Frequency Inverter

CFW-11

User's Guide

CFW-11 VECTRUE INVERTER

FREQUENCY INVERTER MANUAL

Series: CFW-11

Language: English

Document: 10000784107 / 00

Models: 242...720 A / 380...480 V

Models with Special DC Hardware:
242...720 A / 380...480 V

06/2010

Summary of Revisions

Revision	Description	Chapter
1	First edition	-

CHAPTER 1
Safety Instructions

CHAPTER 2
General Information

CHAPTER 3
Installation and Connection

CHAPTER 4
KEYPAD (HMI)

CHAPTER 5
First Time Power-Up and Start-Up

CHAPTER 6
Troubleshooting and Maintenance

CHAPTER 7
Option Kits and Accessories

CHAPTER 8
Technical Specifications

SAFETY INSTRUCTIONS

This manual provides information for the proper installation and operation of the CFW-11 frequency inverter.

Only trained and qualified personnel should attempt to install, start-up, and troubleshoot this type of equipment.

1.1 SAFETY WARNINGS IN THE MANUAL

The following safety warnings are used in this manual:

DANGER!
The procedures recommended in this warning have the purpose of protecting the user against dead, serious injuries and considerable material damage.

ATTENTION!
The procedures recommended in this warning have the purpose of avoiding material damage.

NOTE!
The text intents to supply important information for the correct understanding and good operation of the product.

1.2 SAFETY WARNINGS IN THE PRODUCT

The following symbols are attached to the product and require special attention:

High voltages are present.

Components sensitive to electrostatic discharge.
Do not touch them.

Mandatory connection to the protective ground (PE).

Connection of the shield to the ground.

Hot surface.

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!

Only qualified personnel familiar with the CFW-11 frequency inverter and associated equipment should plan or implement the installation, start-up and subsequent maintenance of this equipment. These personnel must follow all the safety instructions included in this Manual and/or defined by local regulations.

Failure to comply with these instructions may result in death, serious injury, and equipment damage.

NOTE!

For the purposes of this manual, qualified personnel are those trained and able to:

1. Install, ground, power-up and operate the CFW-11 according to this manual and the effective legal safety procedures;
2. Use protection equipment according to the established regulations;
3. Provide first aid.

DANGER!

Always disconnect the main power supply before touching any electrical component associated to the inverter.

Several components can remain charged with high voltages or remain in movement (fans) even after the AC power is disconnected or switched off.

Wait at least 10 minutes to assure a total discharge of the capacitors.

Always connect the equipment frame to the protection earth (PE) at the suitable connection point.

ATTENTION!

Electronic boards have components sensitive to electrostatic discharges. Do not touch directly on components or connectors. If necessary, touch the grounded metallic frame before or use an adequate grounded wrist strap.

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

NOTE!

Frequency Inverter may interfere with other electronic equipment. In order to reduce these effects, take the precautions recommended in the chapter 3 - Installation and Connections.

NOTE!

Read the User Manual completely before installing or operating the inverter.

ATTENTION!

The operation of this equipment requires installation instructions and detailed operation provided in the user manual, programming manual and communication manuals. A hard copy of the user manual, quick parameters reference guide and for the kits and accessories are provided together with the equipment. Other manuals are provided only in electronic format available in the CD-ROM supplied with the inverter or it can be obtained at WEG website - www.weg.net. The CD-ROM should always be kept with the equipment. A hard copy of the files available in the CD-ROM can be ordered through a local WEG agent.

GENERAL INFORMATION

2.1 ABOUT THE MANUAL

This manual exposes how to install, to start-up in V/f (scalar) mode, the main characteristics and shows how to troubleshoot the most common problems of the CFW-11 inverter series frame sizes F and G models.

It is also possible to operate the CFW-11 in VVW, Sensorless Vector and Vector with Encoder modes. For more details on the start-up in the other control modes, refer to the Programming Manual.

For information on other functions, accessories and operation conditions, consult the following manuals:

- ☑ Programming Manual, with a detailed description of the CFW-11 parameters and advanced functions.
- ☑ Incremental Encoder Interface Module Manual.
- ☑ I/O Expansion Module Manual.
- ☑ RS-232/RS-485 Serial Communication Manual.
- ☑ CANopen Slave Communication Manual.
- ☑ Anybus-CC Communication Manual.

These manuals are included on the CD supplied with the inverter or can be downloaded from the WEG website at - www.weg.net.

2.2 TERMS AND DEFINITIONS USED IN THE MANUAL

Normal Duty Cycle (ND): The duty cycle that defines the steady state current value I_{nom-ND} and an overload of 110 % during 1 minute. It is selected by programming P0298 (Application) = 0 (Normal Duty – ND). It must be used for driving motors that are not subject in that application to high torques with respect to their rated torque, when operating at constant speed, during start, acceleration or deceleration.

I_{nom-ND}: Inverter rated current for use with normal duty cycle (ND = Normal Duty).
Overload: 1.1 x I_{nom-ND} / 1 minute.

Heavy Duty Cycle (HD): The duty cycle that defines the steady state current value I_{nom-HD} and an overload of 150 % during 1 minute. It is selected by programming P0298 (Application) = 1 (Heavy Duty – HD). It must be used for driving motors that are subject in that application to high torques with respect to their rated torque, when operating at constant speed, during start, acceleration or deceleration.

I_{nom-HD}: Inverter rated current for use with heavy duty cycle (HD = Heavy Duty).
Overload: 1.5 x I_{nom-HD} / 1 minute.

Rectifier: The input circuit of the inverters that converts the input AC voltage into DC. It is made of thyristors and power diodes.

Pre-charge circuit: It charges the DC link capacitors with a limited current, thus avoiding higher current peaks when powering the inverter.

DC Link: Inverter intermediate circuit; DC voltage obtained from the rectification of the AC input voltage or from an external power supply. It feeds the inverter output IGBT bridge.

U, V and W Arms: Set of two IGBTs forming the inverter output phases U, V and W.

IGBT: "Insulated Gate Bipolar Transistor"; It is the output inverter bridge basic component, working as an electronic switch either in the saturated (closed switch) or in the cut off mode (open switch).

PTC: It is a resistor, whose resistance value in ohms increases proportionally to the temperature increase, being used as temperature sensor in motors.

NTC: It is a resistor, whose resistance value in ohms decreases proportionally to the temperature increase, being used as temperature sensor in power modules.

HMI: "Human-Machine Interface"; It is the device that allows the control of the motor, the visualization and the modification of the inverter parameters. The CFW-11 HMI presents keys for commanding the motor, navigation keys and a graphic LCD display.

Flash memory: It is the nonvolatile memory that can be electrically written and erased.

RAM memory: Random Access Memory (volatile).

USB: "Universal Serial Bus"; It is a serial bus standard that allows devices to be connected using the"Plug and Play" concept.

PE: Protective Ground.

RFI filter: "Radio Frequency Interference filter". A filter that avoids interference in the radiofrequency range.

PWM: "Pulse Width Modulation". A pulsed voltage that feeds the motor.

Switching Frequency: It is the inverter bridge IGBTs commutation frequency, normally specified in kHz.

General enable: When activated, it accelerates the motor via acceleration ramp. When deactivated, this function immediately blocks the PWM pulses. The general enable function can be controlled through a digital input programmed for this function or via serial communication.

Run/Stop: Inverter function that when activated (Run) accelerates the motor with the acceleration ramp until reaching the speed reference, and when deactivated (Stop) decelerates the motor with the deceleration ramp down to stop. It can be commanded through a digital input programmed for that function or via serial communication. The HMI keys I (Run) and O (Stop) work in a similar manner.

Heatsink: It is a metal part designed for dissipating the heat generated by the power semiconductors.

PLC: Programmable Logic Controller.

Amp, A: Ampères.

°C: Celsius degree.

°F: Fahrenheit degree.

AC: Alternating Current.

DC: Direct Current.

CFM: "Cubic feet per minute"; It is a flow measurement unit.

cm: Centimeter.

CV: "cheval-vapeur" = 736 Watts; Power measurement unit, normally used to indicate the mechanical power of electric motors.

ft: Foot.

hp: "Horse Power" = 746 Watts; Power measurement unit, normally used to indicate the mechanical power of electric motors.

Hz: Hertz.

in: Inch.

kg: Kilogram = 1000 grams.

kHz: Kilohertz = 1000 Hertz.

l/s: Liters per second.

lb: Pound.

m: Meter.

mA: Miliampère = 0.001 Ampère.

min: Minute.

mm: Millimeter.

ms: Millisecond = 0.001 seconds.

N.m: Newton meter; torque measurement unit.

rms: "Root mean square"; Effective value.

rpm: "Revolutions per minute"; Speed measurement unit.

s: Second.

V: Volts.

Ω: Ohms.

2.3 ABOUT THE CFW-11

The CFW-11 is a high performance Variable Frequency Drive that makes it possible the control of speed and torque of three-phase AC induction motors. The central characteristic of this product is the "Vectrue" technology, which presents the following advantages:

- ☑ (V/f), VVW or vector control programmable in the same product;
- ☑ The vector control can be programmed as "sensorless" (which means standard motors, without the need of encoder) or vector control with motor encoder;
- ☑ The "sensorless" vector control allows high torque and fast response, even at very slow speeds or during starting;
- ☑ The vector control with encoder allows very high speed accuracy and control for the entire speed range (speed control down to 0 rpm);
- ☑ The "Optimal Braking" function for the vector control allows a controlled motor braking, eliminating in some applications the braking resistor;
- ☑ The vector control "Self-Tuning" function allows the automatic setting of the regulators and control parameters, from the identification (also automatic) of the motor and load parameters.

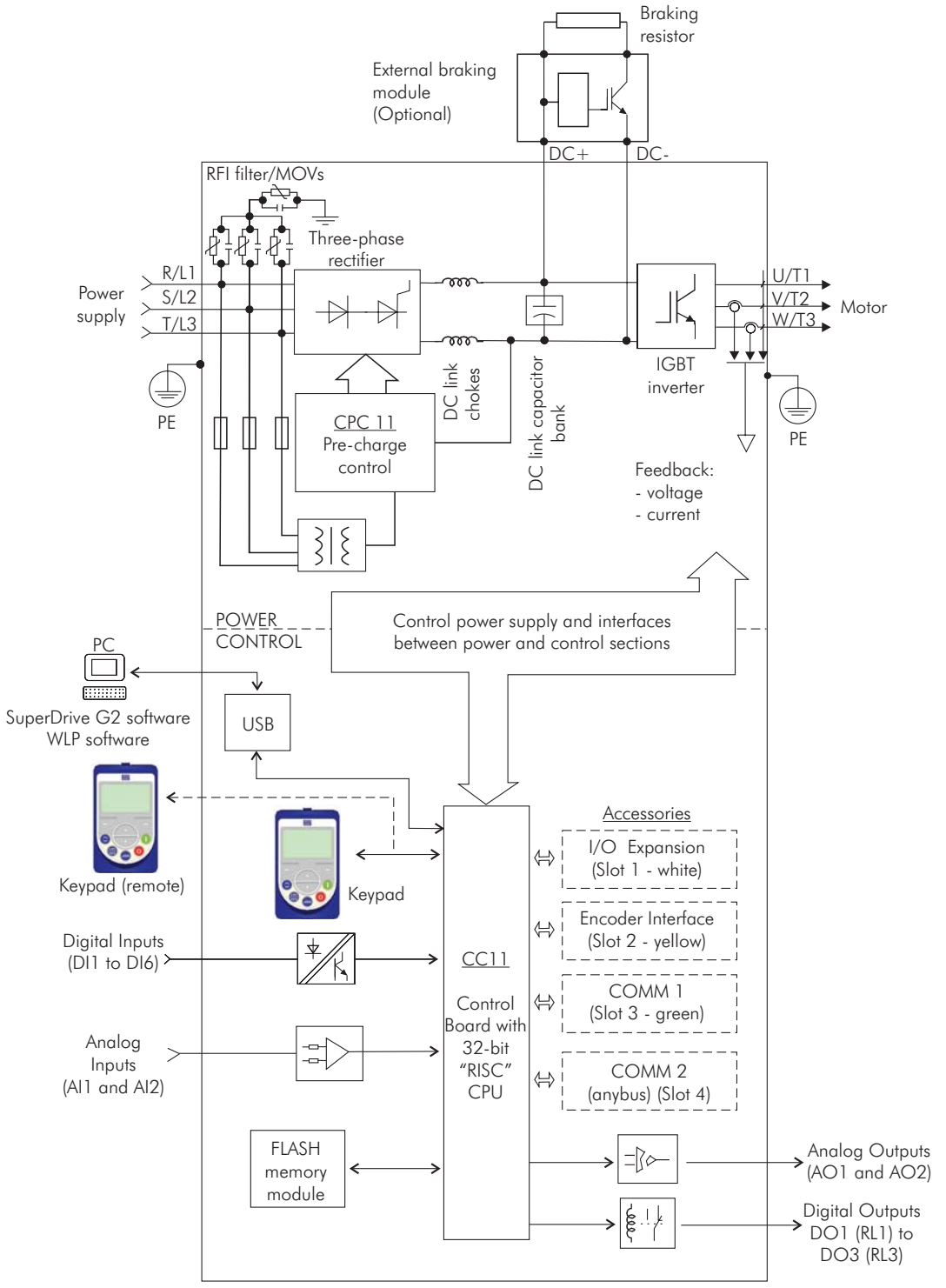


Figure 2.1 (a) - *Frame sizes F and G CFW-11 block diagram Standard models with alternating current feeding*

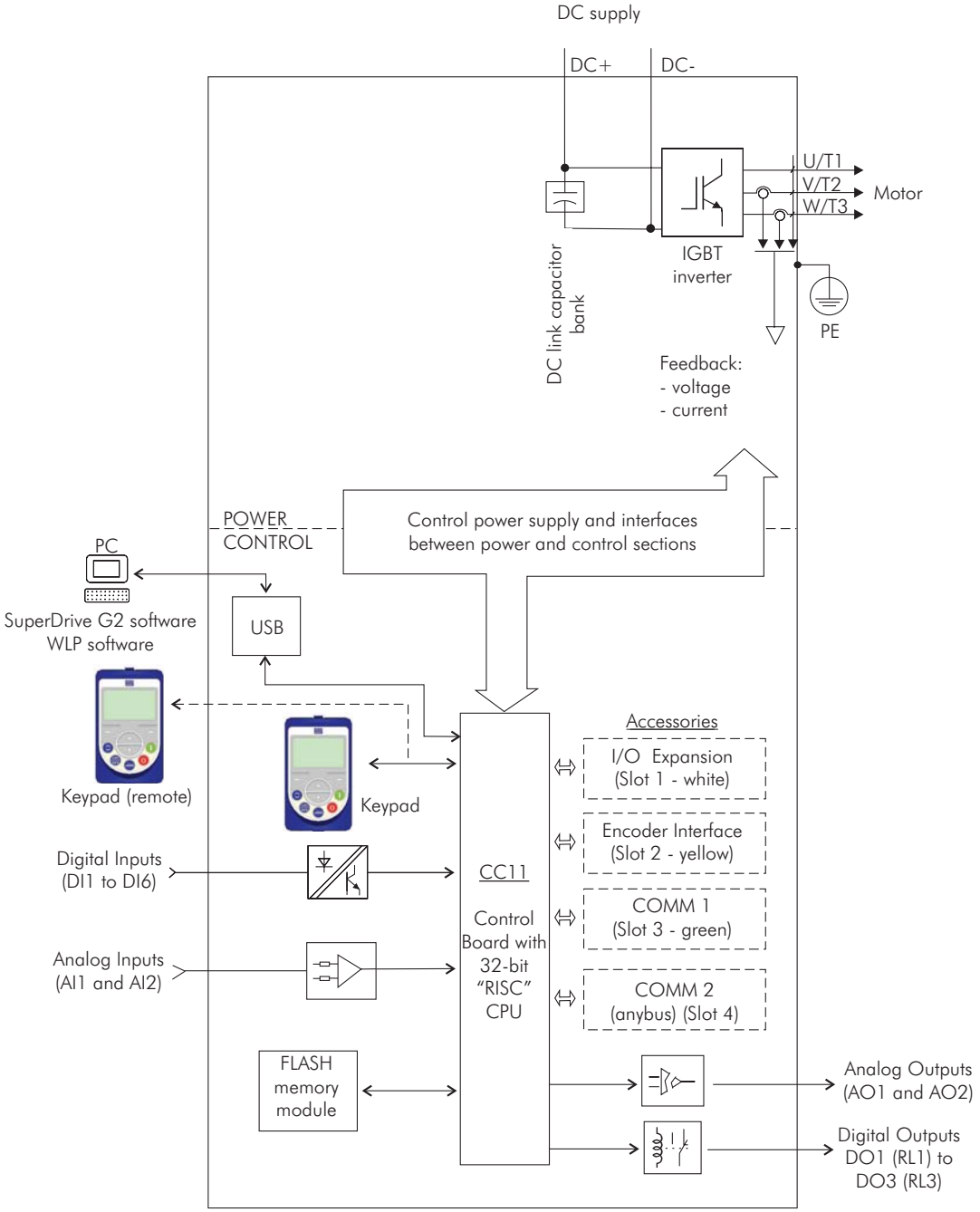
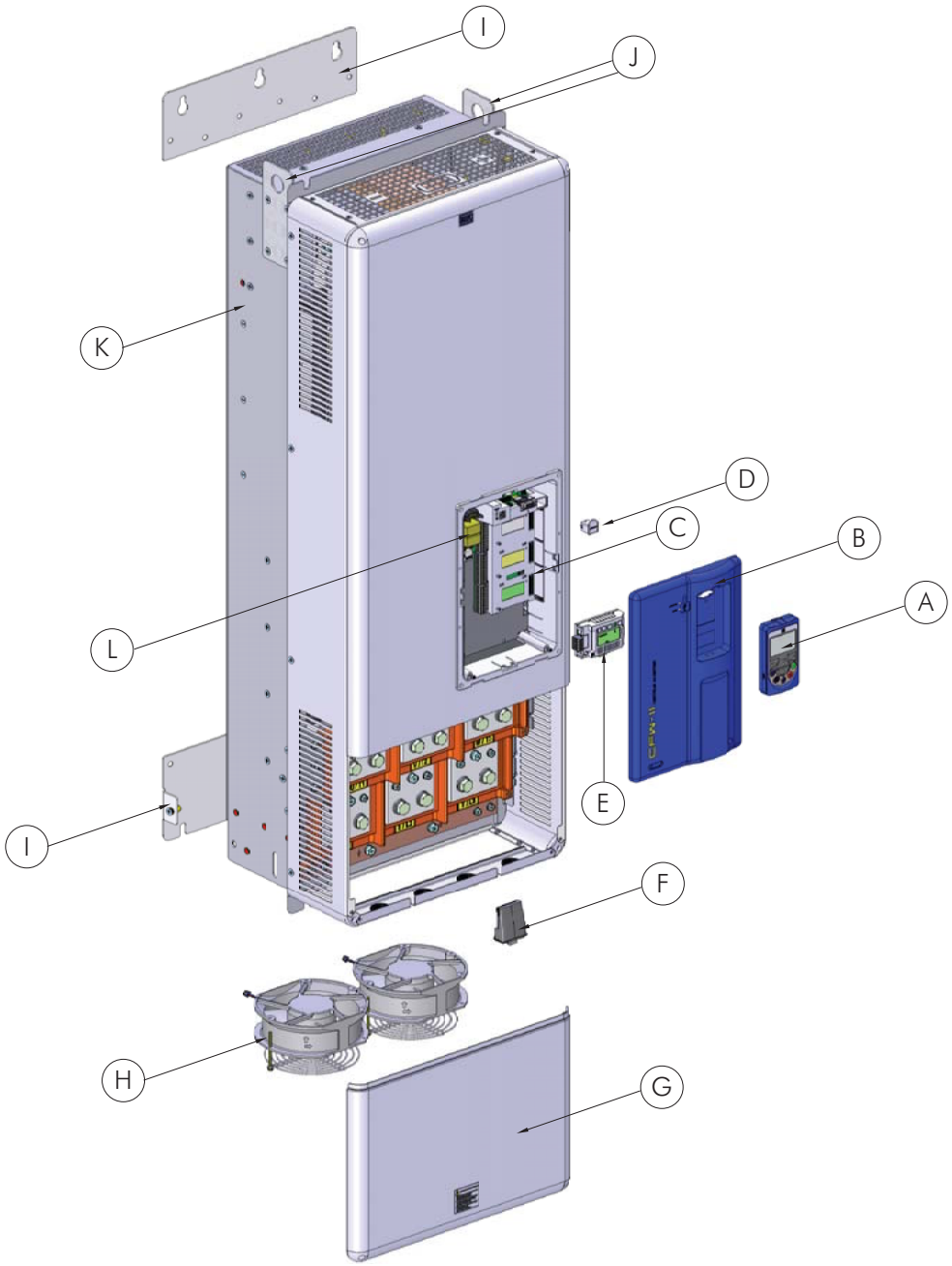


Figure 2.1 (b) - *Frame sizes F and G CFW-11 block diagram Models with DC voltage feeding (Special DC Hardware)*



A - HMI
B - Control rack cover
C - CC11 control board
D - FLASH memory module
E - Control accessory module
F - Anybus-CC accessory module
G - Bottom front cover
H - Heatsink fan
I - Mounting supports (for surface mounting)
J - Hoisting eye
K - Rear part of the inverter (external part for flange mounting)
L - SRB2 safety stop board

Figure 2.2 - *CFW11 main components*

① USB connector

② USB LED
Off: Without USB connection
On/blinking: USB communication active

③ Status LED
Green: Normal operation without fault or alarm
Yellow: In the alarm condition
Blinking red: In the fault condition

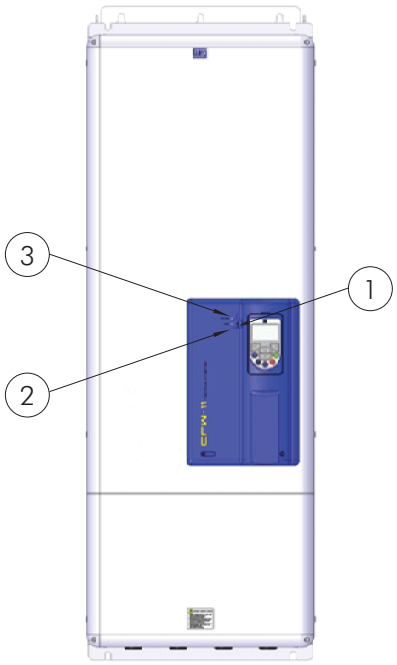
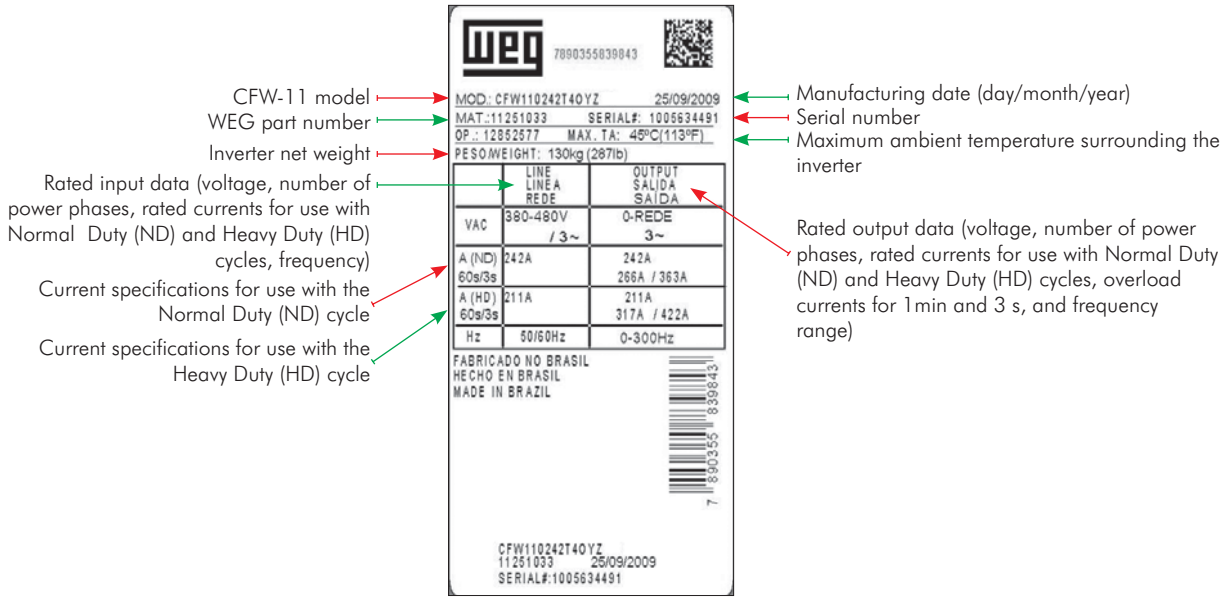


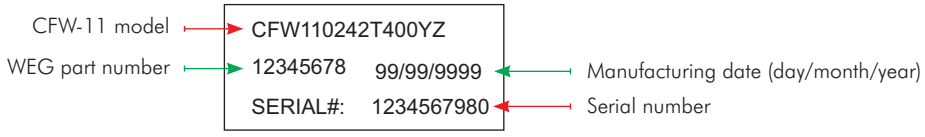
Figure 2.3 - *LEDs and USB connector*

2.4 CFW-11 IDENTIFICATION LABELS

There are two identification labels on the CFW-11: one complete nameplate is affixed at the side of the inverter and a simplified label is located under the keypad. The label under the keypad allows the identification of the most important characteristics of the inverter even if they are mounted side-by-side.

