Motors | Automation | Energy | Transmission & Distribution | Coatings

Frequency Inverter

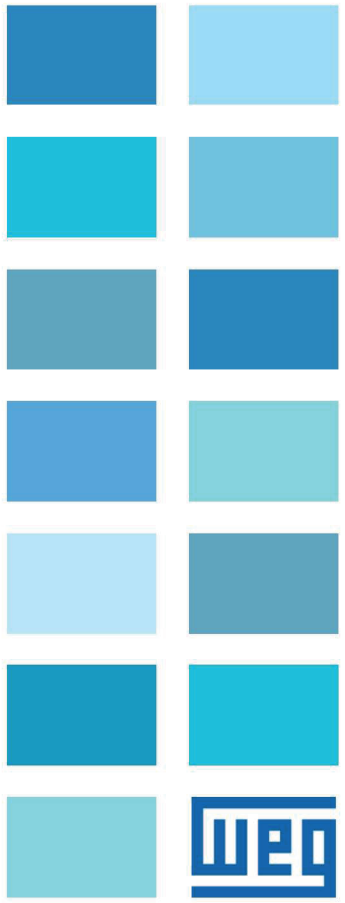
CFW500

User's Manual

AGISYS

BEST

Bonfiglioli



weg

English

The information below describes the reviews made in this manual.

Version	Review	Description
-	R00	First edition
-	R01	General review and inclusion of the new models
-	R02	Modification in Table B.6 on page 166 and in the printing of the filter switch
-	R03	General review and inclusion of frame size D
-	R04	General review
-	R05	General review and inclusion of frame size C 500 / 600 V
-	R06	General review and inclusion of frame size E
-	R07	General review
-	R08	General review, inclusion of frame size F and functional safety
-	R09	General overhaul, inclusion of F 200 V frame, G frame and IP66 protection rating

NOTE!
The inverters CFW500 have the default parameters set as described below:
- 60 Hz for models without internal filter.
- 50 HZ for models with internal filter (check the smart code E.g.: CFW500A04P3S2NB20C2).

ATTENTION!
Check the frequency of the power supply.
In case the power supply frequency is different from the default frequency (check P0403), it is necessary to set:
- P0204 = 5 for 60 Hz.
- P0204 = 6 for 50 Hz.

It is only necessary to set these parameters once.
Refer to the programming manual of the CFW500 for further details about the setting of parameter P0204.

English

1 SAFETY INSTRUCTIONS

This manual contains the information necessary for the correct use of the frequency inverter CFW500.

It was developed to be operated by people with proper technical training or qualification to handle this kind of equipment. Those people must follow the safety instructions defined by local standards. The non compliance with the safety instructions may result in death risks and/or damages to the equipment.

1.1 SAFETY WARNINGS IN THIS MANUAL

DANGER!
The procedures recommended in this warning aim at protecting the user against death, serious injuries and considerable material damages.

DANGER!
Les procédures concernées par cet avertissement sont destinées à protéger l'utilisateur contre des dangers mortels, des blessures et des détériorations matérielles importantes.

ATTENTION!
The procedures recommended in this warning aim at preventing material damages.

NOTE!
The information mentioned in this warning is important for the proper understanding and good operation of the product.

1.2 SAFETY WARNINGS IN THE PRODUCT

High voltages present.

Components sensitive to electrostatic discharges. Do not touch them.

The connection to the protection grounding is required (PE).

Connection of the shield to the grounding.

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!
Always disconnect the general power supply before changing any electric component associated to the inverter. Many components may remain loaded with high voltages and/or moving (fans), even after the AC power supply input is disconnected or turned off. Wait for at least ten minutes in order to guarantee the full discharge of the capacitors. Always connect the grounding point of the inverter to the protection grounding.

DANGER!
Débranchez toujours l'alimentation principale avant d'entrer en contact avec un appareil électrique associé au variateur. Plusieurs composants peuvent rester chargés à un potentiel électrique élevé et/ou être en mouvement (ventilateurs), même après la déconnexion ou la coupure de l'alimentation en courant alternatif. Attendez au moins 10 minutes que les condensateurs se déchargent complètement. Toujours connecter le point de mise à la terre du variateur sur la mise à la terre de protection.

NOTES!
- Frequency inverters may interfere in other electronic equipment. Observe the recommendations of Chapter 3 INSTALLATION AND CONNECTION on page 13 in order to minimize these effects.
- Read the entire manual before installing or operating this inverter.

Do not execute any applied potential test (hi-pot test) on the inverter!
If necessary, contact WEG.

ATTENTION!
The electronic cards have components sensitive to electrostatic discharges. Do not touch the components or connectors directly. If necessary, first touch the grounding point of the inverter which must be connected to the protection ground or use a proper grounding strap.

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

DANGER!
This product was not designed to be used as a safety element. Additional measures must be taken so as to avoid material and personal damages.
The product was manufactured under strict quality control, however, if installed in systems where its failure causes risks of material or personal damages, additional external safety devices must ensure a safety condition in case of a product failure, preventing accidents.

DANGER!
Risque d'écrasement
Afin d'assurer la sécurité dans les applications de levage de charges, les équipements électriques et/ou mécaniques doivent être installés hors du variateur pour éviter une chute accidentelle des charges.

DANGER!
Ce produit n'est pas conçu pour être utilisé comme un élément de sécurité. Des précautions supplémentaires doivent être prises afin d'éviter des dommages matériels ou corporels.
Ce produit a été fabriqué sous un contrôle de qualité conséquent, mais s'il est installé sur des systèmes où son dysfonctionnement entraîne des risques de dommages matériels ou corporels, alors des dispositifs de sécurité externes supplémentaires doivent assurer des conditions de sécurité en cas de défaillance du produit, afin d'éviter des accidents.

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

English

2 GENERAL INFORMATION

2.1 ABOUT THE MANUAL

This manual contains information for the proper installation and operation of the inverter, as well as start-up procedures, main technical features and how to identify the most usual problems of the different models of inverters of the line CFW500.

ATTENTION!
The operation of this equipment requires detailed installation and operation instructions provided in the user's manual, programming manual and communication manuals. These file are available on the WEG's website - www.weg.net. A printed copy of the files can be requested at your local WEG dealer.

NOTE!
It is not the intention of this manual to present all the possibilities for the application of the CFW500, as well as WEG cannot take any liability for the use of the CFW500 which is not based on this manual.

Part of the figures and tables are available in the appendixes, which are divided into APPENDIX A - FIGURES on page 152 and APPENDIX B - TECHNICAL SPECIFICATIONS on page 158. The information is presented in three languages.

2.2 ABOUT THE CFW500

The frequency inverter CFW500 is a high-performance product which allows the speed and torque control of three-phase induction motors. This product offers up to four options to control the motor: V/f scalar control, VVW control, vector control with sensor and sensorless.

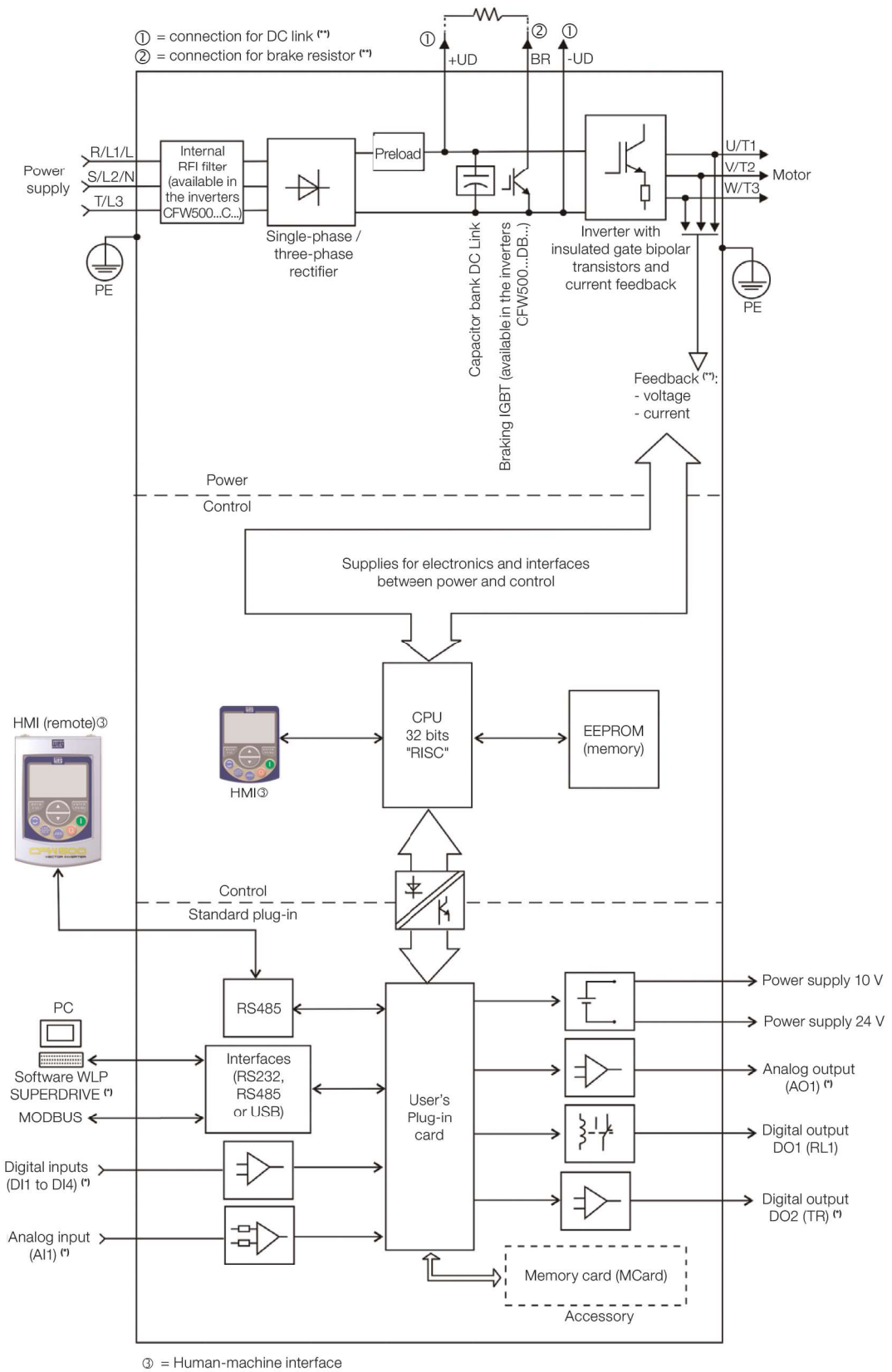
In the vector control, the operation is optimized for the used motor, providing a better performance in terms of speed and torque control. The "Self-Tuning" function, available for the vector control, allows the automatic setting of control parameters and controllers based on the identification of the motor parameters.

The VVW control (Voltage Vector WEG) has a performance and precision between the V/f scalar control and the vector control; on the other hand, it adds robustness and simplicity to drive motors without speed sensors. The self-tuning function is also available in the VVW control.

The scalar control (V/f) is recommended for simpler applications, such as the activation of most pumps and fans. The V/f mode is used when more than a motor is activated by an inverter simultaneously (multimotor applications).

The frequency inverter CFW500 also has functions of PLC (Programmable Logic Controller) by means of the SoftPLC (integrated) feature. For further details regarding the programming of those functions, refer to the SoftPLC user's manual of the CFW500.

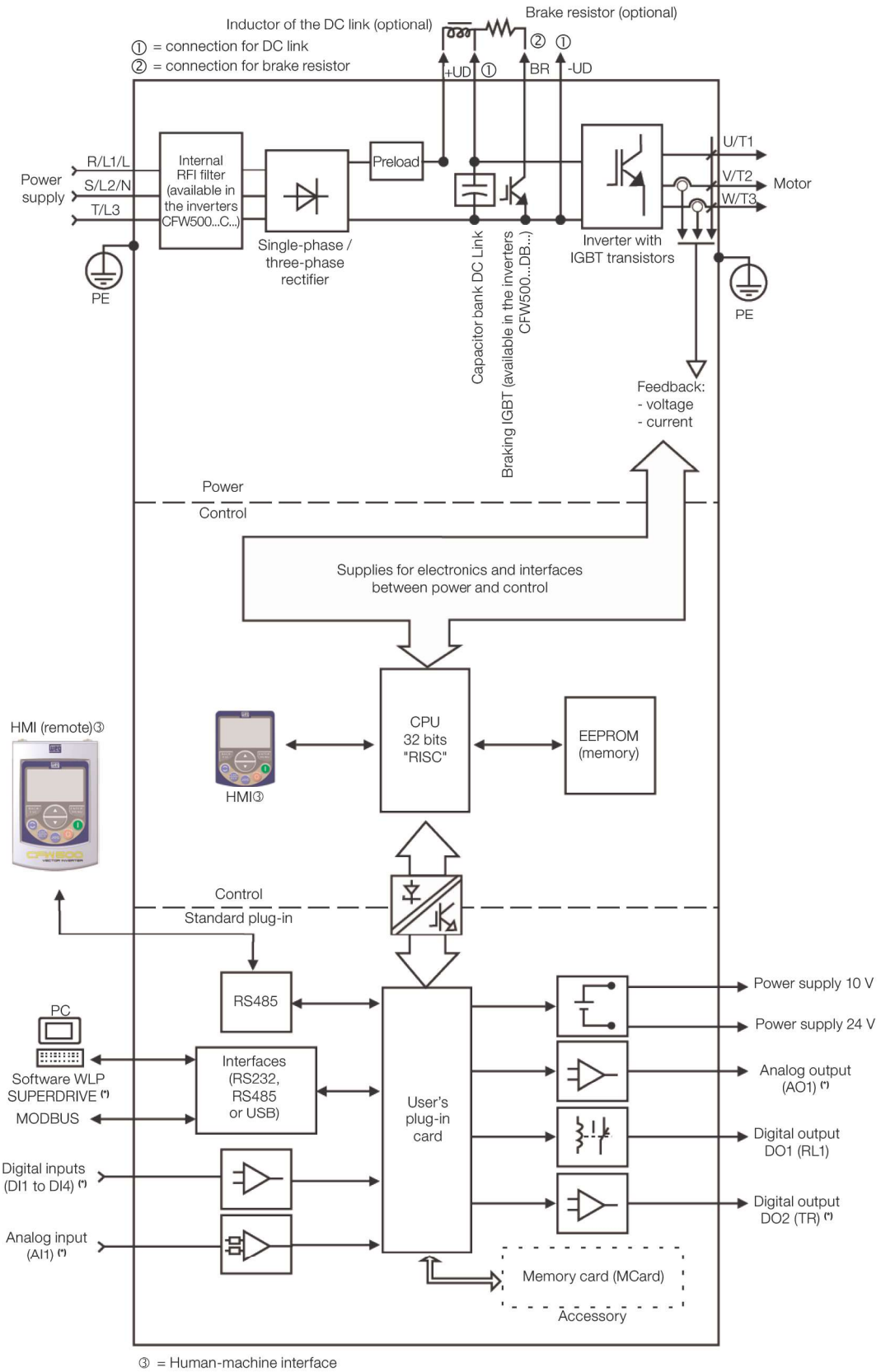
The main components of the CFW500 can be viewed in the block diagram Figure 2.1 on page 5 for frame sizes A, B, and C, Figure 2.2 on page 6 for frame sizes D and E and Figure 2.3 on page 7 for frame sizes F and G.



