

*Frequency Inverter*

**Convertidores de Frecuencia**

**Inversores de Freqüência**



**CFW 08**  
VECTOR INVERTER

**CFW 08**  
VECTOR INVERTER *Plus*



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*User's  
Guide*

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Guia del  
Usuario

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Manual  
do usuário

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# FREQUENCY INVERTER MANUAL

**Series:** CFW-08

**Software:** version 3.9X

0899.4690 E/5

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08/2003



## **ATTENTION!**

It is very important to check if the inverter software version is the same as indicated above.

## Summary of Revisions

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The table below describes all revisions made to this manual.

<b>Revision</b>	<b>Description</b>	<b>Section</b>
1	First Edition	-
2	Item 3.3 - CE Installation Included	See item 3.3
3	General Revision	-
4	External Parallel Keypad and Fixs Kit Included and General Revision	See item 8.3 and 8.12
5	General Revision	-
6	Description changed of the Parallel Cable for the External Parallel Keypad. Item 7.5 (Spare Part List) Removed. Parameter 536 included and General Revision	See item 8.5 and 6.3.5

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## QUICK PARAMETER REFERENCE, FAULT AND STATUS MESSAGES

Software: V3.9X

Application:

Model:

Serial Number:

Responsible:

Date: / / .

## 1. Parameters

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
<b>P000</b>	Parameter Access	0 ... 4, 6 ... 999 = Read 5 = Alteration	0	-		72
<b>READ ONLY PARAMETERS (P002 ... P099)</b>						
<b>P002</b>	Frequency Proportional Value (P208xP005)	0 ... 6553	-	-		72
<b>P003</b>	Motor Current	0 ... 1.5I <sub>nom</sub>	-	-		72
<b>P004</b>	DC Link Voltage	0 ... 862V	-	-		72
<b>P005</b>	Motor Frequency	0.00 ... 99.99, 100.0 ... 300.0Hz	-	-		72
<b>P007</b>	Motor Voltage	0 ... 600V	-	-		72
<b>P008</b>	Heatsink Temperature	25 ... 110°C	-	-		72
<b>P009</b>	Motor Torque	0.0 ... 150.0%	-	-	Only available in vector control mode (P202=2)	72
<b>P014</b>	Last Fault	00 ... 41	-	-		72
<b>P023</b>	Software Version	x.y.z	-	-		73
<b>P040</b>	PID Process Variable (Value % x P528)	0 ... 6553	-	-		73
<b>REGULATION PARAMETERS (P100 ... P199)</b>						
<b>Ramps</b>						
<b>P100</b>	Acceleration Time #1	0.1 ... 999s	5.0			73
<b>P101</b>	Deceleration Time #1	0.1 ... 999s	10.0			73
<b>P102</b>	Acceleration Time #2	0.1 ... 999s	5.0			73
<b>P103</b>	Deceleration Time #2	0.1 ... 999s	10.0			73
<b>P104</b>	S Ramp	0 = Inactive 1 = 50% 2 = 100%	0			73
<b>Frequency Reference</b>						
<b>P120</b>	Digital Reference Backup	0 = Inactive 1 = Active 2 = Backup by P121 (or P525 - PID)	1			74
<b>P121</b>	Keypad Reference	P133 ... P134	3.00			74
<b>P122</b>	JOG Speed Reference	0.00 ... P134	5.00			74
<b>P124</b>	Multispeed Reference 1	P133 ... P134	3.00			75
<b>P125</b>	Multispeed Reference 2	P133 ... P134	10.00			75
<b>P126</b>	Multispeed Reference 3	P133 ... P134	20.00			75
<b>P127</b>	Multispeed Reference 4	P133 ... P134	30.00			75
<b>P128</b>	Multispeed Reference 5	P133 ... P134	40.00			75
<b>P129</b>	Multispeed Reference 6	P133 ... P134	50.00			75
<b>P130</b>	Multispeed Reference 7	P133 ... P134	60.00			75
<b>P131</b>	Multispeed Reference 8	P133 ... P134	66.00			75







## CFW-08 - QUICK PARAMETER REFERENCE

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
<b>Speed Limits</b>						
<b>P133</b>	Minimum Frequency ( $F_{min}$ )	0.00 ... P134	3.00			76
<b>P134</b>	Maximum Frequency ( $F_{max}$ )	P133 ... 300.0Hz	66.00			76
<b>V/F Control</b>						
<b>P136</b>	Manual Torque Boost (IxR Compensation)	0.0 ... 30.0%	5.0 or 2.0 or 1.0 <sup>(2)</sup>		Only available in V/F control Control Mode P202=0 or 1.	76
<b>P137</b>	Aut. Torque Boost (aut. IxR compensation)	0.00 ... 1.00	0.00			76
<b>P138</b>	Slip Compensation	0.0 ... 10.0%	0.0			77
<b>P142</b> <sup>(1)</sup>	Maximum Output Voltage	0.0 ... 100%	100			78
<b>P145</b> <sup>(1)</sup>	Field Weakening Frequency ( $F_{nom}$ )	P133 ... P134	50.00Hz or 60.00Hz depending on the market			78
<b>DC Link Voltage Regulation</b>						
<b>P151</b>	DC Link Regulation Level	200V models: 325 ... 410V 400V models: 564 ... 820V	380V 780V			79
<b>Overload Current</b>						
<b>P156</b>	Motor Overload Current	$0.2 \times I_{nom}$ ... $1.3 \times I_{nom}$	$1.2 \times P401$			79
<b>Current Limitation</b>						
<b>P169</b>	Maximum Output Current	$0.2 \times I_{nom}$ ... $2.0 \times I_{nom}$	$1.5 \times I_{nom}$			80
<b>Flux Control</b>						
<b>P178</b>	Rated Flux	50.0 ... 150%	100		Only available in V/F control mode (P202=2).	80
<b>CONFIGURATION PARAMETERS (P200 ... P398)</b>						
<b>Generic Parameters</b>						
<b>P202</b> <sup>(1)</sup>	Control Mode	0 = Linear V/F Control 1 = Quadratic V/F Control 2 = Sensorless Vector	0			81
<b>P203</b> <sup>(1)</sup>	Special Function Selection	0 = No function 1 = PID Regulator	0			82
<b>P204</b> <sup>(1)</sup>	Load Factory Setting	0 ... 4 = No Function 5 = Loads Factory Default	0	-		82
<b>P205</b>	Display Default Selection	0 = P005 1 = P003 2 = P002 3 = P007 4, 5 = Not used 6 = P040	2			82
<b>P206</b>	Auto-Reset Time	0 ... 255s	0			82
<b>P208</b>	Reference Scale Factor	0.00 ... 99.9	1.00			83
<b>P215</b> <sup>(1)</sup>	Keypad Copy Function	0 = Off 1 = Copy (inverter to keypad) 2 = Paste (keypad to inverter)	0		Only available via HMI-CFW08-RS keypad.	83
<b>P219</b> <sup>(1)</sup>	Switching Frequency Reduction Point	0.00 ... 25.00Hz	6.00			84

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

<sup>(2)</sup> The factory default of Parameter P136 depends on the inverter model as follows:  
- models 1.6-2.6-4.0-7.0A/200-240V or 1.0-1.6-2.6-4.0A/380-480V: P136=5.0%;  
- models 7.3-10-16A/200-240V or 2.7-4.3-6.5-10A/380-480V: P136=2.0%;  
- models 13-16A/380-480V: P136=1.0%.

## CFW-08 - QUICK PARAMETER REFERENCE

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
<b>Local/Remote Definition</b>						
<b>P220</b> <sup>(1)</sup>	Local/Remote Selection Source	0 = Always Local 1 = Always Remote 2 = HMI-CFW08-P or HMI-CFW08-RP keypad (default: local) 3 = HMI-CFW08-P or HMI-CFW08-RP keypad (default: remote) 4 = DI2 ... DI4 5 = Serial or HMI-CFW08-RS keypad (default: local) 6 = Serial or HMI-CFW08-RS keypad (default: remote)	2			85
<b>P221</b> <sup>(1)</sup>	Local Reference Selection	0 = Keypad  and  1 = AI1 2, 3 = AI2 4 = E.P. (Electronic Pot.) 5 = Serial 6 = Multispeed 7 = Add AI>=0 8 = Add AI	0			86
<b>P222</b> <sup>(1)</sup>	Remote Reference Selection	0 = Keypad  and  1 = AI1 2, 3 = AI2 4 = E.P. (Electronic Pot.) 5 = Serial 6 = Multispeed 7 = Add AI>=0 8 = Add AI	1			86
<b>P229</b> <sup>(1)</sup>	Local Command Selection	0 = HMI-CFW08-P or HMI-CFW08-RP keypad 1 = Terminals 2 = Serial or HMI-CFW08-RS keypad	0			86
<b>P230</b> <sup>(1)</sup>	Remote Command Selection	0 = HMI-CFW08-P or HMI-CFW08-RP keypad 1 = Terminals 2 = Serial or	1			86
<b>P231</b> <sup>(1)</sup>	Forward/Reverse Selection	HMI-CFW08-RS keypad 0 = Forward 1 = Reverse 2 = Commands	2			86
<b>Analog Input(s)</b>						
<b>P234</b>	Analog Input AI1 Gain	0.00 ... 9.99	1.00			86
<b>P235</b> <sup>(1)</sup>	Analog Input AI1 Signal	0 = 0-10V/0-20mA 1 = 4-20mA	0			87
<b>P236</b>	Analog Input AI1 Offset	-120 ... 120%	0.0			88
<b>P238</b>	Analog Input AI2 Gain	0.00 ... 9.99	1.00		Only available in CFW-08 Plus Version	88
<b>P239</b> <sup>(1)</sup>	Analog Input AI2 Gain	0 = 0-10V/0-20mA 1 = 4-20mA	0			87
<b>P240</b>	Analog Input AI2 Offset	-120 ... 120%	0.0			88
<b>P248</b>	Analog Inputs Filter Time Constant	0 ... 200ms	200			88

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## CFW-08 - QUICK PARAMETER REFERENCE

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
<b>Analog Output</b>						
<b>P251</b>	Analog Output AO Function	0 = Output Frequency (Fs) 1 = Input Reference (Fe) 2 = Output Current (Is) 3, 5, 8 = Not used 4 = Motor Torque 6 = Process Variable (PID) 7 = Active Current 9 = PID Setpoint	0		Only available in CFW-08 Plus version.	88
<b>P252</b>	Analog Output AO Gain	0.00 ... 9.99	1.00			88
<b>Digital Inputs</b>						
<b>P263</b> <sup>(1)</sup>	Digital Input DI1 Function	0 = No Function or General Enable 1 ... 7 and 10 ... 12 = General Enable 8 = Forward Run 9 = Start/Stop 13 = FWD Run Using Ramp #2 14 = Start (3-wire)	0			89
<b>P264</b> <sup>(1)</sup>	Digital Input DI2 Function	0 = Forward/Reverse 1 = Local/Remote 2 ... 6 and 9 ... 12 = Not used 7 = Multispeed (MS2) 8 = Reverse 13 = REV Run - Ramp #2 14 = Stop (3-wire)	0			89
<b>P265</b> <sup>(1)(2)</sup>	Digital Input DI3 Function	0 = Forward/Reverse 1 = Local/Remote 2 = General Enable 3 = JOG 4 = No External Fault 5 = Increase E.P. 6 = Ramp #2 7 = Multispeed (MS1) 8 = No Function or Start/Stop 9 = Start/Stop 10 = Reset 11, 12 = Not used 13 = Flying Start Disable 14 = Multispeed (MS1) Using Ramp #2 15 = Manual/Automatic PID) 16 = Increase E.P. with Ramp #2	10			89
<b>P266</b> <sup>(1)</sup>	Digital Input DI4 Function	0 = Forward/Reverse 1 = Local/Remote 2 = General Enable	8			89

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

<sup>(2)</sup> Value may change as a function of P203.

## CFW-08 - QUICK PARAMETER REFERENCE

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
		3 = JOG 4 = No External Fault 5 = Decrease E.P. 6 = Ramp #2 7 = Multispeed (MS0) 8 = Not used or Start/Stop 9 = Start/Stop 10 = Reset 11, 12, 14 and 15 = Not Used 13 = Flying Start Disable 16 = Decrease E.P. with Ramp #2				
<b>Digital Output(s)</b>						
<b>P277</b> <sup>(1)</sup>	Relay Output RL1 Function	0 = Fs>Fx 1 = Fe>Fx 2 = Fs=Fe 3 = Is>Ix 4 and 6 = Not used 5 = Run 7 = No Fault	7			94
<b>P279</b> <sup>(1)</sup>	Relay Output RL2 Function	0 = Fs>Fx 1 = Fe>Fx 2 = Fs=Fe 3 = Is>Ix 4 and 6 = Not used 5 = Run 7 = No Fault	0		Only available in CFW-08 Plus version.	94
<b>Fx and Ix</b>						
<b>P288</b>	Fx Frequency	0.00 ... P134	3.00			95
<b>P290</b>	Ix Current	0 ... 1.5xI <sub>nom</sub>	1.0xI <sub>nom</sub>			95
<b>Inverter Data</b>						
<b>P295</b> <sup>(1)</sup>	Rated Inverter Current (I <sub>nom</sub> )	300 = 1.0A 301 = 1.6A 302 = 2.6A 303 = 2.7A 304 = 4.0A 305 = 4.3A 306 = 6.5A 307 = 7.0A 308 = 7.3A 309 = 10A 310 = 13A 311 = 16A	According to the inverter model			95
<b>P297</b> <sup>(1)</sup>	Switching Frequency	4 = 5.0kHz 5 = 2.5kHz 6 = 10kHz 7 = 15kHz	4		In vector control mode (P202=2) it is not possible to set P297=7 (15kHz).	96
<b>DC Braking</b>						
<b>P300</b>	DC Braking Time	0.0 ... 15.0s	0.0			97

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## CFW-08 - QUICK PARAMETER REFERENCE

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
<b>P301</b>	DC Braking Start Frequency	0.00 ... 15.00Hz	1.00			97
<b>P302</b>	DC Braking Current	0.0 ... 130%	0.0			97
<b>Skip Frequencies</b>						
<b>P303</b>	Skip Frequency 1	P133 ... P134	20.00			98
<b>P304</b>	Skip Frequency 2	P133 ... P134	30.00			98
<b>P306</b>	Skip Band Range	0.00 ... 25.00Hz	0.00			98
<b>Serial Communication Interface I</b>						
<b>P308</b> <sup>(1)</sup>	Inverter Address	1 ... 30 (Serial WEG) 1 ... 247 (Modbus-RTU)	1			98
<b>Flying Start and Ride-Through</b>						
<b>P310</b> <sup>(1)</sup>	Flying Start and Ride-Through	0 = Inactive 1 = Flying Start 2 = Flying Start and Ride-Through 3 = Ride-Through	0			99
<b>P311</b>	Voltage Ramp	0.1 ... 10.0s	5.0			100
<b>Serial Communication Interface II</b>						
<b>P312</b> <sup>(1)</sup>	Serial Interface Protocol	0 = Serial WEG 1 = Modbus-RTU 9600 bps without parity 2 = Modbus-RTU 9600 bps with odd parity 3 = Modbus-RTU 9600 bps with even parity 4 = Modbus-RTU 19200 bps without parity 5 = Modbus-RTU 19200 bps with odd parity 6 = Modbus-RTU 19200 bps with even parity 7 = Modbus-RTU 38400 bps without parity 8 = Modbus-RTU 38400 bps with odd parity 9 = Modbus-RTU 38400 bps with even parity	0			100
<b>P313</b>	Serial Interface Watchdog Action	0 = Disabling by ramp 1 = General disable 2 = Shows only E28 3 = Goes to local mode	2			100
<b>P314</b>	Serial Interface Watchdog Timeout	0.0 = Disables the function 0.1 ... 99.9s = Set value	0.0			100

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## CFW-08 - QUICK PARAMETER REFERENCE

Parameter	Function	Adjustable Range	Factory Setting	User Setting	Note	Page
<b>MOTOR PARAMETERS (P399 ... P499)</b>						
<b>Rated Parameters</b>						
<b>P399</b> <sup>(1)</sup>	Rated Motor Efficiency	50.0 ... 99.9%	According to inverter model (motor matched to the inverter - see item 9.3) and sales market		Only available in vector mode (P202=2).	101
<b>P400</b> <sup>(1)</sup>	Rated Motor Voltage	0 ... 600V				101
<b>P401</b>	Rated Motor Current	0.3x <sub>nom</sub> ... 1.3x <sub>nom</sub>			Only available in vector mode (P202=2).	101
<b>P402</b>	Rated Motor Speed	0 ... 9999rpm				101
<b>P403</b> <sup>(1)</sup>	Rated Motor Frequency	0.00 ... P134				101
<b>P404</b> <sup>(1)</sup>	Rated Motor Power	0 = 0.16HP / 0.12kW 1 = 0.25HP / 0.18kW 2 = 0.33HP / 0.25kW 3 = 0.50HP / 0.37kW 4 = 0.75HP / 0.55kW 5 = 1HP / 0.75kW 6 = 1.5HP / 1.1kW 7 = 2HP / 1.5kW 8 = 3HP / 2.2kW 9 = 4HP / 3.0kW 10 = 5HP / 3.7kW 11 = 5.5HP / 4.0kW 12 = 6HP / 4.5kW 13 = 7.5HP / 5.5kW 14 = 10HP / 7.5kW 15 = 12.5HP / 9.2kW				102
<b>P407</b> <sup>(1)</sup>	Rated Motor Power Factor	0.50 ... 0.99				102
<b>Measured Parameters</b>						
<b>P408</b> <sup>(1)</sup>	Self-Tuning	0 = No 1 = Yes	0	-	Only available in vector mode (P202=2).	102
<b>P409</b>	Motor Stator Resistance	0.00 ... 99.99Ω	According to inverter model			103
<b>SPECIAL FUNCTION (P500 ... P599)</b>						
<b>PID Regulator</b>						
<b>P520</b>	PID Proportional Gain	0.000 ... 7.999	1.000			109
<b>P521</b>	PID Integral Gain	0.000 ... 9.999	1.000			109
<b>P522</b>	PID Differential Gain	0.000 ... 9.999	0.000			109
<b>P525</b>	Setpoint Via Keypad of the PID Regulator	0.00 ... 100.0%	0.00			109
<b>P526</b>	Process Variable Filter	0.01 ... 10.00s	0.10			109
<b>P527</b>	PID Action	0 = Direct 1 = Reverse	0			109
<b>P528</b>	Process Variable Scale Factor	0.00 ... 99.9	1.00			109
<b>P536</b>	Automatic Setting of P525	0=Active 1=Inactive	0		109	

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## CFW-08 - QUICK PARAMETER REFERENCE

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### 2. Fault Messages

Display	Description	Page
<b>E00</b>	Output Overcurrent/Short-Circuit	110
<b>E01</b>	DC Link Overvoltage	110
<b>E02</b>	DC Link Undervoltage	110
<b>E04</b>	Inverter Overtemperature	111
<b>E05</b>	Output Overload (Ixt Function)	111
<b>E06</b>	External Fault	111
<b>E08</b>	CPU Error (Watchdog)	111
<b>E09</b>	Program Memory Error (Checksum)	111
<b>E10</b>	Keypad Copy Function Error	111
<b>E14</b>	Self-tuning Fault	111
<b>E22, E25 E26 and E27</b>	Serial Communication Error	111
<b>E24</b>	Programming Error	111
<b>E28</b>	Serial Interface Watchdog Timeout Error	111
<b>E31</b>	Keypad Connection Fault (HMI-CFW08-RS)	111
<b>E41</b>	Self-Diagnosis Fault	111

### 3. Other Messages

Display	Description
<b>rdy</b>	Inverter is ready to be enabled
<b>Sub</b>	Power supply voltage is too low for the inverter operation (Undervoltage)
<b>dcbr</b>	Inverter in DC braking mode
<b>auto</b>	Inverter is running self-tuning routine
<b>copy</b>	Keypad Copy Function in Progress (only available in the HMI-CFW08-RS) - inverter to keypad
<b>past</b>	Keypad Copy Function in Progress (only available in the HMI-CFW08-RS) - Keypad to Inverter

## SAFETY NOTICES

This Manual contains necessary information for the correct use of the CFW-8 Variable Frequency Drive.  
This Manual has been written for qualified personnel with suitable training and technical qualification to operate this type of equipment.

### 1.1 SAFETY NOTICES IN THE MANUAL

The following Safety Notices will be used in this Manual:



**DANGER!**

If the recommended Safety Notices are not strictly observed, it can lead to serious or fatal injuries of personnel and/or material damage.



**ATTENTION!**

Failure to observe the recommended Safety Procedures can lead to material damage.



**NOTE!**

The content of this Manual supplies important information for the correct understanding of operation and proper performance of the equipment.

### 1.2 SAFETY NOTICE ON THE PRODUCT

The following symbols may be attached to the product, serving as Safety Notice:



**High Voltages**



**Components sensitive to electrostatic discharge. Do not touch them without proper grounding procedures.**



**Mandatory connection to ground protection (PE)**



**Shield connection to ground**

### 1.3 PRELIMINARY RECOMMENDATIONS



**DANGER!**

Only qualified personnel should plan or implement the installation, start-up, operation and maintenance of this equipment. Personnel must review entire Manual before attempting to install, operate or troubleshoot the CFW-08.



**DANGER!**

The inverter control circuit (ECC2, DSP) and the HMI-CFW08-P are not grounded. They are high voltage circuits.



## SAFETY NOTICES

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These personnel must follow all safety instructions included in this Manual and/or defined by local regulations. Failure to comply with these instructions may result in personnel injury and/or equipment damage.



### NOTE!

In this Manual, qualified personnel are defined as people that are trained to:

1. Install, ground, power up and operate the CFW-08 according to this Manual and the local required safety procedures;
2. Use of safety equipment according to the local regulations;
3. Administer Cardio Pulmonary Resuscitation (CPR) and First Aid.



### DANGER!

Always disconnect the supply voltage before touching any electrical component inside the inverter.

Many components are charged with high voltages, even after the incoming AC power supply has been disconnected or switched OFF. Wait at least 10 minutes for the total discharge of the power capacitors.

Always connect the frame of the equipment to the ground (PE) at the suitable connection point.



### ATTENTION!

All electronic boards have components that are sensitive to electrostatic discharges. Never touch any of the electrical components or connectors without following proper grounding procedures. If necessary to do so, touch the properly grounded metallic frame or use a suitable ground strap.

**Do not apply High Voltage (High Pot) Test on the Inverter!  
If this test is necessary, contact the Manufacturer.**



### NOTE!

Inverters can interfere with other electronic equipment. In order to reduce this interference, adopt the measures recommended in Section 3 "Installation".



### NOTE!

Read this entire Manual carefully and completely before installing or operating the CFW-08.

## GENERAL INFORMATION

This chapter defines the contents and purposes of this manual and describes the main characteristics of the CFW-08 frequency inverter. Identification, receiving inspections and storage requirements are also provided.

### 2.1 ABOUT THIS MANUAL

This Manual is divided into 10 Chapter, providing information to the user on how receive, install, start-up and operate the CFW-08:

- Chapter 1 - Safety Notices;
- Chapter 2 - General Information;
- Chapter 3 - Installation;
- Chapter 4 - Start-up;
- Chapter 5 - Keypad HMI) Operation;
- Chapter 6 - Detailed Parameter Description;
- Chapter 7 - Diagnostic and Troubleshooting;
- Chapter 8 - CFW-08 Options and Accessories;
- Chapter 9 - Technical Specifications;
- Chapter 10 - Warranty Policy.

This Manual provides information for the correct use of the CFW-08. The CFW-08 is very flexible and allows for the operation in many different modes as described in this manual.

As the CFW-08 can be applied in several ways, it is impossible to describe here all of the application possibilities. WEG does not accept any responsibility when the CFW-08 is not used according to this Manual.

No part of this Manual may be reproduced in any form, without the written permission of WEG.

### 2.2 SOFTWARE VERSION

It is important to note the Software Version installed in the Version CFW-08, since it defines the functions and the programming parameters of the inverter.

This Manual refers to the Software version indicated on the inside cover. For example, the Version 3.0X applies to versions 3.00 to 3.09, where "X" is a variable that will change due to minor software revisions. The operation of the CFW-08 with these software revisions are still covered by this version of the Manual.

The Software Version can be read in the Parameter P023.

### 2.3 ABOUT THE CFW-08

The CFW-08 is a high performance Variable Frequency Drive that permits the control of speed and torque of a three-phase AC induction motor. Two types of control are available in the same product:

- Programmable scalar (Volts/Hz) control;
- Sensorless Vector Control (VVC: Voltage Vector Control).

In the vector control mode, the motor performance is optimized relating to torque and speed regulation.

The "Self-Tuning" function, available in vector control, permits the automatic setting of the inverter parameter from the identification (also automatic) of the parameters of the motor connected at the inverter output.

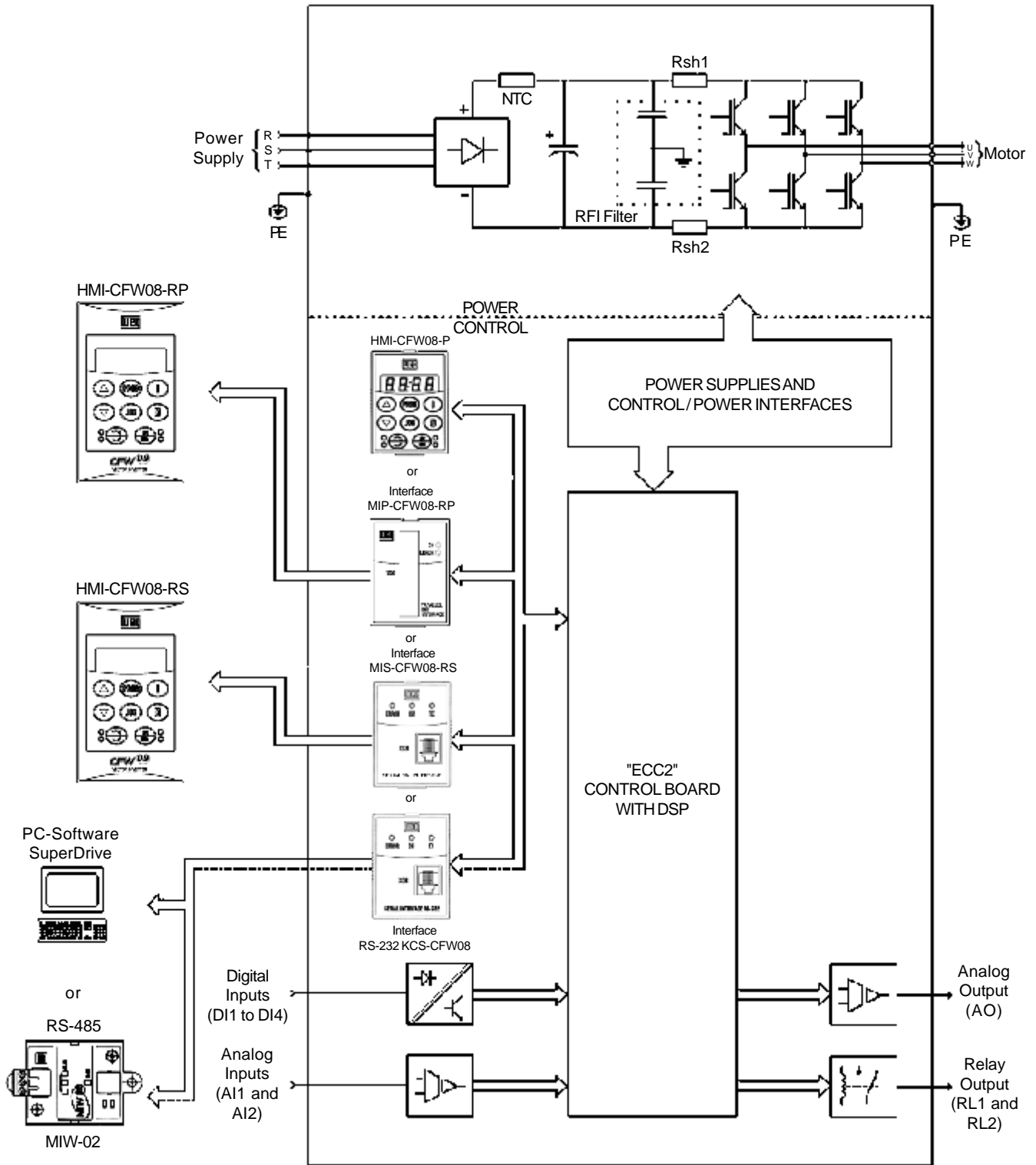
The V/F (scalar) mode is recommended for more simple applications such as pump and fan drives. In these cases one can reduce the motor and inverter losses by using the "Quadratic V/F" option, that results in energy saving.

The V/F mode is also used when more than one motor should be driven simultaneously by one inverter (multimotor application).

There are two CFW-08 versions:

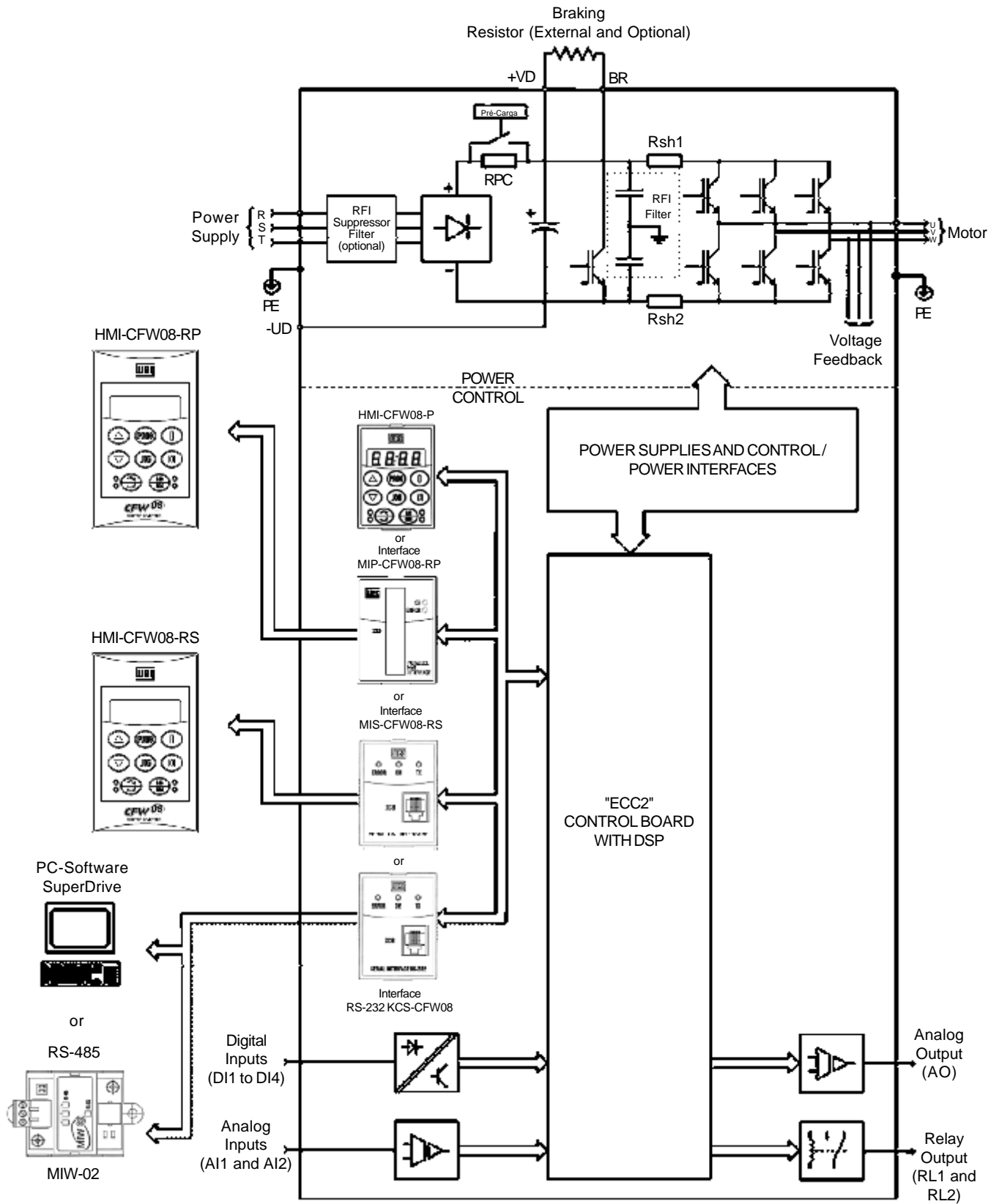
- Standard: it has 4 digital inputs (DIs), 1 analog input (AI) and 1 relay output.
- CFW-08 Plus: compared to the standard version it has one additional analog input and one additional relay output. It has also an analog output (AO).

For power ratings and further technical information, see Chapter 9.



**Figure 2.1** - Block diagram for the models:  
1.6-2.6-4.0-7.0A/200-240V and 1.0-1.6-2.6-4.0A/380-480V

# GENERAL INFORMATION



**Figura 2.2**– Block diagram for the models:  
 7.3-10-16A/200-240V and 2.7-4.3-6.5-10-13-16A/380-480V  
 Note: Model 16A/200-240V is not fitted with RFI filter (optional).

## 2.3.1 Differences between the old $\mu$ line and the new CFW-08

This section aims at showing the differences between the old  $\mu$ line and the new CFW-08. The information below are addressed to user that are used to  $\mu$ line.

Table below shows the equivalence between the accessories of the old  $\mu$ line and the new CFW-08.

Accessoriy	$\mu$ line	CFW-08
Local Keypad (parallel)	IHM-8P (417100258)	HMI-CFW08-P (417100868)
Remote serial Keypad	IHM-8R (417100244)	HMI-CFW08-RS (417100992)
Remote parallel Keypad	-	HMI-CFW08-RP (417100991)
Interface for remote serial Keypad	MIR-8R (417100259)	MIS-CFW08-RS (417100993)
Interface for remote parallel Keypad	-	MIP-CFW08-RP (417100990)
Interfaces for serial communication RS-232	MCW-01 (417100252)	KCS-CFW08 (417100882)
Interface for RS-485 serial communication RS-485	MCW-02 (417100253)	KCS-CFW08 (417100882) + MIW-02 (417100543)

### Product Appearance

- Besides the internal electronics, also the external product appearance have changed, which are:
  - the frontal lettering on the plastic covers (formerly:  $\mu$ line, now: CFW-08 vector inverter);
  - WEG logo is now indicated on all accessories of the CFW-08 line (keypad, communication modules etc).
- Figure below makes a comparison:

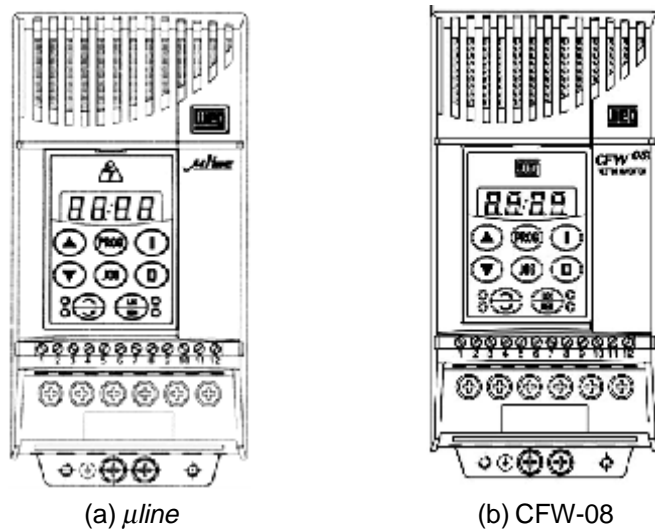


Figure 2.3 - Comparison between  $\mu$ line and CFW-08 appearance

### Version of Software

- The new CFW-08 starts with Software Version V3.00. Thus, the software Versions V1.xx and V2.xx are exclusive for  $\mu$ line.
- Besides the inverter control has been implemented in a DSP (Digital Signal Processor), which enables a more sophisticated control with more parameters and functions.

### Accessories

- With the migration from the 16 bits microcontroller to the DSP of the new CFW-08, the power supply of the electronic circuits had to be changed from 5V to 3.3V. Consequently, the accessories (keypads, communication modules, etc) of the old  $\mu$ line CAN NOT BE USED with the new CFW-08 line. As general rule, use only accessories with WEG logo, as already informed above.

## GENERAL INFORMATION

---

### Expansion of the Power Range

- ☑ The power range of the old  $\mu$ line (0.25-2HP) has been expanded to (0.25-10HP) with the new CFW-08 line.

### Control Modes

- ☑ Only the CFW-08 line has:
  - Voltage Vector Control (VVC) that improves the inverter performance considerably - adding the parameters P178, P399, P400, P402, P403, P404, P407, P408 e P409;
  - the quadratic curve V/F improves the systema energy saving capability when loads with quadratic torque x speed characteristics are driven, like pumps and fans.

### Frequency Resolution

- ☑ The new CFW-08 has a frequency resolution 10 times higher than the old  $\mu$ line, i.e., it has a resolution of 0.01Hz for frequencies up to 100.0Hz and of 0.1Hz for frequencies higher than 99.99Hz.

### Switching Frequencies of 10 and 15kHz

- ☑ When the new CFW-08 is used, one can set the inverter switching frequency to 10 and 15kHz, which enables an extremely quiet operation.
- ☑ The audible noise level generated by the motor with 10 kHz is lower with the CFW-08, when compared with the  $\mu$ line. This is due to the PWM modulation improvements of the CFW-08.

### Inputs and Outputs (I/Os)

- ☑ The CFW-08 Plus line has more I/Os than the old  $\mu$ line, while the CFW-08 is equivalent to the  $\mu$ line in terms of I/Os. See table below:

I/O	$\mu$ line	CFW-08	CFW-08 Plus
Digital Inputs	4	4	4
Analog Input(s)	1	1	2
Analog Outputs	-	-	1
Relay Outputs	1 (REV contact)	1 (REV contact)	2 (1 NO contact, 1 NC contact)

- But the control connections (terminals XC1) differ between the  $\mu$ line and the CFW-08 line. Table below shows these pin differences:

I/O	$\mu$ line	CFW-08	CFW-08 Plus
Digital Input DI1	1	1	1
Digital Input DI2	2	2	2
Digital Input DI3	3	3	3
Digital Input DI4	4	4	4
0V for Digital Inputs	5	5	5
+10V	6	6	6
Analog Input AI1 - voltage signal	7	7 with switch S1:1 at pos. OFF	7 with switch S1:1 at position OFF
Analog Input AI1 - current signal	9	7 with switch S1:1 at pos. ON	7 with switch S1:1 at position ON
0V for analog input(s)	8	5	5
Analog Input AI2 - voltage signal	not available	not available	8 with switch S1:2 at position OFF
Analog Input AI2 - current signal	not available	not available	8 with switch S1:2 at position ON
Saída Analógica AO	not available	not available	9
Relay Output RL1	10(NF), 11(C) and 12(NA)	10(NF), 11(C) and 12(NA)	11-12(NO)
Relay Output RL2	not available	not available	10-11(NC)

### Parameters and Functions

#### Parameters that are already used in $\mu$ line but have been changed

##### a) P136 - Manual Torque Boost (IxR Compensation)

- Besides the parameter name, also the way the user enters the IxR compensation value has been changed. In the old  $\mu$ line, the parameter P136 had a family of 10 curves (value range: 0 to 9). In the new CFW-08, the IxR Compensation is set by entering a percent (relating to the input voltage) that defines the output voltage for an output frequency equal to zero. So larger curve set and a larger variation range is obtained.

- Table below shows the equivalence between which was programmed in the old  $\mu$ line and which must be programmed in the new CFW-08 to obtain the same result.

P136 set in $\mu$ line	P136 to be set in the CFW-08
0	0.0
1	2.5
2	5.0
3	7.5
4	10.0
5	12.5
6	15.0
7	17.5
8	20.0
9	22.5



- b) Automatic Torque Boost (Automatic IxR Compensation) and Slip Compensation
- In the  $\mu$ line only the rated motor current (P401) was used in the Automatic IxR Compensation and the Slip Compensation functions. In the  $\mu$ line the rated motor power factor of the motor was considered as a fixed value and equal to 0.9.
  - Now in the new CFW-08, are used the parameters P401 and P407 (rated motor power factor). Thus:

$$P401 \Big|_{\mu\text{line}} \cdot 0.9 = P401 \times P407 \Big|_{\text{CFW-08}}$$

Example: When in an application with the  $\mu$ line the following setting was required: P401=3.8A, now with the new CFW-08 you must perform the following setting: P401=3.8A and P407=0.9

or

$$P407 = \text{rated } \cos \varnothing \text{ of the used motor and } P401 = 3.8 \times \frac{0.9}{P407}$$

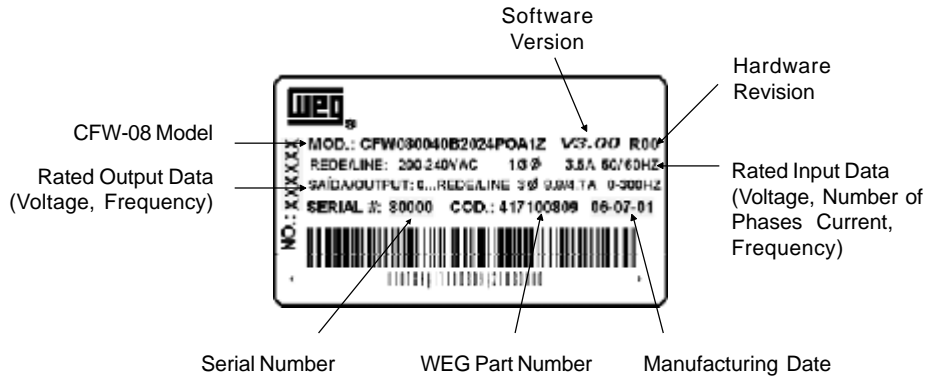
### Parameters existing only in Special Software Versions of the $\mu$ line

- a) Quick Inputs
- In the new CFW-08, the response time of the the digital inputs is 10ms (max.).
  - In addition, the minimum acceleration and deceleration time was reduced from 0.2s ( $\mu$ line) to 0.1s (CFW-08). Besides the DC braking process can be interrupted before it has been concluded, for instance, when a new enabling is required.
- b) Other changes
- P120=2 - digital reference backup via P121 independently of the reference source.
  - P265=14 - DI3: multispeed using ramp #2.

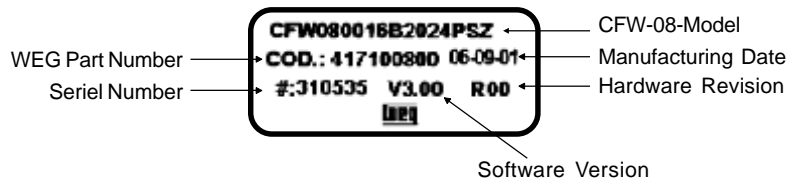
### New Parameters and Functions

- The reference 1 of the multispeed that was in Parameter P121 (in  $\mu$ line) is now in Parameter P124 (in CFW-08).
- The DC link regulation level (ramp holding) can now be programmed in Parameter P151 - in the  $\mu$ line this level was fixed to 377V for the 200-240V line and 747V for the 380-480V line.
- Also the programming way of Parameter P302 has changed. In the  $\mu$ line P302 was related to the voltage applied to the output during the DCbraking, now in the new CFW-08, P302 defines the DC Braking Current.
- PID regulator.
- Suammarizing, the new parameters are: P009, P040, P124, P151, P178, P202, P203, P205, P219, P238, P239, P240, P251, P252, P279, P399, P400, P402, P403, P404, P407, P408, P409, P520, P521, P522, P525, P526, P527 e P528.

**2.4 CFW-08 IDENTIFICATION**

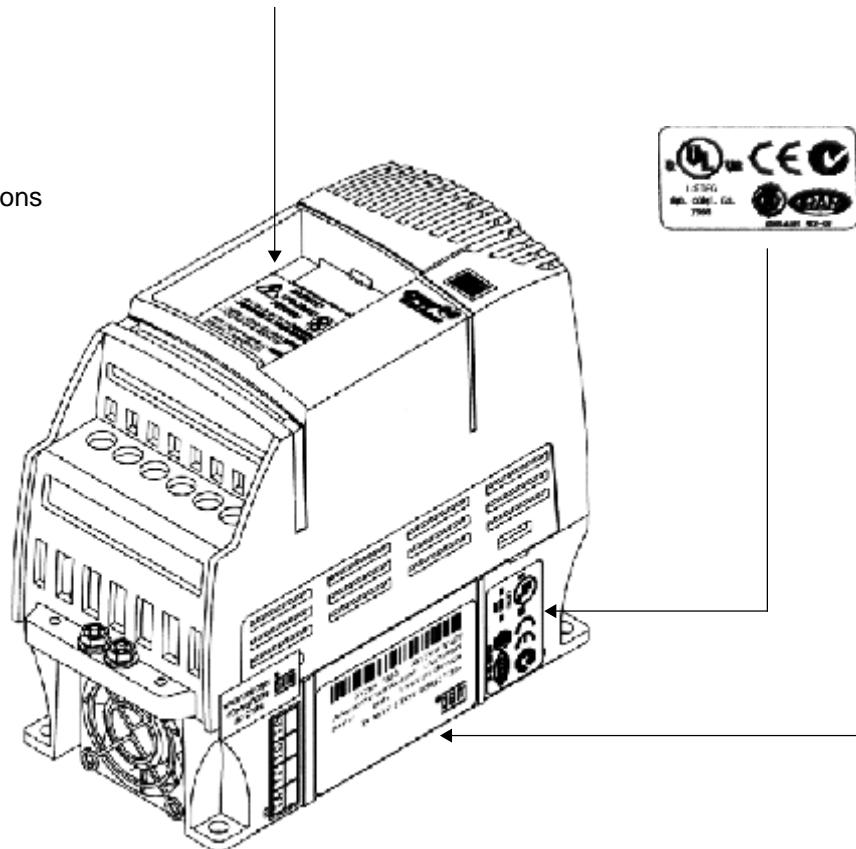


**Lateral Nameplate of the CFW-08**



**Frontal Nameplate of the CFW-08 (under the keypad)**

Note: To remove the keypad, see instructions in 8.1.1 (Figure 8.2).



**Figure 2.4 - Description and location of the nameplates**

## HOW TO SPECIFY THE CFW-08 MODEL:

CFW-08	0040	B	2024	P	O	00	00	00	00	00	00	Z
WEG Series 08 Frequency Inverter	Rated Output Current for <b>200 to 240V:</b> 0016=1.6A 0026=2.6A 0040=4.0A 0070=7.0A 0073=7.3A 0100=10A 0160=16A  <b>380 to 480V:</b> 0010=1.0A 0016=1.6A 0026=2.6A 0027=2.7A 0040=4.0A 0043=4.3A 0065=6.5A 0100=10A 0130=13A 0160=16A	Number of phases of the power supply: S=single phase T=three phase B=single phase or three phase	Power Supply: 2024 = 200 to 240V 3848 = 380 to 480V	Manual Language: P= Portug. E= English S= Spanish F= French G= German	Options: S= standard O= with options	Degree of Protection: Blank = standard N1= Nema 1	Human Machine Interface: blank standard SI= without interface (with dummy panel)	Control Board: Blank = standard control A1= control 1 (Plus Version)	RFI Filter: Blank= without filter FA= Class A RFI filter (internal or footprint)	Special Hardware: 00 = none	Special Software: 00 = none	End Code



### NOTE!

- ☑ The Option field (S or O) defines if the CFW-08 is a standard version or if it will be equipped with any optional devices. If the standard version is required, the specification code ends here.

The model number has always the letter Z at the end. For example:

CFW080040S2024ESZ = standard 4.0A CFW-08 inverter, single-phase at 200...240V input with manual in English.

For the effect of this code, the standard product is conceived as follows:

- CFW-08 with standard control board.
- Degree of protection: NEMA 1 for the models 13 and 16A/380-480V; IP20 for the other models.

If the CFW-08 is equipped with any optional devices, you must fill out all fields in the correct sequence up to the last optional device, the model number is completed with the letter Z. It is not necessary to indicate the code number 00 for those optional devices that are standard or that will not be used.

Thus, for instance if the product above is required with NEMA 1 degree of protection:

CFW080040S2024EON1Z = CFW-08 inverter, 4A, single-phase, 200...240V input, with manual in English language and with kitf for NEMA 1 degree of protection.

- ☑ The CFW-08 Plus is formed by the inverter and the control board 1. Example: CFW080040S2024EOA1Z.
- ☑ 7.0 and 16.0A/200-240V and for all 380-480V models are just available with three-phase power supply.
- ☑ A RFI Class A filter (optional) can be installed inside the inverter in models 7.3 and 10A/200-240V (single-phase) and 2.7, 4.3, 6.5, 10, 13 and 16A/380-480V. Models 1.6, 2.6 and 4.0A/200-240V (single-phase) and 1.0, 1.6, 2.6 and 4.0A/380-480V can be provided mounted on a footprint RFI Class A filter (optional).
- ☑ The listing of the existing models (voltage/current) is shown in item 9.1.

## 2.5 Receiving and Storing

The CFW-08 is supplied in cardboard boxes.

The outside of the packing box has a nameplate that is identical to that on the CFW-08.

Please check if the CFW-08 is the one you ordered.

Check if the:

- ☑ CFW-08 nameplate data matches with your purchase order.
- ☑ The equipment has not been damaged during transport.

If any problem is detected, contact the carrier immediately.

If the CFW-08 is not installed immediately, store it in a clean and dry room (storage temperatures between  $-25^{\circ}\text{C}$  and  $60^{\circ}\text{C}$ ). Cover it to protect it against dust, dirt or other contamination.

## INSTALLATION

### 3.1 MECHANICAL INSTALLATION

This chapter describes the procedures for the electrical and mechanical installation of the CFW-08.

These guidelines and suggestions must be followed for proper CFW-08 operation.

#### 3.1.1 Environment

The location of the inverter installation is an important factor to assure good performance and high product reliability. For proper installation, we make the following recommendations:

- ☑ Avoid direct exposure to sunlight, rain, high moisture and sea air.
- ☑ Avoid exposure to gases or explosive or corrosive liquids;
- ☑ Avoid exposure to excessive vibration, dust, oil or any conductive particles or materials.

Environmental Conditions:

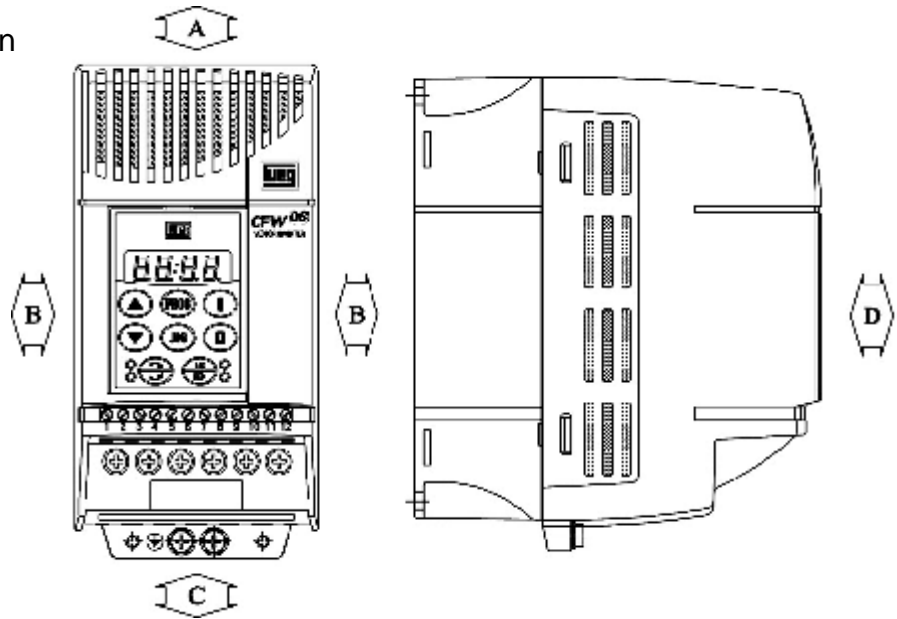
- ☑ Temperature : 32...104°F (0 ... 40°C) - nominal conditions. 32...122°F (0 ... 50°C) - with 2% current derating for each 1.8°F (1°C) degree above 104°F (40°C).
- ☑ Relative Air Humidity: 5% to 90% - non-condensing.
- ☑ Maximum Altitude: 3,300 ft (1000m) - nominal conditions. 3,300...13,200 ft (1000 ... 4000m) - with 10% current reduction for each 3,300 ft (1000m) above 3,300 ft (1000m).
- ☑ Pollution Degree: 2 (according to EN50178 and UL508C)



#### **NOTE!**

When inverters are installed in panels or in closed metallic boxes, adequate cooling is required to ensure that the temperature arounds the inverter will not exceed the maximim allowed temperature. See Dissipated Power in Section 9.1.

## 3.1.2 Mounting Specification



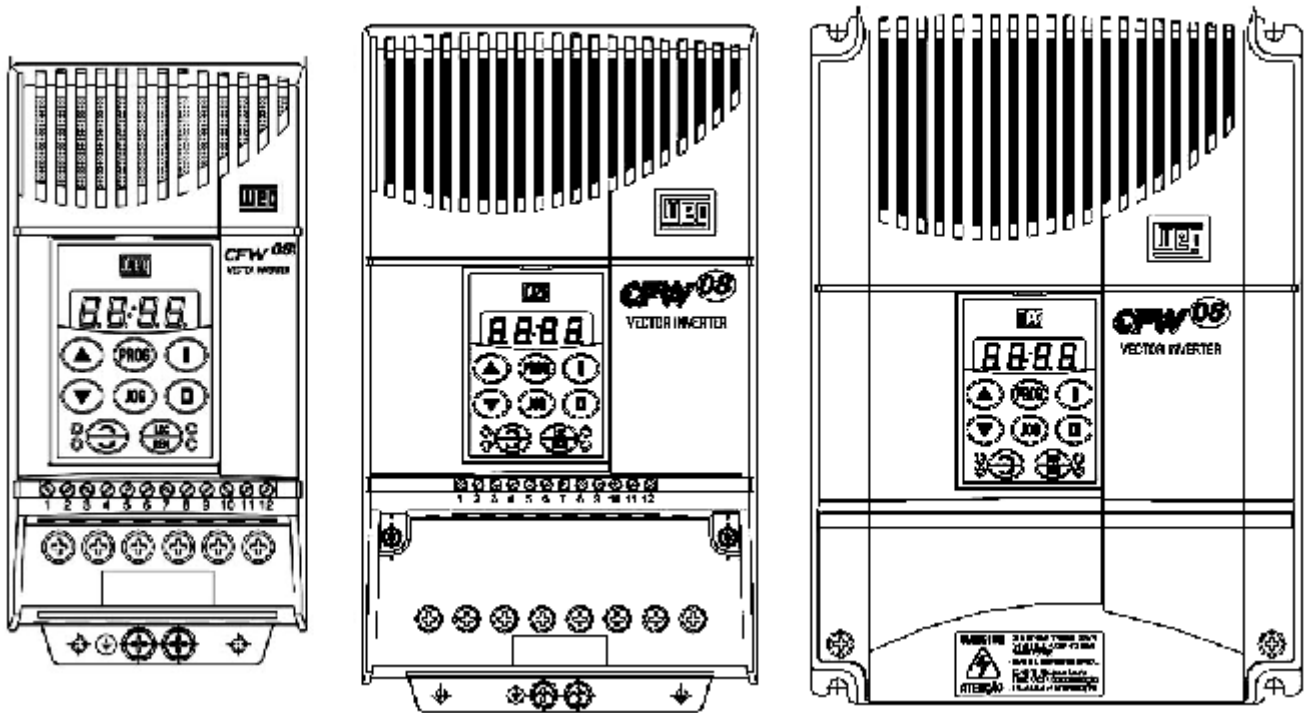
**Figure 3.1 - Free Space for Cooling**

CFW-08 Model	A		B		C		D	
1.6A / 200-240V	30 mm	1.18 in	5 mm	0.20 in	50 mm	2 in	50 mm	2 in
2.6A / 200-240V								
4.0A / 200-240V								
7.0A / 200-240V								
1.0A / 380-480V								
1.6A / 380-480V								
2.6A / 380-480V								
4.0A / 380-480V	35 mm	1.38 in	15 mm	0.59 in	50 mm	2 in	50 mm	2 in
7.3A / 200-240V								
10.0A / 200-240V								
16.0A / 200-240V								
2.7A / 380-480V								
4.3A / 380-480V								
6.5A / 380-480V	40 mm	1.57 in	30 mm	1.18 in	50 mm	2 in	50 mm	2 in
10.0A / 380-480V								
13.0A / 380-480V								
16.0A / 380-480V								

**Table 3.1 - Recommended free spaces**

- Install the inverter in vertical position.
- Leave free space around the inverter as indicated in Table 3.1.
- Do not install heat sensitive components immediately above the inverter.
- When inverters are installed side by side, maintain the minimum recommended distance B.
- When inverters are installed top and bottom, maintain the minimum recommended distance A + C and deflect the hot air coming from the inverter below.
- Install the inverter on a flat surface.
- External dimensions and mounting holes are according to Fig. 3.2.
- For CFW-08 installation procedures, see Fig. 3.3.
- Provide independent conduits for signal, control and power conductors. (Refer to Electrical Installation). Separate the motor cables from the other cables.

