Size of the applicative to be downloaded;</li> <li>■ File compilation date;</li> <li>■ File compilation time;</li> <li>■ Confirmation command to transfer the compiled applicative.</li> </ul>  |   |
| Configuration of the user parameters dialog box containing: <ul style="list-style-type: none"> <li>■ Parameter number;</li> <li>■ Name given to the parameter by the user;</li> <li>■ Unit given to the parameter by the user;</li> <li>■ Minimum and maximum values;</li> <li>■ Number of decimal positions;</li> <li>■ Options for visualization in hexadecimal format, with sign, ignoring the password, visualization on the HMI, retentive and for change confirmation;</li> <li>■ Commands for opening, editing, performing the download and for closing the dialog box of the user parameters.</li> </ul> |  |
| Dialog box for the download of the values configured with the crane vertical motion configuration wizard.  |  |

## 7 MONITORING DIALOG BOXES

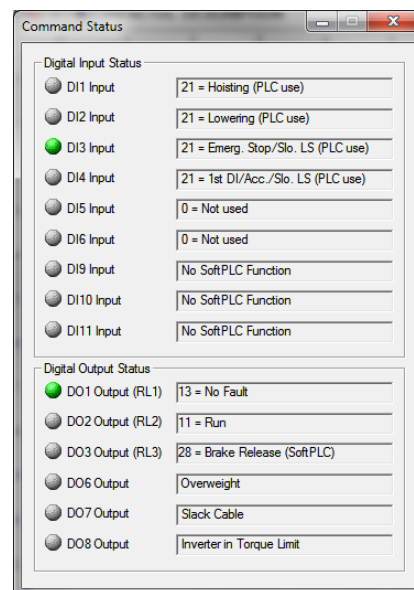
Through the WLP, it is possible to monitor and change the crane vertical motion applicative parameters.

*Table 7.1 – Crane vertical motion applicative monitoring dialog boxes*

| Description  | WLP Monitoring Dialog Box  |
|--|--|
| <p>Monitoring of the crane vertical motion operation. It allows the visualization of the following variables:</p> <ul style="list-style-type: none"> <li>■ Hoisting or lowering command;</li> <li>■ Brake release command;</li> <li>■ Indication of brake released and command to brake release enabled;</li> <li>■ Status of the hoisting slowdown, stop hoisting and stop lowering limit switches;</li> <li>■ Speed, current, frequency and torque of the crane vertical motion motor driven by the CFW-11 inverter;</li> <li>■ Actual speed reference value in Hz;</li> <li>■ Present fault and present alarm;</li> <li>■ System fault reset command.</li> </ul>  |   |
| <p>Monitoring of the crane vertical motion and drive status. It shows the following variables:</p> <ul style="list-style-type: none"> <li>■ Load hoisting or load lowering command;</li> <li>■ Brake release command;</li> <li>■ Indication of brake released and command to brake release enabled;</li> <li>■ Crane vertical motion in lightweight operation mode (A750);</li> <li>■ Alarm indication due to coast to stop (A752), fast stop (A754), emergency stop (A756) or stop by simultaneous hoisting and lowering commands (A758);</li> <li>■ Alarm indication due to hoisting slowdown limit switch (A760), stop hoisting limit switch (A762), stop lowering limit switch (A764), detected overweight (A770) and/or detected slack cable (A772);</li> <li>■ Fault indication due to detected slack cable (F773), inverter in torque limit (F775) and/or improper operation of the crane vertical motion (F777);</li> <li>■ General enabled, forward rotation direction, remote situation, undervoltage, alarm and fault status of the CFW-11 inverter.</li> </ul> |  |

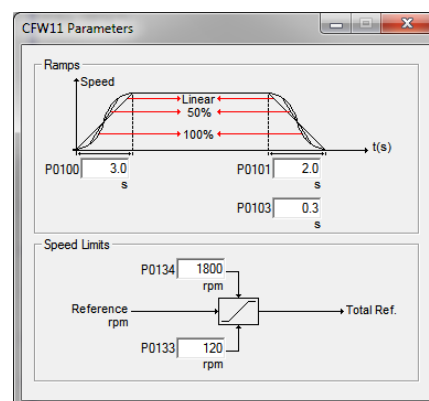
Monitoring of the crane vertical motion commands. It shows the following variables:

- Status of the CFW-11 inverter digital inputs;
- Digital input functions in the crane vertical motion;
- Status of the CFW-11 inverter digital outputs;
- Digital output functions in the crane vertical motion.



