FREQUENCY INVERTER MANUAL WITH POWER HIGHER THAN 500 HP

380-480 V

500-600 V

660-690 V

User´s Guide

CONTENTS

1. INTRODUCTION

- ☑ This Manual gives information about the CFW-09 frequency inverter line with power higher than 500HP and in voltage ranges of 380-480V, 500-600V e 660-690V. Please read the Manual of the CFW-09 Frequency Inverter before to proceed with the reading of this Manual. All information indicated in that Manual about the Software Version, Specification, Safety Notices, HMI Use, Detailed Parameter Description, Diagnostics, Troubleshooting and Warranty are also valid for this inverter line.
- ☑ To specify the CFW-09 model, indicate the desired current in the field for rated output current for constant torque according to code below:

380-480V	500-600V:	660-690V:
0686= 686 A	0600= 600 A	0492= 492 A
0855= 855 A	0652= 652 A	0580= 580 A
1140= 1140 A	0794= 794 A	0646= 646 A
1283= 1283 A	0897= 897 A	0813= 813 A
1710=1710A	0978= 978 A	0869= 869 A
	1191= 1191 A	0969= 969 A
	1345= 1345 A	220= 1220 A

Ex.: CFW090855T3848PSZ corresponds to a three-phase CFW-09 standard inverter for 855 A, with power supply from 380 to 480V, and Manual in Portuguese. An inverter with power supply from 500 to 600V would be specified as CFW09XXXXT5060PSZ and with power supply from 660 to 690V would be specified as CFW09XXXXT6669PSZ (where XXXX is substituted for the inverter current).

2. CFW-09 SERIES - CURRENT HIGHER THAN 500 HP_____

☑ The inverters of the CFW-09 series for currents higher than 500 A are designed in modular assembling with two or three module configurations. The modular feature increases the inverter reliability and makes the maintenance services easier (Figure 1 and 2).

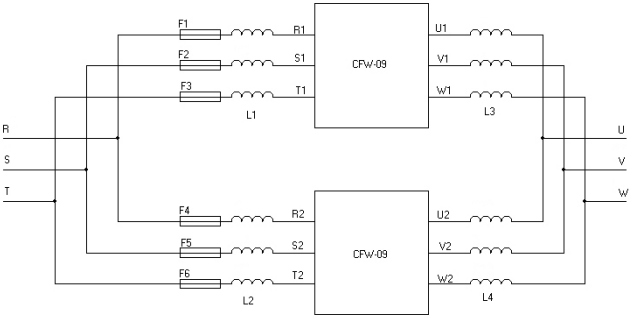


Figure 1 *- Assembling with two modules*

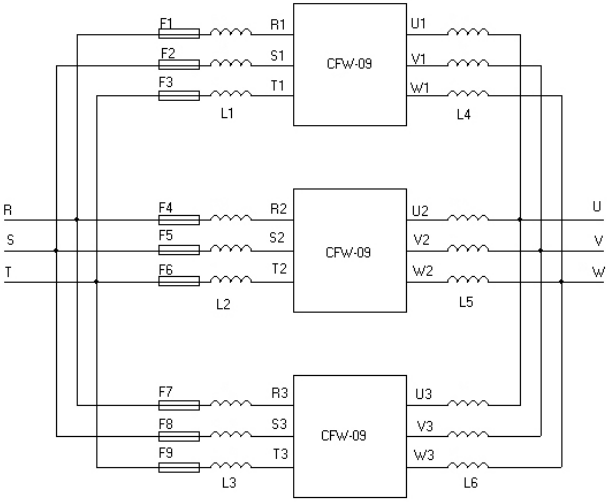


Figure 2 *- Mounting of three parallel connected modules*

☑ The Figures 1 and 2 shows standard configuration. However when the harmonic distortion of the input current may cause problem, you can create a DC bus from the 12-pulse rectifier (Fig. 3) and supply the modules through the DC link directly (Fig. 4). For this connect a CFW-09 HD at the output.

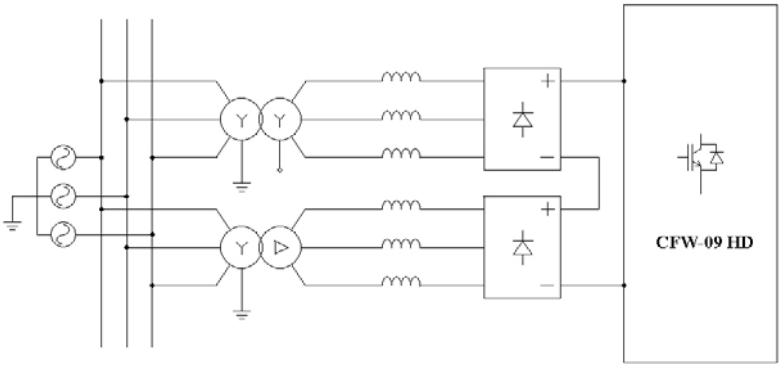


Figure 3 *- 12 pulse rectifier by using two transformers*

☑ Figure 3 shows 12-pulse rectifier by using two transformers. You can also use only one transformer with two secondary windings.

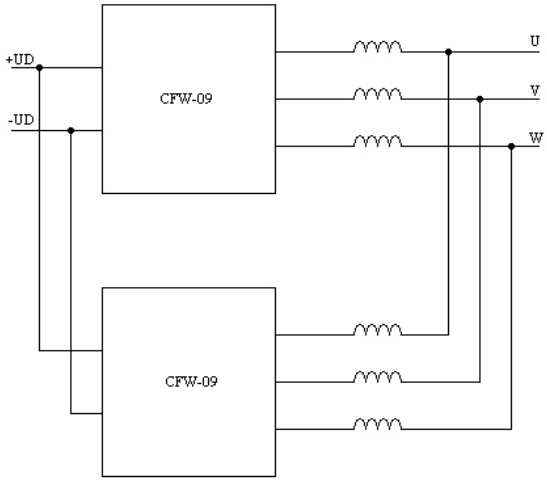


Figure 4 *- Modules supplied directly by the DC link*

☑ The use of the CFW-09 RB is another supply possibility through the DC link with low distortion. CFW-09 RB (Fig. 5). This configuration is also available with three modules. The CFW-09 RB is only available for 380-480V-supply voltage.