# INSTALLATION AND CONNECTION



VIEW OF THE MOUNTING BASE

FRONTAL VIEW

LATERAL VIEW

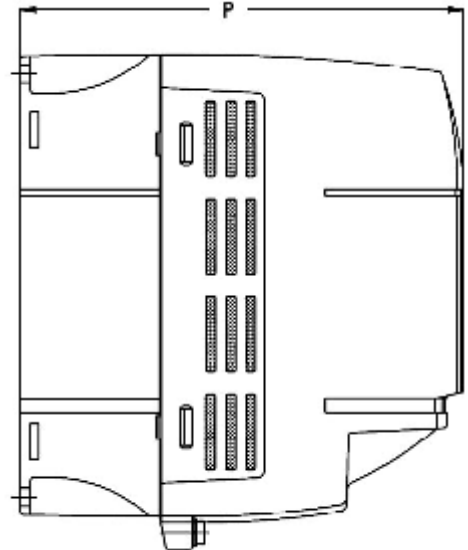
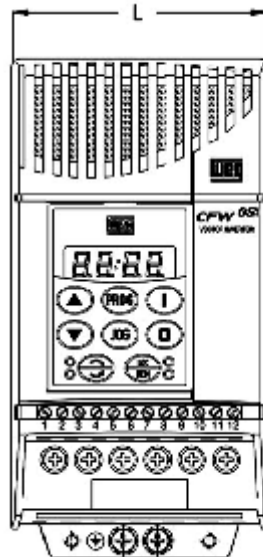
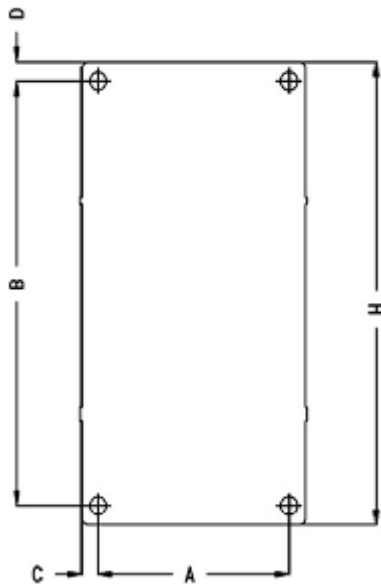
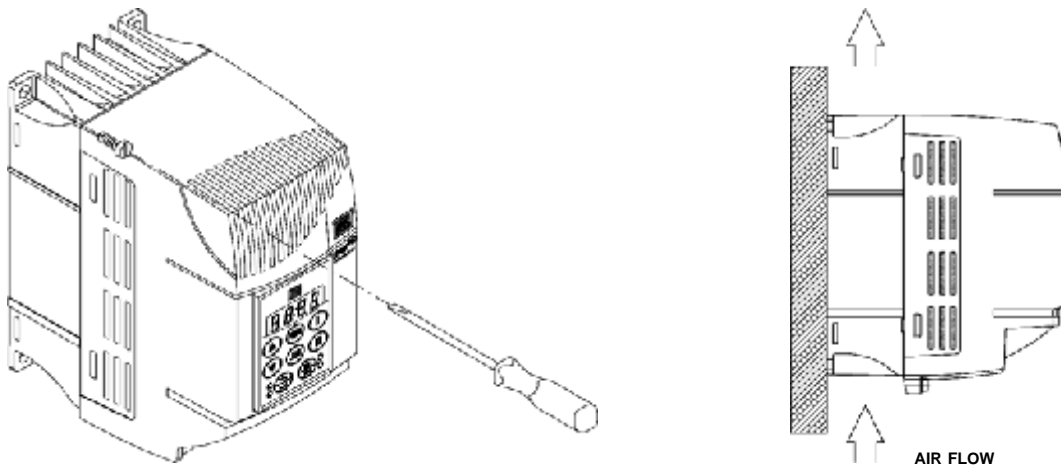


Figure 3.2 - Dimensional Drawings of the CFW-08

# INSTALLATION AND CONNECTION

Inverter Model	Dimensions			Fixing base				Mounting Screw	Weight lb (kg)	Degree of Protection
	Width L in (mm)	Height H in (mm)	Depth P in (mm)	A in (mm)	B in (mm)	C in (mm)	D in (mm)			
1.6A / 200-240V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
2.6A / 200-240V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
4.0A / 200-240V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
7.0A / 200-240V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
7.3A / 200-240V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
10A / 200-240V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
16A / 200-240V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
1.0A / 380-480V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
1.6A / 380-480V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
2.6A / 380-480V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
2.7A / 380-480V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
4.0A / 380-480V	2.95 (75)	5.95 (151)	5.16 (131)	2.52 (64)	5.08 (129)	0.20 (5)	0.24 (6)	5/32 (M4)	2.2 (1.0)	IP20 / NEMA1
4.3A / 380-480V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
6.5A / 380-480V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
10A / 380-480V	4.53 (115)	7.87 (200)	5.91 (150)	3.98 (101)	6.97 (177)	0.28 (7)	0.20 (5)	5/32 (M4)	4.4 (2.0)	IP20 / NEMA1
13A / 380-480V	5.63 (143)	7.99 (203)	6.50 (165)	4.76 (121)	7.09 (180)	0.43 (11)	0.39 (10)	3/16 (M5)	5.5 (2.5)	NEMA1
16A / 380-480V	5.63 (143)	7.99 (203)	6.50 (165)	4.76 (121)	7.09 (180)	0.43 (11)	0.39 (10)	3/16 (M5)	5.5 (2.5)	NEMA1

**Table 3.2 - Installation data (dimensions in mm) - Refer to Section 9.1**



**Figure 3.3 - Mounting procedures for CFW-08**



# INSTALLATION AND CONNECTION

## 3.2 ELECTRICAL INSTALLATION

### 3.2.1 Power / Grounding Connections



#### **DANGER!**

AC input disconnection: provide and AC input disconnecting switch to switch OFF the input power to the inverter. This device shall disconnect the inverter from the AC input supply when required (e.g. during maintenances services).



#### **DANGER!**

This AC input disconnecting switch can not be used as an emergency stop device.



#### **DANGER!**

Be sure that the AC input power is disconnected before making any terminal connection.



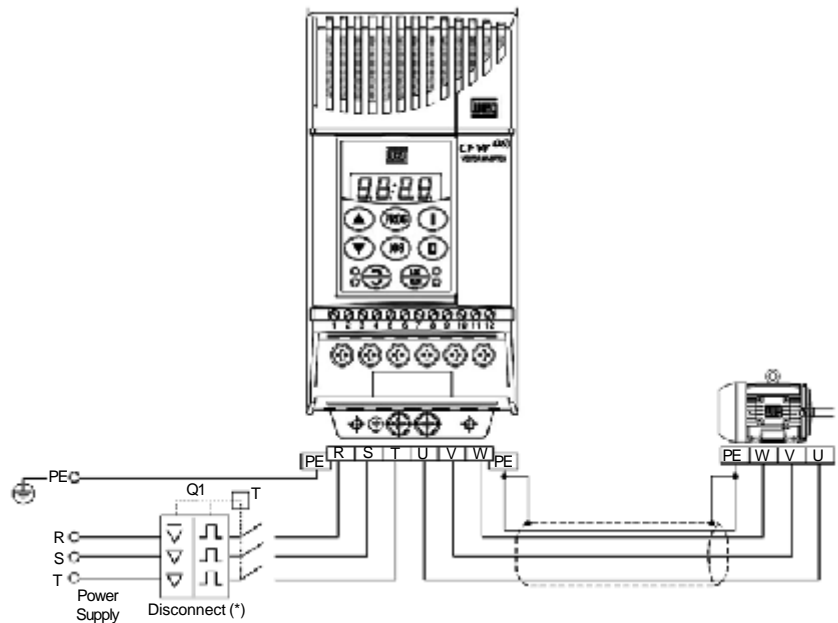
#### **DANGER!**

The information below will be a guide to achieve a proper installation. Follow also all applicable local standards for electrical installations.

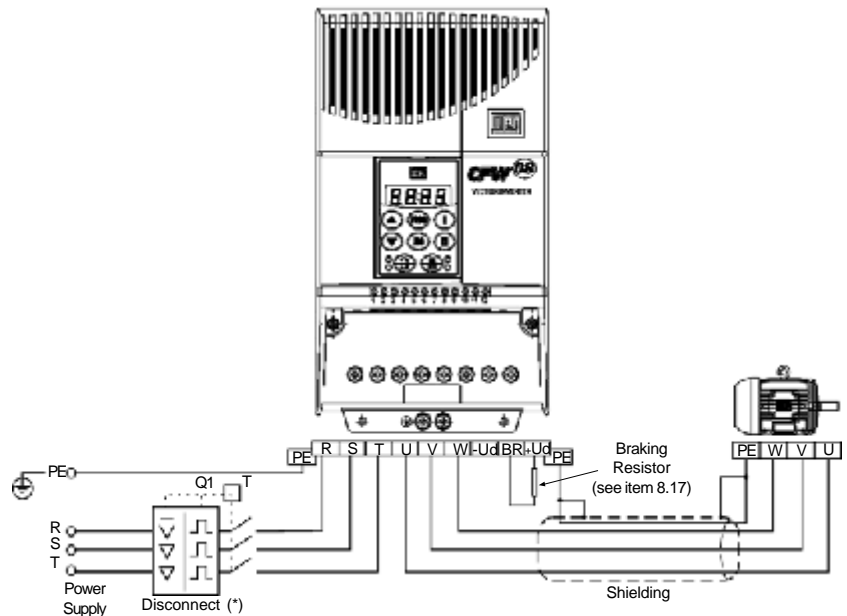


#### **ATTENTION!**

Provide at least 10 in (0.25m) spacing between the equipment and sensitive wirings and between the cables of the inverter and motor. For instance: PLCs, temperature monitoring devices, thermocouples, etc.



**(a) Models 1.6-2.6-4.0-7.0A / 200-240V and 1.0-1.6-2.6-4.0A / 380-480V**



**(b) Models 7.3-10-16A / 200-240V e 2.7-4.3-6.5-10-13-16A / 380-480V**

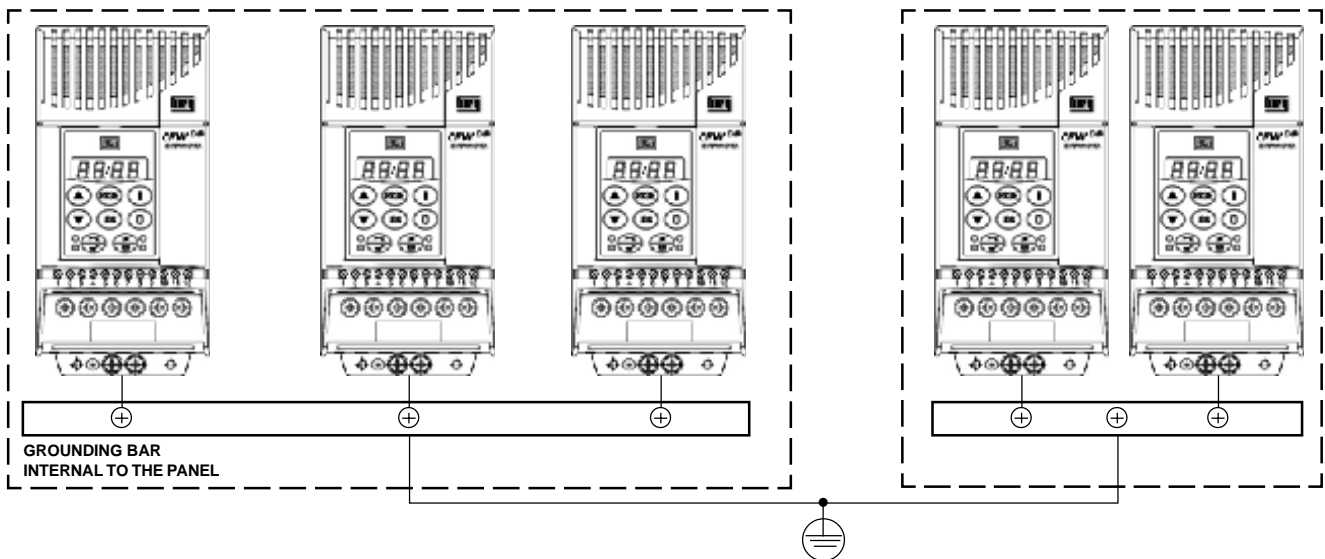
Note: (\*) In case of single-phase power supply with phase and neutral cable, connect only the phase cable to the disconnecting switch.

**Figure 3.4 - Power / Grounding Connections**



## DANGER!

The inverter must be grounded to a protective earth for safety purposes (PE). The earth or ground connection must comply with the local regulations. For grounding, use cables with cross sections as indicated in Table 3.3. Make the ground connection to a grounding bar or to the general grounding point (resistance  $10 < \text{ohms}$ ). Do not share the ground wiring with other equipment that operate with high currents (for instance: high voltage motors, welding machines, etc). If several inverters are used together, refer to Figure 3.5.



**Figure 3.5 - Grounding connections for more than one inverter**



## NOTE!

Do not use the neutral conductor for grounding purposes.

## INSTALLATION AND CONNECTION



### ATTENTION!

The AC input for the inverter must have a grounded neutral conductor.



### NOTE!

- ☑ The AC input voltage must be compatible with the inverter rated voltage.
- ☑ The requirements for use of line reactors depends on several application factors. Refer to Section 8.15.
- ☑ Capacitors for power factor correction are not required at the input (L/L1, N/L2, L3 or R, S, T) and they must not be connected at the output (U, V and W).

When inverters with dynamic braking (DB) are used, the DB resistor shall be mounted externally. Figure 8.21 shows how to connect the braking resistor. Size it according to the application, not exceeding the maximum current of the braking circuit. For the connection between inverter and the braking resistor, use twisted cable. Provide physical separation between this cable and the signal and control cables. When the DB resistor is mounted inside the panel, consider watt loss generated when the enclosure size and required ventilation are calculated.

- ☑ When electromagnetic interference (EMI), generated by the inverter, interferes in the performance of other equipment, use shielded wires, or install the motor wires in metallic conduits. Connect one end of the shielding to the inverter grounding point and the other end to the motor frame. Always ground the motor frame. Ground the motor in the panel where the inverter is installed or ground it to the inverter. The inverter output wiring must be laid separately from the input wiring as well as from the control and signal cables.
- ☑ The inverter is provided with electronic protection against motor overload. This protection must be set according to the specific motor. When the same inverter drives several motors, use individual overload relays for each motor. Maintain the electrical continuity of the motor cable shield.
- ☑ If a disconnect switch or a contactor is inserted in the motor supply line, do not operate them with motor running or when inverter is enabled. Maintain the electrical continuity of the motor cable shield.
- ☑ Use wire sizing and circuit breakers as recommended in Table 3.3. Tightening torque is as indicated in Table 3.4. Use (70°C) copper wires only.

Amp Rating [A]	Power Cables [mm <sup>2</sup> ]	Grounding Cables [mm <sup>2</sup> ]	Circuit-Breaker	
			Current [A]	WEG Model
1.0	1.5	2.5	4	DMW25-4
1.6 (200-240V)	1.5	2.5	10	DMW25-6,3
1.6 (380-480V)	1.5	2.5	4	DMW25-4
2.6 (200-240V)	1.5	2.5	10	DMW25-10
2.6 (380-480V)	1.5	2.5	6	DMW25-6.3
2.7	1.5	2.5	6	DMW25-6.3
4.0 (200-240V)	1.5	2.5	15	DMW25-16
4.0 (380-480V)	1.5	2.5	10	DMW25-10
4.3	1.5	2.5	10	DMW25-10
6.5	2.5	4.0	15	DMW25-16
7.0	2.5	4.0	10	DMW25-10
7.3	2.5	4.0	20	DMW25-20
10.0	2.5	4.0	30	DW125H-32
13.0	2.5	4.0	30	DW125H-25
16.0	2.5	4.0	35	DW125H-32

**Table 3.3** - Recommended wiring and circuit-breakers - use 70°C copper wires only



## NOTE!

The wire sizing indicated in Table 3.3 are reference values only. The exact wire sizing, depends on the installation conditions and the maximum acceptable line voltage drop.

Inverter Model	Grounding Wiring		Power Cables	
	N.m	Lbf.in	N.m	Lbf.in
1.6A / 200-240V	0.4	3.5	1.0	8.68
2.6A / 200-240V	0.4	3.5	1.0	8.68
4.0A / 200-240V	0.4	3.5	10	8.68
7.0A / 200-240V	0.4	3.5	1.0	8.68
7.3A / 200-240V	0.4	3.5	1.76	15.62
10.0A / 200-240V	0.4	3.5	1.76	15.62
16.0A / 200-240V	0.4	3.5	1.76	15.62
1.0A / 380-480V	0.4	3.5	1.2	100
1.6A / 380-480V	0.4	3.5	1.2	10.0
2.6A / 380-480V	0.4	3.5	1.2	10.0
2.7A / 380-480V	0.4	3.5	1.76	15.62
4.0A / 380-480V	0.4	3.5	1.2	10.0
4.3A / 380-480V	0.4	3.5	1.76	15.62
6.5A / 380-480V	0.4	3.5	1.76	15.62
10.0A / 380-480V	0.4	3.5	1.76	15.62
13.0A / 380-480V	0.4	3.5	1.76	15.62
16.0A / 380-480V	0.4	3.5	1.76	15.62

**Table 3.4** - Recommended tightening torque for power and grounding connections



## NOTE!

Supply line capacity:

The CFW-08 is suitable for use in circuits capable of supplying not more than symmetrical 30.000Arms (240/480V).

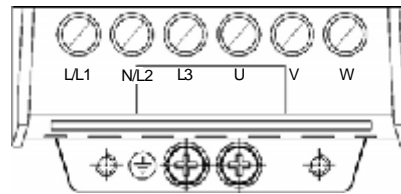
The CFW-08 can be installed on power supplies with a higher fault level if an adequate protection is provided by fuses or circuit breaker.

### 3.2.2 Power Terminals

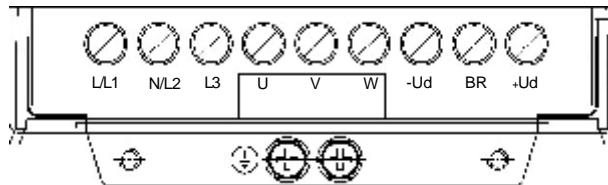
Description of the power terminals:

- ☑ L/L1, N/L2 and L3 (R, S and T): AC supply line  
200-240 V models (except 7.0A and 16A) can be operated with two phases (single-phase operation) without current derating. In this case, the AC supply can be connected to any 2 of the 3 input terminals.
- ☑ U, V and W: Motor connection.
- ☑ -UD: Negative pole of the DC link circuit.  
Not available on the models 1,6-2,6-4,0-7,0A/200-240V and on the models 1.0-1.6-2.6-4.0A/380-480V. This pole is used when inverter shall be supplied with DC voltage (jointly with the +UD terminal). To avoid wrong connection of the braking resistor (mounted outside the inverter), inverter is supplied with a rubber plug on this terminal that must be removed when the use of the -UD terminal is required.
- ☑ BR: Connection for Dynamic Braking Models (DB).  
Not available on types 1.6-2.6-4.0-7.0A/200-240V and on models 1.0-1.6-2.6-4.0A/380-480V.
- ☑ +UD: Positive pole of the DC link circuit.  
Not available on models 1.6-2.6-4.0-7.0A/200-240V and on models 1.0-1.6-2.6-4.0A/380-480V. This terminal is used to connect the dynamic braking (DB) (jointly with the BR terminal) or when inverter shall be supplied with DC voltage (jointly with the -UD terminal).

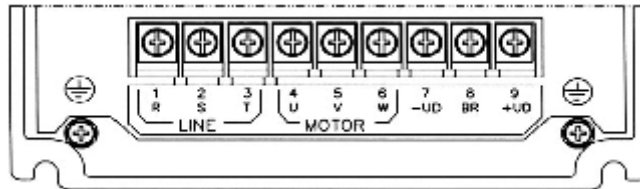
# INSTALLATION AND CONNECTION



(a) models 1.6-2.6-4.0-7.0A/200-240V and 1.0-1.6-2.6-4.0A/380-480V



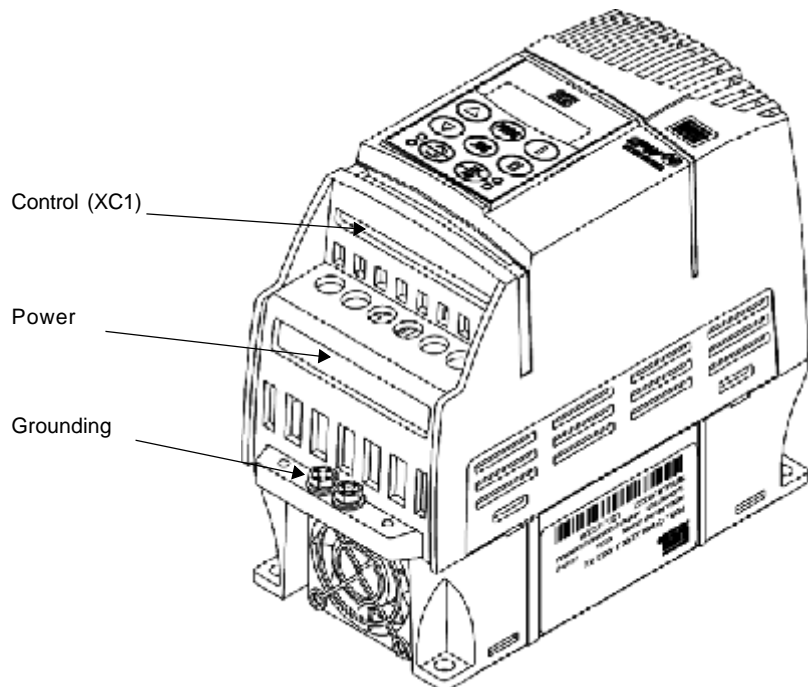
(b) models 7.3-10-16A/200-240V and 2.7-4.3-6.5-10A/380-480V



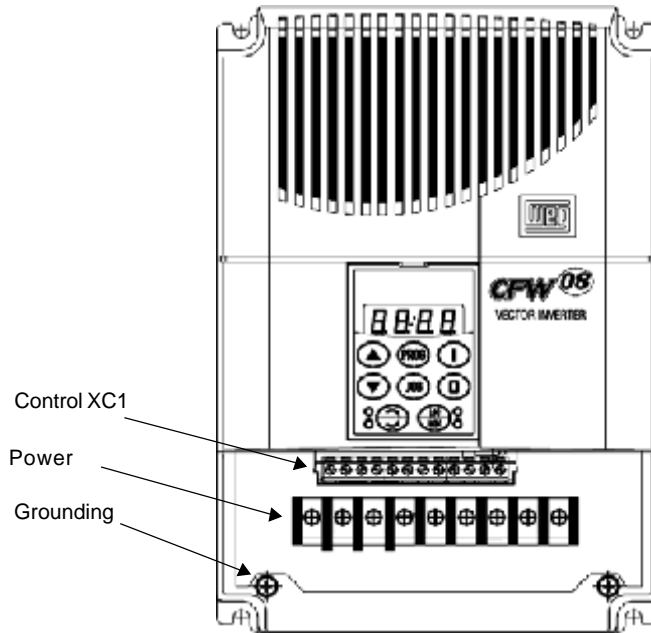
(c) models 13-16A/380-480V

**Figure 3.6 - Power terminals**

## 3.2.3 Location of the Power, Grounding and Control Connections



(a) Models 1.6-2.6-4.0-7.0-7.3-10-16A/200-240V and 1.0-1.6-2.6-2.7-4.0-4.3-6.5-10A/380-480V



(b) Models 13-16A/380-480V

**Figure 3.7** - Location of the power/grounding and control connections

### 3.2.4 Control Wiring

The control wiring (analog inputs/outputs, digital inputs and relay outputs) is made on the XC1 connector of control board (see location in Figure 3.7, Section 3.2.3).

There are two configurations for the control board: standard version (CFW-08 line) and Plus version (CFW-08 Plus line), as shown below:

XC1 Terminal	Description		Specifications
		Factory Default Function	
1	DI1	Digital Input 1	4 isolated digital inputs Minimum High Level: 10VDC Maximum Low Level: 3VDC Input current: -11mA @ 0V Max. input current: -20 mA
		General Enable (remote mode)	
2	DI2	Digital Input 2	
		FWD / REV (remote mode)	
3	DI3	Digital Input 3	
		Reset	
4	DI4	Digital Input 4	
		Start / Stop (remote mode)	
5	GND	0V Reference	Not connected to PE
6	AI1	Analog Input 1	0 to 10VDC or 0(4) to 20mA (fig. 3.10). Impedance: 100kΩ (0...10V input), 500Ω (0/4...20mA input). Resolution: 7bits. Max. input voltage: 30 VDC
		Frequency / Speed Reference (remote mode)	
7	+10V	Potentiometer reference	+10VDC ± 5%, capacity: 2mA
8		Not used	
9		Not used	
10	NC	Relay Output 1 - NC contact	 Contact capacity: 0.5A / 250VAC
		No Fault	
11	Common	Relay Output 1 - common point	
12	NO	Relay Output 1 - NO contact	
		No Fault	

Note: NC = Normally Closed Contact, NO = Normally Open Contact

**Figure 3.8** - XC1 control terminal description (standard control board - CFW-08)

# INSTALLATION AND CONNECTION

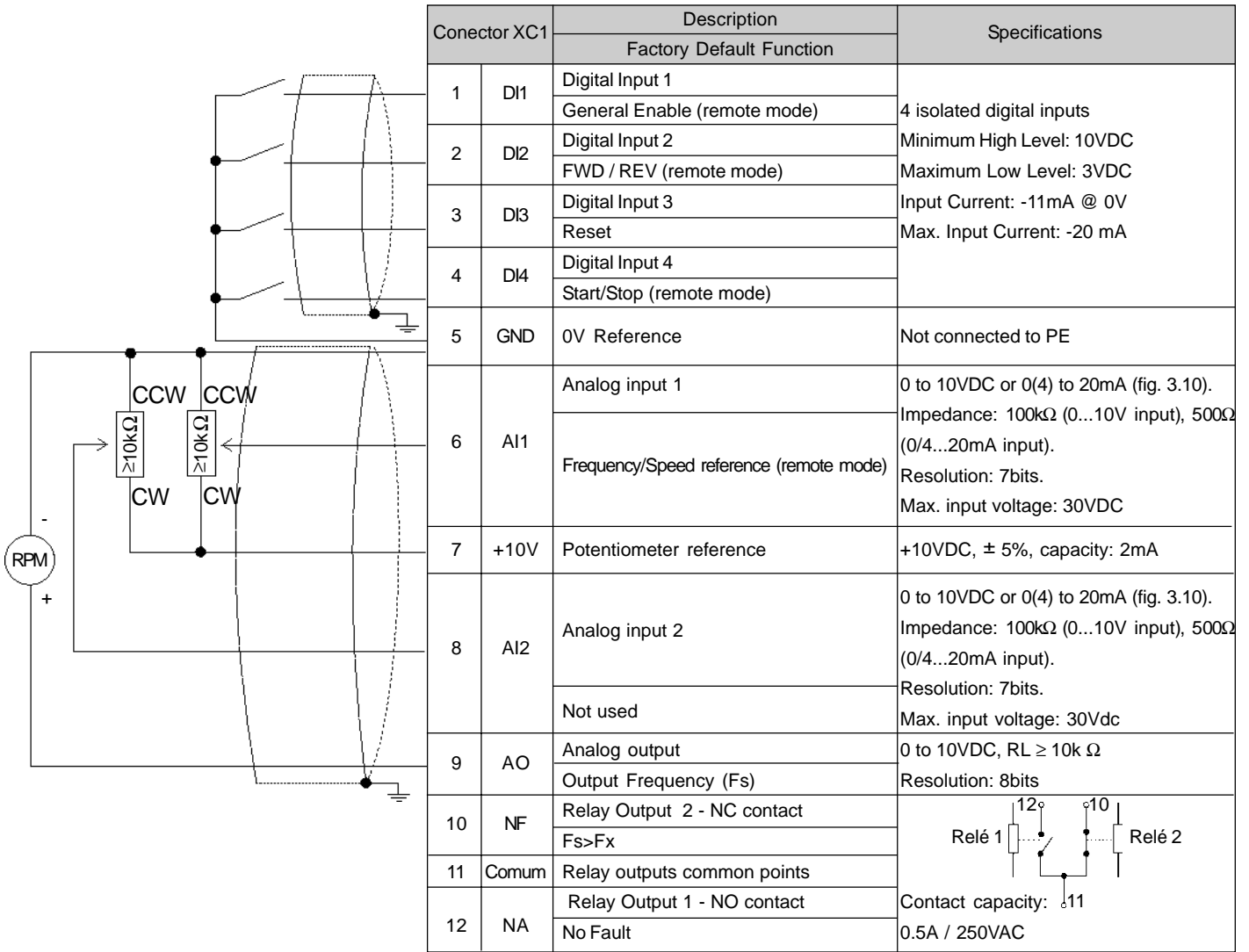


Figure 3.9 - XC1 control terminal description of the control board 1 (CFW-08 Plus)

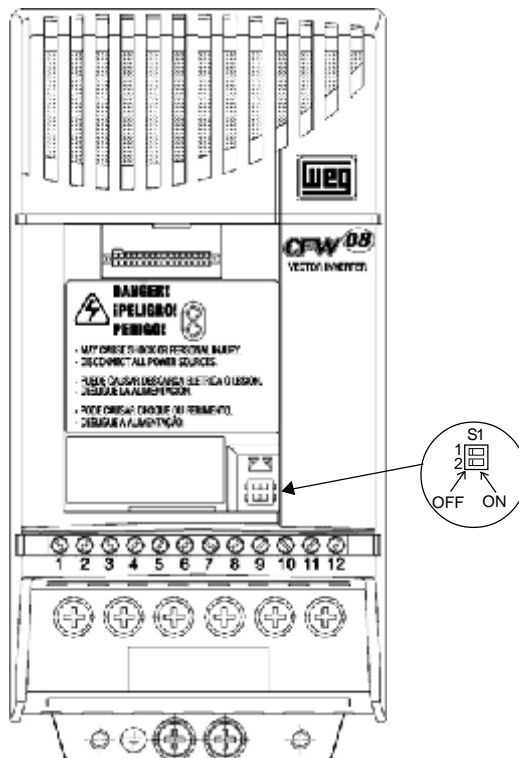


Figure 3.10 - Dip switch position for 0 ...10V/4 ... 20mA selection

## INSTALLATION AND CONNECTION

As a default the analog input(s) is(are) selected as 0...10V. This can be changed using dip switch S1 on the control board and parameters P235 and P239 (see note below).

Analog Input	Factory Deafault Setting	Dip Switch	Selection
AI1	Frequency / Speed Reference (remote mode)	S1.1	OFF: 0 ... 10V ON: 4 ... 20mA or 0 ... 20mA
AI2	No function	S1.2	OFF: 0 ... 10V ON: 4 ... 20mA or 0 ... 20mA

**Table 3.5 - Dip switch configuration**



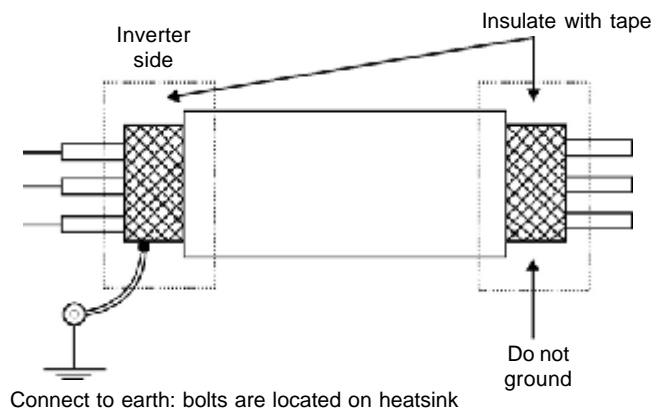
### NOTE!

- ☑ Jumpers S1 are factory set to OFF position (0 ... 10V signal).
- ☑ If it's used a 4 ... 20mA signal, set parameter P235 and/or P239, that defines the signal type at AI1 and AI2, respectively.
- ☑ The parameters related to the analog inputs are: P221, P222, P234, P235, P236, P238, P239 e P240. For more details, please refer to Chapter 6.

During the signal and control wire installation note please the following:

- 1) Cable cross section: 20 ... 14 AWG (0.5...1.5mm<sup>2</sup>).
- 2) Max. Torque: 0.50 N.m (4.50 lbf.in).
- 3) XC1 wiring must connected with shielded cables and installed separately at a distance of 10 cm each other for lengths up to 100m and at distance of 25cm each other for lengths over 100m. If the crossing of these cables is unavoidable, install them perpendicular, maintaining a minimum separation distance of 2 in (5 cm) at the crossing point.

Connect the shield as shown below:



**Figure 3.11 - Shield connection**

- 4) For wiring distances longer than 150 ft ( 50 m), it's necessary to use galvanic isolators for the XC1:5...9 analog signals.



# INSTALLATION AND CONNECTION

- 5) Relays, contactors, solenoids or eletromagnetic braking coils installed near inverters can generate interferences in the control circuit. To eliminate this interference, connect RC suppressor in parallel with the coils of AC relays. Connect free-wheeling diode in case of DC relays.
- 6) When external keypad (HMI) is used (refer to Chapter 8), separate the cable that connects the keypad to the inverter from other cables, maintaining a minimum distance of 4 in (10 cm) between them.
- 7) **When analog reference (AI1 or AI2) is used and the frequency oscillates (problem caused by eletromagnetic interference) connect XC1:5 to the inverter heatsink.**


## 3.2.5 Typical Terminal Connections

### Connection 1 - Keypad Start/Stop (Local Mode)

With the **factory default programming**, you can operate the inverter in **local mode** with the minimum connections shown in Figure 3.4 (Power) and without control connections. This operation mode is recommended for users who are operating the inverter for the first time. Note that there is no need of connection of control terminals.

For start-up according to this operation mode, refer to Chapter 4.

### Connection 2 - 2-Wire Start/Stop (Remote Mode)

Valid for **factory default programming** and inverter operating in **remote mode**. For the factory default programming, the selection of the operation mode (local/remote) is made via the key  (default is local).

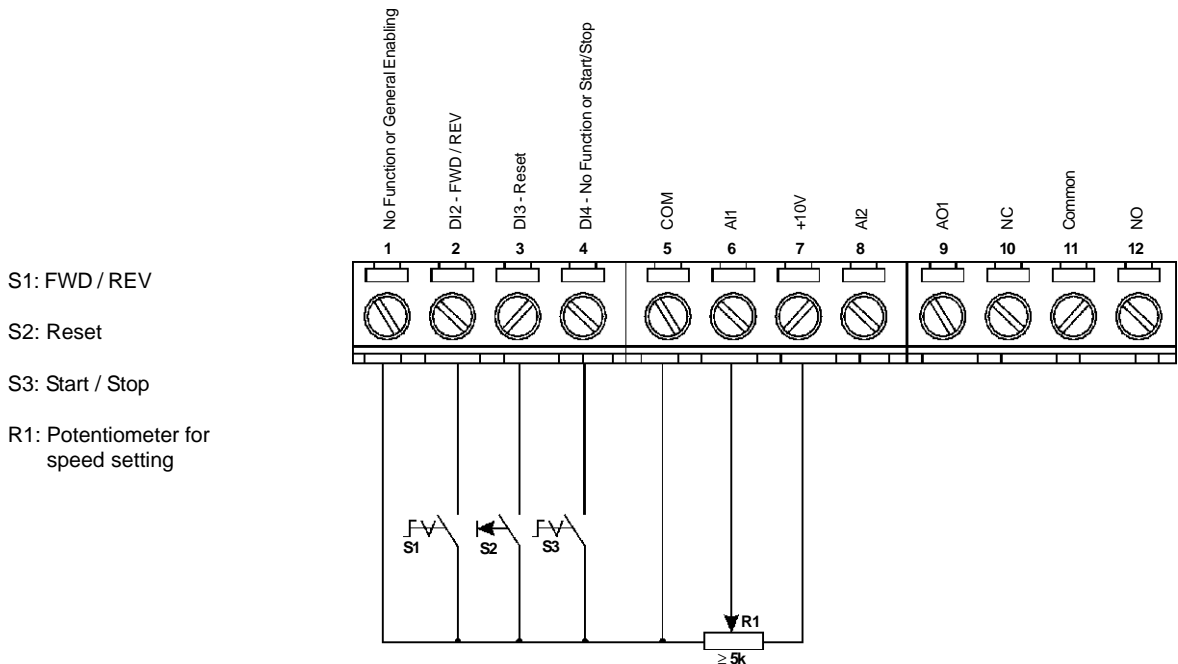


Figure 3.12 - XC1 wiring for connection 2



## NOTE!

- ☑ The frequency reference can be sent via AI1 analog input (as shown in figure above), via keypad HMI-CFW08-P, or via any other source (as described in Chapter 6 - P221 and P222).
- ☑ When a line fault occurs by using this type of connection with switch S3 at position "RUN", the motor will be enabled automatically as soon as the line is re-established.

### Connection 3 - 3 Wire Start/Stop

Function enabling (three wire control):

Set DI1 to Start: P263=14

Set DI2 to Stop: P264=14

Set P229=1 (command via terminals) if you want the 3-wire control in local mode.

Set P230=1 (command via terminals) if you want the 3-wire control in remote mode.

FWD / REV Selection:

Program P265=0 (DI3) or P266=0 (DI4), according to the selected digital input (DI).

If P265 and P266≠0, the direction of rotation is always FWD.

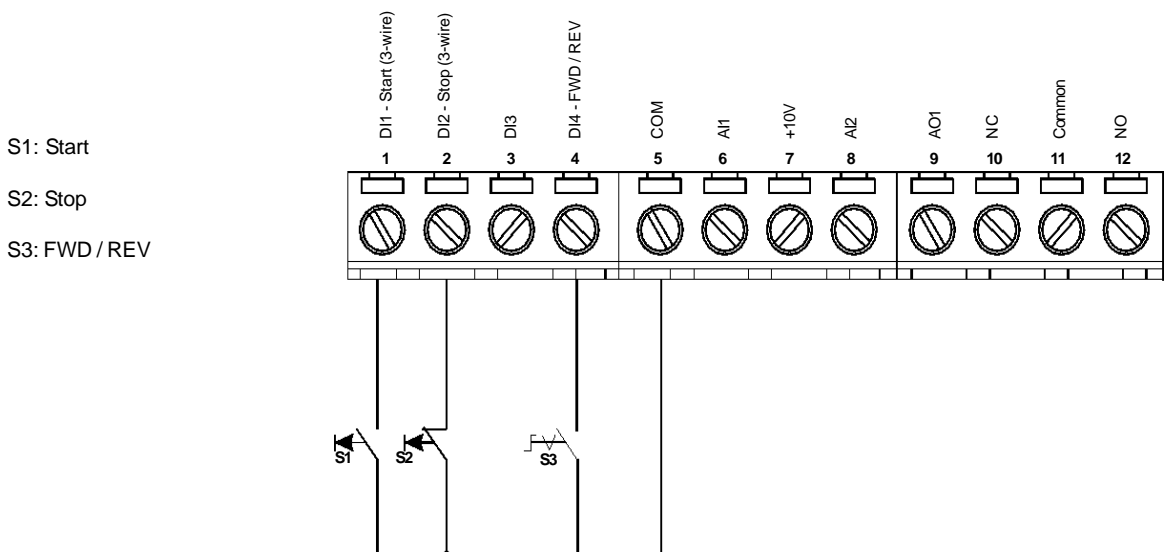


Figure 3.13 - XC1 wiring for connection 3



## NOTE!

- ☑ S1 and S2 are push buttons, NO and NC contact, respectively.
- ☑ The speed reference can be via Analog Input AI1 (as in connection 2), via keypad (HMI-CFW08-P), or via any other source (see Chapter 6 - P221 and P222).  
When a line fault occurs by using this connection with the motor running and the S1 and S2 switches are in original position (S1 opened and S2 closed), the inverter will not be enabled automatically as soon as the line is re-established.  
The Start/Stop function is described in Chapter 6.

## Connection 4 - FWD RUN / REV RUN

Parameter to be programmed:

Set DI1 to Forward Run : P263 = 8

Set DI2 to Reverse Run: P264 = 8

Make sure the inverter commands are via terminals, i.e., P229=1 to local mode or P230=1 to remote mode.

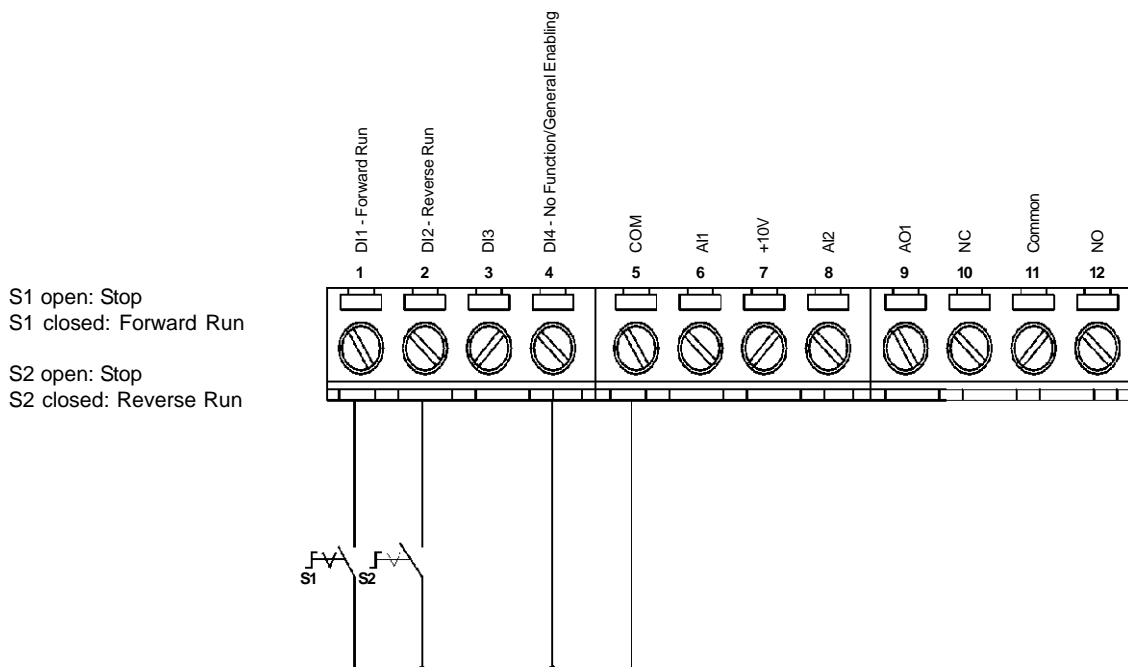


Figure 3.14 - XC1 wiring for connection 4



### NOTE!

- ☑ The speed reference can be via Analog Input AI1 (as in connection 2), via keypad (HMI-CFW08-P), or via any other source (see description of parameters P221 and P222 in Chapter 6).
- ☑ When a line fault occurs, this connection with switch S1 or switch S2 is closed, the motor will be enabled automatically as soon as the line is re-established.

## 3.3 European EMC Directive - Requirements for Conforming Installations

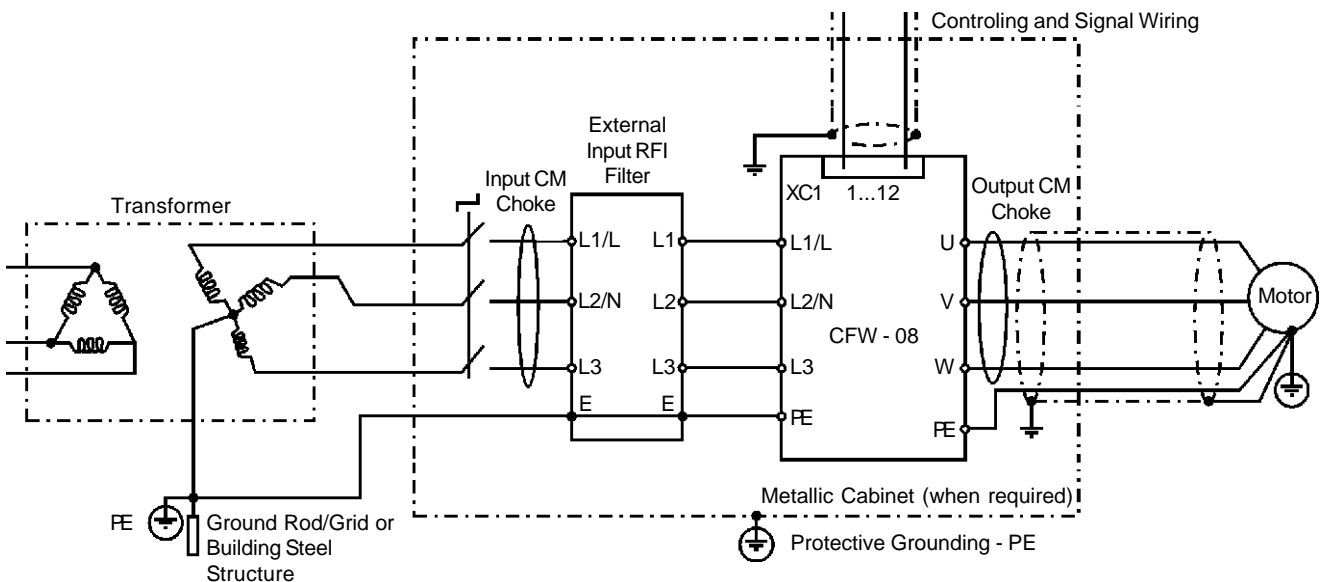
The CFW-08 inverter series was designed considering safety and EMC (ElectroMagnetic Compatibility) aspects.

The CFW-08 units do not have an intrinsic function until connected with other components (e. g. a motor). Therefore, the basic product is not CE marked for compliance with the EMC Directive. The end user takes personal responsibility for the EMC compliance of the whole installation. However, when installed according to the recommendations described in the product manual and including the recommended filters and EMC measures the CFW-08 fulfill all requirements of the EMC Directive (89/336/EEC) as defined by the **EMC Product Standard for Adjustable Speed Electrical Power Drive Systems EN61800-3**.

Compliance of the CFW-08 series is based on the testing of the representative models. A Technical Construction File was checked and approved by a Competent Body.

### 3.3.1 Installation

Figure 3.15 below shows the EMC filters connection.



Obs.: Single-phase input inverters use single-phase filters and only L1/L and L2/N are used.

**Figure 3.15 - EMC filters connection - general condition**

The following items are required in order to have a conforming installation:

- 1) The motor cable must be armored, flexible armored or installed inside a metallic conduit or trunking with equivalent attenuation. Ground the screen/metallic conduit at both ends (inverter and motor).
- 2) Control (I/O) and signal wiring must be shielded or installed inside a metallic conduit or trunking with equivalent attenuation.
- 3) The inverter and the external filter must be mounted on a common metallic back plate with a positive electrical bond and in close proximity to one another. Ensure that a good electrical connection is made between the heatsink (inverter) / frame (external filter) and the back plate.
- 4) The length of the wiring between filter and inverter must be kept as short as possible.
- 5) The cable's shielding must be solidly connected to the common back plate, using a metal bracket.
- 6) Grounding as recommended in this manual.
- 7) Use short and thick earthing cable to earth the external filter or inverter. When an external filter is used, only use an earth cable at filter input - the inverter earth connection is done by the metallic back plate.
- 8) Earth the back plate using a braid, as short as possible. Flat conductors (e.g. braids or brackets) have lower impedance at high frequencies.
- 9) Use cable glands whenever possible.

## INSTALLATION AND CONNECTION

### 3.3.2 Inverter Models and Filters

Table 3.6 below shows the inverter models and the respective RFI filter and the EMC category number. A description of each EMC category is given in item 3.3.3. The characteristics of the footprint and external input RFI filters are given in item 3.3.4.

Id	Inverter Model	Input RFI Filter	EMC Category	Dimensions (Width x Height x Depth)
1	CFW080016S2024...FAZ	Built-in filter [ FEX1-CFW08 (footprint filter) ]	Category I (industrial)	79x190x182mm
2	CFW080026S2024...FAZ			
3	CFW080040S2024...FAZ			
4	CFW080016B2024...FAZ (single-phase input)			
5	CFW080026B2024...FAZ (single-phase input)			
6	CFW080040B2024...FAZ (single-phase input)			
7	CFW080073B2024...FAZ (single-phase input)	Built-in filter		115x200x150mm
8	CFW080100B2024...FAZ (single-phase input)			
9	CFW080016S2024...	FS6007-16-06 (external filter)		Inverter: 75x151x131mm Filter: 85.5x119x57.6mm
10	CFW080026S2024...			
11	CFW080040S2024...			
12	CFW080016B2024... (single-phase input)			
13	CFW080026B2024... (single-phase input)	FS3258-7-45 (external filter)	Category II (domestic)	Inverter: 75x151x131mm Filter: 40x190x70mm
14	CFW080040B2024... (single-phase input)			
15	CFW080016B2024... (three-phase input)			
16	CFW080026B2024... (three -phase input)	FN3258-16-45 (external filter)		Inverter: 75x151x131mm Filter: 45x250x70mm
17	CFW080040B2024... (three -phase input)			
18	CFW080070T2024...	FS6007-25-08 (external filter)		Inverter: 115x200x150mm Filter: 85.5x119x57.6mm
19	CFW080073B2024... (single-phase input)	FN3258-16-45 (external filter)		Inverter: 115x200x150mm Filter: 45x250x70mm
20	CFW080073B2024... (three-phase input)	FS6007-36-08 (external filter)		Inverter: 115x200x150mm Filter: 85.5x119x57.6mm
21	CFW080100B2024... (single-phase input)	FN3258-16-45 (external filter)		Inverter: 115x200x150mm Filter: 45x250x70mm
22	CFW080100B2024... (three-phase input)	FN3258-30-47 (external filter)		Inverter: 115x200x150mm Filter: 50x270x85mm
23	CFW080160T2024...	Built-in filter [ FEX2-CFW08 (footprint filter) ]	Category I (industrial)	79x190x182mm
24	CFW080010T3848...FAZ			
25	CFW080016T3848...FAZ			
26	CFW080026T3848...FAZ			
27	CFW080040T3848...FAZ			
28	CFW080027T3848...FAZ			
29	CFW080043T3848...FAZ	Built-in filter		115x235x150mm
30	CFW080065T3848...FAZ			
31	CFW080100T3848...FAZ			
32	CFW080130T3848...FAZ			
33	CFW080160T3848...FAZ			

Id	Inverter Model	Input RFI Filter	EMC Category	Dimensions (Width x Height x Depth)
34	CFW080010T3848...	FN3258-7-45 (external filter)	Category II (domestic)	Inverter: 75x151x131mm Filter: 40x190x70mm
35	CFW080016T3848...			
36	CFW080026T3848...			Inverter: 115x200x150mm Filter: 40x190x70mm
37	CFW080040T3848...			
38	CFW080027T3848...			
39	CFW080043T3848...	FN3258-16-45 (external filter)		Inverter: 115x200x150mm Filter: 45x250x70mm
40	CFW080065T3848...			
41	CFW080100T3848...	FN3258-30-47 (external filter)		Inverter: 143x203x165mm Filter: 45x250x70mm
42	CFW080130T3848...			
43	CFW080160T3848...			Inverter: 143x203x165mm Filter: 50x270x85mm

**Table 3.6** - Inverter models list with filters and EMC category

Obs.:

- 1) Category II systems must be mounted inside a metallic cabinet in order to have radiated emissions below the limits for first environment and restricted distribution (see item 3.3.3). Category I systems do not require a metallic cabinet. Exception: models 7 and 8, that need to be mounted inside a cabinet to pass in the radiated emission test for second environment and unrestricted distribution (see item 3.3.3). When a metallic cabinet is required, the maximum length of the remote keypad cable is 3m. In this case, the control (I/O) and signal wiring must be located inside the cabinet and the remote keypad can be installed in the cabinet front door (see items 8.3.1 and 8.5).
- 2) The maximum switching frequency is 10kHz. Exception: 5kHz for models 24 up to 33 (category I, 380-480V models). For category I systems see also note 7.
- 3) The maximum motor cable length is 20m for models 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 34, 35, 36 and 37, 10m for models 1, 2, 3, 4, 5, 6, 7, 8, 24, 25, 26, 27, 38, 39, 40, 41, 42 and 43 and 5m for models 28, 29, 30, 31, 32 and 33. For category I systems see also note 7.
- 4) In models 28, 29, 30 and 31 (see also note 7), a CM choke at inverter output is required: TOR1-CFW08, 1 turn. The toroid is mounted inside the N1 kit that is provided with these models. For installation see figure 3.15.
- 5) In models 38, 39, 40, 41, 42 and 43, a CM choke at filter input is required: TOR2-CFW08, 3 turns. For installation see figure 3.15.
- 6) In models 38, 39, 40 and 41, it is required to use a shielded cable between the external filter and the inverter.
- 7) Category I systems were also tested using second environment unrestricted distribution limits for conducted emissions (for definitions see notes 2 and 3 of item 3.3.3). In this case:
  - the maximum cable length is 30m for models 1, 2, 3, 4, 5, 6, 7, 8, 32 and 33 and 20m for models 24, 25, 26, 27, 28, 29, 30 and 31;
  - the maximum switching frequency is 10kHz for models 28, 29, 30 and 31 and 5kHz for models 1, 2, 3, 4, 5, 6, 7, 8, 24, 25, 26, 27, 32 and 33;
  - models 28, 29, 30 and 31 do not require any CM choke at inverter output (as stated in note 4).

## INSTALLATION AND CONNECTION

### 3.3.3 EMC Categories Description

There are two EMC categories: Category I for industrial applications and Category II for residential applications, as described below.

#### Category I

EMC phenomenon	Basic standard for test method	Level
<b>Emission:</b>		
Conducted emissions (mains terminal disturbance voltage - freq band 150kHz to 30MHz)	IEC/EN61800-3	First environment (*1), restricted distribution (*4,5) - Class A
Radiated emissions (electromagnetic radiation disturbance - freq band 30MHz to 1000MHz)	IEC/EN61800-3	Second environment (*2), unrestricted distribution (*3)
<b>Immunity:</b>		
Electrostatic discharge (ESD)	IEC 61000-4-2	6kV contact discharge
Fast transient-burst	IEC 61000-4-4	4kV/2.5kHz (capacitive clamp) input cable; 2kV/5kHz control cables; 2kV/5kHz (capacitive clamp) motor cable; 1kV/5kHz (capacitive clamp) external keypad cable
Conducted radio-frequency common mode	IEC 61000-4-6	0.15 to 80MHz; 10V; 80% AM (1kHz) - motor control and remote Keypad cable
Surge	IEC 61000-4-5	1.2/50µs, 8/20µs; 1kV coupling line to line; 2kV coupling line to earth
Radio-frequency electromagnetic field	IEC 61000-4-3	80 to 1000MHz; 10V/m; 80% AM (1kHz)

#### Category II

EMC phenomenon	Basic standard for test method	Level
<b>Emission:</b>		
Conducted emissions (mains terminal disturbance voltage - freq band 150kHz to 30MHz)	IEC/EN61800-3	First environment (*1), unrestricted distribution (*3) - Class B
Radiated emissions (electromagnetic radiation disturbance - freq band 30MHz to 1000MHz)	IEC/EN61800-3	First environment (*1), restricted distribution (*4,5)
<b>Immunity:</b>		
Electrostatic discharge (ESD)	IEC 61000-4-2	6kV contact discharge
Fast transient-burst	IEC 61000-4-4	4kV/2.5kHz (capacitive clamp) input cable; 2kV/5kHz control cables; 2kV/5kHz (capacitive clamp) motor cable; 1kV/5kHz (capacitive clamp) external keypad cable
Conducted radio-frequency common mode	IEC 61000-4-6	0.15 to 80MHz; 10V; 80% AM (1kHz) - motor control and remote Keypad cable
Surge	IEC 61000-4-5	1.2/50µs, 8/20µs; 1kV coupling line to line; 2kV coupling line to earth
Radio-frequency electromagnetic field	IEC 61000-4-3	80 to 1000MHz; 10V/m; 80% AM (1kHz)

Obs.:

- 1) First environment: environment that includes domestic premises. It also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes.
- 2) Second environment: environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.
- 3) Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.
- 4) Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

(source: these definitions were extracted from the product standard IEC/EN61800-3 (1996) + A11 (2000))

- 5) This is a product of restricted sales distribution class according to the product standard IEC/EN61800-3 (1996) + A11 (2000). In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
- 6) The harmonic current emissions defined by the standards IEC/EN61000-3-2 and EN61000-3-2 / A14 do not apply because the CFW-08 inverter series are intended for professional applications.

