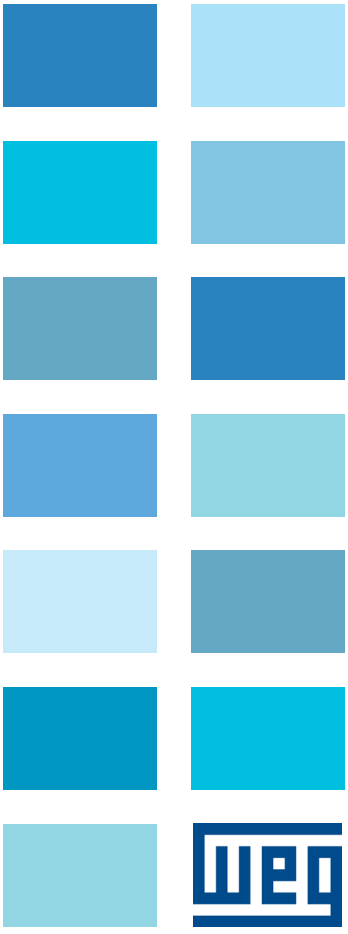
Modular Drive

CFW-11W

User's Manual



User's Manual

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Summary of Revisions

Version	Revision	Description
-	R00	First edition

1 SAFETY INSTRUCTIONS

This manual contains the necessary information for the correct use of the CFW-11W frequency inverter models 1445...3900 A / 500...690 V.

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

1.1 SAFETY NOTICES IN THE MANUAL

The following safety notices are used in this manual:

DANGER!
Failure to comply with the procedures recommended in this warning may lead to death, serious injuries and considerable material damages.

ATTENTION!
Failure to comply with the procedures recommended in this warning may lead to material damages.

NOTE!
The text provides important information for the full understanding and proper operation of the product.

1.2 SAFETY WARNINGS ON THE PRODUCT

The following symbols are attached to the product as safety warnings:

High voltages present.

Components sensitive to electrostatic discharges.
Do not touch them.

Mandatory connection to the protection earth (PE).

Connection of the shield to the ground.

Hot surface.

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!
Only qualified personnel, familiar with the CFW-11W frequency inverter and related equipment must plan or perform the installation, start-up, operation and maintenance of this equipment.
Such personnel must follow the safety instructions described in this manual and/or defined by local standards.
Failure to comply with the safety instructions may cause risk of death and/or equipment damage.

NOTE!
For the purpose of this manual, qualified personnel are people trained so as to be able to:
1. Install, ground, energize and operate the CFW-11W according to this manual and the legal safety procedures in force.
2. Use protective equipment in accordance with the standards.
3. Give first aid.

DANGER!
Always disconnect the general power supply before touching any electrical component linked to the inverter.
Many components may remain charged with high voltages and/or moving parts (fans) even after the AC power supply input is disconnected or turned off.
Wait for at least ten minutes in order to guarantee the full discharge of the capacitors.
Always connect the equipment frame to the protective earth (PE) at the proper terminal.

ATTENTION!
Electronic boards have components sensitive to electrostatic discharges. Do not touch the components or connectors directly. If necessary, first touch the grounded metallic frame or wear a ground strap.

Do not execute any applied potential test on the inverter!
If necessary, contact WEG.

NOTE!
Frequency inverters may interfere in other electronic devices. Observe the recommendations of Chapter 3 INSTALLATION AND CONNECTION on page 3-1 in order to minimize those effects.

NOTE!
Read this manual completely before installing or operating this inverter.

ATTENTION!
The operation of this equipment requires installation instructions and detailed operation provided in the user's manual, programming manual and manuals/guides for kits and accessories. Only the user's manual is supplied in print. The other manuals are available at **www.weg.net**. A printed copy of the files available on WEG's website can be requested at your local WEG dealer.

ATTENTION!
When in operation, electric energy systems – such as transformers, converters, motors and cables – generate electromagnetic fields (EMF), posing a risk to people with pacemakers or implants who stay in close proximity to them. Therefore, those people must stay at least 2 meters away from such equipment.

2 GENERAL INFORMATION

2.1 ABOUT THE MANUAL

This manual contains information for the proper installation and start-up in the V/f (scalar) control mode, the main technical data and how to identify and correct the most usual problems of the CFW-11W inverters.

It is also possible to operate the CFW-11W in the VVW, Vector Sensorless and Vector with Encoder control modes. For further details about the start-up and other control modes, refer to the programming manual.

For information on other functions, accessories and operating conditions, refer to the following manuals:

- Programming manual with detailed description of the parameters and advanced functions of the CFW-11 inverter.
- Manual of the interface modules for incremental encoder.
- Manual of the I/O expansion modules.
- RS-232/RS-485 serial communication manual.
- CANopen slave communication manual.
- Anybus-CC communication manual.

Those manuals are supplied in electronic format and can be downloaded on WEG website - **www.weg.net**.

2.2 TERMS AND DEFINITIONS USED IN THE MANUAL

Normal Duty Cycle (ND): operating duty of the inverter that defines the maximum current values for continuous operation Inom-ND and overload of 110 % for one minute. It is selected by programming P0298 (Application) = 0 (Normal Duty (ND)). It should be used to drive motors which are not subject, in the application, to high torques in relation to its rated torque, when operating in steady state, at the start, at the acceleration or deceleration.

$\mathbf{I_{nom\ -ND}}$: rated inverter current for use with normal duty (ND). Overload: 1.1 x Inom-ND/ 1 minute.

Current Unbalance (%):

Power unit unbalance X - phase Y = $\left|\frac{I_{YX} - I_{YAVG}}{I_{YAVG}}\right| .100$

IYAVG = $\frac{I_{Y1} + I_{Y2} \ldots + I_{YN}}{N}$

Where:

N = number of power units

I_{YN} = current of phase Y (U, V or W) of the power unit N (P0815 to P0823)

I_{YAVG} = average current of phase Y

Rectifier: input circuit of the inverters which converts the AC input voltage into DC. Formed by thyristors and power diodes.

Pre-Charge Circuit: it loads the capacitors of the DC link with limited current, avoiding greater current peaks at the energizing of the inverter.

DC link: intermediate circuit of the inverters; voltage in direct current obtained by rectifying the alternate supply voltage or through external power supply; it supplies the output inverter bridge of the inverters, formed by IGBTs.

Arm U, V and W: set of two IGBTs of the inverter output phases U, V and W.

IGBT: Insulated Gate Bipolar Transistor, basic component of the output inverters. They work as an electronic switch in the saturated (closed switch) and cut-off (open switch) modes.

Braking IGBT: it works as a switch to turn on the braking resistors. It is controlled by the DC link level.

PTC: resistor whose resistance value in ohms increases proportionally to the temperature; used as temperature sensor on motors.

NTC: resistor whose resistance value in ohms decreases proportionally to the temperature increase; used as temperature sensor on power modules.

HMI: Human-Machine Machine Interface; device which allows controlling the motor, viewing and changing the inverter parameters. The HMI of the CFW-11W features keys to control the motor and navigate on the graphic LCD display.

FLASH Memory: nonvolatile memory that can be electrically written and erased.

RAM memory: Random Access Memory.

USB: Universal Serial Bus; serial communication protocol conceived to work according to the plug-and-play concept.

PE: Protective Earth.

RFI Filter: Radio Frequency Interference Filter; filter to reduce interference in the radio frequency band.

PWM: Pulse Width Modulation; pulsed voltage generated by the output inverter which feeds the motor.

Switching Frequency: switching frequency of the IGBTs of the inverter bridge, normally expressed in kHz.

General Enable: when enabled, it accelerates the motor by acceleration ramp. When this function is disabled on the inverter, the PWM pulses will be immediately blocked. It may be controlled by digital input programmed for this function or via serial.

Run/Stop: function of the inverter that, when enabled (run), accelerates the motor by acceleration ramp up to the reference speed, and, when disabled (stop), decelerates the motor by deceleration ramp until full stop, when the PWM pulses are then blocked. It may be controlled by digital input programmed for this function or via serial. The HMI I (Run) and O (Stop) keys operate in a similar way.

Heatsink: piece of metal designed to dissipate the heat generated by power semiconductors.

CLP: Programmable Logic Controller.

Amp, A: ampere.

°C: Degrees celsius.

CA: Alternated Current .

CC: Direct Current.

CFM: cubic feet per minute; a flow measurement unit.

cm: centimeter.

ft: foot.

hp: horse power = 746 Watts; unit of power, usually used to indicate mechanical power of electric motors.

Hz: hertz.

in: inch.

kg: kilogram = 1000 grams.

kHz: kilohertz = 1000 Hertz.

l/min: liters per minute.

lb: pound.

m: meter.

mA: milliampere = 0.001 ampere.

min: minute.

mm: millimeter.

ms: millisecond = 0.001 second.

Nm: Newton meter; torque measurement unit.

rms: root mean square; effective value.

rpm: revolutions per minute.

s: second.

V: volts.

Ω: ohms.

2.3 ABOUT THE CFW-11W

The CFW-11W frequency inverter is a high-performance product which allows speed and torque control of three-phase induction motors. The main characteristic of this product is the "Vectrue" technology, which provides the following advantages:

- High compactness and power density.
- Programmable Vector, Scalar (V/f) or V V W control on the same product.
- The vector control can be programmed as sensorless (which means standard motors, without requiring encoder) or as vector control with encoder on the motor.
- The sensorless vector control allows high torque and fast response, even at very low speeds or at the start.
- The vector control with encoder enables high precision in the drive throughout the speed range (even with the motor stopped).
- "Optimal Braking" function for vector control, allowing the controlled braking of the motor, eliminating the use of braking resistor in some applications.
- "Self-Tuning" function for vector control: It allows the automatic setting of control parameters and regulators based on the identification (also automatic) of the motor parameters and load.

The CFW-11W inverters present a modular design, with configurations from one to five power units (UP11), one control unit (UC11) and wiring cables. The modular assembly increases the reliability of the inverter and simplifies

its maintenance. There is a single control unit (UC11) which can control up to 3 UP11s.

These inverters are water cooled, being more compact than other inverters. Moreover, the DC link features plastic film capacitors, which reduce losses and increase maintenance intervals.

The UP11s are directly powered by the DC link, and the UC11 is powered by a +24 Vdc power supply.

Figure 2.1 on page 2-4 shows a general diagram of the inverter, considering the configuration with two UP11s connected in parallel.

The control of the power units is done by the UC11 control unit. The control unit contains the control rack of the CFW-11 line and the IFSC board. This board sends signals to all UP11 (PWM, control signals, etc.), and it receives signals from them (current, voltage feedback, etc.).

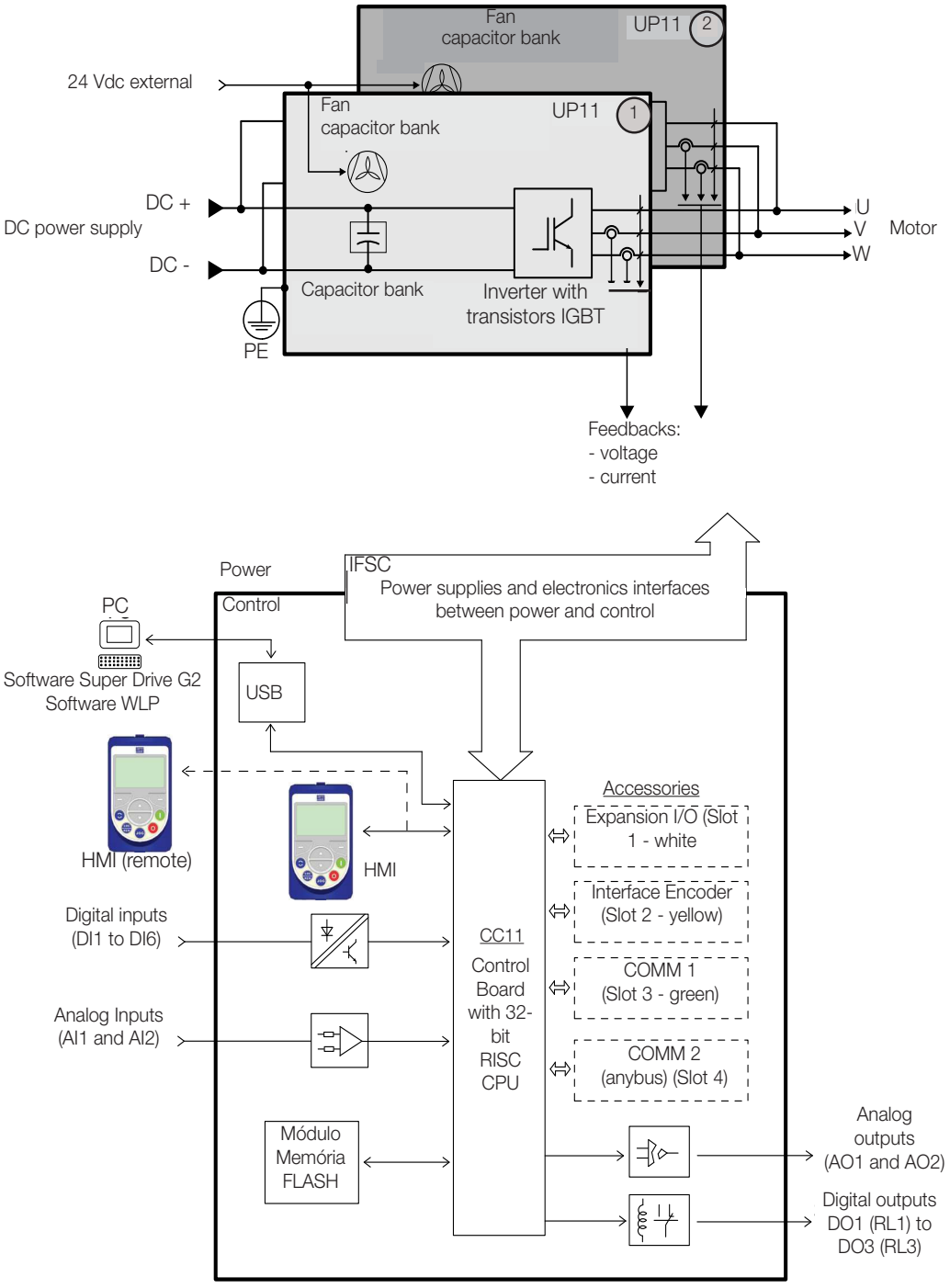


Figure 2.1: *Block diagram for the CFW-11W*

Figure 2.2: *Power Unit (UP11)*

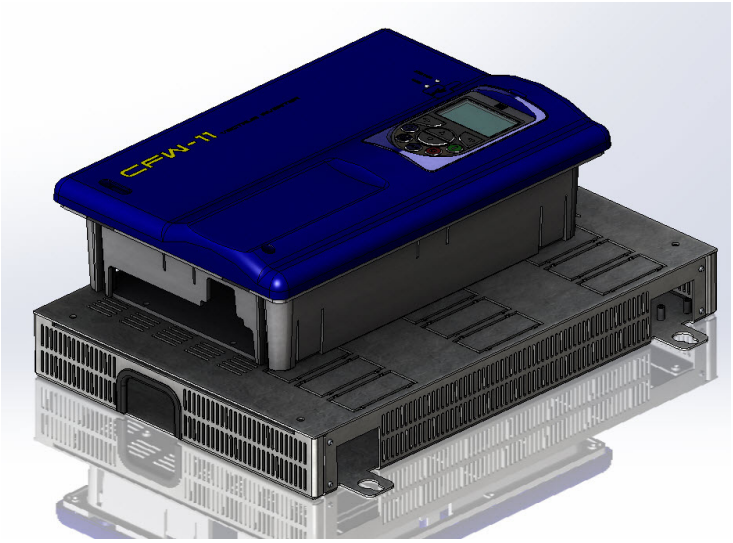


Figure 2.3: *Control Unit (UC11)*

NOTE!
To assemble the complete drive, several additional items are necessary, such as input rectifier, fuses on the DC power supply of each UP11 power unit, external pre-charge circuit and input reactance with minimum input impedance of 3 % when dealing with a 6-pulse rectifier.

NOTE!
It is not necessary to include a current transformer (CT) in the drive for protection against short circuit with the ground in the output, since each UP11 has its own internal protection.

2.4 UC11 NAMEPLATE

The UC11 nameplate is located on the control rack.

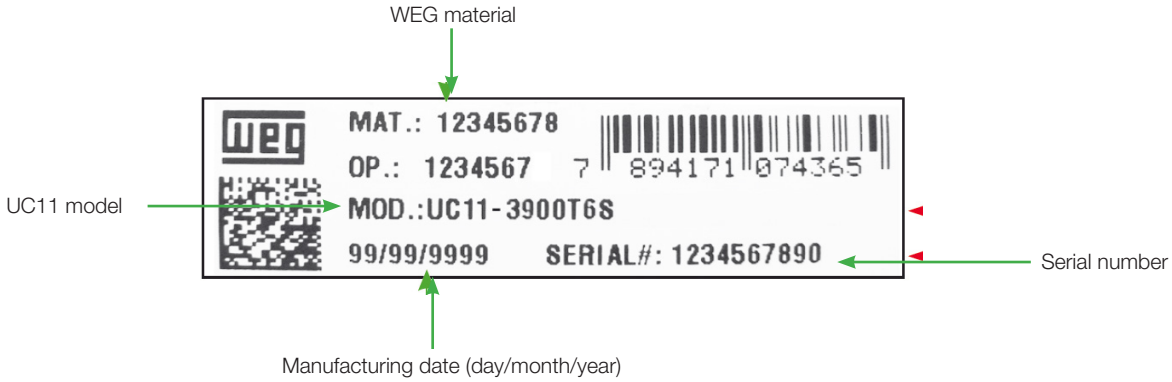


Figure 2.4: *Nameplate of the UC11*

Figure 2.5: *Nameplate location*

2.5 UP11 NAMEPLATE

The nameplate is located on the front of the UP11.

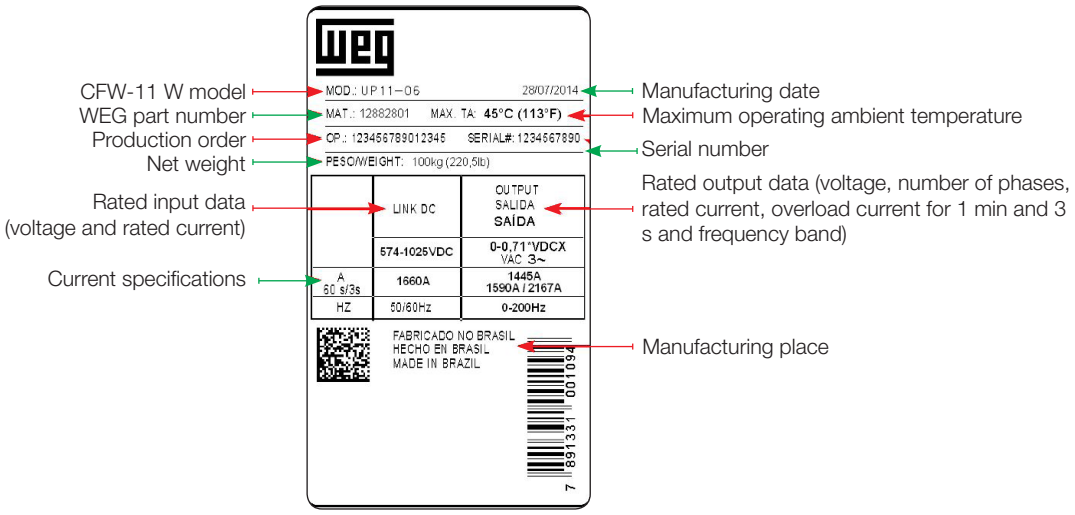


Figure 2.6: *UP11 nameplate*

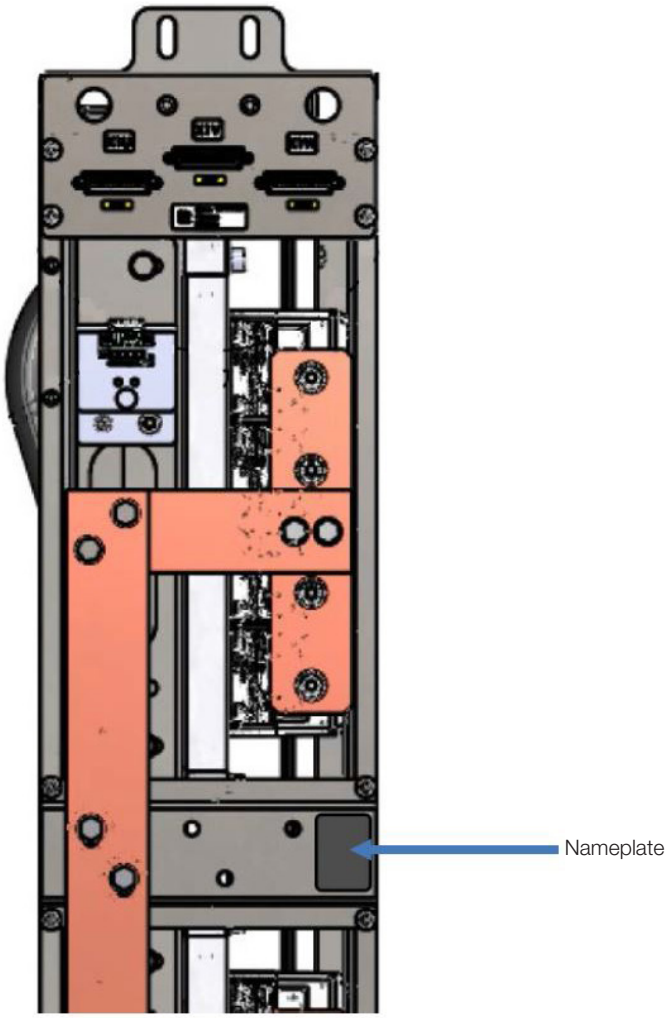


Figure 2.7: *Nameplate location*

2.6 HOW TO SPECIFY THE MODEL OF THE CFW-11W (SMART CODE)

In order to specify the model of the CFW-11W, it is necessary to replace the smart code values with the desired rated supply voltage and rated output current in the respective fields for operation under normal duty (ND), as shown in the example of Table 2.1 on page 2-8:

***Table 2.1:** Smart code*

		Inverter Model					**Available Option Kits**				
		See the list of models in Chapter 8 TECHNICAL SPECIFICATIONS on page 8-1, which also contains the technical data of the inverters.					See Chapter 7 ACCESSORIES on page 7-1 for further details on the optional items.				
Example	**BR**	**CFW11W**	**1445**	**T**	**6 (*)**	**S**	**—**	**—**	**—**	**—**	**Z**
Field designation	Market identification (sets the language of the manual and factory settings)	WEG frequency inverter - series 11	Rated output current for use under normal duty (ND)	Number of output phases	Rated output voltage	Optional items	Braking	Safety stop	Special hardware	Special software	Final coding indicator digit
Available options	2 characters			**T**=Three-phase	**6**= 500...690 V	**S**=Standard product **O**=Product with optional	Blank= standard (no internal dynamic braking) **RB**= regenerative braking	**Y**=with safety stop according to EN-954-1 category 3	Blank= standard **H1**= special hardware #1	Blank= standard **S1**= special software #1	

(*) This field (voltage) represents the input three-phase voltage on the rectifier that supplies the CFW-11W with DC voltage. The rectifier is not part of CFW-11W.
E.g.: CFW11W1445T6OYZ corresponds to a CFW-11W three-phase inverter, with input supply voltage from 500 V to 690 V, with optional safety stop. The options for the inverter rated current under normal duty (ND) are shown in Table 2.2 on page 2-9, according to the inverter rated input voltage.

Table 2.2: Rated currents under normal duty (ND)

500-690 V
1445 = 1445 A
2600 = 2600 A
3900 = 3900 A

2.7 RECEIPT AND STORAGE

The power units of the CFW-11W, as well as the control sets, are supplied in a wooden box.

ATTENTION!
Do not stack more than three boxes of UP11.

The external part of the packages bear nameplates (the same as those affixed to the respective products.