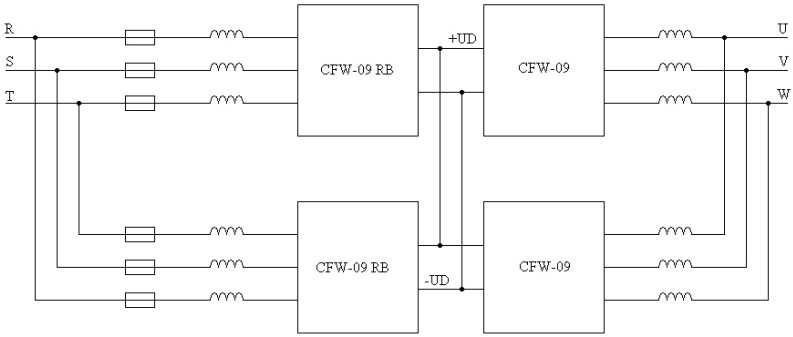


Figure 5 *- Supply by regenerative converter*

☑ One of the module (HM module) is fitted with the control board (CC9), HMI, and a board (PIB1 for 380-480V and PIB2 for the other voltages) responsible for the interface with the other module(s) (HS Module). The board CC9 is connected to the PIB1 board (through the XC2 cable) that distributes the control signals to the HS Module(s) and combines the error signals of all modules.

☑ When the modules are supplied directly through the DC link, the module that has the control board and the PIB board receives the designation HF and the other(s) are designated as HG. Fig. 4 shows the configuration with two modules, but the configuration with three modules also exists.

☑ The HM, HS, HF and HG modules have the same enclosure and the same power circuit like the CFW-09 inverters, as shown in Table 1 below.

☑ The available currents and the respective configurations are shown in Tables 1, 2 and 3 below.

Current	Number of Modules
686	2X CFW-09 361
855	2X CFW-09 450
1140	2X CFW-09 600
1283	3X CFW-09 450
1710	3X CFW-09 600

Table 1 *- Currents and configurations for 380-480V*

Current	Number of Modules
600	2X CFW-09 315
652	2X CFW-09 343
794	2X CFW-09 418
897	2X CFW-09 472
978	3X CFW-09 343
1191	3X CFW-09 418
1345	3X CFW-09 472

Table 2 *- Currents and configurations for 500-600V*

Current	Number of Modules
492	2X CFW-09 315
580	2X CFW-09 343
646	2X CFW-09 418
813	2X CFW-09 472
869	3X CFW-09 343
969	3X CFW-09 418
1220	3X CFW-09 472

Table 3 *- Currents and configurations for 660-690V*

☑ There are two alternatives for purchasing these inverters:

A. Purchase of a complete WEG panel mounted inverter (Types AFW upon request)

B. Purchase of a complete inverter (without panel), including power modules, reactance chokes and a KMP kit containing the PIB board and the flat cables.

NOTE!

In Item B above are not included the fuses and the current transformer for ground fault detection . These items must be purchased separately.

NOTE!
As there is more than one supplier for the semiconductors, a colored label is stuck beside the product nameplate. It is very important that all used inverters have the same label with the same data and color.

NOTE!
If the replacement of a module by a standard inverter is required, please contact WEG Automação. This replacement can not be made directly, some changes are required.

3. MECHANICAL INSTALLATION

- ☑ The instructions refer to alternative B in Item 2.
- ☑ Figures 6 and 7 show the spacing that must be assured when two or three modules mounted. The figures show size 10 of the 380-480V series. The installation of the 500-600V and 660-690V series is similar.
- ☑ The environmental conditions required for the installation are the same as described in Item 3.1.1 for the installation of the CFW-09 frequency inverter.
- ☑ The minimum required airflow for two modules assembled in the same panel is 3740 CFM (1765 L/s). For three modules is 5610 CFM (2640 L/s). Please consider other equipment installed within the panel, such as, external rectifier, additional modules, etc. The environmental conditions are the same as for the standard CFW-09 series.