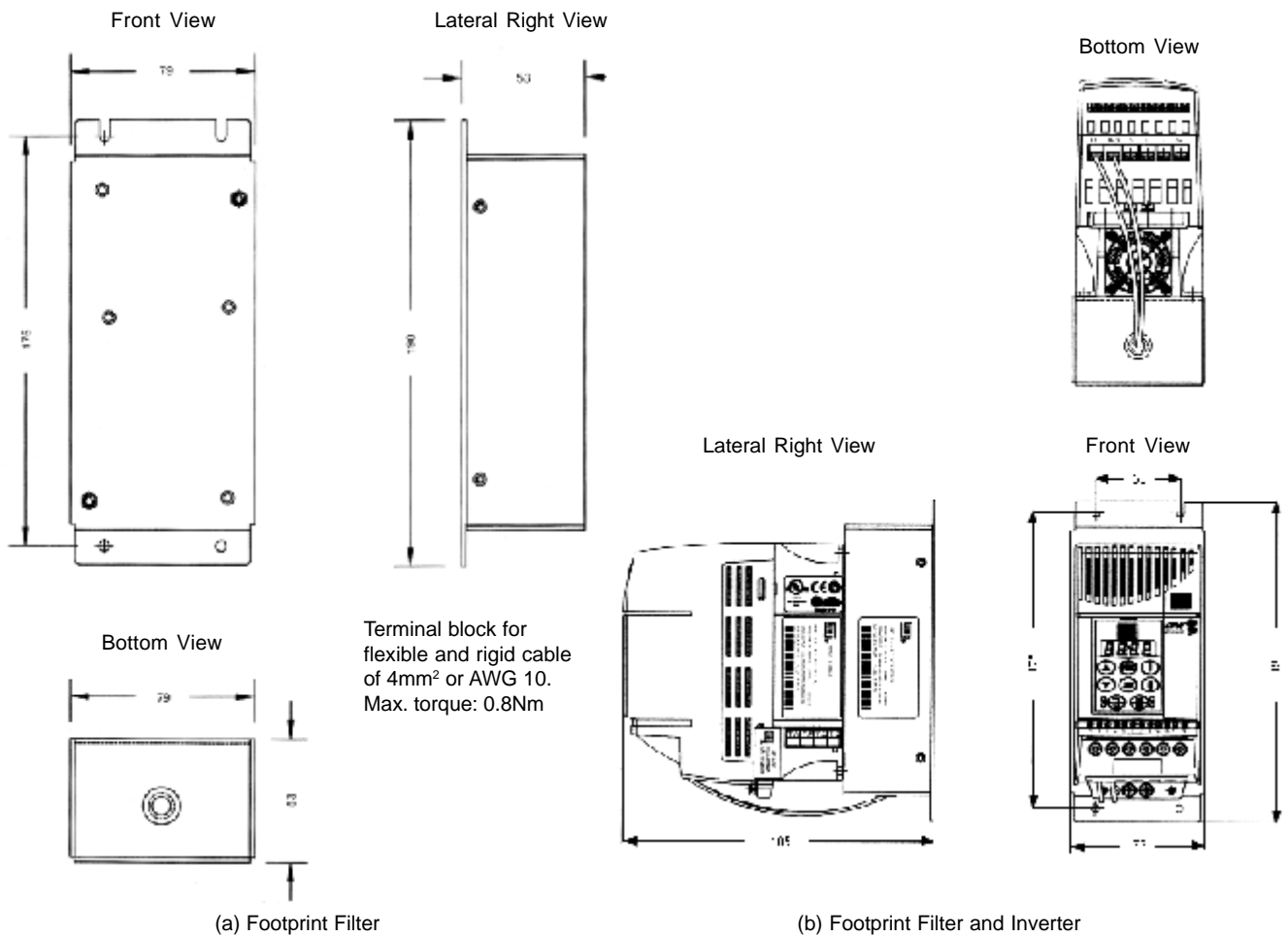
### 3.3.4 EMC Filters Characteristics Filter

Filter	WEG P/N	Rated current	Weight	Dimensions (Width x Height x Depth)	Drawings
FEX1-CFW08	417118238	10A	0.6kg	79x190x51mm	Fig. 3.16
FEX2-CFW08	417118239	5A			
FS6007-16-06	0208.2072	16A	0.9kg	85.5x119x57.6mm	Fig. 3.17
FS6007-25-08	0208.2073	25A	1.0kg	85.5x119x57.6mm	Fig. 3.18
FS6007-36-08	0208.2074	36A	1.0kg		
FN3258-7-45	0208.2075	7A	0.5kg	40x190x70mm	Fig. 3.19
FN3258-16-45	0208.2076	16A	0.8kg	45x250x70mm	
FN3258-30-47	0208.2077	30A	1.2kg	50x270x85mm	
TOR1-CFW08	417100895	-	80g	$\phi_e=35\text{mm}$ , $h=22\text{mm}$	Fig. 3.20
TOR2-CFW08	417100896	-	125g	$\phi_e=52\text{mm}$ , $h=22\text{mm}$	Fig. 3.21

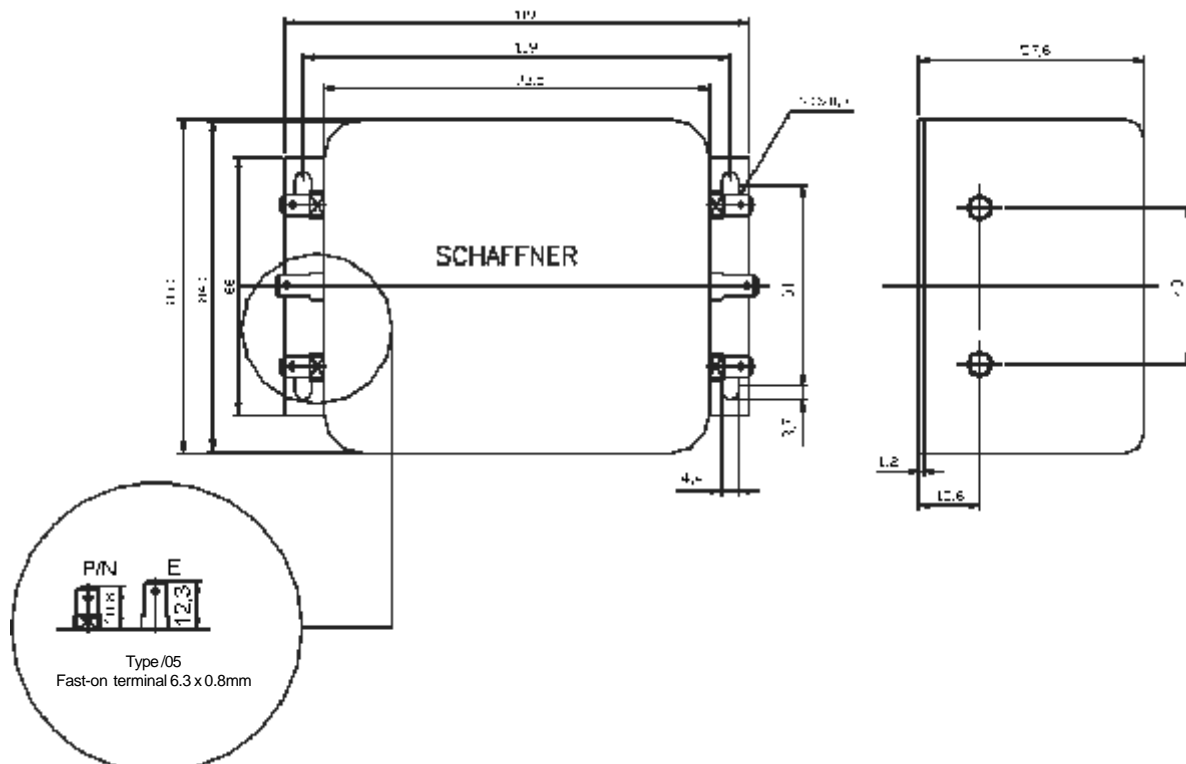
**Table 3.7 - EMC filters characteristics**



# INSTALLATION AND CONNECTION



**Figure 3.16 - FEX1-CFW08 and FEX2-CFW08 footprint filter drawing**



**Figure 3.17 - FS6007-16-U6 external filter drawing**

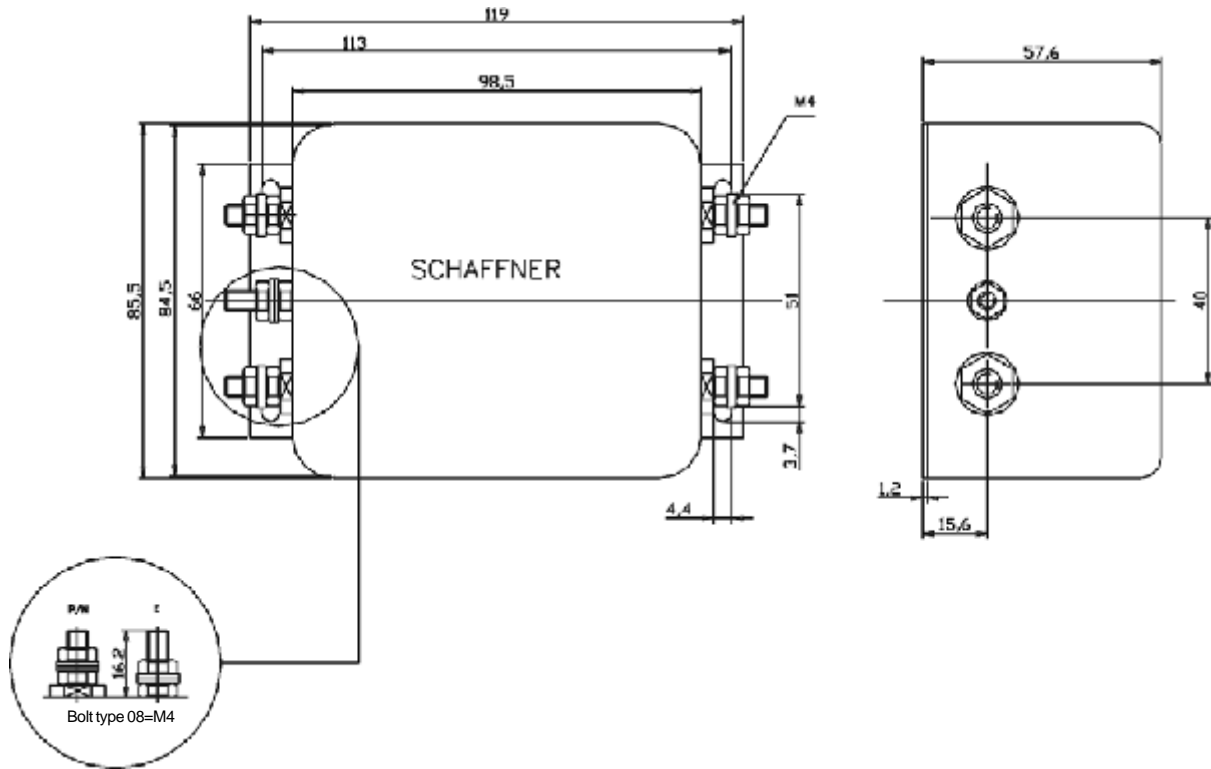


Figure 3.18 - FS6007-25-08 and FS6007-36-08 external filter drawing

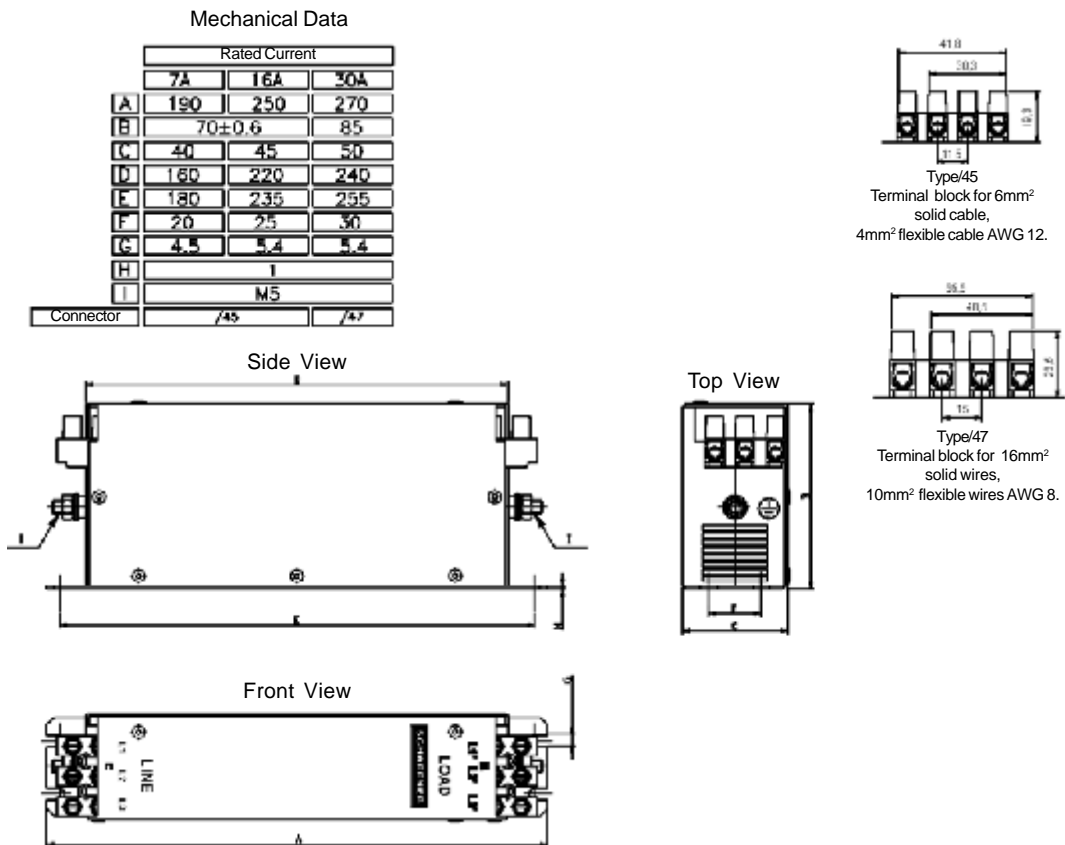


Figure 3.19 - FS3258-xx-xx external filter drawing

# INSTALLATION AND CONNECTION

Toroid: Thornton NT35/22/22-4100-IP12R  
(WEG P/N 0208.2102)

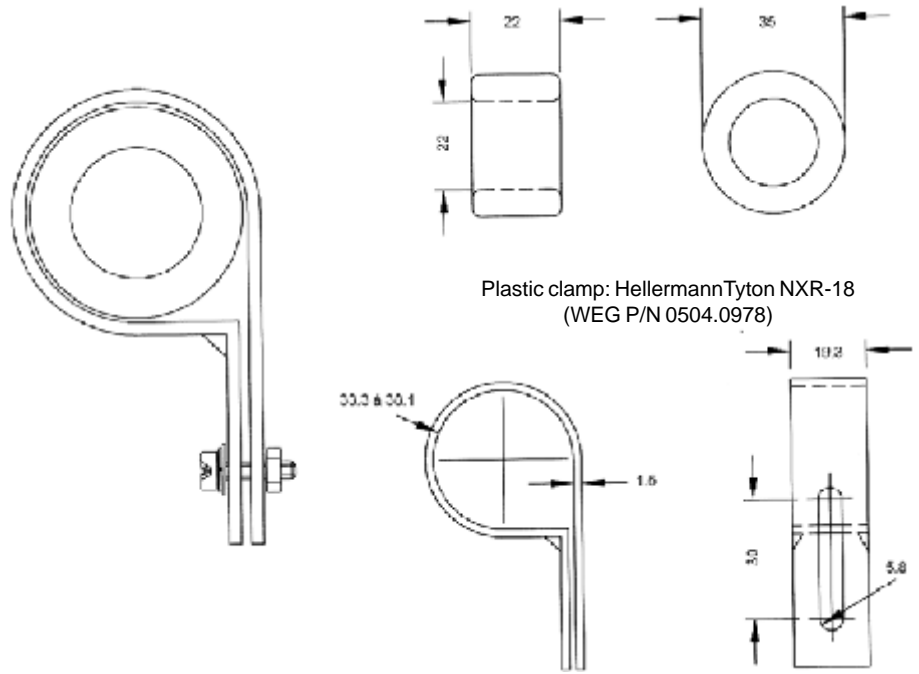


Figure 3.20 - TOR1-CFW08 drawing

Toroid: Thornton NT52/32/20-4400-IP12E  
(WEG P/N 0208.2103)

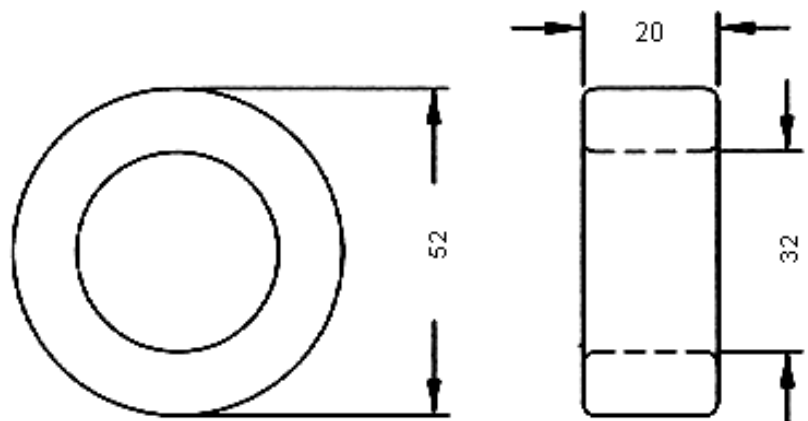


Figure 3.21 - TOR2-CFW08 drawing



## EU DECLARATION OF CONFORMITY

We

Manufacturer's Name: **WEG Indústrias S/A - Automação**

Address: Rua Waldemar Grubba, 3000  
89256-900 Jaraguá do Sul - SC - Brazil  
Telephone: +55 47 372 4515  
Fax: +55 47 372 4020

And our representative established within the European Community:

**WEG Europe SA**  
Parc Silic Rhône Alpes  
17, rue de Bruxelles  
38070 St. Quentin Fallavier - France  
Telephone: +33 474 991135  
Fax: +33 474 991144

Herewith declare that the product: **CFW-08 Frequency Inverter**

Models: **CFW08...**

Has been designed and manufactured in accordance with the following standards:

Safety: **EN 50178 (1997)** Electronic Equipment for Use in Power Installations  
**EN 60204-1 (1997)** Safety of Machinery - Electrical Equipment of Machines -  
Part 1: General Requirements

EMC: **EN 61800-3 (1996)** Adjustable Speed Electrical Power Drive Systems - Part 3:  
EMC Product Standard Including Specific Test Methods

Technical Construction File N° WEG001-2002

Prepared by: WEG Indústrias S/A - Automação

Function: Manufacturer

Date: 20/Aug/2002

Competent Body:

Name: SGS United Kingdom Ltd.

Address: South Industrial Estate - Bowburn - Co. Durham -  
United Kingdom - DH6 5AD

Certification N°: DUR24182/CST/AR/02

and when installed in accordance with the installation recommendations contained in  
the product documentation, conforms to relevant provisions of:

Low Voltage Directive 73/23/EEC as amended by the Directive 93/68/EEC and  
EMC Directive 89/336/EEC as amended by 92/31/EEC and 93/68/EEC.

Year of CE Marking: 2002

  
Umberto Gobato  
WEG Indústrias S/A - Automação  
Managing Director

  
Date

Wilmar Henning  
WEG Europe SA  
Director

  
Date

4.1 PRE-POWER CHECKS



**START-UP**

This Chapter provides the following information:

- ☑ how to check and prepare the inverter before power-up;
- ☑ how to power-up and check for proper operation;
- ☑ how to operate the inverter when it is installed according to the typical connections (refer to Section 3.2 - Electrical Installation).

The inverter shall be installed according to Chapter 3 - Installation and Connection. If the drive project is different from the typical suggested connections, follow the procedures below.

**DANGER!**

Always disconnect the AC input power before making any connections.

**1) Check all connections**

Check if the power, grounding and control connections are correct and well tightened.

**2) Check the motor**

Check all motor connections and verify if its voltage, current and frequency match the inverter specifications.

**4) Uncouple the load from the motor**

If the motor can not be uncoupled, make sure that the direction of rotation (FWD/REV) can not cause damage to the machine.

4.2 INITIAL POWER-UP

After the inverter has been checked, AC power can be applied:

**1) Check the power supply**

Measure the line voltage and check if it is within the specified range (rated voltage: + 10% / - 15%).

**2) Power-up the AC input**

Close the input circuit breaker or disconnect switch.

**3) Check if the power-up has been successful**

**- Inverter with keypad (HMI-CFW08-P or HMI-CFW08-RS)**

The keypad display will show:



The four LEDs of the keypad remains ON during this procedure. Inverter runs some self-diagnosis routines. If no problems are found, the display shows:



This means that the inverter is ready (rdy = ready) to be operated.

**- Inverter with dummy panel (TCL-CFW08 or TCR-CFW08).**

The LEDs ON (green) and ERROR (red) are ON.

Inverter runs some self-diagnosis routines. If no problems are found the LED ERROR (red) turns OFF. This means that the inverter is now ready to be operated.

**4.3 START-UP**

This Section describes start-up procedures when operating via the keypad (HMI). Two types of control will be considered:

**V/F and Vector Control**

The V/F control is recommended in the following cases:

- ☑ several motors driven by the same inverter;
- ☑ rated current of the motor is lower than 1/3 of rated inverter current
- ☑ for test purposes, inverter is start-up without load.

The V/F control can also be used in applications that do not require fast dynamic responses, accurate speed regulations or high starting torque (speed error will be a function of the motor slip); when you program parameter **P138** - rated slip - you can obtain a speed accuracy of 1%.

For the most applications, we recommend the vector control mode, that permits a higher speed control accuracy (typical 0.5%), higher starting torque and a faster dynamic response.



**DANGER!**

Even after the AC power supply has been disconnected, high voltages may be still present. Wait at least 10 minutes after powering down to allow full discharge of the capacitors.

The sequence below is valid for the connection 1 (refer to Section 3.2.5). Inverter must be already installed and powered up according to Chapter 3 and Section 4.2.

**4.3.1 Start-up**

Operation via Keypad  
(HMI)- Type of Control:  
Linear V/F(P202=0)

Connections according to Figure 3.4.

ACTION	HMI DISPLAY	DESCRIPTION
Power-up the inverter		Inverter is ready to be operated
Press the  key		Motor accelerates from 0Hz to 3Hz* (min. frequency), in the forward (CW) direction of rotation <sup>(1)</sup> * 90rpm for 4 pole motor.
Press the  key and hold it depressed until 60 Hz is reached		Motor accelerates up to 60Hz* <sup>(2)</sup> * 1800rpm for 4-pole motor
Press the  key		Motor decelerates <sup>(3)</sup> down to 0 rpm and then reverses the direction of rotation CW⇒CWW accelerating back to 60Hz
Press the  key		Motor decelerates down to 0 rpm
Press the  key and hold it depressed		Motor accelerates up to JOG frequency given by P122. Ex: P122 = 5.00Hz. Reverse (CCW)



## START-UP

---

ACTION	DISPLAY HMI	DESCRIPTION
Release the  key		Motor decelerates down to 0 rpm



### NOTE!

The last frequency reference (speed) value set via the  and  keys is saved.








If you wish to change this value before inverter enabling, change parameter P121 (Keypad Reference).

### NOTES:

- (1) If the direction of rotation of the motor is not correct, switch off the inverter. Wait at least for 10 minutes to allow complete capacitor discharge and then swap any two wires at the motor output.
- (2) If the acceleration current becomes too high, mainly at low frequencies, set the torque boost (IxR compensation) at **P136**.  
Increase/decrease the content of **P136** gradually until you obtain an operation with constant current over the entire frequency range.  
For the case above, refer to Parameter Description in Chapter 6.
- (3) If E01 fault occurs during deceleration, increase the deceleration time at **P101 / P103**.

**4.3.2 Start-up**  
**Operation Via Terminals -**  
**Control Mode:**  
**Linear V/F (P202=0)**

Connections are according to Figures 3.4 and 3.12.

ACTION	HMI DISPLAY	DESCRIPTION
See Figure 3.12 Switch S1 (FWD / REV)=open Switch S2 (Reset)=open Switch S3 (Start/Stop)=open Potentiometer R1 (Ref.)=totalzly CCW Power-up inverter		Inverter is ready to be operated.
Press the  key This procedure is not necessary when inverters were delivered dummy panel, since it will be automatically in remote mode.		Led LOCAL switches OFF and led REMOTE switches ON. Control and Reference are are switched to REMOTE (via terminals). To maintain inverter permanently in REMOTE mode, set P220 = 1. Note: If the inverter is switched off and afterwards switched on, it will now operate in local mode because P220=2 (factory setting). This setting means that the local/remote selection source is via keypad and the default mode (that is the mode when the inverter is switched on) is local. For further information see description of P220 in Chapter 6.
Close <b>S3</b> – Start/Stop		Motor accelerates from 0Hz to 3Hz* (min. frequency), CW direction <sup>(1)</sup> * 90rpm for 4-pole motor The frequency reference is given by the potentiometer R1.
Turn potentiometer totally CW.		Motor accelerates up to the the maximum frequency (P134 = 66Hz) <sup>(2)</sup>
Clse <b>S1</b> – FWD / REV		Motor decelerates <sup>(3)</sup> down to 0 rpm (0Hz), reverses the direction of rotation (CW ⇒ CWW) accelerating back up to the maximum frequency (P134 = 66Hz).
Open <b>S3</b> – Start / Stop		Motor decelerates <sup>(3)</sup> down to 0 rpm.



**NOTES!**

- (1) If the direction of roation of the motor rotation is not correct, switch off the inverter. Wait 10 minutes to allow a complete capacitor discharge and the swap any two wires at the motor output.
- (2) If the acceleration current becomes too high, mainly at low frequencies, set the torque boost (IxR compensation) at **P136**. Increase/decrease the content of **P136** gadually until you obtain an operation with constant current over the entire frequency range. For the case above, refer to Parameter Description in Chapter 6.
- (3) If E01 fault occurs during deceleration, increase the deceleration time at **P101 / P103**.



## START-UP

### 4.3.3 Start-up

Operation via Keypad -  
Control Mode:  
Vector (P202=2)

The sequence below is based on the following inverter and motor example:

**Inverter:** CFW080040S2024ESZ

**Motor:** WEG-IP55

Power: 0.75HP/0.55kW;

Frame size: 71; RPM: 1720; Number of Poles: IV;

Power factor (cos  $\varphi$ ): 0.70;

Efficiency ( $\eta$ ): 71%;

Rated Current at 220V: 2.90A;



































Frequency: 60Hz.

































#### NOTE!









The notes in Table below can be found on page 60.

ACTION	HMI DISPLAY	DESCRIPTION
Power-up inverter		Inverter is ready to be operated
Press <b>PROG</b> key. Press the  key until <b>P000</b> is reached. You can also use the key  to reach the Parameter <b>P000</b> .		P000=access for changing parameters
Press the <b>PROG</b> key to enter into the programming mode.		Enter the programming mode
Use the keys  and  to set the password value.		P000=5: permits parameter changing
Press the <b>PROG</b> key to save the selected option and to exit the programming mode.		Exit the programming mode
Press the key  or  until <b>P202</b> is reached.		This parameter defines the control type 0=V/F Linear 1=V/F Quadratic 2=Vector
Press the <b>PROG</b> key to enter into the programming mode.		Enter the programming mode
Use the  and  keys to select the control type		P202=2: Vector
Press the <b>PROG</b> to save the selected option and to start the tuning routine after changing to Vector Control mode		Motor efficiency: 50 ... 99,9%
Press the <b>PROG</b> key and use the keys  and  to set the correct rated motor efficiency (in this case 71%)		Set motor efficiency: 71%

ACTION	HMI DISPLAY	DESCRIPTION
Press the  key to save the selected option and to exit the programming mode		Exit the programming mode
Press the  key to go to the next parameter		Rated motor voltage range: 0 ... 600V
Press the  key and use the keys  and  to set the correct rated motor voltage		Set rated motor voltage: 220V (the default value is maintained) <sup>(2)</sup>
Press the  key to save the selected option and exit the programming mode		Exit the programming mode
Press the  key to go to the next parameter		Rated motor current range: $0.3 \times I_{nom} \dots 1.3 \times I_{nom}$
Press the  key and use the keys  and  to set the correct rated motor current (in this case 2.90A)		Set rated motor current: 2.90A
Press the  key to save the selected option and to exit the programming mode		Exit the programming mode
Press the  key to go to the next parameter		Rated motor RPM range: 0 ... 9999 rpm
Press the  key and use the keys  and the  to set the correct motor speed (in this case 1720rpm)		Programmed rated motor RPM: 1720rpm
Press the  key to save the selected option and exit the programming mode		Exit the programming mode
Press the  key to go to the next parameter		Rated motor frequency: $0 \dots F_{max}$
Press the  and use the keys  and  to set the correct value for the motor frequency.		Set rated motor frequency: 60Hz (the default value is maintained) <sup>(2)</sup>
Press the  key to save the selected option and exit the programming mode		Exit the programming mode




## START-UP

ACTION	HMI DISPLAY	DESCRIPTION
Press the  key to go to the next parameter		Rated motor power range: 0 ... 15 (each value represents a power value)
Press the  key and use the keys  and  to set the the correct motor power.		Selected rated motor power: 4 = 0.75HP / 0.55kW
Press the  key to save the selected option and exit the programming mode		Exit the programming mode
Press the  key to got to the next parameter		Motor power factor range: 0.5 ... 0.99
Press the  key and use the keys  and  to set the correct motor power factor (in this case 0.70)		Set motor power factor: 0.70
Press the  key to save the selected option and exit the programming mode		Exit the programming mode
Press the  key to go to the next parameter		Parameter estimation? 0 = No 1 = Yes
Press the  key and use the keys  and  to authorize or not the start of the parameter estimate		1 = Yes
Press the  key to start the self-tuning routine. While the self-tuning routine is running, the display shows "Auto".		Self-tuning is running
The running of the Self-Tuning Routine can last until 2 minutes and after ending display will show "rdy" (ready), when the motor parameter were acquired with success. Otherwise the fault "E14" is shown. In this case refer to Note <sup>(1)</sup> below.	 OR 	Inverter finished the self-tuning routine and is ready for operation  or Running of self-tuning routine has not been realized with success <sup>(1)</sup>
Press the  key		Motor accelerates up to 90rpm (for IV pole motor - minimum speed) in CW direction of rotation <sup>(3)</sup>
Press the  key and hold it depressed until the speed of 1980rpm is reached		Motor accelerates up to 1980rpm (for IV pole motor - maximum speed)

ACTION	HMI DISPLAY	DESCRIPTION
Press the  key		Motor decelerates <sup>(4)</sup> to 0 rpm and the reverses the direction of rotation accelerating back to 1980rpm
Press  key		Motor decelerates down to 0 rpm
Press the key  and hold it depressed		Motor accelerates from 0 rpm up to the JOG speed set at P122. <b>Ex:</b> P122 = 5.00Hz that corresponds to 150rpm for IV-pole motor. Reverse (CCW) direction of rotation
Release the  key		Motor decelerates down to 0 rpm



## NOTE!

- The last speed reference value set via key  and  keys is saved.
- If you wish to change this value before enabling of inverter, change the value of the Parameter P121 - Keypad Reference;
- The self-tuning routine can be cancelled by pressing the  key.

## NOTES:

- (1) If during the running of the Self-Tuning Routine the display shows E14, this means that the motor parameters were not acquired correctly by the inverter. The most common reason for this fault may be that the motor has not been coupled to the inverter output. However motors with very lower currents than the used inverter, or incorrect motor connection may also cause the fault E14. In this case, operate the inverter in V/F mode (P202=0). When the motor is not connected and the fault condition E14 is indicated, proceed as follows:
  - Switch off the inverter. Wait at least 5 minutes to allow a complete discharge of the capacitors.
  - Connect the motor to the inverter output.
  - Switch on the inverter.
  - Set P000=5 and P408=1.
  - Follow from now on the start-up procedures described in Section 4.3.3.
- (2) For each inverter type, the parameters P399...P407 are set automatically to the rated motor data, considering a standard WEG motor, IV poles, 60Hz.  
When different motors are used, you must set the parameters manually, according to the motor nameplate data.
- (3) If the direction of rotation of the motor is not correct, switch off the inverter. Wait at least 5 minutes to allow a complete discharge of the capacitors and then swap any two wires at the motor output.
- (4) If fault E01 occurs during deceleration, you must increase the deceleration time at **P101/P103**.

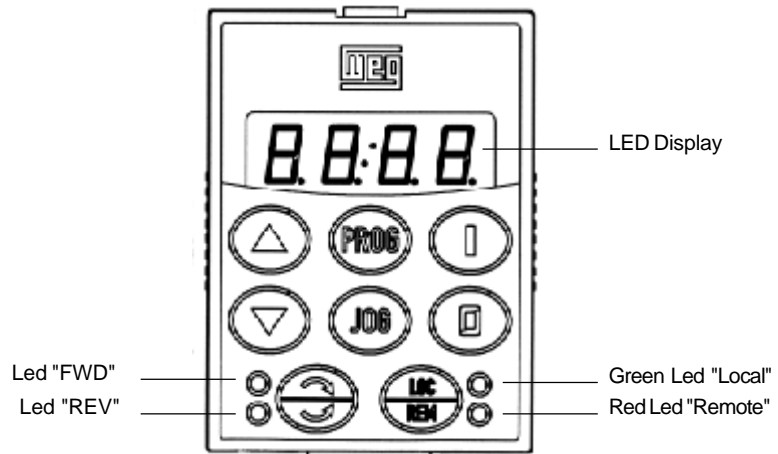
## KEYPAD (HMI) OPERATION

This chapter describes the CFW-08 operation via standard keypad or Human-Machine Interface (HMI), providing the following information:

- ☑ general keypad description (HMI);
- ☑ use of the keypad;
- ☑ parameter programming;
- ☑ description of the status indicators.

### 5.1 KEYPAD (HMI) DESCRIPTION

The standard CFW-08 keypad has a LED display with 4 digits of 7 segments, 4 status LEDs and 8 keys. Figure 5.1 shows the front view of the keypad and indicates the position of the display and the status LEDs.



*Figure 5.1 - CFW-08 standard keypad*

#### **Functions of the LED Display:**

The LED display shows the fault codes and drive status (see Quick Parameter Reference, Fault and Status), the parameter number and its value. For units of current, voltage or frequency, the LED display shows the unit in the right side digit [U = Volts, A = Ampères, ° = Celsius Degree (°C)]

#### **Functions of the “Local” and “Remote” LEDs:**

Inverter in Local Mode:  
Green LED ON and red LED OFF.

Inverter in Remote Mode:  
Green LED OFF and red LED ON.

#### **Functions of the FWD/REV LEDs - Direction of Rotation**

Refer to Figure 5.2

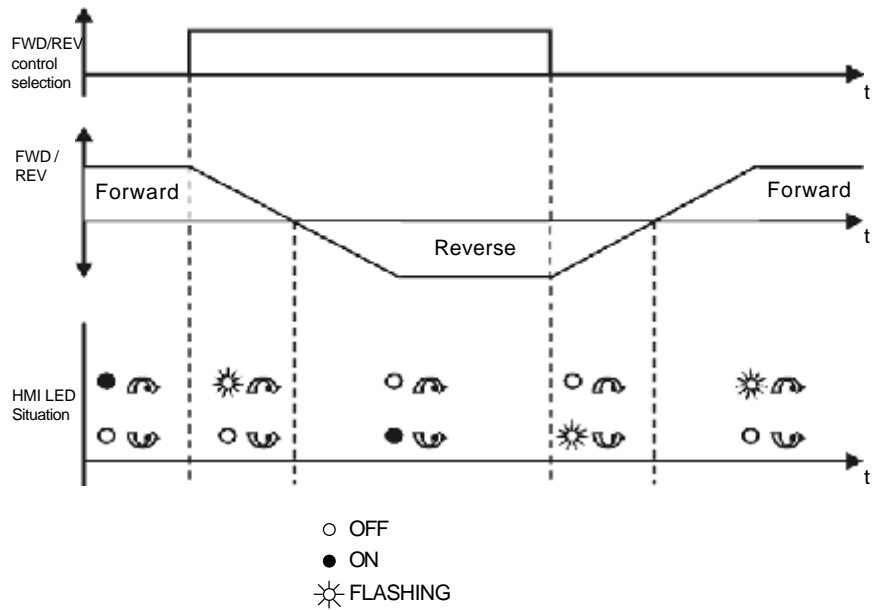

















Figure 5.2 - Direction of rotation (FWD/REV) LEDs

### Basic Functions of the Keys:

-  Starts the inverter via acceleration ramp.
-  Stops (disables) the inverter via deceleration ramp. Also resets inverter after a fault has occurred.
-  Toggles the LED display between parameter number and its value (number/value).
-  Increases the frequency, the parameter number or the parameter value.
-  Decreases the frequency, the parameter number or the parameter value.
-  Reverses the direction of motor rotation between Forward/Reverse
-  Toggles between the LOCAL and REMOTE modes of operation .
-  Performs the JOG function when pressed. Any DI programmed for General Enable (if any) must be closed to enable the JOG function.

## 5.2 USE OF THE KEYPAD HMI

The keypad is used for programming and operating the CFW-08, allowing the following functions:

- indication of the inverter status and operation variables;
- fault indication and diagnostics;
- viewing and programming parameters;
- operation of the inverter (keys , , ,  and  ) and speed reference setting (keys  and  ).

## KEYPAD (HMI) OPERATION




---

### 5.2.1 Keypad Operation


All functions relating to the CFW-08 operation (Start/Stop, Direction of Rotation, JOG, Increment/Decrement of the Speed (Frequency) Reference, and selection of LOCAL/REMOTE mode) can be performed through the HMI selection. For factory default programming of the inverter, all keypad keys are enabled when the LOCAL Mode has been selected. These same functions can be performed through digital and analog inputs. Thus you must program the parameters related to these corresponding inputs.



#### NOTE!

The control keys ,  and  are only enabled if:

- P229=0 for LOCAL Mode operation
- P230=0 for REMOTE Mode operation

The key  depends of the parameters above and if:

- P231=2

Keypad keys operation description:



When enabled (P220 = 2 or 3), selects the control input and the speed reference (speed) source, toggling between LOCAL and REMOTE Mode.



When pressed, starts the motor according to acceleration ramp up to the speed (frequency) reference. The function is similar to that performed through digital input START/STOP, when it is closed (enabled) and maintained enabled.



Stop disables the inverter via deceleration Ramp. The Function is similar to that performed through digital input START/STOP, when it is open (disabled) and maintained disabled.



When the JOG key is pressed, it accelerates the motor according to the acceleration ramp up to the JOG speed programmed in P122. This key is only enabled when the inverter digital inputs, programmed to general enable (if any) are closed.



When enabled (refer to the note above), reverses the motor direction of rotation.



Motor speed (frequency) setting: these keys are enabled for speed setting only when:

- the speed reference source is the keypad (P221 = 0 for LOCAL Mode and/or P222 = 0 for REMOTE Mode);
- the following parameter content is displayed: P002, P005 or P121.

Parameter P121 stores the speed reference set by these keys.





When pressed, it increases the speed (frequency) reference.



When pressed, it decreases the speed (frequency) reference.

## Reference Backup

The last frequency reference set by the keys the  and  is stored when inverter is stopped or the AC power is removed, provided P120 = 1 (reference backup active is the factory default). To change the frequency reference before starting the inverter, the value of the parameter P121, must be changed.

## 5.2.2 Inverter Status



Inverter is READY to be started.



Line voltage is too low for inverter operation (undervoltage condition).



Inverter is in a Fault condition. Fault code is flashing on the display. In our example we have the fault code E02 (refer to chapter Maintenance).



Inverter is applying a DC current on the motor (DC braking) according to the values programmed at P300, P301 and P302 (refer to Chapter 6).



Inverter is running self-tuning routine to identify motor parameters automatically. This operation is controlled by P408 (refer to Chapter 6).



### NOTE!

The display also flashes in the following conditions, besides the fault conditions:

- trying to change a parameter value when it is not allowed.
- inverter in overload condition (refer to Chapter Maintenance).

## 5.2.3 Read-Only Variables

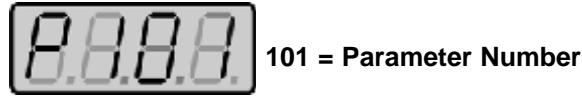
Parameters P002 to P099 are reserved for the display of read-only values. The factory default display when power is applied to the inverter is P002 (frequency proportional value in V/F control mode and motor speed in rpm in vector control mode). Parameter P205 defines the initial monitoring parameter, i.e., defines the read-only variable that will be displayed when the inverter is powered up. For further information refer to P205 description in Chapter 6.



# KEYPAD (HMI) OPERATION

## 5.2.4 Parameter Viewing and Programming

All CFW-08 settings are made through parameters. The parameter are shown on the display by the letter **P** followed by a number:  
Exmple (P101):



Each parameter is associated with a numerical value (parameter value), that corresponds to the selected option among the available ones for this parameter.

The parameter values define the inverter programming or the value of a variable (e.g.: current, frequency, voltage). For inverter programming you should change the parameter content(s).

To allow the reprogramming of any parameter value (except for P000 and P121) it is required to set P000 = 5.

Otherwise you can only read the parameter values, but not reprogram them. For more details, see P000 description in Chapter 6.

ACTION	HMI DISPLAY	DESCRIPTION
Turn ON the inverter		Inverter is ready to be started
Press the  key		
Use the keys  and  to reach P100		Select the desired parameter
Press the  key		Numerical value associated with the parameter <sup>(4)</sup>
Use the keys  and  keys		Set the new desired value <sup>(1) (4)</sup>
Press the  key		<sup>(1) (2) (3)</sup>



### NOTE!

(1) For parameters that can be changed with the motor running, the inverter will use the new value immediately after it has been set. For parameters that can be changed only with motor stopped, the inverter will use this new value only after the key is pressed.

(2) By pressing the key after the reprogramming, the new programmed value will be stored automatically and will remain stored until a new value is programmed.

- (3) If the last programmed value in the parameter is not functionally compatible with other parameter values already programmed, E24 - Programming Error - will be displayed.  
 Example of programming error:  
 Programming of two digital inputs (DI) with the same function. Refer to Table 5.1 for list of programming errors that can generate an E24 Programming Error.
- (4) To allow the reprogramming of any parameter value (except for P000 and P121) it is required to set P000 = 5.  
 Otherwise you can only read the parameter values, but not reprogram them. For more details, see P000 description in Chapter 6.

P265=3 (JOG) and other(s) DI(s) ≠ Start/Stop or forward run and reverse or FWD run and REV run using Ramp #2
P266=3 (JOG) and other(s) DI(s) ≠ Start/Stop or forward run and reverse or FWD run and REV run using Ramp #2
Two or more parameters among P264, P265 and P266 equal to 1 (LOC/REM)
P265=13 and P266=13 (flying start disable)
P265=10 and P266=10 (reset)
P263=14 and P264≠14 or P263≠14 and P264=14 (3-wire - Start/Stop)
Two or more parameter among P264, P265 and P266 equal to 0 (FWD/REV)
P263=8 and P264≠8 and P264≠13
P263≠8 and P263≠13 and P264=8
P263=13 and P264≠8 and P264≠13
P263≠8 and P263≠13 and P264=13
P263=8 or 13 and P264=8 or 13 and P265=0 or P266=0
P263=8 or 13 and P264=8 or 13 and P231≠2
P221=6 or P222=6 and P264≠7 and P265≠7 and P266≠7 (multispeed)
P221≠6 or P222≠6 and P264=7 or P265=7 or 14 or P266=7
P265=14 and P221≠6 and P222≠6
P221=4 or P222=4 and P265≠5 and P266≠5 (EP)
P221≠4 or P222≠4 and P265=5 and P266=5
P295 incompatible to the inverter model (size and voltage).
P300≠0 and P310= 2 or 3 (DC braking and ride-through active)
P203=1 (PID special function) and P221 or P222=1, 4, 5, 6, 7 or 8
P265=6 and P266=6 (ramp #2)
P221=2 or 3 or 7 or 8 and standard inverter
P222=2 or 3 or 7 or 8 and standard inverter
P265=13 and P266=3 (flying start disable)
P221=4 or P222=4 (reference = P.E.) and P265≠5 and 16 and P266≠5 and 16 (DI3 and DI4 not programmed to P.E.).
P265=5 or 16 or P266=5 or 16 (DI3 or DI4 programmed to P.E.) and P221≠4 and P222≠4 (reference≠P.E.).
P265=6 or P266=6 (DI3 or DI4 programmed to the 2nd ramp) and P263=13 or P264=13 (fwd/rev with 2 <sup>nd</sup> ramp).

**Table 5.1 - Incompatibility of parameters - E24**

## DETAILED PARAMETER DESCRIPTION

This chapter describes in detail all CFW-08 parameters and functions.

### 6.1 SYMBOLS

Please find below some symbols used in this chapter:

**AIx** = Analog input number x.

**AO** = Analog output.

**DIx** = Digital input number x.

**F\*** = Frequency reference. This is the frequency value that indicates the desired motor speed at the inverter output.

**F<sub>e</sub>** = Input frequency of the acceleration and deceleration ramp.

**F<sub>max</sub>** = Maximum output frequency, defined at P134.

**F<sub>min</sub>** = Minimum output frequency, defined at P133.

**F<sub>s</sub>** = Output frequency - frequency applied to the motor.

**I<sub>nom</sub>** = Rated inverter output current (rms), in Ampères (A). This value is defined in P295.

**I<sub>s</sub>** = Inverter output current.

**I<sub>a</sub>** = Active current at inverter output, i.e., it is the component of the total motor current proportional to active electric power absorbed by the motor.

**RLx** = Relay output number x.

**U<sub>d</sub>** = DC link voltage in the DC link circuit.

### 6.2 INTRODUCTION

This section describes the main concepts related to the CFW-08 frequency inverter.

#### 6.2.1 Control Modes

As already informed in section 2.3, CFW-08 has in the same product a V/F control and a sensorless vector control (VVC: "voltage vector control"). The user must choose one of them. Please find below a description of each control mode.

#### 6.2.2 V/F Control

This control mode is based on the constant V/F curve (P202=0 - linear V/F curve). Its performance is limited at low frequencies as function of the voltage drop in the stator resistance, that causes a significant magnetic flux reduction in the motor air gap and consequently reducing the motor torque. This deficiency should be compensated by using manual and automatic boost torque (IxR compensations), that are set manually and depend on the user experience.

In most applications (for instance: centrifugal pumps and fans) the setting of these functions is enough to obtain the required performance. But there are applications that require a more sophisticated control. In these cases it's recommended the use of the sensorless vector control, that will be described in the section below.

In V/F control, the speed regulation, that can be obtained by setting properly slip compensation can be maintained within 1 to 2% of the rated speed. For instance, for a 4V pole motor/60Hz, the minimum speed variation at no load condition and at rated load can be maintained between 18 and 36rpm.

There is still a variation of the linear V/F control: the quadratic V/F control. This control mode is suitable for applications like centrifugal pumps and fans (loads with quadratic torque x speed characteristics), since it enables a motor loss reduction, resulting in an additional energy saving by using an inverter.

For more details about the V/F control mode, please refer to the description of the parameters P136, P137, P138, P142 and P145.

### 6.2.3 Vector Control (VVC)

Inverter performance improvements can be achieved when the sensorless vector control is selected (P202=2).

The CFW-08 vector control is sensorless, i.e., it does not require a signal of the speed feedback through tachogenerator or encoder coupled on motor shaft.

To maintain the magnetic flow in the motor air gap constant, and consequently the motor torque, within the whole speed variation range (from zero up to the field weakening point), a sophisticated control algorithm is used that considers the mathematic model of the induction motor.

Thus one can maintain the magnetic flow in the motor air gap approximately constant at frequencies down to approximately 1 Hz.

In vector control mode one can obtain a speed regulations about 0.5% (relating to the rated speed). Thus, for instance, for a 4V pole motor/60Hz one can obtain a speed variation in the range of 10rpm (!).

Other advantage of the vector control is its easy setting procedure.

The user needs only to enter in the parameters P399 and 407 the information about the used motor (nameplate data) and runs the self-tuning routine (by setting P408=1) and the inverter configures itself to the required application. So the inverter is ready to be operated in an optimized manner. For more information, refer to the description of the following parameters: P178 and P399 to P409.

### 6.2.4 Frequency Reference Sources

The frequency reference (i.e., the desired output frequency, or alternatively, the motor speed) can be defined in several ways:



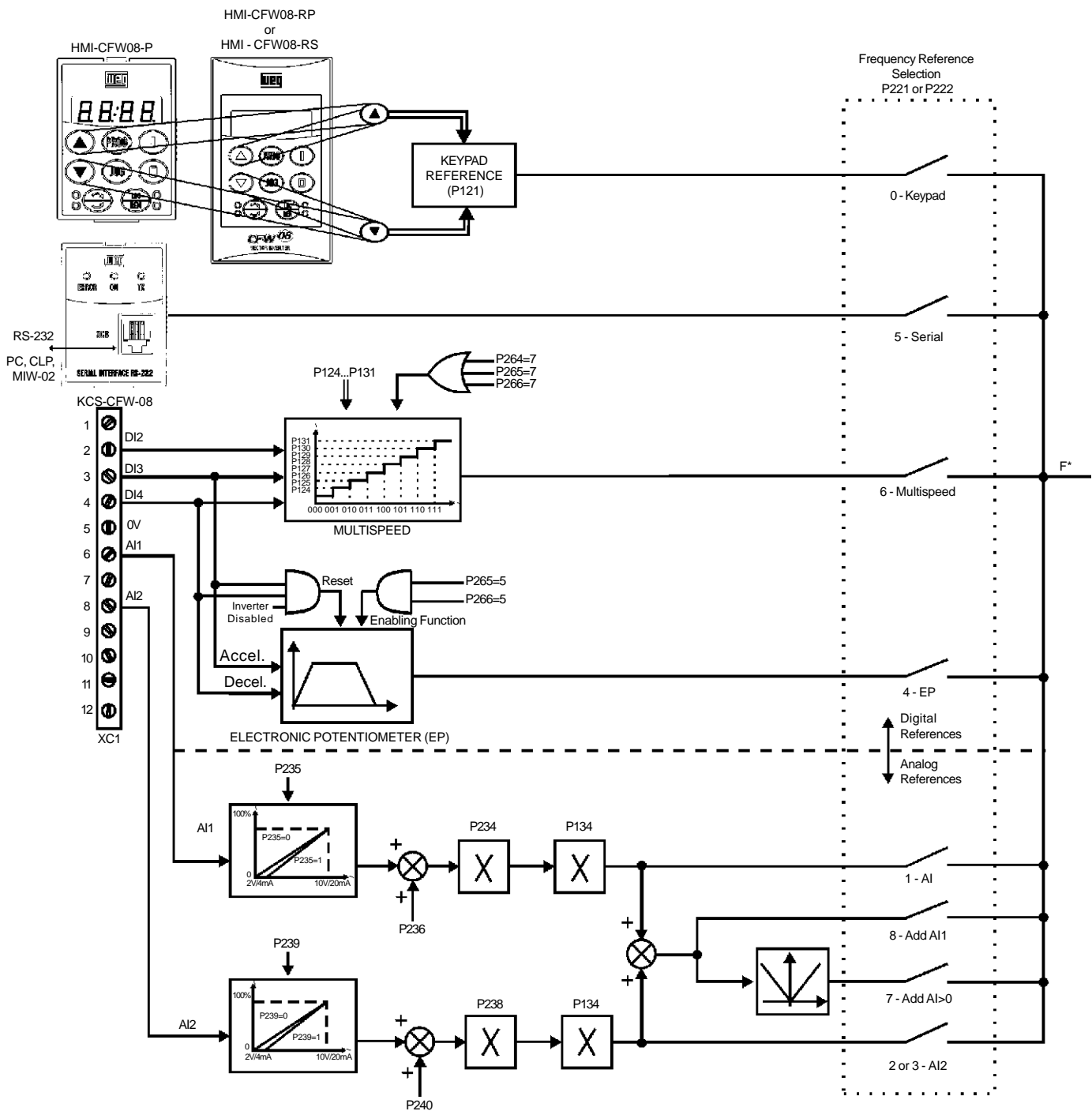
- the keypad - digital reference that can be changed through the keypad (HMI), by using the keys  and  (see P221, P222 and P121);
- analog input - the analog input AI1 (XC1:6) or the AI2 (XC1:8) can be used, or both (see P221, P222 and P234 to P240);
- multispeed - up to 8 preset digital references (see P221, P222 and P124 to P131);
- electronic potentiometer (EP) - another digital reference, its value is defined by using 2 digital inputs (DI3 and DI4) - see P221, P222, P265 and 266;
- via serial.

Figure 6.1 shows through a diagram block the frequency reference definition to be used by the inverter.

The block diagram in Figure 6.2 shows the inverter control.

# DETAILED PARAMETER DESCRIPTION

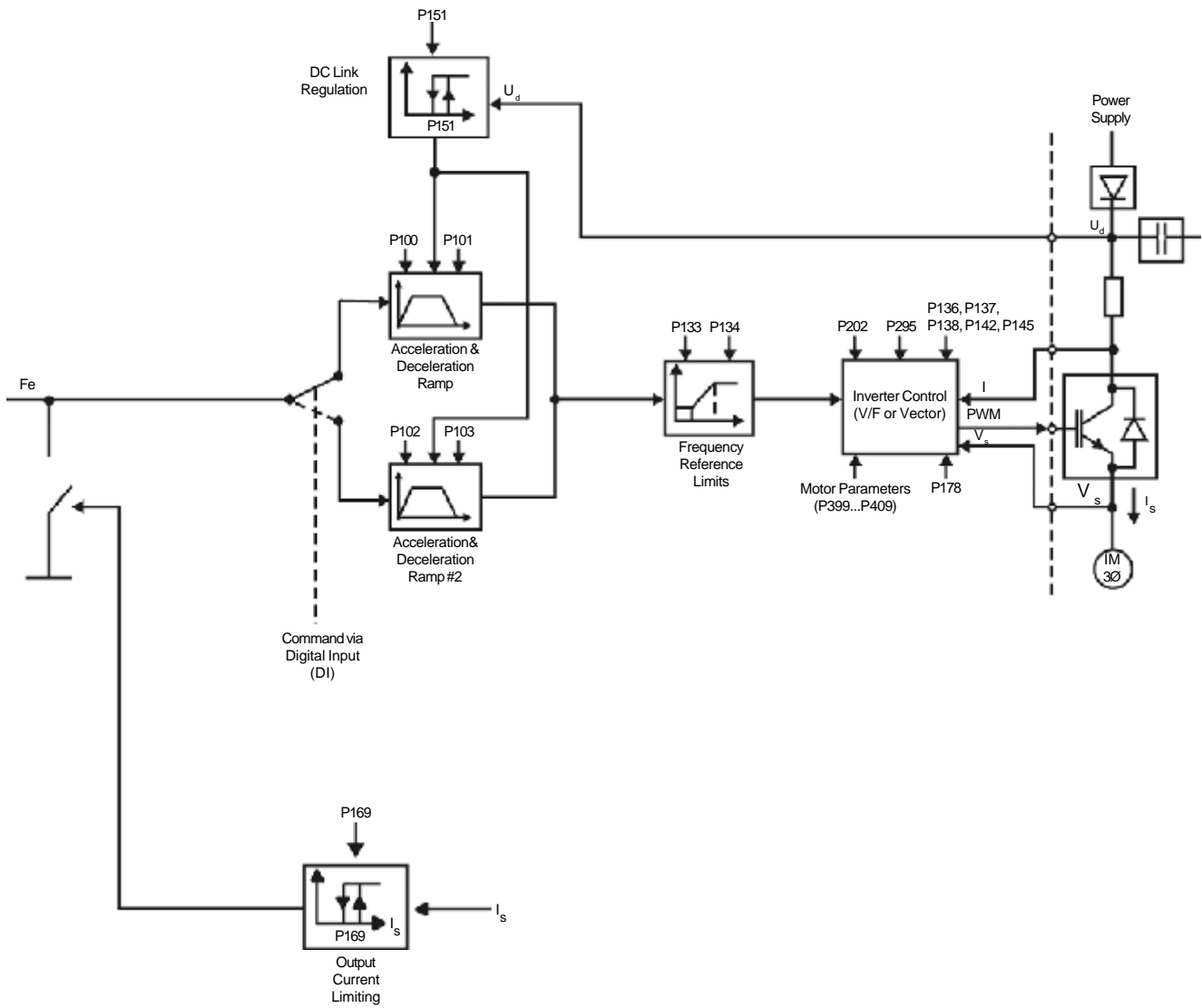


## NOTE!

- ☑ AI2 is only available in CFW-08 Plus version.
- ☑ DIs ON when connected to 0V (XC1:5).
- ☑ When  $F^* < 0$  one takes the module of  $F^*$  and reverses the direction of rotation (if this is possible - P231=2 and if the selected control is not forward run/reverse run).