In order to open the package:

1. Remove the front cover of the package.

2. Remove the plastic or styrofoam protection.

3. Fasten at least two eyebolts to the upper part of the UP11.

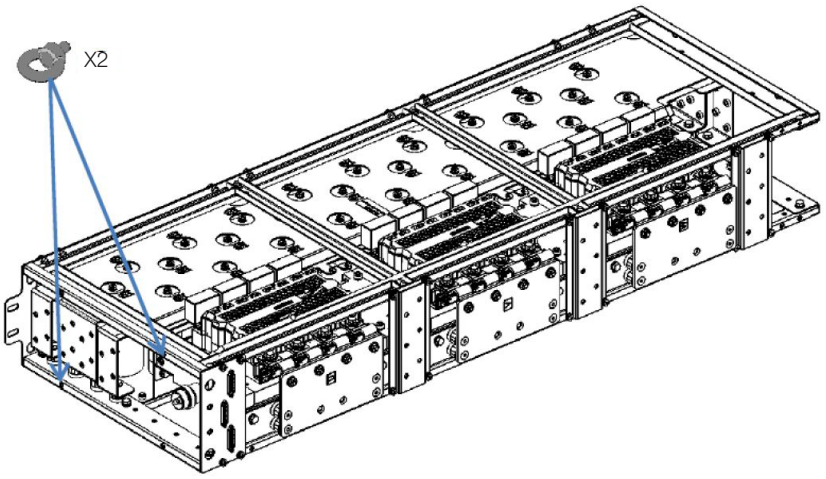


Figure 2.8: Points for installing the eyebolts

4. Lift the UP11 by the two eyebolts and put it in the vertical position.

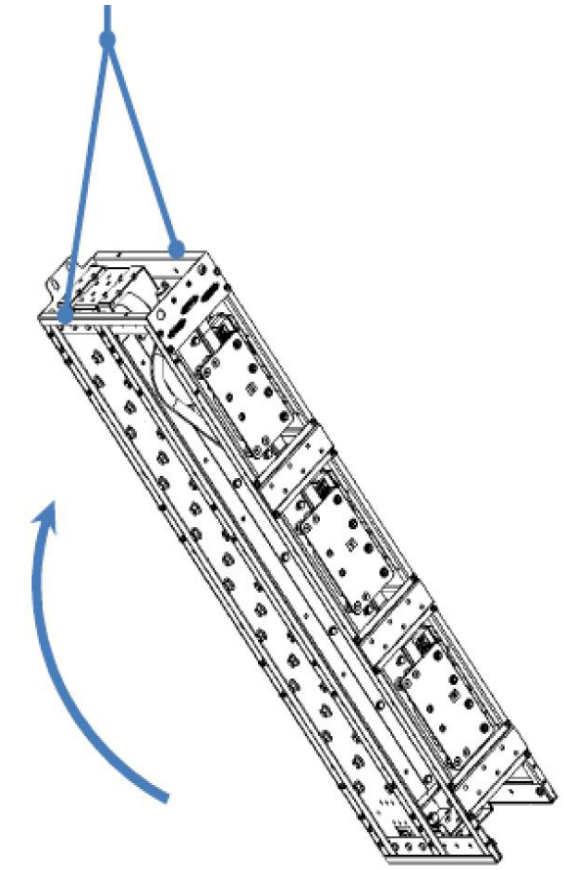


Figure 2.9: *Lifting the UP11*

5. Insert the UP11 into the panel.

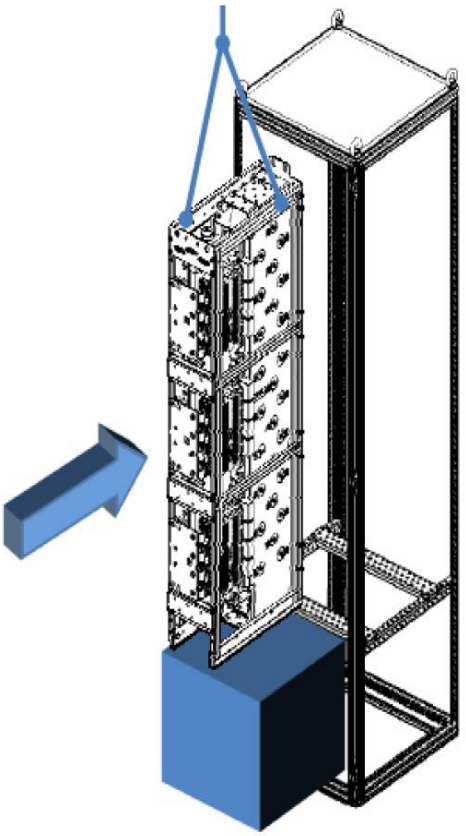


Figure 2.10: *Inserting the UP11 into the panel*

Check if:

- The nameplates correspond to the models purchased.
- There were any damages during transportation.

If any problems are detected, contact the carrier immediately.

If the products are not immediately installed, store them in a clean and dry location (temperature between -25 ºC (77 ºF) and 60 ºC (140 ºF)), with a cover to prevent the ingress of dust.

3 INSTALLATION AND CONNECTION

This chapter describes the electrical and mechanical installation procedures for the Modular Drive CFW-11W. The directions and suggestions must be observed so as to ensure the safety of people and equipment, and proper operation of the inverter.

3.1 MECHANICAL INSTALLATION

3.1.1 Environment Conditions

Avoid:

- Direct exposure to sunlight, rain, high humidity or sea-air.
- Explosive or corrosive liquids or gases.
- Dust, metal particles or oil suspended in the air.

Environment conditions permitted for operation:

- Ambient temperature: 0 °C to 45 °C (32 °F to 113 °F) - rated conditions (measured around the inverter). From 45 ºC to 50 ºC (113 °F to 122 °F) - 1 % of current derating for each Celsius degree (1.8 °F) above 45 ºC (113 °F).
- Input temperature of the coolant: 0 ºC to 40 ºC (32 °F to 104 °F) according to the coolant used. From 40 ºC to 50 ºC (104 °F to 122 °F) - 3 % of current derating for each Celsius degree (1.8 °F) above 40 ºC (104 °F).
- Flow of the coolant: 20 l/min.
- Air relative humidity: 5 % to 85 % non-condensing (see Table 3.5 on page 3-6).
- Maximum altitude: up to 1000 m – rated conditions. From 1000 m to 4000 m – 1% of current derating for each 100 m above 1000 m of altitude. From 2000 m to 4000 m – 1.1% derating of the maximum voltage for each 100 m above 2000 m, maximum altitude of 4000 m.
- Pollution degree: 2 (according to EN50178 and UL508C), with non-conductive pollution.Condensation must not cause conduction of the accumulated residues.

3.1.2 Part List

The kit for panel mounting is composed of the control set, UP11 power units and DB-25 cables necessary to connect the IFSC board to the power units.

Table 3.1: *Currents and settings at 500-690 V*

Rated Current (A) ND	Number of UP11-06 Power Units	Number of DB-25 Cables
1445	1	3
2600	2	6
3900	3	9

ATTENTION!
Use the DB25 cables supplied by WEG only.

The other components of the drive are under the responsibility of the panel builder. Among those components, we may point out the input rectifier, power busbar, pre-charge circuit, panel fans, protection fuses, input reactance, etc.

3.1.3 Panel Mounting

The power units must be installed in the drive panel appropriately, allowing easy extraction and reinstallation in case of maintenance. The mounting must be such to avoid damage during the panel transportation.

The insertion of the UP11 into the panel must be done as shown in the Section 2.7 RECEIPT AND STORAGE on page 2-9.

The UP11 must be fastened to the panel in the following points:

- 2 back top fastening points.
- 2 front top fastening points.

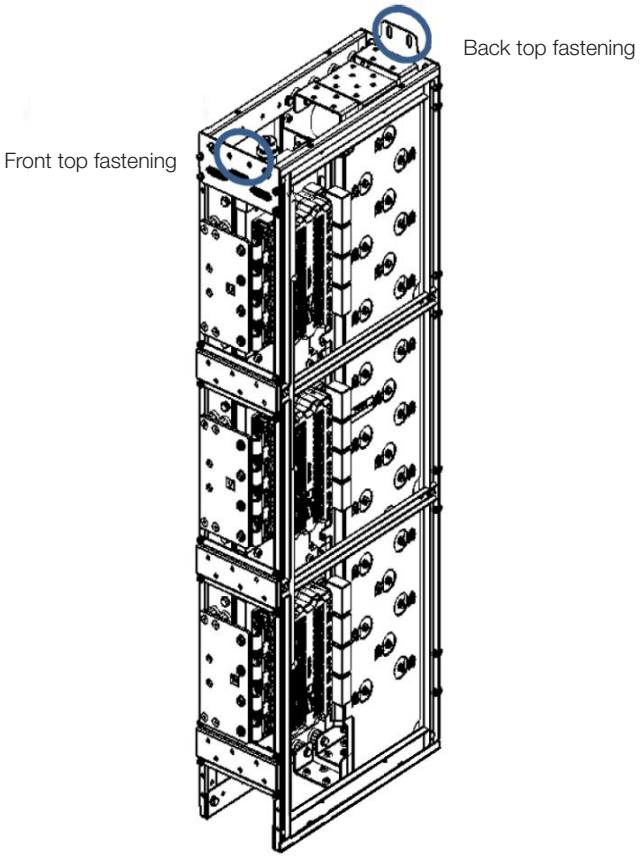


Figure 3.1: *Fastening points*

The fastening must be done with M8 screws (not supplied.

3.1.4 Panel Ventilation

The efficiency of the panel ventilation depends on the equipment installed inside the panel, such as fans, air inlets and filters. The internal fan of the UP11 is not enough to cool the entire panel. The hot spots of the UP11 must be measured with thermocouples to validate the panel ventilation.

The main hot spots of the UP11 are: DC link capacitors, snubber capacitors, DC link busbars and DC connections. Those spots are presented in Figure 3.2 on page 3-3.

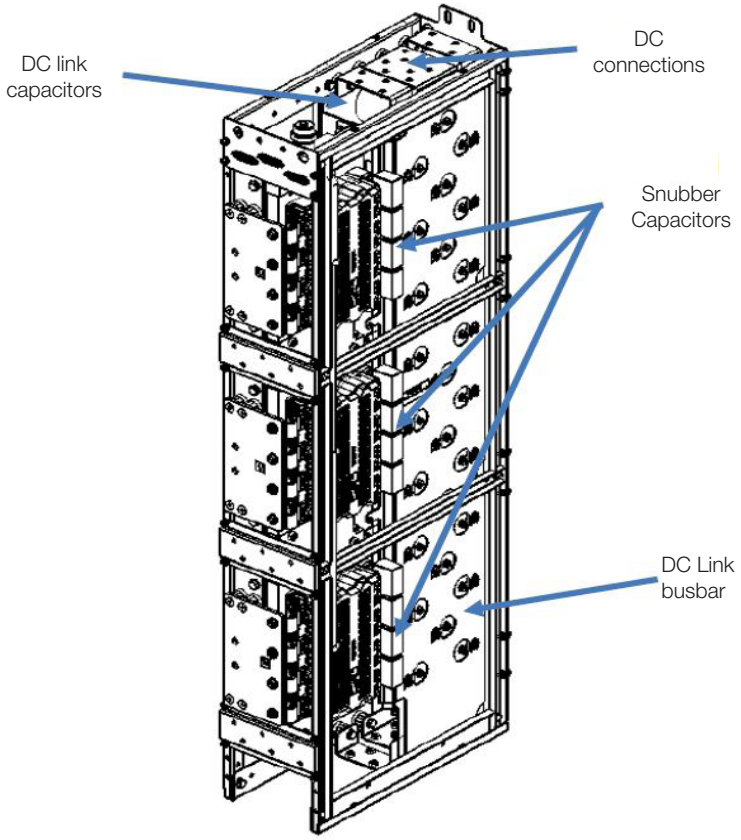


Figure 3.2: *Hot spots of the UP11*

The UP11 is equipped with a cooling fan on the capacitor bank.

The maximum operating temperatures on the inverter hot spots are presented in Table 3.2 on page 3-3.

Table 3.2: *Maximum operating temperature on the hot spots*

Component	Maximum Recommended Operating Temperature
Capacitors	65 °C (149°F)
Snubber Capacitors	100 °C (212°F)
DC Link busbars	100 °C (212°F)
DC Connections	100 °C (212°F)

Figure 3.3 on page 3-4 shows the recommended direction for the ventilation air flow.

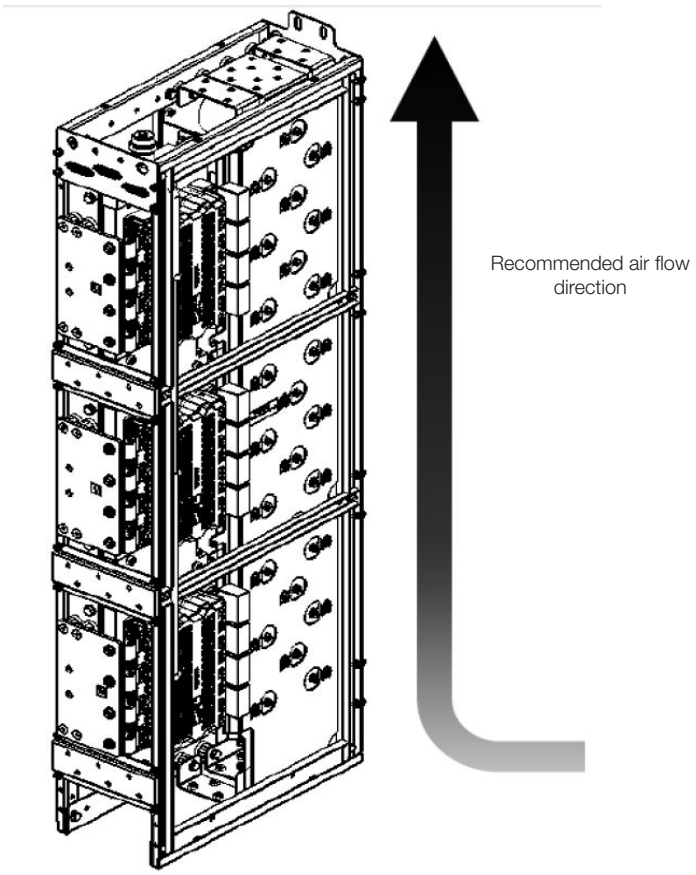


Figure 3.3: *Recommended ventilation air flow direction*

Dust build-up jeopardizes the ventilation efficiency. It is recommended to install air filters to prevent dust from building up.

The fan is located in the lower part of the UP11, as shown in Figure 3.4 on page 3-4.

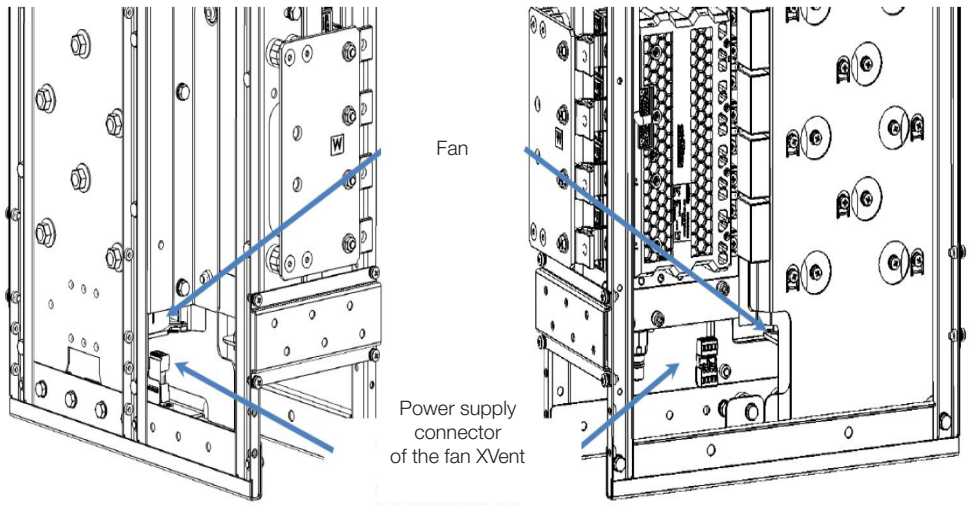


Figure 3.4: *Detail of the fan power supply connector*

The fan power supply connector must be wired as shown in Table 3.3 on page 3-5.

Table 3.3: Description of the XVent fan connector

XVent	
Pin	**Description**
1	GND
2	+24 Vdc
3	NC
4	NC

The specifications of the fan power supply are the following:

- Voltage: 24 Vdc (±5 %).
- Current: 3.75 A.
- Starting current: 5.6 A.

3.1.5 Cooling System

Figure 3.5 on page 3-5 shows the inverter hydraulic connections. The cooling system specifications and coolant used are shown in Table 3.4 on page 3-6.

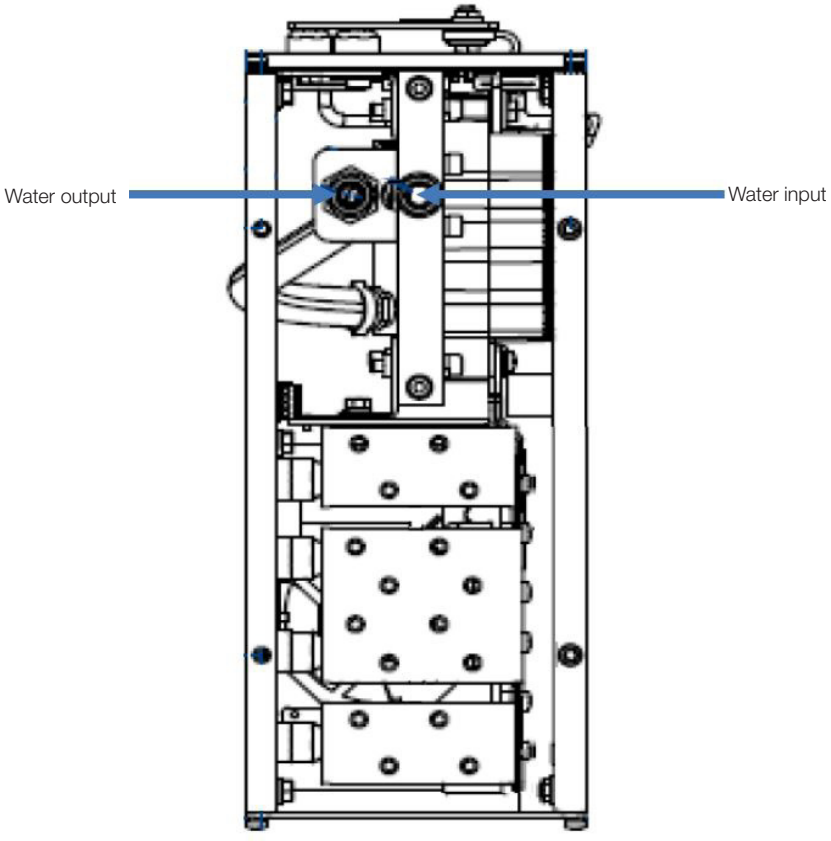


Figure 3.5: Detail of the coolant input and output

Table 3.4: Specifications of the cooling system

Coolant Input Temperature	0 ºC to 40 ºC (32 ºF to 104 ºF) according to the coolant used. 40 ºC to 50 ºC (104 ºF to 122 ºF) with 3% current derating for each ºC (1.8 ºF) above 40 ºC (104 ºF)
Coolant Used	5 ºC to 40 ºC (41 ºF to 104 ºF): filtered water + corrosion inhibitor (according to dosage recommended by the supplier). 0 ºC to 5 ºC (32 ºF to 41 ºF): 80 % filtered water + 20 % ethylene glycol + corrosion inhibitor (according to dosage recommended by the supplier)
Coolant Flow	20 l/min
Maximum Pressure of the System in Relation to the Atmosphere	6 bar (600 kPa)
Recommended Pressure of the System in Relation to the Atmosphere	0.8 to 4.5 bar (80 to 450 kPa)
Coolant Input and Output Connections	Female RMI12 (Stäubli) connector

Condensation may occur when the incoming water temperature is too lower than the ambient temperature. The water temperature to avoid condensation varies according to the air relative humidity and ambient temperature.

The temperature at which the water vapor contained in the air turns into liquid as small water drops is known as "dew point".

Table 3.5 on page 3-6 shows the dew point in relation to the air relative humidity and the ambient temperature for an atmospheric pressure of 1 atm. If the water temperature is lower than the presented value, condensation may occur.

Table 3.5: Dew point in relation to the air relative humidity and the ambient temperature

		Air Relative Humidity [%]									
		5	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
Ambient Temperature [°C]	**10**	<0	<0	<0	<0	<0	0.1	2.6	4,8	6,7	8,4
	20	<0	<0	<0	1.9	6.0	9.3	12.0	14,4	16,4	18,3
	25	<0	<0	0.5	6.2	10.5	13.8	16.7	19,1	21,3	23,2
	30	<0	<0	4.6	10.5	14.9	18.4	21.4	23,9	26,2	28,2
	35	<0	<0	8.7	14.8	19.4	23.0	26.1	28,7	31,0	33,1
	40	<0	2,6	12.7	19.1	23.8	27.6	30.7	33,5	35,9	38,0
	45	<0	6,3	16.8	23.4	28.2	32.1	35.4	38,2	40,7	43,0

ATTENTION!
The water temperature must always be higher to the dew point.

3.2 ELECTRICAL INSTALLATION

DANGER!
The following information is intended to be a guide for proper installation. Comply with applicable local regulations for electrical installations.

DANGER!
Make sure the power supply is disconnected before starting the connections.

ATTENTION!
The short-circuit protection of the inverter does not provide short-circuit protection for the feeder circuit. The short-circuit protection of the feeder circuit must be provided in accordance with applicable local regulations.

3.2.1 General Wiring Diagram

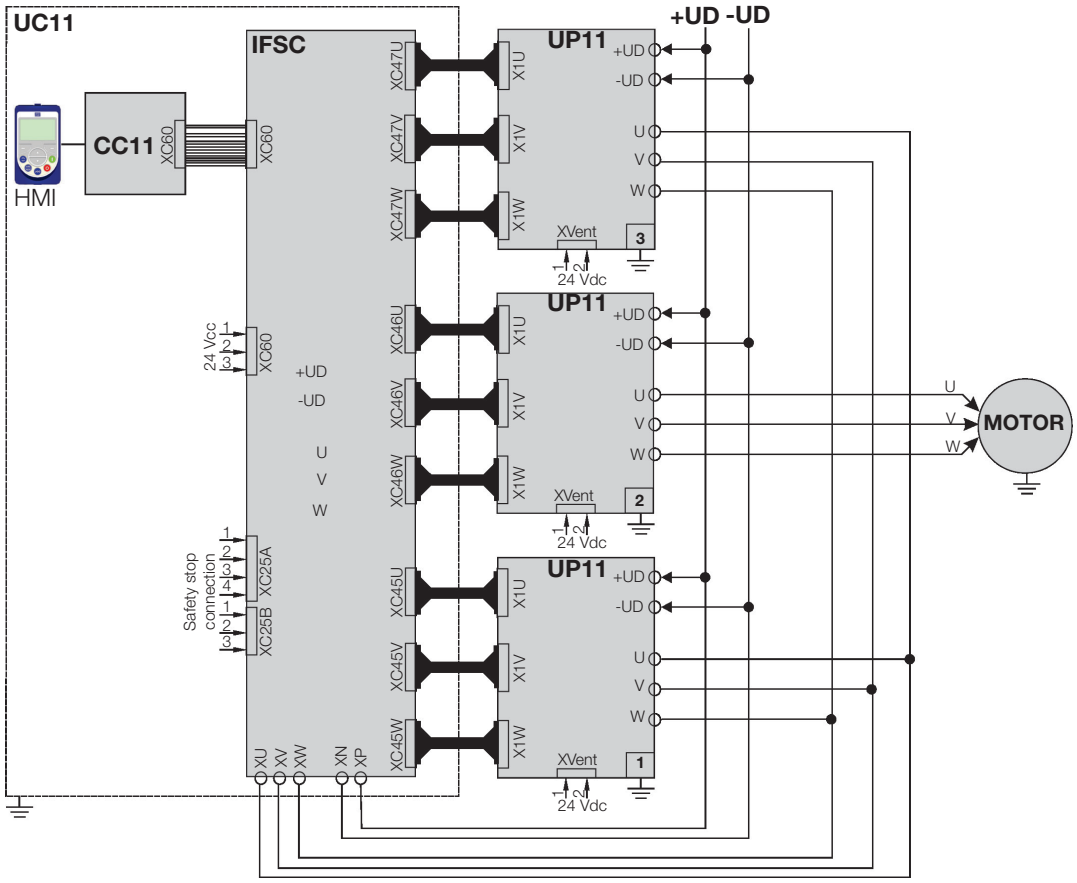


Figure 3.6: *General wiring diagram*

3.2.2 Power Connections

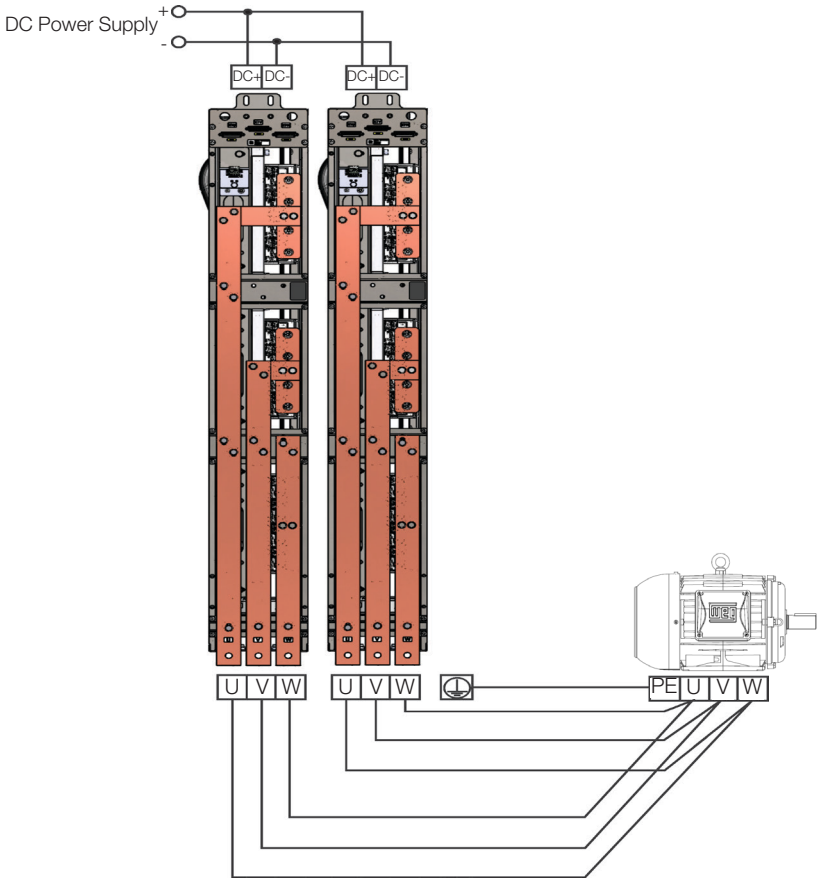


Figure 3.7: *Power and grounding connections*

U, V and W: connections to the motor.

