Frequency Inverter
Convertidores de Frecuencia
Inversores de Freqüência

CFW 09

Vectrue Technology™

User's Guide

Guia del Usuario

Manual do usuário

FREQUENCY
INVERTER
MANUAL

Series: CFW-09

Software Version: 2.6X

Manual Number/Revision:

0899.4782 E/9

04/2004

ATTENTION!

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

Summary of Revisions

The table below describes all revisions made to this manual.

Revision	Description	Section
1	First Edition	-
2	Inclusion of the functions Fieldbus and Serial Communication	See section 8.12 and 8.13
2	Inclusion of the Spare Part List	See section 7.5
2	Dimension Changing	See itens 3.1.2 and 9.4
3	Inclusion of the PID Regulator	See item 6
4	Inclusion of the German Language - Ride-through and Flying-start functions	See item 6
4	Inclusion of DBW-01; KIT KME; DC Link Inductor	See item 8
5	Inclusion of item 3.3 - CE Installation	See item 3
5	Inclusion of new functions such as Ride-Through for Vector Control, Motor Phase Loss	See item 6
5	New I/O Expansion Boards EBB.04 and EBB.05	See item 8
6	General Revision	-
7	Inclusion of the models from 2.9 to 32A / 500-600V	See items 2.4; 3.1; 3.2.1; 3.3; 4.2; 6.2; 6.3; 7.1; 7.2; 7.4; 7.5; 8.7.1; 8.10.1; 9.1 and 9.1.3
8	Inclusion of new functions: Control Type of the Speed Regulator, Speed Regulator Differential Gain, Stop Mode Selection, Access to the parameters with different content than the factory default, Hysteresis for Nx/Ny, Hours Hx, kWh Counter, Load User 1 e 2 via DIx, Parameter Setting Disable via DIx, Help Message for E24, “P406=2 in SensorLess Vector Control”, Automatic Set of P525, Last 10 errors indication, Motor Torque indication via AOx.	See item 6
8	New optional boards: EBC and PLC1	See item 8
8	New model CFW-09 SHARK NEMA 4X/IP56	See item 8
8	New models for voltages, currents and powers: Models 500-600V	See itens 1 to 9
8	Inclusion of the itens 8.14 Modbus-RTU, 8.17 CFW-09 Supplied by the DC Link - Line HD, 8.18 CFW-09 RB Regenerative Converter.	See item 8
8	Updating of the Spare Part List	7
9	Inclusion of new functions: Overcurrent Protection, Default factory reset 50Hz, Time Rele of the time, Ramp Holding	
9	New lines of the Current and supply power;	
9	PID Regulator to “Academic” Changing	

Quick Parameter Reference, Fault and Status Messages

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

Diagnostics and Troubleshooting

CHAPTER 8

CFW-09 Options and Accessories

CHAPTER 9

Technical Specification

CHAPTER 10

Warranty

QUICK PARAMETER REFERENCE, FAULT AND STATUS MESSAGES

Software: V2.6X
Application:
CFW-09 Model:
Serial Number:
Responsible:
Date: / / .

1. Parameters

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P000	Parameter Access	0 ... 999	0		97
	READ ONLY PARAMETERS	**P001 ... P099**			
P001	Speed Reference	0 ... P134 rpm			97
P002	Motor Speed	0 ... P134 rpm			97
P003	Motor Current	0 ... 2600 A			97
P004	DC Link Voltage	0... 1235V			97
P005	Motor Frequency	0 ... 1020Hz			97
P006	Inverter Status	•rdy •run •Sub •EXY			98
P007	Motor Voltage	0 ... 800V			98
P009	Motor Torque	0...150.0%			98
P010	Output Power	0.0...1200 kW			98
P012	Digital Inputs DI1...DI8 Status	•1 = Active (Closed) •0 = Inactive (Open)			98
P013	Digital and Relay Outputs DO1, DO2, RL1, RL2, and RL3 Status	•1 = Active (Picked-up) •0 = Inactive (Dropped-out)			99
P014	Last Fault	0...70			99
P015	Second Previous Fault	0...70			99
P016	Third Previous Fault	0...70			99
P017	Fourth Previous Fault	0...70			99
P018	Analog Input AI1’ Value	-100%...100%			99
P019	Analog Input AI2’ Value	-100%...100%			99
P020	Analog Input AI3’ Value	-100%...100%			99
P021	Analog Input AI4’ Value	-100%...100%			99
P022	WEG Use	0%...100%			100
P023	Software Version	X.XX			100
P024	A/D Conversion Value of AI4	-32768...32767			100
P025	A/D Conversion Value of Iv	0...1023			100
P026	A/D Conversion Value of Iw	0...1023			100
P040	PID Process Variable	0.0...100%			100
P042	Powered Time	0 ... 65530 h			100
P043	Enabled Time	0... 6553 h			100
P044	kWh Counter	0...65535 kWh			101
P060	Fifth Error	0...70			101
P061	Sixth Error	0...70			101

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P062	Seventh Error	0...70			101
P063	Eighth Error	0...70			101
P064	Ninth Error	0...70			101
P065	Tenth Error	0...70			101
	REGULATION PARAMETERS	**P100 ... P199**			
	Ramps				
P100	Acceleration Time	0.0 ... 999s	20s		101
P101	Deceleration Time	0.0 ... 999s	20s		101
P102	Acceleration Time 2	0.0 ... 999s	20s		101
P103	Deceleration Time 2	0.0 ... 999s	20s		101
P104	S Ramp	0=Inactive (Linear) 1=50 % 2=100%	0=Inactive		102
	Speed References				
P120	Reference Backup	0=Inactive 1=Active	1=Active		102
P121	Keypad Speed Reference	P133 ... P134	90 rpm		102
P122 (2)	JOG or JOG+ Speed Reference	00 ... P134	150rpm (125rpm) (11)		103
P123 (2)	JOG- Speed Reference	00 ... P134	150rpm (125rpm) (11)		103
P124 (2)	Multispeed Reference 1	P133 ... P134	90rpm (75rpm) (11)		103
P125 (2)	Multispeed Reference 2	P133 ... P134	300rpm (250rpm) (11)		103
P126 (2)	Multispeed Reference 3	P133 ... P134	600rpm (500rpm) (11)		103
P127 (2)	Multispeed Reference 4	P133 ... P134	900rpm (750rpm) (11)		103
P128 (2)	Multispeed Reference 5	P133 ... P134	1200rpm (1000rpm) (11)		103
P129 (2)	Multispeed Reference 6	P133 ... P134	1500rpm (1250rpm) (11)		104
P130 (2)	Multispeed Reference 7	P133 ... P134	1800rpm (1500rpm) (11)		104
P131 (2)	Multispeed Reference 8	P133 ... P134	1650rpm (1375rpm) (11)		104
	Speed Limits				
P132	Maximum Overspeed Level	0 ... 99% x P134 100%=Disabled	10%		104
P133 (2)	Minimum Speed Reference	0 ... (P134-1)	90rpm (75rpm) (11)		104
P134 (2)	Maximum Speed Reference	(P133+1)...(3.4 x P402)	1800rpm (1500rpm) (11)		104
	I/F Control				
P135 (2)	Speed for I/F Control	0...90 rpm	18 rpm		105
P136(*)	Current Reference (I*) for I/F Control	0= I_{mr} 1=1.11x I_{mr} 2=1.22x I_{mr} 3=1.33x I_{mr} 4=1.44x I_{mr} 5=1.55x I_{mr} 6= 1.66x I_{mr} 7=1.77x I_{mr} 8=1.88x I_{mr} 9=2.00x I_{mr}	1=1.11x I_{mr}		105
	V/F Control				
P136(*)	Manual Boost Torque	0 ... 9	1		106
P137	Autommatic Torque Boost	0.00 ... 1.00	0.00		106
P138 (2)	Slip Compensation	-10.0% ... 10.0 %	2.8%		107
P139	Output Current Filter	0.0...16 s	0.2s		108
P140	Dwell Time at Start	0...10 s	0s		108
P141	Dwell Speed at Start	0...300 rpm	90 rpm		108

(*)P136 Has Different Functions for V/F and I/F control

CFW-09 - *QUICK PARAMETER REFERENCE*

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
	Adjustable V/F				
P142 (1)	Maximum Output Voltage	0...100%	100%		109
P143 (1)	Intermediate Output Voltage	0...100%	50%		109
P144 (1)	Output Voltage at 3Hz	0...100%	8%		109
P145 (1)	Field Weakening Speed	P133 (>90 rpm)...P134	1800 rpm		109
P146 (1)	Intermediate Speed	90 rpm...P145	900 rpm		109
	DC Link Voltage Regulation				
P150 (1)	DC Link Voltage Regulation Mode	0=With Losses 1=Without Losses 2=Enable/Disable via DI3...DI8	1=Without Losses		109
P151 (6)	Regulation Level	• 339V...400V (P296=0) • 585V...800V (P296=1) • 616V...800V (P296=2) • 678V...800V (P296=3) • 739V...800V (P296=4) • 809V...1000V (P296=5) • 885V...1000V (P296=6) • 924V...1000V (P296=7) • 1063V...1200V (P296=8)	•400V •800V •800V •800V •800V •1000V •1000V •1000V •1200V		110
P152	Proportional Gain	• 0.00...9.99	•0.00		113
P153 (6)	Dynamic Braking Level	• 339V...400V (P296=0) • 585V...800V (P296=1) • 616V...800V (P296=2) • 678V...800V (P296=3) • 739V...800V (P296=4) • 809V...1000V (P296=5) • 885V...1000V (P296=6) • 924V...1000V (P296=7) • 1063V...1200V (P296=8)	•375V •618V •675V •748V •780V •893V 972V •972V •1174V		113
P154	Dynamic Braking Resistor	0.0 ... 500 Ω	0.0 Ω		114
P155	DB Resistor Power Rating	0.02 ... 650 kW	2.60 kW		114
	Overload Currents				
P156 (2) (7)	Overload Current 100% Speed	P157 ... 1.3xP295	1.1xP401		114
P157 (2) (7)	Overload Current 50% Speed	P158...P156	0.9xP401		114
P158 (2) (7)	Overload Current 5% Speed	0.2xP295 ...P157	0.5xP401		114
	Speed Regulator				
P160 (1)	Speed Regulator Control Mode	0=Speed 1=Torque	0=Speed		115
P161 (3)	Proportional Gain	0.0...63.9	7.4		116
P162 (3)	Integral Gain	0.000...9.999	0.023		116
P163	Local Speed Reference Offset	-999 ... 999	0		117
P164	Remote Speed Reference Offset	-999 ... 999	0		117
P165	Speed Filter	0.012 ... 1.000 s	0.012 s		117
P166	Differential Gain	0.00...7.99	0.00 (without differential action)		117
	Current Regulator				
P167 (4)	Proportional Gain	0.00...1.99	0.5		117
P168 (4)	Integral Gain	0.000...1.999	0.010		117
P169 (*) (7)	Maximum Output Current (V/F Control)	0.2xP295 ... 1.8xP295	1.5xP295		117
P169 (*) (7)	Maximum Forward Torque (Vector Control)	0...1.8xP295	125% (P295)		117

(*) V/F or Vector Different Function in P169.

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P170	Maximum Reverse Torque (Vector Control)	0...1.8xP295	125% (P295)		119
P171	Maximum Forward Torque Current at Maximum Speed (P134)	0...1.8xP295	100% (P295)		119
P172	Maximum Reverse Torque Current at Maximum Speed (P134)	0...1.8xP295	100% (P295)		119
P173	Curve Type of the Max. Torque	0=Ramp 1=Step	0=Ramp		119
	Flux Regulator				
P175 (5)	Proportional Gain	0.0...31.9	2.0		119
P176 (5)	Integral Gain	0.000...9.999	0.020		119
P177	Minimum Flux	0...120%	0%		120
P178	Nominal Flux	0...120%	100%		120
P179	Maximum Flux	0...120%	120%		120
P180	Field Weakenig Start Point	0...120%	95%		120
P181 (1)	Magnetization Mode	0=General Enable 1=Run/Stop	0=General Enable		120
	CONFIGURATION PARAMETERS	**P200 ... P399**			
	Generic Parameters				
P200	Password	0=Off 1=On	1=On		120
P201	Language Selection	0=Portuguese 1=English 2=Spanish 3=German	(11)		120
P202 (1) (2)	Type of Control	0=V/F 60Hz 1=V/F 50Hz 2=V/F Adjustable 3=Sensorless Vector 4=Vector with Encoder Feedback	(11)		121
P203 (1)	Special Function Selection	0=None 1=PID Regulator	0=None		121
P204 (1) (10)	Load/Save Parameters	0=Not Used 1=Not Used 2=Not Used 3=Reset P043 4=Reset P044 5=Loads Factory Default-60Hz 6=Loads Factory Default-50Hz 7=Loads User Default 1 8=Loads User Default 2 9=Not Used 10=Save User Default 1 11=Save User Default 2	0=Not Used		121
P205	Display Default Selection	0=P005 (Motor Frequency) 1=P003 (Motor Current) 2=P002 (Motor Speed) 3=P007 (Motor Voltage) 4=P006 (Inverter Status) 5=P009 (Motor Torque) 6=P040	2=P002		122

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P206	Auto-Reset Time	0 ... 255s	0s		122
P207	Reference Engineering Unit 1	32 ... 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	114=r		122
P208 (2)	Reference Scale Factor	1 ... 18000	1800 (1500) (11)		122
P209	Motor Phase Loss Detection	0=Off 1=On	0=Off		123
P210	Decimal Point of the Speed Indication	0, 1, 2 or 3	0		123
P211	Zero Speed Disable	0=Off 1=On	0=Off		123
P212	Condition to Leave Zero Speed Disable	0=N* or N>0 1=N*>0	0=Ref. or Speed		124
P213	Time Delay for Zero Speed Disable	0 ... 999s	0s		124
P214 (1) (9)	Line Phase Loss Detection	0=Off 1=On	1=On		124
P215 (1)	Keypad Copy Function	0=Off 1=Inverter → Keypad 2=keypad → Inverter	0=Off		124
P216	Reference Engineering Unit 2	32 ... 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	112=p		126
P217	Reference Engineering Units 3	32...127 (ACSII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	109=m		126
P218	LCD Display Contrast Adjustment	0 ... 150	127		126
	Local/Remote Definition				
P220 (1)	Local/Remote Selection Source	0=Always Local 1=Always Remote 2=Keypad (Default Local) 3=Keypad (Default Remote) 4=DI2 ... DI8 5=Serial (L) 6=Serial (R) 7=Fieldbus (L) 8=Fieldbus (R) 9=PLC (L) 10=PLC (R)	2=Keypad (Default Local)		126
P221(1)	Local Speed Reference Selection	0=keypad 1=AI1 2=AI2 3=AI3 4=AI4 5=Add AI > 0 6=Add AI 7=EP 8=Multispeed	0=Keypad		126

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		9=Serial 10=Fieldbus 11=PLC			
P222 (1)	Remote Speed Reference Selection	0=keypad 1=AI1 2=AI2 3=AI3 4=AI4 5=Add AI > 0 6=Add AI 7= EP 8=Multispeed 9=Serial 10=Fieldbus 11=PLC	1=AI1		126
P223 (1) (8)	Local FWD/REV Selection	0=Forward 1=Reverse 2=Keypad (Default FWD) 3=Keypad (Default REV) 4=DI2 5=Serial (Default FWD) 6=Serial (Default REV) 7=Fieldbus (Default FWD) 8=Fieldbus (Default REV) 9=Polarity AI4 10=PLC (H) 11=PLC (AH)	2=Keypad (Default FWD)		127
P224 (1)	Local Start/Stop Selection	0=[I] and [O] Keys 1=DIx 2=Serial 3=Fieldbus 4=PLC	0=[I] and [O] Keys		127
P225 (1) (8)	Local JOG Selection	0=Disable 1=Keypad 2=DI3 ... DI8 3=Serial 4=Fieldbus 5=PLC	1=Keypad		127
P226 (1) (8)	Remote FWD/REV Selection	0=Always Forward 1=Always Reverse 2=Keypad (Default FWD) 3=Keypad (Default REV) 4=DI2 5=Serial (Default FWD) 6=Serial (Default REV) 7=Fieldbus (Default FWD) 8=Fieldbus (Default REV) 9=Polarity AI4 10=PLC (H) 11=PLC (AH)	4=DI2		127

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P227 (1)	Remote Start/Stop Selection	0=[I] and [O] Keys 1=DIx 2=Serial 3=Fieldbus 4=PLC	1=DIx		128
P228 (1) (8)	Remote JOG Selection	0=Disable 1=Keypad 2=DI3 ... DI8 3=Serial 4=Fieldbus 5=PLC	2=DI3 ... DI8		128
	Stop Model Definition				
P232 (1)	Stop Mode Selection	0=Run/Stop 1=General Enable 2=Fast Stop	0=Run/Stop		132
	Analog Inputs				
P233	Analog Inputs Dead Zone	0=Off 1=On	0=Off		132
P234	Analog Input AI1 Gain	0.000 ... 9.999	1.000		133
P235 (1)	Analog Input AI1 Signal	0=0...10V/0...20mA 1=4...20mA 2=10...0V/20...0mA 3=20...4mA	0=0...10V/0...20 mA		133
P236	Analog Input AI1 Offset	-100% ... 100%	0.0 %		133
P237 (1)	Analog Input AI2 Function	0=P221/P222 1=N* Ramp Ref. 2=Maximum Torque Current 3=PID Process Variable	0=P221/P222		133
P238	Analog Input AI2 Gain	0.000 ... 9.999	1.000		134
P239 (1)	Analog Input AI2 Signal	0=0...10V/0...20mA 1=4...20mA 2=10...0V/20...0mA 3=20...4mA	0=0...10V/0...20 mA		134
P240	Analog Input AI2 Offset	-100% ... 100%	0.0 %		135
P241 (1)	Analog Input AI3 Function (Requires Optional I/O Expansion Board EBB)	0=P221/P222 1=No Ramp. Ref. 2=Maximum Torque Current 3=PID Process Variable	0=P221/P222		135
P242	Analog Input AI3 Gain	0.000 ... 9.999	1.000		135
P243 (1)	Analog Input AI3 Signal	0=0...10V/0...20mA 1=4...20mA 2=10...0V/20...0mA 3=20...4mA	0=0...10V/ 0...20 mA		135
P244	Analog Input AI3 Offset	-100% ... 100%	0.0%		135
P245	Analog Input AI4 Gain	0.000 ... 9.999	1.000		135
P246 (1)	Analog Input AI4 Signal (Requires Optional I/O Expansion Board EBA)	0=0...10V/0...20mA 1=4...20mA 2=10...0V/20...0mA 3=20...4mA 4=-10V...+10V	0=0...10V/ 0...20 mA		136

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P247	Analog Input AI4 Offset	-100% ... 100%	0.0%		136
P248	Input Filter AI2	00...16.0s	0.0s		136
	Analog Outputs				
P251	Analog Output AO1 Function	0=Speed Reference 1=Total Reference 2=Real Speed 3=Torque Current Reference (Vector) 4=Torque Current (Vector) 5=Output Current 6=PID Process Variable 7=Active Current (V/F) 8=Power (kW) 9=PID Setpoint 10=Positive Torque Current 11=Motor Torque 12=PLC	2=Real Speed		136
P252	Analog Output AO1 Gain	0.000 ... 9.999	1.000		136
P253	Analog Output AO2 Function	0=Speed Reference 1=Total Reference 2=Real Speed 3=TorqueCurrent Reference (Vector) 4=Torque Current (Vector) 5=Output Current 6=PID Process Variable 7=Active Current (V/F) 8=Power (kW) 9=PID Setpoint 10=Positive Torque Current 11=Motor Torque 12=PLC	5= Output Current		136
P254	Analog Output AO2 Gain	0.000 ... 9.999	1.000		136
P255	Analog Output AO3 Function (Requires Optional I/O Expansion Board EBA)	0=Speed Reference 1= Total Reference 2=Real Speed 3=Torque Current Reference (Vector) 4=Torque Current (Vector) 5=Output Current 6=PID Process Variable 7=Active Current(V/F) 8=Power (kW) 9=PID Setpoint 10= Positive Torque Current 11=Motor Torque 12=PLC 25 signals for exclusive use of WEG	2=Real Speed		137
P256	Analog Output AO3 Gain	0.000 ... 9.999	1.000		137

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P257	Analog Output AO4 Function (Requires optional I/O Expansion Board EBA)	0=Speed Reference 1=Total Reference 2=Real Speed 3=Torque Current Reference (Vector) 4=Torque Current (Vector) 5=Output Current 6=PID Process Variable 7=Active Current (V/F) 8=Power (kW) 9=PID Setpoint 10= Positive Torque Current 11=Motor Torque 12=PLC 25 signals for exclusive use of WEG	5=Output Current		137
P258	Analog Output AO4 Gain	0.000 ... 9.999	1.000		137
	Digital Inputs				
P263 (1)	Digital Input DI1 Function	0=Not Used 1=Start/Stop 2=General Enable 3=Fast Stop	1=Start/Stop		139
P264 (1)	Digital Input DI2 Function	0=FWD/REV 1=Local/Remote 2=Not Used 3=Not Used 4=Not Used 5=Not Used 6=Not Used 7=Not Used 8=Reverse Run	0=FWD/REV		139
P265 (1) (8)	Digital Input DI3 Function	0=Not Used 1=Local/ Remote 2=General Enable 3=JOG 4=No External Fault 5=Increase Electronic Pot. 6=Ramp 2 7=Not Used 8=Forward Run 9=Speed/Torque 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Start (3 wire) 15=Man/Auto 16=Not Used 17=Disables Flying Start	0=Not Used		139

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		18=DC Voltage Regulator 19=Parameter Setting Disable 20=Load User 21=Timer (RL2) 22=Timer (RL3)			
P266 (1)	Digital Input DI4 Function	0=Not Used 1=Local/ Remote 2=General Enable 3=JOG 4=No external Fault 5=Decrease Electronic Pot. 6=Ramp 2 7=Multispeed (MS0) 8=Reverse Run 9= Speed/Torque 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop 15=Man/Auto 16=Not Used 17=Disables Flying Start 18=DC Voltage Regulator 19=Parameter Setting Disable 20=Load User 21=Timer (RL2) 22=Timer (RL3)	0=Not Used		139
P267 (1)	Digital Input DI5 Function	0=Not Used 1=Local/ Remote 2=General Enable 3=JOG 4=No External Fault 5=Accelerates 6=Ramp 2 7=Multispeed (MS1) 8=Fast Stop 9= Speed/Torque 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Start (3 wire) 15=Man/Auto 16=Not Used 17=Disables Flying Start 18=DC Voltage Regulator 19=Parameter Setting Disable 20=Load User	3=JOG		139

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		21=Timer (RL2) 22=Timer (RL3)			
P268 (1)	Digital Input DI6 Function	0=Not Used 1=Local/ Remote 2=General Enable 3=JOG 4=No External Fault 5=Decelerates EP 6=Ramp 2 7=Multispeed (MS2) 8=Fast Stop 9= Speed/Torque 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop (3 wire) 15=Man/Auto 16=Not Used 17=Disables Flying Start 18=DC Voltage Regulator 19=Parameter Setting Disable 20=Load User 21=Timer (RL2) 22=Timer (RL3)	6=Ramp 2		139
P269(1)	Digital Input DI7 Function (Requires Optional EBA or EBB Expansion Board)	0=Not Used 1=Local/ Remote 2=General Enable 3=JOG 4=No External Fault 5=Not Used 6=Ramp 2 7=Not Used 8=Fast Stop 9= Speed/Torque 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Start (3 wire) 15=Man/Auto 16=Not Used 17=Disables Flying Start 18=DC Voltage Regulator 19=Parameter Setting Disable 20=Load User 21=Timer (RL2) 22=Timer (RL3)	0=Not Used		139

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P270 (1)	Digital Input DI8 Function (Requires Optional I/O Expansion Board EBA or EBB)	0=Not Used 1=Local/ Remote 2=General Enable 3=JOG 4=No External Fault 5=Not Used 6=Ramp 2 7=Not Used 8=Fast Stop 9= Speed/Torque 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop (3 wire) 15=Man/Auto 16=Motor Thermistor 17=Disables Flying Start 18=DC Voltage Regulator 19=Parameter Setting Disable 20=Not Used 21=Timer (RL2) 22=Timer (RL3)	0=Not Used		139
	Digital Outputs				
P275(1)	Digital Ouput DO1 Function (Requires Optional I/O Expansion Board EBA or EBB)	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N =N* 5=Zero Speed 6=Is > Ix 7=Is < Ix 8=Torque > Tx 9=Torque < Tx 10=Remote 11=Run 12=Ready 13=No Fault 14=No E00 15=No E01+E02+E03 16=No E04 17=No E05 18=4...20mA OK 19=Fieldbus 20=FWD 21=Proc.Var. > VPx 22=Proc. Var. < VPy 23=Ride-Through 24=Pre-charge OK 25=Fault 26=Enable Hours > Hx	0=Not Used		145

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		27=Not Used 28=Not Used 29=N > Nx and Nt > Nx			
P276 (1)	Digital Output DO2 Function (Requires Optional I/O Expansion Board EBA or EBB)	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N =N* 5=Zero Speed 6=Is > Ix 7=Is < Ix 8=Torque > Tx 9=Torque < Tx 10=Remote 11=Run 12=Ready 13=No Fault 14=No E00 15=No E01+E02+E03 16=No E04 17=No E05 18=4...20mA OK 19=Fieldbus 20=FWD 21=Proc.Var. > VPx 22=Proc. Var. < VPy 23=Ride-Through 24=Pre-charge OK 25=Fault 26=Enable Hours > Hx 27=Not Used 28=Not Used 29=N > Nx and Nt > Nx	0=Not Used		145
P277 (1)	Relay Output RL1 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N =N* 5=Zero Speed 6=Is > Ix 7=Is < Ix 8=Torque > Tx 9=Torque < Tx 10=Remote 11=Run 12=Ready 13=No Fault 14=No E00 15=No E01+E02+E03 16=No E04 17=No E05 18=4...20mA OK 19=Fieldbus	13=No Fault		145

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		20=FWD 21=Proc.Var. > VPx 22=Proc. Var. < VPy 23=Ride-Through 24=Pre-charge OK 25=Fault 26=Enable Hours > Hx 27=PLC 28=Not Used 29=N > Nx and Nt > Nx			
P279 (1)	Relay Output RL2 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N =N* 5=Zero Speed 6=Is > Ix 7=Is < Ix 8=Torque > Tx 9=Torque < Tx 10=Remote 11=Run 12=Ready 13=No Fault 14=No E00 15=No E01+E02+E03 16=No E04 17=No E05 18=4...20mA OK 19=Fieldbus 20=FWD 21=Proc.Var. > VPx 22=Proc. Var. < VPy 23=Ride-Through 24=Pre-charge OK 25=Fault 26=Enable Hours > Hx 27=PLC 28=Timer 29=N > Nx and Nt > Nx	2= N > Nx		145
P280 (1)	Relay Output RL3 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N =N* 5=Zero Speed 6=Is > Ix 7=Is < Ix 8=Torque > Tx 9=Torque < Tx 10=Remote 11=Run 12=Ready 13=No Fault	1= N*>Nx		145

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		14=No E00 15=No E01+E02+E03 16=No E04 17=No E05 18=4...20mA OK 19=Fieldbus 20=FWD 21=Proc.Var. > VPx 22=Proc. Var. < VPy 23=Ride-Through 24=Pre-charge OK 25=Fault 26=Enable Hours > Hx 27=PLC 28=Timer 29=N > Nx and Nt > Nx			
	P283	Time for RL2 ON	0.0 ... 300s	0.0s	147
	P284	Time for RL2 OFF	0.0 ... 300s	0.0s	147
	P285	Time for RL3 ON	0.0 ... 300s	0.0s	147
	P286	Time for RL3 OFF	0.0 ... 300s	0.0s	147
	Nx, Ny, Ix, Zero Speed Zone,				
	N=N* and Tx				
P287	Hysterese for Nx/Ny	0 ... 5%	1.0%		150
P288 (2)	Nx Speed	0 ... P134	120rpm (100rpm) (11)		150
P289 (2)	Ny Speed	0 ... P134	1800rpm (1500rpm) (11)		150
P290 (7)	Ix Current	0 ... 2.0xP295	1.0xP295		150
P291	Zero Speed Zone	1...100%	1%		150
P292	N=N* Band	1...100%	1%		150
P293	Tx Torque	0 ... 200% x P401	100% x P401		150
P294	Hours Hx	0 ... 6553 h	4320 h		150
	Inverter Data				
P295 (1)	Inverter Rated Current	0=3.6A 1=4.0A 2=5.5A 3=6.0A 4=7.0A 5=9.0A 6=10.0A 7=13.0A 8=16.0A 9=24.0A 10=28.0A 11=30.0A 12=38.0A 13=45.0A 14=54.0A 15=60.0A 16=70.0A 17=86.0A 18=105.0A 19=130.0A 20=142.0A	According to Inverter Model		150

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		21=180.0A 22=240.0A 23=361.0A 24=450.0A 25=600.0A 26=200.0 A 27=230.0 A 28=320.0 A 29=400.0 A 30=570.0 A 31=700.0 A 32=900.0 A 33=686.0 A 34=855.0 A 35=1140.0 A 36=1283.0 A 37=1710.0 A 38=2.0 A 39=2.9 A 40=4.2 A 41=12.0 A 42=14.0 A 43=22.0 A 44=27.0 A 45=32.0 A 46=44.0 A 47=53.0 A 48=63.0 A 49=79.0 A 50=100.0 A 51=107.0 A 52=127.0 A 53=147.0 A 54=179.0 A 55=211.0 A 56=225.0 A 57=247.0 A 58=259.0 A 59=305.0 A 60=315.0 A 61=340.0 A 62=343.0 A 63=418.0 A 64=428.0 A 65=472.0 A 66=33.0 A 67=312.0 A 68=492.0 A 69=515.0 A 70=580.0 A 71=646.0 A			

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		72=652.0 A 73=794.0 A 74=813.0 A 75=869.0 A 76=897.0 A 77=969.0 A 78=978.0 A 79=1191.0 A 80=1220.0 A 81=1345.0 A			
P296 (1)	Inverter Rated Voltage	0=220V/230V 1=380V 2=400V/415V 3=440V/460V 4=480V 5=500V/525V 6=550V/575V 7=600V 8=660V/690V	0 for models 220V-230V 3 for models 380V-480V 6 for models 500V-600V and 500V-690V 8 for models 660V-690V (11)	Attention! Refer to selection 3.2.3 for AC Line Voltage Selection	150
P297 (1) (2)	Switching Frequency	0=1.25 kHz 1=2.5 kHz 2=5.0 kHz 3=10.0 kHz	2=5.0 kHz		151
	DC Braking				
P300	DC Braking Time	0.0 ... 15.0 s	0.0 s		151
P301	DC Braking Start Speed	0 ... 450 rpm	30 rpm		151
P302	DC Braking Voltage	0.0 ... 10.0%	2.0 %		151
	Skip Speed				
P303	Skip Speed 1	P133 ... P134	600 rpm		152
P304	Skip Speed 2	P133 ... P134	900 rpm		152
P305	Skip Speed 3	P133 ... P134	1200 rpm		152
P306	Skip Band	0 ... 750 rpm	0 rpm		152
	Serial Communication				
P308 (1)	Inverter Address	1...30	1		152
P309 (1)	Fieldbus	0=Disable 1=ProDP 2I/O 2=ProDP 4I/O 3=ProDP 6I/O 4=DvNET 2I/O 5=DvNET 4I/O 6=DvNET 6I/O	0=Disable		152
P312	Type of Serial Protocol	0=WEG Protocol 1=Modbus-RTU, 9600 bps, no parity 2=Modbus-RTU, 9600 bps, odd parity 3= Modbus-RTU, 9600 bps, even parity 4=Modbus-RTU, 19200 bps, no parity	0=WEG Protocol		152

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		5=Modbus-RTU, 19200 bps, odd parity 6=Modbus-RTU, 19200 bps, even parity 7=Modbus-RTU, 38400 bps, no parity 8=Modbus-RTU, 38400 bps, odd parity 9=Modbus-RTU, 38400 bps, even parity			
P313 (1)	Type of disabling by E28/E29/E30	0=Disable by Stop/Run 1=Disable by general Enabling 2=Not Used 3=Changes to LOC	0=Disable by Stop/Run		153
P314	Time for Serial Watchdog Action	0.0 s=Disabled 0.1 ... 999.0 s	0.0=Disabled		153
	Flying Start/Ride-Through				
P320 (1)	Flying Start/Ride-Through	0=Inactive 1=Flying Start 2=Flying Start/Ride-Through 3=Ride-Through	0=Inactive		153
P321 (6)	Ud Line Loss Level	178 V...282 V (P296=0) 307 V...487 V (P296=1) 324 V...513 V (P296=2) 356 V...564 V (P296=3) 388 V...616 V (P296=4) 425V...674V (P296=5) 466V...737V (P296=6) 486V...770V (P296=7) 559V...885V (P296=8)	252 V 436 V 459 V 505 V 550 V 602V 660V 689V 792V		153
P322 (6)	Ud Ride-Through	178 V...282 V (P296=0) 307 V...487 V (P296=1) 324 V...513 V (P296=2) 356 V...564 V (P296=3) 388 V...616 V (P296=4) 425V...674V (P296=5) 466V...737V (P296=6) 486V...770V (P296=7) 559V...885V (P296=8)	245 V 423 V 446 V 490 V 535 V 588V 644V 672V 773V		154
P323 (6)	Ud Line Recover Level	178 V...282 V (P296=0) 307 V...487 V (P296=1) 324 V...513 V (P296=2) 356 V...564 V (P296=3) 388 V...616 V (P296=4) 425V...674V (P296=5) 466V...737V (P296=6) 486V...770V (P296=7) 559V...885V (P296=8)	267 V 461 V 486 V 534 V 583 V 638V 699V 729V 838V		155

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P325	Ride-Through Proportional Gain	0.0...63.9	22.8		155
P326	Ride-Through Integral Gain	0.000...9.999	0.128		156
P331	Voltage Ramp	0.2 ... 10.0s	2.0s		156
P332	Dead Time	0.1 ... 10.0s	1.0s		156
	MOTOR PARAMETERS	**P400...P499**			
	Motor Nameplate Data				
P400 (1) (6)	Motor Rated Voltage	0...690V	P296		158
P401 (1)	Motor Rated Current	0.0 ... 1.30xP295	1.0xP295		158
P402 (1) (2)	Motor Rated RPM	0...18000rpm (P202 ≤ 2) 0...7200rpm (P202 > 2)	1750rpm (1458rpm) (11)		158
P403 (1)	Motor Rated Frequency	0...300 Hz (P202 ≤ 2) 30...120 Hz (P202 > 2)	60Hz (50Hz) (11)		158
P404 (1)	Motor Rated HP	0=0.33 HP/0.25 kW 1=0.50 HP/0.37 kW 2=0.75 HP/0.55 kW 3=1.0 HP/0.75 kW 4=1.5 HP/1.1 kW 5=2.0 HP/1.5 kW 6=3.0 HP/2.2 kW 7=4.0 HP/3.0 kW 8=5.0 HP/3.7 kW 9=5.5 HP/4.0 kW 10=6.0 HP/4.5 kW 11=7.5 HP/5.5 kW 12=10.0 HP/7.5 kW 13=12.5 HP/9.0 kW 14=15.0 HP/11.0 kW 15=20.0 HP/15.0 kW 16=25.0 HP/18.5 kW 17=30.0 HP/22.0 kW 18=40.0 HP/30.0 kW 19=50.0 HP/37.0 kW 20=60.0 HP/45.0 kW 21=75.0 HP/55.0 kW 22=100.0 HP/75.0 kW 23=125.0 HP/90.0 kW 24=150.0 HP/110.0 kW 25=175.0 HP/130.0 kW 26=180.0 HP/132.0 kW 27=200.0 HP/150.0 kW 28=220.0 HP/160.0 kW 29=250.0 HP/185.0 kW 30=270.0 HP/200.0 kW 31=300.0 HP/220.0 kW 32=350.0 HP/260.0 kW 33=380.0 HP/280.0 kW 34=400.0 HP/300.0 kW 35=430.0 HP/315.0kW 36=440.0 HP/330.0kW 37=450.0 HP/335.0 kW 38=475.0 HP/355.0 kW 39=500.0 HP/375.0 kW	0=0.33 HP/0.25 kW		158

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
		40=540.0 HP/400.0kW 41=600.0 HP/450.0 kW 42=620.0 HP/460.0kW 43=670.0 HP/500.0kW 44=700.0 HP/525.0 kW 45=760.0 HP/570.0 kW 46=800.0 HP/600.0 kW 47=850.0 HP/630.0kW 48=900.0 HP/670.0 kW 49=1100.0 HP/820.0 kW 50=1600.0 HP/1190.0 kW			
P405	Encoder PPR	250...9999	1024		159
P406 (1)	Motor Ventilation Type	0=Self Ventilated 1=Separate Ventilation 2=Special Motor	0=Self Ventilated (2)		159
	Measured Parameters				
P408 (1)	Self-Tuning	0=No 1=No Rotation 2=Run for I_{mr} 3=Run for T_M 4=Estimate T_M	0=No		160
P409 (1)	Motor Stator Resistance (Rs)	0.000...77.95Ω	0.000Ω		161
P410	Motor Magnetizing Current (I_{mr})	0.0...1.25xP295	0A		161
P411 (1)	Motor Flux Leakage Inductance (σLS)	0.00...99.99mH	0mH		161
P412	L_R/R_R Constant (Rotor Time Constant (Tr))	0.000...9.999	0s		161
P413 (1)	T_M Constant (Mechanical Time Constant)	0.00...99.99	0s		162
	SPECIAL FUNCTION Parameters				
	PID Regulator				
P520	PID Proportional Gain	0.000 ... 7.999	1.000		166
P521	PID Integral Gain	0.000...7.999	0.043		166
P522	PID Differential Gain	0.000...3.499	0.000		166
P523	PID Ramp Time	0.0...999s	3.0s		166
P524 (1)	Selection of PID Feedback	0=AI2 (P237) 1=AI3 (P241)	0=AI2 (P237)		167
P525	PID Setpoint	0...100%	0%		167
P526	Process Variable Filter	0.0...16.0s	0.1s		167
P527	PID Action	0=Direct 1=Reverse	0=Direct		167
P528	Proc. Var. Scale Factor	1...9999	1000		169
P529	Decimal Point of Proc. Var.	0, 1, 2 or 3	1		169
P530	Engineering Unit of Proc. Var. 1	32 ... 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	37=%		169
P531	Engineering Unit of Proc. Var. 2	32 ... 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	32=blank		169

Parameters	Function	Adjustable Range	Factory Setting	User's Setting	Page
P532	Engineering Unit of Proc. Var. 3	32 ... 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	32=blank		169
P533	Value of Proc. Var. X	0.0...100%	90.0%		169
P534	Value of Proc. Var. Y	0.0...100%	10.0%		169
P535	Wake Up Band	0...100%	0%		169
P536 (1)	Automatic Setting of P525	0=Active 1=Inactive	0=Active		169

(1) Parameter can be changed only with the inverter disabled (motor stopped)
(2) Values may change as a function of the “Motor Parameters”.
(3) Values may change as a function of P413 (Tm Constant - obtained during Self-tuning).
(4) Values may change as a function of P409 and P411 (obtained during Self-tuning).
(5) Values may change as a function of P412 (Tr Constant - obtained during Self-tuning).
(6) Values may change as a function of P296.
(7) Values may change as a function of P295.
(8) Values may change as a function of P203.
(9) Values may change as a function of P320.
(10) User’s Standard (for new inverters) = without parameter
(11) The inverter will be delivered with settings according to the market, considering the HMI language, V/F 50 or 60 Hz and the required voltage. The reset of the standard factory setting may change the parameters related to the frequency (50Hz/60 Hz). Values within parenthesis mean the factory setting for 50 Hz.

2. Fault Messages

Display	Description	Page
E00	Output Overcurrent/Short-Circuit	170
E01	DC Link Overvoltage	170
E02	DC Link Undervoltage	170
E03	Power Supply Undervoltage/Phase Loss	170
E04(*)	Inverter Overtemperature/Pre-charge Circuit Failure	171
E05	Output Overload (Ixt Function)	171
E06	External Fault	171
E07	Encoder Fault Valid for P202=4 (Vector with Encoder)	171
E08	CPU Error (watchdog)	171
E09	Program Memory Error	171
E10	Error in the Copy Function	171
E11	Output Ground Fault	171
E12	Dynamic Braking Resistor Overload	171
E13	Motor or Encoder with Inverted Wires (Self-Tuning) (Valid for P202=4)	172
E17	Overspeed Fault	172
E15	Motor Phase Loss	172
E28...30	Serial communication error	172
E24	Programming Error	172
E31	Keypad Connection Fault	172
E32	Motor Overtemperature	172
E41	Self-Diagnosis Fault	172
E70	Internal DC Supply Undervoltage	172

(*) E04 can be "Pre-charge Circuit Failure" only in the following models: 86, 105, 142,180...600A (380V-480V) and 70, 86, 105, 130A (220V-230V), 44A/53A/63A, 79A (500-600V) and for all 500-690 and 660-690V models.
E04 can also occur when signal with inverted polarity is applied at analog inputs AI1/AI2.
The E04 fault message can also occur in the models up to 142, when the temperature at the heat sink is lower than - 10ºC

3. Other Messages

Display	Description
rdy	Inverter is Ready to be Enabled
run	Inverter is Enabled
Sub	Power Supply Voltage is Too Low for the Inverter Operation (Undervoltage)
dCbr	Inverter in DC Braking Mode. (See P300)

SAFETY NOTICES

This Manual contains all necessary information for the correct installation and operation of the CFW-09 Variable Frequency Drive.
The CFW-09 Instruction Manual has been written for qualified personnel with suitable training or technical qualifications 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 Instructions are not strictly observed, it can lead to serious or fatal injuries of personnel and/or equipment damage.

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

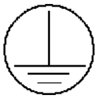
NOTE!
The content of this Manual supplies important information for the correct understanding of operation and proper performance of the equipment.

1.2 SAFETY NOTICES ON THE PRODUCT

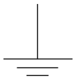
The following symbols may be attached to the product, serving as Safety Notice:

High Voltages

Components are sensitive to electrostatic discharge. Do not touch them without following 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, startup, operation and maintenance of this equipment. Personnel must review this entire Manual before attempting to install, operate or troubleshoot the CFW-09.

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-09 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-09.

GENERAL INFORMATION

This chapter defines the contents and purpose of this manual and describes the main characteristics of the CFW-09 frequency inverter. Identification of the CFW-09, receiving and storage requirements are also provided.

2.1 ABOUT THIS MANUAL

This Manual is divided into 10 Chapters, providing information to the user on how to receive, install, start-up and operate the CFW-09:

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 - Diagnostics and Troubleshooting;
Chapter 8 - CFW-09 Options and Accessories;
Chapter 9 - Technical Specifications;
Chapter 10-Warranty Policy.

This Manual provides information for the correct use of the CFW-09. The CFW-09 is very flexible and allows for the operation in many different modes as described in this manual.

As the CFW-09 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-09 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-09, 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 1.0X applies to versions 1.00 to 1.09, where “X” is a variable that will change due to minor software revisions. The operation of the CFW-09 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-09

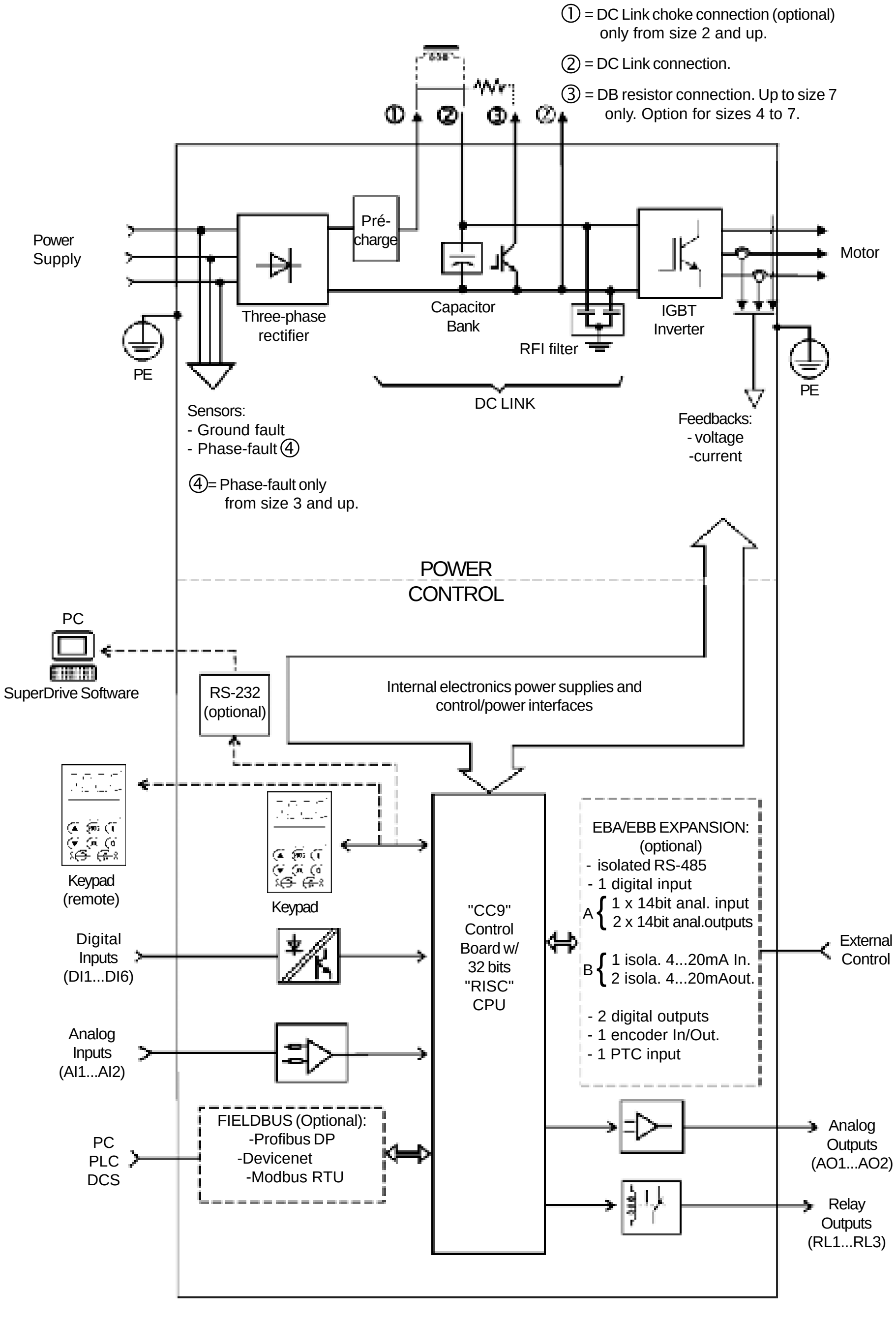
The CFW-09 is a high performance Variable Frequency Drive that permits the control of speed and torque of a three-phase AC induction motor. The technological advantage of the CFW-09 is due to the “Vectrue” technology that provides the following benefits:

☑ Programmable scalar (Volts/Hz) or vector control with the same product;
☑ Vector Control can be programmed for “Sensorless” (that means that standard motors can be controlled without encoder feedback), or “Closed Loop” (with an encoder attached to the motor shaft);

- ☑ The sensorless vector control permits high torques and quick response, even at very low speeds and during the starting of the motor;
- ☑ The “Optimal Braking” function allows controlled motor braking without using a Dynamic Braking (DB) resistor.
- ☑ “Self-tuning” auto-tune function with vector control, permitting automatic setting of the control regulators and control parameters by means of the automatic identification of the motor and the load parameters.

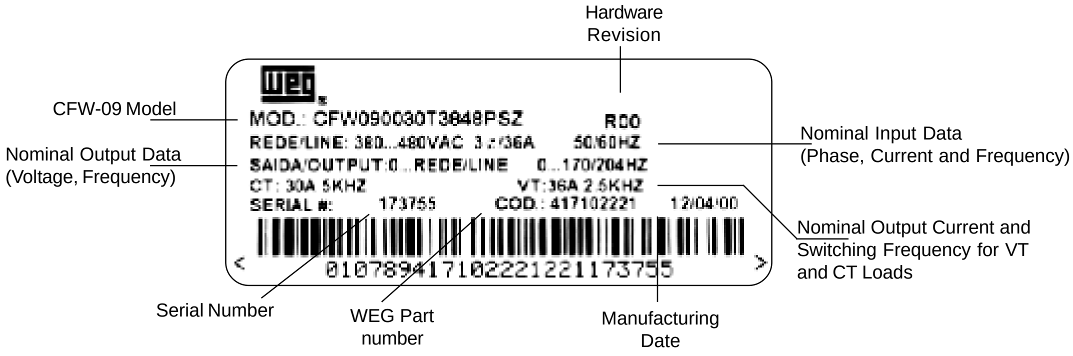
Please find the product line technical specifications in Section 9.

The block diagram below gives a general view of the CFW-09:

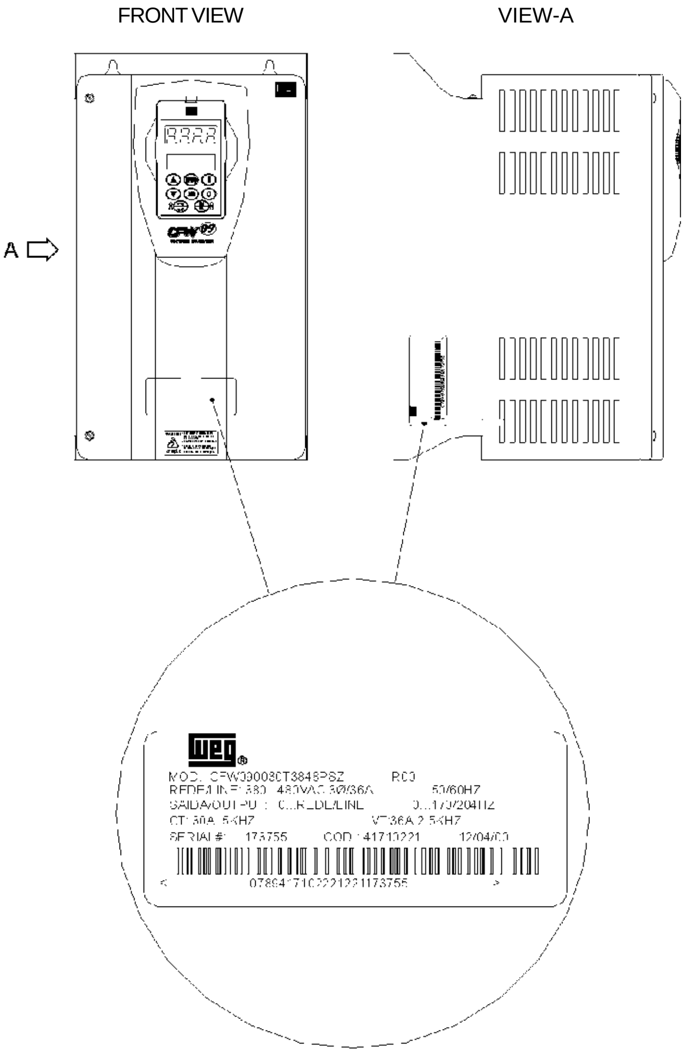


Note: The DC link choke is included in the standars models for 44A/53A/63A and 79A (500-600V) all models 500-690 and 660-690V.

2.4 CFW-09 IDENTIFICATION



Location of the CFW-09 Nameplate:



HOW TO SPECIFY THE CFW-09 MODEL:

CFW-09	*0016*	*T*	*3848*	*P*	*O*	*00*	*00*	*00*	*A1*	*DN*	*00*	*00*	*Z*
WEG Series 09 Frequency Inverter	Output Rated Current (Constant Torque): **220-230V:** 0006=6A 0007=7A 0010=10A 0013=13A 0016=16A 0024=24A 0028=28A 0045=45A 0054=54A 0070=70A 0086=86A 0105=105A 0130=130A **380-480V:** 0003=3.6A 0004=4A 0005=5.5A 0009=9A 0013=13A 0016=16A 0024=24A 0030=30A 0038=38A 0045=45A 0060=60A 0070=70A 0086=86A 0105=105A 0142=142A 0180=180A 0211=211A 0240=240A 0312=312A 0361=361A 0450=450A 0515=515A 0600=600A **500-600V:** 0002=2.9 A 0004=4.2 A 0007=7 A 0010=10 A 0012=12 A 0014=14 A 0022=22 A 0027=27 A 0032=32 A 0044=44A 0053=53A 0063=63A 0079=79A **500-690V:** 0107=107A 0147=147A 0211=211A 0247=247A 0315=315A 0343=343A 0418=418A 0472=472A **660-690V:** 0100=100A 0127=127A 0179=179A 0225=225A 0259=259A 0305=305A 0340=340A 0428=428A Note: - For rated output current specification of variable torque (VT), see chapter 9. - The rated output current indicated for the models 500-690V are only valid for 500 to 600V supply. - For rated output current specification (CT and VT) of the models with supply voltage higher than 600V, see chapter 9.	Three-phase Power Supply	Power Supply Voltage 3848 = 380 to 480V 2223 = 220 to 230V 5060 = 500 to 600V 5069= 500 to 690V 6669= 660 to 690V	Manual Language P= Portuguese E=English S=Spanish G=German	Options: S= standard O= with options (see note 1 below)	Enclosure Degree of Protection: Blank=standard (see note 1 below) N4=NEMA 4/IP56 (See note 1 below) (See chapter 8)	Keypad (HMI): Blank= Standard IL= Keypad with LED Display Only SI= Without Keypad (See note 1 below)	Braking: Blank= Standard DB= Dynamic Braking (See note 1 below) RB=Regenerative Converter (Active Front input unit). (See chapter 8.18)	Expansion Boards: Blank= None A1= EBA Board Complete B1= EBB Board Complete C1= EBC Board Complete (See note 1 below) Refer to Chapter 8 for other Configurations P1=PCL 1.01 Board (See chapter 8)	Fieldbus Communication Boards: Blank= None DN= Device-Net PD= Profibus DP MR= Modbus RTU (See note 1 below)	Special Hardware: Blank= None HN= Without DC link inductor (only valid for 500-690V and 660-690V models) HD= DC link supply (refer to chapter 8) HC, HV= DC Link inductor (only valid for 220-230V and 380-480V models) (See item 8.7.2) (See note 1 below)	Special Software: Blank= None (See note 1 below)	End of Code (See note 1 below)

Note 1:
The option field (S or O) defines if the CFW-09 is a standard version or if it is equipped with any optional devices. If the standard version is required, the code ends here. The model number always has the letter Z at the end. For example:
CFW090045T2223ESZ = Standard 45 A CFW-09 inverter with three phase input at 220...230 V with the Manual in English.
If the CFW-09 is equipped with any optional devices, you must fill out all fields in the correct sequence up to the last optional device, then 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 a product of the example above is required with a complete expansion card EBA, indicate:
CFW090045T2223EOA1Z = 45 A CFW-09 inverter – three-phase input at 220...230 V, with the manual in English and with the optional EBA card.
The standard product is defined as described here:
· Degree of protection: NEMA 1 / IP20 from 3.6 to 240A
IP20 from 361 to 600A
· Human Machine Interface: HMI-CFW09-LCD
(with LED and LCD displays)
· Braking: Standard DB Transistor for DB Resistor braking incorporated in the sizes: 6A to 45A – 220 to 230 V
3.6A to 30A – 380 to 480 V
2.9A to 14A – 500 to 600 V
Optional DB Transistor for DB Resistor braking incorporated in the sizes:
54 to 130A – 220 to 230 V
38 to 142A – 380 to 480 V
22 to 79A – 500 to 600 V
The sizes 180 to 600A/380-480V, 107 to 472A/500-690V and 100 to 428A/660-690V, do not have the capability to use an internal DB Transistor for DB Resistor Braking. In this case, use the external DB Transistor option (see item 8.10.3 - Dinamic Braking Module - DBW-01 and DBW-02).

2.5 RECEIVING

The CFW-09 is supplied in cardboard boxes up to size 3 (see Item 9) and for models above, the packing will be with wood pallet and cardboard box.
The outside of the packing container has a nameplate that is identical to that on the CFW-09. Please check if the nameplate data matches the ordered ones.
The boxes up to size 7 must be placed and opened on a table (sizes above 3 with the help of two persons).
Open the box, remove the cardboard protection and remove the bolts that fasten the CFW-09 on the pallet.
The boxes of sizes above 7 must be opened on the floor. Open the box, remove the cardboard protection and remove the bolts that fasten the CFW-09 on the pallet. The CFW-09 must be handled with hoist.
Check if:

☑ CFW-09 nameplate data matches the purchase order;
The equipment has not been damaged during transport.
☑ If any problem is detected, contact the carrier immediately.

If the CFW-09 is not to be installed immediately, store it in a clean and dry room (Storage temperatures between - 25°C and 60°C). Cover it to prevent dust, dirt or other contamination of the drive.

INSTALLATION

This chapter describes the procedures for the electrical and mechanical installation of the CFW-09.
These guidelines must be followed for proper CFW-09 operation.

3.1 MECHANICAL INSTALLATION

3.1.1 Environment

The location of the CFW-09 installation is an important factor to assure good performance and high product reliability.
For proper installation of the inverter, 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...104º F (0 ... 40º C) – nominal conditions.
32...122º F (0 ... 50º C) – with 2% current derating for each 1.8º F (1º C) degree above 104º F (40º 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)
(It is not allowed to have water, condensation or conductive dust/particles in the air)

NOTE!
When inverters are installed in panels or closed metallic boxes, adequate cooling is required to ensure that the temperature around the inverter will not exceed the maximum allowed temperature. See Dissipated Power in Section 9.1. Please meet the minimum recommended panel dimensions and its cooling requirements:

Model CFW-09	Panel Dimensions						Cooling
	Width		Height		Depth		CFM (l/s)
	(mm)	(in)	(mm)	(in)	(mm)	(in)	
6 to 16A/220-230V 3.6 to 16A/380-480V 2.9 to 14A/500-600V	600	23.6	1000	39.36	400	15.74	226 (107)
24 to 28A/220-230V 28A/380-480V			1200	47.24			
45 to 70A/220-230V 30 to 70A/380-480V 22 to 32A/500-600V			1500	59.05			
86 to 105A/220-230V 86 to 105A/380-480V			2000	78.73	600	23.6	
130A/220-230V 142A/380-480V 44 to 79A/500-600V							452 (214)
180A/380-480V	800	31.5					
211A/380-480V 240A/380-480V 107 to 211A/500-690V 100 to 179A/660-690V							1700 (800)
312A/380-480V 361A/380-480V					800	31.5	
450 to 600A/380-480V 247 to 472A/500-690V 225 to 428A/660-690V	900	35.43					

***Table 3.1** - Dimensions and cooling of panels*

3.1.2 Mounting Specifications

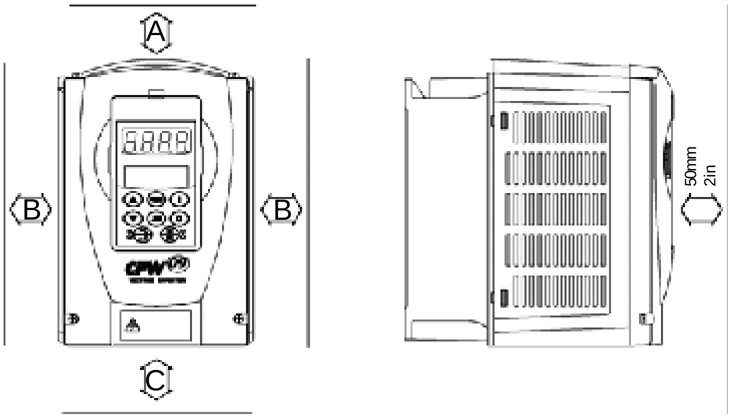


Figure 3.1 - *Free Space for Cooling*

Model CFW-09	A	B	C
6 to 28A/220-230V 3.6 to 24A/380-480V 2.9 to 14A/500-600V	1.57 in (40 mm)	1.18 in (30 mm)	2 in (50 mm)
45 to 130A/220-230V 30 to 142A/380-480V 22 to 79A/500-600V	4 in (100 mm)	1.57 in (40 mm)	5.12 in (130 mm)
180 to 600A/380-480V 107 to 472A/500-690V 100 to 428A/660-690V	16 in (150 mm)	3.15 in (80 mm)	10 in (250 mm)

Table 3.2 - *Recommended free spaces*

Install the inverter in the vertical position:

- ☑ Leave free space around the inverter as shown in Fig. 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 inverter below.
- ☑ Install the inverter on a flat surface;
- ☑ External dimensions and mounting holes are according to Fig. 3.2
- ☑ For the inverters 45 to 130A/220-230V, 30 to 600A/380-480V, 22 to 32A/500-600V, 44 to 79A/500-600V, 107 to 472A/500-690V and 100 to 428A/660-690V first partially tighten the bolts on the surface, then install the inverter and screw-down the bolts. For inverters 6 to 28A/220-230V, 3.6 to 24/380-480V and 2.9 to 14A/500-600V, install the 2 bottom mounting bolts first, rest the inverter on the base and then mount the 2 top bolts.
- ☑ Provide independent conduits for signal, control and power conductors (Refer to Section 3.2: Electrical Installation)
- ☑ Figure 3.3 shows the installation of the CFW-09 on a mounting plate. The CFW-09 can also be installed with the heatsink through the mounting plate, as shown in Figure 3.4
  In this case, see installation drawings shown in Figure (3.4) and maintain the distances indicated in table 3.4.

NOTE!

When installing the heatsink through the mounting surface, according to Figure 3.4, the degree of protection behind this surface is NEMA 1 / IP20. NEMA1 rating does not protect against dust and water.

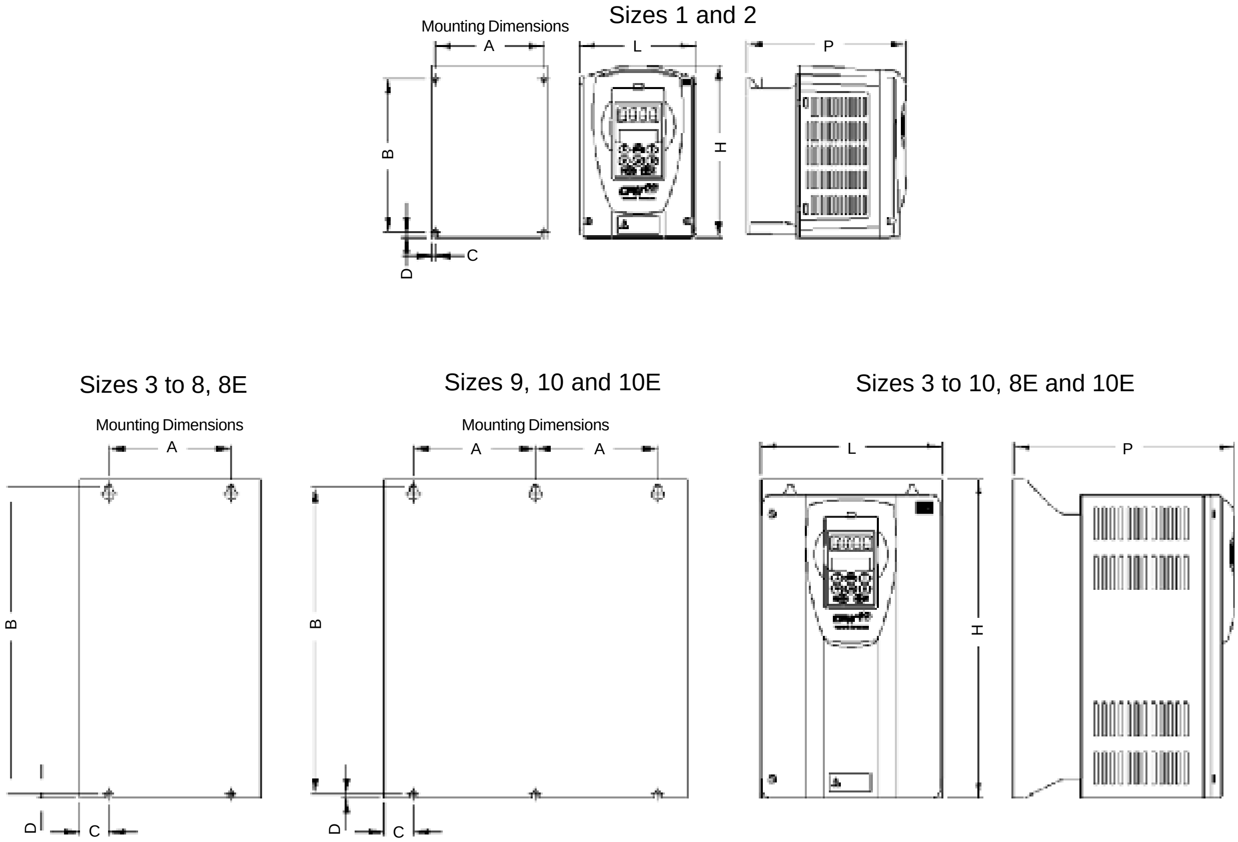
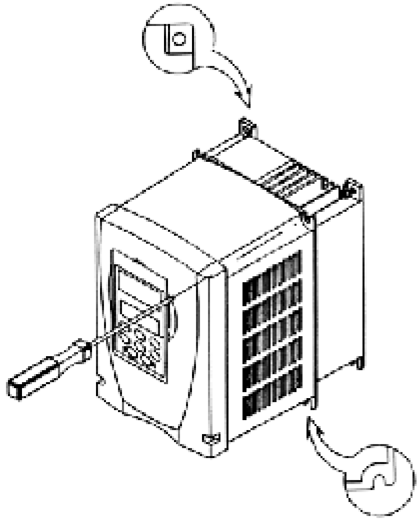


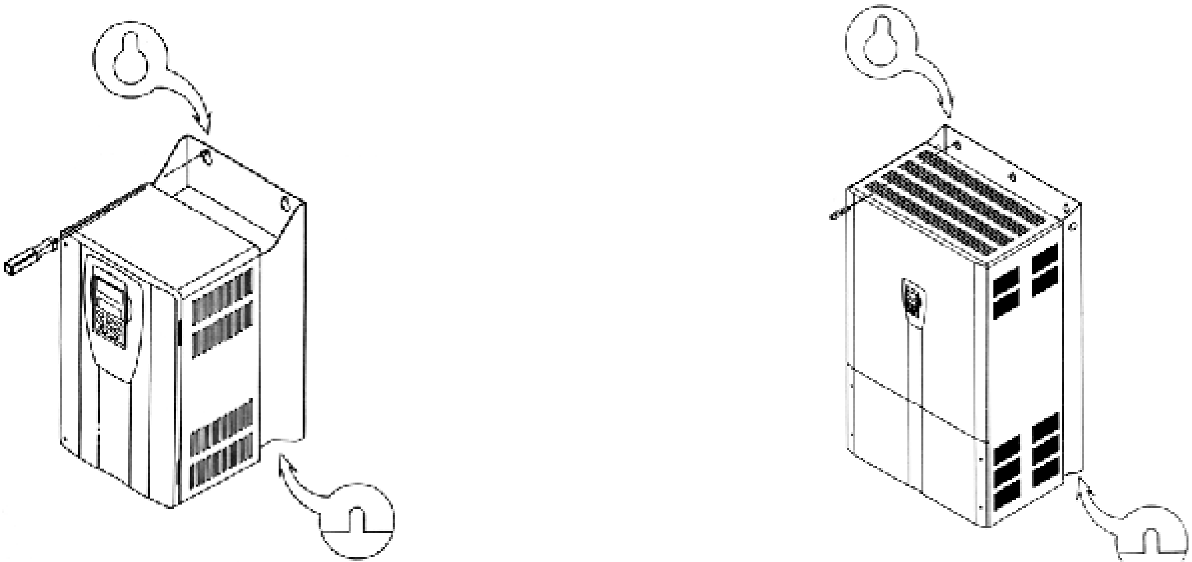
Figure 3.2 *- Dimensional Drawings of CFW-09*

Model	Height H in (mm)	Width L in (mm)	Depth P in (mm)	A in (mm)	B in (mm)	C in (mm)	D in (mm)	Mounting Screw in (mm)	Weight lb (kg)	Degree of Protection
Size 1	8.27 (210)	5.63 (143)	7.72 (196)	4.76 (121)	7.09 (180)	0.43 (11)	0.37 (9.5)	3/16 (M5)	7.7 (3.5)	NEMA1/ IP20
Size 2	11.42 (290)	7.16 (182)	7.72 (196)	6.34 (161)	10.24 (260)	0.41 (10.5)	0.37 (9.5)	3/16 (M5)	13.2 (6.0)	
Size 3	15.35 (390)	8.78 (223)	10.79 (274)	5.90 (150)	14.76 (375)	1.44 (36.5)	0.20 (5)	1/4 (M6)	41.9 (19.0)	
Size 4	18.70 (475)	9.84 (250)	10.79 (274)	5.90 (150)	17.72 (450)	1.97 (50)	0.39 (10)	1/4 (M6)	49.6 (22.5)	
Size 5	21.65 (550)	13.19 (335)	10.79 (274)	7.87 (200)	20.67 (525)	2.66 (67.5)	0.39 (10)	5/16 (M8)	90.4 (41)	
Size 6	26.57 (675)	13.19 (335)	11.77 (300)	7.87 (200)	25.59 (650)	2.66 (67.5)	0.39 (10)	5/16 (M8)	121.3 (55.0)	
Size 7	32.87 (835)	13.19 (335)	12.20 (300)	7.87 (200)	31.89 (810)	2.66 (67.5)	0.39 (10)	5/16 (M8)	154.3 (70)	
Size 8	38.38 (975)	16.14 (410)	14.57 (370)	10.83 (275)	37.40 (950)	2.66 (67.5)	0.39 (10)	3/8 (M10)	220.5 (100)	
Size 8E	45.08 (1145)	16.14 (410)	14.57 (370)	10.83 (275)	44.09 (1120)	2.66 (67.5)	0.39 (10)	3/8 (M10)	253 (115)	
Size 9	39.37 (1020)	27.56 (688)	19.33 (492)	10.83 (275)	37.99 (985)	2.95 (69)	0.59 (15)	3/8 (M10)	476.2 (240)	IP20
Size 10	46.65 (1185)	27.56 (700)	19.33 (492)	10.83 (275)	45.27 (1150)	2.95 (75)	0.59 (15)	3/8 (M10)	571 (288)	
Size 10E	46.65 (1185)	27.56 (700)	22.91 (582)	10.83 (275)	45.27 (1150)	2.95 (75)	0.59 (15)	3/8 (M10)	682 (310)	

Table 3.3 *– Installation Data – Refer to Section 9.1*

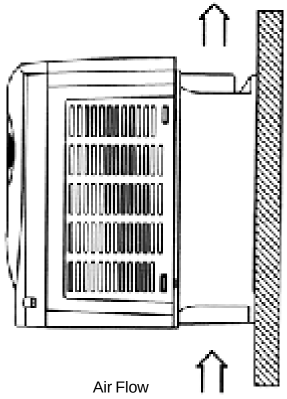


a) Sizes 1 and 2



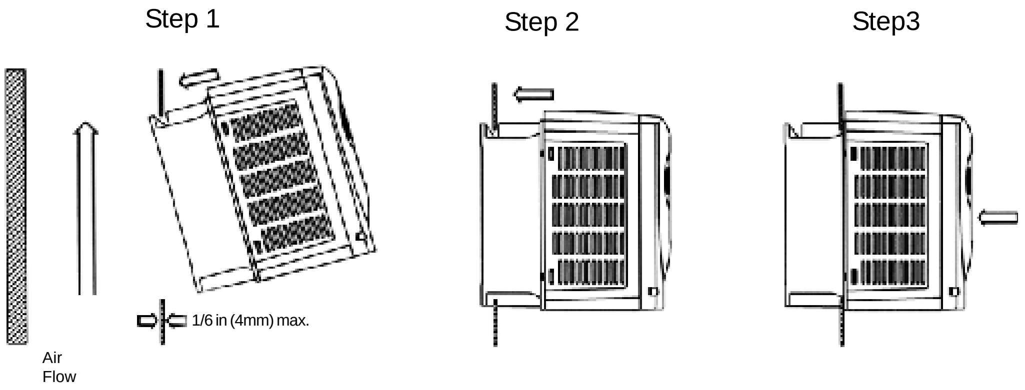
b) Sizes 3 to 8

c) Sizes 9 and 10

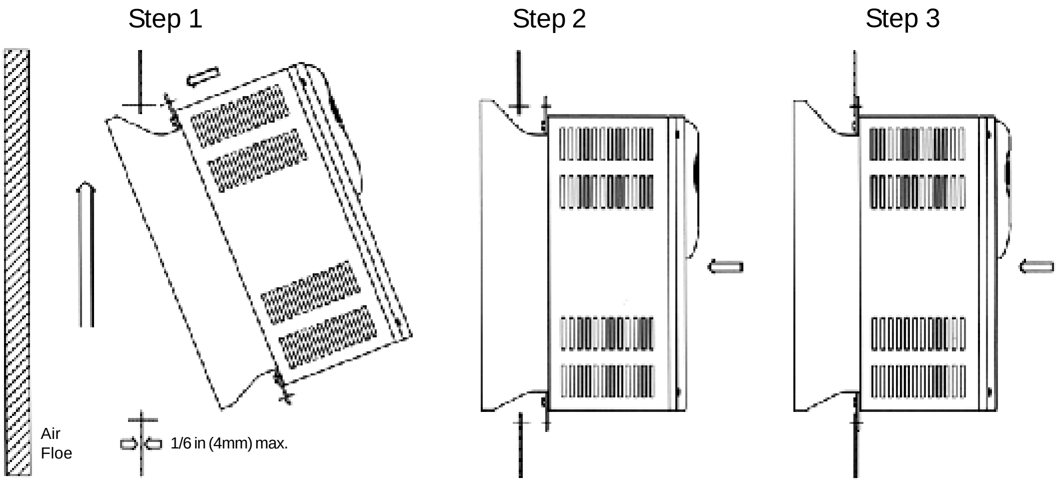


d) Positioning (for all sizes)

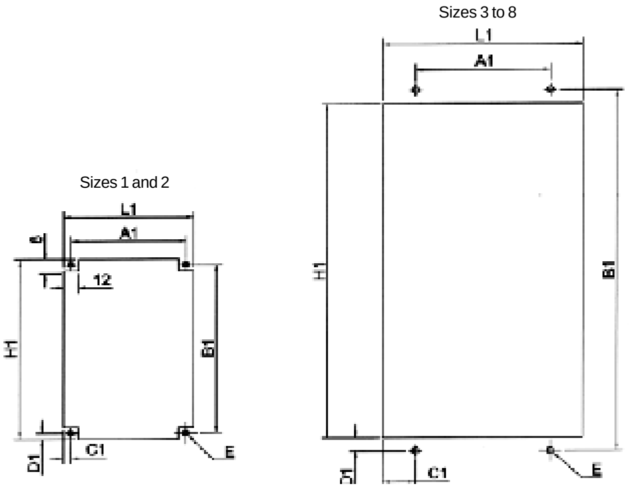
Figure 3.3 *–Mounting procedure for the CFW-09*



a) Sizes 1 and 2



b) Sizes 3 to 8E



c) Cutout dimensions (Refer to Table 3.4)

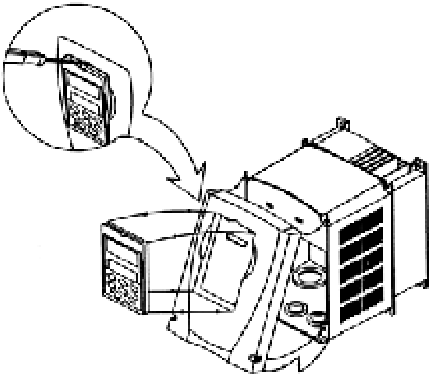
***Figure 3.4** – Mounting procedure for the CFW-09 with the heatsink through the mounting surface*

CFW-09 Size	L1 in (mm)	H1 in (mm)	A1 in (mm)	B1 in (mm)	C1 in (mm)	D1 in (mm)	E mim. in (mm)	Through Surface Mouting KIT Part #
Size 1	5.47 (139)	7.72 (196)	5.00 (127)	7.52 (191)	0.24 (6)	0.10 (2.5)	0.24 (6)	------------
Size 2	7.00 (178)	10.87 (276)	6.57 (167)	10.67 (271)	0.24 (6)	0.10 (2.5)	0.24 (6)	------------
Size 3	8.86 (225)	14.64 (372)	5.91 (150)	15.75 (400)	1.44 (37.5)	0.59 (14)	0.31 (8)	417102514
Size 4	9.92 (252)	17.79 (452)	5.91 (150)	18.90 (480)	1.97 (51)	0.59 (14)	0.31 (8)	417102515
Size 5	13.27 (337)	20.75 (527)	7.87 (200)	21.85 (555)	2.70 (68.5)	0.59 (14)	0.35 (10)	417102516
Size 6	13.27 (337)	25.67 (652)	7.87 (200)	26.77 (680)	2.70 (68.5)	0.59 (14)	0.39 (10)	417102517
Size 7	13.27 (337)	31.97 (812)	7.87 (200)	33.07 (840)	2.70 (68.5)	0.59 (14)	0.39 (10)	417102518
Size 8	16.22 (412)	37.48 (952)	10.83 (275)	38.58 (980)	2.70 (68.5)	0.59 (14)	0.39 (10)	417102519
Size 8E	16.22 (412)	44.17 (1122)	10.83 (275)	45.27 (1150)	2.70 (68.5)	0.59 (14)	0.39 (10)	417102521

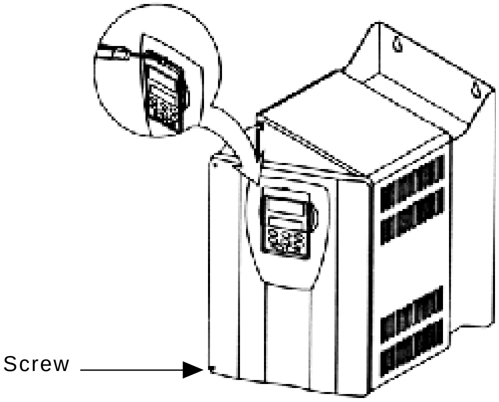
Table 3.4 *– Cutout dimensions for through surface mounting*

*NOTE: The Through Surface Mounting KIT is a set of supports for the CFW-09 as shown on Figure 3.4.

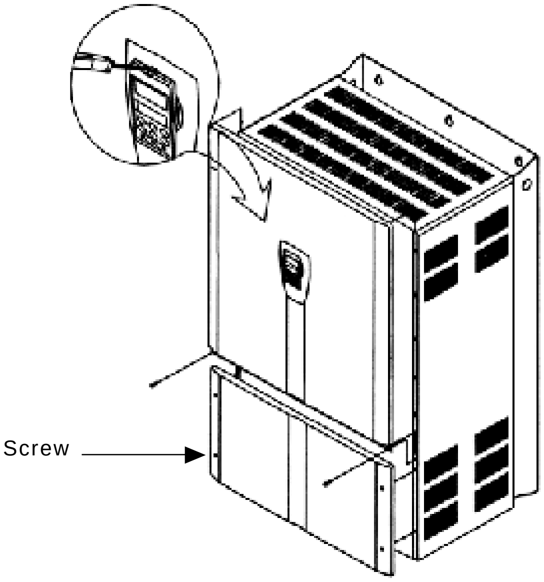
3.1.3 Keypad (HMI) and Cover Removal



a) Sizes 1 and 2



b) Sizes 3 to 8, 8E



c) Sizes 9 and 10, 10E

Figure 3.5 *– Keypad (HMI) and cover removal procedure*

3.2 ELECTRICAL INSTALLATION

3.2.1 Power/Grounding Connections

DANGER!
AC input disconnect: provide an AC input disconnecting switch to switch OFF input power to the inverter.
This device shall disconnect the inverter from the AC input supply when required (e.g. during maintenance services).

DANGER!
The AC input disconnect cannot 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 low voltage wiring and the inverter, line or load reactors, AC input power, and AC motor cables.