Figure 6.1 - Block diagram of the frequency reference

# DETAILED PARAMETER DESCRIPTION



## NOTE!

- ☑ In V/F control mode (P202=0 or 1),  $F_e = F^*$  (see Fig. 6.1) if P138=0 (slip compensation disabled). If P138≠0, see Figure 6.9 for the relation between  $F_e$  and  $F^*$ .
- ☑ In vector control mode (P202) always  $F_e = F^*$  (see Figure 6.1).

Figure 6.2 - Inverter block diagram

## DETAILED PARAMETER DESCRIPTION





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### 6.2.5 Commands



The inverter has the following commands: PWM pulse enabling/disabling, definition of the direction of rotation and JOG.

As the reference, the inverter commands can be defined in several ways.


The command sources are the following:

- via keypad - keys , ,  and  ;
- via control terminals (XC1) - digital inputs;
- via serial interface.

The inverter enabling and disabling commands can be defined as follows:

- via keypad  and  of the HMI;
- via serial;
- start/stop (terminals XC1 - DI(s) - see P263 ... P266);
- general enable (terminals XC1 - DI(s) - see P263 ... P266);
- forward run  
It defines also the direction of rotation;
- ON/OFF (3-wire controls) (terminals XC1 - DIs - see P263 e P264).

The definition of the direction of rotation can be defined by using:

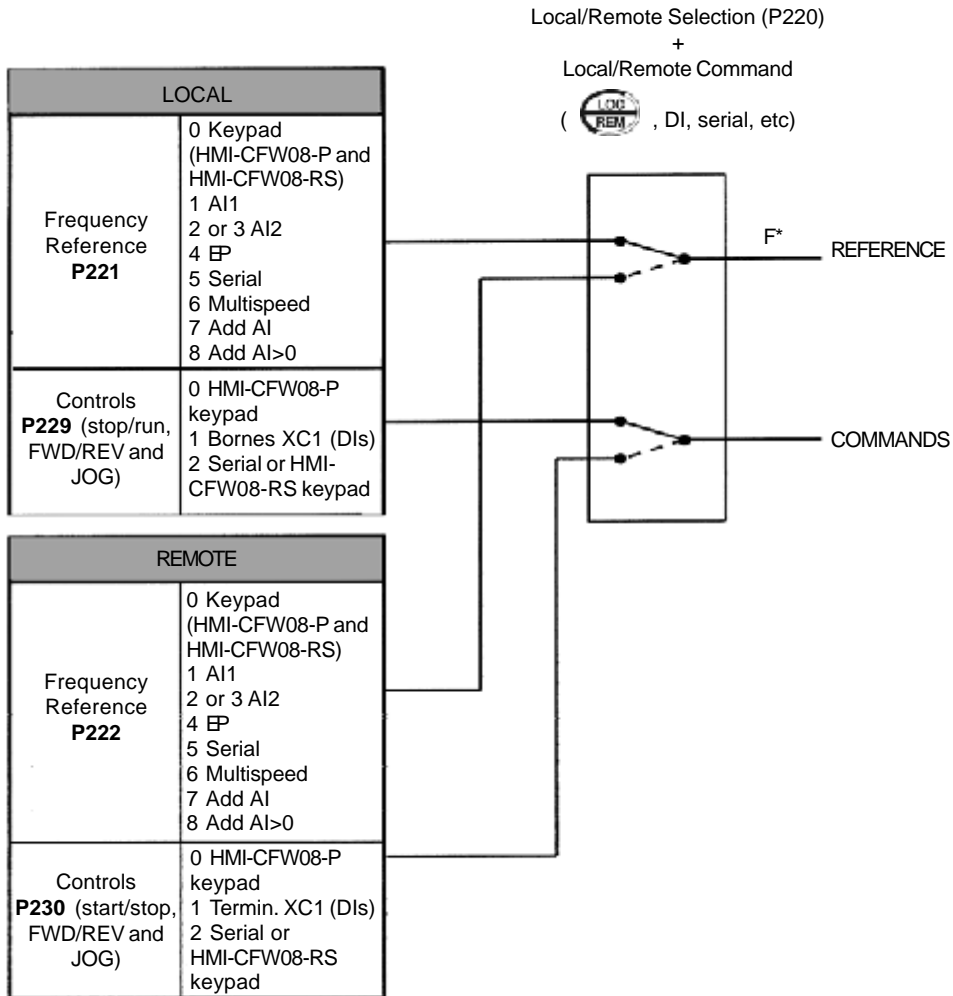
- the  key of the keypad;
- serial;
- digital input (DI) programmed for FWD/REV (see P264 ... P266);
- digital inputs programmed as FWD / REV, that defines both inverter enabling or disabling and direction of rotation (see P263 e P264);
- analog input - when the reference is via analog input and a negative offset is programmed (P236 or P240<0), the reference may assume negative values, thus reversing the direction of the motor rotation.

### 6.2.6 Local/Remote Operation Modes

User can define two different conditions relating to the frequency reference source and the inverter commands: these are the local and the remote operation modes.

Figure 6.3 shows the local and remote operation modes in a block diagram. With the factory setting in local mode the inverter can be controlled by using the keypad, while in remote mode all controls are via terminals (XC1).

# DETAILED PARAMETER DESCRIPTION



**Figure 6.3** - Block diagram of the local and remote operation mode

## 6.3 PARAMETER LISTING


In order to simplify the explanation, the parameters have been grouped by characteristics and functions:

Read-Only Parameters	Variables that can be viewed on the display, but can not be changed by the user.
Regulation Parameters	Programmable values used by the CFW-08 functions.
Configuration Parameters	They define the inverter characteristics, the functions to be executed, as well as the input/output functions of the control board.
Motor Parameters	Data about the applied motor: data indicated on the motor nameplate and those obtained during the running of the self-tuning routine.
Special Function Parameters	Here are included parameters related to special functions, like PID regulator.



## DETAILED PARAMETER DESCRIPTION

### 6.3.1 Access and Read Only Parameters - P000 ... P099

Parameter	Range [Factory Setting] Unit	Description / Notes												
<b>P000</b> Access Parameter	0...999 [ 0 ] 1	<input checked="" type="checkbox"/> Releases the access to change the parameter values. <input checked="" type="checkbox"/> The password is 5. <input checked="" type="checkbox"/> The use of the password is always active.												
<b>P002</b> Frequency Proportional Value	0...6553 [ - ] 0.01 (<100.0); 0.1 (<1000); 1 (>999.9)	<input checked="" type="checkbox"/> Indicates the value of P208 x P005. <input checked="" type="checkbox"/> When the vector control mode is used (P202=2), P002 indicates the actual motor speed in rpm. <input checked="" type="checkbox"/> In case of different scales and units, use P208.												
<b>P003</b> Output Current (Motor)	0...1.5 x I <sub>nom</sub> [ - ] 0.01A (<10.0A); 0.1A (>9.99A)	<input checked="" type="checkbox"/> Indicates the inverter output current in Amps. (A).												
<b>P004</b> DC Link Voltage	0...862V [ - ] 1V	<input checked="" type="checkbox"/> Indicates the inverter DC Link voltage in Volts (V).												
<b>P005</b> Output Frequency (Motor)	0...300Hz [ - ] 0.01Hz (<100.0Hz); 0.1Hz (>99.99Hz)	<input checked="" type="checkbox"/> Indicates the inverter output frequency in Hertz (Hz).												
<b>P007</b> Output Voltage (Motor)	0...600V [ - ] 1V	<input checked="" type="checkbox"/> Indicates the inverter output voltage in Volts (V).												
<b>P008</b> Heatsink Temperature	25...110°C [ - ] 1°C	<input checked="" type="checkbox"/> Indicates the current power at the heatsink in Celsius degrees (°C). <input checked="" type="checkbox"/> The inverter overtemperature protection (E04) acts when heatsink temperature reaches: <table border="1" style="margin-left: 20px; margin-top: 10px;"> <thead> <tr> <th>Inverter</th> <th>P008 [°C] @ E04</th> </tr> </thead> <tbody> <tr> <td>1.6-2.6-4.0-7.0A/200-240V</td> <td>103</td> </tr> <tr> <td>1.0-1.6-2.6-4.0A/380-480V</td> <td>90</td> </tr> <tr> <td>7.3-10-16A/200-240V</td> <td>90</td> </tr> <tr> <td>2.7-4.3-6.5-10A/380-480V</td> <td>103</td> </tr> <tr> <td>13-16A/380-480V</td> <td>103</td> </tr> </tbody> </table>	Inverter	P008 [°C] @ E04	1.6-2.6-4.0-7.0A/200-240V	103	1.0-1.6-2.6-4.0A/380-480V	90	7.3-10-16A/200-240V	90	2.7-4.3-6.5-10A/380-480V	103	13-16A/380-480V	103
Inverter	P008 [°C] @ E04													
1.6-2.6-4.0-7.0A/200-240V	103													
1.0-1.6-2.6-4.0A/380-480V	90													
7.3-10-16A/200-240V	90													
2.7-4.3-6.5-10A/380-480V	103													
13-16A/380-480V	103													
<b>P009</b> Motor Torque	0.0...150.0% [ - ] 0.1%	<input checked="" type="checkbox"/> Indicates the torque developed by motor in, in percent (%) relating to the set rated motor torque. <input checked="" type="checkbox"/> The rated motor torque is defined by the parameters P402 (motor speed) and P404 (motor power). I.e.: $T_{nom} = 716 \cdot \frac{P_{nom}}{n_{nom}}$ where T <sub>nom</sub> is given in kgf.m, P <sub>nom</sub> is the rated motor power in watts-HP - (P404), and n <sub>nom</sub> is the rated motor speed in rpm - P402.												
 <b>This parameter is only shown in vector control (P202=2)</b>														
<b>P014</b> Last Fault	00...41 [ - ] -	<input checked="" type="checkbox"/> Indicates the code of the last occurred fault. <input checked="" type="checkbox"/> Section 7.1 shows a list of possible faults, their code numbers and possible causes.												

## DETAILED PARAMETER DESCRIPTION

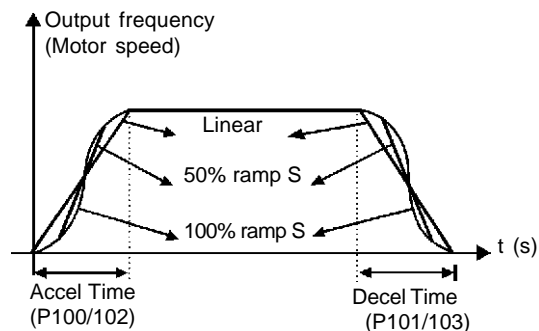
Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P023</b> Software Version	x.yz [ - ] -	<ul style="list-style-type: none"> <li>☑ Indicates the software version installed in the DSP memory located on the control board.</li> <li>☑ Parameter P040, P203, P520 to P528 are only available from the software version V3.50 on.</li> </ul>
<b>P040</b> Process Variable (PID)	0...P528 [ - ] 1	<ul style="list-style-type: none"> <li>☑ Indicates the value of the process variable used as PID feedback, in percent (%).</li> <li>☑ The PID function is only available from the software version V3.50 on.</li> <li>☑ The indication unit can be changed through P528.</li> <li>☑ See detailed description of the PID regulator in Section 6.3.5 - Special Function Parameters.</li> </ul>

### 6.3.2 Regulation Parameters - P100 ... P199

<b>P100</b> Acceleration Time #1	0.1...999s [ <b>5.0s</b> ] 0.1s (<100); 1s (>99.9)	<ul style="list-style-type: none"> <li>☑ This set of parameters defines the time to accelerate linearly from zero up to the rated frequency and to decelerate linearly from the rated frequency down to zero.</li> <li>☑ The rated frequency is defined by parameter:                             <ul style="list-style-type: none"> <li>- P145 in V/F control (P202=0 ou 1);</li> <li>- P403 in vector control (P202=2).</li> </ul> </li> <li>☑ When factory setting is used, inverter always follows the time defined in P100 and P101.</li> <li>☑ Ramp #2 is used, the the acceleration and deceleration times follow the values programmed at P102 and P103, use a digital input. See parameters P263 ... P265.</li> <li>☑ Depending on the load inertia, too short acceleration times can disable the inverter due to overcurrent (E00).</li> <li>☑ Depending on the load inertia, too short deceleration times can disable the inverter due to overvoltage (E01). For more details, refer to P151.</li> </ul>
<b>P101</b> Deceleration Time #1	0.1...999s [ <b>10.0s</b> ] 0.1s (<100); 1s (>99.9)	
<b>P102</b> Acceleration Time #2	0.1...999a [ <b>5.0s</b> ] 0.1s (<100); 1s (>99.9)	
<b>P103</b> Deceleration Time #2	0.1...999s [ <b>10.0s</b> ] 0.1s (<100); 1s (>99.9)	

<b>P104</b> S Ramp	0...2 [ <b>0 - Inactive</b> ] -	<ul style="list-style-type: none"> <li>☑ The ramp S reduces mechanical stress during the acceleration and deceleration of the load.</li> </ul>
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P104	Ramp S
0	Inactive
1	50%
2	100%



**Figure 6.4 - S or linear ramp**

- ☑ It is recommended to use the S ramp with digital frequency/speed references.

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes										
<b>P120</b> Digital Reference Backup	0...2 [ 1 - ativo ] -	<p><input checked="" type="checkbox"/> Defines if the inverter should save or not the last used digital reference. This backup function is only applicable to the keypad reference.</p> <table border="1"> <thead> <tr> <th>P120</th> <th>Reference Backup</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Inactive</td> </tr> <tr> <td>1</td> <td>Active</td> </tr> <tr> <td>2</td> <td>Active, but always give by P121, independently of the source reference</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> If the digital reference backup is inactive (P120=0), the reference will be equal to the minimum frequency every time the inverter is enabled, according to P133.</p> <p><input checked="" type="checkbox"/> When P120=1, inverter saves automatically the digital reference value, independent of the reference source, keypad, EP or serial).</p> <p><input checked="" type="checkbox"/> P120=2, could be helpful when the reference is via EP and the user do not want to start at the minimum frequency nor at the last frequency. It is desirable to start at a fixed value, that should be set in P121. After finishing the acceleration ramp the reference is passed do EP again.</p>	P120	Reference Backup	0	Inactive	1	Active	2	Active, but always give by P121, independently of the source reference		
P120	Reference Backup											
0	Inactive											
1	Active											
2	Active, but always give by P121, independently of the source reference											
<b>P121</b> Frequency Reference by key  and 	P133...P134 [ 3.00Hz ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<p><input checked="" type="checkbox"/> Defines the keypad reference value that can be set by using the keys  and  when the parameters P002 or P005 are being displayed.</p> <p><input checked="" type="checkbox"/> The keys  and  are enabled if P221=0 (in local mode) or P222=0 (in remote mode). The value of P121 is maintained at the last set value, even when inverter is disabled or turned OFF, provided P120=1 or 2 (backup active).</p>										
<b>P122</b> JOG Reference	P133...P134 [ 5.00Hz ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<p><input checked="" type="checkbox"/> Defines the frequency reference (speed) for the JOG function. The JOG function can be activated in several ways:</p> <table border="1"> <tbody> <tr> <td>The  key of the HMI-CFW08-P</td> <td>P229=0 (local mode) or P230=0 (remote mode)</td> </tr> <tr> <td>The  key of the HMI-CFW08-RS</td> <td>P229=2 (local mode) or P230=2 (remote mode)</td> </tr> <tr> <td>DI3</td> <td>P265=3 and P229=1 (local) or P230=1 (remote)</td> </tr> <tr> <td>DI4</td> <td>P266=3 and P229=1 (local) or P230=1 (remote)</td> </tr> <tr> <td>Serial</td> <td>P229=2 (local mode) or P230=2 remote mode)</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> To operate JOG function works, the inverter must be disabled by ramp (stopped motor). Thus if the control source is via terminal, there must be at least one digital input programmed as start/stop enabling (otherwise E24 will be displayed), which must be OFF to enable the JOG function via digital input.</p> <p><input checked="" type="checkbox"/> The direction of rotation is defined by parameter P231.</p>	The  key of the HMI-CFW08-P	P229=0 (local mode) or P230=0 (remote mode)	The  key of the HMI-CFW08-RS	P229=2 (local mode) or P230=2 (remote mode)	DI3	P265=3 and P229=1 (local) or P230=1 (remote)	DI4	P266=3 and P229=1 (local) or P230=1 (remote)	Serial	P229=2 (local mode) or P230=2 remote mode)
The  key of the HMI-CFW08-P	P229=0 (local mode) or P230=0 (remote mode)											
The  key of the HMI-CFW08-RS	P229=2 (local mode) or P230=2 (remote mode)											
DI3	P265=3 and P229=1 (local) or P230=1 (remote)											
DI4	P266=3 and P229=1 (local) or P230=1 (remote)											
Serial	P229=2 (local mode) or P230=2 remote mode)											

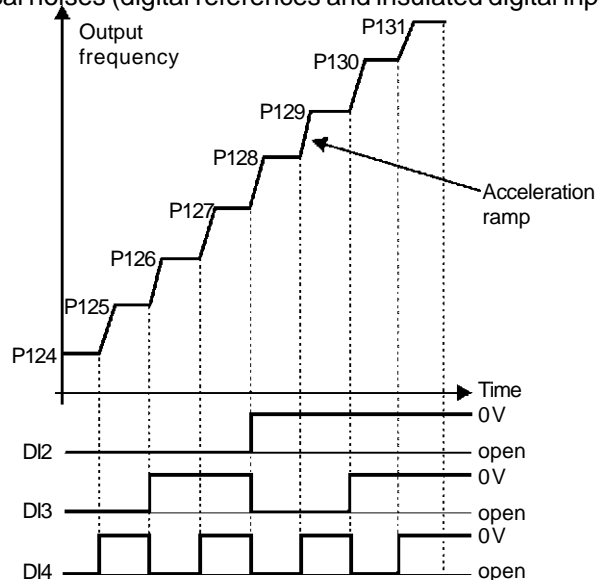
# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description/Notes
<b>P124</b> <sup>(1)</sup> Multispeed Ref. 1	P133...P134 [ <b>3.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<input checked="" type="checkbox"/> Multispeed is used when the selection of a number up to 8 pre-programmed speeds is desired. <input checked="" type="checkbox"/> It allows the control of the output speed by relating the values programmed by the parameters P124...P131, according to the logical combination of the digital inputs programmed for multispeed.
<b>P125</b> <sup>(1)</sup> Multispeed Ref. 2	P133...P134 [ <b>10.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<input checked="" type="checkbox"/> Activation of the multispeed function: - ensure that the reference source is given by the multispeed function, i.e., set P221=6 in local mode or P222=6 in remote mode; - program one or more digital inputs to para multispeed, according to table below:
<b>P126</b> <sup>(1)</sup> Multispeed Ref. 3	P133...P134 [ <b>20.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	
<b>P127</b> <sup>(1)</sup> Multispeed Ref. 4	P133...P134 [ <b>30.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	
<b>P128</b> <sup>(1)</sup> Multispeed Ref. 5	P133...P134 [ <b>40.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<input checked="" type="checkbox"/> The frequency reference is defined by the status of the digital inputs programmed to multispeed as shown in table below:
<b>P129</b> <sup>(1)</sup> Multispeed Ref. 6	P133...P134 [ <b>50.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	
<b>P130</b> <sup>(1)</sup> Multispeed Ref. 7	P133...P134 [ <b>60.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	
<b>P131</b> <sup>(1)</sup> Multispeed Ref. 8	P133...P134 [ <b>66.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	

DI	Programming
DI2	P264 = 7
DI3	P265 = 7
DI4	P266 = 7

8 speeds			
4 speeds			Freq. Reference
2 speeds			
DI2	DI3	DI4	
Open	Open	Open	P124
Open	Open	0V	P125
Open	0V	Open	P126
Open	0V	0V	P127
0V	Open	Open	P128
0V	Open	0V	P129
0V	0V	Open	P130
0V	0V	0V	P131

The multispeed function has some advantages for the stability of the fixed preprogrammed references and the immunity against electrical noises (digital references and insulated digital inputs).




**Figure 6.5 - Time diagram of the multispeed function**

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P133</b> <sup>(1)</sup> Minimum Frequency ( $F_{min}$ )	0.00...P134 [ <b>3.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Defines the maximum and minimum output frequency (motor) when inverter is enabled.</li> <li><input checked="" type="checkbox"/> It is valid for any type of speed reference.</li> <li><input checked="" type="checkbox"/> The parameter P133 defines a dead zone when analog inputs are used - see parameters P234 ... P240.</li> </ul>
<b>P134</b> <sup>(1)</sup> Maximum Frequency ( $F_{max}$ )	P133...300.0 [ <b>66.00Hz</b> ] 0.01Hz (<100.0); 0.1Hz (>99.99)	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> P134 and the gain and offset of the analog input(s) (P234, P236, P238 and P240) define the scale and the range of the speed variation via analog input(s). For more details see parameters P234 ... P240.</li> </ul>
<b>P136</b> Manual Torque Boost (IxR Compensation)	0.0...30.0% [ <b>5.0%</b> for 01.6-2.6-4.0-7.0A/ 200-240V and 1.0-1.6-2.6-4.0A/ 380-480V; <b>2.0%</b> for 7.3-10-16A/ 200-240V and 2.7-4.3-6.5-10A/ 380-480V; <b>1.0%</b> for 13-16A/380-480V ] 0.1%	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Compensates the voltage drop due to the motor stator resistance. It acts at low speeds by increasing the inverter output voltage, in order to maintain a constant torque during the V/F operation.</li> <li><input checked="" type="checkbox"/> The best setting is to program the lowest value for P136 that still permits the motor start satisfactorily. If the value is higher than required, an inverter overcurrent (E00 or E05) may occur due to high motor currents at low speeds.</li> </ul>

 **This parameter is only available in V/F control (P202=0 or 1)**

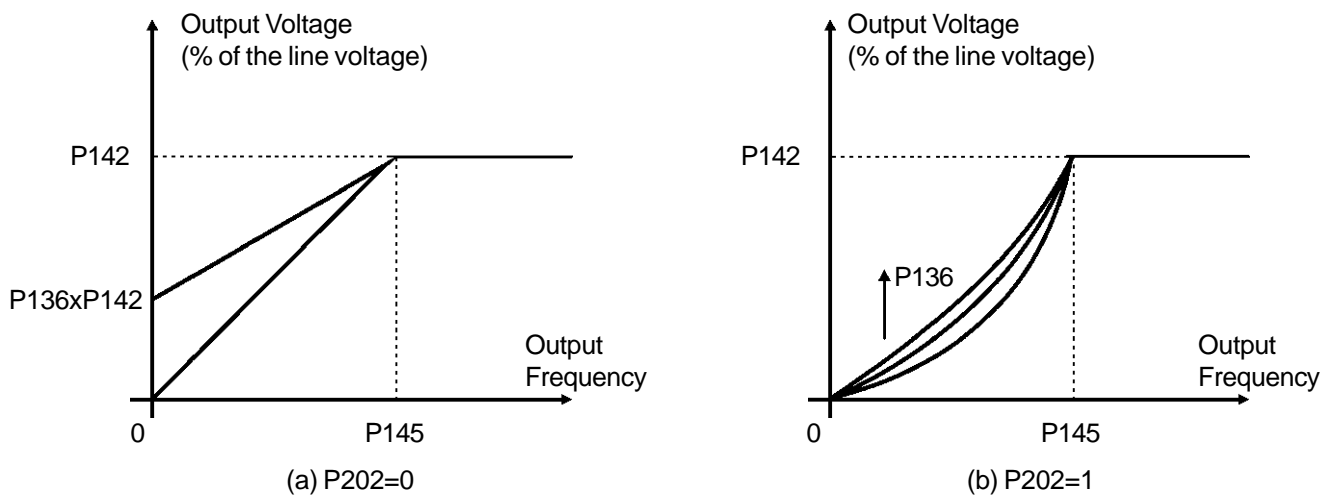



Figure 6.6 - V/F curve and details of the manual torque boost (IxR compensation)

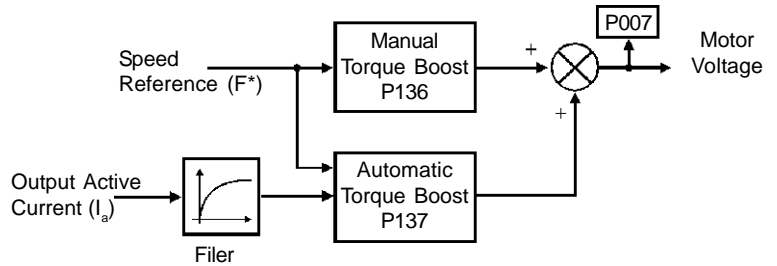
<b>P137</b> Automatic Torque Boost (Automatic IxR Compensation)	0.00...1.00% [ <b>0.00</b> ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The automatic torque boost compensates for the voltage drop in the stator resistance as a function of the active motor current.</li> <li><input checked="" type="checkbox"/> The criteria for setting P137 are the same as for the parameter P136.</li> </ul>
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 **This parameter is shown only in V/F control (P202=0 or 1)**

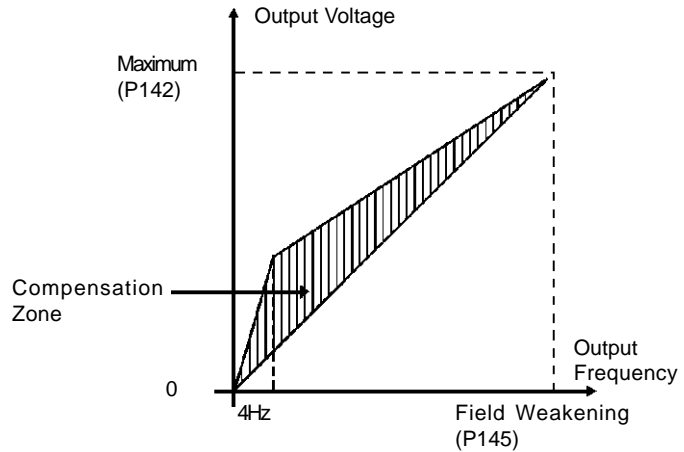
<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
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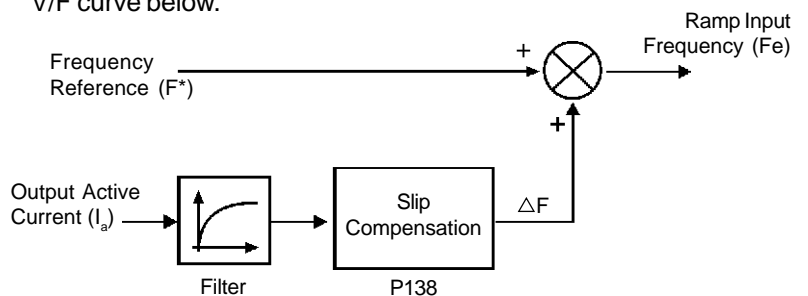


**Figure 6.7** - Block diagram of the automatic torque boost function



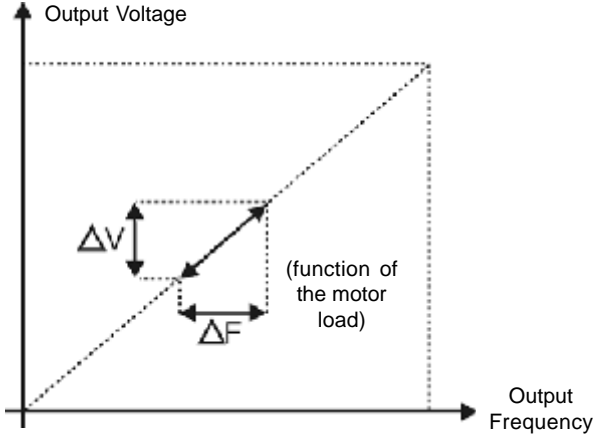

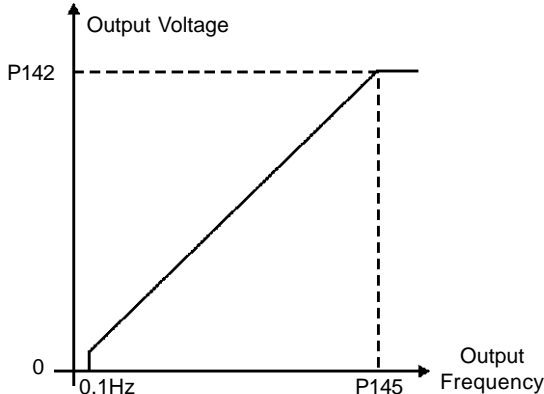
**Figure 6.8** - V/F curve with automatic torque boost (automatic  $I \times R$  compensation)

<p><b>P138</b> Slip Compensation</p> <p><b>⚠ This parameter is only available in V/F control (P202=0 or 1)</b></p>	<p>0.0...10.0% <b>[0.0]</b> 0.1%</p>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The parameter P138 is used in the motor slip compensation function.</li> <li><input checked="" type="checkbox"/> This function compensates the drop of the motor speed due to load, which is an inherent characteristic relating to the operation principle of the induction motor.</li> <li><input checked="" type="checkbox"/> This speed drop is compensated by increasing the output frequency (and voltage) (applied to the motor) as a function of the increase of the active motor current, as shown in the block diagram and in the V/F curve below.</li> </ul>
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**Figure 6.9** - Block diagram of the slip compensation function

# DETAILED PARAMETER DESCRIPTION

Parameter	Range [factory Setting] Unit	Description / Notes
		 <p data-bbox="802 853 1310 882"><b>Figure 6.10 - V/F curve with slip compensation</b></p> <ul style="list-style-type: none"> <li data-bbox="663 909 1453 1099"> <input checked="" type="checkbox"/> To set the parameter P138 use the following procedure:           <ul style="list-style-type: none"> <li>- run the motor without load up to approximately half of the application top speed;</li> <li>- measure the actual motor or equipment speed;</li> <li>- apply rated load to equipment;</li> <li>- increase parameter P138 until the speed reaches its no-load speed.</li> </ul> </li> </ul>
<p data-bbox="132 1155 384 1256"><b>P142<sup>(1)</sup></b> Maximum Output Voltage</p> <p data-bbox="132 1317 384 1451"><b>P145<sup>(1)</sup></b> Field Weakening Frequency (<math>F_{nom}</math>)</p> <p data-bbox="132 1480 384 1644"> <b>These parameters are only available in V/F control (P202=0 or 1)</b></p>	<p data-bbox="464 1155 576 1189">0...100%</p> <p data-bbox="472 1223 568 1285">[ 100% ] 1%</p> <p data-bbox="424 1317 616 1451">P133...P134 [ 60.00Hz ] 0.01Hz (&lt;100.0) 0.1Hz (&gt;99.99)</p>	<ul style="list-style-type: none"> <li data-bbox="663 1155 1453 1189"><input checked="" type="checkbox"/> Define the V/F curve used in V/F control (P202=0 or 1).</li> <li data-bbox="663 1189 1453 1249"><input checked="" type="checkbox"/> These parameters allow changing the standard V/F curve defined at P202 - programmable V/F curve.</li> <li data-bbox="663 1249 1453 1310"><input checked="" type="checkbox"/> P142 sets the maximum output voltage. This value is set as a percent of the inverter supply voltage.</li> <li data-bbox="663 1310 1453 1346"><input checked="" type="checkbox"/> Parameter P145 defines the rated frequency of the motor used.</li> <li data-bbox="663 1346 1453 1435"><input checked="" type="checkbox"/> The V/F curve relates the inverter output voltage and frequency (applied to the motor) and consequently the magnetizing flux of the motor.</li> <li data-bbox="663 1435 1453 1570"><input checked="" type="checkbox"/> The programmable V/F curve can be used in special applications where the motors used require a rated voltage and/or frequency different than the standard ones. Examples: motor for 220V/400Hz and a motor for 200V/60Hz.</li> <li data-bbox="663 1570 1453 1644"><input checked="" type="checkbox"/> Parameter P142 is also useful in applications that require rated voltage different from the inverter supply voltage. Example: 440V line and 380V motor.</li> </ul>
		 <p data-bbox="866 2078 1249 2107"><b>Figure 6.11 - Adjustable V/F curve</b></p>

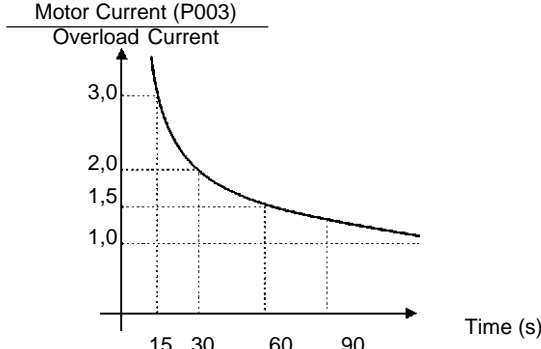
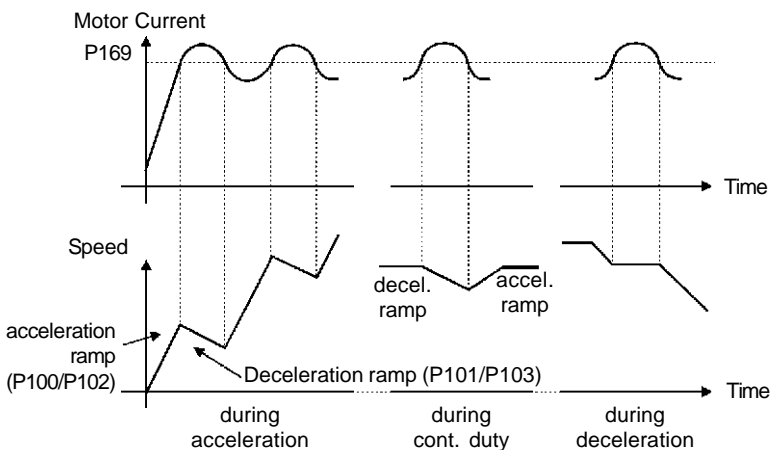

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P151</b> DC Link Voltage Regulation Level	325...410V (line 200-240V) [ <b>380V</b> ] 1V  564...820V (line 380-480V) [ <b>780V</b> ] 1V	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The DC link voltage regulation (ramp holding) avoids overvoltage trips (E01) during deceleration of high inertia loads and/or short deceleration times.</li> <li><input checked="" type="checkbox"/> It acts in order to increase the deceleration time (according to load - inertia), thus avoiding the E01 activation.</li> </ul> <div style="text-align: center; margin: 10px 0;"> </div> <p style="text-align: center;"><b>Figure 6.12 - Deceleration curve with DC Link voltage limitation (regulation)</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> By this function an optimized deceleration time (minimum) is achieved for the driven load.</li> <li><input checked="" type="checkbox"/> This function is useful in applications with medium inertia that require short deceleration times.</li> <li><input checked="" type="checkbox"/> In case of overvoltage trip during the deceleration, you must reduce gradually the value of P151 or increase the time of the deceleration ramp (P101 and/or P103).</li> <li><input checked="" type="checkbox"/> The motor will not stop if the line is permanently with overvoltage (<math>U_d &gt; P151</math>). In this case, reduce the line voltage, or increase the value of P151.</li> <li><input checked="" type="checkbox"/> If even with these settings the motor does not decelerate within the required time, you will have the following alternatives               <ul style="list-style-type: none"> <li>- use the dynamic braking (for more details, see Item 8.20);</li> <li>- if inverter is being operated in V/F control, increase P136;</li> <li>- if inverter is being operated in vector control, increase P178.</li> </ul> </li> </ul> <p><b>NOTE!</b>            When dynamic braking is used, set P151 to the maximum value.</p>
<b>P156</b> Motor Overload Current	0.2xPI <sub>nom</sub> ...1.3xPI <sub>nom</sub> [ <b>1.2xP401</b> ] 0.01A (<10.0A); 0.1A (>9.99A)	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> This function is used to protect the motor against overload (Ixt function - E05).</li> <li><input checked="" type="checkbox"/> The motor overload current is the current level above which the inverter will consider the motor operating under overload. The higher the difference between the motor current and the overload current, the sooner the Ixt function - E05 - will act.</li> </ul>

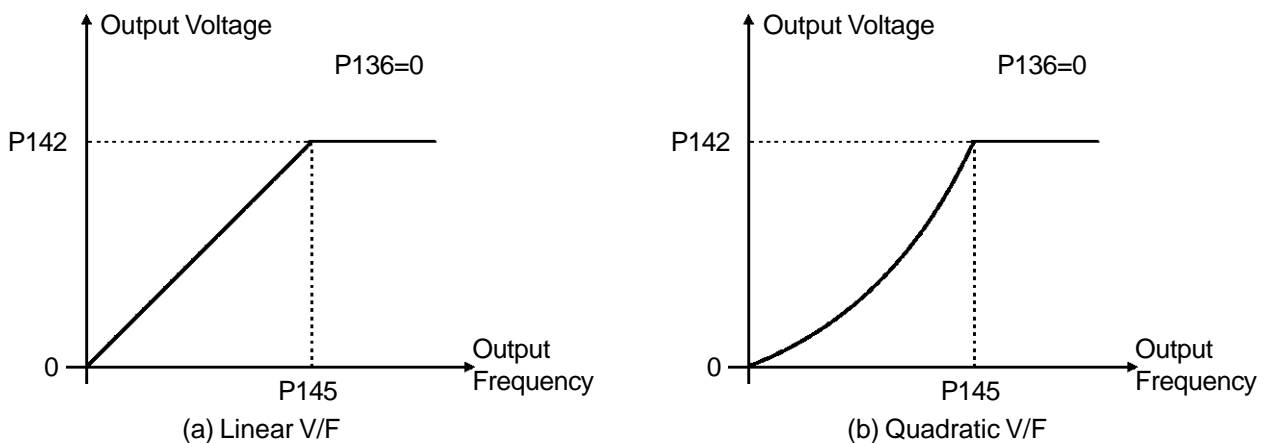


# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
		 <p><b>Figure 6.13 - Ixt function – Overload detection</b></p> <ul style="list-style-type: none"> <li>☑ Parameter P156 must be set from 10% to 20% higher than the rated motor current (P401).</li> <li>☑ Always P401 is changed, P156 is adjusted automatically to 1.1xP401.</li> </ul>
<b>P169</b> Maximum Output Current	$0.2 \times PI_{nom} \dots 2.0 \times PI_{nom}$ <b>[ 1.5xP295 ]</b> 0.01A (<10.0A); 0.1A (>9.99A)	<ul style="list-style-type: none"> <li>☑ Prevents motor stalling during an overload. If motor load increases its current will increase too. If the motor current attempts to exceed the value set at P169, the motor speed will be decreased by following the deceleration ramp until the current becomes lower than P169. As soon as the overload condition disappears, the motor speed is resumed.</li> </ul>  <p><b>Figure 6.14 – Curves showing the actuation of the current limitation</b></p> <ul style="list-style-type: none"> <li>☑ The current limitation function is disabled when <math>P169 &gt; 1.5 \times P295</math>.</li> </ul>
<b>P178</b> Rated Flux   <b>This parameter is shown only in vector control (P202=2)</b>	50.0...150.0% <b>[ 100% ]</b> 0.1% (<100%); 1% (>99.9%)	<ul style="list-style-type: none"> <li>☑ Defines the flux in the motor air gap, when in vector control. It is expressed as a percentage (%) of the nominal flux.</li> <li>☑ Generally it is not necessary to change P178 of the default value (100%). But in some specific cases, different values at P178 may be set. These conditions may be:               <ul style="list-style-type: none"> <li>- to increase the inverter torque capacity (<math>P178 &gt; 100\%</math>).</li> </ul>               Examples:               <ol style="list-style-type: none"> <li>1) to increase the motor starting torque and thus ensure faster motor starts;</li> <li>2) to increase the inverter braking torque and thus allow faster stops, without using dynamic braking.</li> </ol> <li>- to reduce the inverter energy consumption (<math>P178 &lt; 100\%</math>).</li> </li></ul>

## 6.3.3 Configuration Parameters - P200 ... P398

Parameter	Range [factory Setting] Unit	Description / Notes								
<b>P202<sup>(1)</sup></b> Type of Control	0...2 [ 0 - V/F linear ] -	<input checked="" type="checkbox"/> Defines the inverter control mode. Item 4.3 gives some guidelines relating to the selection of control type. <table border="1" style="margin: 10px auto; width: 50%;"> <thead> <tr> <th style="text-align: center;">P202</th> <th style="text-align: center;">Type of Control</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Linear V/F Control (scalar)</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Quadratic V/F Control (scalar)</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Vector Control</td> </tr> </tbody> </table> <input checked="" type="checkbox"/> As shown in table above, there are 2 V/F control modes: <ul style="list-style-type: none"> <li>- Linear V/F control: this control mode ensures a flux in the motor air gap approximately constant from around 3Hz up to the field weakening (defined by the parameters P142 and P145). Thus in this speed range, an approximately constant torque capacity is obtained. This control mode is recommended for belt conveyors, extruding machines, etc.</li> <li>- Quadratic V/F control: in this control mode the flux in the motor air gap is proportional to the output frequency up to the field weakening point (defined at P142 and P145). Thus the torque capacity is a function of the quadratic speed. The main advantage of this type of control is the energy saving capability with variable torque loads, due to the reduction of the motor losses (mainly due to motor iron losses and magnetic losses).</li> </ul> <p>Main application fields for this type of control are: centrifugal pumps, fans, multimotor drivings.</p>	P202	Type of Control	0	Linear V/F Control (scalar)	1	Quadratic V/F Control (scalar)	2	Vector Control
P202	Type of Control									
0	Linear V/F Control (scalar)									
1	Quadratic V/F Control (scalar)									
2	Vector Control									



**Figure 6.15** -V/F control modes (scalar)

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [factory Setting] Unit	Description / Notes														
		<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The vector control allows a better performance regarding to torque and speed control. The CFW-08 vector control operates without motor speed sensor (sensorless). It must be applied when following performances are required: <ul style="list-style-type: none"> <li>- better dynamics (faster accelerations and stoppings);</li> <li>- when a more accurate speed control is required;</li> <li>- when high torques at low speeds are required (<math>\leq 5\text{Hz}</math>).</li> </ul> Examples: in positioning, such as load moving, packing machines, pumps, dosing machines, etc. </li> <li><input checked="" type="checkbox"/> The vector control can not be used in multimotor applications.</li> <li><input checked="" type="checkbox"/> The performance of the vector control with a switching frequency of 10kHz is not so good as when a switching frequency of 5kHz or 2.5kHz is used. It is not possible to use a vector control with a switching frequency of 15kHz.</li> <li><input checked="" type="checkbox"/> For more details about the vector control, refer to Item 6.2.3.</li> </ul>														
<b>P203<sup>(1)</sup></b> Special Function Selection	0...1 [ 0 - None ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Selects or not the special function of the PID regulator. <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>P203</th> <th>Special function</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">None</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">PID regulator</td> </tr> </tbody> </table> </li> <li><input checked="" type="checkbox"/> See detailed description of PID regulator parameters (P520...P528) in Section 6.3.5.</li> <li><input checked="" type="checkbox"/> When P203 is changed to 1, P265 is changed automatically to 15 (DI3 = manual/automatic).</li> </ul>	P203	Special function	0	None	1	PID regulator								
P203	Special function															
0	None															
1	PID regulator															
<b>P204<sup>(1)</sup></b> Load Factory setting	0...5 [ 0 ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Programs all parameters to the standard factory default, when P204=5.</li> <li><input checked="" type="checkbox"/> The parameters P142 (max. output voltage), P145 (field weakening frequency), P295 (rated current), P308 (inverter address) and P399 to P407 (motor parameters) are not changed when the factory default parameters are loaded through P204=5.</li> </ul>														
<b>P205<sup>(1)</sup></b> Display Default Selection	0...6 [ 2 - P002 ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Selects which of the parameters listed below will be shown on the display as a default after the inverter has been powered up. <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>P205</th> <th>Read Parameter</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td>P005 [Output Frequency (Motor)]</td> </tr> <tr> <td style="text-align: center;">1</td> <td>P003 [Output Current (Motor)]</td> </tr> <tr> <td style="text-align: center;">2</td> <td>P002 (Value Proportional to Frequency)</td> </tr> <tr> <td style="text-align: center;">3</td> <td>P007 [Output Voltage (Motor)]</td> </tr> <tr> <td style="text-align: center;">4, 5</td> <td>Not used</td> </tr> <tr> <td style="text-align: center;">6</td> <td>P040 (PID Process Variable)</td> </tr> </tbody> </table> </li> </ul>	P205	Read Parameter	0	P005 [Output Frequency (Motor)]	1	P003 [Output Current (Motor)]	2	P002 (Value Proportional to Frequency)	3	P007 [Output Voltage (Motor)]	4, 5	Not used	6	P040 (PID Process Variable)
P205	Read Parameter															
0	P005 [Output Frequency (Motor)]															
1	P003 [Output Current (Motor)]															
2	P002 (Value Proportional to Frequency)															
3	P007 [Output Voltage (Motor)]															
4, 5	Not used															
6	P040 (PID Process Variable)															
<b>P206</b> Auto-Reset Time	0...255s [ 0 ] 1s	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> In the event of a fault trip, except for E14, E24 and E41, the inverter can initiate an automatic reset after the time given by P206 is elapsed.</li> <li><input checked="" type="checkbox"/> If <math>P206 \leq 2</math> Auto-Reset does not occur.</li> <li><input checked="" type="checkbox"/> If after Auto-Reset the same fault is repeated three times consecutively, the Auto-Reset function will be disabled. A fault is considered consecutive if it happens again within 30 seconds after the Auto-Reset. Thus if a fault occurs four times consecutively, this fault remains indicated permanently (and inverter disabled).</li> </ul>														

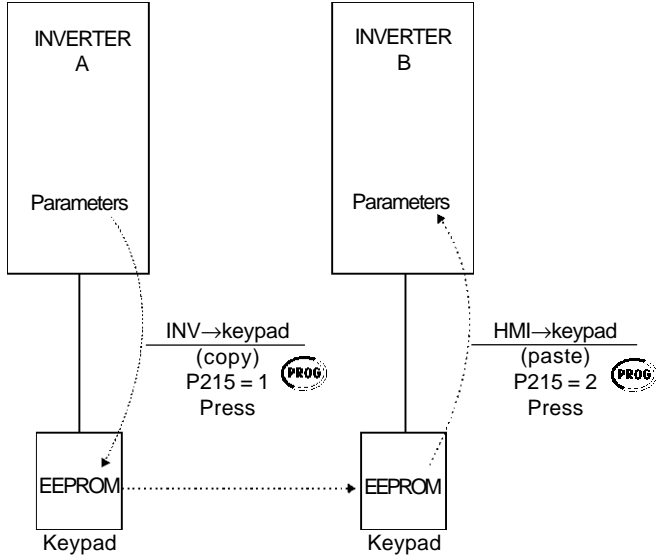
<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes												
<b>P208</b> Reference Scale Factor	0.00...99.9 [ <b>1.00</b> ] 0.01 (<10.0) 0.1 (>9.99)	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> It allows that the read-only parameter P002 indicates the motor speed in value, for instance, rpm.</li> <li><input checked="" type="checkbox"/> The indication of P002 is equal to the output frequency value (P005) multiplied by the value of P208, i.e., <math>P002 = P208 \times P005</math>.</li> <li><input checked="" type="checkbox"/> If desired, the conversion from Hz to rpm is made as a function of the pole number:                             <table border="1" style="margin: 10px auto; border-collapse: collapse; width: 80%;"> <thead> <tr> <th style="text-align: center;">Motor Pole Number</th> <th style="text-align: center;">P208 to P002 indicate the speed in rpm</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">II poles</td> <td style="text-align: center;">60</td> </tr> <tr> <td style="text-align: center;">IV poles</td> <td style="text-align: center;">30</td> </tr> <tr> <td style="text-align: center;">VI poles</td> <td style="text-align: center;">20</td> </tr> </tbody> </table> </li> <li><input checked="" type="checkbox"/> Always when programmed to vector mode (P202=2), the parameter P208 is set according to the value of P402 (motor speed) to indicate the speed in rpm, in P002.</li> </ul>	Motor Pole Number	P208 to P002 indicate the speed in rpm	II poles	60	IV poles	30	VI poles	20				
Motor Pole Number	P208 to P002 indicate the speed in rpm													
II poles	60													
IV poles	30													
VI poles	20													
<b>P215<sup>(1)</sup></b> Copy Function  <b>This parameter is only available via HMI-CFW08-RS keypad</b>	0...2 [ <b>0 - No function</b> ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The keypad Copy function is used to transfer the content of the parameters from one inverter to another.</li> </ul> <table border="1" style="margin: 10px auto; border-collapse: collapse; width: 80%;"> <thead> <tr> <th style="text-align: center;">P215</th> <th style="text-align: center;">Action</th> <th style="text-align: center;">Notes</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Off</td> <td style="text-align: center;">-</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Copy (inverter → keypad)</td> <td>Transfers the current parameter values of the inverter to non volatile memory (EEPROM) of the HMI-CFW08-RS keypad. The current inverter parameters are not changed.</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Paste (keypad → inverter)</td> <td>Transfers the content of the non volatile memory of the keypad (EEPROM) to the current inverter parameters.</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Procedure is as follows:                             <ol style="list-style-type: none"> <li>1. Connect the keypad (HMI-CFW08-RS) to the inverter from which the parameters will be copied (Inverter A - source inverter).</li> <li>2. Set P215=1 (copy) to transfer the parameter values from the inverter A to the keypad. Press  key. During running of the Copy Function, display will show  . P215 resets automatically to 0 (Off) after transfer has been completed.</li> <li>3. Disconnect the keypad from the inverter (A).</li> <li>4. Connect the same keypad to the inverter to which the parameters will be transferred (Inverter B - target inverter).</li> <li>5. Set P215=2 (paste) to transfer the content of the keypad (EEPROM has the inverter A parameters) to inverter B. Press the  key. While the keypad is running the paste function, the display shows  , an abbreviation for paste.</li> </ol> <p>When P215 returns to 0, the parameter transfer has been concluded. Now inverters A and B will have the same parameter values.</p> </li> </ul>	P215	Action	Notes	0	Off	-	1	Copy (inverter → keypad)	Transfers the current parameter values of the inverter to non volatile memory (EEPROM) of the HMI-CFW08-RS keypad. The current inverter parameters are not changed.	2	Paste (keypad → inverter)	Transfers the content of the non volatile memory of the keypad (EEPROM) to the current inverter parameters.
P215	Action	Notes												
0	Off	-												
1	Copy (inverter → keypad)	Transfers the current parameter values of the inverter to non volatile memory (EEPROM) of the HMI-CFW08-RS keypad. The current inverter parameters are not changed.												
2	Paste (keypad → inverter)	Transfers the content of the non volatile memory of the keypad (EEPROM) to the current inverter parameters.												












<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes								
		<p>Please consider still the following:</p> <ul style="list-style-type: none"> <li>-If the inverters A and B are driving different motors, check the motor parameters (P399 ... P409) related to inverter B.</li> <li>-To copy the parameter content of the inverter A to other inverter(s), repeat steps 4 to 6 above.</li> </ul>  <p><b>Figure 6.16</b> - Copying the parameters from the inverter A to the inverter B, by using the Copy Function and the HMI-CFW08-RS keypad</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> While the keypad (HMI) is running the Copy Function (read or write procedures), you can not operate it.</li> </ul> <p><b>NOTE!</b></p> <p>The copy function is only available when the inverters are of the same model (voltage and current) and when compatible software versions are installed. The software version is considered compatible when the digits x and y (Vx.yz) are equal. If they are different, E10 will be displayed and the parameters will not be loaded to the destination inverter.</p>								
<p><b>P219<sup>(1)</sup></b> Switching Frequency Reduction Point</p>	<p>0.00...25.00Hz [ 6.00Hz ] 0.01Hz</p>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Defines the point where the switching frequency is modified automatically to 2.5kHz.</li> <li><input checked="" type="checkbox"/> This improves considerably the measurement of the output current at low frequencies, and consequently improves the inverter performance, <u>mainly when in vector control mode</u> (P202=2).</li> <li><input checked="" type="checkbox"/> It is recommended to set P219 according to the switching frequency as shown below:</li> </ul> <table border="1" data-bbox="884 1899 1289 2033"> <thead> <tr> <th>P297 (f<sub>sw</sub>)</th> <th>Recommended P219</th> </tr> </thead> <tbody> <tr> <td>4 (5kHz)</td> <td>6.00Hz</td> </tr> <tr> <td>6 (10kHz)</td> <td>12.00Hz</td> </tr> <tr> <td>7 (15kHz)</td> <td>18.00Hz</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> In application where it is not possible to operate the inverter at 2.5kHz (for instance, due to acoustic noise), set P219=0.00.</li> </ul>	P297 (f <sub>sw</sub> )	Recommended P219	4 (5kHz)	6.00Hz	6 (10kHz)	12.00Hz	7 (15kHz)	18.00Hz
P297 (f <sub>sw</sub> )	Recommended P219									
4 (5kHz)	6.00Hz									
6 (10kHz)	12.00Hz									
7 (15kHz)	18.00Hz									

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes		
<b>P220<sup>(1)</sup></b> Local/Remote Source Selection	0...6 [ 2 - Key HMI-CFW08-P ] -	<input checked="" type="checkbox"/> Defines the source of the Local/Remote selection.		
		P220	Local/Remote Selection	Default Mode (*)
		0	Always Local mode	-
		1	Always Remote mode	-
		2	Key  of the keypad (HMI-CFW08-P or HMI-CFW08-RP)	Local
		3	Key  of the keypad (HMI-CFW08-P or HMI-CFW08-RP)	Remote
		4	DI2...DI4	-
		5	Key  of the keypad (HMI-CFW08-RS) or serial interface	Local
6	Key  of the keypad (HMI-CFW08-RS) or serial interface	Remote		
Note: (*) When inverter is powered up (initialization).				
<input checked="" type="checkbox"/> In the factory default setting, the inverter is started in local mode and the key  of the HMI-CFW08-P keypad will select the local/remote mode.				
<input checked="" type="checkbox"/> The inverters with dummy panel (without HMI-CFW08-P keypad) are factory supplied with P220=3.				
<input checked="" type="checkbox"/> For more details, refer to item 6.2.6.				
<b>P221<sup>(1)</sup></b> Local Reference Selection	0...8 [ 0 - Teclas ] -	<input checked="" type="checkbox"/> Defines the frequency reference selection in the Local and Remote mode.		
<b>P222<sup>(1)</sup></b> Remote Reference Selection	0...8 [ 1 - AI1 ] -			
P221/P222	Reference Source			
0	Keys  and  of the HMIs (P121)			
1	Analog input AI1' (P234, P235 e P236)			
2 or 3	Analog input AI2' (P238, P239 e P240)			
4	Electronic potentiometer (EP)			
5	Serial			
6	Multispeed (P124...P131)			
7	Sum of the Analog Inputs (AI1'+AI2') ≥ 0 (negative values are zeroed).			
8	Sum of the Analog Inputs (AI1'+AI2')			
<input checked="" type="checkbox"/> The description AI1' as apposed to AI1 refers to the analog signal after scaling and/or gain calculations have been applied to it.				
<input checked="" type="checkbox"/> For factory default setting, the local reference is via the  and  keys of the keypad and the remote reference is via analog input AI1.				
<input checked="" type="checkbox"/> The reference value set by the  and  keys is contained in parameter P121.				
<input checked="" type="checkbox"/> For details of the Electronic Potentiometer (EP) operation, refer to Figure 6.19.				
<input checked="" type="checkbox"/> When option 4 (EP) is selected, set P265 and P266 to 5.				
<input checked="" type="checkbox"/> When option 6 (multispeed) is selected, set P264 and/or P265 and/or P266 to 7.				
<input checked="" type="checkbox"/> For more details, refer to items 6.2.4 and 6.2.6.				