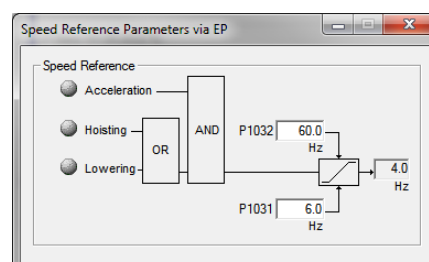
It shows the CFW-11 inverter ramp and speed limit parameters, configured for the crane vertical motion. It allows the modification of the following variables:

- P0100: Acceleration time;
- P0101: Deceleration time;
- P0103: Emergency stop time (2nd ramp deceleration);
- P0133: Minimum speed reference limit;
- P0134: Maximum speed reference limit.



It shows the speed reference parameters when the electronic potentiometer has been selected. It allows the visualization and modification of the following variables

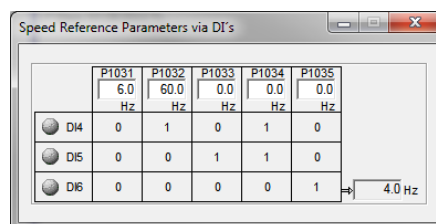
- P1031: Minimum speed reference;
- P1032: Maximum speed reference;
- Actual speed reference value in Hz;
- Acceleration command to increase the speed reference;
- Command for hoisting or lowering.



## Monitoring Dialog Boxes

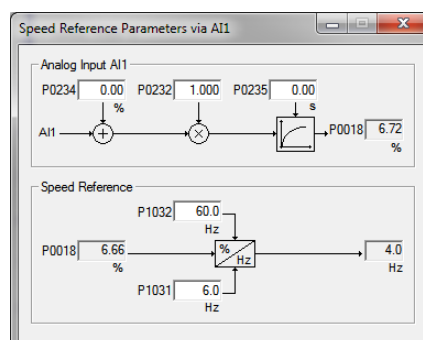
It shows the speed reference parameters when the digital input combination has been selected. It allows the visualization and modification of the following variables:

- P1031: Speed reference 1;
- P1032: Speed reference 2;
- P1033: Speed reference 3;
- P1034: Speed reference 4;
- P1035: Speed reference 5;
- Actual speed reference value in Hz;
- Status of the digital inputs DI4, DI5 and DI6, which compose the logical combination for the speed reference value selection.



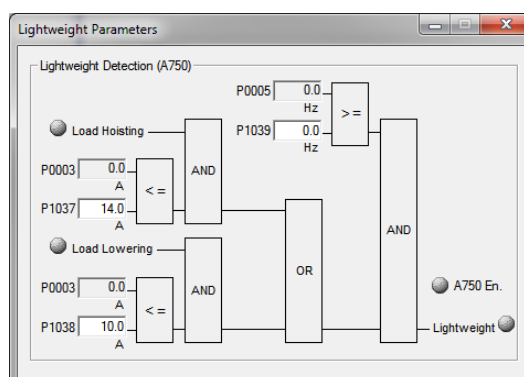
It shows the speed reference parameters when the analog input AI1 has been selected. It allows the visualization and modification of the following variables:

- P0018: AI1 value;
- P0232: AI1 gain;
- P0234: AI1 offset;
- P0235: AI1 filter;
- P1031: Minimum speed reference;
- P1032: Maximum speed reference;
- Actual speed reference value in Hz.



It presents the parameters for the operation of the lightweight detection logic. It allows the visualization and modification of the following variables:

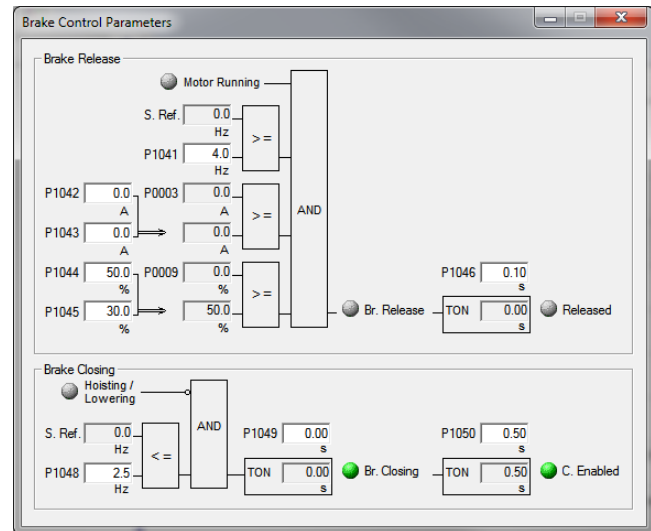
- P0003: Motor current;
- P0005: Motor frequency;
- P1037: Hoisting current threshold for lightweight detection;
- P1038: Lowering current threshold for lightweight detection;
- P1039: Speed threshold for lightweight detection enabling;
- Hoisting or lowering command;
- Lightweight detection enabled indication;
- Operation in lightweight mode indication.