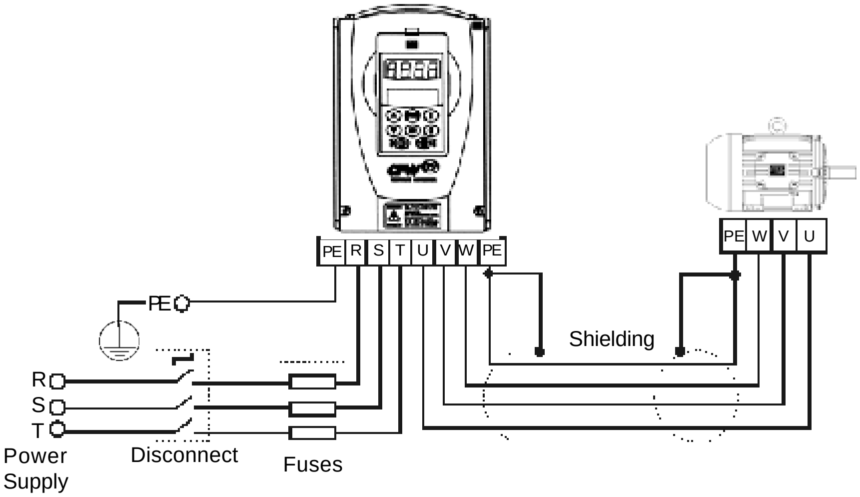


Figure 3.6 *– Power/Grounding Connections*

DANGER!
Inverters must be grounded for safety purposes (PE). The earth or ground connection must comply with the local regulations. For grounding use cables with cross section as indicated in Table 3.5. Make the ground connection to a grounding bar or to the general grounding point (resistance ≤ 10 ohms). Do not share the ground wiring with other equipment that operate with high current (for instance, high voltage motors, welding machines, etc). If several inverters are used together, Refer to Figure 3.7.

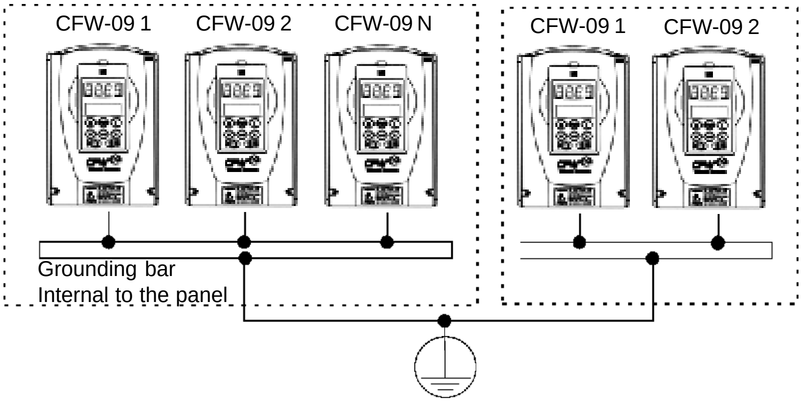


Figure 3.7 *– Grounding connections for more than one inverter*

NOTE!

Do not use the neutral conductor for grounding purpose.

ATTENTION!

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

ATTENTION!

For IT networks (also known as ungrounded or high earthing impedance networks) it is necessary to consider the following:

☑ Models 180...600A/380-480V, 2.9...79A/500-600V, 107...472A/500-690V and 100...428A/660-690V have a varistor and capacitor connected between input phase and ground that must be disconnected if an IT network is used. For that, remove the jumper as shown in figure 3.8. In 500-600V/500-690V/660-690V models, the jumper is accessible taking out (models 2.9...14A/500-600V) or opening (models 22...79A/500-600V, 107...211A/500-690V and 100...179A/660-690V) the front cover or taking out the connections cover (247...472A/500-600V e 225...428A/660-690V). In models 180...600A/380-480V, besides opening or taking out the front cover(s), it is required to remove the control board mounting plate (shield). The external RFI filters that are necessary in order to fulfill the requirements of European EMC Directive as stated in item 3.3, cannot be used with IT networks.

☑ The user must check and assume the responsibility of personnel electrical shock risk when using inverters in IT networks.

☑ About the use of a differencial relay at the inverter input:

- The indication of phase-to-ground short-circuit must be processed by the user, in order to indicate only a fault message or to turn off the inverter.
- Check with the relay manufacturer its proper operation with frequency inverters, because of the existing high-frequency leakage currents flowing through the inverter, cable and motor parasitic capacitances to the earth.

ATTENTION!
Set jumper to select the rated line voltage 380-480 V. For inverters 86 A or higher, Refer to Section 3.2.3.

ATTENTION!
See Item 8.7 relating to the requirement for using the Line Reactor / DC Link Inductor

NOTES!

☑ The AC input voltage must be compatible with the inverter rated voltage.

☑ Capacitors for power factor correction are not required at the input (R, S, T) and they MUST not be connected at the output (U, V, W).

☑ With the Dynamic Braking (DB) option, the DB resistor shall be mounted externally. Figure 8.19 shows how to connect the DB resistor. Size it according to the application, not exceeding the maximum current of the braking circuit. Use twisted cable for the connection between inverter and DB resistor. Provide physical separation between this cable and the signal and control cables. When the DB resistor is mounted inside the panel, consider the watt loss generated when the enclosure size and ventilation required are calculated.

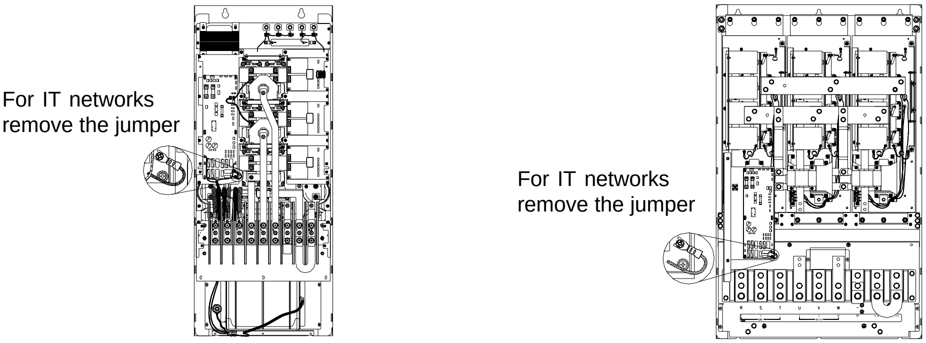
☑ When electromagnetic interference (EMI), generated by the inverter, causes problems with other equipment, use shielded wires, or install the motor wires in metallic conduits. Connect one end of the shielding to the inverter grounding point and the other end to the motor frame.

☑ 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 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.

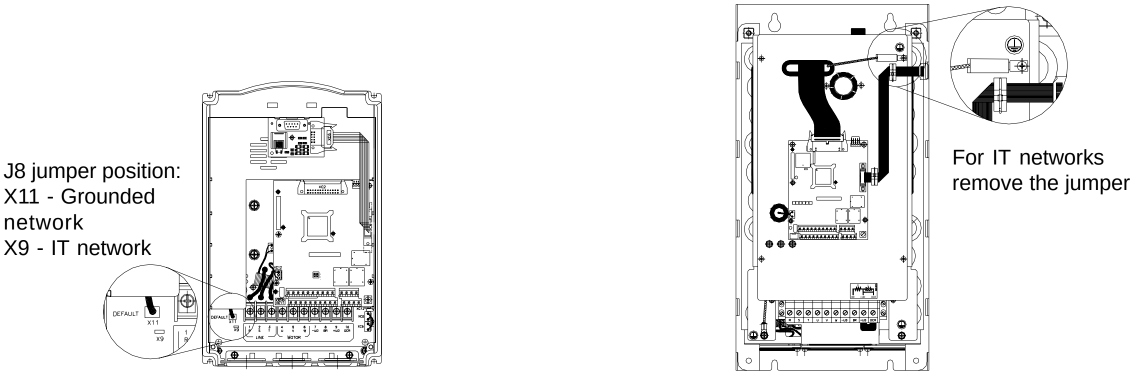
☑ If a disconnect switch or a contactor is inserted in the motor supply line, DO NOT operate the disconnect with the motor running or when inverter is enabled. Maintain the electrical continuity of the motor cable shield.

☑ Use wire sizing and fuses as recommended in Table 3.5. The tightening torque is as indicated in Table 3.6. Use 75ºC copper wire only.



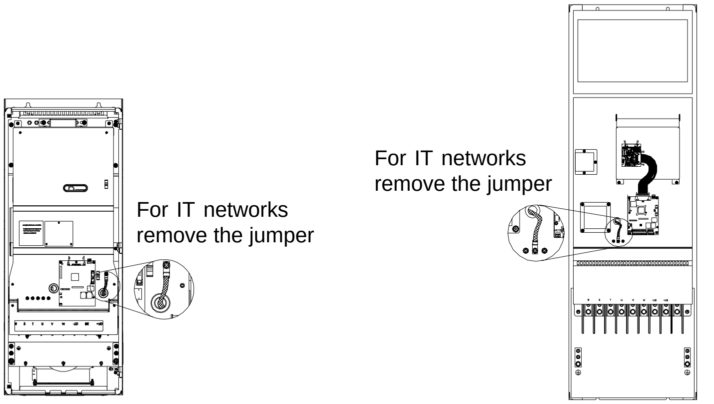
(a) Models 180...240A/380-480V

(b) Models 312..600A/380-480V



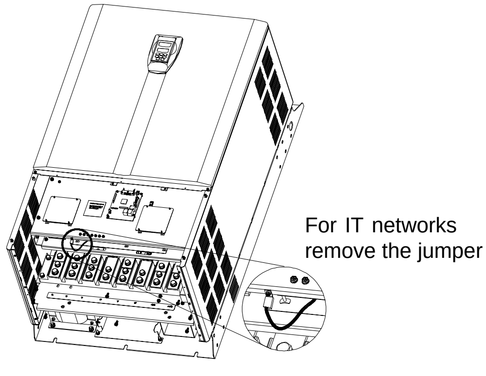
(c) Models 2.9...14A/500-600V

(d) Models 22...32A/500-600V



(e) Models 44...79A/500-600V

(f) Models 107...211A/500-600V and 100...179A/660-690V



(g) Models 247...472A/500-600V and 225...428A/660-690V

***Figura 3.8** - Location of jumper to disconenect the varistor and capacitor between input phase and ground - necessary only in models when IT network is used*

CFW-09 Rating Amps/volts		Power Cables AWG/MCM (mm^2)		Grounding Cables AWG/MCM (mm^2)		High Speed Semiconductor Fuse Amps	Fuse I^2t @25°C (A^2s)
CT/VT	VT	CT/VT	VT	CT/VT	VT		
2.9/500-600	4.2/500-600	14 (1.5)	14 (1.5)	12 (2.5)	12 (2.5)	15	500
3.6/380-480	-	14 (1.5)	-	12 (2.5)	-	15	500
4.0/380-480	-	14 (1.5)	-	12 (2.5)	-	15	500
4.2/500-600	7.0/500-600	14 (1.5)	12 (2.5)	12 (2.5)	12 (2.5)	15	500
5.5/380-480	-	14 (1.5)	-	12 (2.5)	-	25	500
6.0/220-230	-	12 (2.5)	-	12 (2.5)	-	25	500
7.0/220-230	-	12 (2.5)	-	12 (2.5)	-	25	500
7.0/500-600	10/500-600	12 (2.5)	12 (2.5)	12 (2.5)	12 (2.5)	25	500
9.0/380-480	-	12 (2.5)	-	12 (2.5)	-	25	500
10/220-230	-	12 (2.5)	-	12 (2.5)	-	25 (red trifásica) 35 (red monofásica)	500
10/500-600	12/500-600	12 (2.5)	12 (2.5)	12 (2.5)	12 (2.5)	25	500
12/500-600	14/500-600	12 (2.5)	12 (2.5)	12 (2.5)	10 (4.0)	35	500
13/220-230 13/380-480	-	12 (2.5)	-	12 (2.5)	-	35	500
14/500-600	-	12 (2.5)	-	10 (4.0)	-	35	500
16/220-230 16/380-480	-	12 (2.5)	-	10 (4.0)	-	35	500
22/500-600	27/500-600	10 (4.0)	8 (6.0)	10 (4.0)	8 (6.0)	50	7200
24/220-230	-	10 (4.0)	-	10 (4.0)	-	35	500
24/380-480	-	10 (4.0)	-	10 (4.0)	-	35	1300
27/500-600	32/500-600	8 (6.0)	6 (16)	8 (6.0)	6 (16)	50	7200
28/220-230	-	8 (6.0)	-	8 (6.0)	-	50	1300
30/380-480	36/380-480	8 (6.0)	6 (16)	8 (6.0)	6 (16)	50	2100
32/500-600	-	6 (16)	-	6 (16)	-	50	7200
38/380-480	45/380-480	6 (16)	6 (16)	6 (16)	6 (16)	50	2100
44/500-600	-	6 (16)	6 (16)	6 (16)	6 (16)	63	10000
45/220-230	-	6 (16)	6 (16)	6 (16)	6 (16)	63	2450
45/380-480	54/380-480	6 (16)	6 (16)	6 (16)	6 (16)	63	2100
53/500-600	44/500-600	4 (25)	4 (25)	6 (16)	6 (16)	80	10000
54/220-230	68/220-230	6 (16)	4 (25)	6 (16)	6 (16)	80	2100
60/380-480	70/380-480	4 (25)	4 (25)	6 (16)	6 (16)	80	4000
63/500-600	53/500-600	4 (25)	4 (25)	6 (16)	6 (16)	80	10000
70/220-230 70/380-480	86/220-230 86/380-480	4 (25)	2 (35)	6 (16)	6 (16)	100	4000
-	63/500-600	2 (35)	1 (50)	6 (16)	4 (25)	125	10000
79/500-600	-	2 (35)	1 (50)	6 (16)	4 (25)	125	15000
86/220-230	105/220-230	2 (35)	1 (50)	6 (16)	4 (25)	125	4000
86/380-480	105/380-480	2 (35)	1 (50)	6 (16)	4 (25)	125	6000
-	79/500-600	1 (50)	1/0 (70)	4 (25)	2 (35)	2500	15000
100/660-690	127/660-690	1 (50)	1/0 (70)	4 (25)	2 (35)	250	320000
105/220-230 105/380-480	130/220-230 130/380-480	1 (50)	1/0 (70)	4 (25)	2 (35)	250	6000
107/500-690	147/500-690	1 (50)	1/0 (70)	4 (25)	2 (35)	250	320000
127/660-690	179/660-690	1/0 (70)	3/0 (95)	2 (35)	1 (50)	250	320000
130/220-230	150/220-230	1/0 (70)	3/0 (95)	2 (35)	1 (50)	250	6000
142/380-480	174/380-480	1/0 (70)	3/0 (95)	2 (35)	1 (50)	250	6000
147/500-690	196/500-690	1/0 (70)	3/0 (95)	2 (35)	1 (50)	250	320000
179/660-690	179/660-690	3/0 (95)	3/0 (95)	1 (50)	1 (50)	250	320000
180/380-480	-	3/0 (95)	-			250	320000
211/380-480	-	300 (185)	-	1/0 (70)	-	315	320000
211/500-690	211/500-690	300 (185)	300 (185)	1/0 (70)	1/0 (70)	250	320000
225/660-690	259/660-690	300 (185)	300 (185)	1/0 (70)	1/0 (70)	315	320000
240/380-480	-	300 (185)	-	1/0 (70)	-	315	320000
247/500-690	315/500-690	300 (185)	2x2/0 (2x70)	1/0 (70)	2/0 (70)	500	320000
259/660-690	305/660-690	300 (185)	1/0 (70)	2x2/0 (2x70)	2/0 (70)	500	320000
305/660-690	340/660-690	1/0 (70)	2x4/0 (2x120)	2/0 (70)	4/0 (120)	500	320000
312/380-480	-	2x2/0 (2x70)	-	2/0 (70)	-	500	320000
315/500-690	343/500-690	2x2/0 (2x70)	2x4/0 (2x120)	2/0 (70)	4/0 (120)	500	320000
340/660-690	428/660-690	2x4/0 (2x120)	2x250 (2x150)	4/0 (120)	1x250 (1x150)	700	1051000
343/500-690	418/500-690	2x4/0 (2x120)	2x250 (2x150)	4/0 (120)	1x250 (1x150)	700	320000
361/380-480	-	2x4/0 (2x120)	-	4/0 (120)	-	500	320000
418/500-690	472/500-690	2x4/0 (2x120)	2x250 (2x150)	4/0 (120)	1x250 (1x150)	700	1051000
428/660-690	428/660-690	2x250 (2x150)	2x250 (2x150)	1x250 (1x150)	1x250 (1x150)	700	1445000
472/500-690	555/500-690	2x250 (2x150)	3x250 (3x120)	1x250 (1x150)	2x3/0 (2x95)	900	1445000
450/380-480	-	2x250 (2x150)	-	250 (150)	-	700	1051000
515/380-480	-	3x4/0 (3x120)	-	2x2/0 (2x70)	-	900	1445000
600/380-480	-	3x250 (3x150)	-	2x3/0 (2x95)	-	900	1445000

CT - Constante Torque **VT** - Variable Torque

Table 3.5 *– Recommended Wiring/Fuses - Use 75ºC copper wires only*

NOTE!
The wire sizing indicated in Table 3.5 are reference values only. The exact wire sizing depends on the installation conditions and the maximum acceptable line voltage drop.

☑ When flexible wires are used for power and grounding connections it is necessary to provide appropriate crimp terminals.

☑ Line Fuses:
- For protecting the input rectifier diodes and the wiring, use UR Type (Ultra-Rapid) fuses with i^2t equal or lower than indicated in table 3.5.
- Standard fuses may be used optionally at the input with currents as indicated in Table 3.5, or circuit breakers dimensioned for 1.2 x rated inverter input current for the CT or the VT operation (see items 9.1.1 and 9.1.2). However in this case, only the installation will be protected against short-circuit, but not the diodes of the rectifier bridge at the inverter input. This option may damage the inverter in case of short-circuit of some internal component.

CFW-09 Rating Amps/Volts	Grounding Wiring N.m (lbf.in)	Power Cables N.m (lbf.in)
6 to 13A/220-230 3.6 to 13A/380-480	1.00 (8.85)	1.76 (15.58)
16 to 28A/220-230 16 to 24A/380-480 2.9 to 14A/500-600	2.00 (17.70)	2.00 (17.70)
30A/380-480	4.50 (39.83)	1.40 (12.30)
45A/220-230 38 to 45A/380-480 22 to 32A/500-600	4.50 (39.83)	1.40 (12.30)
54 to 86A/220-230 60 to 86A/380-480	4.50 (39.83)	3.00 (26.10)
105 to 130A/220-230 105 to 142A/380-480 44 to 79A/500-600	15.50 (132.75)	15.50 (132.75)
180 to 240A/380-480	15.50 (132.75)	30.00 (265.50)
312 to 600A/380-480 107 to 472A/500-690 100 to 428A/660-690	30.00 (265.50)	60.00 (531.00)

***Table 3.6** - Recommended tightening torque for power and grounding connections*

NOTE!
Supply line capacity:
The CFW-09 is suitable for use in circuits capable of supplying not more than X Arms symmetrical and Y Volts maximum. (Refer to Table 3.7).

CFW-09 Rating Amps/Volts	X	Y
3.6...600A 380-480V	30000	480
6...130A 220-230V	30000	240
2.9...79A 500-600V	30000	600
107...472A 500-690V 100...428A 660-690V	30000	690

Table 3.7 *- AC supply capacity*

The CFW-09 can be installed on power supplies with a higher fault level provided that adequate protection is provided by the fuses or circuit breaker.

3.2.2 Power Terminals

The power connection terminals can be of different sizes and configurations, depending on the inverter model as shown in Figure 3.9.
Terminals:

☑ R, S, T : AC supply line. Models up to 10 A at 220-230 V 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.

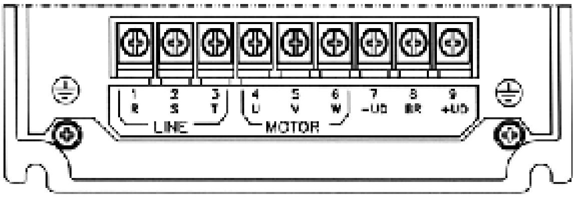
☑ U, V, W: Motor connection.

☑ -UD: Negative pole of the DC link circuit.

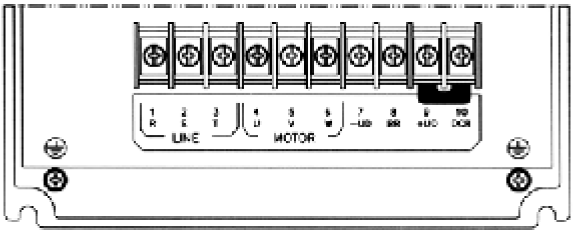
☑ BR: Dynamic Braking resistor connection.

☑ +UD: Positive pole of the DC link circuit.

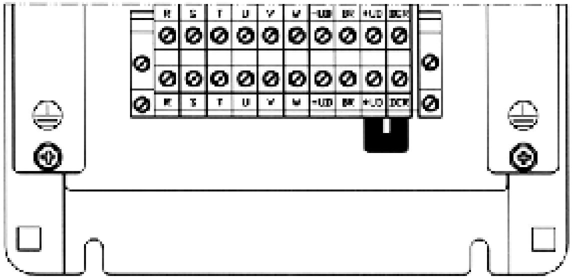
☑ DCR: Connection to the external DC link choke (optional).



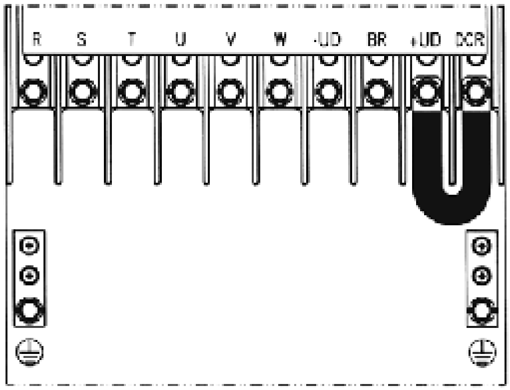
a) Size 1 models



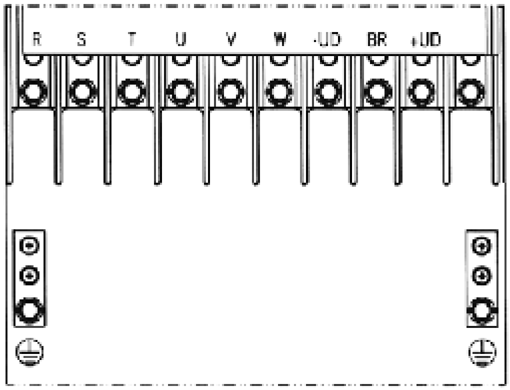
b) Size 2 models



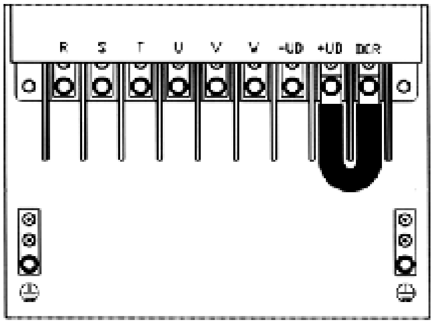
c) Size 3, 4 and 5 models



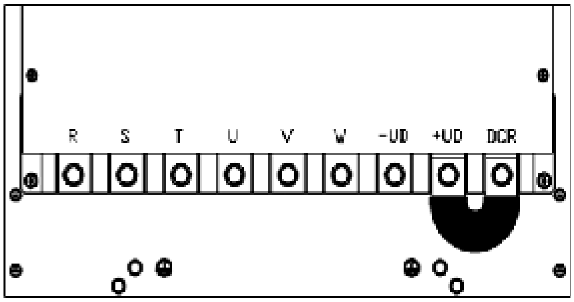
d) Size 6 and 7 (220-230V
and 380 - 480V models)



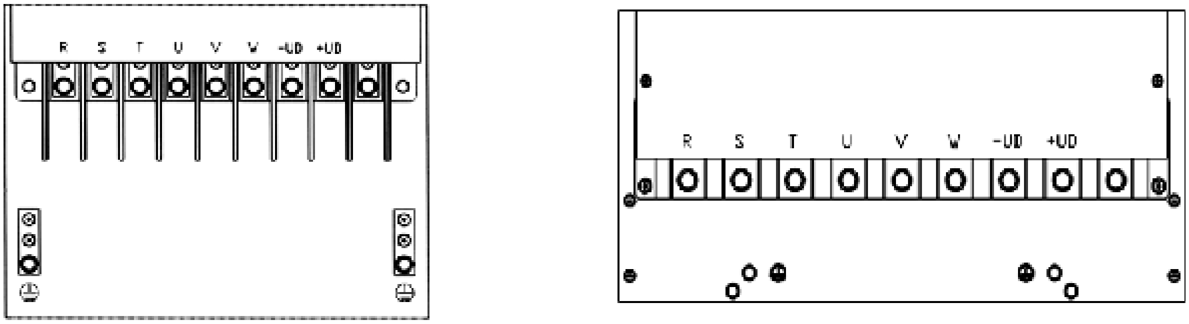
e) Size 7 (500-600V models)



f) Size 8 (380-480V models)



g) Size 9 and 10 (380-480V models)

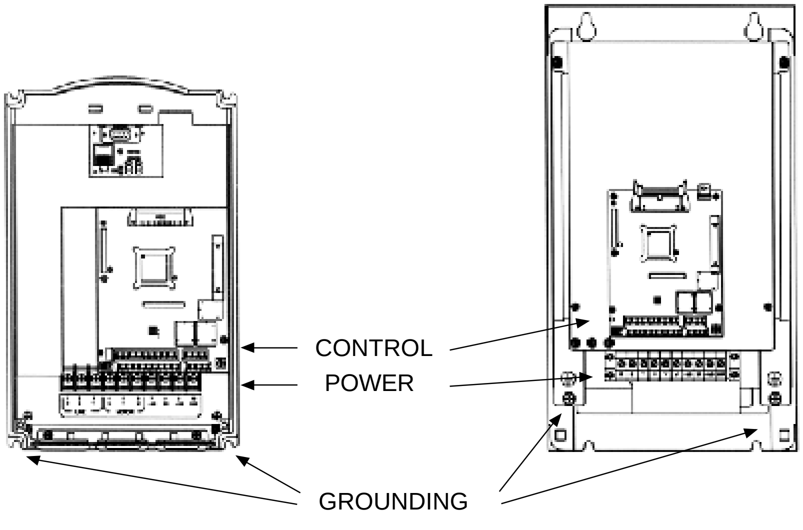


h) Size 8E
(500-690V and 660-690V models)

i) Size10E
(500-690V and 660-690V models)

Figure 3.9 – *Power Terminals*

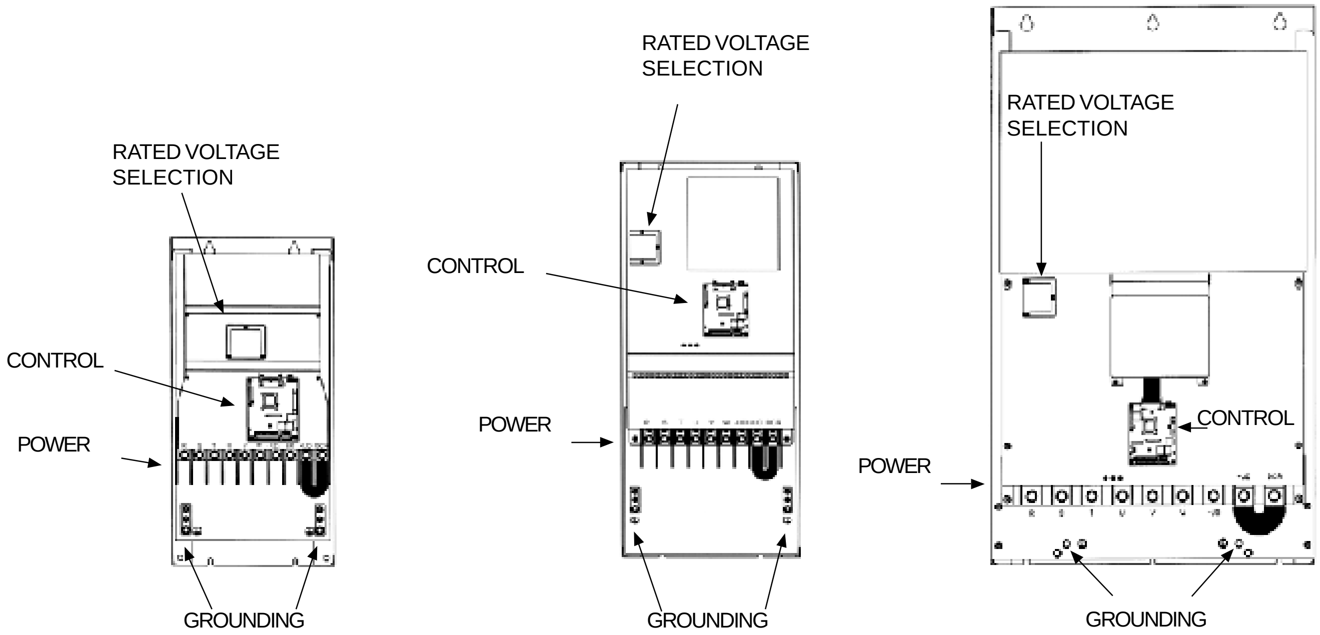
3.2.3 Location of the Power/Grounding/Control Connections and Rated Voltage Selection



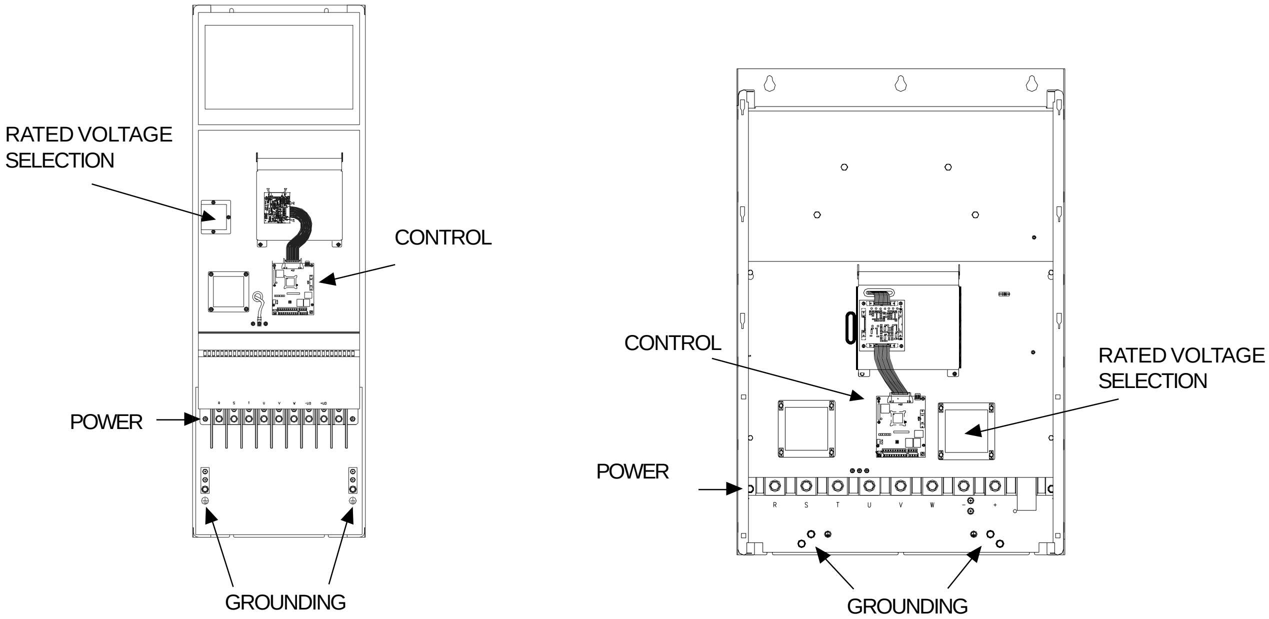
a) Size 1 and 2 models

b) Size 3, 4 and 5 models

NOTE: No voltage Selection needed for these models



c) Size 6 and 7 models d) Size 8 models e) Size 9 and 10 models



f) Size 8E g) Size 10E

***Figure 3.10**- Location of the Power/Grounding/Control Connections and Rated Voltage Selection*

NOTE!

RATED VOLTAGE SELECTION:

This is necessary for inverters:

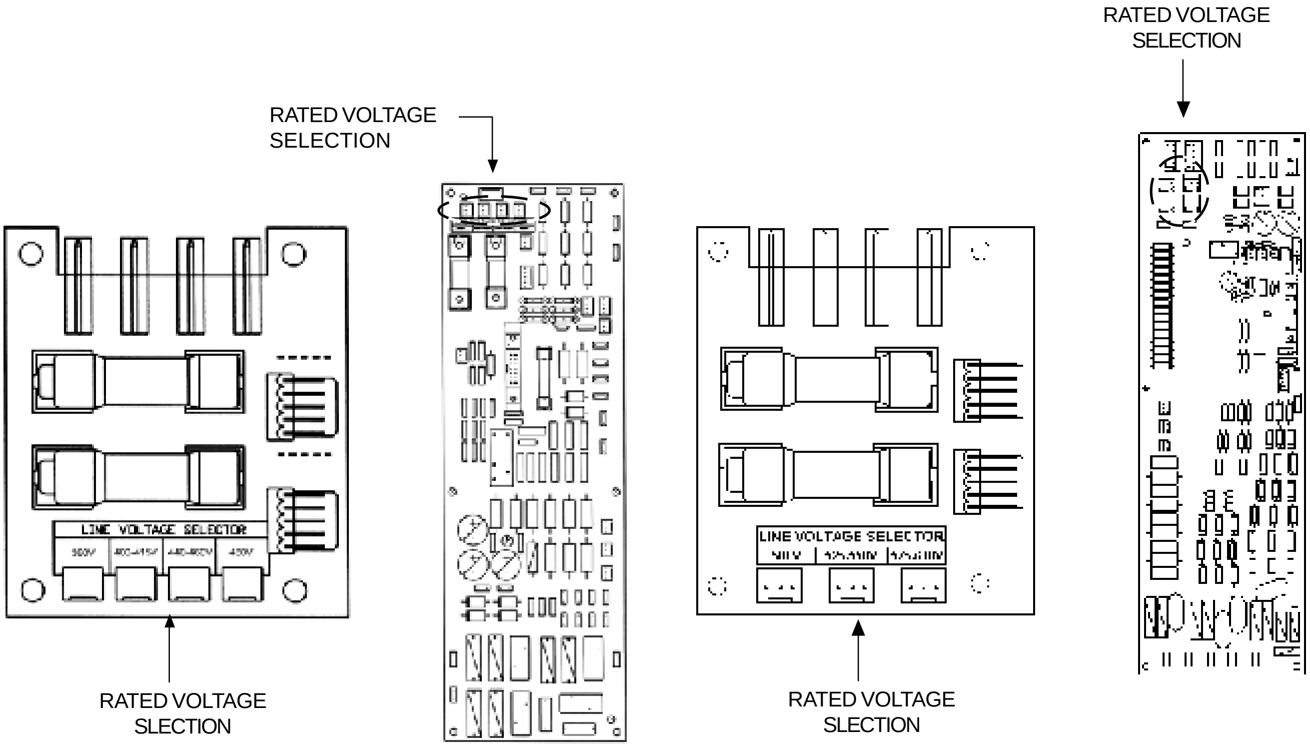
- 86A/380-480V or larger with line voltages different from 440/460V.
- 44A/500-600V or larger with line voltages different from 575V.
- 500-690V with line voltage different from 575V.

PROCEDURE:

☑ 380-480V models :
Remove jumper on the LVS1 board (or from the CIP2 for models ≥ 180A) from position XC60 (440-460V) and insert it on the proper position according to the application line voltage.

☑ 500-600V models :
Remove jumper on the LVS2 board from position XC62 (575-600V) and insert it on the proper position according to the line voltage.

☑ 500-690V models :
Remove jumper on the CIP3 board from position XC62 (575-600V) and insert it on the proper position according to the line voltage.



a) LVS1

b) CIP2

c) LVS2
(size 7, 500-600V)

d) CIP3
(size 8E and 10E, 500-690V)

Figure 3.11 *– Rated Voltage Selection on boards LVS1, CIP2, LVS2 and CIP3*

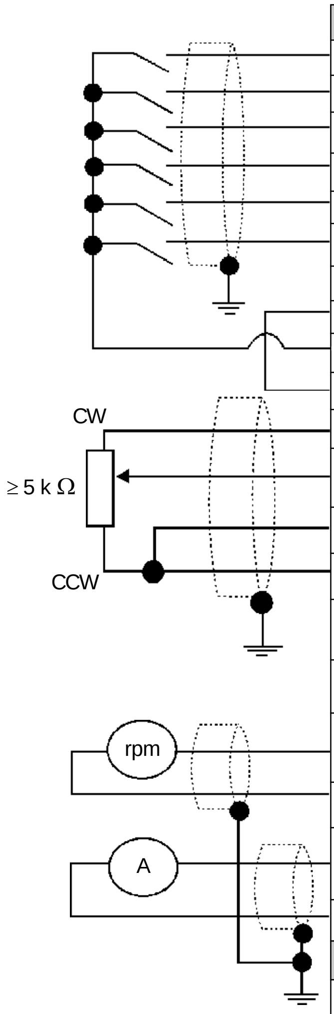
3.2.4 Control Wiring

The control wiring (analog inputs/outputs, digital inputs/outputs and relay outputs) is made on the following terminal blocks of the Electronic Control Board CC9 (see location in Figure 3.10, Section 3.2.3).

XC1 : **Digital and Analog Signals**

XC1A : **Relay Outputs**

The following diagram shows the control wiring with the digital inputs as active high as set on factory (jumper between XC1:8 and XC1:10).

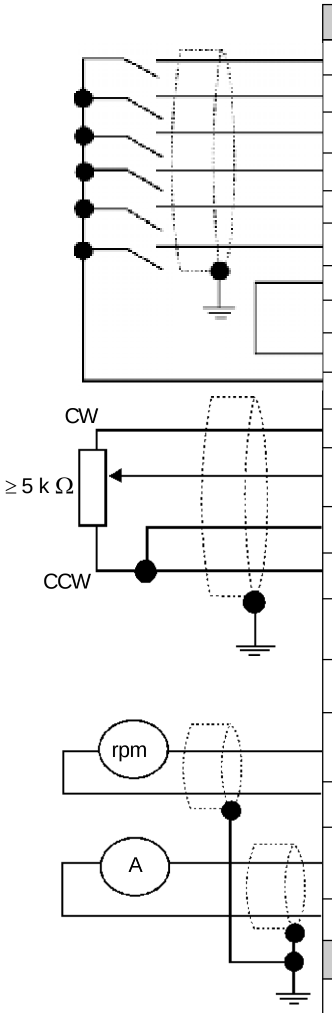


Terminal XC1		Factory Default Function	Specifications
1	DI1	Start / Stop	6 Isolated Digital Inputs Minimum High Level: 18 Vdc Maximum Low Level: 3 Vdc Maximum Voltage: 30 Vdc Input Current: 11mA @ 24Vdc
2	DI2	FWD / REV Section (Remote Mode)	
3	DI3	No function	
4	DI4	No function	
5	DI5	JOG (Remote Mode)	
6	DI6	Ramp # 2 Selection	
7	COM	Digital Inputs Common	
8	COM	Digital Inputs Common	
9	24Vcc	Digital inputs 24 Vdc source	Isolated 24 Vdc±8%,Capac: 90mA
10	DGND*	0V Reference of the 24 Vdc Source	Grounded by a 249Ω resistor
11	+REF	Positive Reference for Potentiometer	+ 5.4 Vdc ± 5%, Capacity: 2mA
12	AI1+	Analog Input 1: Speed Reference (Remote Mode)	Valid for AI1and AI2 differential, resolution: 10 bits,0 to +10 Vdc or 0(4) to 20 mA (Fig. 3.12)
13	AI1-		
14	- REF	Negative Reference for Potentiometer	-4.7 Vdc± 5%, Capacity: 2mA
15	AI2+	Analog Input 2: No Function	Valid for AI1and AI2 Impedance: 400 kΩ [0 to + 10 Vdc] 500Ω [0(4) to 20mA]
16	AI2-		
17	AO1	Analog Output 1: Speed	0 a +10Vdc, R_L ≥ 10k Ω(Max load.) resolution: 11bit
18	DGND	0V Reference for Analog Outputs	Grounded by a 5.1Ω resistor
19	AO2	Analog Output: Motor Current	0 to +10Vdc, R_L ≥ 10k Ω(Max. Load) Resolution: 11bit
20	DGND	0V Reference for Analog Outputs	Grounded by a 5.1Ω resistor
Terminal XC1A		Factory Default Function	Specification
21	RL1 NC	Relay Output - No Fault	Contact capacity: 1A 240Vac
22	RL1 NO		
23	RL2 NO	Relay Output - Speed > P288 (N>Nx)	
24	RL1 C	Relay Output - No Fault	
25	RL2 C	Relay Output - Speed > P288 (N>Nx)	
26	RL2 NC		
27	RL3 NO	Relay Output - Speed Reference > P228 (N*>Nx)	
28	RL3 C		

Note: **NC** = normally closed contact, **NO** = normally open contact, **C** = common

Figure 3.12 (a) *- XC1/XC1A Control Terminals Description (CC9 board) - Active High Digital Inputs*

The following diagram shows the control wiring with the digital inputs as active low (without a jumper between XC1:8 and XC1:10).



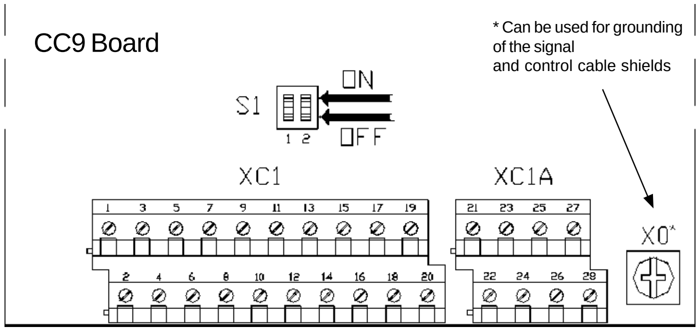
Terminal XC1		Factory Default Function	Specifications
1	DI1	Start / Stop	6 Isolated Digital Inputs Minimum High Level: 18 Vdc Maximum Low Level: 3 Vdc Maximum Voltage: 30 Vdc Input Current: 11mA @ 24Vdc
2	DI2	FWD / REV Section (Remote Mode)	
3	DI3	No function	
4	DI4	No function	
5	DI5	JOG (Remote Mode)	
6	DI6	Ramp # 2 Selection	
7	COM	Digital Inputs Common	
8	COM	Digital Inputs Common	
9	24Vcc	Digital inputs 24 Vdc source	Isolated 24 Vdc ± 8%,Capac: 90mA
10	DGND*	0V Reference of the 24 Vdc Source	Grounded by a 249Ω resistor
11	+ REF	Positive Reference for Potentiometer	+ 5.4 Vdc ± 5%, Capacity: 2mA
12	AI1+	Analog Input 1: Speed Reference (Remote Mode)	Valid for AI1and AI2 differential, resolution: 10 bits,0 to +10 Vdc or 0(4) to 20 mA (Fig. 3.12)
13	AI1-		
14	- REF	Negative Reference for Potentiometer	-4.7 Vdc ± 5%, Capacity: 2mA
15	AI2+	Analog Input 2: No Function	Valid for AI1and AI2 Impedance: 400 kΩ [0 to + 10 Vdc] 500Ω [0(4) to 20mA]
16	AI2-		
17	AO1	Analog Output 1: Speed	0 a +10Vdc, R_L ≥ 10k Ω (Max load.) resolution: 11bit
18	DGND	0V Reference for Analog Outputs	Grounded by a 5.1Ω resistor
19	AO2	Analog Output: Motor Current	0 to +10Vdc, R_L ≥ 10k Ω (Max. Load) Resolution: 11bit
20	DGND	0V Reference for Analog Outputs	Grounded by a 5.1Ω resistor
Terminal XC1A		Factory Default Function	Specification
21	RL1 NC	Relay Output - No Fault	Contact capacity: 1 A 240Vac
22	RL1 NO		
23	RL2 NO	Relay Output - Speed > P288 (N>Nx)	
24	RL1 C	Relay Output - No Fault	
25	RL2 C	Relay Output - Speed > P288 (N>Nx)	
26	RL2 NC		
27	RL3 NO	Relay Output - Speed Reference > P228 (N*>Nx)	
28	RL3 C		

Note: **NC** = normally closed contact, **NO** = normally open contact, **C** = common

Figure 3.12 (b) *- XC1/XC1A Control Terminals Description (CC9 board) - Active Low Digital Inputs*

NOTE!

For using the digital inputs as active low it is necessary to remove the jumper between XC1:8 and XC1:10 and place it between XC1:7 and XC1:9.



* Can be used for grounding of the signal and control cable shields

Figure 3.13 *- Dip switch position for 0..+10V / 0 (4)..20 mA selection*

As a default the analogue inputs are selected as 0…10V. This can be changed using the dip switch S1 on the control board.

Analog Input	Factory Default Function	Dip Switch	Selection
AI1	Speed Reference	S1.2	**OFF** 0...+10V (Factory Default) **ON** 4...20mA / 0...20mA
AI2	No Function	S1.1	**OFF** 0...+10V (Factory Default) **ON** 4...20mA / 0...20mA

Table 3.8 *– Dip switch configuration*

Related Parameters: P221, P222, P234 ... P240.

During the signal and control wire installation you must follow these guidelines:

1) Cable Cross Section: 20...14 AWG (0.5...1.5mm²);
2) Max. Torque: 4.50 lbf.in (0.50 N.m);
3) XC1 wiring must be connected with shielded cables and installed separately from other wiring (power, control at 110/220 Vac, etc.), according to Table 3.9.

CFW-09 Amp Rating	Wiring Length	Min. Separation Distance
≤ 24A	≤330ft (100m)	≥ 4in (10cm)
	>330ft (100m)	≥10 in (25cm)
≥ 28A	≤100ft (30m)	≥ 4 in (10cm)
	>100ft (30m)	≥ 10in (25cm)

Table 3.9 *– Wiring separation distances*

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:

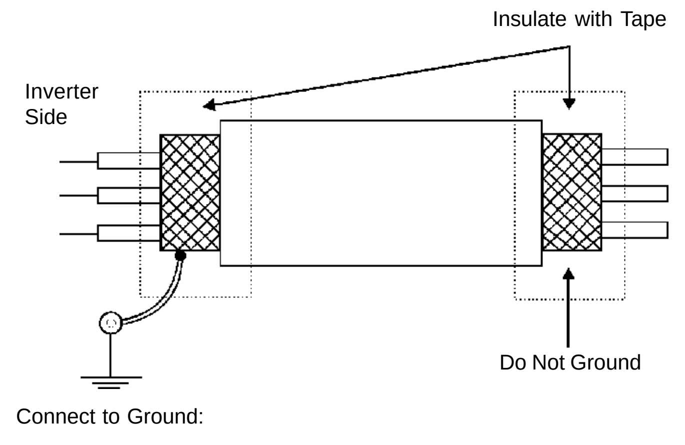


***Figure 3.14** – Shield Connection*

4) For wiring distances longer than 150 ft (50 m), it is necessary to use galvanic isolators for the XC1:11...20 analog signals.
5) Relays, contactors, solenoids or electromagnetic braking coils installed near inverters can generate interference in the control circuit. In order to eliminate this interference, connect RC suppressors in parallel with the coils of AC relays. Connect a free - wheeling diode in case of DC relays/ coils.
6) When an 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.

3.2.5 Typical Terminal Connections

<u>Connection 1</u> – Keypad Start/Stop (Local Mode)

☑ With the **factory default setting**, you can operate the inverter in the local mode. This operation mode is recommended for users who are operating the inverter for the first time; without additional control connections.
For start-up according to this operation mode, follow Chapter 4.

☑ <u>Connection 2</u> - 2-Wire Start/Stop (Remote Mode)

Valid for **factory default setting** and inverter operating in **remote mode**.
For the factory default programming, the selection of the operation mode (Local/Remote) is made via the key LOC/REM (default is Local).
Pass default of the key LOC/REM to remote P220=3.

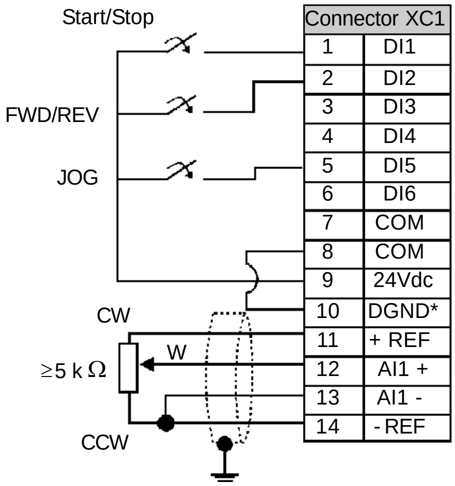


Figure 3.15 *- XC1 (CC9) Wiring for Connection 2*

☑ Connection 3 - 3-Wire Start/Stop

Parameters to be programmed:
Set DI3 to START
P265=14
Set DI4 to STOP
P266=14

Program P224=1 (DIx) if you want the 3 wire control in local mode.
Program P227=1 (DIx) if you want the 3 wire control in remoto mode.

To Program the FWD / REV Selection via DI2
Set P223=4 if in Local Mode **or**
Set P226=4 if in Remote Mode.
S1 and S2 are momentary push buttons, NO contact for Start and NC contact for Stop.
The speed reference can be via Analog Input AI (as in Connection 2), via keypad (HMI) (as in Connection 1), or via any other source.

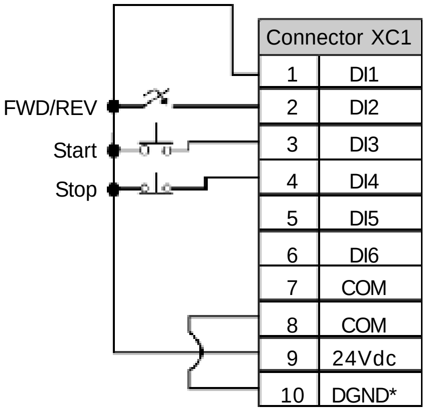


Figure 3.16 *-XC1 (CC9) Wiring for Connection 3*

☑ Connection 4 - FWD Run / REV Run

Parameters to be programmed:

Set DI3 to FORWARD Run
P265=8

Set DI4 to REVERSE Run
P266=8

When the FWD Run / REV Run Function is programmed, the function is always active, in both local and remote operation modes.
At the same time, the keys 0 and I remain inactive (even when **P224 =** 0 or **P227 =** 0)
The direction of rotation is defined automatically by the FWD Run / REV Run commands.
Clockwise rotation for Forward and Counter Clockwise rotation for Reverse.
The speed reference can be from any source (as in Connection 3).

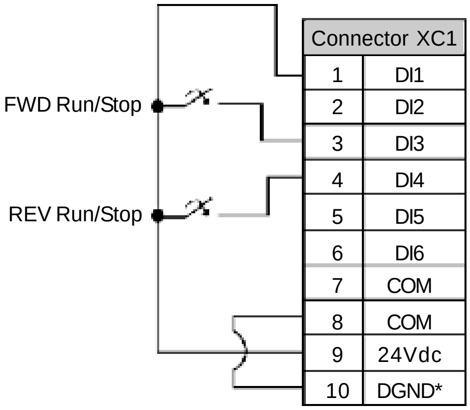


Figure 3.17 *- XC1 (CC9) Wiring for Connection 4*

3.3 European EMC Directive - Requirements for Conforming Installations

The CFW-09 inverter series was designed taking in consideration safety and EMC aspects. The CFW-09 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/EMC measures the CFW-09 fulfill all requirements of the EMC Directive (89/336/EEC) as defined by the **EMC Product Standard for Power Drive Systems EN61800-3**. Compliance of the whole serie of the CFW-09 is based on testing some representative models. A Technical Construction File was checked and approved by a Competent Body.
The CFW-09 inverter series are intended for professional applications only. Therefore, the harmonic current emissions defined by the standards EN 61000-3-2 and EN 61000-3-2/A 14 do not apply.

NOTE!

☑ The 500-600V and 660-690V models are intended to be connected to an industrial low voltage power supply network, or public network which does not supply buildings used for domestic purpose - second environment according to the EN61800-3 standard.

☑ The filters specified in the item 3.3.3 do not apply to the 500-600V and 660-690V models.

3.3.1 Installation

3.3.1.1 Installation for **Second Environment** (Industrial areas) / **Restricted** distribution (EN61800-3):

The following items are required:

1. Output cables (motor cables) must be armored, flexible armored or installed inside a metallic conduit or trunking with equivalent attenuation.
2. Control (I/O) and signal wiring must be shielded or installed inside a metallic conduit or trunking with equivalent attenuation.
3. Grounding as recommended in this manual.

3.3.1.2 Installation for **First Environment** (Residential areas) **/ Restricted** distribution and **Second Environment** (Industrial areas) / **Unrestricted** distribution (EN61800-3):

Attention:
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 this case the user may be required to take adequate measures.

The following items are required:

1. Filters as called out on the EMC Filter/Dimension table and connected as recommended in figure 3.18.
2. Output cables (motor cables) must be armored, flexible armored or installed inside a metallic conduit or trunking with equivalent attenuation.
3. Control (I/O) and signal wiring must be shielded.
4. Grounding as recommended in this manual.

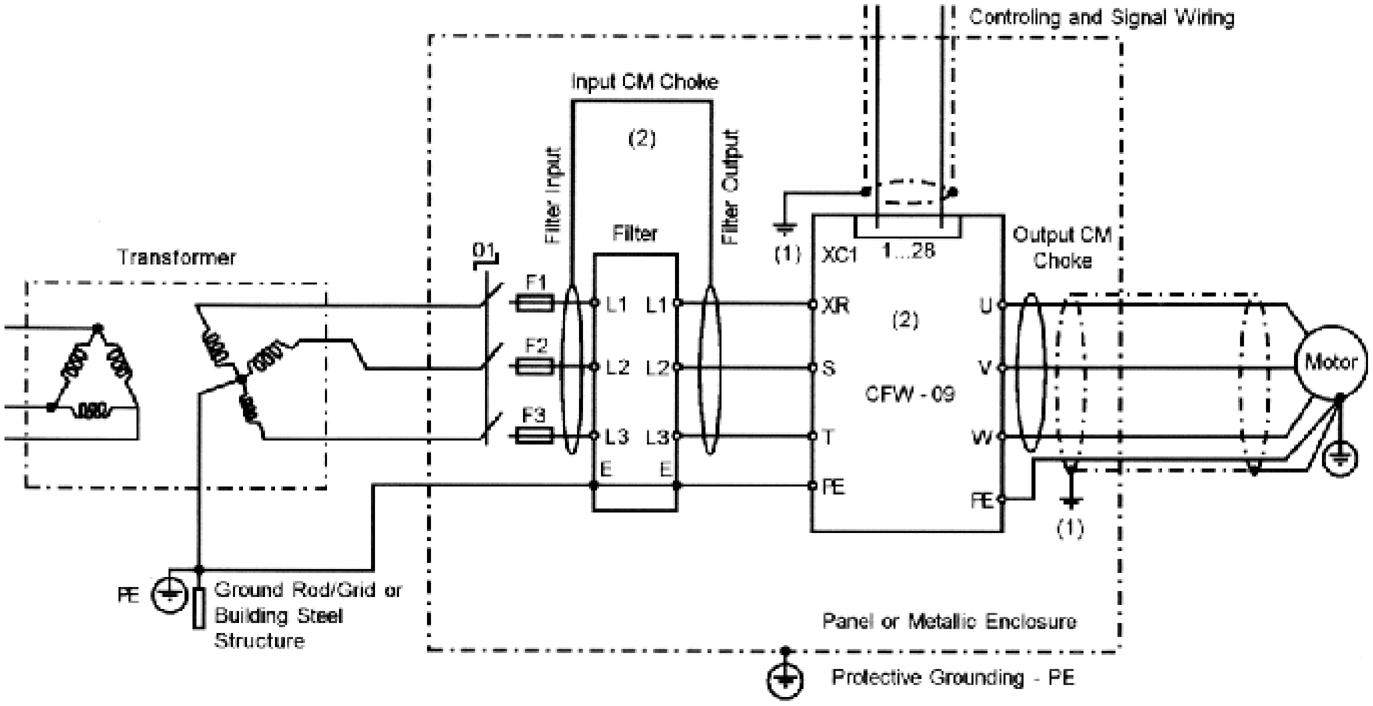


Figure 3.18 *- EMC Filters connection*

(1) The cable's shielding must be solidly connected to the common backplane, using a bracket.
(2) The inverter and filter must be mounted on a common backplane with a positive electrical bond and in close proximity to one another. The length of the wiring between filter and inverter must be kept as short as possible.

3.3.2 EMC Filter characteristics:

Filter	WEG P/N	Rated current [A]	Power Losses [W]	Weight [kg]	Drawing (Dimensions)	Connector Type
FS6007-16-06	0208.2072	16	4	0.9	1	/05
FS6007-25-08	0208.2073	25	4	1.0	2	/08
FS6007-36-08	0208.2074	36	5	1.0	2	/08
FN3258-7-45	0208.2075	7	3.8	0.5	3	/45
FN3258-16-45	0208.2076	16	6	0.8	3	/45
FN3258-30-47	0208.2077	30	12	1.2	3	/47
FN3258-55-52	0208.2078	55	26	1.8	3	/52
FN3258-100-35	0208.2079	100	35	4.3	3	/35
FN3258-130-35	0208.2080	130	43	4.5	3	/35
FN3359-150-28	0208.2082	150	28	6.5	4	/28
FN3359-250-28	0208.2082	250	57	7	4	/28
FN3359-400-99	0208.2083	400	50	10.5	4	Busbar /99
FN3359-600-99	0208.2084	600	65	11	4	Busbar /99
FN3359-1000-99	0208.2085	1000	91	18	4	Busbar /99
Choke 1151-042	0208.2086	-	-	-	-	-
Choke 1151-043	0208.2087	-	-	-	-	-
Choke 1151-044	0208.2088	-	-	-	-	-

3.3.3 Table of Filters/EMC measures and achieved levels

380-480V Line voltage

Model	Optional Device	Input filter	Input CM Choke	Output CM Choke	Inside Metallic Panel	Electromagnetic radiation disturbance level (Product Standard EN61800-3 (1996) + A11 (2000) *1	Conducted Emission Class *2
3,6 A	RS-232	FN-3258-7-45	No	No	No	First environment, restricted distribution	B
4 A, 5 A	EBA RS-485 Serial Interface	FN-3258-7-45	No	No	No	Second environment, unrestricted distribution	B
9 A	EBA RS-485 Serial Interface	FN-3258-16-45	No	No	No	Second environment, unrestricted distribution	B
13 A	No	FN-3258-16-45	No	No	No	First environment, restricted distribution	B
16 A 24 A	No	FN-3258-30-47	No	No	No	First environment, restricted distribution	B
30 A	EBB RS-485 Serial Interface	FN-3258-55-52	Schaffner 203 (1151-042) - 2 turns (filter input side)	No	Yes	First environment, restricted distribution	A1
30 A 38 A	No	FN-3258-55-52	No	No	No	First environment, restricted distribution	A1
45 A	No	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides)	No	No	First environment, restricted distribution	A1
45 A	EBA RS-485 Serial Interface	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/ output sides)	No	No	First environment, restricted distribution	A1
45 A	EBB RS-485 Serial Interface	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides) Schaffner 203 (1151-042) 2 turns in the control cable	No	No	First environment, restricted distribution	A1
45 A	Profibus-DP 12 MBaud	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides)	No	No	First environment, restricted distribution	A1
60 A 70 A	No	FN-3258-100-35	No	No	Yes	Second environment, unrestricted distribution	A1
86 A 105 A	No	FN-3359-150-28	2 X Schaffner 203 (1151-042) Output filter side	2 X Schaffner 203 (1151-042) (UVW)	Yes	First environment, restricted distribution	A1
142 A	No	FN-3359-250-28	2 X Schaffner 167 (1151-043) output filter side	2 X Schaffner 167 (1151-043) (UVW)	Yes	First environment, restricted distribution	A1
180 A	No	FN-3359-250-28	Schaffner 159 (1151-044) output filter side	Schaffner 159 (1151-044) (UVW)	Yes	First environment, restricted distribution	A1

211 A 240 A 312 A 361 A	No	FN-3359-400-99	Schaffner 159 (1151-044) Output filter side	Schaffner 159 (1151-044) (UVW)	Yes	First environment, restricted distribution	A1
450 A	No	FN-3359-600-99	Schaffner 159 (1151-044) Output filter side	Schaffner 159 (1151-044) (UVW)	Yes	First environment, restricted distribution	A1
515A 600 A	No	FN-3359-1000-99	Schaffner 159 (1151-044) Output filter side	Schaffner 159 (1151-044) (UVW)	Yes	First environment, restricted distribution	A1

220V-230V Line voltage

Model	Optional Device	Input filter	Common mode Ferrite (Input)	Common mode Ferrite (Output)	Inside Metallic Panel	Electromagnetic radiation disturbance level (Product Standard EN61800-3 (1996) + A11 (2000)) *1	Conducted Emission Class *2
6 A 1 phase	No	FS6007-16-06	No	Schaffner 203 (1151-042) 2 turns	No	First environment, restricted distribution	B
7 A 1 phase	No	FS6007-25-08	No	No	No	First environment, restricted distribution	B
10 A 1 phase	No	FS6007-36-08	No	No	No	First environment, restricted distribution	B
10 A 1 phase	EBA RS-485 Serial Interface	FS6007-36-08	No	No	No	First environment, restricted distribution	B
10 A 1 phase	EBB RS-485 Serial Interface	FS6007-36-08	2 x Schaffner 203 (1151-042) - (filter input/output sides (2 turns))	No	No	First environment, restricted distribution	B
6 A	No	FN-3258-7-45	No	No	No	First environment, restricted distribution	B
7 A 10 A 13 A	No	FN-3258-16-45	No	No	No	First environment, restricted distribution	B
16 A 24 A	No	FN-3258-30-47	No	No	No	First environment, restricted distribution	B
28 A	No	FN-3258-55-52	No	No	Yes	First environment, restricted distribution	A1
45 A	No	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides)	No	No	First environment, restricted distribution	A1
45 A	EBA RS-485 Serial Interface	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides)	No	No	First environment, restricted distribution	A1
45 A	EBB RS-485 Serial Interface	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides) Schaffner 203 (1151-042)choke-2 turns in the control cable	No	No	First environment, restricted distribution	A1

45 A	Profibus-DP 12 MBaud	FN-3258-100-35	2 x Schaffner 203 (1151-042) - (filter input/output sides)	No	No	First environment, restricted distribution	A1
54 A 70 A	No	FN-3258-100-35	No	No	Yes	Second environment, unrestricted distribution	A1
86 A	No	FN-3258-130-35	2 X Schaffner 203 (1151-042) Filter output side	2 X Schaffner 203 (1151-042) (UVW)	Yes	First environment, restricted distribution	A1
105 A	No	FN-3359-150-28	2 X Schaffner 203 (1151-042) Filter output side	2 X Schaffner 203 (1151-042) (UVW)	Yes	First environment, restricted distribution	A1
130 A	No	FN-3359-250-28	2 X Schaffner 167 (1151-043) Filter output side	2 X Schaffner 167 (1151-043) (UVW)	Yes	First environment, restricted distribution	A1

*1

First environment/restricted distribution (Basic Standard CISPR 11):
30 to 230 MHz: 30dB (uV/m) in 30 m
230 to 1000 MHz: 37dB (uV/m) in 30 m

Attention:
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.

Second environment/unrestricted distribution (Basic Standard CISPR 11: Group 2, class A):
30 to 230 MHz: 40dB (uV/m) in 30 m
230 to 1000 MHz: 50dB (uV/m) in 30 m

*2

Motor shielded cable length: 20 m.

3.3.4 Mechanical drawing of the filters

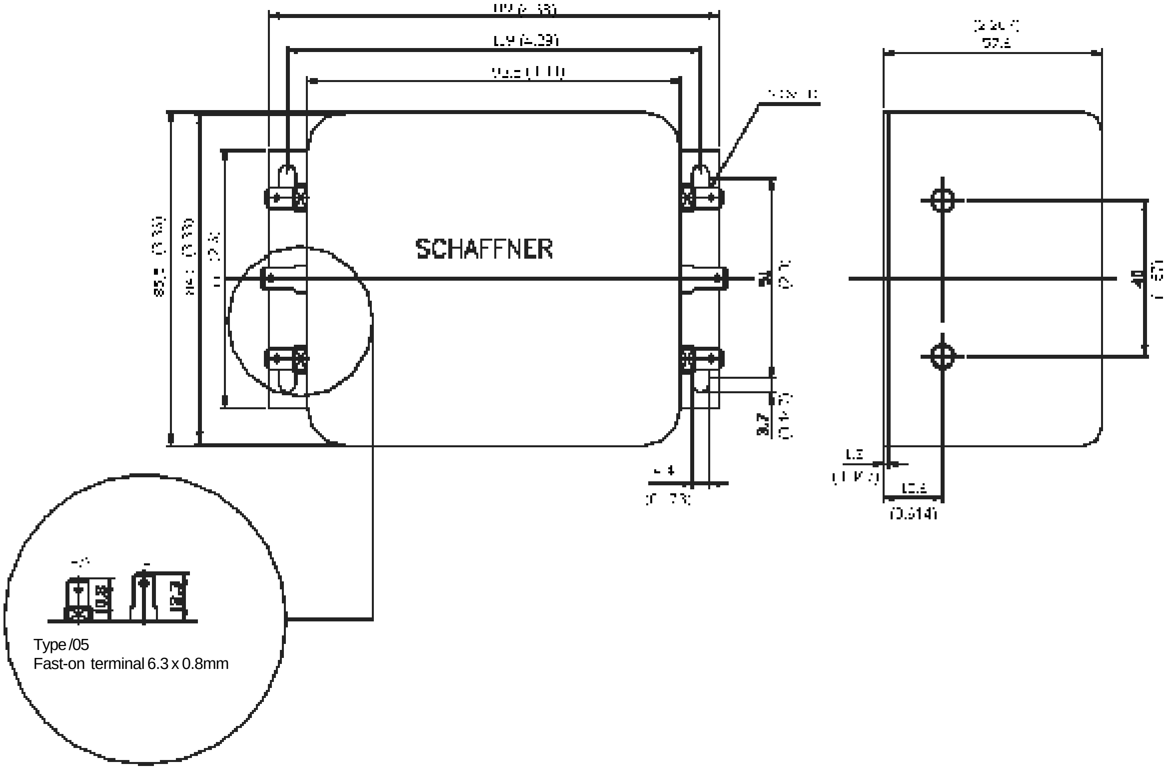


Figure 3.19 - Drawing of Filter 1 - Dimesions in mm (inch)

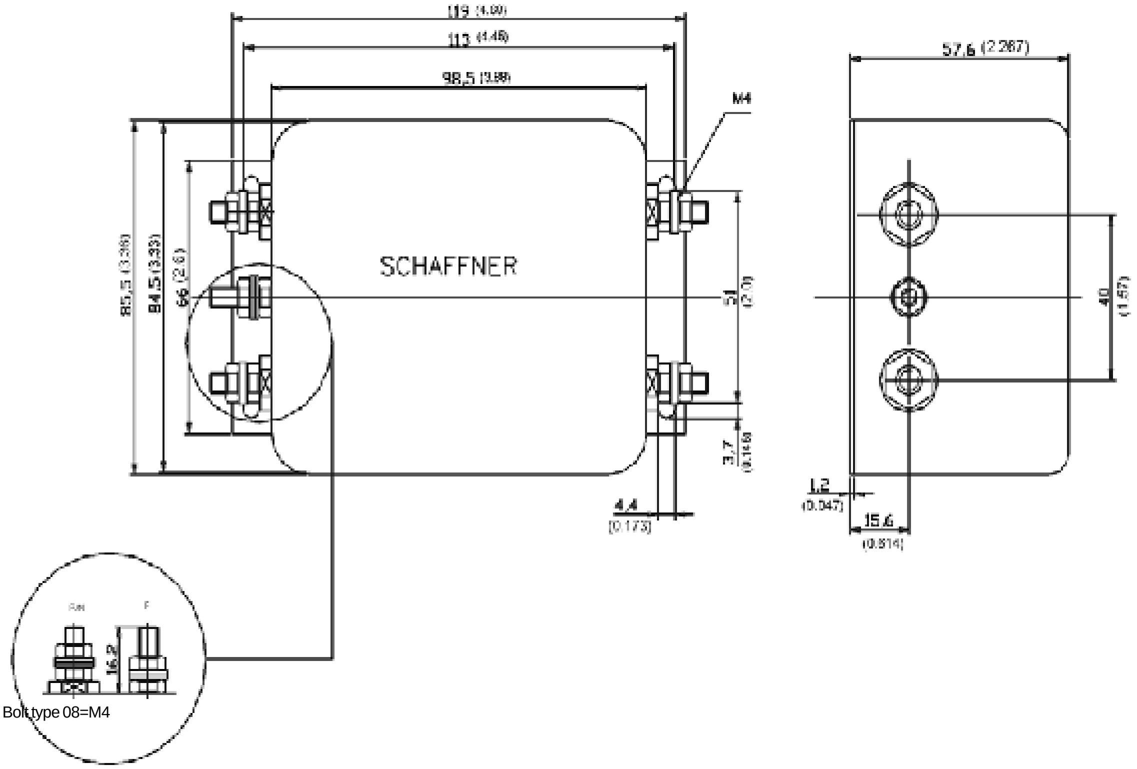
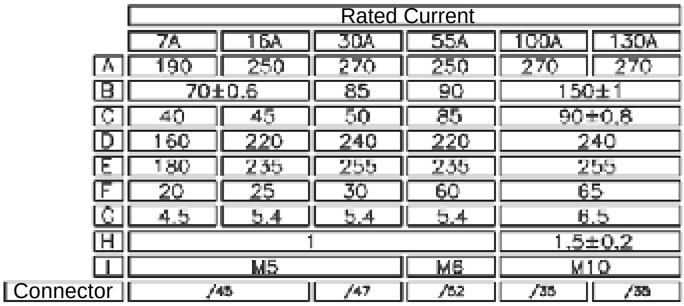
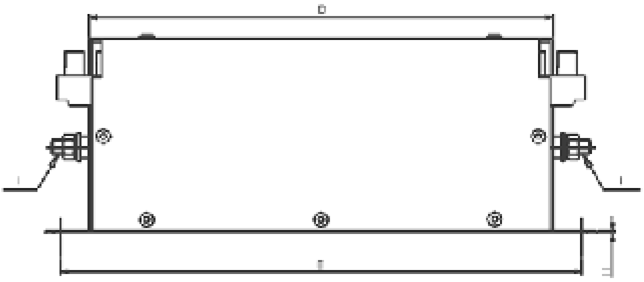


Figure 3.20 - Drawing of Filter 2 - - Dimesions in mm (inch)

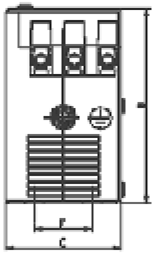


	Rated Current					
	7A	16A	30A	55A	100A	130A
A	190	250	270	250	270	270
B	70±0.6		85	90	150±1	
C	40	45	50	85	90±0,8	
D	160	220	240	220	240	
E	180	235	255	235	255	
F	20	25	30	60	65	
G	4.5	5.4	5.4	5.4	6.5	
H	1				1,5±0,2	
I	M5			M8	M10	
Connector	/45		/47	/52	/35	/35

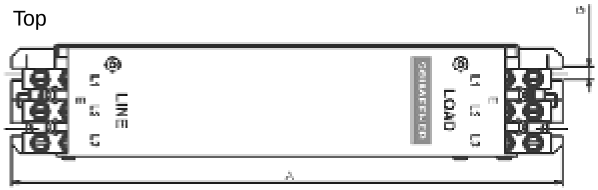
MECHANICAL DATA SIDE VIEW

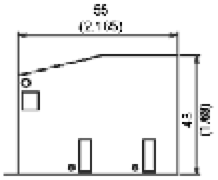


FRONT VIEW

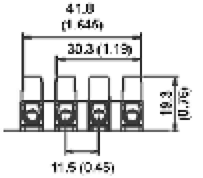


Top

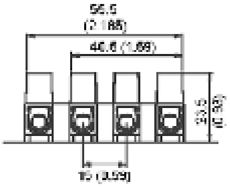




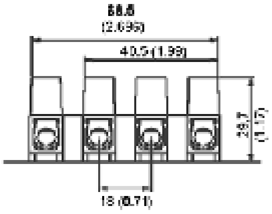
Type/35 - Dimesions in mm (inch)
Terminal block for flexible and rigid cable of 50mm^2 or AWG 1/0.
Max.Torque : 8Nm



Type/45 - Dimesions in mm (inch)
Terminal block for 6mm^2 solid cable, 4mm^2 flexible cable AWG 12.



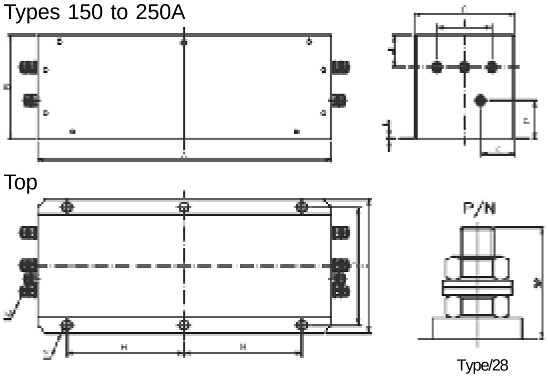
Type/47 - Dimesions in mm (inch)
Terminal block for 16mm^2 solid wires,10mm^2 flexible wires AWG 8.



Type/52 - Dimesions in mm (inch)
Terminal block for 25mm^2 solid wires,16mm^2 flexible wires AWG 6.

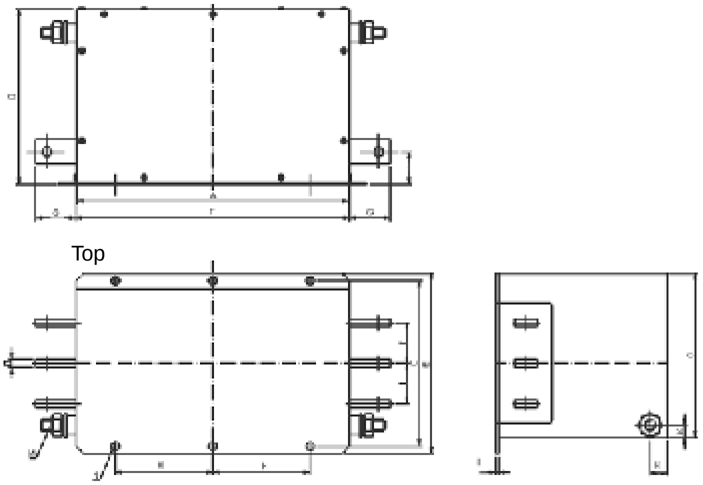
Figure 3.21 *- Drawing of filter 3*

Types 150 to 250A



Type/28
M10 bolt

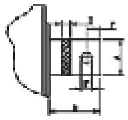
Types 400 to 1000A



	RATED CURRENT				
	150A	250A	400A	600A	1000A
A	300				350
B	120A	125	115	135	170
C	160	180	210		230
D	185	205	235		255
E	210	230	260		280
F			306		356
G			40		50
H	120				145
I	100	110	50		
J	40		35		64
K	55	62.5	20		25
L	2				3
M	M10		M12		
N	12				
O			6	8	
P	30	35			
Connector	/28		/99		

Buss bar connection(Type/99)
Series FN 2259

	400A	600A	1000A
A	25		40
B	6	8	
C	15		20
D	40		50
E	10.5		14



These filters are supplied with M12
bolts for the grounding connection.

Figure 3.22 *- Drawing of Filter 4*

EU DECLARATION OF CONFORMITY

We
Manufacturer's Name: **Weg Automação Ltda**
Address: Rua Waldemar Grubba, 3000
89256900 Jaraguá do Sul - SC – Brazil

And our representative established within the European Community:
WEG France
Parc Silic Rhône Alpes
17, rue de Bruxelles
38070 St. Quentin Fallavier –France

Herewith declare that the product: **CFW-09 Frequency Inverter**

Models: **CFW-09....T....**

Has been designed and manufactured in accordance with the following standards:
Safety: EN 50178(1997) Electronic Equipment for Use in Power Instalations
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 Contruction File Nº WEG001-2001
Prepared by: Weg Automação Ltda
Function: Manufacturer
Date: 02/oct/2001
Competent Body:
Name: Phoenix Test-Lab Gmbh
Address: Königswinkel 10 D-32825 Blomberg – Germany
Certification Nº: Z011101 and Z011102

and when installed in accordance with the installations 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: 2001

Umberto Gobbato
Weg Automação Ltda
Managing Director

21/12/01
Date

Wilmar Henning
WEG France
Director

21/12/01
Date

CHAPTER 4

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 (Refer to Section 3.2: Electrical Installation).

4.1 PRE-POWER CHECKS

The inverter shall be installed according to Chapter 3: Installation.

DANGER!

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) **Clean the inside of the inverter**
Remove all shipping material from the inside of the inverter or cabinet.

3) **Check if the selected inverter AC power is correct (Refer to Section 3.2.3)**

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

5) **Uncouple the load from the motor**
If the motor cannot be uncoupled, make sure that the direction of rotation (FWD/REV) cannot cause damage to the machine.

6) **Close the inverter cover or cabinet doors**

4.2 INITIAL POWER-UP

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

1) **Check the supply voltage**
Measure the line voltage and check if it is within the specified range (Rated Voltage + 10% / - 15%).

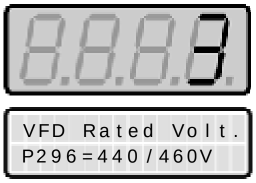
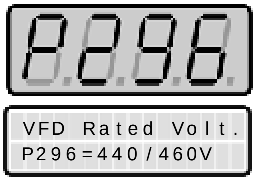
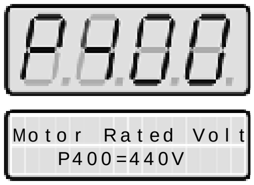
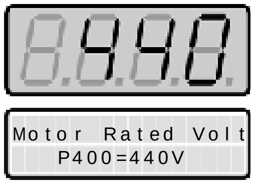
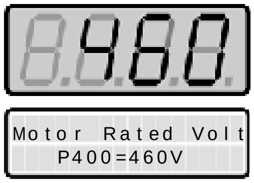
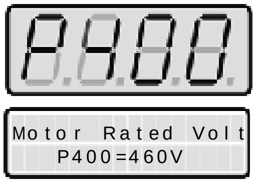
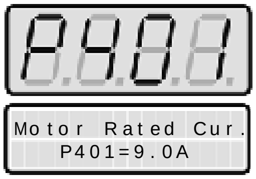
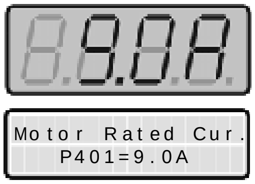
2) **Power-up the AC input**
Close the input circuit breaker or disconnect switch.