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes								
<b>P229<sup>(1)</sup></b> Local Command Selection	0...2 [ 0 - Keys ] -	<input checked="" type="checkbox"/> Define the control sources for the inverter enabling disabling FWD/REV and JOG.								
<b>P230<sup>(1)</sup></b> Remote Command Selection	0...2 [ 1 - Terminals ] -	<table border="1"> <thead> <tr> <th>P229/P230</th> <th>Control source</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>HMI-CFW08-P or HMI-CFW08-RP Keypad</td> </tr> <tr> <td>1</td> <td>Terminals (XC1)</td> </tr> <tr> <td>2</td> <td>HMI-CFW08-RS keypad or serial interface</td> </tr> </tbody> </table>	P229/P230	Control source	0	HMI-CFW08-P or HMI-CFW08-RP Keypad	1	Terminals (XC1)	2	HMI-CFW08-RS keypad or serial interface
P229/P230	Control source									
0	HMI-CFW08-P or HMI-CFW08-RP Keypad									
1	Terminals (XC1)									
2	HMI-CFW08-RS keypad or serial interface									
		<input checked="" type="checkbox"/> The direction of rotation is the only operation control that depends on other parameter for operation - P231. <input checked="" type="checkbox"/> For more details, refer to Items 6.2.4, 6.2.5 and 6.2.6.								
<b>P231<sup>(1)</sup></b> Forward/Reverse - Local/Remote Modes	0...2 [ 2 - Commands ] -	<input checked="" type="checkbox"/> Defines the direction of rotation.								
		<table border="1"> <thead> <tr> <th>P231</th> <th>Direction of rotation</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Always forward</td> </tr> <tr> <td>1</td> <td>Always reverse</td> </tr> <tr> <td>2</td> <td>Commands as defined in P229 and P230</td> </tr> </tbody> </table>	P231	Direction of rotation	0	Always forward	1	Always reverse	2	Commands as defined in P229 and P230
P231	Direction of rotation									
0	Always forward									
1	Always reverse									
2	Commands as defined in P229 and P230									
<b>P234</b> Analog Input AI1 Gain	0.00...9.99 [ 1.00 ] 0.01	<input checked="" type="checkbox"/> The analog inputs AI1 and AI2 define the inverter frequency reference as shown in the curve below.								
		<p><b>Figure 6.17 - Determination of the frequency reference from the analog inputs AI1 and AI2</b></p>								
		<input checked="" type="checkbox"/> Note that there is always a dead zone at the starting of the curve where the frequency reference remains at the value of the minimum frequency (P133), even when the input signal is changed. This dead zone is only suppressed when P133=0.00.								

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).






## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes												
		<p><input checked="" type="checkbox"/> The internal value <math>Alx'</math> that defines the frequency reference to be used by the inverter, is given as percent of the full scale reading and is obtained by using on of the following equations (see P235 and P239):</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">P235/P239</th> <th style="text-align: center;">Signal</th> <th style="text-align: center;">Equation</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0...10V</td> <td style="text-align: center;"><math>Alx' = \left( \frac{Alx}{10} + \frac{OFFSET}{100} \right) \cdot GAIN</math></td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0...20mA</td> <td style="text-align: center;"><math>Alx' = \left( \frac{Alx}{20} + \frac{OFFSET}{100} \right) \cdot GAIN</math></td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">4...20mA</td> <td style="text-align: center;"><math>Alx' = \left( \frac{Alx-4}{16} + \frac{OFFSET}{100} \right) \cdot GAIN</math></td> </tr> </tbody> </table> <p>where:</p> <ul style="list-style-type: none"> <li>- <math>x = 1, 2</math>;</li> <li>- <math>Alx</math> is given in V or mA, according to the used signal (see parameters P235 and P239);</li> <li>- <math>GAIN</math> is defined by the parameters P234 and P238 for <math>Al1</math> and <math>Al2</math> respectively;</li> <li>- <math>OFFSET</math> is defined by the parameters P236 and P240 for <math>Al1</math> and <math>Al2</math> respectively.</li> </ul> <p><input checked="" type="checkbox"/> This is shown in the block diagram below:</p> <div style="text-align: center; margin: 10px 0;"> </div> <p><b>Figure 6.18</b> - Block diagram of the analog inputs <math>Al1</math> and <math>Al2</math></p> <p><input checked="" type="checkbox"/> Example: a 0 ... 10V signal is used (<math>P235 = 0</math>), <math>Al1=5V</math>, <math>P234=1.00</math> and <math>P236=-70\%</math>. Thus:</p> $Al1' = \left[ \frac{5}{10} + \frac{(-70)}{100} \right] \cdot 1 = -0.2 = -20\%$ <p>The motor will run in reverse direction of rotation as defined by the commands (negative value) - if this is possible (<math>P231=2</math>), with a module reference equal to 0.2 or 20% of the maximum output frequency (<math>P134</math>). I.e., if <math>P134=66.00\text{Hz}</math>, then the frequency reference is equal to 13.2Hz.</p>	P235/P239	Signal	Equation	0	0...10V	$Alx' = \left( \frac{Alx}{10} + \frac{OFFSET}{100} \right) \cdot GAIN$	1	0...20mA	$Alx' = \left( \frac{Alx}{20} + \frac{OFFSET}{100} \right) \cdot GAIN$	2	4...20mA	$Alx' = \left( \frac{Alx-4}{16} + \frac{OFFSET}{100} \right) \cdot GAIN$
P235/P239	Signal	Equation												
0	0...10V	$Alx' = \left( \frac{Alx}{10} + \frac{OFFSET}{100} \right) \cdot GAIN$												
1	0...20mA	$Alx' = \left( \frac{Alx}{20} + \frac{OFFSET}{100} \right) \cdot GAIN$												
2	4...20mA	$Alx' = \left( \frac{Alx-4}{16} + \frac{OFFSET}{100} \right) \cdot GAIN$												
<b>P235<sup>(1)</sup></b> Analog Input $Al1$ Signal	0...1 [ 0 - 0...10V/0...20mA ] -	<p><input checked="" type="checkbox"/> Defines the signal type of the analog input, as shown in table below:</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">P235/P239</th> <th style="text-align: center;">Signal type</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0...10V ou 0...20mA</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">4...20mA</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> When current signals are used, change the switch position <math>S1:1</math> and/or <math>S1:2</math> to ON.</p>	P235/P239	Signal type	0	0...10V ou 0...20mA	1	4...20mA						
P235/P239	Signal type													
0	0...10V ou 0...20mA													
1	4...20mA													

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).



## DETAILED PARAMETER DESCRIPTION

Parameter	Range [factory Setting] Unit	Description / Notes																		
<b>P236</b> Analog Input AI1 Offset	-120...120% [ <b>0.0</b> ] 0.1 (<100); 1 (>99.9)	<input checked="" type="checkbox"/> See P234.																		
<b>P238</b> Analog Input AI2 Gain	0.00...9.99 [ <b>1.00</b> ] 0.01	<input checked="" type="checkbox"/> See P234.																		
 <b>This parameter is only available in the CFW-08 Plus version</b>																				
<b>P239<sup>(1)</sup></b> Analog Input AI2 Signal	0...1 [ <b>0</b> - 0...10V/0...20mA]	<input checked="" type="checkbox"/> See P235.																		
 <b>This parameter is only available in the CFW-08 Plus version</b>																				
<b>P240</b> Analog Input AI2 Offset	-120...120% [ <b>0.0</b> ] 0.1 (<100); 1 (>99.9)	<input checked="" type="checkbox"/> See P234.																		
 <b>This parameter is only available in the CFW-08 Plus version</b>																				
<b>P248</b> Analog Inputs Filter Time Constant	0...200ms [ <b>200ms</b> ] 1ms	<input checked="" type="checkbox"/> It configures the time constant of the analog inputs filter between 0 (without filtering) and 200ms. <input checked="" type="checkbox"/> Thus the analog input will have a response time equal to three time constants. For instance, if the time constant is 200ms, and a step is applied to the analog input, the response will be stabilized after 600ms.																		
<b>P251</b> Analog Output AO Function	0...9 [ <b>0 - f<sub>s</sub></b> ] -	<input checked="" type="checkbox"/> P251 defines the variable to be indicated at the analog output. <table border="1" data-bbox="719 1574 1382 1883"> <thead> <tr> <th>P251</th> <th>AO Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Output frequency (Fs) - P005</td> </tr> <tr> <td>1</td> <td>Frequency reference or input frequency (Fe)</td> </tr> <tr> <td>2</td> <td>Output current - P003</td> </tr> <tr> <td>3, 5 and 8</td> <td>No function</td> </tr> <tr> <td>4</td> <td>Torque - P009</td> </tr> <tr> <td>6</td> <td>Process variable - P040</td> </tr> <tr> <td>7</td> <td>Active current</td> </tr> <tr> <td>9</td> <td>PID Setpoint</td> </tr> </tbody> </table>	P251	AO Function	0	Output frequency (Fs) - P005	1	Frequency reference or input frequency (Fe)	2	Output current - P003	3, 5 and 8	No function	4	Torque - P009	6	Process variable - P040	7	Active current	9	PID Setpoint
P251	AO Function																			
0	Output frequency (Fs) - P005																			
1	Frequency reference or input frequency (Fe)																			
2	Output current - P003																			
3, 5 and 8	No function																			
4	Torque - P009																			
6	Process variable - P040																			
7	Active current																			
9	PID Setpoint																			
<b>P252</b> Analog Output AO Gain	0.00...9.99 [ <b>1.00</b> ] 0.01																			
 <b>These parameters are only available in the CFW-08 Plus version</b>		 <b>NOTE!</b> -Option 4 is only available in the vector control mode. -Options 6 and 9 are only available from Software Version V3.50 on. <input checked="" type="checkbox"/> For factory Setting, AO=10V when the output frequency is equal to maximum frequency (defined by P134), i.e., equal to 66Hz. <input checked="" type="checkbox"/> Indication scale at the analog outputs (full scale =10V):																		

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes																																																																																																																																		
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Variable</th> <th style="text-align: center;">Full scale</th> </tr> </thead> <tbody> <tr> <td>Frequency (P251=0 or 1)</td> <td>P134</td> </tr> <tr> <td>Current (P251=2 or 7)</td> <td>1.5xI<sub>nom</sub></td> </tr> <tr> <td>Torque (P251=4)</td> <td>150%</td> </tr> <tr> <td>Process variable - PID (P251=6)</td> <td>P528</td> </tr> <tr> <td>Setpoint PID (P251=9)</td> <td>P528</td> </tr> </tbody> </table>	Variable	Full scale	Frequency (P251=0 or 1)	P134	Current (P251=2 or 7)	1.5xI <sub>nom</sub>	Torque (P251=4)	150%	Process variable - PID (P251=6)	P528	Setpoint PID (P251=9)	P528																																																																																																																						
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<b>P263<sup>(1)</sup></b> Digital Input DI1 Function	0...14 [ 0 - Not used or General Enabling ] -	<input checked="" type="checkbox"/> Check possible options on table below and details about each function operation on Figure 6.19. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">DI Parameter Function</th> <th style="text-align: center;">DI1 (P263)</th> <th style="text-align: center;">DI2 (P264)</th> <th style="text-align: center;">DI3 (P265)</th> <th style="text-align: center;">DI4 (P266)</th> </tr> </thead> <tbody> <tr> <td>General Enable</td> <td style="text-align: center;">1...7 and 10...12</td> <td style="text-align: center;">-</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Start/Stop</td> <td style="text-align: center;">9</td> <td style="text-align: center;">-</td> <td style="text-align: center;">9</td> <td style="text-align: center;">9</td> </tr> <tr> <td>No Function or Start/Stop</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>No Function or Start/Stop</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">8</td> <td style="text-align: center;">8</td> </tr> <tr> <td>Forward Run</td> <td style="text-align: center;">8</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Reverse Run</td> <td style="text-align: center;">-</td> <td style="text-align: center;">8</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>FWD with Ramp #2</td> <td style="text-align: center;">13</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>REV with Ramp #2</td> <td style="text-align: center;">-</td> <td style="text-align: center;">13</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Start (3-wire)</td> <td style="text-align: center;">14</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Stop (3-wire)</td> <td style="text-align: center;">-</td> <td style="text-align: center;">14</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Multispeed</td> <td style="text-align: center;">-</td> <td style="text-align: center;">7</td> <td style="text-align: center;">7</td> <td style="text-align: center;">7</td> </tr> <tr> <td>Multispeed with ramp #2</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">14</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Increase EP</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">5</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Decrease EP</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">5</td> </tr> <tr> <td>FWD/REV</td> <td style="text-align: center;">-</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> <tr> <td>Local/Remote</td> <td style="text-align: center;">-</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td>JOG</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">3</td> <td style="text-align: center;">3</td> </tr> <tr> <td>No external fault</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: 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style="text-align: center;">11, 12, 14 and 15</td> </tr> <tr> <td>Increase EP with Ramp #2</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">16</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Decrease EP with Ramp #2</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">16</td> </tr> </tbody> </table>	DI Parameter Function	DI1 (P263)	DI2 (P264)	DI3 (P265)	DI4 (P266)	General Enable	1...7 and 10...12	-	2	2	Start/Stop	9	-	9	9	No Function or Start/Stop	0	-	-	-	No Function or Start/Stop	-	-	8	8	Forward Run	8	-	-	-	Reverse Run	-	8	-	-	FWD with Ramp #2	13	-	-	-	REV with Ramp #2	-	13	-	-	Start (3-wire)	14	-	-	-	Stop (3-wire)	-	14	-	-	Multispeed	-	7	7	7	Multispeed with ramp #2	-	-	14	-	Increase EP	-	-	5	-	Decrease EP	-	-	-	5	FWD/REV	-	0	0	0	Local/Remote	-	1	1	1	JOG	-	-	3	3	No external fault	-	-	4	4	Ramp #2	-	-	6	6	Reset	-	-	10	10	Disable Flying Start	-	-	13	13	Manual/Automatic (PID)	-	-	15	-	Not used	-	2...6 and 9...12	11 and 12	11, 12, 14 and 15	Increase EP with Ramp #2	-	-	16	-	Decrease EP with Ramp #2	-	-	-	16
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<b>P264<sup>(1)</sup></b> Digital Input DI2 Function	0...14 [ 0 - FWD/REV ] -																																																																																																																																			
<b>P265<sup>(1)</sup></b> Digital Input DI3 Function	0...15 [ 10 - Reset ] -																																																																																																																																			
<b>P266<sup>(1)</sup></b> Digital Input DI4 Function	0...15 [ 8 - Not used [Start/Stop ] -																																																																																																																																			

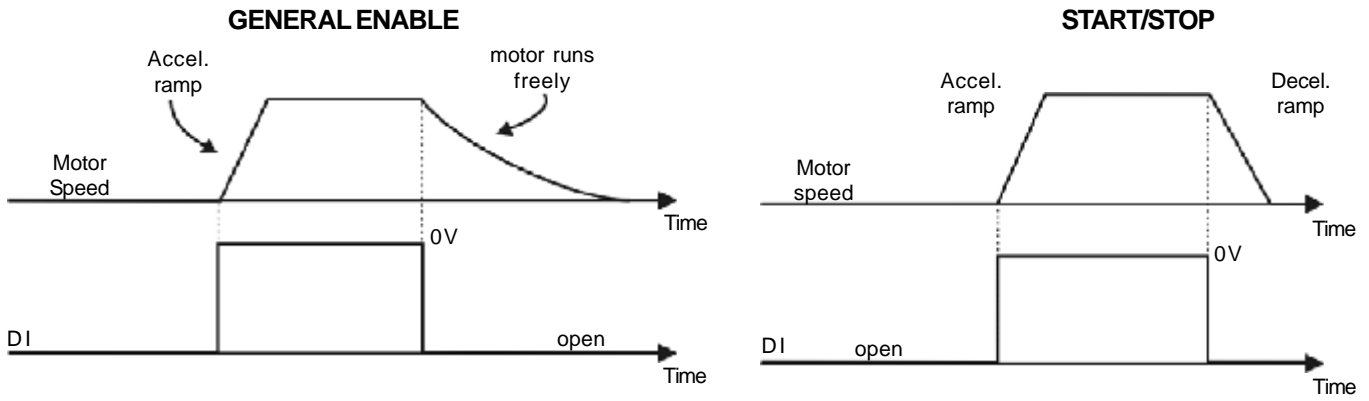
Functions activated with 0V at digital input.

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

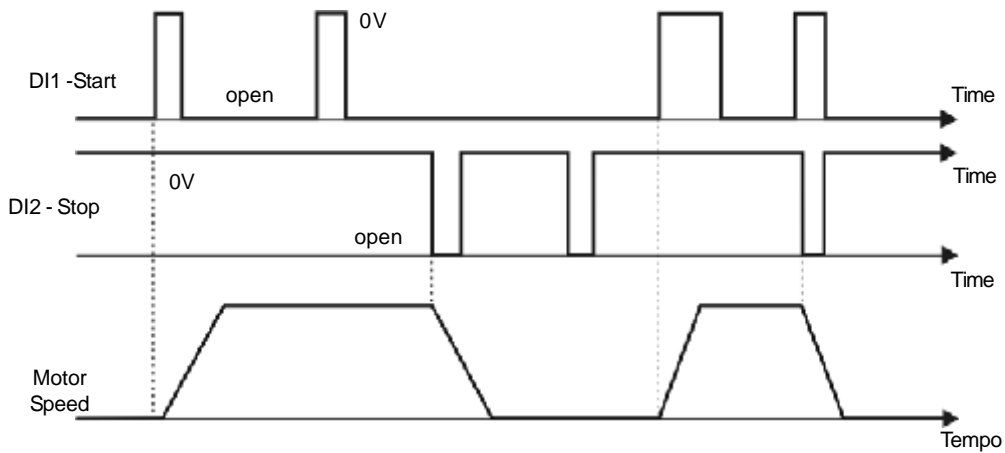
## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
		<p><b>NOTES!</b></p> <ol style="list-style-type: none"> <li>1) Local/Remote = open/0V at the digital input respectively.</li> <li>2) P263=0 (not used or general enable) operates as follows:               <ul style="list-style-type: none"> <li>- if the comand source are the terminals, i.e., if P229=1 for the local mode or P230=1 for the remote mode, the DI1 operates as general enable;</li> <li>- otherwise, no function is assigned to the input DI1.</li> </ul> </li> <li>3) The programming of P265 or P266=8 (not used or start/stop) operates in similar way, i.e.:               <ul style="list-style-type: none"> <li>- if inverter is running in local mode and P229=1, the digital input DI3/DI4 operates as start/stop;</li> <li>- if inverter is running in remote mode and P230=1, the digital input DI3/DI4 operates as start/stop;</li> <li>- otherwise no function is associated to the input DI3/DI4.</li> </ul> </li> <li>4) The selection of P265=P266=5 (EP) requires the programming of P221 and/or P222=4.</li> <li>5) The selection of P264 and/or P265 and/or P266=7 (multispeed) requires the programming of P221 and/or P222=6.</li> <li>6) If different acceleration and deceleration times are desired for a given operation condition (for instance for a set of frequencies or for a direction of rotation), check if it possible to use the multispeed function with ramp #2 and FWD/REV with ramp #2.</li> <li>7) See explanation about Flying Start Disable at P310 and P311.</li> <li>8) The option manual/automatic is explained in item 6.3.5 - Special Function Parameters (PID).</li> </ol>

# DETAILED PARAMETER DESCRIPTION



## 3-WIRE START/STOP



## FOWARD RUN / REVERSE RUN

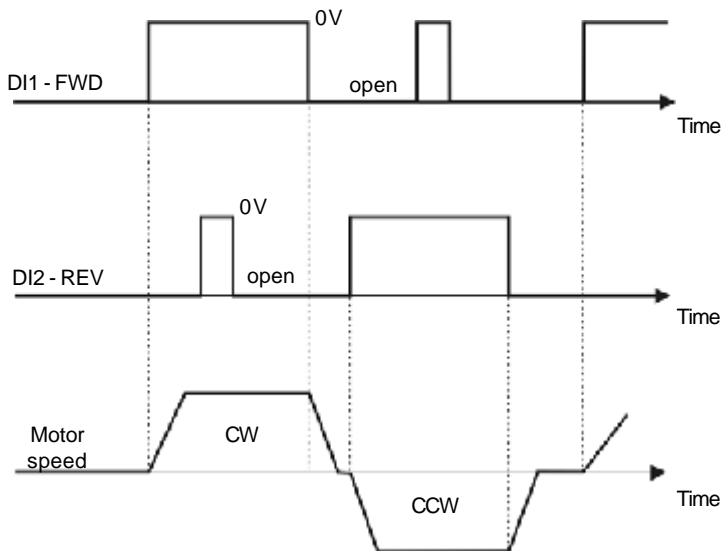
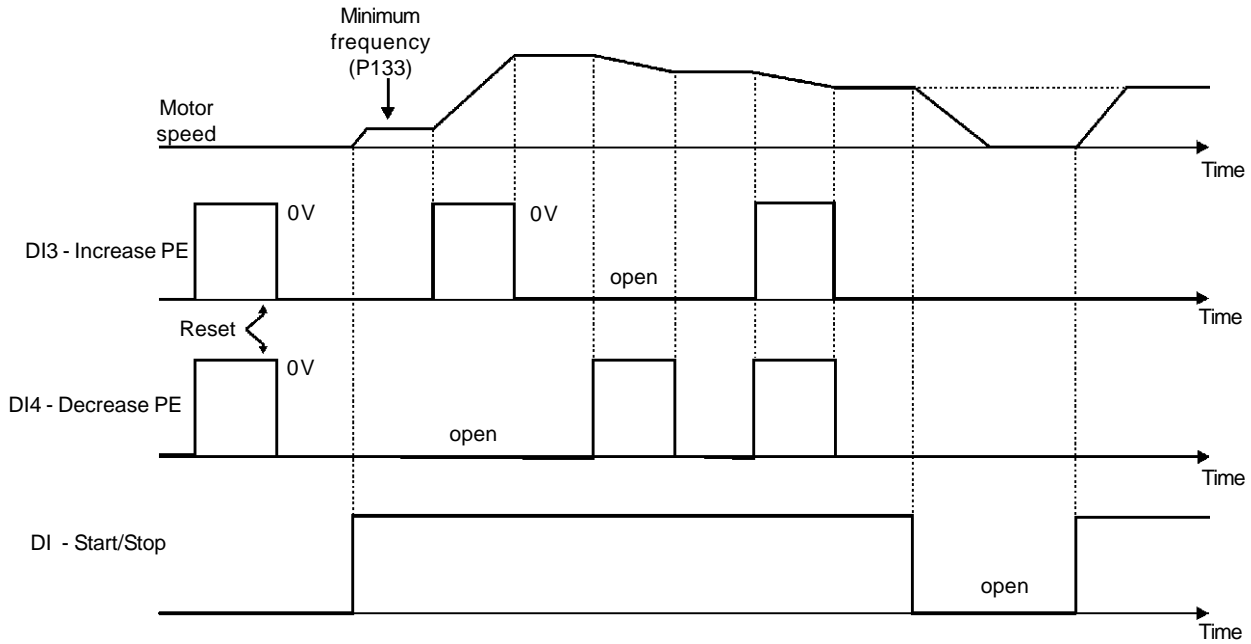


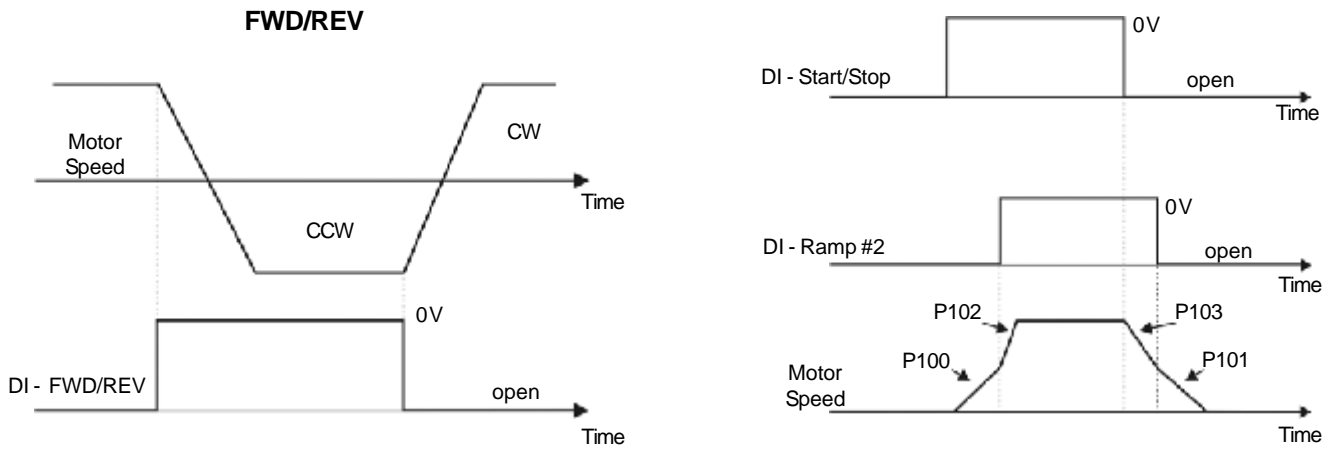
Figure 6.19 - Time diagrams of digital input functions

# DETAILED PARAMETER DESCRIPTION

## ELECTRONIC POTENTIOMETER (EP)



## RAMP #2



## JOG

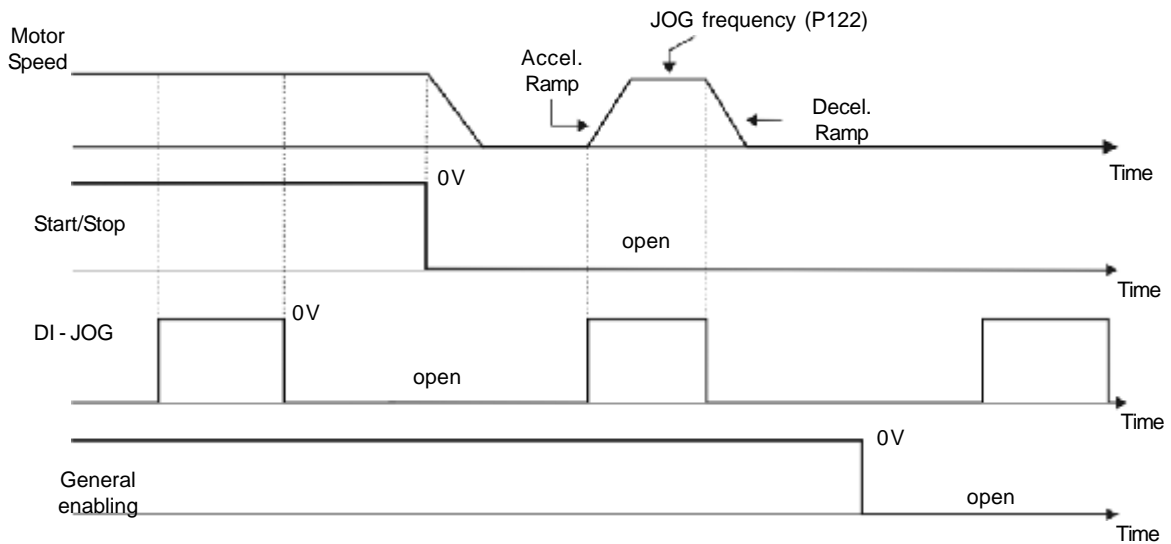


Figure 6.19 - Time diagrams of digital input functions (cont.)

# DETAILED PARAMETER DESCRIPTION

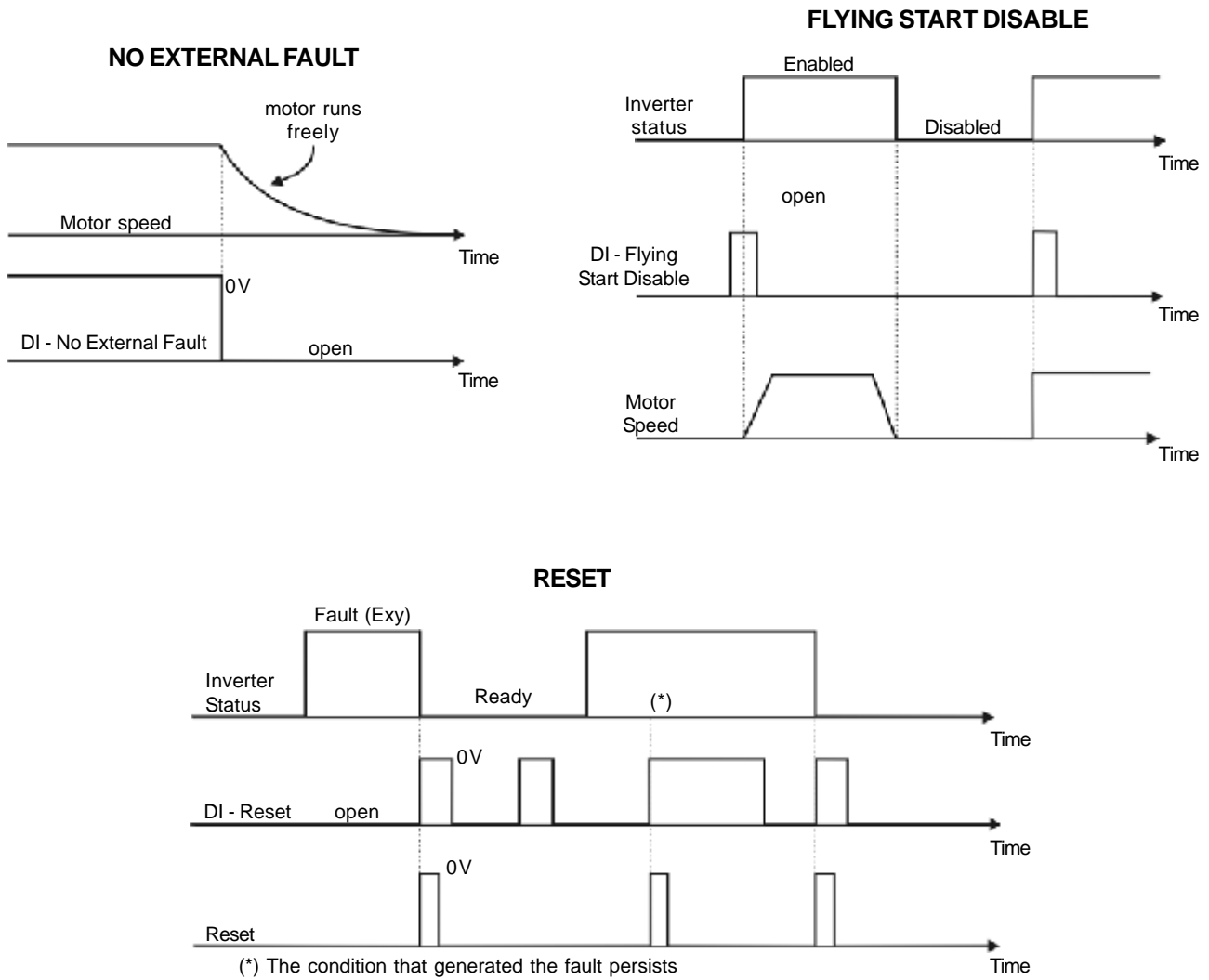


Figure 6.19 - Time diagrams of the digital input functions (cont.)

# DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P277<sup>(1)</sup></b> Relay Output RL1 Function	0...7 [ 7 - No fault ] -	<input checked="" type="checkbox"/> Check possible options on table below and details about each function operation on Figure 6.20.
<b>P279<sup>(1)</sup></b> Relay Output RL2 Function	0...7 [ 0 - Fs > Fx ] -	

Function	P277 (RL1)	P279 (RL2)
Fs > Fx	0	0
Fe > Fx	1	1
Fs = Fe	2	2
Is > Ix	3	3
Not used	4 and 6	4 and 6
Run (inverter enabled)	5	5
No fault	7	7

**Parameter P279 is only available in the CFW-08 Plus version**

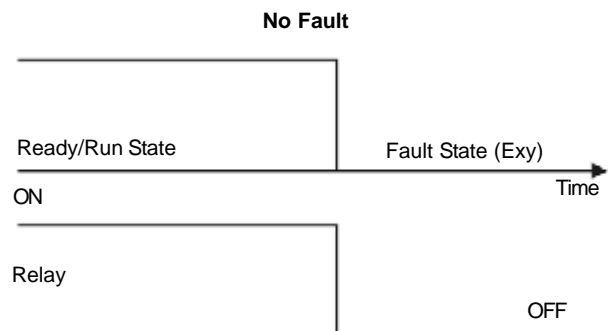
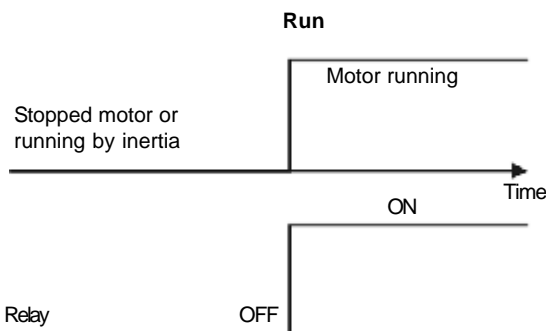
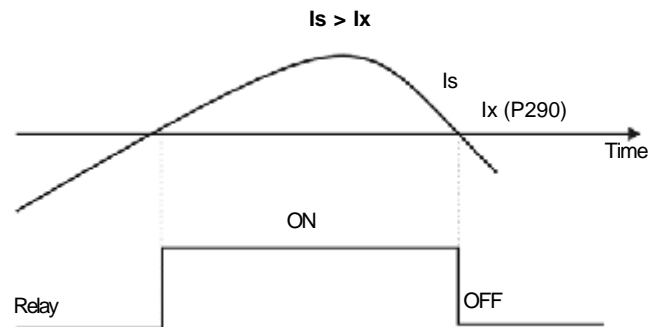
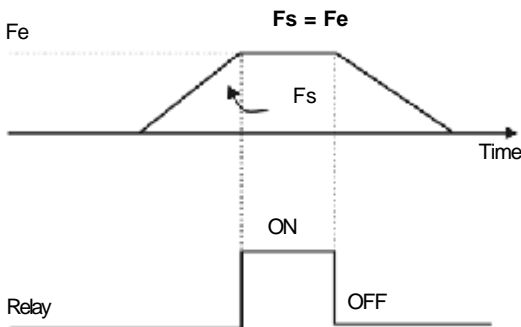
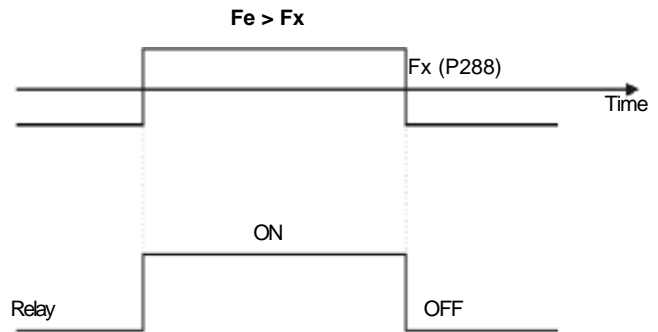
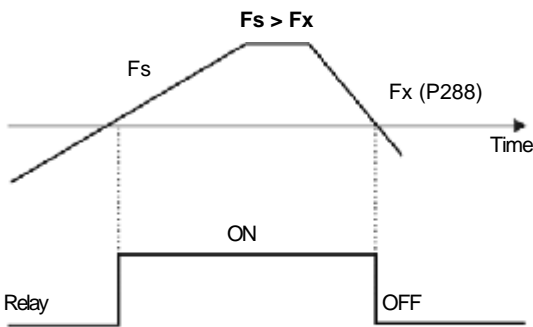


Figure 6.20 - Details about the operation of the digital relay output functions

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes																										
		<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> When the definition in the function name is true, the digital output will be activated, i.e., the relay coil is energized.</li> <li><input checked="" type="checkbox"/> When the option 'Not used' has been programmed, the relay output(s) will be disabled, i.e., the coil is not energized.</li> <li><input checked="" type="checkbox"/> CFW-08 Plus has 2 relay outputs (1 NO and 1 NC contact). It is possible to emulate a reversal contact relay by setting P277 = P279.</li> <li><input checked="" type="checkbox"/> Definitions of the used symbols in the functions:               <ul style="list-style-type: none"> <li>- Fs = P005 - output frequency (motor)</li> <li>- Fe = reference frequency (ramp input frequency)</li> <li>- Fx = P288 - Fx frequency (user selected frequency point)</li> <li>- Is = P003 - output current (motor)</li> <li>- Ix = P290 - Ix current (user selected current point)</li> </ul> </li> </ul>																										
<b>P288</b> Fx Frequency	0.00...300.0Hz [ <b>3.00Hz</b> ] 0.01Hz (<100.0Hz); 0.1Hz (>99.99Hz)	<input checked="" type="checkbox"/> Used in the relay output functions Fs>Fx, Fe>Fx and Is>Ix (see P277 and P279).																										
<b>P290</b> Ix Current	0...1.5xP295 [ <b>1.0xP295</b> ] 0.01A (<10.0A); 0.1A (>9.99A)																											
<b>P295<sup>(1)</sup></b> Rated Inverter Current ( $I_{nom}$ )	300...311 [ According to the rated inverter current $I_{nom}$ ] -	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">P295</th> <th style="text-align: center;">Rated Inverter Current (<math>I_{nom}</math>)</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">300</td><td style="text-align: center;">1.0A</td></tr> <tr><td style="text-align: center;">301</td><td style="text-align: center;">1.6A</td></tr> <tr><td style="text-align: center;">302</td><td style="text-align: center;">2.6A</td></tr> <tr><td style="text-align: center;">303</td><td style="text-align: center;">2.7A</td></tr> <tr><td style="text-align: center;">304</td><td style="text-align: center;">4.0A</td></tr> <tr><td style="text-align: center;">305</td><td style="text-align: center;">4.3A</td></tr> <tr><td style="text-align: center;">306</td><td style="text-align: center;">6.5A</td></tr> <tr><td style="text-align: center;">307</td><td style="text-align: center;">7.0A</td></tr> <tr><td style="text-align: center;">308</td><td style="text-align: center;">7.3A</td></tr> <tr><td style="text-align: center;">309</td><td style="text-align: center;">10A</td></tr> <tr><td style="text-align: center;">310</td><td style="text-align: center;">13A</td></tr> <tr><td style="text-align: center;">311</td><td style="text-align: center;">16A</td></tr> </tbody> </table>	P295	Rated Inverter Current ( $I_{nom}$ )	300	1.0A	301	1.6A	302	2.6A	303	2.7A	304	4.0A	305	4.3A	306	6.5A	307	7.0A	308	7.3A	309	10A	310	13A	311	16A
P295	Rated Inverter Current ( $I_{nom}$ )																											
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304	4.0A																											
305	4.3A																											
306	6.5A																											
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308	7.3A																											
309	10A																											
310	13A																											
311	16A																											

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).



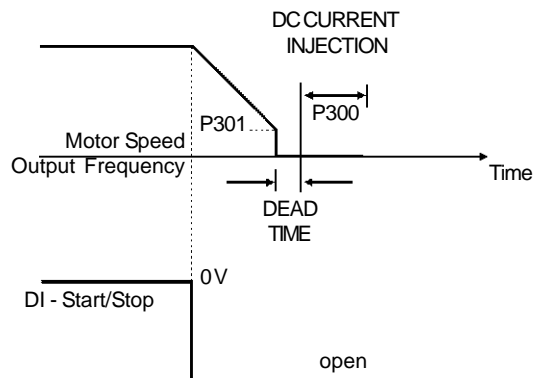
## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes																																																																																																																			
<b>P297<sup>(1)</sup></b> Switching Frequency	4...7 [ 4 - 5kHz ] -	<p><input checked="" type="checkbox"/> Defines the switching frequency of the IGBTs in the inverter.</p> <table border="1"> <thead> <tr> <th>P297</th> <th>Switching Frequency (f<sub>sw</sub>)</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>5kHz</td> </tr> <tr> <td>5</td> <td>2.5kHz</td> </tr> <tr> <td>6</td> <td>10kHz</td> </tr> <tr> <td>7</td> <td>15kHz</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> The switching frequency is a compromise between the motor acoustic noise level and the inverters IGBTs losses. Higher switching frequencies cause lower motor acoustic noise level, but increase the IGBTs losses, increasing the drive components temperature and thus reducing their useful life.</p> <p><input checked="" type="checkbox"/> The predominant frequency on the motor is twice the switching frequency set at P297.</p> <p><input checked="" type="checkbox"/> Thus, P297=4 (5kHz) results in an audible motor noise corresponding to 10kHz. This is due to the used PWM technique .</p> <p><input checked="" type="checkbox"/> The reduction of the switching frequency also contributes to the reduction of instability and resonance that may occur in certain application conditions, as well as reduces the emission of electromagnetic energy by the inverter.</p> <p><input checked="" type="checkbox"/> The reduction of the switching frequencies also reduces the leakage currents to ground, which may avoid the nuisance activation of the ground fault protection (E00).</p> <p><input checked="" type="checkbox"/> The option 15kHz (P297=7) is not available in vector control mode.</p> <p><input checked="" type="checkbox"/> Use currents according to table below:</p> <table border="1"> <thead> <tr> <th>Inverter Model</th> <th>2,5kHz (P297=5)</th> <th>5kHz (P297=4)</th> <th>10kHz (P297=6)</th> <th>15kHz (P297=7)</th> </tr> </thead> <tbody> <tr><td>CFW080016S2024...</td><td>1.6A</td><td>1.6A</td><td>1.6A</td><td>1.6A</td></tr> <tr><td>CFW080016B2024...</td><td>1.6A</td><td>1.6A</td><td>1.6A</td><td>1.6A</td></tr> <tr><td>CFW080026S2024...</td><td>2.6A</td><td>2.6A</td><td>2.6A</td><td>2.1A</td></tr> <tr><td>CFW080026B2024...</td><td>2.6A</td><td>2.6A</td><td>2.6A</td><td>2.6A</td></tr> <tr><td>CFW080040S2024...</td><td>4.0A</td><td>4.0A</td><td>4.0A</td><td>3.4A</td></tr> <tr><td>CFW080040B2024...</td><td>4.0A</td><td>4.0A</td><td>4.0A</td><td>4.0A</td></tr> <tr><td>CFW080070T2024...</td><td>7.0A</td><td>7.0A</td><td>7.0A</td><td>6.3A</td></tr> <tr><td>CFW080073B2024...</td><td>7.3A</td><td>7.3A</td><td>7.3A</td><td>7.3A</td></tr> <tr><td>CFW080100B2024...</td><td>10A</td><td>10A</td><td>10A</td><td>10A</td></tr> <tr><td>CFW080160T2024...</td><td>16A</td><td>16A</td><td>14A</td><td>12A</td></tr> <tr><td>CFW080010T3848...</td><td>1.0A</td><td>1.0A</td><td>1.0A</td><td>1.0A</td></tr> <tr><td>CFW080016T3848...</td><td>1.6A</td><td>1.6A</td><td>1.6A</td><td>1.6A</td></tr> <tr><td>CFW080026T3848...</td><td>2.6A</td><td>2.6A</td><td>2.6A</td><td>2.3A</td></tr> <tr><td>CFW080027T3848...</td><td>2.7A</td><td>2.7A</td><td>2.7A</td><td>2.7A</td></tr> <tr><td>CFW080040T3848...</td><td>4.0A</td><td>4.0A</td><td>3.6A</td><td>2.8A</td></tr> <tr><td>CFW080043T3848...</td><td>4.3A</td><td>4.3A</td><td>3.9A</td><td>3.0A</td></tr> <tr><td>CFW080065T3848...</td><td>6.5A</td><td>6.5A</td><td>6.5A</td><td>6.3A</td></tr> <tr><td>CFW080100T3848...</td><td>10A</td><td>10A</td><td>8.4A</td><td>6.4A</td></tr> <tr><td>CFW080130T3848...</td><td>13A</td><td>13A</td><td>11A</td><td>9A</td></tr> <tr><td>CFW080160T3848...</td><td>16A</td><td>16A</td><td>12A</td><td>10A</td></tr> </tbody> </table>	P297	Switching Frequency (f <sub>sw</sub> )	4	5kHz	5	2.5kHz	6	10kHz	7	15kHz	Inverter Model	2,5kHz (P297=5)	5kHz (P297=4)	10kHz (P297=6)	15kHz (P297=7)	CFW080016S2024...	1.6A	1.6A	1.6A	1.6A	CFW080016B2024...	1.6A	1.6A	1.6A	1.6A	CFW080026S2024...	2.6A	2.6A	2.6A	2.1A	CFW080026B2024...	2.6A	2.6A	2.6A	2.6A	CFW080040S2024...	4.0A	4.0A	4.0A	3.4A	CFW080040B2024...	4.0A	4.0A	4.0A	4.0A	CFW080070T2024...	7.0A	7.0A	7.0A	6.3A	CFW080073B2024...	7.3A	7.3A	7.3A	7.3A	CFW080100B2024...	10A	10A	10A	10A	CFW080160T2024...	16A	16A	14A	12A	CFW080010T3848...	1.0A	1.0A	1.0A	1.0A	CFW080016T3848...	1.6A	1.6A	1.6A	1.6A	CFW080026T3848...	2.6A	2.6A	2.6A	2.3A	CFW080027T3848...	2.7A	2.7A	2.7A	2.7A	CFW080040T3848...	4.0A	4.0A	3.6A	2.8A	CFW080043T3848...	4.3A	4.3A	3.9A	3.0A	CFW080065T3848...	6.5A	6.5A	6.5A	6.3A	CFW080100T3848...	10A	10A	8.4A	6.4A	CFW080130T3848...	13A	13A	11A	9A	CFW080160T3848...	16A	16A	12A	10A
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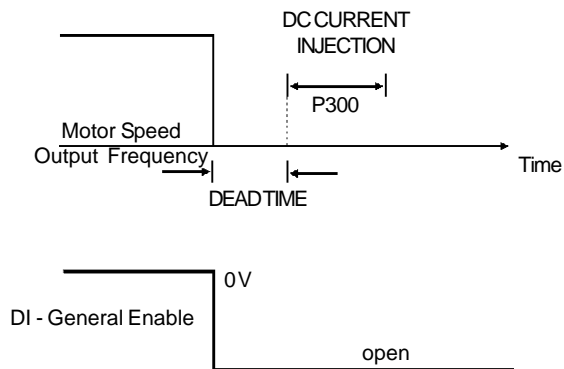
<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P300</b> DC Braking Time	0.0...15.0s [ <b>0.0</b> ] 0.1s	<ul style="list-style-type: none"> <li>☑ The DC braking feature provides a motor fast stop via DC current injection.</li> <li>☑ The applied DC braking current, that is proportional to the braking torque, is set at P302, and is adjusted as a percentage (%) relating to the rated <u>inverter</u> current.</li> </ul>
<b>P301</b> DC Braking Start Frequency	0.00...15.00Hz [ <b>1.00Hz</b> ] 0.01Hz	<ul style="list-style-type: none"> <li>☑ The figures below show the DC braking operation at the two possible conditions: ramp disabling and general disabling.</li> </ul>
<b>P302</b> DC Braking Current	0.0...130% [ <b>0.0%</b> ] 0.1%	



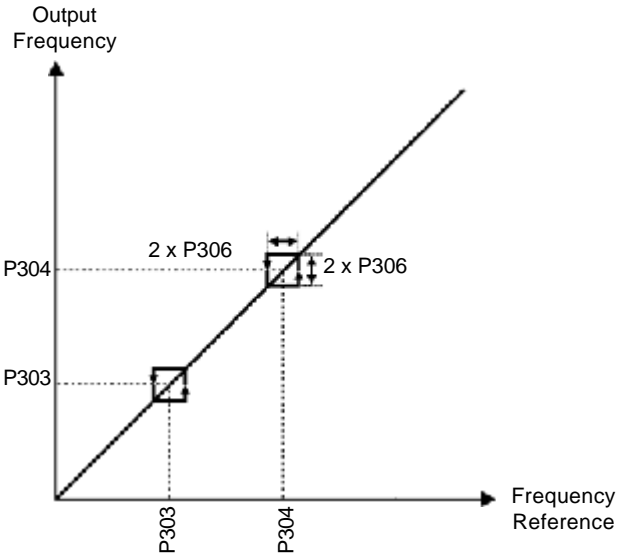
**Figure 6.21** - DC braking after ramp disabling



**Figure 6.22** - ADC braking after general disabling

- ☑ Before DC braking starts, there is a "Dead Time" (motor runs freely) required for the motor demagnetization. This time is function of the motor speed at which the DC braking occurs.
- ☑ During the DC braking the LED display flashes 8888.
- ☑ If the inverter is enabled during the braking process, this process will be aborted and motor operates normally.
- ☑ DC braking can continue its braking process even after the motor has stopped. Pay special attention to the dimensioning of the motor thermal protection for cyclic braking of short times.
- ☑ In applications where the motor current is lower than the rated inverter current, and where the braking torque is not enough for the braking condition, please contact WEG to optimize the settings.

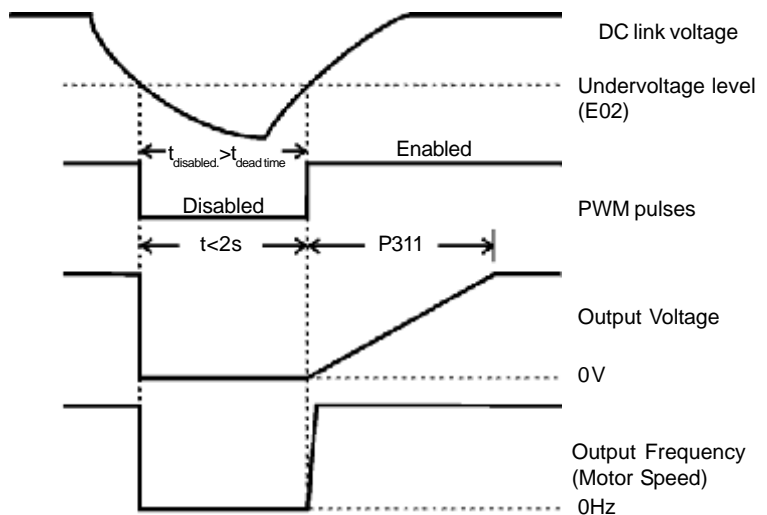
## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P303</b> Skip Frequency 1	P133...P134 [ <b>20.00Hz</b> ] 0.01Hz (<100.0Hz); 0.1Hz (99.99Hz)	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> This feature (skip frequencies) prevents the motor from operating permanently at speeds where the mechanical system enters into resonance, causing high vibration or noise levels.</li> <li><input checked="" type="checkbox"/> The enabling of this function is performed by setting P306 ≠ 0.00.</li> </ul>
<b>P304</b> Skip Frequency 2	P133...P134 [ <b>30.00Hz</b> ] 0.01Hz (<100.0Hz); 0.1Hz (99.99Hz)	<div style="text-align: center;">  </div> <p style="text-align: center;"><b>Figure 6.23 - Skip Frequency" curves</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> The passage through the skip speed band (2xP306) is made according to the selected acceleration/deceleration rates.</li> <li><input checked="" type="checkbox"/> This function does not operate properly when two skip frequencies are overlapped.</li> </ul>
<b>P306</b> Skip Band Range	0.00...25.00Hz [ <b>0.00</b> ] 0.01Hz	
<b>P308<sup>(1)</sup></b> Inverter Address	1...30 (WEG Protocol) 1...247 (Modbus-RTU) [ <b>1</b> ] 1	

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes															
<b>P310<sup>(1)</sup></b> Flying Start and Ride-Through	0...3 [ 0 - Inativas ] -	<input checked="" type="checkbox"/> The parameter P310 selects the active function(s): <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>P310</th> <th>Flying Start</th> <th>Ride-Through</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Inactive</td> <td>Inactive</td> </tr> <tr> <td>1</td> <td>Active</td> <td>Inactive</td> </tr> <tr> <td>2</td> <td>Active</td> <td>Active</td> </tr> <tr> <td>3</td> <td>Inactive</td> <td>Active</td> </tr> </tbody> </table>	P310	Flying Start	Ride-Through	0	Inactive	Inactive	1	Active	Inactive	2	Active	Active	3	Inactive	Active
P310	Flying Start	Ride-Through															
0	Inactive	Inactive															
1	Active	Inactive															
2	Active	Active															
3	Inactive	Active															
<b>P311</b> Voltage Ramp	0.1...10.0s [ 5.0s ] 0.1s	<input checked="" type="checkbox"/> Parameter P311 sets the time required for the motor restart, both for flying start function and the ride-through function. In other words, it defines the time to set the output voltage starting from 0V and up to reaching the rated voltage.  <input checked="" type="checkbox"/> Operation of the flying start function: <ul style="list-style-type: none"> <li>- It allows the motor to start when it is running. This functions acts only when the inverter is enabled. During the start, the inverter will impose the speed reference, creating a voltage ramp with time defined at P311.</li> <li>- The motor can be started in conventional form, even when the flying start has been selected (P310=1 or 2), adjusting one of the digital inputs (D13 or D14) to 13 (flying start disable) and driving it (0V) during the motor start.</li> </ul> <input checked="" type="checkbox"/> Ride-Through operation: <ul style="list-style-type: none"> <li>- Permits the inverter recovery, without disabling by E02 (undervoltage), when a momentary voltage drop in the line occurs. The inverter will be disabled only by E02, if the voltage drop is longer than 2.0s.</li> <li>- When the ride-through function is enabled (P310=2 or 3) and if a voltage drop in the line occurs, so the link circuit voltage becomes lower than the permitted undervoltage level, the output pulses will be disabled (motor runs freely) and the inverter waits up to 2s for the line re-establishment. If the line returns to its normal status within this time, the inverter will enable again the PWM pulses, imposing the frequency reference instantaneously and providing a voltage ramp with time defined at P311.</li> <li>- There is a dead time before this voltage ramp is started, required for the motor demagnetization. This time is proportional to the output frequency (motor speed).</li> </ul>															



**Figure 6.24 - Ride-Through actuation**





<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes																														
<b>P312<sup>(1)</sup></b> Serial Interface	0...9 [ 0 - WEG Protocol ] 1	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> It sets the type of the protocol for the serial communication.</li> <li><input checked="" type="checkbox"/> The serial interface can be configured for two distinct protocols: WEG and Modbus-RTU.</li> <li><input checked="" type="checkbox"/> The WEG protocol is described in Item 8.21 and is selected by setting P312=0.</li> <li><input checked="" type="checkbox"/> The Modbus-RTU protocol, described in item 8.22 has nine predefined formats, as shown in table below:</li> </ul> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>P312</th> <th>Rate (bps)</th> <th>Parity</th> </tr> </thead> <tbody> <tr><td>1</td><td>9600</td><td>-</td></tr> <tr><td>2</td><td>9600</td><td>Odd</td></tr> <tr><td>3</td><td>9600</td><td>Even</td></tr> <tr><td>4</td><td>19200</td><td>-</td></tr> <tr><td>5</td><td>19200</td><td>Odd</td></tr> <tr><td>6</td><td>19200</td><td>Even</td></tr> <tr><td>7</td><td>38400</td><td>-</td></tr> <tr><td>8</td><td>38400</td><td>Odd</td></tr> <tr><td>9</td><td>38400</td><td>Even</td></tr> </tbody> </table>	P312	Rate (bps)	Parity	1	9600	-	2	9600	Odd	3	9600	Even	4	19200	-	5	19200	Odd	6	19200	Even	7	38400	-	8	38400	Odd	9	38400	Even
P312	Rate (bps)	Parity																														
1	9600	-																														
2	9600	Odd																														
3	9600	Even																														
4	19200	-																														
5	19200	Odd																														
6	19200	Even																														
7	38400	-																														
8	38400	Odd																														
9	38400	Even																														
<b>P313</b> Serial Interface Watchdog Action	0...3 [ 2 ] 1	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> If the inverter does not receive any valid message (via serial interface) during the interval programmed at P314, the action set at P313 will be performed and error E28 is shown on the display.</li> <li><input checked="" type="checkbox"/> The different actions are: <ul style="list-style-type: none"> <li>- P313=0 : disables inverter via deceleration ramp;</li> <li>- P313=1 : triggers the general disable command of the inverter;</li> <li>- P313=2 : indicates only E28;</li> <li>- P313=3 : changes the command reference to local mode.</li> </ul> </li> <li><input checked="" type="checkbox"/> If the communication is re-established, E28 switches off and the inverter does not change its status.</li> </ul>																														
<b>P314</b> Serial Interface Watchdog Timeout	0.0...99.9 [ 0.0 – Disable Function ] 0	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Actuation interval of the Serial Watchdog. If the value of P314 is equal to 0, the Serial Watchdog function is disabled. Otherwise, if the the inverter does not receive any valid message during this interval, it assumes the action that has been programmed at P313.</li> </ul>																														





## DETAILED PARAMETER DESCRIPTION

### 6.3.4 Motor Parameters - P399 ... P499

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P399<sup>(1)</sup></b> Rated Motor Efficiency   <b>This parameter is only available in Vector Control (P202=2)</b>	50.0...99.9% [ according to the inverter model ] 0.1%	<input checked="" type="checkbox"/> Set this parameter according to motor nameplate. <input checked="" type="checkbox"/> If this data are not available: - If the rated motor power factor is known (cos Ø=P407), determine the efficiency by the following equation: $P399 = \eta_{nom} = 433 \times \frac{P}{V \times I \times \cos \varnothing}$ where P is the motor power in HP, V is the rated motor voltage in Volts (V) - P400, and I is the rated motor current in ampere (A) - P401. - For an approximation, use the values from the table of item 9.3. <input checked="" type="checkbox"/> It is used only in Vector Control Mode.
<b>P400<sup>(1)</sup></b> Rated Motor Voltage   <b>This parameter is only available in Vector Control (P202=2)</b>	0...600V [ according to the inverter model and market ] 1V	<input checked="" type="checkbox"/> Rated motor voltage indicated on the motor nameplate. It is the rms-value of the motor line voltage. <input checked="" type="checkbox"/> Set this parameter according to the motor nameplate data and the connection digram in the terminal box. <input checked="" type="checkbox"/> This parameter is used only in Vector Control Mode.
<b>P401</b> Rated Motor Current	0.3xPI <sub>nom</sub> ...1.3xPI <sub>nom</sub> [ according to the inverter model ] 0.01A (<10.0A); 0.1A (>9.99A)	<input checked="" type="checkbox"/> Rated motor current indicated on the motor nameplate. It is the rms-value of the rated motor line current. <input checked="" type="checkbox"/> Set this parameter according to the motor nameplate data and the connection digram in the terminal box. <input checked="" type="checkbox"/> This parameter is used in V/F control [slip compensation function and automatic torque boost function (automatic IxR)] and vector control.
<b>P402</b> Rated Motor Speed   <b>This parameter is only available in Vector Control (P202=2)</b>	0...9999rpm [ according to the inverter model and market ] 1rpm	<input checked="" type="checkbox"/> Set this parameter according to the motor nameplate data. <input checked="" type="checkbox"/> This parameter is used only in Vector Control mode.
<b>P403<sup>(1)</sup></b> Rated Motor Frequency   <b>This parameter is only available in Vector Control (P202=2)</b>	0.00...P134 [ <b>50.00Hz or 60.00Hz</b> depending on the market ] 0.01Hz (<100.0Hz); 0.1Hz (>99.99Hz)	<input checked="" type="checkbox"/> Set this parameter according to the motor nameplate data. <input checked="" type="checkbox"/> This parameter is used only in Vector Control mode.