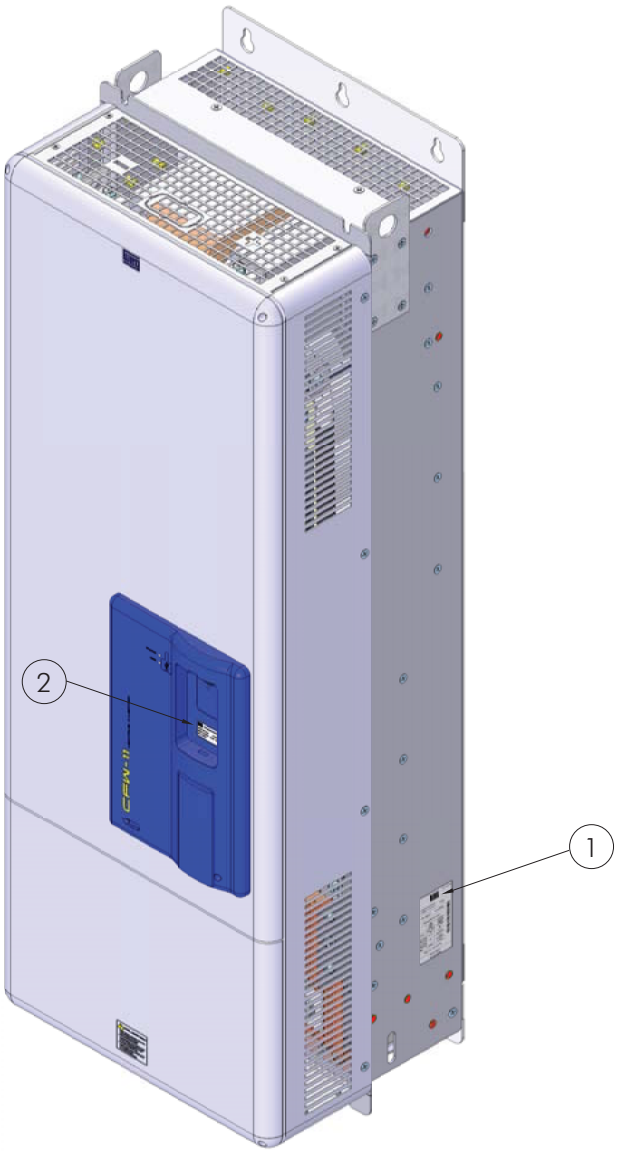


(a) Nameplate affixed at the side of the inverter



(b) Label located under the keypad

Figure 2.4 (a) and (b) - *Identification labels*



① Nameplate affixed to the side of the inverter

② Label under the keypad

Figure 2.5 - *Location of the identification labels*

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

		INVERTER MODEL					AVAILABLE OPTION KITS (INSTALLED IN THE PRODUCT AT THE FACTORY)								
		Refer to the frame sizes F and G CFW-11 model list in the chapter 8, where the technical specifications of the inverters are also presented					Refer to chapter 8 to check option kit availability for each inverter model								
Example	**BR**	**CFW11**	**0242**	**T**	**4**	**S**	**_ _**	**_ _**	**_ _**	**_ _**	**_ _**	**_ _**	**_ _**	**_ _**	**Z**
Field description	Market identification (defines the manual language and the factory settings)	WEG CFW-11 frequency inverter series	Rated output current for use with the Normal Duty (ND) cycle	Number of power phases	Power supply voltage	Option kit	Enclosure protection degree	Keypad	Braking	RFI filter	Safety stop	External 24 Vdc control power supply	Special hardware	Special software	Character that identifies the code end
Available options	2 caracters		**0242**=211 A (HD) / 242 A (ND) **0312**=242 A (HD) / 312 A (ND) **0370**=312 A (HD) / 370 A (ND) **0477**=370 A (HD) / 477 A (ND) **0515**=477 A (HD) / 515 A (ND) **0601**=515 A (HD) / 601 A (ND) **0720**=560 A (HD) / 720 A (ND)	**T =** three-phase power supply	**4**=380...480 V	**S** = standard product **O =** product with option kit	Blank = standard (IP20) **IP00 =** Special hardware (DC)	Blank = standard keypad **IC =** no keypad (blind cover)	Blank = standard (no braking IGBT)	Blank = standard (with internal RFI filter)	Blank = standard (safety stop function is not available) **Y** = with safety stop function according to EN-954-1 category 3	Blank= standard (not available) **W =** with external 24 Vdc control power supply	Blank = standard **DC =** feeding with DC	Blank = standard **S1 =** special software nr. 1	

2.5 RECEIVING AND STORAGE

The CFW-11 inverters from the frame size F and G models are supplied packed in wooden boxes.

There is an identification label affixed to the outside of the package, identical to the one affixed to the side of the inverter.

To open the package:
1 - Remove the package front cover;
2 - Take out the polystyrene foam protection.

Verify whether:
- ☑ The CFW-11 nameplate corresponds to the purchased model;
- ☑ Any damage occurred during transportation.

Report any damage immediately to the carrier that delivered your CFW-11 inverter.

If the CFW-11 is not installed soon, store it in a clean and dry location (temperature between -25 °C and 60 °C (-13 °F and 140 °F)), with a cover to prevent dust accumulation inside it.

ATTENTION!
When the inverter is stored for a long period, it becomes necessary to perform the capacitor reforming. Refer to the procedure in the section 6.5 - table 6.3.

INSTALLATION AND CONNECTION

This chapter describes the CFW-11 electrical and mechanical installation procedures. The guidelines and suggestions must be followed aiming personnel and equipment safety, as well as the proper operation of the inverter.

3.1 MECHANICAL INSTALLATION

3.1.1 Environmental Conditions

Avoid installing the inverter in an area with:

- ☑ Direct exposure to sunlight, rain, high humidity, or sea-air;
- ☑ Inflammable or corrosive gases or liquids;
- ☑ Excessive vibration;
- ☑ Dust, metallic particles, and oil mist.

Environment conditions for the operation of the inverter:

- ☑ Temperature: -10 °C to 45 °C (14 °F to 113 °F) (40 °C (104 °F) for the 720 A model) – nominal conditions (measured surrounding the inverter).
- ☑ From 45 °C to 55 °C (113 °F to 131 °F) - 2 % of current derating for each Celsius degree (or 1.11 % each °F) above 45 °C (113 °F) (40 °C (104 °F) for the 720 A model).
- ☑ Air relative humidity: 5 % to 90 % non-condensing.
- ☑ Altitude: up to 1000 m (3,300 ft) - nominal conditions (no derating required).
- ☑ From 1000 m to 4000 m (3,300 ft to 13,200 ft) - 1 % of current derating for each 100 m (or 0.3 % each 100 ft) above 1000 m (3,300 ft) altitude.
- ☑ Pollution degree: 2 (according to EN50178 and UL508C), with non-conductive pollution. Condensation must not originate conduction through the accumulated residues.

3.1.2 Positioning and Mounting

Consult the inverter weight at the table 8.1.

Mount the inverter in the upright position on a flat and vertical surface.

External dimensions and fixing holes position according to the figure 3.1. Refer to the section 8.3 for more details.

First put the screws on the surface where the inverter will be installed, install the inverter and then tighten the screws.

Allow the minimum clearances indicated in the figure 3.2, in order to allow the cooling air circulation.

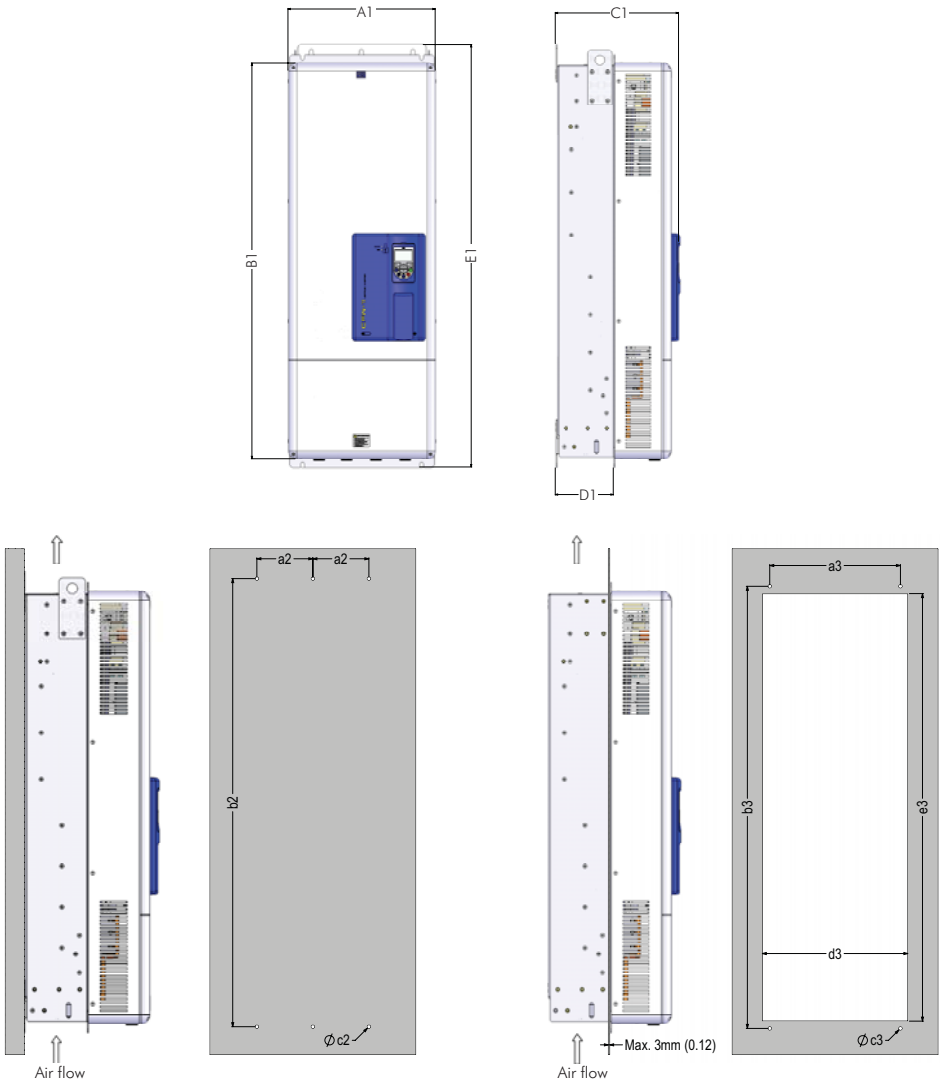
Do not install heat sensitive components right above the inverter.

ATTENTION!

When installing two or more inverters vertically, respect the minimum clearance A + B (figure 3.2) and provide an air deflecting plate so that the heat rising up from the bottom inverter does not affect the top inverter.

ATTENTION!

Provide independent conduits for the physical separation of signal, control, and power cables (refer to the section 3.2 - Electrical Installation).

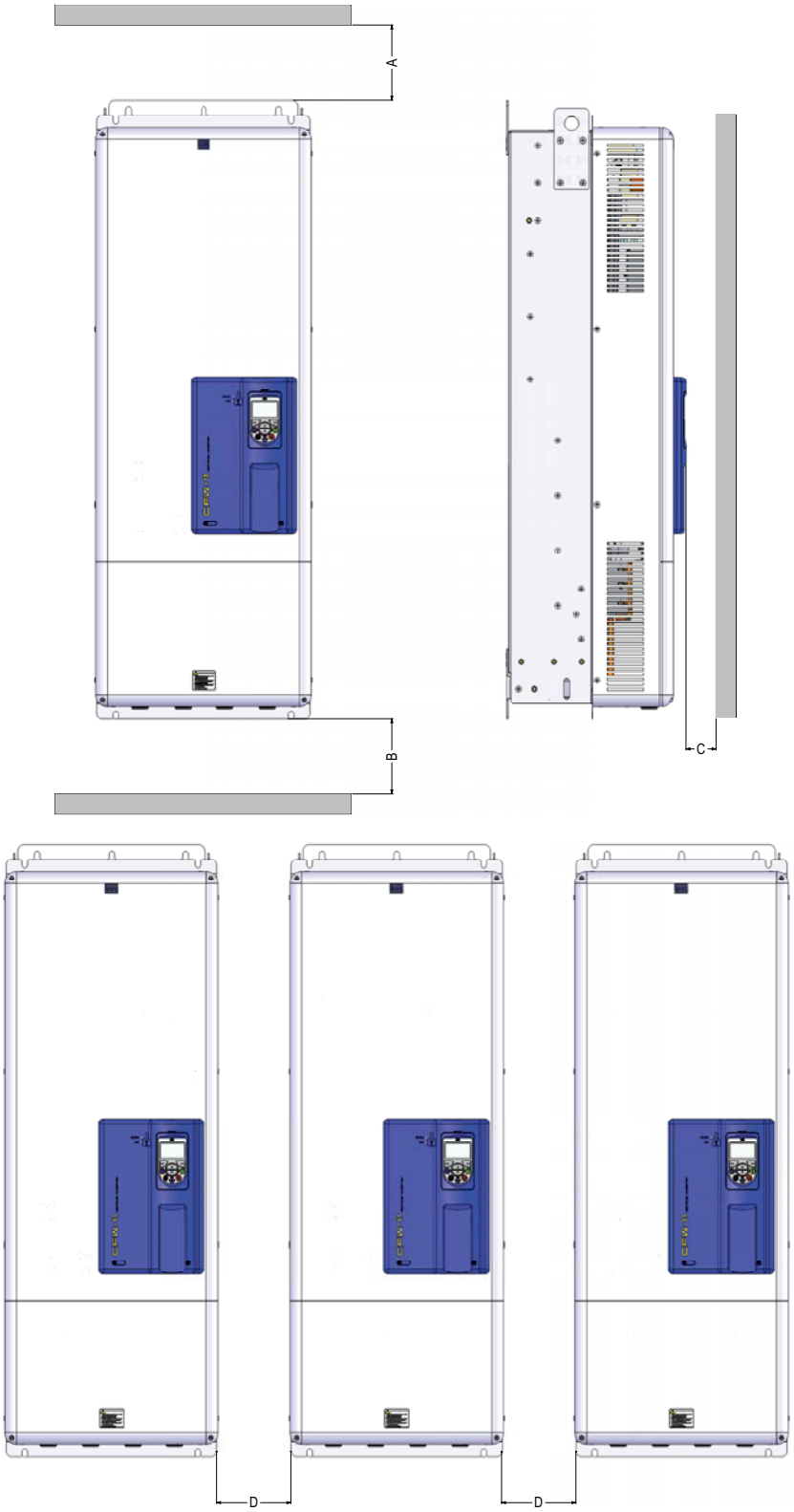


(a) Surface mounting ***(b) Flange mounting***

Model	A1	B1	C1	D1	E1	a2	b2	c2	a3	b3	c3	d3	e3
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)	M	mm (in)	mm (in)	M	mm (in)	mm (in)
Frame F	430 (16.93)	1156 (45.51)	360 (14.17)	169 (6.65)	1234 (48.58)	150 (5.91)	1200 (47.24)	M10	350 (13.78)	1185 (46.61)	M10	391 (15.39)	1146 (45.12)
Frame G	535 (21.06)	1190 (46.85)	426 (16.77)	202 (7.95)	1264 (49.76)	200 (7.87)	1225 (48.23)	M10	400 (15.75)	1220 (48.03)	M10	495 (19.49)	1182 (46.53)

Tolerance for dimensions d3 and e3: +1.0 mm (+0.039 in)
Tolerance for the other dimensions: ±1.0 mm (±0.039 in)

Figure 3.1 (a) and (b) - *Mechanical installation details - mm (in)*



A	B	C	D
mm (in)	mm (in)	mm (in)	mm (in)
150 (5.91)	250 (9.84)	20 (0.78)	80 (3.15)

Tolerance: ±1.0 mm (±0.039 in)

Figure 3.2 - *Ventilation clearances*

3.1.3 Cabinet Mounting

It is possible to mount the inverters in two manners, either on the mounting surface, or with the heatsink mounted outside the cabinet, so that the air for cooling the power heatsink is kept outside the enclosure (flange mounting). For these cases, consider:

Surface mounting:

- ☑ Provide adequate exhaustion, so that the internal cabinet temperature remains within the allowed range for the inverter operation conditions.
- ☑ The power dissipated by the inverter at its rated condition, as specified in table 8.1 "Dissipated power in Watts - Surface mounting".
- ☑ Cooling air flow according to the table 3.1.
- ☑ The position and diameter of the mounting holes according to the figure 3.1.

Flange mounting:

ATTENTION!
The part of the inverter that stays outside the cabinet is rated IP20.

- ☑ The power specified in the table 8.1 under "Dissipated power in Watts - Flange mounting" will be dissipated inside the cabinet. The other losses (power modules) will be dissipated at the external ventilation duct.
- ☑ The inverter mounting supports and the hoisting eyes must be removed. Refer to the figure 2.2, positions I and J.
- ☑ Dimensions of the flange-mounting opening and the diameters of the securing holes must be according to the figure 3.1.

Table 3.1 - *Cooling air flow for frame sizes F and G models*

Model	Frame	CFM	l/s	m³/min
CFW110242T4	F	250	118	7.1
CFW110312T4		320	151	9.1
CFW110370T4		380	180	10.1
CFW110477T4		460	217	13.0
CFW110515T4 CFW110601T4 CFW110770T4	G	680	321	19.3

3.1.4 Access to the Control and Power Terminals

In order to get access to the control terminals, it is necessary to remove the HMI and the control rack cover, as showed in the figure 3.3.

Figure 3.3 - *Removal of the HMI and the control rack cover*

In order to get access to the power terminals, it is necessary to remove the bottom front cover, as showed in the figure 3.4.

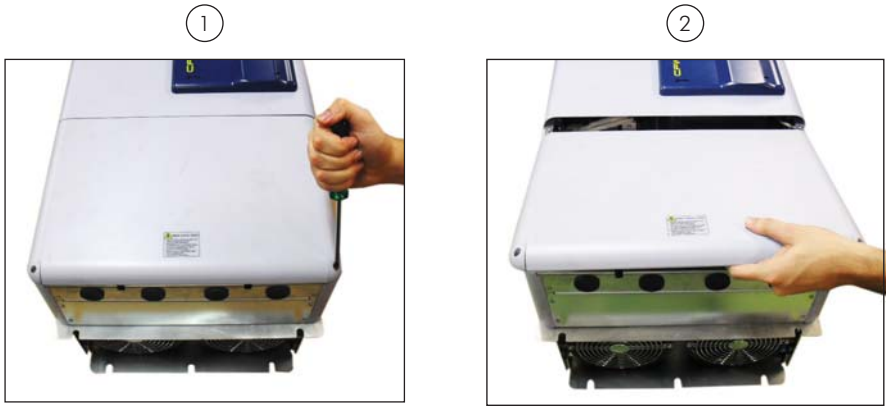


Figure 3.4 - *Removal of the bottom front cover, to access to the power supply and motor connection terminals*

In order to connect the power cables (line and motor), remove the bottom plate, as showed in the figure 3.5. In this case the protection degree of the inverter bottom part will be reduced.

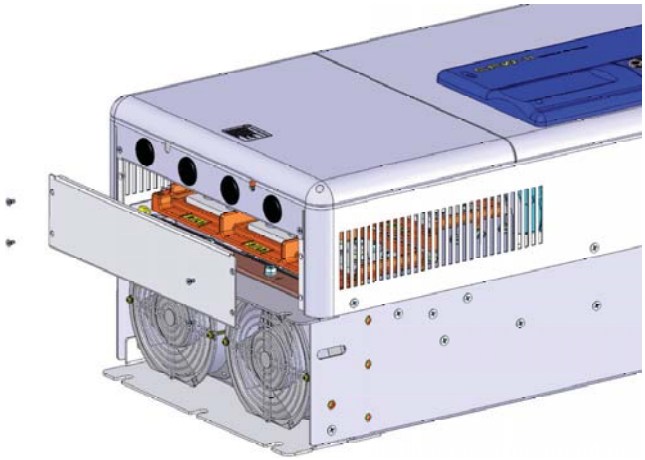


Figure 3.5 - *Removal of the bottom plate, to access the power terminals*

3.1.5 HMI Installation at the Cabinet Door or Command Panel (Remote HMI)

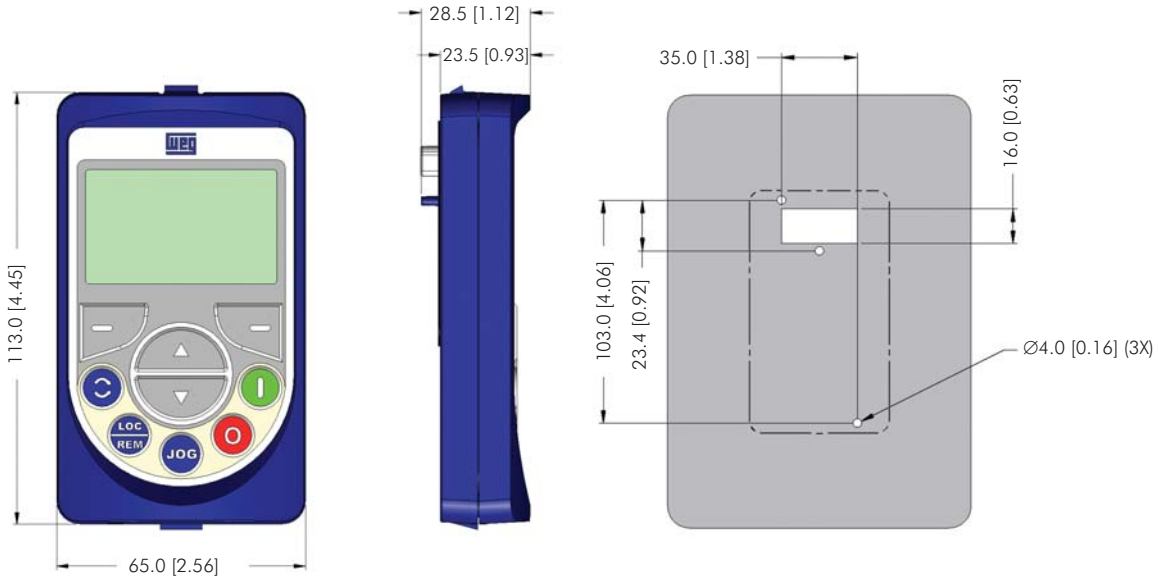


Figure 3.6 - *Data for the HMI installation at the cabinet door or command panel – mm [in]*

The keypad frame accessory can also be used to fix the HMI, as mentioned in the table 7.2.