DC+: Positive pole of the DC power supply.

DC-: Negative pole of the DC power supply.

: Grounding cable connection.

DANGER!
The UP11 frame must be connected to the panel metal frame, which must be grounded. The UP11 is grounded through the frame.

ATTENTION!
The motor protective earth must be connected to the panel ground.

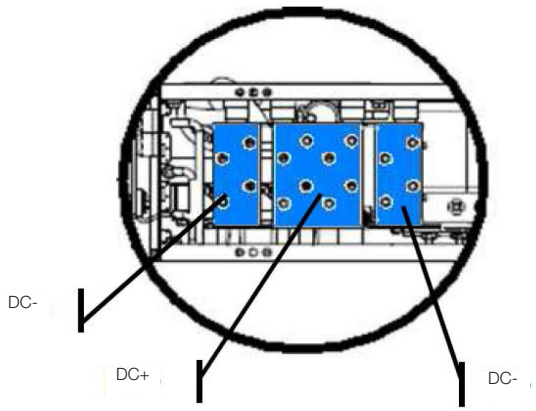


Figure 3.8: *DC power supply terminals*

On the DC power connections, M8X20 mm hexagonal screws are used (recommended torque 15 N.m.).

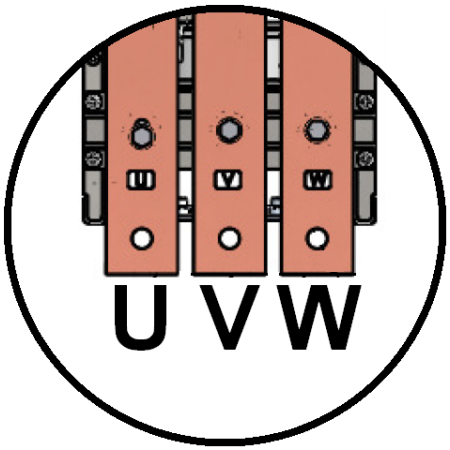


Figure 3.9: *U, V and W terminals*

On the power connections, M12 hexagonal screws are used (recommended torque 60 N.m.).

3.2.3 Input Rectifier

The main rectifier bridge is sized according to the drive rated power. The heat dissipation caused by the losses on the rectifier bridge must be taken into account both in the sizing of the bridge heatsink and in the heating of the air inside the panel.

The resistors of the pre-charge circuit must be sized according to the following criteria:

- Maximum voltage.
- Maximum energy.
- Power overload capacity of the resistors during the pre-charge period (energy dissipation capacity).

Table 3.6: *Sizing of the pre-charge*

Peak current during the pre-charge (A)	0.82.(Vline/R)
Energy stored in the capacitor bank (J)	N.0.02.$Vline^2$
Duration of the pre-charge	0.06.N.R

Where R is the ohmic value of the resistor used in each phase and N is the number of power units.
Example:
In a drive composed of two power units, whose line voltage in the rectifier input is 690 Vrms, the obtained values would be:

- Energy stored in the capacitor bank: $2.0,02.690^2$ = 19044 J.
- Using three 10 Ω resistors (one per phase), each resistor must withstand 6348 J.
- The manufacturer of the resistor may inform the energy the component withstands.
- The peak current during the pre-charge would be 56.6 A and the duration of the pre-charge would be 1.2 s.

3.2.4 Input Connections

DANGER!
Provide a disconnector device for the inverter power supply. This device must cut off the inverter power supply whenever necessary (during maintenance for instance).

ATTENTION!
Using a contactor or another device that disconnects the inverter power supply to often start and stop the motor may damage the inverter power supply circuit. The inverter is designed to use control signals to start and stop the motor. If so used, the device in the input cannot exceed one operation every ten minutes or the inverter may be damaged.

NOTE!
The supply voltage must not exceed the inverter rated values (see Table 8.1 on page 8-1).

3.2.5 Output Connections

ATTENTION!
The inverter has an electronic motor overload protection that must be set according to the motor. When several motors are connected to the same inverter, install individual overload relays for each motor.

ATTENTION!
The motor overload protection available on the CFW-11W complies with IEC609047-4-2 and UL508C; notice the information below:
- Trip current equal to 1.25 times the motor rated current (P0401) set on the "Oriented Start-up" menu.
- The maximum value of parameter P0398 (Motor Service Factor) is 1.15.
- Parameters P0156, P0157 and P0158 (overload current at 100 %, 50 % and 5 % of the rated speed, respectively) are automatically set when parameters P0401 (motor rated current) and/or P0406 (motor cooling) are set on the "Oriented Start-up" menu. If parameters P0156, P0157 and P0158 are manually set, the maximum value allowed is 1.05 x P0401.

ATTENTION!
If a switch-disconnector or a contactor is installed in the inverter output, never operate them with the motor spinning or with voltage in the inverter output.

The parallel connection of the UP11 must be done according to Figure 3.10 on page 3-11. The inverters are interconnected in the motor terminal box; the stray inductance of the output cables is used as paralleling reactance.

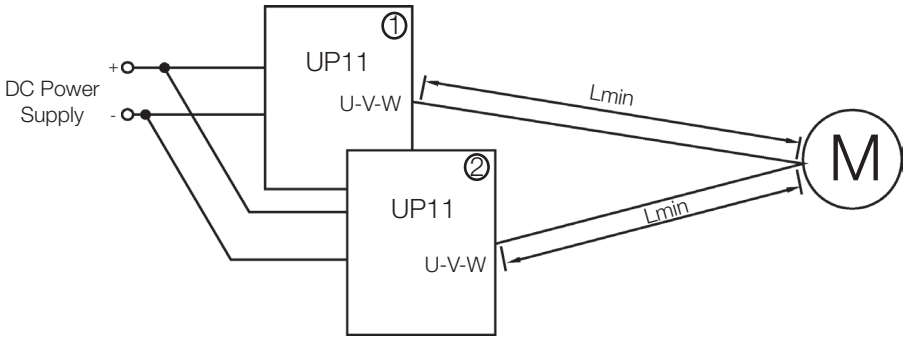


Figure 3.10: *Connection of the UP11 in parallel*

ATTENTION!
The minimum length of the output cables L_{min}, Figure 3.10 on page 3-11, must be 8 m. In case it is not possible to use 8 m cables, it is recommended to use 0.5 % parallel reactances in the output of each UP11.

ATTENTION!
The output cables of all phases of all UP11 must have the same length so as to prevent current imbalance.

The characteristics of the cable used to connect the motor to the inverter, as well as its interconnection and routing, are extremely important to avoid electromagnetic interference in other equipment and not to affect the life cycle of windings and bearings of the controlled motors.

Instructions for the motor cables:

Cables without Shield:

- They can be used when it is not necessary to comply with the European electromagnetic compatibility directive (2014/30/EU).
- Keep motor cables away from other cables (signal cables, sensor cables, control cables, etc.), according to Table 3.7 on page 3-12.
- The emission of the cables can be reduced by installing them within a metal conduit, which must be grounded at least at both ends.
- Connect a fourth cable between the motor ground and the inverter ground.

Note:

The magnetic field created by the current flowing on those cables may induce currents on metal parts nearby, heating them up and causing additional electric losses. Therefore, keep the three cables (U, V, W) always together.

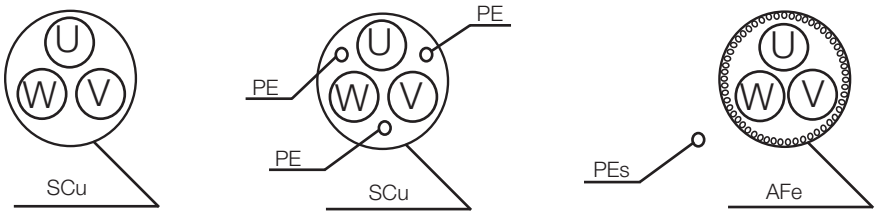
Shielded Cables:

- They are mandatory when it is necessary to comply with the electromagnetic compatibility directive (2014/30/EU), as defined by EN 61800-3 “Adjustable Speed Electrical Power Drive Systems”. It mainly acts reducing the electromagnetic radiation disturbance produced by the motor cables in the radio frequency band.
- Regarding the installation types and details, follow the recommendations of IEC 60034-25 “Guide For Design and Performance of Cage Induction Motors Specifically Designed For Converter Supply”; see summary in Figure 3.11 on page 3-12. Refer to the standard for further details and occasional changes related to the new revisions.
- Keep motor cables away from other cables (signal cables, sensor cables, control cables, etc.), according to Table 3.7 on page 3-12.

- The grounding system must present a good interconnection between the different locations of the installation, such as between the motor and of the inverter grounding points. Voltage or impedance differences between the different points may cause the flow of eddy currents between the devices connected to the ground, leading to problems of electromagnetic interference.

Table 3.7: Minimum separation distance between the motor cables and the others

Wiring Length	Minimum Separation Distance
≤ 30 m (100 ft)	≥ 10 cm (3.94 in)
> 30 m (100 ft)	≥ 25 cm (9.84 in)



Symmetrical shielded cables: three concentric conductors with or without a ground conductor, symmetrically manufactured, with an external shield of copper or aluminum

Note:
(1) SCu - copper or aluminum external shielding
(2) AFe - steel or galvanized iron
(3) PE - ground conductor
(4) Cable shielding shall be grounded at both ends (inverter and motor). Use 360º connections for a low impedance to high-frequencies.
(5) For using the shield as a protective ground, it shall have at least 50 % of the power cables conductivity. Otherwise, add an external ground conductor and use the shield a s an EMC protection.
(6) Shielding conductivity at high-frequencies shall be at least 10 % of the power cables conductivity.

Figure 3.11: Cables recommended by IEC 60034-25 to connect the motor

3.2.6 Grounding Connections

DANGER!
Do not share the grounding wiring with other devices that operate with high currents (e.g., high power motors, welding machines, etc.).

ATTENTION!
The neutral conductor of the line that powers up the inverter must be solidly grounded; however, this conductor must not be used to ground the inverter.

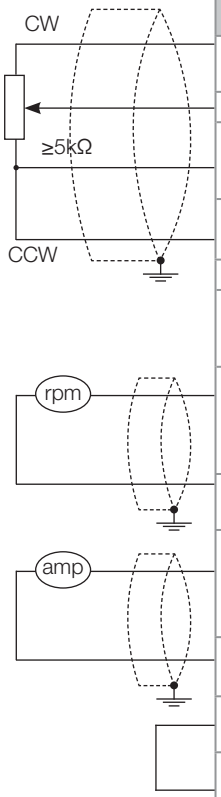
DANGER!
The UP11 metal frame must be connected to the panel grounded metal frame.
The whole UP11 metal frame is interconnected.
After the mounting of the UP11 to the panel, the panel builder must check and measure the electrical resistance of the panel ground busbar and the UP11 frame. The electrical resistance must be smaller than 3 mΩ.

DANGER!
The inverter must be connected to a protective earth (PE).
Observe the following:
- Connect the grounding points of the inverter to a specific grounding rod, or specific grounding point or to the general grounding point (resistance ≤ 10 Ω).
- For compatibility with IEC 61800-5-1 standard, use at least one copper cable of 10 mm^2 to connect the inverter to the protective earth, since the leakage current is higher than 3.5 mA AC.

3.2.7 Control Connections

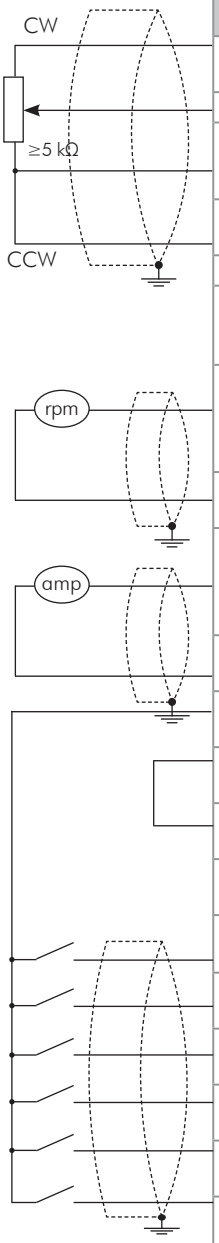
The control connections (analog inputs/outputs, digital inputs/outputs) must be done to connector XC1 of the CC11 Control Electronic Board.

The typical connections and functions are shown in Figure 3.12 on page 3-14.



Connector XC1		Factory Default Function	Specifications
1	+REF	Positive reference for potentiometer	Output voltage:+5.4 V, ±5 % Maximum output current: 2 mA
2	AI1+	Analog input #1: Speed reference (remote)	Differential Resolution: 12 bits Signal: 0 to 10 V (RIN = 400 kΩ) / 0 to 20 mA / 4 to 20 mA (RIN = 500 Ω) Maximum voltage: ±30 V
3	AI1-		
4	REF-	Negative reference for potentiometer	Output voltage: -4.7 V, ±5 % Maximum output current: 2 mA
5	AI2+	Analog input #2: No function	Differential Resolution: 11 bits + signal Signal: 0 to ±10 V (R_{IN} = 400 kΩ) / 0 to 20 mA / 4 to 20 mA (R_{IN} = 500 Ω) Maximum voltage: ±30 V
6	AI2-		
7	AO1	Analog output #1: Speed	Galvanic isolation Resolution: 11 bits Signal: 0 to 10 V (RL ≥ 10 kΩ) / 0 to 20 mA / 4 to 20 mA (RL ≤ 500 Ω) Protected against short-circuit
8	AGND (24 V)	Reference (0 V) for the analog outputs	Connected to the ground (frame) through impedance: 940 Ω resistor in parallel with a 22 nF capacitor
9	AO2	Analog output #2: Motor current	Galvanic Isolation Resolution: 11 bits Signal: 0 to 10 V (RL ≥ 10 kΩ) / 0 to 20 mA / 4 to 20 mA (RL ≤ 500 Ω) Protected against short-circuit
10	AGND (24 V)	Reference (0 V) for the analog outputs	Connected to the ground (frame) through impedance: 940 Ω resistor in parallel with a 22 nF capacitor
11	DGND*	Reference (0 V) for the 24 Vdc power supply	Connected to the ground (frame) through impedance: 940 Ω resistor in parallel with a 22 nF capacitor
12	COM	Common point of the digital inputs	
13	24 Vdc	24 Vdc power supply	24 Vdc power supply, ±8 % Capacity: 500 mA
14	COM	Common point of the digital inputs	
15	DI1	Digital input #1: Start / Stop	6 isolated digital inputs High level ≥ 18 V Low level ≤ 3 V Maximum input voltage = 30 V Input current: 11mA @ 24 Vdc
16	DI2	Digital input #2: Direction of rotation (remote)	
17	DI3	Digital input #3: No function	
18	DI4	Digital input #4: No function	
19	DI5	Digital input #5: Jog (remote)	
20	DI6	Digital input #6: 2nd ramp	
21	NF1	Digital output #1 DO1 (RL1): No fault	Contact rating: Maximum voltage: 240 Vac Maximum current: 1 A NC - Normally closed contact C - Common NO - Normally open contact
22	C1		
23	NA1		
24	NF2	Digital output 2 DO2 (RL2): N > N_x - speed > P0288	
25	C2		
26	NA2		
27	NF3	Digital output 3 DO3 (RL3): N* > N_x - speed reference > P0288	
28	C3		
29	NA3		

(a) Digital inputs working as 'Active High'



Connector XC1		Factory Default Function	Specifications
1	+REF	Positive reference for potentiometer	Output voltage:+5.4 V, ±5 % Maximum output current: 2 mA
2	AI1+	Analog input #1: Speed reference (remote)	Differential Resolution: 12 bits Signal: 0 to 10 V (R_{IN}= 400 kΩ) / 0 to 20 mA / 4 to 20 mA (R_{IN}= 500 Ω) Maximum voltage: ±30 V
3	AI1-		
4	REF-	Negative reference for potentiometer	Output voltage: -4.7 V, ±5 % Maximum output current: 2 mA
5	AI2+	Analog input #2: No function	Differential Resolution: 11 bits + signal Signal: 0 to ±10 V (RIN= 400 kΩ) / 0 to 20 mA / 4 to 20 mA (RIN= 500 Ω) Maximum voltage: ±30 V
6	AI2-		
7	AO1	Analog output #1: Speed	Galvanic Isolation Resolution: 11 bits Signal: 0 to 10 V (R_L ≥ 10 kΩ) / 0 to 20 mA / 4 to 20 mA (R_L ≤ 500 Ω) Protected against short-circuit
8	AGND (24 V)	Reference (0 V) for the analog outputs	Connected to the ground (frame) through impedance: 940 Ω resistor in parallel with a 22 nF capacitor
9	AO2	Analog output #2: Motor current	Galvanic Isolation Resolution: 11 bits Signal: 0 to 10 V (RL ≥ 10 kΩ) / 0 to 20 mA / 4 to 20 mA (RL ≤ 500 Ω) Protected against short-circuit
10	AGND (24 V)	Reference (0 V) for the analog outputs	Connected to the ground (frame) through impedance: 940 Ω resistor in parallel with a 22 nF capacitor
11	DGND*	Reference (0 V) for the 24 Vdc power supply	Connected to the ground (frame) through impedance: 940 Ω resistor in parallel with a 22 nF capacitor
12	COM	Common point of the digital inputs	
13	24 Vdc	24 Vdc power supply	24 Vdc power supply, ±8 % Capacity: 500 mA
14	COM	Common point of the digital inputs	
15	DI1	Digital input #1: Start / Stop	6 isolated digital inputs High level ≥ 18 V Low level ≤ 3 V Input voltage ≤ 30 V Input current: 11 mA @ 24 Vdc
16	DI2	Digital input #2: Direction of rotation (remote)	
17	DI3	Digital input #3: No function	
18	DI4	Digital input #4: No function	
19	DI5	Digital input #5: Jog (remote)	
20	DI6	Digital input #6: 2nd ramp	
21	NF1	Digital output #1 DO1 (RL1): No fault	Contact rating: Maximum voltage: 240 Vac Maximum current: 1 A NC - Normally closed contact C - Common NO - Normally open contact
22	C1		
23	NA1		
24	NF2	Digital output 2 DO2 (RL2): N > N_X - Speed > P0288	
25	C2		
26	NA2		
27	NF3	Digital output 3 DO3 (RL3): N* > N_X - speed reference > P0288	
28	C3		
29	NA3		

(b) Digital inputs working as 'Active Low'

Figure 3.12: *(a) and (b) - Signals at connector XC1*

NOTE!
In order to use the digital inputs as "Active Low", remove the jumper between XC1:11 and 12 and install it between XC1:12 and 13.

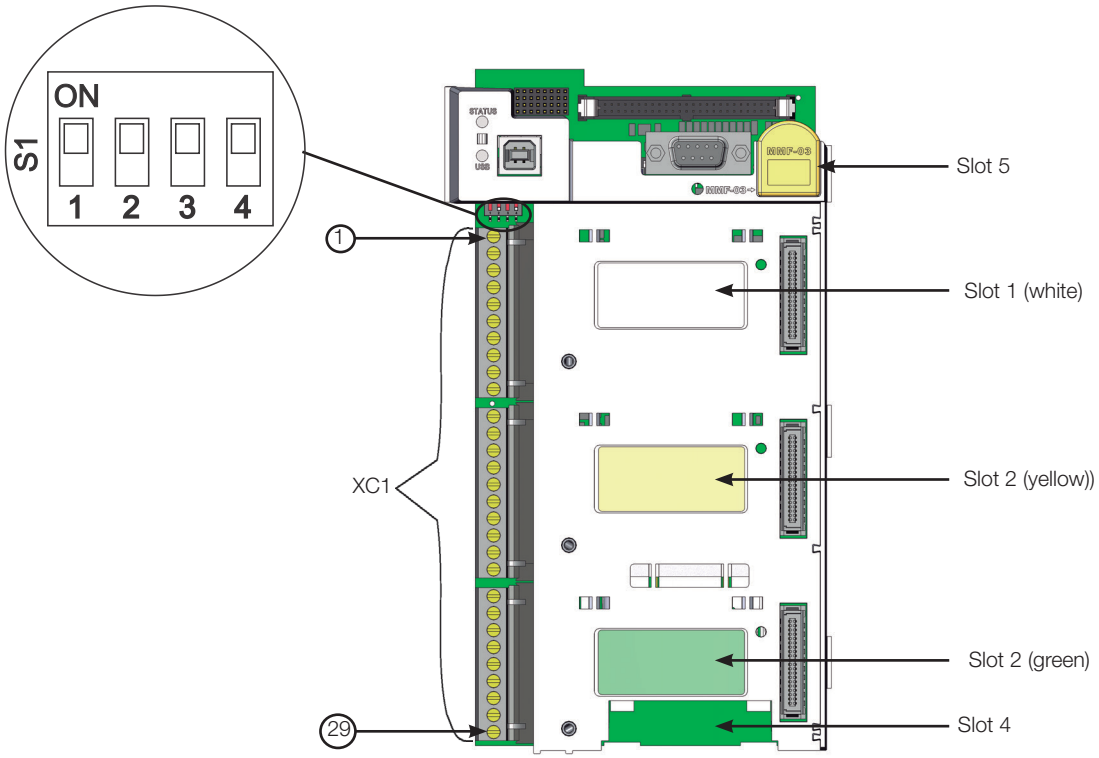


Figure 3.13: *Connector XC1 and switches to select the signal type of the analog inputs and outputs*

As factory standard, the analog inputs and outputs are selected within the range from 0 to 10 V, and they can be changed using switch S1.

Table 3.8: *Configurations of the switches to select the signal type of the analog inputs and outputs*

Signal	Factory Default Function	Setting Element	Selection	Factory Setting
AI1	Speed Reference (remote))	S1.4	OFF: 0 to 10 V (factory default) ON: 4 to 20 mA / 0 to 20 mA	OFF
AI2	No function	S1.3	OFF: 0 to ±10 V (factory default) ON: 4 to 20 mA / 0 to 20 mA	OFF
AO1	Speed	S1.1	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 to 10 V (factory default)	ON
AO2	Motor Current	S1.2	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 to 10 V (factory default)	ON

The parameters related to AI1, AI2, AO1 and AO2 must also be set according to the selection of the switches and desired values.

For the correct connection of the control, use:

1. Gauge of the cables: 0.5 mm² (20 AWG) to 1.5 mm² (14 AWG).

2. Maximum torque: 0,5 N.m (4.50 lbf.in).

3. Wiring on XC1 must be done with shielded cables separated from the other wiring (power, control in 110/220Vac, etc.), according to Table 3.9 on page 3-16. If those cables must cross other cables, it must be done perpendicularly, keeping the minimum separation distance of 5 cm at the crossing point.

Table 3.9: Wiring separation distance

Wiring Length	Minimum Separation Distance
≤ 30 m (100 ft)	≥ 10 cm (3.94 in)
> 30 m (100 ft)	≥ 25 cm (9.84 in)

The correct connection of the cable shield is shown in Figure 3.15 on page 3-16.