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes																																																																							
<b>P404<sup>(1)</sup></b> Rated Motor Power   This parameter is only displayed in Vector Control (P202=2)	0...15 [ According to the inverter model ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Set this parameter according to motor nameplate, as shown in table below.</li> </ul> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">P404</th> <th colspan="3">Rated Motor power</th> </tr> <tr> <th>CV</th> <th>HP</th> <th>kW</th> </tr> </thead> <tbody> <tr><td>0</td><td>0.16</td><td>0.16</td><td>0.12</td></tr> <tr><td>1</td><td>0.25</td><td>0.25</td><td>0.18</td></tr> <tr><td>2</td><td>0.33</td><td>0.33</td><td>0.25</td></tr> <tr><td>3</td><td>0.5</td><td>0.5</td><td>0.37</td></tr> <tr><td>4</td><td>0.75</td><td>0.75</td><td>0.55</td></tr> <tr><td>5</td><td>1</td><td>1</td><td>0.75</td></tr> <tr><td>6</td><td>1.5</td><td>1.5</td><td>1.1</td></tr> <tr><td>7</td><td>2</td><td>2</td><td>1.5</td></tr> <tr><td>8</td><td>3</td><td>3</td><td>2.2</td></tr> <tr><td>9</td><td>4</td><td>4</td><td>3.0</td></tr> <tr><td>10</td><td>5</td><td>5</td><td>3.7</td></tr> <tr><td>11</td><td>5.5</td><td>5.5</td><td>4.0</td></tr> <tr><td>12</td><td>6</td><td>6</td><td>4.5</td></tr> <tr><td>13</td><td>7.5</td><td>7.5</td><td>5.5</td></tr> <tr><td>14</td><td>10</td><td>10</td><td>7.5</td></tr> <tr><td>15</td><td>12.5</td><td>12.5</td><td>9.2</td></tr> </tbody> </table> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> This parameter is used only in Vector Control mode.</li> </ul>	P404	Rated Motor power			CV	HP	kW	0	0.16	0.16	0.12	1	0.25	0.25	0.18	2	0.33	0.33	0.25	3	0.5	0.5	0.37	4	0.75	0.75	0.55	5	1	1	0.75	6	1.5	1.5	1.1	7	2	2	1.5	8	3	3	2.2	9	4	4	3.0	10	5	5	3.7	11	5.5	5.5	4.0	12	6	6	4.5	13	7.5	7.5	5.5	14	10	10	7.5	15	12.5	12.5	9.2
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15	12.5	12.5	9.2																																																																						
<b>P407<sup>(1)</sup></b> Rated Motor Power Factor	0.50...0.99 [ According to the inverter model ] 0.01	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Set this parameter according to motor nameplate.</li> <li><input checked="" type="checkbox"/> If this value is not available:                             <ul style="list-style-type: none"> <li>- If the rated motor efficiency is known (<math>\eta_{nom}=P399</math>), obtain the power factor through the following equation:</li> </ul> <math display="block">P407 = \cos \varnothing = 433 \times \frac{P}{V \times I \times \eta_{nom}}</math> <ul style="list-style-type: none"> <li>where P is the motor power in HP, V is the rated line voltage of the motor in volts (V) - P400, and I is the rated motor current in ampère (A) - P401.</li> <li>- For an approximation value, use the values of the table in item 9.3.</li> </ul> </li> <li><input checked="" type="checkbox"/> This parameter is used in V/F control [slip compensation function and automatic torque boost function (automatic IxR)] and vector control.</li> </ul>																																																																							
<b>P408<sup>(1)</sup></b> Run Self-Tuning   This parameter is shown on the display only when in Vector Control (P202=2)	0...1 [ 0 ] -	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Through this parameter you can run the self-tuning routine, where the stator resistance of the used motor is estimated automatically by the inverter. The motor will not run.</li> <li><input checked="" type="checkbox"/> By setting P408=1, the Self-Tuning routine is started.</li> <li><input checked="" type="checkbox"/> During the running of the Self-Tuning routine, the display flashes .</li> <li><input checked="" type="checkbox"/> If the interruption of the Self-Tuning routine is desired, press .</li> <li><input checked="" type="checkbox"/> If the estimated value of the motor stator resistance is too high for the applied inverter (examples: motor is not connected or motor is too small for the inverter) the inverter displays E14. You can only exit from this condition by switching off the inverter.</li> </ul>																																																																							

<sup>(1)</sup> This parameter can be changed only with the inverter disabled (motor stopped).

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes
<b>P409</b> Motor Resistance   This parameter is shown of the display only when in Vector Control (P202=2)	0.00...9.99 [ According to the inverter type ] 0.01	<input checked="" type="checkbox"/> Value estimated by the Self-Tuning routine. <input checked="" type="checkbox"/> The table in item 9.3 shows the stator resistance for standard, IV pole, 60Hz, 220/380V motors. <input checked="" type="checkbox"/> The value of the stator resistance can also be entered at P409 directly, if this value is known.   <b>NOTE!</b> P409 shall contain the equivalent value of the stator resistance of one phase, by supposing that the the motor is star connected (Y).   <b>NOTE!</b> If the value of P409 is to high for the motor, a disabling of the inverter can occur due to overcurrent (E00).



## DETAILED PARAMETER DESCRIPTION

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### 6.3.5 Special Function Parameters - P500 ... P599

#### 6.3.5.1 PID Introduction

- ☑ CFW-08 is fitted with the PID regulator that can be used for closed loop process control. This function acts as a proportional, integral and derivative regulator, superimposed on the normal inverter speed control.
- ☑ The speed will be changed in order to maintain the process variable (the variable that should be controlled - for instance: water level of a container) at the desired value, set in the setpoint.
- ☑ This regulator can, for instance, control the flow in a piping system. The setpoint (flow) can be given by the analog input AI2 or through P525 (digital setpoint), and the flow feedback signal is given at analog input AI1.
- ☑ Other application examples: level control, temperature control, dosing control, etc.

#### 6.3.5.2 Description

- ☑ Figure 6.25 shows the block diagram of the PID regulator.
- ☑ The feedback signal must be sent to the analog input AI1.
- ☑ The setpoint is the value of the process variable at which the operation is desired. This value is entered as a percentage and is defined by the following equation:

$$\text{setpoint (\%)} = \frac{\text{setpoint (UP)}}{\text{full scale of the used sensor (UP)}} \times P234 \times 100\%$$

where both the setpoint and the full scale value of the sensor are given by the process unit (°C, bar, etc.).

Example: a pressure transducer (sensor) with output 4 - 20mA and full scale of 25bar (i.e., 4mA=0bar and 20mA=25bar) and P234=2.00. If the control of 10bar is desired, you should enter the following setpoint:

$$\text{setpoint (\%)} = \frac{10}{25} \times 2 \times 100\% = 80\%$$

- ☑ The setpoint can be defined via:
  - Keypad: digital setpoint, parameter P525.
  - Analog input AI2 (only available in the CFW-08 Plus): the percentage value is determined by considering P238, P239 and P240 (see description of these parameters).
- ☑ The parameter P040 indicates the value of the process variable (feedback) in the scale selected at P528, that is set according to the following equation:

$$P528 = \frac{\text{full scale value of the used sensor}}{P234}$$

Example: Consider the data of the example above (pressure sensor of 0-25bar and P234=2.00) . P528 must be set to 25/2=12.5.

- ☑ The parameter P040 can be selected as the display default parameter P205=6.

# DETAILED PARAMETER DESCRIPTION

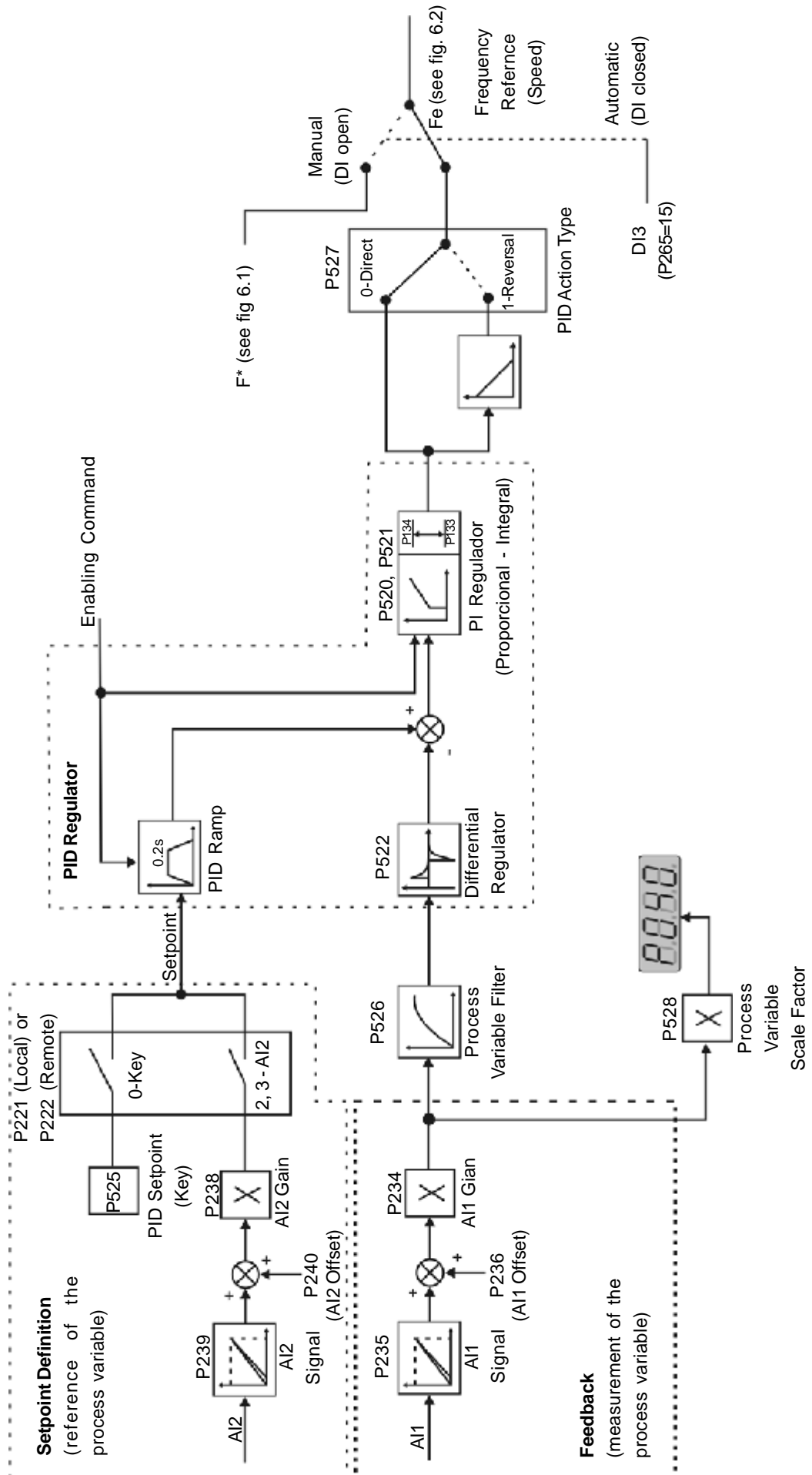


Figure 6.25 - Block diagram of the PID regulator function



### NOTE!

When the PID function (P203=1) is set:

- ☑ The digital input DI3 is automatically set to manual/automatic (P265=15). Thus when DI3 is open, the manual mode is activated and when DI3 is closed, the PID regulator starts to operate (closed loop control - automatic mode).

If the function of this digital input (DI3) is changed, the operation of the inverter will be always in manual mode.

- ☑ If P221 or P222 is equal to 1, 4, 5, 6, 7 or 8 the E24 error message will be displayed. Set P221 and P222 equal to 0 or 2 according to the requirement.

- ☑ The JOG and the FWD/REV functions are disabled. The inverter enabling and disabling commands are defined by P229 and P230.

- ☑ In the manual mode, the frequency reference is given by  $F^*$ , as shown in figure 6.1.

- ☑ When the operation mode is changed from manual to automatic, P525 is automatically set to the value of P040 (at the instant immediately before the commutation). Thus when the setpoint is defined by P525 (P221 or P222=0), the changing from manual to automatic is smooth [there's not occur abrupt oscillation in the frequency (speed) reference].

- ☑ The analog output can be programmed to indicate the process variable (P040) or the PID setpoint with P251=6 or 4, respectively.

- ☑ Figure 6.26 shows an application example of an inverter controlling a process in closed loop (PID regulator).

### 6.3.5.3 PID Start-Up Guide

- ☑ Please find below a start-up procedure for the PID regulator:

#### **Initial Definition**

- 1) Process - Definition of the PID action type that the process requires: direct or reverse. The control action must be direct (P527=0) when it is required to increase the motor speed and so also increment the process variable. Otherwise select reverse (P527=1).

Examples:

- a) Direct: pump driven by inverter and filling a tank where the PID regulates the tank level. To increase the level height (process variable) the flow must be increased and consequently also the motor speed must be increased.

- b) Reverse: fan driven by an inverter to cool a cooling tower, with the PID controlling the temperature of this tower. When it is required to increase the tower temperature (process variable), the cooling power must be decreased by reducing the motor speed.

- 2) Feedback (process variable measurement): The feedback is always realized via analog input AI1.

- ☑ Transducer (sensor) to be used for the feedback of the control variable: it is recommended to use a sensor with full scale with at least 1.1 times higher than the largest value of the process variable that shall be controlled. Example: If a pressure control at 20bar is desired, select a sensor with a control capacity of at least 22bar.

- ☑ Signal type: set P235 and the position of the switch S1 on the control board according to the transducer signal (4-20mA, 0-20mA or 0-10V).

## DETAILED PARAMETER DESCRIPTION

- ☑ Set P234 and P236 according to the variation range of the used feedback signal (for more details, see description of the parameters P234 to P240).

Example: suppose the following application:

- full scale of the transducer (maximum value at the transducer output) = 25bar (FS=25);

- operation range (range of interest) = 0 to 15bar (FO=15).

Considering a safety margin of 10%, the measuring range of the process variable must be set to: 0 a 16.5bar.

Thus:  $FM=1.1 \times FS=16.5$ .

Parameter P234 must be set to:

$$P234 = \frac{FS}{FM} = \frac{25}{16.5} = 1.52$$

As the operation range starts at zero,  $P236=0$ , thus a setpoint of 100% represents 16.5bar, i.e., the operation range, in percentage, is within: 0 to 90.9%.



### NOTE!

In the most cases it is not necessary to set the gain and the offset ( $P234=1.00$  and  $P236=0.0$ ). Thus the percentage value of the setpoint is equivalent to the percentage value of the full scale of the used sensor. However if the maximum resolution of the analog input AI1 (feedback) is desired, set P234 and P238 according to comments above.

- ☑ Setting of the display indication to the process variable measuring unit (P040): set P528 according to the full scale of the used transducer (sensor) and defined P234 (see description of parameter P528 below).
- 3) Reference (setpoint):
    - ☑ Local/remote mode.
    - ☑ Reference source: set P221 or P222 according to definition above.
  - 4) Speed limits: set P133 and P134 according to the application.
  - 5) Indication:
    - ☑ Display (P040): P040 can be the display default parameter by setting  $P205=6$ .
    - ☑ Analog output (AO): it is possible to indicate the process variable (feedback) or the setpoint of the PID regulator at the analog output by setting P251 to 6 or 9, respectively.

### Start-up

- 1) Manual operation (DI3 open):
  - ☑ Display indication (P040): check indication based on external measurement and on the feedback signal (transducer) at AI1.
  - ☑ Indication of the process variable at the analog output (AO), if  $P251=6$ .
  - ☑ Set the frequency reference ( $F^*$ ) until the desired value of the process variable is reached.  
Only then switch to the automatic mode (inverter will set automatically  $P525=P040$ ).
- 2) Automatic operation: close DI3 and make the dynamic setting of the PID regulator, i.e., adjust the proportional gain (P520), integral gain (P521) and differential gain (P522).

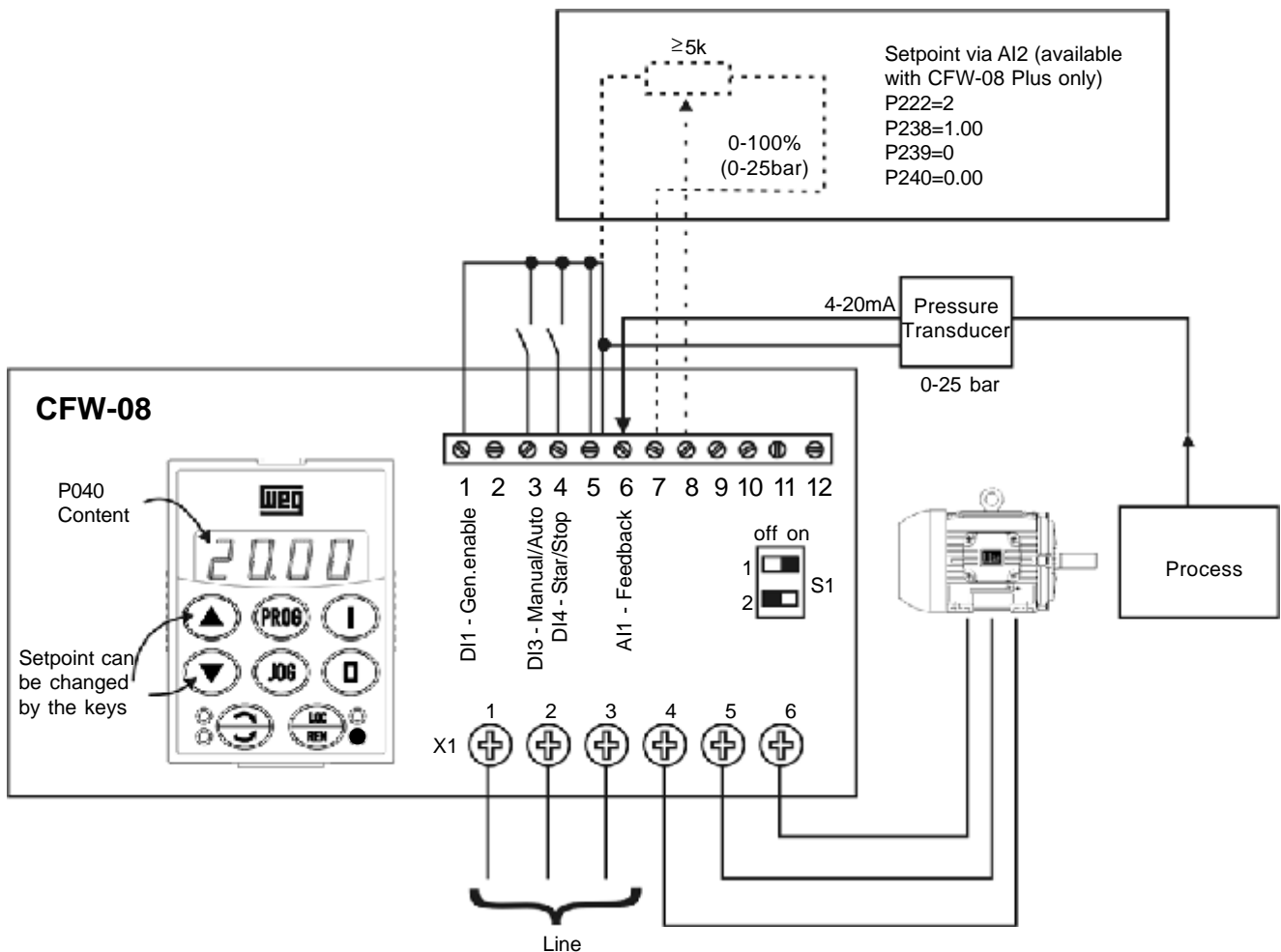
## DETAILED PARAMETER DESCRIPTION



### NOTE!

The inverter setting must be correct in order to obtain a good performance of the PID regulator. Ensure the following settings:

- ☑ torque boosts (P136 and P137) and slip compensation (P138) in the V/F control (P202=0 ou 1);
- ☑ ensure that the self-tuning has been run, if in vector control (P202=2);
- ☑ acceleration and deceleration ramps (P100...P103);
- ☑ current limitation (P169).



Remote mode operation (P220=1)



Setpoint via keypad.

Inverter Parametrization:

P220=1	P520=1.000
P222=0	P521=1.000
P234=1.00	P522=0.000
P235=1	P525=0
P238=0.00	P526=0.1s
P203=1	P527=0
P205=6	P528=25

Figure 6.26 - Application example of an inverter with PID regulator

## DETAILED PARAMETER DESCRIPTION

Parameter	Range [Factory Setting] Unit	Description / Notes															
<b>P520</b> PID Proportional Gain	0.000...7.999 [ <b>1.000</b> ] 0.001	<input checked="" type="checkbox"/> The integral gain can be defined as being the time required to change the PI regulator output from 0 to P134, that is given, in seconds, by the equation below: $t = \frac{16}{P521 \cdot P525}$															
<b>P521</b> PID Integral Gain	0.000...9.999 [ <b>1.000</b> ] 0.001	for the following conditions: <ul style="list-style-type: none"> <li>- P040=P520=0;</li> <li>- DI3 in automatic position.</li> </ul>															
<b>P522</b> PID Differential Gain	0.000...9.999 [ <b>0.000</b> ] 0.001																
<b>P525</b> The PID Setpoint	0.00...100.0% [ <b>0.00</b> ] 0.01%	<input checked="" type="checkbox"/> Provides the setpoint (reference) of the process via control via the  and  keys for the PID regulator, provided that P221=0 (local) or P222=0 (remote) has been set to automatic mode. If it has been set to Manual Mode, the frequency reference is given by P121. <input checked="" type="checkbox"/> If P120=1 (backup active), the value of P525 is maintained at the last set value (backup), even when the inverter is disabled or tuned off.															
<b>P526</b> Process Variable Filter	0.00...10.00s [ <b>0.10s</b> ] 0.01s	<input checked="" type="checkbox"/> It sets the time constant of the Process Variable Filter. <input checked="" type="checkbox"/> It is useful for noise filtering at the analog input AI1 (feedback of the process variable).															
<b>P527</b> PID Action	0...1 [ <b>0</b> ] -	<input checked="" type="checkbox"/> Defines the action type of the PID regulator. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>P527</th> <th>Action Type</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Direct</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Reverse</td> </tr> </tbody> </table> <input checked="" type="checkbox"/> Select it according to the table below: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Process variable requirement</th> <th>For this the motor speed must</th> <th>P527 to be used</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Increase</td> <td style="text-align: center;">Increase</td> <td style="text-align: center;">0 (Direct)</td> </tr> <tr> <td style="text-align: center;">Decrease</td> <td style="text-align: center;">Increase</td> <td style="text-align: center;">1 (Reverse)</td> </tr> </tbody> </table>	P527	Action Type	0	Direct	1	Reverse	Process variable requirement	For this the motor speed must	P527 to be used	Increase	Increase	0 (Direct)	Decrease	Increase	1 (Reverse)
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Increase	Increase	0 (Direct)															
Decrease	Increase	1 (Reverse)															
<b>P528</b> Process Variable Scale Factor	0.00...99.9 [ <b>1.00</b> ] 0.01(<10); 0.1 (>9.99)	<input checked="" type="checkbox"/> Defines the process variables scale. It makes the conversion between percentage value (used internally by the inverter) and the process variable unit. <input checked="" type="checkbox"/> P528 defines how the process variable at P040 will be shown: P040=value % x P528. <input checked="" type="checkbox"/> Set P528 to: $P528 = \frac{\text{full scale of the used sensor (FM)}}{P234}$															
<b>P536</b> Automatic Setting of P525	0...1 [ <b>0</b> ] -	<input checked="" type="checkbox"/> It is possible to enable/disable the copy of P040 (PID process variable) in P525 when the changing from manual to automatic mode using parameter P536, that is described below. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>P536</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Active (copies the value of P040 in P525)</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Inactive (does not copies the value of P040 in P525)</td> </tr> </tbody> </table>	P536	Function	0	Active (copies the value of P040 in P525)	1	Inactive (does not copies the value of P040 in P525)									
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## DIAGNOSTICS AND TROUBLESHOOTING

This chapter assists the user to identify and correct possible faults that can occur during the CFW-08 operation. Also instructions about required periodical inspections and cleaning procedures are also provided.

### 7.1 FAULTS AND POSSIBLE CAUSES

When a fault is detected, the inverter is disabled and the fault code is displayed on the readout in EXX form, where XX is the actual fault code.

To restart the inverter after a fault has occurred, the inverter must be reset. The reset can be made as follows:


- disconnecting and reapplying the AC power (power-on reset);
- by pressing the  key (manual reset);
- automatic reset through P206 (auto-reset);
- via digital input: DI3 (P265 = 10) or DI4 (P266 = 10).

The table below defines each fault code, explains how to reset the fault and shows the possible causes for each fault code.






**NOTE!**

The fault E22, E23, E25, E26, E27 and E28 are related to the serial communication and are described in Item 8.18.5.3.

FAULT	RESET <sup>(1)</sup>	POSSIBLE CAUSES
E00 Output Overcurrent (between phases or between phase and ground)	<input checked="" type="checkbox"/> Power-on <input checked="" type="checkbox"/> Manual (key  ) <input checked="" type="checkbox"/> Auto-reset <input checked="" type="checkbox"/> DI	<input checked="" type="checkbox"/> Short-circuit between two motor phases. <input checked="" type="checkbox"/> Short-circuit between ground and one of more output phases. <input checked="" type="checkbox"/> Motor cable capacitance to ground too high, causing peak current at the output (see note on next page) <input checked="" type="checkbox"/> Inertia of the load too high, or acceleration ramp too short. <input checked="" type="checkbox"/> P169 set too high. <input checked="" type="checkbox"/> Undue set of P136 and/or P137, when in V/F control (P202=0 or 1). <input checked="" type="checkbox"/> Undue set of P178 and/or P409 when in vector control (P202=2). <input checked="" type="checkbox"/> IGBT transistor module is short-circuited
E01 DC Link Overvoltage		<input checked="" type="checkbox"/> Power supply voltage too high, causing a DC link voltage higher than the allowed value: Ud>410V - 200-240V models Ud>820V - 380- 480V models <input checked="" type="checkbox"/> Load inertia too high or deceleration ramp too short. <input checked="" type="checkbox"/> Setting of P151 too high. <input checked="" type="checkbox"/> Load inertia too high and acceleration ramp too short (vector control - P202=2)
E02 DC Link Undervoltage		<input checked="" type="checkbox"/> Power supply voltage too low, causing a DC link voltage higher than the allowed value (read the value in parameter P004): Ud<200V - 200V - 240V models Ud<360V - 380V - 480V models

## DIAGNOSTICS AND TROUBLESHOOTING

FAULT	RESET <sup>(1)</sup>	POSSIBLE CAUSES
E04 Inverter Overtemperature	<input checked="" type="checkbox"/> Power-on <input checked="" type="checkbox"/> Manual (key  ) <input checked="" type="checkbox"/> Auto-reset <input checked="" type="checkbox"/> DI	<input checked="" type="checkbox"/> Ambient temperature too high (>40°C) and/or output current too high. <input checked="" type="checkbox"/> Blower locked or defective.
E05 Motor/Inverter Overload Ixt Function		<input checked="" type="checkbox"/> P156 set too low for the motor that is being used. <input checked="" type="checkbox"/> Motor is under an actual overload condition.
E06 External Fault		<input checked="" type="checkbox"/> Ani DI (DI3 and/or DI4) programmed for external fault detection is open (not connected to GND - XC1).
E08 CPU Error (Watchdog)		<input checked="" type="checkbox"/> Electrical noise.
E09 Program Memory Error (Checksum)	Contact WEG (refer to section 7.3)	<input checked="" type="checkbox"/> Memory with corrupted values.
E10 Keypad Error	<input checked="" type="checkbox"/> Power-on <input checked="" type="checkbox"/> Manual (key  ) <input checked="" type="checkbox"/> Auto-reset <input checked="" type="checkbox"/> DI	<input checked="" type="checkbox"/> Defective contact in the HMI-CFW08-RS cable. <input checked="" type="checkbox"/> Electrical noise in the installation (electromagnetic interference).
E14 Self-Tuning Fault	<input checked="" type="checkbox"/> Power-on <input checked="" type="checkbox"/> Manual (key  )	<input checked="" type="checkbox"/> Motor is not connected to the inverter output. <input checked="" type="checkbox"/> Wrong motor connection (wrong voltage, lack of one phase). <input checked="" type="checkbox"/> The used motor is too small for the inverter (P401 < 0.3 x P295). Use V/F control. <input checked="" type="checkbox"/> The value of P409 (stator resistance) is too high for the used inverter.
E24 Programming error	It is automatically reset when the incompatible parameters are changed	<input checked="" type="checkbox"/> Incompatible parameters were programmed Refer to table 5.1.
E31 Keypad (HMI) Connection Fault	It is reset automatically when the communication between inverter and the keypad is reestablished.	<input checked="" type="checkbox"/> Keypad cable misconnected. <input checked="" type="checkbox"/> Electrical noise in the installation (electromagnetic interference).
E41 Self- Diagnosis Fault	Contact WEG (refer to section 7.3)	<input checked="" type="checkbox"/> Inverter power circuit is defective.

**Note:**

(1) In case of E04 Fault due to inverter overtemperature, allow the inverter to cool down before trying to reset it.  
 In the types 10A/200-240 and 10A/380-480V fitted with internal Class A RFI-filters, the fault E04 can be caused by internal airflow overtemperature. Please check blower installed inside.



**NOTE!**

Long motor cables (longer than 150ft (50 m)) can generate excessive capacitance to ground. This can cause nuisance ground fault trip and consequently disabling by E00 fault immediately after the inverter has been enabled. Solution:

- Reduce the switching frequency (P297).
- Connect a load reactor in series with the motor supply line.  
Refer to Section 8.16.



# DIAGNOSTICS AND TROUBLESHOOTING



## NOTE!

The faults act as follows:

- E00 ... E06: switches off the relay that has been programmed to “no fault”, disables the PWM pulses, displays the fault code on the display and the “ERROR” LED flashes.  
 Some data are saved on the EEPROM memory: keypad reference and EP (electronic potentiometer) (when the function “backup of the references” at P120 has been enabled), the occurred fault number, the status of the integrator of the IxT function (overcurrent).
- E24: Indicates the fault code on the LED display.
- E31: Inverter proceeds to operate normally, but it does not accept the keypad commands; the fault code is indicated on the LED display.
- E41: does not allow inverter operation (it is not possible to enable the inverter); the fault code is indicated on the LED display and on the “ERROR” LED.

Indication on the Inverter Status LEDs:

Power LED	Error LED	Description
		Inverter is powered up and is ready
	 (Flashing)	A fault has been detected. The Error LED flashes, indicating the number of the fault code. Example: E04 

## 7.2 TROUBLESHOOTING

PROBLEM	POINT TO BE CHECKED	CORRECTIVE ACTION
Motor does not run	Incorrect wiring	1. Check the power and the control connections. For example, the digital inputs DIx programmed for Start/Stop or General Enable or No External Fault must be connected to GND (pin 5 of the control connector XC1).
	Analog reference (if used)	1. Check if the external signal is properly connected. 2. Check the status of the speed potentiometer (if used).
	Incorrect Programming	1. Check if the parameters are properly programmed for the application.
	Fault	1. Check if the inverter has not been disabled due to detected fault condition (refer to Table above).
	Motor Stall	1. Reduce the motor load. 2. Increase P169 or P136/P137.



## DIAGNOSTICS AND TROUBLESHOOTING



### ATTENTION!

Electronic boards have components sensitive to electrostatic discharges. Never touch the components or connectors directly. If this is unavoidable, first touch the metallic frame or use a suitable ground strap.

**Never apply a high voltage test on the inverter!  
If this is necessary, contact WEG.**

To avoid operation problems caused by harsh ambient conditions, such as high temperature, moisture, dirt, vibration or premature ageing of the components, periodic inspections of the inverter and installations are recommended.

COMPONENTS	PROBLEMS	CORRECTIVE ACTIONS
Terminal blocks	Loose screws	Tighten them
	Loose connectors	
Blowers (1) / Cooling system	Blowers are dirty	Clean them
	Abnormal acoustic noise	Replace the blowers
	Blower is not running	
	Abnormal vibration	
	Dust in the air filters	Clean or replace them
Printed circuit boards	Dust, oil or moisture accumulation	Clean them and/or replace them
	Smell	Replace them

**Table 7.1** - Periodic inspection after start-up

**Notes:**

(1) It is recommended to replace the blowers after 40,000 hours of operation.



### ATTENTION!

If the inverter is stored for long periods, we recommend to power it up once a year during 1 hour. For all models (200-240V or 380-480V) apply supply voltage of approx. 220V, three-phase or single phase input, 50 or 60 Hz, without connecting motor at output. After this energization, wait 24 hours before installing it.

### 7.4.1 Cleaning Instructions

When required to clean the inverter, flow the instructions below:

a) Cooling System:

- Remove AC power from the inverter and wait 10 minutes.
- Remove all dust from ventilation openings by using a plastic brush or a soft cloth.
- Remove dust accumulated on the heatsink fins and from the blower blades with compressed air.

b) Electronic Boards:

- Remove AC power from the inverter and wait 10 minutes.
- Disconnect the inverter cables, ensuring that they are marked carefully to facilitate later reconnection.
- Remove the keypad and the plastic cover (refer to section 3).
- Remove all dust from the printed circuit boards by using an anti-static soft brush and/or remove it with an ionized compressed air gun; (for example: Charges Burtes Ion Gun (non nuclear) Ref. A6030-6 DESCO).

**CFW-08 OPTIONS AND ACCESSORIES**

This Chapter describes the optional devices that can be used internal or external with the CFW-08 . Table below shows a list of existing optional devices and the types to which they are applied. Are also given information about the optional devices and their application.

Name	Function	Models to which are applied	WEG Item Number
HMI-CFW08-P	Parallel keypad (HMI)	All	417100868
TCL-CFW08	Over to be inserted in the place of the parallel HMI (when it is mounted in the inverter or it is remote - kit KMR-CFW08-P).		417100881
HMI-CFW08-RP	HMI parallel keypad. For remote use with MIP-CFW08-RP interface and CAB-CFW08-RP (up to 10m).		417100991
MIP-CFW08-RP	Interface for the external parallel keypad (remote) HMI-CFW08-RP		417100990
HMI-CFW08-RS	HMI serial keypad. For remote use with MIS-CFW08-RS interface and CAB-RS (up to 10m). Copy Function.		417100992
MIS-CFW08-RS	Interface for the external serial keypad (remote) HMI-CFW08-RS		417100993
CAB-RS-1	Cable for the remote serial keypad - cable: 1m		0307.7827
CAB-RS-2	Cable for the remote serial keypad - cable: 2m		0307.7828
CAB-RS-3	Cable for the remote serial keypad - cable: 3m		0307.7829
CAB-RS-5	Cable for the remote serial keypad - cable: 5m		0307.7830
CAB-RS-7.5	Cable for the remote serial keypad - cable: 7.5m		0307.7831
CAB-RS-10	Cable for the remote serial keypad - cable: 10m		0307.7832
CAB-RP-1	Cable for the remote parallel keypad - cable: 1m		0307.7711
CAB-RP-2	Cable for the remote parallel keypad - cable: 2m		0307.7712
CAB-RP-3	Cable for the remote parallel keypad - cable: 3m		0307.7713
CAB-RP-5	Cable for the remote parallel keypad - cable: 5m		0307.7833
CAB-RP-7.5	Cable for the remote parallel keypad - cable: 7.5m		0307.7834
CAB-RP-10	Cable for the remote parallel keypad - cable: 10m		0307.7835
KCS-CFW08	RS-232 communication interface (PC, PLC, etc). RS-485 possible when module MIW-02 is used.		417100882
KSD-CFW08	RS-232 PC Communication kit : interface RS-232 (KCS-CFW08), cable RJ-6 to DB9, 3m long, software "SUPERDRIVE".		417100875
KMD-CFW08-M1	Rail Kit -DIN EN 50.022	1.6-2.6-4.0-7.0A/ 200-240V 1.0-1.6-2.6-4.0A/ 380-480V	417100879
KFIX-CFW08-M1	Fix Kit -M1	1.6-2.6-4.0-7.0A/ 200-240V 1.0-1.6-2.6-4.0A/ 380-480V	417100994
KFIX-CFW08-M2	Fix Kit - M2	7.3-10-16A/ 200-240V 2.7-4.3-6.5-10A/ 380-480V	417100995
KN1-CFW08-M1	Kit NEMA 1/IP20 for the connection of the metallic conduit -M1	1.6-2.6-4.0-7.0A/ 200-240V 1.0-1.6-2.6-4.0A/ 380-480V	417100877
KN1-CFW08-M2	Kit NEMA1/IP20 for the connection of the metallic conduit -M2	7.3-10-16A/ 200-240V 2.7-4.3-6.5-10A/ 380-480V	417100880
MIW-02	RS-232 to RS-485 conversion module (external). CFW-08 must be fitted with KCS-CFW08 module.	All	417100543

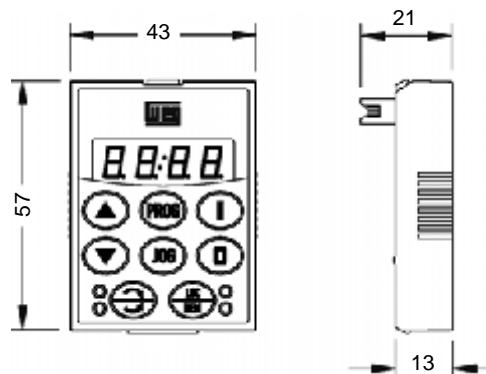
## CFW-08 OPTIONS AND ACCESSORIES

Name	Function	Models to which are applied	WEG Item Number
FIL1	Internal class A suppressor filter RFI - A - 7.3A/200-240V	7.3-10A/200-240V	4151.2661
FIL2	Internal class A suppressor filter RFI- A - 2.7-4.3-6.5-10A/380-480V	2.7-4.3-6.5-10A/380-480V	4151.0994
FIL4	Internal class A suppressor filter - RFI - 13-16A/380-480V	13-16A/380-480V	4151.2148
FEX1-CFW08	10A/200-240V class A RFI filter - footprint	1.6-2.6-4.0A/200-240V	41718238
FEX2-CFW08	5A/380-480V class A RFI filter - footprint	1.0-1.6-2.6-4.0A/380-480V	41718239
FS6007-16-06	External class B suppressor filter - RFI - 1.6-2.6-4.0A/200-240V	1.6-2.6-4.0A/200-240V	0208.2072
FN3258-7-45	External class B suppressor filter - RFI - 1.0-1.6-2.6-2.7-4.0-4.3A/380-480V	1.0-1.6-2.6-2.7-4.0-4.3A/380-480V	0208.2075
FS6007-25-08	External class B suppressor filter - RFI - 7.3A/200-240V single-phase	7.3A/200-240V	0208.2073
FS6007-36-08	External class B suppressor filter - RFI - 10A/200-240V single-phase	10A/200-240V	0208.2074
FN3258-16-45	External class B suppressor filter - RFI - 6.5-10-13A/380-480V	6.5-10-13A/380-480V, 7A/200-240V, 7.3-10A/200-240V three-phase	0208.2076
FN3258-30-47	External class B suppressor filter - RFI - 16A/380-480V	16A/200-240V; 16A/380-480V	0208.2077
TOR1-CFW08	CM choke toroid #1 (Thornton NT35/22/22-4100-IP12R) and plastic clamp	2.7-4.3-6.5-10A/380-480V	417100895
TOR2-CFW08	CM choke toroid #2 (Thornton NT52/32/20-4400-IP12E)	2.7-4.3-6.5-10-13-16A/380-480V	417100896

**Table 8.1** - Available Optional Devices for the CFW-08

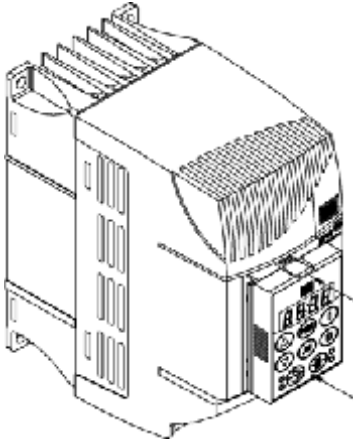
### 8.1 HMI-CFW08-P

**Parallel keypad (HMI):** is the keypad that is mounted at the front side of the inverter.

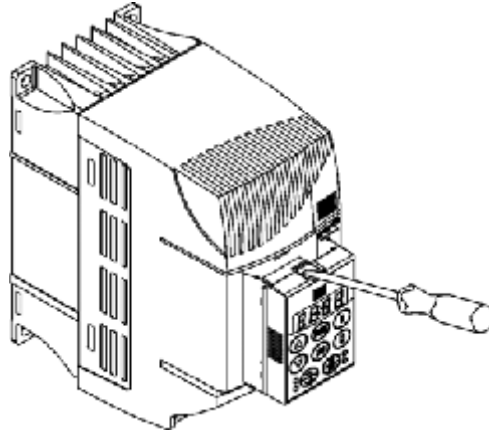


**Figure 8.1** - Dimensions of the parallel HMI - HMI-CFW08-P

## 8.1.1 Instruction for Insertion and Removing of the HMI-CFW08-P



1. Place the keypad as shown above.
  2. Press it.
- (a) Insertion**

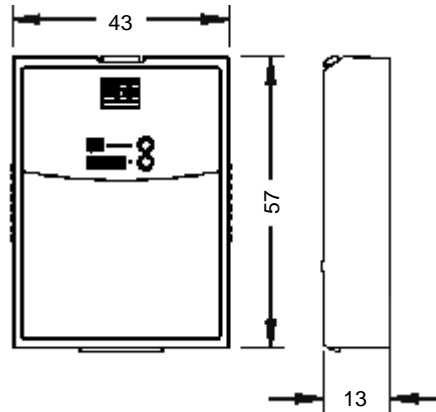


1. Unlock the keypad by using a screwdriver as shown above.
  2. Remove the keypad by pulling on the lateral sides.
- (b) Removing**

**Figure 8.2** - Instructions for HMI-CFW-08-P insertion and removing

## 8.2 TCL-CFW08

Dummy panel to be inserted in the place of the parallel keypad (HMI-CFW08-P).



**Figure 8.3** - Dimensions of the dummy panel TCL-CFW08 for the parallel HMI

## 8.3 HMI-CFW08-RP

**External parallel keypad:** this keypad is mounted externally to the inverter and can be used in the following cases:

- Applications that require a remote keypad (up to 10m / 394in);
  - Installation of a keypad directly on the panel door (0,12in);
  - For a better visualization on the display and to facilitate the key operation, when compared with the parallel keypad (HMI-CFW08-P).
- The external parallel keypad (HMI-CFW08-RP) must be used with the MIP-CFW08-RP interface and CAB-RP-X cable.

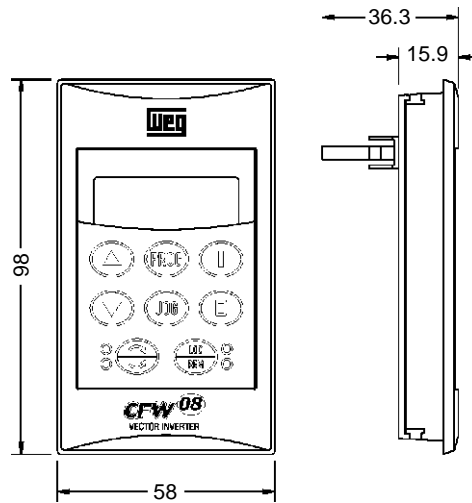


Figure 8.4 - Dimensions of the HMI-CFW08-RP

### 8.3.1 HMI-CFW08-RP Installation

The HMI-CFW08-RP can be installed directly on the panel door (0,12in), as shown in the figures below:

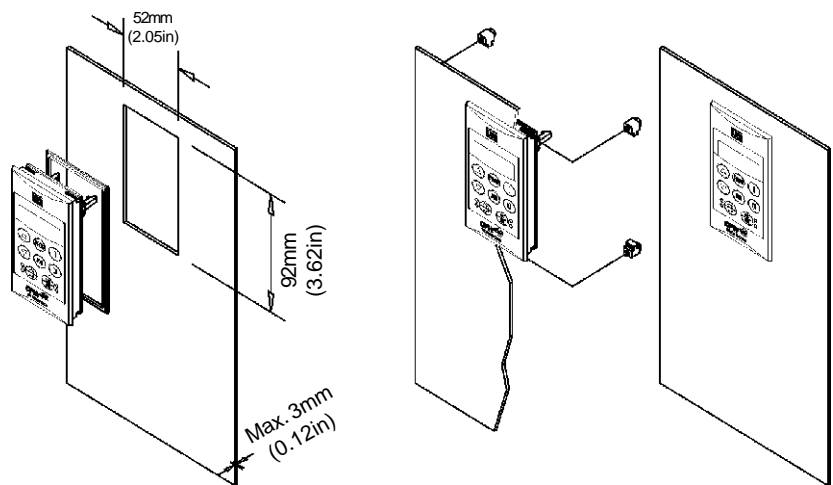


Figure 8.5 - Installation of the HMI-CFW08-RP

### 8.4 MIP-CFW08-RP

**Isolation interface:** Isolation interface installed in the inverter instead of the standard keypad only when the remote parallel keypad (HMI-CFW08-RP) is used.

The procedures for insertion and removing of the MIP-CFW08-RP are similar to those shown in figure 8.13 for the KCS-CFW08 module.

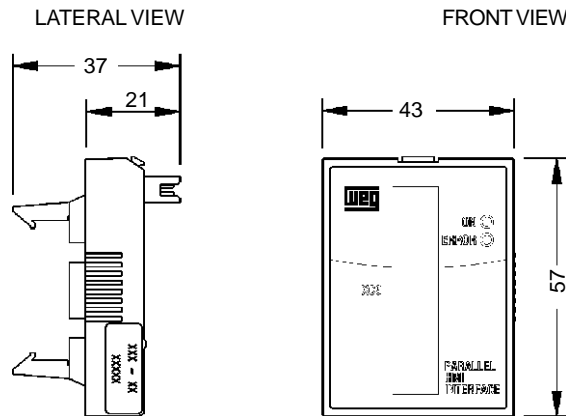


Figure 8.6 - Dimensions of the MIP-CFW08-RP

- 8.5 CAB-RP-1
- CAB-RP-2
- CAB-RP-3
- CAB-RP-5
- CAB-RP-7.5
- CAB-RP-10

Cables used to connect the inverter to the external parallel interface keypad (HMI-CFW08-RP).

There are 6 cables options ranging in lengths from 1m (39in) to 10m (394in). The user must select among these lengths according to his requirement.

The cable CAB-RP must be laid separately from the power wiring by meeting the requirements for the control wiring (refer to item 3.2.4).

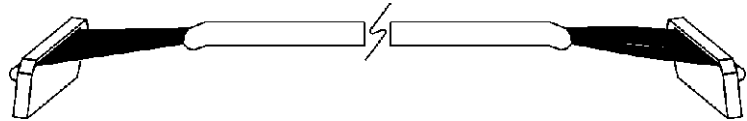


Figure 8.7 - CAB-RP-X

## 8.6 HMI-CFW08-RS

**External serial keypad:** this interface is mounted external to the inverter and must be used when the copy function is needed:

- For more details about copy function refer to the description of the parameter P215 in section 6.

It operates with the MIS-CFW08-RS and the cable CAB-RS-X, which length must be chosen according to the needs (up to 10m).

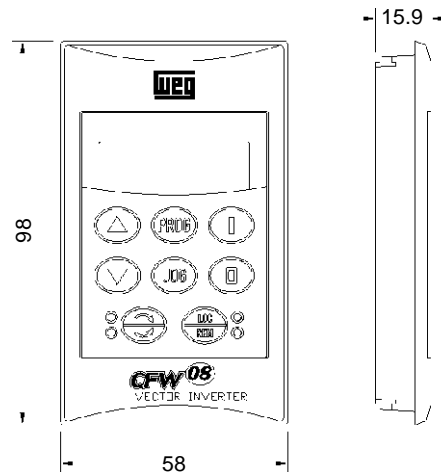
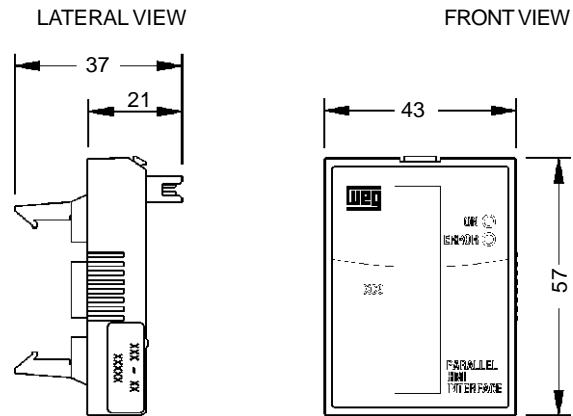


Figure 8.8 - Dimensions of the HMI-CFW08-RS





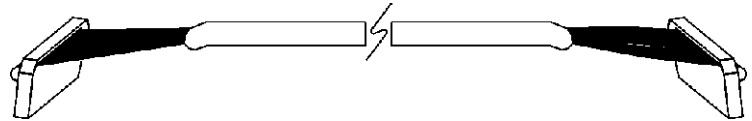
**Figure 8.6** - Dimensions of the MIP-CFW08-RP

- 8.5 CAB-HMI08-RP-1
- CAB-HMI08-RP-2
- CAB-HMI08-RP-3
- CAB-HMI08-RP-5
- CAB-HMI08-RP-7.5
- CAB-HMI08-RP-10

Cables used to connect the inverter to the external parallel interface keypad (HMI-CFW08-RP).

There are 6 cables options ranging in lengths from 1m (39in) to 10m (394in). The user must select among these lengths according to his requirement.

The cable CAB-HMI08-RP must be laid separately from the power wiring by meeting the requirements for the control wiring (refer to item 3.2.4).



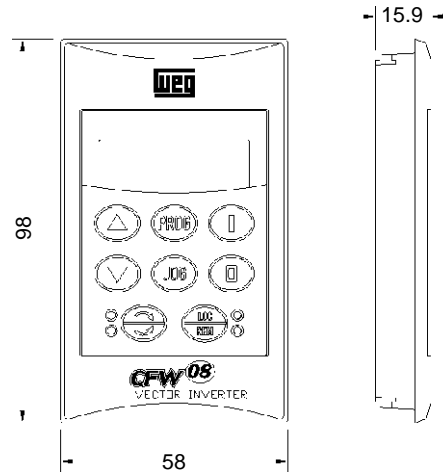
**Figure 8.7** - CAB-CFW08-RP

**8.6 HMI-CFW08-RS**

**External serial keypad:** this interface is mounted external to the inverter and must be used when the copy function is needed:

- For more details about copy function refer to the description of the parameter P215 in section 6.

It operates with the MIS-CFW08-RS and the cable CAB-RS-X, which length must be chosen according to the needs (up to 10m).



**Figure 8.8** - Dimensions of the HMI-CFW08-RS

Function via HMI-CFW08-RS	Local Mode	Remote Mode
Frequency reference	P221 = 0	P222 = 0
Commands (*)	P229 = 2	P230 = 2
Forward/Reverse Selection	P231 = 2	
Loca/Remote Selection	P220 = 5 (default local) or P220 = 6 (default remote)	

Note:

Factory setting

(\*) Except the forward/reverse selection that also depends on the parameter P231.

**Table 8.2** - Parameter setting for HMI-CFW08-RS operation

### 8.6.3 Keypad Copy Function

The HMI-CFW08-RS keypad still has an additional function: the keypad copy function. This function is useful when one wants to copy the settings of one inverter (source inverter) to another (target inverter) or one needs to program several inverters with the same settings.

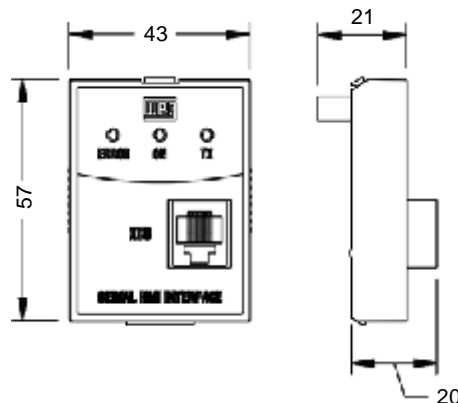
This is done as follows: the parameters of the source inverter are copied to a non-volatile memory of the HMI-CFW08-RS keypad, and then from this keypad to another inverter ("target inverter"). The keypad copy function is controlled by the parameter P215.

For further information on this function refer to section 6.

### 8.7 MIS-CFW08-RS

Serial interface used exclusively for HMI-CFW08-RS keypad connection to inverter.

The procedures for insertion and removing of the MIS-CFW08-RS are similar to those shown in Figure 8.13 for the KCS-CFW08 module.



**Figure 8.11** - Dimensions of the MIS-CFW08 serial communication module for the external serial HMI

- 8.8 CAB-RS-1
- CAB-RS-2
- CAB-RS-3
- CAB-RS-5
- CAB-RS-7.5
- CAB-RS-10

Cables used to connect the inverter to the external serial interface keypad (HMI-CFW08-RS). There are 6 cable options ranging in lengths from 1m to 10 m. The user must select among these lengths according to his requirement.