(*) The number of analog/digital inputs/outputs, as well as other resources, may vary according to the plug-in module used. For further information, refer to the guide supplied with the accessory.

(**) Not available in frame size A.

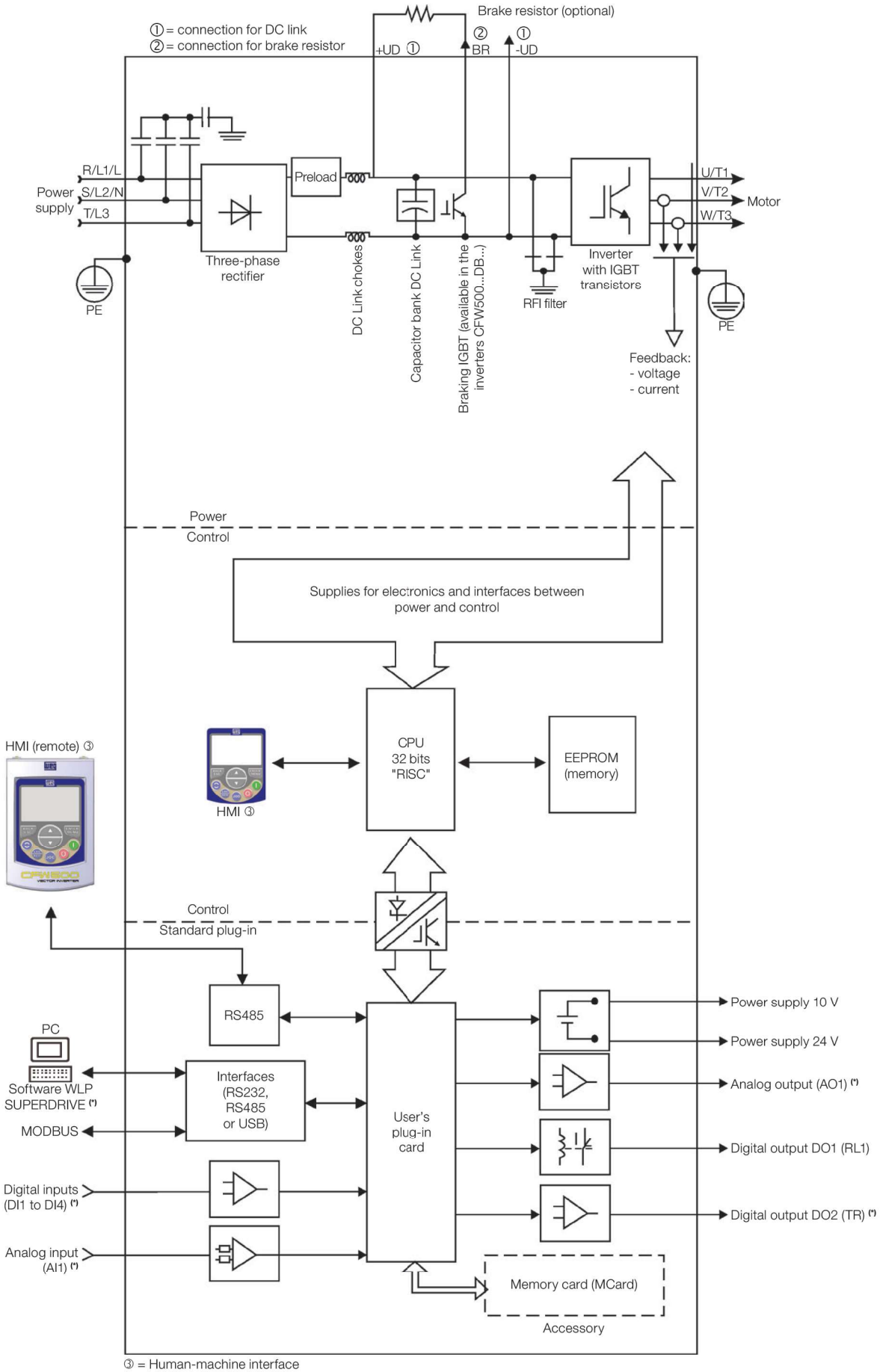
Figure 2.1: *Block diagram of CFW500 for frame sizes A, B and C*



③ = Human-machine interface

(*) The number of analog/digital inputs/outputs, as well as other resources, may vary according to the plug-in module used. For further information, refer to the guide supplied with the accessory.

Figure 2.2: *Block diagram of CFW500 for frame sizes D and E*



(*) The number of analog/digital inputs/outputs, as well as other resources, may vary according to the plug-in module used. For further information, refer to the guide supplied with the accessory.

Figure 2.3: *Block diagram of CFW500 for frame sizes F and G*

2.3 NOMENCLATURE

Table 2.1: Nomenclature of the inverters CFW500

	Product and Series	Identification of the Model				Brake (*)	Protection Rate (*)	Conducted Emission Level (*)	Safety Functions	Disconnecting Switch	Hardware Version	Special Software Version	Generation
		Frame Size	Rated Current	No of Phases	Rated Voltage								
Eg.:	CFW500	A	02P6	T	4	NB	20	C2	--	--	---	--	--
Available options	CFW500	See Table 2.2 on page 9							Blank = without safety functons	Blank = without disconnecting switch		Blank = standard	Blank = Generation 1
									Y2 = with safety functons (STO and SS1-t, as per IEC/ EN 61800-5-2)	DS = with disconnecting switch		Sx = special software	
		NB = without dynamic braking									Blank = standard plug-in module		G2 = Generation 2
		DB = with dynamic braking									H00 = without plug-in		
		20 = IP20											
		66 = IP66											
		N1 = cabinet Nema1 (type 1 as per UL) (protection rate according to standard IEC IP20)						Blank = it does not meet the levels of standards for conducted emission					
								C2 or C3 = as per category 2 (C2) or 3 (C3) of IEC/EN 61800-3, with internal RFI filter					

(*) The available options for each model are in Table 2.2 on page 9.

NOTE!
For models with a special software version (Sx in the smart code) and for specific applications, refer to the application manual available for download on **www.weg.net**.

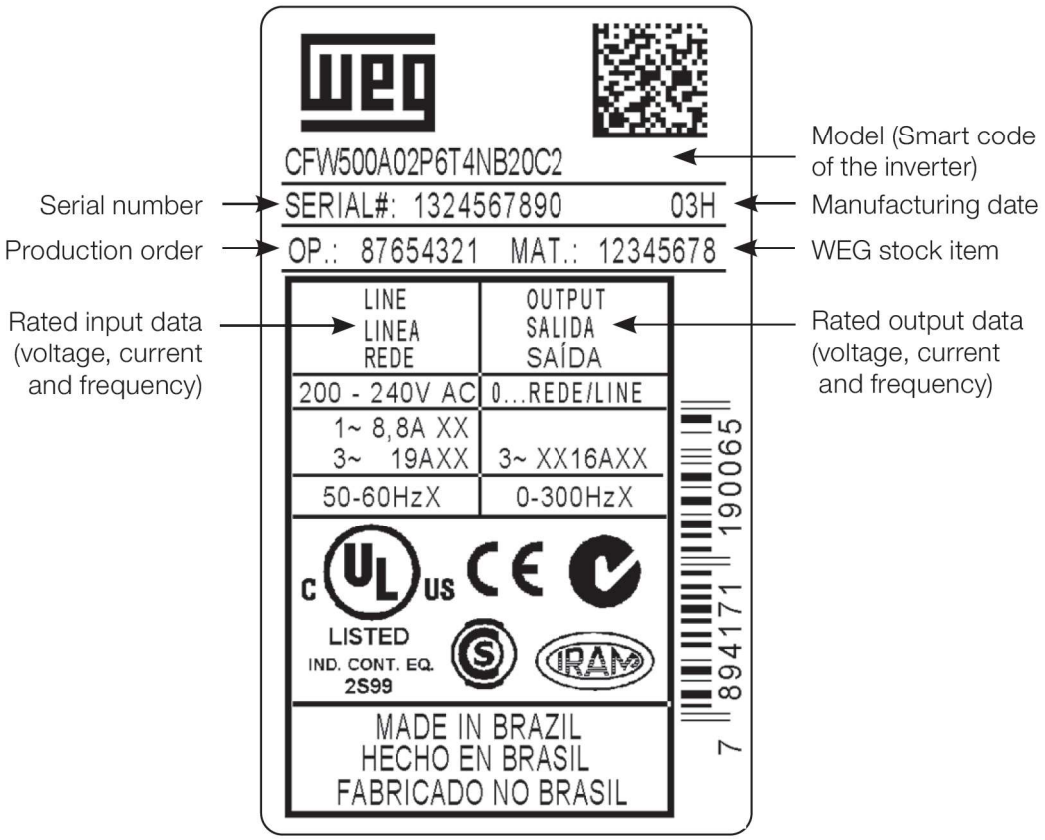
Table 2.2: *Available options for each field of the nomenclature according to the rated current and voltage of the inverter*

Frame Size	Output Rated Current (1)	N° of Phases	Rated Voltage	Available Options for the Remaining Identification Codes of the Inverters			
				Brake	Protection Rate	Conducted Emission Level	Hardware Version
A	01P6 = 1.6 A	S = single-phase power supply	2 = 200... 240 V	NB	20 or N1	Blank or C2	Blank or H00
	02P6 = 2.6 A						
	04P3 = 4.3 A						
	07P0 = 7.0 A					Blank or C3	
B	07P3 = 7.3 A			DB		C2	
	10P0 = 10 A						
A	01P6 = 1.6 A	B = single-phase or three-phase power supply		NB		Blank	
	02P6 = 2.6 A						
	04P3 = 4.3 A						
B	07P3 = 7.3 A			DB			
	10P0 = 10 A						
A	07P0 = 7.0 A	T = three-phase power supply		NB			
	09P6 = 9.6 A						
B	16P0 = 16 A			DB		Blank or C3	
C	24P0 = 24 A						
D	28P0 = 28 A						
	33P0 = 33 A						
	47P0 = 47 A						
E	56P0 = 56 A						
F	77P0 = 77 A						
	88P0 = 88 A						
	0105 = 105 A						
G	0145 = 145 A			NB or DB			
	0180 = 180 A						
	0211 = 211 A						
A	01P0 = 1.0 A		4 = 380...480 V	NB		Blank or C2	
	01P6 = 1.6 A						
	02P6 = 2.6 A						
	04P3 = 4.3 A						
	06P1 = 6.1 A					Blank or C3	
B	02P6 = 2.6 A			DB		Blank or C2	
	04P3 = 4.3 A						
	06P5 = 6.5 A						
	10P0 = 10 A					Blank or C3	
C	14P0 = 14 A					Blank or C2	
	16P0 = 16 A						
D	24P0 = 24 A					Blank or C3	
	31P0 = 31 A						
E	39P0 = 39 A						
	49P0 = 49 A						
F	77P0 = 77 A						
	88P0 = 88 A						
	0105 = 105 A						
G	0142 = 142 A			NB or DB			
	0180 = 180 A						
	0211 = 211 A						
C	01P7 = 1.7 A		5 = 500...600 V	DB		Blank	
	03P0 = 3.0 A						
	04P3 = 4.3 A						
	07P0 = 7.0 A						
	10P0 = 10 A						
	12P0 = 12 A						

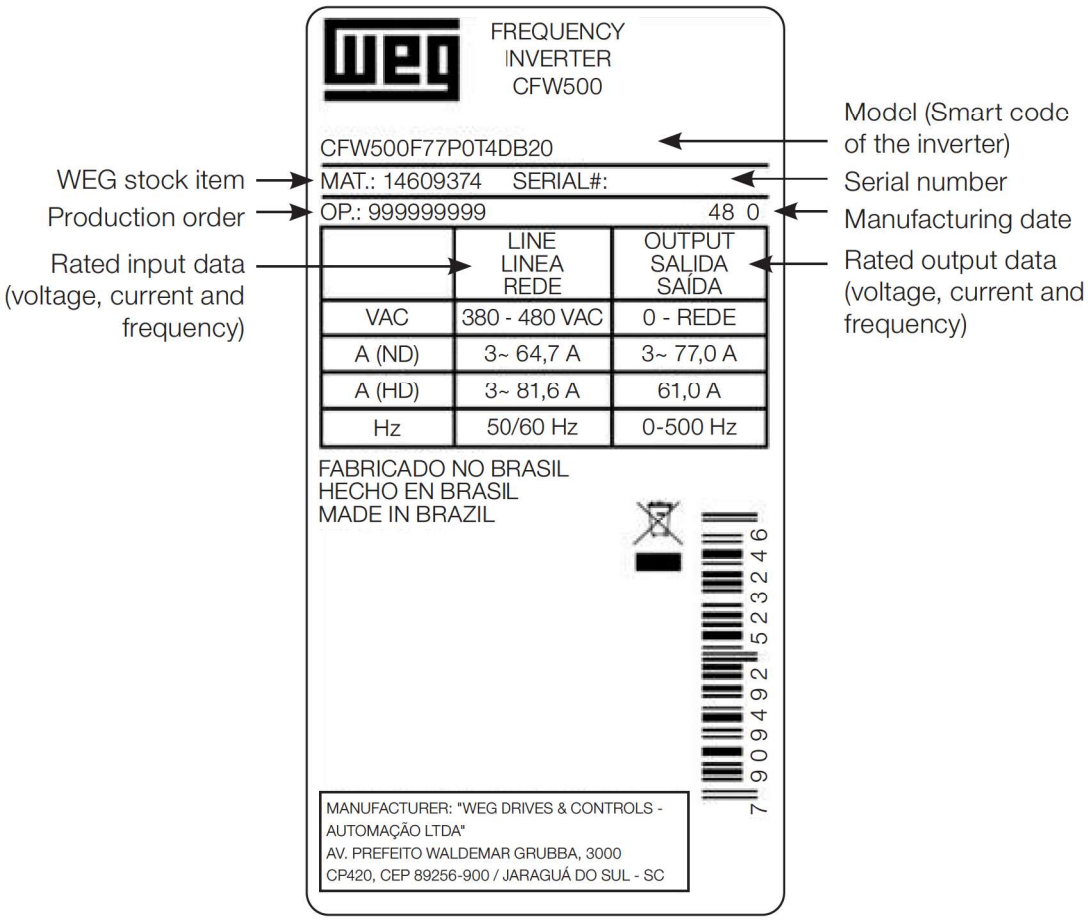
(1) Informed currents in frame sizes A ... E are for HD operation and in frame sizes F and G, for ND operation.