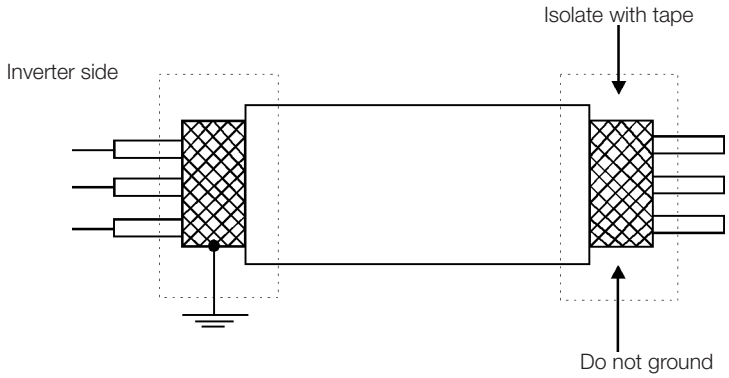


Figure 3.14: Shield connection

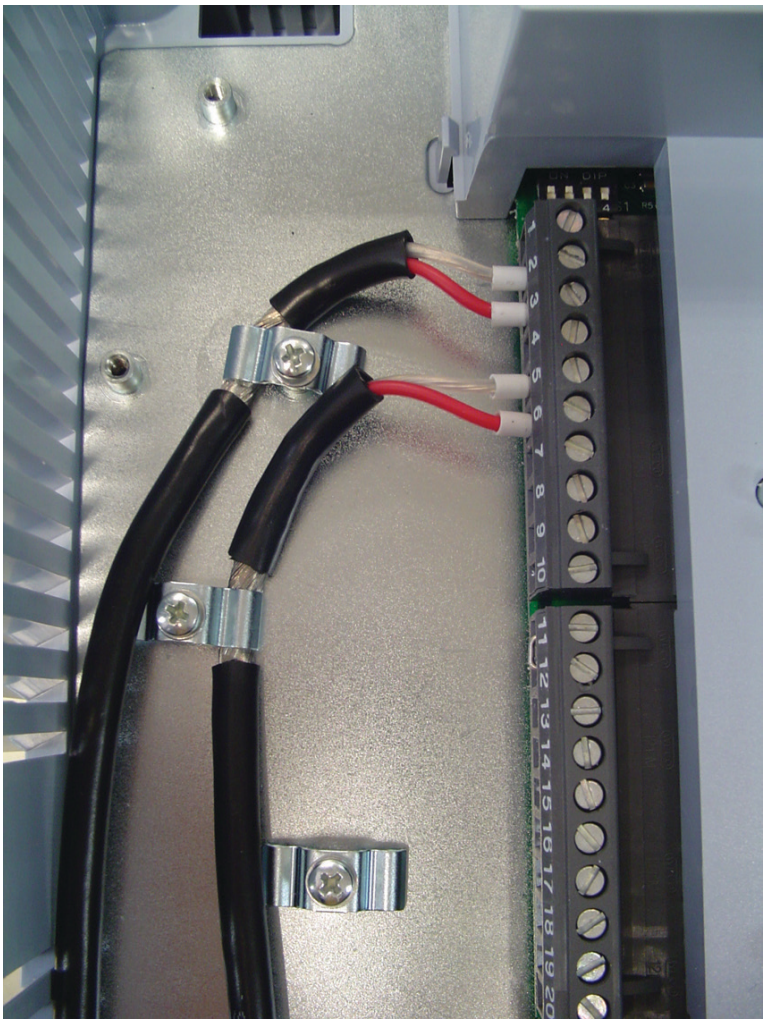


Figure 3.15: Example of shield connection for the control wiring

4. Relays, contactors, solenoids or electromechanical braking coils installed close to the inverters may generate interference in the control circuit. To eliminate this effect, RC suppressors must be connected in parallel to the coils of those devices in case of AC power supply, and freewheel diodes in case of DC power supply.

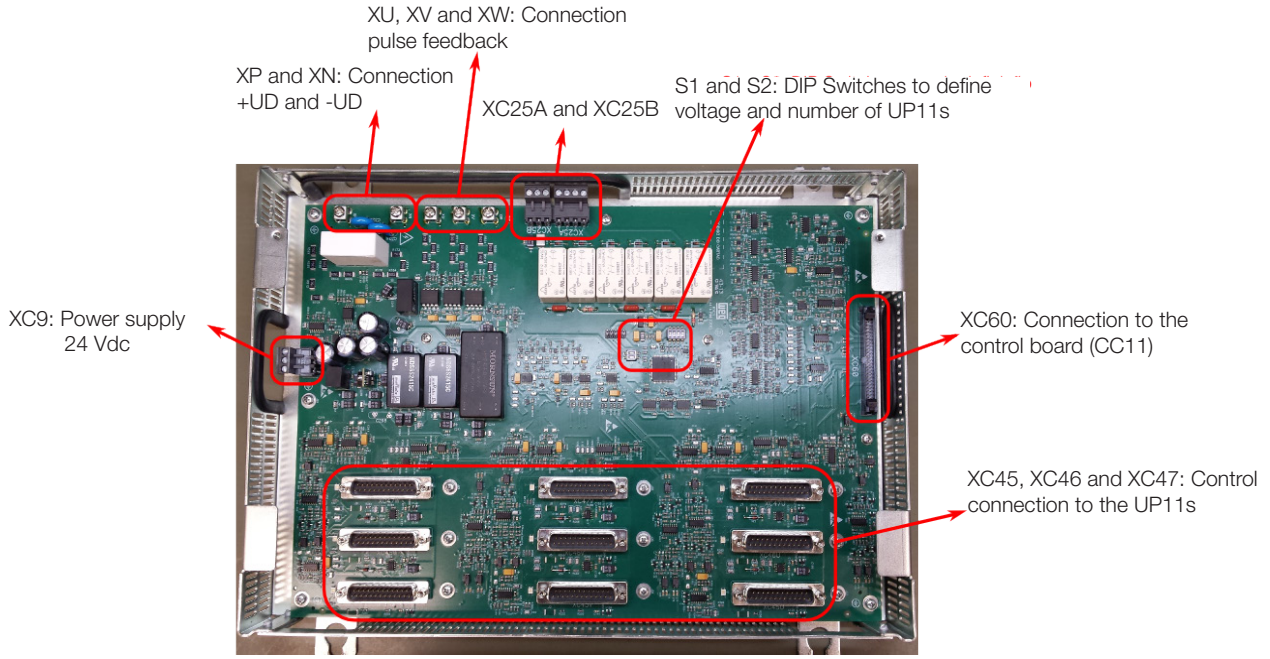


Figure 3.16: *IFSC board connection points*

The control rack is powered via connector XC9, located on the IFSC board; it is described in Table 3.10 on page 3-17.

Table 3.10: *Description of connector XC9*

XC9		Function	Specifications
1	+24 VDC	Positive pole of the +24 Vdc power supply	24 Vdc power supply (±3 %) 1 UP11 connected: 3 A 2 UP11s connected: 6 A 3 UP11s connected: 9 A
2	NC	Not connected	
3	GND	Negative pole of the +24 Vdc power supply	

Table 3.11: *Description of connectors XU, XV, XW, XP and XN*

Signal	Function Factory Default
XU	Connect to phase U of the UP11 #1
XV	Connect to phase V of the UP11 #1
XW	Connect to phase W of the UP11 #1
XP	Connect to the positive pole of the DC link
XN	Connect to the negative pole of the DC link

DIP switches S1 and S2, Figure 3.17 on page 3-17, have the function, respectively, to select the level of the inverter alternating supply voltage and the number of UP11 connected.

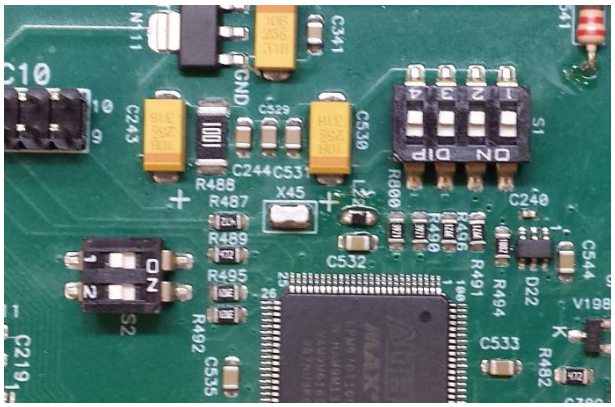


Figure 3.17: *Detail of DIP switches S1 and S2*

Table 3.12: DIP switch S1:1 - S1:3 configuration

S1:3	S1:2	S1:1	Alternating Supply Voltage
OFF (*)	OFF (*)	OFF (*)	660 - 690 V (*)
OFF	ON	OFF	500 - 600 V

(*) Factory default.

Table 3.13: DIP switch S1:4 configuration

S1:4	Operating Mode
OFF (*)	Normal (*)
ON	Reduced Power

(*) Factory default.

Table 3.14: DIP switch S2 configuration

S2:2	S2:1	Number of UP11 Connected
OFF (*)	OFF (*)	1 (*)
ON	ON	2
ON	ON	3

(*) Factory default.

ATTENTION!
Connectors XC25A and XC25B must be wired as shown in Figure 3.18 on page 3-18.

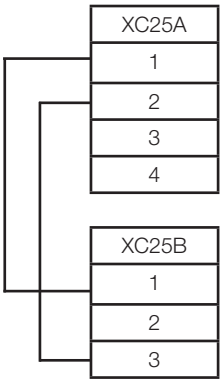


Figure 3.18: Wiring to be done in XC25A and XC25B

The grounding of the UP11 plus UC11 must be done according to the diagram shown in Figure 3.19 on page 3-19.

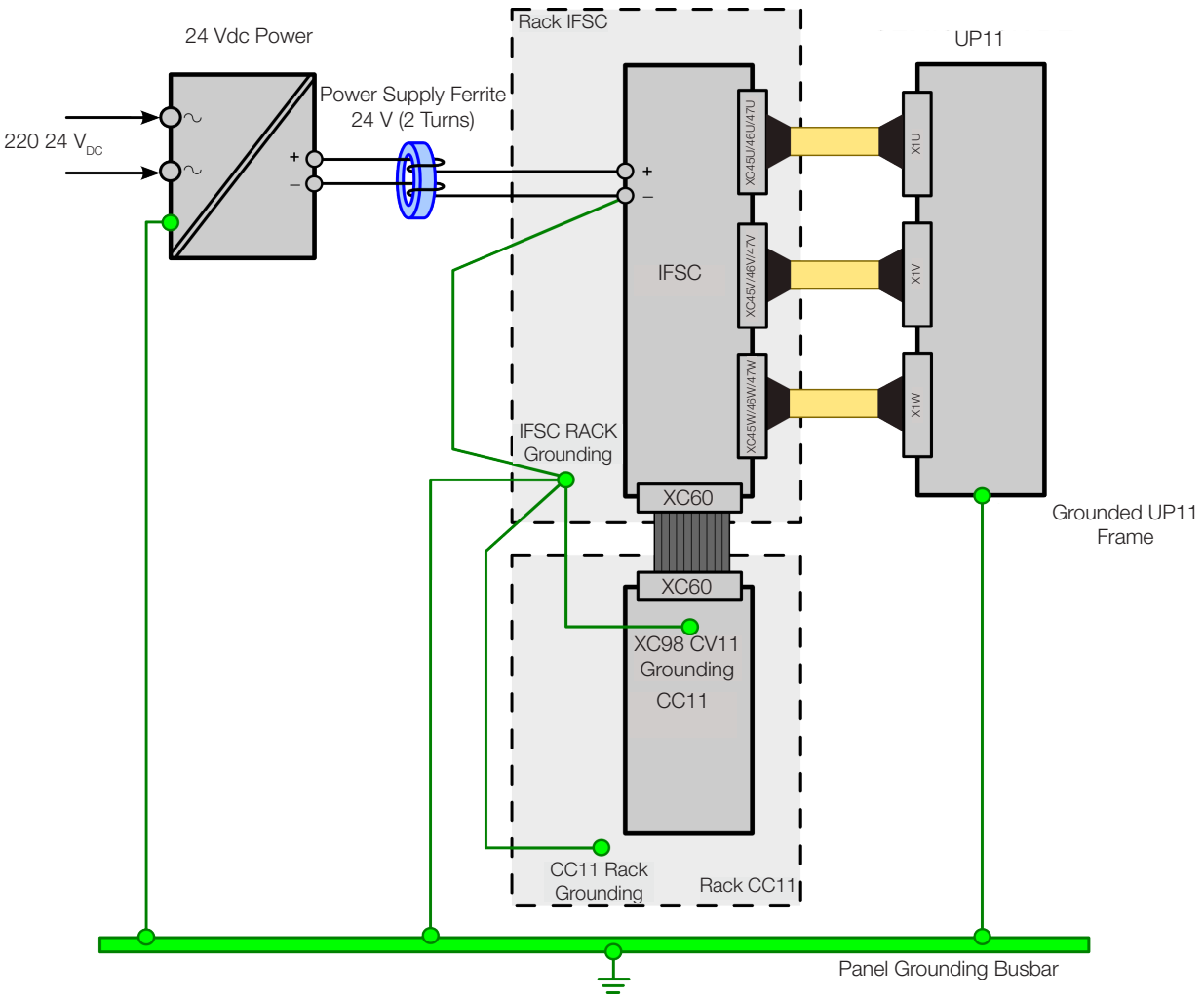


Figure 3.19: *Grounding diagram of the UP11 plus UC11*

The recommended ferrite core for use in the 24 V_{DC} power supply is the following:

- Part Number: NT-27/16/12-2700-IP12R.
- Manufacturer: THORNTON.
- WEG Item: 10189850.

3.2.8 Typical Control Connections

Control connection 1 - Run/Stop function with control via HMI (Local Mode).

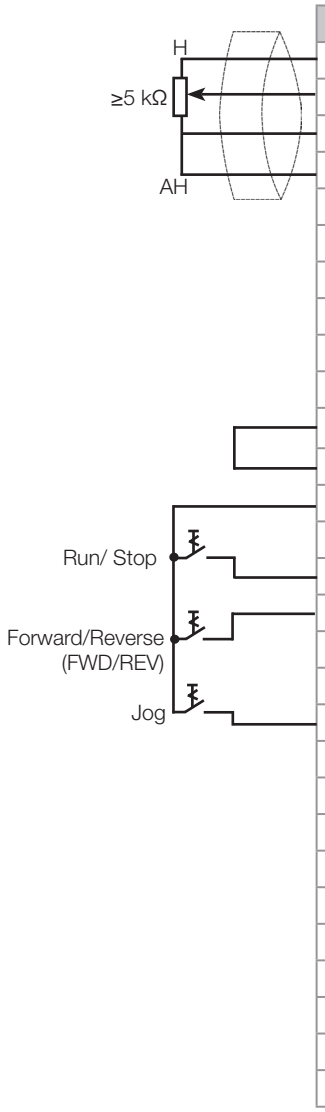
With the factory default programming, it is possible to operate the inverter in the local mode. This operating mode is recommended for users that are using the inverter for the first time, as a form of learning, without additional connections in control.

In order to perform the start-up in this operating mode, refer to Chapter 5 FIRST TIME POWER-UP AND START-UP on page 5-1.

Control connection 2 - Run/Stop function with two-wire control (Remote Mode).

Valid for factory default setting and inverter operating in the remote mode. In the factory default, the selection of the operating mode (local/remote) is done by the key LOC REM (default local).

In order to change the default setting of the key LOC REM to remote, set P0220 = 3.



Connector XC1		
1	+ REF	
2	AI1 +	
3	AI1 -	
4	- REF	
5	AI2 +	
6	AI2 -	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vdc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 3.20: *Connections in XC1 for control connection 2*

Control connection 3 - Run/Stop function with three-wire control.

Enabling of the Run/Stop function with three-wire control.

Parameters to set:

Program DI3 to START

P0265 = 6

Program DI4 to STOP

P0266 = 7

Program P0224 = 1 (DIx) in case you wish the 3-wire control in Local mode.

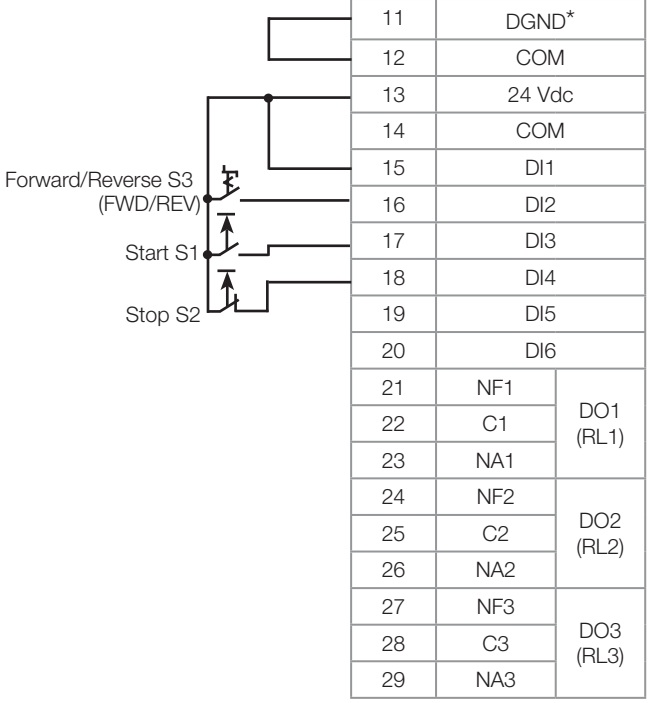
Program P0227 = 1 (DIx) in case you wish the 3-wire control in Remote mode.

Set the Forward/Reverse selection by using digital input 2 (DI2).

Program P0223 = 4 for Local Mode or P0226 = 4 para Remote Mode.

S1 and S2 are, respectively, ON (NO contact) and OFF (NC contact) pushbuttons.

The speed reference can be via analog input (as in Control connection 2), via HMI (as in Control connection 1) or another source.



Connector XC1		
1	+ REF	
2	AI1 +	
3	AI1 -	
4	- REF	
5	AI2 +	
6	AI2 -	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vdc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 3.21: *Connections in XC1 for control connection 3*

Control connection 4 - Forward/Reverse.

Enabling of the Forward/Reverse function.

Parameters to set:

Program DI3 to FORWARD

P0265 = 4

Program DI4 to REVERSE

P0266 = 5

When the Forward/Reverse function is programmed, it will be enabled, both in local and remote mode.

At the same time the keys O and I are always disabled (even if P0224 = 0 or P0227 = 0).
The direction of rotation is defined by the forward and reverse inputs.

Clockwise rotation for forward and counterclockwise for reverse.

The speed reference can come from any source (like in control connection 3).

Connector XC1		
1	+ REF	
2	AI1 +	
3	AI1 -	
4	- REF	
5	AI2 +	
6	AI2 -	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vdc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 3.22: *Connections in XC1 for control connection 4*

3.3 INSTALLATION ACCORDING TO THE EUROPEAN DIRECTIVE OF ELECTROMAGNETIC COMPATIBILITY

The CFW-11W inverters, when correctly installed, meet the requirements of the electromagnetic compatibility directive “EMC Directive 2014/30/EU”.

The CFW-11W inverters were developed for professional applications only. Therefore, the limits for emission of harmonic currents established by the EN 61000-3-2 and EN 61000-3-2/A14 standards are not applicable.

3.3.1 Conformal Installation

For conformal installation use:

- Standard CFW-11W inverter for emission levels according to IEC/EN61800-3 Adjustable Speed Electrical Power Drive Systems, category C4.
- Additional external filters to meet the levels of conducted emission category C2 or C3.

- Shielded output cables (motor cables) with the shield connected at both ends, motor and inverter, with low-impedance connection for high frequency. Keep the separation from the other cables according to Table 3.7 on page 3-12.
- Control cables must be shielded and the separation distance from other cables must be kept according to Item 3.2.7 Control Connections on page 3-12.
- Grounding of the inverter according to instructions of Item 3.2.6 Grounding Connections on page 3-12.

3.3.2 Definition of the Standards

IEC/EN 61800-3: “Adjustable Speed Electrical Power Drives Systems”

Environments:

First Environment: environments that include domestic premises, as well as establishments directly connected without intermediate transformers to the low voltage power line which supplies installations used for domestic purposes.

Example: houses, apartments, commercial installations or offices located in residential buildings.

Second Environment: environments that include all the buildings other than those directly connected to the low voltage power line which supplies buildings used for domestic purposes.
Example: industrial areas, technical areas of any building supplied by a dedicated transformer.

Categories:

Categoria C1: inverters with voltage rating below 1000 V and intended for use in the First Environment.

Categoria C2: inverters with a voltage rating below 1000 V intended for use in the First Environment, not provided with a plug connector or movable installations. They must be installed and commissioned by a professional.

Note: a professional is a person or organization familiar with the installation and/or commissioning of inverters, including their EMC aspects.

Categoria C3: inverters with voltage ratings below 1000 V developed for application in the "Second Environment" and not designed for application in the “First Environment”.

Categoria C4: inverters with voltage rating equal to or higher than 1000 V, or with a current rating equal to or greater than 400 A, or intended for use in complex systems in the "Second Environment".

EN 55011: “Threshold values and measuring methods for radio interference from industrial, scientific and medical (ISM) high-frequency equipment”

Class B: equipment intended for use in the low voltage power supply network (residential, commercial and light industrial environments).

Class A1: equipment intended for use in the low voltage power supply network. Restricted distribution.

Note: it must be installed and commissioned by a professional when applied in the low voltage power supply network.

Class A2: equipment intended for use in industrial environments.

3.3.3 Emission and Immunity Levels

Table 3.15: *Emission and immunity levels*

EMC Phenomenon	Basic Standard	Level
Emission:		
Mains Terminal Disturbance Voltage Frequency Range: 150 kHz to 30 MHz)	IEC/EN61800-3	Without external filter: - Category C4. With external filter: - Category C2 or C3
Eletromagnetic Radiation Disturbance Frequency Range: 30 kHz to 1 GHz		
Immunity:		
Electrostatic Discharge (ESD)	IEC/EN61000-4-2	4 kV discharge per contact and 8 kV discharge through the air
Fast Transient-Burst	IEC/EN61000-4-4	2 kV/5 kHz (coupling capacitor) input cables 1 kV/5 kHz control cables 2 kV/5 kHz (coupling capacitor) motor cables
Conducted Radio-Frequency Common Mode	IEC/EN61000-4-6	0.15 to 80 Mhz; 10 V; 80 % AM (1 kHz) Motor and control cables
Surges	IEC/EN61000-4-5	1,2/50 µs, 8/20 µs 1 kV line-to-line coupling 2 kV line-to-ground coupling
Radio-Frequency Electromagnetic Field	IEC/EN61000-4-3	80 a 1000 MHz 10 V/m 80 % AM (1 kHz)

4 HMI

This chapter contains the following information:

- HMI keys and functions.
- Indications on the display.
- Parameter structure.

4.1 INTEGRAL KEYPAD - HMI-CFW11

Using the keypad, it is possible to command the inverter, and to view and set all parameters. It presents a navigation method similar to that used in cell phones, with the option to access the parameters sequentially or by means of groups (Menu).

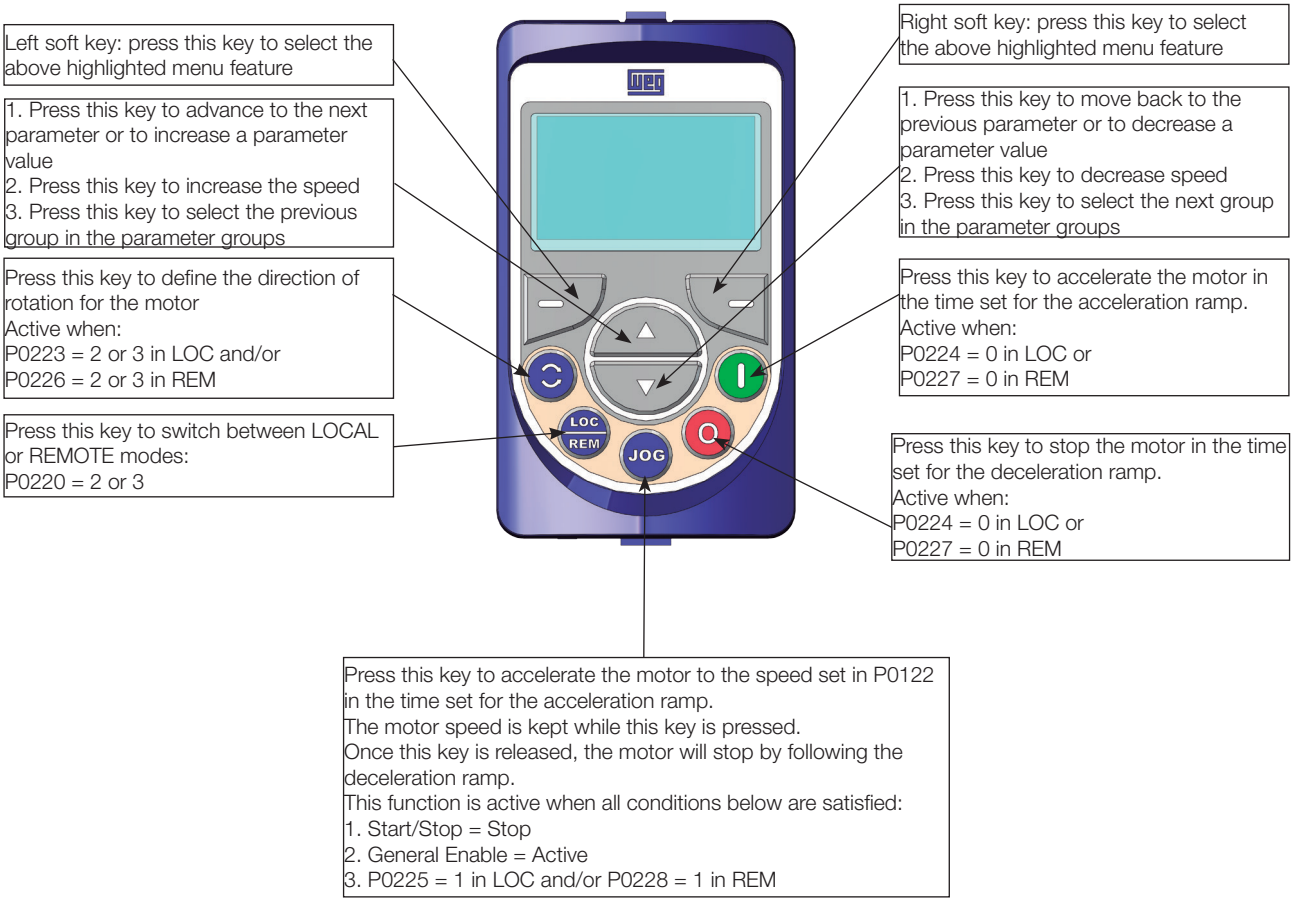


Figure 4.1: *HMI Keys*

Battery:

NOTE!
The battery is only necessary to maintain operation of the internal clock when the inverter stays without power. If the battery is completely discharged, or not installed on the HMI, the clock time becomes incorrect and alarm A181 – "Clock with invalid value" will be indicated every time the inverter is powered up.