The cable CAB-RS must be laid separately from the power wiring by meeting the requirements for the control wiring (refer to item 3.2.4).



**Figure 8.12-** CAB-HMI08-S cable the HMI-CFW08-RS

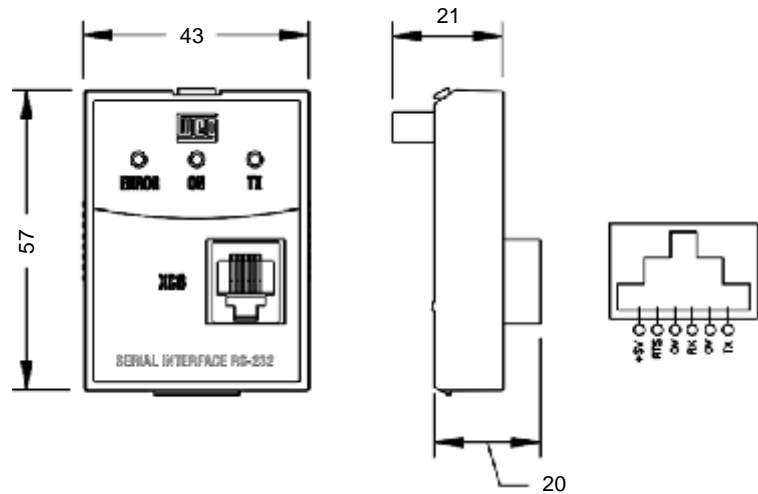
## 8.9 KCS-CFW08

Serial communication module RS-232: is inserted in the place of the parallel keypad, enabling the RS-232 connection (connector RJ-6).

The RS-232 serial interface enables the point-to-point connection (inverter - master). It is galvanically isolated and enables the use of interconnecting cables in lengths up to 10 m.

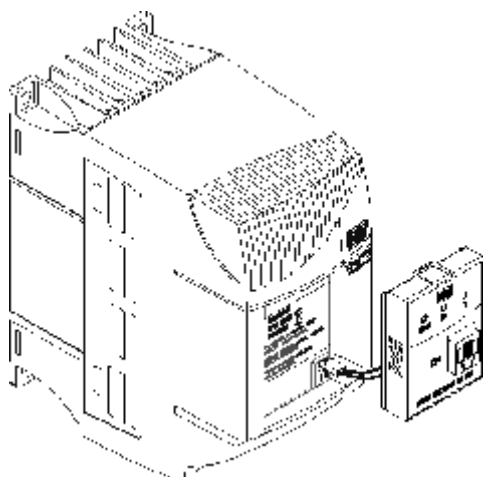
Through the RS-232 serial interface you can control, set parameters and monitor the CFW-08. The communication protocol is based on the communication by enquiry/response (master/slave), according to ISO 1745, ISO 646, with character exchange of type ASCII between the inverter (slave) and the master. The Master can be a PLC, a PC, etc. The maximum transfer rate is 38400 bps.

For the RS-485 serial communication, both point-to-point (an inverter and a master) or multipoint (up to 30 inverters and one master), you can connect the KCS-CFW08 module to an external MIW-02 module - for more details, refer to section 8.13.

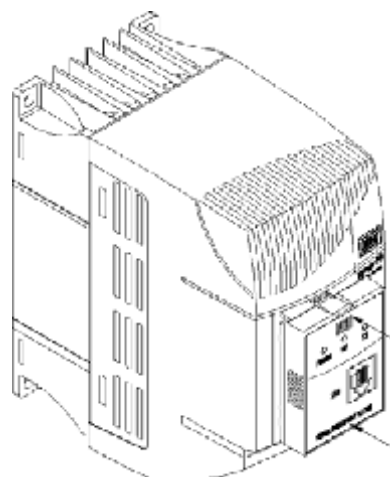


**Figure 8.13 -** Dimensions of the RS-232 serial communication module KCS-CFW08 and RJ(XC8) signal connector

### 8.9.1 Instructions for KCS-CFW08 Insertion/Removal

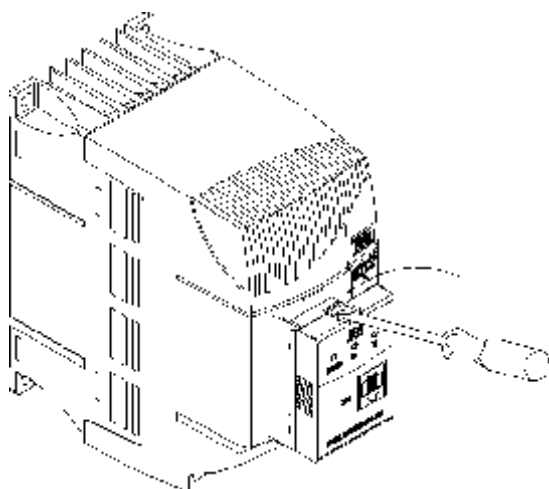


-Connect the cable of the communication module to XC5

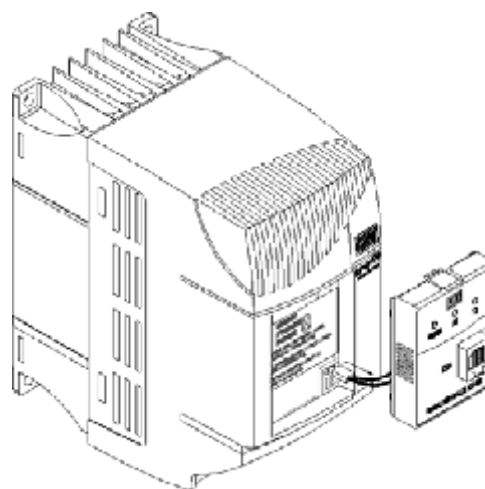


- Place the communication module as shown in figure above.  
- Press it.

#### (a) Insertion



- Use a screwdriver to unlock the communication module.  
- Remove the module by pulling it on the lateral sides



- Remove the cable from the XC5 connector.

#### (b) Removing

**Figure 8.14** - Insertion and removal of the serial communication module RS-232 KCS-CFW08

### 8.10 KSD-CFW08

The complete kit, that enables the connection of the CFW-08 to a PC via RS-232 contains:

- Serial communication module RS-232 (KCS-CFW08);
- 3m cable RJ-6 for the DB9;
- Software "SUPERDRIVE" for Windows 95/98, Windows NT Workstation V4.0 (or later operational system), that enables the CFW-08 programming, operating and monitoring.

## CFW-08 OPTIONS AND ACCESSORIES

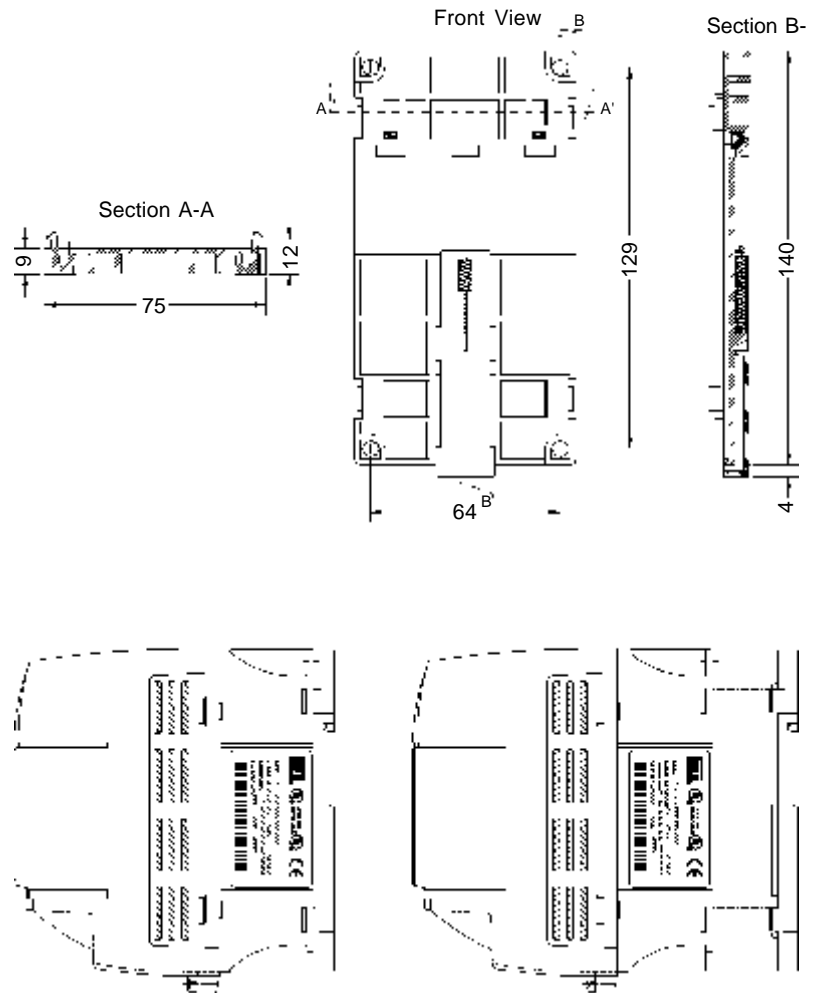
To install the RS-232 communication kit on the PC, proceed as follows:

- Remove the parallel keypad (HMI-CFW08-P) from the inverter.
- Install the serial communication module RS-232 (KCS-CFW08) in the place of the keypad.
- Install the software "SUPERDRIVE" in the PC.
- Connect the inverter to the PC through the cable.
- Follow the instruction given by the "SUPERDRIVE".

### 8.11 KMD-CFW08-M1

This device must be used when the installation of the inverter on 35mm rail, according to DIN EN 50.022, is desired

Only available for the models: 1.6-2.6-4.0-7.0A/ 200-240V and  
1.0-1.6-2.6-4.0A/380-480V



**Figure 8.15** - Inverter with DIN rail kit (KMD-CFW-08-M1)

### 8.12 KFIX-CFW08-M1 KFIX-CFW08-M2

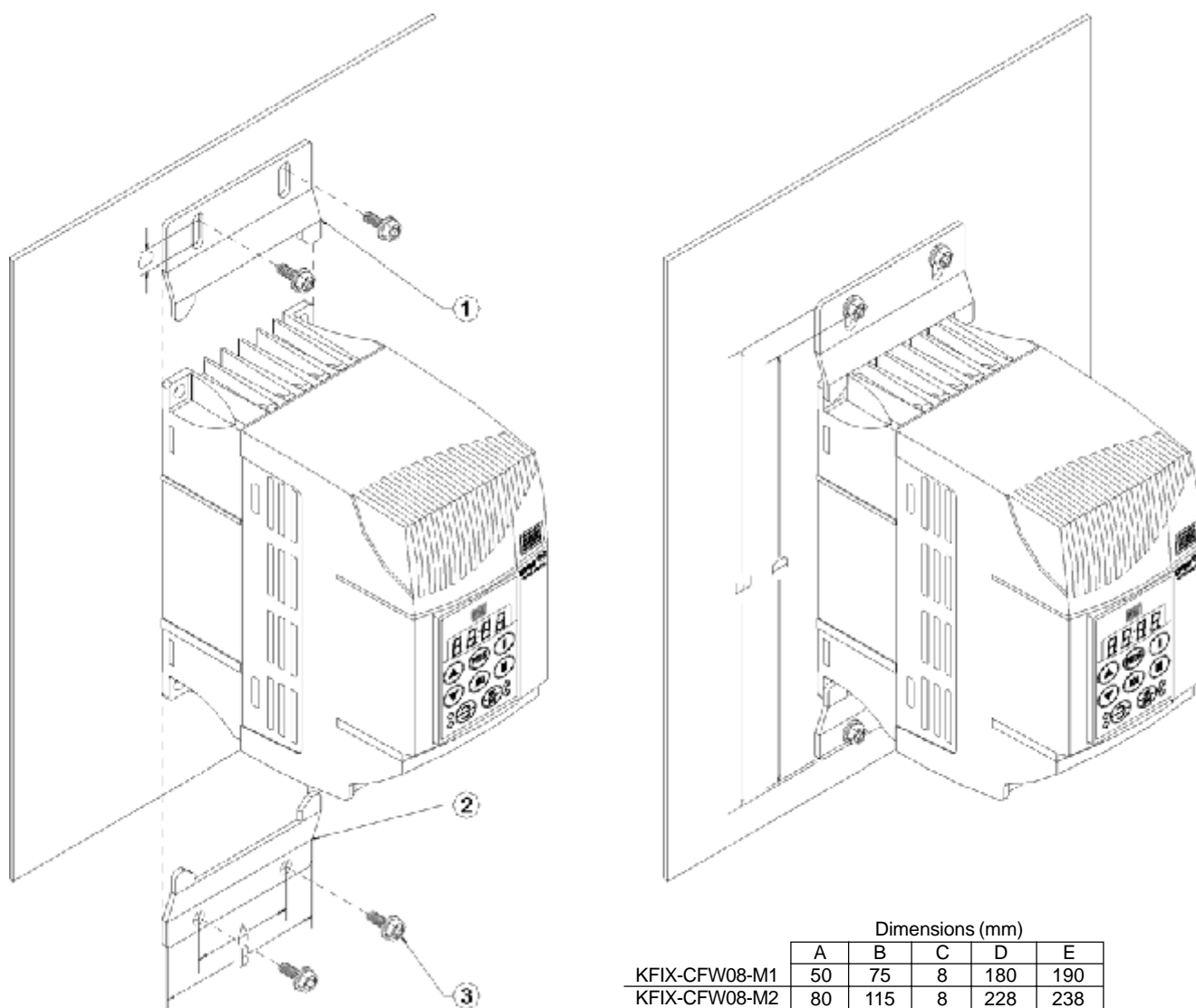
This kit must be used when a better access to the screw hole of the inverter is needed. Models that used this kit:

KFIX-CFW08-M1

1,6 - 2,6 - 4,0 - 7,0A/200-240V; 1,0 - 1,6 - 2,6 - 4,0A/380-480V

KFIX-CFW08-M2

7,3 - 10 - 16A/200-240V; 2,7 - 4,3 - 6,5 - 10A/380-480V



**Figura 8.16 - Dimensions of the inverter with the kit  
(KFIX-CFW08-MX)**

## CFW-08 OPTIONS AND ACCESSORIES

### 8.13 KN1-CFW08-M1 KN1-CFW08-M2

This kit is used, when a NEMA 1/IP20 degree of protection is desired for the inverter or when for the inverter wiring metallic conduits are desired.

Models that use this kit:

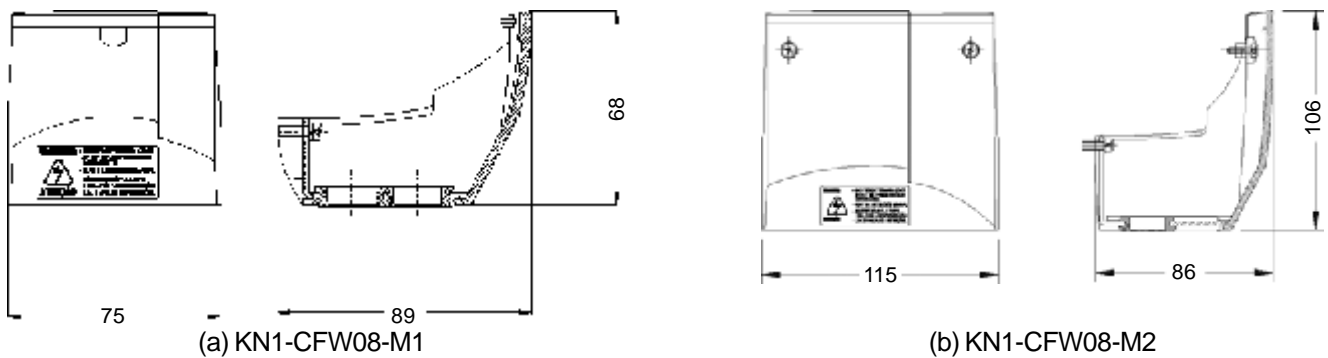
KN1-CFW08-M1:

1.6-2.6- 4.0-7.0/220-240V; 1.0-1.6-2.6-4.0/380-480V

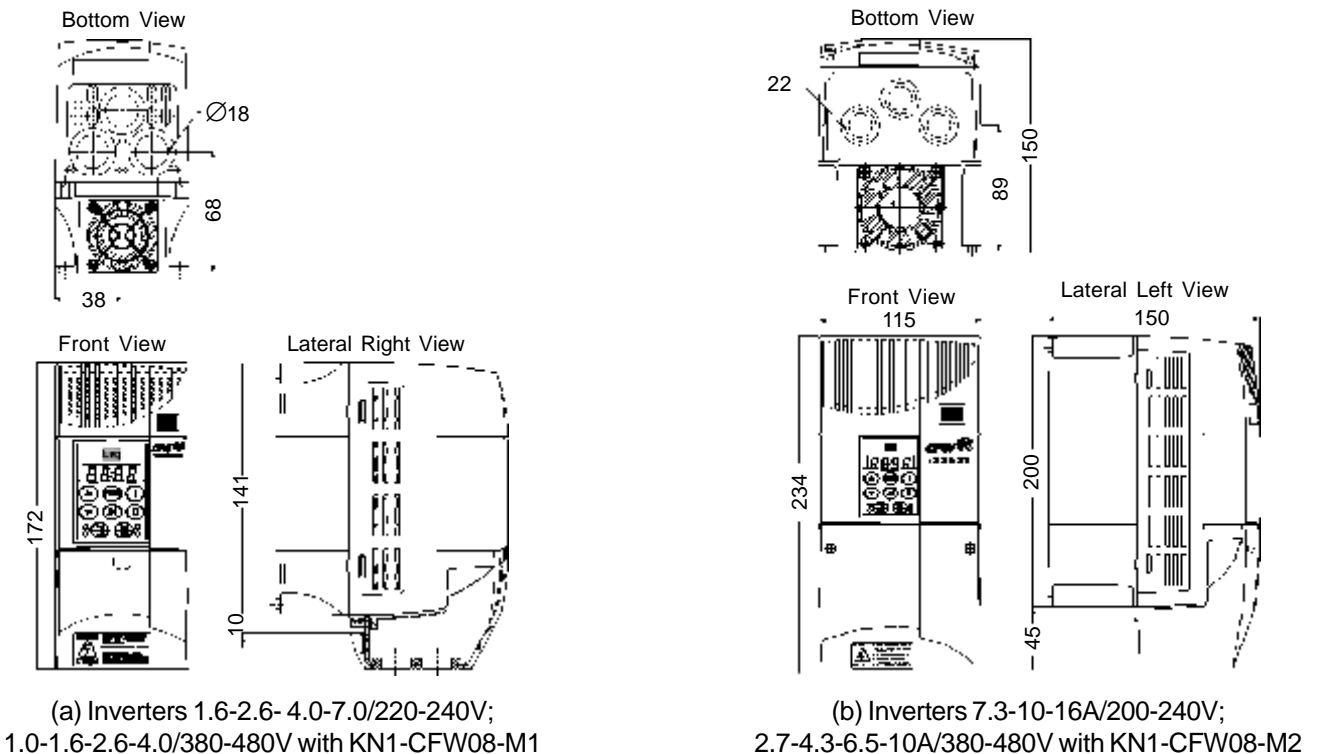
KN1-CFW08-M2:

7.3-10-16A/200-240V; 2.7-4.3-6.5-10A/380-480V

Models 13 and 16A/380-480V have Nema 1/IP20 degree of protection in the standard version.



**Figure 8.17** - Dimensions of the NEMA1/IP20 kits

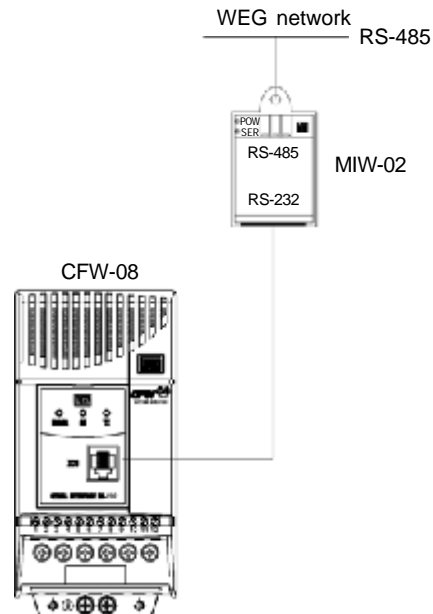


**Figure 8.18** - External dimensions of the inverter with NEMA1/IP20 kit

### 8.14 MIW-02

External module for conversion from RS-232 to RS-485: it allows the connection of the CFW-08, when fitted with RS-232 serial module (KCS-CFW08) to a standard RS-485 line.

So the inverter can participate in a multipoint line up to 1000m without the use of transducers. For more details about this connection, see item 8.18.7 and the MIW-02 USER MANUAL. The communication protocols supported by this serial interface are detailed in items 8.18 WEG and 8.19 RTU-Modbus.



**Figure 8.19** - Connection of the CFW-08 to a standard RS-485 communication network

### 8.15 RFI FILTER

The installation of frequency inverters requires some care in order to prevent electromagnetic interferences (EMI).

This electromagnetic interference may disturb the operation of the inverter itself or other devices, such as electronic sensors, PLCs, transducers, radio equipment, etc. installed in the proximity.

To avoid these troubles, follow the installation instructions contained in this Manual.

In this case, avoid the installation of electromagnetic noise generating circuits, such as power cables, motors, etc. near to signal or control cables.

Care should also be taken with the radiated interference, by shielding the cables and the circuits that tend to emit electromagnetic waves and can cause interference.

The electromagnetic interference can also be transmitted through power supply line. This type of interference is minimized in the most cases by capacitive filters which are already installed inside the CFW-08.

However, when inverters are installed in residential areas, the installation of additional filter may be required.

These filters may be installed internally (on some types) or externally.

As defined in standards, the Class B filter has more attenuation capacity than the Class A filter, thus being more suitable for residential areas.

Section 8.1 lists the available RFI filters with the respective inverter models. The inverters with internal Class A filters have the same external dimensions as the inverters without filter.

The external Class B filters must be installed between the power supply line and the inverter input, as shown in Figure 8.18 below.

Instructions for the RFI filter installation:

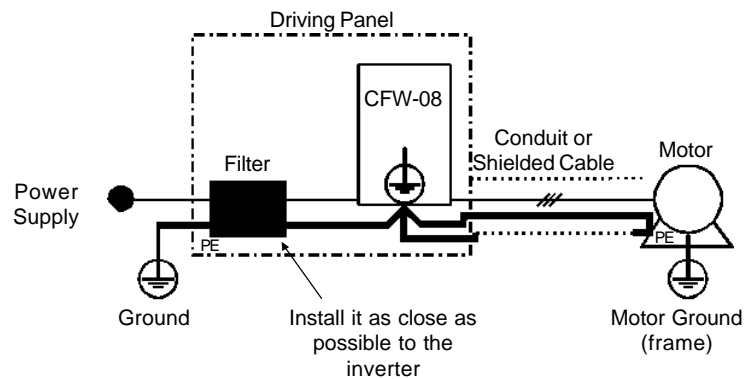
- ☑ Install the inverter and the filter on a metallic grounded plate as near to each other as possible and ensure a good electrical contact between the grounded plate and the inverter and filter frames.
- ☑ For motor connection use a shielded cable or individual cables inside a grounded metallic conduit.





### NOTE!

For installations that must meet the European standards refer to item 3.3.



**Figure 8.20** - Connection of the external RFI filter - Class B

## 8.16 LINE REACTOR

Due to the input circuit characteristic, common to the most inverters available on the market, consisting of a diode rectifier and a capacitor bank, the input current (drained from the power supply line) of inverters is a non sinusoidal waveform and contains harmonics of the fundamental frequency (frequency of the power supply - 60 or 50Hz).

These harmonic currents circulate through the power supply line and cause harmonic voltage drops which distort the power supply voltage of the inverter and other loads connected to this line. These harmonic currents and voltage distortions may increase the electrical losses in the installation, overheating the components (cables, transformers, capacitor banks, motors, etc.), as well as lowering the power factor.

The harmonic input currents depend on the impedance values that are present in the rectifier input/output circuit.

The installation of a line reactor reduces the harmonic content of the input current, providing the following advantages:

- ☑ increasing the input power factor;
- ☑ reduction of the RMS input current;
- ☑ reduction of the power supply voltage distortion;
- ☑ increasing the life of the DC link capacitors.
- ☑ reduction of the overvoltage transients that may occur in the power supply line.

### 8.16.1 Application Criteria

In a general manner, the CFW-08 series inverters can be connected directly to the power supply line without line reactors. But in this case, ensure the following:

- ☑ To ensure the inverter expected life, a **minimum line impedance** that introduces a voltage drop as shown in table 8.3, as a function of the motor load, is recommended. If the line impedance (transformers + wirings) is lower than these values, it is recommended to use line reactor(s).
- ☑ When it is necessary to add a line reactor to the system, it is **recommended** to size it considering a 2 to 4% voltage drop (for nominal output current). This practice results in a compromise between motor voltage drop, power factor improvement and harmonic current distortion reduction.

This practice results in a compromise between motor voltage drop, power factor improvement and harmonic current distortion reduction.

- ☑ Always add a line reactor, when capacitors for power factor correction are installed in the same line and near to the inverter.
- ☑ Figure 8.19 shows the line reactor connection to the input.
- ☑ Use the following equation to calculate the value of the line reactor necessary to obtain the desired percentage of the voltage drop:

$$L = 1592 \times \frac{\Delta V}{f} \times \frac{V_e}{I_{s, nom}} \text{ [\mu H]}$$

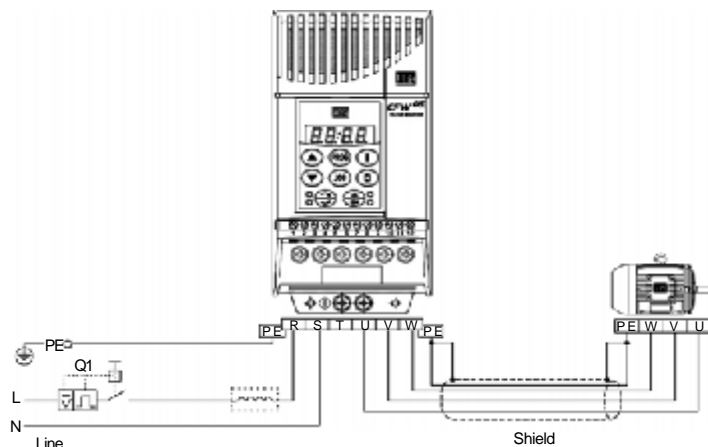
where:

- $\Delta V$  - desired line voltage drop, in percentage (%);
- $V_e$  - **phase voltage** at inverter input (line voltage), given in Volts (V);
- $I_{s, nom}$  - rated inverter output current;
- $f$  - line frequency.

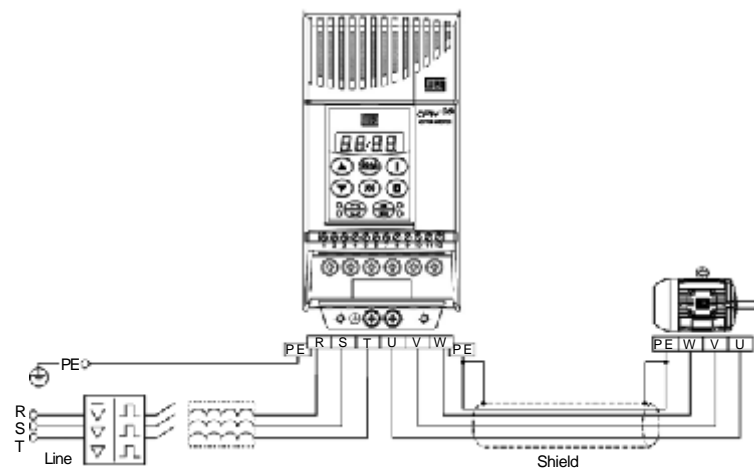
Inverter	Minimum Line Impedance		
	With rated load at the inverter output ( $I_s = I_{s, nom}$ )	With 80% of the rated load at the inverter output ( $I_s = 0,8I_{s, nom}$ )	With 50% of the rated load at the inverter output ( $I_s = 0,5I_{s, nom}$ )
1.6A / 220-240V	0.25%	0.1%	0.5%
2.6A / 220-240V	0.1%	0.05%	
4.0A / 220-240V	1.0%	0.5%	
7.0A / 220-240V	0.5%	0.25%	
7.3A / 220-240V	1.0%	0.25%	
10A / 220-240V	0.5%	0.25%	
16A / 220-240V	1.0%	0.5%	
1.0A / 380-480V	0.05%	0.05%	
1.6A / 380-480V	0.05%	0.05%	
2.6A / 380-480V	0.1%	0.05%	
2.7A / 380-480V	0.25%	0.1%	
4.0A / 380-480V	1.0%	0.5%	
4.3A / 380-480V	1.0%	0.5%	
6.5A / 380-480V	0.5%	0.25%	
10A / 380-480V	0.5%	0.25%	
13A / 380-480V	0.5%	0.25%	
16A / 380-480V	1.0%	0.5%	

Note: These values ensure a life of 20,000 hour for the DC link capacitors, i.e., they can be operated during 5 years with operation of 12 hours per day.

**Table 8.3** - Minimum network impedance for several load conditions.



(a) Single-phase power supply models



(b) Three-phase power supply models

**Figure 8.21** - Power connection with line reactor at the input

As an **alternative criterion**, we recommend to add a line reactor always the transformer that supplies the inverter has rated output higher than indicated in table below.

Inverter Model	Transformer Apparent Power [kVA]
1.6A and 2.6A/200-240V	30 x rated inverter apparent power [kVA]
4A/200-240V	6 x rated inverter apparent power [kVA]
7A and 7.3A/200-240V	10 x rated inverter apparent power [kVA]
10A/200-240V	7.5 x rated inverter apparent power [kVA]
16A/200-240V	4 x rated inverter apparent power [kVA]
1A; 1.6A and 2.6A/380-480V	30 x rated inverter apparent power [kVA]
4.0 and 4.3A/380-480V	6 x rated inverter apparent power [kVA]
2.7A/380-480A	15 x rated inverter apparent power [kVA]
6.5;10A and 13A/380-480	7.5 x rated inverter apparent power [kVA]
16A/380-480	4 x rated inverter apparent power [kVA]

Note: The value for the rated apparent power can be obtained in section 9.1 of this manual.

**Table 8.4** - Alternative criteria for use of line reactor - Maximum values of the transformer power

## 8.16 LOAD REACTOR

The use of a three-phase load reactor, with an approximate 2% voltage drop, adds an inductance at the inverter PWM output to the motor. This decreases the  $dV/dt$  (voltage rising rate) of the pulses generated at the inverter output. This practice reduces the voltage spikes on the motor windings and the leakage currents that may be generated when long cables between inverter and motor (as a function of the "transmission line" effect) are used.

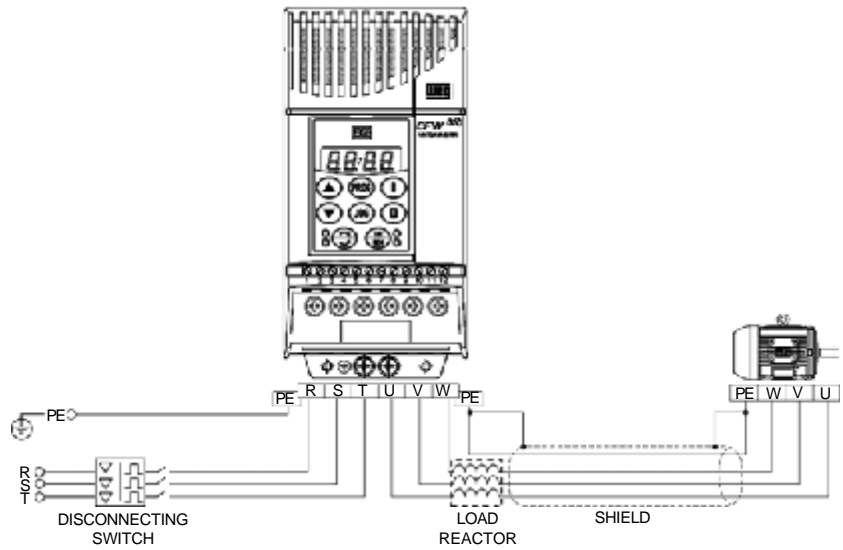
There are many factors that influence the peak level ( $V_p$ ) and the rise time ( $t_r$ ) of voltage spikes: cable type, cable length, motor size, switching frequency and so on.

WEG recommends using a load reactor when the supply voltage is higher than 500V, though this is not always required.

WEG, as a specialist in both motors and inverters (VSDs) is able to provide an integrated solution.

The load reactor value is calculated in the same way as the line reactor (see item 8.15.1).

If the cables between inverter and motor are longer than 300 ft (100 m), the cable capacitance to ground may cause nuisance overcurrent (E00) trips. In this case it is also recommended to use a load reactor.



**Figure 8.22 - Load Reactor Connection**

**8.18 DYNAMIC BRAKING**

The dynamic braking is used where short deceleration times are required or where high inertia is present.

For the correct sizing of the braking resistor, application data such as, deceleration time, load inertia, braking duty cycle must be considered. In any case, the rms current capacity and the maximum peak current must be considered.

The maximum peak current defines the minimum permitted ohmic value for the braking resistor. Refer to table 8.4.

The DC link voltage level for the actuation of the dynamic braking is as follows:

- Inverter supplied with 200...240V: **375Vcc**
- Inverters supplied with 380...480V: **750Vcc**

**8.18.1 Resistor Sizing**

The braking torque, that can be obtained through the frequency inverter, without using the dynamic braking module, varies from 10 to 35% of the rated motor torque. During the deceleration process, the kinetic energy of the load is regenerated into the inverter DC link. This energy loads up the capacitors by increasing the DC link voltage. When this energy is not fully dissipated, it may generate a DC link overvoltage trip (E01) and disabling the inverter.

To obtain higher braking torques, the use of dynamic braking is recommended where the excess of the regenerated energy is dissipated in a resistor mounted externally to the inverter. The braking resistor is defined according to the deceleration time, load inertia and resistive torque. In most cases, a resistor with an ohmic value as indicated on the table below and a power rating of 20% of the driven motor can be used.

Use wire type or tape type resistors with suitable insulation to withstand the instantaneous current peaks.

For critical applications with very short braking times, high inertia loads (ex.: centrifuges) or with very short and frequent duty cycles, contact WEG to define the most suitable resistor.

## CFW-08 OPTIONS AND ACCESSORIES

Inverter Model	Maximum Braking Current	P <sub>max</sub> (Maximum Resistor Power)	RMS Braking Current (*1)	P <sub>rated</sub> (Rated Resistor Power)	Recommended Resistor	Recommended Wiring
1.6A / 200-240V						
2.6A / 200-240V						
4.0A / 200-240V						
7.0A / 200-240V						
7.3A / 200-240V	10 A	3.9 kW	5 A	0.98 kW	39 Ω	2.5 mm <sup>2</sup> / 14 AWG
10A / 200-240V	15 A	6.1 kW	7 A	1.3 kW	27 Ω	2.5 mm <sup>2</sup> / 14 AWG
16A / 200-240V	20 A	8.8 kW	10 A	2.2 kW	22 Ω	4 mm <sup>2</sup> / 12 AWG
1.0A / 380-480V						
1.6A / 380-480V						
2.6A / 380-480V						
2.7A / 380-480V	6 A	4.6 kW	3.5 A	1.6 kW	127 Ω	1.5 mm <sup>2</sup> / 16 AWG
4.0A / 380-480V						
4.3A / 380-480V	6 A	4.6 kW	3.5 A	1.6 kW	127 Ω	1.5 mm <sup>2</sup> / 16 AWG
6.5A / 380-480V	8 A	6.4 kW	4 A	1.6 kW	100 Ω	2.5 mm <sup>2</sup> / 14 AWG
10A / 380-480V	16 A	12 kW	10 A	4.7 kW	47 Ω	4 mm <sup>2</sup> / 12 AWG
13A / 380-480V	24 A	19 kW	14 A	6.5 kW	33 Ω	6 mm <sup>2</sup> / 10 AWG
16A / 380-480V	24 A	19 kW	14 A	6.5 kW	33 Ω	6 mm <sup>2</sup> / 10 AWG

**Table 8.5 - Recommended Braking Resistors**

(\*1) The rms braking current can be determined by:

$$I_{\text{rms}} = I_{\text{max}} \cdot \sqrt{\frac{t_{\text{br}}^{[\text{min}]}}{5}}$$

where  $t_{\text{br}}$  corresponds to the sum of the braking times during the most severe 5 minute cycle.

### 8.18.2 Installation

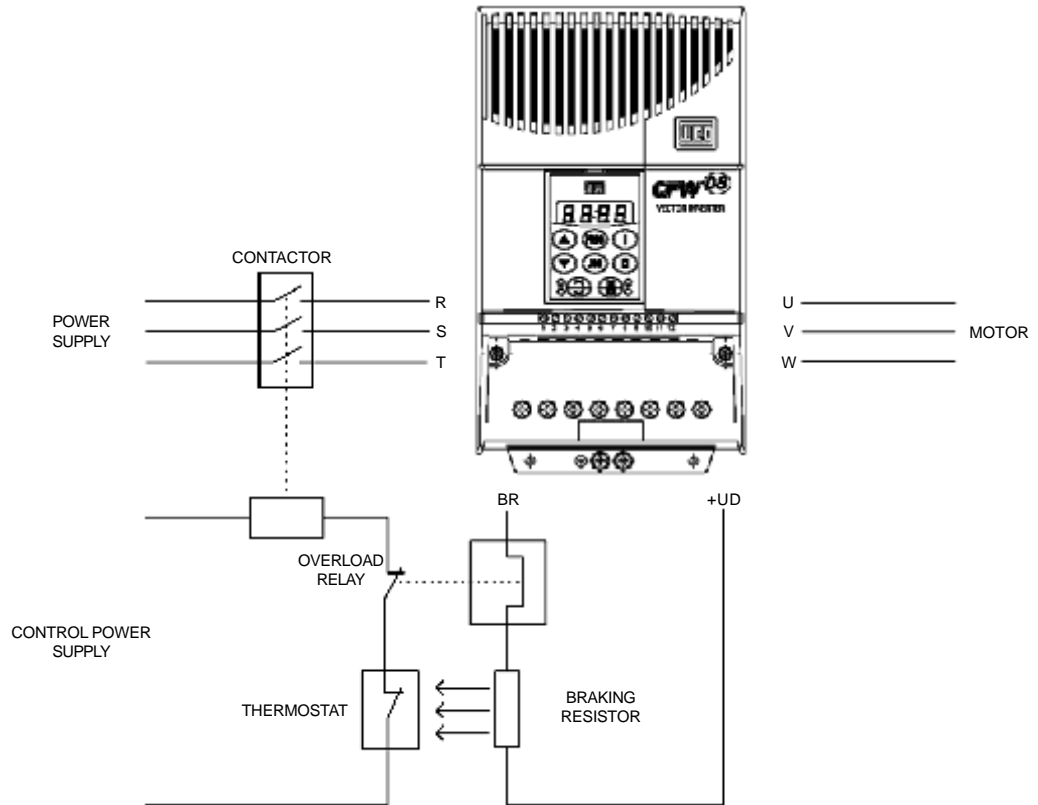
- Connect the braking resistor between the +UD and BR power terminals (refer to section 3.2.2).
- Make this connection with a twisted pair. Run this cable separately from any signal or control wire. Size the cable cross section according to the application, by considering the maximum and the rms current.
- If the braking resistor is installed inside the inverter panel, consider the heat dissipated by the resistor when defining the panel ventilation.



#### **DANGER!**

The internal inverter braking circuit and the braking resistor can be damaged when not correctly sized or when the line voltage exceeds the maximum allowed value

In this case, the only guaranteed method to avoid burning the braking resistor and eliminate risk of fire is the installation of a thermal overload relay in series connected with the resistor and/or the installation of a thermostat on the resistor body, wiring it in such a way that it disconnects the inverter power supply in case of overheating, as shown in figure 8.22 below:

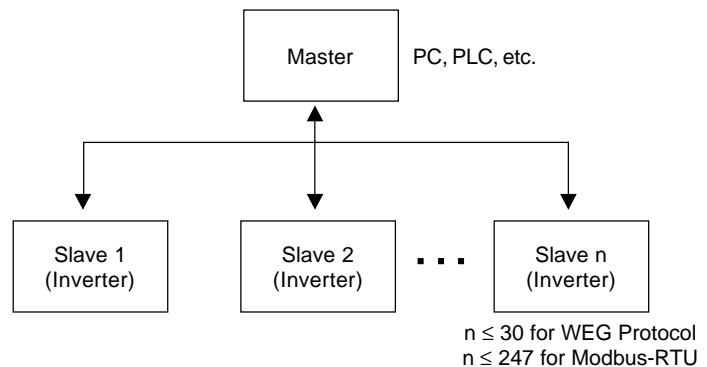


**Figure 8.23 - Braking resistor connection**  
(only for models 7.3-10-16A/200-240V e 2.7-4.3-6.5-10-13-16/380-480V)

## 8.19 SERIAL COMMUNICATION

### 8.19.1 Introduction

The basic objective of the serial communication is the physical connection of the inverters in an equipment network configured as follows:



The inverters have a control software for data transmission/reception through serial interface, thus facilitating the reception of data that have been sent by the master and the transmission of the data requested by the master.

This software supports WEG protocol and nine different Modbus-RTU modes, that can be selected via parameter P312. The subjects broached in this Section refers to WEG protocol. For more details about the Modbus-RTU, see item 8.19.

The transfer rate is 9600 bits/s, following an exchange protocol of question/answer type by using ASCII characters.

The master is able to realize the following operations related to each inverter:

### - IDENTIFICATION

- network address;
- inverter;
- software version.

### - CONTROL

- general enabling/disabling;
- enabling/disabling by ramp;
- direction of rotation;
- frequency/speed reference;
- local/remote;
- JOG;
- error and fault RESET.

### - STATUS RECOGNITION

- ready;
- Sub;
- run;
- local/remote;
- error;
- JOG;
- direction of rotation.

### - PARAMETER READING

### - CHANGE OF PARAMETERS

Typical examples of network use:

- PC (master) for the parametrization of one or several inverters at the same time;
- SDCD monitoring inverter variables;
- PLC controlling the operation of one or more inverters in a industrial process.

## 8.19.2 Interfaces Description

The physical connection between the inverters and the master is performed according to one of the standards below:

- a. RS-232 (point-to-point up to 10m);
- b. RS-485 (multipoint, galvanic isolation, up to 1000m);

### 8.19.2.1 RS-485

This interface permits the linkage of up to 30 inverters to a master (PC, PLC, etc.), attributing and setting for each inverter an address (1 to 30). In addition to these 30 addresses, there are two addresses to perform special tasks:

- Address 0:** any inverter in the network is inquired, independently of its address. Only one inverter can be connected to the network (point-to-point) in order to prevent short-circuits in the line interface.

- Address 31:** a control can be transmitted to all inverters in the network simultaneously, without acceptance recognition.
- List of addresses and corresponding ASCII characters.**

ADDRESS (P308)	ASCII		
	CHAR	DEC	HEX
0	@	64	40
1	A	65	41
2	B	66	42
3	C	67	43
4	D	68	44
5	E	69	45
6	F	70	46
7	G	71	47
8	H	72	48
9	I	73	49
10	J	74	4A
11	K	75	4B
12	L	76	4C
13	M	77	4D
14	N	78	4E
15	O	79	4F
16	P	80	50
17	Q	81	51
18	R	82	52
19	S	83	53
20	T	84	54
21	U	85	55
22	V	86	56
23	W	87	57
24	X	88	58
25	Y	89	59
26	Z	90	5A
27	[	91	5B
28	\	92	5C
29	]	93	5D
30	^	94	5E
31	-	95	5F

### Other ASCII characters used by the protocol

CODE	ASCII	
	DEC	HEX
0	48	30
1	49	31
2	50	32
3	51	33
4	52	34
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
=	61	3D
STX	02	02
ETX	03	03
EOT	04	04
ENQ	05	05
ACK	06	06
NAK	21	15

The connection between the network participants is performed through a pair of wires. The signal levels are according to the EIA RS-485 STANDARD with differential receivers and transmitters. You must use the serial communication module KCS-CFW-08 (refer to section 8.9) connected to the external module MIW-02 (refer to section 8.13 and/or to MIW-02 User Manual Cod. 0899.4435).

When the master is fitted only with a RS-232 serial interface, you must apply a level conversion module from RS-232 to RS-485.



## CFW-08 OPTIONS AND ACCESSORIES

### 8.19.2.2 RS-232

In this case we have the connection of a master to an inverter (point-to-point). The data can be exchanged in a bi-directional way, but not simultaneously (HALF DUPLEX).

The logical levels meet the EIA RS-232C STANDARD, that specifies the use of balanced signals. In this case one wire is used for the transmission (TX), one wire for the reception (RX) and one wire for the return (0V). This configuration is a three wire economy model.

You must use the RS-232 (KCS-CFW08) module in the inverter (refer to Section 8.9).

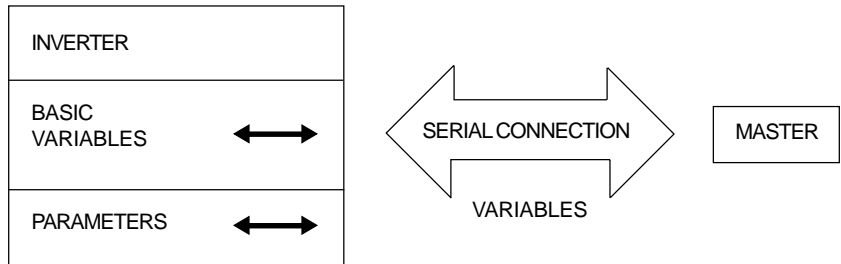
### 8.19.3 Definitions

The terms of this Section describe the protocol used in the serial communication.

#### 8.19.3.1 Used Terms

- Parameters: are those existing in the inverters whose visualization or alteration is possible through the keypad (HMI) interface.
- Variables: are values that have specific inverter functions and that can be read and, in some cases, modified by the master.
- Basic variables: are those that can be accessed only through the serial interface.

SCHEMATIC DIAGRAM:



#### 8.19.3.2 Parameter/Variables Resolution

The variables and the parameters have 16 bits format, i. e., from -32767 to +32768 for signed variables or from 0 to 65535 for unsigned variables.

All variables are considered as signed variables, except those related to time (time, period, frequency, ...)

In addition, the maximum and minimum values must consider the parameter range limits.

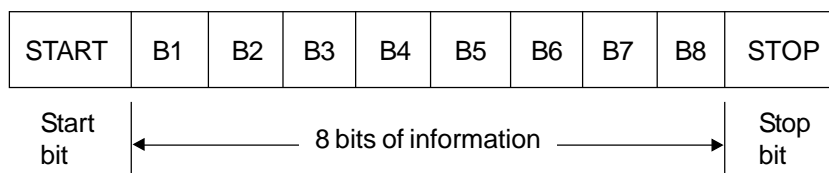
The below shows the main variables and their respective resolutions.

Parameter	Unit	Resolution
Frequency	H	0.01Hz/unit
Current (AC or DC)	A	0.01A/unit
Voltage (AC or DC)	V	1V/unit
Time	s	0.1s/unit
Percentage	%	0.01%/unit
Gain	-	0.01/unit
RPM	RPM	1RPM/unit

#### 8.19.3.3 Character Format

- 1 start bit;
- 8 information bits [they codify text characters and transmission characters, removed from the 7 bits code, according to ISO 646 and complemented for the even parity (eighth bit)];
- 1 stop bit.

After the start bit, follows the less significant bit:



### 8.19.3.4 Protocol

The transmission protocol meets the Standard ISO 1745 for the transmission in code.

Only text character sequences without headers are used. The error/fault monitoring is made through transmission related to the parity of the individual 7 bit characters, according to ISO 646. The parity monitoring is made according to DIN 66219 (even parity). The master uses two types of messages:

- READING MESSAGE:** for inquiring of the inverter variable content;
- WRITING MESSAGE:** to change the inveter variable content or to send comands to the inverters.

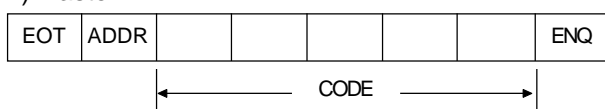
**NOTE:**

No transmission between two inverters is possible.  
The master has the bus access control.

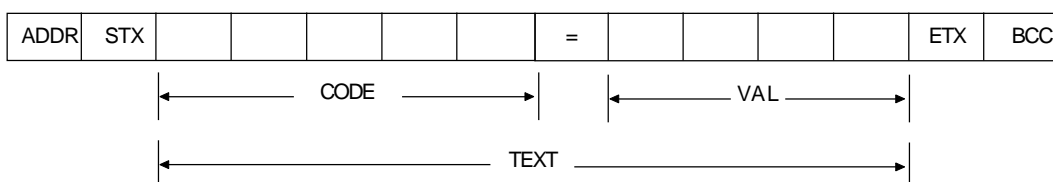
#### 8.19.3.4.1 Reading Message

This message allows the master receive from the inverter the content that corresponding to the inquiry code. In the answer message, the inverter transmits the data requested by the master and it finishes the transmission with EOT.

1) Master:



2) Inverter:



3) Master:



Format of the reading message:

- EOT:** control character of End Of Transmission;
- ADR:** inverter address (ASCII @, A, B, C, ...) (ADdRes);
- CODE:** address of the 5-digit variable coded in ASCII;
- ENQ:** control character ENQuiry (enquiry);

Format of the inverter answer message:

- ADR:** 1 character - inverter address;
- STX:** control character - Start of TeXt;
- TEXT:** consists in:
  - CODE:** address of the variable;
  - " = ":** separation character;
  - VAL:** 4 digits value HEXADECIMAL;

**ETX:** control character - End of Text;  
**BCC:** CheCksum Byte - EXCLUSIVE OR of all bytes between STX (excluded) and ETX (included).

NOTE:

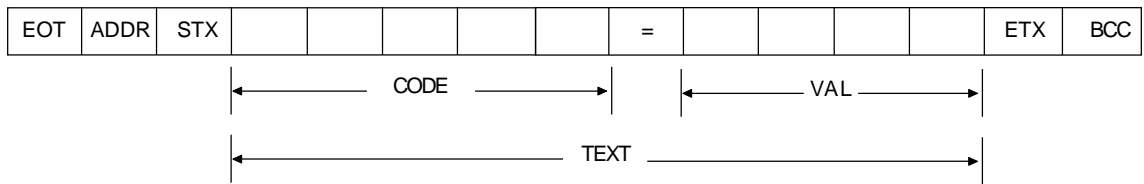
In some cases there can be an inverter answer with:

**ADR** **NAK** refer to Item 8.18.3.5

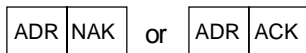
**8.19.3.4.2 Writing Message**

This message sends data to the inverter variables. The inverter will answer by indicating if the data have been accepted or not.

1) Master:



2) Inverter:



3) Master:



Format of the writing message:

- EOT:** control character of the End Of Transmission;
- ADR:** inverter address;
- STX:** control character of the Start of TeXt;
- TEXT:** consists in:
  - CODE:** variable address;
  - “ = “: separation character;
  - VAL:** 4 HEXADECIMAL digit values;
- ETX:** control character of the End of TeXt;
- BCC:** CheCksum Byte - EXCLUSIVE OR of all the bytes between STX (excluded) and ETX (included).

Format of the inverter answer message:

- Acceptance:**
  - ADR:** inverter address.
  - ACK:** ACKnowledge control character.
- Without Acceptance:**
  - ADR:** inverter address.
  - NAK:** Not AcKnowledge control character.  
This means that the data were not accepted and the addressed variable continues with its old value.

**8.19.3.5 Execution and Message Test**

The inverter and the master test the message syntax. The answers for the respective verified conditions are defined as follows:

**Reading Message:**

- no answer: with wronG message structure, control characters received incorrectly or wrong inverter address;
- NAK:** CODE corresponding to a non existing variable or there is only a writing variable;
- TEXT:** with valid messages.

**Writing Message:**

- no answer: with wrong message structure, control characters received incorrectly or wrong inverter address;
- NAK: CODE corresponding to a non existing variable, wrong BCC (checksum byte), only reading variable, VAL out of the allowed range for the respective variable, operation parameter out of the alteration mode;
- ACK: with valid message;

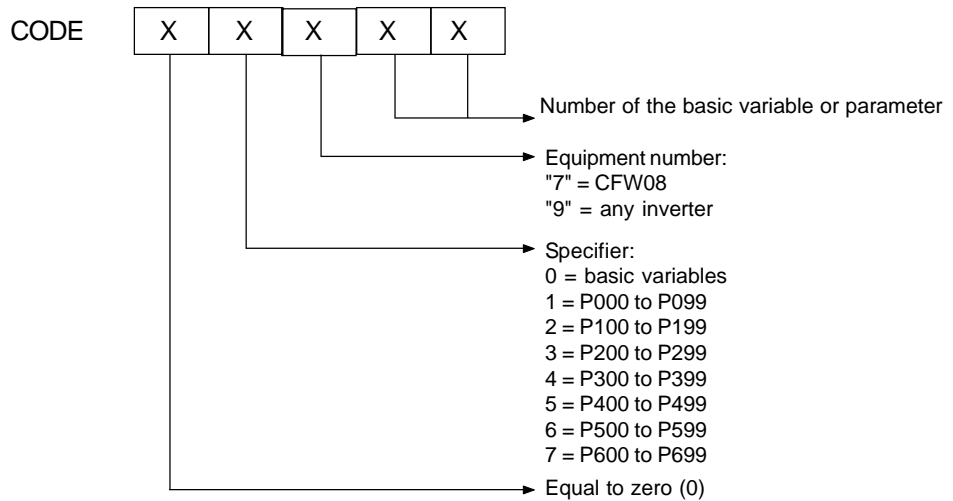
The master should maintain, between two variable transmissions to the same inverter, a waiting time that is compatible with the used inverter.

**8.19.3.6 Message Sequence**

The messages are processed in the inverter in determined intervals. Therefore, a pause larger than the sum of the times  $T_{proc} + T_{di} + T_{txi}$  should be ensured between two messages addressed to the same inverter (refer to section 8.18.6.).

**8.19.3.7 Variable Code**

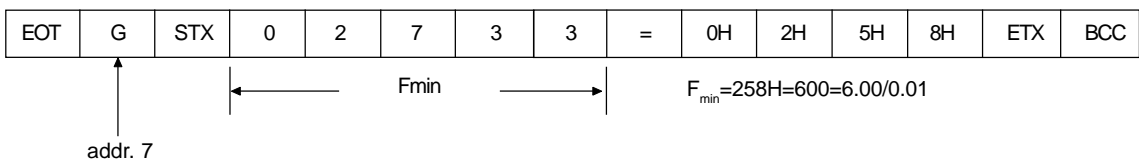
The field designated with CODE determines the parameter address and the basic variables formed by 5 digits (ASCII characters) as follows:



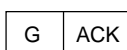
**8.19.4 Message Examples**

- Change of the minimum frequency (P133) to 6.00Hz in the inverter 7.

1) Master:



2) Inverter:

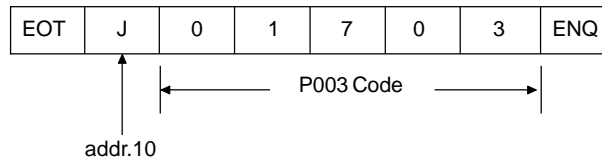


3) Master:

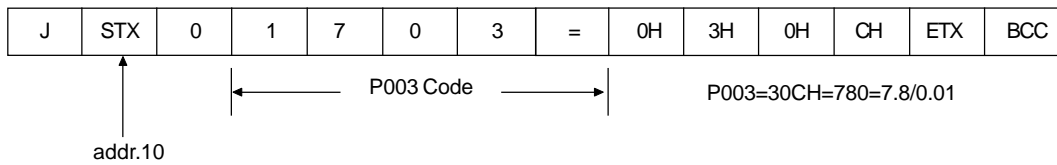


- Reading of the output current from the inverter 10 (supposing the the same was at 7.8A at the moment of the enquiry).

1) Master:



2) Inverter:



3) Master:



## 8.19.5 Variables and Errors of the Serial Communication

### 8.19.5.1 Basic Variables

#### 8.19.5.1.1 V00 (code 00700)

#### Indication of the inverter model (reading variable).

The reading of this variable permits the identification of the inverter type. For the CFW-08 this values is 7, as defined in 8.21.3.7.