3) **Check if the power-up has been successful**
When the inverter is powered up for the first time or when the factory default parameter values are loaded (P204 = 5), a start-up sub-routine is run. This sub-routine requests the user to program some basic parameters to ensure proper operation and motor protection.
A start-up programming example is shown below:

Inverter
Line: CFW-09
Rated Current: 9 A
Rated Voltage: 380...480 V
Model: CFW090009T3848ESZ
Motor
Power: 5 HP
rpm: 1730, 4 POLE
Rated Current: 7.9 A
Rated Voltage: 460 V
Frequency: 60 Hz
Cooling: Self-ventilated

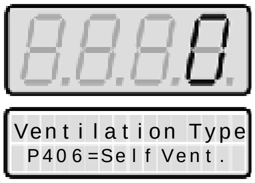
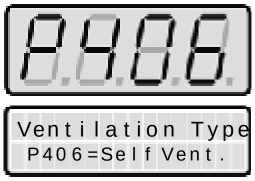
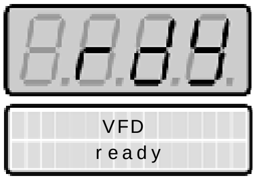
Initial Power-up - Programming via Keypad (HMI) (Based on the example above):

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
After power-up, the display shows the following message	P201 language P201=English	Language Selection: 0=Português 1=English 2=Español 3=German
Press the PROG key to enter the programming mode	1 language P201=English	Enter the programming mode
User the ▲ and ▼ keys to select the language	1 language P201=English	Selected Language: 1 = English
Press the PROG key to save the selected option and exit the programming mode	P201 language P201=English	Exit the programming mode.
Press the key ▲ to go to the next parameter	P296 VFD Rated Volt. P296=440/460V	Inverter Rated Voltage Selection: 0=220V/230V 1=380V 2=400V/415V 3=440V/460V 4=480V 5=500V/525V 6=550/575V 7=600V 8=660V/690V
Press the PROG key to enter the programming mode	3 VFD Rated Volt. P296=440/460V	Enter the programming mode

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Use the and keys ▲ to ▼ select the inverter power supply voltage.	 VFD Rated Volt. P296=440/460V	Selected Inverter Rated Voltage: 3 = 440/460 V
Press the PROG key to save the selected option and exit the programming mode	 VFD Rated Volt. P296=440/460V	Exit the programming mode.
Press the ▲ key to go to the next parameter.	 Motor Rated Volt P400=440V	Motor Rated Voltage: 0...690V
Press the PROG key to enter the programming mode	 Motor Rated Volt P400=440V	Enter the programming mode
Use the and keys ▲ to ▼ set the correct motor rated voltage value	 Motor Rated Volt P400=460V	Programmed Motor Rated Voltage: 460 V
Press the PROG key to save the programmed value and exit the programming mode	 Motor Rated Volt P400=460V	Exit the programming mode.
Press the ▲ key to go to the next parameter	 Motor Rated Cur. P401=9.0A	Motor Rated Current Range: 0.0 ... 1.30xP295
Press the PROG key to enter the programming mode.	 Motor Rated Cur. P401=9.0A	Enter the programming mode

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Use the ▲ and ▼ keys to set the correct motor rated current value	7.9A Motor Rated Cur. P401=7.9A	Programmed Motor Rated Current: 7.9 A
Press the PROG key to save the programmed value and exit the programming mode	P401 Motor Rated Cur. P401=7.9A	Exit the programming mode.
Press the key ▲ to go to the next parameter	P403 Motor Rated Freq P403=060Hz	Motor Rated Frequency Range: 0...300Hz
Press the PROG key to enter the programming mode	60H Motor Rated Freq P403=060Hz	Enter the programming mode
Use the ▲ and ▼ keys to set the correct motor rated frequency value	60H Motor Rated Freq P403=060Hz	Programmed Motor Rated Frequency: 60 Hz
Press the PROG key to save the programmed value and exit the programming mode	P403 Motor Rated Freq P403=060Hz	Exit the programming mode.
Press the ▲ key to go to the next parameter	P402 Motor Rated rpm P402=1750rpm	Motor Rated rpm Range: 0...18000 rpm
Press the PROG key to enter the programming mode	1750 Motor Rated rpm P402=1750rpm	Enter the programming mode

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Use the ▲ and ▼ keys to set the correct motor rated rpm value	1730 Motor Rated rpm P402=1730rpm	Programmed Motor Rated rpm: 1730 rpm
Press the PROG key to save the programmed value and exit the programming mode	P402 Motor Rated Speed P402=1730rpm	Exit the programming mode.
Press the ▲ key to go to the next parameter	P404 Motor Rated HP P404=0.33HP	Motor Rated HP Range: 1 ... 1600 HP 1 ... 1190 kW
Press the PROG key to enter the programming mode	0 Motor Rated HP P404=0.33HP	Enter the programming mode
Use the ▲ and ▼ keys to select the motor rated power	7 Motor Rated HP P404=5.0HP	Selected Motor Rated Power: 5.0 HP/3.7 kW
Press the PROG key to save the selected option and exit the programming mode.	P404 Motor Rated HP P404=5.0HP	Exit the programming mode.
Press the ▲ key to go to the next parameter	P406 Ventilation Type P406=Self Vent.	Motor Ventilation Type Selection: 0=Self Ventilated 1=Separate Ventilation
Press the PROG key to enter the programming mode	0 Ventilation Type P406=Self Vent.	Enter the programming mode

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Use the ▲ and ▼ keys to select the motor ventilation type	 Ventilation Type P406=Self Vent.	Selected Motor Ventilation Type: 0 = Self Ventilated
Press the PROG key to save the selected option and exit the programming mode	 Ventilation Type P406=Self Vent.	Exit the programming mode.
Refer to Section 4.3	 VFD ready	The first power-up routine is finished. Inverter is ready to operate.

Open the input circuit breaker or disconnect switch to shut down the CFW-09

NOTES!

- ☑ To repeat the initial power-up procedure:
  Set the parameter **P204** = 5 or 6 (this loads the factory default parameters) and follow the initial power-up sub-routine again;
- ☑ The initial power-up sub-routine described above automatically sets some parameters according to the entered data. For more details, refer to Chapter 6.

4.3 START-UP

This Section describes the start-up procedure when operating via the Keypad (HMI). Three types of control will be considered:
V/F 60Hz, Sensorless Vector and Vector with Encoder Feedback

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

- ☑ Several motors driven by the same inverter;
- ☑ Motor rated current lower than 1/3 of the inverter rated current;
- ☑ For test purposes, without a motor connected to the inverter.

The V/F control can also be used in applications that do not require fast dynamic responses, accurate speed regulation or high starting torque (speed error will be a function of the motor slip).
When parameter **P138** (Rated Slip) is programmed, speed accuracy of 1% can be obtained.
For the majority of the applications, the **Sensorless Vector** control is recommended. This mode permits an operation over a 100:1 speed range, a speed control accuracy of 0.5 % (Refer to P412 - Chapter 6), high torque and fast dynamic response.

Another advantage of this type of control is a higher immunity to sudden AC input voltage variation and load changes, thus avoiding nuisance tripping due to overcurrent.
The adjustments necessary for a good sensorless control operation are made automatically.
The Vector Control with Encoder Feedback offers the same advantages as the **Sensorless Control** described above, with the following additional benefits:

- ☑ torque and speed control down to zero speed (rpm);
- ☑ accuracy of 0.01 % in the speed control

The closed loop vector control with encoder requires the use of the optional board EBA or EBB for encoder connection - Refer to Chapter 8.

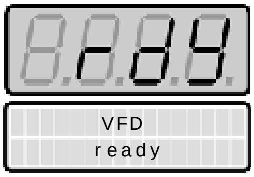
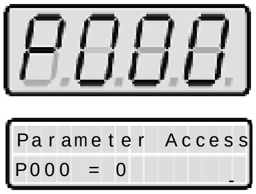
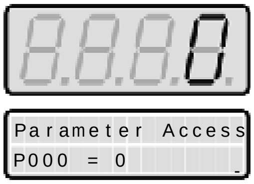
OPTIMAL BRAKING:
This setting allows controlled motor braking within shortest possible times without using other means, such as DC Link chopper with baking resistor (for more details about this function refer to P151 – Chapter 6). The inverter is supplied with this function set at maximum. This means that the braking is disabled. To enable the braking, set P151 according to Table 6.2.

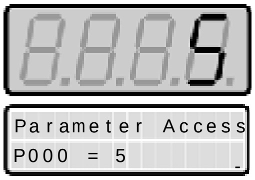
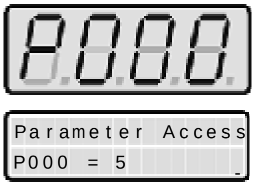
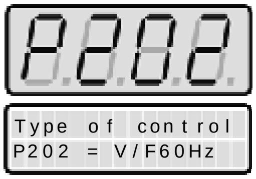
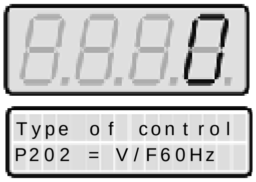
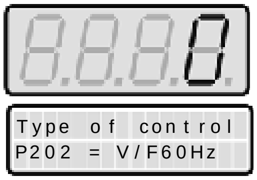
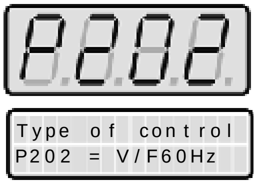
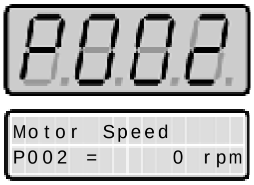
DANGER!
Even after the AC input is disconnected, high voltages may still be present.

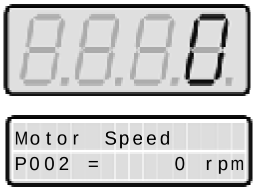
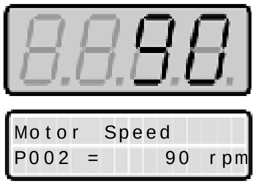
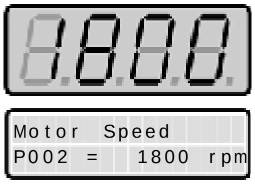
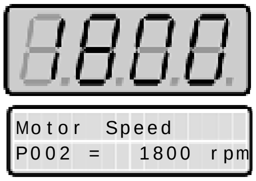
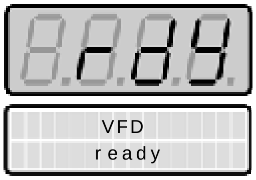
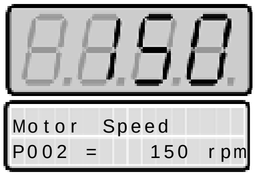
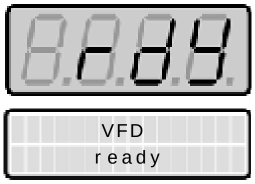
Wait at least 10 minutes after powering down to allow a full discharge of the capacitors.

4.3.1 Start-up - Operation Via Keypad (HMI) - Type of Control: V/F 60Hz

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

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Power-up the inverter	 VFD ready	Inverter is ready to be operated.
Press the PROG key. Press the keys ▼ or ▲ until P000 is reached	 Parameter Access P000 = 0	Enables the access to change parameters' content. With the factory default programming [P200 = 1 (Password Active)], P000 must be set to 5 to allow parameters changes
Press the PROG key to enter the programming mode	 Parameter Access P000 = 0	Enter the programming mode

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Use the ▲ and ▼ keys to set the password value	 Parameter Access P000 = 5	Password value (factory default = 5)
Press the PROG key to save the programmed value and exit the programming mode	 Parameter Access P000 = 5	Exit the programming mode.
Press the keys ▲ or ▼ until P202 is reached	 Type of control P202 = V/F60Hz	Type of Control Selection: 0=V/F 60Hz 1=V/F 50Hz 2=V/F Adjustable 3=Sensorless Vector 4=Vector with Encoder
Press the PROG key to enter the programming mode	 Type of control P202 = V/F60Hz	Enter the programming mode
Use the ▲ and ▼ keys to select the type of control	 Type of control P202 = V/F60Hz	If the option V/F 60Hz is already programmed, ignore this action
Press the PROG key to save the selected option and exit the programming mode	 Type of control P202 = V/F60Hz	Exit the programming mode.
Press the ▼ keys or until P002 is reached	 Motor Speed P002 = 0 rpm	Motor Speed (rpm)

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key	 0 Motor Speed P002 = 0 rpm	This is a read-only parameter
Press the I Start key	 90 Motor Speed P002 = 90 rpm	Motor accelerates from 0 to 90 rpm* (Minimum Speed), in the Forward (CW) direction of rotation (1) * for 4 pole motors
Press the ▲ key and hold until 1800 rpm is reached	 1800 Motor Speed P002 = 1800 rpm	Motor accelerates up to 1800 rpm* (2) * for 4 pole motors
Press the ⇄ FWD / REV key. Obs: The LED's on the keypad show whether the motor is running FWD or REV.	 1800 Motor Speed P002 = 1800 rpm	Motor decelerates (3) down to 0 rpm and then reverses the direction of rotation accelerating back up to 1800 rpm
Press the 0 Stop key	 rdy VFD ready	Motor decelerates down to 0 rpm
Press the JOG key and hold it	 150 Motor Speed P002 = 150 rpm	Motor accelerates from 0 rpm up to the speed set at P122. **Ex.**: P122 = 150 rpm
Release the JOG key	 rdy VFD ready	Motor decelerates down to 0 rpm

☛ **NOTE!**
The last frequency reference value set via the ▲ and ▼ keys is saved If you wish to change this value before enabling the inverter, change parameter **P121** (Keypad Reference).

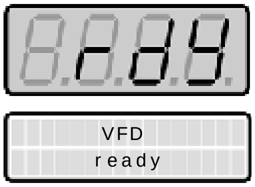
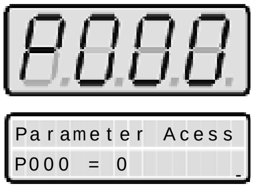
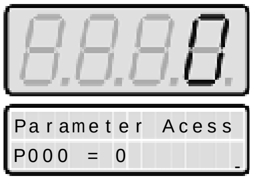
OBSERVATIONS:
1) If the rotation direction of the motor is not correct, switch off the inverter. Wait 10 minutes to allow a complete discharge of the capacitors and then swap any two wires at the motor output.
2) If the acceleration current becomes too high, specially at low frequencies (<15Hz), adjust the Torque Boost at **P136**.

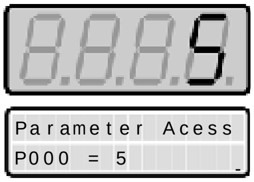
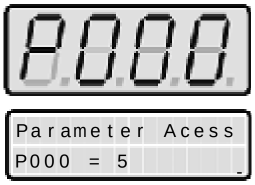
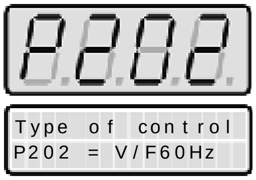
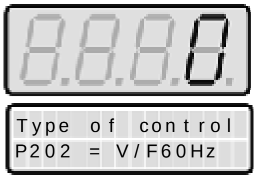
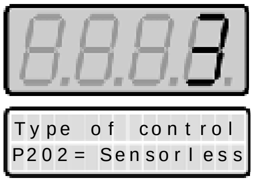
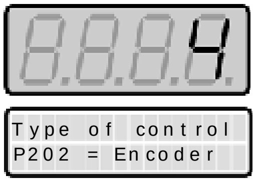
   Increase/decrease the content of **P136** gradually until you obtain an operation with constant current over the entire frequency range.

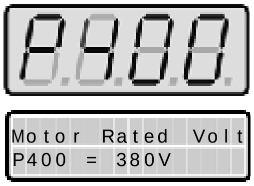
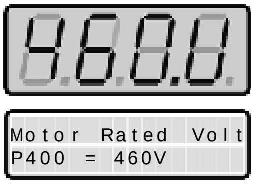
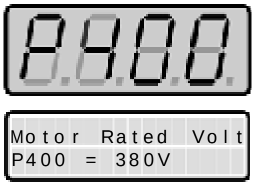
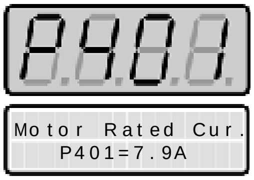
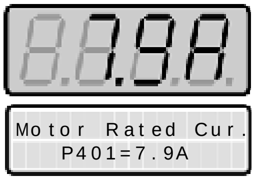
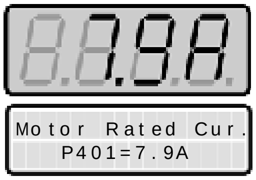
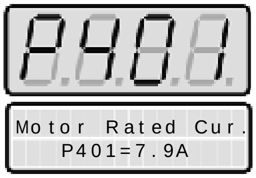
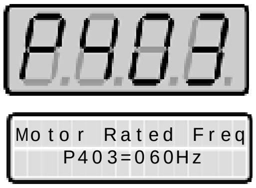
   Refer to P136 in Chapter 6.
3) If E01 fault occurs during deceleration, increase the deceleration time at **P101** / **P103**.

4.3.2 Start-up - Operation Via Keypad (HMI) - Type of Control: Vector Sensorless or With Encoder

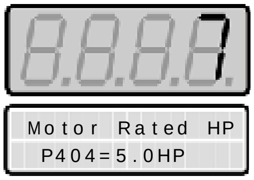
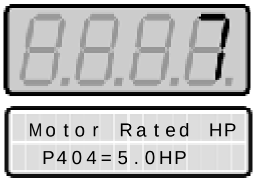
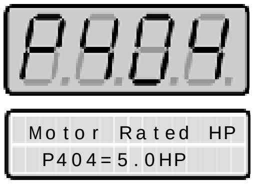
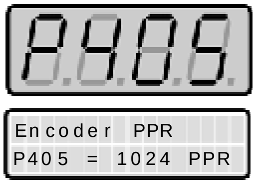
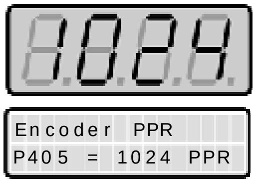
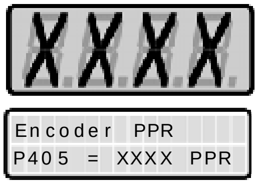
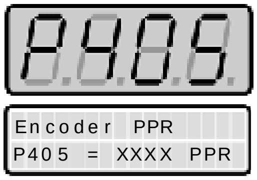
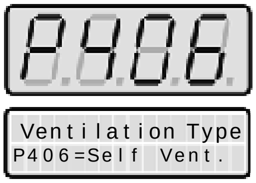
The sequence below is based on the example in Section 4.2

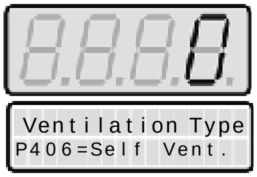
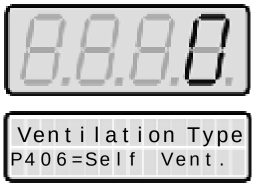
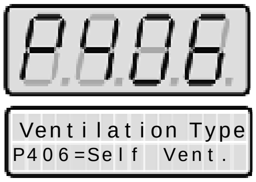
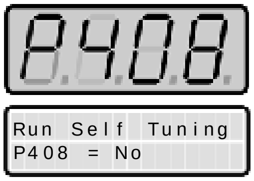
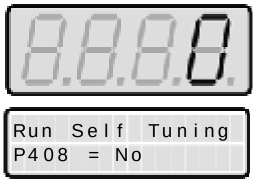
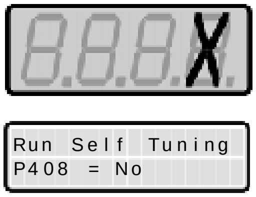
ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Power-up the inverter		Inverter is ready to be enabled
Press the PROG key. Press the keys ▲ or ▼ until P000 is reached		Enables the access to change parameters content. With the factory default programming [P200 = 1 (Password Active)], P000 must be set to 5 to allow parameters changes
Press the PROG key to enter the programming mode		Enter the programming mode

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Use the ▲ and ▼ keys to set the password value	 Parameter Acess P000 = 5	Password value (factory default = 5)
Press the PROG key to save the programmed value and exit the programming mode	 Parameter Acess P000 = 5	Exit the programming mode.
Press the keys ▲ or ▼ until P202 is reached	 Type of control P202 = V/F60Hz	Type of Control Selection: 0=V/F 60Hz 1=V/F 50Hz 2=V/F Adjustable 3=Sensorless Vector 4=Vector with Encoder
Press the PROG key to enter the programming mode	 Type of control P202 = V/F60Hz	Enter the programming mode
Use the ▲ and ▼ keys to select the type of control (Sensorless)	 Type of control P202= Sensorless	Selected Type of Control: 3 = Sensorless Vector
	OR	
Use the ▲ and ▼ keys to select the type of control (with Encoder)	 Type of control P202 = Encoder	Selected Type of Control: 4 = Vector with Encoder

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key to save the selected option and start the tuning routine after changing to Vector Control mode	 Motor Rated Volt P400 = 380V	Motor Rated Voltage Range: 0...690V
Press the PROG key and use the ▲ and ▼ keys to set the correct motor rated voltage value	 Motor Rated Volt P400 = 460V	Programmed Motor Rated Voltage: 460V
Press the PROG key to save the programmed value and exit the programming mode	 Motor Rated Volt P400 = 380V	Exit the programming mode.
Press the ▲ key to go to the next parameter	 Motor Rated Cur. P401=7.9A	Motor Rated Current Range: 0.0 ... 1.30xP295
Press the PROG key to enter the programming mode	 Motor Rated Cur. P401=7.9A	Enter the programming mode
Use the ▲ and ▼ keys to set the correct motor rated current value	 Motor Rated Cur. P401=7.9A	Programmed Motor Rated Current: 7.9 A
Press the PROG key to save the programmed value and exit the programming mode	 Motor Rated Cur. P401=7.9A	Exit the programming mode.
Press the ▲ key to go to the next parameter	 Motor Rated Freq P403=060Hz	Motor Rated Frequency Range: 0...300Hz

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key to enter the programming mode	60H Motor Rated Freq P403=060Hz	Enter the programming mode
Use the ▲ and ▼ keys to set the correct motor rated frequency value	60H Motor Rated Freq P403=060Hz	Programmed Motor Rated Frequency: 60 Hz
Press the PROG key to save the programmed value and exit the programming mode	P403 Motor Rated Freq P403=060Hz	Exit the programming mode.
Press the ▲ key to go to the next parameter	P402 Motor Rated rpm P402=1730rpm	Motor Rated rpm Range: 0...1800 rpm
Press the PROG key to enter the programming mode	1730 Motor Rated rpm P402=1730rpm	Enter the programming mode
Use the ▲ and ▼ keys to set the correct motor rated rpm value	1730 Motor Rated rpm P402=1730rpm	Programmed Motor Rated rpm: 1730 rpm
Press the PROG key to save the programmed value and exit the programming mode	P402 Motor Rated rpm P402=1730rpm	Exit the programming mode.
Press the ▲ key to go to the next parameter	P404 Motor Rated HP P404=5.0HP	Motor Rated HP Range: 1 ... 1600 HP 1 ... 1190 kW

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key to enter the programming mode	 Motor Rated HP P404=5.0HP	Enter the programming mode
Use the ▲ and ▼ keys to select the motor rated power	 Motor Rated HP P404=5.0HP	Selected Motor Rated Power: 7=5.0 HP/3.7 kW
Press the PROG key to save the selected option and exit the programming mode	 Motor Rated HP P404=5.0HP	Exit the programming mode.
Press the ▲ key to go to the next parameter	 Encoder PPR P405 = 1024 PPR	Encoder Pulses per Rotation (PPR) Range: 0 ... 9999
Press the PROG key to enter the programming mode. (Vector with Encoder only)	 Encoder PPR P405 = 1024 PPR	Enter the programming mode
Use the ▲ and ▼ keys to set the correct encoder PPR value. (Vector with Encoder only)	 Encoder PPR P405 = XXXX PPR	Programmed Encoder PPR: XXXX
Press the PROG key to save the programmed value and exit the programming mode. (Vector with Encoder only)	 Encoder PPR P405 = XXXX PPR	Exit the programming mode.
Press the ▲ key to go to the next parameter	 Ventilation Type P406=Self Vent.	Motor Ventilation Type Selection: 0=Self Ventilated 1=Separate Ventilation 2=Special Motor (only for P202=3)

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key to enter the programming mode	 Ventilation Type P406=Self Vent.	Enter the programming mode
Use the ▲ and ▼ keys to select the motor ventilation type	 Ventilation Type P406=Self Vent.	Selected Motor Ventilation Type: 0 = Self Ventilated
Press the PROG key to save the selected option and exit the programming mode	 Ventilation Type P406=Self Vent.	Exit the programming mode.
Press the ▲ key to go to the next parameter Note: Display shows during 3s: P409...P413=0 Run Self-tuning	 Run Self Tuning P408 = No	Self-tuning Mode Selection: 0=No 1=No Rotation 2=Run for I_m 3=Run for T_M (only with Encoder) 4=Estimate T_M (only with Encoder)
Press the PROG key to enter the programming mode	 Run Self Tuning P408 = No	Enter the programming mode
Use the ▲ and ▼ keys to select the desired Self-tuning mode	 Run Self Tuning P408 = No	Sensorless: Only select option 2 (Run for Im) if no load is coupled to the motor shaft. Otherwise , select option 1 (No Rotation). With Encoder: In addition to the options above, it is also possible to estimate the TM (Mechanical Time Constant) value. With the load coupled to the motor shaft, select 3 (Run for TM). The motor will only run when TM is estimated. All other parameters are estimated with the motor at standstill. If only T_M estimation is desired, select option 4 (Estimate T_M) (Refer to P408 in Chapter 6)

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key to start the self-tuning routine	Messages and values of the estimated parameters are shown	Self-tuning routine in progress...
End of the Self-tuning routine. Inverter is back to normal operation	P002 Motor Speed P002 = XXXX rpm	Motor Speed (rpm)
Press the I Start key	90 Motor Speed P002=90rpm	Motor accelerates from 0 to 90 rpm* (Minimum Speed), in the Forward (CW) direction of rotation (1) * for 4 pole motors
Press the ▲ key and hold until 1800 rpm is reached	1800 Motor Speed P002=1800rpm	Motor accelerates up to 1800 rpm* (2) * for 4 pole motors
Press the ⟲ FWD / REV key Obs: The LED's on the keypad show whether the motor is running FWD or REV	1800 Motor Speed P002=1800rpm	Motor decelerates (3) down to 0 rpm and then reverses the direction of rotation accelerating back up to 1800 rpm
Press the 0 Stop key	rdy VFD ready	Motor decelerates down to 0 rpm
Press the JOG key and hold it	150 Motor Speed P002=150rpm	Motor accelerates from 0 rpm up to the speed set at P122 **Ex.:** P122 = 150 rpm
Release the JOG key	rdy VFD ready	Motor decelerates down to 0 rpm

NOTES!

1. The last speed reference value set via the ▲ and ▼ keys is saved.
   If you wish to change this value before enabling the inverter, change parameter **P121** (Keypad Reference).
2. The self-tuning routine can be cancelled by pressing the 0 key.

OBSERVATIONS:

1. If the rotation direction of the motor is not correct, switch off the inverter. Wait 10 minutes to allow a complete discharge of the capacitors and the swap any two wires at the motor output. If motor is equipped with an encoder, change the phase of the encoder connections (exchange channel A and $\overline{A}$).
2. If E01 fault occurs during deceleration, you must increase deceleration time at **P101 / P103**.

ATTENTION!

In Vector mode (P202=3 or 4), when the command STOP (START/STOP) is enabled - see Figure 6.33, the motor will decelerate up to zero speed, but it maintains the magnetization current (no-load current). This maintains the motor with rated flux and when the next START command is given, it will achieve a quick response.
For self-ventilated motors with no-load current higher than 1/3 of the rated current (generally small motors lower than 10 HP), it is recommended that the motor does not stay in this condition (magnetization current) for a long time, since it may overheat. In these cases, we recommend to deactivate the command “General Enable” (when the motor has stopped), thus decreasing the motor current to zero when stopped.
Another way to disable magnetization current with the motor stopped is to program P211 to 1 (zero speed disable is ON) for both vector modes and, for vector with encoder, still another option or to program P181 to 1 (Magnetization mode). If magnetization current is disabled with the motor stopped, there will be a delay at start while the flux builds up.

CHAPTER 5

KEYPAD (HMI) OPERATION

This Chapter describes the CFW-09 operation via the standard Keypad or Human-Machine Interface (HMI), providing the following information:

- ☑ General Keypad Description;
- ☑ Use of the Keypad;
- ☑ Parameter Programming;
- ☑ Description of the Status Indicators.

5.1 DESCRIPTION OF THE KEYPAD

The standard CFW-09 Keypad has two readout displays: an LED readout with a 4 digit, seven-segment display and an LCD display with two lines of 16 alphanumeric characters. There are also 4 indicator LED's and 8 keys. Figure 5.1 shows the front view of the Keypad and indicates the position of the readouts, keys and status LED's.

Functions of the LED Display:
The LED Display shows the fault codes, drive 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 (L.S.D.) as shown here.

- A→current (Amps)
- U→voltage (Volts)
- H→ frequency (Hertz)
- Blank→speed and other parameters

When the indication is higher than 9999 (for instance in rpm) the number corresponding to the ten of thousand will not be displayed (ex.: 12345 rpm will be read as 2345 rpm). The correct indication will be displayed only on the LCD display.

Functions of the LCD Display:
The LCD Display shows the parameter number and its value simultaneously, without requiring the toggling of the PROG key.It also provides a brief description of each parameter function, fault code and inverter status.

LOCAL and REMOTE LED's:

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

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

Direction of Rotation (FWD/REV) LED's:
Refer to Figure 5.2.

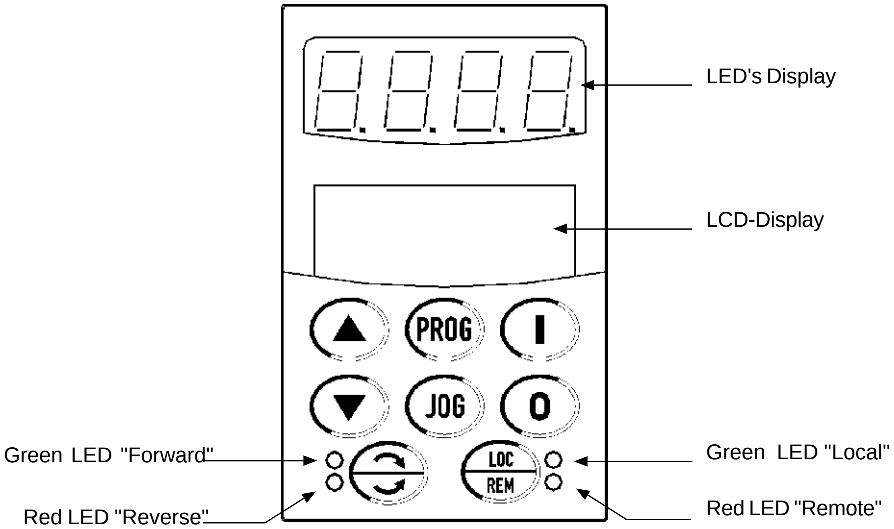


Figure 5.1 - *CFW-09 Standard Keypad*

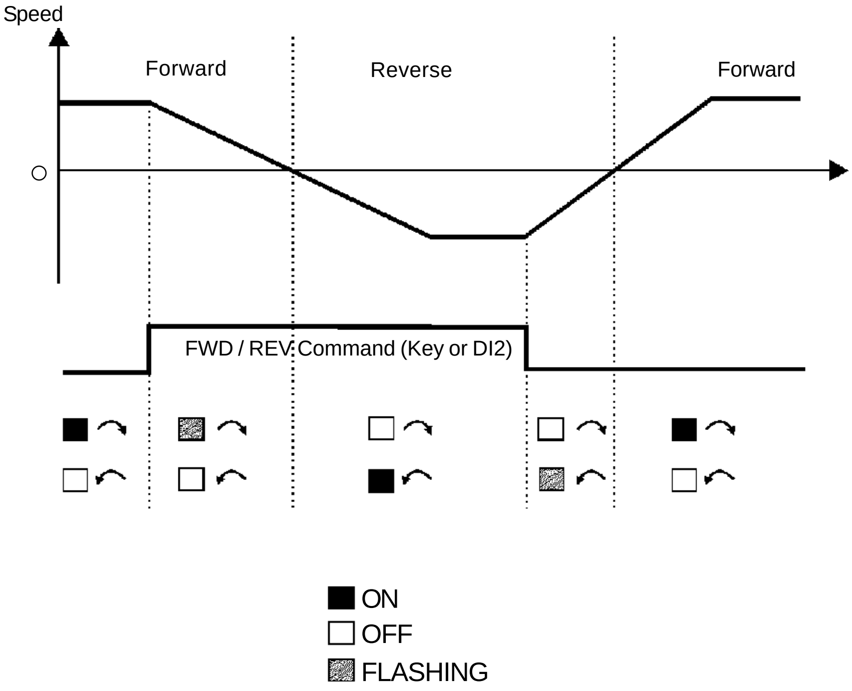
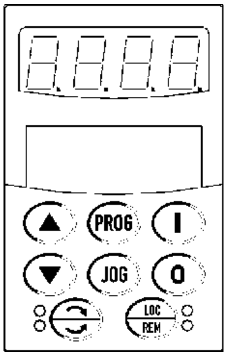


Figure 5.2 *- Direction of Rotation (FWD / REV) LED's*



Basic Functions of the Keys:

The functions described below are valid for factory default programming and Local Mode operation. The actual function of the keys may vary if parameters P220 through P228 are re-programmed.

I Starts the inverter via the acceleration ramp. After starting, the display sequences through these units at each touch of the Start key in the order shown here:

→ rpm → Volts → Status → Torque → % → Hz → Amps ⟲

0 Stops (disables) the inverter via the deceleration ramp. Also resets the inverter after a fault has occurred.

PROG Toggles the LED display between the parameter number and its value (Number/Value).

▲ Increases the speed, the parameter number or the parameter value.
▼ Decreases the speed, the parameter number or the parameter value.

⟲ Reverses the direction of motor rotation between Forward/Reverse.

LOC/REM Toggles between the LOCAL and REMOTE modes of operation.

JOG Performs the JOG function when pressed.
Any DIx programmed for General Enable must be closed to enable JOG function.

5.2 USE OF THE KEYPAD (HMI)

The keypad is used for programming and operating the CFW-09 allowing the following functions:

☑ Indication of the inverter status and operation variables;

☑ Fault Indication and Diagnostics;

☑ Viewing and programming parameters;

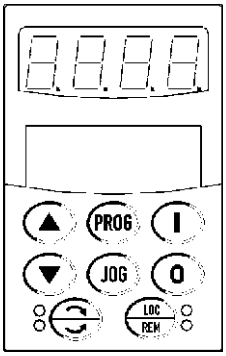
☑ Operation.

5.2.1 Keypad Operation

All functions relating to the CFW-09 operation (Start, Stop, Motor Direction of Rotation, JOG, Increment/Decrement of the Speed Reference and Selection of Local Mode/Remote Mode) can be performed through the Keypad. This is valid with the factory default programming of the inverter. All keypad keys are enabled when the Local Mode has been selected. These same functions can be performed in Remote Mode by means of digital and analog inputs.
Flexibility is provided through the ability to program the parameters that define the input and output functions.

Keypad keys operation description:

LOC/REM Selects the control input and speed reference source, toggling between LOCAL Mode and REMOTE Mode.
Enabled when P220 = 2 (Keypad LOC) or 3 (Keypad REM).



I Starts the inverter via the Acceleration Ramp.

0 Stops the inverter via Deceleration Ramp. It resets the inverter after a Fault Trip (always active).
Both “I “ and “O” keys are enabled when P224 = 0 (I, O Key) for Local Mode and/or P227 = 0 (I,O Key) for Remote Mode.

JOG When the Jog key is pressed, it accelerates the motor according to the Acceleration Ramp up to the JOG speed programmed in P122 (default is 150 rpm). When released, the motor decelerates according to the Deceleration Ramp and stops.
Enabled when P225 = 1 (Keypad) for Local Mode and/or P228 = 1 (Keypad) for Remote Mode.
If a Digital Input is set to General Enable (P263...270 = 2) it has to be closed to allow the JOG function.

⟲ Reverses the motor direction of rotation.
Enabled when P223 = 2 (Keypad FWD) or 3 (Keypad REV) for Local Mode and/or P226 = 2 (Keypad FWD) or 3 (Keypad REV) for Remote Mode.

▲ When pressed it increases the speed reference.

▼ When pressed it decreases the speed reference.
Enabled when P221 = 0 (Keypad) for Local Mode and/or P222 = 0 (Keypad) for Remote Mode.

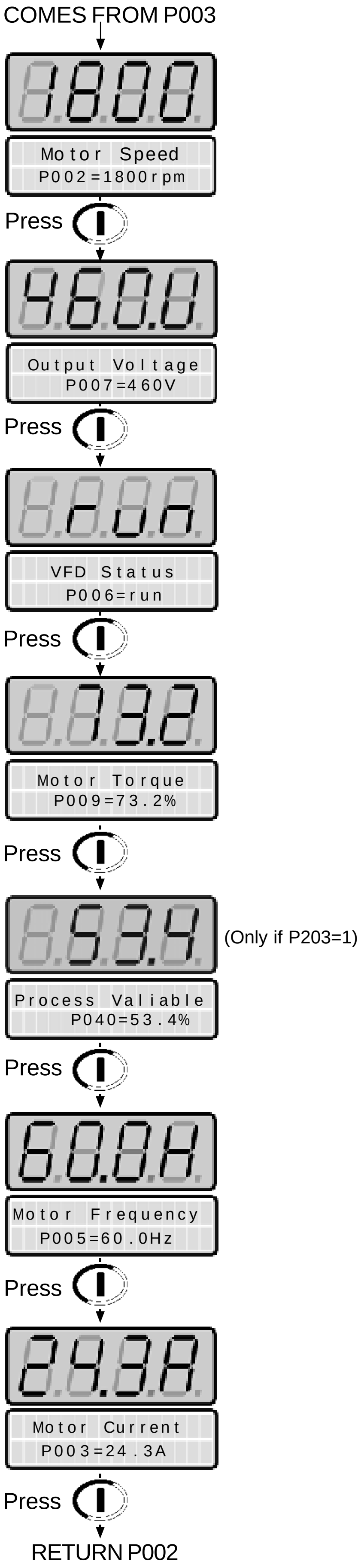
Parameter P121 contains the speed reference set by the keypad.

☛ **Reference Backup**
The last frequency Reference set by the keys ▲ and ▼ is stored when the 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 parameter P121 must be changed.

5.2.2 "Read-Only" Variables and Status

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. Motor speed in rpm. The user can scroll through the various read-only parameters or use the factory configured display of the key values. This is done by pressing the start key.

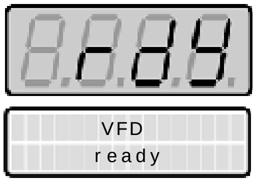
a) Some selected "read-only" variables can be viewed following the procedure below:



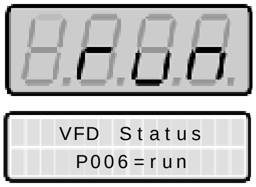
The “read-only” variable to be shown after AC power is applied to the inverter is defined in Parameter P205:

P205	Initial Monitoring Parameter
0	P005 (Motor Frequency)
1	P003 (Motor Current)
2	P002 (Motor Speed)
3	P007 (Output Voltage)
4	P006 (Inverter Status)
5	P009 (Motor Torque)
6	P040 (PID Process Variable)

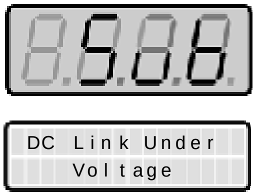
b) Inverter Status:



Inverter is READY to be started
(No Fault condition)



Inverter has been started
(Run condition)



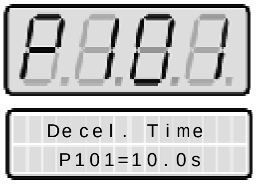
Line voltage in too low for inverter operation
(Undervoltage condition)

c) LED display flashing:
The display flashes in the following conditions:

- ☑ during the DC Injection braking
- ☑ trying to change a parameter value when it is not allowed
- ☑ Inverter in a current overload condition (Refer to Chapter 7 - Diagnostics and Troubleshooting)
- ☑ Inverter in Fault condition (Refer to Chapter 7 - Diagnostics and Troubleshooting)

5.2.3 Parameter Viewing and Programming

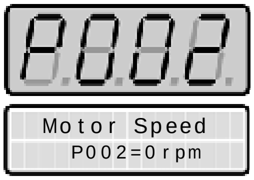
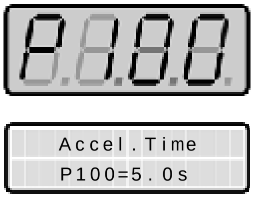
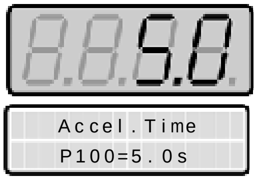
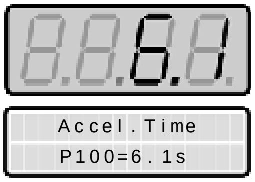
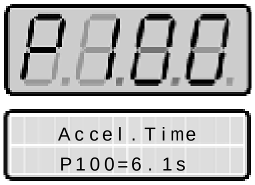
All CFW-09 settings are made through the parameters. The parameters are shown on the display with the letter **P** followed by a number:
Example (P101):



101 = Parameter Number

Each parameter is associated to a numerical value (parameter content), that corresponds to an option selected among those options that are available for this parameters.
The values of the parameters 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 it is required to change parameter P000 to the password value. The factory default password value is 5. Otherwise you can only read the parameter values and not reprogram them. For more detail see P000 description in Chapter 6.

ACTION	LED DISPLAY LCD DISPLAY	Comments
Press the PROG key		
Use the ▲ and ▼ keys to reach P100		Select the desired parameter
Press the PROG key		Numeric value associated to the parameter **(Note 4)**
Use the ▲ and ▼ keys to set the the new value		Sets the new desired value. **(Notes 1 and 4)**
Press the PROG key		**(Notes 1, 2 and 3)**

NOTES:

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 the parameters that can be changed only with motor stopped, the inverter will use this new set value only after the PROG key is pressed.

2 - By pressing the PROG 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 value programmed in the parameter is not functionally compatible with other parameter values already programmed, an E24 **-** Programming Error - will be displayed.
Example of programming error:
Programming two digital inputs (DIx) with the same function. Refer to Table 5.1 for the list of programming errors that will generate an E24 Programming Error.

4 - To allow the reprogramming of any parameter value it is required to change parameter P000 to the password value. The factory default password value is 5. Otherwise you can only read the parameter values and not reprogram them. For more detail see P000 description in Chapter 6.

Two or more parameters between P264, P265, P266, P267, P268, P269 and P270 equal to 1 (LOC/REM)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 6 (Ramp 2)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 9 (Speed/Torque)
P265 equal to 8 and P266 different than 8 or vice versa (FWD Run / REV Run)
P221 or P222 equal to 8 (Multispeed) and P266≠7 and P267≠ 7 and P268≠7
[P221=7 or P222=7] and [(P265≠5 and P267≠5) or (P266≠5 and P268≠5)] (with reference=EP and without DIx=increase EP or without DIx=decrease EP)
P264 and P266 equal to 8 (Reverse Run)
[P221≠ 7 and P222≠ 7] and [(P265=5 or P267=5 or P266=5 or P268=5)] (without reference=EP and with DIx=increase EP or with DIx=decrease EP)
P265 or P267 or P269 equal to 14 and P266 and P268 and P270 different than 14 (with DIx=Start and DIx ≠Stop)
P266 or P268 or P270 equal to 14 and P265 and P267 and P269 different than 14 (with DIx ≠Start and DIx=Stop)
P220 > 1 and P224 = P227 = 1 without any DIx set for Start/Stop or DIx = Fast Stop or General Enable
P220 = 0 and P224 = 1 and without DIx = Start/Stop or Fast Stop and without DIx = General Enable
P220 = 1 and P227 = 1 and without DIx = Start/Stop or Fast Stop and without DIx = General Enable
DIx = START and DIx = STOP, but P224≠1 and P227≠1
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 15 (MAN/AUT)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 17 (Disables Flying-Start)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 18 (DC Voltage Regulator)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 19 (Parameter Setting Disable)
Two or more parameters between P265, P266, P267, P268 and P269 equal to 20 (Load user via DIx)
P296=8 and P295=4, 6, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, or 49 (P295 incompatible with inverter model – To avoid damages of the internal inverter components)
P296=5, 6, 7 or 8 and P297=3 (P297 incompatible with inverter model)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 21 (Timer RL2)
Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 22 (Timer RL3)
P265, P266, P267, P268, P269 or P270=21 and P279≠28
P265, P266, P267, P268, P269 or P270=22 and P280≠28
P279=28 and P265, P266, P267, P268, P269 or P270≠21
P280=28 and P265, P266, P267, P268, P269 or P270≠22
P202 ≤ 2 and P237=1 or P241=1 or P265...P270=JOG+ or P265...P270=JOG-

Table 5.1 *- Incompatibility between Parameters - E24*

DETAILED PARAMETER DESCRIPTION

This Chapter describes in detail all CFW-09 parameters. In order to simplify the explanation, the parameters have been grouped by characteristics and functions:

Read Only Parameters	Variables that can only be viewed on the display but not changed. Examples would be motor speed or motor current.
Regulation Parameters	Programmable values used by the CFW-09 functions. Examples would be Acceleration and Deceleration times.
Configuration Parameters	Set-up parameters that are programmed during inverter start-up and define its basic operation. Examples would be Control Type, Scale Factors and the Input/Output functions.
Motor Parameters	Motor data that is indicated on the motor nameplate. Other motor parameters are automatically measured or calculated during the Self-tuning routine.
Special Function Parameters	It includes parameters related to special functions.

Symbols and definitions used in the text below:

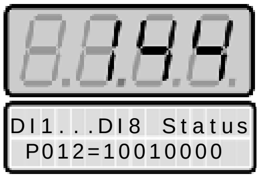
‘(1)’ Indicates that the parameter can be changed only with the inverter disabled (motor stopped).
‘(2)’ Indicates that the values can change as a function of the motor parameters.
‘(3)’ Indicates that the values can change as a function of P413 (Tm Constant - obtained during Self-tuning).
‘(4)’ Indicates that the values can change as a function of P409, P411 (obtained during Self-tuning).
‘(5)’ Indicates that the values can change as a function of P412 (Tr Constant - obtained during Self-tuning).
‘(6)’ Indicates that the values can change as a function of P296.
‘(7)’ Indicates that the values can change as a function of P295.
‘(8)’ Indicates that the values can change as a function of P203.
‘(9)’ Indicates that the values can change as a function of P320.
‘(10)’ (For new drives) User Default = no parameters.
‘(11)’ The inverter will be delivered with settings according to the market, considering the HMI language, V/F 50 or 60 Hz and the required voltage. The reset of the standard factory setting may change the parameters related to the frequency (50Hz/60 Hz). Values within parenthesis mean the factory setting for 50 Hz.

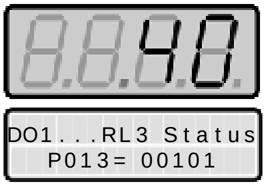
Torque Current = it is the component of the motor total current responsible for torque generation (used in Vector Control).

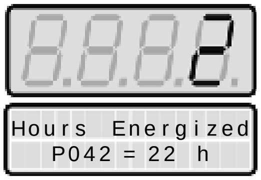
Active Current = it is the component of the motor total current proportional to active electric power absorbed by the motor (used in V/F control).

6.1 ACCESS AND READ ONLY PARAMETERS - P000....P099

Parameter	**Range [Factory Setting] Unit**	**Description / Notes**
P000 Parameter Access/ Password Value Setting	0...999 [0] -	☑ This parameter opens the access to change other parameter values. The factory default password is P000 = 0. When P200 = 1 (Password Active)] it is necessary to set P000 = 5 to change parameter values. ☑ By programming P000 with the password that releases access to changing of parameter content plus 1 (Password + 1), you will obtain access only to the parameters with different content that the factory default setting. ☑ To change the password to any other value (password 1), proceed as follows: (1) Set P000=5 (current password) and P200= 0 (password inactive). (2) Press the Key PROG . (3) Change P200 to 1 (password active). (4) Press PROG again: display shows: P000. (5) Press PROG again: display shows 5 (last password). (6) Use the ▲ and ▼ keys to change to the desired password value (password 1). (7) Press PROG : display shows P000. From this moment on, the new password becomes active. Thus, to change parameters content P000 has to be set to the new password. (Password 1).
P001 Speed Reference	0...P134 [-] 1rpm	☑ Speed Reference value in rpm (Factory Default). With filter of 0.5s. ☑ The displayed units can be changed from rpm to other units at parameters P207, P216 and P217. The scale factor can be changed at P208 and P210. ☑ It does not depend on the speed reference source. ☑ Through this parameter is possible to change the speed reference (P121) when P221 or P222=0.
P002 Motor Speed	0...P134 [-] 1rpm	☑ Indicates the actual motor speed in rpm, (factory default). ☑ The displayed units can be changed from rpm to other units at parameters P207, P216 and P217. The scale factor can be changed at P208 and P210. ☑ Through this parameter is possible to change the speed reference (P121) when P221 or P222=0.
P003 Motor Current	0...2600 [-] 0.1A(<100)-1A(>99.9)	☑ Indicates inverter output current in Amps.
P004 DC Link Voltage	0...1235 [-] 1V	☑ Indicates the inverter DC Link voltage in Volts.
P005 Motor Frequency	0...1020 [-] 0.1Hz	☑ Indicates the inverter output frequency in Hz.

Parameter	Range [Factory Setting] Unit	Description / Notes
P006 Inverter Status	Rdy, run, sub, Exy [-] -	☑ Indicates the inverter status: **'rdy'** inverter is ready to be started or enabled; **'run'** inverter is enabled; **'Sub'** inverter is disabled and line voltage is too low for operation (undervoltage); **'Exy'** inverter is in a fault condition, ‘xy’ is the number of the Fault code, example: E06.
P007 Output Voltage	0...800 [-] -	☑ Indicates the inverter output voltage in Volts.
P009 Motor Torque	0...150.0 [-] 0.1%	☑ Indicates the torque developed by the motor. It is determined as follows: $P009 = \frac{Tm.100}{I_{TM}}\ x\ Y$ Where: Tm = Measured motor torque current I_{TM} = Nominal motor torque current given by: N = Speed $I_{TM} = \sqrt{P401^2 - X^2}$ $\quad Y = 1$ for $N \leq N_{rated}$ $X = P410\ x\ \frac{P178}{100}$ $\quad Y = \frac{N_{rated}}{N}$ for $N > N_{rated}$
P010 Output Power	0.0...1200 [-] 0.1kW	☑ Indicates the instantaneous output power in kW.
P012 Digital Inputs DI1...DI8 Status	LCD=1...0 LED=0 ... 255 [-] -	☑ Indicates on the Keypad LCD display the status of the 6 digital inputs of the control board (DI1 to DI6), and the 2 digital inputs of the I/O Expansion Board (DI7 and DI8). Number 1 stands for Active (DIx closed) and number 0 stands for Inactive (DIx open), in the following order: DI1, DI2,...,DI7, DI8. ☑ The LED display shows a decimal value related to the 8 Digital Inputs, where the status of each input is considered one bit of a binary number where Active = 1, Inactive = 0 and the DI1 status is the most significant bit (MSB). Example: DI1=Active (+24V); DI2=Inactive (0V) DI3=Inactive (0V); DI4=Active (+24V) DI5=Inactive (0V); DI6=Inactive (0V) DI7=Inactive (0V); DI8=Inactive (0V) This is equivalent to the binary sequence: 10010000 Which corresponds to the decimal number 144. The Keypad displays will be as follows: 

Parameter	Range [Factory Setting] Unit	Description / Notes
P013 Digital and Relay Outputs DO1, DO2 RL1, RL2 and RL3 Status	LCD = 1, 0 LED = 0...255 [-] -	☑ Indicates on the Keypad LCD Display the status of the 2 Digital Outputs of the I/O Expansion Board (D01, D02) and the 3 Relay Outputs of the control board. Number 1 stands for Active and number 0 stands for Inactive, in the following order: D01, D02, RL1, RL2, RL3. ☑ The LED display shows a decimal value related to the status of the 5 Digital and Relay Outputs, where the status of each output is considered one bit of a binary number where Active = 1, Inactive = 0 and the status of DO1 is the most significant bit (MSB). The 3 least significant bits are always '0'. Example: DO1=Inactive; DO2=Inactive RL1=Active: RL2=Inactive; RL3=Active This is equivalent to the binary sequence: 00101000 Which corresponds to the decimal number 40. The Keypad displays will be: 
P014 Last Fault	0...70 [-] -	☑ Indicates the numbers of the last, second, third and fourth previous Faults. ☑ Fault Sequence: Exy → P014 → P015 → P016 → P017 → P060 → P061 → P062 → P062 → P063 → P064 → P065. ☑ Ex: When the display shows 0 (zero), this means E00, 1 (one) means E01 and so on.
P015 Second Previous Fault	0...70 [-] -	
P016 Third Previous Fault	0...70 [-] -	
P017 Fourth Previous Fault	0...70 [-] -	
P018 Analog Input AI1' Value	-100...100 [-] 0.1%	☑ Indicate the percentage value of the analog inputs AI1 ... AI4. The indicated values are obtained after offset action and multiplication by the gain. Refer to parameters P234 ... P247.
P019 Analog Input AI2' Value	-100...100 [-] 0.1%	
P020 Analog Input AI3' Value	-100...100 [-] 0.1%	
P021 Analog Input AI4' Value	-100...100 [-] 0.1%	

Parameter	Range [Factory Setting] Unit	Description / Notes
P022 WEG Use	- [-] -	
P023 Software Version	XXX [-] -	☑Indicates the CFW-09 Software Version.
P024 A/D Conversion Value of Analog Input AI4	LCD: -32768...32767 LED: 0...FFFFH [-] -	☑Indicates the A/D conversion result of the analog input A14 located on the I/O Expansion Board. ☑The LCD display indicates the conversion value as a decimal number and the LED display as a hexadecimal number with negative values in supplement of 2.
P025 A/D Conversion Value of Iv Current	0...1023 [-] -	☑P025 and P026 indicate the A/D conversion result, in module, of the V and W phase currents, respectively.
P026 A/D Conversion Value of Iw Current	0...1023 [-] -	
P040 PID Process variable	0...P528 [-] 1	☑It indicates the process variable in % (factory setting), used as the PID Feedback. ☑The indication unit can be changed through P530, P531 and P532. The scale can be changed through P528 and P529. ☑See detailed description in Item 6.5 - Special Function Parameters.
P042 Powered Time	LCD: 0...65530h LED: 0...6553h (x10) [-] 1	☑Indicates the total number of hours that the inverter was powered. ☑The LED Display shows the total number of hours that the inverter was energized divided by 10. ☑This value remains stored even when the inverter is turned OFF. Example: Indication of 22 hours powered. 
P043 Enabled Time	0...6553h [-] 0.1 (<999.9) 1 (<6553)	☑Indicates the total number of hours that the inverter has run. ☑Indicates up to 6553 hours, rolls over to 0000. ☑If P204 is set to 3, the P043 is reset to zero. ☑This value remains stored even when inverter is turned OFF.

Parameter	Range [Factory Setting] Unit	Description / Notes
P044 kWh Counter	0...65535kWh [-] 1	☑Indicates the energy consumed by the motor. ☑Indicates up to 65535 kWh, then it return to zero. ☑If P204 is set to 4, the P044 is reset to zero. ☑This value remains stored even when inverter is turned OFF.
P060 Fifth Error	0...70 [-] -	☑Indicates the numbers of the fifth, sixth, seventh, eighth ninth and tenth occurred error, respectively ☑Record Systematic: Exy → P014 → P015 → P016 → P017 → P060 → P061 → P062 → P063 → P064 → P065 ☑Ex: When the display show 0 (zero), this means E00, 1 (one) means E01 and so on.
P061 Sixth Error	0...70 [-] -	
P062 Seventh Error	0...70 [-] -	
P063 Eighth Error	0...70 [-] -	
P064 Ninth Error	0...70 [-] -	
P065 Tenth Error	0...70 [-] -	

6.2 REGULATION PARAMETERS - P100 ... P199

P100 Acceleration Time	0.0...999 [20] 0.1s (< 99.9) -1s (>99.9)	☑Setting the vallue to 0.0s results in no Acceleration ramp. ☑Defines the time to accelerate linearly from zero up to the maximum speed (P134) or to decelerate linearly from the maximum speed down to 0 rpm. ☑The selection of the Acceleration / Deceleration Time 2 can be made by reprogramming one of the digital inputs DI3...DI8. Refer to P265...P270.
P101 Deceleration Time	0.0...999 [20] 0.1s (< 99.9) -1s (>99.9)	
P102 Acceleration Time 2	0.0... 999 [20] 0.1s (< 99.9) - 1s (>99.9)	
P103 Deceleration Time 2	0.0...999 [20] 0.1s (< 99.9) - 1s (>99.9)	

Parameter

Range
[Factory Setting]
Unit

Description / Notes

P104
S Ramp

0...2
[0]
-

P104	S Ramp
0	Inactive
1	50%
2	100%

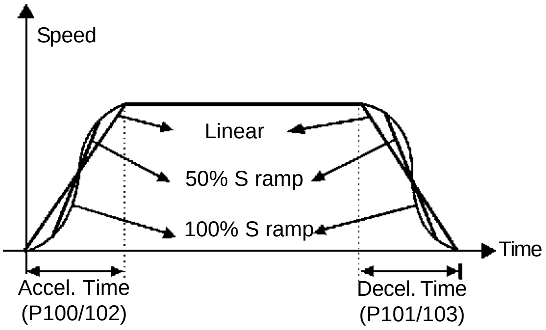


Figure 6.1 *- S or Linear Ramp*

☑The ramp S reduces the mechanical stress during the acceleration and deceleration of the load.

P120
Speed Reference
Backup

0...1
[1]
-

☑Defines if the Frequency Reference Backup function is enabled (1) or disabled (0).

☑If P120 = Off, the inverter does not save the current reference value, when the inverter is enabled again, it will restart from the minimum frequency setting (P133).

☑This back-up function is only applicable to the keypad reference.

P120	Backup
0	Off
1	On

P121
Keypad Speed
Reference

P133...P134
[90]
1rpm

☑To activate the ▲ and ▼ active: P221=0 or P222=0

☑With P120 = 1 (On) the content of P121 is maintained (backup) even when the inverter is disabled or turned off.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td>P122
JOG or JOG+
Speed Reference
(2)

P123
JOG -
Speed Reference
(2)</td><td>0...P134
[150 (125)] (11)
1rpm

0...P134
[150 (125)] (11)
1rpm</td><td>
☑ The JOG command source is defined at P225 (Local Mode) or P228 (Remote Mode).
☑ If the JOG command is selected for DI3...DI8, one of the Digital Inputs must be programmed as follows:
<table>
<tr><th>Digital Input</th><th>Parameters</th></tr>
<tr><td>DI3</td><td>P265 = 3 (JOG)</td></tr>
<tr><td>DI4</td><td>P266 = 3 (JOG)</td></tr>
<tr><td>DI5</td><td>P267 = 3 (JOG)</td></tr>
<tr><td>DI6</td><td>P268 = 3 (JOG)</td></tr>
<tr><td>DI7</td><td>P269 = 3 (JOG)</td></tr>
<tr><td>DI8</td><td>P270 = 3 (JOG)</td></tr>
</table>
☑ During the JOG command, the motor accelerates to the value defined at P122, following the acceleration ramp setting.
☑ The direction of rotation is defined by the Forward/Reverse function (P223 or P226).
☑ JOG is effective only with the motor at standstill.
☑ The JOG+ and JOG- commands are always via Digital Inputs.
☑ One DIx must be programmed for JOG+ and another for JOG- as follows:
<table>
<tr><th rowspan="2">Digital Inputs</th><th colspan="2">Parameters</th></tr>
<tr><th>JOG+</th><th>JOG-</th></tr>
<tr><td>DI3</td><td>P265 = 10</td><td>P265 = 11</td></tr>
<tr><td>DI4</td><td>P266 = 10</td><td>P266 = 11</td></tr>
<tr><td>DI5</td><td>P267 = 10</td><td>P267 = 11</td></tr>
<tr><td>DI6</td><td>P268 = 10</td><td>P268 = 11</td></tr>
<tr><td>DI7</td><td>P269 = 10</td><td>P269 = 11</td></tr>
<tr><td>DI8</td><td>P270 = 10</td><td>P270 = 11</td></tr>
</table>
☑ During the JOG + or JOG- commands the values of P122 or P123 are respectively added to, or subtracted from the speed reference to generate the total reference. Refer to Figure 6.25.
</td></tr>
<tr><td>P124
Multispeed Ref. 1
(2)

P125
Multispeed Ref. 2
(2)

P126
Multispeed Ref. 3
(2)

P127
Multispeed Ref. 4
(2)

P128
Multispeed Ref. 5
(2)</td><td>P133...P134
[90 (75)] (11)
1rpm

P133...P134
[300 (250)] (11)
1rpm

P133...P134
[600 (500)] (11)
1rpm

P133...P134
[900 (750)] (11)
1rpm

P133...P134
[1200 (1000)] (11)
1rpm</td><td>
☑ These parameters (P124 to P131) are shown only when P221 = 8 and/or P222 = 8 (Multispeed).
☑ Multispeed is used when the selection of a number (up to 8) of pre-programmed speeds is desired:
If you want to use only 2 or 4 speeds, any input combination of DI4, DI5 and DI6 can be used. The input(s) programmed for other function(s) must be considered as 0V in the table 6.1.
It allows control of the speed by relating the values programmed in parameters P124 to P131 to a logical combination of the Digital Inputs.
☑ Multispeed function is active when P221 (Local Mode) or P222 (Remote Mode) is set to 8 (Multispeed).
</td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description / Notes
P129 Multispeed Ref. 6 (2)	P133...P134 [1500 (1250)] (11) 1rpm	
P130 Multispeed Ref. 7 (2)	P133...P134 [1800 (1500)] (11) 1rpm	
P131 Multispeed Ref. 8 (2)	P133...P134 [1650 (1375)] (11) 1rpm	

Digital Input	Programming
DI4	P266 = 7
DI5	P267 = 7
DI6	P268 = 7

8 speeds			
	4 speeds		
		2 speeds	
DI6	**DI5**	**DI4**	**Speed Ref.**
0V	0V	0V	P124
0V	0V	24V	P125
0V	24V	0V	P126
0V	24V	24V	P127
24V	0V	0V	P128
24V	0V	24V	P129
24V	24V	0V	P130
24V	24V	24V	P131

Table 6.1 *- Multispeed References*

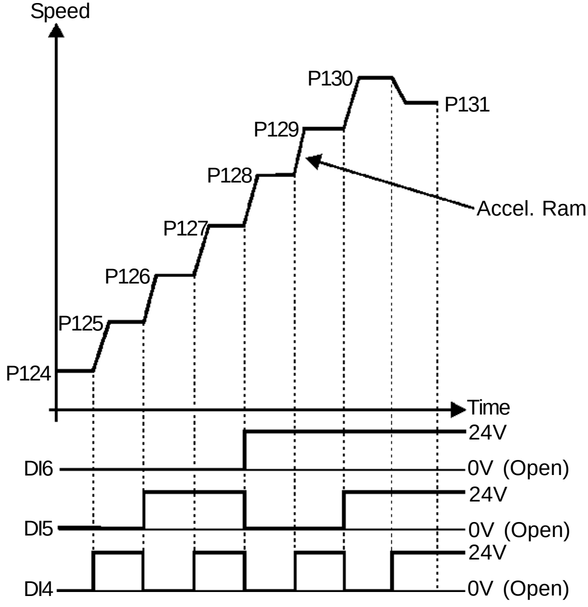
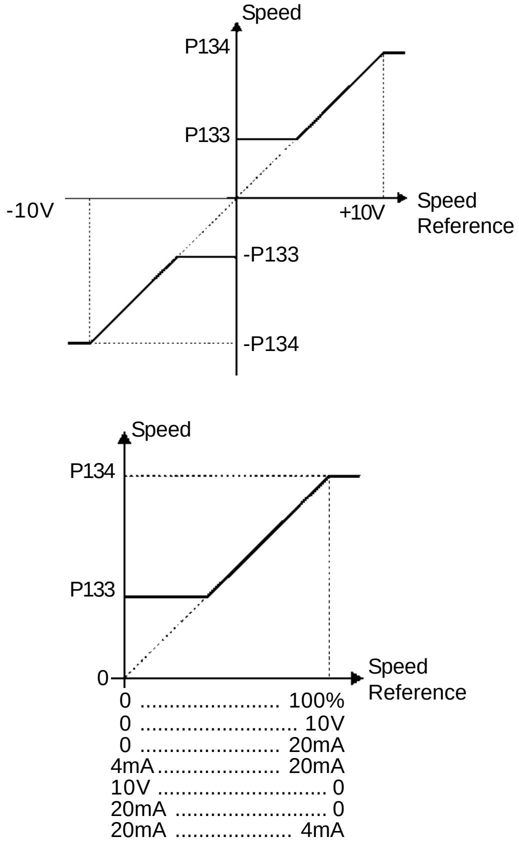


Figure 6.2 *- Multispeed*

P132 Maximum Overspeed Level	0...100 [10] 1%	☑ When the effective overspeed exceeds the value of P134+P132 longer than 20ms, the CFW-09 will disable the PWM pulses by E17. ☑ The P132 setting is a value in percent of P134. ☑ When programmed P132 = 100%, this function remains disabled.
P133 Minimum Speed Ref. (2)	0.0...(P134-1) [90 (75)] (11) 1rpm	☑ Defines the maximum and minimum motor operation speed reference. Are valid for any type of speed reference signal. ☑ For more details about the actuation of P133 refer to P233 (Analog Inputs Dead Zone).
P134 Maximum Speed Ref. (2)	(P133+1)...(3.4xP402) [1800 (1500)] (11) 1rpm	

Parameter	Range [Factory Setting] Unit	Description / Notes
		 ***Figure 6.3*** *- Speed limits considering the "Dead Zone" active (P233=1)*
P135 Speed transition to I/F Control [only for P202 =3 (Sensorless Vector)] (2) **This parameter is shown on the display(s) only when P202 = 3 (Sensorless Vector Control)**	0...90 [18] 1rpm	☑The speed at which the transition from Sensorless Vector Control to I/F (Scalar Control with Imposed Current) occurs. The minimum speed recommended for Sensorless Vector control is 18 rpm for 60 Hz motors and 15 rpm for 50 Hz motors, with 4 poles. ☑For P135≤3 the CFW-09 will always operate in Sensorless Vector mode when P202 = 3, (There is no transition to the I/F mode). ☑The current level to be applied on the motor in the I/F mode is set at P136. ☑Scalar control with imposed current means only current control working with current reference level adjusted by P136. There is no speed control, just open loop frequency control.
P136 **For V/F Control (P202 = 0, 1 or 2):** Manual Torque Boost	0...9 [1]	☑Compensates for the voltage drop on the motor stator resistance at low frequencies and increases the inverter output voltage in order to maintain a constant torque in V/F operation. ☑Always set P136 to the lowest value that permits the motor to start satisfactorily. If the value is higher than required, an inverter overcurrent (E00 or E05) may occur due to high motor currents at low frequencies.

Parameter	Range [Factory Setting] Unit	Description / Notes

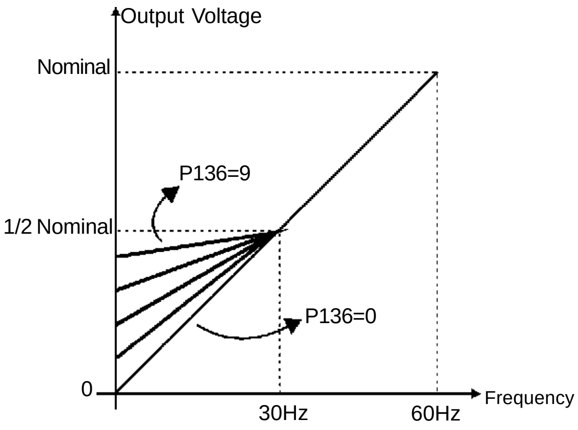


Figure 6.4 - *P202=0- V/F 60Hz Curve*

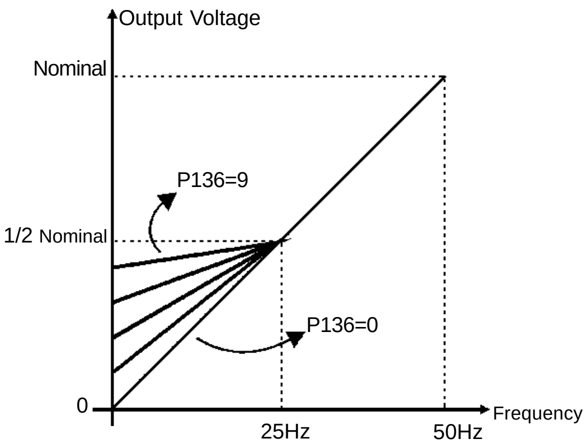


Figure 6.5 *- P202 = 1 - V/F 50Hz Curve*

P136
ForSensorless Vector Control (P202=3):
Current Reference for I/F Mode

0...9
[1]
1

☑ Sets the current to be applied to the motor when in I/F mode. I/F mode occurs when the motor speed is lower than the value defined by parameter P135.

P136	Current in I/F mode % of P410 (Imr)
0	100%
1	111%
2	122%
3	133%
4	144%
5	155%
6	166%
7	177%
8	188%
9	200%

P137
Automatic Torque Boost

0.00...1.00
[0.00]
0.01

☑ The automatic Torque Boost compensates for the voltage drop in the stator resistance as a function of the motor active current.

☑ The criteria for setting P137 are the same as for the parameter P136.

This parameter is shown on the display(s) only when P202 = 0, 1 or 2 (V/F Control)

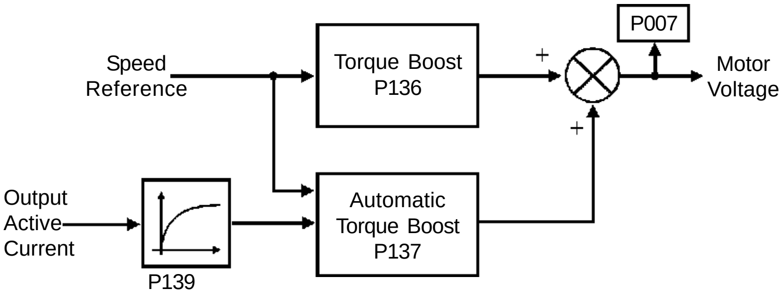


Figure 6.6 *- Block Diagram P137*

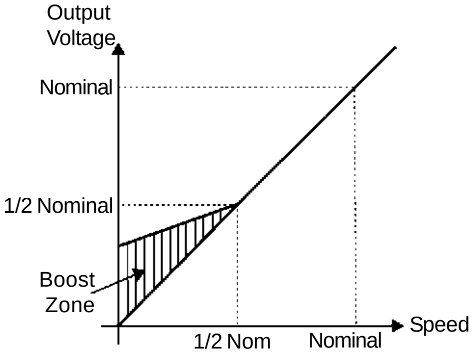


Figure 6.7 *- V/F curve with automatic torque boost*

Parameter	Range [Factory Setting] Unit	Description / Notes
P138 Slip Compensation (2) ☞ **This parameter is shown on the display(s) only when P202 = 0, 1 or 2 (V/F Control)**	-10.0...10.0% [2.8] 0.1%	☑P138 (for values between 0.0 and +10.0%) is used in the Motor Slip Compensation output frequency function, which compensates for the speed drop as the load increases. ☑P138 allows the user to set the VSD for more accurate slip compensation. Once set up P138 will compensate for speed variations due to load by automatically adjusting both voltage and frequency.

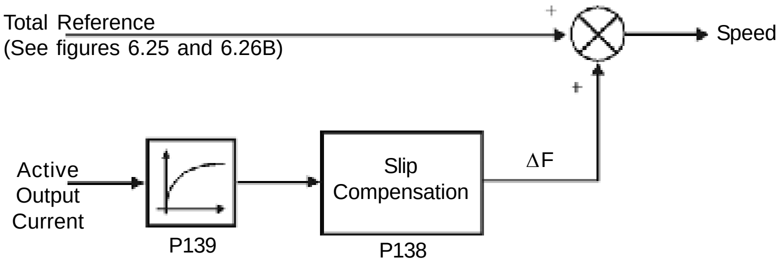
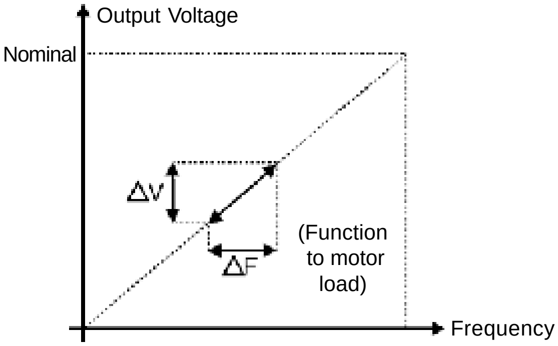
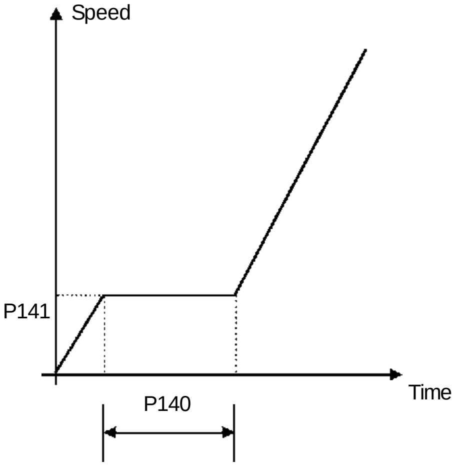
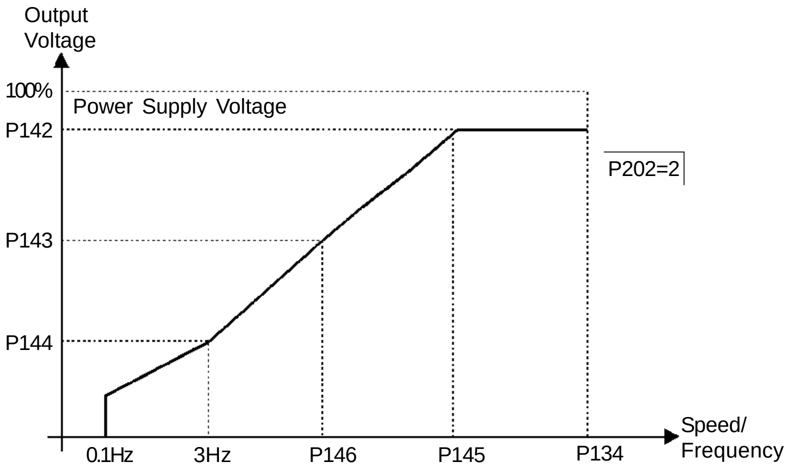
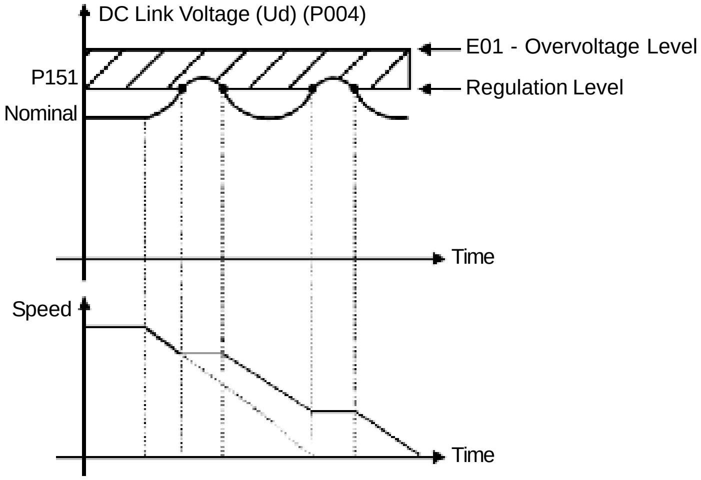


Figure 6.8 *- Block Diagram P138*

Parameter	Range [Factory Setting] Unit	Description / Notes
		 **Figure 6.9** - *V/F Curve with Slip Compensation* ☑**To set Parameter 138:** ⇒Run the motor without load up to approximately half of the application top speed; ⇒Measure the actual motor or equipment speed; ⇒Apply load; ⇒Increase **P138** until the speed reaches its no-load value. ☑Values of P138 < 0.0 are used in special applications, where the reduction of the output speed is desired as function of the motor current increase. Ex.: load sharing between two motor/drive sets.
P139 Output Current Filter [only for P202 = 0, 1 or 2 (for V/F control)] ☞ **This parameter is shown on the display(s) only when P202 = 0, 1 or 2 (V/F Control)**	0.0...16 [0.2] 0.1s	☑Adjusts the time constant of the active current filter ☑Adjusts the response time of the slip compensation and automatic torque boost. Refer to Figures 6.6 and 6.8.
P140 Dwell Time at Start	0...10 [0] 0.1s	☑Assist during high torque starts by allowing the motor to establish the flux before starting to accelerate the load.  **Figure 6.10** - *Curve for high torque starts*
P141 Dwell Speed at Start ☞ **These parameter are shown on the display(s) only when P202 = 0, 1 or 2 (V/F Control)**	0...300 [90] 1rpm	

Parameter	Range [Factory Setting] Unit	Description / Notes
P142 Maximum Output Voltage (1)	0...100 [100] 0.1%	☑These parameters allow changing the standard V/F curves defined at P202. Special V/F profiles may be necessary when motors with non-standard voltages/frequencies are used. ☑Function activated by setting P202 = 2 (V/F Adjustable).. ☑The factory default value of P144 (8.0%) is defined for standard 60 Hz motors. If the rated motor frequency (set at P403) is different from 60 Hz, the factory default value of P144 can become unsuitable and may cause troubles during motor start. A good approach for the setting of P144 is given by $P144 = \frac{3}{P403} \text{ x } 100\%$ If an increase of the starting torque is required, increase the value of P144 gradually. ☑Procedures for the parameter setting of the function “Adjustable V/F”: 1.Disable Inverter; 2.Check inverter data (P295...P297); 3.Set motor data (P400...P406); 4.Set display data in P001 and P002 (P208, P210, P207, P216 andP217); 5.Set speed limits (P133 and P134); 6.Set parameters of the function “Adjustable V/F” (P142...P146); 7.Enable function “Adjustable V/F” (P202=2).  **Figure 6.11** - *Adjustable V/F Curve V/F*
P143 Intermediate Output Voltage (1)	0...100 [50] 0.1%	
P144 Output Voltage at 3 Hz (1)	0...100 [8] 0.1%	
P145 Field Weakening Speed (1)	P133(>90)...P134 [1800] 1rpm	
P146 Intermediate Speed (1) ☞ **These parameter are shown on the display(s) only when P202 = 0, 1 or 2 (V/F Control)**	90...P145 [900] 1rpm	
P150 DC Link Voltage Regulation Mode ☞ **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0...2 [1] -	

P150	Action
0=With losses	Optimal braking is active as described in P151. This gives the shortest possible deceleration time without using dynamic braking or regeneration.
1=Without losses	Automatic deceleration ramp control. Optimal braking is not active. The deceleration ramp is automatically adjusted to keep the DC link voltage below the level set in P 151. This avoids E01 DC link overvoltage tripping. Can also be used with eccentric loads.
2=Enable/Disable via DIx	☑ **DIx=24V:** The Optmal Braking acts as described for P150=1; ☑ **DIx=0V:** The Optmal Braking becomes inactive. The DC link voltage will be controlled by parameter P153 (Dynamic Braking).

Parameter	Range [Factory Setting] Unit	Description / Notes
P151 **For V/F Control** **(P202=0,1 or 2):** DC Link Voltage Regulation Level (6)	339...400 (P296=0) [400] 1V 585...800 (P296=1) [800] 1V 616...800 (P296=2) [800] 1V 678...800 (P296=3) [800] 1V 739...800 (P296=4) [800] 1V 809...1000 (P296=5) [1000] 1V 885...1000 (P296=6) [1000] 1V 924...1000 (P296=7) [1000] 1V 1063..1200 (P296=8) [1200] 1V	☑ P151 sets the DC Link Voltage Regulation Level to prevent E01-overvoltage. This Parameter jointly with the Parameter P152 allows two operation modes for the DC Link Voltage Regulation. Please find below a description of the two operation modes: **DC Link Voltage Regulation type when P152=0.00 and P151 is different from the maximum value:** ramp Holding – When the DC Link Voltage reaches the Regulation Level during the deceleration, the deceleration ramp time is increased and the speed is maintained at a constant value till the DC Link Voltage leaves the actuation. See Figure 6.12. ☑ This DC Link Voltage Regulation (ramp holding) tries to avoid the inverter disabling through fault relating to DC Link Overvoltage(E01), when the deceleration of loads with high inertia is carried out, or deceleration with short times are performed.  *Figure 6.12 - Deceleration with Ramp Holding* ☑ With this function you ca achieve a optimized deceleration time (minimum) for the driven load. ☑ This function is useful in application where loads with medium moment of inertia are driven, that require short deceleration ramps. ☑ If even so the inverter is disabled during the acceleration due to overvoltage (E01), reduce the value of P151 gradually, or increase the deceleration ramp time (P101 and/or P103). ☑ In case the supply line is permanently under overvoltage (Ud>P151), the inverter cannot decelerate. In this case reduce the line voltage or increment P151. ☑ If even after these settings the motor cannot decelerate within the required deceleration time, use the dynamic braking. (For more details about the dynamic braking, see 8.10).

Type of DC Link Voltage Regulation when P152>0.00 and P151 are set different that than the maximum value: When the DC Link Voltage reaches the regulation level during the deceleration, the deceleration ramp time is increased and the motor is decelerated within a percentage speed of the synchronous speed till the moment when the DC Link Voltage leaves the actuation level. See Figure 6.13.

Inverter V_{rated}	220/230V	380V	400/415V	440/460V	480V	500/525V	575V	600V	660/690V
P296	0	1	2	3	4	5	6	7	8
P151	375V	618V	675V	748V	780V	893V	972V	972V	1174V

Table 6.2 - *Recommended values for DC link voltage regulation level*

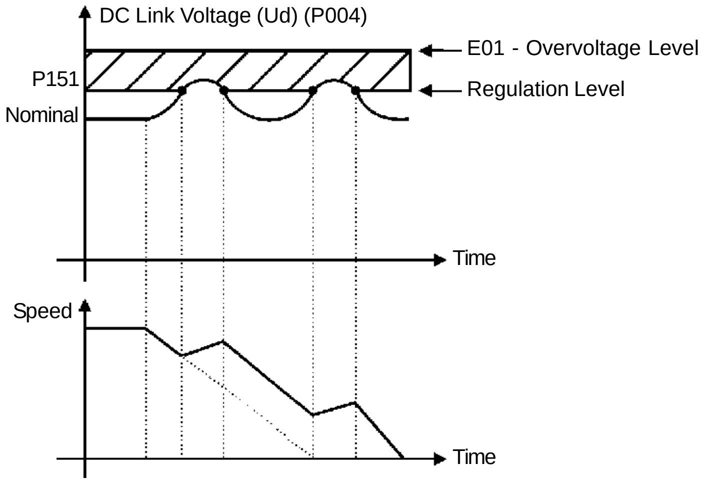


Figure 6.13 *- Deceleration curve with DC Link voltage limitation (regulation)*

☑ The factory setting is at maximum (link regulation is deactivated). To activate this regulation, we recommend to set P151 according Table 6.2.