The life expectation of the battery is of approximately 10 years. Replace the battery, when necessary, by a CR2032 battery.

①

Cover for battery access

②

Press the cover and rotate it counterclockwise

③

Remove the cover

④

Remove the battery with the help of a screwdriver positioned in the right side

⑤

HMI without the battery

⑥

Install the new battery positioning it first at the left side

⑦

Press the battery for its insertion

⑧

Put the cover back and rotate it clockwise

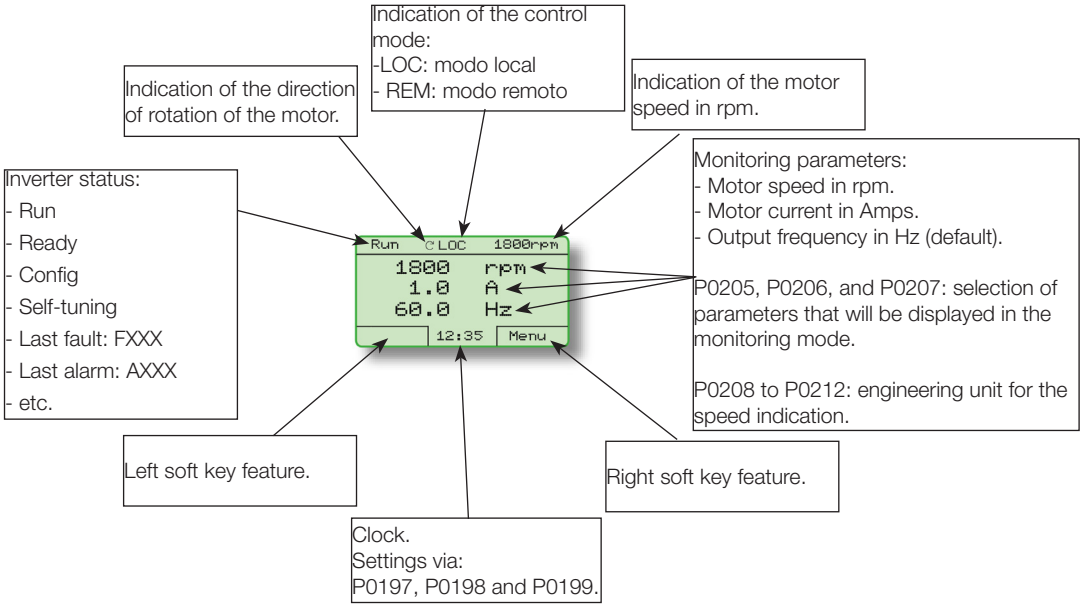
Figure 4.2: *HMI battery replacement*

NOTE!
At the end of the battery useful life, please do not discard batteries in your waste container, but use a battery disposal site.

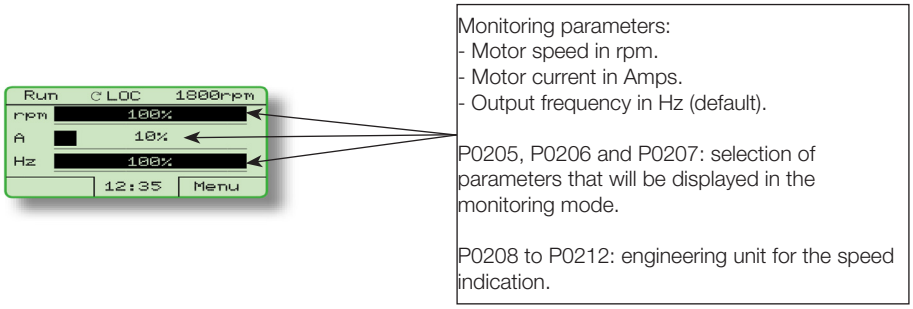
Installation:

The keypad can be installed or removed with the inverter energized or not.

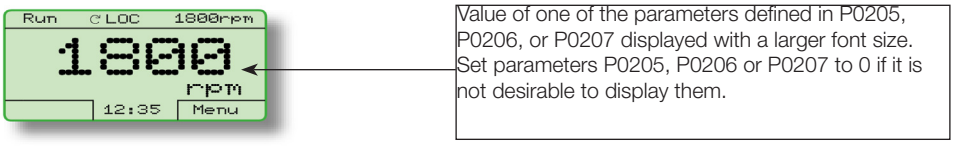
Whenever the inverter is energized, the display goes to the monitoring mode. For the factory setting, a screen similar to Figure 4.3 on page 4-3 (a). By setting proper parameters, other variables can be shown in the monitoring mode or the content of the parameters can be presented as bar graphs or larger characters as shown in Figure 4.3 on page 4-3 (b) and (c).



(a) Monitoring screen with the factory default settings



(b) Example of a monitoring screen with bar ghaphs



(c) Example of a monitoring screen displaying a parameter with a larger font size

Figure 4.3: *(a) to (c) - Keypad monitoring modes*

ATTENTION!
In the operation of the UP11, the remote HMI cable must not be used.

4.2 PARAMETER STRUCTURE

When the right soft key is pressed in the monitoring mode (“MENU”), the first four parameter groups are shown on the display. The parameter group structure is shown in Table 4.1 on page 4-4. For further details on the existing groups in the software version in use, refer to the programming manual.

Table 4.1: *Parameter groups*

Level 0	Level1		Level 2		Level 3	
Monitoring	00	ALL PARAMETERS				
	01	PARAMETER GROUPS	20	Ramps		
			21	Speed References		
			22	Speed Limits		
			23	V/f Control		
			24	Adjust. V/f Curve		
			25	VVW Control		
			26	V/f Current Limit.		
			27	V/f DC Volt. Limit.		
			28	Dynamic Braking		
			29	Vector Control	90	Speed Regulator
					91	Current Regulator
					92	Flux Regulator
					93	I/F Control
					94	Self-Tuning
					95	Torque Curr. Limit.
					96	DC Link Regulator
			30	HMI		
			31	Local Command		
			32	Remote Command		
			33	3-Wire Command		
			34	FWD/REV Run Comm.		
			35	Zero Speed Logic		
			35	Multispeed		
			37	Electr. Potentiom.		
			38	Analog Inputs		
			39	Analog Outputs		
			40	Digital Inputs		
			41	Digital Outputs		
			42	Inverter Data		
			43	Motor Data		
			44	FlyStart/ Ride Thru		
			45	Protections		
			46	PID Regulator		
			47	DC Braking		
			48	Skip Speed		
			49	Communication	110	Local/Rem Config.
					111	Status/Commands
					112	CANopen/DeviceNet
					113	Serial RS232/485
					114	Anybus
					115	Profibus DP
			50	SoftPLC		
			51	PLC		
			52	Trace Function		
	02	ORIENTED START-UP				
	03	CHANGED PARAMETERS				
	04	BASIC APPLICATION				
	05	SELF-TUNING				
	06	BACKUP PARAMETERS				
	07	I/O CONFIGURATION	38	Analog Inputs		
			39	Analog Outputs		
			40	Digital Inputs		
			41	Digital Outputs		
	08	FAULT HISTORY				
	09	READ ONLY PARAMS.				

5 FIRST TIME POWER-UP AND START-UP

This chapter explains:

- How to check and prepare the inverter before power-up.
- Power-up the inverter and check the result.
- How to program the inverter for operation in the V/f mode using the Oriented Start-up routine and the Basic Application group.

NOTE!
In order to program the inverter in Vector or VVW control mode and other existing functions, refer to the programming manual of the CFW-11.

5.1 START-UP PREPARATION

The inverter must have already been installed according to Chapter 3 INSTALLATION AND CONNECTION on page 3-1. If the drive project is different from the typical drives suggested, the steps below may also be followed.

DANGER!
Always disconnect the main power supply before making any connections.

1. Check if the power, grounding and control connections are correct and firm.

2. Remove all the materials left behind from the installation work from inside the inverter or cabinet.

3.Verify the motor connections and if the motor voltage and current are within the inverter rated value.

4. Make a pressure test on the Cooling System to check for leaks.

5. Turn on the Cooling System and set the flow and the incoming water temperature to the values of Table 3.4 on page 3-6.

6. Keep the water flowing for five minutes and check for leaks on the hydraulic connections.

7. Close the inverter or cabinet covers.

8. Power-up the control (+24 Vdc).

9. The keypad must indicate undervoltage with the electronics energized and the power units de-energized. The DC Link voltage monitoring signal is zero.

10. Measure the voltage of the line and verify if it is within the allowed range, according to Chapter 8 TECHNICAL SPECIFICATIONS on page 8-1.

11. Verify if the automatic hardware identification recognized the current and voltage of the inverter properly. The inverter current must be compatible with the number of power units installed.

12. Mechanically uncouple the motor from the load:

If the motor cannot be uncoupled, make sure that any speed direction (forward or reverse) will not result in personnel injury and/or equipment damage.

13. Command the drive, pre-charge the link and close the main circuit breaker/contactor.

14. Check the result of the energization:

The display must show the standard monitoring screen (Figure 4.3 on page 4-3 (a)), and the status LED must turn on and remain on in green.

5.2 START-UP

The start-up in the V/f mode is simply explained in three steps, using the programming facilities with the existing parameter groups Oriented Start-Up and Basic Application.

Sequence:

(1) Set the password to change parameters.

(2) Execute of the **Oriented Start-Up** routine.

(3) Setting the parameters of the **Basic Application group**.

5.2.1 Password Setting in P0000

Step	Action/Result	Display Indication
1	- Monitoring mode - Press **"Menu"** (rigth soft key)	Ready LOC 0rpm 0 rpm 0.0 A 0.0 Hz 15:45 Menu
2	- Group **"00 ALL PARAMETERS"** is already selected - Press **"Select"**	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 15:45 Select
3	- Parameter **"Access to Parameters P0000: 0"** is already selected - Press **"Select"**	Ready LOC 0rpm Access to Parameters P0000: 0 Speed Reference P0002: 380 V Return 15:45 Select
4	- To set the password, press the Up Arrow until number **5** is displayed in the keypad	Ready LOC 0rpm P0000 Access to Parameters 0 Return 15:45 Save
5	- When number **5** is displayed in the keypad, press **"Save"**	Ready LOC 0rpm P0000 Access to Parameters 5 Return 15:45 Save
6	- If the setting has been properly performed, the keypad should display **"Access to Parameters P0000: 5"** - Press **"Return"** (left soft key)	Ready LOC 0rpm Access to Parameters P0000: 5 Speed Reference P0001: 90 rpm Return 15:45 Select
7	- Press **"Return"**	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 15:45 Select
8	- The display returns to the monitoring mode	Ready LOC 0rpm 0 rpm 0.0 A 0.0 Hz 15:45 Menu

Figure 5.1: *Sequence for allowing parameter change via P0000*

5.2.2 Oriented Start-up

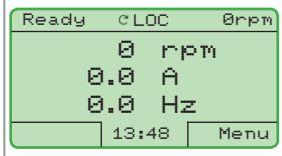
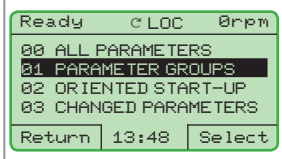
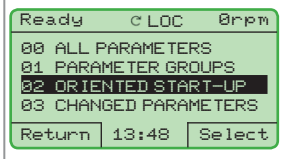
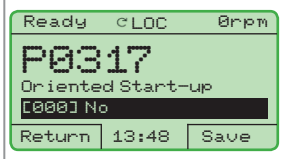
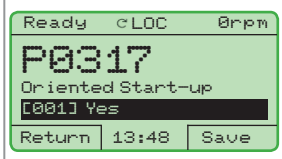
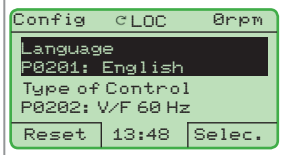
In order to simplify the setting of the inverter, there is a parameter group called Oriented Start-Up. Within this group is parameter P0317, which can be used to access the Oriented Start-Up routine.

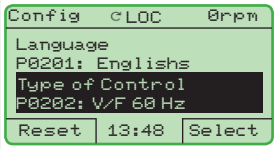
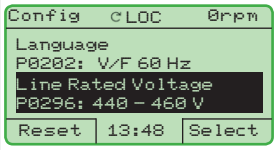
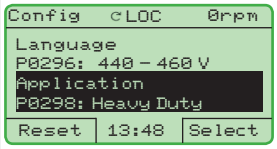
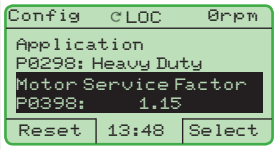
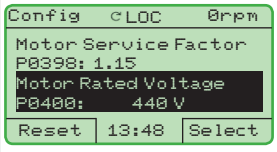
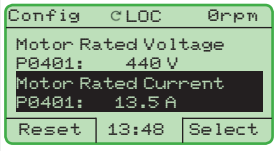
The Oriented Start-up routine shows on the HMI the main parameters in a logical sequence, so that their setting, according to the operating conditions, prepares the inverter for operation according to the supply voltage and motor used.

In order to enter the Oriented Start-Up routine, follow the sequence presented in Figure 5.2 on page 5-4, first changing P0317=1, and then setting the other parameters as they are displayed on the HMI.

The setting of the parameters presented in this operating mode automatically changes the content of other inverter parameters and/or internal variables.

During the Oriented Start-Up routine the “Config” (Configuration) status will be indicated on the top left corner of the HMI.

Step	Action/Result	Display Indication
1	- Monitoring mode - Press **"Menu"** (right soft key)	
2	- Group **"00 ALL PARAMETERS"** has been already selected	
3	- Group **"01 PARAMETER GROUPS"** is selected	
4	**-** Group **"02 ORIENTED START-UP"** is then selected **-** Press **"Select"**	
5	- Parameter **"Oriented Start-Up P0317: No"** has been already selected. - Press **"Select"**	
6	- The value of **"P0317 = [000] No"** is displayed	
7	- The parameter value is modified to **"P0317 = [001] Yes"** - Press **"Save"**	
8	- At this point the Oriented Start-up routine starts and the "Config" status is displayed at the top left corner of the keypad - The parameter **"Language P0201: English"** is already selected - If needed, change the language by pressing **"Select"**. Then, press or to scroll through the available options and press **"Save"** to select a different language	

Step	Action/Result	Display Indication
9	- If needed, change the value of P0202 according to the type of control. To do so, press **"Select"** - The settings listed here are valid only for P0202=0 (V/f 60 Hz) or P0202=1 (V/f 50 Hz). For other options (Adjustable V/f, VVW, or Vector modes), please refer to the programming manual	
10	- If needed, change the value of P0296 according to the line rated voltage. To do so, press **"Select"** This modification will affect P0151, P0153, P0185, P0321, P0322, P0323, and P0400	
11	- If needed, change the value of P0298 according to the inverter application. To do so, press **"Select"** This modification will affect P0156, P0157, P0158, P0401, P0404 and P0410 (this last one only if P0202 = 0, 1, or 2 – V/f control). The time and the activation level of the overload protection will be affected as well	
12	- If needed, change the value of P0398 according to the motor service factor To do so, press **"Select"** This modification will affect the current value and the activation time of the motor overload function	
13	- If needed, change the value of P0400 according to the motor rated voltage To do so, press **"Select"** This modification adjusts the output voltage by a factor x = P0400/P0296	
14	- If needed, change the value of P0401 according to the motor rated current. To do so, press **"Select"** This modification will affect P0156, P0157, P0158, and P0410	

5

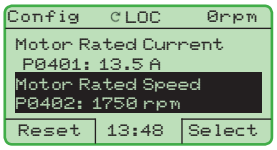
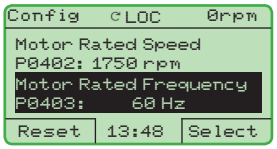
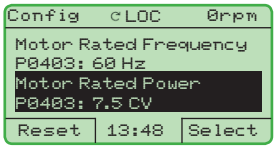
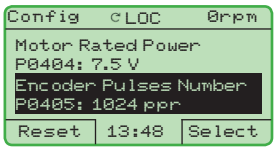
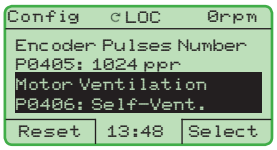
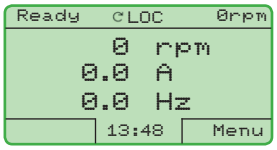
15	- If needed, set P0402 according to the motor rated speed. To do so, press **"Select"**. This modification affects P0122 to P0131, P0133, P0134, P0135, P0182, P0208, P0288, and P0289	
16	- If needed, set P0403 according to the motor rated frequency. To do so, press **"Select"**. This modification affects P0402	
17	- If needed, change the value of P0404 according to the motor rated power To do so, press **"Select"** This modification affects P0410	
18	- This parameter will only be visible if the encoder board ENC1 is installed in the inverter - If there is an encoder connected to the motor, set P0405 according to the encoder pulses number. To do so, press **"Select"**	
19	- If needed, set P0406 according to the motor ventilation. To do so, press **"Select"** - To complete the Oriented Start-Up routine, press **"Reset"** (left soft key) or	
20	- After few seconds, the display returns to the monitoring mode	

Figure 5.2: *Oriented Start-up*

5.2.3 Basic Application Parameter Settings

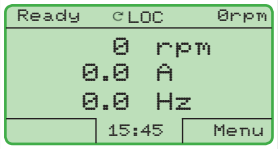
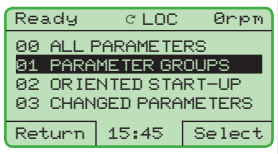
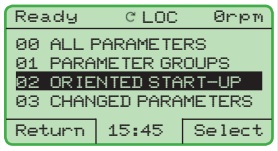
After the Oriented Start-Up routine is executed and the parameters are correctly set, the inverter is ready for operation in the V/f mode.

The inverter has a series of other parameters that allow its adaptation to different applications.

This manual contains some basic parameters whose setting is necessary in most cases.

In order to simplify this task, there is a group called Basic Application. To set the parameters contained in the Basic Application group, follow the sequence of Figure 5.3 on page 5-5. For further details, refer to the programming manual of the CFW-11.

After setting those parameters, the start-up in the V/f mode will be completed.

Step	Action/Result	Display Indication
1	- Monitoring mode - Press **"Menu"** (right soft key)	
2	- Group **"00 ALL PARAMETERS"** has been already selected	
3	- Group **"01 PARAMETER GROUPS"** is then selected	
4	- Group **"03 CHANGED PARAMETERS"** is selected	
5	- Group **"03 CHANGED PARAMETERS"** is selected	

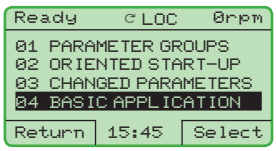
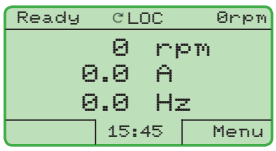
Step	Action/Result	Display Indication
6	- Group **"04 BASIC APPLICATION"** is selected - Press **"Select"**	
7	- Parameter "Acceleration Time P0100: 20.0 s" has been already selected - If needed, set P0100 according to the desired acceleration time. To do so, press **"Select"** - Proceed similarly until all parameters of group **"04 BASIC APPLICATION"** have been set. When finished, press **"Return"** (left soft key)	
8	- Press **"Return"**	
9	- The display returns to the Monitoring Mode and the inverter is ready to run	

Figure 5.3: *Setting parameters of the basic a pplication group*

Table 5.1: Parameters contained in the Basic Application group

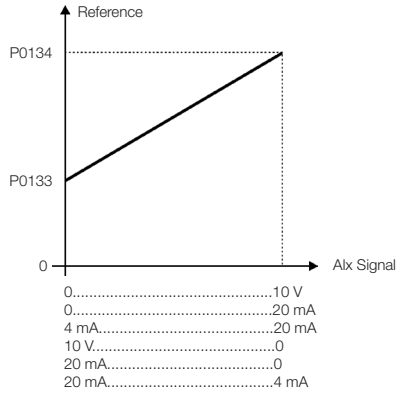
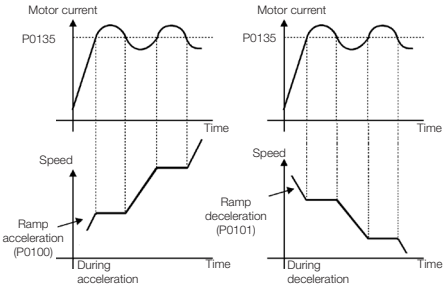
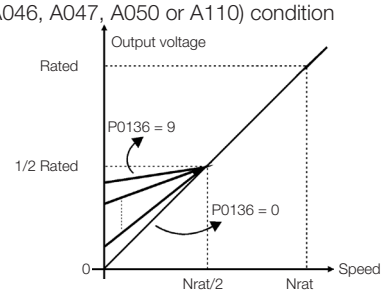
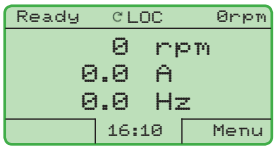
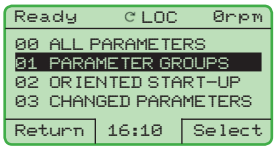
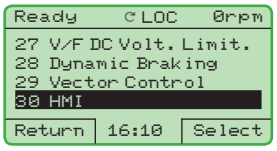
Parameter	Name	Description	Setting Range	Factory Setting	User Setting
P0100	Acceleration Time	- Defines the time to linearly accelerate from 0 up to the maximum speed (P0134) - If set to 0.0 s, it means no acceleration ramp	0.0 to 999.0 S	20.0 s	
P0101	Deceleration Time	- Defines the time to linearly decelerate from the maximum speed (P0134) up to 0 - If set to 0.0 s, it means no deceleration ramp	0.0 to 999.0 S	20.0 s	
P0133	Minimum Speed	- Defines the minimum and maximum values of the speed reference when the drive is enabled - These values are valid for any reference source 	0 to 18000 rpm	90 rpm (motor 60 Hz) 75 rpm (motor 50 Hz)	
P0134	Maximum Speed			1800 rpm (motor 60 Hz) 1500 rpm (motor 50Hz)	
P0135	Max. Output Current	- Avoids motor stall under torque overload condition during the acceleration or deceleration - The factory default setting is for "Ramp Hold": if the motor current exceeds the value set at P0135 during the acceleration or deceleration, the motor speed will not be increased (acceleration) or decreased (deceleration) anymore. When the motor current reaches a value below the programmed in P0135, the motor speed is again increased or decreased - Other options for the current limitation are available. Refer to the CFW-11 programming manual 	0.2 x I_{nom-HD} to 2 x I_{nom-HD}	1.5 x I_{nom-HD}	
P0136	Manual Torque Boost	- Operates in low speeds, modifying the output voltage x frequency curve to keep the torque constant - Compensates the voltage drop at the motor stator resistance. This function operates in low speeds increasing the inverter output voltage to keep the torque constant in the V/f mode - The optimal setting is the smallest value of P0136 that allows the motor to start satisfactorily. An excessive value will considerably increase the motor current in low speeds, and may result in a fault (F048, F051, F071, F072, F078 or F183) or alarm (A046, A047, A050 or A110) condition 	0 to 9	1	