2.4 IDENTIFICATION LABELS

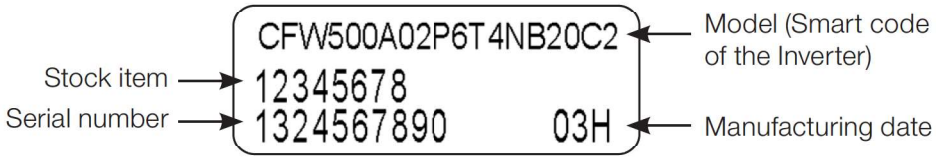
There are two identification labels, one complete nameplate, located on the side of the inverter and a simplified label under the plug-in module. The label under the plug-in module allows the identification of the most important characteristics of the inverter even in inverters mounted side-by-side. For further details about the position of the labels, see Figure A.2 on page 154.



a) Side label of the CFW500 - frame sizes A to E



b) Side label of the CFW500 - frame sizes F and G



c) Front label of the CFW500 (Under the Plug-In Module)

Figure 2.4: *(a) to (c) Description of the identification labels on the CFW500*

2.5 RECEIVING AND STORAGE

The CFW500 comes packaged in a cardboard box up to frame size E inverter models. The bigger models are packed in wooden box. On this package, there is an identification label which is the same as the one attached to the side of the inverter.

Follow the steps below to open the packaging of models larger than frame size E:

1. Put the shipping container over a flat and stable area with the assistance of another two people.

2. Open the wood crate.

3. Remove all the packing material (the cardboard or styrofoam protection) before removing the inverter.

Check if:

- The identification of the CFW500 matches the model purchased.
- Any damages occurred during transportation.

Report any damage immediately to the carrier.

If the CFW500 is not installed soon, store it in a clean and dry location (temperature between -25 °C and 60 °C (-77 °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 recommended in Section 6.4 PREVENTIVE MAINTENANCE on page 39 - of this manual.

3 INSTALLATION AND CONNECTION

3.1 MECHANICAL INSTALLATION

3.1.1 Environmental Conditions

Avoid:

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

Environmental conditions permitted for the operation of the inverter:

- Temperature surrounding the inverter: from -10 °C (14 °F) to the nominal temperature specified in Table B.4 on page 163 and Table B.5 on page 165.
- Inverters for mechanics A to E: for temperatures surrounding the inverter higher than the specifications in Table B.4 on page 163, it is necessary to apply of 2 % of current derating for each Celsius degree, limited to an increase of 10 °C (50 °F).
- Inverters for mechanics F and G: for temperatures surrounding the inverter higher than the specifications in Table B.5 on page 165, it is necessary to apply of 1 % of current derating for each Celsius degree, until 50 °C (122 °F) and 2 % of current derating for each Celsius degree, until 60 °C (140 °F).
- Air relative humidity: 5 % to 95 % non-condensing.
- Maximum altitude: up to 1000 m (3.300 ft) - nominal conditions.
- 1000 m to 4000 m (3.300 ft to 13.200 ft) - 1 % of current derating for each 100 m (328 ft) above 1000 m of altitude.
- From 2000 m to 4000 m (6.600 ft to 13.200 ft) above sea level - maximum voltage reduction (240 V for 200...240 V models, 480 V for 380...480 V models and 600 V for 500...600 V models)of 1.1 % for each 100 m (330 ft) above 2000 m (6.600 ft).
- Pollution degree: 2 (according to EN 50178 and UL 508C), with non-conductive pollution. Condensation must not originate conduction through the accumulated residues.

3.1.2 Positioning and Mounting

The external dimensions and the drilling for the mounting, as well as the net weight (mass) of the inverter are presented in Figure B.2 on page 171. For further details of each frame size, refer to Figure B.5 on page 176, Figure B.6 on page 177, Figure B.7 on page 178, Figure B.8 on page 179, Figure B.9 on page 180, Figure B.10 on page 181 and Figure B.11 on page 182.

Mount the inverter in the upright position on a flat and vertical surface. First, put the screws on the surface where the inverter will be installed, install the inverter and then tighten the screws observing the maximum torque for the screws indicated in Figure B.2 on page 171.

Allow the minimum clearances indicated in Figure B.3 on page 173, 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 (as per Figure B.3 on page 173) and provide an air deflecting plate so that the heat rising up from the bottom inverter does not affect the top inverter.
- Provide independent conduits for the physical separation of signal, control, and power cables (refer to the Section 3.2 ELECTRICAL INSTALLATION on page 15).

3.1.2.1 Cabinet Mounting

For inverters installed inside cabinets or metallic boxes, provide proper exhaustion, so that the temperature remains within the allowed range. Refer to the dissipated powers in Table B.4 on page 163 and Table B.5 on page 165.

As a reference, Table 3.1 on page 14 shows the air flow of nominal ventilation for each frame size. **Cooling Method:** fan with air flow upwards.

Table 3.1: *Air flow of the fan*

Frame Size	CFM	l/s	m³/min
A	20	9.4	0.56
B	30	14.1	0.85
C	30	14.1	0.85
D (T2)(*)	100	47.2	2.83
D (T4) (**)	80	37.8	2.27
E	180	84.5	5.09
F	214	100.4	6.05
G (145T2 and 142T4)	180	95	5.1
G (180T2, 180T4, 211T2 and 211T4)	265	125	7.5

(*) T2 - CFW500 frame size D line 200 V (200...240 V).
(**) T4 - CFW500 frame size D line 400 V (380...480 V).

3.1.2.2 Surface Mounting

Figure B.3 on page 173 illustrates the procedure for the installation of the CFW500 on the mounting surface.

3.1.2.3 DIN-Rail Mounting

In frame sizes A, B and C, the inverter CFW500 can also be mounted directly on 35-mm rail as per DIN EN 50.022. For this mounting, you must first position the lock(*) down and then place the inverter on the rail, position the lock(*) up, fixing the inverter.

(*) The fastening lock of the inverter on the rail is indicated with a screwdriver in Figure B.3 on page 173.

3.1.2.4 Flange mounting

In frame sizes F and G, the inverter CFW500 can also be mounted in flange. For this mounting, remove the drive mounting brackets for flange mounting. The protection degree of the inverter outside the panel is IP55 for flange mounting. It is necessary to provide proper seal for the opening where the inverter is installed to ensure the protection degree of the panel. Example: sealing with silicone. Please refer to Figure B.3 on page 173 for flange mounting data.

3.2 ELECTRICAL INSTALLATION

DANGER!
- The following information is merely a guide for proper installation. Comply with applicable local regulations for electrical installations.
- Make sure the power supply is disconnected before starting the installation.
- The CFW500 must not be used as an emergency stop device. Provide other devices for that purpose.

DANGER!
- Les informations suivantes constituent uniquement un guide pour une installation correcte. Respectez les réglementations locales en vigueur pour les installations électriques.
- Vérifiez que l'alimentation secteur CA est débranchée avant de commencer l'installation.
- Le CFW500 ne devra pas être utilisé comme un dispositif d'arrêt d'urgence. Utilisez des dispositifs additionnels appropriés dans ce but.

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

The power terminals can be of different sizes and configurations, depending on the model of the inverter, according to Figure B.4 on page 175. The location of the power, grounding and control connections are shown in Figure A.3 on page 156.

Description of the power terminals:

- **L/L1, N/L2 and L3 (R, S, T)**: AC power supply. Some models of voltage 200-240 V (see option of models in Table B.1 on page 158 and Table B.2 on page 160 can operate in 2 or 3 phases (single-phase/three-phase inverters) without derating of the rated current. In this case, the AC power supply can be connected to two of the three input terminals without distinction. For the single-phase models only, the power voltage must be connected to L/L1 and N/L2.
- **U, V, W**: connection for the motor.
- **-UD**: negative pole of the voltage of the DC Link.
- **BR**: connection of the brake resistor.
- **+UD**: positive pole of the voltage of the DC Link.
- **DCR:** connection to the external DC Link inductor (optional). Only available for models 28 A, 33 A, 47 A and 56 A / 200-240 V and 24 A, 31 A, 39 A and 49 A / 380-480 V.

The maximum torque of the power terminals and grounding points must be checked in Figure B.4 on page 175.

3.2.2 Power and Grounding Wiring, Circuit Breakers and Fuses

ATTENTION!

- Use proper cable lugs for the power and grounding connection cables. Refer to Table B.1 on page 158, Table B.2 on page 160 and Table B.3 on page 161 for recommended wiring, circuit breakers and fuses.
- Keep sensitive equipment and wiring at a minimum distance of 0.25 m from the inverter and from the cables connecting the inverter to the motor.
- It is not recommended the use of mini circuit breakers (MDU), because of the actuation level of the magnet.

ATTENTION!

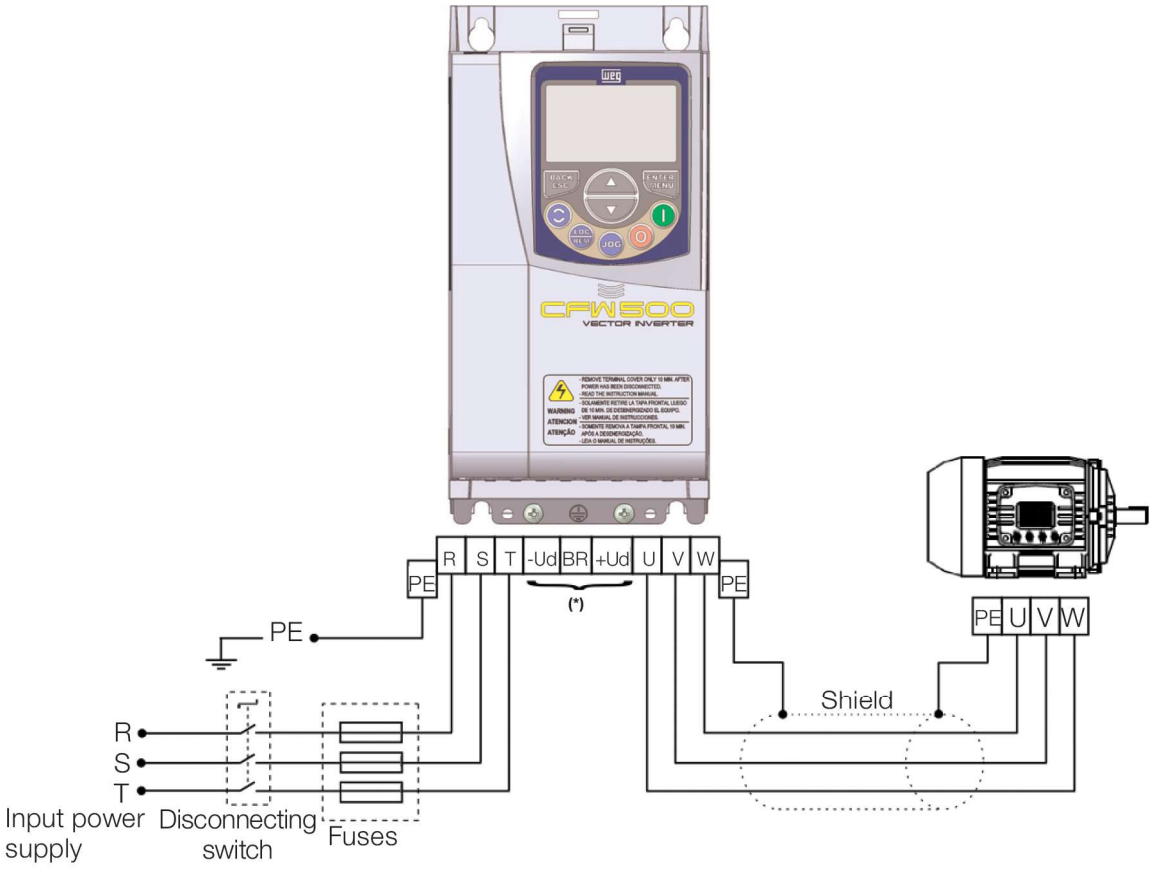
Residual Current Device (RCD):

- When used in the inverter supply, it must have a pick-up current of 300 mA.
- Depending on the installation (motor cable length, cable type, multimotor configuration, etc.), the RCD protection may be activated. Contact the RCD manufacturer for selecting the most appropriate device to be used with inverters.

NOTE!