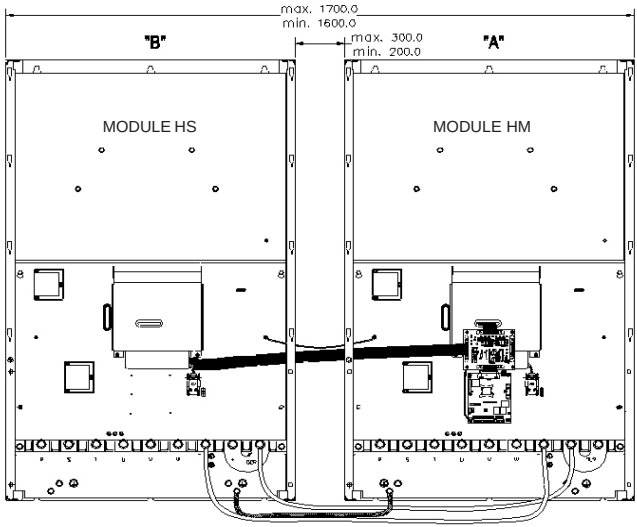


Figure 6 *- Mounting with two modules*

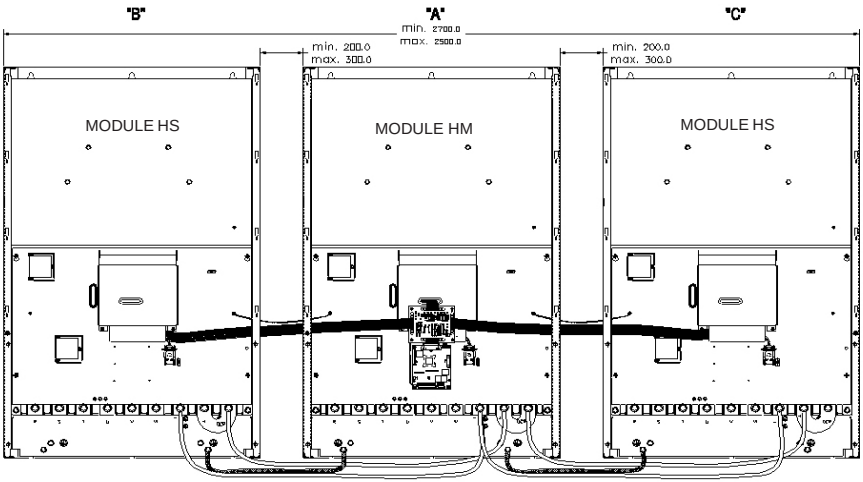


Figure 7 *- Mounting with three modules*

4. ELECTRICAL INSTALLATION

☑ The input reactances (Fig. 1 and 2) shall have a min. drop of 2% and their impedance shall be identical, i.e. , they shall be electrically as similar as possible. Also the output reactances (Fig. 1 and 2) shall be electrically similar, where a drop lower than 2% is not permitted, recommending a typical value of 2%. It is recommended that the sum of input and the output reactance percentage does not exceed 5%. **The reactance symmetry is very important for the current division among the modules**. **The difference between the reactances should be smaller or equal to 3% at the rated current. Each reactance must be fitted** with a coil NF **140°C** Thermostat. The formula for the inductance calculation is given by the Equation below:

$$L = \frac{\text{Percentual voltage drop [\%] x Linevoltage [V]}}{\sqrt{3} \text{ x } 2 \text{ x } \pi \text{ x Netwotk Frequency [Hz] x Individual Inverter Current [A]}} \text{ [H]}$$

☑ The input reactances in Table 4 were dimensioned for a drop of 2% at 440V (60Hz). The reactances in Table 5 were dimensioned for a drop of 2% at 575V (60Hz) and the reactances in Table 6 were dimensioned for 690V. For any other condition you must calculate the reactances again.

Input/Output Reactances - 380-480V				
Inverter (A)	Reactance @ Inominal	Reactance @ 150% of Inominal	Thermal Current	Number of Units
686	39μH@361A	26μH@542A	397A	2
855	31μH@450A	21μH@675A	495A	2
1140	23μH@600A	16μH@900A	660A	2
1283	31μH@450A	21μH@675A	495A	3
1710	23μH@600A	16μH@900A	660A	3

Table 4 *- Input/Output Reactances - 380-480V*

Input/Output Reactances - 500-600V				
Inverter (A)	Reactance @ Inominal	Reactance @ 150% of Inominal	Thermal Current	Number of Units
600	56μ@315A	37μ@473A	347A	2
652	52μ@343A	34μ@515A	377A	2
794	42μ@418A	28μ@627A	460A	2
897	37μ@472A	25μ@708A	519A	2
978	52μ@343A	34μ@515A	377A	3
1191	42μ@418A	28μ@627A	460A	3
1345	37μ@472A	25μ@708A	519A	3

Table 5 *- Input/Output Reactances 500-600V*

Input/Output Reactances - 660-690V				
Inverter (A)	Reactance @ Inominal	Reactance @ 150% of Inominal	Thermal Current	Number of Units
492	98μ@259A	65μ@389A	285	2
580	83μ@305A	55μ@457A	336	2
646	75μ@340A	50μ@510A	374	2
813	60μ@428A	40μ@642A	471	2
869	83μ@305A	55μ@457A	336	3
969	75μ@340A	50μ@510A	374	3
1220	60μ@428A	40μ@642A	471	3

Table 6 *- Input/Output Reactances 660-690V*

- ☑ When a CFW-09 RB regenerative converter is used, the calculation of the reactances is made in a different manner. Check the specific Manual. The output reactances are always calculated in the same manner, i. e, as specified in this Manual.
- ☑ The drive mounting must be symmetric as possible, since the symmetry also affects the current division among the modules. The network connections up to the input reactances and from the input reactances up to the modules shall be of the same length. The connections from the output of the modules up to the output reactances and from the output reactances up to the load shall also be of the same length.
  This symmetry is easier to be reached when three modules are applied, since the power connections of the HM module are generally shorter. For more details, please contact WEG.
- ☑ For the power and grounding wire dimensioning and fuses selection for each module, please refer to Table 3.5 in the Frequency Inverter Manual - CFW-09. The input fuses must be individual for each module and they must be fitted with a micro-switch for indication.
- ☑ The module DC Link must be interconnected.
- ☑ For the rated voltage selection of the modules and for location of the power and ground- ding connections, refer to section 3.2.3 in the Frequency Inverter Manual - CFW-09.
- ☑ The grounding must be realized on the HM/HF module and the grounding connections of the other module(s) (HS/HG) must be connected to the HM/HF module. Also the motor must be grounded on the HM/HF module.
- ☑ The lower module shields must be interconnected by stranded copper cable that is supplied with the KMP Kit.