Table 5.2: Main read only parameters

Parameter	Description	Setting Range
P0001	Speed Reference	0 to 18000 rpm
P0002	Motor Speed	0 to 18000 rpm
P0003	Motor Current	0.0 to 4500.0 A
P0004	DC Link Voltage (Ud)	0 to 2000 V
P0005	Motor Frequency	0.0 to 300.0 Hz
P0006	VFD Status	0 = Ready 1 = Run 2 = Undervoltage 3 = Fault 4 = Self-tuning 5 = Configuration 6 = DC-Braking 7 = STO
P0007	Motor Voltage	0 to 2000 V
P0009	Motor Torque	-1000.0 to 1000.0 %
P0010	Output Power	0.0 to 6553.5 kW
P0012	DI8 to DI1 Status	0000h to 00FFh
P0013	DO5 to DO1 Status	0000h to 001FL
P0018	AI1 Value	-100.00 to 100.00 %
P0019	AI2 Value	-100.00 to 100.00 %
P0020	AI3 Value	-100.00 to 100.00 %
P0021	AI4 Value	-100.00 to 100.00 %
P0023	Software Version	0.00 to 655.35
P0027	Accessories Config. 1	Hexadecimal code representing the identified accessories. Refer to Chapter 7 ACCESSORIES on page 7-1
P0028	Accessories Config. 2	
P0029	Power Hardware Config.	Hexadecimal code according to the available models and option kits. Refer to the programming manual for a complete code list
P0030	IGBTs Temperature U	-20.0 to 150.0 °C (-4 °F to 302 °F)
P0031	IGBTs Temperature V	-20.0 to 150.0 °C (-4 °F to 302 °F)
P0032	IGBTs Temperature W	-20.0 to 150.0 °C (-4 °F to 302 °F)
P0033	Rectifier Temperature	-20.0 to 150.0 °C (-4 °F to 302 °F)
P0034	Internal Air Temp.	-20.0 to 150.0 °C (-4 °F to 302 °F)
P0036	Fan Heatsink Speed	0 to 15000 rpm
P0037	Motor Overload Status	0 to 100 %
P0038	Encoder Speed	0 to 65535 rpm
P0040	PID Process Variable	0.0 to 100.0 %
P0041	PID Setpoint Value	0.0 to 100.0 %
P0042	Time Powered	0 to 65535h
P0043	Time Enabled	0.0 to 6553.5h
P0044	kWh Output Energy	0 to 65535 kWh
P0045	Fan Enabled Time	0 to 65535h
P0048	Present Alarm	0 to 999
P0049	Present Fault	0 to 999

Parameter	Description	Setting Range
P0050	Last Fault	0 to 999
P0051	Last Fault Day/Month	00/00 to 31/12
P0052	Last Fault Year	0 to 99
P0053	Last Fault Time	00:00 to 23:59
P0054	Second Fault	0 to 999
P0055	Second Flt. Day/Month	00/00 to 31/12
P0056	Second Fault Year	00 to 99
P0057	Second Fault Time	00:00 to 23:59
P0058	Third Fault	0 to 999
P0059	Third Fault Day/Month	00/00 to 31/12
P0060	Third Fault Year	00 to 99
P0061	Third Fault Time	00:00 to 23:59
P0062	Fourth Fault	0 to 999
P0063	Fourth Flt. Day/Month	00/00 to 31/12
P0064	Fourth Fault Year	00 to 99
P0065	Fourth Fault Time	00:00 to 23:59
P0066	Fifth Fault	0 to 999
P0067	Fifth Fault Day/Month	00/00 to 31/12
P0068	Fifth Fault Year	00 to 99
P0069	Fifth Fault Time	00:00 to 23:59
P0070	Sixth Fault	0 to 999
P0071	Sixth Fault Day/Month	00/00 to 31/12
P0072	Sixth Fault Year	00 to 99
P0073	Sixth Fault Time	00:00 to 23:59
P0074	Seventh Fault	0 to 999
P0075	Seventh Flt.Day/Month	00/00 to 31/12
P0076	Seventh Fault Year	00 to 99
P0077	Seventh Fault Time	00:00 to 23:59
P0078	Eighth Fault	0 to 999
P0079	Eighth Flt. Day/Month	00/00 to 31/12
P0080	Eighth Fault Year	00 to 99
P0081	Eighth Fault Time	00:00 to 23:59
P0082	Ninth Fault	0 to 999
P0083	Ninth Fault Day/Month	00/00 to 31/12
P0084	Ninth Fault Year	00 to 99
P0085	Ninth Fault Time	00:00 to 23:59
P0086	Tenth Fault	0 to 999
P0087	Tenth Fault Day/Month	00/00 to 31/12
P0088	Tenth Fault Year	00 to 99
P0089	Tenth Fault Time	00:00 to 23:59
P0090	Current At Last Fault	0,0 to 4000,0 A
P0091	DC Link At Last Fault	0 to 2000 V
P0092	Speed At Last Fault	0 to 18000 rpm
P0093	Reference Last Fault	0 to 18000 rpm
P0094	Frequency Last Fault	0,0 to 300,0 Hz
P0095	Motor Volt.Last Fault	0 to 2000 V
P0096	DIx Status Last Fault	0000h to 00FFh
P0097	DOx Status Last Fault	0000h to 001Fh

5.3 DATE AND TIME SETTING

Step	Action/Result	Display Indication
1	- Monitoring mode - Press **"Menu"** (right soft key)	
2	- Group **"00 ALL PARAMETERS"** is already selected 	
3	- Group **"01 PARAMETER GROUPS"** is selected - Press **"Select"** 	
4	- A new list of groups is displayed and group **"20 Ramps"** is selected  - Press until you reach group **"30 HMI"**	
5	- Group **"30 HMI"** is selected - Press **"Select"**	

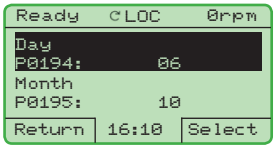
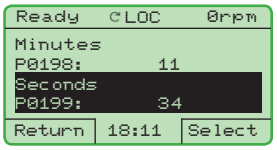
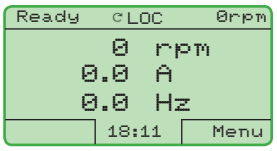
Step	Action/Result	Display Indication
6	- Parameter **"Day P0194"** is already selected - If needed, set P0194 according to the actual day. To do so, press **"Select"** and then,P0194  or  to change P0194 value - Follow the same steps to set parameters **"Month P0195"** to **"Seconds P0199"**	
7	- Once the setting of P0199 is over, the Real Time Clock is now updated - Press **"Return"** (left soft key)	
8	- Press **"Return"**	
9	- Press **"Return"**	
10	The display is back to the monitoring mode	

Figure 5.4: *Setting date and time*

5.4 LOCKING OF PARAMETER MODIFICATION

In case you want to prevent unauthorized people from changing parameters, just change the content of P0000 to a value different from 5. Follow basically the same procedure presented in Item 5.2.1 Password Setting in P0000 on page 5-2.

5.5 HOW TO CONNECT A PC

NOTE!

- Always use standard host/device shielded USB cable. Cables without shield may cause communication errors.
- Example of cables: Samtec:
  - USBC-AM-MB-B-B-S-1 (1 meter);
  - USBC-AM-MB-B-B-S-2 (2 meters);
  - USBC-AM-MB-B-B-S-3 (3 meters).
- The USB connection is galvanically isolated from the electric line and other high voltages inside the inverter. However, it is not isolated from the protective earth (PE). Use an isolated laptop for connection to the USB connector or desktop with connection to the same protective earth as the inverter protective earth.

To control the motor speed via PC or to view and program the inverter via PC, it is necessary to install the SuperDrive G2 software on the PC.

Basic procedure to transfer data from the PC to the inverter:

1. Install the SuperDrive G2 software on the PC.

2. Connect the PC to the inverter via USB cable.

3. Start the SuperDrive G2.

4. Select “Open” and the files stored on the PC are shown.

5. Select the proper file.

6. Use the function "Write Parameters to the Drive".

All parameters are now transferred to the inverter.

For further details and other functions related to the SuperDrive G2, refer to the Manual of the SuperDrive.

5.6 FLASH MEMORY MODULE

Location according to Figure 5.5 on page 5-9.

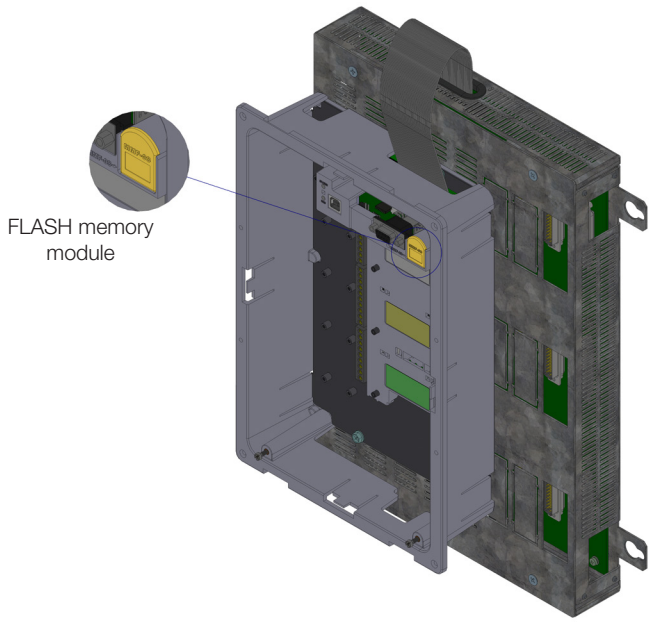


Figure 5.5: *Detail of the FLASH memory module location*

Functions:

- It stores an image of the inverter parameters.
- It allows transferring parameters stored in the FLASH memory module to the inverter.
- It allows transferring firmware stored in the FLASH memory module to the inverter.
- It stores the program generated by the SoftPLC.

Whenever the inverter is energized, it transfers this program to the RAM, located on the inverter control board, and it executes the program.

For further details, refer to the programming manual and SoftPLC manual of the CFW-11.

ATTENTION!
To connect or disconnect the FLASH memory module, first turn off the inverter and wait for the discharge of the capacitors.

5.7 OPERATION WITH A REDUCED NUMBER OF POWER UNITS

The CFW-11W can operate with a reduced number of UP11 and reduced power for a short time. That operating mode is called "Reduced Power Mode". It may be applied to critical processes in which you do not want to stop a whole machine when one UP11 fails, enabling the operation with reduced power until you have a UP11 for replacement.

The general scheme of a drive with 3 UP11 is shown in Figure 3.6 on page 3-7. The reduced power mode works as a drive of up to 2 UP11.

Assuming that in the drive of Figure 3.6 on page 3-7, composed of 3 UP11, the UP11 number 2 fails. In order to reestablish the drive operation with reduced power (Reduced Power Mode), you must follow the steps below:

1. Disconnect the power supply from the drive.

2. Identify the defective UP11 (in this case, number 2).

3. Disconnect the power and control connections of the UP11 number 2, according to Figure 5.6 on page 5-11.

4. Move the control connections on the IFSC board, as shown in Figure 5.7 on page 5-12. Connect the control cables of UP11 number 3 to position 2 of the IFSC board. Thus, UP11 3 becomes UP11 2.

5. Configure the new number of UP11 through DIP switch S2 located on the IFSC board, according to Table 5.3 on page 5-10.

Table 5.3: *DIP switch S2 configuration*

S2:2	S2:1	Number of UP11 Connected
OFF	OFF	1
OFF	ON	2
ON	ON	3

6. Change DIP switch S1:4 to ON; thus, it will be informed to the control that the CFW-11W drive is operating with a reduced number of UP11.

ATTENTION!
It is recommended that the drive operate short of one UP11 at most.

7. Reconnect only the power supply of the drive control.

8. Alarm A420 will be indicated (Reduced Power Mode), informing that the CFW-11W is operating in the reduced power mode.

9. Check if parameters P0295 (Rat. Curr. ND/HD Inv.) and P0296 (Rated Line Voltage) are according to the voltage and the number of connected UP11.

10. Set the following control parameters:
    a. P0169: Maximum Torque Current +;
    b. P0170: Maximum Torque Current -;
    c. Parameters P0169 and P0170 must be set so that the maximum torque current will not exceed the maximum inverter current. The values of those parameters are referenced to the motor rated current, as you can see on Item 11.8.6 of the CFW-11 programming manual.

11. Connect the drive power source.

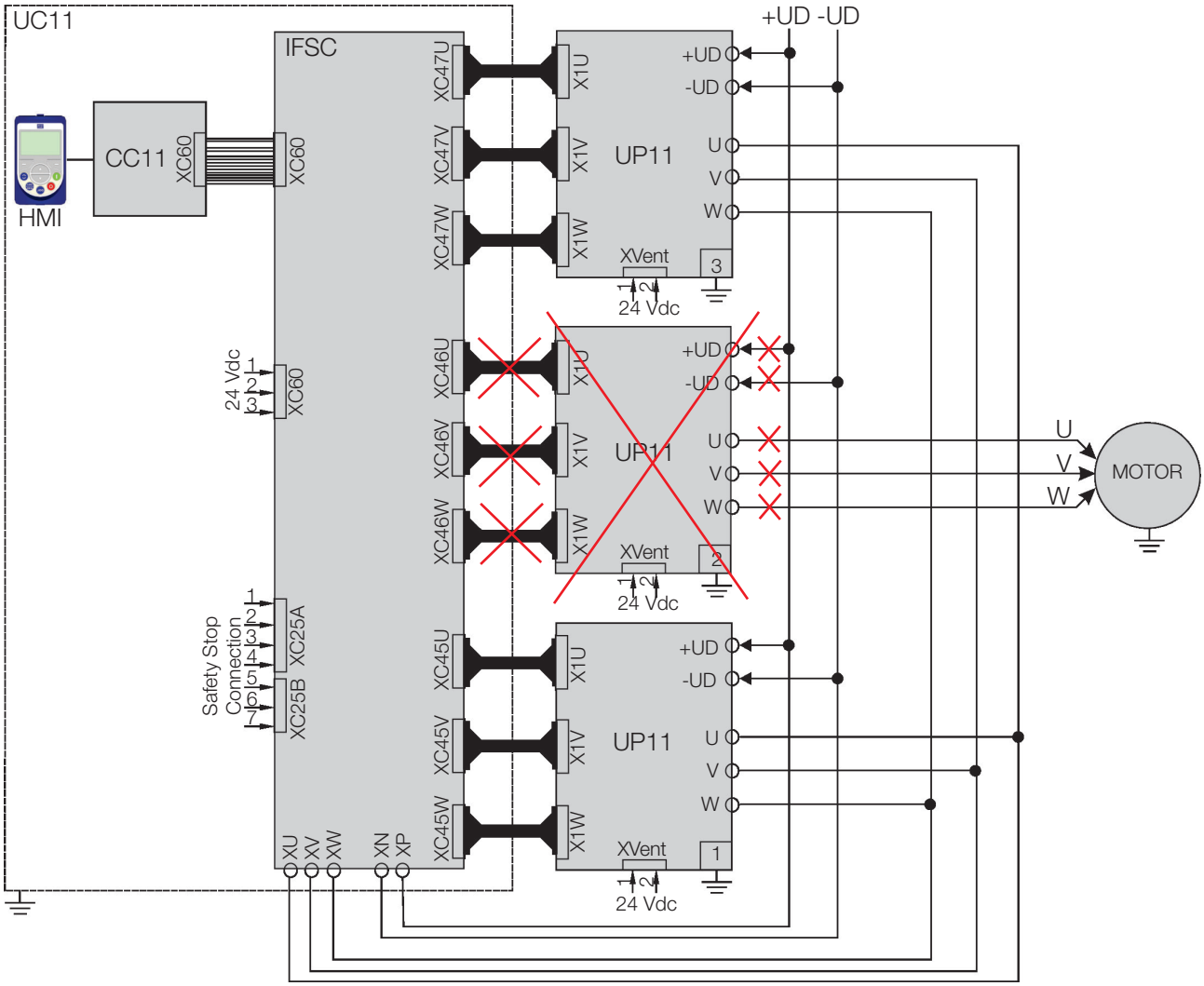


Figure 5.6: *Disconnection of the power and control cables of UP11 number 2*

ATTENTION!
It is not allowed the execution of self-tuning when the inverter is operating in the emergency mode.

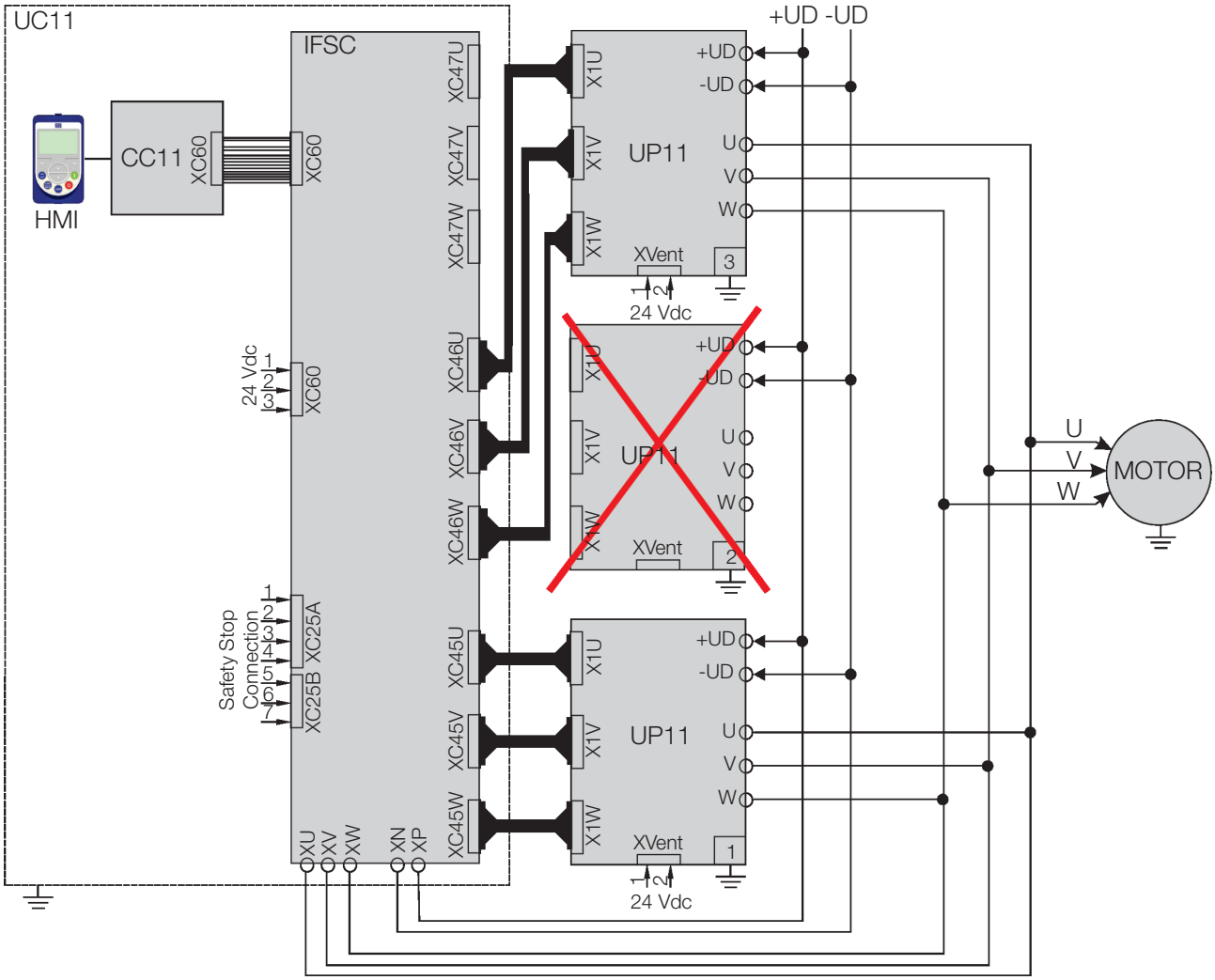


Figure 5.7: *Moving the control connections on the IFSC board*

6 TROUBLESHOOTING AND MAINTENANCE

This chapter presents:

- Lists all faults and alarms that may occur.
- Indicates the possible causes of each fault and alarm.
- Lists most frequent problems and corrective actions.
- Presents instructions for periodic inspections and preventive maintenance on the equipment.

6.1 OPERATION OF THE FAULTS AND ALARMS

When a fault (FXXX) is identified, what occurs is:

- Blocking of the PWM pulses.
- Indication on the display of the fault description and code.
- The “STATUS” LED flashes red.
- The relay programmed for “NO FAULT” is turned off.
- Saving of some data on the EEPROM of the control circuit:

  - Speed reference via HMI and E.P. (Electronic Potentiometer), in case the “Reference backup” function in P0120 is enabled.

  - The code of the fault or alarm occurred (it moves the nine previous faults).

  - The status of the integrator of the motor overload function.

  - The status of the hours enabled (P0043) and energized (P0042) counter.

For the inverter to return to normal operation right after the occurrence of a fault, it is necessary to reset it, which can be done as follows:

- Switching off the power supply, and switching it back on (power-on reset).
- Pressing the O (manual reset).
- Via soft key "Reset".
- Automatically by means of the P0340 setting (auto-reset).
- Via digital input: DIx = 20 (P0263 to P0270).

When an alarm (AXXX) is identified, what occurs is:

- Indication on the display of the alarm description and code.
- The “STATUS” LED becomes yellow.
- The inverter remains in operation, without blocking the PWM pulses.

6.2 ALARMS, FAULTS AND POSSIBLE CAUSES

Table 6.1: Alarms, faults and possible causes

Fault/Alarm	Description	Possible Causes
F021: DC Link Undervoltage	DC Link undervoltage condition occurred.	■ Supply voltage too low, producing voltage on the DC link below the minimum value (read value in parameter P0004): Ud < 530 V - Supply voltage 500-525 V (P0296 = 5). Ud < 580 V - Supply voltage 500-575 V (P0296 = 6). Ud < 605 V - Supply voltage 600 V (P0296 = 7). Ud < 696 V - Supply voltage 660-690 V (P0296 = 8). ■ Phase loss in the input. ■ Fault on the pre-charge circuit. ■ Parameter P0296 was set to a value above of the power supply rated voltage.
F022: DC Link Overvoltage	DC Link overvoltage condition occurred.	■ Supply voltage too high, producing voltage on the DC link above the maximum value: Ud > 1000 V - Models 500-600 V (P0296 = 5, 6 and 7). Ud > 1200 V - Models 660-690 V (P0296 = 8). ■ Driven load inertia too high or deceleration ramp too fast. ■ Setting of P0151 or P0153 or P0185 too high.
F030: (1) U Arm Fault	Desaturation on the IGBTs of arm U.	■ Short circuit between phases U and V or U and W of the motor.
F034: (1) V Arm Fault	Desaturation on the IGBTs of arm V.	■ Short circuit between phases V and U or V and W of the motor.
F038: (1) W Arm Fault	Desaturation on the IGBTs of arm W.	■ Short circuit between phases W and U or W and V of the motor.
A046: High Load on the Motor	Motor overload alarm. **Note:** It may be disabled by setting P0348 = 0 or 2.	■ Setting of P0156, P0157 and P0158 too low for the motor. ■ Overload on the motor shaft.
A047: Overload on the IGBTs	IGBT overload alarm. **Note:** It may be disabled by setting P0350 = 0 or 2.	■ High current in the inverter output.
F048: Overload on the IGBTs	IGBT overload fault.	■ Current in the inverter output too high.
F067: Encoder /Motor Wiring Is Inverted	Fault related to the phase relation of the encoder signals, if P0202 = 4 and P0408 = 2, 3 or 4. **Note:** - This error can only occur during self-tuning. - This fault cannot be reset. - In this case, turn off the power supply, solve the problem, and then turn it on again.	■ U, V, W wiring to the motor is inverted. ■ Encoder channels A and B are inverted. ■ Error in the encoder assembly position.
F070: Overcurrent/Short Circuit	Overcurrent or short circuit in the output, DC link or braking resistor.	■ Short circuit between two motor phases. ■ Short circuit of the connecting cables of the dynamic braking resistor. ■ IGBT modules short circuited.
F071: Overcurrent in the Output	Output overcurrent fault.	■ Load inertia too high or acceleration ramp too fast. ■ Setting of P0135 or P0169, P0170, P0171 and P0172 too high.
F072: Motor Overload	Motor overload fault. **Note:** It may be disabled by setting P0348 = 0 or 3.	■ Setting of P156, P157 and P158 too low for the motor. ■ Load on the motor shaft is too high.
F074: (4) Ground Fault	Ground overcurrent fault. **Note:** It may be disabled by setting P0343 = 0.	■ Short circuit to the ground in one or more output phases. ■ Motor cable capacitance too high, causing current peaks in the output (2).
F076: Motor Current Imbalance	Motor current imbalance fault. **Note:** It may be disabled by setting P0342 = 0.	■ Poor contact or interrupted wiring in the connection between the inverter and the motor. ■ Vector control with orientation loss. ■ Vector control with encoder, wiring of the encoder or connection to the motor inverted.
F077: Overload on the Braking Resistor	Overload on the dynamic braking resistor fault.	■ Load inertia too high or deceleration ramp too fast. ■ Load on the motor shaft is too high. ■ Values of P0154 and P0155 programmed incorrectly.