☑ If even after this setting the inverter is still disabled due to overvoltage (E01) during the load acceleration, increase the value of the Parameter P152 gradually, or increase the deceleration ramp time (P101 and/or P103). The inverter will not decelerate, if the supply line is permanently under overvoltage Ud > P151). In this case reduce the line voltage or increment P151.

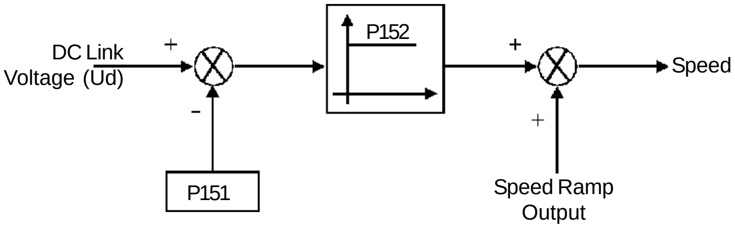
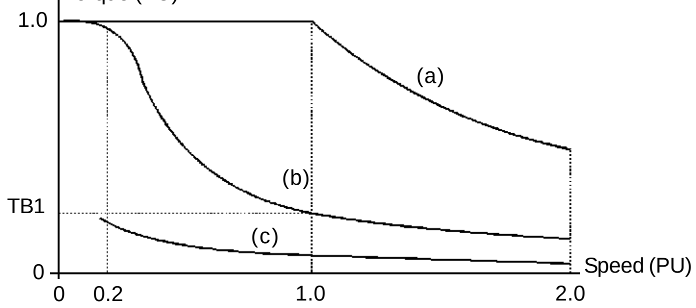


Figure 6.14 *- Voltage Regulation Block Diagram of the DC-Link*

NOTE!

For large motors we recommend the use of the ramp holding function.

Parameter	Range [Factory Setting] Unit	Description / Notes
P151 **For Vector Control (P202=3 or 4):** DC Link Voltage Regulation Level with Optimal Braking (6)	339...400 (P296=0) [400] 1V 585...800 (P296=1) [800] 1V 616...800 (P296=2) [800] 1V 678...800 (P296=3) [800] 1V 739...800 (P296=4) [800] 1V 809...1000 (P296=5) [1000] 1V 885...1000 (P296=6) [1000] 1V 924...1000 (P296=7) [1000] 1V 1063...1200 (P296=8) [1200] 1V	☑ The Optimal Braking is a unique method of stopping the motor that provides more braking torque than DC Injection Braking without requiring Dynamic Braking components. In the case of DC Braking, except for the friction losses, only the rotor losses are used to dissipate the stored energy due to the driven mechanical load. With Optimal Braking, both the total motor losses and the inverter losses are used. In this way, it is possible to achieve a braking torque of approximately 5 times higher than with the DC braking (Refer to Figure 6.15). ☑ This feature allows high dynamic performance without the use of a Dynamic Braking resistor. ☑ It prevents a DC Link Overvoltage Fault (E01) during deceleration. ☛ The factory setting is set at maximum (optimal braking deactivated). To activate this optimal braking, set P151 according to table 6.2 and P150=0 ☑ Figure 6.15 shows a Torque x Speed curve of a typical 7.5 kW/10 HP, IV pole motor. The braking torque developed at full speed, with torque (P169 and P170) limited by the CFW-09 at a value equal to the motor rated torque, is given by TB1 point. TB1 value depends on the motor efficiency and disregarding the friction losses it is given by the following equation: $TB1 = \frac{1 - \eta}{\eta}$ Where: η = motor efficiency For the case in Figure 6.15, the motor efficiency at full load condition is 84% $\eta = 0.84$, tthat results in TB1 = 0.19 or 19% of the motor rated torque. Starting at TB1 point, the braking torque varies in the reverse proportion of the speed (1/N). At low speeds, the braking torque reaches the torque limit level set by the inverter. For the case of Figure 6.15, the torque limit (100%) is reached when the speed is 20% of the rated speed. The braking torque indicated in Figure 6.15 can be increased by increasing the inverter torque limit: P169 (maximum forward torque current) or P170 (maximum reverse torque current). ☑ In general, smaller motors have lower efficiency (higher losses) consequently Optimal Braking can achieve higher braking torques with smaller motors. Examples: 0.75 kW/1 HP, IV poles: η = 0.76 that results in TB1= 0.32 15 kW/20 HP, IV poles: η = 0.86 that results in TB1= 0.16 150 kW/200 HP, IV poles: η = 0.88 that results in TB1= 0.14  ***Figure 6.15*** *- T x rpm curve for optimal braking and typical 10HP/7.5kW motor driven by an inverter with torque limitation set for a value equal to the rated motor torque*

Parameter	Range [Factory Setting] Unit	Description / Notes
		(a) Torque generated by the motor in normal operation, driven by an inverter in "motor mode". (b) Braking torque generated by Optimal Braking (c) Braking torque generated with DC Injection Braking NOTE! The enabling of the optimal braking can increase the motor noise level and the vibration level. If this not desired, disable the optimal braking. NOTE! TO DISABLE OPTIMAL BRAKING: If the use of the Optimal Braking is not desired, or if the use of Dynamic Braking is preferred, set P151 at its maximum value (400, 800, 1000 or 1200V).
P152 Proportional Gain of the DC Link Voltage Regulator [Only for P202= 0, 1 or 2 (V/F control)]	0.00...9.99 [0.00] 0.01	☑ Refer to P151 for V/F Control (Figure 6.14). ☑ If P152 = 0.00 and P151 is different from the maximum value, the Ramp Holding function is active. (See P151 for the Scalar Control Mode) ☑ P152 multiplies the DC link voltage error, i.e. DC link actual - DC link setting (P151). P152 is typically used to prevent overvoltage in applications with eccentric loads.
P153 Dynamic Braking Voltage Level (6)	339...400 (P296=0) [375] 1V 585...800 (P296=1) [618] 1V 616...800 (P296=2) [675] 1V 678...800 (P296=3) [748] 1V 739...800 (P296=4) [780] 1V 809...1000 (P296=5) [893] 1V 885...1000 (P296=6) [972] 1V 924...1000 (P296=7) [972] 1V 1063...1200 (P296=8) [1174] 1V	☑ Dynamic braking can only be used if the inverter is fitted with a dynamic braking resistor. The voltage level for actuation of the brake chopper must be set according to the supply voltage. If P153 is set too close to the overvoltage trip level (E01) an overvoltage trip may occur before the brake chopper and resistor can dissipate the braking energy. The following are the recommended settings:

Inverter V_{nom}	P296	P153	E01
220/230V	0	375V	> 400V
380V	1	618V	> 800V
400/415V	2	675V	
440/460V	3	748V	
480V	4	780V	
500/525V	5	893V	> 1000V
550/575V	6	972V	
600V	7	972V	
660/690V	8	1174V	> 1200V

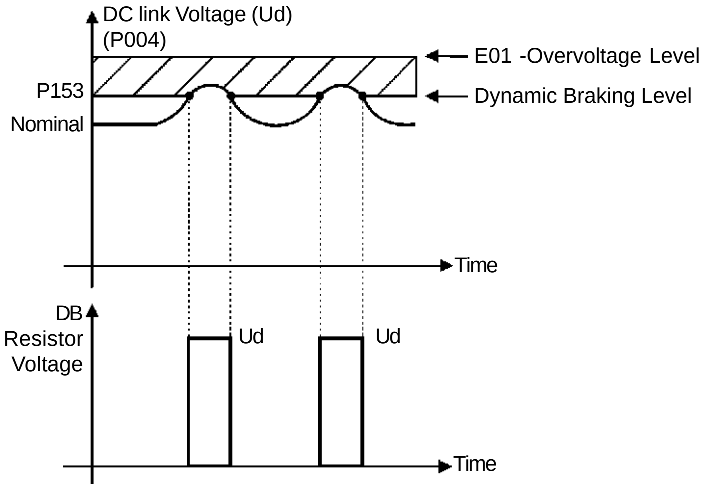
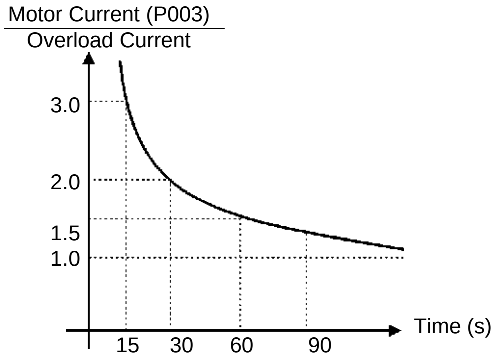
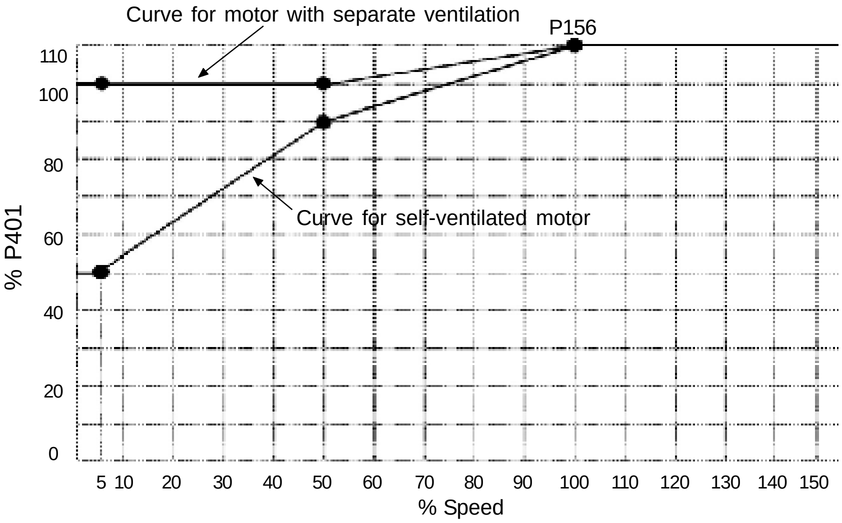


Figure 6.16 - *Curve of the Dynamic Braking Actuation*

Parameter	Range [Factory Setting] Unit	Description / Notes
		☑To actuate the Dynamic Braking: ⇒ Connect the DB resistor. Refer to Section 8 ⇒ Set P154 and P155 according to the size of the Dynamic braking resistor. ⇒ Set P151 to its maximum value: 400V (P296=0), 800V (P296=1,2,3 or 4), 1000V (P296=5, 6 or 7) or 1200V (P296=8), to avoid actuation of the DC link Voltage Regulation before Dynamic Braking.
P154 Dynamic Braking Resistor	0...500 [0] 0.1Ω (≤99.9)-1Ω (≥100)	☑Resistance value of the Dynamic Braking resistor (in ohms). ☑P154 = 0 disables the braking resistor overload protection. Must be programmed to 0 when braking resistor is not used.
P155 DB Resistor Power Rating	0.02 ... 650 [2.60] 0.01kW (<9.99) 0.1kW (>9.99) 1kW(>99.9)	☑Adjusts the overload protection for Dynamic Braking resistor. Set it according to the power rating of the DB resistor (in kW). ☑If the average power in the braking resistor during 2 minutes is higher than the value set at P155, the inverter trips on an E12 fault. ☑See item 8.10.
P156 Motor Overload Current at 100% Speed (2) (7)	P157 ... 1.3xP295 [1.1xP401] 0.1A(<100)-1A(>99.9)	 ***Figure 6.17*** *- Ixt Function - overload detection*  ***Figure 6.18*** *- Overload protection levels* ☑Used to protect motor and inverter against timed overload (I x t - E05). ☑The Motor Overload Current (P156, P157 and P158) is the current level above which the CFW-09 will consider the motor operating under overload. ☑The higher the overload, the sooner the Overload Fault E05 will occur.
P157 Motor Overload Current at 50% Speed (2) (7)	P158 ... P156 [0.9xP401] 0.1A(<100)-1A(>99.9)	
P158 Motor Overload Current at 5% Speed (2) (7)	0.2xP295 ... P157 [0.5xP401] 0.1A(<100)-1A(>99.9)	

Parameter	Range [Factory Setting] Unit	Description / Notes
		☑ Parameter P156 (motor overload current at base speed) must be set 10% higher than the used rated motor current (P401). ☑ The overload current is given as a function of the motor speed. The parameters P156, P157 and P158 are the three points used to form the overload curve, as shown in Figure 6.18 with the factory default levels. ☑ This overload curve adjustment improves the protection of self-ventilated motors, or it can be programmed with a constant overload level at any speed for blower cooled motors. ☑ This curve is changed when P406 (Ventilation Type) is changed during the start-up subroutine.(See 4.2).
P160 Optimization of the Speed Regulator for the Torque Control	0...1 [0] -	

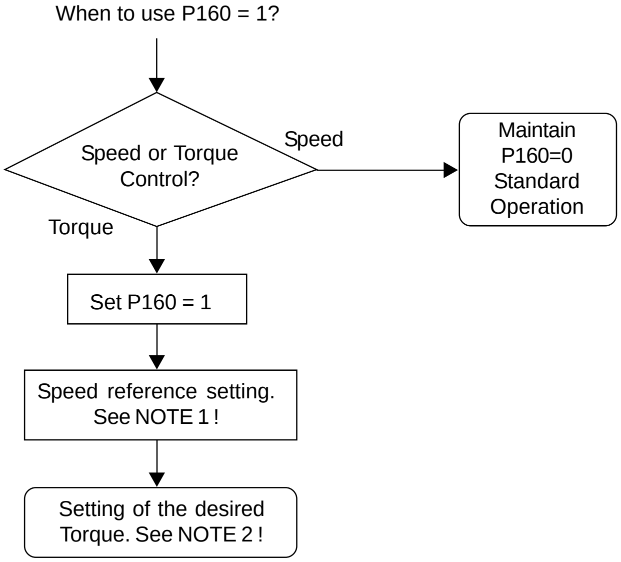


Figure 6.19 *- Torque Control*

NOTE 1!

The speed reference must be set 10% or higher than the working speed and so ensuring that the output of the speed regulator is equal to the maximum setting permitted for the maximum torque current. (P169 or P170). In this case one says that the regulator is operating with current limitation (or that it is saturated).

When the speed regulator is positive saturated, i. e. the direction of rotation determined by the command defined at P223/P226 is clockwise, the current limitation is set at P169. When the speed regulator is negative saturated, i. e. the direction of rotation determined by the command defined at P223/P226 is counter-clockwise, the current limitation is set at P170. The torque control through saturated speed regulator has also a protection function (limiting). For instance, for a winder, when the winding material ruptures, the regulator leaves the saturated condition and starts now to control the motor speed, which will increase only up to the value that has been set at the speed reference.

NOTE 2!

The desired torque may be set as follows:

1. Via parameters P169/P170 (by keypad, Serial Wegbus or via Fieldbus)
2. Via AI2 (P237 = 2 – Max. Torque current)
3. Via AI3 (P241 = 2 - Max. Torque current)

Note:

- For achieving a torque control with required precision, choose the rated motor current so that it matches the rated CFW-09 current.
- The sensorless mode (P202=3) does not control the torque at frequencies lower than 3Hz. For applications with torque control at frequencies down to 0Hz, apply the vector mode with encoder (P202=4).
- The torque limitation (P169/P170) must be higher than or equal to 15% in order to ensure that the motor starts in sensorless mode (P202=3). After starting, and the motor running above 3Hz (P202=3), the torque limitation may be reduced below 15%, when so required.
- The torque at the motor shaft (T_{motor}) can be determined through the value at P169/P170 by the following formula:

$$T_{motor} = \left(\frac{P295 \times \frac{P169*}{100} \times K}{\left((P401)^2 - \left(P410 \times \frac{P178}{100} \right)^2 \right)^{\frac{1}{2}}} \right) \times 100$$

Where:

T_{motor} - Value in percent of the rated torque generated by the motor

$$K = \begin{cases} 1 \quad for \quad N \leq N_{rated} \\ \frac{N_{rated}}{N} \times \frac{P180}{100} \quad for \quad N > N_{rated} \end{cases}$$

N_{rated} = Motor synchronous speed

N = Motor effective Speed

* NOTE: The formula above supplies clockwise torque. For counter-clockwise torque, replace P169 by P170.

Parameter	Range [Factory Setting] Unit	Description / Notes
P161 Speed Regulator Proportional Gain (3)	0.0...63.9 [7.4] 0.1	☑ Gains adjusted as a function of parameter P413 (Tm Constant) and by the Self-tuning routine. ☑ These gains can be set manually in order to optimize the dynamic speed response. Increase these gains to have a faster response. If the speed starts to oscillate, decrease the gains.
P162 Speed Regulator Integral Gain (3)	0.000...9.999 [0.023] 0.001	

Parameter	Range [Factory Setting] Unit	Description / Notes
P163 Local Speed Reference Offset	-999...999 [0] 1	☑ When the speed reference is set via the Analog Inputs AI1...AI4, the parameters P163 or P164 may be used to compensate for a bias offset in the analog input signals.
P164 Remote Speed Reference Offset ☛ **These parameters (P160 to P164) are shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	-999...999 [0] 1	
P165 Speed Filter ☛ **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.012 ... 1.000s [0.012s] 0.001s	☑ It sets the time constant of the Speed Filter.
P166 Differential Gain ☛ **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.00...7.99 [0.00] -	☑ When the value of P166 is 0.00, the differential action is inactive. ☑ By setting P166 with different of 0.00 value (0.01 to -7.99), the differential action acts when the load is applied or removed.
P167 Current Regulator Proportional Gain (4)	0.00...1.99 [0.5] 0.01	☑ Gains adjusted as a function of parameters P411 and P409 respectively and by the Self-tuning routine.
P168 Current Regulator Integral Gain (4) ☛ **These parameters are shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.000...1.999 [0.010] 0.001	
P169 **For V/F Control** (P202=0, 1 or 2): Maximum Output Current (7)	0.2xP295...1.8xP295 [1.5xP295] 0.1A(<100) -1A(>99.9)	☑ Avoids motor stalling during an overload. If the motor current attempts to exceed the value set at P169, the motor speed will be decreased, following the deceleration ramp until the current becomes lower than P169. When the overload condition disappears the motor speed is resumed.

Parameter	Range [Factory Setting] Unit	Description / Notes

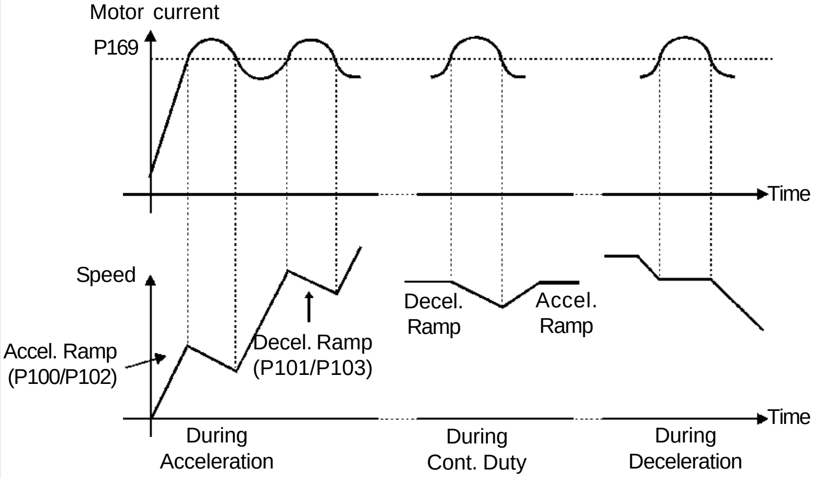
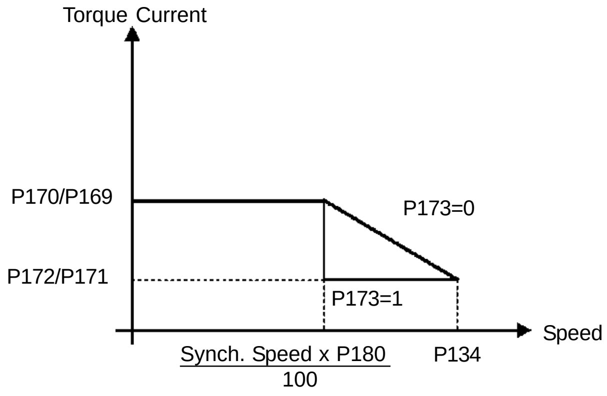


Figure 6.20 *- Curves showing the actuation of the current limitation*

Parameter	Range [Factory Setting] Unit	Description / Notes
P169 **For Vector Control** (P202 = 3 or 4): Maximum Forward Torque Current	0...180 [125] 1%	☑ Limits the component of the motor current that generates torque. The setting is expressed in % of the inverter rated current (parameter P295). ☑ The value of P169/P170 may be determined from the maximum desired motor current (Imotor) by the formula below: $\text{P169/P170(\%)} = \sqrt{\left(\frac{100 \text{ x Imotor}}{\text{P295}}\right)^2 - \left(\frac{100 \text{ x P410}}{\text{P295}}\right)^2}$ ☑When in limitation, the motor current can be calculated by: $\text{Imotor} = \sqrt{\left(\frac{\text{P169 or P170 x P295}}{100}\right)^2 + (\text{P410})^2}$ ☑The maximum generated torque by the motor is given by: $\text{Tmotor (\%)} = \left(\frac{\text{P295 x} \frac{\text{P169}}{100} \text{ x K}}{\left((\text{P401})^2 - \left(\text{P410 x} \frac{\text{P178}}{100}\right)^2\right)^{1/2}}\right) \text{x100}$ where: $K = \begin{cases} 1 \text{ for } N \leq N_{rated} \\ \frac{N_{rated}}{N} \text{ x } \frac{\text{P180}}{100} \text{ for } N > N_{rated} \end{cases}$ ☑ During Optimal Braking, P169 limits the output current to generate braking torque (Refer to P151).

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td>P170
Maximum Reverse Torque Current
☞ These parameters (P169 and P170) are shown on the display(s) only when P202 = 3 or 4 (Vector Control)</td><td>0...180
[125]
1%</td><td>☑ Refer to the description of P169 above.</td></tr>
<tr><td>P171
Maximum Forward Torque at Maximum Speed (P134)

P172
Maximum Reverse Torque at Maximum Speed (P134)
☞ These parameters (P169 and P170) are shown on the display(s) only when P202 = 3 or 4 (Vector Control)</td><td>0...180
[100]
1%

0...180
[100]
1%</td><td>☑ Torque current limitation as a function of speed:


<i>Figure 6.21</i> - <i>Actuation Curve of the torque limitation at max. Speed P172</i>
☑ These functions remain disabled while the content of P171/P172 is higher or equal to the content of P169/P170.
☑ P171 and P172 also limit the maximum output current during Optimal Braking.</td></tr>
<tr><td>P173
Curve Type of the Maximum Torque
☞ These parameters are shown on the display(s) only when P202 = 3 or 4 (Vector Control)</td><td>0...1
[0]
-</td><td>☑ It defines the actuation curve of the torque limitation in the field weakening zone. See figure 6.21.<table><tr><th>P173</th><th>Curve Tipe</th></tr><tr><td>0</td><td>Ramp</td></tr><tr><td>1</td><td>Step</td></tr></table></td></tr>
<tr><td>P175
Flux Regulator Proportional Gain
(5)

P176
Flux Regulator Integral Gain
(5)</td><td>0.0...31.9
[2.0]
0.1

0.000...9.999
[0.020]
0.001</td><td>☑ Gains adjusted as a function of parameter P412 and by the Self-tuning routine.</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td>P177
Minimum Flux</td><td>0...120
[0]
1%</td><td></td></tr>
<tr><td>P178
Nominal Flux</td><td>0...120
[100]
1%</td><td></td></tr>
<tr><td>P179
Maximum Flux
☞ P177 and P179 are active only when P202=3 (Sensorless Vector)</td><td>0...120
[120]
1%</td><td></td></tr>
<tr><td>P180
Field Weakening Start Point
☞ These parameters (P175, P176, P178, P180) are shown on the display(s) only when P202 = 3 or 4 (Vector Control)</td><td>0...120
[95]
1%</td><td>☑ Express, as % of the motor speed (parameter P402), the speed from where the motor field starts weakening.
When P202 = 3 (Sensorless Vector) and the motor does not reach speeds near or higher than rated speed, parameters P180 and/or P178 should be gradually reduced.
When P202 = 4 (Vector with Encoder) and the motor does not reach speeds near or higher than rated speed, parameters P180 and/or P178 should be gradually reduced.</td></tr>
<tr><td>P181
Magnetization Mode
☞ This parameter is shown on the display only when P202 = 4 (Vector Control with Encoder)</td><td>0,1
[0]
-</td><td><table><tr><th>P181</th><th>Action</th></tr><tr><td>0=General Enable</td><td>It applies magnetization current after General Enable ON</td></tr><tr><td>1=Start/Stop</td><td>It applies magnetization current after Start/Stop ON</td></tr></table>☑ In sensorless vector, magnetization current is permanently ON. To disable magnetization current when the motor is stopped, program P211 to 1 (ON). This can be given a time delay by programming P213 greater than zero.</td></tr>
</table>

6.3 CONFIGURATION PARAMETERS - P200....P399

<table>
<tr><td>P200
Password</td><td>0,1
[1]
-</td><td><table><tr><th>P200</th><th>Result</th></tr><tr><td>0 (Off)</td><td>Disables the Password and allows changing parameters content independently of P000</td></tr><tr><td>1 (On)</td><td>Enables the Password and allows changing parameters content only when P000 is set to the password value.</td></tr></table>☑The factory default for the password is P000 = 5.
☑To change the password refer to P000.</td></tr>
<tr><td>P201
Language Selection</td><td>0...3
[(11)]
-</td><td><table><tr><th>P201</th><th>Language</th></tr><tr><td>0</td><td>Português</td></tr><tr><td>1</td><td>English</td></tr><tr><td>2</td><td>Español</td></tr><tr><td>3</td><td>Deutsch</td></tr></table></td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description / Notes
P202 Type of control (1) (2)	0...4 [(11)] -	

P202	Type of Control
0	V/F 60Hz
1	V/F 50Hz
2	V/F Adjustable (Refer to P142...P146)
3	Sensorless vector
4	Vector with Encoder

☑For details on the Type of Control selection Refer to Section 4.3.

Parameter	Range [Factory Setting] Unit	Description / Notes
P203 Special Function Selection (1)	0,1 [0] -	

☑It defines the selection type of special functions:

P203	**Functions**
0	Not Used
1	PID Regulator

☑For the special function of PID regulator, see detailed description of related parameters (P520...P535).
When P203 is changed to 1, P265 is changed automatically to 15 - Manual/Auto.

Parameter	Range [Factory Setting] Unit	Description / Notes
P204 Load/Save Parameters (1) (10)	0...11 [0] -	

☑The parameters P295 (Inverter Rated Current), P296 (Inverter Rated Voltage), P297 (Switching Frequency), P308 (Serial Address) and P201 (Language) are not changed when the factory default parameters are loaded through P204 = 5 and 6.

☑Once entered the user parameters are automatically saved to the VSD EEPROM. In addition it is possible to save two further sets of parameters, or to use these as a “backup”.

☑The operation of Load User 1 and/or 2 can also be done by DIx (See parameters P265...P269).

☑The options P204=5, 6, 7, 8, 10 and 11 are disables when P309 ≠ 0 (Active Fieldbus).

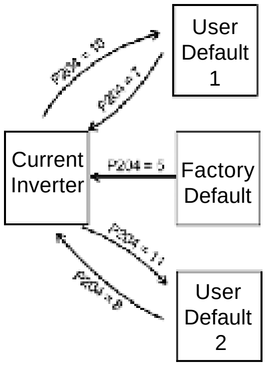


Figure 6.22 *- Parameter Transference*

P204	Action
0, 1, 2, 9	**Not Used:** No action
3	**Reset P043:** Resets the Time Enabled hour meter to zero
4	**Reset P044:** Resets the kWh counter to zero
5	**Load WEG-60Hz:** Resets all parameters to the 60Hz factory default values.

Parameter	Range [Factory Setting] Unit	Description / Notes

6	**Load WEG-50Hz:** Resets all parameters to the 50Hz factory default values.
7	**Load User 1:** Resets all parameters to the values stored in Parameter Memory 1.
8	**Load user 2:** Resets all parameters to the value stored in Parameter Memory 2.
10	**Save User 1:** Stores all current inverter parameter values to Parameter Memory 1.
11	**Save User 2:** Stores all current inverter parameter values to Parameter Memory 2.

NOTE!

The action of loading/saving parameters will take effect only after P204 has been set and the PROG key is pressed.

P205
Display Default

0...6
[2]
-

☑ Selects which of the parameters listed below will be shown on the display as a default after the inverter has been powered up:

P202	Display Default
0	P005 (Motor Frequency)
1	P003 (Motor Current)
2	P002 (Motor Speed)
3	P007 (Motor Voltage)
4	P006 (Inverter Status)
5	P009 (Motor Torque)
6	P040 (PID Process Variable)

P206
Auto-Reset
Time

0...255
[0]
1s

☑ In the event of a fault trip, except for E09, E24, E31 and E41,the CFW-09 can initiate an automatic reset after the time given by P206 is elapsed.

☑ If P206 ≤ 2 Auto-Reset does not occur.

☑ 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 Auto-Reset.

P207
Reference
Engineering Unit 1

32...127
[114 (r)]
-

☑ This parameter is useful only for inverters provided with a keypad with LCD display.

☑ P207 is used to apply a customised display to P001 (Speed reference) and P002 (motor speed). The letters rpm can be changed to user selected characters, E.g. CFM, L/s etc.

☑ The Reference Engineering Unit is formed by three characters, which will be applied to the Speed Reference (P001) and the Motor Speed (P002) LCD display indications. P207 defines the left character. P216 defines the center character and P217 the right character.

☑ All characters correspondent to the ASCII code from 32 to 127 can be chosen.
Examples: A, B, ..., Y, Z, a, b, ..., y, z, 0, 1, ..., 9, #, $, %, (,), *, +, ...

P208
Reference Scale
Factor
(2)

1...18000
[1800 (1500) (11)]
1

☑ Defines how the Speed Reference (P001) and the Motor Speed (P002) will be displayed.

☑ **For indicating the values in rpm:**
Set the synchronous speed according to the following table.

Parameter	Range [Factory Setting] Unit	Description / Notes

Frequency	Motor Pole Number	Syncronous Speed
50Hz	2	3000
	4	1500
	6	1000
	8	750
60Hz	2	3600
	4	1800
	6	1200
	8	900

For indicating other values:

☑ The displayed value when the motor is running at synchronous speed can be calculated through the following equations:
P002 = Speed x P208 / Sync speed x $(10)^{P210}$
P001 = Reference x P208 / Sync speed x $(10)^{P210}$
Where:
Reference = Speed Reference in rpm.
Speed = Motor speed in rpm;
Sync Speed = Motor synchronous speed (120 x P403 / Poles);
Poles = Motor number of poles (120 x P403 / P402);
Example:
Desired indication: 90.0 l/s at 1800 rpm
Motor synchronous speed: 1800 rpm
Programming: P208 = 900, P210 = 1, P207 = l, P216 = /, P217 = s

---

P209
Motor Phase Loss Detection

0,1
[0]
-

P209	Motor Phase Loss (E15)
0	Off
1	On

☑ With the Motor Phase Loss Detector enabled (P209=1), E15 happens when the following conditions occur simultaneously during a minimum time of 2 seconds:
i. P209 = On;
ii. Inverter enabled;
iii. Speed reference higher than 3%;
iv. $| I_u - I_v | > 0.125xP401$ or $| I_u – I_w | > 0.125xP401$ or $| I_v – I_w | > 0.125xP401$.

P210
Decimal point of the Speed Indication

0...3
[0]
1

☑ Defines the number of digits after the decimal point of the Speed Reference (P001) and the Motor Speed indications (P002).

P211
Zero Speed Disable

0,1
[0]
-

P211	Zero Speed Disable
0	Off
1	On

☑ When active, it disables (general disabling, motor runs freely) the inverter when the speed reference and the actual motor speed are lower than the value set at P291 (Zero Speed Zone).
The CFW-09 will be enabled again, when one of the conditions defined by the Parameter P212 is satisfied.

Parameter	Range [Factory Setting] Unit	Description / Notes

P212
Condition to Leave Zero Speed Disable

0,1
[0]
-

P212	Inverter leaves zero speed disable if
0	P001 (Speed Ref. N*) > P291 or P002 (Motor Speed N) > P291
1	P001 (Speed Ref. N*) >0

☑ When the PID Regulator is active (P203=1) and in Automatic mode, the inverter leaves the Zero Speed, besides the programmed condition in P212, only when the PID input error (the difference between setpoint and process variable) is higher than the value programmed in P535.

P213
Time Delay for Zero Speed Disable

0...999
[0]
1s

☑ P213=0: Zero speed disable without timing.

☑ P213>0: Zero speed disable will only become active after the time delay set in P213. Timing starts when the zero speed zone conditions are met. If these conditions are no longer met during the delay time, the timer will reset.

P214
Line Phase Loss Detection
(1)
(9)

0,1
[1]
-

P214	Line Undervoltage/ Phase Fault (E03)
0	Off
1	On

☑ The phase loss detector is active when:
P214 = On and the CFW-09 is enabled.
The display indication and the updating of the fault memory happens 3 seconds after the fault has occurred.

NOTE!
The phase loss detection is not available in types up to 28A for 220-230V and 380-480V supply voltage and in types up to 14A for 500-600V supply voltage, independently of the value set in P214.

P215
Copy Function
(1)

0...2
[0]
-

P215	Action
0=Off	None
1= INV→ Keypad	Transfers the current parameter values and the content of the User 1/2 Memories to the non volatile EEPROM memory of the Keypad (HMI). The current inverter parameters are not changed.
2= Keypad → INV	Transfers the content of the Keypad (HMI) memory to the current inverter parameters and to the User 1/2 Memories.

☑ The copy function is used to transfer the content of the parameters from one inverter to another. The inverters must be of the same type (voltage/ current and the same software version must be installed.

NOTE!
If the HMI has parameters saved of a “different version” than installed in the inverter to which it is trying to copy the parameters, the operation will not be executed and the inverter will display the error E10 (Error: not permitted Copy Function). “Different Version” are those that are different in “x” or “y”, supposing that the numbering of Software Versions is described as **Vx.yz**.

Parameter	Range [Factory Setting] Unit	Description / Notes

Example: version V1.60 → (x=1, y=6 e z=0) stored in the HMI previously

i. Inverter version: V1.75 → (x´=1, y´=7 e z´=5)
   P215=2 → E10 [(y=6) ≠ (y´=7)]

ii. Inverter version: V1.62 → (x´=1, y´=6 e z´=2)
   P215=2 → normal copy [(y=6) = (y´=6)]

The procedure is as follows:

1. Connect the Keypad to the inverter from which the parameters will be copied (Inverter A);
2. Set P215=1 (INV → HMI) to transfer the parameter values from the Inverter A to the Keypad. Press the PROG key. P204 resets automatically to 0 (Off) after the transfer is completed.
3. Disconnect the Keypad from the inverter.
4. Connect the same Keypad to the inverter to which the parameters will be transferred (Inverter B).
5. Set P215=2 (HMI → INV) to transfer the content of the Keypad memory (containing the Inverter A parameters) to Inverter B.

Press the PROG key. When P204 returns to 0, the parameter transfer has been concluded. Now Inverters A and B have the same parameter values.

6. In case Inverters A and B are not of the same model, check the values of P295 (Rated Current) and P296 (Rated Voltage) of Inverter B. If the inverters are driving different motors, check the motor related parameters of Inverter B.
7. To copy the parameters content of the Inverter A to other inverters, repeat items 4 to 6 of this procedure.

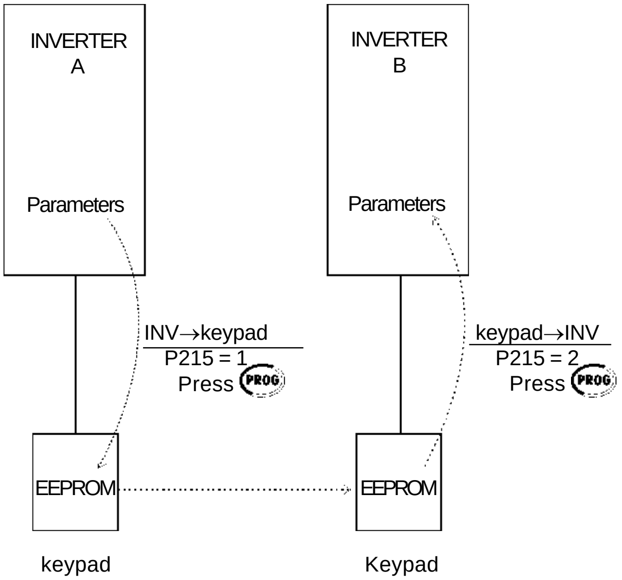


Figure 6.23 *-Copying the Parameters from the “Inverter A” to the “Inverter B”*

☑ While the Keypad runs the reading or writing procedures, it cannot be operated.

Parameter	Range [Factory Setting] Unit	Description / Notes
P216 Reference Engineering Unit 2 **P217** Reference Engineering Unit 3	32...127 [112 (p)] - 32...127 [109 (m)] -	☑These parameters are useful only for inverters provided with a keypad with LCD display. ☑For more details, refer to Parameter P207
P218 LCD Display Contrast Adjustment	0...150 [127] -	☑This parameter is useful only for inverters provided with a keypad with LCD display. ☑It allows the adjustment of the LCD Display contrast. Increase/decrease the parameter content to obtain the best contrast.
P220 LOCAL/REMOTE Selection Source (1)	0...10 [2] -	☑Defines the source of the LOCAL / REMOTE selection command.

P220	LOCAL/REMOTE Selection
0	Always LOCAL Mode
1	Always REMOTE mode
2	Key LOC/REM of the Keypad (HMI) (LOCAL Default)
3	Key LOC/REM of the Keypad (HMI) (REMOTE Default)
4	Digital inputs DI2 ... DI8 (P264 ... P270)
5	Serial (Local Default)
6	Serial (Remote Default)
7	Fieldbus (Local Default)
8	Fieldbus (Remote Default)
9	PLC (L)
10	PLC (R)

☑In the factory default setting, the key LOC/REM of the Keypad (HMI) will select Local or Remote Mode. When powered up, the inverter starts in Local mode.

Parameter	Range [Factory Setting] Unit	Description / Notes
P221 LOCAL Speed Reference Selection (1) **P222** REMOTE Speed Reference Selection (1)	0...11 [0] - 0...11 [1] -	☑ The description AI1' as apposed to AI1 refers to the analogue signal after scaling and/or gain calculations have been applied to it.

P221/P222	LOCAL REMOTE Speed Reference Selection
0	▲ and ▼ of the keypad
1	Analog Input AI1' (P234/P235/P236)
2	Analog Input AI2' (P237/P238/P239/P240)
3	Analog Input AI3' (P241/P242/P243/P244)
4	Analog Input AI4' (P245/P246/P247)
5	Sum of the Analog Inputs AI1' + AI2' > 0 (Negative values are zeroed)
6	Sum of the Analog Inputs AI1' + AI2'
7	Electronic Potentiometer (EP)
8	Multispeed (P124...P131)
9	Serial
10	Fieldbus
11	PLC

☑The reference value set by the ▲ and ▼ keys is contained in parameter P121.

☑Details of the Electronic Potentiometer (EP) operation in Figure 6.33.

☑When option 7 (EP) is selected, program P265 or P267=5 and P266 or P268=5 to 5.

☑When option 8 is selected, program P266 and/or P267 and/or P268 to 7.

☑When P203=1, do not use the reference via EP (P221/P222=7).

Parameter	Range [Factory Setting] Unit	Description / Notes
P223 LOCAL FWD/REV Selection (1) (8)	0...11 [2] -	See table P223
P224 LOCAL START/STOP Selection (1)	0...4 [0] -	See table P224
P225 LOCAL JOG Selection (1) (8)	0...5 [1] -	See table P225
P226 REMOTE FWD/REV Selection (1) (8)	0...11 [4] -	See table P226

P223	LOCAL FWD/REV Selection
0	Always Forward
1	Always Reverse
2	Key ⟲ of the Keypad (Default Forward)
3	Key ⟲ of the Keypad (Reverse Default)
4	Digital Input DI2 (P264 = 0)
5	Serial (CW Default)
6	Reserved Serial (CCW Default)
7	Fieldbus (CW Default)
8	Fieldbus (CCW Default)
9	Polarity AI4
10	PLC (H)
11	PLC (AH)

P224	LOCAL START/STOP Selection
0	I and 0 of the Keypad.
1	Digital Input DIx
2	Serial
3	Fieldbus
4	PLC

Note: If the Digital Inputs are programmed for Forward Run/Reverse Run, the I and 0 keys will remain disabled independently of the value programmed at P224.

P225	LOCAL JOG Selection
0	Disable
1	Key JOG of the Keypad
2	Digital inputs DI3... DI8 (P265...P270)
3	Serial
4	Fieldbus
5	PLC

☑ The JOG speed reference is given by parameter P122.

P226	REMOTE FWD/REV Selection
0	Always Forward
1	Always Reverse
2	Key ⟲ of the Keypad (Default Forward)
3	Key ⟲ of the Keypad (Default Reverse)
4	Digital Input DI2 (P264 = 0)
5	Serial (CW Default)
6	Serial (CCW Default)
7	Fieldbus (CW Default)
8	Fieldbus (CCW Default)
9	Polarity AI4
10	PLC (H)
11	PLC (AH)

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td>P227
REMOTE START/ STOP Selection
(1)</td><td>0...4
[1]
-</td><td>
<table>
<tr><th>P224</th><th>LOCAL START/STOP Selection</th></tr>
<tr><td>0</td><td>I and 0 of the Keypad.</td></tr>
<tr><td>1</td><td>Digital Input DIx</td></tr>
<tr><td>2</td><td>Serial</td></tr>
<tr><td>3</td><td>Fieldbus</td></tr>
<tr><td>4</td><td>PLC</td></tr>
</table>
Note: If the Digital Inputs are programmed for Forward Run/Reverse Run, the I and 0 keys will remain disabled independently of the value programmed at P227.
</td></tr>
<tr><td>P228
REMOTE JOG Selection
(1)
(8)</td><td>0...5
[2]
-</td><td>
<table>
<tr><th>P225</th><th>LOCAL JOG Selection</th></tr>
<tr><td>0</td><td>Disable</td></tr>
<tr><td>1</td><td>Key JOG of the Keypad</td></tr>
<tr><td>2</td><td>Digital inputs DI3... DI8 (P265...P270)</td></tr>
<tr><td>3</td><td>Serial</td></tr>
<tr><td>4</td><td>Fieldbus</td></tr>
<tr><td>5</td><td>PLC</td></tr>
</table>
☑The JOG speed reference is given by parameter P122.
</td></tr>
</table>

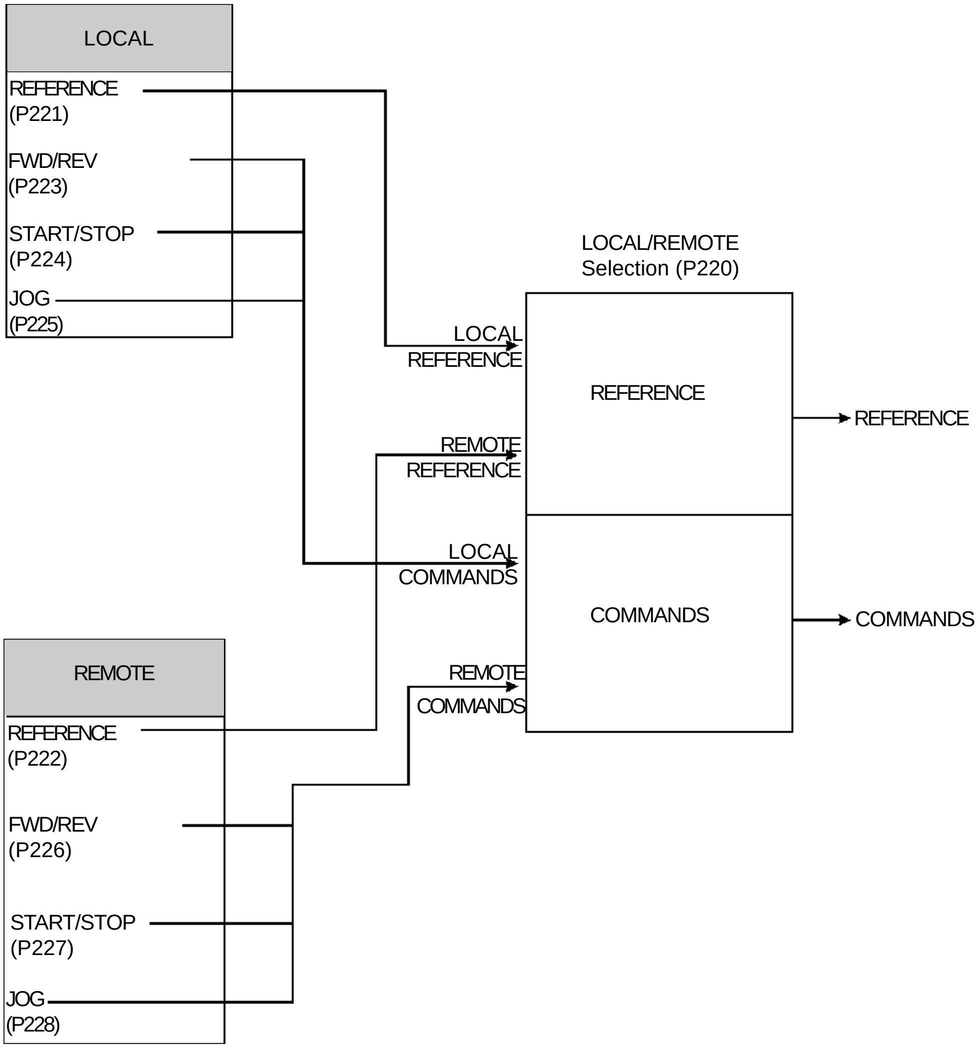
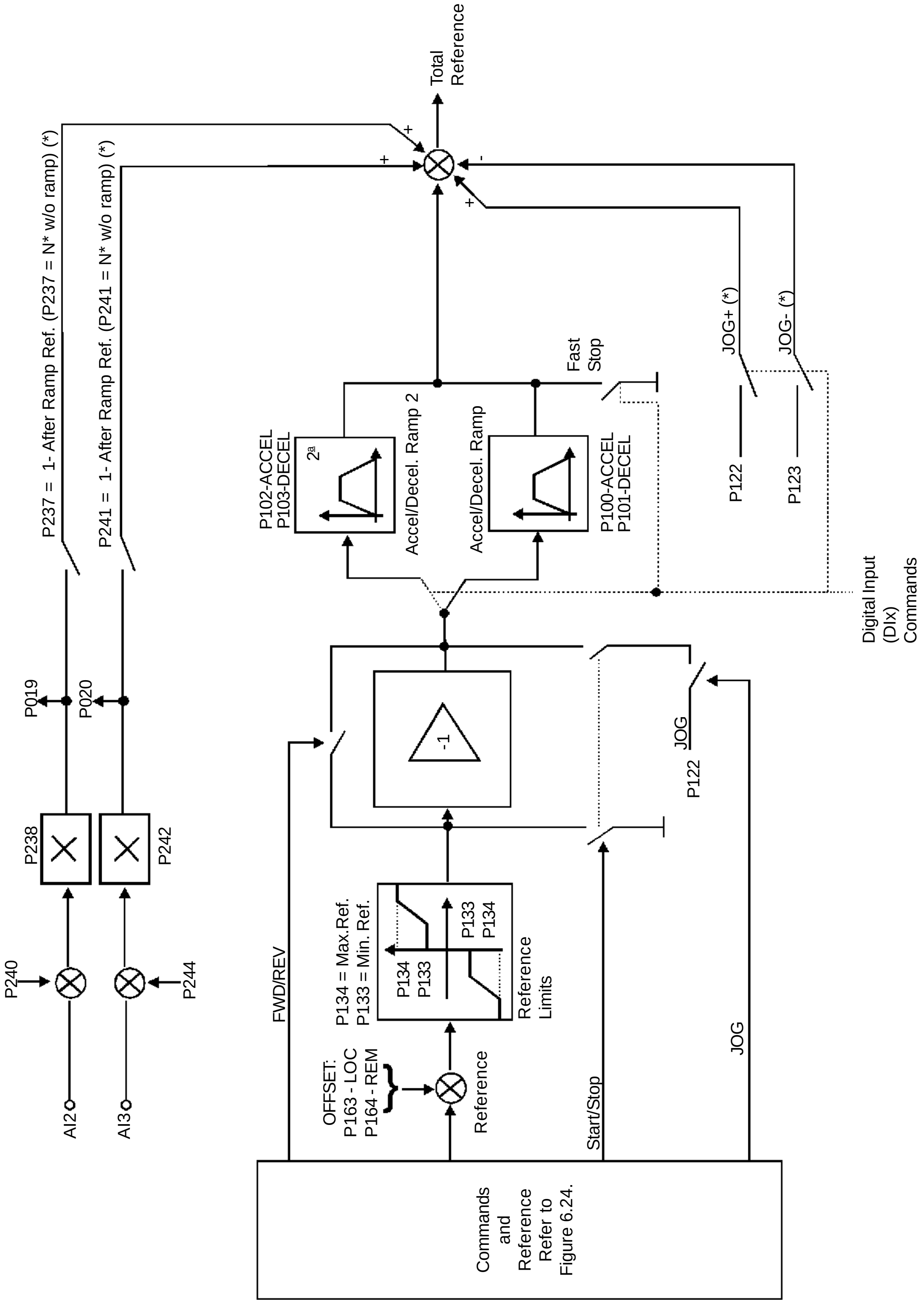


Figure 6.24 *- Block diagram of the Local / Remote mode*



(*) Valid only for P202 ≥ 3

Figure 6.25 *- Block diagram of the Frequency Reference*

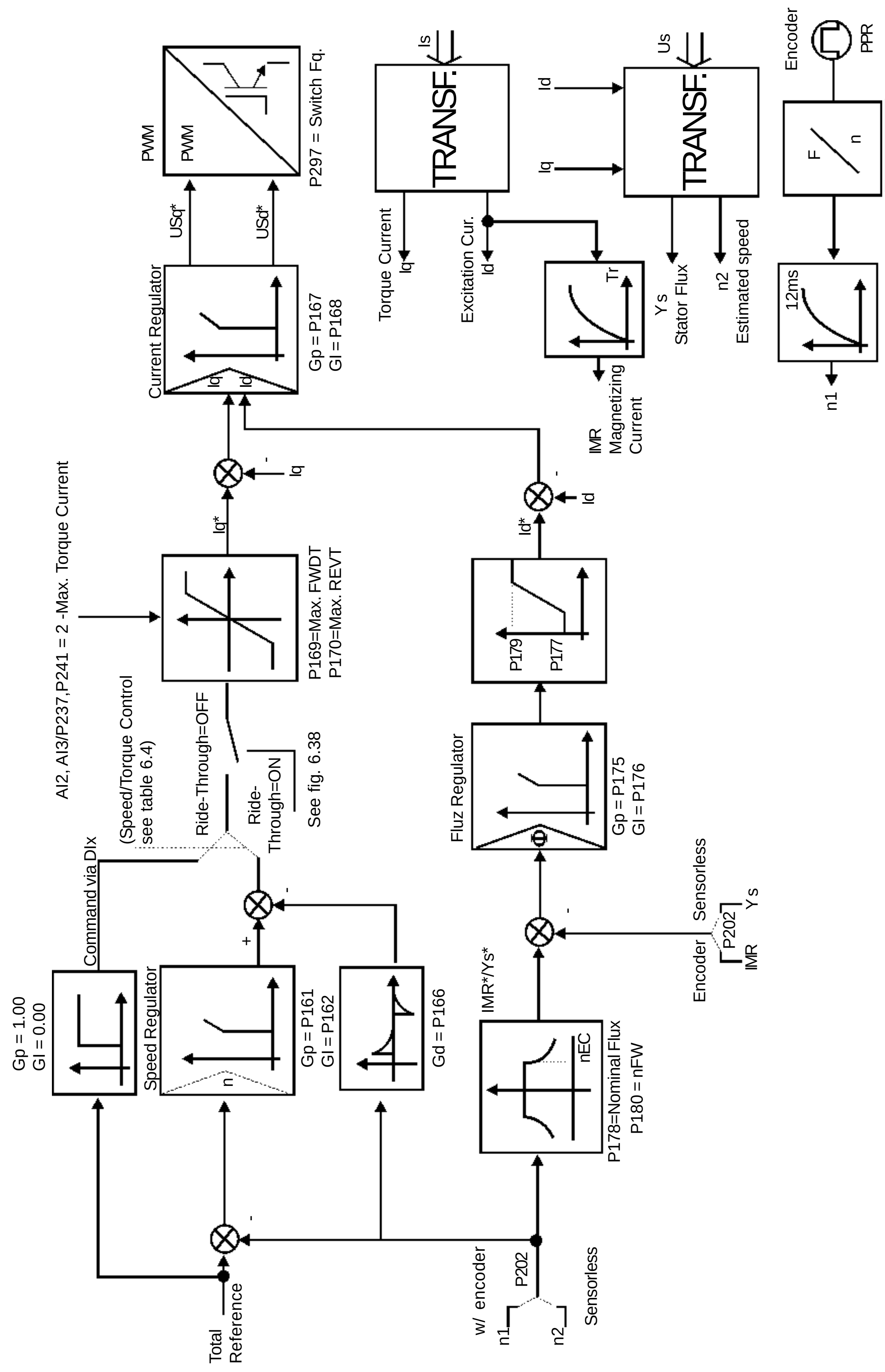


Figure 6.26A - *Block Diagram of the Vector Control*

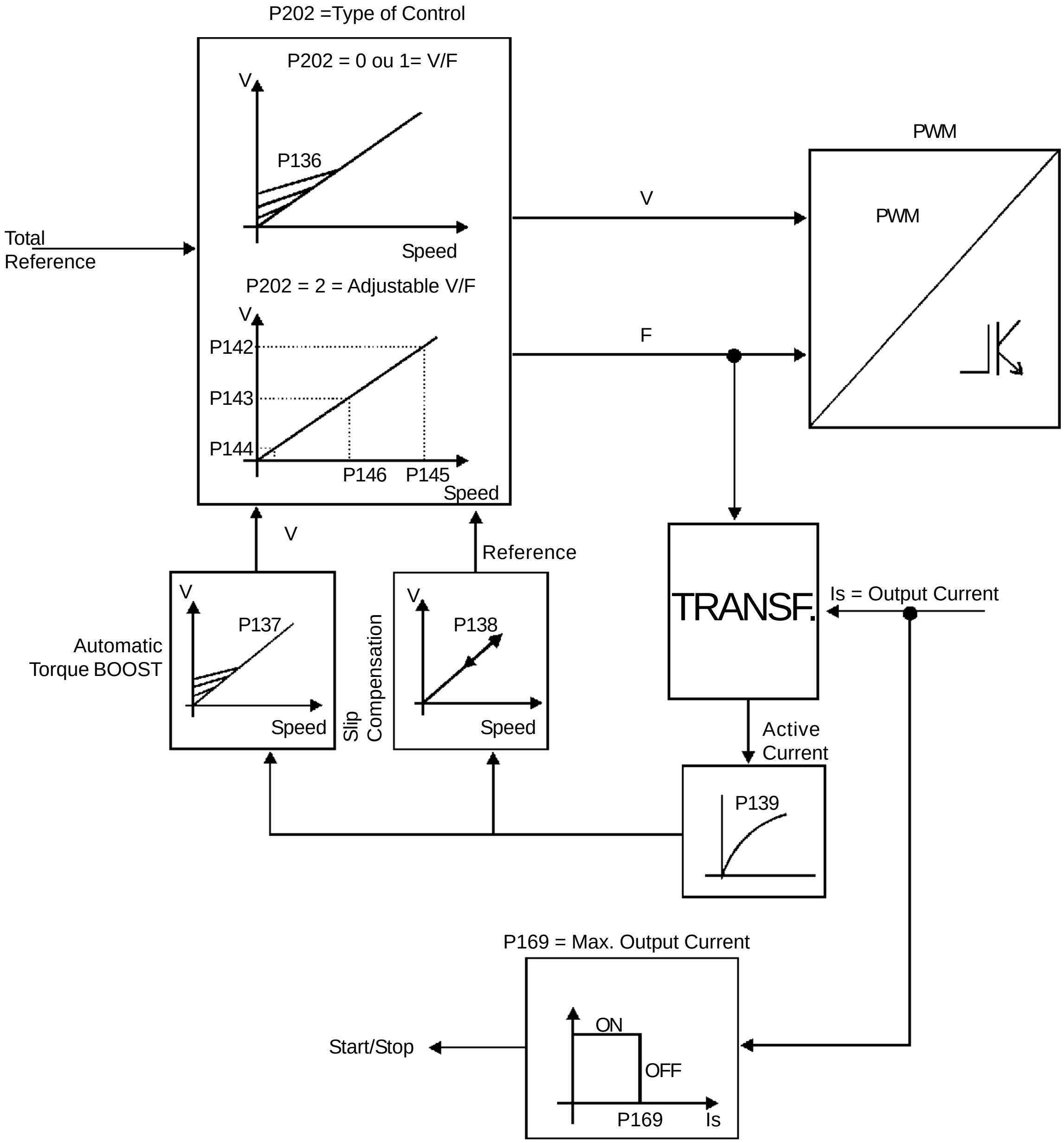


***Figure 6.26B** - Block Diagram of the V/F control (Scalar)*

Parameter	Range [Factory Setting] Unit	Description / Notes

P232
Stop Mode
Selection
(1)

0...2
[0]
-

P232	Stop Mode
0	Run/Stop
1	General Disable
2	Fast Stop

☑ By programming at P232, it is possible to select the stop modes (RUN/STOP/GENERAL DISABLE and FAST STOP for the key [O] or for the STOP function (via DIx).

☑ When the scalar control mode is selected, the option Quick Stop will not be available.

NOTE!

When the stop mode “GENERAL DISABLE” is programmed, start the motor only after it has stopped completely.

P233
Analog Inputs
Dead Zone

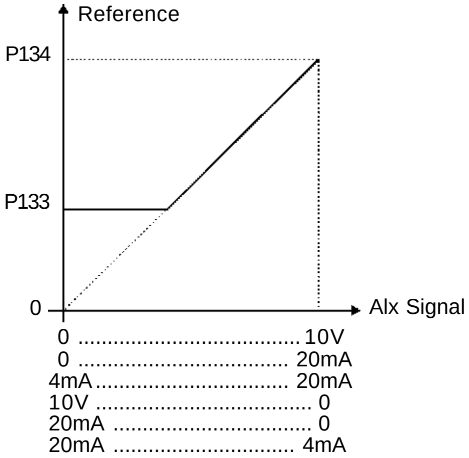
0,1
[0]
-

☑ When set to 1 enables the Dead Zone for the Analog Inputs.

☑ If P233 = 0 (Off) the “zero” signal at the Analog Inputs (0V/0mA/ 4mA or 10V/20mA) is directly related to the minimum speed programmed at P133. Refer to Figure 6.27a.

☑ If P233 = 1 (On) the Analog Inputs have a “dead zone”, and the speed reference remains at its minimum value (defined by P133) until the input signal reaches a level proportional to the minimum speed. Refer to Figure 6.27b.

(a) Active Dead Zone
P233=1



(b) Inactive Dead Zone
P233=0

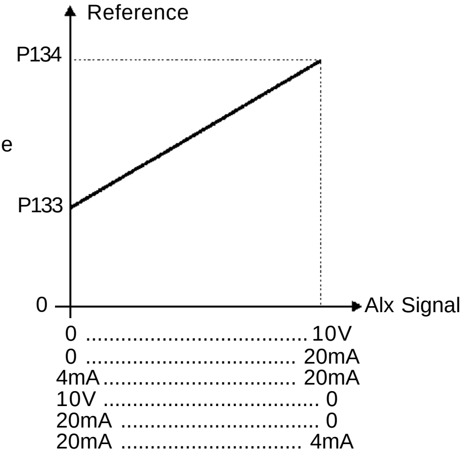


Figure 6.27 *- Actuation of the Analog Inputs*

Parameter | **Range [Factory Setting] Unit** | **Description / Notes**

☑When the Analog Input AI4 is programmed for -10V...+10V (P246 = 4), the curves shown in Figure 6.27 are still valid, with the difference that with AI4 negative the direction of rotation is reversed.

P234
Analog Input AI1 Gain

0.000...9.999
[1.000]
0.001

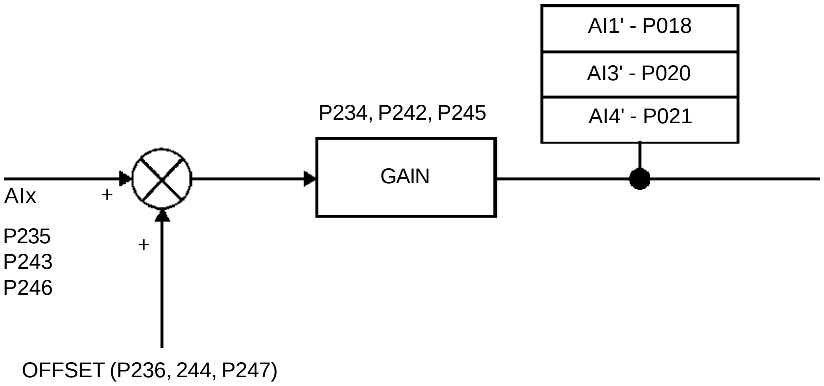


Figure 6.28 *- Block diagram of the Analog Input AI1, AI3, AI4*

☑The internal values AI1', AI3', and AI4' are the result of the following equation:

$$AIx' = (AIx + \frac{OFFSET}{100} x\ 10\ V)\ x\ Gain$$

For example : AI1 = 5V, Offset = -70% and Gain = 1.00:

$$AI1' = (5 + \frac{(-70)}{100} x\ 10\ V)\ x\ 1 = -2\ V$$

AI1' = -2V, means that the motor will run in reverse with a reference equal to 2V.

P235
Analog Input AI1
Signal
(1)

0...3
[0]
-

P235	Input AI1 Signal
0	0...10V/0...20mA
1	4...20mA
2	10...0V/20...0mA
3	20...4mA

☑When a current signal is used at the Analog Input AI1, set the S1.2 switch on the control board to “ON”.

☑Options 2 and 3 provide an inverse reference with which is possible to have maximum speed with minimum reference.

P236
Analog Input AI1
Offset

-100...100
[0.0]
0.1%

☑ Refer to P234.

P237
Analog Input AI2
Function
(1)

0...3
[0]
-

P237	Input AI2 Function
0	P221/P222
1	After Ramp Reference
2	Maximum Torque Current
3	PID Process Variable

☑When the option 0 (P221/P222) is selected, AI2 may supply the speed reference (if set to do so at P221/P222), which is subject to the speed

Parameter | **Range [Factory Setting] Unit** | **Description / Notes**

limits (P133, P134) and the acceleration/deceleration ramps (P100...P103). Refer to Figure 6.25.

☑ The option 1 (After Ramp Reference, valid only for P202>=3) is generally used as an additional reference signal, for instance, in applications with a dancer. Refer to Figure 6.25. It bypasses the accel/decel ramp.

☑ The option 2 (Maximum Torque Current) permits controlling the torque current limit P169, P170, through the analog input AI2. In this case P169, P170 will be Ready-Only-Parameters. See figure 6.26A. For this type of control, check if P160 (Type of Control) equal to one (Torque Control Regulator).

☑ When AI2 is set to maximum (P019 = 100%), the torque limit will be also maximum - P169/P170 = 180%.

☑ The option 3 (PID Process Variable) defines the input AI2 as feedback signal of the PID regulator (for instance: presure, temperature sensor, etc.), if P524=0.

P238
Analog Input AI2
Gain

0.000...9.999
[1.000]
0.001

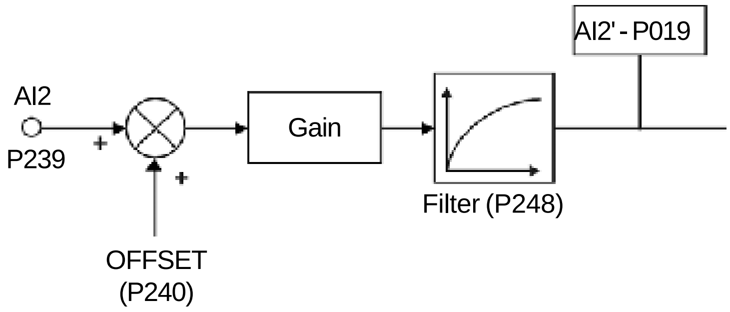


Figure 6.29 *- Block diagram of the Analog Input AI2*

☑ The internal value of AI2' is the result of the following equation:

$$AI2' = (AI2 + \frac{OFFSET}{100} \text{ x } 10V) \text{ x Gain}$$

For example: AI2 = 5V, OFFSET = -70% and Gain = 1.00:

$$AI2' = (5 + \frac{(-70)}{100} \text{ x } 10V) \text{ x } 1 = -2V$$

AI2' = -2V, means that the motor runs in reverse direction reference equal to 2V

P239
Analog Input AI2
Signal
(1)

0...3
[0]
-

P239	Input AI2 Signal
0	0...10V/0...20mA
1	4...20mA
2	10...0V/20...0mA
3	20...4mA

☑ When a current signal is used at the Analog Input AI2, set the switch S1.1 on the control board to “ON”.

☑ Options 2 and 3 provide an inverse reference with which is possible to have maximum speed with minimum reference.When a current signal is used at the Analog Input AI2, set the switch S1.1 on the control board to “ON”.

☑ Options 2 and 3 provide an inverse reference with which is possible to have maximum speed with minimum reference.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td>P240
Analog Input AI2 Offset</td><td>-100...100
[0.0]
0.1%</td><td>☑Refer to P234.</td></tr>
<tr><td>P241
Analog Input AI3 Function (Isolated analog input on the optional board EBB. Refer to Chapter 8)
(1)</td><td>0...3
[0]
-</td><td>
<table>
<tr><th>P241</th><th>Input AI3 Function</th></tr>
<tr><td>0</td><td>P221/P222</td></tr>
<tr><td>1</td><td>After Ramp Reference</td></tr>
<tr><td>2</td><td>Maximum Torque Current</td></tr>
<tr><td>3</td><td>PID Process Variable</td></tr>
</table>
☑When the option 0 (P221/P222) is selected, AI3 may supply the speed reference (if set to do so at P221/P222), which is subject to the speed limits (P133, P134) and the acceleration/deceleration ramps (P100...P103). Refer to Figure 6.25.
☑The option 1 (After Ramp Reference, valid only for P202>=3) is generally used as an additional reference signal, for instance, in applications with a dancer. Refer to Figure 6.25. It bypasses the accel/decel ramp.
☑The option 2 (Maximum Torque Current) permits controlling the torque current limit P169, P170, through the analog input AI3. In this case P169, P170 will be Ready-Only-Parameters. See figure 6.26A. For this type of control, check if P160 (Type of Control) equal to one (Torque Control Regulator).
☑When AI3 is set to maximum (P020 = 100%), the torque limit will be also maximum - P169/P170 = 180%.
☑The option 3 (Process Variable) defines the inpout AI3 as feedback signal of the PID Regulator (for instance: pressure, temperature sensor, etc.), if P524=1.</td></tr>
<tr><td>P242
Analog Input AI3 Gain</td><td>0.000...9.999
[1.000]
0.001</td><td>☑ Refer to P234.</td></tr>
<tr><td>P243
Analog Input AI3 Signal
(1)</td><td>0...3
[0]
-</td><td>
<table>
<tr><th>P243</th><th>Input AI3 Signal</th></tr>
<tr><td>0</td><td>0...10V/0...20mA</td></tr>
<tr><td>1</td><td>4...20mA</td></tr>
<tr><td>2</td><td>10...0V/20...0mA</td></tr>
<tr><td>3</td><td>20...4mA</td></tr>
</table>
☑When a current signal is used at the Analog Input AI3, set the S4.1 switch on the EBB board to “ON”.
☑Options 2 and 3 provide an inverse reference with which is possible to have maximum speed with minimum reference.</td></tr>
<tr><td>P244
Analog Input AI3 Offset</td><td>-100...100
[0.0]
0.1%</td><td>☑ Refer to P234.</td></tr>
<tr><td>P245
Analog Input AI4 Gain (14 bit Analog Input of the optional board EBA. Refer to Chapter 8)</td><td>0.000...9.999
[1.000]
0.001</td><td>☑ Refer to P234.</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td>P246
Analog Input AI4 Signal
(1)</td><td>0...4
[0]
-</td><td>
<table>
<tr><th>P246</th><th>Input AI4 Signal</th></tr>
<tr><td>0</td><td>0...10V/0...20mA</td></tr>
<tr><td>1</td><td>4...20mA</td></tr>
<tr><td>2</td><td>10...0V/20...0mA</td></tr>
<tr><td>3</td><td>20...4mA</td></tr>
</table>
☑When a current signal is used at the Analog Input AI4, set the switch S2.1 on the EBA board to “ON”.
☑Options 2 and 3 provide an inverse reference with which is possible to have maximum speed with minimum reference.</td></tr>
<tr><td>P247
Analog Input AI4 Offset</td><td>-100...100
[0.0]
0.1%</td><td>☑Refer to P234.</td></tr>
<tr><td>P248
Filter Input AI2</td><td>0.0...16.0
[0.0]
0.1s</td><td>☑It sets the time constant of the RC Filter of the Input AI2 (see Figure 6.29)</td></tr>
<tr><td>P251
Analog Output AO1 Function</td><td>0...10
[2]
-</td><td>☑Check possible options on Table 6.3.
☑With factory default values (P251 = 2 and P252 = 1.000) AO1 = 10V when the motor speed is equal to the maximum speed defined at P134.
☑The AO1 output can be physically located on the control board CC9 (as a 0...10V output) or on the option board EBB (AO1I , as a 0(4) a 20mA output). Refer to Chapter 8.</td></tr>
<tr><td>P252
Analog Output AO1 Gain</td><td>0.000...9.999
[1.000]
0.001</td><td>☑Adjusts the gain of the AO1 analog output. For P252=1.000 the AO1 output value is set according to the description after figure 6.30.</td></tr>
<tr><td>P253
Analog Output AO2 Function</td><td>0...10
[5]
-</td><td>☑Check possible options on Table 6.3.
☑With factory default values (P253 = 5 and P254 = 1.000) AO2 = 10V when the output current is equal to 1.5 x P295.
☑The AO2 output can be physically located on the control board CC9 (as a 0...10V output) or on the option board EBB (AO2I , as a 0(4) a 20mA output). Refer to Chapter 8.</td></tr>
<tr><td>P254
Analog Output AO2 Gain</td><td>0.000...9.999
[1.000]
0.001</td><td>☑Adjusts the gain of the AO2 analog output. For P254=1.000 the AO2 output value is set according to the description after figure 6.30.</td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description / Notes
P255 Analog Output AO3 Function (Located on the Optional I/O Expansion Board EBA)	0...35 [2] -	☑Check possible options on Table 6.3. ☑With factory default values (P255 = 2 and P256 = 1.000) AO3 = 10V when the motor speed is equal to maximum speed defined at P134. ☑For more information about the Analog Output AO3, refer to Chapter 8.
P256 Analog Output AO3 Gain	0.000...9.999 [1.000] 0.001	☑Adjusts the gain of the AO3 analog output for P256=1.000 the AO3 output value is set according to the description after figure 6.30.
P257 Analog Output AO4 Function (Located on the Optional I/O Expansion Board EBA)	0...35 [5] -	☑Check possible options on Table 6.3. ☑For factory default values (P257 = 5 and P258 = 1.000) AO4 = 10V when the output current is equal to 1.5 x P295. ☑For more information about the AO4 output, refer to Chapter 8.
P258 Analog Output AO4 Gain	0.000...9.999 [1.000] 0.001	☑Adjusts the gain of the AO4 analog output for P258=1.000 the AO4 output value is set according to the description after figure 6.30.

	Speed Reference	Total Reference	Real Speed	Torque Reference [P202 = 3 or 4 (Vector)]	Torque Current [P202 = 3 o 4 (Vector)]	Output Current (with filter 0.3s)	PID Process Variable	Active Current [P202 = 0,1 or 2 (V/F)] (with filter 0.1s)	Power (kW) (with filter 0.5s)	PID Setpoint	Torque Positive [P202=3 or 4 (vector)]	Motor Torque	PLC	WEG Use
P251 (AO1)	0	1	2	3	4	5	6	7	8	9	10	11	12	-
P253 (AO2)	0	1	2	3	4	5	6	7	8	9	10	11	12	-
P255 (AO3)	0	1	2	3	4	5	6	7	8	9	10	11	12	13...37
P257 (AO4)	0	1	2	3	4	5	6	7	8	9	10	11	12	13...37

Table 6.3 *- Functions of the Analog Outputs*

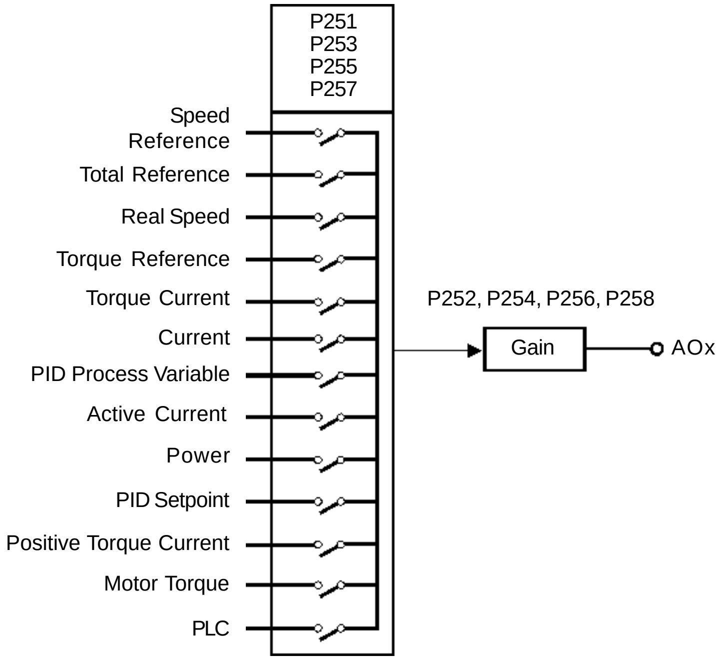


Figure 6.30 *- Block diagram of the Analog Outputs*

☑ Scale of the Analog Outputs indications:
Full scale = 10V: for outputs AO1 and AO2 located on the control board CC9 and AO3 and AO4 located on the optional board EBA;
Full scale = 20mA for the outputs AO1I and AO2I located on the optional board EBB.
Speed Reference (P001): Full scale = P134
Total Reference: Full scale = P134
Motor Speed (P002): Full scale = P134
Torque Reference: Full scale = 2.0 x P295

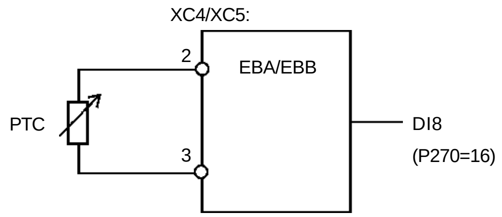
Parameter	Range [Factory Setting] Unit	Description / Notes
		Torque Current: Full scale = 2.0 x P295 Output Current: Full scale = 1.5 x P295 PID Process Variable: full scale = 1.0 x P528 Active Current: Full scale = 1.5 x P295 Power: Full scale = 1.5 x$\sqrt{3}$.P295 x P296 PID Setpoint: full scale = 1.0 x P528 Motor Torque: full scale = 2.0 x P295
P263 Digital Input DI1 Function (1)	0...3 [1 (Start/Stop)] -	
P264 Digital Input DI2 Function (1)	0...8 [0 (FWD/REV)] -	
P265 Digital Input DI3 Function (1) (8)	0...22 [0 (Not Used)] -	
P266 Digital Input DI4 Function (1)	0...22 [0 (Not Used)] -	
P267 Digital Input DI5 Function (1)	0...22 [3 (JOG)] -	
P268 Digital Input DI6 Function (1)	0...22 [6 (Ramp 2)] -	
P269 Digital Input DI7 Function (Located on the optional board EBA or EBB) (1)	0...22 [0 (Not Used)] -	
P270 Digital Input DI8 Function (Located on the optional board EBA or EBB) (1)	0...22 [0 (Not Used)] -	

☑Check possible options on Table 6.4 and details about each function's operation on Figure 6.30.

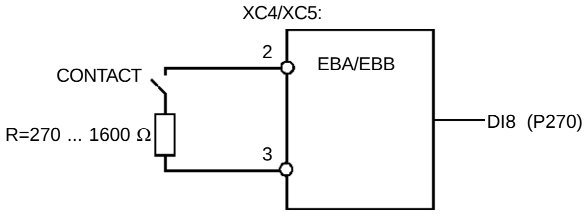
☑The status of the digital inputs can be monitored at Parameter P012.

☑Notes about the Digital Inputs Functions:

- **'Increase EP'** (Electronic Potentiometer) is active when DI3 or DI5 = +24V.
- **'Decrease EP'** (Electronic Potentiometer) is active when DI4 or DI6 = 0V.
- **'Local/Remote'** = 0V/24V at the digital input, respectively.
- **'Speed /Torque'** is valid for P202 = 3 and 4 (Vector Control Sensorless and Vector Control with encoder).
- **'Speed'** = DIx Open (0V), Torque = DIx Closed (+24V).
- When Torque is selected the speed regulators gains P161 and P162 are not used and changed to: Gp (Proportional Gain) = 1.00 and Gi (Integral Gain) = 0.00. Thus the Total Reference becomes the input of the Torque Regulator. Refer to Figure 6.26.
- When Speed is selected , the speed regulator gains are defined again by P161 and P162. In applications with torque control, proceed as described at P160.
- The Option **'DC Link Voltage Regulator'** must be used, when P150=2. See description of parameter P150.
- DI8 is designed to be used as **'Motor Termistor'** (PTC) input in the option boards EBA/EBB:



If DI8 should be used as normal digital input, program the parameter P270 to the required function and connect a resistor between 270 and 1600 in series with the input 4, as indicated below:



CONTACT	DI8
OPEN	DEACTIVATED
CLOSED	ACTIVATED

Parameter	Range [Factory Setting] Unit	Description / Notes

☑ The function **'Loads user via DIx'**, permits the memory selection of the user 1 or 2, process similar to P204=7 and P204=8, but the user is loaded from the transition of a DIx programmed for this function.
The memory of user 1 is loaded, when the DIx status changes from low level to high level (transition from 0 Volt to 24 Volt) and P265...P269=20, provided the current parameter contents of the inverter have been transferred previously to the parameter memory 1 (P204=10).
The memory of user 2 is loaded, when the DIx status changes from high level to low level (transition from 24 Volt to 0 Volt) and P265...P269=20, provided the current parameter contents of the inverter have been transferred previously to the parameter memory 2 (P204=11).

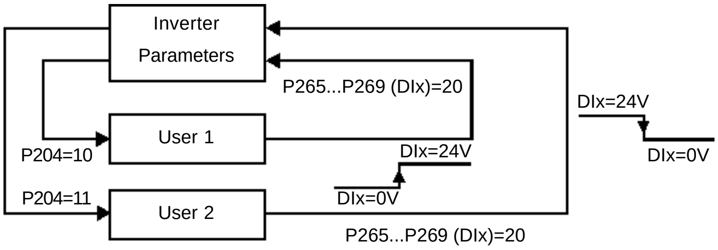


***Figure 6.31** - Details about the operation of the function load user via DIx*

NOTE!

☑ Ensure that when using this function, the parameter sets (User Memory 1 and 2) are totally compatible with the used installations (motors, ON/OFF commands, etc.).

☑ User memory cannot be loaded when motor is enabled.

When two different motor parameter sets are saved into the User
☑ Memory 1 and 2, respectively, set for each user the correct values at the Parameters P156, P157 and P158.

☑ When the function **'Parameter Setting Disable'** is programmed and the DIx input is +24V, the parameters cannot be changed, independent of the values that have been set at P000 and P200. When the Dix input is set to 0V, the parameter changing will be conditioned to the values set at P000 and P200.

☑ The function **'Timer RL2 and RL3'.** This Timer enables and disables the Relays 2 and 3 (RL2 e RL3).
When the timing function of the relays 2 and 3 is programmed at any DIx, and when is effected the transition from 0Volt to 24Volts, the relay will be enabled according to the time set at P283 (RL2) or P285 (RL3). When the transition from 24Volts to 0Volt occurs, the programmed relay will be disabled according to the time set at P284(RL2) or P286(RL3).
After the DIx transition, to enable or disable the programmed relay, it is required that the Dix remains in on/off status during the time set at parameters P283/P285 and P284/P286. Otherwise the relay will be reset. See figure 6.32.
Note: For this function, program P279 and/or P280 = 28 (Timer).