- ☑ The connection between the PIB1 (HM/HF module) and the HS/HG module(s) must be realized through shielded flat cable that is also supplied with the KMP Kit.
- ☑ The HF and HG modules are fitted with a terminal for the supply of the cooling fans (Fig. 9). The supply voltage is 220V/60Hz and the drained current is 2,7 A. Na external protection through fuses must be provided for the fan supply.

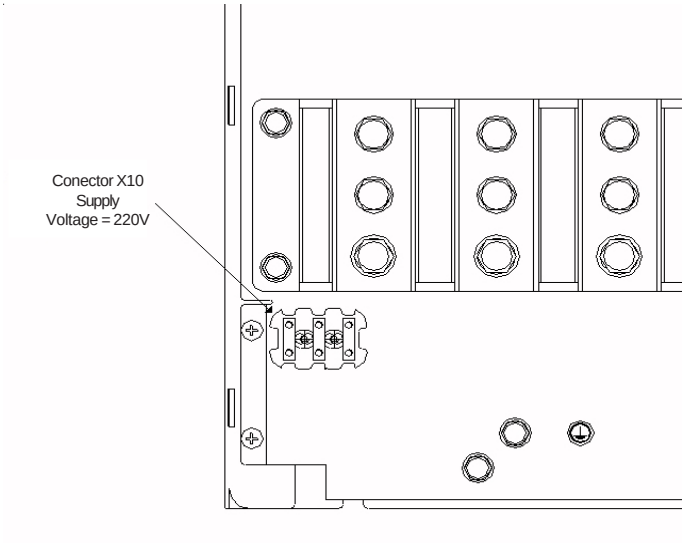


Figure 8 *- Fan supply*

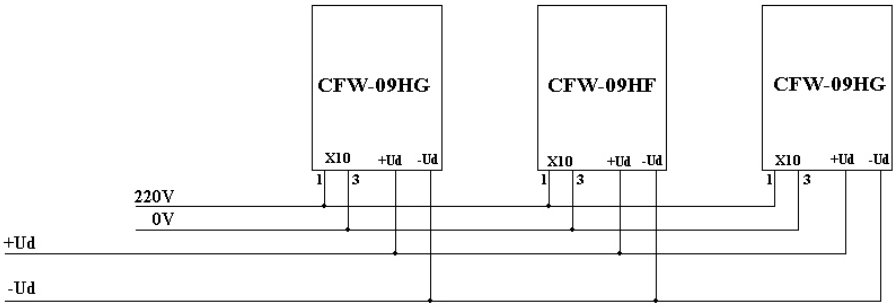


Figure 9 *- Fan supply View*

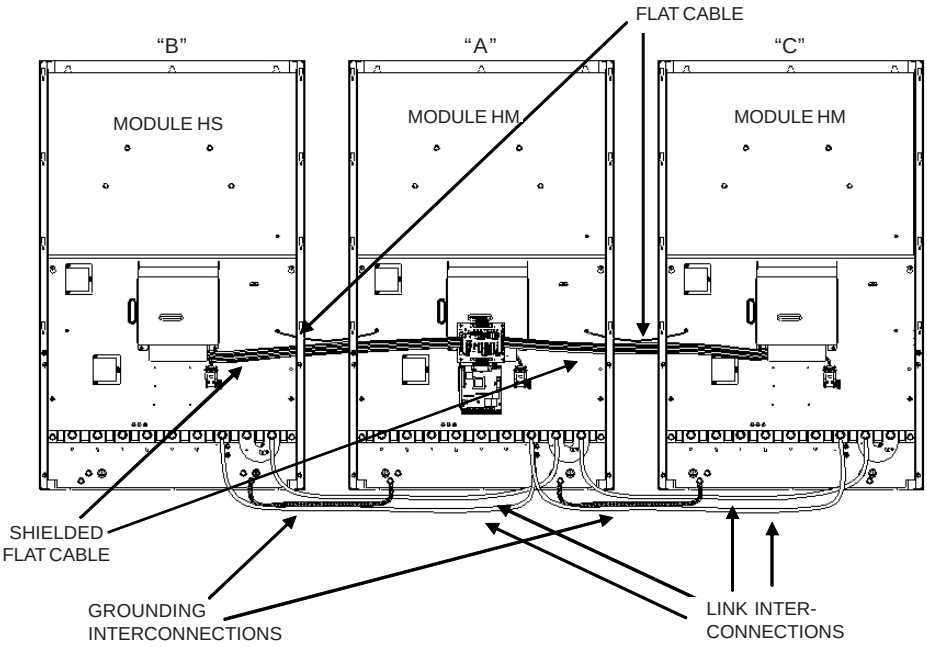


Figure 10 *- Mounting of three Modules*

- ☑ Figure 10 shows the mounting with three modules; if the mounting is only with two modules, eliminate only the "C" module and its connections.
- ☑ The grounding fault protection of the modules must be realized externally. The CT of the grounding fault current with the ratio of 4500:5 shall be connected to the general power supply (Fig. 11), where the cables of the three phases (R, S and T) pass through the CT window.