3.2 ELECTRICAL INSTALLATION

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

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

ATTENTION!
Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with applicable local codes.

3.2.1 Identification of the Power Terminals and Grounding Points

R/L1, S/L2, T/L3: AC power supply.
U/T1, V/T2, W/T3: motor connection.
DC+: DC link positive terminal.
DC-: DC link negative terminal.

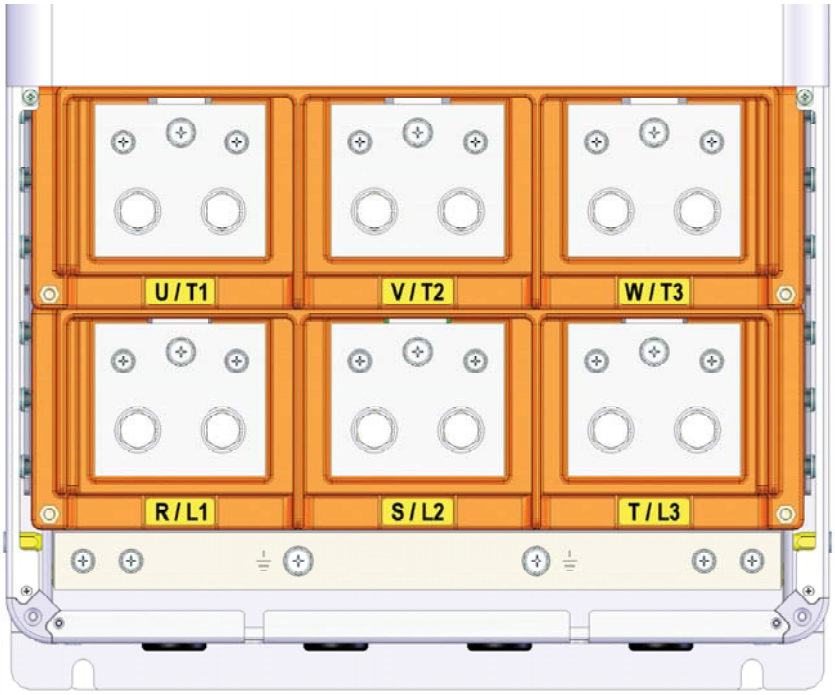


Figure 3.7 (a) - *Frame size F: Power terminals and grounding points*

Figure 3.7 (b) - *Frame size F with special DC hardware: Terminals for DC voltage supply. Terminals R/L1, S/L2 and T/L3 are not internally connected in this version*

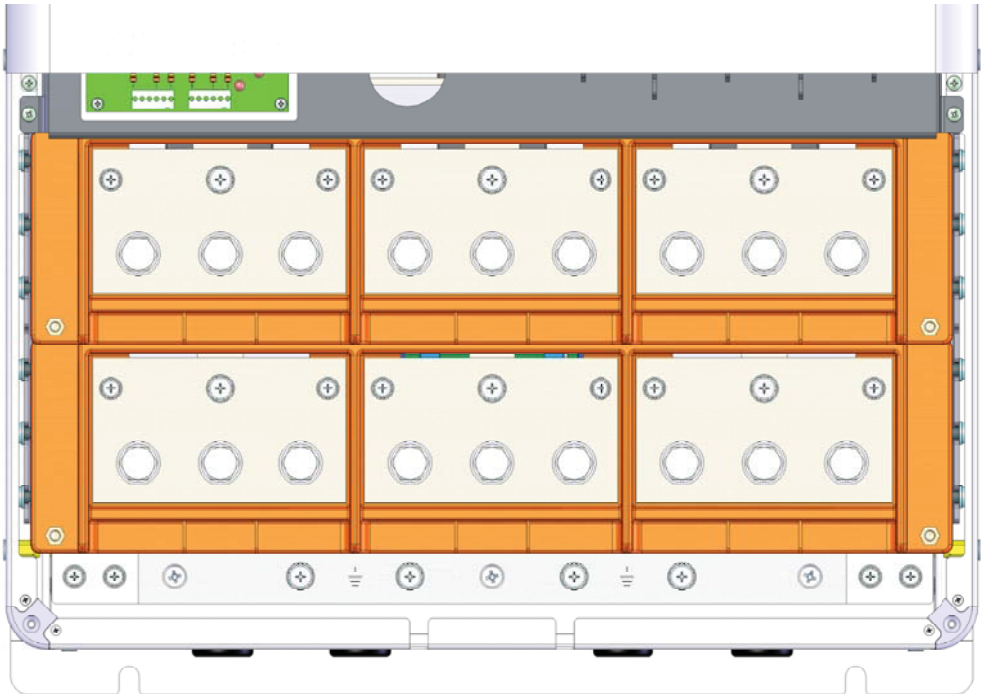


Figure 3.7 (c) - *Frame size G: Power terminals and grounding points*

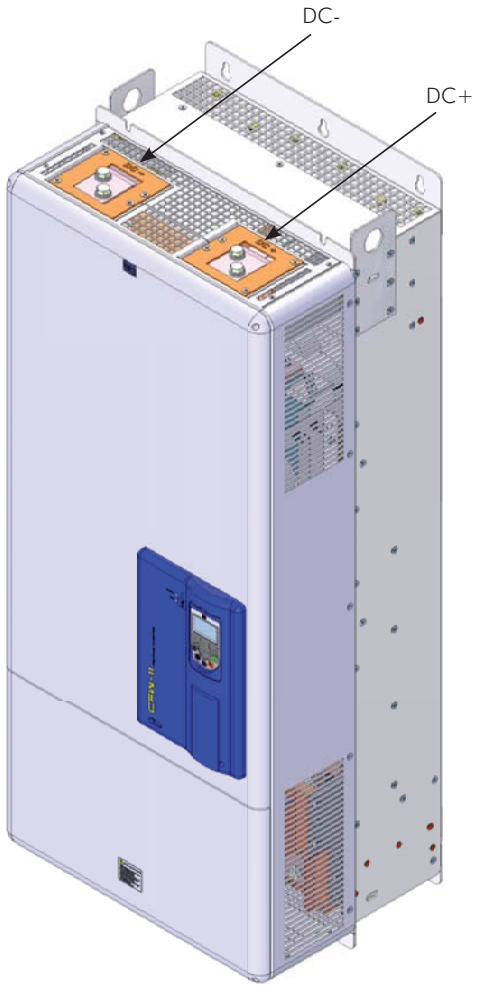


Figure 3.7 (d) - *Frame size G with special DC hardware: Terminals for DC voltage supply. Terminals R/L1, S/L2 and T/L3 are not internally connected in this version*

3.2.2 Power / Grounding Wiring and Fuses

ATTENTION!

Use proper cable lugs for the power and grounding connection cables.

ATTENTION!

Sensitive equipment such as PLCs, temperature controllers, and thermocouple cables, must be kept at a minimum distance of 0.25 m (9.84 in) from the frequency inverter and from the cables connecting the inverter to the motor.

DANGER!

Wrong cable connections:

- The inverter will be damaged if the power supply is connected to the output terminals (U/T1, V/T2, or W/T3).
- Check all the connections before powering up the inverter.
- When replacing an existing inverter by a CFW-11, check if the installation and wiring are according to the instructions listed in this manual.

ATTENTION!

Residual Current Device (RCD):

- When installing an RCD to guard against electrical shock, only devices with a trip current of 300 mA should be used on the supply side of the inverter.
- Depending on the installation (motor cable length, cable type, multimotor configuration, etc.), RCD nuisance trips may occur. Contact the RCD manufacturer for selecting the most appropriate device to be used with inverters.

NOTE!

The wire gauges listed in the table 3.2 are orientative values. Installation conditions and the maximum permitted voltage drop must be considered for the proper wiring sizing.

Input fuses

- ☑ Use High Speed Fuses at the input for the protection of the inverter rectifier and wiring. Refer to table 3.2 for selecting the appropriate fuse rating (I^2t must be equal to or less than indicated in table 3.2, consider the cold (and not the fusion) current extinction value).
- ☑ In order to meet UL requirements, use class J fuses at the inverter supply with a current not higher than the values of table 3.2.
- ☑ Optionally, slow blow fuses can be used at the input. They must be sized for 1.2 x the inverter rated input current. In this case, the installation is protected against short-circuit, but not the inverter input rectifier. This may result in major damage to the inverter in the event of an internal component failure.

Table 3.2 - *Recommended wire gauge and fuses for standard models - use only copper wire [75 °C (167 °F)]*

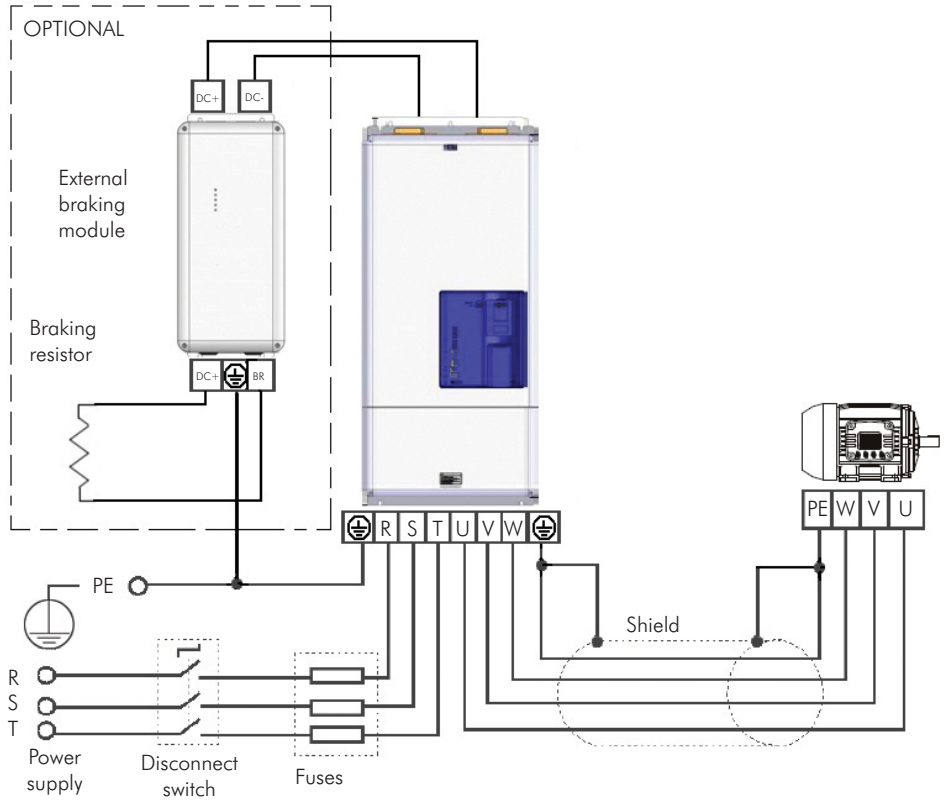
Model	Frame	Power terminals			Duty cycle	Wiring			Fuse [A]	Fuse I^2t @ 25 °C [A^2s]
		Terminals	Bolt (wrench/bolt head type)	Recommended torque N.m (lbf.in)		mm²	AWG	Cable lugs		
CFW110242T4	F	R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	150	2x1/0	Ring tongue type	315	320.000
					ND	2x70	2x2/0			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	50	1/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	70	2/0			
CFW110312T4		R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x70	2x2/0	Ring tongue type	500	414.000
					ND	2x120	2x4/0			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	50	1/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
CFW110370T4		R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x120	2x4/0	Ring tongue type	500	414.000
					ND	2x120	2x4/0			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	50	1/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
CFW110477T4		R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x120	2x4/0	Ring tongue type	700	1.051.000
					ND	2x150	2x300			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	50	1/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	150	300			
CFW110515T4	G	R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x150	2x300	Ring tongue type	900	1.445.000
					ND	3x120	3x4/0			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	150	300			
CFW110600T4		R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	3x120	3x4/0	Ring tongue type	900	1.445.000
					ND	3x150	3x300			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	2x120	2x4/0			
CFW110720T4		R/L1,S/L2/T/L3,U/T1, V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	3x150	3x300	Ring tongue type	1100	1.445.000
					ND	3x150	3x300			
		DC+, DC- (use them only for braking)	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	2x120	2x4/0			

Table 3.3 - *Recommended wire gauge and fuses for models fed with DC voltage (Special DC hardware) - use only copper wire [75 °C (167 °F)]*

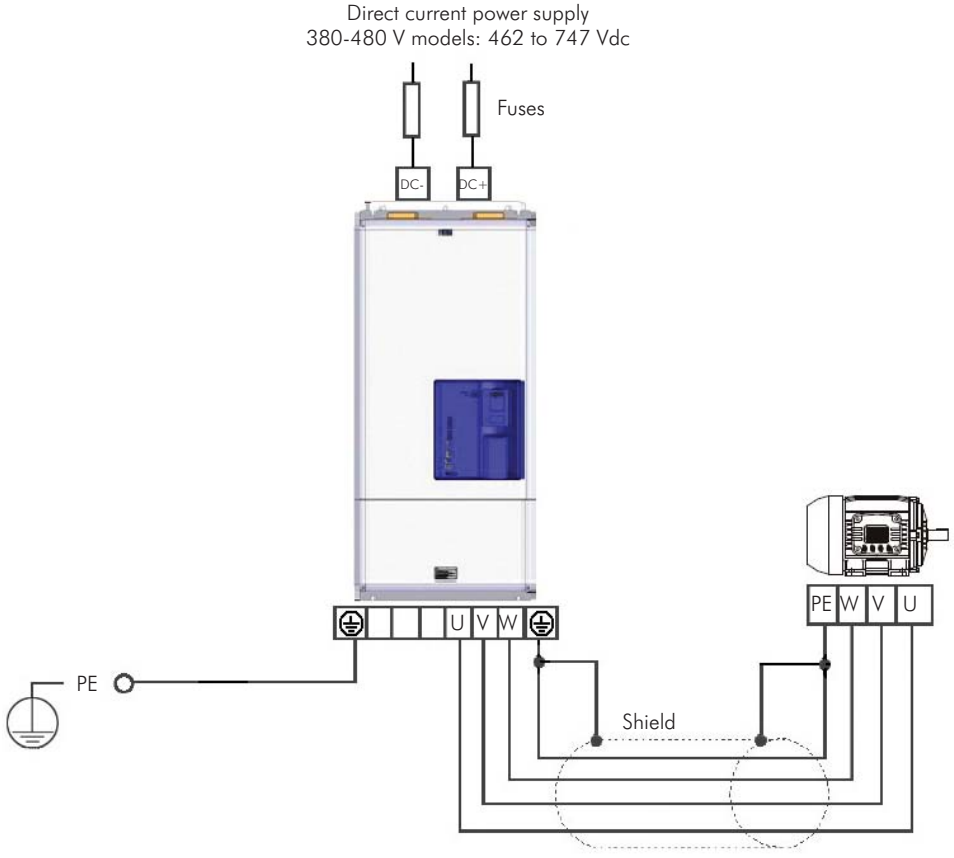
Model	Frame	Power terminals			Duty cycle	Wiring			Fuse [A]	Fuse I^2t @ 25 °C [A^2s]
		Terminals	Bolt (wrench/bolt head type)	Recommended torque N.m (lbf.in)		mm²	AWG	Cable lugs		
CFW110242T4DC	F	U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	150	2x1/0	Ring tongue type	420	See note 1
					ND	2x70	2x2/0			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	2x70	2x2/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	70	2/0			
CFW110312T4DC		U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x70	2x2/0	Ring tongue type	540	See note 1
					ND	2x120	2x4/0			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	2x120	2x4/0			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
CFW110370T4DC		U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x120	2x4/0	Ring tongue type	640	See note 1
					ND	2x120	2x4/0			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	3x3/0	3x70			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	120	4/0			
CFW110477T4DC		U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x120	2x4/0	Ring tongue type	830	See note 1
					ND	2x150	2x300			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	3x4/0	3x100			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	150	300			
CFW110515T4DC	G	U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	2x150	2x300	Ring tongue type	890	See note 1
					ND	3x120	3x4/0			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	3x150	3x300			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	150	300			
CFW110600T4DC		U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	3x120	3x4/0	Ring tongue type	1035	See note 1
					ND	3x150	3x300			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	4x4/0	4x100			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	2x120	2x4/0			
CFW110720T4DC		U/T1,V/T2,W/T3	M12 (Phillips hex head)	60 (531.00)	HD	3x150	3x300	Ring tongue type	1245	See note 1
					ND	3x150	3x300			
		DC+,DC-	M12 (Phillips hex head)	60 (531.00)	HD/ND	4x150	4x300			
		⏚	M8 (Phillips hex head)	10 (88.5)	HD/ND	2x120	2x4/0			

Note 1: Use fuses with I^2t value less or equal to the value specified in the table 3.2, with voltage rating and interruption capacity for 800 Vdc.

3.2.3 Power Connections



(a) Models with alternating current power supply (IP20)



(b) Models with direct current power supply (IP00)

Figure 3.8 - *Power and grounding connections*

3.2.3.1 Input Connections

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

ATTENTION!
A contactor or another device that frequently disconnects and reapplies the AC supply to the inverter, in order to start and stop the motor, may cause damage to the inverter power section. The drive is designed to use control signals for starting and stopping the motor. If used for that purpose, the input device must not exceed one operation per minute; otherwise, the inverter may be damaged.

ATTENTION!
The power supply that feeds the inverter must have a grounded neutral. In case of IT networks, follow the instructions described in item 3.2.3.1.1.

NOTE!
The input power supply voltage must be compatible with the inverter rated voltage.

NOTE!
Power factor correction capacitors are not needed at the inverter input (R, S, T) and must not be installed at the output (U, V, W).

Short-circuit capacity

☑ The CFW-11 is suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical (230 V / 480 V).

3.2.3.1.1 IT Networks

ATTENTION!
To use frame size F and G CFW-11 inverters in IT networks (neutral ungrounded or grounded through a high ohmic value resistor), or in corner-grounded delta networks, it is necessary to disconnect the cable with the ring tongue lug from the ground busbar and connect it to the isolated point on the power terminal block, as showed in the figure 3.9.

Figure 3.9 - *Connection for IT network operation*

3.2.3.1.2 Pre-charge Circuit Fuses

4 A / 690 V slow blow fuse.
Manufacturer: Ferraz Shawmut.
Commercial reference: 17019-G.
WEG part number: 10411503.

3.2.3.2 Dynamic Braking

ATTENTION!
Frame sizes F and G CFW-11 models do not have internal braking IGBT. External braking modules and resistors must be installed when necessary, as showed in the figure 3.8 **(a)**.

NOTE!
Set P0151 and P0185 to the maximum value (400 V or 800 V) when using dynamic braking.

The braking torque that can be obtained using frequency inverters without dynamic braking varies between 10 % and 35 % of the motor rated torque.

In order to obtain higher braking torques, resistors for dynamic braking must be used. In this case, the energy regenerated in excess is dissipated on a resistor mounted outside the inverter.

This type of braking is used in cases when short deceleration times are desired or when high inertia loads are driven.

For the vector control mode, there is the possibility of using the "Optimal Braking", eliminating in many cases the need of dynamic braking use.

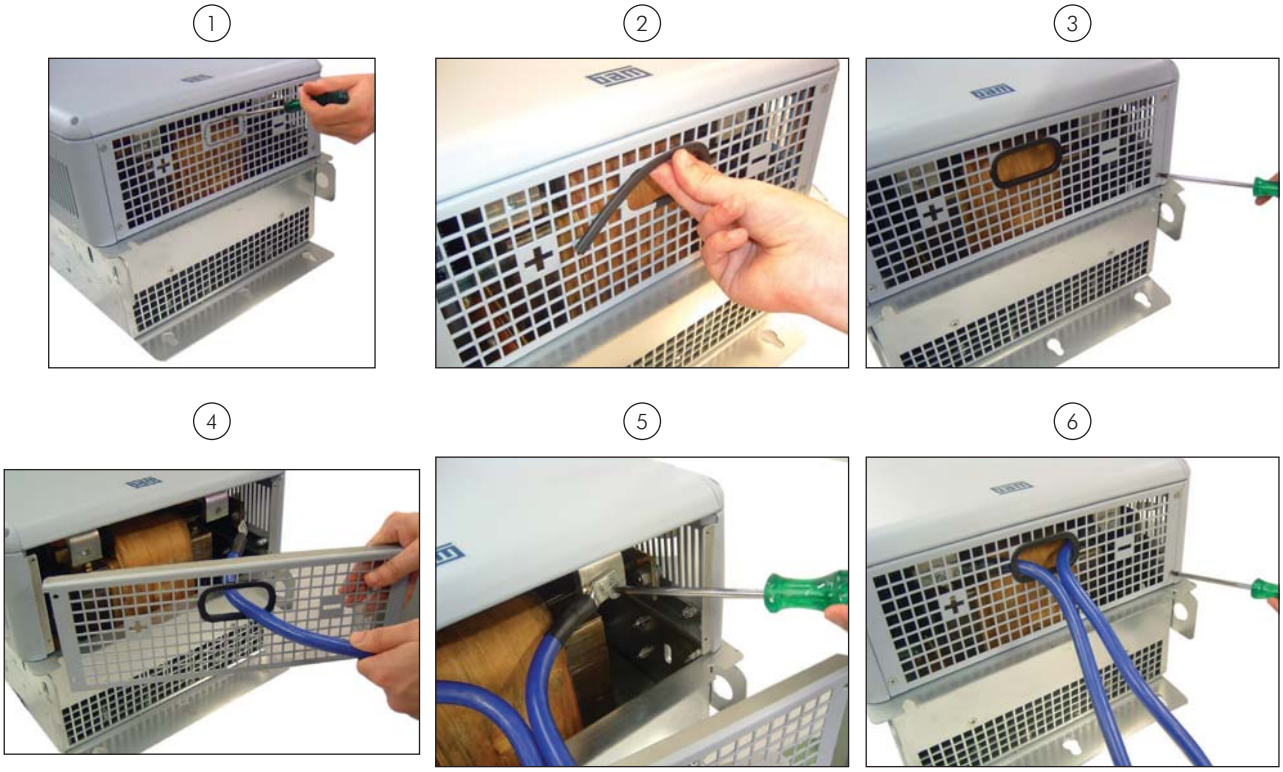


Figure 3.10 - *Sequence for the connection of external dynamic braking cables*

3.2.3.3 Output Connections

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

ATTENTION!
The motor overload protection available in the CFW-11 is in accordance with the IEC60947-4-2 and UL508C standards. Note the following information:

- ☑ Trip current equal to 1.25 times the motor rated current (P0401) adjusted in the oriented start-up menu.
- ☑ The maximum value for 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 adjusted when parameters P0401 (Motor rated current) and/or P0406 (Motor ventilation) are adjusted in the oriented start-up routine. If parameters P0156, P0157 and P0158 are manually adjusted, the maximum allowed value is 1.05 x P0401.

ATTENTION!
If a disconnect switch or a contactor is installed between the inverter and the motor, never operate it with a spinning motor or with voltage at the inverter output.

The characteristics of the cable used to connect the motor to the inverter, as well as its 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.

Recommendations for motor cables:

Unshielded cables:

- ☑ Can be used when it is not necessary to meet the European directive of electromagnetic compatibility (89/336/EEC).
- ☑ Keep motor cables away from other cables (signal cables, sensor cables, control cables, etc.), according to the table 3.4.
- ☑ The emission of the cables may be reduced by installing them inside a metal conduit, which must be grounded at both ends.
- ☑ Connect a fourth cable between the motor ground and the inverter ground.

Note:

The magnetic field created by the current circulation in these cables may induce currents in nearby metal parts, heating them, and cause additional electrical losses. Therefore, keep the three cables (U, V, W) always together.