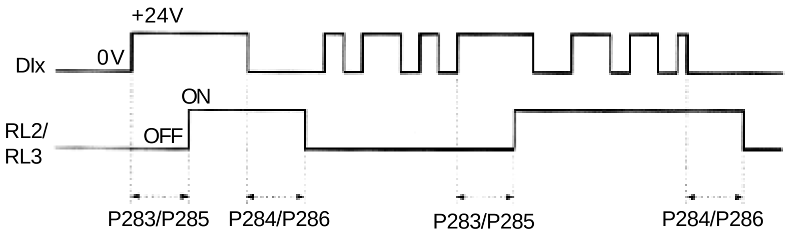


Figura 6.32 *- Operation of the function of the Timers RL2 and RL3*

Parameter (Input) / Function	P263 (DI1)	P264 (DI2)	P265 (DI3)	P266 (DI4)	P267 (DI5)	P268 (DI6)	P269 (DI7)	P270 (DI8)
Not Used	0	-	0, 7 and 16	0 and 16	0 and 16	0 and 16	0, 5, 7 and 16	0, 5 and 7
Start/Stop	1	-	-	-	-	-	-	-
General Enable	2	-	2	2	2	2	2	2
Fast Stop	3	-	-	-	8	8	8	8
FWD/REV	-	0	-	-	-	-	-	-
Local/Remote	-	1	1	1	1	1	1	1
JOG	-	-	3	3	3	3	3	3
No external Fault	-	-	4	4	4	4	4	4
Increase EP	-	-	5	-	5	-	-	-
Decrease EP	-	-	-	5	-	5	-	-
Ramp 2	-	-	6	6	6	6	6	6
FWD Run	-	-	8	-	-	-	-	-
REV Run	-	8	-	8	-	-	-	-
Speed/Torque	-	-	9	9	9	9	9	9
JOG+	-	-	10	10	10	10	10	10
JOG-	-	-	11	11	11	11	11	11
Reset	-	-	12	12	12	12	12	12
Fieldbus	-	-	13	13	13	13	13	13
Start (3 wire)	-	-	14	-	14	-	14	-
Stop (3 wire)	-	-	-	14	-	14	-	14
Multispeed (MSx)	-	-	-	7	7	7	-	-
Manual/Automatic	-	-	15	15	15	15	15	15
Motor Thermistor	-	-	-	-	-	-	-	16
Disables Flying Start	-	-	17	17	17	17	17	17
DC Link Voltage Regulator	-	-	18	18	18	18	18	18
Parameter Setting Disable	-	-	19	19	19	19	19	19
Load User	-	-	20	20	20	20	20	-
Timer RL2	-	-	21	21	21	21	21	21
Timer RL3	-	-	22	22	22	22	22	22

Table 6.4 *- Functions of the Digital Inputs*

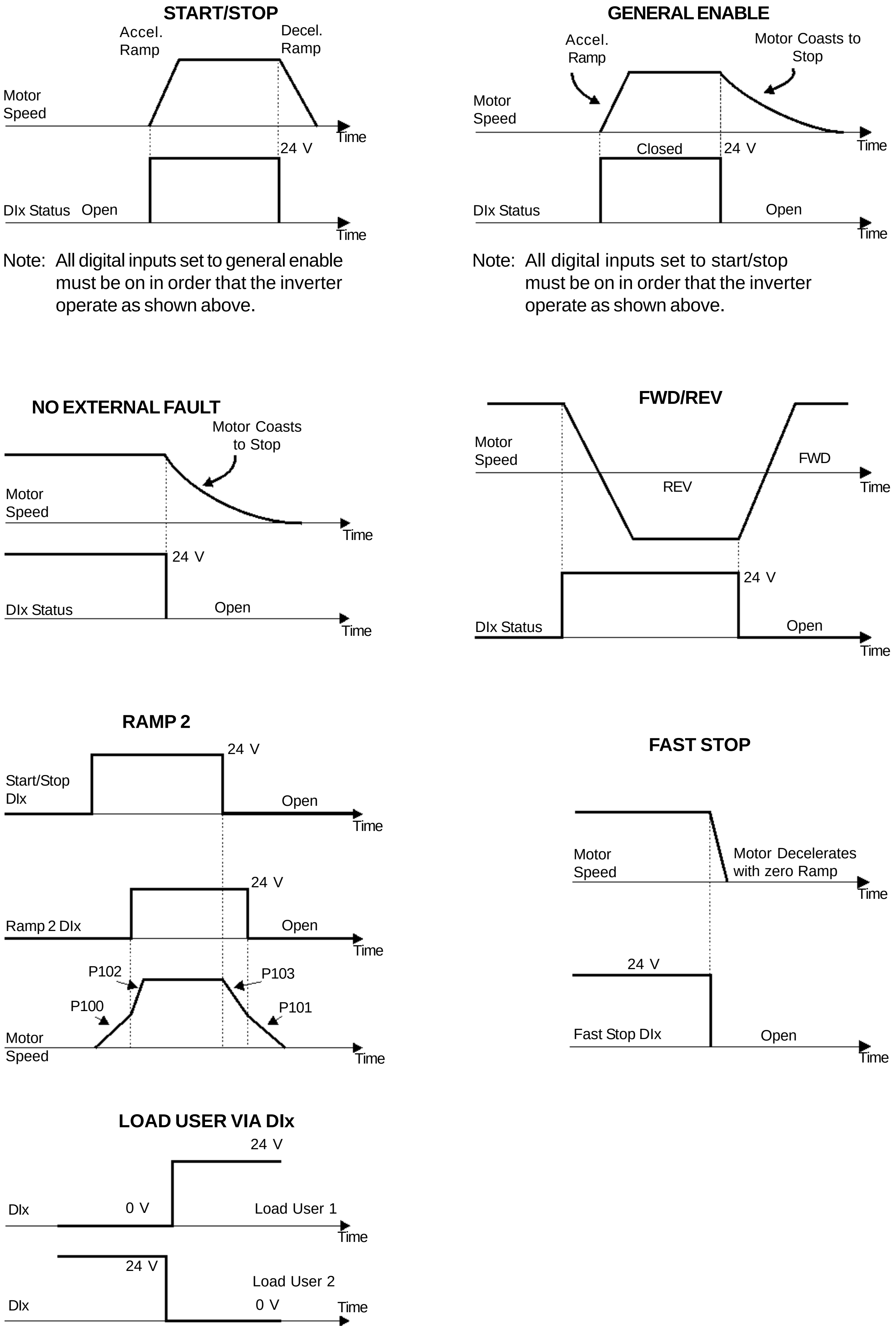
NOTES!

☑ For the function Start/Stop enable, program also P224 and/or P227 = 1.

☑ The selection P265 or P267=5 and P266 or P268=5 (EP) requires that P221 and/or P222 = 7.

☑ The selection of P266 and/or P267 and or P268 = 7 requires that P221 and/or P222=8.

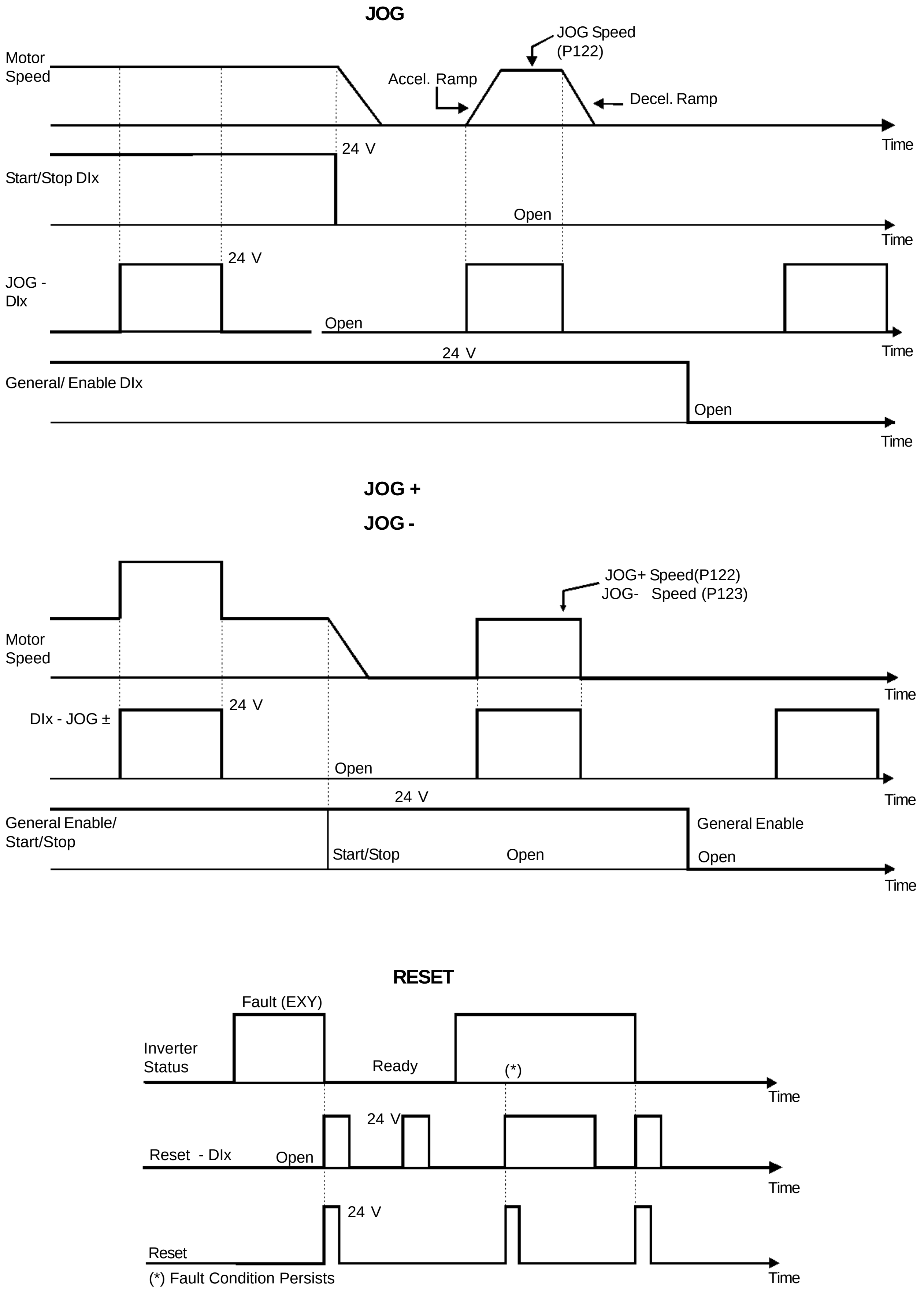
☑ The functions JOG+ and JOG- are valid only for P202 ≥ 3.



Note: All digital inputs set to general enable must be on in order that the inverter operate as shown above.

Note: All digital inputs set to start/stop must be on in order that the inverter operate as shown above.

Figure 6.33 *- Details about the function of the Digital Inputs*


JOG

JOG +

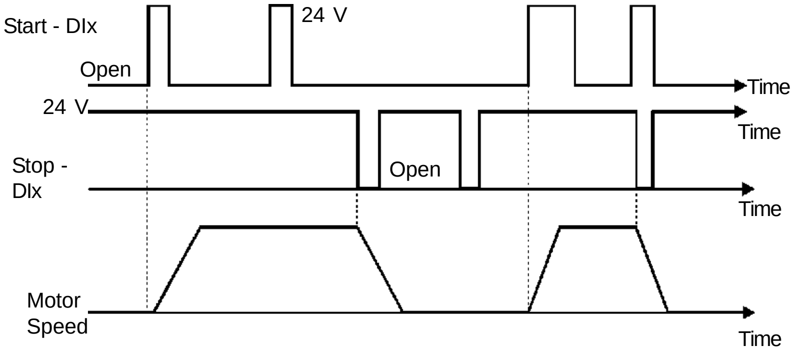
JOG -

RESET

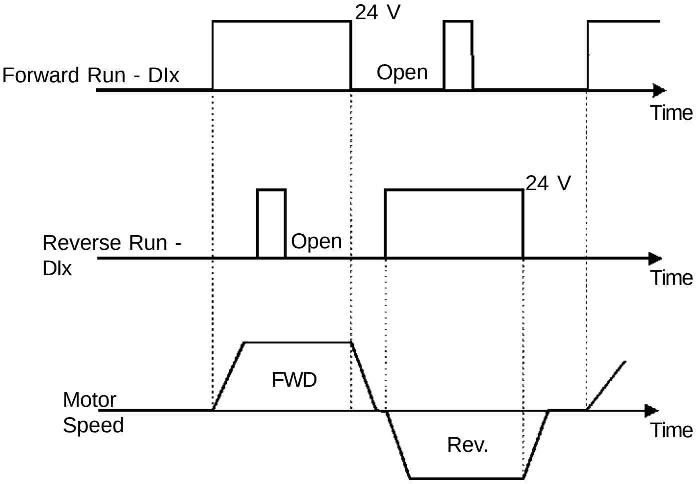
(*) Fault Condition Persists

Figure 6.33 *- Details about the function of the Digital Inputs (cont.)*

3 WIRE START / STOP



FORWARD RUN / REVERSE RUN



ELECTRONIC POTENTIOMETER (EP)

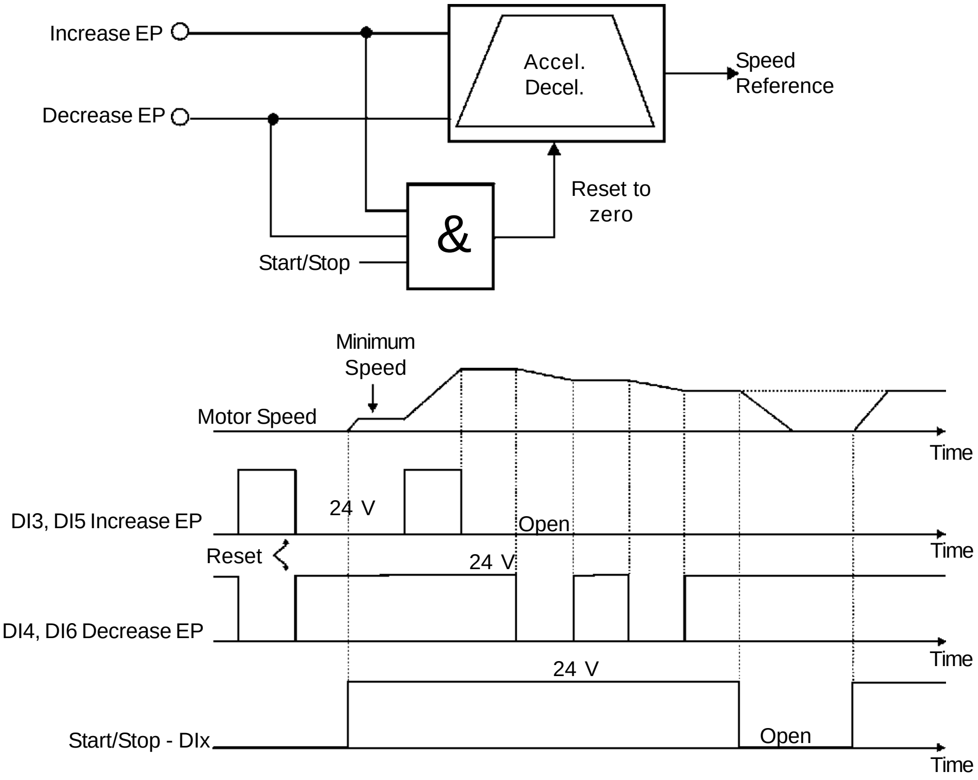


Figure 6.33 *- Details about the function of the Digital Inputs (cont.)*

Parameter	Range [Factory Setting] Unit	Description / Notes
P275 Digital Output DO1 Function (located on the Optional I/O Expansion Board EBA or EBB) (1)	0...29 [0 (Not Used)] -	☑Check possible options on Table 6.5 and details about each function's operation on Figure 6.34. ☑The status of the Digital Outputs can be monitored at Parameter P013. ☑The Digital Output will be activated when the condition stated by it's function becomes true. In case of a Transistor Output, 24Vdc will be applied to the load connected to it. For a Relay Output, the relay will pick up when the output is activated. ☑Additional Notes about the Digital Output Functions: - **Remote:** Inverter is operating in Remote mode. - **Run:** Inverter is enabled (the IGBTs are switching, the motor may be at any speed, including zero). - **Ready:** Inverter neither is in fault non in undervoltage condition. - **No Fault:** Inverter is not in any fault condition. - "With Error" means that the inverter is disabled due to some error. - **No E00:** Inverter is not in an E00 fault condition. - **No E01+E02+E03:** Inverter is not in an E01 or E02 or E03 fault condition. - **No E04:** Inverter is not in an E04 fault condition. - **No E05:** Inverter is not in an E05 fault condition. - **4 ... 20mA OK:** If applicable, the 4 to 20 mA current reference is present. - **Zero Speed:** Motor speed is lower than the value set at P291 (Zero Speed Zone) - **Not Used:** Digital Output remains inactive. - **Forward:** Motor is running forward. - **Torque > Tx and Torque < Tx:** Valid only for P202 = 3 or 4 (Vector Control). Torque corresponds to motor Torque as indicated in Parameter P009. - **Ride-Through:** means that the inverter is executing the Ride-Through function. - **Pre-charge OK:** means that the DC-Link voltage is higher than the pre-charge voltage level. - **N > Nx and Nt > Nx:** (this option works only for P202=4 - Vector with Encoder Control) means that both conditions must be satisfied in order that DOx = Saturated Transistor and/or RLx= relay picked up. The Digital Outputs will come back to its OFF state, that is, DOx = Cut-off Transistor and/or RLx = released relay, when only **N>Nx** condition is not satisfied (that is, independent of **Nt>Nx** condition).
P276 Digital Output DO2 Function (located on (the Optional I/O Expansion Board EBA or EBB) (1)	0...29 [0 (Not Used)] -	
P277 Relay Output RL1 Function (1)	0...29 [13 (No Fault)] -	
P279 Relay Output RL2 Function (1)	0...29 [2 (N>Nx)] -	
P280 Relay Output RL3 Function (1)	0...29 [1 (N*>Nx)] -	

Parameter	Range [Factory Setting] Unit	Description / Notes

☑ Symbols used in the Digital Output functions:
N = P002 (Motor speed)
N* = P001 (Frequency Reference)
Nx = P288 (Speed Nx) - User selected speed reference point.
Ny = P289 (Speed Ny) - User selected speed reference point.
Ix = P290 (Current Ix) - User selected current reference point.
Is = P003 (Motor Current)
Torque = P009 (Motor Torque)
Tx = P293 (Torque Tx) - User selected torque reference point.
Vpx = P533 (Process Variable x) - User selected reference point.
Vpy = P534 (Process Variable y) - User selected reference point.
Nt = Total Reference (See Figure 6.25) after all scalings, offsets, additions, etc.
Hx = P294 (Hours Hx)
PLC= See PLC board manual

Parameter (Output) / Function	P275 (DO1)	P276 (DO2)	P277 (RL1)	P279 (RL2)	P280 (RL3)
Not Used	0 and 27	0 and 27	0	0	0
N* > Nx	1	1	1	1	1
N > Nx	2	2	2	2	2
N < Ny	3	3	3	3	3
N = N*	4	4	4	4	4
Zero Speed	5	5	5	5	5
Is > Ix	6	6	6	6	6
Is < Ix	7	7	7	7	7
Torque > Tx	8	8	8	8	8
Torque < Tx	9	9	9	9	9
Remote	10	10	10	10	10
run	11	11	11	11	11
ready	12	12	12	12	12
No Fault	13	13	13	13	13
No E00	14	14	14	14	14
No E01+E02+E03	15	15	15	15	15
No E04	16	16	16	16	16
No E05	17	17	17	17	17
4...20 mA OK	18	18	18	18	18
Fieldbus	19	19	19	19	19
FWD	20	20	20	20	20
Proc. Var. >VPx	21	21	21	21	21
Proc. Var. >VPy	22	22	22	22	22
Ride-Through	23	23	23	23	23
Pre-charge OK	24	24	24	24	24
With error	25	25	25	25	25
Enabled Hours > Hx	26	26	26	26	26
PLC	-	-	27	27	27
Timer	-	-	-	28	28
N > Nx and Nt > Nx	29	29	29	29	29

Table 6.5 *- Functions of the Digital Outputs and Relay Outputs*

Parameter	Range [Factory Setting] Unit	Description / Notes
P283 Time for RL2 ON	0.0...300 [0.0] 0.1s	☑Used in the function as Relay Output: Timer of the relay 2.
P284 Time for RL2 OFF	0.0...300 [0.0] 0.1s	☑Used in the function as Relay Output: Timer of the relay 2.
P285 Time for RL3 ON	0.0...300 [0.0] 0.1s	☑Used in the function as Relay Output: Timer of the relay 3.
P286 Time for RL3 OFF	0.0...300 [0.0] 0.1s	☑Used in the function as Relay Output: Timer of the relay 3.

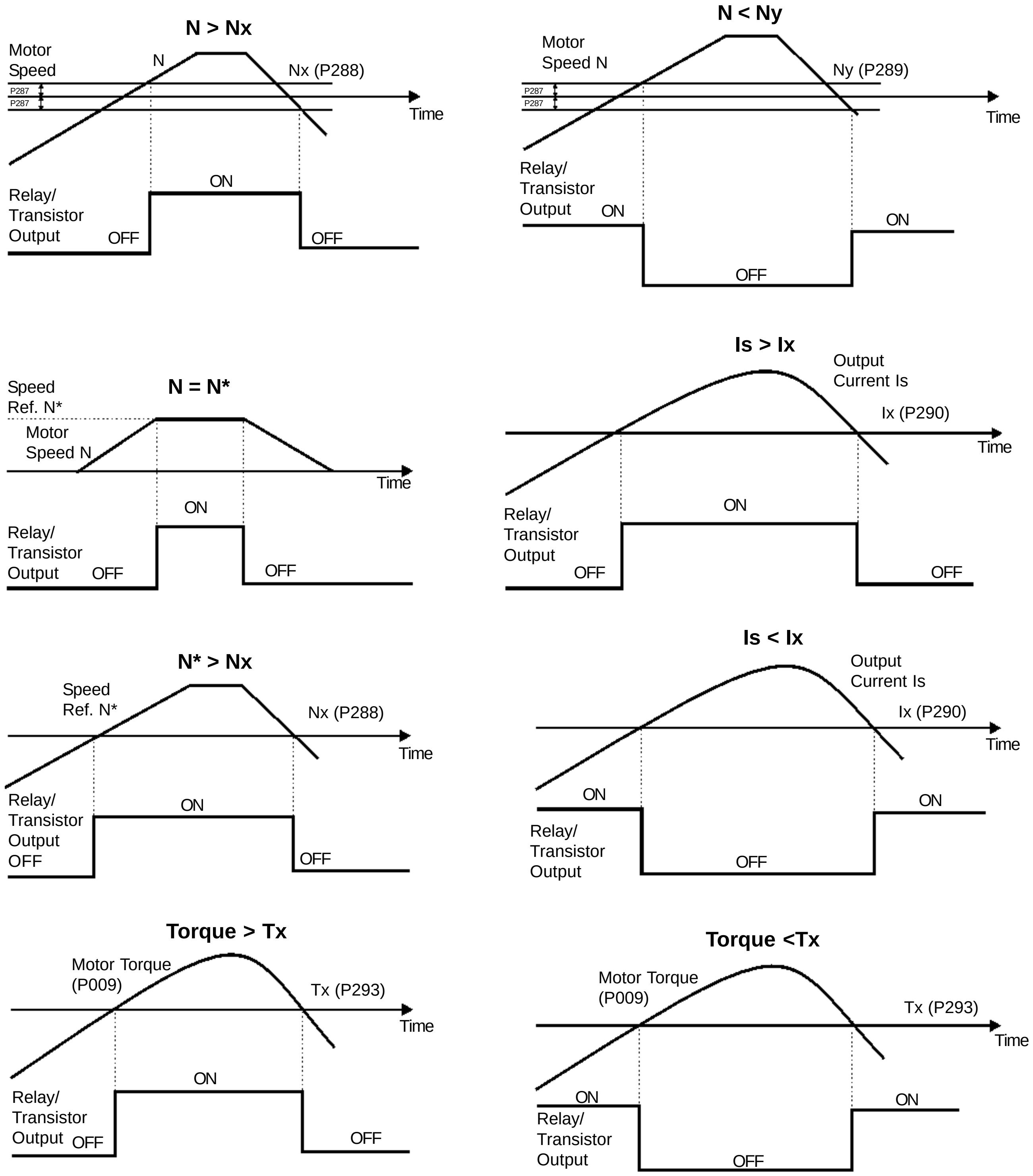
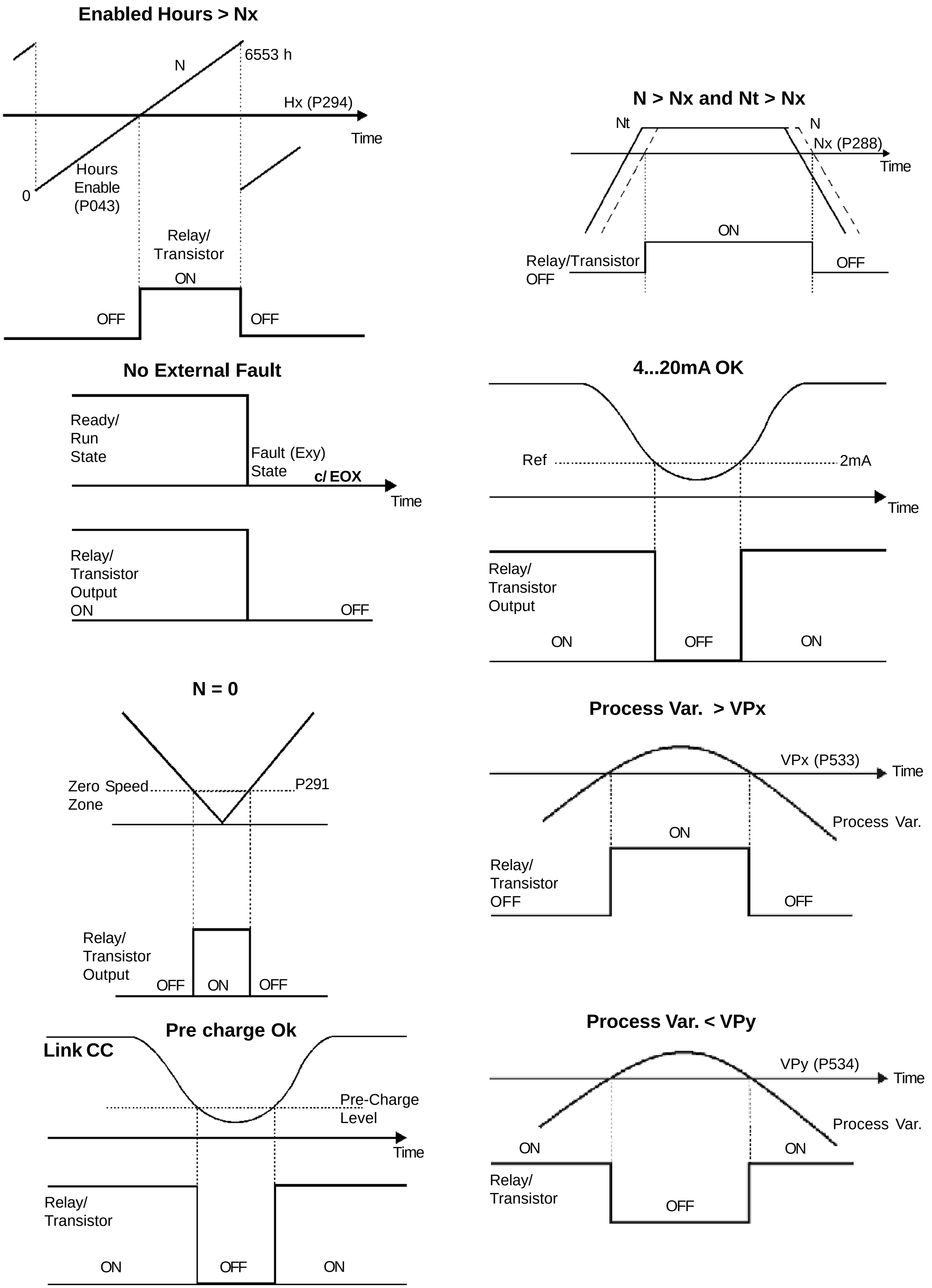


***Figure 6.34** - Details about the operation of the Digital Output Functions*



Enabled Hours > Nx

N > Nx and Nt > Nx

No External Fault

4...20mA OK

N = 0

Process Var. > VPx

Pre charge Ok

Process Var. < VPy

***Figure 6.34** - Details about the operation of the Digital Output Functions (cont.)*

Parameter	Range [Factory Setting] Unit	Description / Notes
P287 Hysteresis for Nx/Ny	0...5% [1.0] 0.1	☑ Used by the Digital and Relay Outputs functions: N > Nx and N < Ny.
P288 Nx Speed (2)	0...P134 [120 (100)] (11) 1rpm	☑ Used by the Digital and Relay Outputs functions: N* > Nx, N > Nx and N < Ny.
P289 Ny Speed (2)	0...P134 [1800 (1500)] (11) 1rpm	
P290 Ix Current (7)	0.0...2.0xP295 [1.0xP295] 0.1A(<100)-1A(>99.9)	☑ Used by the Digital and Relay Outputs functions: Is > Ix and Is < Ix.
P291 Zero Speed Zone	1...100 [1] 1%	☑ Used by the Digital and Relay Outputs function Zero Speed and the Zero Speed Disable (Refer to P211 and P212).
P292 N=N* Band (At Speed Band)	1...100 [1] 1%	☑ Used by the Digital and Relay Outputs function N = N* (At Speed).
P293 Tx Torque	0...200 [100] 1%	☑ Used by the Digital and Relay Outputs functions Torque > Tx and Torque < Tx. In this output mode, the motor torque indicated in parameter P009 is compared with the value programmed in P293.
P294 Hours Hx	0...6553h [4320] 1.0	☑ Used in the functions of the digital outputs Hours Enabled higher than Hx.
P295 Inverter Rated Current (1)	0...65 [According to the CFW-09 rated current] -	0=3.6A; 1=4.0A; 2=5.5A; 3=6.0A; 4=7.0A; 5=9.0A; 6=10.0A; 7=13.0A; 8=16.0A; 9=24.0A; 10=28.0A; 11=30.0A; 12=38.0A; 13=45.0A; 14=54.0A; 15=60.0A; 16=70.0A; 17=86.0A; 18=105.0A; 19=130.0A; 20=142.0A; 21=180.0A; 22=240.0A; 23=361.0A; 24=450.0A; 25=600.0A; 26=200.0A; 27=230.0A; 28=320.0A; 29=400.0A; 30=570.0A; 31=700.0A; 32=900.0A; 33=686.0A; 34=855.0A; 35=1140.0A; 36=1283.0A; 37=1710.0A; 38=2.0A; 39=2.9A; 40=4.2A; 41=12.0A; 42=14.0A; 43=22.0A; 44=27.0A; 45=32.0A; 46=44.0A; 47=53.0A; 48=63.0A; 49=79.0A; 50=100.0A; 51=107.0A; 52=127.0A; 53=147.0A; 54=179.0A; 55=211.0A; 56=225.0A; 57=247.0A; 58=259.0A; 59=305.0A; 60=315.0A; 61=340.0A; 62=343.0A; 63=418.0A; 64=428.0A; 65=472.0A; 66=33.0 A; 67=312.0 A; 68=492.0 A; 69=515.0 A; 70=580.0 A; 71=646.0 A; 72=652.0 A; 73=794.0 A; 74=813.0 A; 75=869.0 A; 76=897.0 A; 77=969.0 A; 78=978.0 A; 79=1191.0 A; 80=1220.0 A; 81=1345.0 A.
P296 Inverter Rated Voltage (1) (11)	0...8 [0 for models 220-230V 3 for models 380-480V 6 for models 500-600V and 500-690V 8 for models 600-690V] -	

P296	Inverter Rated Voltage
0	220V/230V
1	380V
2	400V/415V
3	440V/460V
4	480V
5	500V/525V
6	550V/575V
7	600V
8	660V/690V

⚠ ATTENTION!

☑ Set P296 according to the AC line voltage!

☑ For CFW-09 models with rated current ≥ 86A and rated voltage of 380V to 480V, also adjust the voltage selection jumper (Refer to Section 3.2.3).

Parameter	Range [Factory Setting] Unit	Description / Notes
P297 Switching Frequency (1) (2)	0...3 [2 (5.0 kHz)] -	See below

P297	Switching Frequency
0	1.25 kHz
1	2.5 kHz
2	5.0 kHz
3	10.0 kHz

☑ The rated switching frequency for each model is shown in item 9.1. When a higher switching frequency is used, it is necessary to derate the output current as specified in item 9.1 note 3.

☑ The switching frequency is a compromise between the motor acoustic noise level and the inverter IGBTs losses. Higher switching frequencies cause lower motor acoustic noise level, but increase the IGBTs losses, increasing drive components temperature, thus reducing their useful life.

☑ The predominant frequency on the motor is twice the switching frequency programmed at P297.
P297 = 5.0 kHz results in an audible motor noise corresponding to 10.0 kHz. This is due to the PWM technique used.
A reduction of the switching frequency also:
- Helps reducing instability and resonance problems that may occur in certain application conditions.- Reduces the leakage currents to ground, which may avoid nuisance E11 (Output Ground Fault).

☑ The option 1.25kHz is not valid for the Vector Control (P202=3 or 4).

☑ The option 10kHz is not valid for the Sensorless Vector Control (P202=3) and for the models with supply voltage between 500 and 690V (2.9...79A/ 500-600V, 107...472A/500-690V and 100...428A/660-690V).

Parameter	Range [Factory Setting] Unit
P300 DC Braking Time [only for P202= 0, 1 or 2 (V/F Control)]	0.0...15.0 [0.0] 0.1s
P301 DC Braking Start Speed [only for P202=0, 1 or 2 (V/F control)]	0...450 [30] 1rpm
P302 DC Braking Voltage [only for P202= 0, 1 or 2 (V/F Control)]	0.0...10.0 [0.0] 0.1%

☑ The DC braking feature provides a motor fast stop via DC current injection.

☑ The DC voltage, or indirectly the braking torque, can be adjusted in P302 (0 to 10% of the AC supply voltage). This adjustment can be made by increasing the value of P302 gradually until the desired braking torque is reached.

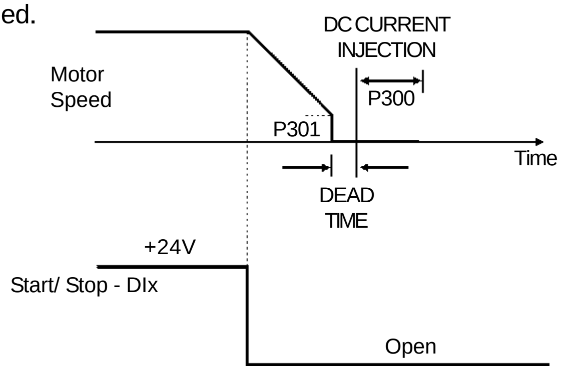


***Figure 6.35**- DC Brake after ramp disabling (ramp disabling)*

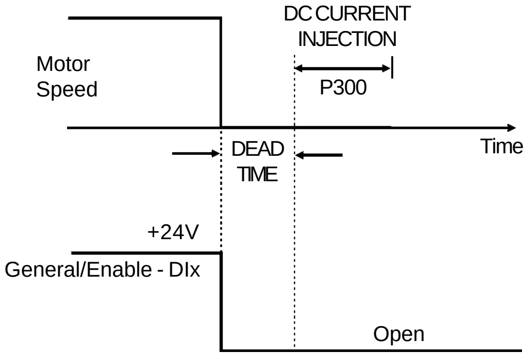


***Figure 6.36** - DC Brake during general disabling*

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description / Notes</th></tr>
<tr><td></td><td></td><td>☑ Before DC braking starts, there is a “Dead Time” (motor runs freely), required for motor demagnetization. This time is a function of the motor speed at which DC braking occurs. During DC Braking the LED display flashes
☑ DC Braking does not act with P202=2 or 4 dCbr .
☑ 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 brakings of short times.</td></tr>
<tr><td>P303
Skip Speed 1

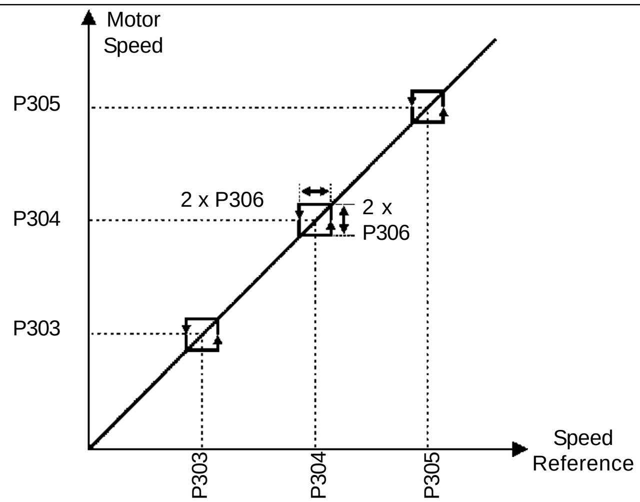
P304
Skip Speed 2

P305
Skip Speed 3

P306
Skip Band Range</td><td>P133...P134
[600]
1rpm

P133...P134
[900]
1rpm

P133...P134
[1200]
1rpm

0...750
[0]
1rpm</td><td>

<i>Figure 6.37 - “Skip Frequency” Curves</i>

☑ This feature prevents the motor from operating permanently at speeds where the mechanical system enters into resonance, causing high vibration or noise levels.
☑ The passage through the skip speed band (2xP306) is made at the programmed acceleration/deceleration rates.
☑ This Function does not operate properly when two skip speeds are overlapped.</td></tr>
<tr><td>P308
Serial Address
(1)</td><td>1...30
[1]
-</td><td>☑ Sets the address of the inverter for the serial communication. See item 8.13.</td></tr>
<tr><td>P309
Fieldbus
(1)</td><td>0...6
[0]
-</td><td>☑ 0 = Fieldbus inactive
☑ 1...6 = defines the Fieldbus standard to be used (Profibus DP or Device NET) or the number of variables to be exchanged with the master. See item 8.12.4.
☑ It is applicable only for the Profibus-DP kit (optional) or DeviceNet kit (optional).</td></tr>
<tr><td>P312
Type of Serial Protocol</td><td>0...9
[0]
-</td><td><table>
<tr><th>P312</th><th>Type of Serial Protocol</th></tr>
<tr><td>0</td><td>WEG Protocol</td></tr>
<tr><td>1</td><td>Modbus-RTU, 9600 bps, no parity</td></tr>
<tr><td>2</td><td>Modbus-RTU, 9600 bps, odd parity</td></tr>
<tr><td>3</td><td>Modbus-RTU, 9600 bps, even parity</td></tr>
<tr><td>4</td><td>Modbus-RTU, 19200 bps, no parity</td></tr>
<tr><td>5</td><td>Modbus-RTU, 19200 bps, odd parity</td></tr>
<tr><td>6</td><td>Modbus-RTU, 19200 bps, even parity</td></tr>
<tr><td>7</td><td>Modbus-RTU, 38400 bps, no parity</td></tr>
<tr><td>8</td><td>Modbus-RTU, 38400 bps, odd parity</td></tr>
<tr><td>9</td><td>Modbus-RTU, 38400 bps, even parity</td></tr>
</table>
☑ It defines the protocol type used for the serial communication.</td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description / Notes

P313
Disabling with
E28/E29/E30

P313	Disabling with E28/E29/E30
0	Disable via Start/Stop
1	Disable via General Enable
2	Not used
3	Changes to LOC

☑ Defines the inverter behavior when the serial communication is inactive (causing error E28), when physical connection with the master of the Fieldbus is interrupted (causing error E29) or when the Fieldbus board is inactive (causing error E30). See item 8.12.5.3.

P314
Time for Serial
Watchdog Action

0.0...999.0s
[0.0]
-

P314	Time for serial watchdog action
0.0	Disable
0.1...999.0	Enable

☑ If the inverter does not receive any valid serial telegram after the time programmed at P314 has elapsed, the Fault Message E28 on the HMI and the inverter will return to the action programmed at P313 – Type of Disabling by E28/E29/E30.

☑ To enable the inverter to execute this action, the inverter commands must be programmed to the "Serial" option at the parameters P220...P228.

P320
Flying Start/Ride-Through
(1)

0...3
[0 (Inactive)]
-

☑ The Parameter P320 selects the use of the following functions:
- P320 = 1, only Flying Start is active [valid for P202=0,1 or 2 (V/F Control) only];
- P320 = 3, only Ride-Through is active;
- P320 = 2, Flying Start and Ride-Through are active [valid for P202=0,1 or 2 (V/F Control) only];
- P320 = 0, Inactive;

☑ The activation of the Ride-Through function can be visualized at the outputs DO1, DO2, RL1, RL2 and/or RL3 (**P275, P276, P277**, **P279 and/or P280**) provided they are also programmed to "23=Ride-Through";

NOTE!
When one of the functions, Ride-Through or Flying Start is activated, the parameter P214 (Line Phase Loss Detection) is automatically set to 0=off.

NOTE!
This parameter works together with P321, P322, P323, P325, P326 for Ride-Through in Vector Control, and with P331, P332 for V/F Control Ride-Through and Flying-Start.

P321
Ud Line Loss Level
(6)

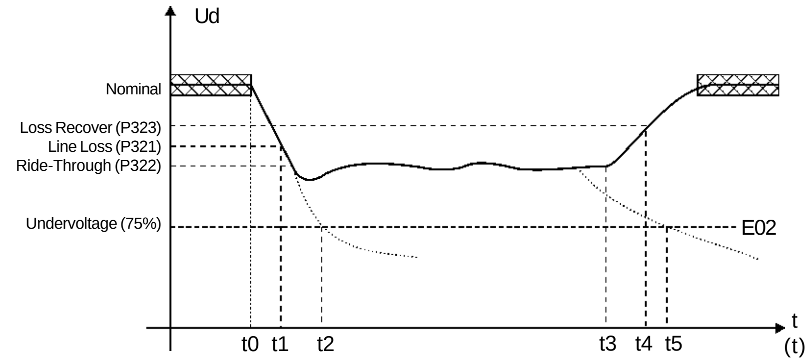
This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)

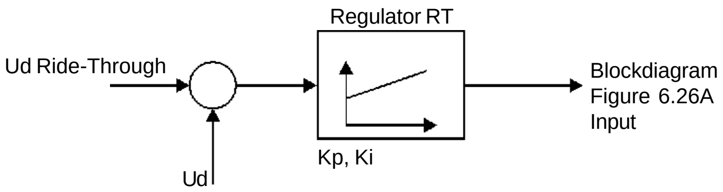
178 V ... 282 V
(P296=0)
[252 V]
1V
307 V ... 487 V
(P296=1)
[436 V]
1V
324 V ... 513 V
(P296=2)
[459 V]
1V

Actuation with P202=3 or 4 (Vector Control):

☑ The purpose of the Ride-Through function, in Vector mode (P202 = 3 or 4), is to ensure that the inverter maintains the motor running during the line loss, not allowing interruption or fault storing. The energy required for motor running is obtained from the kinetic energy of the motor (inertia) during its deceleration. As soon as the line is reestablished, the motor accelerates again to the speed defined by the reference.

☑ After line loss (t0), the DC link voltage (Ud) starts to decrease in a rate that depends on the motor load condition and may reach the undervoltage level (t2), if the Ride-Through function is not operating. The time required for this condition, typical for rated load, situates in a range from 5 to 15 ms;

Parameter	Range [Factory Setting] Unit	Description / Notes
	356 V ... 564 V (P296=3) [505V] 1V 388 V ... 615 V (P296=4) [550V] 1V 425 V ... 674 V (P296=5) [602V] 1V 466 V ... 737 V (P296=6) [660V] 1V 486 V ... 770 V (P296=7) [689V] 1V 559 V ... 885 V (P296=8) [792V] 1V	☑ With Ride-Through function active, the line loss is detected when Ud voltage becomes lower than the “Ud line loss” value (t1). The inverter immediately starts a controlled motor deceleration, regenerating the energy into the DC link and thus maintaining the motor running, where the Ud voltage is regulated to the “Ud Ride-Through” value. ☑ If the line loss is not recovered, the motor remains in this condition as long as possible (depending on the energy equilibrium), until the undervoltage condition (E02 at t5) occurs. If the line loss is recovered (t3) before the undervoltage condition, the inverter detects its reestablishment when the Ud voltage reaches the “Ud Loss Recover” level (t4). Then the motor is accelerated according to the set ramp, from the current speed value up to the value defined by the active speed reference. **NOTE!** **Cares with Application:** ☑ The use of the line reactance is mandatory to limit the inrush current when the network is reestablished. ☑ Due to the same reason, use overdimensioned UR-fuses or normal fuses. **NOTE!** The function Ride-Trough in Vector Mode is not available in the models 107A to 472A/500-690V and 100 to 428A/660-690 line.
P322 Ud Ride-Through (6) **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	178 V ... 282 V (P296=0) [245 V] 1V 307 V ... 487 V (P296=1) [423V] 1V 324 V ... 513 V (P296=2) [446 V] 1V 356 V ... 564 V (P296=3) [490 V] 1V 388 V ... 615 V (P296=4) [535 V] 1V 425 V ... 674 V (P296=5) [588V] 1V 466 V ... 737 V (P296=6) [644V] 1V	 ***Figure 6.38*** *- Actuation of the Ride-Through function in Vector Control mode* ☑ t0 - Line loss; ☑ t1 - Line loss detection; ☑ t2 - Trip by Undervoltage (E02 without Ride-Through); ☑ t3 - Line Recover; ☑ t4 - Line Recover detection; ☑ t5 - Trip by Undervoltage (E02 with Ride-Through);

Parameter	Range [Factory Setting] Unit	Description / Notes
	486 V ... 770 V (P296=7) [672V] 1V 559 V ... 885 V (P296=8) [773V] 1V	
P323 Ud Loss Recover Level (6) ☞ **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	178 V ... 282 V (P296=0) [267 V] 1V 307 V ... 487 V (P296=1) [461 V] 1V 324 V ... 513 V (P296=2) [486 V] 1V 356 V ... 564 V (P296=3) [534 V] 1V 388 V ... 615 V (P296=4) [583 V] 1V 425 V ... 674 V (P296=5) [638V] 1V 466 V ... 737 V (P296=6) [699V] 1V 486 V ... 770 V (P296=7) [729V] 1V 559 V ... 885 V (P296=8) [838V] 1V	
P325 Ride-Through Proportional Gain ☞ **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.0 ... 63.9 [22.8] 0.1	 ***Figure 6.39*** *- Ride-Through PI Controller*

Parameter	Range [Factory Setting] Unit	Description / Notes
P326 Ride-Through Integral Gain **☞ This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.000 ... 9.999 [0.128] 0.001	☑ Normally the factory setting for P325/P326 is adequate for most applications. Please do not change these parameters.
P331 Voltage Ramp	0.2...10.0 [2.0] 0.1s	<u>Actuation with P202=0, 1 or 2 (V/F Control):</u> ☑ Parameter P331 sets the time required for the output voltage starting from 0V and reaching the rated voltage; ☑ The Flying Start function allows the motor start when it is still running. This function acts only when the inverter is enabled. During the start, the inverter will impose the speed reference, following a voltage ramp with time defined at P331; ☑ It is possible to disable the Flying Start function even with P320=1 or 2. To do this, set only one of the Digital Inputs (DI3 ... DI8) to 17 =Disables Flying Start and apply (+24V) during the motor start; ☑ The parameter P332, used for the Ride-Through function, sets the minimum time which the inverter will wait to restart the motor after voltage re-establishment. This time is computed from the line loss and is required for the motor demagnetization. Set this time at two times the motor rotor constant, as shown in Table of Item 6, P412. This time is also used in the start with Flying Start. ☑ The Ride-Through function permits the inverter recovery, without disabling by E02 (undervoltage), when the line loss occurs. The inverter will indicate E02, if the line loss is longer than 2.0s, for P332 $\leq$1.0 s, or two times the set time at P332, for P332 > 1.0 s; ☑ If this function is enabled and if a line loss occurs and the DC link voltage becomes lower than the permitted voltage level, the output pulses will be disabled (motor runs freely). If the line is re-established, the inverter will again enable the pulses, imposing the speed reference following a voltage ramp with time defined at P331. Refer to Figure 6.40; ☑ The Flying Start function is disabled when P202=3 or 4.
P332 Dead Time **☞ These parameters (P331 and P332) are only displayed when P202 = 0, 1 or 2 (V/F Control)**	0.0...10.0 [1.0] 0.1s	

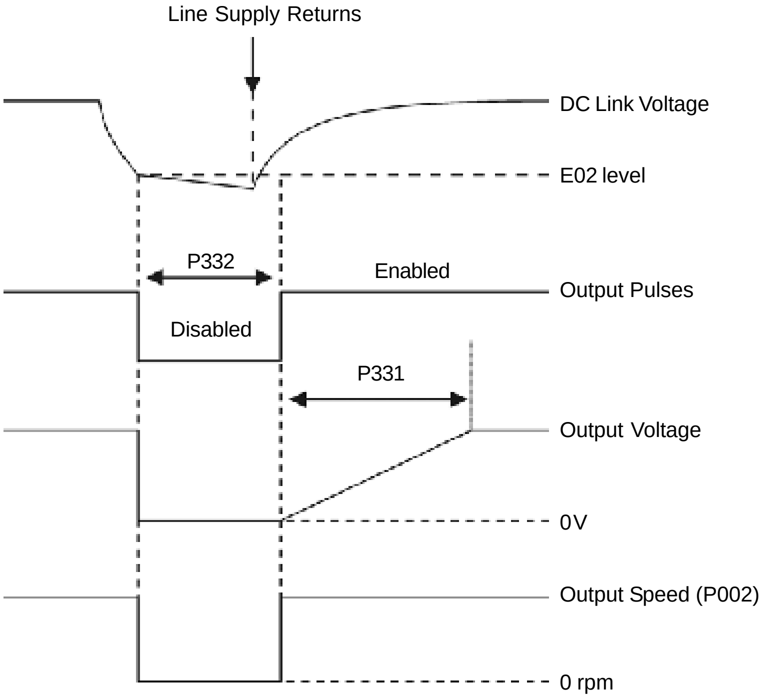


Figure 6.40A - *Ride-Through actuation (Line returns before time set at P332 elapses) in V/F mode*

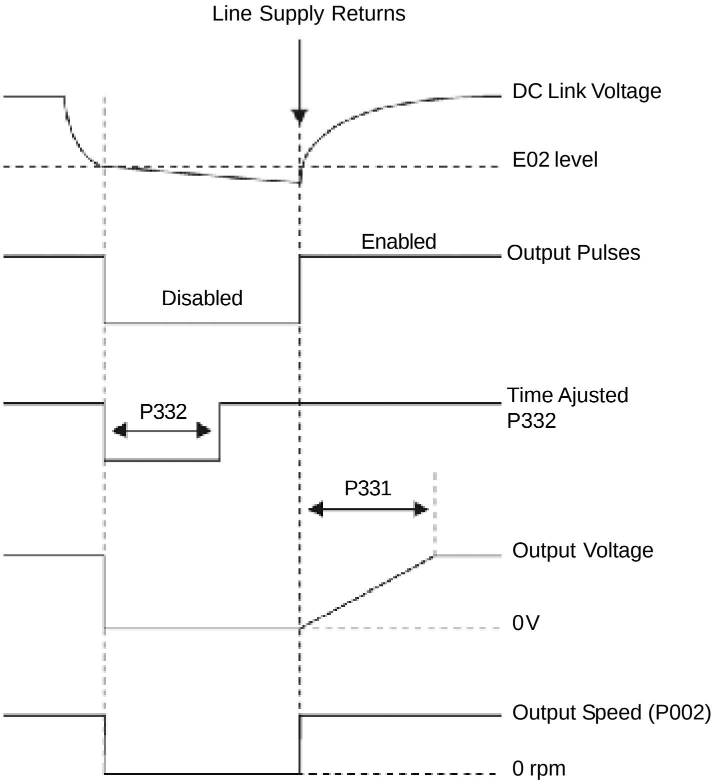


Figure 6.40B - *Ride-Through actuation (Line returns after time set in P332, but before 2sec for P332 ≤ 1sec or before 2 x P332 for P332 ≥ 1sec) in V/F mode*

6.4 MOTOR PARAMETERS - P400....P499

Parameter	Range [Factory Setting] Unit	Description / Notes
P400 Motor Rated Voltage (1) (6)	0...690 [P296] 1V	☑ Set this parameter value according to the motor nameplate and the connection diagram in the terminal box.
P401 Motor Rated Current (1)	0.0...1.30xP295 [1.0xP295] 0.1A(<100)-1A(>99.9)	☑ Set this parameter according to the motor nameplate, considering the motor operating voltage.
P402 Motor Rated Speed (1) (2)	0...18000 [1750 (1458)] (11) 1rpm 0...7200 [1750 (1458)] (11) 1rpm	☑ Set this parameter according to the motor nameplate. ☑ 0...18000rpm for V/F Control. ☑ 0...7200rpm for Vector Control.
P403 Motor Rated Frequency (1)	0...300 [60 (50)] (11) 1Hz 30...120 [60 (50)] (11) 1Hz	☑ Set this parameter according to the motor nameplate. ☑ 0 to 300Hz for V/F Control. ☑ 30 to 120Hz for Vector Control.
P404 Motor Rated Power (1)	0...50 [0] -	☑ Set this parameter according to the motor nameplate. 0=0.33 HP/0.25 kW 1=0.50 HP/0.37 kW 2=0.75 HP/0.55 kW 3=1.0 HP/0.75 kW 4=1.5 HP/1.1 kW 5=2.0 HP/1.5 kW 6=3.0 HP/2.2 kW 7=4.0 HP/3.0 kW 8=5.0 HP/3.7 kW 9=5.5 HP/4.0kW 10=6.0 HP/4.5 kW 11=7.5 HP/5.5 kW 12=10.0 HP/7.5 kW 13=12.5 HP/9.0 kW 14=15.0 HP/11.0 kW 15=20.0 HP/15.0 kW 16=25.0 HP/18.5 kW 17=30.0 HP/22.0 kW 18=40.0 HP/30.0 kW 19=50.0 HP/37.0 kW 20=60.0 HP/45.0 kW 21=75.0 HP/55.0 kW 22=100.0 HP/75.0 kW 23=125.0 HP/90.0 kW 24=150.0 HP/110.0 kW 25=175.0 HP/130.0 kW 26=180.0 HP/132.0kW 27=200.0 HP/150.0 kW 28=220.0 HP/160.0kW 29=250.0 HP/185.0 kW 30=270.0 HP/200.0 kW 31=300.0 HP/220.0 kW

Parameter	Range [Factory Setting] Unit	Description / Notes
		32=350.0 HP/260.0 kW 33=380.0 HP/280.0 kW 34=400.0 HP/300.0 kW 35=430.0 HP/315.0kW 36=440.0 HP/330.0kW 37=450.0 HP/335.0 kW 38=475.0 HP/355.0 kW 39=500.0 HP/375.0 kW 40=540.0 HP/400.0kW 41=600.0 HP/450.0 kW 42=620.0 HP/460.0kW 43=670.0 HP/500.0kW 44=700.0 HP/525.0 kW 45=760.0 HP/570.0 kW 46=800.0 HP/600.0 kW 47=850.0 HP/630.0kW 48= 900.0 HP/670.0 kW 49=1100.0 HP/ 820.0 kW 50=1600 HP/1190.0 kW
P405 Encoder PPR ☛ **This parameter is shown on the display(s) only when P202 = 4 (Vector Control with Encoder)**	250...9999 [1024] 1	☑ Sets the number of pulses per revolution (PPR) of the incremental encoder, when P202 = 4 (Vector with Encoder).
P406 Motor Ventilation Type (1)	0...2 [0 (Self-ventilated)]	

P406	Function
0	Self-ventilated
1	Separate Ventilation
2	Special Motor

☑ During the Initial Power-up (Refer to Sections 4.2, 4.3 e 4.3.1) or when P202 is changed from 0, 1 or 2 (V/F) to 3 or 4 (Vector, Refer to Section 4.3.2), the value set at P406 changes automatically the motor overload protection as follows:

P406	P157	P158
0	0.9xP401	0.5xP401
1	1.0xP401	1.0xP401
2	1.0xP401	1.0xP401

⚠ ATTENTION!

The option P406=2 may be used (see use conditions below) when motor should be operated at low frequencies with rated torque, without requiring forced ventilation, for the operation range 12:1, i.e., 5 to 60Hz/4.2 at 50Hz according the rated motor frequency.

CONDITIONS FOR USING OPTION P406=2:

i. Sensorless Vector Mode (P202=3);

ii.WEG motors from the High Efficiency and Nema Premium Efficiency series, IV and VI poles, in the whole power range.

Parameter	Range [Factory Setting] Unit	Description / Notes
P408 Run Self-Tuning (1)	- - -	

This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)

The Self-tuning Routine can be cancelled by pressing the ⓪ key, only when P409...P413 are different from zero.

Self-tuning can be realized only with P309=Inactive (0)

P408	Run Self-Tuning
0	No
1	No rotation
2	**Run for I_{mr}**
3	**Run for** T_M
4	**Estimate** T_M

(*) only for P202= 4 (Vector with Encoder)

☑ This parameter activates the Self-tuning Routine, which automatically measures the motor parameters P409 to P413.

☑ Best self tuning results are obtained when the motor is hot.

NOTE!

If the Self-tuning Routine is run with P408 = 2 (Run for I_{mr}), with a load coupled to the motor, a wrong value can be estimated for P410 (I_{mr}), and consequently generate errors in the estimations of P412 (Lr/Rr Constant) and of P413 (T_M Constant). An overcurrent trip (E00) may also occur during the Self-tuning procedure. Load means also a gear without load, or an inertia wheel, for example.

☑ Guidelines for P408 selection:

P202= 3 (Sensorless Vector):

(a) When it is possible to run the motor decoupled from the load, set P408 to 2 (Run for Imr).

(b) When it is NOT possible to run the motor decoupled from the load, set P408 to 1 (No Rotation). In this case, parameter P410 will be obtained from a pre-stored value array valid for WEG motors. Up to 12 poles.
This occurs only if the content of P410 is equal to zero before Self-tuning is started. In case P410 is different from zero, the Self-tuning routine will maintain the existing value.
If a non WEG motor is being used set this parameter to the correct value the motor no load current before starting Self-tuning

NOTE!

For the cases (a) and (b) above, parameter P413 (T_M Constant) will be set to an approximate value considering the rotor inertia of the motor (data valid for WEG motors), the rated current and voltage of the inverter.

P202= 4 (Vector with Encoder):

(a) When it is possible to run the motor decoupled from the load, set P408 to 2 (Run for I_{mr}).
After the Self-tuning routine is finished, couple the load to the motor and set P408 to 4 (Estimate T_M) in order to estimate P413 (T_M Constant). In this case, P413 will also consider the driven load.

(b) When it is NOT possible to run the motor decoupled from the load use P408 = 3 (Run for T_M). In this case, parameter P410 will be obtained from a pre-stored value array valid for WEG motors, up to 12 poles.
This occurs only if the content of P410 is equal to zero before Self-tuning is started. In case P410 is different from zero, the Self-tuning routine will maintain the existing value.
If a non WEG motor is being used set this parameter to the correct value before starting Self-tuning.

Parameter	Range [Factory Setting] Unit	Description / Notes
P409 Motor Stator Resistance (Rs) (1) **☛ This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.000...77.95 [0.000] 0.001Ω	☑Value estimated by the Self-tuning routine.
P410 Motor Magnetizing Current (I_{mr}) **☛ This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0...1.25xP295 [0.0] 0.1A	☑When the motor can operate decoupled from the load (P408 = 2) this value is estimated by the Self-tuning routine (P408=1 or 3) otherwise it is obtained from a pre-stored value array valid for WEG motors. ☑If a non WEG motor is being used set this parameter to the correct value before starting Self-tuning. ☑For P202=4 (vector with encoder), the value set at P410 determines the motor flux. Thus ensure correct setting. Is this setting i too low, motor losses flux and toque, if too high, the motor running starts to oscillate at rated speed or even this speed may not be reached. In this case, decrement P410 or P178 till speed oscillation stops or the rated speed is reached.
P411 Motor Flux Leakage Inductance (1) **☛ This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.00...99.99 [0.00] 0.01mH	☑ Value estimated by the Self-tuning routine.
P412 Lr/Rr Constant (Rotor Time Constant - Tr) **☛ This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.000...9.999 [0.000] 0.001s	☑Value estimated by the Self-Tuning routine up to the power of 75 HP. For higher power values, the constant comes from the table of WEG standard motors. ☑This parameter affects the speed accuracy in Sensorless Vector mode. The Rotor Time Constant varies with temperature and normally the Self-tuning is run when the motor is cold. Therefore, in Sensorless Vector mode, P412 should be fine tuned when the motor is hot. This can be done by running the motor at 50% speed and adjusting P412 so that the motor on load speed (measuring motor shaft speed with tachometer) is the same as at no load or the speed indicated on the CFW-09 display.

Parameter	Range [Factory Setting] Unit	Description / Notes
		☑ For P202=4 (vector control with encoder), if the setting of P412 is not correct, motor will loss its torque. Set P412 so that when 50% of the rated speed und constant load is reached, the motor current (P003) is the lowest possible. ☑ Typical T_R values for WEG standard motors:

Motor Power (cv-hp) / (kW)	T_R (s): Number of Poles 2 (50Hz/60Hz)	4 (50Hz/60Hz)	6 (50Hz/60Hz)	8 (50Hz/60Hz)
2 / 1.5	0.19 / 0.14	0.13 / 0.14	0.1 / 0.1	0.07 / 0.07
5 / 3.7	0.29 / 0.29	0.18 / 0.12	- / 0.14	0.14 / 0.11
10 / 7.5	- / 0.38	0.32 / 0.25	0.21 / 0.15	0.13 / 0.14
15 / 11	0.52 / 0.36	0.30 / 0.25	0.20 / 0.22	0.28 / 0.22
20 / 15	0.49 / 0.51	0.27 / 0.29	0.38 / 0.2	0.21 / 0.24
30 / 22	0.70 / 0.55	0.37 / 0.34	0.35 / 0.37	- / 0.38
50 / 37	- / 0.84	0.55 / 0.54	0.62 / 0.57	0.31 / 0.32
100 / 75	1.64 / 1.08	1.32 / 0.69	0.84 / 0.64	0.70 / 0.56
150 / 110	1.33 / 1.74	1.05 / 1.01	0.71 / 0.67	- / 0.67
200 / 150	- / 1.92	- / 0.95	- / 0.65	- / 1.03
300 / 220	- / 2.97	1.96 / 2.97	1.33 / 1.30	- / -
350 / 250	- / -	1.86 / 1.85	- / 1.53	- / -
500 / 375	- / -	- / 1.87	- / -	- / -

P413 T_M Constant (Mechanical Time Constant) (1) ☞ **This parameter is shown on the display(s) only when P202 = 3 or 4 (Vector Control)**	0.00...99.99 [0.00] 0.01s	☑ Value estimated by the Self-tuning routine when P408 = 3 or 4. ☑ For P408=1 or 2, T_M will be a function of the programmed motor inertia (memory stored data), only when P413=0. When P408=1 or 2 and P413>0, the value of P413 will not be changed during self-tuning.

6.5 SPECIAL FUNCTIONS PARAMETERS - P500....P699

6.5.1 PID Regulator

☑ The CFW-09 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 control, for example, the flow in a piping system through the flow feedback to the analog input AI2 or AI3 (selected via P524), and the flow reference set at P221 or P222 - AI1, when the inverter drives the motor of a pump that circulates the fluid through this piping system.

☑ Other application examples: level control, temperature control, dosing control, etc.

6.5.2 Description

☑ The function of the PID regulator is activated by setting P203 to 1.

☑ Figure 6.41 shows the block diagram of the Academic PID regulator.

☑ The transference function in the frequency domain of the Academic PID regulator is:

$$y(s) = Kp\ e(s)[1 + \frac{1}{sTi} + sTd]$$

Substituting the integrator by a sum and the derivative by the incremental quotient, we will obtain an approximate value for the discrete (recursive) transfer equation shown below:

$$\begin{aligned} y(kTa) = y(k-1)Ta + Kp[(e(kTa) - e(k-1)Ta) + \\ + Kie(k-1)Ta + Kd(e(kTa) - 2e(k-1)Ta + e(k-2)Ta)] \end{aligned}$$

where:

Kp (Proportional Gain): Kp = P520 x 4096;
Ki (Integral Gain) : Ki = P521 x 4096 = [Ta/Ti x 4096];
Kd (Differential Gain) : Kd = P522 x 4096 = [Td/Ta x 4096].
Ta = 0,02sec(sampling period of the PID Regulator).
SP* : reference, has 13 bits max. (0...8191).
X : process variable (or controlled), read at AI2 or AI3, has 13 bits maximum;
$y(kTa)$: current PID output, has 13 bits maximum;
$y(k\text{-}1)Ta$: previous OPID output;
$e(kTa)$: current error [SP*(k) – X(k)];
$e(k\text{-}1)Ta$: previous error [SP*(k-1) – X(k-1)];
$e(k\text{-}2)Ta$: error of the two previous samplings [SP*(k-2) – X(k-2)];

☑ The feedback signal must be sent to the analog inputs AI2' and AI3' (See figure 6.28 and 6.29).

☑ The setpoint can be defined:
- keypad: parameter P525.
- Analog inputs AI1’, AI2’, AI3’, AI4’, (AI1’+ AI2’)>0, (AI1’+ AI2’), Multispeed, Serial, Fieldbus and PLC.

Note: When P203=1, do not use the reference via EP (P221/P222=7).

☑ When the PID function (P203=1) is set:
- The change between Manual/Automatic can be realized by one of the digital inputs DI3...DI8 (**P265**...**P270**).
- When the function of the PID regulator is activated (P203=1) the digital input DI3 is programmed automatically for the function Manual/ Automatic (P265=15):

DIx	Action Type
0 (0V)	Manual
1 (24V)	Automatic

- Parameter P040 indicates the value of the Process Variable feedback) in the chosen scale/unit. This parameter can be selected as monitoring variable (see Item 5.2.2), provided P205=6. To prevent the saturation of the analog feedback input during the regulation “overshoot”, the signal must vary between 0 ... 9,0V (0(4)..18mA). The adaptation between the setpoint and the feed back can be realized by changing the gain of the selected analog input as feedback (P238 for AI2 or P242 for AI3). The Process Variable can also be displayed at the outputs AO1...AO4 provided they were programmed at P251, P253, P255 or P257. The same is valid for the PID setpoint.

- The outputs DO1, DO2 and RL1...RL3 can be programmed (P275...P277, P279 or P280) to the functions of the Process Variable > VPx (P533) and Process Variable < VPy (P534).The JOG Function and the direction of rotation function remain disabled. The Enabling and Start/Stop controls are defined in P220, P224 and P227.

- When the setpoint is defined by P525 (P221 or P222=0), and if it is changed from manual to automatic, following setting P525=P040 is performed automatically, provided the parameter P536 is active. In this case, the commutation from manual to automatic is smooth (there is no abrupt speed oscillation).

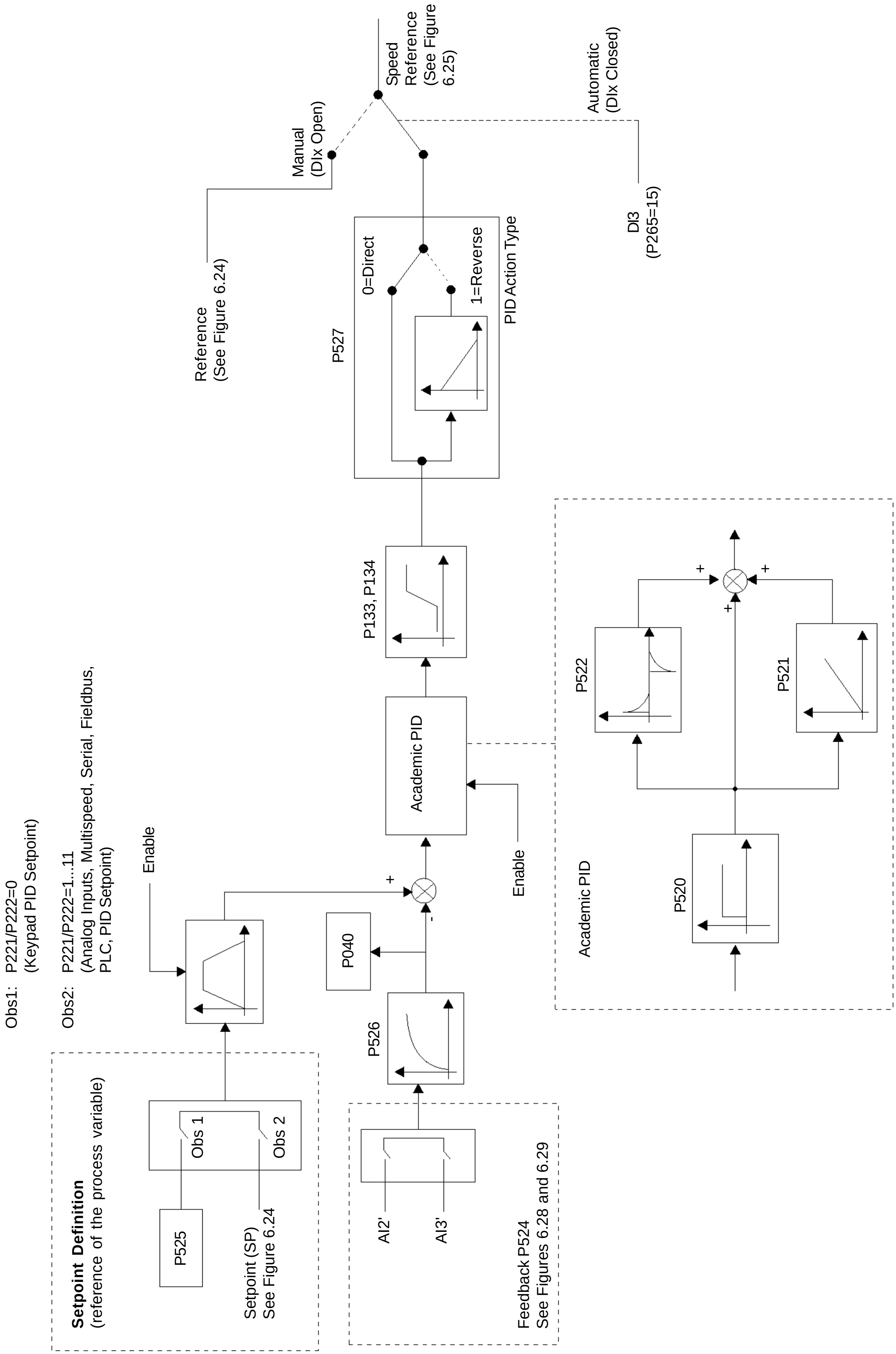


Figure 6.41 - Block diagram of the PID Regulator Function

Parameter	Range [Factory Setting] Unit	Description / Notes
P520 PID Proportional Gain	0.000...7.999 [1.000] 0.001	☑ Some examples of initial settings of the PID Regulator Gains and PID Ramp Times for some applications mentioned in Item 6.5.1, are shown in table 6.6.
P521 PID Integral Gain	0.000...7.999 [0.043] 0.001	
P522 PID Differential Gain	0.000...3.499 [0.000] 0.001	
P523 PID Ramp Time	0.0...999 [3.0] 0.1s (<99.9s) 1s (>99.9s)	

Magnitude	Gains			PID Ramp Time P523	Action Time P527
	Proportional P520	Integral P521	Derivative P522		
Pressure in a pneumatic system	1	0.043	0.000	3.0	0 = Direct
Flow in a pneumatic system	1	0.037	0.000	3.0	0 = Direct
Pressure in a hydraulic system	1	0.043	0.000	3.0	0 = Direct
Flow in a hydraulic system	1	0.037	0.000	3.0	0 = Direct
Temperature	2	0.004	0.000	3.0	See Note
Level	1	See Note	0.000	3.0	See Note

***Table 6.6**- Suggestions for gain settings of the PID regulator*

Obs:

- For temperature and level control, the action type will depend on the process. For instance, in the level control, when the inverter drives the motor that removes fluid from a tank, the action will be contrary as when the inverter drives the motor that fills a tank and thus the fluid level increases and the inverter should increase the motor speed to lower the fluid level, otherwise the inverter action that drives the pump motor to pump fluid into the tank will be direct.

- In case of level control, the setting of the integral gain will depend on the time required to fill the tank from the minimum acceptable level up the desired level, in the following conditions:
  i. For the direct action, the time should be measured by considering the maximum input flow and the minimum output flow.
  ii. In the inverse action, the time should be measured by considering the minimum input flow and the maximum output flow.

  The formula to calculate an initial value for P521 (PID Integral Gain) as a function of the system response time, is presented below:

P521 = 0.02 / t

t=time (seconds)

Parameter | **Range [Factory Setting] Unit** | **Description / Notes**

P524
Selection of the
PID Feedback

0...1
[0]
-

☑It selects the feedback input (Process Variable) of the PID regulator:

P254	Alx
0	AI2 (P237...P240)
1	AI3 (P241...P244)

☑After the feedback input has been chosen, you must set the input function selected at P237 (to AI2) or P241 (to AI3).

☑Feedback Type:

- The PID action Type described above considers that the variable feedback signal increases when the process variable also increases (direct feedback). This is the most common used feedback type.
- When the process variable feedback decreases when the process variable increases (inverse feedback), It is required to program the selected analog input for the PID (AI2 or AI3) as inverse reference: P239=2 (10...0V/20...0mA) or 3(20...4mA) when the feedback is through AI2 and (10...0V/20...0mA) or 3(20...4mA) when the feedback is through AI3. When this setting is not present, PID does not operate correctly.

P525
Keypad PID Setpoint

0.0...100
[0.0]
0.1%

☑It provides the setpoint via the and keys for the PID Regulator (P203=1) provided that P221=0 (LOC) or P222=0 (REM) has been set to Automatic mode. If it has been set to Manual Mode, the speed reference is given by P121.

☑The value of P525 is maintained at the last set value (backup), even when inverter is disabled or enabled with P120 = 1 (Active)].

☑Once PID is in Automatic mode, the Setpoint value for PID regulator is entered into the CFW09 via any reference set by P221 (LOCAL mode) or P222 (REMOTE mode). Particularly, most of general PID applications uses the setpoint via the AI1 [P221=1 (LOC) or P222=1(REM)] or via the ▲ and ▼ keys [P221=0 (LOC) or P222=0(REM)]. Refer to Figure 6.41 Block Diagram of the PID Regulator."

P526
Process Variable
Filter

0.0...16.0
[0.1]
0.1s

☑It sets the time constant of the Process Variable Filter.

☑Generally a 0.1 will be a suitable value, excepting the process variable signal has a too high noise level. In this case, increase this value gradually by checking the result.

P527
PID Action

0,1
[0]
-

☑ It defines the control action type:

P527	Action Type
0	Direct
1	Reverse

☑ Select according to the process

Motor Speed	Process Variable	Select
INCREASE	INCREASE	DIRECT
	DECREASE	REVERSE

Parameter	Range [Factory Setting] Unit	Description / Notes
		☑Process requirement: - PID action type: the PID action should be selected as direct, when it is required to increase the motor speed in order to increase the process variable. Otherwise, select the inverse. Example 1 – Direct: pump driven by frequency inverter and filling a tank, where PID regulates the level. To increase the level (process variable) it is required to increase the flow and consequently, the motor speed. Example 2 – Inverse: Fan driven by frequency inverter and cooling a cooling tower, with PID controlling its temperature. When the temperature (process variable) should be increased, the cooling effect should de reduced by reducing the motor speed.
P528 Process Variable Scale Factor **P529** Decimal Point of Process Variable	1...9999 [1000] 1 0...3 [1] -	☑P528 and P529 define the way the Process variable (P040) will be shown. ☑P529 defines how many digits are indicated after the decimal point. ☑ P528 must be set according to the equation below: $P528 = \frac{\text{F. S. V. Indication x Process x } (10)^{P529}}{\text{Gain (AI2 or AI3)}}$ where: F. S. V. Indication . Process is the full scale value of the Process Variable, corresponding to 10V (20mA) at the Analog Input (AI2 or AI3) used as feedback. Example 1: (Pressure Transducer 0...25 bar - Output 4...20 mA) - Desired indication: 0 to 25 bar (F. S.) - Feedback Input: AI3 - Gain AI3=P242=1.000 - Signal AI3=P243=1 (4...20mA) P529=0 (no digit after decimal point) $P528 = \frac{25 \text{ x } (10)^0}{1.000} = 25$

Parameter	Range [Factory Setting] Unit	Description / Notes
		Example 2 (values are factory standards): - Desired indication: 0.0% to 100.0% (F. S.) - Feedback Input: AI2 - Gain AI2=P238=1.000 P529=1 (one number after decimal point) $P528 = \frac{100.0 \text{ x } (10)^1}{1.000} = 1000$
P530 Eng. Unit Proc. Var. 1	32...127 [37 (%)] -	☑These parameters are only useful, if the inverter is fitted with HMI with LCD display. ☑The Engineering Unit of the Process Variable is formed by three characters, that are used for the indication of P040. P530 defines the left character, P531 defines the central character and P532 defines the right character.
P531 Eng. Unit Proc. Var. 2	32...127 [32 ( )] -	☑Possible characters to be chosen: Characters corresponding to the ASCII code from 32 to 127. Examples: A, B, ..., Y, Z, a, b, ..., y, z, 0, 1, ..., 9, #, $, %, (,), *, +, ...
P532 Eng. Unit Proc. Var. 3	32...127 [32 ( )] -	☑Examples: - To indicate "bar": P530="b" (98) P531="a" (97) P532="r" (114) - To indicate "%": P530="%" (37) P531=" " (32) P532=" " (32)
P533 Value of Proc. Var. X	0.0...100 [90.0] 0.1%	☑ Used in the functions of the Digital/Relay Outputs: V. Pr. > VPx and V. Pr. < VPy aiming signaling/alarm.
P534 Value of Proc. Var. Y	0.0...100 [10.0] 0.1%	☑ Full scale percentual values of the Process Variable: $(P040 = \frac{(10)^{P529}}{P528} \text{x} 100\%)$
P535 Wake Up Band	0...100 [0%] 1%	☑The value of this parameter is used along with P212 (Condition to Leave Zero Speed Disable), providing additional condition to leave zero speed disable, that is, error of PID > P535. See P211...P213.
P536 Automatic Set of P525 (1)	0,1 [0] -	☑When the setpoint of the PID regulator is via HMI (P221/P222 = 0) and P536 is zero (active) by commutating from manual to automatic, the process variable value will be loaded at P525. In this way do you prevent PID oscillations during the commutation from "Manual" to "Automatic".