Fault/Alarm	Description	Possible Causes
F078: Motor Overtemperature	Fault related to PTC temperature sensor installed on the motor. **Note:** - It may be disabled by setting P0351 = 0 or 3. - It is necessary to program analog input and output for PTC function PTC.	■ Load on the motor shaft is too high. ■ Load cycle is too high (high number of starts and stops per minute). ■ High ambient temperature around the motor. ■ Poor contact or short circuit (resistance <60Ω) in the wiring connected to the motor thermistor. ■ Motor thermistor not installed. ■ Motor shaft locked.
F079: Encoder Signals Fault	Lack of encoder signals.	■ Wiring between encoder and encoder interface accessory interrupted. ■ Encoder is defective.
F080: CPU Fault (Watchdog)	Watchdog fault on the microcontroller.	■ Electric noise.
F082: Copy Function Fault	Fault in the copy of parameters.	■ Attempt to copy parameters from the HMI to the inverter with incompatible software versions.
F084: Self-Diagnose Fault	Self-Diagnose Fault.	■ Defect on the inverter internal circuits.
A088: Communication Lost	Communication fault of the HMI with the control board.	■ Loose keypad cable connection. ■ Electric noise on the installation.
A090: External Alarm	External alarm via DI. **Note:** It is necessary to program DI for "no external alarm".	■ Open wiring at digital inputs (DI1 to DI8) programmed for "no external alarm".
F091: External Fault	External fault via DI. **Note:** It is necessary to program DI for "no external fault".	■ Open wiring at digital inputs (DI1 to DI8) programmed for "no external fault".
F099: Invalid Current Offset	Current measurement circuit is measuring a wrong value for null current.	■ Defect on the inverter internal circuits.
A110: High Motor Temperature	Alarm related to PTC temperature sensor installed on the motor. **Note:** - It may be disabled by setting P0351 = 0 or 2. - It is necessary to program analog input and output for PTC function.	■ Overload on the motor shaft. ■ Load cycle too high (high number of starts and stops per minute). ■ High ambient temperature around the inverter. ■ Motor thermistor not installed. ■ Blocked motor shaft.
A128: Serial Communication Timeout	It indicates that the inverter stopped receiving valid telegrams within a certain period. **Note:** It may be disabled by setting P0314 = 0.0 s.	■ Check the wiring and grounding installation. ■ Make sure the master sent a new telegram in a period of time shorter than the setting in P0314.
A129: Anybus Offline	Alarm that indicates interruption in the Anybus-CC communication.	■ PLC went to the idle status. ■ Programming error. Number of I/O words programmed on the slave is different from the setting on the master. ■ Loss of communication with the master (broken cable, connector unplugged, etc.).
A130: Anybus Access Error	Alarm that indicates error of access to the Anybus-CC communication module.	■ Anybus-CC module defective, not recognized or incorrectly installed. ■ Conflict with WEG optional board.
A133: CAN Not Powered	Alarm of power supply missing on the CAN controller.	■ Broken or disconnected cable. ■ Power supply turned off.
A134: Bus Off	Inverter CAN interface has entered into the bus-off state.	■ Incorrect baud rate. ■ Two nodes on the network with the same address. ■ Wrong cable connection (inverted signals).
A135: CANopen Communication Error	Alarm that indicates communication error.	■ Communication problems. ■ Incorrect programming of the master. ■ Incorrect configuration of the communication objects.
A136: Idle Master	Network master went to the idle status.	■ PLC switch in the IDLE position. ■ Bit of the PLC command register in zero (0).
A137: DNet Connection Timeout	DeviceNet I/O connections timeout alarm.	■ One or more allocated I/O connections went to the timeout status.

Fault/Alarm	Description	Possible Causes
A138: (2) Profibus DP Interface in Clear Mode	It indicates that the inverter received the command from the DP Profibus network master to go into Clear mode.	■ Check the network master status, ensuring it is in the run mode (Run). ■ For further information, refer to the Profibus DP communication manual.
A139: (2) Offline Profibus DP Interface	It indicates interruption in the communication between the DP Profibus network master and the inverter.	■ Check if the network master is correctly configured and operating properly. ■ Check the network installation in general – cabling, grounding. ■ For further information, refer to the Profibus DP communication manual.
A140: (2) Profibus DP Module Access Error	It indicates an error in the access to the data of the Profibus DP communication module data.	■ Check if the Profibus DP module is correctly fitted in slot 3. ■ For further information, refer to the Profibus DP communication manual.
F150: Motor Overspeed	Overspeed Fault. Enabled when the real speed exceeds the value of P0134 x (100 % + P0132) for more than 20 ms.	■ Incorrect setting of P0161 and/or P0162.
F151: Flash Memory Module Fault	Fault on the Flash Memory Module (MMF-01).	■ Defective Flash memory module. ■ Flash memory module not well fitted.
A152: Internal Air High Temperature	High internal air temperature alarm. **Note:** It may be disabled by setting P0353 = 1 or 3.	■ High ambient temperature around the inverter (> 40 °C (104 °F)). ■ High temperature inside the panel (> 40 °C (104 °F)).
F153: Internal Air Overtemperature	Internal air overtemperature fault.	
F160: Safety Stop Relay	Fault on the Safety Stop relays.	■ One of the relays is defective or without the +24 Vdc voltage on the coil.
F161: Timeout PLC11 CFW-11	See the programming manual of the PLC11-01 module.	
A162: Incompatible PLC Firmware		
A163: Broken Wire AI1	It indicates that AI1 current signal (4-20 mA or 20-4 mA) is out of the signal 4 to 20 mA range.	■ Broken AI1 cable. ■ Bad contact at the signal connection to the terminal strip.
A164: Broken Wire AI2	It indicates that AI1 current signal (4-20 mA or 20-4 mA) is out of the signal 4 to 20 mA range.	■ Broken AI2 cable. ■ Bad contact at the signal connection to the terminal strip.
A165: Broken Wire AI3	It indicates that AI1 current signal (4-20 mA or 20-4 mA) is out of the signal 4 to 20 mA range.	■ Broken AI3 cable. ■ Bad contact at the signal connection to the terminal strip.
A166: Broken Wire AI4	It indicates that AI1 current signal (4-20 mA or 20-4 mA) is out of the signal 4 to 20 mA range.	■ Broken AI4 cable. ■ Bad contact at the signal connection to the terminal strip.
A181: Invalid Clock Value	Invalid clock value alarm.	■ Necessary to set the date and time in P0194 to P0199. ■ Keypad battery is discharged, defective, or not installed.
F183: IGBTs Overload +Temperature	Overtemperature related to IGBT overload protection.	■ High ambient temperature around the inverter. ■ Operation with frequencies below 10 Hz.
F186: (3) Sensor 1 Temperature Fault	Temperature fault in sensor 1.	■ High temperature on the motor.
F187: (3) Sensor 2 Temperature Fault	Temperature fault in sensor 2.	■ High temperature on the motor.
F188: (3) Sensor 3 Temperature Fault	Temperature fault in sensor 3.	■ High temperature on the motor.
F189: (3) Sensor 4 Temperature Fault	Temperature fault in sensor 4.	■ High temperature on the motor.
F190: (3) Sensor 5 Temperature Fault	Temperature fault in sensor 5.	■ High temperature on the motor.

Fault/Alarm	Description	Possible Causes
A191: (3) Sensor 1 Temperature Alarm	Temperature alarm in sensor 1.	■ High temperature on the motor. ■ Problem in the wiring that connects the IOE-01 Module (02 or 03) to the sensor.
A192: (3) Sensor 2 Temperature Alarm	Temperature alarm in sensor 2.	■ High temperature on the motor. ■ Problem in the wiring that connects the IOE-01 Module (02 or 03) to the sensor.
A193: (3) Sensor 3 Temperature Alarm	Temperature alarm in sensor 3.	■ High temperature on the motor. ■ Problem in the wiring that connects the IOE-01 Module (02 or 03) to the sensor.
A194: (3) Sensor 4 Temperature Alarm	Temperature alarm in sensor 4.	■ High temperature on the motor. ■ Problem in the wiring that connects the IOE-01 Module (02 or 03) to the sensor.
A195: (3) Sensor 5 Temperature Alarm	Temperature alarm in sensor 5.	■ High temperature on the motor. ■ Problem in the wiring that connects the IOE-01 Module (02 or 03) to the sensor.
A196: (3) Sensor 1 Cable Alarm	Broken cable alarm in sensor 1.	■ Short circuited temperature sensor.
A197: (3) Sensor 2 Cable Alarm	Broken cable alarm in sensor 2.	■ Short circuited temperature sensor.
A198: (3) Sensor 3 Cable Alarm	Broken cable alarm in sensor 3.	■ Short circuited temperature sensor.
A199: (3) Sensor 4 Cable Alarm	Broken cable alarm in sensor 4.	■ Short circuited temperature sensor.
A200: (3) Sensor 5 Cable Alarm	Broken cable alarm in sensor 5.	■ Short circuited temperature sensor.
F229: Anybus Offline	■ Refer to the Anybus-CC communication manual.	
F230: Anybus Access Error		
F233: CAN Bus Power Failure	■ Refer to the CANopen communication manual and/or refer to the DeviceNet communication manual.	
F234: Bus Off		
F235: CANopen Communication Error	Refer to the CANopen communication manual.	
F236: Master Idle	Refer to the DeviceNet communication manual.	
F237: DeviceNet Connection Timeout		
F238: (2) Profibus DP Interface in Clear Mode	It indicates that the inverter received the command from the Profibus DP network master to enter Clear mode.	■ Check the network master status, ensuring it is in the Run mode. ■ The fault indication will occur if P0313 = 5. ■ For further information, refer to the Profibus DP communication manual.
F239: (2) Profibus Offline	It indicates interruption in the communication between the Profibus DP network master and the inverter.	■ Check if the network master is correctly configured and operating properly. ■ Check the network installation in general – cabling, grounding. ■ The fault indication will occur if P0313 = 5. ■ For further information, refer to the Profibus DP communication manual.

Fault/Alarm	Description	Possible Causes
F240: (2) Profibus DP Module Access Error	It indicates error in the access to the data of the Profibus DP communication module.	■ Check if the Profibus DP Module is correctly fitted in slot 3. ■ The fault indication will occur if P0313 = 5. ■ For further information, refer to the Profibus DP communication manual.
A300: High Temperature IGBT U B1	Alarm of high temperature measured on the temperature sensor (NTC) of the IGBT of phase U of book 1.	■ High ambient temperature (> 40 °C or 45 °C ((>104 °F or 113 °F) depending on the model, refer to Item 3.1.1 Environment Conditions on page 3-1) and high output current. ■ Locked or defective fan. ■ Fins of the book heatsink too dirty, hindering the air flow.
F301: Overtemperature IGBT U B1	Fault of overtemperature measured on the temperature sensor (NTC) of the IGBT of phase U of book 1.	■ High temperature of the coolant (> 40 °C) (> 104 °F). ■ Hydraulic circuit is clogged. ■ Hydraulic pump is defective. ■ Power supply fault on the hydraulic pump. ■ Leakage.
A303: High Temperature IGBT V B1	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase V of book 1.	
F304: Overtemperature IGBT V B1	Fault of overtemperature measured on the temperature sensor (NTC) of IGBT of phase V of book 1.	
A306: High Temperature IGBT W B1	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase W of book 1.	
F307: Overtemperature IGBT W B1	Fault of overtemperature measured on the temperature sensor (NTC) of IGBT of phase W of book 1.	
A309: High Temperature IGBT U B2	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase U of book 2.	
F310: Overtemperature IGBT U B2	Fault of overtemperature measured on the temperature sensor (NTC) of the IGBT of phase U of book 2.	
A312: High Temperature IGBT V B2	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase V of book 2.	
F313: Overtemperature IGBT V B2	Fault of overtemperature measured on the temperature sensor (NTC) of IGBT of phase V of book 2.	
A315: High Temperature IGBT W B2	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase W of book 2.	
F316: Overtemperature IGBT W B2	Fault of overtemperature measured on the temperature sensor (NTC) of IGBT of phase W of book 2.	
A318: High Temperature IGBT U B3	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase U of book 3.	■ High temperature of the coolant (> 40 °C) (> 104 °F). ■ Hydraulic circuit is clogged. ■ Hydraulic pump is defective. ■ Power supply fault on the hydraulic pump. ■ Leakage.
F319: Overtemperature IGBT U B3	Fault of overtemperature measured on the temperature sensor (NTC) of the IGBT of phase U of book 3.	
A321: High Temperature IGBT V B3	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase V of book 3.	
F322: Overtemperature IGBT V B3	Fault of overtemperature measured on the temperature sensor (NTC) of IGBT of phase V of book 3.	
A324: High Temperature IGBT W B3	Alarm of high temperature measured on the temperature sensor (NTC) of IGBT of phase W of book 3.	
F325: Overtemperature IGBT W B3	Fault of overtemperature measured on the temperature sensor (NTC) of IGBT of phase W of book 3.	

Fault/Alarm	Description	Possible Causes
A345: High Load IGBT U B1	Alarm of overload on the IGBT of phase U of book 1.	■ High current in the inverter output (refer to Table 8.1 on page 8-1).
F346: Overload on IGBT U B1	Fault of overload on the IGBT of phase U of book 1.	
A348: High Load IGBT V B1	Alarm of overload on the IGBT of phase V of book 1.	
F349: Overload on IGBT V B1	Fault of overload on the IGBT of phase V of book 1.	
A351: High Load IGBT W B1	Alarm of overload on the IGBT of phase W of book 1.	
F352: Overload on IGBT W B1	Fault of overload on the IGBT of phase W of book 1.	
A354: High Load IGBT U B2	Alarm of overload on the IGBT of phase U of book 2.	
F355: Overload on IGBT U B2	Fault of overload on the IGBT of phase U of book 2.	
A357: High Load IGBT V B2	Alarm of overload on the IGBT of phase V of book 2.	
F358: Overload on IGBT V B2	Fault of overload on the IGBT of phase V of book 2.	
A360: High Load IGBT W B2	Alarm of overload on the IGBT of phase W of book 2.	
F361: Overload on IGBT W B2	Fault of overload on the IGBT of phase W of book 2.	
A363: High Load IGBT U B3	Alarm of overload on the IGBT of phase U of book 3.	
F364: Overload on IGBT U B3	Fault of overload on the IGBT of phase U of book 3.	
A366: High Load IGBT V B3	Alarm of overload on the IGBT of phase V of book 3.	
F367: Overload on IGBT V B3	Fault of overload on the IGBT of phase V of book 3.	■ High current in the inverter output (refer to Table 8.1 on page 8-1).
A369: High Load IGBT W B3	Alarm of overload on the IGBT of phase W of book 3.	
F370: Overload on IGBT W B3	Fault of overload on the IGBT of phase W of book 3.	

Fault/Alarm	Description	Possible Causes
A390: Current Unbalance Phase U B1	Alarm of current imbalance of phase U book 1. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	■ Bad electrical connection between the DC link and the power unit. ■ Bad electrical connection between the power unit output and the motor. **Note:** In case of quick accelerations and brakes, this alarm may be momentarily indicated, disappearing after some seconds. This does not indicate a malfunction on the inverter. In case this alarm persists when the motor is operating at constant speed, it is an indication of abnormal current distribution between the power units.
A391: Current Unbalance Phase V B1	Alarm of current imbalance of phase V book 1. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
A393: Current Unbalance Phase U B2	Alarm of current imbalance of phase U book 2. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
A394: Current Unbalance Phase V B2	Alarm of current imbalance of phase V book 2. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
A395: Current Unbalance Phase W B2	Alarm of current imbalance of phase W book 2. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
A396: Current Unbalance Phase U B3	Alarm of current imbalance of phase U book 3. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
A397: Current Unbalance Phase V B3	Alarm of current imbalance of phase V book 3. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
A398: Current Unbalance Phase W B3	Alarm of current imbalance of phase W book 3. It indicates an imbalance of 20 % in the current distribution between this phase and the smallest current of the same phase in another book, only when the current in this phase is higher than 75 % of its rated value.	
F406: Overtemperature on the Braking Module	This fault/alarm is linked to the configuration of parameters P0832 and P0833. - Function of DIM 1 input. - Function of DIM 2 input.	■ Overtemperature (rectifier/braking). ■ Failure in the electrical connection between the digital input and the sensor. ■ Failure of the corresponding sensor. ■ Failure on the device monitored by the sensor.
F408: Fault on the Cooling System		
F410: External Fault		
F412: Overtemperature on the the Rectifier		
A010: High temperature on the Rectifier		
A700: (5) HMI Disconnected	Alarm or Fault linked to the disconnection of the HMI.	■ RTC function block was enabled in the SoftPLC application and the HMI is disconnected from the inverter.
F701: (5) HMI Disconnected		

Fault/Alarm	Description	Possible Causes
A702: (5) Inverter Disabled	Alarm indicating that the General Enable command is not active.	■ The SoftPLC Run/Stop command is equal to Run or a movement block has been enable while the inverter is general disabled.
A704: (5) Two Enabled Movements	Two movements enabled.	■ It occurs when two or more movement blocks are simultaneously enabled.
A706: (5) Speed Reference Not Programmed for SoftPLC	Speed reference not programmed for SoftPLC.	■ It occurs when a movement block is enabled and the speed reference is not configured for SoftPLC (check P0221 and P0222).

Models in which it may occur:

1. In case of Modular Drive, the HMI does not show in which book the fault occurred. LEDs on the IFSC board indicate which UP11 caused the fault, Figure 6.1 on page 6-9. When a reset is performed the LEDs are switched off, going on again if the fault persists.

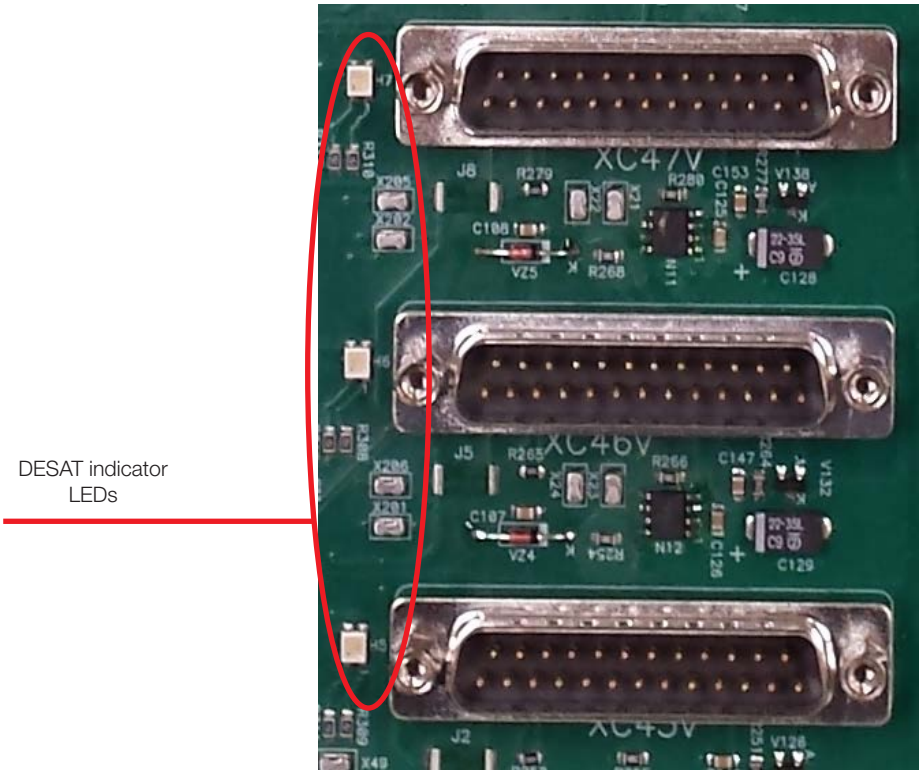


Figure 6.1: *LEDs that indicate fault on the arms of the power units (desaturation)*

2. With Profibus DP module connected to slot 3 (XC43).

3. With IOE-01 (02 or 03) module connected to slot 1(XC41).

4. Motor very long cable, over 100-meter long, will present a high stray capacitance to the ground. The circulation of eddy currents in these capacitances may cause the activation of the ground fault circuit and, consequently, blocking due to F074 immediately after the inverter is enabled.

5. All models with SoftPLC application.

NOTE!
The range from P0750 to P0799 is intended for user's Faults and Alarms of the SoftPLC application.

6.3 SOLUTIONS FOR THE MOST FREQUENT PROBLEMS

Table 6.2: Solutions for the most frequent problems

Problem	Point to be Verified	Corrective Action
Motor does not start	Incorrect wiring	1. Check all power and control connections. For instance, the digital inputs set to Start/Stop, General Enable, or no external error must be connected to the 24 Vdc or to DGND* terminals (refer to Figure 3.12 on page 3-14)
	Analog reference (if used)	1. Check if the external signal is properly connected 2. Check the status of the control potentiometer (if used)
	Incorrect settings	1. Check if the parameter values are correct for the application
	Fault	1. Check whether the inverter is disabled due to a fault condition 2. Make sure that the terminals XC1:13 and XC1:11 are not shorted (short-circuit at the 24 Vdc power supply)
	Stalled motor	1. Decrease the motor overload 2. Increase P0136, P0137 (V/f), or P0169/P0170 (vector control
Motor speed oscillates	Loose connections	1. Stop the inverter, turn off the power supply, check and tighten all the power connections 2. Check all the internal connections of the inverter
	Defective speed reference potentiometer	1. Replace the potentiometer
	Oscillation of the external analog reference	1. Identify the cause of the oscillation. If it is caused by electrical noise, use shielded cables or separate them from the power and control wiring
	Incorrect settings (vector control)	1. Check parameters P0410, P0412, P0161, P0162, P0175 and P0176 2. Refer to the programming manual
Too high or too low motor speed	Incorrect settings (reference limits)	1. Check whether the values of P0133 (minimum speed) and P0134 (maximum speed) are properly set for the used motor and application
	Control signal from the analog reference (if used)	1. Check the level of the reference control signal 2. Check the settings (gain and offset) of parameters P0232 to P0249
	Motor nameplate	1. Check whether the used motor matches the application
Motor does not reach the rated speed, or motor speed starts oscillating around the rated speed (Vector Control)	Settings	1. Decrease P0180 2. Check P0410
Display is off	Keypad connections	1. Check the inverter keypad connection
	Power supply voltage	1. Control rack supply voltage out of the limits specified in Table 3.10 on page 3-17
	Mains supply fuses open	1. Replace the fuses
Low motor speed and P0009 = P0169 or P0170 (motor operating with torque limitation), for P0202 = 4 - vector with encoder	Encoder signals are inverted or power connections are inverted	1. Check signals A - $\overline{A}$, B - $\overline{B}$, refer to the incremental encoder (ENC -01 and ENC-02) interface guide. If signals are properly installed, exchange two of the output phases. For instance U and V

6.4 INFORMATION TO CONTACT TECHNICAL SUPPORT

NOTE!
For technical support and servicing, it is important to have the following information at hand:
- Inverter model.
- Serial number, manufacturing date and hardware revision indicated on the nameplate of the product (refer to Section 2.4 UC11 NAMEPLATE on page 2-6).
- Installed software version (refer to the parameter P0023).
- Application data and inverter settings.

6.5 PREVENTIVE MAINTENANCE

DANGER!
- Always turn off the main power supply before touching any electrical component associated to the inverter.
- High voltages may still be present even after disconnecting the power supply.
- Wait at least 10 minutes for the complete discharge of the power capacitors.
- Always connect the equipment frame to the protective earth (PE) at the proper terminal.

ATTENTION!
Electronic boards have components sensitive to electrostatic discharges.
Do not touch the components or connectors directly. If necessary, first touch the grounded metallic frame or wear a ground strap.

Do not perform any withstand voltage test!
If necessary, contact WEG.

When installed in proper environment and operating conditions, the inverters require little maintenance. Table 6.3 on page 6-11 presents the main procedures and time intervals for preventive maintenance.