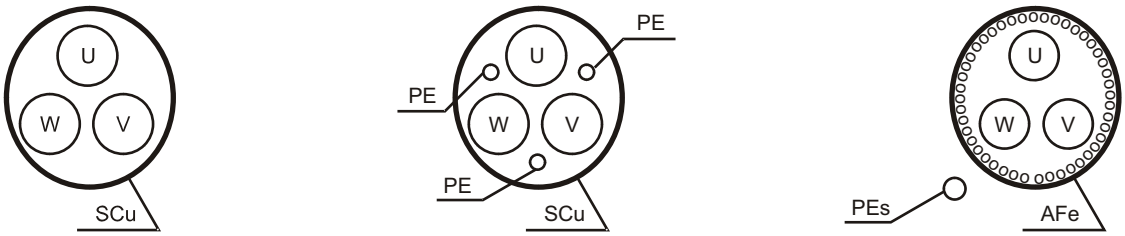
Shielded Cables:

- ☑ Are mandatory when the electromagnetic compatibility directive (89/336/EEC) has to be met, as defined by the standard EN 61800-3 "Adjustable Speed Electrical Power Drive Systems". These cables act mainly by reducing the irradiated emission in the radio-frequency range.
- ☑ Regarding to the types and installation details, follow the recommendations of IEC 60034-25 "Guide for Design and Performance of Cage Induction Motors Specifically Designed for Converter Supply", verify the summary in the figure 3.11. Refer to the standard for further details and eventual modifications related to new revisions.
- ☑ Keep motor cables away from other cables (signal cables, sensor cables, control cables, etc.), according to the table 3.4.
- ☑ The grounding system must be well interconnected among the several installation locations such as the grounding points of the motor and the inverter. Voltage difference or impedance between the several points may cause the circulation of parasite currents among the equipments connected to the ground, resulting in electromagnetic interference problems.

3

***Table 3.4** - Minimum separation distance between motor cables and all other cables*

Cable length	Minimum separation distance
≤ 30 m	≥ 10 cm
> 30 m	≥ 25 cm



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

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

***Figure 3.11** - Motor connection cables recommended by IEC 60034-25*

3.2.4 Grounding Connections

DANGER!

Do not share the grounding wiring with other equipment that operate with high currents (e.g. high power motors, soldering machines, etc.). When installing several inverters, follow the procedures presented in figure 3.12 for the grounding connection.

ATTENTION!

The neutral conductor of the network must be solidly grounded; however, this conductor must not be used to ground the inverter.

DANGER!

The inverter must be obligatorily connected to a protective ground (PE).

Observe the following:

- Use a minimum wire gauge for ground connection equal to the indicated in the table 3.2 or 3.3. Conform to local regulations and/or electrical codes in case a different wire gauge is required.
- Connect the inverter grounding connections to a ground bus bar, to a single ground point, or to a common grounding point (impedance ≤ 10 Ω).
- To comply with IEC 61800-5-1 standard, connect the inverter to the ground by using a single conductor copper cable with a minimum wire gauge of 10 mm^2, since the leakage current is greater than 3.5 mAac.

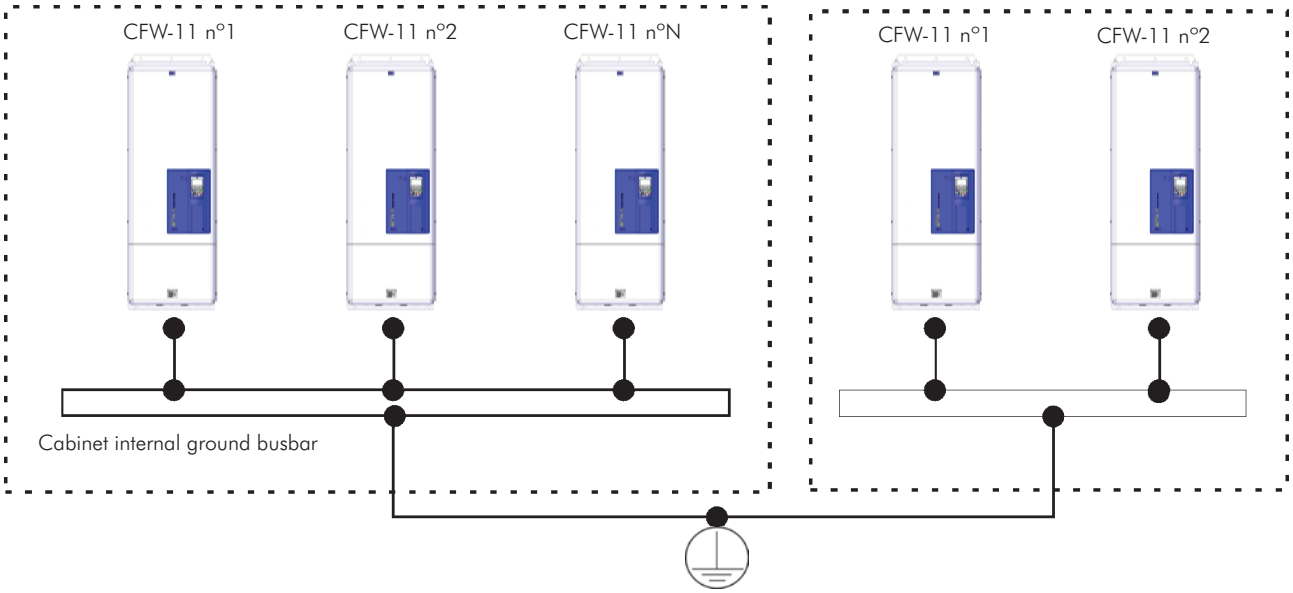
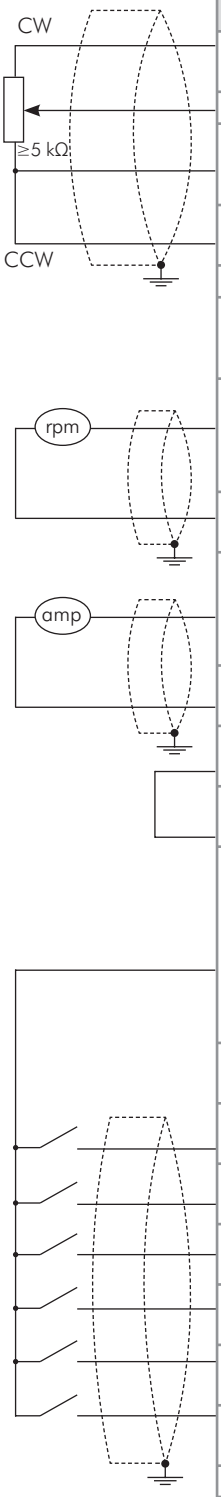


***Figure 3.12** - Grounding connections with multiple inverters*

3.2.5 Control Connections

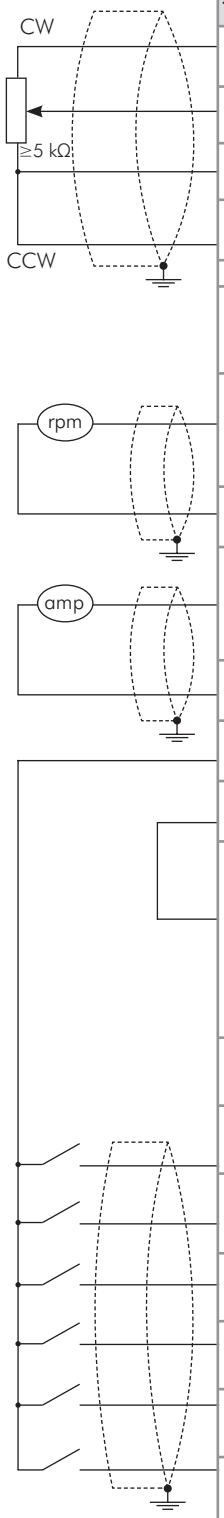
The control connections (analog inputs/outputs, digital inputs/outputs), must be made at the CC11 control board terminal strip XC1.

Functions and typical connections are presented in figures 3.13 **(a)** and **(b)**.



XC1 Terminal Strip		Factory Setting 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 (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 (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 an 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 (R_L ≥ 10 kΩ) / 0 to 20 mA / 4 to 20 mA (R_L ≤ 500 Ω). Protected against short-circuit.
10	AGND (24 V)	Reference (0 V) for the analog outputs.	Connected to the ground (frame) through an 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 an 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. **Note:** In the models with the 24 Vdc external control power supply (CFW11XXXXXXOW) the terminal 13 of XC1 becomes an input, i.e., the user must connect a 24 V power supply for the inverter (refer to the section 7.1.2 for more details). In all the other models this terminal is an output, i.e., the user has a 24 Vdc power supply available there.
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: 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	NC1	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	NO1		
24	NC2	Digital output #2 DO2 (RL2): N > N_X - Speed > P0288.	
25	C2		
26	NO2		
27	NC3	Digital output #3 DO3 (RL3): N* > N_X - Speed reference > P0288.	
28	C3		
29	NO3		

Figure 3.13 (a) - *Signals at connector XC1 - Digital inputs working as "Active High"*



XC1 Terminal Strip		Factory Setting 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 (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 ($R_L \geq$ 10 kΩ) / 0 to 20 mA / 4 to 20 mA ($R_L \leq$ 500 Ω). Protected against short-circuit.
8	AGND (24 V)	Reference (0 V) for the analog outputs.	Connected to the ground (frame) through an 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 ($R_L \geq$ 10 kΩ) / 0 to 20 mA / 4 to 20 mA ($R_L \leq$ 500 Ω). Protected against short-circuit.
10	AGND (24 V)	Reference (0 V) for the analog outputs.	Connected to the ground (frame) through an 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 an impedance: 940 Ω resistor in parallel with a 22 nF capacitor.
12	COM	Common point of the digital inputs.	
13	24 Vcc	24 Vdc power supply.	24 Vdc power supply, ±8 %. Capacity: 500 mA. **Note:** In the models with the 24 Vdc external control power supply (CFW11XXXXXXOW) the terminal 13 of XC1 becomes an input, i.e., the user must connect a 24 V power supply for the inverter (refer to the section 7.1.2 for more details). In all the other models this terminal is an output, i.e., the user has a 24 Vdc power supply available there.
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	NC1	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	NO1		
24	NC2	Digital output #2 DO2 (RL2): N > N_X - Speed > P0288.	
25	C2		
26	NO2		
27	NC3	Digital output #3 DO3 (RL3): N* > N_X - Speed reference > P0288.	
28	C3		
29	NO3		

Figure 3.13 (b) - *Signals at connector XC1 - Digital inputs working as "Active Low"*

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.

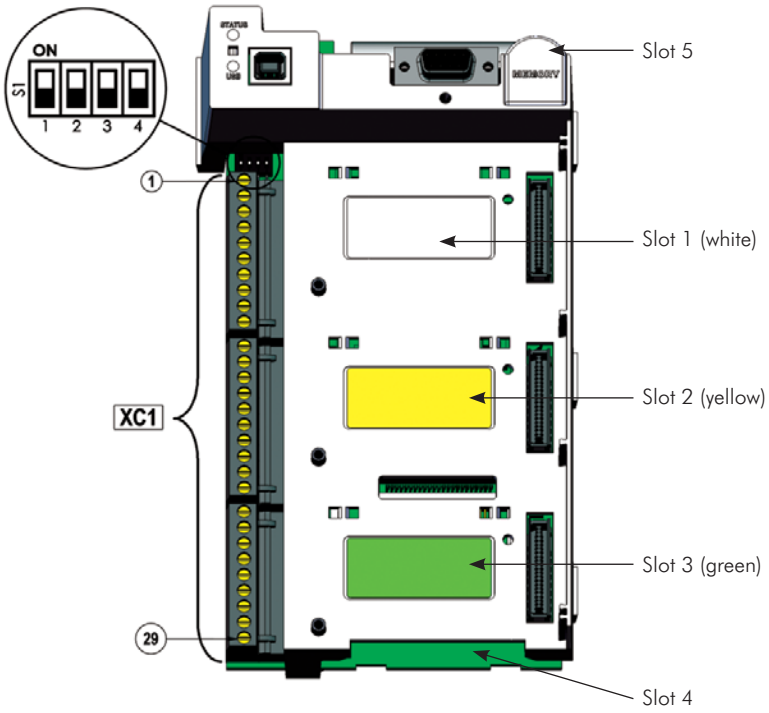


Figure 3.14 - *XC1 terminal strip and DIP-switches for selecting the signal type of analog inputs and outputs*

As the factory setting, the analog inputs and outputs are adjusted to operate in the 0 to 10 V range, but they can be changed by using the S1 DIP-switch.

Table 3.5 - *Configuration of DIP-switches for selecting the signal type of analog inputs and outputs*

Signal	Factory Setting Function	DIP-switch	Selection	Factory Setting
AI1	Speed reference (remote)	S1.4	OFF: 0 to 10 V (factory setting) ON: 4 to 20 mA / 0 to 20 mA	OFF
AI2	No function	S1.3	OFF: 0 to ±10 V (factory setting) 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 setting)	ON
AO2	Motor current	S1.2	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 to 10 V (factory setting)	ON

Parameters related to the analog inputs and outputs (AI1, AI2, AO1, and AO2) must be programmed according to the DIP-switches settings and desired values.

Follow instructions below for the proper installation of the control wiring:

1) Wire gauge: 0.5 mm² (20 AWG) to 1.5 mm² (14 AWG);
2) Maximum tightening torque: 0.5 N.m (4.50 lbf.in);
3) Use shielded cables for the connections at XC1 and run the cables separated from the remaining circuits (power, 110 V / 220 Vac control, etc.), as presented in table 3.6. If control cables must cross other cables, it must be done perpendicularly among them, keeping a minimum of 5 cm (1.9 in) distance at the crossing point.

Table 3.6 - *Minimum separation distances between wiring*

Cable length	Minimum separation distance
≤ 30 m (100 ft)	≥ 10 cm (3.94 in)
> 30 m (100 ft)	≥ 25 cm (9.84 in)

4) The correct connection of the cable shield is showed in the figure 3.16.

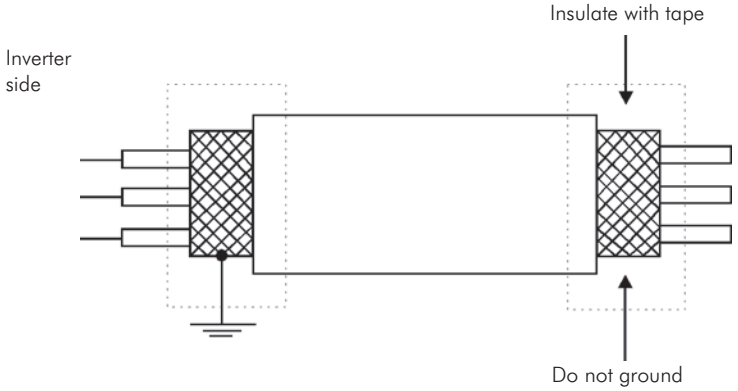


Figure 3.15 - *Shield connection*

Figure 3.16 - *Example of control wiring shield connection*

5) Relays, contactors, solenoids or coils of electromechanical brakes installed close to the inverter may occasionally generate interferences in the control circuitry. To eliminate this effect, RC suppressors (with AC power supply) or freewheel diodes (with DC power supply) must be connected in parallel to the coils of these devices.

3.2.6 Typical Control Connections

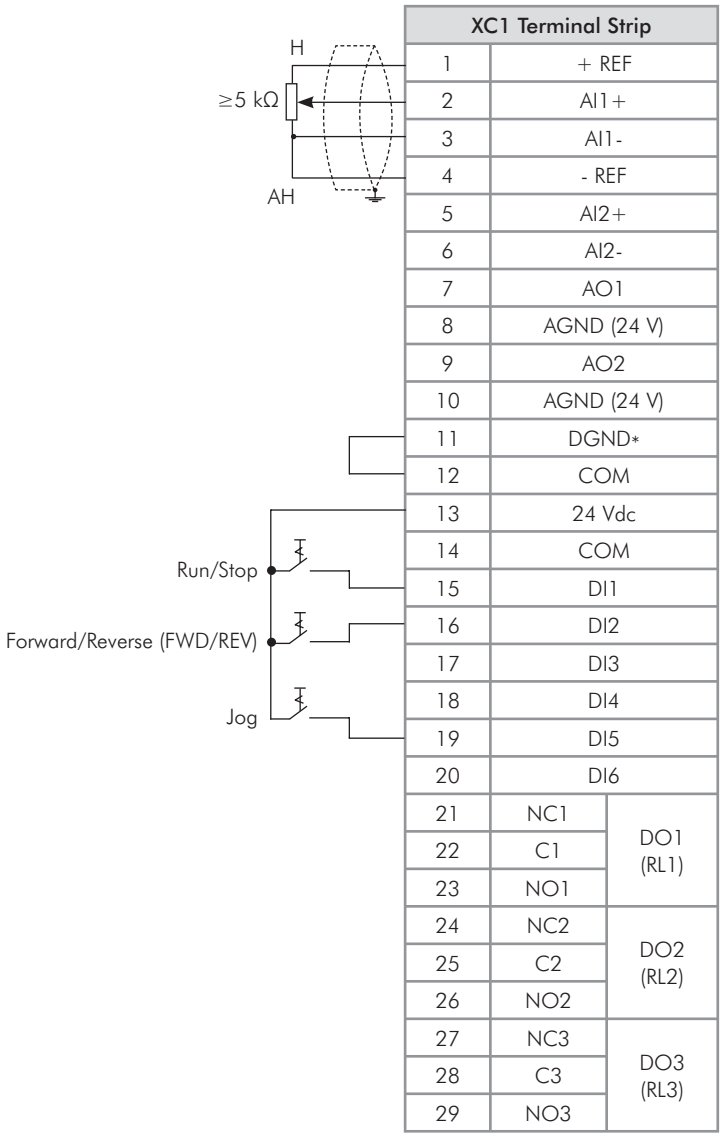
Control connection # 1 - Run/Stop function controlled from the keypad (Local Mode).

With this control connection, it is possible to run the inverter in local mode with the factory default settings. This operation mode is recommended for first-time users, since no additional control connections are required.

For the start-up in this operation mode, please follow instructions listed in chapter 5.

Control connection # 2 - 2-Wire Run/Stop function (Remote Mode).

This wiring example is valid only for the default factory settings and if the inverter is set to remote mode.
With the factory default settings, the selection of the operation mode (local/remote) is performed through the HMI key LOC REM (local mode is default). Set P0220=3 to change the default setting of HMI key LOC REM to remote mode.



XC1 Terminal Strip		
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	NC1	DO1 (RL1)
22	C1	
23	NO1	
24	NC2	DO2 (RL2)
25	C2	
26	NO2	
27	NC3	DO3 (RL3)
28	C3	
29	NO3	

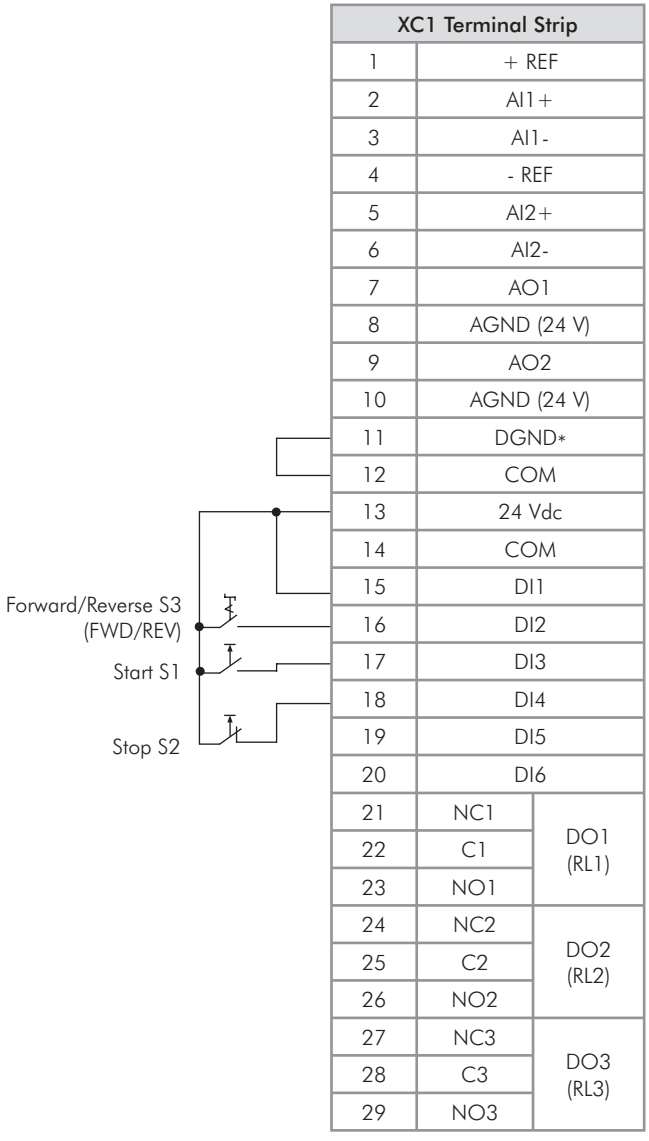
Figure 3.17 - *XC1 wiring for control connection # 2*

Control connection # 3 - 3-Wire Start/Stop function.

Enabling the Run/Stop function with 3-wire control.
Parameters to set:
Set DI3 to START
P0265=6
Set DI4 to STOP
P0266=7

Set P0224=1 (DIx) for 3-wire control in Local mode.
Set P0227=1 (DIx) for 3-wire control in Remote mode.

Set the Forward/Reverse selection by using digital input # 2 (DI2).
Set P0223=4 for Local Mode or P0226=4 for Remote Mode.
S1 and S2 are Start (NO contact) and Stop (NC contact) pushbuttons respectively.
The speed reference can be provided through the analog input (as in control connection # 2), through the keypad (as in control connection # 1) or through other available source.



XC1 Terminal Strip		
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	NC1	DO1 (RL1)
22	C1	
23	NO1	
24	NC2	DO2 (RL2)
25	C2	
26	NO2	
27	NC3	DO3 (RL3)
28	C3	
29	NO3	

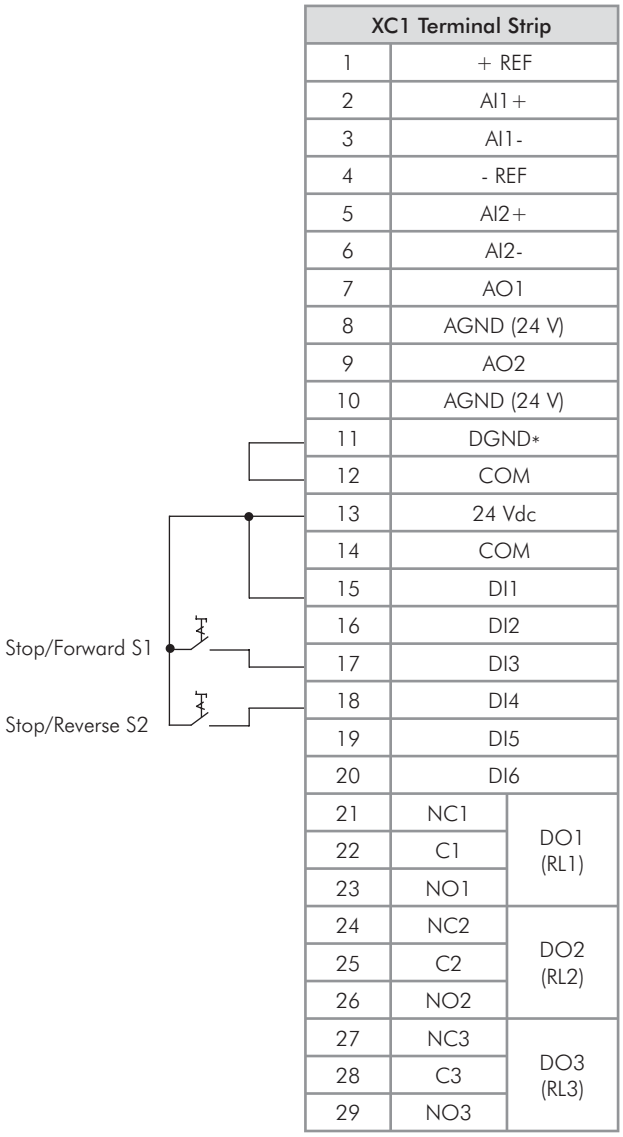
Figure 3.18 - *XC1 wiring for control connection # 3*

Control connection # 4 - Forward/Reverse.