P536	Action Type
0	Active
1	Inactive

CHAPTER 7

DIAGNOSTICS AND TROUBLESHOOTING

This Chapter assists the user to identify and correct possible faults that can occur during the CFW-09 operation. Guidance on Preventive Maintenance is 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 the EXX form, where XX is the actual Fault Code. (ie. E01). To restart the inverter after a fault has occurred, the inverter must be reset. The reset can be made as follows:

- ☑ disconnecting and reapplying AC power (power-on reset);
- ☑ by pressing the key "0/RESET" (manual reset)
- ☑ automatic reset through P206 (auto-reset);
- ☑ via digital input: DI3...DI8 (P265...P270 set to 12 - Reset)

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

FAULT	RESET	POSSIBLE CAUSES
E00 Output Overcurrent	☑ Power-on ☑ Manual reset (Key 0/RESET) ☑ Auto-reset ☑ DIx (Digital Input)	☑ Short-circuit between two motor phases; ☑ Inertia of the load too high, or acceleration ramp too short; ☑ Transistor module shorted; Improper setting of regulation and/or configuration parameter(s); ☑ P169...P172 set too high.
E01 DC Link Overvoltage (Ud)		☑ Power Supply voltage too high; Check Ud in P004: 220-230V Models - Ud > 400V 380-480V Models - Ud > 800V 500-600V Models - Ud > 1000V 500-690V and 660-690V Models - Ud>1200V ☑ Load inertia too high or deceleration ramp too short. ☑ P151 or P153 set too high.
E02 DC Link Undervoltage (Ud)		☑ Power Supply voltage too low; Check Ud in P004: 220-230V Power Supply - Ud < 223V 380V Power Supply - Ud < 385V 400-415V Power Supply - Ud < 405V 440-460V Power Supply - Ud < 446V 480V Power Supply - Ud < 487V 500-525V Power Supply - Ud < 532V 550-575V Power Supply - Ud < 582V 600V Power Supply - Ud < 608V 660-690V Power Supply - Ud < 699V ☑ Phase loss at the input; ☑ Pre-charge circuit fuse blown (see Section 3.2.3); ☑ Pre-charge contactor defective; ☑ P296 set to a voltage higher than the power supply voltage.
E03 Input Undervoltage/ Phase loss (1)		☑ Power Supply voltage is too low; Check Power Supply voltage: 220-230V Models - Power Supply < 154V 380-480V Models - Power Supply < 266V 500-600V and 500-690V Models - Power Supply < 361V 660-690V Models - Power Supply < 462V ☑ Phase loss at the inverter input. ☑ Activation Time: 2.0s

FAULT	RESET	POSSIBLE CAUSES
E04 Inverter Overtemperature or Pre-charge Circuit Defective (2) (3)		☑ Ambient temperature too high (>40°C) and/or output current too high; or ambient temperature <- 10ºC; ☑ Blowers locked or defective (3) ☑ Pre-charge circuit fuse blown (see Section 3.2.3); ☑ Problem with the supply voltage - voltage sag or interruption (phase loss) - last for more than 2 seconds and with the phase loss detection disabled (P214=0); ☑ Signal with inverted Polarity at Analog inputs AI1/AI2.
E05 Inverter / Motor Overload Ixt Function		☑ P156, P157 and P158 set too low for the motor being used; ☑ Motor is under an actual overload condition.
E06 External Fault		☑ Any DIx (DI3...DI7) programmed for external fault detection (P265...P270 set to 4 – No Ext Flt) is open (not connected to + 24V); ☑ Terminal block XC12 on the control board CC9 is not properly connected.
E07 Encoder Fault (Valid only if P202 = 4 - Encoder) P202= 4 - Vector with Encoder		☑ Miswiring between encoder and terminal block XC9 (optional board EBA/EBB). Refer to Section 8.2; ☑ Encoder is defective.
E08 CPU Error (watchdog)		☑ Electrical noise.
E09 Program Memory Error (Checksum)	Contact WEG (Refer to Section 7.3)	☑ Memory with corrupted values.
E10 Error in the Copy Function	☑ Power-on ☑ Manual Reset (Key 0/RESET) ☑ Auto-reset ☑ DIx	☑ A bid to copy the HMI parameters to the inverter with different Software version.
E11 Ground Fault		☑ Short-circuit between one or more output phases and ground; ☑ Motor cable capacitance to ground is too high (see note below).
E12 Braking Resistor Overload		☑ Load inertia too high or deceleration ramp too short; ☑ Load on the motor shaft too high; P154 and P155 programmed incorrectly.

FAULT	RESET	POSSIBLE CAUSES
E13 Motor or Encoder Miswired (for P202 = 4 - Encoder), with P408=runs to I_{mr}		☑ Cables U, V, W to motor are inverted; ☑ Encoder miswiring. Note: This fault can only occur during Self-tuning.
E15 Motor Phase Loss		☑ Bad contact or broken wiring between motor and inverter; ☑ Incorrect value programmed in P401; ☑ Vector control without orientation; ☑ Vector control with encoder, encoder wiring or connection to motor is inverted.
E17 Overspeed Fault	☑ Power-on ☑ Manual Reset (Key 0/RESET) ☑ Auto-reset ☑ DIx	☑ When the effective overspeed exceeds the value of P134+P132 longer than 20ms.
E24 Programming Error (5)	It is automatically reset when the incompatible parameters are correctly programmed.	Incompatible parameters were programmed. Refer to Table 5.1.
E31 Keypad (HMI) Connection Fault	It is automatically reset when HMI communication with inverter is restablished.	☑ Keypad cable misconnected; ☑ Electrical noise in the installation (electromagnetic interference).
E32 Motor Overtemperature (4)	☑ Power-on ☑ Manual Reset (Key 0/RESET) ☑ Auto-reset ☑ DIx	☑ Motor is under an actual overload condition; ☑ Duty cycle is too high (too many starts/stops per minute); ☑ Ambient temperature is too high; ☑ Motor thermistor.miswiring or short-circuit (resistance < 100 Ω) at the terminals XC4:2 and 3 of the optional board XC4:2 and 3 of the optional board EBA or at the terminals XC5:2 and 3 of the optional board EBB. ☑ P270 programmed to 16 unintentionally, with EBA/EBB board not installed and/or motor thermistor not connected; ☑ Motor in locked rotor condition.
E41 Self Diagnosis Fault	Contact WEG (Refer to Section 7.3)	☑ Memory error or any internal inverter circuit defective.
E70 Internal DC Supply Under Voltage (6)	Power-on Manual Reset (key 0/RESET) Auto-reset DIx	☑ Phase loss at the R or S input.

Note:

(1) E03 Fault can occur only with:
- 220-230V Models with rated current equal or higher than 45 A;
- 380-480V Models with rated current equal or higher than 30 A;
- 500-600V Models with rated current equal or higher than 22 A;
- 500-690V Models
- 660-690V Models
- P214 set to1.

(2) In case of E04 Fault due to inverter overtemperature, allow the inverter to cool before trying to reset it. The E04 fault code can also indicate a failure in the pre-charge circuit. But this is valid only for:

- 220-230V Models with rated current equal or higher than 70 A;
- 380-480V Models with rated current equal or higher than 86A.

The failure in the pre-charge circuit means that the pre-charge contactor (sizes up to 142A) or pre-charge thyristor (sizes above 142A) is not closed, thus overheating the pre-charge resistors.

- 500-690V Models with radet current equal or righer than 107A;
- 660-690V Models with radet current equal or righter than 1000A.

(3) For:

- 220-230V Models with rated current equal or higher than 16 A;
- 380-480V Models with rated current equal or higher than 13A, and equal or lower than 142A;
- 500-600V Models with rated current equal or higher than 12A, and equal or smaller than 79A;

E04 Fault can also be caused by internal airflow overtemperature. In this case, check the electronics blower.

(4) When E32 is displayed due to motor overtemperature, please allow the motor to cool down before restarting the inverter.

(5) When an incompatible parameter is programmed, a Fault Message – E24 - will be displayed and the LCD display will show a Help Message by indicating the Cause and how to correct the fault status.

(6) Only for models 107A to 472A/500-690V and 100A to 428A/660-690V.

NOTE!

Long motor cables (longer than 330ft (100m)) can cause excessive capacitance to ground. This can cause nuisance E11 ground fault trips 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 8.8.

NOTE!

When a fault occurs the following steps take place:

☑ E00...E08, E10, E11, E12, E13, E15, E17 and E32:
- “No Fault” relay drops “out”;
- PWM pulses are stopped;
- The LED display indicates the fault code;
- The LCD display indicates the fault code and description;
- The “ERROR” LED flashes;
- The following data is stored in the EEPROM:
  - Speed reference via Keypad or EP (Electronic Potentiometer), if the function “Reference Backup” is active (P120 set to 1 – On);
  - Fault code;
  - The status of the I x t function (motor overload);
  - The status of the powered time (P042) and Enabled Time (P043).

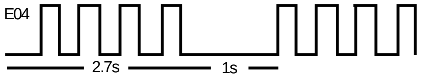
☑ E09:
- Does not allow inverter operation.

☑ E24:
- Indicates the code on the LED display plus and description on the LCD display;
- It blocks the PWM pulses;
- It doe nor permit motor driving;
- It switches OFF the relay that has been programmed to “Without Error”;
- It switches ON the relay that has been programmed to “With Error”.

☑ E31:
- The inverter continues to operate normally;
- It does not accept the Keypad commands;
- The fault code is indicated on the LED display;
- The LCD display indicates the fault code and description;

☑ E41:
- Does not allow inverter operation;
- The fault code is indicated on the LED display;
- The LCD display indicates the fault code and description;
- The “ERROR” LED flashes.

Indication of the inverter status LEDs:

Led Power	Led Error	Description
☼	○	Inverter is powered up and is ready
☼	☼ (Flashing)	A fault has been detected. The FAULT LED flashes, indicating the number of the Fault Code Exemple:  Note: If the fault E00 occurs, the ERROR LED is ON continuously.

7.2 TROUBLESHOOTING

PROBLEM	POINT TO BE CHECKED	CORRECTIVE ACTION
Motor does not run	Incorrect Wiring	1.Check the power and control connections. For example the digital inputs DIX programmed for Start/Stop, General Enable and No External Fault must be connected to +24V. For factory default programming, XC1:1 (DI1) must be connected to +24V (XC1:9) and XC1:10 connected to XC1:8.
	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 is not disabled due to a Fault condition (Refer to table above). 2.Check if there is a short-circuit between terminals XC1:9 and 10 (short-circuit at 24Vdc power supply).
	Motor Stall	1.Reduce the motor load. 2.Increase P169/P170 or P136/P137.
Motor speed varies (oscillates)	Loose Connections	1.Disable the inverter, switch OFF the supply voltage and tighten all connections. 2.Check if all internal connection are titghtened.
	Speed Potentiometer	1.Replace the speed potentiometer.
	Variation of the external analog reference	1.Identify the cause of the variation.
	Parameters not set correctly (for P202=3 or 4)	1.See Section 6, parameters P410, P412, P161, P162, P175 and P176.

PROBLEM	POINT TO BE CHECKED	CORRECTIVE ACTION
Motor speed too high or too low	Programming error (reference limits)	1.Check if the contents of P133 (Min. Speed) and P134 (Max. Speed) are according to the motor and the application.
	Signal of the reference control	1.Check the control signal level of the reference. 2.Check the programming (gains and offset) in P234 to P247.
	Motor Nameplate Data	1.Check if the used motor meets the application requirements.
Motor does not reach rated speed or it starts to oscillate at rated speed for P202= 3 or 4 - Vector		1.Reduce P180 (set to 90...99%).
Display OFF	Connection of the Keypad	1.Check the Keypad connections to the inverter.
	Power Supply voltage	1.The power supply voltage must be within the following ranges: 220-230V power supply: - Min: 187V - Max:253V 380-480V power supply: - Min: 323V - Max.528V 500-600V power supply: - Min: 425V - Max.660V 660-690V power supply: - Min: 561V - Max.759V
	Blown Fuse(s)	1. Replace the fuse(s)
Motor does not enter the field weakening range (for P202= 3 or 4)		1.Set P180, between 90% and 99%
Motor speed too low and P009 = P169 or P170 (motor with torque limitation), for P202 = 4 - vector with encoder	Encoder signals or power connections	Check the signals A - $\overline{A}$, B - $\overline{B}$ according to figure 8.7. If this connections are correct invert two output phases, for instance U and V. Refer to Figure 3.6.

7.3 CONTACTING WEG

NOTE!

When contacting WEG for service or technical assistance, please have the following data on hand:

- ☑ Inverter Model;
- ☑ Serial number, manufacturing date and hardware revision, as indicated on the inverter nameplate (Refer to Section 2.4);
- ☑ Software Version (Refer to Section 2.2);
- ☑ Information about the application and inverter programming.

7.4 PREVENTIVE MAINTENANCE

DANGER!

Always disconnect the power supply voltage before touching any component of the inverter.

Even after switching OFF the inverter, high voltages may be present. Wait 10 minutes to allow complete discharge of the power capacitors.
Always connect the equipment frame to a suitable ground (PE) point.

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 aging of the components, periodic inspections of the inverter and installations are recommended.

COMPONENT	PROBLEMS	CORRECTIVE ACTIONS
Terminal blocks, connectors	Loose screws	Tighten them
	Loose connectors	
Blowers (1)/ Cooling System	Blowers are dirty	Clean them
	Abnormal acoustic noise	Replace the blower
	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
	Smell	Replace them
Power module/ power connections	Dust, oil or moisture accumulation, etc.	Clean them
	Connection screws are loose	Tighten them
DC Bus Capacitors (2)	Discoloration / smell / electrolyte leakage	Replace them
	Safety valve is expanded or broken	
	Deformation	
Power resistor	Discoloration	Replace it
	Smell	

***Table 7. 1** - Periodic Inspections after Start-up*

Notes:

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

(2) Check the capacitors every six months. It is recommended to replace them after five years of operation;

(3) If the inverter is stored for long periods, we recommend to power it up once a year during 1 hour. For 220-230V and 380-480V models apply supply voltage of aprox. 220Vac, three-phase or single-phase input, 50 or 60 Hz, without connecting motor at output. After this energization, wait 24 hours before installing it. For 500-600V, 500-690V and 660-690V models use the same procedure applying a voltage between 300 and 330Vac to the inverter input.

7.4.1 Cleaning Instructions

When necessary clean the CFW-09 following the instructions below:

a) Cooling system:

☑ Remove AC power from the inverter and wait 10 minutes;
☑ Remove all dust from the ventilation openings by using a plastic bush or a soft cloth;
☑ Remove dust accumulated on the heat sink fins and from the blower blades with compressed air;

b) Electronic Boards:

☑ Remove AC power form the inverter and wait 10 minutes;
☑ Remove all dust from the printed circuit boards by using an anti-static soft brush or remove it with an ionized compressed air gun;
☑ If necessary, remove the PCBs from the inverter;
☑ Always use a ground strap.

7.5 SPARE PART LIST

Models 220-230V

Name	Item Nº	Especification	Types (Ampéres)							
			6	7	10	13	16	24	28	45
			Units per Inverter							
Fans	5000.5275	Fan 0400.3284 Comp. 190mm (60x60)	1	1	1	1				
	5000.5291	Fan 0400.3217 Comp.145mm (40x40)					1	1	1	
	5000.5267	Fan 0400.2482 Comp. 150mm (80x80)								2
	5000.5364	Fan 0400.3217 Comp. 200mm (40x40)								1
	5000.5305	Fan 2x04002423 (60x50)					1	1	1	
Fuse	0305.6716	Fuse 6.3X32 3.15A 500V	1	1	1	1	1	1	1	1
HMI-CFW09-LCD	S417102024	HMI-LCD	1	1	1	1	1	1	1	1
CC9 - 00	S41509651	Control Board CC9.00	1	1	1	1	1	1	1	1
CFI1.00	S41509929	Interface Board with the HMI	1							
DPS1.00	S41512431	Driver and Power Supply Board	1	1	1	1	1	1	1	1
CRP1.00	S41510960	Pulse Feedback Board								
KML-CFW09	S417102035	Kit KML	1	1						
P06 - 2.00	S41512296	Power Board P06-2.00			1					
P07 - 2.00	S41512300	Power Board P07-2.00				1				
P10 - 2.00	S41512318	Power Board P10-2.00					1			
P13 - 2.00	S41512326	Power Board P13-2.00						1		
P16 - 2.00	S41512334	Power Board P16-2.00							1	
P24 - 2.00	S41512342	Power Board P24-2.00								1
P28 - 2.00	S41512350	Power Board P28-2.00								
P45 - 2.00	S41510587	Power Board P45-2.00	1	1	1	1	1	1	1	1
HMI-CFW09-LED	S417102023	HMI-LED (Optional)	1	1	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1	1	1
CFI1.01	S41510226	Interface Board with HMI (Optional)	1	1	1	1	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.01	S41510200	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNET Board (Optional)	1							

Models 220-230V

Name	Item Nº	Especification	Types (Ampéres)				
			54	70	86	105	130
			Units per Inverter				
Preload Contactors	035502345	Cont.CWM32.00 220V 50/60Hz		1	1		
	035502394	Cont.CWM50.00 220V 50/60Hz				1	1
Preload Resistor	0301.1852	Vitrified wire Resistor 20R 75W			1	1	1
Fan	5000.5267	Fan 0400.2482 Comp.150mm	2				
	5000.5127	Fan 0400.2482 Comp. 230mm	1				
	5000.5208	Fan 0400.2490 Comp. 230mm (120x120)		1	1		
	0400.2547	Fan 220V 50/60Hz				1	1
	5000.5216	Fan 0400.2490 Comp. 330mm		1	1		
	5000.5364	Fan 0400.3217 Comp. 200mm (40x40)	1	1	1	1	1
Fuse	0305.6716	Fuse 6.3x32 3.15A 500V	1	1	1	1	1
	0305.5604	Ret Fuse 0.5A 600V FNQ-R1		2	2	2	2
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1
CC9.00	S41509651	Control Board CC9.00	1	1	1	1	1
LVS1.01	S41510927	Board LVS1.01		1	1	1	1
CFI1.00	S41509929	Interface Board with the HMI	1	1	1	1	1
DPS1.00	S41509775	Power Supplies and Firing Board	1				
KML-CFW09	S417102035	Kit KML	1	1	1	1	1
DPS1.01	S41509783	Driver and Power Supply Board		1	1	1	1
*P54 - 2.00	S41510522	Power Board P54-2.00	1				
P54 - 2.01	S41511443	Power Board P54-2.01	1				
*P70 - 2.00	S41511354	Power Board P70-2.00		1			
P70 - 2.01	S41511451	Power Board P70-2.01		1			
*P86 - 2.00	S41510501	Power Board P86-2.00			1		
P86 - 2.01	S41511460	Power Board P86-2.01			1		
*P105 - 2.00	S41511362	Power Board P105-2.00				1	
P105 - 2.01	S41511478	Power Board P105-2.01				1	
*P130 - 2.00	S41510439	Power Board P130-2.00					1
P130 - 2.01	S41511486	Power Board P130-2.01					1
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1
CFI1.01	S41510226	Interface Board with HMI (Optional)	1	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1	1
EBB1.01	S41510200	Function Expansion Board (Optional)	1	1	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1	1	1
SCI1.00	S41510846	RS-232 module for PC (Optional)	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNET Board (Optional)	1	1	1	1	1
Current Trasducers	0307.2495	Current transducers 200A/100mA				2	2

* Only the types specified with braking (DB)

Models 380-480V

Name	Item Nº	Especification	Type (Ampéres)							
			3.6	4	5.5	9	13	16	24	30
			Units per Inverter							
Fans	5000.5275	Fan 0400.3284 Comp. 190mm (60x60)	1	1	1	1				
	5000.5305	Fan 2x0400.2423 150/110mm (60x60)					1	1		
	5000.5291	Fan 0400.3217 Comp.145mm (40x40)					1	1	1	
	5000.5283	Fan 2x0400.3284 150/110mm (60x60)							1	
	5000.5259	Fan 0400.2482 Comp. 90mm (80x80)								2
	5000.5364	Fan 0400.3217 Comp. 200mm (40x40)								1
Fuse	0305.6716	Fuse 6.3x32 3.15A 500V								1
CC9.00	S41509651	Control Board CC9.00	1	1	1	1	1	1	1	1
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1	1	1	1
CFI1.00	S41509929	Interface Board with HMI	1	1	1	1	1	1	1	1
DPS1.00	s41512431	Driver and Power Supply Board								1
CRP1.01	S41510820	Pulse Feedback Board	1	1	1	1	1	1	1	
KML-CFW09	S417102035	Kit KML								1
P03 - 4.00	S41512369	Power Board P03-4.00	1							
P04 - 4.00	S41512377	Power Board P04-4.00		1						
P05 - 4.00	S41512385	Power Board P05-4.00			1					
P09 - 4.00	S41502393	Power Board P09-4.00				1				
P13 - 4.00	S41512407	Power Board P13-4.00					1			
P16 - 4.00	S41512415	Power Board P16-4.00						1		
P24 - 4.00	S41512413	Power Board P24-4.00							1	
P30 - 4.00	S41509759	Power Board P30-4.00								1
HMI-CFW09-LED	S417102023	HMI LED (Opcional)	1	1	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1	1	1
CFI1.01	S41510226	Interface Board with HMI (Optional)	1	1	1	1	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.01	S41510200	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNET Board (Optional)	1	1	1	1	1	1	1	1

Supply Voltage 380-480V

Name	Item Nº	Especification	Type (Ampéres)						
			38	45	60	70	86	105	142
			Units per inverter						
Preload Contactor	035502394	Contactor CWM50.00 220V 50/60Hz				1	1	1	1
Preload Transfor	0307.0034	Transformer 100VA					1	1	
	0307.0042	Transformer 300VA							1
Preload Resistor	0301.1852	Vitrified wire Resistor 20R 75W					1	1	1
Fans	5000.5267	Fan 0400.2482 Comp.150mm (80x80)	3	3					
	5000.5208	Fan 0400.2490 Comp. 230mm (120x120)			1	1			
	0400.2547	Fan 220V 50/60Hz					1	1	
	5000.5364	Centrifugal Fan 230V 50/60Hz	1	1	1	1	1		
	5000.5216	Fan 0400.2490 Comp. 300mm (40x40)			1	1			
Fuse	0305.5604	Ret. Fuse 0.5A 600V FNQ-R1					2	2	
	0305.5663	Ret. Fuse 1.6A 600V							2
	0305.6716	Fuse 6.3x32 3.15A 500V	1	1	1	1	1	1	1
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1	1	1
CC9.00	S41509651	Controle Board CC9.00	1	1	1	1	1	1	1
CFI1.00	S41509929	HMI Interface Board	1	1	1	1	1	1	1
DPS1.00	S41512431	Driver and Power Supply Board	1	1					
DPS1.01	S41512440	Driver and Power Supply Board			1	1	1	1	1
LVS1.00	S41510269	Voltage Selection Board					1	1	1
CB1.00	S41509996	Board CB1.00			2	2			
CB3.00	S41510285	Board CB3.00					2	2	2
KML-CFW09	S417102035	Kit KML	1	1	1	1	1	1	1
*P38-4.00	S41511753	Power Board P38-4.00	1						
P38-4.01	S41511370	Power Board P38-4.01	1						
*P45-4.00	S41509805	Power Board P45-4.00		1					
P45-4.01	S41511389	Power Board P45-4.01		1					
*P60-4.00	S41511338	Power Board P60-4.00			1				
P60-4.01	S41511397	Power Board P60-4.01			1				
*P70-4.00	S41509970	Power Board P70-4.00				1			
P70-4.01	S41511400	Power Board P70-4.01				1			
*P86-4.00	S41511346	Power Board P86-4.00					1		
P86-4.01	S41511419	Power Board P86-4.01					1		
*P105-4.00	S41509953	Power Board P105-4.00						1	
P105-4.01	S41511427	Power Board P105-4.01						1	
*P142-4.00	S41510056	Power Board P142-4.00							1
P142-4.01	S41511435	Power Board P142-4.01							1
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1	1
CFI1.01	S41510226	Interface Board with HMI (Optional)	1	1	1	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1	1	1	1
EBB1.01	S41510200	Function Expansion Board (Optional)	1	1	1	1	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1	1	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1	1	1	1	1

SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNET Board (Optional)	1	1	1	1	1	1	1
Current Trasducers	0307.2495	Current transducers 200A/100mA					2	2	2

*Only for the types specified with braking (DB)

Models 380-480V

Name	Item Nº	Especification	Type (Ampéres)							
			180	211	240	312	361	450	515	600
			Units per inverter							
IGBT Module	0303.7118	IGBT Module 200A 1200V	6							
	0303.9315	IGBT Module 300A 1200V		6	6					
IGBT´s Supports	417102497	Inverter Support 361A - EP				3	3			
	417102498	Inverter Support 450A - EP						3		
	417102499	Inverter Support 600A - EP							3	3
	417102496	Inverter Support 600A without CT				6	6	9	12	12
	0298.0001	IGBT Module 300A - (EUPEC)	3	3	3					
Thyristor-Diode Module	0298.0016	Thyristor-Diode Module TD330N16				3	3			
	0303.9986	Thyristor-Diode Module TD425N16						3		
	0303.9994	Thyristor-Diode Module TD500N16							3	3
	0298.003	Thyristor-Diode Module SKKH 250/16	1	1	1					
Preload Transformer	0307.0204	Transformer of Trigger Fan 250VA				1	1	1	1	1
	0307.0212	Transformer of Trigger Fan 650VA	6	6	6	10	10	10	10	10
Preload Resistor	0301.1852	Vitrified Wire Resistor 20R 75W	1	1	1	1	1	1	1	1
Rectifier Bridge	0303.9544	Three-Phase Rectifier Bridge 35A 1400V	8	12	12	18	18	24	30	30
Electrolytic Capacitor	0302.4873	Electrolytic Capacitor 4700uF/400V	1	1	1	3	3	3	3	3
Fan	0400.2512	Centrifugal Fan 230V 50/60Hz	2	2	2					
Fuses	0305.5663	Ret. Fuse 1.6A 600V				2	2	2	2	2
	0305.6112	Ret. Fuse 2.5A 600V	1	1	1	1	1	1	1	1
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1	1	1	1
KML-CFW09	S417102035	Kit KML	1	1	1	1	1	1	1	1
CC9.00	S41509651	Control Board CC9.00	1	1	1	1	1			
DPS2.00	S41510897	Driver and Power Supply Board DPS2.00						1	1	1
DPS2.01	S41511575	Driver and Power Supply Board DPS2.01	3	3	3	3	3			
CRG2.00	S41512615	Gate Resistor Board CRG2X.00						3		
CRG3X.01	S41512618	Gate Resistor Board CRG3X.01							3	3
CRG3X.00	S41512617	Gate Resistor Board CRG3X.00	1							
CIP2.00	S41510870	Board CIP2.00		1	1					
CIP2.01	S41511583	Board CIP2.01				1	1			
CIP2.02	S41511591	Board CIP2.02						1		
CIP2.03	S41511605	Board CIP2.03							1	1
CIP2.04	S41511613	Board CIP2.04							1	1
CIP2.52	S41513103	Board CIP2.52		1						
CIP2.53	S41513104	Board CIP2.53				1				
CIP2.53	S41513105	Board CIP2.54							1	
SKHI23MEC8	S41511532	Board SKHI23/12 for MEC8	3	3	3					
SKHI23MEC10	S41511540	Board SKHI23/12 for MEC10				3	3	3		
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1	1	1
CFI1.01	S41510226	Interface Board with HMI (Optional)	1	1	1	1	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1

Name	Item Nº	Especification	Type (Ampéres)							
			180	211	240	312	361	450	515	600
			Units per inverter							
EBB.04	S41512671	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
EBB.05	S41510846	Function Expansion Board (Optional)	1	1	1	1	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNETBoard (Optional)	2	2	2					
Current Transducers	0307.2509	Current Trasnducers 200A/100mA	1	1	1	1	1	1	1	1
	0307.2550	Current Trasnducers 5000A/1A LT SI							2	2
Current Transducers	0307.2070	Current Trasnducers LT 100SI				2	2	2		

Models 500-600V

Name	Item Nº	Especification	Types (Ampéres)					
			2.9	4.2	7	10	12	14
			Units per Inverter					
Fans	5000.5291	Fan 0400.3217 Comp. 145mm (40x40)	1	1	1	1	1	1
	5000.5435	Fan 2x400.3284 290/200mm (60x60)	2	2	2	2	2	2
CC9.00	S41509651	Control Board CC9.00	1	1	1	1	1	1
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1	1
CIF1.00	S41509929	Interface Board with HMI	1	1	1	1	1	1
CRP2.00	S41512862	Pulse Feedback Board	1	1	1	1	1	1
P14-6.00	S41512855	Power Board P14-6.00	1					
P14-6.01	S41512856	Power Board P14-6.01		1				
P14-6.02	S41512857	Power Board P14-6.02			1			
P14-6.03	S41512858	Power Board P14-6.03				1		
P14-6.04	S41512859	Power Board P14-6.04					1	
P14-6.05	S41512860	Power Board P14-6.05						1
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1
CIF1.01	S41510226	Interface Board with HMI (Optional)	1	1	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1	1	1
EBB1.01	S41510200	Function Expansion Board (Optional)	1	1	1	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNet Board (Optional)	1	1	1	1	1	1

Models 500-600V

Name	Item Nº	Especification	Types (Ampéres)		
			22	27	32
			Units per Inverter		
Fans	5000.5267	Fan 0400.2482 Comp. 150mm (80x80)	3	3	3
Fuse	0305.6716	Fuse 6.3x32 3.15A 500V	1	1	1
CC9.00	S41509651	Control Board CC9.00	1	1	1
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1
CIF1.00	S41509929	Interface Board with HMI	1	1	1
KML-CFW09	S417102035	Kit KML	1	1	1
DPS4.00	S41512864	Driver and Power Supply Board	1	1	1
P27-6.01	S41512867	Power Board P27-6.01	1		
*P27-6.00	S41512866	Power Board P27-6.00	1		
P27-6.03	S41512869	Power Board P14-6.03		1	
*P27-6.02	S41512868	Power Board P27-6.02		1	
P32-6.01	S41512872	Power Board P32-6.01			1
*P32-6.00	S41512871	Power Board P32-6.00			1
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1
CIF1.01	S41510226	Interface Board with HMI (Optional)	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1
EBB1.01	S41510200	Function Expansion Board (Optional)	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNet Board (Optional)	1	1	1

* Only for types specified with braking (DB).

Models 500-600V

Name	Item Nº	Especification	Types (Ampéres)			
			44	53	63	79
			Units per Inverter			
Preload Contactor	1410.4704	Contactor CWM50.00 220V 50/60Hz	1	1	1	1
Preload Transform.	0299.0152	Preload Transformer	1	1	1	1
Preload Resistor	0301.1852	Vetrified Wire Resistor 20R 75W	1	1	1	1
Fan	0400.2547	Fan 220V 50/60Hz	1	1	1	1
Fuse	0305.6166	Fuse 14x51mm 2A 690V	2	2	2	2
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1
CC9	S41509651	Control Board CC9	1	1	1	1
CFI1.00	S41509929	HMI Interface Board	1	1	1	1
DPS5.00	S41512966	Driver and Power Supply Board DPS5.00	1	1	1	1
LVS2.00	S41512990	Voltage Selection Board LVS2.00	1	1	1	1
CB4.00	S41512986	Board CB4.00	1	1	1	1
KML-CFW09	S417102035	Kit KML	1	1	1	1
*P44-6.00	S41512968	Power Board P44-6.00	1			
P44-6.01	S41512969	Power Board P44-6.01	1			
*P53-6.00	S41512973	Power Board P53-6.00		1		
P53-6.01	S41512974	Power Board P53-6.01		1		
*P63-6.00	S41512975	Power Board P63-6.00			1	
P63-6.01	S41512976	Power Board P63-6.01			1	
*P79-6.00	S41512977	Power Board P79-6.00				1
P79-6.01	S41512978	Power Board P79-6.01				1
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1
CFI1.01	S41510226	HMI Interface Board (Optional)	1	1	1	1
EBA1.01	S41510110	Function Expansion Board (Optional)	1	1	1	1
EBA1.02	S41511761	Function Expansion Board (Optional)	1	1	1	1
EBA1.03	S41511770	Function Expansion Board (Optional)	1	1	1	1
EBB1.01	S41511200	Function Expansion Board (Optional)	1	1	1	1
EBB1.02	S41511788	Function Expansion Board (Optional)	1	1	1	1
EBB1.03	S41511796	Function Expansion Board (Optional)	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNet Board (Optional)	1	1	1	1

* Only for types specified with braking (DB).

Models 500-690V

Name	Item Nº	Especification	Types (Ampéres)							
			107	147	211	247	315	343	418	472
			Cantidad por Convertidor							
IGBT Module	0298.0008	IGBT Module 200A 1700V		6						
	0298.0009	IGBT Module 300A 1700V	3		6	6	9	9	12	12
IGBT's Supports	S417104460	Inverter Leg 247A – EP				3				
	S417104461	Inverter Leg 315A – EP					3			
	S417104462	Inverter Leg 343A – EP						3		
	S417104463	Inverter Leg 418A – EP							3	
	S417104464	Inverter Leg 472A – EP								3
Thyristor-Diode Module	0303.9978	Thyristor-Diode Module TD250N16	3	3	3	3	3	3		
	0303.9986	Thyristor-Diode Module TD425N16							3	
	0303.9994	Thyristor-Diode Module TD500N16								3
Rectifier Bridge	0298.0026	Rectifier Bridge 36MT160	1	1	1	1	1	1	1	1
Preload Resistor	0301.1852	Vitrified Wire Resistor 20R 75W	6	6	6	8	8	8	8	10
Fan	0400.2512	Centrifugal Fan 230V 50/60Hz	1	1	1	3	3	3	3	3
Electrolytic Capacitor	0302.4873	Electrolytic Capacitor 4700uF/400V	9	12	12	18	18	18	18	27
Fuse	0302.6156	Fuse2A 690V	2	2	2					
	0302.6171	Fuse 4 690V				2	2	2	2	2
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1	1	1	1
KML-CFW09	S417102035	Kit KML	1	1	1	1	1	1	1	1
CC9	S41509651	Control Board CC9	1	1	1	1	1	1	1	1
DPS3	S41512834	Driver and Power Supply Board DPS3.00	1	1	1	1	1	1	1	1
CRG7	S41512951	Gate Resistor Board CRG7.00	3	3	3	3				
CRG6	S41512798	Gate Resistor Board CRG6.00					3	3	3	3
FCB1	S41512821	Board FCB1.00				3	3	3	3	3
FCB1.01	S41512999	Board FCB1.01				3	3	3	3	3
FCB2	S41513011	Board FCB2.00	1	1	1					
CIP3	S41512803	Board CIP3.00	1	1	1	1	1	1	1	1
RCS3	S41512846	Rectifier Snubber Board RCS3.00							3	3
CIS1	S41512836	Signal Interface Board CIS1.00	1							
	S41512883	Signal Interface Board CIS1.01		1						
	S41512884	Signal Interface Board CIS1.02			1					
	S41512885	Signal Interface Board CIS1.03				1				
	S41512886	Signal Interface Board CIS1.04					1			
	S41512887	Signal Interface Board CIS1.05						1		
	S41512888	Signal Interface Board CIS1.06							1	
	S41512889	Signal Interface Board CIS1.07								1
GDB1.00	S41512963	Gate Driver Board GDB1.00	3	3	3	3	3	3	3	3
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1	1	1
CFI1.01	S41510226	Interface board with HMI (Optional)	1	1	1	1	1	1	1	1
EBA1.01	S41510110	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.02	S41511761	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.03	S41511770	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.01	S41511200	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.02	S41511788	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1

EBB1.03	S41511796	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNet Board (Optional)	1	1	1	1	1	1	1	1

Models 660-690V

Name	Item Nº	Especification	Types (Ampéres)							
			100	127	179	225	259	305	340	428
			Units per Inverter							
IGBT Module	0298.0008	IGBT Module 200A 1700V		6						
	0298.0009	IGBT Module 300A 1700V	3		6	6	9	9	12	12
IGBT's Supports	S417104460	Inverter Leg 225A – EP				3				
	S417104461	Inverter Leg 259A – EP					3			
	S417104462	Inverter Leg 305A – EP						3		
	S417104463	Inverter Leg 340A – EP							3	
	S417104464	Inverter Leg 428A – EP								3
Thyristor-Diode Module	0303.9978	Thyristor-Diode Module TD250N16	3	3	3	3	3	3		
	0303.9986	Thyristor-Diode Module TD425N16							3	
	0303.9994	Thyristor-Diode Module TD500N16								3
Rectifier Bridge	0298.0026	Rectifier Bridge 36MT160	1	1	1	1	1	1	1	1
Preload Resistor	0301.1852	Vitrified Wire Resistor 20R 75W	6	6	6	8	8	8	8	10
Fan	0400.2512	Centrifugal Fan 230V 50/60Hz	1	1	1	3	3	3	3	3
Electrolytic Capacitor	0302.4873	Electrolytic Capacitor 4700uF/400V	9	12	12	18	18	18	18	27
Fuse	0302.6156	Fuse 2A 690V	2	2	2					
	0302.6171	Fuse 4 690V				2	2	2	2	2
HMI-CFW09-LCD	S417102024	HMI LCD	1	1	1	1	1	1	1	1
KML-CFW09	S417102035	Kit KML	1	1	1	1	1	1	1	1
CC9	S41509651	Control Board CC9	1	1	1	1	1	1	1	1
DPS3	S41512834	Driver and Power Supply Board DPS3.00	1	1	1	1	1	1	1	1
CRG7	S41512951	Gate Resistor Board CRG7.00	3	3	3	3				
CRG6	S41512798	Gate Resistor Board CRG6.00					3	3	3	3
FCB1	S41512821	Board FCB1.00				3	3	3	3	3
FCB1.01	S41512999	Board FCB1.01				3	3	3	3	3
FCB2	S41513011	Board FCB2.00	1	1	1					
CIP3	S41512803	Board CIP3.00	1	1	1	1	1	1	1	1
RCS3	S41512846	Rectifier Snubber Board RCS3.00							3	3
CIS1	S41512890	Signal Interface Board CIS1.08	1							
	S41512891	Signal Interface Board CIS1.09		1						
	S41512892	Signal Interface Board CIS1.10			1					
	S41512893	Signal Interface Board CIS1.11				1				
	S41512894	Signal Interface Board CIS1.12					1			
	S41512895	Signal Interface Board CIS1.13						1		
	S41512896	Signal Interface Board CIS1.14							1	
	S41512897	Signal Interface Board CIS1.15								1
GDB1.00	S41512963	Gate Driver Board GDB1.00	3	3	3	3	3	3	3	3
HMI-CFW09-LED	S417102023	HMI LED (Optional)	1	1	1	1	1	1	1	1
KMR-CFW09	S417102036	Kit KMR (Optional)	1	1	1	1	1	1	1	1
CFI1.01	S41510226	Interface board with HMI (Optional)	1	1	1	1	1	1	1	1
EBA1.01	S41510110	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.02	S41511761	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBA1.03	S41511770	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.01	S41511200	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
EBB1.02	S41511788	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1

EBB1.03	S41511796	Funcion Expancion Board (Optional)	1	1	1	1	1	1	1	1
SCI1.00	S41510846	RS-232 Module for PC (Optional)	1	1	1	1	1	1	1	1
Modbus RTU	S03051277	Anybus-DT Modbus RTU Board (Optional)	1	1	1	1	1	1	1	1
Profibus DP	S03051269	Anybus-S Profibus DP Board (Optional)	1	1	1	1	1	1	1	1
DeviceNet	S03051250	Anybus-S DeviceNet Board (Optional)	1	1	1	1	1	1	1	1

CHAPTER 8

CFW-09 OPTIONS AND ACCESSORIES

This Chapter describes the optional devices that are available for the CFW-09 and the accessories that may be necessary in specific applications. Options include the Expanded I/O Boards (EBA/EBB), LED-only Keypad, Remote Keypad and Cables, Blank Cover, RS-232 PC Communication kit, The accessories comprise: Encoder, Line Reactor, DC Bus Choke, Load Reactor and RFI filter, boards for Fieldbus communication, kit for extractable assembling, NEMA 4X/IP56 line, HD and RB and PLC1 board line.

8.1 I/O EXPANSION BOARDS

The I/O expansion boards expand the function of the CC9 control board. There are two different I/O expansion boards available and their selection depends on the application and extended functions that are required. The two boards **cannot** be used simultaneously. The difference between EBA and EBB option boards is in the analog inputs/outputs. The EBC board is used for the encoder connection, but it does not have own source as the EBA/EBB boards. A detailed description of each board is provided below.

8.1.1 EBA (I/O Expansion Board A)

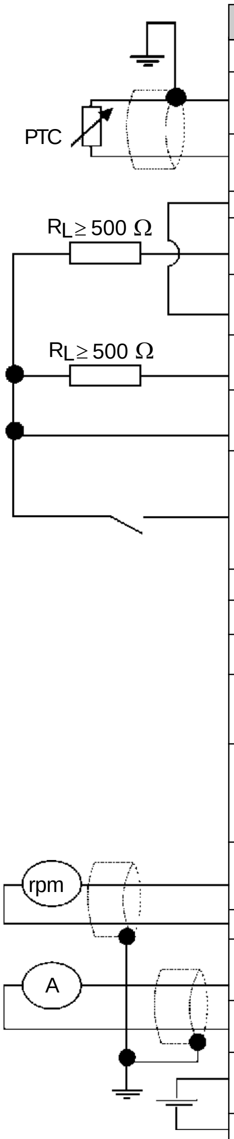
The EBA board includes the following:

a) Power supply for incremental encoder: isolated internal 12V source, differential input;
b) Buffered encoder output signals: isolated input signal repeater, differential output, external 5...15V power supply;
c) Analog Differential Input (AI4): 14 bit (0.006% of the range [±10V]), bipolar: -10V...+10V, 0(4)...20mA, programmable;
d) 2 Analog outputs (AO3/AO4): 14 bit (0.006% of the range [±10V]), bipolar: -10V...+10V, programmable);
e) Isolated RS-485 serial port. The use of the RS-485 serial interface does not allow the use of the standard RS-232 input (they can not be used simultaneously);
f) Digital Input (DI7): isolated, programmable, 24V
g) 2 isolated Open Collector transistor outputs (DO1/DO2): 24V, 50mA, programmable;
h) Input (DI8) for motor thermistor (PTC)): actuation 3.9kΩ ,release 1.6kΩ.

The EBA board can be supplied in different configurations, combining the features mentioned above. The available configurations are shown below:

Board Model	Included Features	Code for CFW-09 Model
EBA.01	Complete - a)...h)	A1
EBA.02	e), f), g) and h)	A2
EBA.03	c), d), f), g) and h)	A3

Table 8.1 *– EBA Board Versions*



Terminal XC4		Factory Default Function	Specifications
1	NC	Not connected	
2	PTC1	Motor Thermistor Input 1 Program **P270 = 16**	Actuation 3k9Ω Release:1k6 Ω Min. resistance: 100 Ω
3	PTC2	Motor Thermistor Input 1 Programar **P270 = 16**	Reference to DGND* though a 249 Ω resistor
4	DGND*	0V reference of the 24Vdc source	Grounded via a 249 Ω resistor
5	DO1	Transistor output 1: Not Used	Isolated, open collector, 24Vdc, 50mA Max.
6	COMMOM	Common point for Digital Input DI7 and Digital Outputs DO1 and DO2	
7	DO2	Transistor Output 2: Not Used	Isolated, open collector, 24Vdc, 50mA Max.
8	24 Vdc	Power Supply for the digital inputs/ outputs	24 Vdc ± 8%. Isolated, Capacity: 90 mA
9	DI7	Isolated Digital Input: Not used	Min. high level: 18 Vdc Max. low level: 3 Vdc Max. Voltage: 30Vdc Input Current.: 11mA @ 24 Vdc
10	SREF	Reference for RS-485	Isolated RS-485 serial Port
11	A-LINE	RS-485 A-LINE	
12	B-LINE	RS-485 B-LINE	
13	AI4 +	Analog input 4: Frequency Reference Program **P221=4 or P222=4**	Differential analog input: **-10V to +10V or 0 (4) to 20 mA** lin.: 14bit (0.006% of±10V) range Impedance: 40kΩ **[-10 V to +10 V]** 500 Ω **[0 (4) to 20 mA]**
14	AI4 -		
15	AGND	0V Reference for Analog Output (internally grounded)	Analog outputs signals: **-10 V to +10 V** Scales: see parameter description P256 and P258 in Chapter 6 lin.: 14bit (0.006% of ±10 V range) $R_L \geq 2k\Omega$
16	AO3	Analog output 3: Speed	
17	AGND	0V Reference for Analog Output (internally grounded)	
18	AO4	Analog Output 4: Motor Current	
19	+ V	External power supply for encoder signals output	**(+5 V ... +15 V),** Consumption: 100 mA @ 5V Outputs not included.
20	COM 1	0V reference of the external PS	

***Figure 8.1** – XC4 Terminal Block description (EBA Board complete)*

ENCODER CONNECTION: Refer to Section 8.2 .

INSTALLATION

The EBA board is installed on the CC9 control board, secured with spacers and connected via terminal blocks XC11 (24V*) and XC3.

NOTE!

For the CFW-09 Size 1 Models (6, 7, 10 and 13 A / 220-230V and 3.6, 4, 5.5 and 9 A / 380-480V) the plastic cover must be removed to install the EBA board.

Mounting Instructions:

1. Set the board configuration via S2 and S3 dip switches (Refer to Table 8.2);
2. Carefully insert terminal block XC3 (EBA) into the female connector XC3 of the CC9 control board.
   Check that all pins fit in the XC3 connector;

3. Press on the EBA board (near XC3) and on the left top edge until complete insertion of the connector and plastic spacer;
4. Secure the board to the metallic spacers with the screws provided;
5. Plug XC11 connector of the EBA board to the XC11 connector of the (CC9) control board.

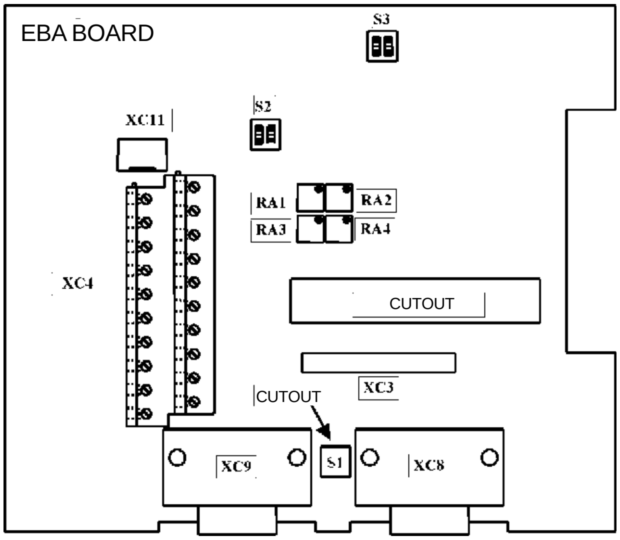


Figure 8.2 *- EBA Board layout*

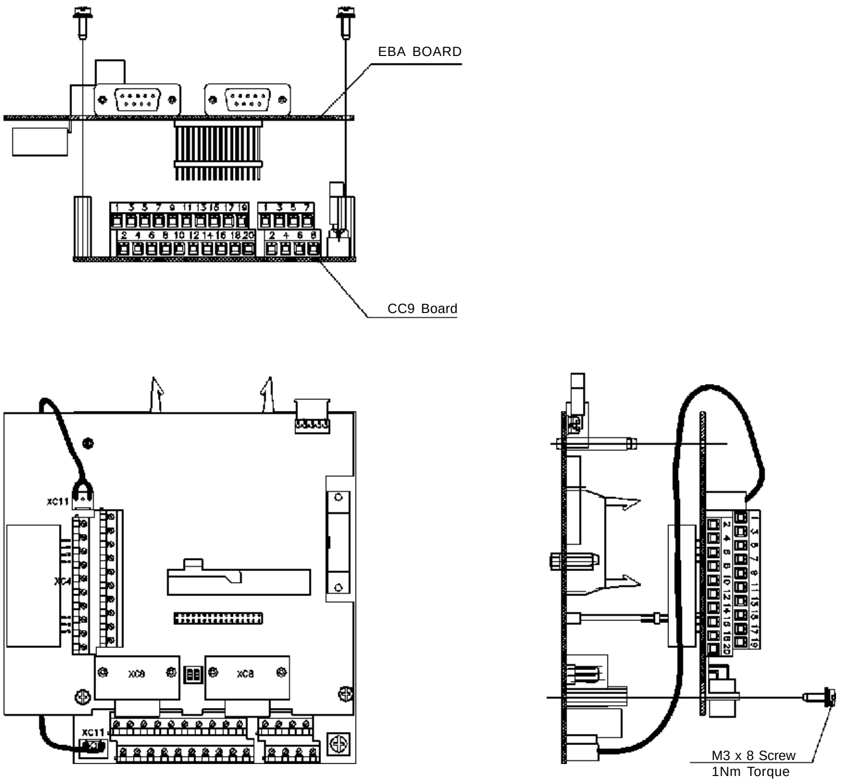


Figure 8.3 *- EBA Board installation procedure*

Signal	Factory default Function	Dip Switch	Selection Options
AI4	Speed Reference	S2.1	**OFF** -10V...+10 V (factory default) **ON** 0(4)...20 mA
RS-485	B-LINE	S3.1*	**OFF** without termination (factory default) **ON** with termination (120 Ω)
RS-485	A-LINE	S3.2*	**OFF** without termination (factory default) **ON** with termination (120 Ω)
AO3	Motor Speed	RA1 and RA2	**RA1** Offset setting (set by WEG) **RA2** Gain setting (set by WEG)
AO4	Motor Current	RA3 and RA4	**RA3** Offset setting (set by WEG) **RA4** Gain setting (set by WEG)

* S3.1 and S3.2 switches must be set for the same option.
Note: For Size 1 models the CFI1 board (interface between the CC9 control board and the HMI) must be removed to clear access to these switches.

Table 8.2 *– EBA board configuration*

NOTE!
The external signal and control wiring must be connected to XC4 (EBA), following the same recommendations as for the wiring of the control board CC9 (Refer to Section 3.2.4).

8.1.2 EBB (Expansion I/O Board B)

The EBB board provides with the following features:

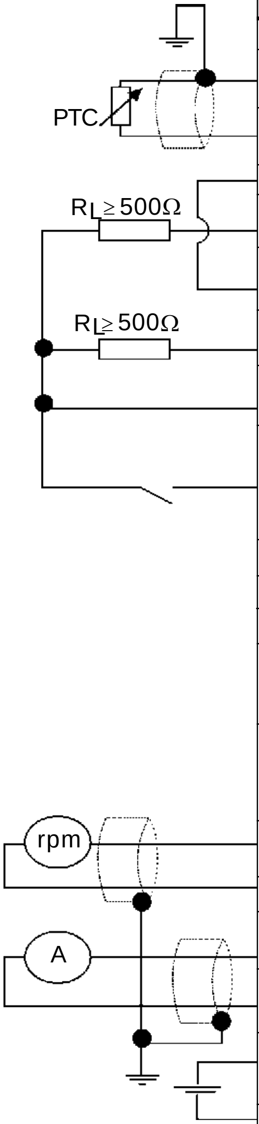
a) Power supply for incremental encoder: isolated internal 12V source, differential input;
b) Buffered encoder signals output: isolated input signal repeater, differential output, external 5...15V power supply;
c) Isolated RS-485 serial port. The use of the RS-485 serial interface does not allow the use of the standard RS-232 input (they can not be used simultaneously);
d) Digital Input (DI7): isolated, programmable, 24V;
e) 2 isolated Open Collector transistor outputs (DO1/DO2):, 24V ,50mA, programmable;
f) Isolated analog input (AI3): unipolar, resolution: 10 bit, 0...+10V/ 0(4)...20mA, programmable;
g) 2 isolated analog outputs (AO1^I/AO2^I): unipolar, resolution: 11 bit (0.05% of full scale), 0(4)...20mA, programmable (functions are identical to the AO1/AO2 outputs of the control board CC9);
h) DI8 Input for the motor thermistor (PTC)): actuation 3k9, release 1k6.

This board can be supplied in different configurations, combining the features mentioned above. The available configurations are shown below:

Board Model	Inclused Features	Code for CFW-09 Model
EBB.01	Complete - a)...h)*	B1
EBB.02	a), d), e) and h)*	B2
EBB.03	d), e), f), g) and h)	B3
EBB.04	Complete - a)...h)**	B4
EBB.05	g)	B5

* Board with 12V source for the encoder;
** Board with 5V source for the encoder.

Table 8.3 *– EBB board versions*



Terminal XC5		Factory Default Function	Specifications
1	NC	Not Connected	
2	PTC1	Motor Thermistor Input 1 Program **P270 = 16**	Actuation: 3.9k Ω Release:1.6k Ω Min: resistance: 100 Ω
3	PTC2	Motor Thermistor Input 2 Program **P270 = 16**	Reference to DGND* trough a 249 Ωresistor
4	DGND*	0V reference of the 24 Vdc source	Grounded via a 249 Ωresistor
5	DO1	Transistor Output 1: Not used	Isolated, open collector, 24Vdc, 50 mA Max.
6	COMMOM	Commom point for Digital Input DI7 and Digital Outputs DO1 and DO2	
7	DO2	Transistor Output 2: Not Used	Isolated, open collector, 24Vdc, 50 mA Max.
8	24 Vdc	Power Supply for the digital inputs/ outputs	24 Vdc ± 8%. Isolated, Capacity: 90 mA
9	DI7	Isolated digital input: Not Used	Min. high level: 18 Vdc Max. low level: 3 Vdc Max. Voltage: 30Vdc Input Current.: 11mA @ 24 Vdc
10	SREF	Reference for RS-485	Isolated RS-485 serial port
11	A-LINE	RS-485 A-LINE	
12	B-LINE	RS-485 B-LINE	
13	AI3 +	Analog Input 3: Frequecy Reference Program **P221=3 or P222=3**	Isolated analog input: **0V to +10V or 0 (4) to 20mA** lin.: 10 bit (0.006% of ±10V range) Impedance: 400kΩ **[0 V to +10 V]** 500Ω **[0 (4) to 20 mA]**
14	AI3 -		
15	AGND^{I}	0V Reference for Analog Speed	Isolated analog Outputs signals: **0 (4) to 20 mA** Scales: see parameter description P252 and P254 in Chapter6 lin.: 11bit (0.006% of the range) $R_L \le 600\Omega$
16	AO1^{I}	Analog Output 1: Speed	
17	AGND^{I}	0V Reference for analog Output	
18	AO2^{I}	Analog Output 2 : Motor Current	
19	+ V	External power supply for Encoder signals output	**(+5 V ... +15 V),** consumption: 100 mA @ 5V Outputs not included.
20	COM 1	0V reference of the next.source	

***Figure 8.4** – XC5 Terminal Block description (complete EBB board)*

ATTENTION!

The isolation of the analog input AI3 and the analog outputs AO1^{I} and AO2^{I} is designed only to interrupt the ground loops. Do not connect these inputs to high potentials.

ENCODER CONNECTION: Refer to Section 8.2.

INSTALLATION

The EBB board is installed on the CC9 control board, secured with spacers and connected via Terminal blocks XC11 (24V*) and XC3.

NOTE!

For the CFW-09 Size 1 Models (6, 7, 10 and 13 A / 220-230V and 3.6, 4, 5.5 and 9 A / 380-480V) the plastic cover must be removed to install the EBB board.

Mounting Instructions:

1. Set the board configuration via S4, S5, S6 and S7 dip switches (Refer to Table 8.4);
2. Carefully insert terminal block XC3 (EBB) into the female connector XC3 of the CC9 control board. Check that all pins fit in the XC3 connector;
3. Press on the EBB board (near XC3) and on the left top edge until complete insertion of the connector and plastic spacer;
4. Secure the board to the metallic spacers with the screws provided;
5. Plug XC11 connector of the EBB board to the XC11 connector of the (CC9) control board.

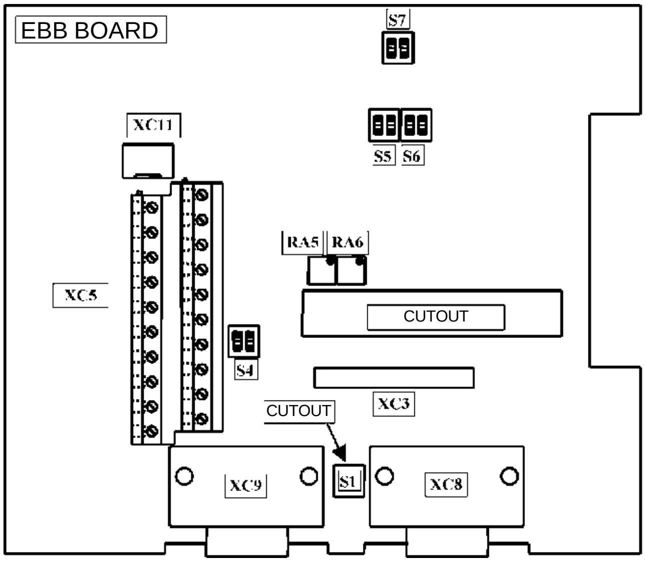


Figure 8.5 *- EBB Board Layout*

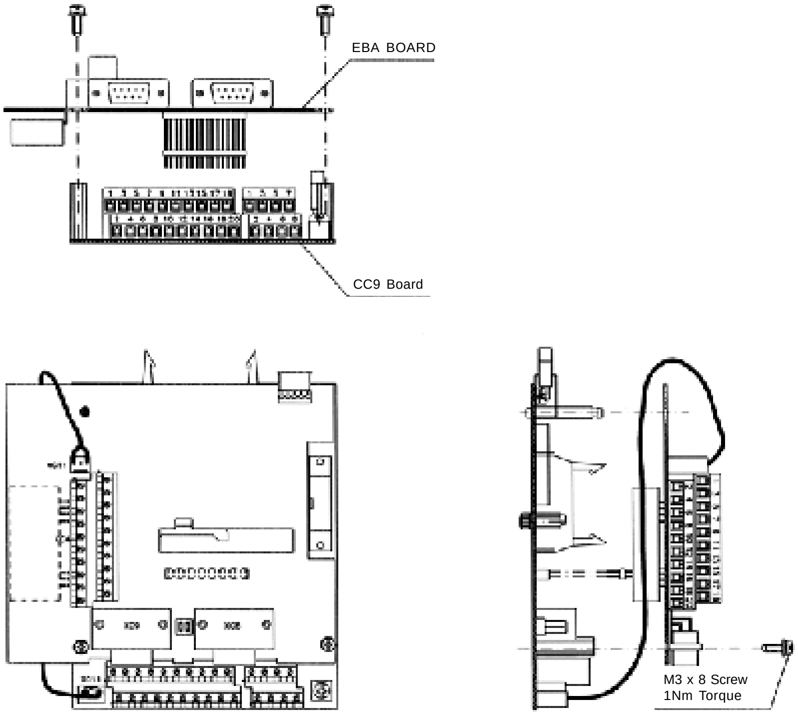


Figure 8.6 *- EBB Board Installation Procedure*

Signal	Factory Default Function	Dip Switch	Selection Options
AI3	Speed Reference	S4.1	**OFF** -10V...+10 V (factory default) **ON** 0(4)...20 mA
RS-485	B-LINE	S7.1*	**OFF** with termination (factory default) **ON** without termination (120 Ω)
RS-485	A-LINE	S7.2*	**OFF** with termination (factory default) **ON** without termination (120 Ω)
A01[I]	Speed	S5.1 e S5.2**	**OFF** 0...20 mA **ON** 4...20 mA (factory default)
		RA5	Full scale adjustment**** (set by WEG)
A02[I]	Motor Current	S6.1 and S6.2***	**OFF** 0...20 mA **ON** 4...20 mA (factory default)
		RA6	Full scale adjustment**** (set by WEG)

* S7.1 and S7.2 switches must be set for the same option.
** S5.1 and S5.2 switches must be set the same option.
* ** S6.1 and S6.2 switches must be set for the same option.
**** When the outputs are set to 0...20 mA, it may be necessary to readjust the full scale
Note: For Size 1 models, the CFI1 board (interface between the CC9 control board and the HMI) must be removed to clear access to S7.1 and S7.2 switches.

Table 8.4 *– EBB Board Configuration*

NOTE!
The external signal and control wiring must be connected to XC (EBB), following the same recommendations as for the wiring of the control board CC9 (Refer to Section 3.2.4).

8.2 INCREMENTAL ENCODER

For applications that require high-speed accuracy, the actual motor speed must be fed back via motor-mounted incremental encoder. The encoder is connected electrically to the inverter through the XC9 (DB9) connector of the Function Expansion Board - EBA or EBB and XC9 or XC10 to EBC.

8.2.1 EBA/EBB Boards

When the board EBA or EBB is used, the selected encoder should have the following characteristics:

☑ Power supply voltage: 12 Vdc, less than 200 mA current draw;
☑ 2 quadrature channels (90º) + zero pulse with complementary outputs (differential): signals A, $\overline{A}$, B, $\overline{B}$, Z and $\overline{Z}$;
☑ “Linedriver” or “Push-Pull” output circuit type (level 12V);
☑ Electronic circuit isolated from encoder frame;
☑ Recommended number of pulses per revolution: 1024 ppr;

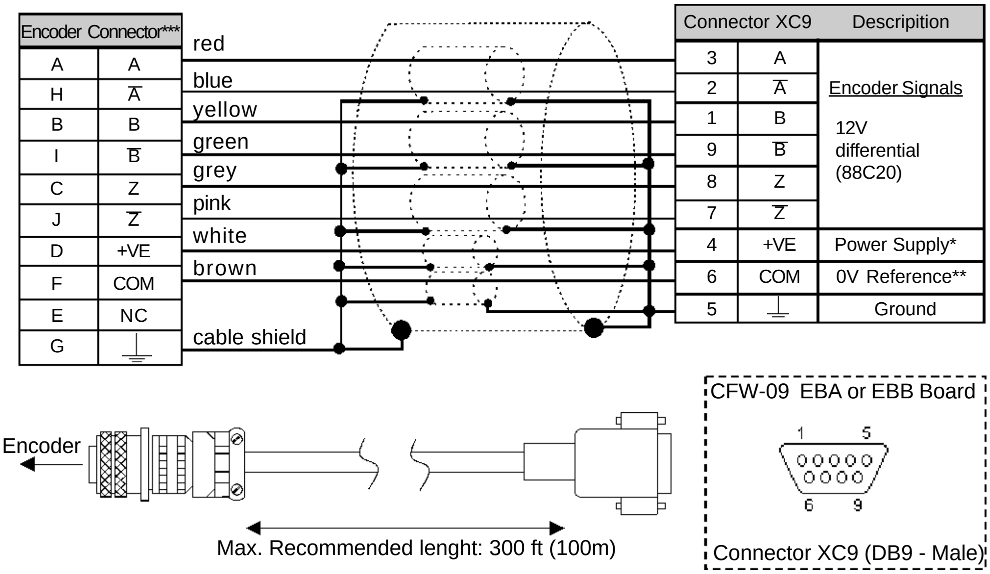
For mounting the encoder on the motor, follow the recommendations bellow:

☑ Couple the encoder directly to the motor shaft (use a flexible coupling without torsional flexibility);
☑ Both the shaft and the metallic frame of the encoder must be electrically isolated from the motor (min. Spacing: 3 mm);
☑ Use high quality flexible couplings to prevent mechanical oscillation or backlash;

The electrical connections must be made with shielded cable, maintaining a minimum distance of about 10 in (25cm) from other wires (power, control cables, etc.). If possible, install the encoder cable in a metallic conduit.

At start-up, program Parameter **P202** – Type of Control to 4 (Vector with Encoder) to operate the motor with incremental encoder speed feedback.

For more details about Vector Control operation refer to Chapter 4.
The Expanded I/O Boards EBA and EBB are provided with externally powered, isolated encoder output signals.

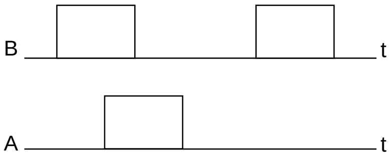


* Power supply voltage 12Vdc / 220mA for encoder
** Referenced to ground via 1μF in parallel with 1kΩ
*** Valid pin position with encoder HR526xxxxB5-Dynapar. For other encoder modules, check the correct connection to meet the required sequence.

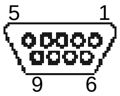
Figure 8.7 *– Encoder Cable*

NOTE!
The max. permitted encoder frequency is 100 kHz.

Sequence of the encoder signals:



Motor running clockwise.



Connector XC8 (DB9 Female)

* External power supply: +5 V..+15 Vdc,
Consumption: 100 mA @ 5 V, outputs not included
Note.: The external power supply can also be connected via:
XC4:19 and XC4:20 (EBA) or
XC5:19 and XC5:20 (EBB)

CFW-09 EBA or EBB Board

Connector XC8		Descrition
3	A	Encoder Signals
2	$\overline{A}$	
1	B	Line Driver differential (88C30) Average high level current: 50 mA
9	$\overline{B}$	
8	Z	
7	$\overline{Z}$	
4	+V*	Power Supply*
6	COM 1*	0 V Reference
5	⏚	Ground

Figure 8.8 *– Encoder signals repeater output*

8.2.2 EBC Board

When the board EBC is used, the selected encoder should have the following characteristics:

☑ Power Supply Voltage: 5...15V;
☑ 2 quadrature channels (90º) with complementary outputs (differential):
☑ Signals $\overline{A}$, A, $\overline{B}$ and B;
”Linedriver” or “Push-Pull” output circuit type (with identical level as the power supply voltage);
☑ Electronic circuit isolated from the encoder frame;
☑ Recommended number of pulse per revolution: 1024 ppr;

INSTALLATION OF THE EBC BOARD
The EBC board is installed directly on the control boar CC9, fixed by means of spacers and connected through the XC3 connector.

NOTE!
For installation in the models of size 1, remove the lateral plastic cover of the product.
Mounting instructions:

1. Insert carefully the pins of the connector XC3 (EBC) into the female connector XC3 of the control board CC9. Check if all pins of the connector XC3 fit exactly;
2. Press on the board center (near to XC3) until the connector is inserted completely.
3. Fix the board to the 2 metallic spacers by means of the 2 bolts;

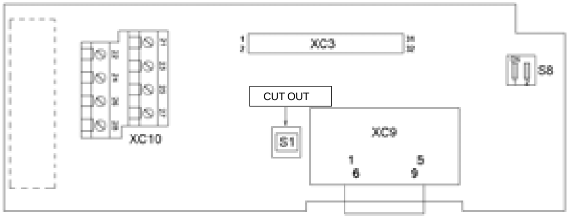


Figure 8.9 - *EBC Board Layout*

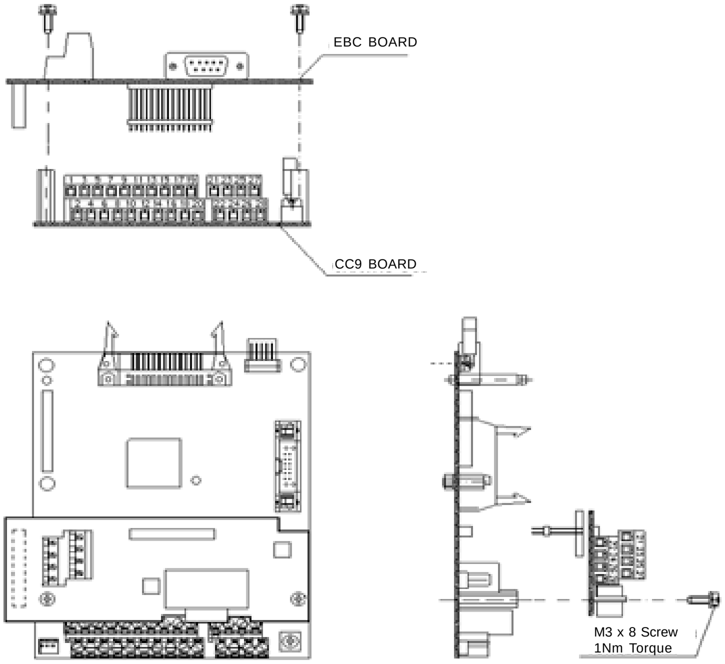


Figure 8.10 - *EBC Board Installation Procedures*

Configurations:

Expansion Board	Power Supply	Encoder Voltage	Customer Action
EBC.01	External 5V	5V	Commutate switch S8 to ON, see figure 8.9
	External 8 to 15V	8 to 15V	None
EBC.02	Internal 5V	5V	None
EBC.03	Internal 12V	12V	None

Table 8.5 - *EBC Borrad configuration*

NOTE!

The terminals XC10:22 and XC10:23 (see Figure 8.9), should be used only for encoder supply, when DB9 connection is not used.

MOUNTING OF THE ENCODER

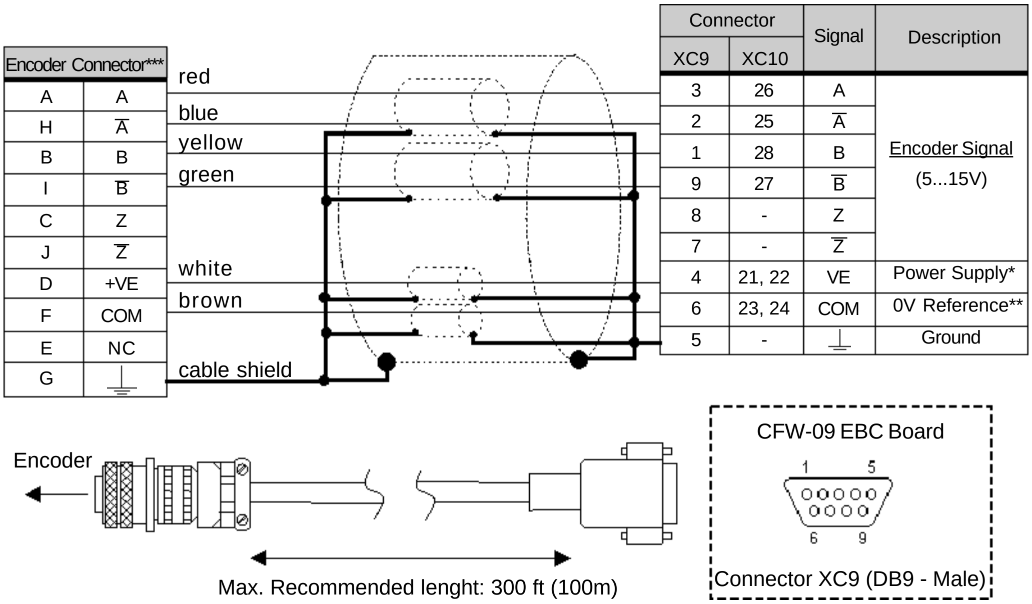
For mounting the encoder on the motor, follow the recommendations below:

- ☑ Couple the encoder directly to the motor shaft (use a flexible coupling without torsional flexibility);
- ☑ Both the shaft and the metallic frame of the encoder must be electrically isolated from the motor. (min. spacing: 0.119 in - 3mm);
- ☑ Use high quality flexible couplings to prevent mechanical oscillation or backlash;

The electrical connection must be made with shielded cable, maintaining a minimum distance of about 10 in (254mm) from other wired (power, control cables, etc.). If possible, install the encoder cable an a metallic conduit.

At start-up, program Parameter **P202** – type of control – to 4 (vector with encoder) to operate the motor with speed feedback through incremental encoder.

For more details about Vector Control operation, refer to Chapter 4.



Encoder Connector***	
A	A
H	$\overline{A}$
B	B
I	$\overline{B}$
C	Z
J	$\overline{Z}$
D	+VE
F	COM
E	NC
G	⏚

Connector		Signal	Description
XC9	XC10		
3	26	A	Encoder Signal (5...15V)
2	25	$\overline{A}$	
1	28	B	
9	27	$\overline{B}$	
8	-	Z	
7	-	$\overline{Z}$	
4	21, 22	VE	Power Supply*
6	23, 24	COM	0V Reference**
5	-	⏚	Ground

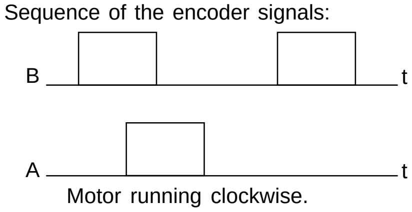
* External Power Supply Voltage for encoder: 5 ... 15 Vdc, consumption = 40 mA more consumption of the encoder

** OV reference of the Power Supply Voltage

*** Valid pin position with encoder HR526xxxxB5-Dynapar. For other encoder models, check the correct connection to meet the required sequence.

Figure 8.11 *– EBC Encoder Input*

NOTE!
The Max. permitted encoder frequency is 100kHz.



8.3 KEYPAD WITH LED´s ONLY

The CFW-09 standard Keypad (HMI) is provided with LED´s and LCD display. It can also be supplied with an LED Display only.
In this case the keypad model number is: HMI-CFW-09-LED. It operates in the same way as the standard keypad, but it does not show the text messages of the LCD and does not provide the copy function.
The dimensions and the electrical connections are the same as for the standard keypad. Refer to Section 8.4.

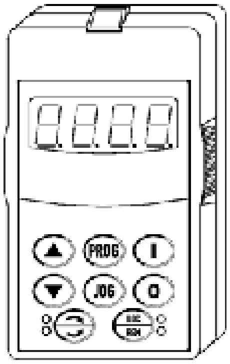


Figure 8.12 *- Keypad with LED display only*

8.4 REMOTE KEYPAD AND CABLES

The CFW-09 keypad (both the standard or the LED display only) can be installed directly on the inverter cover or remotely. If the keypad is installed remotely, the HMI-09 Frame can be used. The use of this frame improves the visual aspect of the remote keypad, as well as provides a local power supply to eliminate voltage drop problems with long cables. It is necessary to use the frame when the keypad cable is longer than 15 ft (5 m).
The table below shows the standard cable lengths and their part numbers:

Cable Length	WEG Part Nº
3 ft (1m)	0307.6890
6 ft (2m)	0307.6881
10 ft (3m)	0307.6873
15 ft (5m)	0307.6865
22 ft (7.5m*)	0307.6857
30 ft (10m*)	0307.6849

* These cabes require the use of the remote HMI-09 frame

Table 8.6 *- CFW-09 keypad cables*

The keypad cable must be installed separately from the power cables, following the same recommendations as for the CC9 control board (Refer to Section 3.2.4).
For assembling see details in figure 8.13 and 8.14.

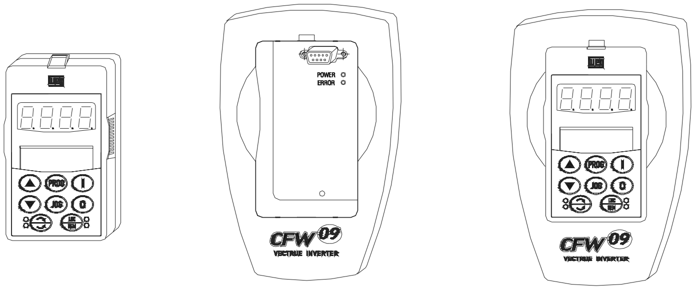
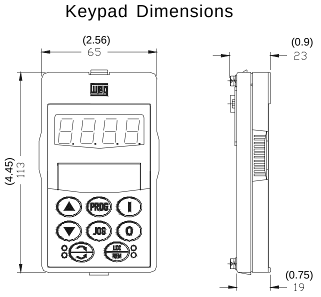
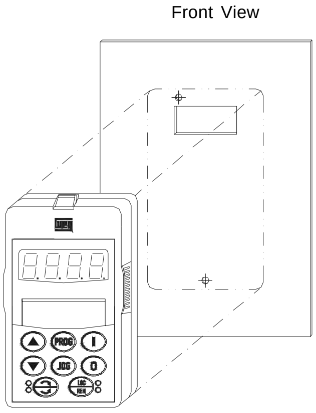


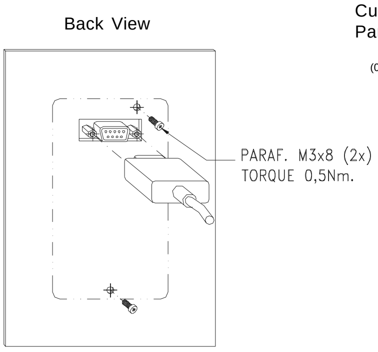
Figure 8.13 *- Standard HMI, remote HMI frame kit and HMI CFW09 – LCD N4 for panel installation*

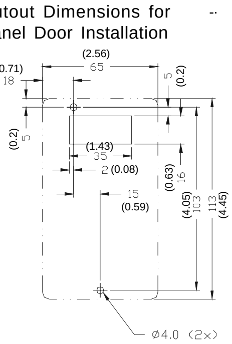
To meet NEMA 250 and IEC 60529 the HMI can be supplied with two specific degrees of protection:

Dimensions of the HMI – CFW09 – LED/LCD with NEMA 5-IP51 degree of protection.

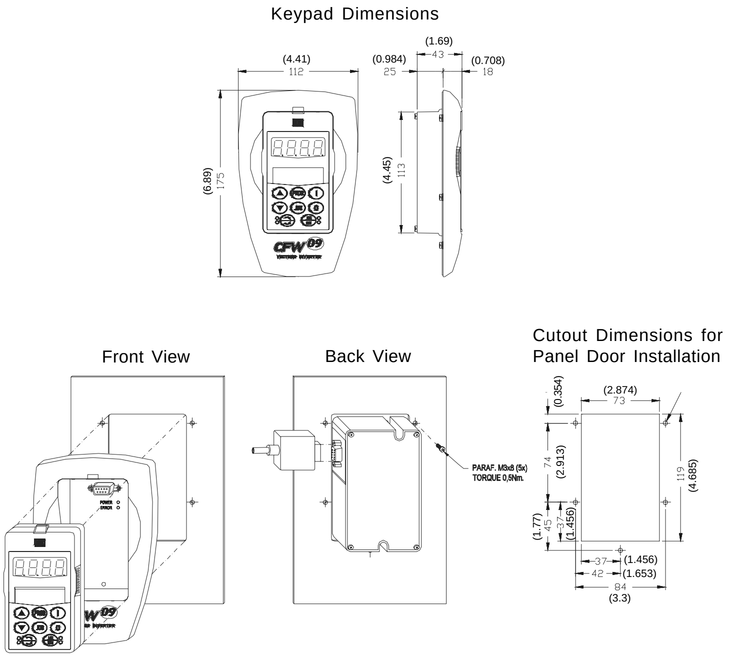








Dimensions of the HMI – CFW09 – LED/LCD + remote HMI frame kit with NEMA IP51 degree of protection.



Dimensions of the HMI – CFW09 – LED/LCD-N4 with NEMA 4-IP56 degree of protection.

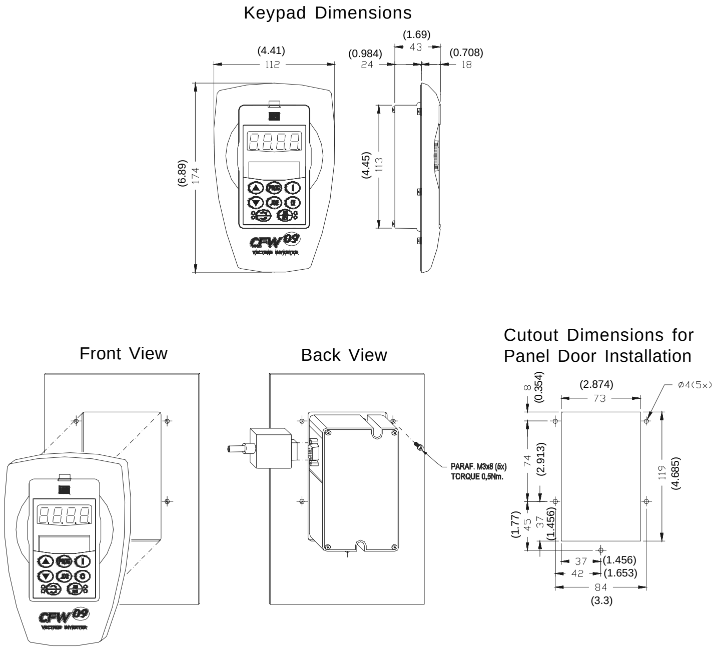


Figure 8.14 *- Keypad dimensions in mm (inch) and mounting procedures*

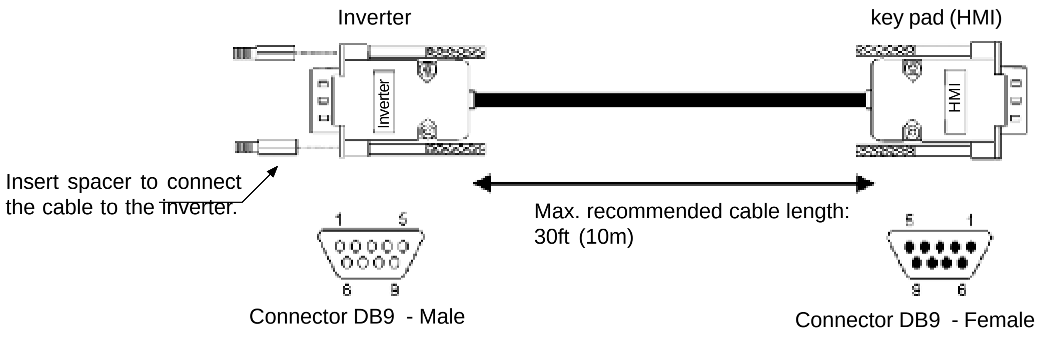


Figure 8.15 *- Cable for remote keypad connection*

15 ft (5m) CABLE CONNECTION	
Connector Pin/ Inverter Side	Connector Pin/ HMI Side
1	1
2	2
3	3
4	4
8	8
9= SHIELD	9= SHIELD

Note: The frame can be used or not.

Table 8.7 *- Connections for remote keypad cable up to 15 ft (5 m)*

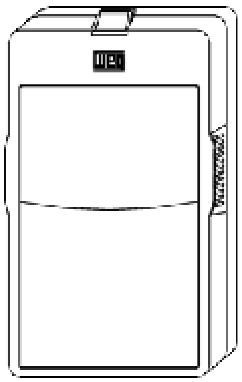
> 15 ft (5m) CABLE CONNECTION	
Connector Pin/ Inverter Side	Connector Pin/ HMI Side
2	2
3	3
4	4
8	8
9= SHIELD	9= SHIELD

Note: The frame must be used.