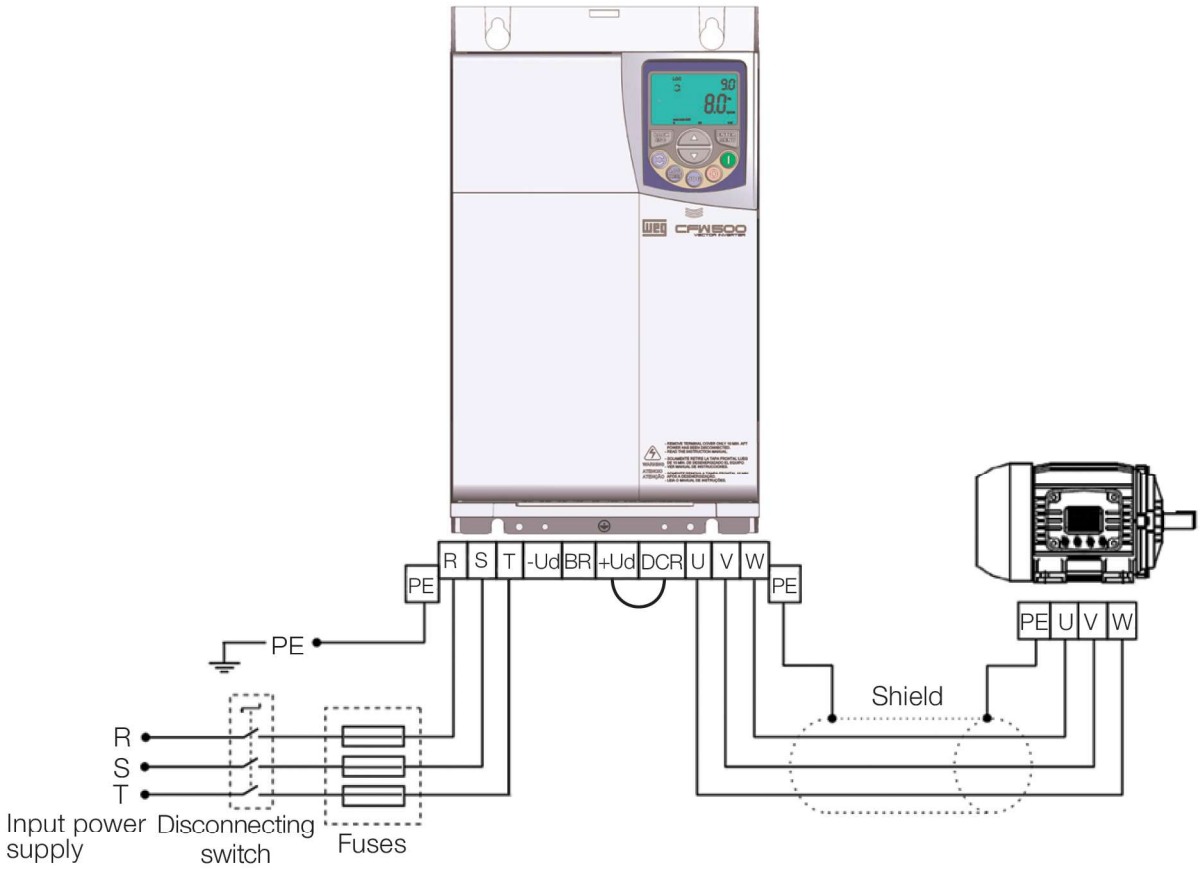
- The wire gauges listed in Table B.1 on page 158 and Table B.2 on page 160 are orientative values. Installation conditions and the maximum permitted voltage drop must be considered for the proper wiring sizing.
- In order to meet UL requirements, use ultra fast (for frame sizes A, B, C and F), and use fuse type J or circuit breaker (for frame sizes D and E) fuses at the inverter supply with a current not higher than the values presented in Table B.3 on page 161.

3.2.3 Power Connections

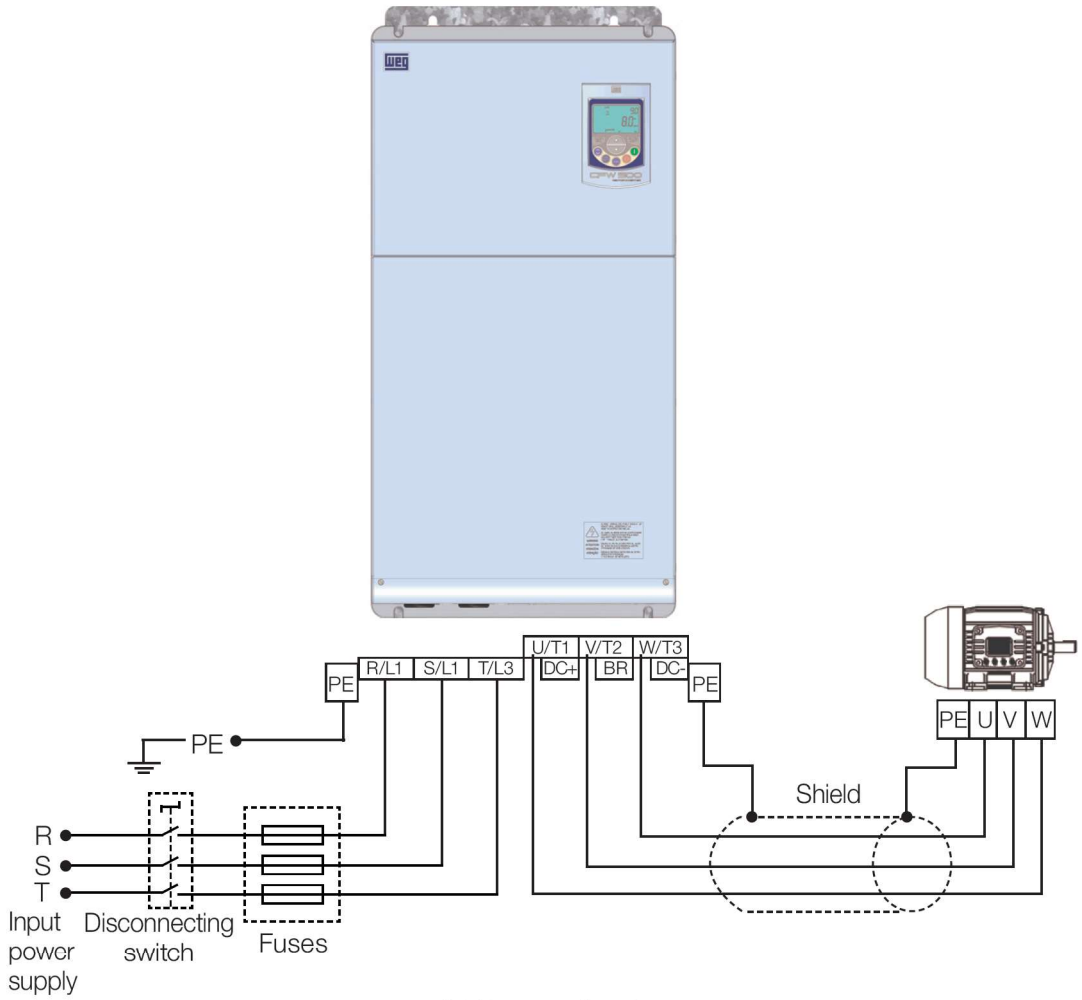


(*) The power terminals -Ud, BR and +Ud are not available in models of frame size A.

(a) Frame sizes A, B, C and F



(b) Frame sizes D and E



(c) Frame size G

Figure 3.1: *(a) to (c) 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).

DANGER!
Montez un dispositif de coupure sur l'alimentation du variateur. Ce composant déconnecte l'alimentation du variateur si cela est nécessaire (ex. pendant l'entretien et la maintenance).

ATTENTION!
The power supply that feeds the inverter must have a grounded neutral. In case of IT networks, follow the instructions described in Item 3.2.3.3 IT Networks on page 19.

NOTE!
- The input power supply voltage must be compatible with the inverter rated voltage.
- Power factor correction capacitors are not needed at the inverter input (L/L1, N/L2, L3 or R, S, T) and must not be installed at the output (U, V, W).

Power supply capacity

- Suitable for use in circuits capable of delivering not more than 30.000 A_{rms} symmetrical (200 V, 480 V or 600 V), when protected by fuses as specified in Table B.3 on page 161.

3.2.3.2 Inductor of the DC Link/ Reactance of the Power Supply

In a general way, the inverters of the series CFW500 can be installed directly in the power supply, without reactance in the supply. However, check the following:

Frame sizes A to E:

- In order to prevent damages to the inverter and assure the expected useful life, you must have a minimum impedance that provide a voltage drop of the input power supply of 1 %. If the impedance of the input power supply (due to the transformers and cabling) is below this value, we recommend the use of reactance in the input power supply.

- For the calculation of the input power supply reactance necessary to obtain the desired percentage voltage drop, use:

$$L = 1592 \cdot \Delta V \cdot \frac{V_e}{I_{s,\,rat} \cdot f} \; [\mu H]$$

Seeing that:
ΔV - desired input power supply drop, in percentage (%).
V_e - voltage of the phase in inverter input, in volts (V).
$I_{s,\,rat}$ - inverter output rated current.
f - input power supply frequency.

Frame sizes F and G:

- No minimum line impedance is required to prevent damages to the inverter and to guarantee the expected service life.

3.2.3.3 IT Networks

ATTENTION!
When inverters with internal RFI filter are used in IT networks (neuter not grounded or grounded through a high ohmic value resistor), always set the grounding switch of the capacitors of the internal RFI filter to the NC position (as shown in Figure A.2 on page 154) for frame sizes A to E or removing the grounding screws of the internal RFI filter (indicated in Figure A.4 on page 157) for frame sizes F and G, since those kinds of network cause damage to the filter capacitors of the inverter.

3.2.3.4 Dynamic Braking

NOTE!
The dynamic braking is available from frame size B.

Refer to Table B.1 on page 158 and Table B.2 on page 160 for the following specifications of the dynamic braking: maximum current, resistance, effective current (*) and cable gauge.

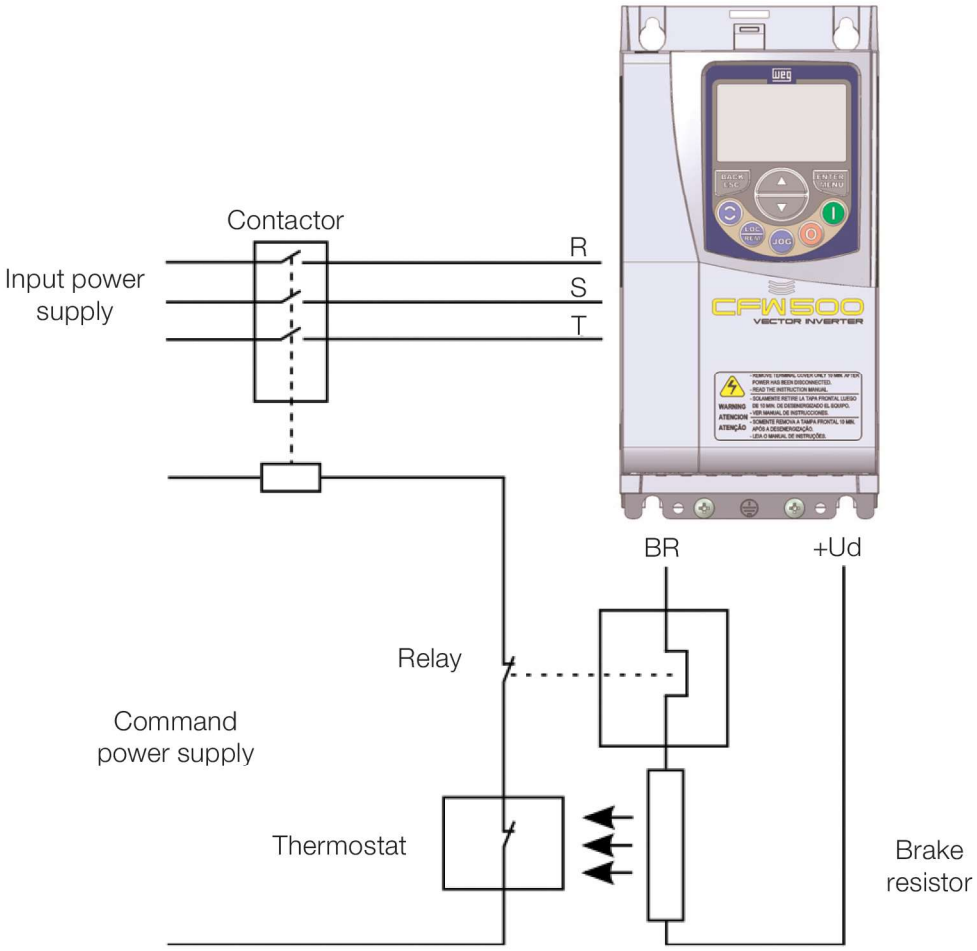


Figure 3.2: *Installation of brake resistor*

(*) The effective braking current can be calculated as follows:

$$I_{effective} = I_{max} \cdot \sqrt{\frac{t_{br}^{(min)}}{5}}$$

Seeing that: t_{br} corresponds to the sum of the braking actuation times during the most severe cycle of five minutes.

The power of the brake resistor must be calculated considering the deceleration time, the inertia of the load and of the resistive torque.

Procedure to use the dynamic braking:

- Connect the brake resistor between the power terminals +Ud and BR.
- Use a twisted cable for the connection. Separate these cables from the signal and control wiring.
- Dimension the cables according to the application, observing the maximum and effective currents.
- If the brake resistor is mounted within the cabinet of the inverter, consider its energy when dimensioning the ventilation of the cabinet.

DANGER!
The internal braking circuit and the resistor may be damaged if the latter is not properly dimensioned and/or if the voltage of the input power supply exceeds the maximum value permitted. In order to avoid the destruction of the resistor or risk of fire, the only guaranteed method is the inclusion of a thermal relay in series with the resistor and/or a thermostat in contact with its housing, connected in such a way to disconnect the input power supply of the inverter in case of overload, as shown in Figure 3.2 on page 20.

DANGER!
Le circuit de freinage du variateur interne et la résistance de freinage peuvent être endommagés s'ils sont mal dimensionnés ou si la tension de ligne dépasse la valeur permise maximale.
Dans ce cas, la seule méthode garantie pour éviter une surchauffe de la résistance de freinage et éliminer le risque d'incendie est l'installation d'un relais de surcharge thermique en série connecté avec la résistance et.ou l'installation d'un thermostat sur le corps de la résistance, en le câblant de manière à ce qu'il déconnecte l'alimentation électrique du variateur en cas de surchauffe, comme indiqué sur la Figure 3.2 on page 20.

- Set P0151 at maximum value when using dynamic braking.
- The voltage level on the DC Link for activation of the dynamic braking is defined by the parameter P0153 (level of the dynamic braking).
- Refer to the CFW500 programming manual.

3.2.3.5 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.
- The motor overload protection available in the CFW500 is in accordance with the UL508C standard. Note the following information:

1. Trip current equal to 1.2 times the motor rated current (P0401).
2. When parameters P0156, P0157 and P0158 (Overload current at 100 %, 50 % and 5 % of the rated speed, respectively) are manually set, the maximum value to meet the condition 1 is 1.1 x P0401.

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

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

Keep motor cables away from other cables (signal cables, sensor cables, control cables, etc.), according to Item 3.2.6 Cable Separation Distance on page 25.

Connect a fourth cable between the motor ground and the inverter ground.

When using shielded cables to install the motor:

- Follow the safety recommendations of IEC/EN 60034-25.
- Use the low impedance connection for high frequencies to connect the cable shield to the grounding. Use parts supplied with the inverter.
- The accessory "CFW500-KPCSx power and control cable shielding kit" can be mounted in the lower part of the cabinet. Figure 3.3 on page 22 shows a detailed example of the connection of the power supply and the motor cable shield to the accessory CFW500-KPCSA. Besides, this accessory allows the connection of the control cable shield.