## Monitoring Dialog Boxes

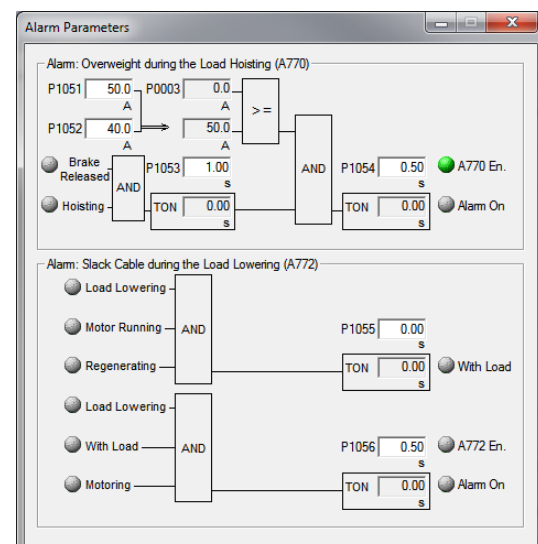
It presents the parameters for the operation of the brake control logic. It allows the visualization and modification of the following variables:

- P0003: Motor current;
- P0009: Motor torque;
- P1041: Brake release frequency threshold;
- P1042: Load hoisting current threshold;
- P1043: Load lowering current threshold;
- P1044: Load hoisting torque threshold;
- P1045: Load lowering torque threshold;
- P1046: Brake response time to release;
- P1047: Inhibition of the brake closing during a hoisting/lowering transition;
- P1048: Brake closing speed threshold;
- P1049: Brake closing delay time;
- P1050: Time to enable a new command to brake release;
- Total speed reference after the ramp (motor frequency) in Hz;
- Value of brake response to release elapsed time, brake closing delay elapsed time and a new command to brake release enabled elapsed time;
- Motor running indication;
- Brake release and closing command indication;
- Brake released and command to brake release enabled indication.



It presents the parameters for the operation of the alarm generation logic. It allows the visualization and modification of the following variables:

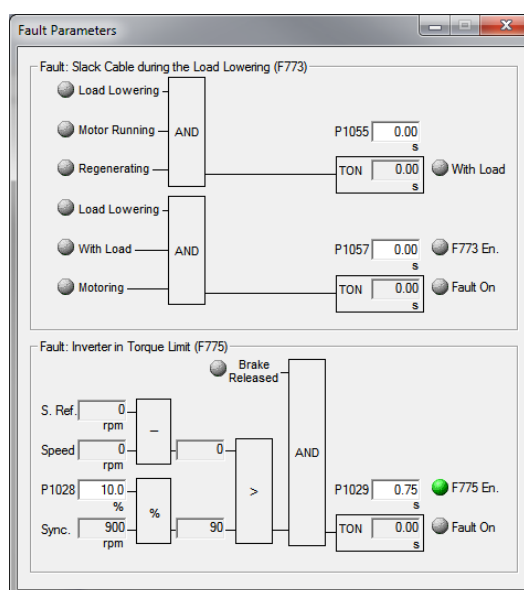
- P0003: Motor current;
- P1051: Overweight current threshold in the minimum speed;
- P1052: Overweight current threshold in the maximum speed;
- P1053: Overweight detection delay time;
- P1054: Overweigh alarm delay time;
- P1055: Load detection time;
- P1056: Slack cable alarm delay time;
- Elapsed time to generate alarms;
- Overweight current value as the overweight curve defined by P1051 and P1052;
- Load hoisting or lowering command indication;
- Brake released indication;
- Indication of running motor, regenerating to or being driven by the inverter;
- Indication of the active alarms;
- Indication of the enabled alarms;
- Detected load indication.