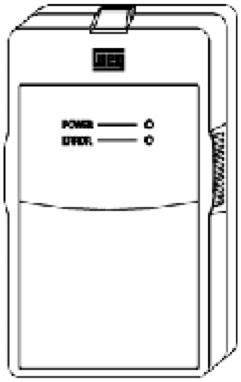
Table 8.8 *- Connections for remote keypad cable from 22 ft (7.5 m) to 30 ft (10 m)*

8.5 BLANK COVERS

As shown in Figure 8.16, two types of blank covers are available to be used, in the inverter or in the frame, when the keypad is not in place.



a) CFW-09 Blank Cover
(to be mounted in the frame)



b) CFW-09 Blank Cover with Power and Error LED's
(to be mounted in the inverter)

Figure 8.16 *– CFW-09 Blank Covers*

8.6 RS-232 PC COMMUNICATION KIT

The CFW-09 can be controlled, programmed and monitored via an RS-232 Serial Interface. The communication protocol is based on question/response telegrams according to ISO 1745 and ISO 646 standards, with ASCII characters exchanged between the inverter and a master (network controller, which can be a PLC, PC, etc.).The maximum transfer rate is 9600 bps. The RS-232 serial interface is not galvanically isolated from the OV reference of the inverter electronics, therefore the maximum recommended serial cable length is 30 ft (10 m). To implement the serial communication, an RS-232 SERIAL INTERFACE module has to be added to the CFW-09. This module is installed in place of the Keypad, making the RS-232 connection (RJ12 connector)available. If the use of the HMI is also required, the RS-232 module also provides its connection.

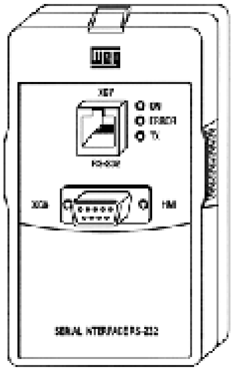


Figure 8.17 *- RS-232 module*

The RS-232 PC Communication Kit which allows the connection of the CFW-09 to a PC via the RS-232 interface is composed of:

☑ RS-232 Serial Interface Module;
☑ 10 ft (3 m) Cable for RJ-12 to DB9 connection;
☑ "SUPERDRIVE" Software for Windows 95/98/NT for CFW-09 programming, operation and monitoring.

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

☑ Remove the keypad from the inverter;
☑ Install RS-232 Serial Interface Module in place of the keypad;
☑ Install the "SUPERDRIVE" software in the PC;
☑ Use the cable to connect the inverter to the PC;
☑ Follow the "SUPERDRIVE" software instructions.

8.7 LINE REACTOR / DC BUS CHOKE

Due to the input circuit characteristic, common to all passive front end inverters available in the market, which consists of a six diode rectifier and capacitor bank, the input current (drained from the power supply line) of inverters is non sinusoidal and contains harmonics of the fundamental frequency.

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

The harmonic input currents depend on the impedance values that are present in the rectifier input/output circuit. The addition of a line reactor and/or DC bus choke reduces the current harmonic content, providing the following advantages:

☑ Increased input power factor;
☑ Reduced RMS input current;
☑ Reduced power supply voltage distortion;
☑ increased life of the DC link capacitors.
☑ The Line Reactor and the DC Bus Choke, when properly sized, have practically the same efficiency in reducing the harmonic currents. The DC Bus Choke has the advantage of not introducing a motor voltage drop, while the Line Reactor is more efficient to attenuate power supply voltage transients.

DC Link Inductor equivalent to the line reactor is:

$$L_{\text{DC- EQUIVALENT}} = L_{AC} \times \sqrt{3}$$

NOTE!

The 44A to 79A/500-600V, 107 to 472A/500-690V and 100A to 428A/660-690V models have a DC link inductor built in the standard version. It is not necessary to have minimun supply impedance or add external line inductors for protecting these models.

8.7.1 Application Criteria

☑ The line reactor or the DC Link Inductor shall be applied when required impedance is insufficient for limiting the input current peaks, thus preventing damages to the CFW-09. The minimum required impedances, expressed as impedance drop in percent are following:
  (a) For the model with rated current ≤130Amps and supply voltage 220-230V ≤ 142Amps for 380-480V or ≤ 32Amps for 500-600V: drop of 1% for the line voltage;
  (b) For the model with rated current ≥180Amps and supply voltage 380-480V: drop of 3% for the line voltage;
  (c) For the model with rated current ≥ 44Amps and supply voltage of 500-600V or ≥170Amps and supply voltage of 500-690V or ≥100Amps for 660-690V: there is no requirement for the minimum required line impedance for the CFW-09 protection. These impedances are ensured by the internal existing DC choke. The same is applicable when DC link inductor is incorporated t=into the product (Special Hardware – Code HC or HV), in the models with currents ≥ 16Amps and supply voltages in 220-230V or ≥13Amps and ≥ 240Amps in 380-480V.
☑ As an **alternative criteria**, a line reactor should be added when the inverter supply transformer has a rated power higher than indicated below:

CFW-09 Rated Current/ Volts	Transformer Power [kVA]
6 to 28/220-230V 3.6 to 24/380-480V 2.9 to 14/500-600V	125
45 to 130/220-230V 30 to 142/380-480V 22 to 32/500-600V	5 X Inverter Rated Power
180 to 600/380-480V	2 X Inverter Rated Power

Table 8.9 - *Line reactor usage criteria*

☑ To determine the line reactor needed to obtain the desired voltage drop, use equation below:

$$L = \frac{\text{Voltage Drop [\%] x Line Voltage [V]}}{\sqrt{3} \text{ x } 2\pi \text{ Line Freq [}Hz\text{] x Rated Cur.[A]}} \text{ [H]}$$

The electrical installation of an input line reactor is shown on Figure 8.18. For CFW-09 sizes above 16 A/220-230V or 13 A/380-480V, the connection of a DC Bus Choke is possible. The DC bus choke connection is also possible in all 2.9...32A/500-600V models. Figure 8.19 shows this connection.

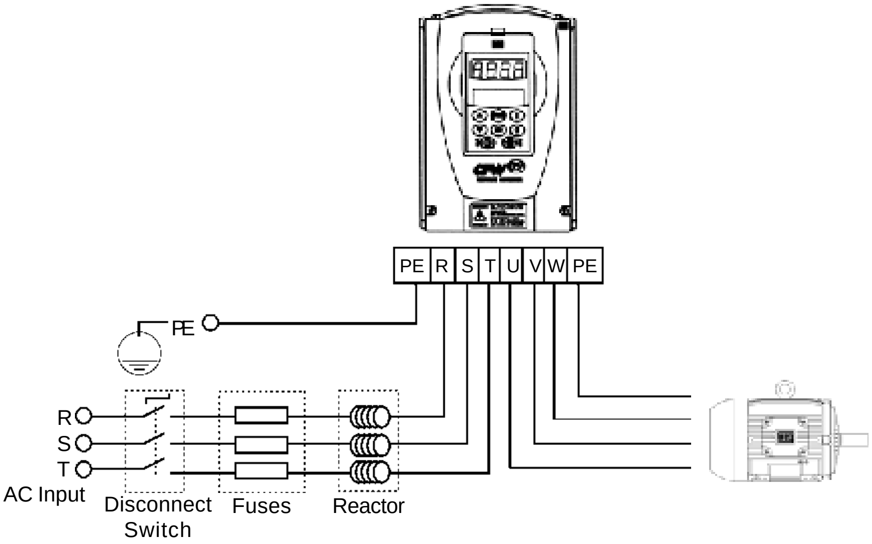


Figure 8.18 – *Line reactor connection*

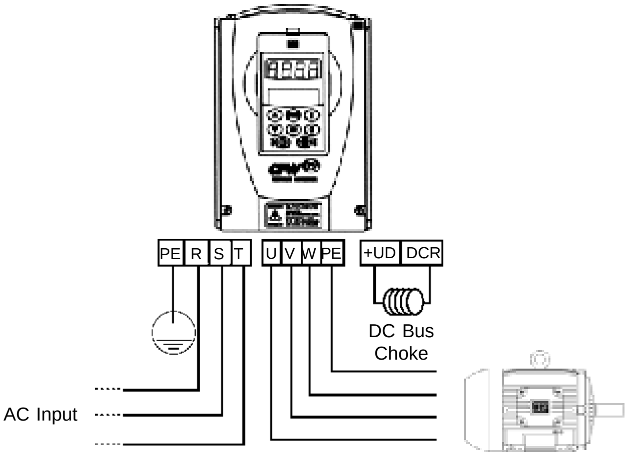
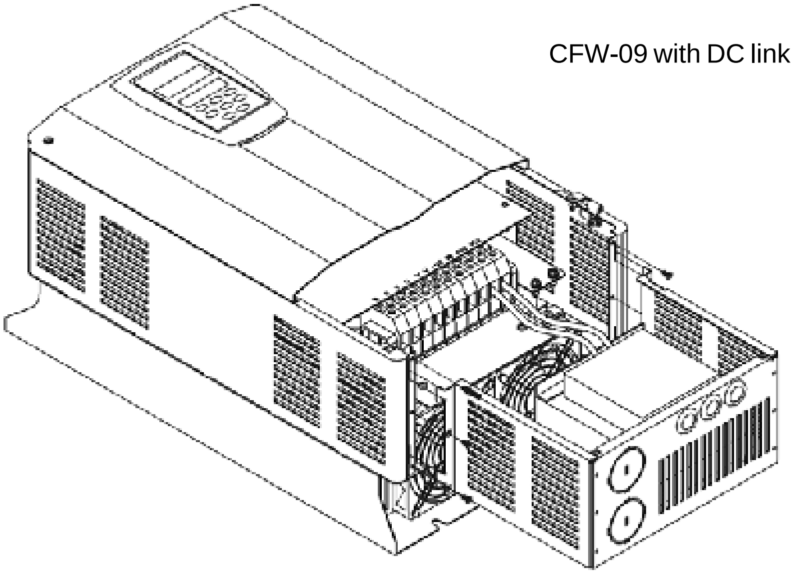


Figure 8.19 – *DC Bus Choke connection*

8.7.2 DC Link Inductor Built in

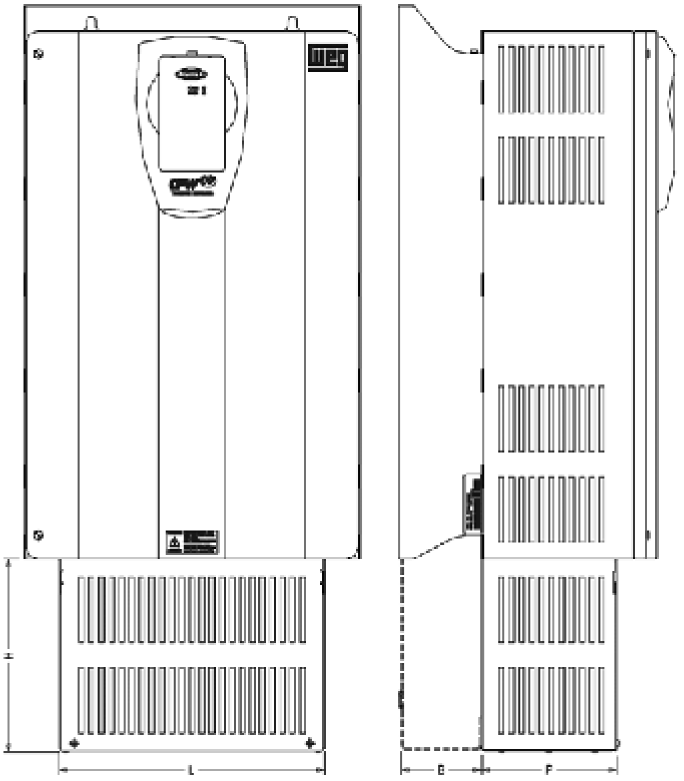
The CFW-09 inverter from sizes 2 to 8 can be fitted with a inductor for the DC Link already incorporated into the product. To request the inverter with a inductor already assembled, please add the code "HC" (for inverter operating at constant torque) or "HV" (for inverter operating with variable torque) in the model CFW-09, in the option field "Special Hardware" (see Item 2.4).

Note: Remember that the operation at higher currents than the rated current in variable Torque mode is not possible with all inverter types (see Item 9.1.1 and Item 9.1.2). Thus the HV option is only possible with the types that can be operated in that situation.



CFW-09 with DC link inductor

Sizes 2 to 8



Dimensions inch (mm)

Model	L	H	P	B
Size 2	6.30 (160)	4.72 (120)	4.15 (105.5)	-
Size 3	6.02 (153)	5.39 (137)	5.27 (134)	-
Size 4	7.08 (180)	6.77 (172)	5.27 (134)	-
Size 5	10.43 (265)	7.57 (193.5)	5.27 (134)	-
Size 6-7	10.43 (265)	8.36 (212.5)	6.25 (159)	-
Size 8	12.79 (325)	9.44 (240)	8.72 (221.5)	3.16 (80.5)

8.8 LOAD REACTOR

The use of a three-phase load reactor, with an approximate 2% voltage drop decreases the dv/dt (voltage rising rate) of the PWM pulses commonly generated at the inverter output of any AC frequecy converter.

This practice reduces the voltage spikes on the motor windings and leakage currents that may be generated when long distance cables between inverter and motor are used.

There are many factors that influence the peak level (Vp) and rise time (tr) of voltage spikes. Cable type, cable length, motor size, switching frequency and other variables all affect Vp and dv/dt.

WEG recommends using a load reactor when V supply > 500V, though this is not always required. WEG, as specialists in both VSD's and motors are able to provide an integrated solution. The load reactor value is calculated in the same way as the line reactor (See item 8.7.1).

If the cables between inverter and motor are longer than 300 ft (100 m), the cable capacitance to ground may cause nuisance overcurrent (E00) or ground fault (E11) trips. In this case it is also recommended to use a load reactor.

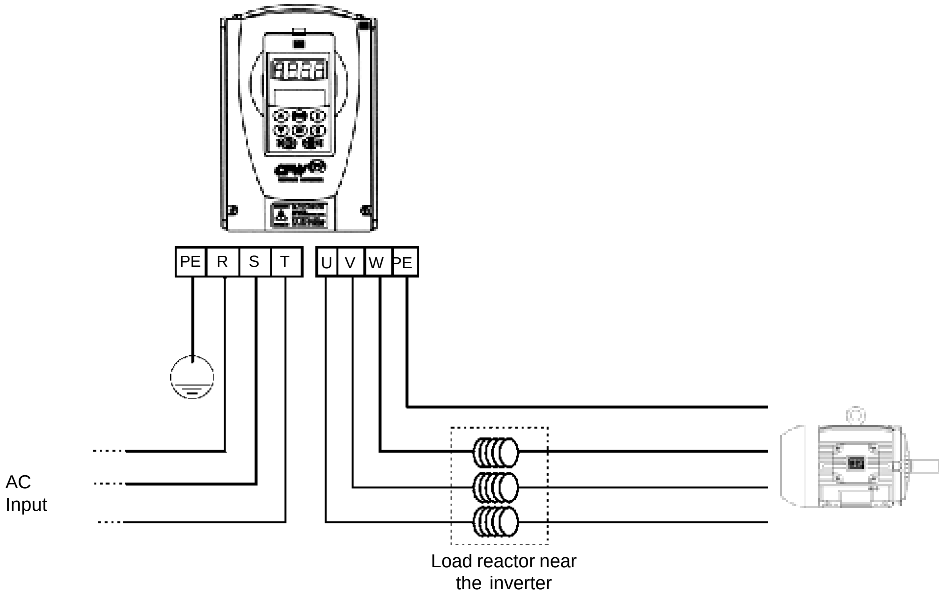


Figure 8.20 *– Load reactor connection*

8.9 RFI FILTER

The installation of frequency inverters requires certain care in order to prevent electromagnetic interference (EMI). This interference may disturb the operation of the inverter itself or other devices, such as, electronic sensors, PLCs, transducers, radio equipment, etc.

To avoid these problems, follow the installation instructions contained in this Manual. Never install electromagnetic noise generating circuits such as input power and motor cables near analog signal or control cables.

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

The electromagnetic interference can also be transmitted through the power supply line. This type of interference is minimized in the most cases by capacitive Radio Frequency Filters (common and differential mode) which are already installed inside the CFW-09. However, when inverters are installed in residential areas, the installation of an external additional filter may be required.

In this case contact WEG to select the most suitable filter type.

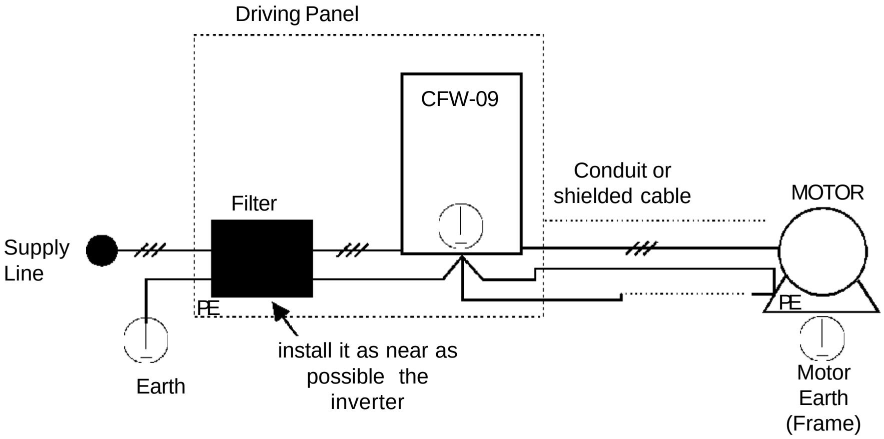


***Figure 8.21** – RFI Filter connection*

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;

☑ If the cable between inverter and filter is longer than 12 in (30 cm), use a shielded cable and ground each shield end on the grounded mounting plate.

NOTE!
Installations that must meet the European standards, see item 3.3.

8.10 DYNAMIC BRAKING

The amount of braking torque that can be generated when a motor is controlled by an inverter, without dynamic braking or any other braking schemes, varies from 10 to 35% of the motor rated torque.
During the deceleration process, the kinetic energy of the load is regenerated into the inverter's DC Link. This energy loads up the capacitors increasing the DC Link voltage. When this energy is not fully dissipated, it may generate a DC Link overvoltage trip (E01).
To obtain higher braking torque, the use of Dynamic Braking, where the excess regenerated energy is dissipated in an external resistor, is recommended .
The Dynamic Braking is used in cases where short braking times are required or where high inertia loads are driven.
For Vector Control modes the “Optimal Braking” feature can be used and in many cases eliminate the need for Dynamic Braking. Refer to Chapter 6, Parameter **P151**. If dynamic braking will be used, set P151 to its maximum value.

8.10.1 DB Resistor Sizing

For a precise sizing of the dynamic braking resistor, application data, such as: deceleration time, load inertia and braking duty cycle must be considered.

The RMS current capacity of the inverter's dynamic braking transistor must also be taken into account, as well as its maximum peak current, which defines the minimum resistance value (Ohms) of the braking resistor. Refer to Table 8.10.

The DC Link voltage level at which dynamic braking is activated is defined by the Parameter **P153** – Dynamic Brake Level.

The braking resistor is defined according to the deceleration time, load inertia and resistive torque. In most cases a resistor with an ohmic value indicated on Table 8.10 and a power rating of 20% of the driven motor can be used.
Use Wire 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-09 Model		Maximum Braking Current [A] (*1)	P_{max} [kW] (*3)	RMS Braking Current [A] (*2)	P_{rated} [kW] (*3)	Recommended Resistor [ohms]	Power Wiring (BR, -UD, +UD) (mm²) - AWG
Power Supply Voltage [V]	Rated Current [A]						
220-230	6	10	3.9	5	0.97	39	(2.5) - 14
	7 and 10	15	6.1	7	1.3	27	(2.5) - 14
	13 and 16	20	8.8	10	2.2	22	(4.0) - 12
	24	26	10.1	13	2.5	15	(6.0) - 10
	28	38	14.4	18	3.2	10	(10) - 8
	45	45	17.4	22	4.2	8.6	(10) - 8
	54	95	42.4	48	10.8	4.7	(35) - 3
	70 and 86	120	47.5	60	11.9	3.3	(50) - 1
	105 and 130	180	71.3	90	17.8	2.2	(95) - 3/0
380 and 400-415	3.6 and 4	6	3.6	3.5	1.2	100	(2.5) - 14
	5.5	8	5.5	4	1.4	86	(2.5) - 14
	9 and 13	16	10.0	10	3.9	39	(4.0) - 12
	16	24	15.6	14	5.3	27	(6.0) - 10
	24	34	20.8	21	7.9	18	(10) - 8
	30	48	34.6	27	10.9	15	(10) - 8
	38 and 45	78	52.3	39	13.1	8.6	(25) - 4
	60 and 70	120	80.6	60	20.1	5.6	(50) - 1
	86 and 105	180	126.4	90	31.6	3.9	(95) - 3/0
	142	250	168.8	125	42.2	2,7	(120) - 4/0
440-460 and 480	3.6 and 4	6	4.3	3.5	1.5	120	(2.5) - 14
	5.5	8	6.4	4	1.6	100	(2.5) - 14
	9 and 13	16	12.0	10	4.7	47	(4.0) - 12
	16	24	19.0	14	6.5	33	(6.0) - 10
	24	34	25.4	21	9.7	22	(10) - 8
	30	48	41.5	27	13.1	18	(10) - 8
	38 and 45	78	60.8	39	15.2	10	(25) - 4
	60 and 70	120	97.9	60	24.5	6.8	(50) - 1
	86 and 105	180	152.3	90	38.1	4.7	(95) - 3/0
	142	250	206.3	125	51.6	3.3	(120) - 4/0
500-525 and 575-600	2.9 and 4.2	8.33	12	4.2	2.08	120	(2.5) - 14
	7	10	10	5	2.5	100	(2.5) - 14
	10	12.2	12.81	6.1	3.05	82	(2.5) - 14
	12	14,71	20.83	7.4	3.68	68	(4.0) - 12
	14	14.71	15.3	7.4	3.68	68	(2.5) - 14
	22, 27 and 32	66.67	337.5	33.33	16.67	15	(95) - 3/0
	44 and 53	100	225	50	25	10	(95) - 3/0
	63 and 79	121.95	184.5	61	30.49	8.2	(95) - 3/0

Table 8.10 *- Recommended Braking Resistor*

(*1) The maximum current can be determined by:
Imax = Value set at P153[V] / Resistor Ohms

(*2) The RMS braking current can be calculated by

$$Irms = Imax.\sqrt{\frac{t_{br}^{[min]}}{5}}$$ Where t_{br} corresponds to the sum of the braking times during the most severe 5 minute cycle.

(*3) P_{max} and P_{rated} are the maximum peak and rated powers that the braking chopper can deliver. The resistor power must be sized according to the application braking duty cycle.

8.10.2 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, considering the maximum and RMS current;
☑ If the braking resistor is installed inside the inverter panel, consider the heat dissipated by the resistor when defining the panel ventilation;
☑ Set Parameter **P154** to the Ohms value of the DB resistor and Parameter **P155** to the resistor power rating in kW.

DANGER!

The CFW-09 provides an electronic thermal protection for the braking resistor to avoid overheating. The braking resistor and the transistor can be damaged if:
- They are not properly sized;
- Parameters P153, P154 and P155 are not properly set;
- the line voltage exceeds the maximum allowed value.

The electronic thermal protection provided by the inverter, if properly programmed, protects the DB resistor in case of overloads not expected during normal operation, but it does not ensure protection in case of a dynamic braking circuit failure.

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

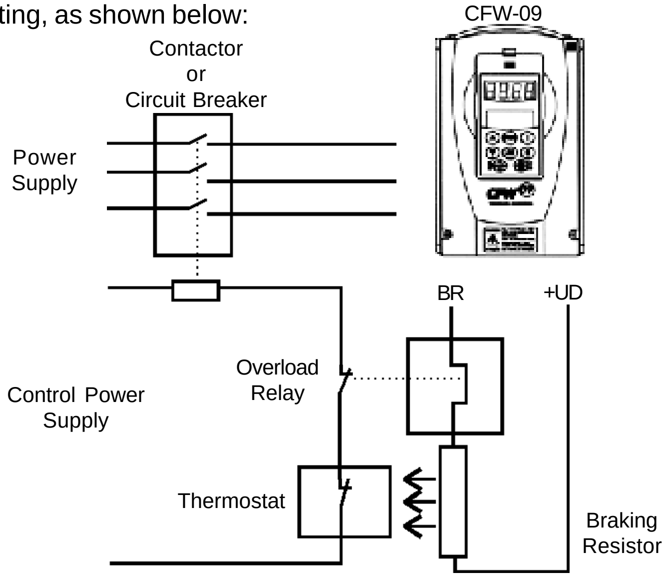


***Figure 8.22** – Braking resistor connection*

NOTE!

Through the power contacts of the bimetallic overload relay circulates Direct Current during the DC-Braking process

8.10.3 DYNAMIC BRAKING MODULE - DBW-01 and DBW-02

In the CFW-09 220-230V or 380-480V types with currents higher or equal to 180A, dynamic braking uses the DBW-01 external braking module. For 500-690V and 660-690V with currents higher or equal 100A, dynamic braking uses the DBW-02 external braking module.

Inverter Types		Braking Module	Max. Braking Current (*1)	RMS Braking Current (*2)	Min. Resistor [ohms]	Power Wiring (BR, -UD,+UD) (mm²) - AWG
Supply Voltage [V]	Rated Current [A]					
220-480	180	DBW010165D21802SZ	200	165	4	(70) 2/0
	211	DBW010240D21802SZ	320	240	2.5	(120) 250 MCM
	240	DBW010240D21802SZ	320	240	2.5	(120) 250 MCM
	312	DBW010300D21802SZ	400	300	2	(2x50) 2x1/0
	361	DBW010300D21802SZ	400	300	2	(2x50) 2x1/0
	450	DBW010300D21802SZ	400	300	2	(2x50) 2x1/0
	515	DBW010300D21802SZ	400	300	2	(2x50) 2x1/0
	600	DBW010300D21802SZ	400	300	2	(2x50) 2x1/0
500-690 660-690	100A,107A	DBW020210D5069SZ	250	210	4.8	(120)250MCM
	127A,147A	DBW020210D5069SZ	250	210	4.8	(120)250MCM
	179A,211A	DBW020210D5069SZ	250	210	4.8	(120)250MCM
	225A,247A	DBW020210D5069SZ	250	210	4.8	(120)250MCM
	259A,315A	DBW020300D5069SZ	400	300	3	(2x50) 2x1/0
	305A,343A	DBW020300D5069SZ	400	300	3	(2x50) 2x1/0
	340A,418A	DBW020380D5069SZ	500	380	2.5	(2x120)2x250MCM
	428A,472A	DBW020380D5069SZ	500	380	2.5	(2x120)2x250MCM

Table 8.11*-Inverter and corresponding DBW*

(*1) The max. current can be calculated by: Imax= set value at P153[V]/value of the resistor [ohms]

(*2) The rms braking current can be calculated by:

$Irms = Imax.\sqrt{\frac{t_{br}{}^{[min]}}{5}}$ where t_{br} corresponds to the sum of the braking actuation times during the most severe 5-minute cycle.

HOW TO SPECIFY THE DBW TYPE:

DBW	0165	D	2180	1	S	Z
WEG Braking Module Series 01 or 02	Rated Output Current: 220 to 480V: 0165=165A 0240=240A 0300=300A 0210=210A 0380=380A	DC Supply at Input	Input Supply Voltage: 2180=210 to 800 VDC 5069=500 to 1200 VDC	Fan Supply Voltage: 1=110VRMS 2=220VRMS	Standard	Code End

Table 8.12 *- DBW Types*

8.10.3.1 DBW-01 and DBW-02 Identification Label

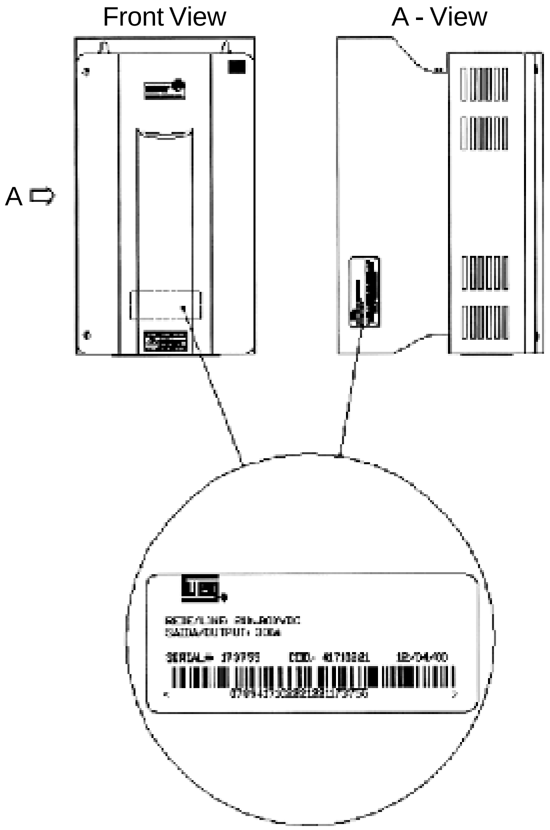


Figure 8.23 - *Identification Label*

8.10.3.2 Mechanical Installation

The environmental operating conditions of the DBW are the same as of the CFW-09 inverter (see item 3.1.1).

For panel installation, provide an additional airflow of 120 CFM (57 L/s) for cooling of the braking module.

When installing module, provide free spaces around the module, as shown in Figure 8.24, where A=100mm (4 in), B=40mm (1.57 in) and C=130mm (5.12 in).

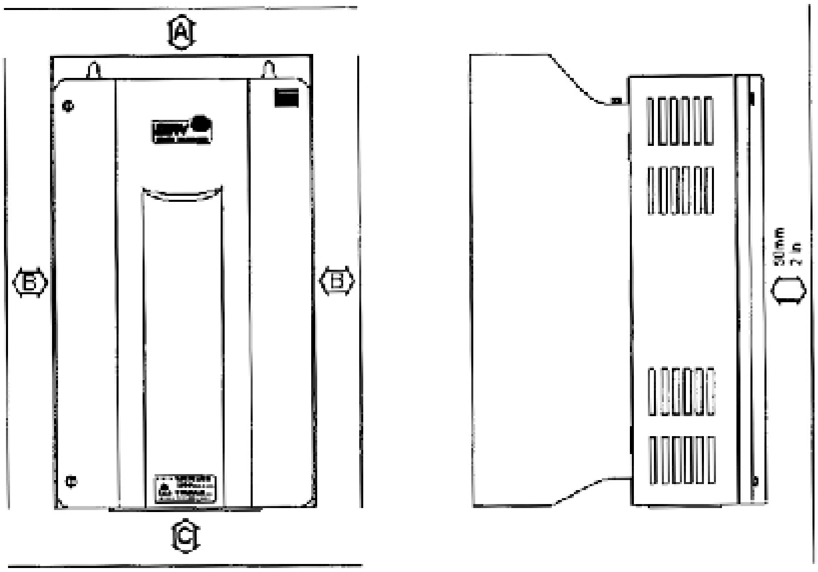


Figure 8.24 - *Free Spaces for Cooling*

Check the other recommendations for the CFW-09 inverter installation, since from the mechanical viewpoint, the module is compatible with CFW-09 frame size 3.

External dimensions and mounting holes are according to Figure 8.25.

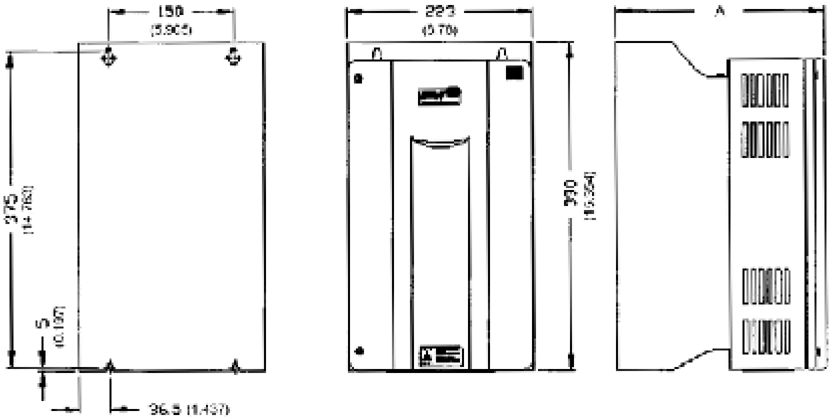


Figure 8.25 *- Dimensional Drawing of DBW-01 and DBW-02 - mm (inch)*

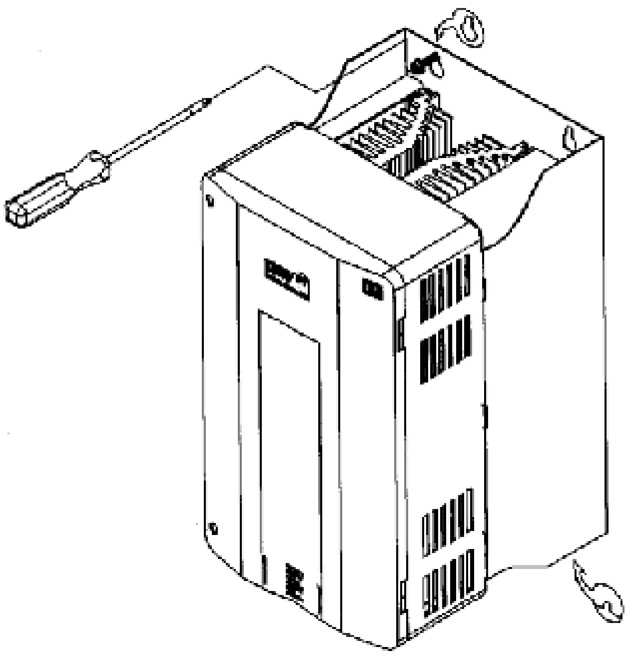


Figure 8.26 *- Installation procedures for the DBW-01 and DBW-02 on surface*

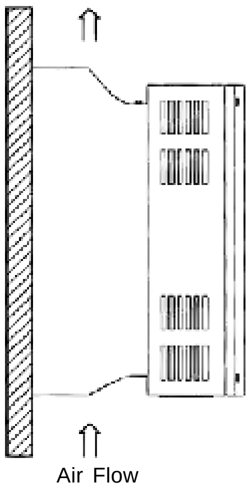


Figure 8.27 *- DBW-01 and DBW-02 Positioning*

The DBW-01 and DBW-02 can also be installed with a through surface mounting kit as described in item 8.11. In this case, use the available installation kit, which contains the respective installation supports. Figure 8.28 shows the mounting cutouts.

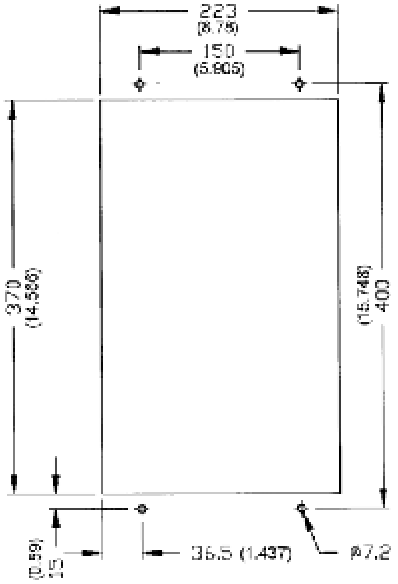


Figura 8.28 *- Cutout dimensions in air duct - Dimensiones mm (inch)*

Table 8.13 shows the weights of the different DBW-01 types.

Type	Fastening Screw	Weigth Kg	Degree of Protection
DBW-01 165	M6	14.2	IP20
DBW-01 240		13.8	
DBW-01 300		13.4	
DBW-02 210		14.2	
DBW-02 300		13.8	
DBW-02 380		13.4	

Table 8.13 *- Mechanical Data of the DBW-01 and DBW-02*

8.10.3.3 Installation/Connection

Location of the power connections is shown in Figures 8.29 and 8.30.

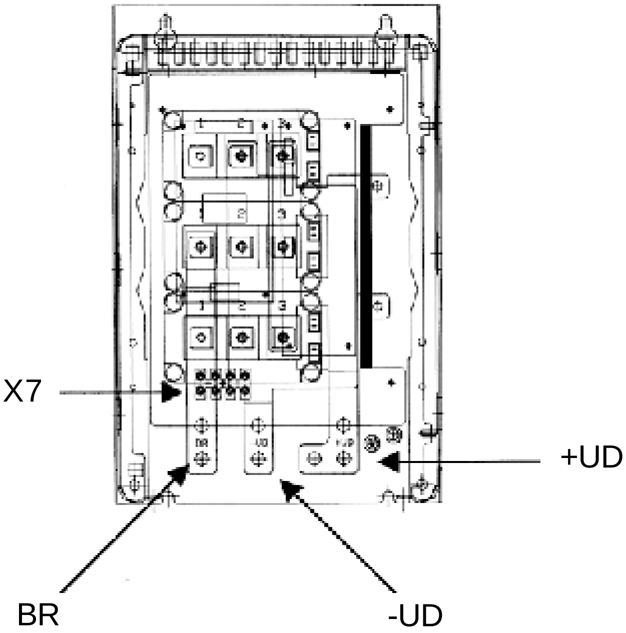


Figure 8.29 *- Connection location*

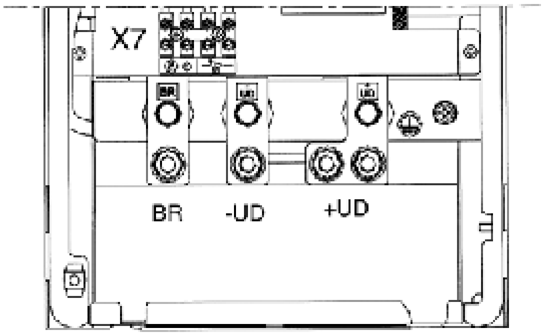


Figure 8.30 *- Power terminals*

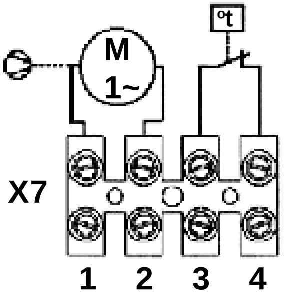


Figure 8.31 *- X7 Terminal block*

Supply the fan of the braking module with the suitable supply voltage (110 or 220VRMS) at X7:1,2 connector (see Figure 8.31). The fan has a requires a current of about 0.14A. The terminals 3 and 4 of the terminal bock X7 are the NC-contact of a thermostat that must be installed for the thermal protection of the braking module. This protection must be installed external to the braking module (see Figure 8.32); in this example, the relay is connected to DI3 (XC1:3,9 of the board CC9) and the parameter P265 is programmed as Without External Error (P265=4).

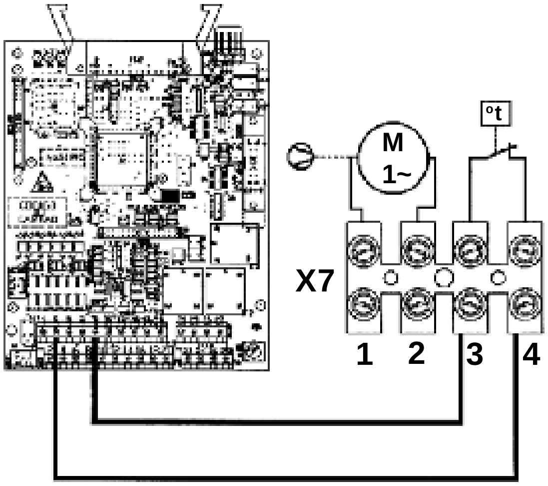


Figure 8.32 *- Example of Thermal Protection*

Connect the +UD grounding of the braking module to the +UD terminal of the inverter;
Connect the -UD grounding of the braking module to the -UD terminal of the inverter;
The control connection between the CFW-09 and the braking module is made through a cable (0307.7560). One end of this cable is connected to the XC3 connector that can be found at the CRG4 board (see figure 8.33) in the braking module. The other end of this cable is connected to a DB9 connector that is fastened to a metallic support at the side of the control board in the CFW-09.

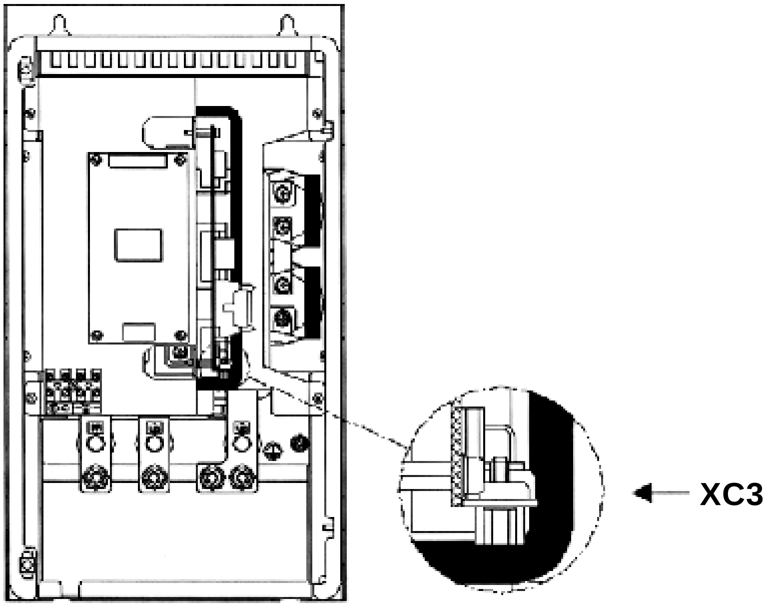


Figure 8.33 *-Location of the XC3 connector*

Figure 8.34 shows the connection of the braking module to the inverter, as well as the connections of the resistor to the braking module. It shows also the inclusion of a thermal relay and a thermostat in contact with the resistor body, thus ensuring its thermal protection. The connection cables between the inverter and the module and between the module the braking resistor must be dimensioned according to the thermal braking cycle.

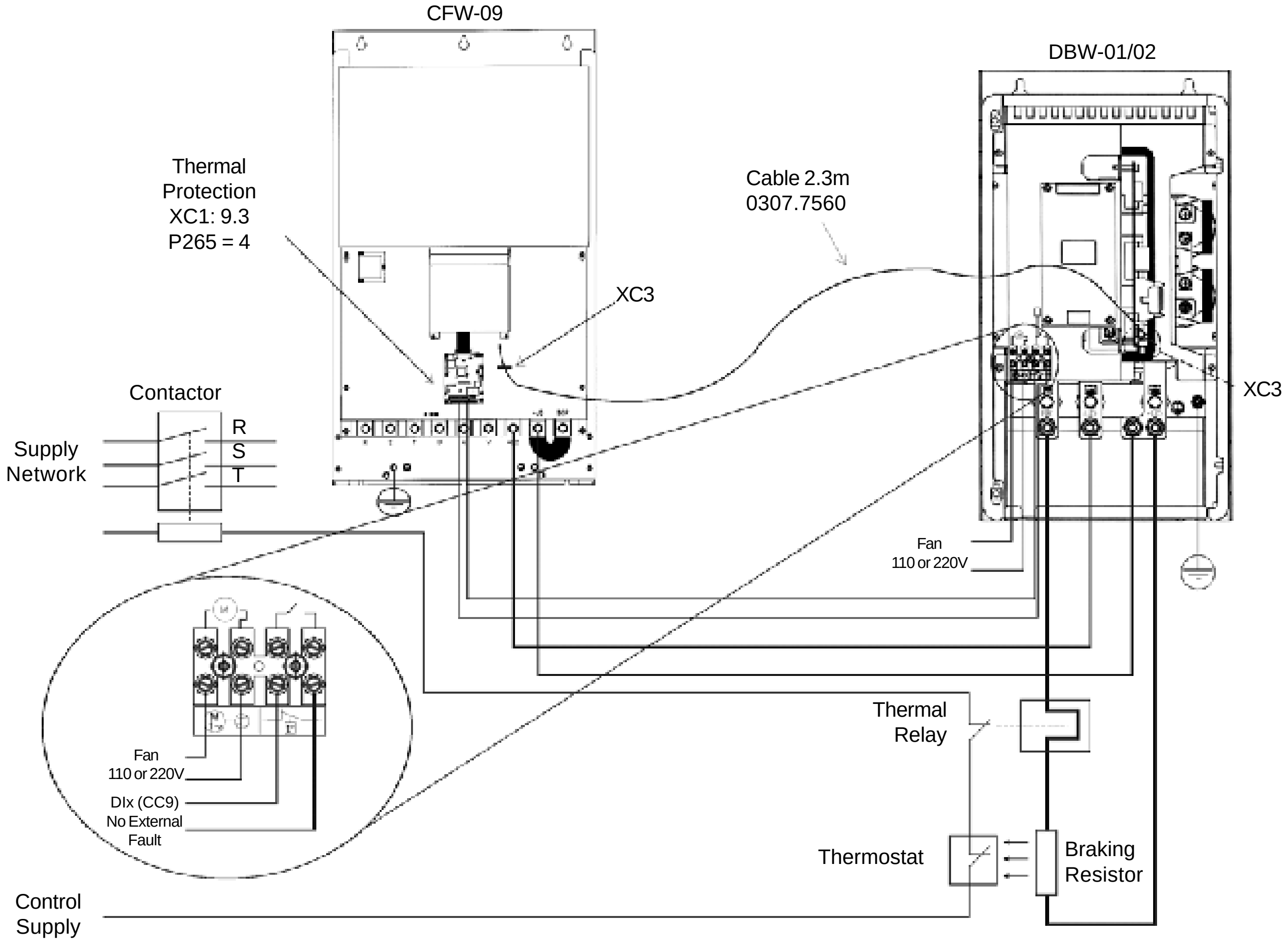


Figure 8.34 *- Connections between the DBW, the CFW-09 and the Braking Resistor*

NOTE!

- ☑ Through the power contacts of the bimetallic overload relay circulates Direct Current during the DC-Braking process.
- ☑ The DBW-02 has a duplicated XC3 connector (A and B). The XC3B is for connecting other DBW-02 module for parallel operation. It is possible to connect up to 3 DBW-02 modules in parallel. The interconnecting cable should be limited to 2 meters maximum cable lenght.

8.11 THROUGH SURFACE MOUNTING KIT

The kit for through surface mounting is composed of metallic supports that must be mounted on the rear of the CFW-09 frames 3 to 8 to allow through surface mounting. For further information refer to Section 3.1.2, Figure 3.4 and Table 3.4. Degree of protection is NEMA 1/IP20.

8.12 FIELDBUS

CFW-09 can be connected to fieldbus networks allowing it's control and parameter setting. For this purpose you need to include an optional electronic board according to the desired Fieldbus standard: Profibus-DP, DeviceNet.

NOTE!

The chosen Fieldbus option can be specified in the suitable field of the CFW-09 coding.
In this case the CFW-09 will be supplied with all needed components already installed in the product. For later installation you must order and install the desired Fieldbus kit (KFB).

8.12.1 Installation of the Fieldbus kit

The communication board that forms the Fieldbus Kit is installed directly onto the CC control board, connected to the XC140 connector and fixed by spacers.

NOTE!

☑ Follow the Safety Notices in Chapter 1

☑ If a Function Expansion Board (EBA/EBB) is already installed, it must be removed provisionally. For the frame size 1 you must remove the lateral plastic cover of the product.

1. Remove the bolt from the metallic spacer near to the XC140 (CC9) connector.
2. Connect carefully the pin connector of the Fieldbus board to the female connector XC140 of the CC9 control board. Check the exact coincidence of all pins of the XC140 connector (Figure 8.35).

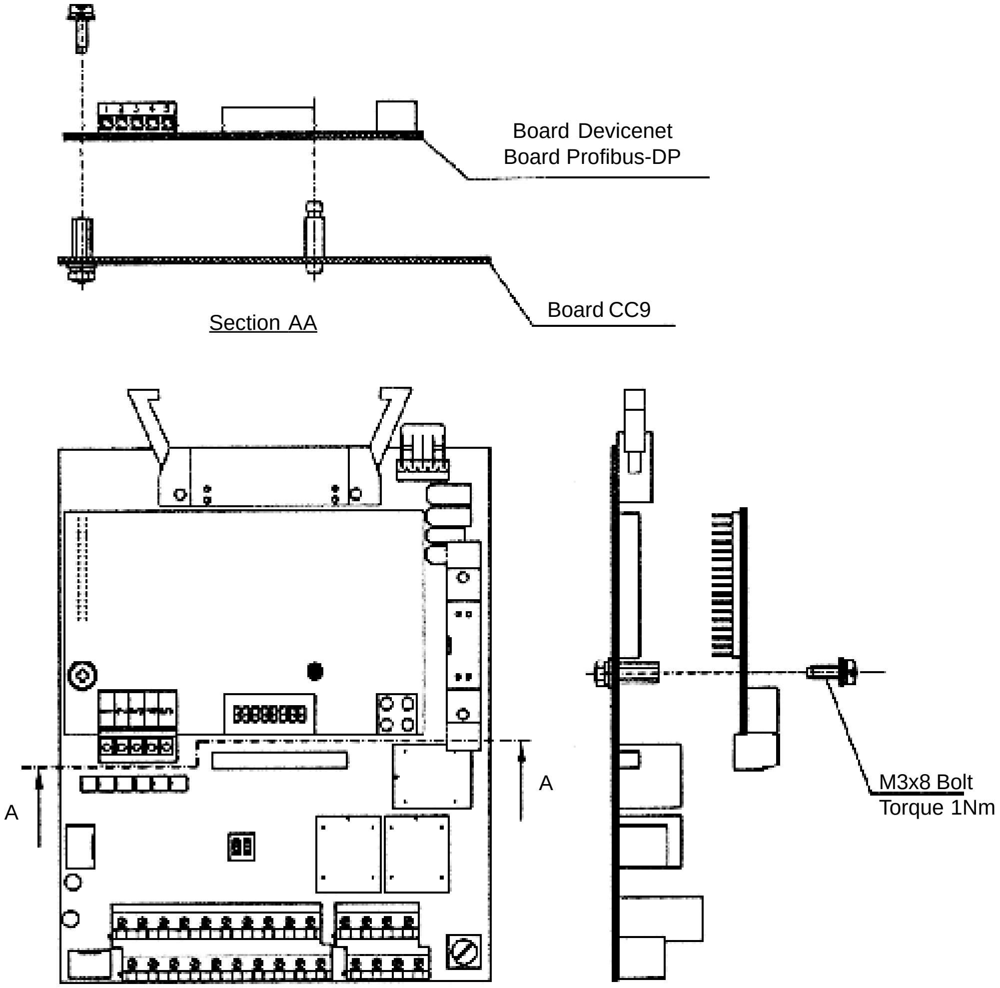


Figure 8.35 *- Installation of the Electronic Board of the Fieldbus*

3. Press the board near to XC140 and on the lower right edge until the connector and the plastic spacer is inserted completely;
4. Fix the board to the metallic spacer through the bolt (except ModBus RTU);
5. Fieldbus Connector:

Sizes 1 and 2 (Models up to 28A):

- Fix the Fieldbus connector to the inverter frame by using the 5.9 in (150 mm) cable (see figure 8.36).

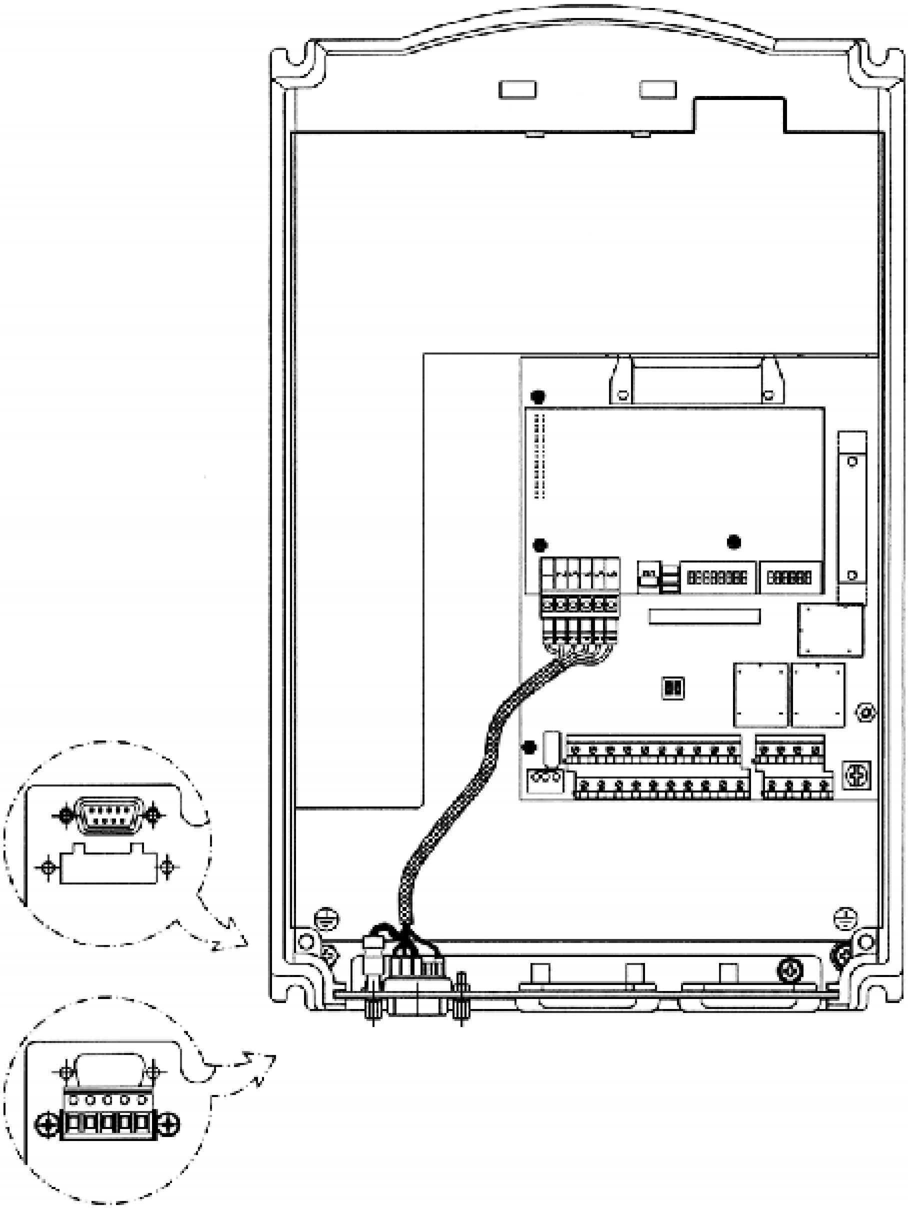


Figure 8.36 *- Fastening of the Fieldbus connector*

Sizes 3 to 10 - (models up to 30A):

- Connect the Fieldbus connector to the metallic “L” by using the 5.9in (150mm).
- Fasten the set to the metallic support palte of the control board (see 8.37).

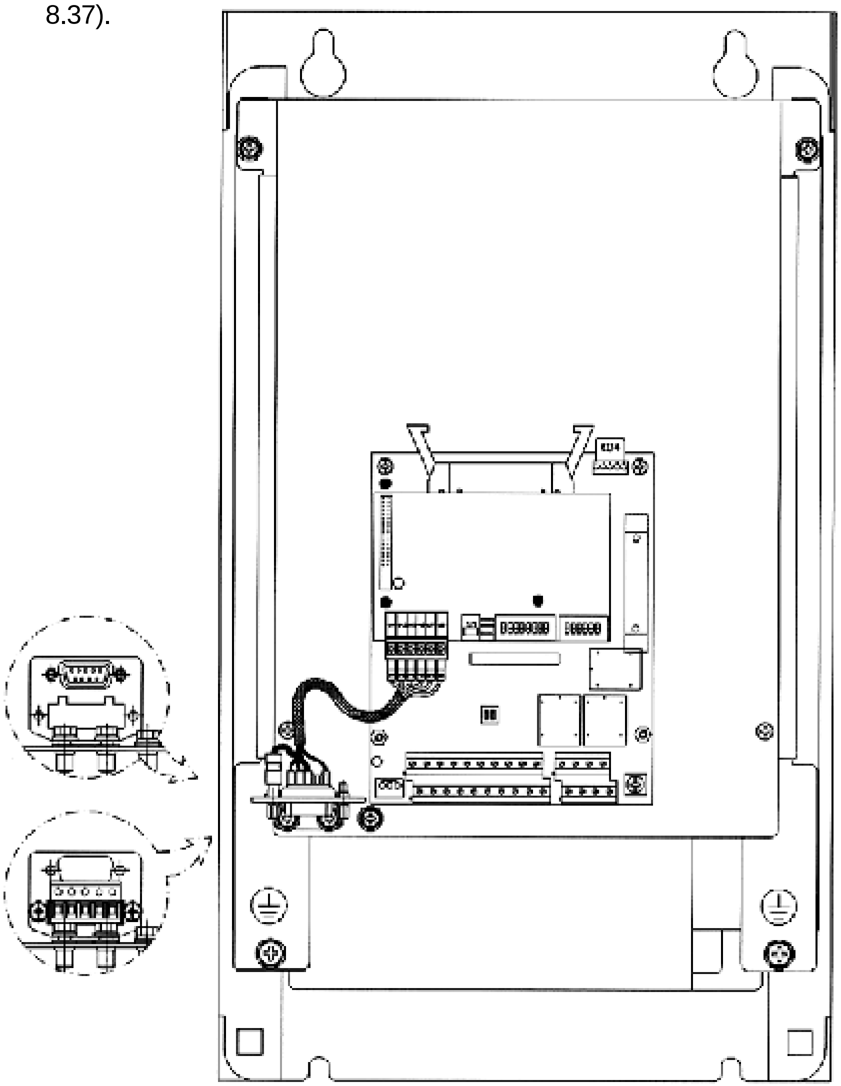


__Figure 8.37__ - Fastening of the Fieldbus connector

6. Connect the other cable end of the Fieldbus connector to the electronic Fieldbus board, as shown in Figure 8.38.

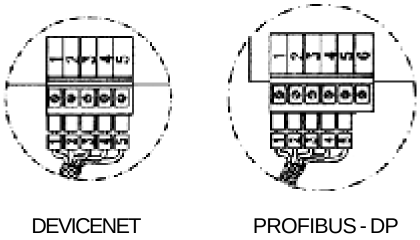


__Figure 8.38__ - Connection to the Fieldbus board

8.12.2 Profibus-DP

Introduction

The inverter that is fitted with the Profibus-DP Kit operates in slave mode, allowing the reading/writing of their parameters through a master. The inverter does not start the communication with other nodes, it only answers to the master controls. A twisted pair of copper cable realizes the connection of the Fieldbus (RS-485) allowing the data transmission at rates between 9.6kbits/s and 12Mbits/s. Figure 8.39 show a general view of a Profibus-DP network.

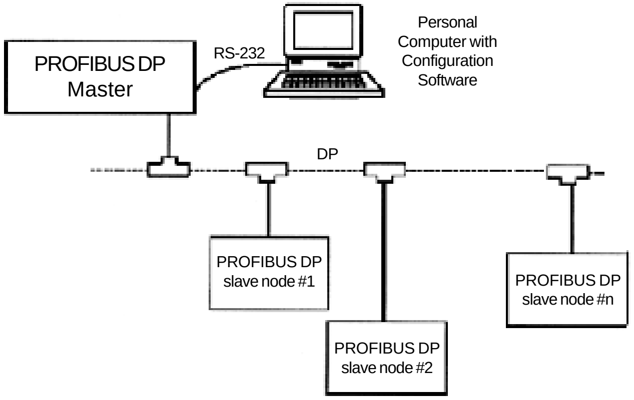


Figure 8.39 *- Profibus-DP network*

- Fieldbus Type: PROFIBUS-DP EN 50170 (DIN 19245)

Physical Interface

- Transmission means: Profibus bus bar line, type A or B as specified in EN50170
- Topology: Master-Salve communication
- Insulation: the bus is supplied by DC/DC inverter and isolated galvanically from remaining electronics and the signals A and B are isolated by means of optocouplers.
- It allows the connection/disconnection of only one node without affecting the network.

Fieldbus connector of the inverter user

- Connector D-sub 9 pins - female
- Pins:

Pin	Name	Function
1	Not connected	
2	Not connected	
3	B-Line	RxD/TxD positive, according to specificacition RS-485
4	Not connected	
5	GND	0V isolated against RS-485 circuit
6	+ 5V	5V isolated against RS-485 circuit
7	Not connected	
8	A-Line	RxD/TxD negative, according to specificacition RS-485
9	Not connected	
Frame	Shield	Connected to the ground protection (PE)

Table 8.14 *- Pin connection (DB9) to the Profibus-DP*

Line Termination
The initial and the en points of the network must be terminated with the characteristic impedance in order to prevent reflections. The DB 9 cable male connector has the suitable termination. When the inverter is the first or the last of the network, the termination switch must be set to Pos. “ON”. Otherwise set the switch to Pos. “OFF”. The terminating switch of the PROFIBUS DP board must be set to 1 (OFF).

Transfer Rate (Baudrate)
The transfer rate of a Profibus-DP network is defined during the master configuration and only one rate is permitted in the same network. The Profibus-DP board has an automatic baudrate detection and the user does not need to configure it on the board. The supported baudrates are: 9.6 kbits/s, 19.2 kbits/s, 45.45 kbits/s, 93.75 kbits/s, 187.5 kbits/s, 500 kbits/s, 1.5 Mbits/s, 3 Mbits/s, 6 Mbits/s and 12 Mbits/s.

Node Address
The node address is established by means of two rotating switches on the electronic Profibus-DP board, permitting the addressing from 1 to 99 addresses. Looking onto the front view of the board with the inverter in normal position, the switch at left sets the ten of the address, while the left switch sets the unit of the address:

Address = (set left rotary switch x 10) + (set right rotary switch x 1)

Configuration File (GSD File)
Each element of a Profibus-DP network is associated to a GSD file that has all information about the element. This file is used by program of the network configuration. Use the file with the extension .gsd stored on the floppy disk contained in the Fieldbus kit.

Signaling
The electronic board has a bicolor LED at right topside indicating the status of the Fieldbus according to the table below:

Color LED	Frequency	Status
Red	2Hz	Fault during the test of the ASIC and Flash ROM
Green	2Hz	Board has not been initialized
Green	1Hz	Board has been initialized and is operating
Red	1Hz	Fault during the RAM test
Red	4Hz	Fault during the DPRAM test

Table 8.15 *- Signaling LED of the Fieldbus board status*

NOTE!
The red fault indications mean hardware problems of the electronic board. The reset is realized by switching OFF / ON the inverter. If the problem persists, replace the electronic board.
The electronic board is also fitted with four other bicolor LED´s placed at the right bottom side, indicating the Fieldbus status according to the Figure below:

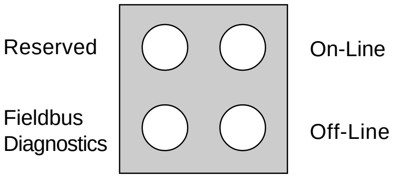


Figure 8.40 *- LED's indicating the status of the Profibus-DP network*

LED	Color	Function
Fieldbus Diagnostics	Red	Indicates certain faults at the Fieldbus: **Flashing 1Hz - Configuration error:** the IN/OUT area size set at board enabling is different from the size set during the network configuration. **Flashing 2Hz -** Error in the User´s Parameter Data: the size/content of the User Parameter data set at board enabling is different from the size/ content set during the network configuration. **Flashing 4Hz -** Enabling error of the Profibus Communication ASIC. **OFF -** no problems.
On-Line	Green	Indicates that the board is On-line at the Fieldbus **ON** - the board is off-line and the data exchange is not possible. **OFF** - the board is not On-line.
Off-Line	Red	Indicates that the board is Off-line at the Fieldbus **ON** - the board is off-line and the data exchange is not possible. **OFF** - the board is not Off-line.

Table 8.16 *- Signaling LED's indicating the status of the Profibus-DP network*

NOTE!
Use of the Profibus-DP/related CFW-09 Parameters
See item 8.12.4.

8.12.3 Device-Net

Introduction

The DeviceNet communication is used for industrial automation, mainly for the control of valves, sensors, input/output units and automation equipment. The DeviceNet communication link is based on a communication protocol “broadcast oriented”, the Controller Area Network (CAN). The connection to the DeviceNet network is realized by means of a shielded cable comprising a twisted pair and two wires for the external power supply. The baudrate can be set to 125k, 250k or 500kbits/s. Figure 8.41 gives a general view of a DeviceNet network.

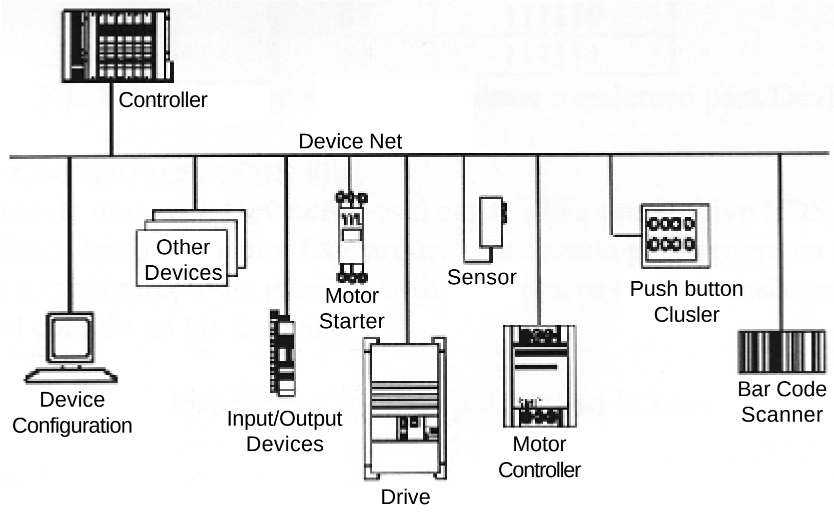


Figure 8.41 *- DeviceNet Network*

NOTE!

The PLC (master) must be programmed to Polled I/O connection.

Fieldbus connector of user of the inverter

- Connector: 5 ways-connector of type plug-in with screwed terminal (screw terminal)
- Pin:

Pin	Description	Color
1	V-	Black
2	CAN_L	Blue
3	Shield	
4	CAN_H	White
5	V+	Red

Table 8.17 *- Connection of the pins to the DeviceNet*

Line Termination

To avoid reflection, the initial and the end points of the network must be terminated with the characteristic impedance. Thus a 120-ohms/0.5W resistor must be connected between the pins 2 and 4 of the Fieldbus connector.

Baudrate/ Node Address

There are three different baudrates for the DeviceNet: 125k, 250k or 500kbits/s. Choose one of these baudrates by setting the DIP switches on the electronic board.

The node address is selected through the six DIPswitches on the electronic board, permitting an addressing from 0 to 63 addresses.

Baudrate [bits/s]	DIP's 1 and 2
125 k	00
250k	01
500k	10
Reserved	11

Address	DIP 3...DIP 8
0	000000
1	000001
2	000010
.	
61	111101
62	111110
63	111111

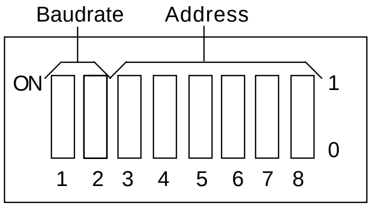


__Figure 8.42__ - Baudrate configuration and addressing to the DeviceNet

Configuration File (EDS File)
Each element of a DeviceNet network is associated to a EDS file, that has all information about the element. This file is used by program of the network configuration during its configuration. Use the file with the extension .eds stored on the floppy disk contained in the Fieldbus kit.

NOTE!

The PLC (master) must be programmed for Polled I/O connection.

Signaling
The electronic board has a bicolor LED at right topside indicating the status of the Fieldbus according to the table 8.15:

Note:

The red fault indications mean hardware problems of the electronic board. The reset is realized by switching OFF / ON the inverter. If the problem persists, replace the electronic board.
The electronic board is also fitted with other four bicolor LED´s placed at the right bottom side, indicating the DeviceNet status according to Figure 8.43 and Table 8.18:

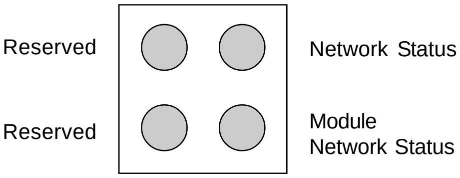


__Figure 8.43__ - LED's for status indication of the DeviceNet network

LED	Color	Description
Module Network Status	ON	Without supply
Module Network Status	Red	Fault not recoverable
Module Network Status	Green	Board operating
Module Network Status	Red Flashing	Smaller fault
Network Status	Off	Without supply/off line
Network Status	Green	Link operanting, connected
Network Status	Red	Critical fault at link
Network Status	Green Flashing	On line not connected
Network Status	Red Flashing	Time out of the connection

Table 8.18 *- Signaling LED's indicating the DeviceNet status*

NOTE!
Use of the DeviceNet /related CFW-09 Parameters. See item 8.12.4.

8.12.4 Use of the Fieldbus/ Related Parameters of the CFW-09

☑ There are two main parameters: P309 and P313.
P309 - defines the used standard Fieldbus (Profibus-DP, DeviceNet) and the number of variables (I/O) exchanged with the master (2, 4 or 6).

- The parameter P309 has the following options:

0 = Inactive, 1 = ProDP 2I/O, 2 = ProDP 4I/O,
3 = ProDP 6I/O, (for Profibus-DP),
4 = DvNet 2I/O, 5 = DvNet 4I/O,
6 = DvNet 6I/O, (for Device Net).

P313 - defines the inverter behavior when the physical connection with the master is interrupted and/or the Fieldbus board is inactive(E29/E30).

- The parameter P313 has the following options:

0 = disables the inverter by using the Run/Stop controls via deceleration ramp.
1 = disables the inverter by using the General Enabling, stop by inertia.
2 = the inverter status is not changed.
3 = the inverter goes to Local mode.

8.12.4.1 Variables Read from the Inverter

1 - Logical Status of the inverter,
2 - Motor speed,
For the option P309 = 1or 4 or 7 (2I/O) - read 1 and 2,
3 - Status of the Digital Inputs(P012)
4 - Parameter Status,
For the option P309 = 2 or 5 or 8 (4I/O) - it reads 1, 2, 3 and 4,
5 - Torque current (P009),
6 - Motor current (P003),
For the option P309 = 3 or 6 or 9 (6I/O) - it reads 1, 2, 3, 4, 5 and 6.

1. Logical Status (E.L.):
The word that defines the E.L. is formed by 16 bits, being 8 bits of high order and 8 bits of low order. It has the following construction:

High-Order Bits - they indicate the status of the associated function
EL.15 - Active error: 0 = No, 1 = Yes;
EL.14 - PID Regulator 0 = Manual, 1 = Automatic;
EL.13 - Undervoltage : 0 = Without, 1 = with;
EL.12 - Local/Remote Control: 0 = Local, 1 = Remote;
EL.11 - JOG Control: 0 = Inactive, 1 = Active;
EL.10 - Direction of rotation: 0 = Counter-Clockwise, 1 = Clockwise;
EL.09 - General Enabling: 0 = Disabled, 1 = Enabled;
EL.08 - Run/Stop: 0 = Stop, 1 = Run.

Low-Order Bits - they indicate the error code number, (i.e. 00, 01, ...,09, 11(0Bh), 12(0Ch), 13(0Dh), 24(18h), 32(20h) and 41(29h)). See Item 7.1-Faults and Possible Causes.

2. Motor Speed:
This variable is shown by using the 13-bit resolution plus signal. Thus the rated value will be equal to 8191(1FFFh)(clockwise rotation) or -8191(E001)(AH rotation) when the motor is running at synchronous speed (or base speed, for instance 1800rpm for IV-pole motor, 60Hz).

3. Status of the Digital Inputs:
Indicates the content of the Parameter P012, where the level 1 indicates active input (with +24V) , and the level 0 indicates the inactive input (with 0V). See Item 6.1-Access and Read Parameter. The digital inputs are so distributed in this byte:

Bit.7 - DI1 status
Bit.6 - DI2 status
Bit.5 - DI3 status
Bit.4 - DI4 status
Bit.3 - DI5 status
Bit.2 - DI6 status
Bit.1 - DI7 status
Bit.0 - DI8. status

4. Parameter Content:
This position permits to read the inverter parameter contents that are selected at Position 4. Number of parameter to be read from the “Variables Written in the Inverter”. The read values will have the same order as described in the product Manual or shown on the HMI .
The values are read without decimal point, when it is the case. Examples:
a) HMI displays 12.3, the read via Fieldbus will be 123,
b) HMI displays 0.246, the read via Fieldbus will be 246.

There are some parameters which representation on the 5 segment display can suppress the decimal point when the values are higher than 99,9. These parameters are: P100, P101, P102 , P103, P155, P156, P157, P158, P169 (for P202<3), P290 and P401.
Example: Indication on the 7 segment display: 130.,
Indication on the LCD display LCD : 130.0, the read value via Fieldbus is: 1300.

The read of the Parameter P006 via Fieldbus has the following meaning:
0 = ready;
1 = run;
2 = Undervoltage;
3 = with fault, except E24,...,E27.

5. Torque Current:
This position indicates de P009 Parameter content, disregarding the decimal point. A lowpass filter with a time constant of 0.5 s filters this variable.

6. Motor Current:
This position indicates de P003 Parameter content, disregarding the decimal point. A lowpass filter with a time constant of 0.3 s filters this variable.

8.12.4.2 Variables Written in the Inverter

The variables are written in the following order:

1 - Logical Control,
2 - Motor speed reference,
  for option P309 = 1, 4 or 7(2I/O) - it writes in 1 and 2;
3 - Status of the Digital Outputs;
4 - Number of the Parameter to be read,
  for option P309 = 2, 5 or 8(4I/O) - it writes in 1, 2, 3 and 4;
5 - Number of the Parameter to be changed;
6 - Content of the Parameter to be changed, selected in the previous position,
  for option P309 = 3, 6 or 9(6I/O) - it writes in 1, 2, 3, 4, 5 and 6.

1. Logical Control (C.L.):
The word that defines the C.L. is formed by 16 bits, being 8 bits of high orders and 8 bits of low orders and having the following construction:

High-Order Bits - they select the function that shall be driven when the bit is set to 1.

CL.15 - Inverter fault reset;
CL.14 - without function;
CL.13 - to save the changes of the parameter P169/P170 in the EEPROM;
CL.12 - Local/Remote control;
CL.11 - Jog control;
CL.10 - Direction of rotation;
CL.09 - General enabling;
CL.08 - Stop/Run.

Low-Order Bits - they determine the status that is wanted for the function selected in the high-order bits.

CL.7 - Inverter fault reset: always it varies from 0 1, an inverter reset is caused, with the presence of faults (except E24, E25, E26 e E27).
CL.6 - without function;
CL.5 - to save P169/P170 in the EEPROM: 0 = to save, 1 = to not save;
CL.4 - Local/Remote control: 0 = Local, 1 = Remote;
CL.3 - Jog control: 0 = Inactive, 1 = Active;
CL.2 - Direction of rotation: 0 = counter-clockwise, 1 = clockwise;
CL.1 - General enabling: 0 = Disabled, 1 = Enabled;
CL.0 - Run/Stop: 0 = Stop, 1 = Run.

NOTE!
The inverter will execute only the command indicated in the low-order bit, when the corresponding high-order bit has the value 1 (one). When the high-order bit has the value 0 (zero), the inverter will disregard the value of the corresponding low-order bit.

NOTE!

CL.13:

The function to save the changes of the parameters content in EEPROM occurs usually when the HMI is used. The EEPROM admits a limit number of writings (100 000). In the applications where the speed regulator is saturated, but the torque control is desired, you must change the current limitation value at P169/P170 (valid for P202>2). In this torque control condition, check if P160 (control type) = 1 (Regulator for torque control). When the network Master is writing in P169/P170 continuously, avoid to save the changes in the EEPROM, by setting:

CL.13 = 1 and CL.5 = 1

To control the functions of the Logical Control, you must set the respective inverter parameters with the Fieldbus option.

a) Local/Remote selection - P220;
b) Speed reference - P221 and/or P222;
c) Direction of rotation - P223 and/or P226;
d) General Enabling, Run/Stop - P224 and/or P227;
e) Jog Selection - P225 and/or P228.

2. Motor Speed Reference

This variable é represented by using 13 bits resolution Thus the reference value equal to 8191(1FFFh) corresponds to the motor synchronous speed (that corresponds to 1800rpm for IV-pole motors and frequency of 60Hz).

3. Status of the Digital Outputs:

It allows changing the status of the Digital Outputs that are programmed for the Fieldbus in the Parameters P275,...,P280.

The word that defines the status of the digital outputs is formed by 16 bits, having the following construction:

High-order bits: define the output that shall be controlled when set to 1,
bit.08 - 1= control of the output DO1;
bit.09 - 1= control of the output DO2;
bit.10 - 1= control of the output RL1;
bit.11 - 1= control of the output RL2;
bit.12 - 1= control of the output RL3;

Low-order bits: define the status desired for each output,
bit.0 - output status DO1: 0 = output inactive, 1 = output active;
bit.1 - output status DO2: ditto;
bit.2 - output status RL1: ditto;
bit.3 - output status RL2: ditto;
bit.4 - output status RL3: ditto.

4. Parameter Number to be Read:

Through this position you can read any inverter parameter.

You must enter the number corresponding to the desired parameter and its content will be displayed in Position 4 of the “Read Inverter Variables”.

5. Number of the Parameter to be changed:
(Parameter Content Changing)
This position works jointly with Pos. 6 below.
If no Parameter change is desired, you have to enter in this position the code **999**.
During the changing process you must:
1) Maintain in Position 5. The code 999;
2) Change the code 999 by the parameter number you want to change;
3) If no fault code (24,...,27) is displayed in the E.L., replace the code number by the code 999, to end the change.
The change can be checked through the HMI or by reading the parameter content.

NOTES!

1) The control change from scalar control to vector control will not be accepted if any of the parameters P409,...,P413 is set to zero. This must be effected through the HMI.
2) Do not set P204=5, since P309=Inactive in the factory setting.
3) The desired content must be maintained by the master during 15.0 ms. Only after this time you can send a new value or write another parameter.

6. Content of the Parameter to be changed, selected at Position 5.
(Number of the Parameter to be changed)
The format of the values set at this position must be as described in the Manual, but the value must be written without the decimal point, when the case.
When Parameters P409,...,P413 are changed, small content differences can occur, when the value sent via Fieldbus is compared with the value read at Position 4 ("Parameter Content"), or with the value read via HMI. This is due the truncation (rounding off) during the reading process.

8.12.4.3 Fault Indications

During the read/write process via Fieldbus the following variable indications in the Logical Status can occur:

☑ **Indications in the Logical Status variable:**

E24 - Parameter changing only permitted with disabled inverter.
- Parameter setting fault (see Item 5.2.3).

E25 - Caused by:
- Read Parameter inexistent, or
- Write Parameter inexistent, or
- Write in P408 and P204

E26 - The desired content value is out of permitted range.

E27 - Caused by:
a) The function selected in the Logical Control is not enabled for the Fieldbus, or
b) The control of the Digital Output is not enabled for the Fieldbus, or
c) The parameter write is read-only.

The fault indication described above will be removed from the Logical Status when the desired action is sent correctly. Except for E27 (case (b)), which reset is via write in the Logical Control.

Example: supposing that no digital output is programmed for Fieldbus, thus when in position 3. the word 11h is written, the inverter answer indicating E27 in E.L.. To remove this indication from E.L., you must:

1) write zero in Pos. 3.(since no DO is programmed for Fieldbus);

2) change the variable of the logical control, to remove from E.L. the E27 indication.

The removal of the fault indication from E.L. described above, can also be realized by writing the code 999 in Pos. 5. of the "Variables written in the Inverter". Except for the fault E27(in the cases (a) and (b)), which reset is realized only through the writing in the Logical Control, as above exemplified.

NOTE!

The faults E24, E25, E26 and E27 do not cause any change in the inverter operation status.

☑ **HMI displays:**

E29 - Fieldbus is inactive

This display appears when the physical connection of the inverter to the Master is interrupted.

You can program in Parameter P313 the action that the inverter shall execute when the fault E29 is detected.

When the PROG key of the HMI is pressed, the E29 Fault indication is removed from the display .

E30 - Fieldbus Board is inactive

This fault is displayed when:

1) P309 is programmed different than Inactive, without Fieldbus board in the XC140 connector of the CC9 control board; or

2) The Fieldbus board is inserted, but is defective; or

3) The Fieldbus board is inserted, but the standard programmed at P309 is not equal to the standard of the used board.

You can program in Parameter P313 which action the inverter will perform when E30 is detected.

When the PROG key of the HMI is pressed, the E30 Fault indication is removed from the display.

8.12.4.4 Addressing of the CFW-09 Variables in the Fieldbus Devices

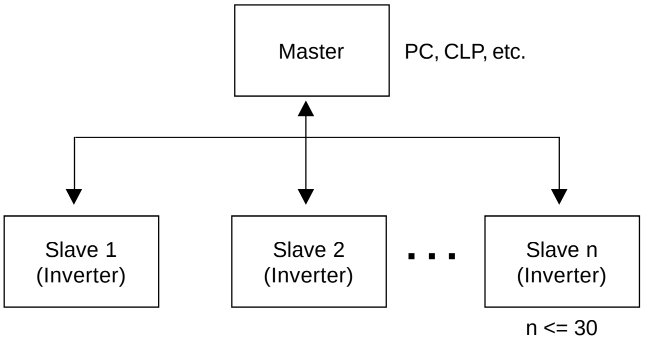
The variables are arranged in the memory of the Fieldbus device, starting at the address 00h, both for writing and reading. The address differences are corrected by the protocol and by communication board.