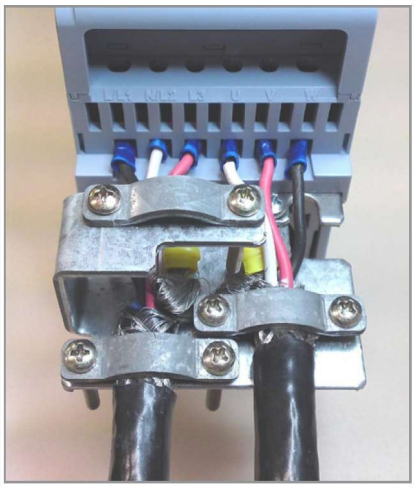


Figure 3.3: *Details of the connection of the power supply and the motor cable shield to the accessory CFW500-KPCSA*

3.2.4 Grounding Connections

DANGER!

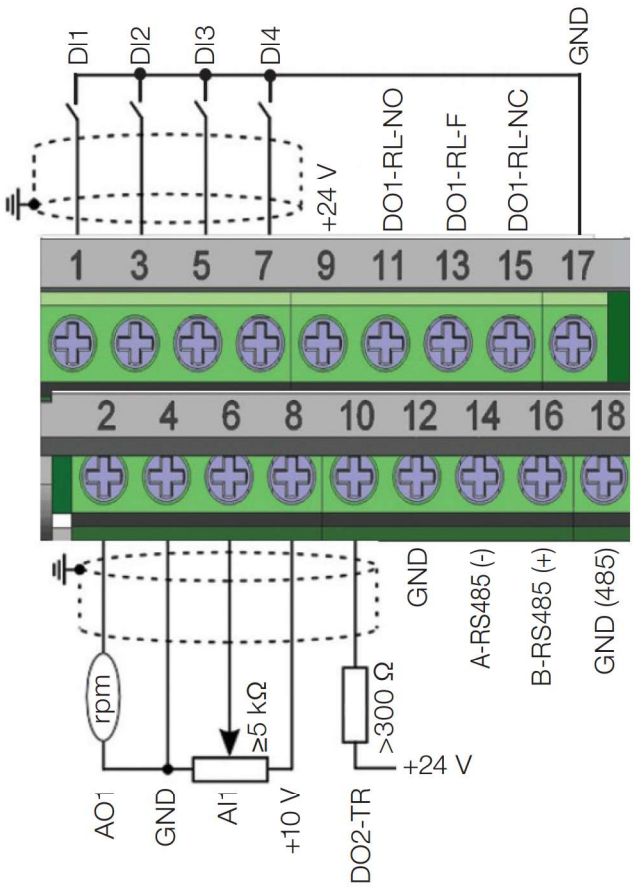
- The inverter must be connected to a protection grounding (PE).
- Use grounding wiring with a gauge at least equal to that indicated in Table B.1 on page 158 and Table B.2 on page 160.
- The maximum tightening torque of the grounding connections is of 1.7 N.m (15 lbf.in).
- Connect the grounding points of the inverter to a specific grounding rod, or specific grounding point or to the general grounding point (resistance ≤ 10 Ω).
- The neuter conductor that powers up the inverter must be solidly grounded; however, this conductor must not be used to ground the inverter.
- Do not share the grounding wiring with other equipment that operate with high currents (e.g. high power motors, soldering machines, etc.).

DANGER!

- Le variateur doit être raccordé à une terre de protection (PE).
- Utilisez la section minimale de raccordement à la terre indiquée dans le Table B.1 on page 158 et la Table B.2 on page 160.
- Le couple de serrage maximal des connexions de mise à la terre est de 1.7 N.m (15 lbf.in).
- Connecter les points de mise à la terre du variateur sur une tige de mise à la terre spécifique, soit sur le point de mise à la terre spécifique soit sur le point de mise à la terre général (résistance ≤ 10 Ω).
- Le conducteur neutre doit être solidement raccordé à la terre; néanmoins, ce conducteur ne doit pas s'utiliser pour raccorder le variateur à la terre.
- Ne pas partager le câblage de mise à la terre avec d'autres appareils qui fonctionnent avec une intensité élevée (par ex.: moteurs haute puissance, soudeuses, etc.).

3.2.5 Control Connections

The control connections (analog input/output, digital input/output and interface RS485) must be performed according to the specification of the connector of the plug-in module connected to the CFW500. Refer to the guide of the plug-in module in the package of the product. The typical functions and connections for the CFW500-IOS standard plug-in module are shown in Figure 3.4 on page 23. For further details about the specifications of the connector signals, refer to Chapter 8 TECHNICAL SPECIFICATIONS on page 45.



	Connector		Description (**)
Top connection	1	DI1	Digital input 1
	3	DI2	Digital input 2 (*)
	5	DI3	Digital input 3
	7	DI4	Digital input 4
	9	+24 V	Power supply +24 Vdc
	11	DO1-RL-NO	Digital output 1 (NO contact of relay 1)
	13	DO1-RL-C	Digital output 1 (Common point of relay 1)
	15	DO1-RL-NC	Digital output 1 (NC contact of relay 1)
	17	GND	Reference 0 V
Bottom connection	2	AO1	Analog output 1
	4	GND	Reference 0 V
	6	AI1	Analog input 1
	8	+10 V	Reference +10 Vdc for potentiometer
	10	DO2-TR	Digital output 2 (transistor)
	12	GND	Reference 0 V
	14	RS485 - A	RS485 (terminal A)
	16	RS485 - B	RS485 (terminal B)
	18	GND (485)	GND (RS485)

(*) The digital input 2 (DI2) can also be used as input in frequency (FI). For further details refer to the programming manual of the CFW500.

(**) For further information, refer to the detailed specification in Section 8.2 ELECTRONICS/GENERAL DATA on page 45.

Figure 3.4: *Signals of the connector of the CFW500-IOS plug-in module*

The location of the plug-in module and DIP-switches to select the type of analog input and output signal and the termination of the RS485 network is shown in Figure A.2 on page 154.

The CFW500 inverters are supplied with the digital inputs configured as active low (NPN), analog input and output configured for signal in voltage 0...10 V and with termination resistor of the RS485 OFF.

NOTE!
- To use the analog inputs and/or outputs with signal in current, you must set the switch S1 and the related parameters as per Table 3.2 on page 24. For further information, refer to the CFW500 programming manual.
- To modify the digital inputs from active low to active high, check the use of parameter P0271 in the CFW500 programming manual.

Table 3.2: *Configuration of the switches to select the type of analog input and output signal on the CFW500-IOS*

Input/ Output	Signal	Setting of Switch S1	Signal Range	Parameter Setting
AI1	Voltage	S1.1 = OFF	0...10 V	P0233 = 0 (direct reference) or 2 (inverse reference)
	Current	S1.1 = ON	0...20 mA	P0233 = 0 (direct reference) or 2 (inverse reference)
			4...20 mA	P0233 = 1 (direct reference) or 3 (inverse reference)
AO1	Voltage	S1.2 = ON	0...10 V	P0253 = 0 (direct reference) or 3 (inverse reference)
	Current	S1.2 = OFF	0...20 mA	P0253 = 1 (direct reference) or 4 (inverse reference)
			4...20 mA	P0253 = 2 (direct reference) or 5 (inverse reference)

NOTE!
Configuration to connect the RS485:
- S1.3 = ON and S1.4 = ON: terminal RS485 ON.
- S1.3 = OFF and S1.4 = OFF: terminal RS485 OFF.

Any other combination of the switches is not allowed.

For the correct connection of the control, use:

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

2. Maximum torque: 0.5 N.m (4.50 lbf.in).

3. Wiring of the plug-in module connector with shielded cable and separated from the other wiring (power, command in 110 V / 220 Vac, etc), according to Item 3.2.6 Cable Separation Distance on page 25. If those cables must cross other cables, it must be done in perpendicularly among them, keeping the minimum separation distance of 5 cm at the crossing point.

Connect the shield according to the figure below:

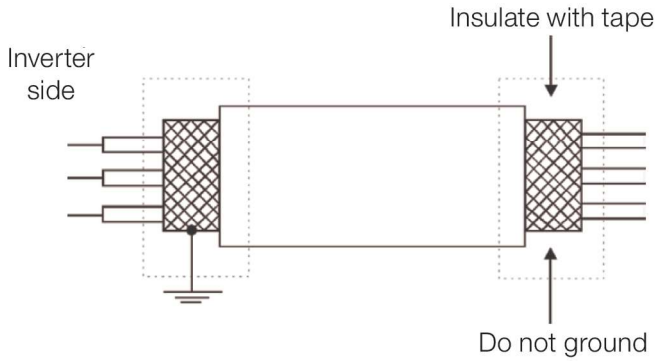


Figure 3.5: *Connection of the shield*

4. Relays, contactors, solenoids or coils of electromechanical brake installed close to the inverters may occasionally generate interference 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.

5. When using the external HMI (refer to Section 7.2 ACCESSORIES on page 42), the cable that connects to the inverter must be separated from the other cables in the installation, keeping a minimum distance of 10 cm.

6. When using analog reference (AI1) and the frequency oscillates (problem of electromagnetic interference), interconnect the GND of the connector of the plug-in module to the inverter grounding connection.

3.2.6 Cable Separation Distance

Provide separation between the control and power cables and between the control cables (relay output cables and other control cables) as per Table 3.3 on page 25.

Table 3.3: *Cable separation distance*

Inverter Output Rated Current	Length of the Cable(s)	Minimum Separation Distance
≤ 24 A	≤ 100 m (330 ft) > 100 m (330 ft)	≥ 10 cm (3.94 in) ≥ 25 cm (9.84 in)
≥ 28 A	≤ 30 m (100 ft) > 30 m (100 ft)	≥ 10 cm (3.94 in) ≥ 25 cm (9.84 in)

3.3 INSTALLATIONS ACCORDING TO EUROPEAN DIRECTIVE OF ELECTROMAGNETIC COMPATIBILITY

Inverters with the option C2 or C3 (CFW500...C...) feature internal RFI filter to reduce the electromagnetic interference. Those inverters, when properly installed, meet the requirements of the directive of the electromagnetic compatibility (2014/30/EU).

For products without an internal filter, it is necessary to use an external filter in order to comply with the EMC Directive.

The CFW500 inverter series was developed for professional applications only. Therefore, the emission limits of harmonic currents by the standards IEC/EN 61000-3-2 and EN 61000-3-2/A 14 are not applicable.

3.3.1 Conformal Installation

1. Inverters with option internal RFI filter CFW500...C... (with grounding switch of the capacitors of the internal RFI filter in the position ⏚) for frame sizes A to E or removing the grounding screws of the internal RFI filter for frame sizes F and G. Check the location of the grounding switch in Figure A.2 on page 154 or the position grounding screws of the internal RFI filter in Figure A.4 on page 157).

2. Shielded output cables (motor cables) with shield connected at both ends, motor and inverter, by means of a low impedance to high frequency connection.
   Maximum motor cable length and conduced and radiated emission levels according to Table B.6 on page 166. For more information (RFI filter commercial reference, motor cable length and emission levels) refer to the Table B.6 on page 166.

3. Use shielded cables for the control connections, and keep them separate from the other cables, according to Table 3.3 on page 25.

4. Grounding of the inverter according to instruction of the Item 3.2.4 Grounding Connections on page 22.

5. Grounded power supply.

3.3.2 Emission and Immunity Levels

Table 3.4: *Emission and immunity levels*

EMC Phenomenon	Basic Standard	Level
Emission:		
Mains terminal disturbance voltage Frequency range: 150 kHz to 30 MHz)	IEC/EN 61800-3	It depends on the inverter model on the length of the motor cable. Refer to Table B.6 on page 166
Electromagnetic radiation disturbance" Frequency range: 30 MHz to 1000 MHz)		
Immunity:		
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	4 kV for contact discharge and 8 kV for air discharge 8 kV
Fast transient-burst	IEC/EN 61000-4-4	2 kV / 5 kHz (coupling capacitor) input cables 1 kV / 5 kHz control cables and remote HMI cables 2 kV / 5 kHz (coupling capacitor) motor cables
Conducted radio-frequency common mode	IEC/EN 61000-4-6	0.15 to 80 MHz; 10 V; 80 % AM (1 kHz) Motor, control and HMI cables
Surges	IEC/EN 61000-4-5	1.2/50 µs, 8/20 µs 1 kV line-to-line coupling 2 kV line-to-ground coupling
Radio-frequency electromagnetic field	IEC/EN 61000-4-3	80 to 1000 MHz 10 V/m 80 % AM (1 kHz)

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

■ **Environments:**
First Environment: environments that include domestic installations, as well as establishments directly connected without intermediate transformer to a low-voltage power supply network which supplies buildings used for domestic purposes.

Second Environment: includes all establishments other than those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes.

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).

English

4 HMI (KEYPAD) AND BASIC PROGRAMMING

4.1 USE OF THE HMI TO OPERATE THE INVERTER

Through the HMI, it is possible to command the inverter, visualize and adjust all of its parameters. The HMI presents two operating modes: monitoring and setting. The functions of the keys and the fields of the display active on the HMI vary according to the operating mode. The setting mode is composed of three levels.

- When in the setting mode, **level 1**: press this key to return to the monitoring mode.
- When in the setting mode, **level 2**: press this key to return to **level 1** of the setting mode.
- When in the setting mode, **level 3**: press this key to cancel the new value (new value is not saved) and return to **level 2** of the setting mode.

- When in the monitoring mode: press this key to increase the speed.
- When in the setting mode, **level 1**: press this key to go to the previous group.
- When in the setting mode, **level 2**: press this key to go to the next parameter.
- When in the setting mode, **level 3**: press this key to increase the content of the parameter.

Press this key to define the motor rotation direction.
Active when:
P0223 = 2 or 3 in LOC and/or
P0226 = 2 or 3 in REM

Press this key to commute between LOCAL and REMOTE mode.
Active when:
P0220 = 2 or 3

- When in the monitoring mode: press this key to enter the setting mode.
- When in the setting mode, **level 1**: press this key to select the desired parameter group - it shows the parameter group selected.
- When in the setting mode, **level 2**: press this key to show the parameter - it shows the content of the parameter in order to change the content.
- When in the setting mode, **level 3**: press this key to save the new content of the parameter - it returns to **level 2** of the setting mode.

- When in the monitoring mode: press this key to decrease the speed.
- When in the setting mode, **level 1**: press this key to go to the next group.
- When in the setting mode, **level 2**: press this key to go to the previous parameter.
- When in the setting mode, **level 3**: press this key to decrease the content of the parameter.