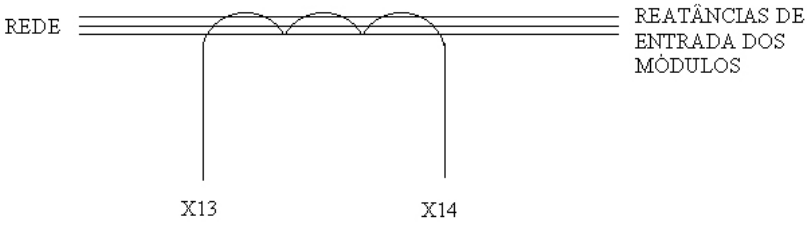


Figure 11 *- Grounding fault CT at the input*

- ☑ The two terminals (Faston type) of the CT must be connected to the PIB1 board (series 380-480V) at X13 and X14 (Fig. 12)

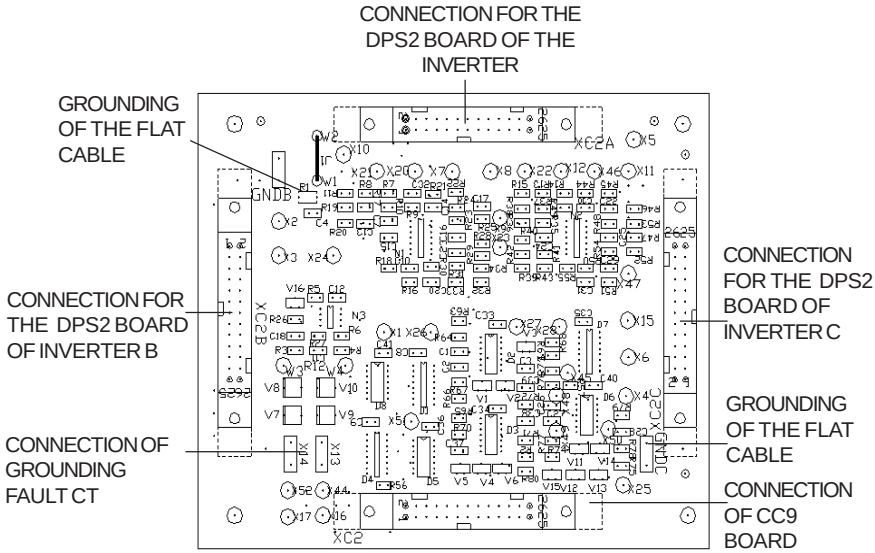


Figure 12 *- Terminals on PIB1 board*

☑ For the other voltage series (500-600V e 660-690V), the CT terminals must be connected at W57 and W58 (Fig. 13). If required disable the ground fault protection. Connect at W59-W60.

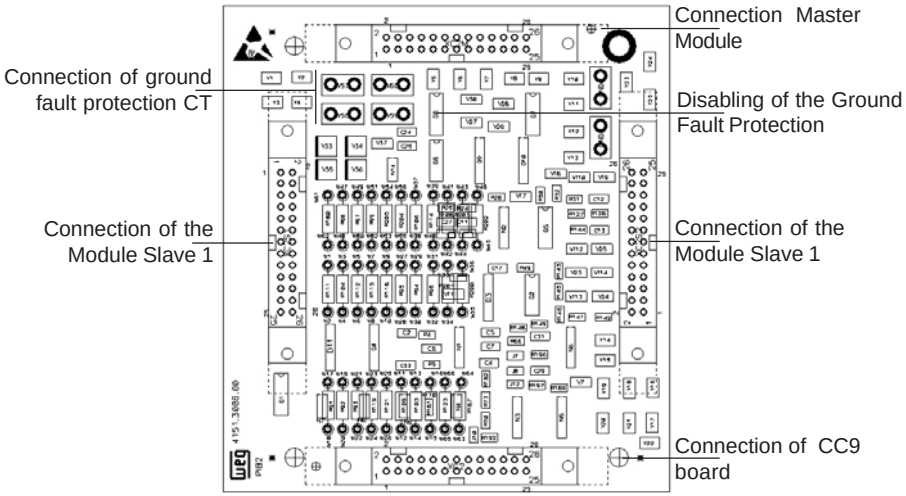


Figure 13 *- Terminals on the PIB2 board*

☑ If the inverters are supplied directly by the DC Link, provide an external preload circuit (Fig. 14). For more details about the circuit dimensioning, please contact WEG Automacão.

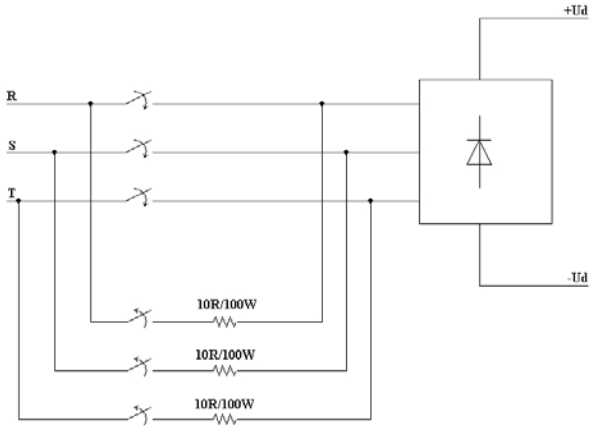


Figure 14 *- Preload Circuit*

☑ The micro-switches and the thermostats of the coils must be interconnected to the drive fault chain in such a manner if one fuse blows, or the temperature of one coils exceeds 140°C, an external fault is indicated. This may be realized by using a digital input of the CFW-09. For more details, refer to the Frequency Inverter Manual (Fig. 14)

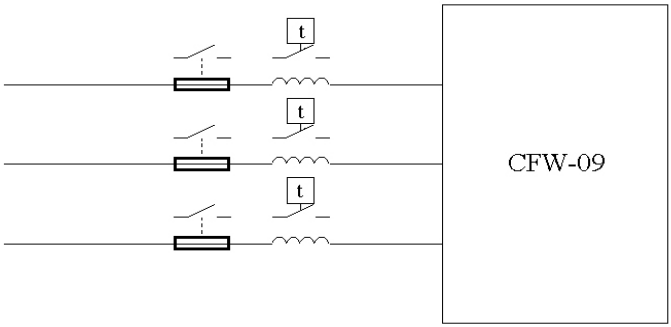


Figure 15 *- Additional external protection for each module*

5. KITS KMP

☑ Tables 7, 8 and 9 below show WEG Items for the KMP kits.