Enabling the Forward/Reverse function.
Parameters to set:
Set DI3 to Forward run
P0265=4
Set DI4 to Reverse run
P0266=5

When the Forward/Reverse function is set, it will be active either in Local or Remote mode. At the same time, the HMI keys O and I will remain always inactive (even if P0224=0 or P0227=0).

The direction of rotation is determined by the Forward run and Reverse run inputs.
Clockwise direction for Forward run and counterclockwise for Reverse run.
The speed reference can be provided by any source (as in the control connection # 3).



XC1 Terminal Strip		
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	NC1	DO1 (RL1)
22	C1	
23	NO1	
24	NC2	DO2 (RL2)
25	C2	
26	NO2	
27	NC3	DO3 (RL3)
28	C3	
29	NO3	

Figure 3.19 - *XC1 wiring for control connection # 4*

3.3 INSTALLATION ACCORDING TO THE EUROPEAN DIRECTIVE OF ELECTROMAGNETIC COMPATIBILITY

The frame size F and G CFW-11 inverters have an internal RFI filter for the reduction of the electromagnetic interference. These inverters, when properly installed, meet the requirements of the electromagnetic compatibility directive "EMC Directive 2004/108/EC".

The CFW-11 inverter series has been designed only for industrial applications. Therefore, the emission limits of harmonic currents defined by the standards EN 61000-3-2 and EN 61000-3-2/A14 are not applicable.

3.3.1 Conformal Installation

For the conformal installation use:

1. Shielded output cables (motor cables) with the shield connected at both ends, motor and inverter, by means of a low impedance to high frequencies connection. Use the clamp supplied with the product, making sure there is a good contact between the shield and that clamp. Keep the separation distance to the other cables according to the table 3.4 indication. Refer to the section 3.2.3 for more information.
   Maximum motor cable length and conduced and radiated emission levels according to the table 3.8. If a lower conducted emission level (category C2) is wished, then an external RFI filter must be used at the inverter input. For more information (RFI filter commercial reference, motor cable length and emission levels) refer to the table 3.8.

2. Shielded control cables, keeping the separation distance to other cables according to the section 3.2.5 indication.

3. Inverter grounding according to the section 3.2.4 instructions.

3.3.2 Standard Definitions

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

- Environment:

First Environment: includes domestic premises. It also includes establishments directly connected without intermediate transformer to a low-voltage power supply network which supplies buildings used for domestic purposes.
Example: houses, apartments, commercial installations, or offices located in residential buildings.

Second Environment: includes all establishments other than those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes.
Example: industrial areas, technical area of any building supplied by a dedicated transformer.

- Categories:

Category C1: inverters with a voltage rating less than 1000 V and intended for use in the First Environment.

Category C2: inverters with a voltage rating less than 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.

Category C3: inverters with a voltage rating less than 1000 V and intended for use in the Second Environment only (not designed for use in the First Environment).

Category C4: inverters with a voltage rating equal to or greater than 1000 V, or with a current rating equal to or greater than 400 Amps, 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 3.7 - *Emission and immunity levels*

EMC Phenomenon	Basic Standard	Level
Emission:		
Mains Terminal Disturbance Voltage Frequency Range: 150 kHz to 30 MHz)	IEC/EN61800-3 (2004)	Refer to the table 3.8.
Electromagnetic Radiation Disturbance Frequency Range: 30 MHz to 1000 MHz)		
Immunity:		
Electrostatic Discharge (ESD)	IEC 61000-4-2 (1995) +A1 (1998) +A2 (2001)	4 kV for contact discharge and 8 kV for air discharge.
Fast Transient-Burst	IEC 61000-4-4 (1995) +A1 (2000) +A2 (2001)	2 kV / 5 kHz (coupling capacitor) power input cables; 1 kV / 5 kHz control cables, and remote keypad cables; 2 kV / 5 kHz (coupling capacitor) motor output cables.
Conducted Radio-Frequency Common Mode	IEC 61000-4-6 (2003)	0.15 to 80 MHz; 10 V; 80 % AM (1 kHz). Motor input cables, control cables, and remote keypad cables.
Surge Immunity	IEC 61000-4-5 (1995)	1.2/50 μs, 8/20 μs; 1 kV line-to-line coupling; 2 kV line-to-ground coupling.
Radio-Frequency Electromagnetic Field	IEC 61000-4-3 (2002)	80 to 1000 MHz; 10 V/m; 80 % AM (1 kHz).

Table 3.8 - *Conducted and radiated emission levels*

Inverter model	Without external RFI filter		With external RFI filter		
	Conducted emission - maximum motor cable length	Radiated emission	External RFI filter part number - (manufacturer: Epcos)	Conducted emission - maximum motor cable length	Radiated emission
	Category C3	Category		Category C2	Category
CFW110242T4	100 m	C3 (2)	B84143-B0250-S021	100 m (3)	C3
CFW11 0312T4	100 m	C3 (2)	B84143-B0320-S021	100 m (3)	C3
CFW110370T4	100 m	C3 (2)	B84143-B0400-S021	100 m (3)	C3
CFW110477T4	100 m	C3 (2)	B84143-B0600-S021	100 m (3)	C3
CFW110515T4	100 m	C3 (2)	B84143-B0600-S021	100 m (3)	C3
CFW110601T4	100 m	C3 (2)	B84143-B0600-S021	100 m (3)	C3
CFW110720T4	100 m	C3 (2)	B84143-B1000-S021	100 m (3)	C3

Notes:
(1) Information valid for networks with solid grounded neutral.
(2) With a toroidal core in the three mains cable. Example: TDK PN: PC40 UU120x160x20.
(3) 2.4 Hz minimum operating frequency.

KEYPAD (HMI)

This chapter describes:
- HMI keys and their functions;
- Display indications;
- Parameter structure.

4.1 INTEGRAL KEYPAD - HMI-CFW11

Through the HMI, it is possible to command the inverter, visualize and adjust all of its parameters. It presents a navigation mode similar to the one used in cell phones, with options to access the parameters sequentially or by means of groups (Menu).

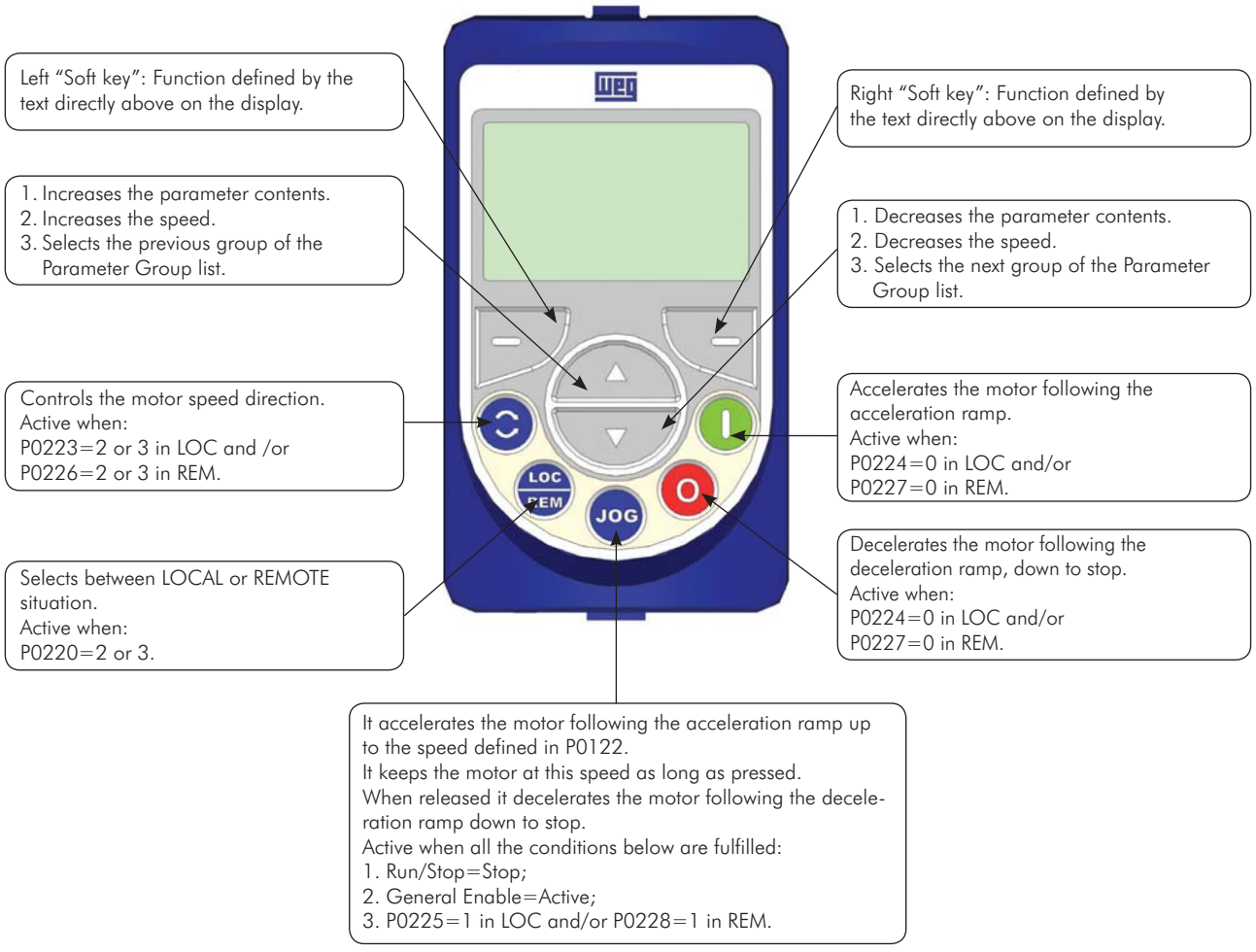


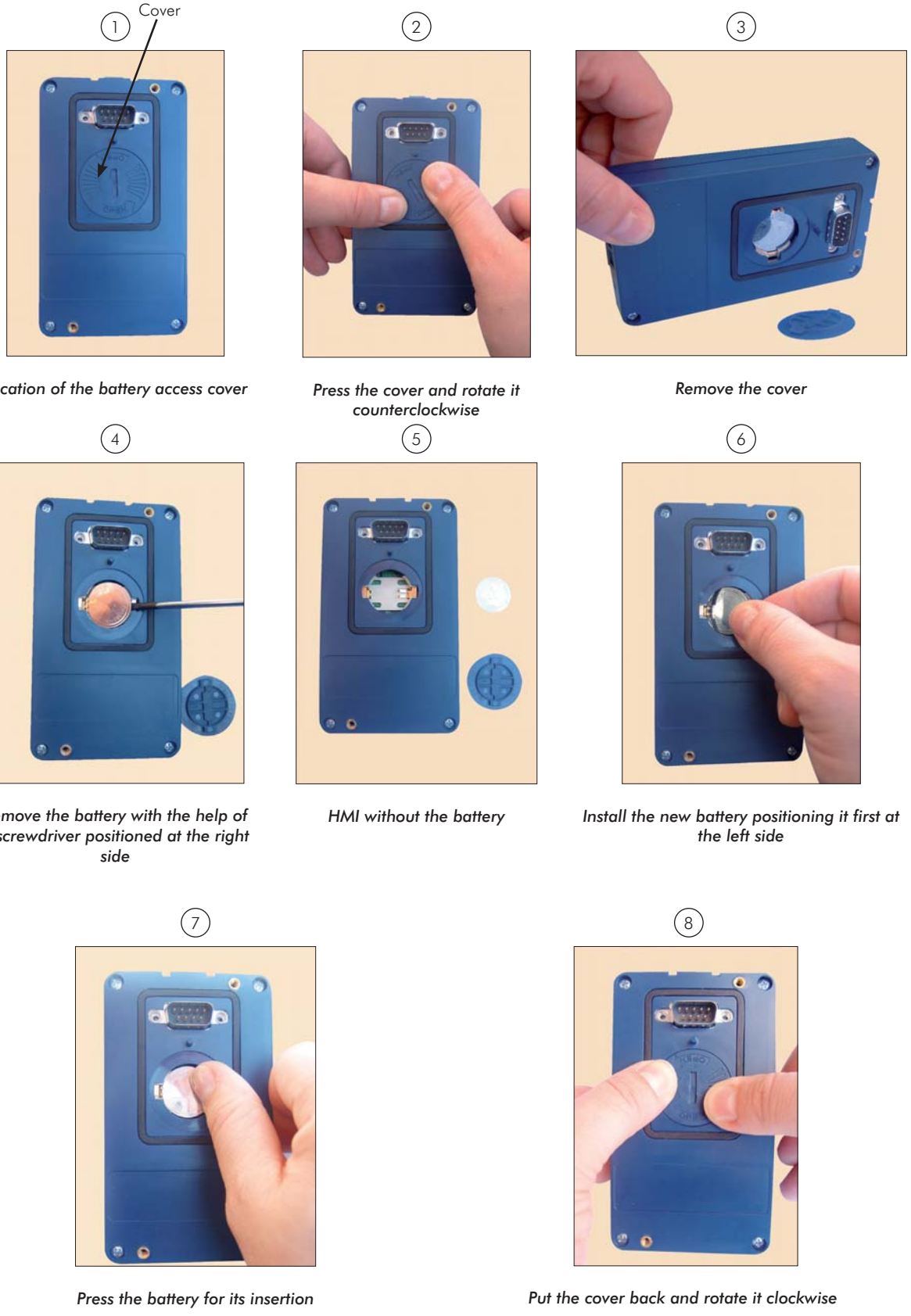
***Figure 4.1** - HMI keys*

Battery:

NOTE!

The battery is necessary only to keep the internal clock operation when the inverter stays without power. If the battery is completely discharged or if it is not installed in the keypad, the displayed clock time will be invalid and an alarm condition "A181 - Invalid clock time" will be indicated every time the inverter is powered up.

The life expectation of the battery is of approximately 10 years. When necessary, replace the battery by another of the CR2032 type.



1 *Location of the battery access cover*

2 *Press the cover and rotate it counterclockwise*

3 *Remove the cover*

4 *Remove the battery with the help of a screwdriver positioned at 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*

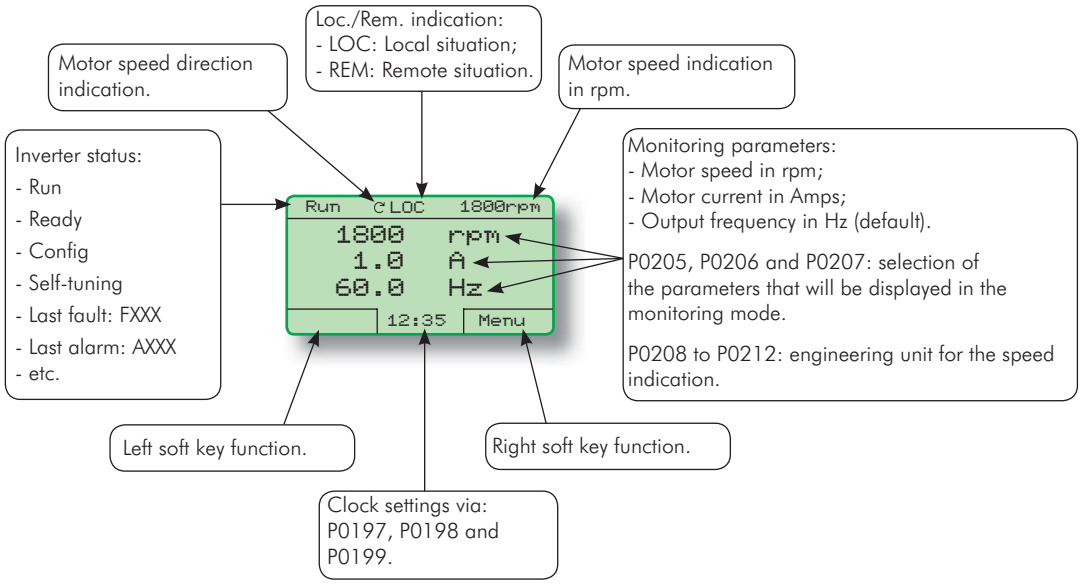
NOTE!

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

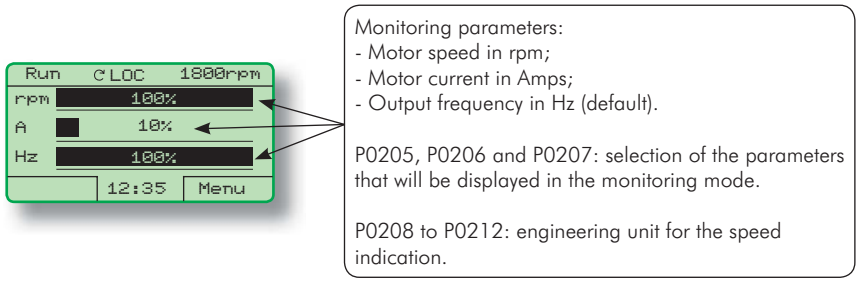
Installation:

- ☑ The keypad can be installed or removed from the inverter with or without AC power applied to it.
- ☑ The HMI supplied with the product can also be used for remote command of the inverter. In this case, use a cable with male and female D-Sub9 (DB-9) connectors wired pin to pin (mouse extension type) or a market standard Null-Modem cable. Maximum length of 10 m (33 ft). It is recommended the use of the M3 x 5.8 standoffs supplied with the product. Recommended torque: 0.5 N.m (4.50 lbf.in).

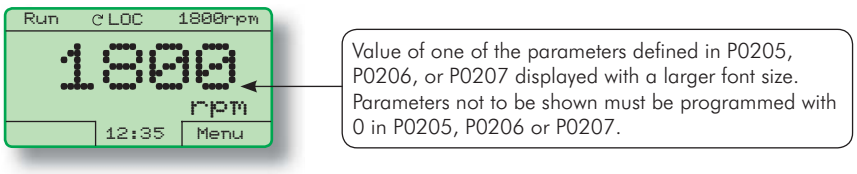
When power is applied to the inverter, the display automatically enters the monitoring mode. Figure 4.3 **(a)** presents the monitoring screen displayed for the factory default settings. By properly setting specific inverter parameters, other variables can be displayed in the monitoring mode or the value of a parameter can be displayed using bar graphs or with larger characters as presented in figures 4.3 **(b)** and **(c)**.



(a) Monitoring screen with the factory default settings



(b) Example of a monitoring screen with bar graphs



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

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

4.2 PARAMETER STRUCTURE

When the right soft key ("MENU") is pressed in the monitoring mode, the display shows the first 4 groups of parameters. An example of how the groups of parameters are organized is presented in table 4.1. The number and name of the groups may change depending on the firmware version used. For further details on the existent groups for the used firmware version, refer to the programming manual.

Table 4.1 - *Groups of parameters*

Level 0		Level 1	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		
			36	Multispeed		
			37	Electr. Potentiom.		
			38	Analog Inputs		
			39	Analog Outputs		
			40	Digital Inputs		
			41	Digital Outputs		
			42	Inverter Data		
			43	Motor Data		
			44	FlyStart/RideThru		
			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.				

FIRST TIME POWER-UP AND START-UP

This chapter describes how to:

- Check and prepare the inverter before power-up.
- Power-up the inverter and check the result.
- Set the inverter for the operation in the V/f mode based on the power supply and motor information by using the Oriented Start-Up routine and the Basic Application group.

NOTE!
In order to use the inverter in VVW or vector control modes, and for other available functions, refer to the CFW-11 programming manual.

5.1 START-UP PREPARATION

The inverter must have been already installed according to the recommendations listed in Chapter 3 - Installation and Connection. The following recommendations are applicable even if the application design is different from the suggested control connections.

DANGER!
Always disconnect the main power supply before performing any inverter connection.

1) Check if power, grounding, and control connections are correct and firmly secured.

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

3) Verify the motor connections and if its voltage and current are within the inverter rated values.

4) 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.

5) Close the inverter or cabinet covers.

6) Measure the power supply voltage and verify if it is within the allowed range, according to the chapter 8.

7) Apply power to the input:
   Close the input disconnect switch.

8) Check the result of the first time power-up:
   The keypad should display the standard monitoring mode (figure 4.3 **(a)**) and the status LED should be steady green.

5.2 START-UP

The start-up procedure for the V/f is described in three simple steps by using the **Oriented Start-up** routine and the **Basic Application** group.

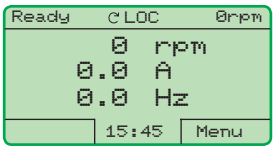
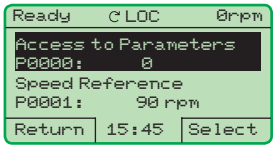
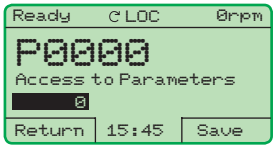
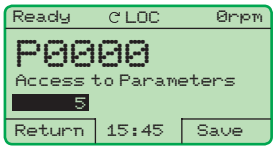
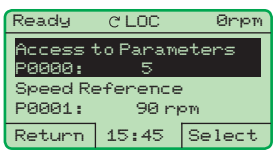
Steps:

(1) Set the password for parameter modification.

(2) Execute the **Oriented Start-up** routine.

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

5.2.1 P0000 Password Setting

Step	Action/Result	Display Indication
1	- Monitoring Mode. - Press **"Menu"** (right soft key).	
2	- The group **"00 ALL PARAMETERS"** is already selected. - Press **"Select"**.	
3	- The parameter **"Access to Parameters P0000: 0"** is already selected. - Press **"Select"**.	
4	- In order to set the password, press  until the number **5** appears on the display.	
5	- When the number **5** appears, press **"Save"**.	
6	- If the setting was performed correctly, the display must show **"Access to Parameters P0000: 5"**. - Press **"Return"** (left soft key).	

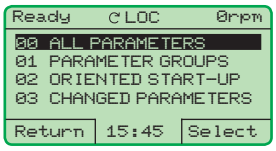
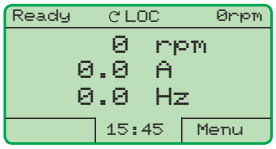
Step	Action/Result	Display Indication
7	- Press **"Return"**.	
8	- The display returns to the Monitoring Mode.	

Figure 5.1 - *Steps for allowing parameter modification via P0000*

5.2.2 Oriented Start-Up

There is a group of parameters named "Oriented Start-up", which makes the inverter settings easier. The parameter P0317 from this group allows entering the Oriented Start-up routine.

The Oriented Start-Up routine presents the main parameters on the HMI in a logical sequence, so that their setting, according to the operation conditions, prepares the inverter for the operation with the used line and motor.

In order to enter into the Oriented Start-up routine, follow the steps presented in figure 5.2, first changing parameter P0317 to 1 and then, setting all remaining parameters as they are presented on the display.

Setting the parameters in the Oriented Start-Up routine causes the automatic content modification of the other parameters and/or internal inverter variables.

During the Oriented Start-up routine, the message "Config" will be displayed at the top left corner of the HMI display.