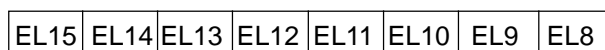
#### 8.19.5.1.2 V02 (code 00702)

#### Indication of the inverter status (reading variable)

- Logical status (byte-high)
- Error code (byte-low)

where:

#### Logical Status:



- |   |   |   |
|---|---|---|
| <p>EL8: 0 = ramp enabling (start/stop) inactive<br/>1 = ramp enabling</p> <p>EL9: 0 = general enabling inactive<br/>1 = general enabling active</p> <p>EL10: 0 = Reverse<br/>1 = Forward</p> <p>EL11: 0 = JOG inactive<br/>1 = JOG active</p> <p>EL12: 0 = local<br/>1 = remote</p> <p>EL13: 0 = without undervoltage<br/>1 = with undervoltage</p> <p>EL14: not used</p> <p>EL15: 0 = without error<br/>1 = with error</p> | } | <p>Inverter<br/>enabled<br/>EL8=EL9=1</p> |
|---|---|---|

**Error Code:** hexadecimal error number

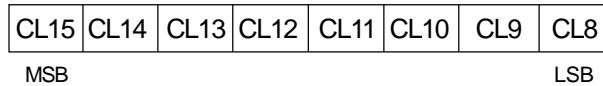
- Ex.: E00 → 00H  
E01 → 01H  
E10 → 0AH

### 8.19.5.1.3 V03 (code 00703)

#### Selection of the Logical Control

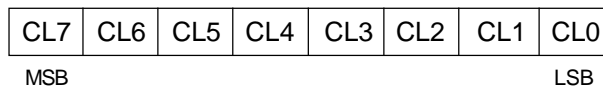
Writing variable, whose bits have the following meaning:

**BYTE HIGH** : desired action mask. In order to enable the action, the corresponding bit should be set to 1.



- CL8: 1 = enabling ramp (start/stop)
- CL9: 1 = general enabling
- CL10: 1 = forward/reverse rotation
- CL11: 1 = JOG
- CL12: 1 = local/remote
- CL13: not used
- CL14: not used
- CL15: 1 = inverter "RESET"

**BYTE LOW:** logical level of the desired action.



- CL0: 1 = enabling (run)  
0 = disabling by ramp (stop)
- CL1: 1 = enabling  
0 = general disabling (stops by inertia)
- CL2: 1 = forward  
0 = reverse
- CL3: 1 = JOG active  
0 = JOG inactive
- CL4: 1 = remote  
0 = local

- CL5: not used
- CL6: not used
- CL7: the transition in this bit from 0 to 1 causes the inverter "RESET" when any error condition is present.

**Note:**

- Disabling via DIx has priority over this disabling.
- To disable the inverter via serial interface, set CL0=CL1=CL8=CL9=1, while the external disabling (example, via DI) must be inactive.
- If CL1=0 and CL9=1, it will occur general disabling.
- If CL0=0 and CL8=1, the inverter will be disabled via ramp.

8.19.5.1.4 V04 (code 00704)

**Frequency reference is given by the serial interface** (reading/writing variable). Permite enviar a referência de frequência (em Hz) para o inversor, desde que P221=5 para o modo local e P222=5 para o modo remoto. A resolução desta variável é mostrada no item 8.18.3.2.

8.19.5.1.5 V05 (code 00705)

**Enabled controls by the serial interface (reading variable)**

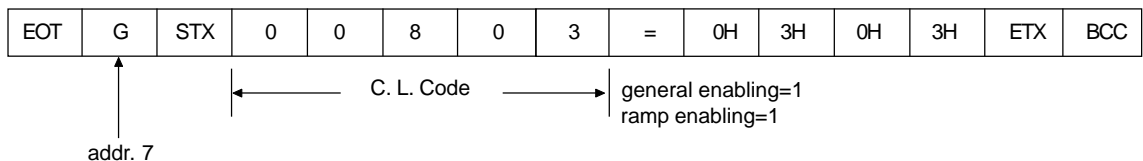
CHSH	CHSL	CHSL	CHSL	CHSL	CHSL	CHSL	CHSL	CHSL	
0	7	6	5	4	3	2	1	0	
				MSB					LSB

- CHSL0: 1 - serial local reference
- CHSL1: 1 - serial local forward/reverse selection
- CHSL2: 1 - serial local On/Off selection
- CHSL3: 1 - serial local JOG
- CHSL4: 1 - serial remote reference
- CHSL5: 1 - serial remote forward/reverse selection
- CHSL6: 1 - serial remote On/Off selection
- CHSL7: 1 - serial remote JOG selection
- CHSH0: 1 - serial local/remote selection.

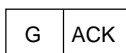
8.19.5.1.6 Message Examples with Basic Variables

- Inverter enabling (provided P229=2 for LOC or P230=2 for REM)

1) Master:



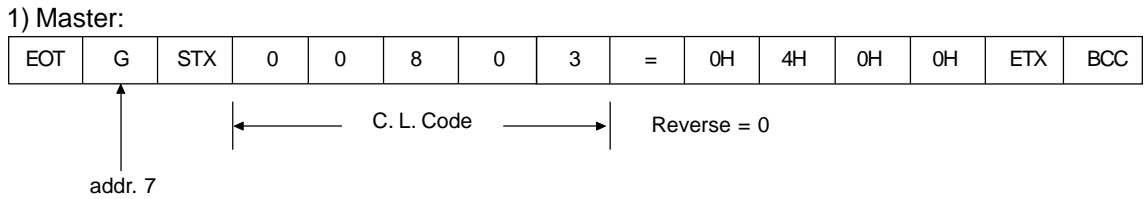
2) Inverter:



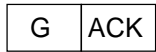
3) Master:



- Changing inverter from forward to reverse (provided P229=2 for LOC or P230=2 for REM) - If P231 = 2



2) Inverter:

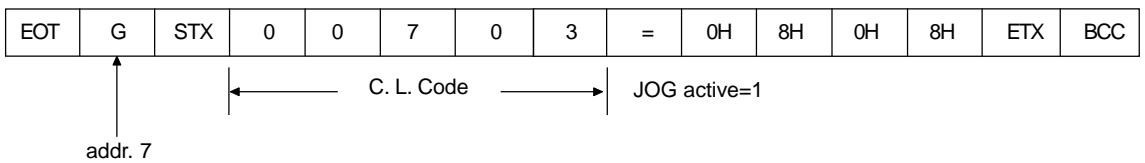


3) Master:

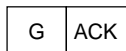


JOG enabling (provided P229=2 for LOC or P230=2 for REM)

1) Master:



2) Inverter:

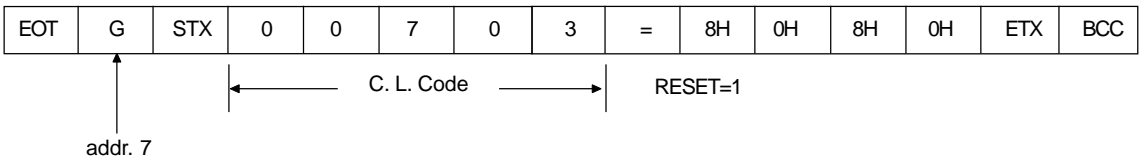


3) Master:

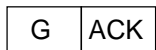


Error reset

1) Master:



2) Inverter:



3) Master:



### 8.19.5.2 Parameters Related to the Serial Communication

Parameter Number	Parameter Description
P220	Local/Remote selection
P221	Local reference selection
P222	Remote reference selection
P229	Local command selection
P230	Remote command selection
P231	Forward/Reverse selection
P308	Inverter address on the Serial Communication Network (value range from 1 to 30)
P312	Serial Interface Protocol
P313	Serial Interface Watchdog Action
P314	Serial Interface Watchdog Timeout

For further information about the parameter above, refer to Chapter 6 - Detailed Parameter Description.



## 8.19.5.3 Errors Related to the Serial Communication

They act as follows:

- they do not disable the inverter;
- they do not disable the fault relay;
- they inform in the word the logical status (V02).

### Fault types:

- E22: longitudinal parity fault (BCC);
- E24: parametrization fault (when some of the situations occurs as indicated in table 5.1 (incompatibility between parameters) or when there is a parameter change attempt that can not be changed with running motor).
- E25: variable or parameter not existing;
- E26: expected values out of allowed limits;
- E27: writing attempt in a read only variable or logical command disabled;
- E29: serial interface watchdog timeout error.

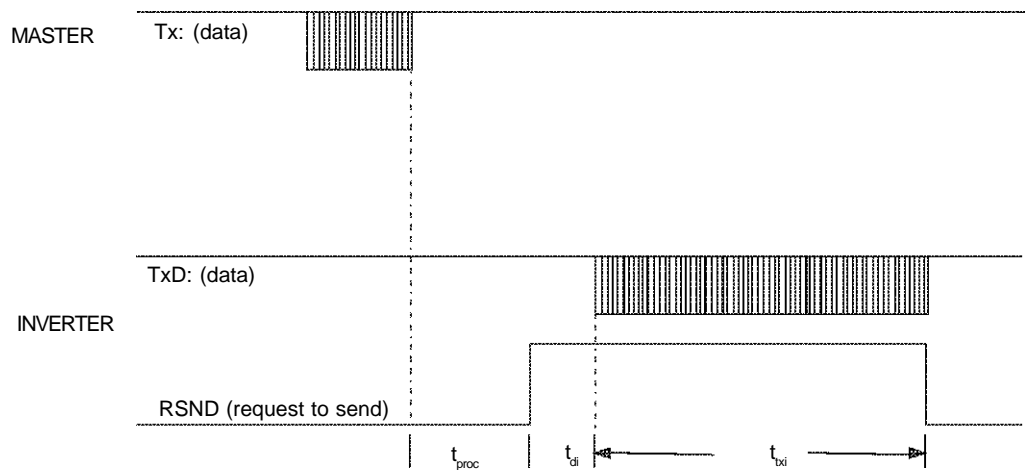
### Note:

If a parity fault is detected during inverter data reception, the message will be ignored. The same happens when syntax errors occur.

Ex.:

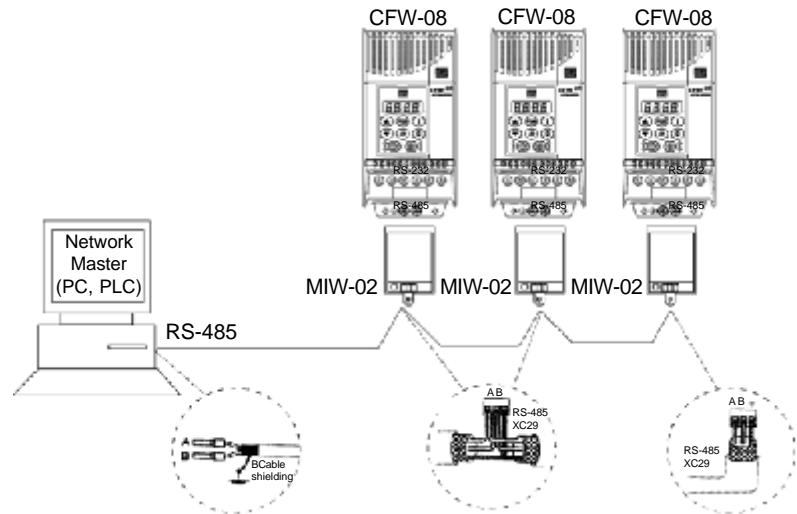
- Code values different from the numbers 0,...,9;
- Separation character different from " = ", etc.

## 8.19.6 Time for Read/Write of Messages



Times (ms)		Typical
$T_{proc}$		10
$T_{di}$		2
$T_{bi}$	reading	15
	writing	3

## 8.19.7 Physical Connection RS-232 and RS-485

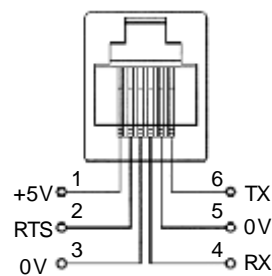


**Figure 8.24** - CFW-08 network connection through RS-485 serial interface

### Notes:

- ☑ **LINE TERMINATION:** connect the termination resistors at the ends of the line.
- ☑ **LINE TERMINATION:** include line termination (120Ω) at the ends, and only at the line ends.
- ☑ **GROUNDING OF THE CABLE SHIELD:** connect the shielding to the equipment frame (suitable grounding);
- ☑ **RECOMMENDED CABLE:** for balanced shielding.  
Ex.: AFS series, manufacturer KMP.

Figure below shows the pin position of the XC8 connector of the KCS-CFW08-S module.



**Figure 8.25** - Description of the XC8 (RJ-6) connector



### Note:

The wiring of the RS-232 must be laid separately from the power cables and the control wiring in 110/220V.



### NOTE!

You can not use RS-232 and RS-485 simultaneously.

**8.20 MODBUS-RTU**

**8.20.1 Introduction to Modbus-RTU Protocol**

Modbus protocol has been already developed 1979 firstly. Currently it is a wide diffused open protocol, used by several manufacturers in different equipment. The Modbus-RTU communication of the do CFW-08 has been developed by considering two documents:

1. MODBUS Protocol Reference Guide Rev. J, MODICON, June 1996.
2. MODBUS Application Protocol Specification, MODBUS.ORG, may 8th 2002.

In these documents are defined the format of the messages used by these elements that are part of the Modbus network, the services (or functions) that can be made available via network, and also how these elements exchange the data on the network.

**8.20.1.1 Transmission Modes**

Two transmission modes are defined in the protocol definition: ASCII and RTU. The transmission modes define the form how the message bytes are transmitted. It is not permitted to use the two transmission modes on the same network.

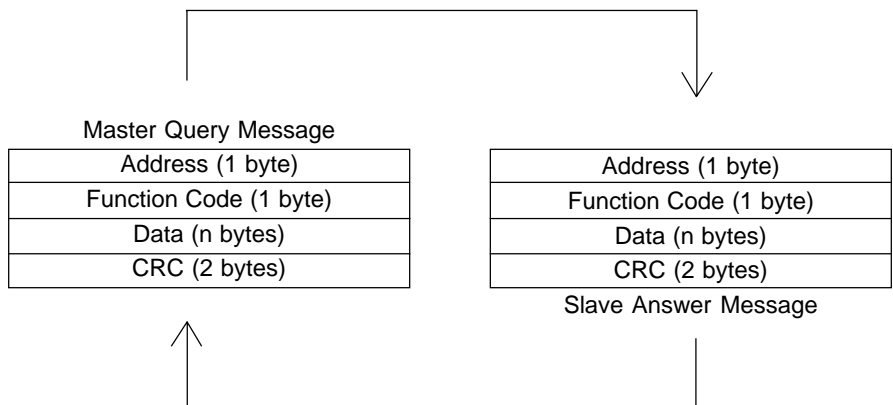
In the RTU mode each transmitted word has one start bit, eight data bits, 1 parity bit (optional) and 1 stop bit (2 stop bits, if no parity bit is used). Thus the bit sequence for the transmission of 1 byte is as follows:

Start	B0	B1	B2	B3	B4	B5	B6	B7	Parity or Stop	Stop
-------	----	----	----	----	----	----	----	----	----------------	------

In the RTU mode each transmitted word has 1 start bit, eight data bits, 1 parity bit (optional) and 1 stop bit (2 stop bits, if parity bit is not used). Thus the bit sequence for the transmission is as follows:

**8.20.1.2 Message Structure**

In RTU Mode The Modbus RTU network operates in Master-Slave system and it can consist of up to 247 slaves but only one Master. The master always initiates the communication with a question to a slave and the slave answers the question. Both messages (question and answer) have the same structure: Address, Function Code, and CRC. Depending on what is being requested, only the data field has variable length.



**Figure 8.26 - Message Structure**

### 8.20.1.2.1 Address

The master initiates the communication by sending one byte with the address of the slave to which the message is addressed. The slave with the right slave address initiates the message with its own address. The master can also send a message destined to address 0 (zero), which means that the message is destined to all network slaves (broadcast). In this case no slave will answer to the master.

### 8.20.1.2.2 Function Code

This field contains an only byte, where the master specifies the type of service or the function requested to the slave (read, write, etc.). According to the protocol, each function is used to access a specific data type. In the CFW-08 all data are available as holding type registers (referenced from the address 40000 or '4x'). Besides these registers, the inverter status (enabled/disabled, with error/no error and the command for the inverter (run/stop, run CW/CCW, etc.) can be also accessed through the coils read/write functions or the internal bits (referenced from the address 00000 or '0x' on).

### 8.20.1.2.3 Data Field

This field has variable length. The format and the content of this field depend on the used function and transmitted values. This field and the respective functions are described in item 8.20.3.

### 8.20.1.2.4 CRC

The last part of the message is the field for checking the transmission errors. The used method is the CRC-16 (Cycling Redundancy Check). This field is formed by two bytes, where the least significant byte (CRC-) is transmitted first and only then the most significant byte is transmitted (CRC+).

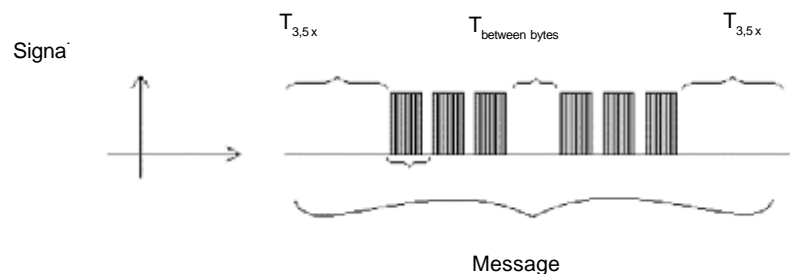
CRC calculation is started by loading a 16-bit variable (mentioned from now on as CRC variable) with FFFFh value. Then following steps are executed with the following routine:

1. The first message byte (only the data bits - the start bit, parity bit and stop bit are not used) is submitted to the XOR logic (OR exclusive) with the 8 least significant bits of the CRC variable, returning the result to the CRC variable,
2. Then the CRC variable is displaced one position to the right, in the direction of the least significant bit and the position of the most significant bit is filled out with zero 0 (zero).
3. After this displacement, the flag bit (bit that has been displaced out the CRC variable) is analyzed, by considering the following:
  - If the bit value is 0 (zero), no change is made.
  - If the bit value is 1, the CRC variable content is submitted to XOR logic with a constant A001h value and the value is returned to the CRC variable.
4. Repeat steps 2 and 3 until the eight displacements have been realized.
5. Repeat the steps 1 to 4, by using the next byte message until the whole message have been processed. The end content of the CRC variable is the value of the CRC field that is transmitted at the end of the message. The least significant part is transmitted first (CRC), only then the most significant part (CRC+) is transmitted.

### 8.20.1.2.5 Times between Messages

In the RTU mode there is no specific character that indicates the beginning or the end of a message. Thus the only indication for the beginning or the end of a new message is the data transmission absence in the network by 3.5 times the time required for transmission of one data word (11 bits). Thus if a message is initiated after elapsing of the minimum time required without transmission, the network elements assume that the received character represents the beginning of a new message. In similar mode, after this time has elapsed, the network elements will assume that the message has been ended.

If during the transmission of a message, the time between the bytes is longer than this minimum required time, the message will be considered invalid, since the inverter will discard the already received bytes and will mount a new message with the bytes that are being transmitted. The table below shows the time for three different communication rates.



**Figure 8.25** - Times required during the communication of a message

Comunicação	$T_{11 \text{ bits}}$	$T_{3,5x}$
9600 kbits/sec	1,146 ms	4,010 ms
19200 kbits/sec	573 $\mu$ s	2,005 ms
38400 kbits/sec	285 $\mu$ s	1,003 ms

$T_{11 \text{ bits}}$  = Time to transmit one word of the message.  
 $T_{\text{entre bytes}}$  = Time between bytes (can not be longer than  $T_{3,5x}$ ).  
 $T_{3,5x}$  = Minimum interval to indicate the begin and the end of the message ( $3,5 \times T_{11 \text{ bits}}$ ).

### 8.20.2 Operation of the CFW-08 in the Modbus-RTU Network

The CFW-08 frequency inverters operate as slaves of the Modbus-RTU network. The communication initiates with the master of the Modbus-RTU network requesting a service for a network address. When the inverter is configured to the corresponding address, it processes the question and answers to the master as requested.

#### 8.20.2.1 Interface Description

The CFW-08 frequency inverters use a serial interface for the communication with the Modbus-RTU network. There are two ways to perform the connection between the network master and the CFW-08:

### 8.20.2.1.1 RS-232

- The interface is used for the point-to-point connection (between a single slave and the master).
- Max. distance: 10 meters.
- Signal levels according to EIA STANDARD RS-232C.
- Three wires: transmission (TX), reception (RX) and return (0V).
- The RS-232 module (KCS-CFW08) must be used (see item 8.9).

### 8.20.2.1.2 RS-485

- This interface is used for multipoint connection (several slaves and the master).
- Max. distance: 1000 meters (use of shielded cables).
- Signal levels according to EIA STANDARD RS-485.
- The RS-232 module (KCS-CFW08) must be used (see item 8.9), connected to the external module MIW-02, to convert from RS-232 to RS-485 (see item 8.14).

Note: for connection, see 8.19.7

### 8.20.2.2 Inverter Configuration in the Modbus-RTU Network

To ensure a correct communication in the network, you must configure the inverter address in the network as well as the transfer rate and the existing parity type, besides the correct physical connection.

#### 8.20.2.2.1 Inverter Address in the Network

- The inverter address is defined through the parameter P308.
- If the serial communication type (P312) has been configured to Modbus-RTU, you may select the addresses from 1 to 247.
- Each slave shall have a different address.
- The master does not have address.
- The slave address must be known, even when connection is made point-to-point.

#### 8.20.2.2.2 Transmission Rate and Parity

- Both configurations are defined by parameter P312.
- Baud rates: 9600, 19200 or 38400 kbits/sec.
- Parity: None, odd parity, even parity.
- All slaves and even the network master must use the same baud rate and parity.

#### 8.20.2.3 Access to the Inverter Data

All parameters and available basic variables for the CFW-08 can be accessed through the network:

- Parameters: are those set in the inverter and that can be displayed and changed through the HMI (Human-Machine Interface) (see item 1 - Parameters).
- Basic Variables: are the internal inverter variables that can be accessed only through serial interface. For instance, through these basic variables you can change the speed reference, read the inverter status, enable or disable the inverter, etc. (see item 8.19.5.1 - Basic Variables).
- Register: nomenclature used to represent both parameters and basic variables during data transfer.
- Internal Bits: bits that are accessed only through the serial interface and that are used for inverter status controlling and monitoring.

Item 8.19.3.2 defines the resolution of the parameters and variables transmitted via serial interface.

### 8.20.2.3.1 Available Functions and Response Times

In the Modbus RTU protocol specification is defined the functions used for accessing different types of registers described in the specification. In the CFW-08 both parameters and basic variables are defined as being holding type registers (referenced as 4x). In addition to these registers, it is also possible to access the internal controlling and monitoring bits directly (referenced as 0x).

Following services (or functions) are available in the CFW-08 frequency inverter for accessing these registers:

- Read Coils
  - Description: reading of internal register blocks or coils.
  - Function code: 01.
  - Broadcast: not supported
  - Response time: 10 to 20 ms.
- Read Holding Registers
  - Description: reading of register blocks of holding type.
  - Function code: 03.
  - Broadcast: not supported
  - Response time: 10 to 20 ms.
- Write Single Coil
  - Description: writing in a single internal bit or coil.
  - Function code: 05.
  - Broadcast: supported.
  - Response time: 10 to 20 ms.
- Write Single Register
  - Description: writing in a single register of holding type.
  - Function code: 06.
  - Broadcast: supported
  - Response time: 10 to 50 ms.
- Write Multiple Coils
  - Description: writing in internal bit blocks or coils.
  - Function code: 15.
  - Broadcast: supported
  - Response time: 10 to 20 ms.
- Write Multiple Registers
  - Description: writing in register blocks of holding type.
  - Function code: 16.
  - Broadcast: supported
  - Response time: 10 to 50 ms for each written register.
- Read Device Identification
  - Description: Identification of the inverter model.
  - Function code: 43.
  - Broadcast: not supported.
  - Response time: 10 to 20 ms.

Note: The Modbus RTU network slaves are addressed from 1 to 247. Master uses address 0 to send messages that are common to all slaves (broadcast)

### 8.20.2.3.2 Data Addressing and Offset

The CFW-08 data addressing is realized with an offset equal to zero that means that the address number is equal to the register number. The parameters are available from address 0 (zero) on, whilst the basic variables are available from address 5000 on. In same way, the status bits are made available from address 0 (zero) on and the control bits are made available from address 100 on.

Table below shows the addressing of bits, parameters and basic variables:

Parameters		
Parameter Number	Endereço Modbus	
	Decimal	Hexadecimal
P000	0	0000h
P001	1	0001h
⋮	⋮	⋮
P100	100	0064h
⋮	⋮	⋮

Basic Variables		
Number of the Basic Variable	Modbus Address	
	Decimal	Hexadecimal
V00	5000	1388h
V01	5001	1389h
⋮	⋮	⋮
V05	5005	138Dh

Status Bits		
Bit Number	Modbus Address	
	Decimal	Hexadecimal
Bit 0	00	00h
Bit 1	01	01h
⋮	⋮	⋮
Bit 7	07	07h

Commands Bits		
Bit Number	Modbus Address	
	Decimal	Hexadecimal
Bit 100	100	64h
Bit 101	101	65h
⋮	⋮	⋮
Bit 107	107	6Bh

Note: All registers (parameters and basic variables) are considered as holding type registers, referenced from 40000 or 4x, whilst the bits are referenced from 0000 or 0x.

The status bits have the same functions of the bits 8 to 15 of the logic status (basic variable 2). These bits are available only for read, thus any attempt to write command returns error status to the master.

Status Bits	
Bit Number	Function
Bit 0	0 = Ramp enabling inactive 1 = Ramp enabling active
Bit 1	0 = General enabling inactive 1 = General enabling active
Bit 2	0 = Counter-clockwise direction of rotation 1 = Clockwise direction of rotation



## CFW-08 OPTIONS AND ACCESSORIES

Status Bits	
Bit Number	Function
Bit 3	0 = JOG inactive 1 = JOG active
Bit 4	0 = Local Mode 1 = Remote Mode
Bit 5	0 = No undervoltage 1 = With undervoltage
Bit 6	Not used
Bit 7	0 = No fault 1 = With fault

The command bits are available to read and write and they have the same function of the logic command bits 0 to 7 (basic variable 3), however no requiring the use of the mask. The basic variable 3 write influences the status of these bits.

Command Bits	
Bit Number	Function
Bit 100	0 = Ramp disable (stops) 1 = Ramp enable (runs)
Bit 101	0 = General disable 1 = General enable.
Bit 102	0 = Counter-clockwise direction of rotation 1 = Clockwise direction of rotation
Bit 103	0 = JOG disable 1 = JOG enable
Bit 104	0 = Goes to local mode 1 = Goes to remote mode
Bit 105	Not used
Bit 106	Not used
Bit 107	0 = It does not reset inverter 1 = It resets inverter

### 8.20.3 Detailed Function Description

This section describes in details the functions that are available in the CFW-08 for the Modbus RTU communication. Please note the following during the message preparation:

- Values are always transmitted as hexadecimal values.
- The address of one data, the data number and the value of the registers are always represented through 16 bits. Thus these fields are transmitted by using two bytes (high and low). To access the bits, and the form to represent one bit depend on the used function.
- The messages, both for enquiry and response, cannot be longer than 128 bytes.
- The resolution of each parameter or basic variable is as described in item 8.19.3.2.

**8.20.3.1 Function 01 -  
Read Coils**

It reads the content of an internal group of bits that must compulsorily in a numerical sequence. This function has the following structure for the read and response messages (the values are always hexadecimal, and each field represents one byte):

Query (Master)		Response (Slave)	
Slave address		Slave address	
Function		Function	
Initial bit address (byte high)		Byte Count Field (number of data bytes)	
Initial bit address (byte low)		Byte 1	
Number of bits (byte high)		Byte 2	
Number of bits (byte low)		Byte 3	
CRC-		etc...	
CRC+		CRC-	
		CRC+	

Each response bit is placed at a position of the data bytes sent by the slave. The first byte, from the bits 0 to 7, receives the first 8 bits from the initial address indicated by the master. The other bytes (if the number of the read bits is higher than 8) remain in the same sequence. If the number of the read bits is not a multiple of 8, the remaining bits of the last byte should be filled out with 0 (zero).

Example: reading of the status bits for general enable (bit 1) and direction of rotation (bit 2) of then CFW-08 at the address 1:

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	01h	Function	01h
Initial bit address (byte high)	00h	Byte Count	01h
Initial bit address (byte low)	01h	Status of the bits 1 and 2	02h
Number of bits (byte high)	00h	CRC-	D0h
Number of bits (byte low)	02h	CRC+	49h
CRC-	ECh		
CRC+	0Bh		

As the number of read bits in the example is smaller than 8, the slave required only 1 byte for the response. The value of the byte was 02h, That as binary value will have the form 0000 0010. As the number of read bits is equal to 2, only the two less significant bits, that have the value 0 = general disable and 1 = direction of rotation are of interest, are of interest. The other bits, as they did not be requested, are filled out with 0 (zero).

**8.20.3.2 Function 03 - Read  
Holding Register**

It reads the content of a group of registers that must be compulsorily in a numerical sequence. This function has following structure for the read and response messages (the values are always hexadecimal values, and each field represents one byte):

## CFW-08 OPTIONS AND ACCESSORIES

Query (Master)	Response (Slave)
Slave address	Slave address
Function	Function
Initial register address (byte high)	Byte Count Field
Initial register address (byte low)	Data 1 (high)
Number of registers (byte high)	Data 1 (low)
Number of registers (byte low)	Data 2 (high)
CRC-	Data 2 (low)
CRC+	etc...
	CRC-
	CRC+

- Example: Read of the value proportional to the frequency value (P002) and motor current (P003) of the CFW-08 at address 1:

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	03h	Function	03h
Initial register (byte high)	00h	Byte Count	04h
Initial register (byte low)	02h	P002 (high)	09h
Number of registers (byte high)	00h	P002 (low)	C4h
Number of registers (byte low)	02h	P003 (high)	02h
CRC-	65h	P003 (low)	8Ah
CRC+	CBh	CRC-	38h
		CRC+	95h

Each register is always formed by two bytes (high e low). For the example, we have P002 = 09C4h, that in decimal number is equal to 2500.

As this parameter have a decimal place indication, the real read value is 25.00 hz. In the same way we will have a current value P003 = 028Ah, that is equal to a 650 decimal. As the current has two decimal resolution, the read value is 6.50 A.

### 8.20.3.3 Function 05 - Write Single Coil

This function is used to write a value to a single bit. The bit value is represented by using two bytes, where FF00h represents the bit that is equal to 1, and 0000h represents the bit that is equal to 0 (zero). It has the following structure (the values are always hexadecimal, and each field represents one byte):

Query (Master)	Response (Slave)
Slave address	Slave address
Function	Function
Bit address (byte high)	Bit address (byte high)
Bit address (byte low)	Bit address (byte low)
Bit value (byte high)	Bit value (byte high)
Bit value (byte low)	Bit value (byte low)
CRC-	CRC-
CRC+	CRC+

- Example: to drive a ramp enable command (bit 100 = 1) of a CFW-08 at the address 1:

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	05h	Function	05h
Bit number (high)	00h	Bit number (high)	00h
Bit number (low)	64h	Bit number (low)	64h
Bit value (high)	FFh	Bit value (high)	FFh
Bit value (low)	00h	Bit value (low)	00h
CRC-	CDh	CRC-	CDh
CRC+	E5h	CRC+	E5h

For this function, the slave response is an identical copy of the query sent by the master.

### 8.20.3.4 Function 06 - Write Single Register

This function is used to write a value to a single register. This function has following structure (values are always hexadecimal values, and each field represents one byte):

Query (Master)		Response (Slave)	
Slave address		Slave address	
Function		Function	
Register address (byte high)		Register address (byte high)	
Register address (byte low)		Register address (byte low)	
Value for the register (byte high)		Value for the register (byte high)	
Value for the register (byte low)		Value for the register (byte low)	
CRC-		CRC-	
CRC+		CRC+	

- Example: write of the speed reference (basic variable 4) equal to 30.00 hz of a CFW-08 at address 1.

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	06h	Function	06h
Register (high)	13h	Register (high)	13h
Register (low)	8Ch	Register (low)	8Ch
Value (high)	0Bh	Value (high)	0Bh
Value (low)	B8h	Value (low)	B8h
CRC-	4Bh	CRC-	4Bh
CRC+	E7h	CRC+	E7h

For this function, the slave response will be again a copy identical to the request made by the master. As already informed above, the basic variables are addressed from 5000, thus the basic variable 4 will be addressed at 5004 (138Ch). The value for this variable is 30.00 hz, that is represented by 3000 (0BB8h).

### 8.20.3.5 Function 15 - Write Multiple Coils

This function allows writing values for a bit group that must be in numerical sequence. This function can be also used to write a single bit (the values are always hexadecimal, and each field represents one byte).

## CFW-08 OPTIONS AND ACCESSORIES

Query (Master)		Response (Slave)	
Slave address		Slave address	
Function		Function	
Initial bit address (byte high)		Initial bit address (byte high)	
Initial bit address (byte low)		Initial bit address (byte low)	
Number of bits (byte high)		Number of bits (byte high)	
Number of bits (byte low)		Number of bits (byte low)	
Byte Count Field (number of data bytes)		CRC-	
Byte 1		CRC+	
Byte 2			
Byte 3			
etc...			
CRC-			
CRC+			

The value of each bit that is being sent is placed at a position of the data bytes sent by the master. The first byte, in the bits 0 to 7, receives the 8 first bits by starting from the initial address indicated by the master. The other bytes (if the number of inscribed bits is higher than 8) remain in sequence. If the number of inscribed bits is not a multiple of 8, the remaining bits of the last byte should be filled in with 0 (zero).

Example: command writing for general enabling (bit 100 = 1), general enabling (bit 101 = 1) and CWW-direction of rotation (bit 102 = 0), for a CFW-08 at address 1:

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	0Fh	Function	0Fh
Initial bit (byte high)	00h	Initial bit (byte high)	00h
Initial bit (byte low)	64h	Initial bit (byte low)	64h
Number of bits (byte high)	00h	Number of bits (byte high)	00h
Number of bits (byte low)	03h	Number of bits (byte low)	03h
Byte Count	01h	CRC-	54h
Bits Value	03h	CRC+	15h
CRC-	BEh		
CRC+	9Eh		

As only three bits are written, the master needed only one byte to transmit the data. The transmitted values are in the three less significant bits of the byte that contains the value for the bits. The other bits of this byte remained with the value 0 (zero).

### 8.20.3.6 Function 16 - Write Multiple Registers

This function allows writing values to a register group that must be in numerical sequence. This function can also be used to write a single register (the values are always hexadecimal values and each field represents one byte).

Query (Master)		Response (Slave)	
Slave address		Slave address	
Function		Function	
Initial register address (byte high)		Initial register address (byte high)	
Initial register address (byte low)		Initial register address (byte low)	
Number of registers (byte high)		Number of registers (byte high)	
Number of registers (byte low)		Number of registers (byte low)	
Byte Count Field (number of data bytes)		CRC-	
Data 1 (high)		CRC+	
Data 1 (low)			
Data 2 (high)			
Data 2 (low)			
etc...			
CRC-			
CRC+			

- Example: writing of the acceleration time (P100) = 1,0 s and deceleration time (P101) = 2,0 s, of a CFW-08 at the address 20:

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	14h	Slave address	14h
Function	10h	Function	10h
Initial register (byte high)	00h	Initial register (byte high)	00h
Initial register (byte low)	64h	Initial register (byte low)	64h
Number of registers (byte high)	00h	Number of registers (byte high)	00h
Number of registers (byte low)	02h	Number of registers (byte low)	02h
Byte Count	04h	CRC-	02h
P100 (high)	00h	CRC+	D2h
P100 (low)	0Ah		
P101 (high)	00h		
P101 (low)	14h		
CRC-	91h		
CRC+	75h		

As the two parameters have a resolution of a decimal place for writing of 1.0 and 2.0 seconds, thus the values 10 (000Ah) and 20 (0014h) should be transmitted.

**8.20.3.7 Function 43 - Read Device Identification**

Auxiliary function that permits reading of the manufacturer, model and version of the product firmware. It has following structure.

## CFW-08 OPTIONS AND ACCESSORIES

Query (Master)	Response (Slave)
Slave address	Slave address
Function	Function
MEI Type	MEI Type
Read Code	Conformity Level
Object Number	More Follows
CRC-	Next Object
CRC+	Number of Objects
	Object Code*
	Object length*
	Object Value*
	CRC-
	CRC+

- The fields are repeated according to the number of objects.

This function permits reading of three information categories:

Basic, Regular and Extended and each category are formed by a group of objects. Each object is formed by a sequence of ASCII characters For the CFW-08 are only available basic information formed by three objects:

- Object 00 - VendorName: always 'WEG'.
- Object 01 - ProductCode: formed by the product code (CFW-08), plus the rated inverter current.
- Object 02 - MajorMinorRevision: it indicates the inverter firmware version, in 'VX.XX' format.

The read code indicates which information categories are being read and if the objects are accessed individually or by sequence.

In the example, the inverter supports 01 (basic information in sequence), and 04 (individual access to the objects).

The other fields for the CFW-08 have fixed values.

- Example: read o basic information in sequence, starting from object 00, of a CFW-08 at address 1:

Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	2Bh	Function	2Bh
MEI Type	0Eh	MEI Type	0Eh
Read Code	01h	Read Code	01h
Object Number	00h	Conformity Level	51h
CRC-	70h	More Follows	00h
CRC+	77h	Next Object	00h
		Number of Objects	03h
		Object Code	00h
		Object Length	03h
		Object Value	'WEG'
		Object Code	01h
		Object Length	0Eh
		Object Value	'CFW-08 7.0A'
		Object Code	02h
		Object Length	05h
		Object Value	'V3.77'
		CRC-	C7h
		CRC+	DEh

In the example the Object Value has not been represented as hexadecimal value, but with corresponding ASCII characters.

For instance, for the object 00, the 'WEG' value has been transmitted as being three ASCII characters, that as hexadecimal have the values 57h (W), 45h (E) e 47h (G).

## 8.20.4 Communication Errors

Errors can occur during the message transmission on network, or in the content of the received messages. Depending on the error type, inverter may answer or not to the master:

When the master sends a message to an inverter configured at determined network address, the inverter will not response if:

- Error in the parity bit.
- Error the CRC.
- Time out between transmitted bytes (3.5 times the time required for the transmission of a 11-bit word).

In the case of a successful reception of the message, the inverter can detect problems and send a error message to the master indicating the problem that has been verified:

- Invalid function (error code = 1): the requested function has not been implemented for the inverter.
- Invalid data address (error code = 2): the data address (register or bit) does not exist.
- Data value invalid (error code = 3): this error occurs in the following conditions:
  - Value is out of permitted range.
  - Writing in data that cannot be changed (only read register, or register that does not allow changing with enabled inverter or bits of logic status).
  - Writing in function of the logic command that has not been enabled via serial interface.

### 8.20.4.1 Error Messages

When any error occurs in the message content (not during the data transfer), the slave must return a message indicating the error type that occurred. The errors that may occur in the CFW-08 during the message processing are errors relating to invalid function (code 01), invalid data address (code 02) and invalid data value (code 03).

The messages sent by the slave have following structure:

Response (Slave)
Slave address
Function Code
(with most significant bit to 1)
Error code
CRC-
CRC+

- Master requests from the slave at address 1 to write parameter 89 (inexistent parameter):



## CFW-08 OPTIONS AND ACCESSORIES

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Query (Master)		Response (Slave)	
Field	Value	Field	Value
Slave address	01h	Slave address	01h
Function	06h	Function	86h
Register (high)	00h	Error Code	02h
Register (low)	59h	CRC-	C3h
Value (high)	00h	CRC+	A1h
Value (low)	00h		
CRC-	59h		
CRC+	D9h		

**TECHNICAL SPECIFICATIONS**

This chapter describes the technical specifications (electrical and mechanical) of the CFW-08 inverter series.

**9.1 POWER DATA**

AC Input Specifications:

- Voltage: + 10%, -15% (with loss of motor efficiency)
- Frequency : 50/60Hz (± 2 Hz)
- Phase unbalance: ≤ 3%
- Overvoltage: Category III (EN 61010/UL 508C)
- Transient voltages according to Category III.

Minimum line impedance: variable according to inverter model.

Refer to Section 8.16.

Power-up: max. 10 ON/OFF cycles per hour.

**9.1.1 200-240V Power Supply**

Model: Current/Voltage	1.6/ 200-240	2.6/ 200-240	4.0/ 200-240	1.6/ 200-240	2.6/ 200-240	4.0/ 200-240	7.0/ 200-240	7.3/ 200-240	10/ 200-240	16/ 200-240
Power (kVA) <sup>(1)</sup>	0.6	1.0	1.5	0.6	1.0	1.5	2.7	2.8	3.8	6.1
Rated Output Current (A) <sup>(2)</sup>	1.6	2.6	4.0	1.6	2.6	4.0	7.0	7.3	10	16
Max. Output Current (A) <sup>(3)</sup>	2.4	3.9	6.0	2.4	3.9	6.0	10.5	11	15	24
Power Supply	Single-phase			Single-phase or three-phase			Three-phase	Single-phase or three-phase		Three-phase
Rated Input Current (A)	3.5	5.7	8.8	2.0/3.5 <sup>(4)</sup>	3.1/5.7 <sup>(4)</sup>	4.8/8.8 <sup>(4)</sup>	8.1	8.6/16 <sup>(4)</sup>	12/22 <sup>(4)</sup>	19
Switching Frequency (kHz)	5	5	5	5	5	5	5	5	5	5
Max. Motor Power <sup>(5)</sup>	0.25HP/ 0.18kW	0.5HP/ 0.37kW	1HP/ 0.75kW	0.25HP/ 0.18kW	0.5HP/ 0.37kW	1HP/ 0.75kW	2HP/ 1.5kW	2HP/ 1.5kW	3HP/ 2.2kW	5HP/ 3.7kW
Dynamic Braking	No	No	No	No	No	No	No	Yes	Yes	Yes
Internal Class A RFI Filter (optional)	No	No	No	No	No	No	No	Yes (single-phase)	Yes (single-phase)	No
Footprint Class A RFI Filter (optional)	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
External Class B RFI Filter (optional)	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Watt Loss (W)	30	35	50	30	35	50	75	90	100	150
Dimensions (Height x Width x Depth)	5.95 x 2.95 x 5.16 in (151 x 75 x 131 mm)						7.87 x 4.53 x 5.91 in (200 x 115 x 150 mm)			

**9.1.2 380-480V Power Supply**

Model: Current/Voltage	1.0/ 380-480	1.6/ 380-480	2.6/ 380-480	4.0/ 380-480	2.7/ 380-480	4.3/ 380-480	6.5/ 380-480	10/ 380-480
Power (kVA) <sup>(1)</sup>	0.8	1.2	2.0	3.0	2.1	3.3	5.0	7.6
Rated Output Current (A) <sup>(2)</sup>	1.0	1.6	2.6	4.0	2.7	4.3	6.5	10
Max. Output Current (A) <sup>(3)</sup>	1.5	2.4	3.9	6.0	4.1	6.5	9.8	15
Rated Input Current (A)	1.2	1.9	3.1	4.7	3.3	5.2	7.8	12
Switching Frequency (kHz)	5	5	5	5	5	5	5	5
Max. Motor Power <sup>(5)</sup>	0.25HP/ 0.18kW	0.5HP/ 0.37kW	1.5HP/ 1.1kW	2HP/ 1.5kW	1.5HP/ 1.1kW	2HP/ 1.5kW	3HP/ 2.2kW	5HP/ 3.7kW
Dynamic Braking	No	No	No	No	Yes	Yes	Yes	Yes
Internal Class A RFI Filter (optional)	No	No	No	No	Yes	Yes	Yes	Yes
Footprint Class A RFI Filter (optional)	Yes	Yes	Yes	Yes	No	No	No	No
External Class B RFI Filter (optional)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Watt Loss (W)	25	30	45	55	45	55	90	240
Dimensions (Height x Width x Depth)	5.95 x 2.95 x 5.16 in (151 x 75 x 131 mm)				7.87 x 4.53 x 5.91 in (200 x 115 x 150 mm)			

## TECHNICAL SPECIFICATIONS

Model: Current/Voltage	13/ 380-480	16/ 380-480
Power (kVA) <sup>(1)</sup>	9.9	12.2
Rated Output Current (A) <sup>(2)</sup>	13	16
Max. Output Current (A) <sup>(3)</sup>	19.5	24
Rated Input Current (A)	15	19
Switching Frequency (kHz)	5	5
Max. Motor Power <sup>(5)</sup>	7.5HP/5.5kW	10HP/7.5kW
Dynamic Braking	Yes	Yes
Internal Class A RFI Filter (optional)	Yes	Yes
External Class B RFI Filter (optional)	Yes	Yes
Watt Loss (W)	150	240
Dimensions (Height x Width x Depth)	7.99 x 5.63 x 6.50 in (203 x 143 x 165 mm)	



### NOTE!

(1) The power rating in VA is determined by the following equation:

$$P(\text{kVA}) = \frac{\sqrt{3} \cdot \text{Voltage (Volt)} \cdot \text{Current (Amp)}}{1000}$$

The values shown in the table were calculated by considering the rated inverter current, input voltage of 220V for the 220-240V models and input voltage of 440V for the 380-480 models.

(2) Rated current is valid for the following conditions:

- Relative air humidity: 5% to 90%, non condensing.
- Altitude : 3300 ft (1000m), up to 13200 ft (4000m) with 10% derating/3300 ft (1000m) of the rated current.
- Ambient temperature: 32° to 104°F (0...40° C) (up to 122°F (50°C) with 2%/°C derating of the rated current).
- The rated current values are valid for the switching frequencies of 2.5kHz or 5kHz (factory setting). For higher switching frequencies, 10kHz and 15kHz, consider the values shown in the description of the parameter P297(refer to chapter 6).

(3) Maximum Current:

Inverter supports an overload of 50% (maximum output current = 1.5 x the rated output current) during 1 minute for each 10 minutes of operation. For higher switching frequencies, 10kHz and 15kHz, consider the values shown at the description of the parameter P297(refer to chapter 6).

(4) Rated input current for single-phase operation.

Note: The models CFW080016B2024..., CFW080026B2024..., CFW080040B2024..., CFW080073B2024... and CFW080100B2024... can be operated both with single-phase voltage and three-phase voltage without output current derating.

(5) The indicated motor power ratings are only orientative values for IV-pole motors and normal duty loads. The precise inverter sizing must consider the actual motor nameplate and application data.

## 9.2 ELECTRONICS/GENERAL DATA

CONTROL	METHOD	<input checked="" type="checkbox"/> Voltage Source Inverter <input checked="" type="checkbox"/> V/F Control or Sensorless Vector Control (VVC - Voltage Vector Control). <input checked="" type="checkbox"/> PWM SVM (Space Vector Modulation).
	OUTPUT FREQUENCY	<input checked="" type="checkbox"/> 0 ... 300Hz, resolution of 0.01Hz.
PERFORMANCE	V/F CONTROL	<input checked="" type="checkbox"/> Speed regulation: 1% of the rated speed.
	VECTOR CONTROL	<input checked="" type="checkbox"/> Speed regulation: 0.5% of the rated speed.
INPUTS (Control Board ECC2)	ANALOG	<input checked="" type="checkbox"/> CFW-08: 1 isolated input, resolution: 7 bits, 0 to +10V or (0)4 to 20mA, Impedance: 100k $\Omega$ (0 $\pm$ 10 V), 500 $\Omega$ [(0) 4 to 20 mA], progr. functions. <input checked="" type="checkbox"/> CFW-08 Plus: 2 isolated inputs, resolution: 7 bits, 0 to +10V or (0)4 to 20 mA, Impedance: 100k $\Omega$ (0 a +10V), 500 $\Omega$ [(0) 4 to 20 mA], programmable functions.
	DIGITAL	<input checked="" type="checkbox"/> 4 isolated digital inputs, 12Vdc, programmable functions
OUPUTS (Control Board)	ANALOG	<input checked="" type="checkbox"/> CFW-08 Plus: 1 isolated output, 0 a +10V, $R_L \leq 10k$ (max. load.), resolution: 8 bits, programmable functions
	RELAY	<input checked="" type="checkbox"/> CFW-08: 1 relay with reverse contacts, 240VAC, 0.5A, programmable functions <input checked="" type="checkbox"/> CFW-08 Plus: 2 relays, one with NO contact and one with NC contact. It can be programmed to operate as 1 reverse, 240VAC, 0.5A, programmable functions
SAFETY	PROTECTION	<input checked="" type="checkbox"/> Overcurrent/output short-circuit <input checked="" type="checkbox"/> Output groung fault <input checked="" type="checkbox"/> DC link under/overvoltage <input checked="" type="checkbox"/> Inverter overtemperature <input checked="" type="checkbox"/> Motor/inverter overload (IxT) <input checked="" type="checkbox"/> External fault <input checked="" type="checkbox"/> Programming error <input checked="" type="checkbox"/> Self-tuning error <input checked="" type="checkbox"/> Defective inverter
KEYPAD (HMI)	STANDARD (HMI-CFW-08-P)	<input checked="" type="checkbox"/> 8 keys: start, stop, increment, decrement, FWD/REV, JOG, local/remote and programming <input checked="" type="checkbox"/> LEDs display: 4 digits with 7 segments <input checked="" type="checkbox"/> LEDs for FWD/REV and LOCAL/REMOTE indication <input checked="" type="checkbox"/> It permits access/alteration of all parameters <input checked="" type="checkbox"/> Display accuracy: - current: 10% of the rated current - speed resolution: 1 rpm - frequency resolution: 0.01Hz
DEGREE OF PROTECTION	NEMA1 / IP20	<input checked="" type="checkbox"/> Models 13 and 16A/380-480V; other models with KN1-CFW08-M1 and KN1-CFW08-M2 kits.
	PROTECTED CHASSIS / IP20	<input checked="" type="checkbox"/> All models without KN1-CFW08-M1 or KN1-CFW08-M2 kit. Exception: Models 13 and 16A/380-480V.
STANDARDS	IEC 146	<input checked="" type="checkbox"/> <i>Inverters and semiconductors</i>
	UL 508 C	<input checked="" type="checkbox"/> <i>Power Conversion Equipment</i>
	EN 50178	<input checked="" type="checkbox"/> <i>Electronic equipment for use in power installations</i>
	EN 61010	<input checked="" type="checkbox"/> <i>Safety requirements for electrical equipment for measurement, control and laboratory use</i>
	EN 61800-3	<input checked="" type="checkbox"/> <i>EMC product standard for adjustable speed electrical power drive systems</i>

## TECHNICAL SPECIFICATIONS

### 9.3 WEG STANDARD IV POLE MOTOR DATA

The inverters are delivered with factory setting to drive WEG three-phase, IV-pole, IP55 motors, frequency of 60Hz, voltage of 220V for 200-240V models or 380V for 380-480V models and with power as indicated in the Tables of Sections 9.1.1 and 9.1.2.

The data of the applied motor must be programmed at P399 to P409 and the value of P409 (stator resistance) obtained through the Self-Tuning (parameter estimation via P408).

The table below shows the data of WEG standard motors as a reference.

Power [P404]		Frame	Voltage [P400] (V)	Current [P401] (Amp)	Freq. [P403] (Hz)	Speed [ P402 ] (rpm)	Efficiency at rated load $\eta$ [P399] (%)	Power Factor at rated load $\cos\phi$ [P407]	Stator Resistance (*) [P409] ( $\Omega$ )		
(HP)	(kW)										
0.16	0.12	63	220	0.85	60	1720	56.0	0.66	21.77		
0.25	0.18	63		1.12		1720	64.0	0.66	14.87		
0.33	0.25	63		1.42		1720	67.0	0.69	10.63		
0.5	0.37	71		2.07		1720	68.0	0.69	7.37		
0.75	0.55	71		2.90		1720	71.0	0.70	3.97		
1.0	0.75	80		3.08		1730	78.0	0.82	4.13		
1.5	1.10	80		4.78		1700	72.7	0.83	2.78		
2.0	1.50	90S		6.47		1720	80.0	0.76	1.55		
3.0	2.20	90L		8.57		1710	79.3	0.85	0.99		
4.0	3.00	100L		11.6		1730	82.7	0.82	0.65		
5.0	3.70	100L		13.8		1730	84.6	0.83	0.49		
6.0	4.50	112M		16.3		1730	84.2	0.86	0.38		
0.16	0.12	63		380		0.49	60	1720	56.0	0.66	65.30
0.25	0.18	63				0.65		1720	64.0	0.66	44.60
0.33	0.25	63	0.82		1720	67.0		0.69	31.90		
0.5	0.37	71	1.20		1720	68.0		0.69	22.10		
0.75	0.55	71	1.67		1720	71.0		0.70	11.90		
1.0	0.75	80	1.78		1730	78.0		0.82	12.40		
1.5	1.10	80	2.76		1700	72.7		0.83	8.35		
2.0	1.50	90S	3.74		1720	80.0		0.76	4.65		
3.0	2.20	90L	4.95		1710	79.3		0.85	2.97		
4.0	3.00	100L	6.70		1730	82.7		0.82	1.96		
5.0	3.70	100L	7.97		1730	84.6		0.83	1.47		
6.0	4.50	112M	9.41		1730	84.2		0.86	1.15		
7.5	5.50	112M	11.49		1740	88.5		0.82	0.82		
10	7.50	132S	15.18		1760	89.0		0.84	0.68		
12.5	9.20	132M	18.48	1755	87.7	0.86	0.47				



#### NOTES!

(\*)

- The inverter considers the value of the stator resistance as the motor has been always star-connected, independently of its connection in the terminal box.
- The values of the stator resistance is a mean value per phase considering the motors with temperature rise ( $\Delta T$ ) of 100°C.

### WARRANTY

#### WARRANTY TERMS FOR FREQUENCY INVERTERS CFW-08

WEG warrants its Frequency Inverters against defects in workmanship and materials under the following conditions:

- 1.0 For the effectiveness of this warranty it is essential that the purchaser inspects carefully the purchased inverter, immediately after receipt, checking its characteristics and following its installation, adjustments, operation and maintenance instructions. The inverter will be considered as accept and approved automatically by the purchaser, when the purchaser does not give written notice within max. five days after the receipt of the product about verified non-conformities.
- 2.0 The warranty period is for twelve months from the invoice date of the equipment issued by WEG or its authorized distributor, proved through equipment invoice, but limited to twenty four months from the manufacturing date, that is indicated on the product nameplate.
- 3.0 In case the inverter fails to function or operate incorrectly during the warranty time, the warranty services will be carried out, at WEG discretion, at its Authorized Repair Shops.
- 4.0 The failed product must be available to the supplier for a required period to detect the cause of the failure and to make the corresponding repairs.
- 5.0 WEG Automação, or its Authorized Repair Shops will analyze the returned inverter and when the existence of the failure covered by the warranty is proved, it will repair, modify or replace, at its discretion, the defective inverter without cost to the purchaser, except as indicated in Item 7.0.
- 6.0 The present warranty responsibility is limited only to repairs, changes or replacement of the supplied inverter. WEG will have no obligation or liability whatsoever to people, third parties, other equipment or installations, including without limitation, any claims for loss of profits, consequential damages or labor costs.
- 7.0 Other expenses as freights, packing, disassembling/assembling and parameter setting costs will be paid exclusively by the purchaser, including all fees, ticket, accommodation and meals expenses for technical personnel, when needed and/or requested by the customer.
- 8.0 The present warranty does not cover the normal wear of the product or equipment, neither damages resulting from incorrect or negligent operation, incorrect parameter setting, improper maintenance or storage, operation out the technical specification, bad installation quality, or operated in ambient with corrosives gases or with harmful electrochemical, electrical, mechanical or atmospheric influences.

## **WARRANTY**

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- 9.0 This warranty does not cover parts or components that are considered consumer goods, such as rubber or plastic parts, incandescent bulbs, fuses, etc.
- 10.0 This warranty will be cancelled automatically, independently of any previous written notice or not, when the purchaser, without previous written authorization by WEG, makes or authorized third parties to make any changes or repair on the product or equipment that failed during the warranty period.
- 11.0 Repairs, changes, or replacements due to manufacturing defects will not stop nor extend the period of the existing warranty.
- 12.0 Any request, complaint, communication, etc. related to the product under warranty, servicing, start-up, etc., shall be sent in writing to WEG Branch or Representative.
- 13.0 The Warranty granted by WEG is conditioned by the observation of this warranty that is the only valid warranty for the good.