Press this key to accelerate the motor within the time determined by the acceleration ramp.
Active when: P0224 = 0 in LOC or
P0227 = 0 in REM

Press this key to decelerate the motor within the time determined by the deceleration ramp.
Active when:
P0224 = 0 in LOC or
P0227 = 0 in REM

Press this key to accelerate the motor up to the speed set in P0122 within the time determined by the acceleration ramp. The motor speed is kept while the key is pressed. When the key is released, the motor decelerates within the time determined by the deceleration ramp, until it stops. This function is active when all the conditions below are met:
1. Turn/Stop = Stop.
2. Enable General = Active.
3. P0225 = 1 in LOC and/or P0228 = 1 in REM.

Figure 4.1: *HMI Keys*

4.2 INDICATIONS ON THE HMI DISPLAY

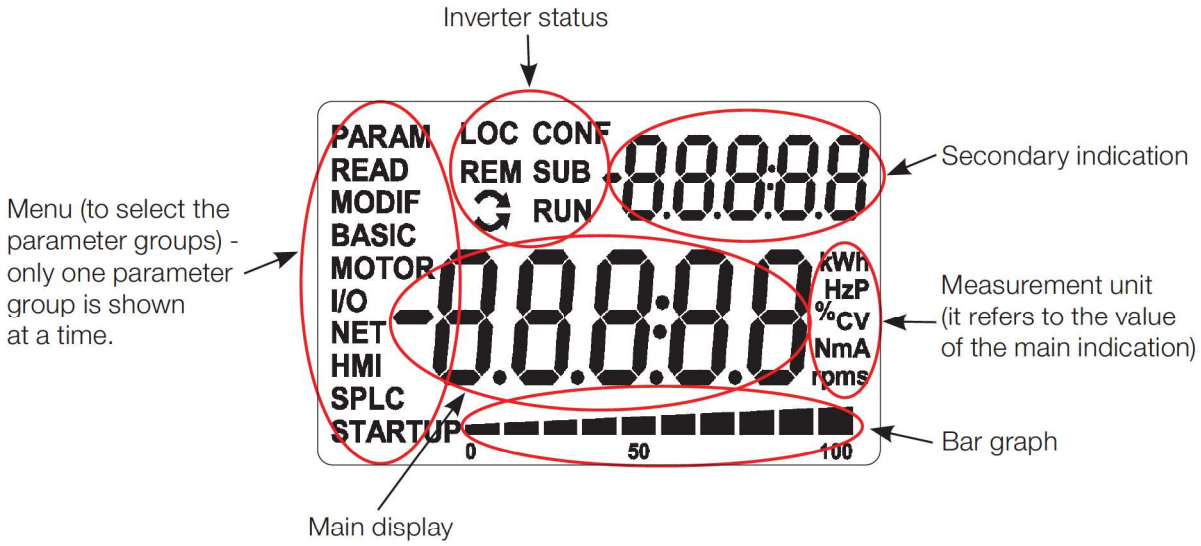


Figure 4.2: *Display fields*

Parameter groups available in the field Menu:

- **PARAM:** all parameters.
- **READ:** reading parameters only.
- **MODIF:** parameters modified in relation to the default only.
- **BASIC:** parameters for basic application.
- **MOTOR:** parameters related to the control of the motor.
- **I/O:** parameters related to digital and analog inputs and outputs.
- **NET:** parameters related to the communication networks.
- **HMI:** parameters to configure the HMI.
- **SPLC:** parameters related to SoftPLC.
- **STARTUP:** parameters for oriented Start-up.

Status of the inverter:

- **LOC:** command source or local references.
- **REM:** command source or remote references.
- ↻ **:** direction of rotation by means of arrows.
- **CONF:** configuration error.
- **SUB:** undervoltage.
- **RUN:** execution.

English

4.3 OPERATING MODES OF THE HMI

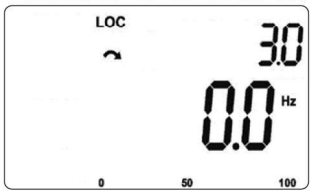
The monitoring mode allows the user to view up to three variables on the main display, secondary display and bar graph. Such fields of the display are defined in Figure 4.2 on page 29.

The setting mode is composed of three levels: Level 1 allows the user to select the Menu items to direct the browsing of the parameters. Level 2 allows browsing the parameters of the group selected by level 1. Level 3, in turn, allows the modification of the parameter selected in Level 2. At the end of this level, the modified value is saved or not if the key ENTER or ESC is pressed, respectively.

Figure 4.3 on page 30 illustrates the basic browsing of the operating modes of the HMI.

Monitoring Mode

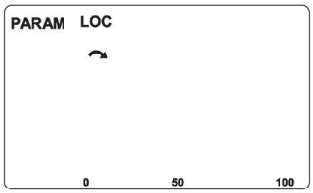
- It is the initial status of the HMI after the powering up and of the initialization screen, with default values
- The field Menu is not active in this mode
- The main display, secondary display and bar graph indicate the values of three parameters predefined by P0205, P0206 and P0207
- From the monitoring mode, when you press the key **ENTER/MENU**, you commute to the setting mode



Setting Mode

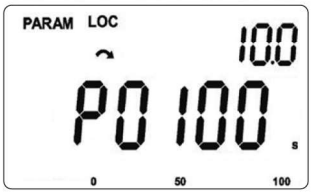
Level 1:

- This is the first level of the setting mode. It is possible to choose the parameter group using the keys ▲ and ▼
- The main display, secondary display, bar graph and measurement units are not shown in this level
- Press the key **ENTER/MENU** to go to level 2 of the setting mode - parameter selection
- Press the key **BACK/ESC** to return to the monitoring mode



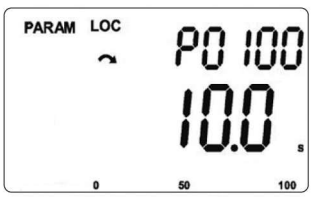
Level 2:

- The number of the parameter is shown on the main display and its content on the secondary display
- Use the keys ▲ and ▼ to find the desired parameter
- Press the key **ENTER/MENU** to go to level 3 of the setting mode - modification of the parameter content
- Press the key **BACK/ESC** to return to level 1 of the setting mode



Level 3:

- The content of the parameter is shown on the main display and the number of the parameter is shown on the secondary display
- Use the keys ▲ and ▼ to configure the new value for the selected parameter
- Press the key **ENTER/MENU** to confirm the modification (save the new value) or **BACK/ESC** to cancel the modification (not save the new value). In both cases, the HMI returns to level 2 of the setting mode



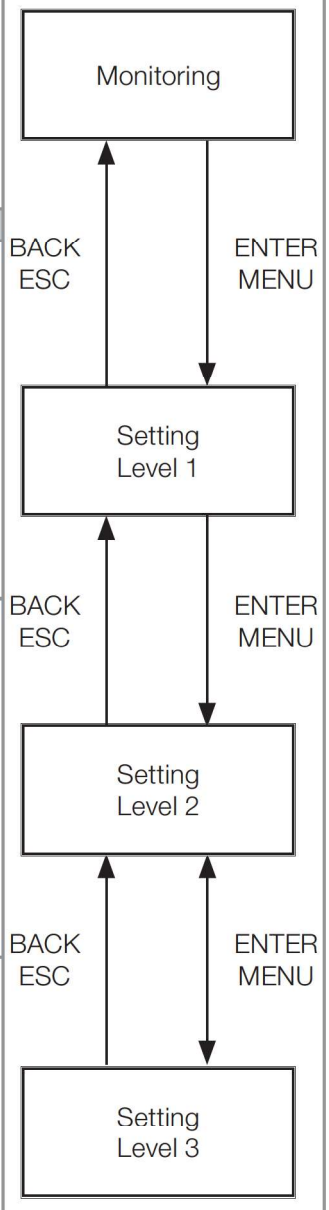


Figure 4.3: *Operating modes of the HMI*

NOTE!
When the inverter is in the fault state, the main display indicates the number of the fault in the format **Fxxxx**. The browsing is allowed after the activation of the key ESC, and the indication **Fxxxx** goes to the secondary display until the fault is reset.

NOTE!
When the inverter is in the alarm state, the main display indicates the number of the Alarm in the format **Axxxx**. The browsing is allowed after the activation of any key, and the indication **Axxxx** goes to the secondary display until the situation causing the alarm is solved.

NOTE!
A list of parameters is presented in the quick reference of the parameters. For further information about each parameter, refer to the programming manual of the CFW500.

English

5 POWERING UP AND STARTUP

5.1 PREPARATION AND POWERING UP

The inverter must be installed according the Chapter 3 INSTALLATION AND CONNECTION on page 13.

DANGER!
Always disconnect the general power supply before making any connection.

DANGER!
Débranchez toujours l'alimentation principale avant d'effectuer une connexion sur le variateur.

1. Check if the power, grounding and control connections are correct and firm.
2. Remove all materials left from the inside of the inverter or drive.
3. Check if the motor connections and if the motor current and voltage match the inverter.
4. Mechanically uncouple the motor from the load. If the motor cannot be uncoupled, be sure that the turning in any direction (clockwise or counterclockwise) will not cause damages to the machine or risk of accidents.
5. Close the covers of the inverters or drive.
6. Measure the voltage of the input power supply and check if it is within the permitted range, as presented in Chapter 8 TECHNICAL SPECIFICATIONS on page 45.
7. Power up the input: close the disconnecting switch.
8. Check the success of the powering up:
   The display of the HMI indicates:

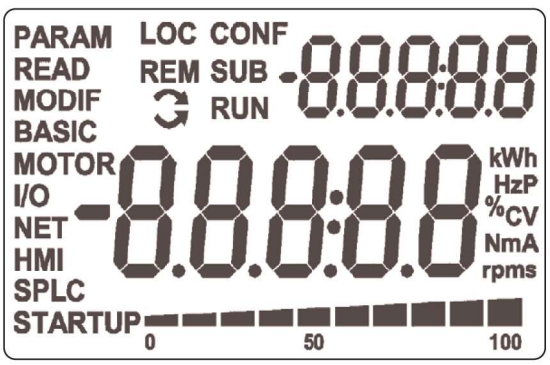


Figure 5.1: *Display of the HMI when energizing*

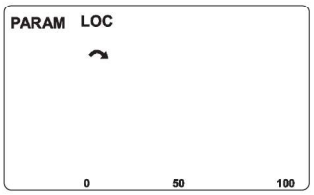
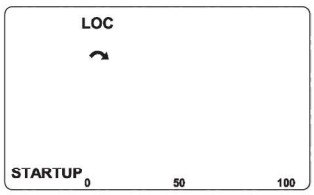
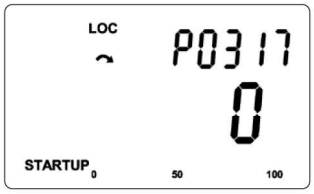
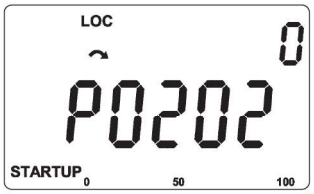
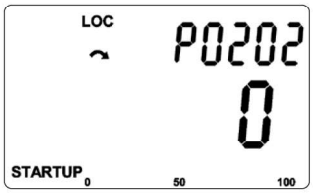
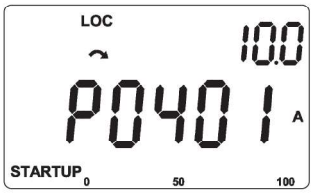
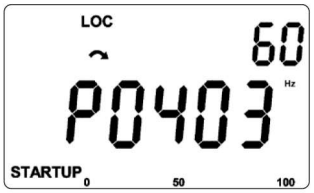
The inverter executes some routines related to data upload or download (parameter configurations and/or SoftPLC). The indication of those routines is presented in the bar graph. After those routines, if there are no problems, the display will show the monitoring model.

5.2 STARTUP

The startup is explained in a very simple way, using the programming features with the existing parameter groups in the menus STARTUP and BASIC.

5.2.1 STARTUP Menu

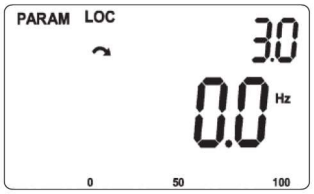
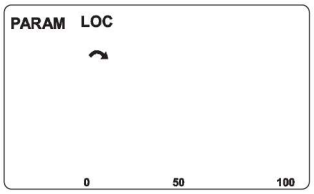
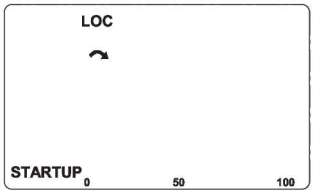
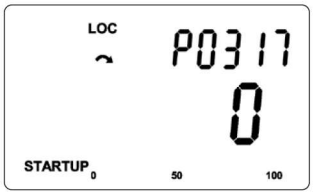
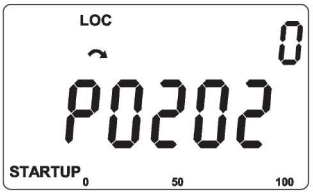
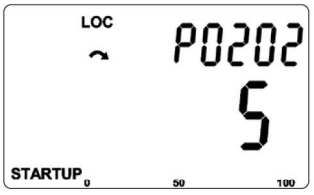
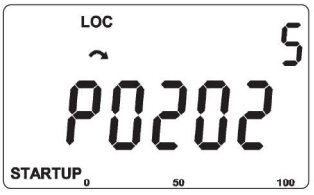
5.2.1.1 V/f Control Type (P0202 = 0)

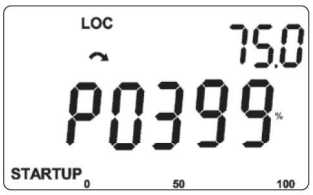
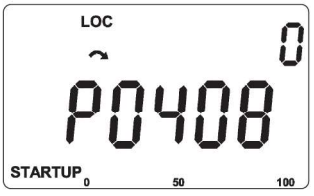
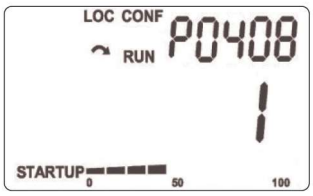
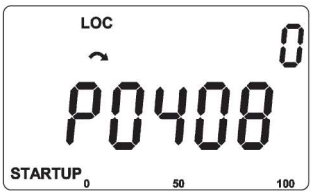
Step	Indication on the Display/Action	Step	Indication on the Display/Action
1	 ■ Monitoring mode ■ Press the key **ENTER/MENU** to enter 1st level of programming mode	2	 ■ The **PARAM** group is selected, press the keys ▲ or ▼ until selecting the **STARTUP** group
3	 ■ When the **STARTUP** group is selected Press the key **ENTER/MENU**	4	 ■ The parameter **"P0317 - Oriented Start-Up"** is then selected, press the **ENTER/MENU** to get into the parameter content
5	 ■ Change the parameter P0317 to "1 - Yes", by using the ▲ key	6	 ■ If necessary, press **ENTER/MENU** to modify the content of "P0202 - Control Type" for P0202 = 0 (V/f)
7	 ■ When the desired value is reached, press **ENTER/MENU** to save the modification ■ Press the key ▲ for the next parameter	8	 ■ If necessary, modify the content of "P0401 - Motor Rated Current" ■ Press the key ▲ for the next parameter
9	 ■ If necessary, modify the content of "P0402 - Motor Rated Speed" ■ Press the key ▲ for the next parameter	10	 ■ If necessary, modify the content of "P0403 - Motor Rated Frequency" ■ Press the key ▲ for the next parameter