Step	Action/Result	Display indication
1	- Monitoring Mode. - Press **"Menu"** (right soft key).	Ready LOC 0rpm 0 rpm 0.0 A 0.0 Hz 13:48 Menu
2	- The group **"00 ALL PARAMETERS"** is already selected.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 13:48 Select
3	- The group **"01 PARAMETER GROUPS"** is selected.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 13:48 Select
4	- The group **"02 ORIENTED START-UP"** is then selected. - Press **"Select"**.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 13:48 Select
5	- The parameter **"Oriented Start-up P0317: No"** is already selected. - Press **"Select"**.	Ready LOC 0rpm Oriented Start-Up P0317: No Return 13:48 Select
6	- The content of **"P0317 = [000] No"** is showed.	Ready LOC 0rpm P0317 Oriented Start-up [000] No Return 13:48 Save
7	- The content of the parameter is changed to **"P0317 = [001] Yes"**. - Press **"Save"**.	Ready LOC 0rpm P0317 Oriented Start-up [001] Yes Return 13:48 Save
8	- At that moment the Oriented Start-up routine is initiated and the "Config" status is indicated at the top left corner of the HMI. - The parameter **"Language P0201: English"** is already selected. - If necessary, change the language by pressing **"Select"**, next and to select the language and then press **"Save"**.	Config LOC 0rpm Language P0201: English Type of Control P0202: V/F 60 HZ Reset 13:48 Select
9	- If necessary, 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.	Config LOC 0rpm Language P0201: English Type of Control P0202: V/F 60 HZ Reset 13:48 Select

Figure 5.2 - *Oriented Start-up*

Step	Action/Result	Display indication
10	- If necessary, 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.	Config LOC 0rpm Type of Control P0202: V/F 60 HZ Line Rated Voltage P0296: 440 – 460 V Reset 13:48 Select
11	- If necessary, 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.	Config LOC 0rpm Line Rated Voltage P0296: 440 – 460 V Application P0298: Heavy Duty Reset 13:48 Select
12	- If necessary, 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.	Config LOC 0rpm Application P0298: Heavy Duty Motor Service Factor P0398: 1.15 Reset 13:48 Select
13	- If necessary, 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.	Config LOC 0rpm Motor Service Factor P0398: 1.15 Motor Rated Voltage P0400: 440 V Reset 13:48 Select
14	- If necessary, 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.	Config LOC 0rpm Motor Rated Voltage P0400: 440V Motor Rated Current P0401: 13.5 A Reset 13:48 Select
15	- If necessary, 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.	Config LOC 0rpm Motor Rated Current P0401: 13.5 A Motor Rated Speed P0402: 1750 rpm Reset 13:48 Select
16	- If necessary, set P0403 according to the motor rated frequency. To do so, press **"Select"**. This modification affects P0402.	Config LOC 0rpm Motor Rated Speed P0402: 1750 rpm Motor Rated Frequency P0403: 60 Hz Reset 13:48 Select
17	- If necessary, change the value of P0404 according to the motor rated power. To do so, press **"Select"**. This modification affects P0410.	Config LOC 0rpm Motor Rated Frequency P0403: 60 Hz Motor Rated Power P0404: 4hp 3kW Reset 13:48 Select
18	<u>- This parameter will only be visible if the encoder board ENC1 is installed in the inverter.</u> - If there is an encoder connected to the motor, set P0405 according to the encoder pulses number. To do so, press **"Select"**.	Config LOC 0rpm Motor Rated Power P0404: 4hp 3kW Encoder Pulses Number P0405: 1024 ppr Reset 13:48 Select
19	- If necessary, 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 O.	Config LOC 0rpm Encoder Pulses Number P0405: 1024 ppr Motor Ventilation P0406: Self-Vent. Reset 13:48 Select
20	- After few seconds, the display returns to the Monitoring Mode.	Ready LOC 0rpm 0 rpm 0.0 A 0.0 Hz 13:48 Menu

Figure 5.2 (cont.) *- Oriented Start-up*

5.2.3 Basic Application Parameter Settings

After running the Oriented Start-up routine and properly setting the parameters, the inverter is ready to operate in the V/f mode.

The inverter has a number of other parameters that allow its adaptation to the most different applications. This manual presents some basic parameters, whose setting is necessary in the majority of cases. To make this task easier, there is a group named Basic Application. A summary of the parameters contained in this group is presented in the table 5.1. Also a group of read-only parameters shows the value of the most important inverter variables such as voltage, current, etc. The main parameters contained in this group are listed in table 5.2. For further details, refer to the CFW-11 programming manual.

Follow steps outlined in figure 5.3 to set the parameters of the Basic Application group.

The procedure for start-up in the V/f operation mode is finished after setting these parameters.

Step	Action/Result	Display indication
1	- Monitoring Mode. - Press **"Menu"** (right soft key).	Ready LOC 0rpm 0 rpm 0.0 A 0.0 Hz 15:45 Menu
2	- Group **"00 ALL PARAMETERS"** has been already selected.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 15:45 Select
3	- Group **"01 PARAMETER GROUPS"** is then selected.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 15:45 Select
4	- Group **"02 ORIENTED START-UP"** is then selected.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 15:45 Select
5	- Group **"03 CHANGED PARAMETERS"** is selected.	Ready LOC 0rpm 00 ALL PARAMETERS 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS Return 15:45 Select
6	- Group **"04 BASIC APPLICATION"** is selected. - Press **"Select"**.	Ready LOC 0rpm 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS 04 BASIC APPLICATION Return 15:45 Select
7	- Parameter **"Acceleration Time P0100: 20.0 s"** has been already selected. - If necessary, 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).	Ready LOC 0rpm Acceleration Time P0100: 20.0s Deceleration Time P0101: 20.0s Return 15:45 Select
8	- Press **"Return"**.	Ready LOC 0rpm 01 PARAMETER GROUPS 02 ORIENTED START-UP 03 CHANGED PARAMETERS 04 BASIC APPLICATION Return 15:45 Select
9	- The display returns to the Monitoring Mode and the inverter is ready to operate.	Ready LOC 0rpm 0 rpm 0.0 A 0.0 Hz 15:45 Menu

Figure 5.3 - *Setting parameters of the Basic Application group*

Table 5.1 - *Parameters contained in the Basic Application group*

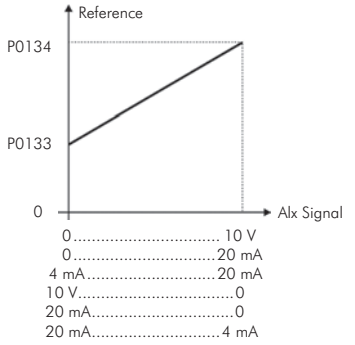
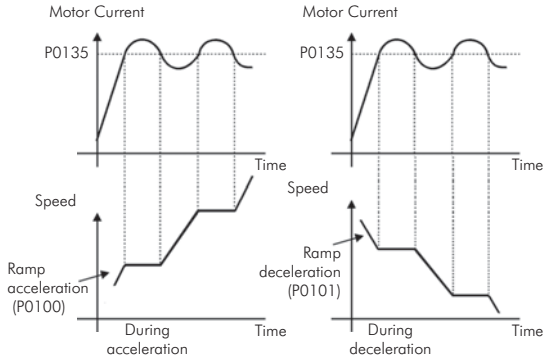
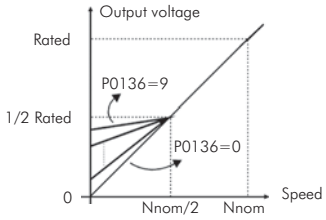
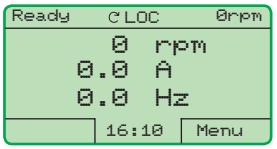
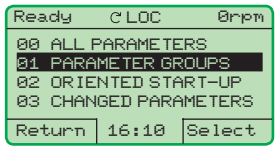
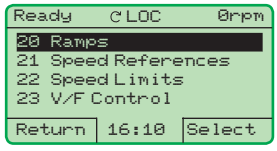
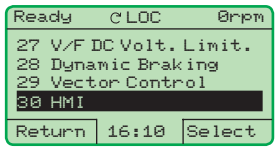
Parameter	Name	Description	Adjustable Range	Factory Setting	User Setting
P0100	Acceleration Time	- It defines the time to accelerate linearly from 0 up to the maximum speed (P0134). - If set to 0.0 s, it means no acceleration ramp.	0.0 to 999.0 s	20.0 s	
P0101	Deceleration Time	- It defines the time to decelerate linearly 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	- They defines the minimum and the maximum values of the speed reference when the drive is enabled. - These values are valid for any reference source.  0 ..... 10 V 0 ..... 20 mA 4 mA ..... 20 mA 10 V ..... 0 20 mA ..... 0 20 mA ..... 4 mA	0 to 18000 rpm	90 rpm (60 Hz motor) 75 rpm (50 Hz motor)	
P0134	Maximum Speed			1800 rpm (60 Hz motor) 1500 rpm (50 Hz motor)	
P0135	Max. Output Current (V/F control mode current limitation)	- It avoids motor stalling 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	- It operates in low speeds, modifying the output voltage x frequency curve to keep the torque constant. - It 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 at 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	Adjustable 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 1020.0 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	Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8
P0013	DO5 to DO1 Status	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5
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.
P0028	Accessories Config. 2	
P0029	Power Hardware Config.	Hexadecimal code according to the available models and option kits. Refer to the software 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 65535 h
P0043	Time Enabled	0.0 to 6553.5 h
P0044	kWh Output Energy	0 to 65535 kWh
P0045	Fan Enabled Time	0 to 65535 h

Parameter	Description	Adjustable Range
P0048	Present Alarm	0 to 999
P0049	Present Fault	0 to 999
P0050	Last Fault	0 to 999
P0051	Last Fault Day/Month	00/00 to 31/12
P0052	Last Fault Year	00 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	Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8
P0097	DOx Status Last Fault	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5

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"**.	

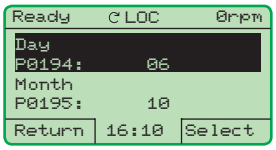
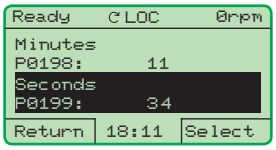
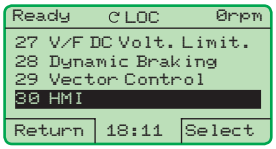
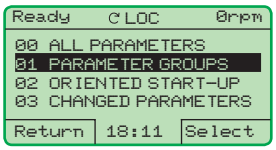
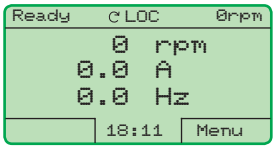
Step	Action/Result	Display indication
6	- Parameter **"Day P0194"** is already selected. - If needed, set P0194 according to the actual day. To do so, press **"Select"** and then, or to change P0194 value. - Follow the same steps to set parameters **"Month P0195"** to **"Seconds P0199"**.	
7	- Once the 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 - *Date and time setting*

5.4 PARAMETER CHANGE PREVENTION

To prevent unauthorized or unintended parameter modifications, the parameter P0000 must be set to a value different from 5. Follow the same procedure described in item 5.2.1.

5.5 HOW TO CONNECT A PC

NOTES!

- Always use a standard host/device shielded USB cable. Unshielded cables may cause communication errors.
- Recommended 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 mains power supply and from other internal inverter high voltages. However, the USB connection is not isolated from the protective ground (PE). Use an isolated notebook for the USB connection or a desktop connected to the same protective ground (PE) of the inverter.

Install the SuperDrive G2 software in order to control the motor speed, and view or edit the inverter parameters through a personal computer (PC).

Basic procedures for transferring data from the PC to the inverter:

1. Install the SuperDrive G2 software in the PC;
2. Connect the PC to the inverter through an USB cable;
3. Start SuperDrive G2;
4. Choose "Open" and the files stored in the PC will be displayed;
5. Select the file;
6. Use the command "Write Parameters to the Drive".

All parameters are now transferred to the inverter.
For further information on the SuperDrive G2 software, refer to the SuperDrive Manual.

5.6 FLASH MEMORY MODULE

Location as presented in figure 2.2 item D.

Functions:

- Store a copy of the inverter parameters;
- Transfer parameters stored in the FLASH memory to the inverter;
- Transfer firmware stored in the FLASH memory to the inverter;
- Store the program created with SoftPLC.

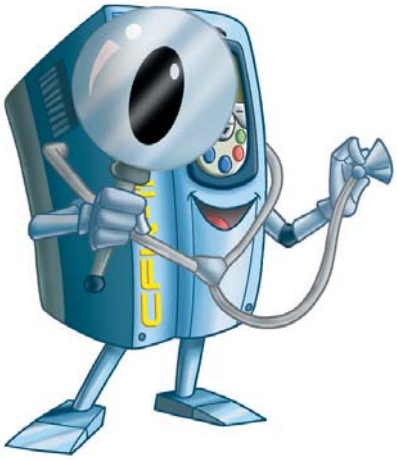
Whenever the inverter is powered up, this program is transferred to the RAM memory located in the inverter control board and executed.

Refer to the CFW-11 programming manual and to SoftPLC manual for further details.

ATTENTION!

Before installing or removing the FLASH memory module, disconnect the inverter power supply and wait for the complete discharge of the capacitors.

TROUBLESHOOTING AND MAINTENANCE



This chapter presents:
- A lists of all the faults and alarms that may occur.
- The possible causes of each fault and alarm.
- A lists of the most frequent problems and corrective actions.
- Instructions for periodic inspections and preventive maintenance on the equipment.

6.1 OPERATION OF FAULTS AND ALARMS

When a fault is detected (FXXX):
- ☑ The PWM pulses are blocked;
- ☑ The keypad displays the fault code and description;
- ☑ The "STATUS" LED starts flashing red;
- ☑ The output relay set to "NO FAULT" opens;
- ☑ Some data is saved in the control circuit EEPROM memory:
  - Keypad and EP (Electronic Pot) speed references, in case the function "Reference backup" is enabled by P0120;
  - The fault code that occurred (shifts the last nine previous faults);
  - The value of the motor overload function integrator;
  - The value of the operating hours counter (P0043) and the powered-up hours counter (P0042).

Reset the inverter to return the drive to a "READY" condition in the event of a fault. The following reset options are available:
- ☑ Removing the power supply and reapplying it (power-on reset);
- ☑ Pressing the HMI O key (manual reset);
- ☑ Through the "Reset" soft key;
- ☑ Automatically by setting P0340 (auto-reset);
- ☑ Through a digital input: DIx = 20 (P0263 to P0270).

When an alarm situation (AXXX) is detected:
- ☑ The keypad displays the alarm code and description;
- ☑ The "STATUS" LED changes to yellow;
- ☑ The PWM pulses are not blocked (the inverter remains operating).

6.2 FAULTS, ALARMS, AND POSSIBLE CAUSES

Table 6.1 - *Faults, alarms and possible causes*

Fault/Alarm	Description	Possible Causes
F006: Imbalance or Input Phase Loss	Mains voltage imbalance too high or phase missing at the input power supply. **Note:** - If the motor is unloaded or operating with reduced load, this fault may not occur. - Fault delay is set at parameter P0357. P0357=0 disables the fault.	☑ Phase missing at the inverter's input power supply. ☑ Input voltage imbalance > 5 %. ☑ Pre-charge circuit fault.
F021: DC Bus Undervoltage	DC bus undervoltage condition occurred.	☑ The input voltage is too low and the DC bus voltage dropped below the minimum permitted value (monitor the value at Parameter P0004): Ud < 223 V - For 200-240 V three-phase supply voltage; Ud < 170 V - For 200-240 V single-phase supply voltage (CFW11XXXXS2 or CFW11XXXXB2 models) (P0296=0); Ud < 385 V - For 380 V supply voltage (P0296=1); Ud < 405 V - For 400-415 V supply voltage (P0296=2); Ud < 446 V - For 440-460 V supply voltage (P0296=3); Ud < 487 V - For 480 V supply voltage (P0296=4); Ud < 530 V - For 500-525 V supply voltage (P0296=5); Ud < 580 V - For 500-575 V supply voltage (P0296=6); Ud < 605 V - For 600 V supply voltage (P0296=7); Ud < 696 V - For 660-690 V supply voltage (P0296=8). ☑ Phase loss at the input power supply. ☑ Pre-charge circuit failure. ☑ Parameter P0296 was set to a value above the power supply rated voltage.
F022: DC Bus Overvoltage	DC bus overvoltage condition occurred.	☑ The input voltage is too high and the DC bus voltage surpassed the maximum permitted value: Ud > 400 V - For 220-230 V models (P0296=0); Ud > 800 V - For 380-480 V models (P0296=1, 2, 3, or 4). Ud > 1200 V - For 500-690 V models (P0296=5, 6, 7 or 8); ☑ Inertia of the driven-load is too high or deceleration time is too short. ☑ Parameters P0151, P0153, or P0185 set to high.
F030: Power Module U Fault	Power Module U IGBT desaturation.	☑ Short-circuit between motor phases U and V or U and W.
F034: Power Module V Fault	Power Module V IGBT desaturation.	☑ Short-circuit between motor phases V and U or V and W.
F038: Power Module W Fault	Power Module W IGBT desaturation.	☑ Short-circuit between motor phases W and U or W and V.
A046: High Load on Motor	The load is too high for the used motor. **Note:** It may be disabled by setting P0348=0 or 2.	☑ Settings of P0156, P0157, and P0158 are too low for the used motor. ☑ Excessive load at the motor shaft.
A047: IGBT Overload Alarm	An IGBT overload alarm occurred. **Note:** It may be disabled by setting P0350=0 or 2.	☑ High current at the inverter output.
F048: IGBT Overload Fault	An IGBT overload fault occurred.	☑ Very high current at the inverter output.

Table 6.1 (cont.) - *Faults, alarms and possible causes*

Fault/Alarm	Description	Possible Causes
A050: U Phase IGBT High Temperature	The IGBT NTC temperature sensors detected a high temperature alarm. **Note:** It may be disabled by setting P0353=2 or 3.	☑ High inverter surrounding air temperature (> 50 °C (122 °F)) and high output current. ☑ Blocked or defective fan. ☑ Very dirty heatsink.
F051: U Phase IGBT Overtemperature	The IGBT NTC temperature sensors detected an overtemperature fault.	
A053: V Phase IGBT High Temperature	The IGBT NTC temperature sensors detected a high temperature alarm. **Note:** It may be disabled by setting P0353=2 or 3.	
F054: V Phase IGBT Overtemperature	The IGBT NTC temperature sensors detected an overtemperature fault.	
A056: W Phase IGBT High Temperature	The IGBT NTC temperature sensors detected a high temperature alarm. **Note:** It may be disabled by setting P0353=2 or 3.	
F057: W Phase IGBT Overtemperature	The IGBT NTC temperature sensors detected an overtemperature fault.	
F067: Inverted Encoder/Motor Wiring	Fault related to the phase relation of the encoder signals, if P0202=4 and P0408=2, 3 or 4. **Note:** - This fault can only happen during the self-tuning routine. - It is not possible to reset this fault. - In this case, turn off the power supply, solve the problem, and then turn it on again.	☑ Output motor cables U, V, W are inverted. ☑ Encoder channels A and B are inverted. ☑ Encoder was not properly mounted.
F071: Output Overcurrent	Output overcurrent fault.	☑ Excessive load inertia or acceleration time too short. ☑ Settings of P0135 or P0169, P0170, P0171, and P0172 are too high.
F072: Motor Overload	The motor overload protection tripped. **Note:** It may be disabled by setting P0348=0 or 3.	☑ Settings of P0156, P0157, and P0158 are too low for the used motor. ☑ Excessive load at the motor shaft.
F074: Ground Fault	A ground fault occurred, either in the cable between the inverter and the motor or in the motor itself. **Note:** It may be disabled by setting P0343=0.	☑ Short-circuit to the ground at one or more of the output phases. ☑ Motor cable capacitance is too large, resulting in current peaks at the output. **(5)**
F076: Motor Current Imbalance	Fault of motor current imbalance. **Note:** It may be disabled by setting P0342=0.	☑ Loose connection or interrupted wiring between motor and inverter. ☑ Vector control lost orientation. ☑ Vector control with inverted encoder wiring or inverted motor connection.
F077: DB Resistor Overload	The dynamic braking resistor overload protection tripped.	☑ Excessive load inertia or deceleration time too short. ☑ Excessive load at the motor shaft. ☑ Parameter P0154 and P0155 incorrect setting.
F078: Motor Overtemperature	Fault related to the PTC temperature sensor installed in the motor. **Note:** - It may be disabled by setting P0351=0 or 3. - It is necessary to set an analog input / output to the PTC function.	☑ Excessive load at the motor shaft. ☑ Too heavy duty cycle (too many starts / stops per minute). ☑ Too high motor surrounding air temperature. ☑ Loose connection or short-circuit (resistance < 60 Ω) in the wiring connected to the motor thermistor. ☑ Motor thermistor is not installed. ☑ Blocked motor shaft.
F079: Encoder Signal Fault	Lack of encoder signals.	☑ Broken wires between the motor encoder and the option and the encoder interface board; ☑ Defective encoder.
F080: CPU Watchdog	Microcontroller watchdog fault.	☑ Electrical noise.
F082: Copy Function Fault	Fault while copying parameters.	☑ An attempt to copy the keypad parameters to an inverter with an incompatible firmware version.
F084: Auto-diagnosis Fault	Auto-diagnosis fault.	☑ Internal inverter circuitry defect.

Table 6.1 (cont.) - *Faults, alarms and possible causes*

Fault/Alarm	Description	Possible Causes
A088: Keypad Comm. Fault	A failure in the communication between the HMI and the control board.	☑ Keypad cable bad connection. ☑ Electrical noise in the installation.
A090: External Alarm	External alarm via digital input. **Note:** It is necessary to set a digital input for "No external alarm".	☑ Open wiring at digital inputs (DI1 to DI8) programmed for "No external alarm".
F091: External Fault	External fault via digital input. **Note:** It is necessary to set a digital input to "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 in the inverter internal circuitry.
A110: High Motor Temperature	Alarm related to the PTC temperature sensor installed in the motor. **Note:** - It may be disabled by setting P0351=0 or 2. - It is necessary to set an analog input / output to the PTC function.	☑ Excessive load at the motor shaft. ☑ Too heavy duty cycle (too many starts / stops per minute). ☑ Too high motor surrounding air temperature. ☑ Motor thermistor is not installed. ☑ Blocked motor shaft.
A128: Timeout for Serial Communication	Indicates that the inverter stopped receiving valid telegrams within a certain time interval. **Note:** It may be disabled by setting P0314=0.0 s.	☑ Check the wiring and grounding installation. ☑ Make sure the inverter has sent a new telegram within the time interval set at P0314.
A129: Anybus is Offline	Alarm that indicates interruption of the Anybus-CC communication.	☑ The PLC has entered the idle state. ☑ Programming error. Master and slave set with a different number of I/O words. ☑ Communication with master has been lost (broken cable, unplugged connector, etc.).
A130: Anybus Access Error	Alarm that indicates an access error to the Anybus-CC communication module.	☑ Defective, unrecognized, or incorrectly installed Anybus-CC module. ☑ Conflict with a WEG option board.
A133: CAN Not Powered	Alarm indicating that the power supply was not connected to the CAN controller.	☑ Broken or loose cable. ☑ Power supply is off.
A134: Bus Off	Inverter CAN interface has entered the bus-off state.	☑ Incorrect baud-rate. ☑ Two nodes configured with the same address in the network. ☑ Wrong cable connection (inverted signals).
A135: CANopen Communication Error	Alarm that indicates a communication error.	☑ Communication problems. ☑ Wrong master configuration/settings. ☑ Incorrect configuration of the communication objects.
A136: Idle Master	Network master has entered the idle state.	☑ PLC in IDLE mode. ☑ Bit of the PLC command register set to zero (0).
A137: DNet Connection Timeout	DeviceNet I/O connection timeout alarm.	☑ One or more allocated I/O connections have entered the timeout state.
A138: (1) Profibus DP Interface in Clear Mode	It indicates that the inverter received a command from the Profibus DP network master to enter the clear mode.	☑ Verify the network master status, making sure it is in execution mode (Run). ☑ Refer to the Profibus DP communication manual for more information.
A139: (1) Offline Profibus DP Interface	It indicates an interruption in the communication between the Profibus DP network master and the inverter.	☑ Verify whether the network master is correctly configured and operating normally. ☑ Verify the network installation in a general manner - cable routing, grounding. ☑ Refer to the Profibus DP communication manual for more information.
A140: (1) Profibus DP Module Access Error	It indicates an error in the access to the Profibus DP communication module data.	☑ Verify whether the Profibus DP module is correctly fit into the slot 3. ☑ Refer to the Profibus DP communication manual for more information.
F150: Motor Overspeed	Overspeed fault. It is activated when the real speed exceeds the value of P0134 x (100 % + P0132) for more than 20 ms.	☑ Wrong settings of P0161 and/or P0162. ☑ Problem with the hoist-type load.
F151: FLASH Memory Module Fault	FLASH Memory Module (MMF-01) fault.	☑ Defective FLASH memory module. ☑ FLASH memory module is not connected properly.