ITEM	DESIGNATION
417102523	KIT KMP 686 A
417102524	KIT KMP 855 A
417102525	KIT KMP 1140 A
417102526	KIT KMP 1283 A
417102527	KIT KMP 1710 A

Table 7 *- KMP kits for the CFW-09 of 380-480V series*

ITEM	DESIGNATION
417104803	KIT KMP 600 A
417104804	KIT KMP 652 A
417104805	KIT KMP 794 A
417104806	KIT KMP 897 A
417104807	KIT KMP 978 A
417104808	KIT KMP 1191A
417104809	KIT KMP 1395A

Table 8 *- KMP kits for the CFW-09 of 500-600V series*

ITEM	DESIGNATION
417104810	KIT KMP 492 A
417104811	KIT KMP 580 A
417104812	KIT KMP 646 A
417104813	KIT KMP 813 A
417104814	KIT KMP 869 A
417104815	KIT KMP 969A
417104816	KIT KMP 1220A

Table 9 *- Kits KMP for CFW-09 - 660-690V series*

☑ The kits contain one PIB1 board, spacers and board mounting bolts, flat cable, stranded cables and product identification label.

Current	Version of the PIB1 Board
686	PIB1.00 (4151.1281)
855	PIB1.01 (4151.2643)
1140	PIB1.01 (4151.2643)
1283	PIB1.10 (4151.2645)
1710	PIB1.11 (4151.2646)

Table 10 *- Versions of the PIB1 board*

Current	Version of the PIB2 Board
600	PIB2.00 (4151.2844)
652	PIB2.01 (4151.3031)
794	PIB2.02 (4151.3032)
897	PIB2.03 (4151.3033)
978	PIB2.04 (4151.3034)
1191	PIB2.05 (4151.3035)
1345	PIB2.06 (4151.3036)

Table 11 *- Versions of the PIB2 Board - 500-600V series*

Current	Version of the PIB2 Board
492	PIB2.07 (4151.3037)
580	PIB2.08 (4151.3038)
646	PIB2.09 (4151.3039)
813	PIB2.10 (4151.3040)
869	PIB2.11 (4151.3041)
969	PIB2.12 (4151.3042)
1220	PIB2.13 (4151.3043)

Table 12 *- Versions of the PIB2 Board - 600-690V series*

6. MOUNTING OF THE KMP KIT

- ☑ Figures 16 and 17 show the mounting configurations of the HM module and the item positions of the KMP kits. When shelf power modules are applied, the HM inverter is fitted with the PIB board. The control boards of the HS module are removed and the HMIs are replaced by blind caps. The figure shows size 10 of 380-480V series. The connections are similar for the other voltages.
- ☑ For the 380-480V series the flat cable connection is carried out at the DPS2 and for the other voltages the connection is made at the DPS3.

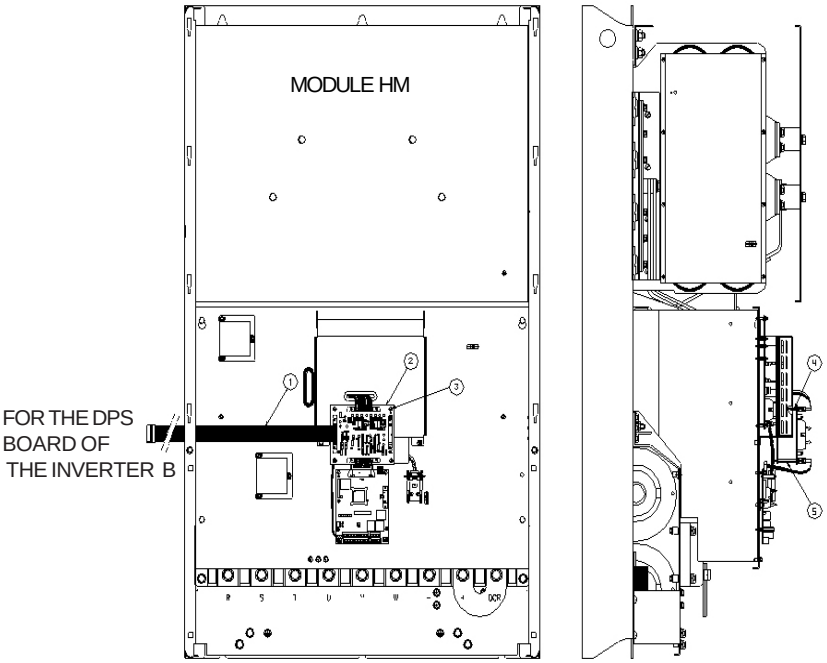


Figure 16 *- Mounting with two modules*

- ☑ Position 1- Flat cable XC2 (0307.7595)
- ☑ Position 2- PIB board (item according to inverter type)
- ☑ Position 3- Philips bolt Al. AP M3X8mm (0401.5045)
- ☑ Position 4- Spacer M3X7mm (0309.0070) at the PIB1
- ☑ Position 5- Spacer M3X35mm (0308.6054) at the PIB1

Note.: When PIB2 is mounted, the spacer corresponding to bolt of position 3 is a metallic spacer M3X10mm (0308.5716). The other spacers are made of plastic – 9.4mm.