Step	Indication on the Display/Action
11	 ■ To end the Start-up routine, press the key **BACK/ESC** ■ To return to the monitoring mode, press the key **BACK/ESC** again

Figure 5.2: *Sequence of the startup group for V/f control*

5.2.1.2 VVW Control Type (P0202 = 5)

Step	Indication on the Display/Action	Step	Indication on the Display/Action
1	 ■ Monitoring mode. Press the key **ENTER/MENU** to enter the 1st level of the programming mode	2	 ■ The **PARAM** group is selected, press the Keys ▲ or ▼ until selecting the **STARTUP** group
3	 ■ When the **STARTUP** group is selected press the key **ENTER/MENU**	4	 ■ The parameter **"P0317 - Oriented Start-Up"** is then selected, press the **ENTER/MENU** to get into the parameter content
5	 ■ Change the parameter P0317 to "1 - Yes", by using the ▲ key	6	 ■ Press **ENTER/MENU** and with the keys ▲ and ▼ set the value 5, which activates the control mode VVW
7	 ■ Press **ENTER/MENU** to save the modification of P0202	8	 ■ Press the key ▲ to proceed with the Startup of the VVW

Step	Indication on the Display/Action	Step	Indication on the Display/Action
9	 ■ If necessary, modify the content of "P0399 - Motor Rated Performance", or press the key ▲ for the next parameter	10	 ■ If necessary, modify the content of "P0400 - Motor Rated Voltage", or press the key ▲ for the next parameter
11	 ■ If necessary, modify the content of "P0401 - Motor Rated Current", or press the key ▲ for the next parameter	12	 ■ If necessary, modify the content of "P0402 - Motor Rated Rotation", or press the key ▲ for the next parameter
13	 ■ If necessary, modify the content of "P0403 - Motor Rated Frequency", or press the Key ▲ for the next parameter	14	 ■ If necessary, modify the content of "P0404 - Motor Rated Power", or press the key ▲ for the next parameter
15	 ■ If necessary, modify the content of "P0407 - Motor Rated Power Factor", or press the key ▲ for the next parameter	16	 ■ At this point, the HMI shows the option to do the self-adjustment. Whenever possible, perform the self-adjustment. Thus, to activate the self-adjustment, change the value of P0408 to "1"
17	 ■ During the Self-Adjustment the HMI will simultaneously indicate the status of **"RUN"** and **"CONF"**. And the bar graph indicates the progress of the operation ■ And the bar graph indicates the progress of the operation. The Self-Adjustment can be interrupted at any time by means of the key O	18	 ■ At the end of the Self-Adjustment, the value of P0408 automatically returns to "0", as well as the Status of **"RUN"** and **"CONF"** are cleared ■ Press the key ▲ for the next parameter

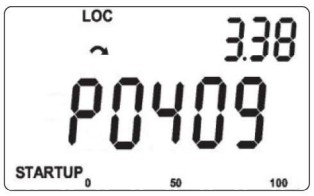
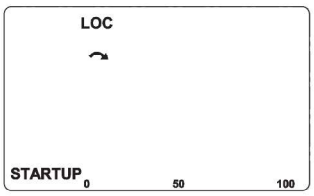
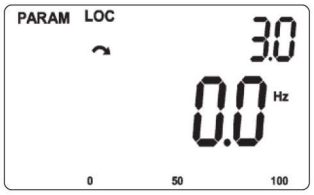
Step	Indication on the Display/Action	Step	Indication on the Display/Action
19	 ■ The result of Self-Adjustment is the value in ohms of the motor stator resistance shown in P0409 ■ This is the last parameter of the Self-Adjustment of the VVW control mode. Press the key ▲ to return to initial parameter P0202	20	 ■ To exit the **STARTUP** menu, just press **BACK/ESC**
21	 ■ Through the keys ▲ and ▼, select the desired menu or press the key **BACK/ESC** again to return directly to the monitoring mode of the HMI		

Figure 5.3: *Sequence of the startup group for VVW control*

5.2.2 Menu BASIC - Basic Application

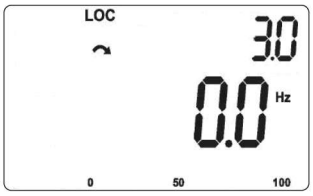
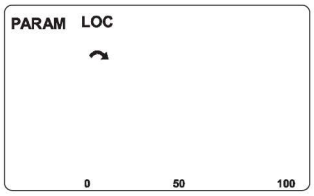
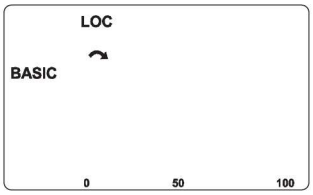
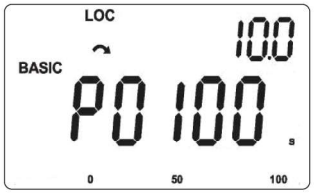
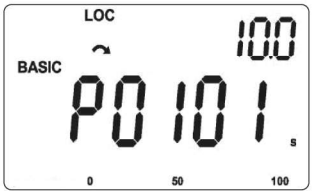
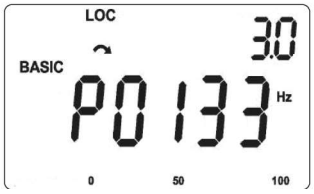
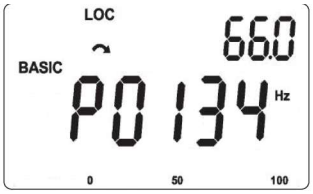
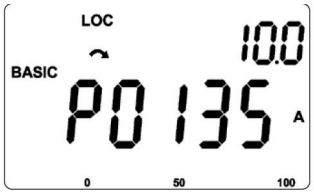
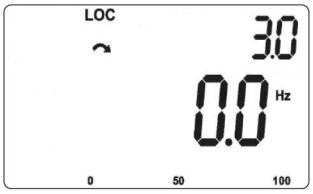
Step	Indication on the Display/Action	Step	Indication on the Display/Action
1	 ■ Monitoring mode. Press the key **ENTER/ MENU** to enter the 1st level of the programming mode	2	 ■ The **PARAM** group is selected, press the keys ▲ or ▼ until selecting the **BASIC** group
3	 ■ When the **BASIC** group is selected press the key **ENTER/MENU**	4	 ■ Basic Application routine is started. If necessary, modify the content of "P0100 - Acceleration Time" ■ Press the key ▲ for the next parameter
5	 ■ If necessary, modify the content of "P0101 - Deceleration Time" ■ Press the key ▲ for the next parameter	6	 ■ If necessary, modify the content of "P0133 - Minimum Speed" ■ Press the key ▲ for the next parameter
7	 ■ If necessary, modify the content of "P0134 - Maximum Speed" ■ Press the key ▲ for the next parameter	8	 ■ If necessary, modify the content of "P0135 - Maximum Output Current" ■ Press the key ▲ for the next parameter
9	 ■ To end the Start-up routine, press the key **BACK/ESC** ■ To return to the monitoring mode, press the key **BACK/ESC** again		

Figure 5.4: *Sequence of the basic application group*

English

6 TROUBLESHOOTING AND MAINTENANCE

6.1 FAULT AND ALARMS

NOTE!
Refer to the quick reference and to the programming manual of the CFW500 for further information about each fault or alarm.

6.2 SOLUTIONS FOR THE MOST FREQUENT PROBLEMS

Table 6.1: *Solutions for the most frequent problems*

Problem	Point to be Verified	Corrective Action
Motor will not start	Incorrect wiring	1. Check all the power and command connections
	Analog reference (if used)	1. Check if the external signal is properly connected. 2. Check the status of the control potentiometer (if used)
	Wrong settings	1. Check if the parameters values are correct for the application
	Fault	1. Check if the inverter is disabled due to a fault condition
	Motor stall	1. Decrease the motor overload 2. Increase P0136, P0137 (V/f)
Motor speed oscillates	Loose connections	1. Stop the inverter, turn off the power supply and tighten all the 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 the cause is electrical noise, use shielded cables or separate them from the power or command wiring 2. Interconnect the GND of the analog reference to the grounding connection of the inverter
Too high or too low motor speed	Incorrect settings (reference limits)	1. Check whether the content of P0133 (minimum speed) and P0134 (maximum speed) are properly set for the motor and application used
	Control signal of the analog reference (if used)	1. Check the level of the reference control signal 2. Check the setting (gain and offset) of parameters P0232 to P0240
	Motor nameplate	1. Check whether the motor used matched the application
Display off	HMI connections	1. Check the connections of the inverter external HMI
	Power supply voltage	1. Rated values must be within the limits specified below: 200 / 240 V power supply: - Min: 170 V - Max: 264 V 380 / 480 V power supply: - Min: 323 V - Max: 528 V
	Main supply fuse open	1. Replace the fuses

6.3 DATA TO CONTACT THE TECHNICAL ASSISTANCE

For information or service request, it is important to have at hand the following data:

- Inverter model.
- Serial number and manufacturing date of the product identification label (refer to Section 2.4 IDENTIFICATION LABELS on page 10).
- Software version installed (see P0023 and P0024).
- Information about the application and programming executed.

6.4 PREVENTIVE MAINTENANCE

DANGER!
Always disconnect the general power supply before changing any electric component associated to the inverter.
High voltages can be present even after the disconnection of the power supply. Wait for at least ten minutes for the full discharge of the power capacitors. Always connect the frame size of the equipment to the protection grounding (PE) at the proper point for that.

DANGER!
Débranchez toujours l'alimentation principale avant d'entrer en contact avec un appareil électrique associé au variateur.
Des tensions élevées peuvent encore être présentes, même après déconnexion de l'alimentation. Pour éviter les risques d'électrocution, attendre au moins 10 minutes après avoir coupé l'alimentation d'entrée pour que les condensateurs de puissance soient totalement déchargées. Raccordez toujours la masse de l'appareil à une terre protectrice (PE). Utiliser la borne de connexion adéquate du variateur.

ATTENTION!
The electronic cards have components sensitive to electrostatic discharges. Do not touch directly on the components or connectors. If necessary, first touch the grounded metallic frame size or use proper grounding strap.
Do not execute any applied potential test on the inverter!
If necessary, contact WEG.

When installed in proper environment and operating conditions, the inverters require little service. Table 6.2 on page 40 lists the main procedures and intervals for routine maintenance. Table 6.3 on page 40 suggests inspections on the product every 6 months after startup.

Table 6.2: Preventive maintenance

Maintenance		Interval	Instructions
Fan replacement		After 40.000 hours of operation	Replacement
Electrolytic capacitors	If the inverter is stocked (not in use): "Reforming"	Every year from the manufacturing date printed on the inverter identification label (refer to Section 2.4 IDENTIFICATION LABELS on page 10)	Apply power to the inverter with 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 for at least 24 hours before using the inverter (reapply power)
	Inverter being used: replace	Every 10 years	Contact WEG technical support to obtain replacement procedure

Table 6.3: Periodic inspection at every 6 months

Component	Abnormality	Corrective Action
Terminals, connectors	Loose screws	Tighten
	Loose connectors	
Fans /Cooling systems (*)	Dirty fans	Cleaning
	Abnormal acoustic noise	Replace fan
	Blocked fan	Cleaning or replacement
	Abnormal vibration	
	Dust in the air filters	
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	Tightening
DC Link capacitors	Discoloration/odor/electrolyte leakage	Replacement
	Safety valve expanded or broken	
	Frame size expansion	
Power resistors	Discoloration	Replacement
	Odor	
Heatsink	Accumulation of dust	Cleaning
	Dirt	

(*) The fan of the CFW500 can be easily replaced as shown in Figure 6.1 on page 41.

6.5 CLEANING INSTRUCTIONS

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

Ventilation system:

- Disconnect the power supply of the inverter and wait for 10 minutes.
- Remove de dust accumulated in the ventilation opening using a plastic brush or cloth.
- Remove the dust accumulated on the fins of the heatsink and fan blades using compressed air.

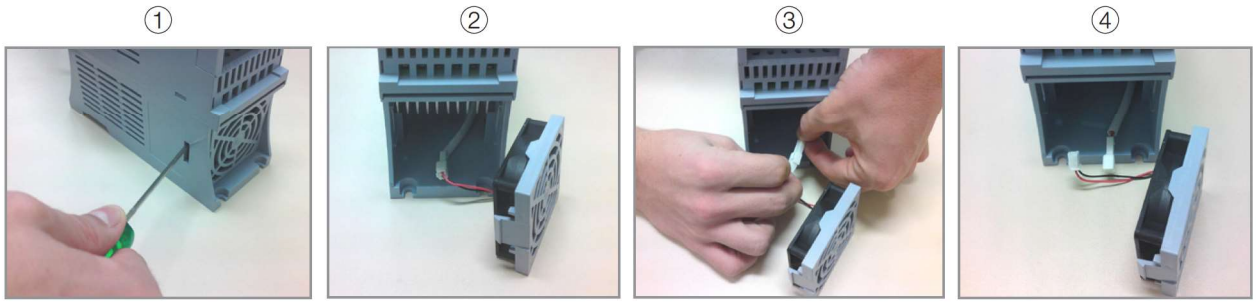


Figure 6.1: *Removal of the heatsink fan*

Cards:

- Disconnect the power supply of the inverter and wait for 10 minutes.
- Disconnect all the cables of the inverter, identifying all of them in order to reconnect them correctly.
- Remove the plastic cover and the plug-in module (refer to Chapter 3 INSTALLATION AND CONNECTION on page 13 and APPENDIX B - TECHNICAL SPECIFICATIONS on page 158).
- Remove the dust accumulated on the cards using and anti-static brush using and/or ion compressed air gun.
- Always use grounding strap.