Table 6.1 (cont.) - *Faults, alarms and possible causes*

Fault/Alarm	Description	Possible Causes
A152: Internal Air High Temperature	Alarm indicating that the internal air temperature is too high. **Note:** It may be disabled by setting P0353=1 or 3.	☑ Defective internal fan (if existent) and high output current. ☑ High temperature inside the cabinet (>45 °C (113 °F)).
F153: Internal Air Overtemperature	Internal air overtemperature fault.	
F156: Undertemperature	Undertemperature fault (below -30 °C (-22 °F)) in the IGBTs or rectifier measured by the temperature sensors.	☑ Surrounding air temperature ≤ -30 °C (-22 °F).
F160: Safety Stop Relays	Safety Stop relay fault.	☑ One of the relays is defective or it does not have +24 V applied to its coil.
F161: Timeout PLC11 CFW-11	☑ Refer to the PLC11-01 module programming manual.	
A162: Incompatible PLC Firmware		
A163: AI1 Broken Wire	It indicates that the AI1 current signal (4-20 mA or 20-4 mA) is out of the 4 to 20 mA range.	☑ Broken AI1 cable. ☑ Bad contact at the signal connection to the terminal strip.
A164: AI2 Broken Wire	It indicates that the AI2 current signal (4-20 mA or 20-4 mA) is out of the 4 to 20 mA range.	☑ Broken AI2 cable. ☑ Bad contact at the signal connection to the terminal strip.
A165: AI3 Broken Wire	It indicates that the AI3 current signal (4-20 mA or 20-4 mA) is out of the 4 to 20 mA range.	☑ Broken AI3 cable. ☑ Bad contact at the signal connection to the terminal strip.
A166: AI4 Broken Wire	It indicates that the AI4 current signal (4-20 mA or 20-4 mA) is out of the 4 to 20 mA range.	☑ Broken AI4 cable. ☑ Bad contact at the signal connection to the terminal strip.
F174: (6) Left Fan Speed Fault	Heatsink left fan speed fault.	☑ Dirt on the blades and in the bearings of the fan. ☑ Defective fan. ☑ Defective fan power supply connection.
F175: (2) Center Fan Speed Fault	Heatsink center fan speed fault.	☑ Dirt on the blades and in the bearings of the fan. ☑ Defective fan. ☑ Defective fan power supply connection.
F176: Right Fan Speed Fault	Heatsink right fan speed fault.	☑ Dirt on the blades and in the bearings of the fan. ☑ Defective fan. ☑ Defective fan power supply connection.
A177: Fan Replacement	Heatsink fan replacement alarm (P0045 > 50000 hours). **Note:** This function may be disabled by setting P0354=0.	☑ The maximum number of operating hours for the heatsink fan has been reached.
F179: Heatsink Fan Speed Fault	Heatsink fan speed feedback fault. **Note:** This function may be disabled by setting P0354=0.	☑ Dirt on the blades and in the bearings of the fan. ☑ Defective fan. ☑ Defective fan power supply connection.
A181: Invalid Clock Value	Invalid clock value alarm.	☑ It is necessary to set date and time at parameters from P0194 to P0199. ☑ Keypad battery is discharged, defective, or not installed.
F182: Pulse Feedback Fault	Indicates a fault at the feedback from the output pulses.	☑ Defect in the inverter internal circuitry.
F183: IGBT overload + Temperature	Overtemperature related to the IGBTs overload protection.	☑ High surrounding air temperature. ☑ Operation with overload at frequencies below 10 Hz.
F186: (3) Temp. Sensor 1 Fault	Temperature fault detected at the sensor 1.	☑ Motor high temperature.
F187: (3) Temp. Sensor 2 Fault	Temperature fault detected at the sensor 2.	☑ Motor high temperature.
F188: (3) Temp. Sensor 3 Fault	Temperature fault detected at the sensor 3.	☑ Motor high temperature.
F189: (3) Temp. Sensor 4 Fault	Temperature fault detected at the sensor 4.	☑ Motor high temperature.
F190: (3) Temp. Sensor 5 Fault	Temperature fault detected at the sensor 5.	☑ Motor high temperature.

Table 6.1 (cont.) - *Faults, alarms and possible causes*

Fault/Alarm	Description	Possible Causes
A191: (3) Temp. Sensor 1 Alarm	Temperature alarm detected at the sensor 1.	☑ Motor high temperature. ☑ A problem in the wiring connecting the sensor to the IOE-01 (02 or 03).
A192: (3) Temp. Sensor 2 Alarm	Temperature alarm detected at the sensor 2.	☑ Motor high temperature. ☑ A problem in the wiring connecting the sensor to the IOE-01 (02 or 03).
A193: (3) Temp. Sensor 3 Alarm	Temperature alarm detected at the sensor 3.	☑ Motor high temperature. ☑ A problem in the wiring connecting the sensor to the IOE-01 (02 or 03).
A194: (3) Temp. Sensor 4 Alarm	Temperature alarm detected at the sensor 4.	☑ Motor high temperature. ☑ A problem in the wiring connecting the sensor to the IOE-01 (02 or 03).
A195: (3) Temp. Sensor 5 Alarm	Temperature alarm detected at the sensor 5.	☑ Motor high temperature. ☑ A problem in the wiring connecting the sensor to the IOE-01 (02 or 03).
A196: (3) Sensor 1 Cable Alarm	Temperature sensor 1 cable alarm.	☑ Shorted temperature sensor.
A197: (3) Sensor 2 Cable Alarm	Temperature sensor 2 cable alarm.	☑ Shorted temperature sensor.
A198: (3) Sensor 3 Cable Alarm	Temperature sensor 3 cable alarm.	☑ Shorted temperature sensor.
A199: (3) Sensor 4 Cable Alarm	Temperature sensor 4 cable alarm.	☑ Shorted temperature sensor.
A200: (3) Sensor 5 Cable Alarm	Temperature sensor 5 cable alarm.	☑ Shorted temperature sensor.
F228: Serial Communication Timeout	☑ Refer to the RS-232 / RS-485 Serial Communication Manual.	
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 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: (1) Profibus DP Interface in Clear Mode	It indicates that the inverter received a command from the Profibus DP network master to enter the clear mode.	☑ Verify the network master status, making sure it is in execution mode (Run). ☑ The fault indication will occur if P0313=5. ☑ Refer to the Profibus DP communication manual for more information.
F239: (1) Offline Profibus DP Interface	It indicates an interruption in the communication between the Profibus DP network master and the inverter.	☑ Verify whether the network master is correctly configured and operating normally. ☑ Verify the network installation in a general manner - cable routing, grounding. ☑ The fault indication will occur if P0313=5. ☑ Refer to the Profibus DP communication manual for more information.
F240: (1) Profibus DP Module Access Error	It indicates an error in the access to the Profibus DP communication module data.	☑ Verify whether the Profibus DP module is correctly fit into the slot 3. ☑ The fault indication will occur if P0313=5. ☑ Refer to the Profibus DP communication manual for more information.

Table 6.1 (cont.) - *Faults, alarms and possible causes*

Fault/Alarm	Description	Possible Causes
A700: (4) Disconnected HMI	Alarm or fault related to the HMI disconnection.	☑ RTC function block has been activated in the SoftPLC applicative and the HMI is disconnected from the inverter.
F701: (4) Disconnected HMI		
A702: (4) Disabled Inverter	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: (4) Two Enabled Movements	Two movements have been enabled.	☑ It occurs when two or more movement blocks are enabled simultaneously.
A706: (4) Speed Reference not Programmed for SoftPLC	Speed reference not programmed for SoftPLC.	☑ It occurs when a movement block has been enabled and the speed reference has not been configured for SoftPLC (check P0221 and P0222).

Models at which they may occur:

(1) With a Profibus DP module connected into the slot 3 (XC43).

(2) All the frame size G models.

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

(4) All the models with a SoftPLC applicative.

(5) Very long motor cables (longer than 100 meters) present a high parasite capacitance against the ground. The circulation of parasite currents through those capacitances may cause the ground fault circuit activation and thus disabling the inverter with F074, immediately after the inverter enabling.

NOTE!
The range from P0750 to P0799 is destined to the SoftPLC applicative user faults and alarms.

(6) CFW110370T4, CFW110477T4, and all the frame size G models.

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 3.18).
	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. Rated values must be within the limits specified below: 220-230 V power supply: - Minimum: 187 V - Maximum: 253 V 380-480 V power supply: - Minimum: 323 V - Maximum: 528 V
	Mains supply fuses open	1. Replace the fuses.
Motor does not operate in the field weakening region (Vector Control)	Settings	1. Decrease P0180.
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 interface manual. If signals are properly wired, invert two of the output phases. For instance U and V.

6.4 INFORMATION NECESSARY FOR CONTACTING TECHNICAL SUPPORT

NOTE!

For technical support and servicing, it is important to have the following information in hand:

- ☑ Inverter model;
- ☑ Serial number, manufacturing date, and hardware revision that are listed in the product nameplate (refer to the section 2.4);
- ☑ Installed software version (check parameter P0023);
- ☑ Application data and inverter settings.

6.5 PREVENTIVE MAINTENANCE

DANGER!

- ☑ Always turn off the mains power supply before touching any electrical component associated to the inverter.
- ☑ High voltage may still be present even after disconnecting the power supply.
- ☑ To prevent electric shock, wait at least 10 minutes after turning off the input power for the complete discharge of the power capacitors.
- ☑ Always connect the equipment frame to the protective ground (PE). Use the adequate connection terminal at the inverter.

ATTENTION!

The electronic boards have electrostatic discharge sensitive components.

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, consult WEG.

The inverters require low maintenance when properly installed and operated. The table 6.3 presents the main procedures and time intervals for preventive maintenance. The table 6.4 provides recommended periodic inspections to be performed every 6 months after the inverter start-up.

Table 6.3 - *Preventive maintenance*

Maintenance		Interval	Instructions
Fan replacement		After 50000 operating hours. (1)	Replacement procedure showed in figure 6.1.
Keypad battery replacement		Every 10 years.	Refer to the chapter 4.
Electrolytic capacitors	If the inverter is stocked (not being used): "Reforming"	Every year from the manufacturing date printed on the inverter identification label (refer to the section 2.4).	Apply power to the inverter (voltage between 220 and 230 Vac, single-phase or three-phase, 50 or 60 Hz) for at least one hour. Then, disconnect the power supply and wait at least 24 hours before using the inverter (reapply power).
	Inverter is being used: replace	Every 10 years.	Contact WEG technical support to obtain replacement procedures.

(1) The inverters are set at the factory for automatic fan control (P0352=2), which means that they will be turned on only when the heatsink temperature exceeds a reference value. Therefore, the operating hours of the fan will depend on the inverter usage conditions (motor current, output frequency, cooling air temperature, etc.). The inverter stores the number of fan operating hours in the parameter P0045. When this parameter reaches 50000 operating hours, the keypad display shows the alarm A177.

Table 6.4 - *Recommended periodic inspections - Every 6 months*

Component	Abnormality	Corrective Action
Terminals, connectors	Loose screws	Tighten
	Loose connectors	
Fans / Cooling system	Dirty fans	Cleaning
	Abnormal acoustic noise	Replace the fan. Refer to the figure 6.1 for the removal of the fan. Install the new fan in the reverse sequence of the removal. Check the fan connections.
	Blocked fan	
	Abnormal vibration	
	Dust in the cabinet air filter	Cleaning or replacement
Printed circuit boards	Accumulation of dust, oil, humidity, etc.	Cleaning
	Odor	Replacement
Power module / Power connections	Accumulation of dust, oil, humidity, etc.	Cleaning
	Loose connection screws	Tighten
DC bus capacitors (DC link)	Discoloration / odor / electrolyte leakage	Replacement
	Expanded or broken safety valve	
	Frame expansion	
Power resistors	Discoloration	Replacement
	Odor	
Heatsink	Dust accumulation	Cleaning
	Dirty	

6.5.1 Cleaning Instructions

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

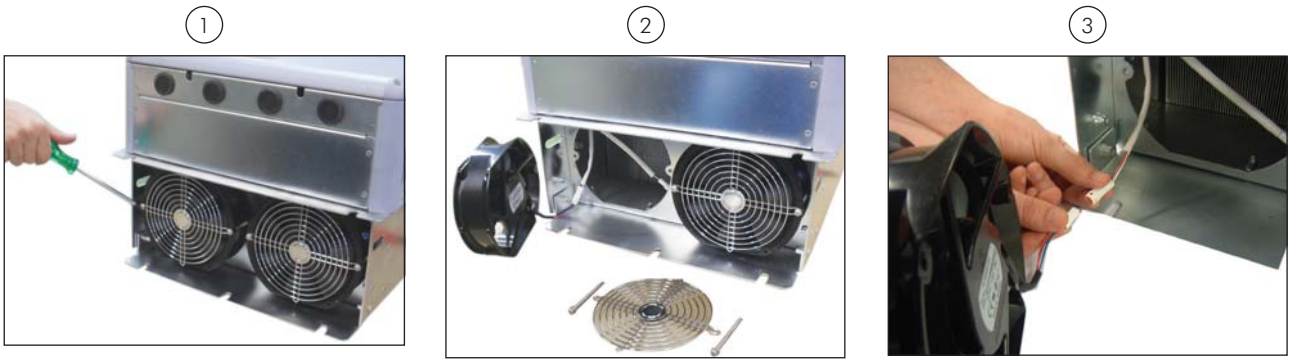
6

Ventilation system:

- ☑ Disconnect the inverter power supply and wait at least 10 minutes.
- ☑ Remove the dust from the cooling air inlet by using a soft brush or a flannel.
- ☑ Remove the dust from the heatsink fins and from the fan blades by using compressed air.

Electronic boards:

- ☑ Disconnect the inverter power supply and wait at least 10 minutes.
- ☑ Remove the dust from the electronic board by using an anti-static brush or an ion air gun (Charges Burtes Ion Gun - reference A6030-6DESCO).
- ☑ If necessary, remove the boards from the inverter.
- ☑ Always wear a ground strap.



Fan securing screws removal ***Fan removal*** ***Cable disconnection***

Figure 6.1 - *Removal of the heatsink fans*

OPTION KITS AND ACCESSORIES

This chapter presents:

- ☑ The option kits that can be integrated to the inverter from the factory:
  - Safety Stop according to EN 954-1 category 3;
  - External 24 Vdc power supply for control and keypad.
- ☑ Instructions for the proper use of the option kits.
- ☑ The accessories that can be integrated to the inverters.

Instructions for the installation, operation, and programming of the accessories are described in their own manuals and are not present in this chapter.

7.1 OPTION KITS

7.1.1 Safety Stop According to EN 954-1 Category 3 (Pending Certification)

Inverters with the following codification: CFW11XXXXXXOY.

The inverters with this option are equipped with an additional board (SRB2) that contains 2 safety relays and an interconnection cable with the power circuit.

Figure 7.1 shows the location of the SRB2 board and the XC25 terminal strip, used for the connection of the SRB2 board signals.

The coils of these relays are available at the XC25 terminal strip, as presented in the table 7.1.

DANGER!
The activation of the Safety Stop, i.e., disconnection of the 24 Vdc power supply from the safety relay coils (XC25: 1(+) and 2(-); XC25:3(+) and 4(-)) does not guarantee the electrical safety of the motor terminals (they are not isolated from the power supply in this condition).

Operation:

1. The Safety Stop function is activated by disconnecting the 24 Vdc voltage from the safety relay coil (XC25:1(+) and 2(-); XC25:3(+) and 4(-)).

2. Upon activation of the Safety Stop, the PWM pulses at the inverter output will be disabled and the motor will coast to stop.
   The inverter will not start the motor or generate a rotating magnetic field even in the event of an internal failure (pending certification).
   The keypad will display a message informing that the Safety Stop is active.

3. In order to return to the normal operation after the Safety Stop activation, it is first necessary to apply 24 Vdc to the relay coils (XC25:1(+) and 2(-); XC25:3(+) and 4(-)).

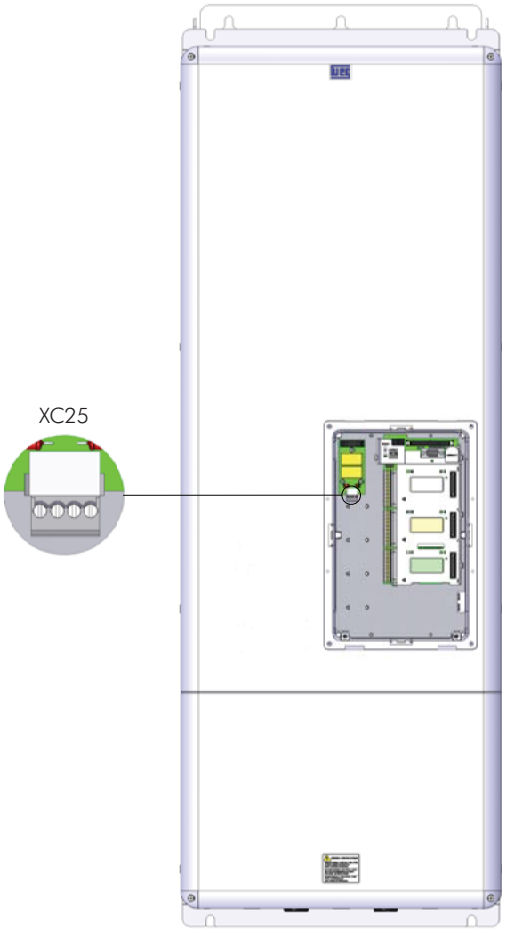


Figure 7.1 - *Location of the SRB2 board in the frame size F and G CFW-11 inverters*

Table 7.1 - *XC25 connections*

XC 25 Terminal strip		Function	Specifications
1	R1+	Relay 1 coil terminal 1	Rated coil voltage: 24 V, range from 20 to 30 Vdc Coil resistance: 960 Ω ±10 % @ 20 °C (68 °F)
2	R1-	Relay 1 coil terminal 2	
3	R2+	Relay 2 coil terminal 1	Rated coil voltage: 24 V, range from 20 to 30 Vdc Coil resistance: 960 Ω ±10 % @ 20 °C (68 °F)
4	R2-	Relay 2 coil terminal 2	

7.1.2 24 Vdc External Control Power Supply

Inverters with the following codification: CFW11XXXXXXOW.

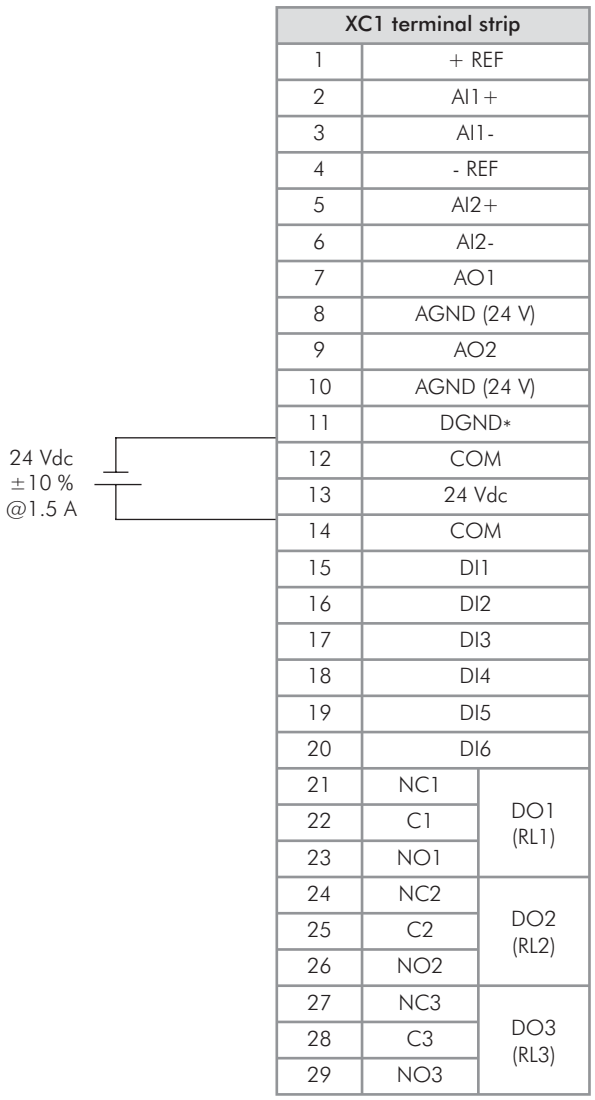
The use of this option kit is recommended with communication networks (Profibus, DeviceNet, etc.), since the control circuit and the network communication interface are kept active (with power supply and responding to the network communication commands) even in the event of main power supply interruption.

Inverters with this option have a built-in DC/DC converter with a 24 Vdc input that provides adequate outputs for the control circuit. Therefore, the control circuit power supply will be redundant, i.e., it can be provided either by a 24 Vdc external power supply (connection as shown in figure 7.2) or by the standard internal switched mode power supply of the inverter.

Observe that the inverters with the external 24 Vdc power supply option use terminals XC1:11 and 13 as the input for the external power supply and no longer as the output like in the standard inverter (figure 7.2).

In case of interruption of the external 24 Vdc power supply, the digital inputs/outputs and analog outputs will no longer be fed, even if the mains power is on. Therefore, it is recommended to keep the 24 Vdc power supply always connected to the terminals XC1:11 and 13.

The keypad displays warnings indicating the inverter status: whether the 24 Vdc power source is connected, whether the mains power source is connected, etc.



XC1 terminal strip		
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	NC1	DO1 (RL1)
22	C1	
23	NO1	
24	NC2	DO2 (RL2)
25	C2	
26	NO2	
27	NC3	DO3 (RL3)
28	C3	
29	NO3	

Figure 7.2 - *External 24 Vdc power supply capacity and connection terminals*

NOTE!
A class 2 power supply must be used in order to comply with the UL508C standard.

7.2 ACCESSORIES

The accessories are installed in the inverter easily and quickly using the "Plug and Play" concept. Once the accessory is inserted into the slot, the control circuitry identifies its model and displays the installed accessory code in P0027 or P0028. The accessory must be installed with the inverter power supply off.

Part number and model of each available accessory are presented in the table 7.2. The accessories can be ordered separately and will be shipped in individual packages containing the components and the manual with detailed instructions for the product installation, operation, and programming.

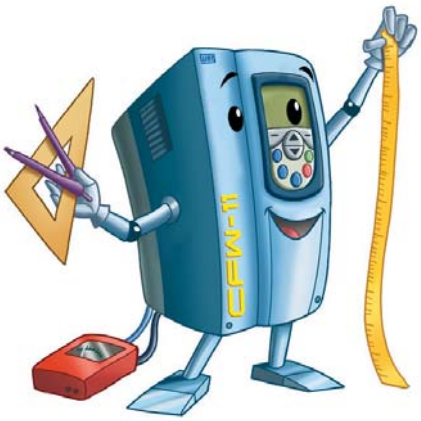
ATTENTION!
Only one module at a time can be fitted into each slot (1, 2, 3, 4 or 5).