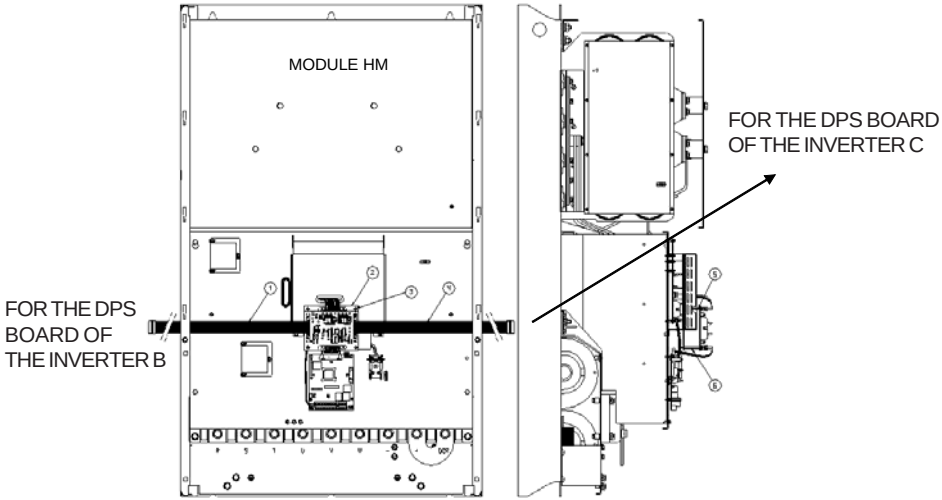


Figure 17 *- Mounting of three modules*

- ☑ Position 1- Flat cable XC2 (0307.7595)
- ☑ Position 2- PIB board (item according to inverter type)
- ☑ Position 3- Philips bolt Al. AP M3X8mm (0401.5045)
- ☑ Position 4 - Flat cable XC6 (0307.48534)
- ☑ Position 5- Spacer M3X7mm (0309.0070) at the PIB1
- ☑ Position 6- Spacer M3X35mm (0308.6054) at the PIB1

Note.: When PIB2 is mounted, the spacer corresponding to bolt of position 3 is a metallic spacer M3X10mm (0308.5716). The other spacers are made of plastic – 9.4mm.

7. START-UP

- ☑ The following tests must be applied after installation:
  - Connect jumper JS1 on the CC9 control board (see Fig. 18);
  - Start-up the inverter in without load mode, operating it in scalar mode; Check the pulse feedback signal with speed reference at 90 RPM (XC4:1,2,3 of the CC9 board relating to the X1-GND). The pulse curves shall be similar to those shown in Figure 19;

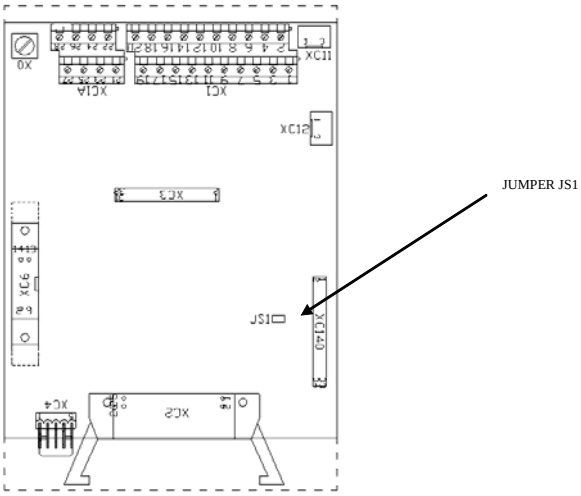


Figure 18 *- Jumper JS1 on the CC9 control board*

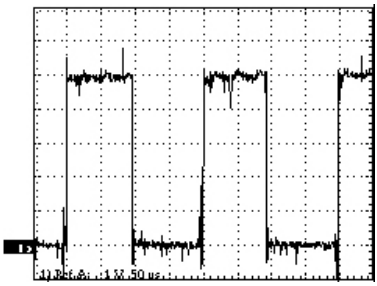


Figure 19 *- Pulse feedback signals*

- Connect a motor of low power to the inverter and check if the motor is running correctly;
- Increase the speed reference to 1800 RPM and check if the motor is running correctly;
- Open jumper JS1 on control board and operate inverter with a low power motor connected at the output. Please check if the motor is running correctly.
- Connect the motor to be driven to the inverter (scalar mode), apply the load and measure the input currents of all inverters (all phases R, S and T): the difference between the phase currents shall be lower than 5%.
- Measure the outputs currents of all inverters (all phases U, V and W): the difference between the phase currents shall be lower than 5%.

For the 380-480V, check the current feedback signal on the board PIB1 (IVA, IVB, IVC, IVT, IWA, IWB, IWC, IWT). The signals at rated inverter current must be similar to those shown in Figure 21 (test points X23, X24, X47, X25, X20, X21, X46, X22 relating to X44-DGND or X51-DGND; Figure 20).

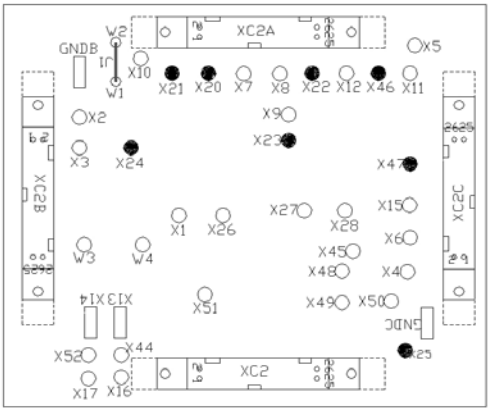


Figure 20 *- Test points on the board PIB1*

☑ When the 500-600V and 660-690V series are applied, check the current feedback signals at the board PIB2 (IVT, IWT), The signals at rated inverter current must be similar to those shown in Figure 21 (test points X14 and X15 relating to GND of the CC9, Figure 20).