English

7 OPTIONAL KITS AND ACCESSORIES

7.1 OPTIONAL KITS

The optional kits are hardware resources added to the inverter in the manufacturing process. Thus, some models cannot receive all the options presented.

Check the optional kits available for each inverter model in Table 2.2 on page 9.

7.1.1 RFI Filter

Inverters with code CFW500...C... are used to reduce the disturbance conducted from the inverter to the main power supply in the high frequency band (>150 kHz). It is necessary to meet the maximum levels of conducted emission of electromagnetic compatibility standards, such as IEC/EN 61800-3. For further details, refer to Section 3.3 INSTALLATIONS ACCORDING TO EUROPEAN DIRECTIVE OF ELECTROMAGNETIC COMPATIBILITY on page 25.

ATTENTION!
When inverters with internal RFI filter are used in IT networks (neuter not grounded or grounded through a high ohmic value resistor), always set the grounding switch of the capacitors of the internal RFI filter to the NC position (as shown in Figure A.2 on page 154) for frame sizes A to E or removing the grounding screws of the internal RFI filter (indicated in Figure A.4 on page 157) for frame sizes F and G, since those kinds of network cause damage to the filter capacitors of the inverter.

7.1.2 Protection Rate Nema1

The inverters with code CFW500...N1 are used when protection rate Nema1 is desired and/or when metallic conduits are used for the wiring of the inverter.

7.1.3 Safety Functions

The inverters with code CFW500...Y2 are used when functional safety is desired. This module is mounted on top of the inverter, as described in the CFW500-SFY2 safety manual. The following safety functions are covered by this module according to IEC/EN 61800-5-2:

- STO: Safe Torque Off.
- SS1-t: Safe Stop 1 Time Controlled.

NOTE!
For further information on the CFW500 safety functions, refer to the CFW500-SFY2 safety manual.

7.2 ACCESSORIES

The accessories are hardware resources that can be added in the application. Thus, all models can receive all the options presented.

The accessories are incorporated to the inverters in an easy and quick way by using the concept "Plug and Play". When an accessory is connected to the inverter, the control circuitry identifies the model and informs the code of the accessory connected in parameter P0027. The accessory must be installed or modified with the inverter with no input voltage applied. They may be ordered separately, and are sent in their own package containing the components and manuals with detailed instructions for their installation, operation and setting.

Table 7.1: *Accessory models*

WEG Item	Name	Description
Control Accessories		
14741859	CFW500-IOS	Standard Plug-in module
14742006	CFW500-IOD	Input and output Plug-in module (I/O) digital
14742129	CFW500-IOAD	Input and output Plug-in module (I/O) digital and analog
14742003	CFW500-IOR	Digital output communication Plug-in module relay
14742001	CFW500-CUSB	USB communication Plug-in module
14741999	CFW500-CCAN	CAN communication Plug-in module
14742005	CFW500-CRS232	RS232 communication Plug-in module
14742132	CFW500-CRS485	RS485 communication Plug-in module
14742131	CFW500-CPDP	Profibus communication Plug-in module
12443605	CFW500-CPDP2	Profibus communication Plug-in module
12619000	CFW500-ENC	Encoder input module (1)
12892814	CFW500-CETH-IP	EtherNet/IP communication Plug-in module
12892815	CFW500-CEMB-TCP	Modbus TCP communication Plug-in module
12892816	CFW500-CEPN-IO	Profinet IO communication Plug-in module
15560296	CFW500-SFY2	Safety Functions Module (STO and SS1-t) (3)
Flash Memory Module		
11636485	CFW500-MMF	Flash Memory Module
External HMI		
11833992	CFW500-HMIR	Serial remote HMI
15578295	HMI-01	Alphanumeric remote HMI (4)
15578297	CFW500-RHMIF	Frame for HMI alphanumeric (4)
12330016	CFW500-CCHMIR01M	1 m serial remote HMI cable kit
12330459	CFW500-CCHMIR02M	2 m serial remote HMI cable kit
12330460	CFW500-CCHMIR03M	3 m serial remote HMI cable kit
12330461	CFW500-CCHMIR05M	5 m serial remote HMI cable kit
12330462	CFW500-CCHMIR75M	7.5 m serial remote HMI cable kit
12330463	CFW500-CCHMIR10M	10 m serial remote HMI cable kit
Mechanical Accessories		
11527460	CFW500-KN1A	Nema1 kit for frame size A (standard for option N1) (2)
11527459	CFW500-KN1B	Nema1 kit for frame size B (standard for option N1) (2)
12133824	CFW500-KN1C	Nema1 Kit for frame size C (standard for option N1) (2)
12692970	CFW500-KN1D	Nema1 kit for frame size D (standard for option N1) (2)
13104601	CFW500-KN1E	Nema1 kit for frame size E (standard for option N1) (2)
14601107	CFW500-KN1F	Nema1 kit for frame size F (standard for option N1) (2)
15461789	CFW500-KN1G	Nema1 kit for frame size G (standard for option N1) (2)
11951056	CFW500-KPCSA	Kit for power cables shielding - frame size A (2)
11951108	CFW500-KPCSB	Kit for power cables shielding - frame size B (2)
12133826	CFW500-KPCSC	Kit for power cables shielding - frame size C (2)
12692971	CFW500-KPCSD	Kit for power cables shielding - frame size D (2)
13055389	CFW500-KPCSE	Kit for power cables shielding - frame size E (2)
14601158	CFW500-KPCSF	Kit for power cables shielding - frame size F (2)
15461788	CFW500-KPCSG	Kit for power cables shielding - frame size G (2)
15614039	CFW500-KAPGM	PG21 to M25 Adapter kit (CFW500 IP66)
12473659	-	Ferrite core M-049-03 (MAGNETEC)
12480705	-	Ferrite core B64290-S8615-X5 (EPCOS)
12983778	-	Ferrite core T60006-L2045-V101

(1) The CFW500-ENC accessory must be only used with the main software version equal to or above the version 2.00.

(2) The Nema1 kit and KPCS Kit cannot be installed simultaneously on the product.

(3) The CFW500-SFY2 accessory can only be used on CFW500 inverters that contain G2 or Y2 in the smart code.

(4) Accessories HMI-01 and CFW500-RHMIF must only be used with the main software version equal to or above version 3.5x.

Table 7.2: I/O configurations of plug-in modules

Plug-In Module	Functions													
	DI	AI	ENC	AO	DOR	DOT	USB	CAN	RS232	RS485	Profibus	EtherNet	Source 10 V	Source 24 V
CFW500-IOS	4	1	-	1	1	1	-	-	-	1	-	-	1	1
CFW500-IOD	8	1	-	1	1	4	-	-	-	1	-	-	1	1
CFW500-IOAD	6	3	-	2	1	3	-	-	-	1	-	-	1	1
CFW500-IOR	5	1	-	1	4	1	-	-	-	1	-	-	1	1
CFW500-CUSB	4	1	-	1	1	1	1	-	-	1	-	-	1	1
CFW500-CCAN	2	1	-	1	1	1	-	1	-	1	-	-	1	1
CFW500-CRS232	2	1	-	1	1	1	-	-	1	1	-	-	-	1
CFW500-CRS485	4	2	-	1	2	1	-	-	-	2	-	-	1	1
CFW500-CPDP	2	1	-	1	1	1	-	-	-	1	1	-	-	1
CFW500-CPDP2	2	1	-	1	1	1	-	-	-	1	1	-	-	1
CFW500-ENC500	5	1	1	1	3	1	-	-	-	1	-	-	-	1
CFW500-CETH-IP	2	1	-	1	1	1	-	-	-	1	-	1	-	1
CFW500-CEMB-TCP	2	1	-	1	1	1	-	-	-	1	-	1	-	1
CFW500-CEPN-IO	2	1	-	1	1	1	-	-	-	1	-	1	-	1

8 TECHNICAL SPECIFICATIONS

8.1 POWER DATA

Power Supply:

- Voltage Tolerance: -15 % to +10 % of nominal voltage.
- 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 (IEC/EN 61010/UL 508C).
- Transient voltage according to Category III.
- Maximum of 10 connections (power up cycles - ON/OFF) per hour (1 every 6 minutes).
- Typical efficiency: ≥ 97 %.

For further information about the technical specifications, refer to APPENDIX B - TECHNICAL SPECIFICATIONS on page 158.

8.2 ELECTRONICS/GENERAL DATA

Table 8.1: *Electronics/general data*

Control	Method	■ Type of control: - V/f (Scalar) - VVW: Voltage vector control - Vector control with encoder - Sensorless vector control (without encoder) ■ PWM SVM (Space Vector Modulation)
	Output frequency	■ 0 to 500 Hz, resolution of 0.015 Hz
Performance	Speed Control	**V/f (Scalar):** ■ Regulation (with slip compensation): 1 % of the rated speed ■ Speed variation range: 1:20 **VVW:** ■ Regulation: 1 % of the rated speed ■ Speed variation range: 1:30 **Sensorless:** ■ Regulation: 0.5 % of the rated speed ■ Speed variation range: 1:100 **Vector with Encoder:** ■ Regulation 0.1 % of the rated speed with a digital reference (keypad, serial, fieldbus, Electronic Potentiometer, Multispeed)
	Speed Control PM Motor	**VVW PM:** ■ Regulation: 0.1 % of the rated speed ■ Speed variation range: 1:20
	Torque Control	■ Range: 10 to 180 %, regulation: ±5 % of the rated torque (with encoder) ■ Range: 20 to 180 %, regulation: ±10 % of the rated torque (sensorless above 3 Hz)

Inputs (*)	Analog	■ 1 insulated input. Levels: (0 to 10) V or (0 to 20) mA or (4 to 20) mA ■ Linearity error ≤ 0.25 % ■ Impedance: 100 kΩ for voltage input, 500 Ω for current input ■ Programmable functions ■ Maximum voltage permitted in the input: 30 Vdc
	Digital	■ 4 insulated inputs ■ Programmable functions: - active high (PNP): maximum low level of 15 Vdc minimum high level of 20 Vdc - active low (NPN): maximum low level of 5 Vdc minimum high level of 9 Vdc ■ Maximum input voltage of 30 Vdc ■ Input current: 4.5 mA ■ Maximum input current: 5.5 mA
Outputs (*)	Analog	■ 1 insulated output. Levels (0 to 10) V or (0 to 20) mA or (4 to 20) mA ■ Linearity error ≤ 0.25 % ■ Programmable functions ■ R_L ≥ 10 kΩ (0 to 10 V) or R_L ≤ 500 Ω (0 to 20 mA / 4 to 20 mA)
Outputs (*)	Relay	■ 1 relay with NA/NF contact ■ Maximum voltage: 240 Vac ■ Maximum current: 0.5 A ■ Programmable functions
	Transistor	■ 1 insulated digital output open sink (uses as reference the 24 Vdc power supply) ■ Maximum current 150 mA(**) (maximum capacity of the 24 Vdc) power supply ■ Programmable functions **Note!** When the digital output load is fed by an external power supply, the output status remains indefinite until the internal 24 V power supply is stable.
	Power supply	■ 24 Vdc ±20 % power supply. Maximum capacity: 150 mA(**) ■ 10 Vdc power supply. Maximum capacity: 2 mA
Communication	Interface RS485	■ Insulated RS485 ■ Modbus-RTU protocol with maximum communication of 38.4 kbps
Safety	Protection	■ Overcurrent/phase-phase short circuit in the output ■ Overcurrent/phase-ground short circuit in the output ■ Under/overvoltage ■ Overtemperature in the heatsink ■ Overload in the motor ■ Overload in the power module (IGBTs) ■ External alarm/fault ■ Setting error
Human-machine interface (HMI)	Standard HMI	■ 9 keys: Start/Stop, Up arrow, Down arrow, Direction of Rotation, Jog, Local/Remote, BACK/ESC and ENTER/MENU ■ LCD display ■ View/edition of all parameters ■ Indication accuracy: - current: 5 % of the rated current - speed resolution: 0.1 Hz
Enclosure	IP20	■ Models of frame sizes A, B, C, D, E, F and G
	Nema1/IP20	■ Models of frame sizes A, B, C, D, E, F and G with kit Nema1
	IP66	■ Models of frame sizes A and B

(*) The number and/or type of analog/digital inputs/outputs may vary. Depending on the Plug-in module (accessory) used. For the table above, it was considered the standard plug-in module. For further information, refer to the programming manual and the guide supplied with the optional item.

(**) The maximum capacity of 150 mA must be considered adding the load of the 24 V power supply and transistor output, that is, the sum of the consumption of both must not exceed 150 mA.

8.2.1 Codes and Standards

Table 8.2: Codes and standards

Safety standards	■ UL 508C - power conversion equipment. **Note:** Suitable for Installation in a compartment handling conditioned air. ■ UL 840 - insulation coordination including clearances and creepage distances for electrical equipment. ■ IEC/EN 61800-5-1 - safety requirements electrical, thermal and energy. ■ EN 50178 - electronic equipment for use in power installations. ■ IEC/EN 60204-1 - safety of machinery. Electrical equipment of machines. Part 1: general requirements. **Note:** for the machine to comply with this standard, the manufacturer of the machine is responsible for installing an emergency stop device and equipment to disconnect the input power supply. ■ IEC/EN 60146 (IEC 146) - semiconductor converters. ■ IEC/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) standards	■ IEC/EN 61800-3 - adjustable speed electrical power drive systems - part 3: EMC product standard including specific test methods. ■ CISPR 11 - industrial, scientific and medical (ISM) radio-frequency equipment - electromagnetic disturbance characteristics - limits and methods of measurement. ■ IEC/EN 61000-4-2 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 2: electrostatic discharge immunity test. ■ IEC/EN 61000-4-3 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 3: radiated, radio-frequency, electromagnetic field immunity test. ■ IEC/EN 61000-4-4 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 4: electrical fast transient/burst immunity test. ■ IEC/EN 61000-4-5 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 5: surge immunity test. ■ IEC/EN 61000-4-6 - electromagnetic compatibility (EMC) - part 4: testing and measurement techniques - section 6: Immunity to conducted disturbances, induced by radio-frequency fields.
Mechanical construction standards	■ IEC/EN 60529 - degrees of protection provided by enclosures (IP code). ■ UL 50 - enclosures for electrical equipment. ■ IEC/EN 60721-3-3 – classification of environmental conditions - part 3: classification of groups of environmental parameters and their severities - section 3: stationary use at weather protected locations level 3m4.

8.3 CERTIFICATIONS

Certifications (*)	Notes
UL and cUL	E184430
CE	
IRAM	
C-Tick	
EAC	

(*) For updated information on certifications, please contact WEG.