## Monitoring Dialog Boxes

It presents the parameters for the operation of the fault generation logic. It allows the visualization and modification of the following variables:

- P1055: Load detection time;
- P1057: Slack cable fault delay time;
- P1028: Speed hysteresis for inverter in torque limit detection;
- P1029: Inverter in torque limit fault delay time;
- Speed reference, actual speed and the motor synchronous speed;
- Speed hysteresis calculated for inverter in torque limit detection;
- Elapsed time to generate faults;
- Load lowering command indication;
- Brake released indication;
- Indication of running motor, regenerating to or being driven by the inverter;
- Indication of active faults;
- Indication of enabled faults;
- Detected load indication.





### 8 TREND VARIABLES DIALOG BOXES

Through the WLP, it is possible to monitor the variables of the crane vertical motion applicative.

#### Crane Vertical Motion Control:

It allows the visualization of the speed reference value after the ramp in Hz, of the actual motor frequency in Hz, of the actual motor current in A, of the actual motor torque in %, of DC link voltage in V, and of command to brake release for an analysis of the crane vertical motion behavior.



Figure 8.1 – Crane vertical motion control trend variable dialog box

#### CFW-11 Regulators:

It allows the visualization of the actual motor speed value and the response of speed ( $I_q^*$ ) and flux ( $I_d^*$ ) regulators, of motor current and torque and of the command to brake release for an analysis of the CFW-11 performance.

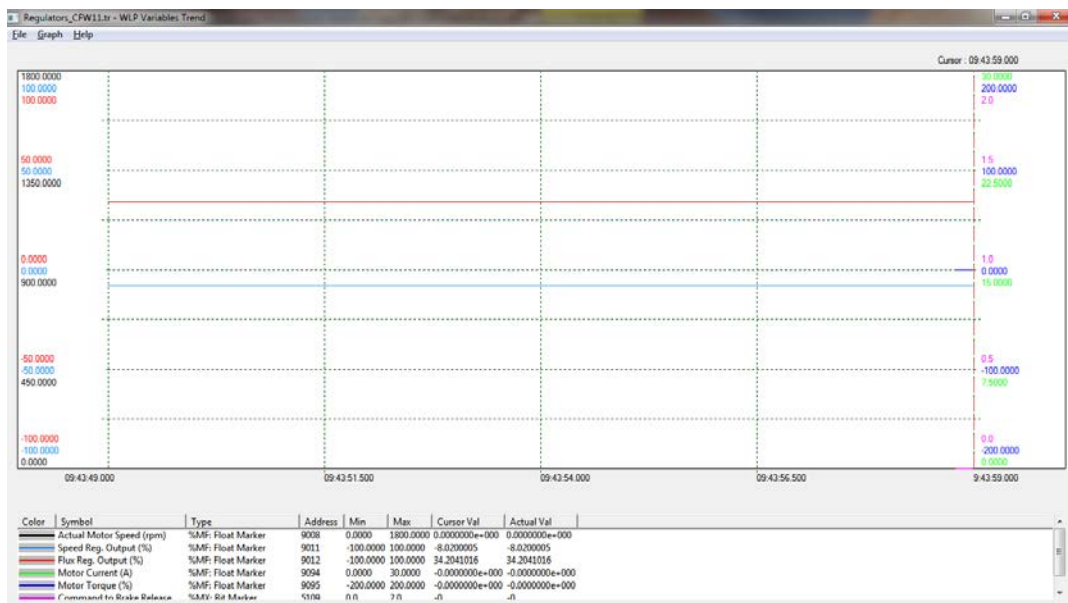


Figure 8.2 – Speed and flux regulators trend variable dialog box



#### NOTE!

Refer to the WLP programming software help topics for more information on the use of the trend variables.

9 PARAMETER VALUE DIALOG

Through the WLP, it is possible to save the parameters of the crane vertical motion applicative.

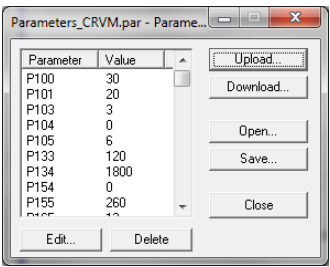


Figure 9.1 – Parameter value dialog



**NOTE!**

Refer to the WLP programming software help topics for more information on the use of the parameter value dialog.