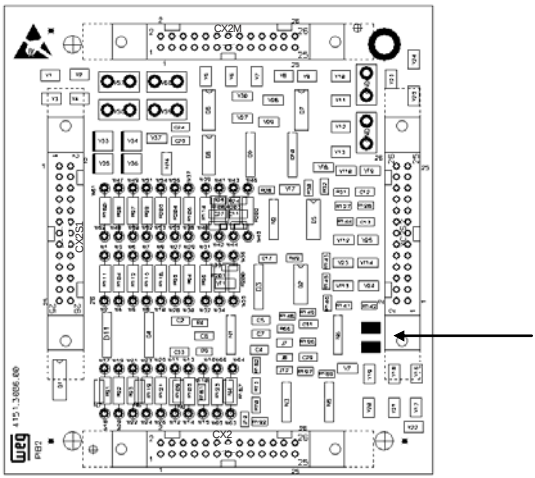


Figure 21 *- Test Points at the PIB2 Board*

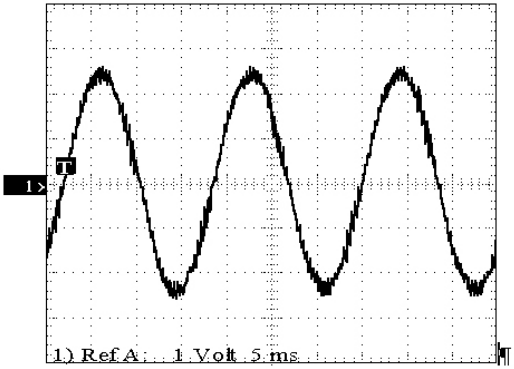


Figure 22 *– Current Feedback Signals*

- If the vector mode is used, program the inverter again and run the self-tuning. For motor with outputs higher than 900 HP, contact WEG about the values of the parameters P410 and P412.

8. OPTIONS AND ACCESSORIES

- ☑ If the use of the rheostatic braking is required, each module is able to control one DBW-01 module. As the Link is interconnected, the braking modules act in parallel. The braking process must be dimensioned according to the used modules and according to the application.
- ☑ If the use of the function expansion board or the field bus board is required, these will be connected to the HM or HF module.

9. POWER DATA

9.1 Network 380-480V

Model: Current / Voltage	686/ 380-480	855/ 380-480	1140/ 380-480	1283/ 380-480	1710/ 380-480
Load [1]	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT
Power (kVA) [2]	523	652	869	978	1303
Rated Output Current (A)[3]	686	855	1140	1283	1710
Maximum Output Current (A) [4]	1029	1283	1710	1925	2565
Rated Input Current (A)	727	906	1208	1360	1813
Switching Frequency (kHz)	2,5	2,5	2,5	2,5	2,5
Maximum Motor (HP) [5]	600	700	900	1000	1500
Rated DC Current (A) [6]	789	984	1311	1476	1967
Watts Loss (kW)	12	15,2	20	23	30
Frame size [7]	2X 9	2X 10	2X 10	3X 10	3X 10

9.2 Network 500-600V

Model: Current / Voltage	600/ 500-600	652/ 500-600	794/ 500-600	897/ 500-600	978/ 500-600
Load [1]	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT
Power (kVA) [2]	598	649	790	893	974
Rated Output Current (A) [3]	600	652	794	897	978
Maximum Output Current (A) [4]	900	978	1191	1345	1467
Rated Input Current (A)	636	691	842	950	1036
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) [5]	600	650	850	950	1000
Rated DC Current (A) [6]	690	750	913	1031	1125
Watts Loss (kW)	12	13.6	16.4	22	20.4
Frame size [7]	2X 10E	2X 10E	2X 10E	2X 10E	3X 10E

Model: Current / Voltage	1191/ 500-600	1345/ 500-600
Load [1]	CT/VT	CT/VT
Power (kVA) [2]	1186	1339
Rated Output Current (A) [3]	1191	1345
Maximum Output Current (A) [4]	1786	2017
Rated Input Current (A)	1262	1425
Switching Frequency (kHz)	2.5	2.5
Maximum Motor (HP) [5]	1300	1500
Rated DC Current (A) [6]	1370	1547
Watts Loss (kW)	24.6	33
Frame size [7]	3X 10E	3X 10E

9.3 Network 660-690V

Model: Current / Voltage	492/ 660-690	580/ 660-690	646/ 660-690	813/ 660-690	869/ 660-690
Load (1)	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT
Power (kVA) (2)	576	693	772	972	1038
Rated Output Current (A)(3)	492	580	646	813	869
Maximum Output Current (A) (4)	738	870	969	1219	1303
Rated Input Current (A)	521	615	678	862	921
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5)	600	750	850	1000	1200
Rated DC Current (A) (6)	566	667	743	935	1000
Watts Loss (kW)	12	13.6	16.4	22	20.4
Frame size (7)	2X 10E	2X 10E	2X 10E	2X 10E	3X 10E

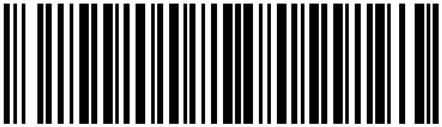
Model: Current / Voltage	969/ 660-690	1220 / 660-690
Load (1)	CT/VT	CT/VT
Power (kVA) (2)	1158	1458
Rated Output Current (A) (3)	969	1220
Maximum Output Current (A) (4)	1453	1830
Rated Input Current (A)	1027	1293
Switching Frequency (kHz)	2.5	2.5
Maximum Motor (HP) (5)	1300	1500
Rated DC Current (A) (6)	1114	1403
Watts Loss (kW)	24.6	33
Frame size (7)	3X 10E	3X 10E

NOTES:

(1) to (5) refer to CFW-09 Frequency Inverter Manual - Item 9.1

(6) For inverters supplied directly by DC Link.

(7) As the assembling is modular, the frame size definition is not applied. The indication shows how many frame sizes equivalent to CFW-09 are used. Information about the mounting of the modules is given in Item 3.



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