Table 7.2 - *Accessory models*

WEG Part Number	Name	Description	Slot	Identification Parameters	
				P0027	P0028
Control accessories for installation in the Slots 1, 2 and 3					
11008162	IOA-01	IOA module: 1 voltage/current analog input (14 bits); 2 digital inputs; 2 voltage/current analog outputs (14 bits); 2 open-collector digital outputs.	1	FD--	----
11008099	IOB-01	IOB module: 2 isolated analog inputs (voltage/current); 2 digital inputs; 2 isolated analog outputs (voltage/current) (the programming of the outputs is identical as in the standard CFW-11); 2 open-collector digital outputs.	1	FA--	----
11008100	ENC-01	5 to 12 Vdc incremental encoder module, 100 kHz, with an encoder signal repeater.	2	--C2	----
11008101	ENC-02	5 to 12 Vdc incremental encoder module, 100 kHz.	2	--C2	----
11008102	RS485-01	RS-485 serial communication module (Modbus).	3	----	CE--
11008103	RS232-01	RS-232C serial communication module (Modbus).	3	----	CC--
11008104	RS232-02	RS-232C serial communication module with DIP-switches for programming the microcontroller FLASH memory.	3	----	CC--
11008105	CAN/RS485-01	CAN and RS-485 interface module (CANopen / DeviceNet / Modbus).	3	----	CA--
11008106	CAN-01	CAN interface module (CANopen / DeviceNet).	3	----	CD--
11008911	PLC11-01	PLC module.	1, 2 and 3	----	--xx(1)(3)
11126732	IOE-01	Input module with 5 PTC type sensors.	1	25--	----
11126735	IOE-02	Input module with 5 PT100 type sensors.	1	23--	----
11126750	IOE-03	Input module with 5 KTY84 type sensors.	1	27--	----
11126674	IOC-01	IOC module with 8 digital inputs and 4 relay outputs (use with SoftPLC).	1	C1	----
11126730	IOC-02	IOC module with 8 digital inputs and 8 NPN open collector digital outputs (use with SoftPLC).	1	C5	----
11045488	PROFIBUS DP-01	Profibus DP communication module.	3	----	C9
Anybus-CC accessories for installation in the 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 (passive) interface module (Modbus).	4	----	--xx(2)(3)
11008161	RS485-05	RS-485 (passive) interface module (Modbus).	4	----	--xx(2)(3)
Flash Memory Module for installation in the Slot 5 – Factory Settings Included					
11008912	MMF-01	FLASH memory module.	5	----	--xx(3)
Stand-alone HMI, blank cover, and frame for remote mounted HMI					
11008913	HMI-01	Stand-alone HMI. (4)	HMI	-	-
11010521	RHMIF-01	Remote HMI frame kit (IP56).	-	-	-
11010298	HMID-01	Blank cover for the HMI slot.	HMI	-	-
Miscellaneous					
11337634	KMF-01	Frame size F movement kit.	-	-	-
11337714	KMG-01	Frame size G movement kit.	-	-	-
10960847	CCS-01	Control cable shielding kit (supplied with the product).	-	-	-
10960846	CONRA-01	Control rack (containing the CC11 control board).	-	-	-

(1) Refer to the PLC module manual.
(2) Refer to the Anybus-CC communication manual.
(3) Refer to the programming manual.
(4) Use DB-9 pin, male-to-female, straight-through cable (serial mouse extension type) for connecting the keypad to the inverter or Null-Modem standard cable. Maximum cable length: 10 m (33 ft).
Examples:
- Mouse extension cable - 1.80 m (6 ft); Manufacturer: Clone.
- Belkin pro series DB9 serial extension cable 5 m (17 ft); Manufacturer: Belkin.
- Cables Unlimited PCM195006 cable, 6 ft DB9 m/f; Manufacturer: Cables Unlimited.

TECHNICAL SPECIFICATIONS



This chapter describes the technical specifications (electric and mechanical) of the CFW-11 inverter series frame sizes F and G models.

8.1 POWER DATA

Power Supply:

- ☑ Voltage tolerance: -15 % to +10 %.
- ☑ Frequency: 50/60 Hz (48 Hz to 62 Hz).
- ☑ Phase imbalance: ≤3 % of the rated phase-to-phase input voltage.
- ☑ Overvoltage according to Category III (EN 61010/UL 508C).
- ☑ Transient voltage according to Category III.
- ☑ Maximum of 60 connections per hour (1 per minute).
- ☑ Typical efficiency: ≥ 97 %.
- ☑ Typical input power factor: 0.94 in nominal conditions.

Table 8.1 - *Technical specifications of the CFW-11 inverter series frame sizes F and G models at rated switching frequencies*

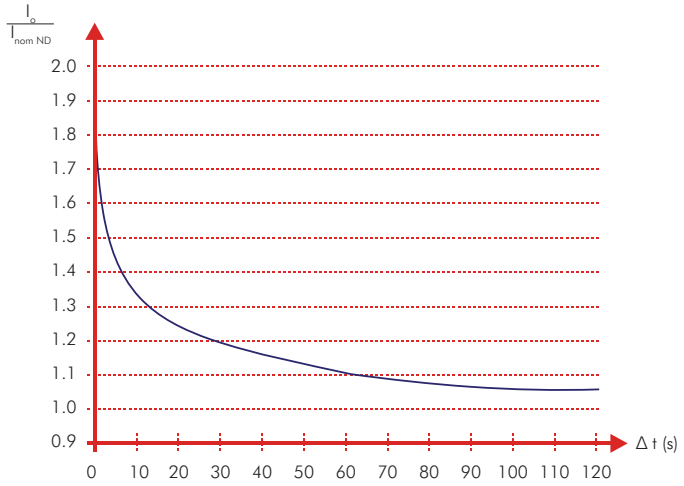
Model			CFW11 0242 T 4	CFW11 0312 T 4	CFW11 0370 T 4	CFW11 0477 T 4	CFW11 0515 T 4	CFW11 0601 T 4	CFW11 0720 T 4
Frame size			F				G		
Number of power phases			3Φ						
Use with Normal Duty (ND) cycle	Rated output current (1) [Arms]		242	312	370	477	515	601	720
	Overload current (2) [Arms]	1 min	266	343	407	525	567	662	792
		3 s	363	468	555	716	773	900	1080
	Rated switching frequency [kHz]		2.5	2.5	2.5	2.5	2.0	2.0	2.0
	Maximum motor (3) [HP/kW]		200/150	250/185	300/220	400/300	400/300	500/370	600/440
	Rated input current [Arms]		242	312	370	477	515	601	720
	Dissipated power [W]	Surface mounting (4)	1518	2034	2497	3273	3338	3875	4576
		Flange mounting (5)	285	375	407	595	769	781	858
Use with Heavy Duty (HD) cycle	Rated output current (1) [Arms]		211	242	312	370	477	515	560
	Overload current (2) [Arms]	1 min	317	363	468	555	716	773	840
		3 s	422	484	624	740	954	1030	1120
	Rated switching frequency [kHz]		2.5	2.5	2.5	2.5	2.0	2.0	2.0
	Maximum motor (3) [HP/kW]		175/132	200/150	250/185	300/220	400/300	400/300	450/330
	Rated input current [Arms]		211	242	312	370	477	515	560
	Dissipated power [W]	Surface mounting (4)	1277	1507	2008	2451	2987	3219	3747
		Flange mounting (5)	227	292	320	465	644	639	653
Surrounding air temperature [°C (°F)]			-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...40 °C (14...104 °F)
RFI filter			Built-in						
Weight [kg (lb)]			130	132	135	140	204	207	215
Availability of option kits that can be integrated into the product (refer to the smart code in the chapter 2)		Safety stop	Yes						
		24 Vdc external control power supply	Yes						

Notes:

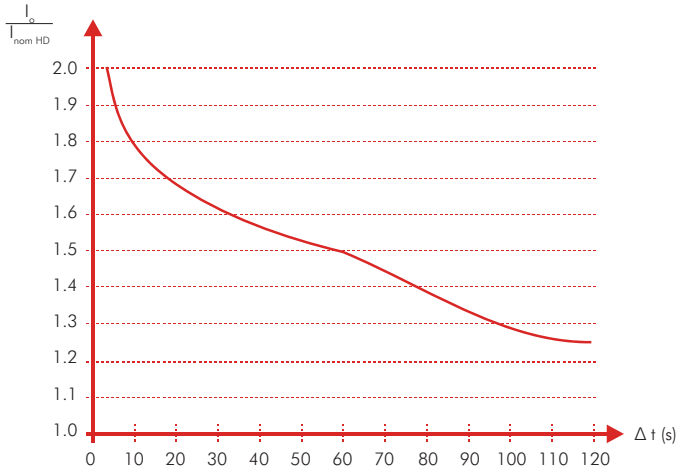
(1) Steady state rated current in the following conditions:

- Indicated switching frequencies. It is necessary to derate the rated output current of the inverter for the operation with switching frequency of 5 kHz, as shown in table 8.2. It is not possible to operate the CFW-11 sizes F and G models with the switching frequency of 10 kHz.
- Surrounding air temperature as specified in the table. For higher temperatures, limited to 55 °C (131 °F), the output current must be derated by 2 % for each °C above the maximum specified temperature.
- Relative air humidity: 5 % to 90 % non-condensing.
- Altitude: 1000 m (3,300 ft). Above 1000 m (3,300 ft) up to 4000 m (13,200 ft) the output current must be derated by 1 % for each 100 m (330 ft) above 1000 m (3,300 ft).
- Ambient with pollution degree 2 (according to EN50178 and UL508C).

(2) Table 8.1 presents only two points of the overload curve (activation time of 1 min and 3 s). The complete IGBT overload curves for Normal and Heavy Duty Cycles are presented next.



(a) IGBTs overload curve for the Normal Duty (ND) cycle



(b) IGBTs overload curve for the Heavy Duty (HD) cycle

Figure 8.1 (a) and (b) - *Overload curves for the IGBTs*

Depending on the inverter operational conditions, as the surrounding air temperature and the output frequency, the maximum time for operation of the inverter with overload may be reduced.

(3) The motor power ratings are merely a guide for 230 V or 460 V, IV pole WEG motors. The adequate inverter sizing must be based on the used motor rated current.
(4) The information provided about the inverter losses is valid for the rated operating condition, i.e., for rated output current and rated switching frequency.
(5) The dissipated power provided for flange mounting corresponds to the total inverter losses disregarding the power module (IGBT and rectifier) losses.

Table 8.2 - *Technical specifications of the CFW-11 inverter series frame sizes F and G models at 5 kHz switching frequency*

Model			CFW11 0242 T 4	CFW11 0312 T 4	CFW11 0370 T 4	CFW11 0477 T 4	CFW11 0515 T 4	CFW11 0601 T 4	CFW11 0720 T 4
Frame size			F				G		
Number of power phases			3Φ						
Use with Normal Duty (ND) cycle	Rated output current (1) [Arms]		175	225	266	343	343	390	468
	Overload current [Arms]	1 min	193	248	293	377	377	429	515
		3 s	263	338	399	515	515	585	702
	Rated switching frequency [kHz]		5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Maximum motor (2) [HP/kW]		150/110	175/132	200/150	300/220	270/200	300/220	400/300
	Rated input current [Arms]		175	225	266	343	343	390	468
	Dissipated power [W]	Surface mounting (3)	905	1329	1558	1950	2062	2339	2727
		Flange mounting (4)	221	295	324	472	624	624	669
Use with Heavy Duty (HD) cycle	Rated output current (1) [Arms]		152	175	225	266	318	335	364
	Overload current [Arms]	1 min	228	263	338	400	515	773	840
		3 s	304	350	450	422	686	1030	1120
	Rated switching frequency [kHz]		5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Maximum motor (2) [HP/kW]		125/90	150/110	175/132	200/150	250/185	270/200	300/220
	Rated input current [Arms]		152	175	225	266	318	335	364
	Dissipated power [W]	Surface mounting (3)	802	1068	1328	1574	1914	2058	2191
		Flange mounting (4)	206	270	294	431	585	581	591
Surrounding air temperature [°C (°F)] (1)			-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...45 °C (14...113 °F)	-10...40 °C (14...104 °F)
RFI filter			Built-in						
Weight [kg (lb)]			130	132	135	140	204	207	215
Availability of option kits that can be integrated into the product (refer to the smart code in the chapter 2)	Safety stop		Yes						
	24 Vdc external control power supply		Yes						

Notes:

(1) Steady state rated current in the following conditions:
- 5 kHz switching frequency.
- Surrounding air temperature as specified in the table. For higher temperatures, limited to 55 °C (131 °F), the output current must be derated by 2 % for each °C above the maximum specified temperature.
- Relative air humidity: 5 % to 90 % non-condensing.
- Altitude: 1000 m (3,300 ft). Above 1000 m (3,300 ft) up to 4000 m (13,200 ft) the output current must be derated by 1 % for each 100 m (330 ft) above 1000 m (3,300 ft).
- Ambient with pollution degree 2 (according to EN50178 and UL508C).

(2) The motor power ratings are merely a guide for 230 V or 460 V, IV pole WEG motors. The adequate inverter sizing must be based on the used motor rated current.

(3) The information provided about the inverter losses is valid for the rated operating condition, i.e., for rated output current and rated switching frequency.

(4) The dissipated power provided for flange mounting corresponds to the total inverter losses disregarding the power module (IGBT and rectifier) losses.

8.2 ELECTRONICS/GENERAL DATA

CONTROL	METHOD	☑ Voltage source. ☑ Type of control: - V/f (Scalar); - VVW: Voltage Vector Control; - Vector control with encoder; - Sensorless vector control (without encoder). ☑ PWM SVM (Space Vector Modulation). ☑ Full digital (software) current, flux, and speed regulators. Execution rate: - current regulators: 0.2 ms (5 kHz); - flux regulator: 0.4 ms (2.5 kHz); - speed regulator / speed measurement: 1.2 ms.
	OUTPUT FREQUENCY	☑ 0 to 3.4 x rated motor frequency (P0403). The rated frequency is programmable from 0 Hz to 300 Hz in the scalar mode and from 30 Hz to 120 Hz in the vector mode. ☑ Output frequency limits as a function of the switching frequency: 125 Hz (switching frequency = 1.25 kHz); 250 Hz (switching frequency = 2.5 kHz); 500 Hz (switching frequency = 5 kHz).
PERFORMANCE	SPEED CONTROL	<u>V/f (Scalar):</u> ☑ Regulation (with slip compensation): 1 % of the rated speed. ☑ Speed variation range: 1:20. <u>VVW:</u> ☑ Regulation: 1 % of the rated speed. ☑ Speed variation range: 1:30. <u>Sensorless (P0202=3 asynchronous motor):</u> ☑ Regulation: 0.5 % of the rated speed. ☑ Speed variation range: 1:100. <u>Vector with Encoder (P0202=4 asynchronous motor or P0202=6 permanent magnet):</u> ☑ Regulation: ±0.01 % of the rated speed with a 14-bits analog input (IOA); ±0.01 % of the rated speed with a digital reference (Keypad, Serial, Fieldbus, Electronic Potentiometer, Multispeed); ±0.05 % of the rated speed with a 12-bits analog 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 (P0202=3, above 3 Hz).
INPUTS (CC11 Board)	ANALOG	☑ 2 isolated differential inputs; resolution of AI1: 12 bits, resolution of 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 analog outputs, (0 to 10) V, $R_L \geq 10$ kΩ (maximum load), 0 to 20 mA / 4 to 20 mA ($R_L \leq 500$ Ω) resolution: 11 bits, programmable functions.
	RELAY	☑ 3 relay outputs with NO/NC contacts, 240 Vac, 1 A, programmable functions.
SAFETY	PROTECTION	☑ Output overcurrent/short-circuit; ☑ Under/Overvoltage; ☑ Phase loss; ☑ Overtemperature; ☑ Braking resistor overload; ☑ IGBTs overload; ☑ Motor overload; ☑ External fault/alarm; ☑ CPU or memory fault; ☑ Output phase-ground short-circuit.
INTEGRAL KEYPAD (HMI)	STANDARD KEYPAD	☑ 9 operator keys: Start/Stop, Up arrow, Down arrow, Direction of rotation, Jog, Local/Remote, Right soft key and Left soft key; ☑ Graphical LCD display; ☑ View/edition of parameters; ☑ Indication accuracy: - current: 5 % of the rated current; - speed resolution: 1 rpm; ☑ Possibility of remote mounting.
ENCLOSURE	IP20	☑ Standard.
	IP00	☑ Special DC hardware.
PC CONNECTION FOR INVERTER PROGRAMMING	USB CONNECTOR	☑ USB standard Rev. 2.0 (basic speed); ☑ Type B (device) USB plug; ☑ Interconnection 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**: The final assembler of the machine is responsible for installing an safety stop device and a supply disconnecting device. ☑ 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 (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 STANDARDS	☑ EN 60529 - Degrees of protection provided by enclosures (IP code). ☑ UL 50 - Enclosures for electrical equipment.

8.3 MECHANICAL DATA

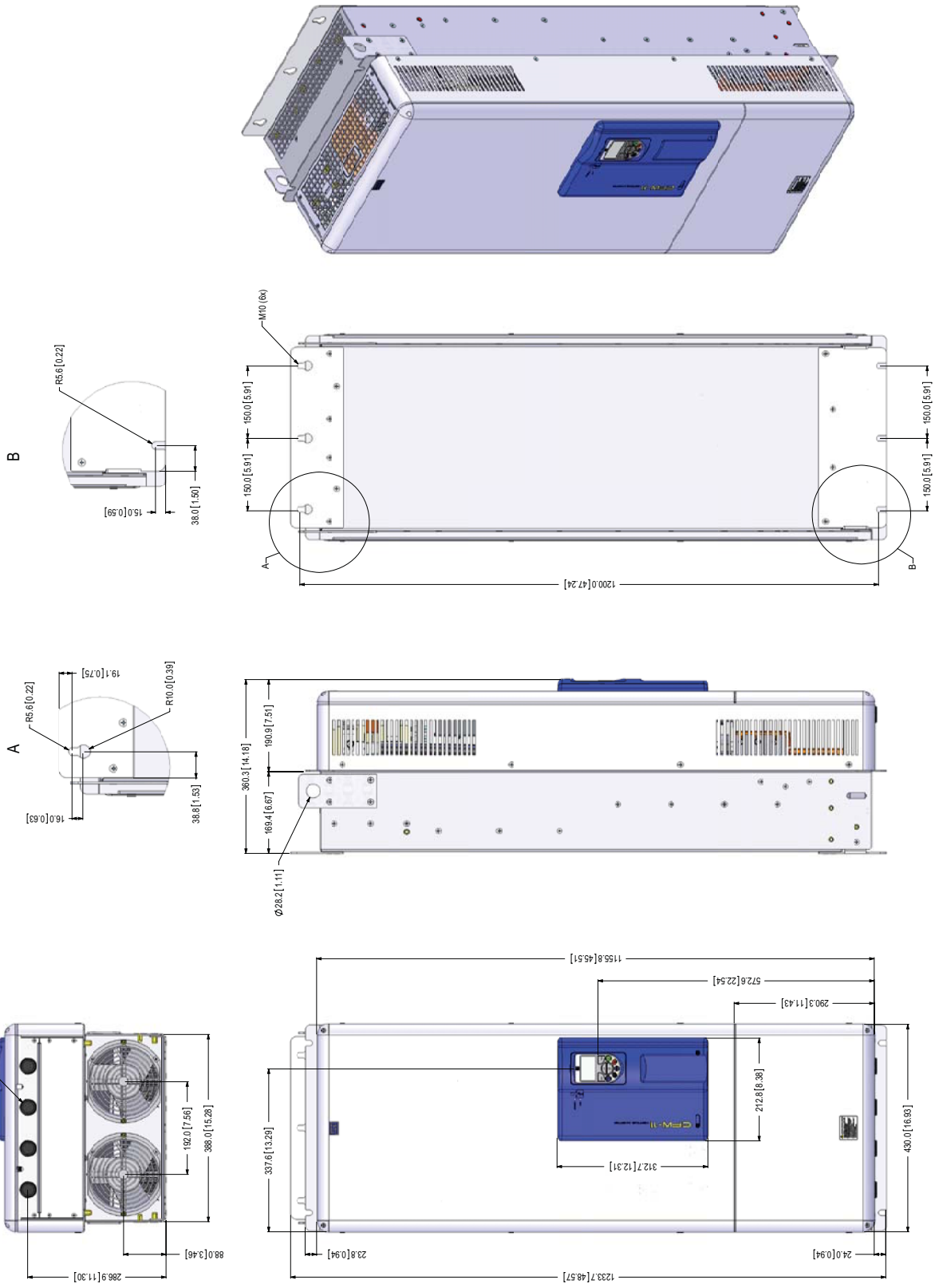


Figure 8.2 - *Frame size F dimensions - mm [in]*

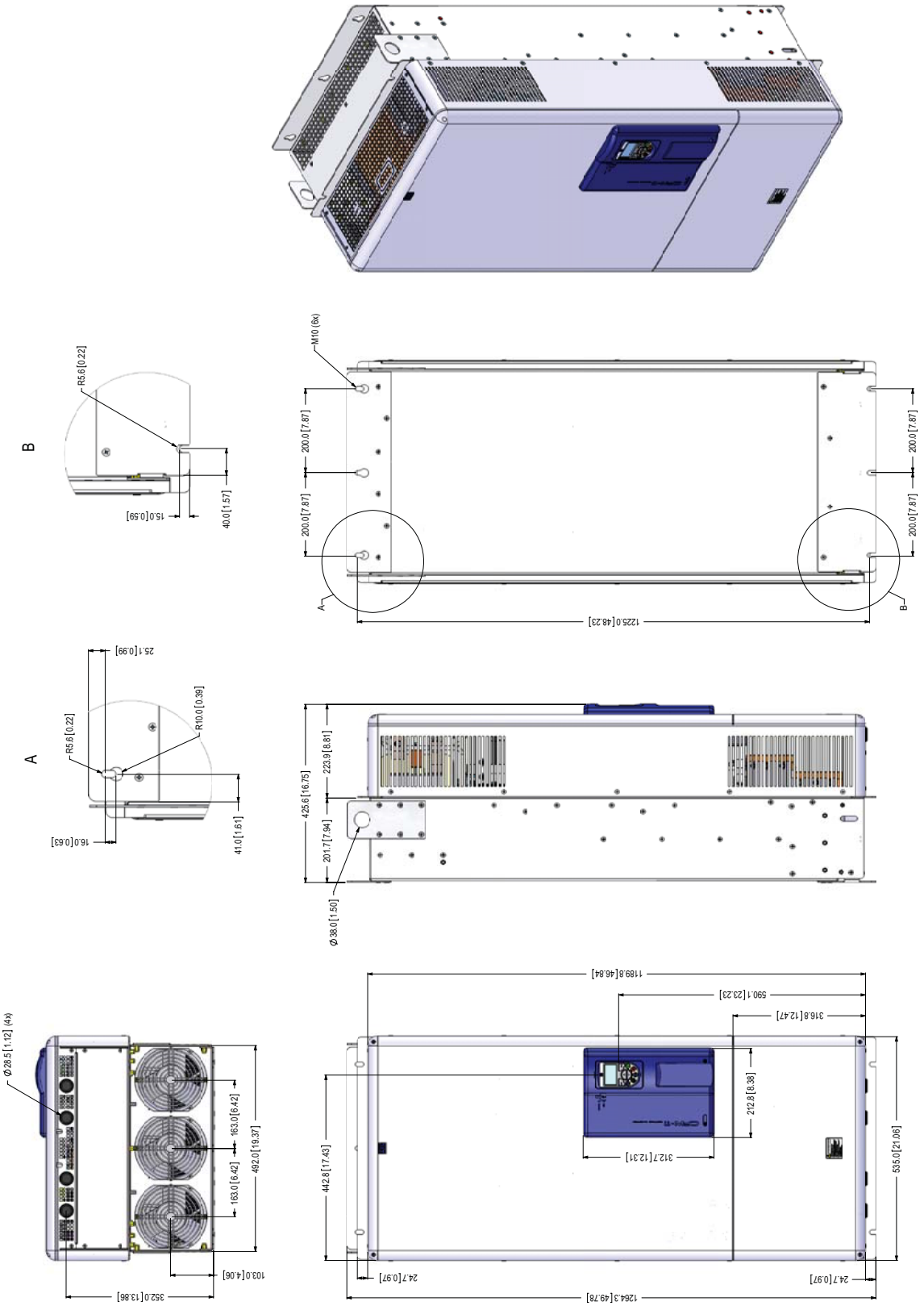


Figure 8.3 - *Frame size G dimensions - mm [in]*