Table 6.3: *Preventive maintenance*

Maintenance	Interval	Instructions
HMI battery replacement	Every 10 years	Refer to the Chapter 4 HMI on page 4-1
Change of the coolant of the primary circuit	Every 6 years	Contact WEG
Fan replacement	Every 5 years	Fan replacement procedure indicated in Figure 6.2 on page 6-12 and Figure 6.3 on page 6-12
Monthly inspection	Once a month	Open the panel and check for leaks. If present, it must be corrected

The fan must be removed as indicated below:

- Step 1: Disconnect the fan power supply connector, Figure 6.2 on page 6-12.
- Step 2: Pull the fan towards the front of the UP11, Figure 6.3 on page 6-12.

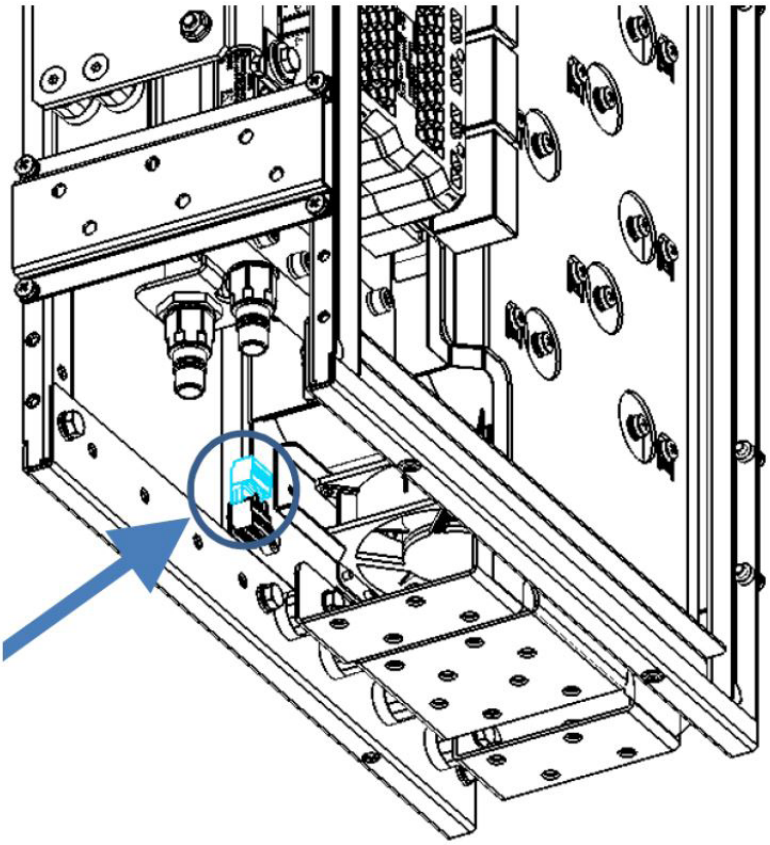


Figure 6.2: *Step 1 to remove the fan*

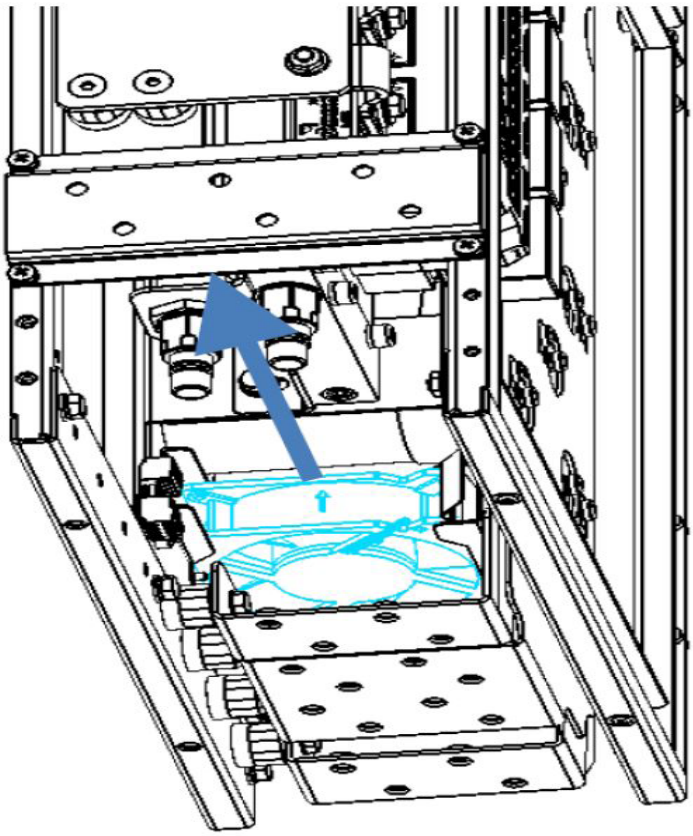


Figure 6.3: *Step 2 to remove the fan*

Table 6.4 on page 6-13 contains the recommended inspections to be performed every 6 months after the start-up.

Table 6.4: Recommended periodic inspections - Every 6 months

Component	Abnormality	Corrective Action
Terminals, connectors	Loose Screws	Tighten
	Loose Connectors	
Printed circuit boards	Accumulation of dust, oil, humidity, etc.	Cleaning
	Smell	Replacement
Power module/Power connections	Accumulation of dust, oil, humidity, etc.	Cleaning
	Loose connection screws	Tighten
Power resistors	Discoloration	Replacement
	Smell	

6.5.1 Cleaning Instructions

When it is necessary to clean the inverter, follow the instructions below:

Electronic boards:

- Disconnect the power supply of the inverter and wait for 10 minutes.
- Remove the dust accumulated on the boards using an anti-static brush or ion air gun (Example: Charges Burtes Ion Gun reference A6030-6DESCO).
- If necessary, remove the boards from the inverter.
- Always wear a grounding strap.

7 ACCESSORIES

This chapter presents:

- The accessories that can be integrated to the inverters.

The installation, operation and programming details of the accessories are presented in the respective manuals and are not included in this chapter.

7.1 ACCESSORIES

The accessories are installed on the inverters easy and quickly using the “Plug and Play” concept.

When an accessory is connected to the slots, the control circuit identifies the model and informs the code of the accessory connected in P0027 or P0028. The accessory must be installed with the inverter power supply disconnected.

The part number and models available of each accessory are presented in Table 7.1 on page 7-2. They may be ordered separately and will be shipped in individual packages containing the components and the manuals with detailed instructions for the product installation, operation and programming.

ATTENTION!
Only one module can be used at a time in each slot 1, 2, 3, 4 or 5.

Table 7.1: Accessory models

WEG Item (material number)	Name	Description	Slot	Identification Parameters	
				P0027	P0028
Control accessories to install in Slots 1, 2 and 3					
11008162	IOA-01	IOA Module: 1 14-bit analog input in voltage and current; 2 digital inputs; 2 14-bit analog outputs in voltage and current; 2 open collector digital outputs.	1	FD--	----
11008099	IOB-01	IOB Module: 2 isolated analog inputs in voltage and current; 2 digital inputs; 2 isolated analog outputs in voltage and current (same output programming as the standard CFW-11 outputs); 2 open-collector digital outputs.	1	FA--	----
11008100	ENC-01	Incremental encoder module, 5 to 12 Vdc, 100 kHz, with repeater of the encoder signals.	2	--C2	----
11008101	ENC-02	Incremental encoder module, 5 to 12 Vdc, 100 kHz.	2	--C2	----
11008102	RS485-01	RS-485 serial communication module (Modbus).	2	----	CE--
11008103	RS232-01	RS-232C serial communication module (Modbus).	2	----	CC--
11008104	RS232-02	RS-232C serial communication module with switches to program the microcontroller FLASH memory.	2	----	CC--
11008105	CAN/RS485-01	CAN and RS-485 interface module (CANopen / DeviceNet / Modbus).	2	----	CA--
11008106	CAN-01	Módulo de interface CAN (CANopen / DeviceNet).	2	----	CD--
11008911	PLC11-01	PLC module.	1, 2 and 3	----	--xx(1) (3)
11094251	PLC11-02	PLC module.	1, 2 and 3	----	--xx(1) (3)
11126732	IOE-01	Input module for 5 PTC sensors.	1	25--	----
11126735	IOE-02	Input module for 5 PT100 sensors.	1	23--	----
11126750	IOE-03	Input module for 5 KTY84 sensors.	1	27--	----
11126674	IOC-01	Module with 8 digital inputs and 4 digital relay outputs (use with SoftPLC.	1	C1	----
11126730	IOC-02	Module with 8 digital inputs and 8 NPN open-collector digital outputs (use with SoftPLC).	1	C5	----
11820111	IOC-03	IOC module with 8 digital inputs and 7 PNP open collector digital outputs.	1	C6	----
11045488	PROFIBUS DP-01	Profibus DP communication module.	3	----	C9
Anybus-CC accessories to install in Slot 4					
11008107	PROFDP-05	Profibus DP interface module.	4	----	--xx(2) (3)
11008158	DEVICENET-05	DeviceNet interface module.	4	----	--xx(2) (3)
10933688	ETHERNET/IP-05	EtherNet/IP interface module.	4	----	--xx(2) (3)
11008160	RS232-05	RS-232 interface module (passive) (Modbus).	4	----	--xx(2) (3)
11008161	RS485-05	RS-485 interface module (passive) (Modbus).	4	----	--xx(2) (3)
Flash memory module to install in Slot 5 - Included in Standard Models					
11719952	MMF-03	FLASH memory module.	5	----	--xx(3)
Separate HMI, blind cover and frame for external HMI					
11008913	HMI-01	Separate HMI.(4)	HMI	-	-
11010298	HMID-01	Blind cover for HMI slot.	HMI	-	-
11010521	RHMIF-01	Remote HMI frame kit IP65.	-	-	-
Miscellaneous					
10794631	DBW030250 D5069SZ	Dynamic braking module DBW03.	-	-	-
13166838	DBW040250 D5069SZ	Dynamic braking module DBW04.	-	-	-

(1) Refer to the PLC module manual.
(2) Refer to the Anybus-CC communication manual.
(3) Refer to the programming manual.

8 TECHNICAL SPECIFICATIONS

This chapter contains the technical data (electrical and mechanical) of the CFW-11W UP11-06.

8.1 POWER DATA

Table 8.1: *Inverter technical data for rated switching frequencies*

Model	Power Supply [V_{dc}]	Normal Duty/Heavy Duty					
		Rated Output Current [Arms]	Overload Current		Rated Switching Frequency [kHz]	Maximum Motor 60 Hz / 690 V [HP/kW]	Rated Input Current [Adc]	Dissipated Power C/E [kW] (*)
			1 min	3 s				
CFW11W 1445 T6	574...1025	1445	1590	2167	2	2000/1500	1661	18,0/1,0
CFW11W 2600 T6		2600	2860	3900	2	3500/2600	2990	36,0/2,0
CFW11W 3900 T6		3900	4290	5850	2	5500/4100	4485	54,0/3,0

(*) C = dissipated power in the coolant.
E = dissipated power in the environment.

Obs.:
(1) Steady state rated current in the following conditions:

- Recommended switching frequencies. It is not possible to use the CFW-11W inverter with switching frequencies of 2.5 kHz, 5 kHz and 10 kHz.
- Ambient temperature around the inverter as specified in Chapter 3 INSTALLATION AND CONNECTION on page 3-1.

(2) One overload every 10 minutes. Table 8.1 on page 8-1 presents only two points of the overload curve (actuation time of 1 min and 3 s). The complete overload curve of the IGBTs for ND load is presented below.

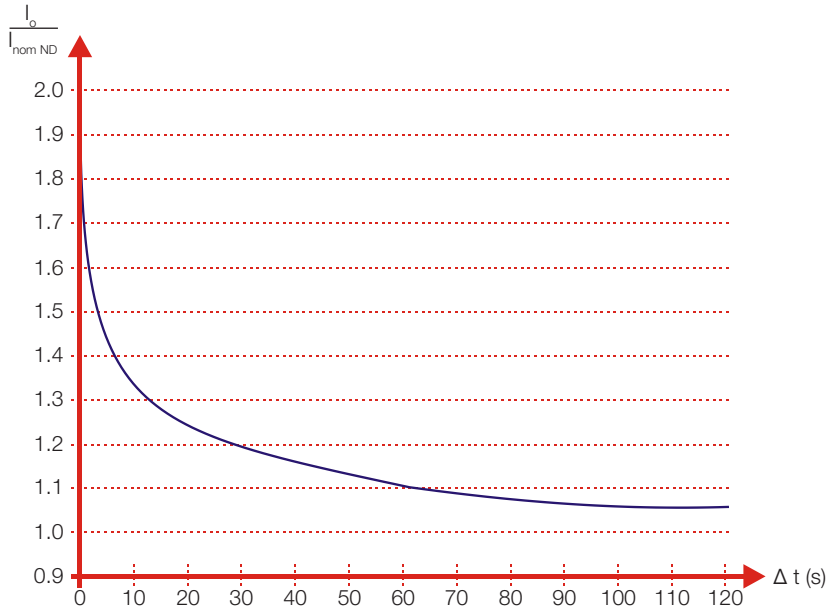


Figure 8.1: *IGBT overload curve*

Depending on the inverter operating conditions, such as ambient temperature and output frequency, the maximum operating time of the inverter with overload may be shorter.

(3) The motor outputs are only for guiding purposes for WEG 4-pole 690 V motor. The proper sizing must be done according to the rated current of the motors used.

(4) The dissipated powers are valid for rated operating conditions, that is, for rated output current and switching frequency.

8.2 ELECTRONICS/GENERAL DATA

Table 8.2: *General data regarding the inverter control and electronics*

Control	**Method**	■ Voltage source. ■ Control types: - V/f (Scalar); - VVW: Voltage vector control; - Vector control with encoder; - Sensorless vector control (without encoder); - Vector control for permanent magnet motors (PMSM). ■ PWM SVM (Space Vector Modulation). ■ Current, flux and speed regulators in software (fully digital). ■ Execution rate: - current regulators: 0.25 ms (switching frequency = 2 kHz); - flux regulator: 0.5 ms (switching frequency = 2 kHz); - speed regulator / speed measurement: 1.2 ms.
	Output Frequency	■ 0 to 3.4 x motor rated frequency (P0403). This rated frequency is adjustable from 0 Hz to 300 Hz in the scalar mode and from 30 Hz to 120 Hz in the vector mode. ■ Output frequency limit as a function of the switching frequency: - 125 Hz (switching frequency = 1.25 kHz); - 200 Hz (switching frequency = 2 kHz);
Performance	**Speed Control**	V/f (Scalar): ■ Regulation (with slip compensation): 1 % of the rated speed. ■ Speed variation range: 1:20. VVW: ■ Regulation: 1% of the rated speed. ■ Speed variation range: 1:30. Sensorless (P0202=3 induction motor): ■ Regulation: 0.5 % of the rated speed. ■ Speed variation range: 1:100. Vector with Encoder (P0202 = 4 induction motor or P0202 = 6 permanent magnet): ■ Regulation: - ±0.01 % of the rated speed with 14-bit analog input (IOA). - ±0.01 % of the rated speed with digital reference (keypad, serial, Fieldbus, Electronic Potentiometer, multispeed); - ±0.05 % of the rated speed with analog 12-bit input (CC11). - Speed variation range: 1:1000.
	Torque Control	■ Range: 10 to 180 %, regulation: ±5 % of the rated torque (P0202 = 4, 6 or 7); ■ Range: 20 to 180 %, regulation: ±10 % of the rated torque: ±10 % do torque nominal (P0202 = 3, above 3 Hz).
Inputs (CC11 board)	**Analog**	■ 2 isolated differential inputs by differential amplifier; resolution of the AI1:12 bits, resolution of the AI2: 11bits + signal, (0 to 10) V, (0 to 20) mA or (4 to 20) mA, Impedance: 400 kΩ for (0 to 10) V, 500 Ω for (0 to 20) mA or (4 to 20) mA, programmable functions.
	Digital	■ 6 isolated digital inputs, 24 Vdc, programmable functions.
Outputs (CC11 board)	**Analog**	■ 2 isolated outputs, (0 to 10) V, RL ≥ 10 kΩ (max. load), 0 to 20 mA / 4 to 20 mA, (RL ≤ 500 Ω) resolution: 11 bits, programmable functions.
	Relay	■ 3 relays with NO/NC contacts, 240 Vac, 1 A, programmable functions.
Safety	**Protection**	■ Overcurrent/short circuit in the output; ■ Under/overvoltage; ■ Phase loss; ■ Overtemperature; ■ Overload on the braking resistor; ■ Overload on the IGBTs; ■ Motor overload; ■ External fault / alarm; ■ CPU or memory fault; ■ Phase-ground short circuit output.
Human Machine Interface HMI	**Standard HMI**	■ 9 keys: Run/Stop, Increment, Decrement, Direction of Rotation, Jog, Local/Remote, right Soft key and left Soft key; ■ Graphic LCD display; ■ View/edition of parameters; ■ Indication accuracy: - current: 5 % of the rated current. - speed resolution: 1 rpm. ■ Possibility of remote mounting.
Degree of Protection	**IP00**	■ Standard.
USB Connector for Programming	**Connection to PC**	■ USB standard Rev. 2.0 (basic speed). ■ Type B (device) USB plug. ■ Interconnecting cable: standard host/device shielded USB cable.

8.2.1 Codes and Standards

Safety Standards	■ UL 508C - Power conversion equipment. ■ UL 840 - Insulation coordination including clearances and creepage distances for electrical equipment. ■ EN61800-5-1 - Safety requirements electrical, thermal and energy. ■ EN 50178 - Electronic equipment for use in power installations. ■ EN 60204-1 - Safety of machinery. Electrical equipment of machines. Part 1: General requirements. **Note:** In order to have a machine in accordance with this standard, the manufacturer of the machine is responsible for installing an emergency stop device and a device for disconnection from the power line. ■ EN 60146 (IEC 146) - Semiconductor converters. ■ EN 61800-2 - Adjustable speed electrical power drive systems - Part 2: General requirements -Rating specifications for low voltage adjustable frequency AC power drive systems.
Electromagnetic Compatibility Standards (EMC)	■ EN 61800-3 - Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods. ■ EN 55011 - Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment. ■ CISPR 11 - Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement. ■ EN 61000-4-2 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test. ■ EN 61000-4-3 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test. ■ EN 61000-4-4 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test. ■ EN 61000-4-5 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test. ■ EN 61000-4-6 - Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.
Mechanical Construction Standards	■ EN 60529 - Degrees of protection provided by enclosures (IP code). ■ UL 50 - Enclosures for electrical equipment.

8.3 MECHANICAL DATA

The UP11 module has a total mass of 95 Kg. Its dimensions are shown in Figure 8.2 on page 8-5.

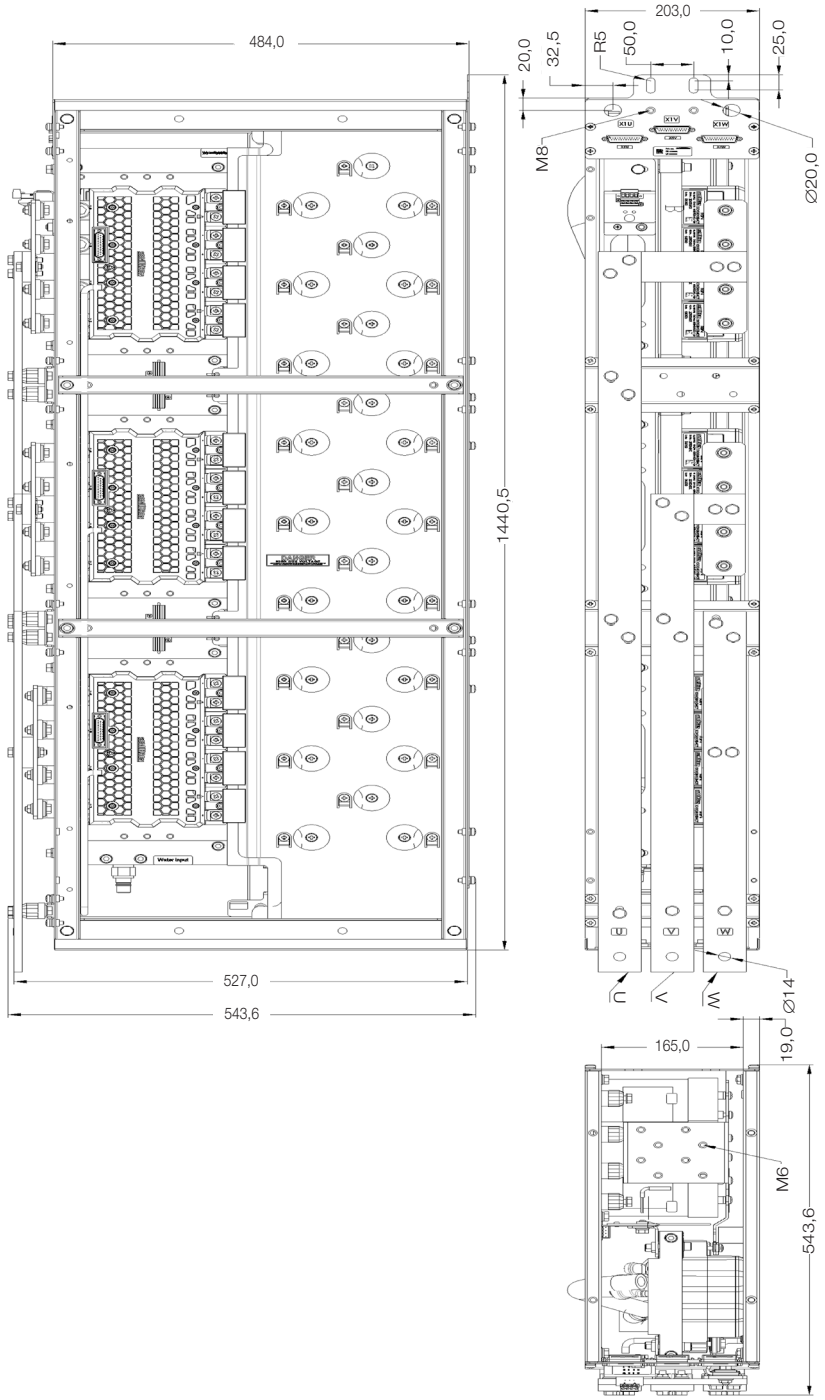


Figure 8.2: *Mechanical dimensions (mm)*

Figure 8.3: *Control rack dimensions (mm)*

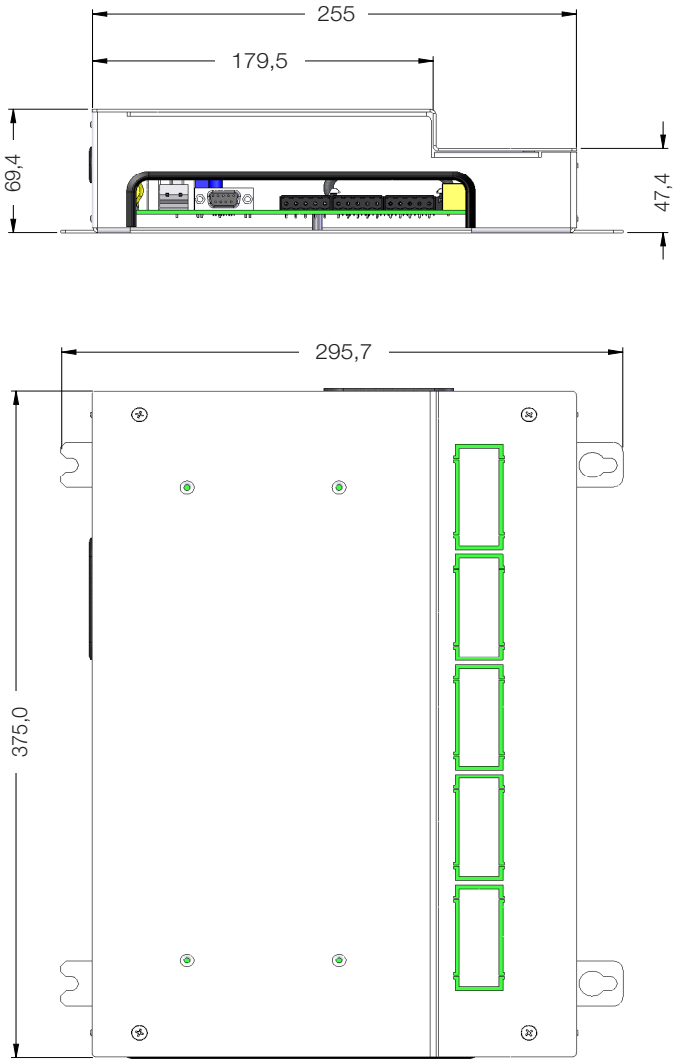


Figure 8.4: *Dimensions of the IFSC board metal enclosure (mm)*

WEG Drives & Controls - Automação LTDA.
Jaraguá do Sul - SC - Brazil
Fone 55 (47) 3276-4000 - Fax 55 (47) 3276-4020
São Paulo - SP - Brazil
Fone 55 (11) 5053-2300 - Fax 55 (11) 5052-4212
automacao@weg.net
www.weg.net