The way the variables are arranged at each address in the memory of the Fieldbus depends on the equipment that is used as Master. For instance: in the PLC A the variables are arranged as High and Low, and in the PLC B the variables are arranged as Low and High.

8.13 SERIAL COMMUNICATION

8.13.1 Introduction

The basic objective of the serial communication is the physical connection of inverters in a configured equipment network, as shown below:



The inverters possess a control software for the transmission/reception of data through the serial interface, to facilitate the data reception sent by the master and the sending of data requested by the same.
The transfer rate is 9600 bits/s, following a exchange protocol, question/answer type by using ASCII characters.
The master is able to realize the following operations related to each inverter:

- IDENTIFICATION
☑ network number;
☑ inverter type;
☑ software version.

- CONTROL
☑ general enabling/disabling;
☑ enabling/disabling by ramp;
☑ direction of rotation;
☑ speed reference;
☑ local/remote
☑ JOG
☑ error RESET.

- STATUS RECOGNITION
☑ ready;
☑ Sub;
☑ run;
☑ local/remote;
☑ fault;
☑ JOG;
☑ direction of rotation;
☑ setting mode after Reset to Factory Setting
☑ setting mode after changing the scalar control mode to vector mode.
☑ self-tuning

- PARAMETERS READING

- CHANGE OF PARAMETERS

Typical examples of network use:

☑ PC (master) for parameterization of one or several inverters at the same time;
☑ SDCD monitoring inverter variables;
☑ PLC controlling the operation of an inverter in an industrial process.

8.13.2 Interfaces Description

The physical connection between the inverters and the network 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);

8.13.2.1 RS-485

This interface allows the connection of up to 30 inverters to a master (PC, PLC, etc), attributing to each inverter an address (1 to 30) that must be set. In addition to these 30 addresses, there are two other addresses to perform special tasks:

☑ Address 0: any network inverter 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	54
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

* Outros caracteres ASCII utilizados pelo protocolo

ASCII		
CODE	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 STANDARD EIA RS-485 with differential receivers and transmitters. Expansion boards of the types EBA.01, EBA.02 or EBB.01 (see Items 8.1.1 and 8.1.2).

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

8.13.2.2 RS-232

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

The logical levels meet STANDARD EIA RS-232C that determines the use of balanced signals.

In this case, one wire is used for transmission (TX), one for reception (RX) and one for return (0V) .This configuration is a three-wire economy model.

8.13.3 Definitions

The items of this chapter describe the protocol used for serial communication.

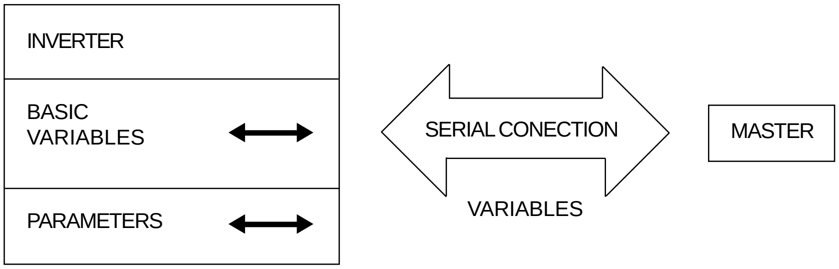
8.13.3.1 Used Terms

☑ Parameters: are those existing in the inverters whose visualization or alteration is possible through the 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:



8.13.3.2 Parameters/Variables Resolution

During the parameter reading/changing the decimal point is disregarded in the values received with the telegram, excepting the Basic Variables V04 (Reference via Serial) and V08 Motor Speed) that are standardized in 13 bits (0...8191). For instance:

- ☑ Writing: if the purpose is to change the content of P100 to 10.0s, you must send 100 (disregarding the decimal point);
- ☑ Reading: If we read 1387 in P409, the value is 1.387((the decimal point is disregarded);
- ☑ Writing: to change the content of V04 to 900 rpm, we must send:

$$\boxed{V04 = 900 \text{ x } \frac{8191}{P208} = 4096}$$

Supposing P208=1800rpm

Reading: If we read 1242 in V08, this value is given by:

$$\boxed{V08 = 1242 \text{ x } \frac{P208}{8191} = 273\text{rpm}}$$

Supposing P208=1800rpm

8.13.3.3 Characters 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 even parity (eighth bit)];
- ☑ 1 stop bit;

After the start bit, follows the less significant bit:

START	B1	B2	B3	B4	B5	B6	B7	B8	STOP

Start bit ← 8 bits of information → Stop bit

8.13.3.4 Protocol

The transmission protocol meets Standard ISO 1745 for data transmission in code. Only text characters sequences without header are used .

The errors 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 TELEGRAM:** for inquiring of the inverter variable content;

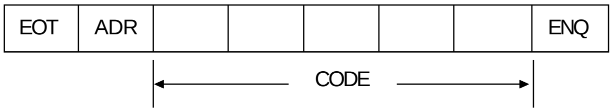
☑ **WRITING TELEGRAM:** to change inverter variable content or to send controls to the inverters.

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

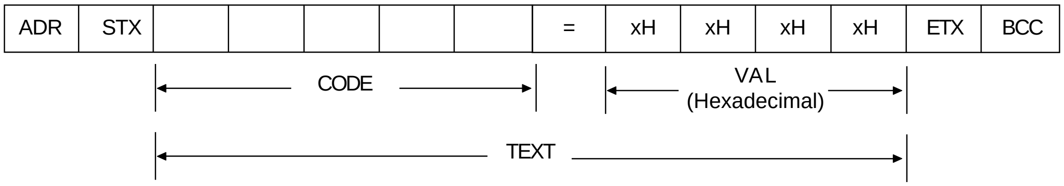
8.13.3.4.1 Reading Telegram

This telegram allows the master receive from the inverter the content corresponding to the inquiry code. In the answer telegram the inverter transmits the data requested by the master.

1) Master:



2) Inverter:



Format of the reading telegram:

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

Format of the inverter answer telegram:

ADR: 1 character - inverter address;
STX: control character - Start of TeXt;
TEXT: consists in:
☑ **CODE:** address of the variable;
☑ **“ =”:** separation of character;
☑ **VAL:** 4 digits value (HEXADECIMAL);
ETX: control character - End of TeXt;
BCC: CheCksum Byte- EXCLUSIVE OR of all the bytes between STX (excluded) and ETX (included).

Note:
In some cases there can be an inverter answer with:

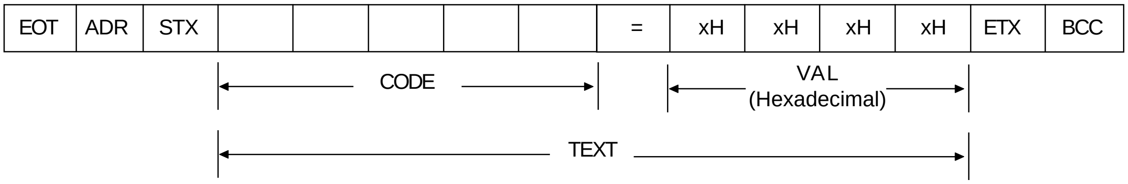
ADR	**NAK**

see item 8.13.3.5

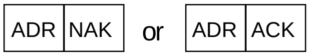
8.13.3.4.2 Writing Telegram

This telegram sends data to the inverters variables. The inverter answers by indicating if the data have been accepted or not.

1) Master:



2) Inverter:



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

Format of the writing telegram:

Acceptance:
☑ **ADR:** inverter address;
☑ **ACK:** ACKnowledge control character;
Não aceitação:
☑ **ADR:** inverter address;
☑ **ACK:** ACKnowledge control character;
That means that the data were not accepted and the addressed variable continues with its old value.

8.13.3.5 Execution and Telegram Test

The inverters and the master test the telegram syntax.
The answers for the respective verified conditions are defined as follows:
Reading telegram:
☑ no answer: with wrong telegram structure, control characters received incorrectly or wrong inverter address;
☑ NAK: CODE corresponding to the variable does not exist or there is only writing variable;
☑ TEXT: with valid telegrams;

Writing telegram:

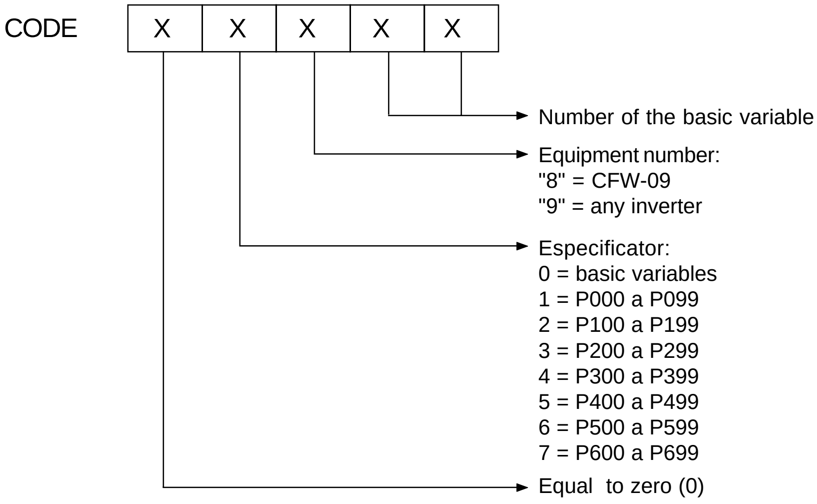
- ☑ no answer: with wrong telegram structure, control characters received incorrectly or wrong inverter address;
- ☑ NAK: code corresponding to the variable does not exist, wrong BCC (checksum byte), only reading variable, VAL out of the allowed range for the respective variable, operation parameter out of the alteration mode;
- ☑ ACK: with valid telegrams;
  The master should maintain, between two variable transmissions to the same inverter, a waiting time that is compatible with the used inverter.

8.13.3.6 Telegram Sequence

In the inverters, the telegrams are processed in determined time intervals. Therefore, a pause larger than the sum of the times T_{proc} + T_{di} + T_{txi} cit should be guaranteed, between two telegrams addressed to the same inverter (see item 8.13.6).

8.13.3.7 Variable Code

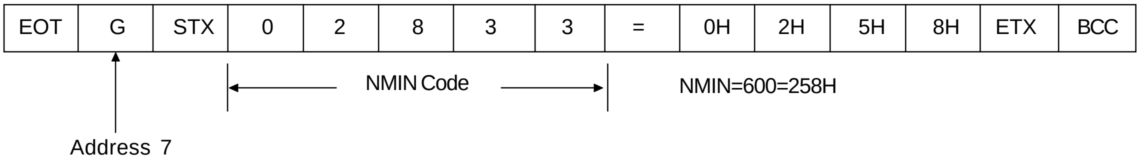
The field designated with CODE contains the parameter address and the basic variables formed by 5 digits (ASCII characters) as follows:



8.13.4 Telegram Examples

- ☑ Change of the min. speed (P133) to 600 rpm in the inverter 7.

1) Master:



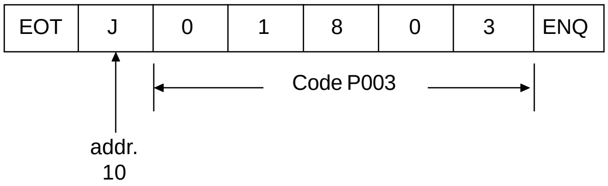
EOT	G	STX	0	2	8	3	3	=	0H	2H	5H	8H	ETX	BCC

2) Inverter:

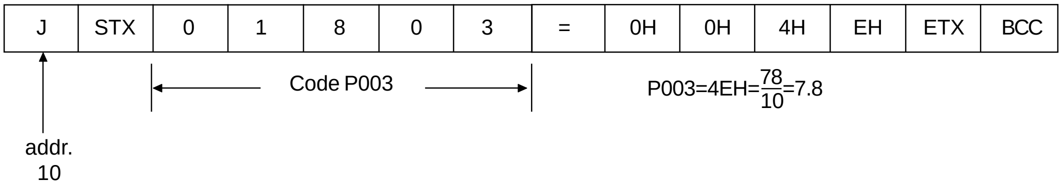
G	ACK

☑ Reading of output current from the inverter 10
(supposing that the same was at 7,8A at the moment of the enquiry).

1) Master:



2) Inverter:



8.13.5 Variables and Errors of the Serial Communication

8.13.5.1 Basic Variables

8.13.5.1.1 V00 (code 00800)

Indication of the inverter type (reading variable)
The reading of this variable allows the inverter type identification. For the CFW-09 this value is 8, as defined in 8.13.3.7.

8.13.5.1.2 V02 (code 00802)

Indication of the inverter state (reading variable)

☑ Logical status (byte-high)

☑ Error code (byte-low)

Where:

Logical status:

EL15	EL14	EL13	EL12	EL11	EL10	EL9	EL8

EL8: 0 = ramp enabling (run/stop) inactive
1 = ramp enabling
EL9: 0 = general enabling inactive
1 = general enabling active

} Inverter enabled EL8=EL9=1

EL10: 0 = reverse
1 = forward
EL11: 0 = JOG inactive
1 = JOG active
EL12: 0 = local
1 = remote
EL13: 0 = without undervoltage
1 = with undervoltage
EL14 : not used
EL15: 0 = without error
1 = with error

Error Code: hexadecimal error number
Ex.: E00 → 00H
E01 → 01H
E10 → 0AH

8.13.5.1.3 V03 (code 00803)

Selection of the Logical Control
Writing variable, whose bits have the following meaning:

BYTE HIGH: desired action mask. The corresponding bit should be set to 1, so the action happens.

CL15	CL14	CL13	CL12	CL11	CL10	CL9	CL8
MSB							LSB

☑ CL8: 1 = enabling ramp (run/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.

CL7	CL6	CL5	CL4	CL3	CL2	CL1	CL0
MSB							LSB

☑ 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 these disabling;
☑ To enable the inverter by the serial it is necessary that CL0=CL1=1 and that the external disabling is inactive;
☑ If CL0=CL1=0 simultaneously, a general disabling occurs.

8.13.5.1.4 V04 (code 00804)

Reference of Frequency given by Serial (reading/writing variable).
It permits sending reference to the inverter provided P221=9 for LOC or P222=9 for REM. This variable has a 13-bit resolution (see Item 8.13.3.2).

8.13.5.1.5 V06 (code 00806)

Status of the Operation Mode (read variable)

EL2 7	EL2 6	EL2 5	EL2 4	EL2 3	EL2 2	EL2 1	EL2 0
MSB							LSB

☑ EL2.0:1 = in setting mode after Reset for Factory Setting/First Start-up. The inverter enter in this status as it is energized by the first time or when the factory setting for the parameters is loaded (P204=5 or 6). In this mode only the parameters P023, P295, P201, P296, P400, P401, P403, P402, P404 and P406 can be accessed. If any other parameter is accessed, the inverter displays E25. For more details, see Item 4.2 - Initial Start-up

☑ EL2.1:1 = in setting mode after changing the scalar control to vector control The inverter enters in this operation mode, when the control mode is changed from scalar control (P202=0, 1 or 2) to vector control (P202=3 or 4). In this mode only the parameters P023, P202, P295, P296, P400. P401, 403, P402, P404, P405, P406, P408, P409, P410, P411, P412 and P413 can be accessed. If any other parameter is accessed, the inverter displays E25. For more details, see Item 4.3.2 - Start-up Operation - Type of Control: Vector Sensorless or with Encoder.

☑ EL2.2:1 = Self-Tuning execution
The inverter enters in this operation mode when P202=3 or 4 and P408$\neq$0. For more details about Self-tuning, see Chapter 6 - Detailed Parameter Description, Parameter 408.
☑ EL2.3: not used
☑ EL2.4: not used
☑ EL2.5: not used
☑ EL2.6: not used
☑ EL2.7: not used

8.13.5.1.6 V07 (code 00807)

Status of the Operation Mode (read/write variable)

CL2 7	CL2 6	CL2 5	CL2 4	CL2 3	CL2 2	CL2 1	CL2 0

MSB LSB

☑ CL2.0: 1 - It exit after reset from the setting mode to factory setting
☑ CL2.1: 1 - After changing it exit from scalar control to vector control
☑ CL2.2: 1 - aborts self-tuning
☑ CL2.3: 1 - not used
☑ CL2.4: 1 - not used
☑ CL2.5: 1 - not used
☑ CL2.6: 1 - not used
☑ CL2.7: 1 - not used

8.13.5.1.7 V08 (code 00808)

Motor speed in 13 bits (read variable). It permits the reading of the motor speed with a 13-bit resolution (see Item 8.13.3.2).

8.13.5.1.8 Examples of Telegrams with basic variables

☑ Inverter enabling (provided P224=2 to LOC or P227=2 to REM)

1) Master:

EOT	G	STX	0	0	8	0	3	=	0H	3H	0H	3H	ETX	BCC

add. 7

C. L. Code

general enabling=1
ramp enabling=1

2) inverter:

G	ACK

☑ Change of the direction of rotation to reverse (provided P223=5 or 6 to LOC or P226=5 or 6 to REM)

1) Master:

EOT	G	STX	0	0	8	0	3	=	0H	4H	0H	4H	ETX	BCC

add. 7

C. L. Code

reverse

2) Inverter:

G	ACK

☑ JOG enabling (provided P225=3 to LOC or P228=3 to REM)

1) Master:

EOT	G	STX	0	0	8	0	3	=	0H	8H	0H	8H	ETX	BCC

C. L. Code

JOG active=1

add. 7

2) Inverter:

G	ACK

☑ Fault Reset

1) Master:

EOT	G	STX	0	0	8	0	3	=	8H	0H	8H	0H	ETX	BCC

C. L. Code

RESET=1

add. 7

2) Inverter:

G	ACK

8.13.5.2 Parameters Related to the Serial Communication

Parameter number	Parameter description
P220	Local/Remote selection
P221	Local reference selection
P222	Remote reference selection
P223	Local forward/reverse selection
P224	Local run/stop selection
P225	Local JOG selection
P226	Remote forward/reverse selection
P227	Remote run/stop selection
P228	Remote JOG selection
P308	Inverter address on the Serial communication network (range values from 1 to 30)

For further information about the parameters above, see Chapter 6 - Detailed Parameter Description.

8.13.5.3 Errors Related to the Serial Communication

They act as follows:

- ☑ they do not disable the inverter;
- ☑ they do not disable defective relays;
- ☑ they are informed in the word the logical status.

Fault Types

- ☑ E22: longitudinal parity fault;
- ☑ E24: parameterization fault (when some situation occurs as indicated in Table 5.1. (parameter incompatibility), - Chapter 5 - Keypad (HMI) Operation, or when there is a parameter change attempt that cannot be changed with running motor;
- ☑ E25: variable or parameter not existing;
- ☑ E26: expected value out of the allowed limits;
- ☑ E27: writing attempt in a read only variable or logical control disabled;
- ☑ E28: Serial communication is inactive. If the time programmed at P314 has elapsed without the inverter receiving a valid Modbus telegram, this is displayed by the HMI and the inverter adopts the action programmed at P313.

Note:

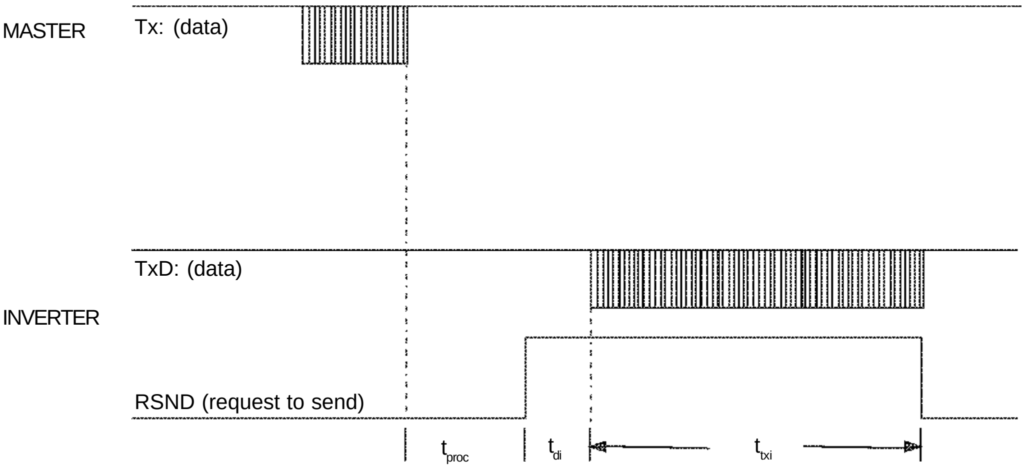
OBS.: If a parity fault is detected during inverter data reception, the telegram will be ignored.

The same happens when syntax errors occur.

Ex.:

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

8.13.6 Times for Read/Write of Telegrams



Time (ms)		Típical
T_{proc}		10
T_{di}		5
T_{txi}	reading	15
	writing	3

8.13.7 Physical Connection of the RS-232 and RS-485 Interface

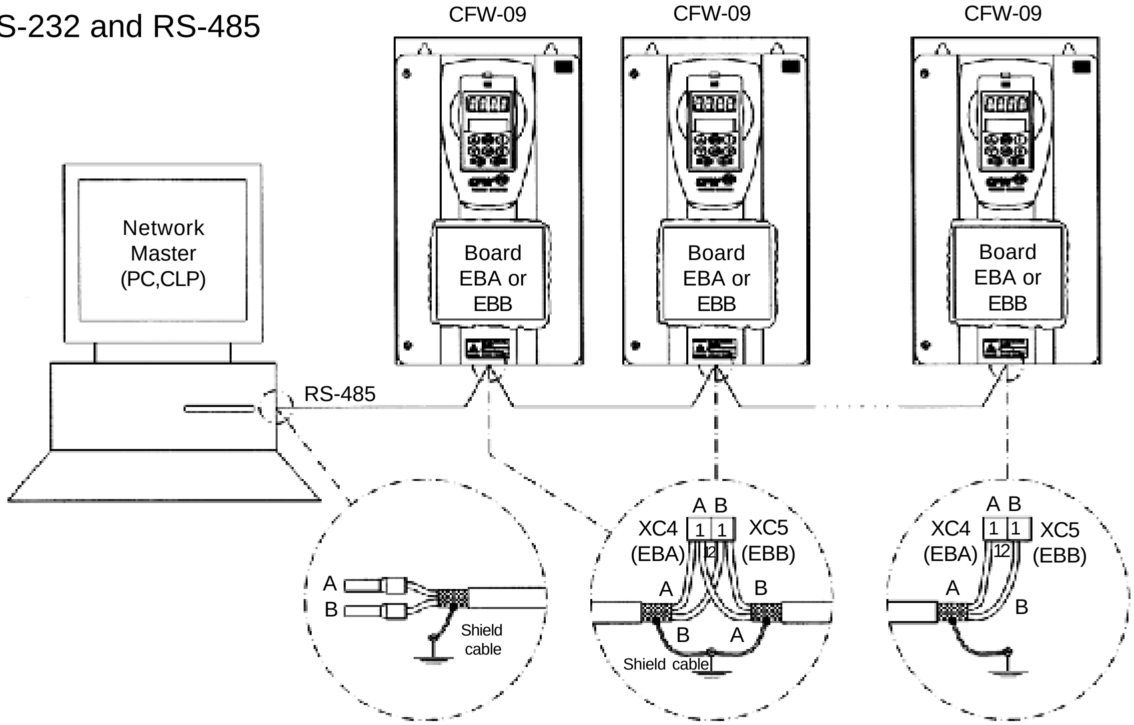


Figure 8.44 *- CFW-09 network connection through RS-485 Serial Interface*

Notes:

☑ LINE TERMINATION: include line termination (120 Ω) and the ends. So set S3.1/S3.2 (EBA) and S7.1 S7.2 (EBB) to “ON” (see items 8.1.1 and 8.1.2);

☑ GROUNDING OF THE CABLE SHIELD: connect the shielding to the equipment frame (suitable grounding)

☑ RECOMMENDED CABLE: for balanced shielding.
Ex: AFS series from KMP;

☑ The RS-485 wiring must be laid separately from the power and control cables in 110/220V.

RS-232 Serial Interface Module

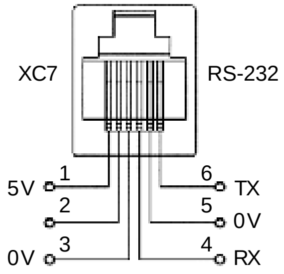


Figure 8.45 *- Description of the XC7 (RJ12) connector*

Note:

The RS-4232 wiring must be laid separately from the power and control cables in 110/220V.

NOTE!

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

8.14 SERIAL COMMUNICATION

8.14.1 Introduction in the Modbus-RTU Protocol

O 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-09 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.

8.14.1.1 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:

8.14.1.2 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.

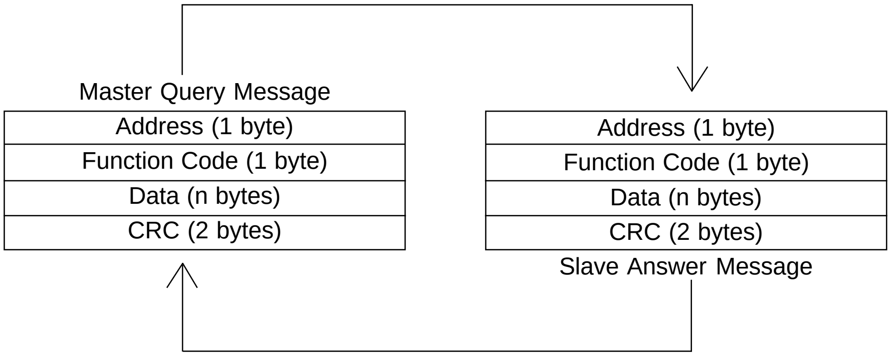


Figure 8.46 *- Message Structure*

8.14.1.2.1 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.

8.14.1.2.2 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-09 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).

8.14.1.2.3 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.

8.14.1.2.4 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.

8.14.1.2.5 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.

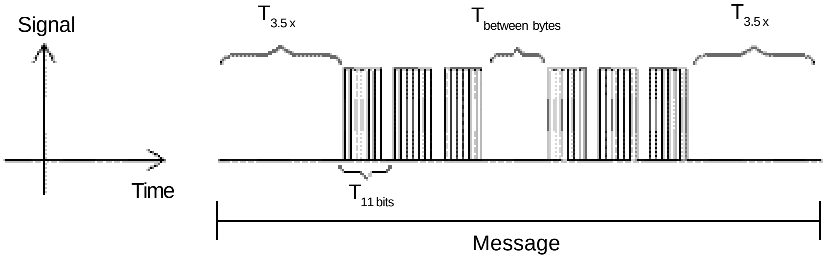


***Figure 8.47**- Times required during the communication of a message*

Communication Rate	$T_{11\ bits}$	$T_{3,5x}$
9600 kbits/sec	1.146 ms	4.010 ms
19200 kbits/sec	573 µs	2.005 ms
38400 kbits/sec	285 µs	1.003 ms

$T_{11\ bits}$ = Time to transmit one word of the message.
$T_{entre\ bytes}$ = 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 x T_{11bits}).

8.14.2 Operation of the CFW-09 in the Modbus-RTU Network

The CFW-09 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.

8.14.2.1 Interface Description

The CFW-09 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-09:

8.14.2.1.1 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 serial interface RS-232 must be used.

8.14.2.1.2 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.
☑ You must use the EBA or EBB expansion board that has interface for the RS-485 communication.
Note: for connection, see 8.13.7.

8.14.2.2 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.

8.14.2.2.1 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.

8.14.2.2.2 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.

8.14.2.3 Access to the Inverter Data

All parameters and available basic variables for the CFW-09 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, trough these basic variables you can change the speed reference, read the inverter status, enable or disable the inverter, etc. (see item 8.18.5.1 - 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 8.13.3.2 defines the resolution of the parameters and variables transmitted via serial interface.

8.14.2.3.1 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-09 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-09 frequency inverter for accessing these registers:

☑ Read Coils
Description: reading of internal register blocks or coils.
Function code: 01.
Broadcast: not supported
Response time: 5 to 10 ms.

☑ Read Holding Registers
Description: reading of register blocks of holding type.
Function code: 03.
Broadcast: not supported
Response time: 5 to 10 ms.

☑ Write Single Coil
Description: writing in a single internal bit or coil.
Function code: 05.
Broadcast: supported.
Response time: 5 to 10 ms.

☑ Write Single Register
Description: writing in a single register of holding type.
Function code: 06.
Broadcast: supported
Response time: 5 to 10 ms.

☑ Write Multiple Coils
Description: writing in internal bit blocks or coils.
Function code: 15.
Broadcast: supported
Response time: 5 to 10 ms.

☑ Write Multiple Registers
Description: writing in register blocks of holding type.
Function code: 16.
Broadcast: supported
Response time: 10 to 20 ms for each written register.

☑ Read Device Identification
Description: Identification of the inverter model.
Function code: 43.
Broadcast: not supported.
Response time: 5 a 10 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).

8.14.2.3.2 Data Addressing and Offset

The CFW-09 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	00h
P001	1	01h
⋮	⋮	⋮
P100	100	64h
⋮	⋮	⋮

Basic Variables		
Number of the Basic Variable	Modbus Address	
	Decimal	Hexadecimal
V00	5000	1388h
V01	5001	1389h
⋮	⋮	⋮
V08	5008	1390h

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 4*x*, whilst the bits are referenced from 0000 or 0*x*.

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
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

8.14.3 Detailed Function Description

This section describes in details the functions that are available in the CFW-09 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 8.13.3.2.

8.14.3.1 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 filed 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-09 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).

8.14.3.2 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):

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-09 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)	03h
Number of registers (byte high)	00h	P002 (low)	84h
Number of registers (byte low)	02h	P003 (high)	00h
CRC-	65h	P003 (low)	35h
CRC+	CBh	CRC-	7Ah
		CRC+	49h

Each register is always formed by two bytes (high e low). For the example, we have P002 = 0384h, that in decimal number is equal to 900.
As these parameters do not have a decimal place indication, the real read value is 900 rpm. In the same way we will have a current value P003 = 0035h, that is equal to a 53 decimal. As the current has a decimal resolution, the read value is 5.3 A.

8.14.3.3 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-09 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.

8.14.3.4 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 900 rpm, of a CFW-09 at address 1. Please remember, that the value for the basic variable 4 depends on the used motor type and that the value 8191 is equal to the rated motor speed. In this case, we suppose that the used motor has a rated speed of 1800 rpm, thus the value to be written into the basic variable 4 for a speed of 900 rpm is the halve of 8191, i.e., 4096 (1000h).

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)	10h	Value (high)	10h
Value (low)	00h	Value (low)	00h
CRC-	41h	CRC-	41h
CRC+	65h	CRC+	65h

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).

8.14.3.5 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).

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-09 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).

8.14.3.6 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-09 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.

8.14.3.7 Function 43 - Read Device Identification

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

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-09 are only available basic information formed by three objects:

- ☑ Object 00 - VendorName: always ‘WEG’.
- ☑ Object 01 - ProductCode: formed by the product code (CFW-09), 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 of 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-09 have fixed values.

Example: read o basic information in sequence, starting from object 00, of a CFW-09 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-09 7.0A’
		Object Code	02h
		Object Length	05h
		Object Value	‘V2.09’
		CRC-	B8h
		CRC+	39h

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) and 47h (G).

8.14.4 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.

8.14.4.1 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):

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		

8.15 KIT KME (for Extractable Mounting)

The kit KME enables the mounting of CFW-09 inverter in the sizes 8, 8E, ß9,10 and 10E (models 361 450 and 600A/380-480V, 211 to 472A/500-690V and 225 to 428A/660-690V) in the panel in an extractable form. The inverter is mounted in the panel like a sliding drawer, thus making easier the assembling and maintenance works. When requesting this kit, please specify the following:

Item	Description	Notes
417102521	KIT KME - CFW-09 M10/L=1000	Size 10 - 450-600A/380-480V y Size 10E - 247-472A/500-690V 255-428A/660-690V Panel width=39.37in (1000mm)
417102520	KIT KME - CFW-09 M9/L=1000	Size 9 - 312-361A/380-480V Panel width=39.37in (1000mm)
417102522	KIT KME - CFW-09 M9/L=800	Size 9 - 312-361A/380-480V Panel width=31.50in (800mm)
417102540	KIT KME - CFW-09 M8/L=600	Size 8 - 211-240A/380-480V y Size 8E - 107A-211A/500-690V 100A-179A/660-690V Panel width=23.62in (600mm)
417102541	KIT KME - CFW-09 M8/L=800	Size 8 - 211-240A/380-480V Size 8E - 107A-211A/500-690V 100A-179A/660-690V Panel width=31.50 (800mm)

Please see drawings in item 9.4.

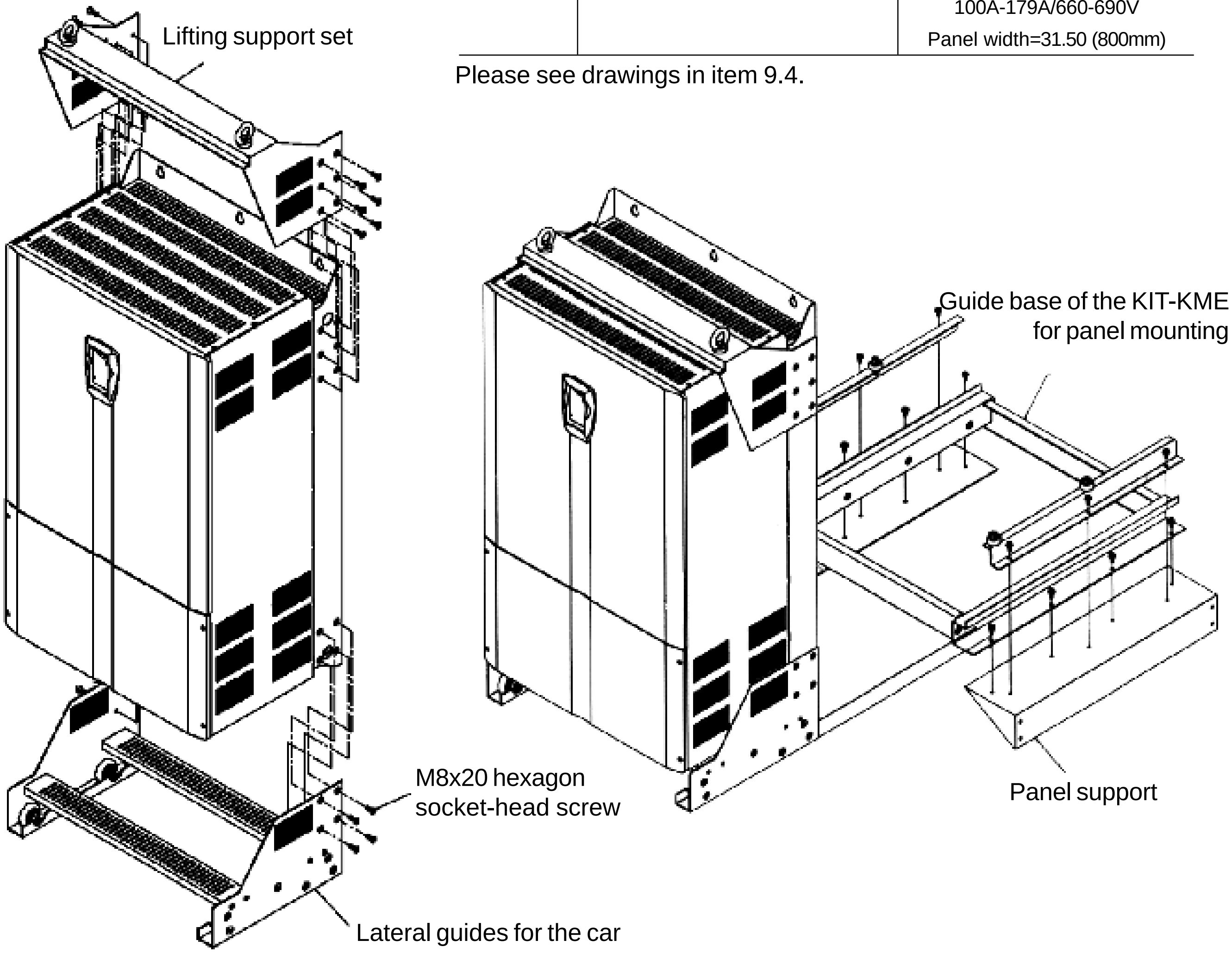


Figure 8.48 - *Mounting of the KIT-KME on the inverter*

8.16 CFW-09 SHARK NEMA 4X

In applications that need a Drive with a higher protection enclosure, the CFW-09 SHARK NEMA 4X is indicated. The NEMA 4X provides protection against dust, dirt and splashing or hose-directed water.

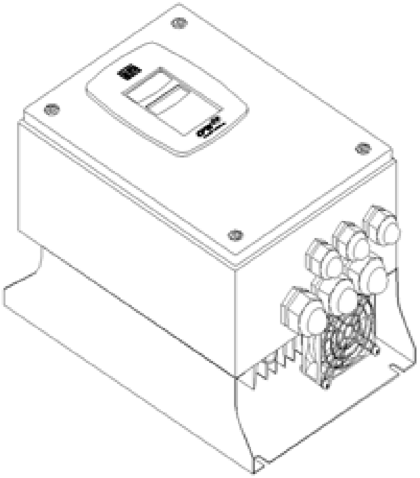


Figure 8.49 *- CFW-09 Shark Nema 4X*

The SHARK NEMA 4X is the CFW-09 standard with a stainless steel enclosure. The models are:

CFW	09	0006	T	2223	Size 1 *
CFW	09	0007	T	2223	
CFW	09	0010	T	2223	
CFW	09	0016	T	2223	Size 2 *
CFW	09	0003	T	3848	Size 1 *
CFW	09	0004	T	3848	
CFW	09	0005	T	3848	
CFW	09	0009	T	3848	Size 2 *
CFW	09	0013	T	3848	
CFW	09	0016	T	3848	

* The Shark Drive dimensions are distinct from the standard CFW-09 Drive, so, the Sizes 1 and 2 from the Shark Drive are different from the Sizes 1 and 2 of the standard CFW-09.

8.16.1 Enclosure Specifications

NEMA Type 4X indoors;
NEMA Type 12 indoors;
IP 56;
Other specifications are same to the standard CFW-09 and are explained along this manual.

8.16.2 Mechanical Installation

The Drive comes covered by a plastic film. Remove this sheet before starting the installation.
Install the drive in an environment that does not exceed Type 4 / 4X / 12 limitations.
Install the Drive on a flat surface, in the vertical position;
External dimensions and mounting holes are according to figures 8.50 and 8.51.

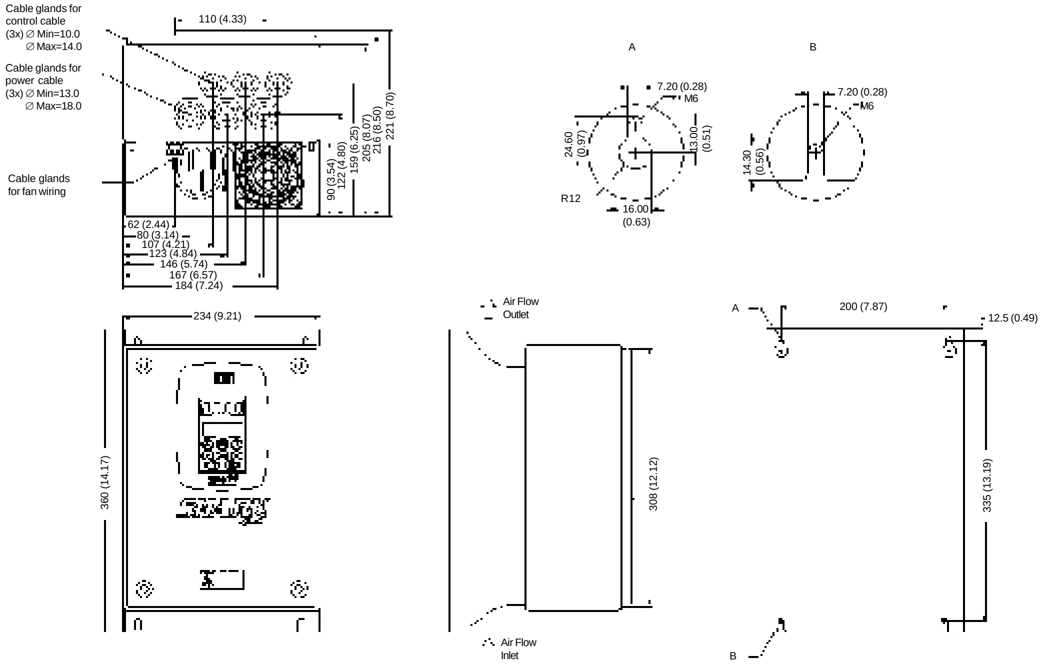


Figure 8.50 - *Mechanical data – Size 1, Dimensiones mm (in)*

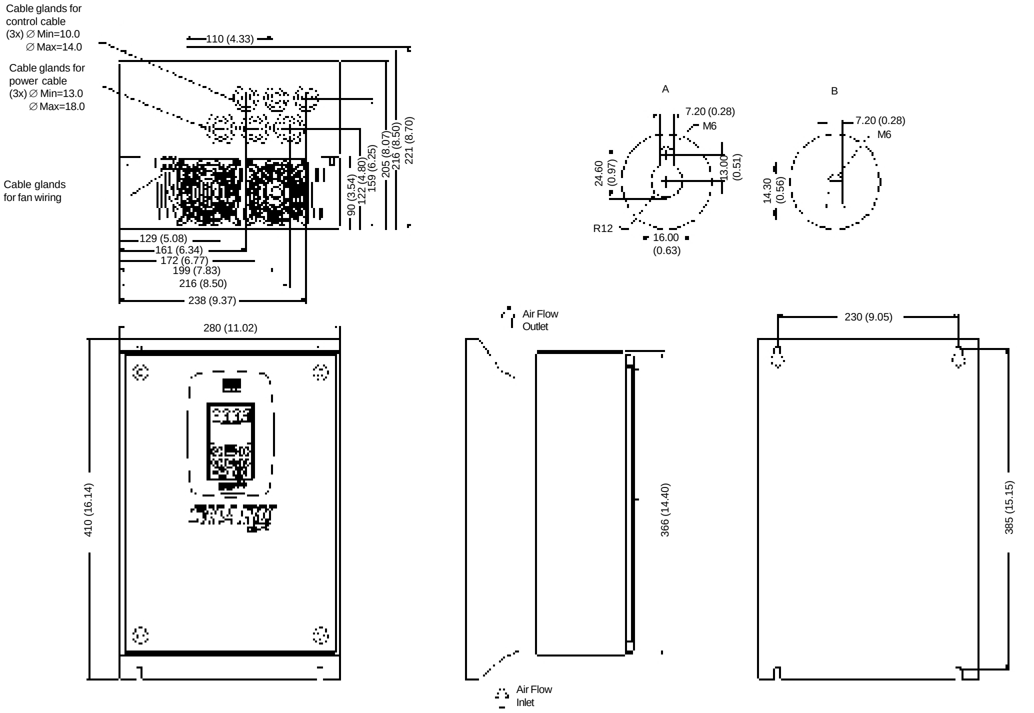


Figure 8.51 - *Mechanical data – Size 2, Dimensiones mm (in)*

8.16.3 Electrical Installation

The electrical installation is the same as CFW-09 standard. Refer to Chapter 3, item 3.2 to make a correct electrical installation.

NOTE!

To assure the NEMA 4X total protection, it is necessary to use correct cables. It is recommended to use armored multi-core cables. For example, one tetra-polar armored cable for Power supply (R,S,T) plus grounding, and another tetra-polar armored cable for output (motor) connection.

The wire sizing and fuses are presented in table 3.5, Chapter 3.

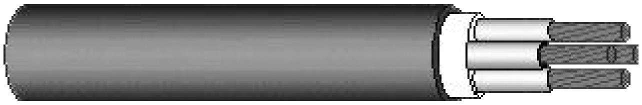


Figure 8.52 *- Tetra-polar armored cable*

The control and power wiring access to the Drive is through the cable glands. All the cable glands come with a gasket inside. To make the electrical installation it is necessary to remove the gasket from the cable gland and then pass the armored multi-core cable in the cable gland.

After doing the electrical connection and arrange the cables properly, tight the cable glands to assure that the cable is very strongly fastened. The recommended torque is 2N.m (0.2kgf.m).

The control wiring has to be made by armored multi-core cables too. It is necessary to use this type of cables to guarantee total closing after cable glands tightening. Check the maximum and minimum diameter of the cables supported by the Cable Glands in figures 8.50 and 8.51.

8.16.4 Closing the Drive

To guarantee NEMA 4X degree of protection, it is very important to close correctly the Drive after doing the electrical installation. Please follow these instructions:

After the electrical installation is completed and the cable glands tightened, close the frontal cover (certify that the flat cable that interconnects the HMI to the control card is correctly connected) by tightening each screw a little at a time, until total tightening.

The gaskets provide the protection of the electronic parts of the SHARK drive. Any problem with them can cause problems with the protection degree. Opening and closing the drive many times reduces the gaskets lifetime. It is recommended to do this no more than 20 times. If problems are detected on the gaskets, we recommend changing the failed gasket immediately.
Certify that the door gasket is on its correct position at the moment you will close the Drive.
Certify that the door screw gaskets are perfect on the moment you are ready to close the drive.
All these recommendations are very important to become a successful installation.

NOTE!

Do not remove the gaskets inside the cable glands, which were not used. They are necessary to guarantee NEMA 4X protection.

8.16.5 How to Specify

To specify a NEMA 4X Drive, it is necessary to include the term "N4" in the field "Enclosure Degree of Protection" according to the CFW-09 specification in Chapter 2, item 2.4 (CFW-09 Identification). Remember that the NEMA 4X line is only up to 10HP.

8.17 CFW-09 SUPPLIED BY THE DC LINK – LINE HD

- ☑ The CFW-09HD inverter line, supplied by DC link, has the same installation, mechanical, programming and performance characteristics as the Standard CFW-09 line;
- ☑ Up to size 5, an HD inverter is required to make the supply through the DC link. In this case is sufficient to supply a standard inverter through the DC link with an external pre-charge circuit.
- ☑ The models of size 6 and larger are fitted with an internal pre-charge circuit and have internal changes;
- ☑ For more detail, refer please to the Addendum of the CFW-09 Frequency Inverter Manual of the CFW-09HD line – supplied by DC Link. (See www.weg.com.br).

8.18 CFW-09 RB REGENERATIVE CONVERTER

There are two problems associated to a conventional drive with diode bridge at the input: harmonics injection to the network and braking of loads with high inertia, or that un at high speeds and require short braking times. The harmonic injection to the network happens with any type of load. The braking problems appear with loads such as sugar centrifuges, dynamometers, cranes and winders. The CFW-09 converter with RB option (Regenerative Braking) is WEG solution for these problems. Figure 8.53.

Shows the main components of a drive with CFW-09 RB.

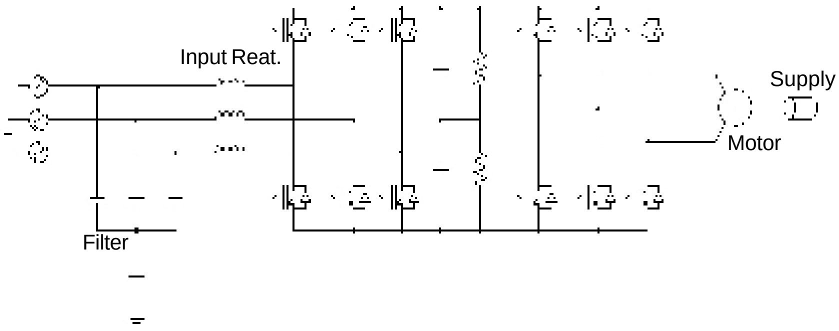


Figure 8.53 *- Simplified diagram of a driving with CFW-09 RB*

As shown in the Figure 8.53, CFW-09RB unit is fitted with a capacitor bank and a IGBT's bridge.
Externally is mounted a network reactance and a capacitive filter.
By switching the IGBT's bridge, the energy can be transferred in a controlled way from the network to the capacitor bank. One van say that by means of the switching process, the CFW-09RB emulates a resistive load. There is also a capacitive filter to prevent the bridge switching interferes in other network loads. To complete this drive, the use of a CFW-09HD is required that drives the motor and its load. This drive is shown in Figure 8.53 by the second de IGBT's bridge. Figure 8.54A shows wave shapes of the CFW-09 RB input voltage and current, when the motor at the drive output is operating normally.

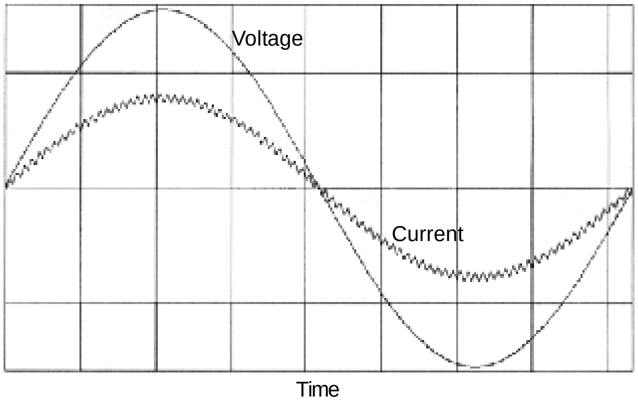


Figure 8.54A *- Functioning during operation as motor*

Figure 8.54B shows the wave shapes of the CFW-09 RB input voltage and current, when the motor at the drive output is submitted to a braking process.

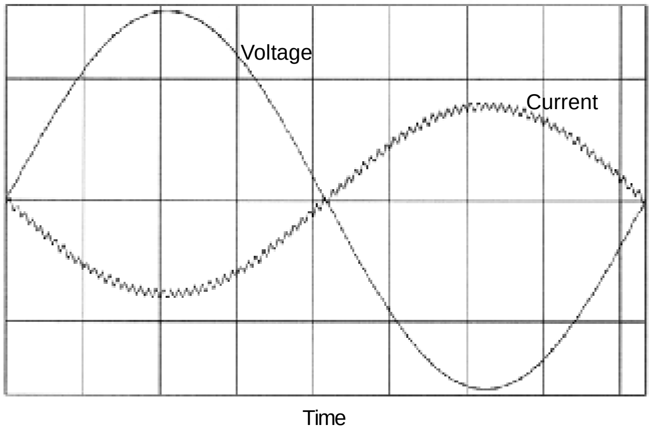


Figure 8.54B *- Functioning during the braking process*

For more details, refer to the CFW-09 RB Regenerative Converter Manual. (See www.weg.com.br).

8.19 PLC1 BOARD

The PLC1 board permits that the CFW-09 frequency inverter assumes the CLP and positioning functions. This board is optional and in incorporated internally into the CFW-09. The board cannot be used simultaneously with the EBA, EBB or EBC boards.

Technical Characteristics

☑ Positioning with trapezoidal and “S” profile (absolute and relative)

☑ Homing (machine zero search)

☑ Programming in *Ladder language through the* WLP Software, Timers,

☑ Contactors, Coils and Contacts
RS-232 with Modbus RTU protocol

☑ Real-time watch

☑ Availability of 100 parameters that may be set by the user through the

☑ Software or via HMI.

☑ It has own 32 bits CPU with flash memory.

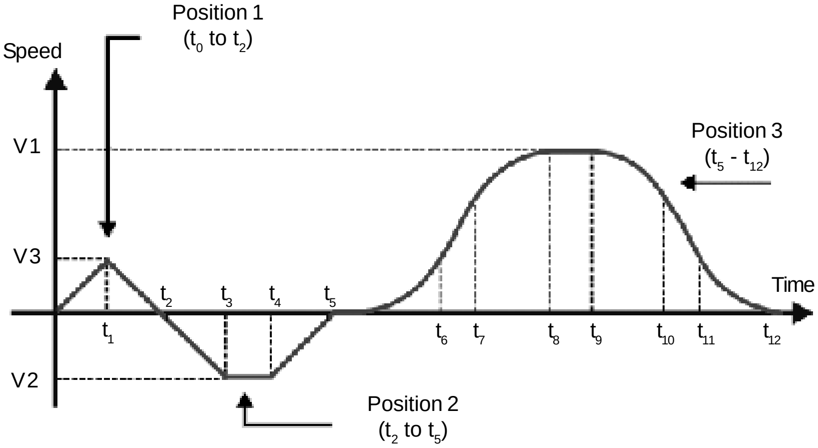


Figure 8.55 *- Trajectory example by using the PLC1 board*

Technical Specifications		
Input/Output	Quantity	Description
Digital inputs	9	5 bipolar 24 Vdc inputs and 4 110Vac inputs or bipolar 24Vdc inputs
Relay outputs	3	250Vca /3A ou 30Vcc/3A
Bipolar transistor outputs	3	24Vcc/500mA
Input for encoder circuit supply	1	18 to 30V
Output for encoder circuit supply	1	15V
Encoder input	1	Isolated input

Note: For more details, see please the PLC Board Manual (0899.4669). The manual download may be effected from the site: www.weg.com.br.

CHAPTER 9

TECHNICAL SPECIFICATIONS

This Chapter describes the technical specifications (electrical and mechanical) of the CFW-09 inverter series.

9.1 POWER DATA

AC Input Specifications:

☑ Operating voltage range:

- 220-230V models: 187 to 253Vac;
- 380-480V models: 323 to 528Vac;
- 500-600V models: 425 to 690Vac;
- 500-690V models: 425 to 759Vac;
- 660-690V models: 561 to 759Vac.

Note: When input voltage is lower than motor rated voltage the motor power will be reduced. When a line voltage higher than 600V (rated value) supplies the 500-690V models, it is necessary to derate the output current as stated in item 9.1.4.

☑ Frequency : 50/60Hz (± 2 Hz);

☑ Phase Unbalance≤ 3%;

☑ Overvoltage Category III (EN 61010/UL 508C);

☑ Transient voltages according to Category III;

☑ Minimum Power Supply line impedance:

- 1% voltage drop for models with rated current 130A/220-230V, up to 142A/380-480V and up to 32A/500-600V.;
- 2% voltage drop for models with rated current 180A and above.
- The models with current higher or equal to 44A/500-600V and all 500-690V and 660-690V models do not require minimum line impedance, because they have an internal DC link inductance.
- See item 8.7.1 guidelines.

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

9.1.1 220-230V Power Supply

Model: Current / Voltage	6/ 220-230	7/ 220-230	10/ 220-230	13/ 220-230	16/ 220-230	24/ 220-230	28/ 220-230
Load (1)	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT
Power (kVA) (2)	2.4	2.8	3.9	5.2	6.4	9.5	11.1
Rated Output Current (A) (3)	6	7	10	13	16	24	28
Maximum Output Current (A) (4)	9	10.5	15	19,5	24	36	42
Rated Input Current (A) (7)	7.2/15 (6)	8.4/18 (6)	12/25 (6)	15.6	19.2	28.8	33.6
Switching Frequency (kHz)	5	5	5	5	5	5	5
Maximum Motor (HP) (5) / (kW)	1.5/1.1	2/1.5	3/2.2	4/3.0	5/3.7	7.5/5.5	10/7.5
Watts Loss (kW)	0.69	0.80	1.14	1.49	1.83	2.74	3.20
Frame Size	1	1	1	1	2	2	2

Note: **CT** = Constant Torque
VT = Variable Torque

▨ Factory Default

Model: Current / Voltage	45/ 220-230	54/ 220-230		70/ 220-230		86/ 220-230		105/ 220-230		130/ 220-230	
Load (1)	CT/VT	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT
Power (kVA) (2)	18	21	27	28	34	34	42	42	52	52	60
Rated Output Current (A) (3)	45	54	68	70	86	86	105	105	130	130	150
Maximum Output Current (A) (4)	68	81		105		129		158		195	
Rated Input Current (A) (7)	54	65	82	84	103	103	126	126	156	156	180
Switching Frequency (kHz)	5	5	2.5	5	2.5	5	2.5	5	2.5	5	2.5
Maximum Motor (HP)(5) / (kW)	15/11	20/ 15	25/ 18.5	25/ 18.5	30/ 22	30/ 22	40/ 30	40/ 30	50/ 37	50/ 37	60/ 45
Watts Loss (kW)	0.5	0.6	0.8	0.8	1.0	1.0	1.2	1.2	1.5	1.5	1.7
Frame Size	3	4		5		5		6		6	

9.1.2 380-480V Power Supply

Model: Current / Voltage	3.6/ 380-480	4/ 380-480	5.5/ 380-480	9/ 380-480	13/ 380-480	16/ 380-480	24/ 380-480
Load (1)	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT
Power (kVA)(2)	2.7	3.0	4.2	6.9	9.9	12.2	18.3
Rated Output Current (A)(3)	3.6	4	5.5	9	13	16	24
Maximum Output Current (A)(4)	5.4	6	8.3	13.5	19.5	24	36
Rated Input Current (A)(7)	4.3	4.8	6.6	10.8	15.6	19.2	28.8
Switching Frequency (kHz)	5	5	5	5	5	5	5
Maximum Motor (HP) (5) / (kW)	1.5/1.1	2/1.5	3/2.2	5/3.7	75/15.5	10/7.5	15/11
Watts Loss (kW)	0.60	0.66	0.92	1.52	2.18	2.68	4.03
Frame Size	1	1	1	1	2	2	2

Model: Current / Voltage	30/ 380-480		38/ 380-480		45/ 380-480		60/ 380-480		70/ 380-480		86/ 380-480		105/ 380-480	
Load (1)	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT
Power (kVA)(2)	24	29	30	36	36	43	48	56	56	68	68	84	84	100
Rated Output Current (A)(3)	30	36	38	45	45	54	60	70	70	86	86	105	105	130
Maximum Output Current A)(4)	45		57		68		90		105		129		158	
Rated Input Current (A)(7)	36	43.2	45.6	54	54	64.8	72	84	84	103	103	126	126	156
Switching Frequency (kHz)	5	2.5	5	2.5	5	2.5	5	2.5	5	2.5	5	2.5	5	2.5
Maximum Motor (HP) /(kW)(5)	20/ 15	25/ 18.5	25/ 18.5	30/ 22	30/ 22	40/ 30	40/ 30	50/ 37	50/ 37	60/ 45	60/ 45	75/ 55	75/ 55	100/ 75
Watts Loss (kW)	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.2	1.2	1.5	1.5	1.8	1.8	2.2
Frame Size	3		4		4		5		5		6		6	

Model: Current / Voltage	142/ 380-480		180/ 380-480	211/ 380-480	240/ 380-480	312 380-480	361/ 380-480	450/ 380-480	515 380-480	600/ 380-480
Load (1)	CT	VT	CT/ VT	CT/ VT	CT/ VT	CT/VT	CT/VT	CT/VT	CT/VT	CT/VT
Power (kVA)(2)	113	138	143	161	191	238	287	358	392.5	478
Rated Output Current (A)(3)	142	174	180	211	240	312	361	450	515	600
Maximum Output Current (A)(4)	213		270	317	360	468	542	675	773	900
Rated Input Current (A)(7)	170	209	191	223	254	331	383	477	546	636
Switching Frequency (kHz)	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) /(kW)(5)	100/ 75	125/ 90	150/ 110	175/ 130.5	200/ 150	250/ 186.5	300/ 220	350/ 250	450/ 335.7	500/ 375
Watts Loss (kW)	2.4	2.9	3	3.5	4	5.2	6	7.6	8.5	10
Frame Size	7		8	8	8	9	9	10	10	10

Note: **CT** = Constant Torque
VT = Variable Torque

▨ Factory Default

9.1.3 500-600V Power Supply

Model: Current / Voltage	2.9/ 500-600		4.2/ 500-600		7/ 500-600		10/ 500-600		12/ 500-600		14/ 500-600
Load (1)	CT	VT	CT	VT	CT	VT	CT	VT	CT	VT	CT/VT
Power (kVA)(2)	2.9	4.2	4.2	7	7	10	10	12	12	13.9	13.9
Rated Output Current (A)(3)	2.9	4.2	4.2	7	7	10	10	12	12	14	14
Maximum Output Current (A)(4)	4.4	4.4	6.3	6.3	10.5	10.5	15	15	18	18	21
Rated Input Current (A)(7)	3.6	5.2	5.2	8.8	8.8	12.5	12.5	15	15	17.5	17.5
Switching Frequency (kHz)	5	5	5	5	5	5	5	5	5	5	5
Maximum Motor (HP) (5) / (kW)	2/1.5	3/2.2	3/2.2	5/3.7	5/3.7	7.5/5.5	7.5/5.5	10/7.5	10/7.5	12.5/9.2	15/11
Watts Loss (kW)	0.46	0.66	0.70	1.17	1.17	1.67	1.63	1.96	2.15	2.50	2.50
Frame Size	2		2		2		2		2		2

Model: Current / Voltage	22/ 500-600		27/ 500-600		32/ 500-600
Load (1)	CT	VT	CT	VT	CT/VT
Power (kVA)(2)	21.9	26.9	26.9	31.9	31.9
Rated Output Current (A)(3)	22	27	27	32	32
Maximum Output Current (A)(4)	33	33	40.5	40.5	48
Rated Input Current (A)(7)	27.5	33.8	33.8	40	40
Switching Frequency (kHz)	5	5	5	5	5
Maximum Motor (HP) (5) / (kW)	20/15	25/18.5	25/18.5	30/22	30/22
Watts Loss (kW)	0.35	0.45	0.45	0.5	0.5
Frame Size	4		4		4

Model: Current / Voltage	44/ 500-600		53/ 500-600		63/ 500-600		79/ 500-600	
Load (1)	CT	VT	CT	VT	CT	VT	CT	VT
Power (kVA)(2)	43.8	52.8	52.8	62.7	62.7	78.7	78.7	98.6
Rated Output Current (A)(3)	44	53	53	63	63	79	79	99
Maximum Output Current (A)(4)	66	66	79.5	79.5	94.5	94.5	118.5	118.5
Rated Input Current (A)(7)	46	56	56	66	66	83	83	104
Switching Frequency (kHz)	5	5	5	5	5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	40/30	50/37	50/37	60/45	60/45	75/55	75/55	100/75
Watts Loss (kW)	1	1.2	1.2	1.5	1.5	1.8	1.8	2.5
Frame Size	7		7		7		7	

Model: Current / Voltage	107/ 500-690		147/ 500-690		211/ 500-690	247/ 500-690	
Load (1)	CT	VT	CT	VT	CT/VT	CT	VT
Power (kVA)(2)	107	147	147	195	210	210	314
Rated Output Current (A)(3)	107	147	147	196	211	247	315
Maximum Output Current (A)(4)	160	160	220.5	220.5	316.5	370.5	370.5
Rated Input Current (A)(7)	107	147	147	196	211	247	315
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	100/75	150/110	150/110	200/150	200/150	250/185	300/220
Watts Loss (kW)	2.5	3	3	4.1	4.1	5.1	6
Frame Size	8E		8E		8E	10E	

Note: **CT** = Constant Torque
VT = Variable Torque

▨ Factory Default

Model: Current / Voltage	315/ 500-690		343/ 500-690		418/ 500-690		472/ 500-690	
Load (1)	CT	VT	CT	VT	CT	VT	CT	VT
Power (kVA)(2)	314	342	342	416	416	470	470	553
Rated Output Current (A)(3)	315	343	343	418	418	472	472	555
Maximum Output Current (A)(4)	472.5	472.5	514.5	514.5	627	627	708	708
Rated Input Current (A)(7)	315	343	343	418	418	472	472	555
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	300/220	350/250	350/250	400/300	400/300	500/370	500/370	600/450
Watts Loss (kW)	6	6.8	6.8	8.2	8.2	11	11	12.3
Frame Size	10E		10E		10E		10E	

9.1.4 660-690V Power Supply

Model: Current / Voltage	100/ 660-690		127/ 660-690		179/ 660-690	225/ 660-690	
Load (1)	CT	VT	CT	VT	CT/VT	CT	VT
Power (kVA)(2)	120	152	152	214	214	269	310
Rated Output Current (A)(3)	100	127	127	179	179	225	259
Maximum Output Current (A)(4)	150	150	190.5	190.5	268.5	337.5	337.5
Rated Input Current (A)(7)	100	127	127	179	179	225	259
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	100/75	150/110	150/110	200/150	200/150	250/185	300/220
Watts Loss (kW)	2.5	3	3	4.1	4.1	5.1	6
Frame Size	8E		8E		8E	10E	

Model: Current / Voltage	259/ 660-690		305/ 660-690		340/ 660-690		428/ 660-690
Load (1)	CT	VT	CT	VT	CT	VT	CT/VT
Power (kVA)(2)	310	365	365	406	406	512	512
Rated Output Current (A)(3)	259	305	305	340	340	428	428
Maximum Output Current (A)(4)	388.5	388.5	457.5	457.5	510	510	642
Rated Input Current (A)(7)	259	305	305	340	340	428	428
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	300/220	350/250	350/250	400/300	400/300	500/370	500/370
Watts Loss (kW)	6	6.8	6.8	8.2	8.2	11	11
Frame Size	10E		10E		10E		10E

Model: Current / Voltage	107/ 500-690		147/ 500-690		211/ 500-690	247/ 500-690	
Load (1)	CT	VT	CT	VT	CT/VT	CT	VT
Power (kVA)(2)	120	152	152	214	214	269	310
Rated Output Current (A)(3)	100	127	127	179	179	225	259
Maximum Output Current (A)(4)	150	150	190.5	190.5	268.5	337.5	337.5
Rated Input Current (A)(7)	100	127	127	179	179	225	259
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	100/75	150/110	150/110	200/150	200/150	250/185	300/220
Watts Loss (kW)	2.5	3	3	4.1	4.1	5.1	6
Frame Size	8E		8E		8E	10E	

Note: **CT** = Constant Torque
VT = Variable Torque

▨ Factory Default

Model: Current / Voltage	315/ 500-690		343/ 500-690		418/ 500-690		472/ 500-690
Load (1)	CT	VT	CT	VT	CT	VT	CT/VT
Power (kVA)(2)	310	365	365	406	406	512	512
Rated Output Current (A)(3)	259	305	305	340	340	428	428
Maximum Output Current (A)(4)	388.5	388.5	457.5	457.5	510	510	642
Rated Input Current (A)(7)	259	305	305	340	340	428	428
Switching Frequency (kHz)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Maximum Motor (HP) (5) / (kW)	300/220	350/250	350/250	400/300	400/300	500/370	500/370
Watts Loss (kW)	6	6.8	6.8	8.2	8.2	11	11
Frame Size	10E		10E		10E		10E

Note: **CT** = Constant Torque
VT = Variable Torque

▨ Factory Default

NOTES:

(1)

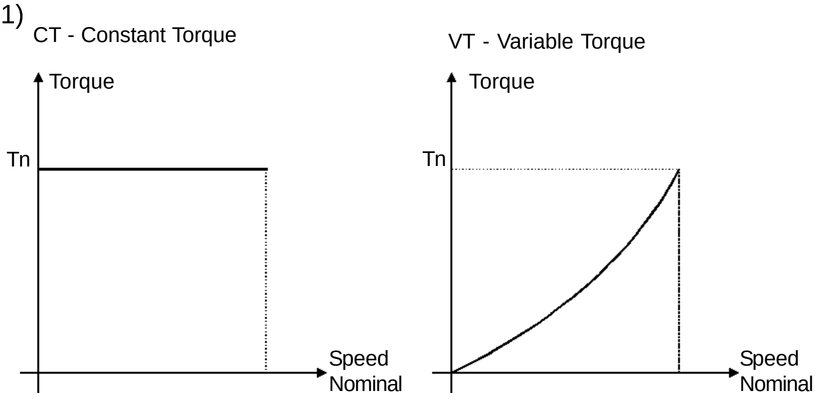


***Figure 9.1** - Load Characteristics*

(2)
The power rating in kVA is determined by the following equation:

$$P(kVA) = \frac{\sqrt{3}. \text{ Input Voltage (V) x Current Rating (A)}}{1000}$$

The values shown on the Table were calculated considering the inverter rated current rating and an input voltage of 230V for 220-230V models, 460V for 380-480V models, 575V for 500-600V models and 690V for 660-690 models.

(3)
Rated Output 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 (1000 m);
☑ Ambient Temperature: 32º to 104ºF (0º to 40º C), up to 122ºF (50º C) with 2% / ºC derating.
☑ The rated current values are valid for the indicated switching frequencies.
☑ The 10kHz keying frequency is not possible for the 2.9...79A/500-600V, 107...472A/500-690V and 100...428A/660-690V models.
☑ The operation at 10kHz is possible for V/F control mode and vector control with encoder mode with the following derating:

Models	Load Type	Comutation Frequency	Output Current Derating
6 to 45A / 220-230V	CT/VT	10kHz	0.8
54 to 130A/220-230V	CT		
	VT	5kHz	Contact WEG
		10kHz	
3.6 to 24A / 380-480V	CT/VT	10kHz	0.7
30 to 142A / 380-480V	CT		
	VT	5kHz	Contact WEG
		10kHz	
180 to 600A / 380-480V	CT/VT	5kHz	
		10kHz	
63A / 500-600V	VT	5kHz	0.8
79A / 500-600V	CT		Contact WEG
	VT		
107 to 472A / 500-690V	CT		
	VT		
100 to 428A / 660-690V	CT		
	VT		

(4)

☑ Maximum Current: 1.5 x I Nominal (for 60 seconds every 10 minutes).
I Nominal = Rated Current for CT applications;

☑ The maximum output current is the same for CT and VT. That means a lower overload capacity in VT for the models with a higher rated current for VT than for CT.

(5)

The indicated maximum motor HP/kW ratings are based on WEG 4 pole motors and normal duty loads. A precise inverter sizing must consider the actual motor nameplate and application data.

(6)

Rated input current for single-phase operation.

Note: The 6 , 7 and 10 A / 220-230 V models can be operated with 2 input phases only (single-phase operation) without output current derating.

(7)

Rated input current for three-phase operation:

This is a conservative value. In practice the value of this current depends on the line impedance. Please see table 9.1:

X (%)	$I_{input\ (rms)}$ (%)
0.5	131
1.0	121
2.0	106
3.0	99
4.0	96
5.0	96

Table 9.1 - *X = Line impedance drop @ rated inverter output current;*
$I_{input\ (rms)}$ = % of the rated output current

9.2 ELECTRONICS/GENERAL DATA

CONTROL	METHOD	☑ Voltage Source V/F (Scalar), or ☑ Vector Control with Encoder Feedback, or ☑ Sensorless Vector Control (without Encoder) ☑ PWM SVM (Space Vector Modulation) ☑ Current, Flux and Speed Digital Regulators Scan Time: ☑ Current Regulators: 0.2 ms (5 kHz) ☑ Flux Regulator: 0.4 ms (2.5 kHz) ☑ Speed Regulator / Speed Measurement: 1.2 ms
	OUTPUT FREQUENCY	☑ 0...3,4 x motor rated frequency (P403). This rated frequency can be set from 0 to 300 Hz in scalar mode and from 30 to 120 Hz in vector mode.
PERFORMANCE (Vector Mode)	SPEED CONTROL	Sensorless: ☑ Regulation: 0.5% of Base Speed ☑ Speed Range: 1:100 With Encoder: (with EBA or EBB Board) ☑ Regulation: ☑ +/- 0.01% of Base Speed with 14 bit Analog Input (EBA Board); ☑ +/- 0.01% of Base Speed with Digital Reference (Keypad, Serial Port, Fieldbus, Electronic Potentiometer, Multispeed); ☑ +/- 0.1% of Base Speed with 10 bit Analog Input (CC9 Board).
	TORQUE CONTROL	☑ Range: 0 ... 150%, Regulation: +/-10% of Rated Torque
INPUTS (CC9 Board)	ANALOG	☑ 2 Non Isolated Differential Inputs: 0 to +10 V or (0)4 to 20 mA; Impedance: 400kΩ(0...+10 V), 500Ω [(0)4...20 mA]; Resolution: 10 bit, Programmable Functions;
	DIGITAL	☑ 6 Isolated Inputs: 24Vdc; Programmable Functions
OUTPUTS (CC9 Board)	ANALOG	☑ 2 Non Isolated Outputs: 0 to +10 V;RL ≥10 kΩ (1 mA Maximum); Resolution: 11 bit; Programmable Functions.
	RELAY	☑ 2 Relays: Form C contacts available; 240 Vac, 1 A; Programmable Functions. ☑ 1 Relay: Form A contact available; 240 Vac, 1 A; Programmable Functions.
SAFETY	PROTECTION	☑ Overcurrent/Output Short-circuit (Trip Point: 2 x Rated Current) ☑ DC Link Under/Overvoltage ☑ Power Supply Undervoltage/Phase Fault (1) ☑ Inverter Overtemperature ☑ Dynamic Braking Resistor Overload ☑ Motor/Inverter Overload (Ixt)

		☑ External Fault ☑ CPU/EPROM Error ☑ Output Ground Fault ☑ Programming Error
KEYPAD (HMI)	STANDARD (HMI-CFW09-LCD)	☑ 8 Keys: Start, Sop, Increase, Decrease, FWD/REV, JOG, Local/Remote and Program ☑ LCD display: 2 lines x 16 characters ☑ LED display: 4 Digits with 7 segments ☑ LED's for FWD/REV and LOC/REM Indication ☑ Display Accuracy: Current: 5% of Rated Current Speed Resolution: 1 rpm ☑ Remote mounting possibility, Cables available up to 30 ft (10 m)
DEGREE OF PROTECTION	NEMA1/IP20	☑ Models 3.6 to 240A (220-230V and 380-480V), 2.9 to 79A (500-600V), 107 to 211A (500-690V) and 100 to 179A (660-690V).
	PROTECTED CHASSIS / IP20	☑ Models 361 to 600A (220-230V and 380-480V), 247 to 472A (500-600V) and 225 to 428A (660-690V).
STANDARDS	IEC 146	☑ Semiconductor Inverters
	UL 508 C	☑ Power Conversion Equipment
	EN 50178	☑ Electronic equipment for use in power installations
	EN 61010	☑ Safety requirements for electrical equipment for measurement, control and laboratory use
	EN 61800 - 3	☑ EMC Product Standard for Power Drive Systems

(1) Available in models ≥ 30A / 220-230V or ≥ 30A / 380-480V or ≥ 22A / 500 -600V or for all 500-690V and 660-690V models.

9.3 OPTIONAL DEVICES

9.3.1 I/O Expansion Board EBA

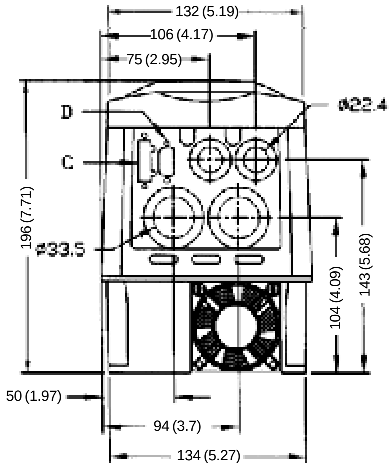
COMMUNI-CATION	SERIAL INTERFACE	☑ Isolated RS-485 Serial Interface (the RS-485 and RS-232 serial interfaces cannot be used simultaneously)
INPUTS	ANALOG	☑ 1 Bipolar Analog Input (AI4): -10V...+10V or 0(4)...20mA Linearity: 14 bit (0.006% of [(10V range)] Programmable Functions
	INCREMENTAL ENCODER	☑ Incremental Encoder Feedback Input:Internal 12 Vdc, 200mA max isolated power supply Differential inputs A, $\overline{A}$, B, $\overline{B}$, Z and $\overline{Z}$ signals (100 kHz max) 14 bit resolution. Used as speed feedback for the speed regulator and digital speed measurement
	DIGITAL	☑ 1 Programmable Isolated 24Vdc Digital Input (DI7) ☑ Programmable Digital Input (DI8). For motor PTC-thermistor Actuation: 3.9k Ω Release: 1.6 kΩ
OUTPUTS	ANALOG	☑ 2 Bipolar Analog Outputs (AO3/AO4): -10V...+10V Linearity: 14 bit (0.006% of +/- 10V range) Programmable Functions
	ENCODER	☑ Buffered Encoder Output:Input signal repeater; Isolated differential outputs
	DIGITAL	☑ 2 Isolated Transistor Outputs (DO1/DO2): Open collector, 24Vdc, 50mA Programmable Functions

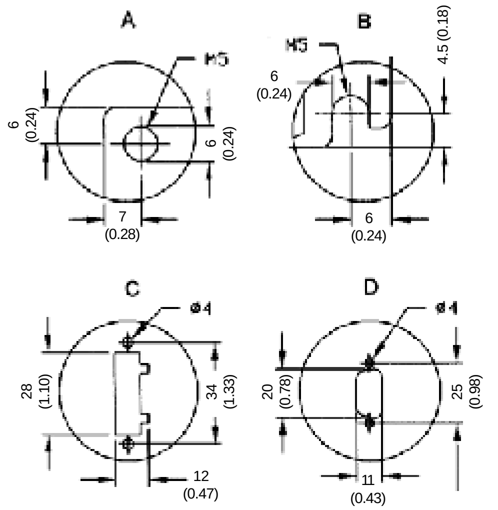
9.3.2 I/O Expansion Board EBB

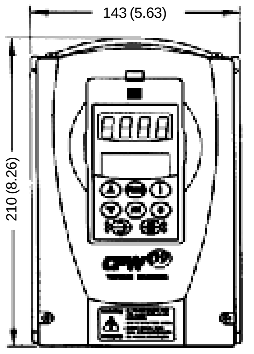
COMMUNI-CATION	SERIAL INTERFACE	☑ Isolated RS-485 Serial Interface (the RS-485 and RS-232 serial interfaces cannot be used simultaneously)
INPUTS	ANALOG	☑ 1 Isolated Analog Input (AI3): 0V...+10V or 0(4)...20mA Resolution: 10 bit; Programmable Functions
	INCREMENTAL ENCODER	☑ Incremental Encoder Feedback Input: Internal 12 Vdc, 200mA max isolated power supply Differential inputs signals A, $\overline{A}$, B, $\overline{B}$, Z and $\overline{Z}$ (100 kHz max) 14 bit resolution. Used as speed feedback for the speed regulator and digital speed measurement
	DIGITAL	☑ 1 Programmable Isolated 24Vdc Digital Input (DI7) ☑ 1 Programmable Digital Input (DI8):For motor PTC-thermistor, Actuation: 3.9kΩ Release: 1.6 k Ω
OUTPUTS	ANALOG	☑ 2 Isolated Analog Outputs (AO1'/AO2'): 0(4)...20mA; Linearity: 11 bit (0.05% of full scale); Programmable Functions (Same as AO1 and AO2 of CC9 control board).
	ENCODER	☑ Buffered Encoder Output: Input signal repeater Isolated differential outputs
	DIGITAL	☑ 2 Isolated Transistor Outputs (DO1/DO2): Open collector 24Vdc, 50mA; Programmable Functions

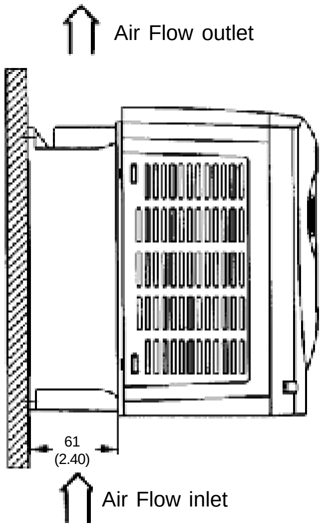
9.4 MECHANICAL DATA

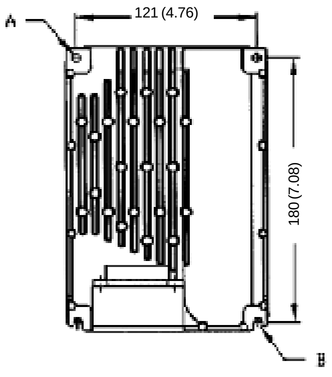
Size 1

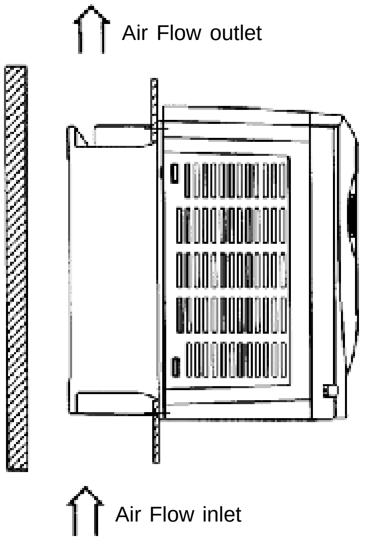


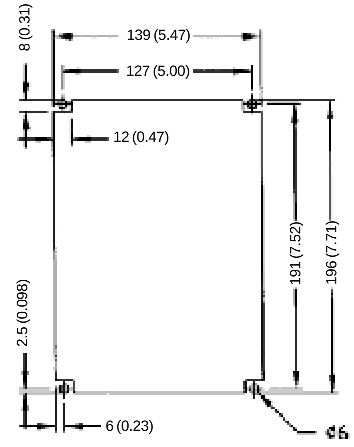






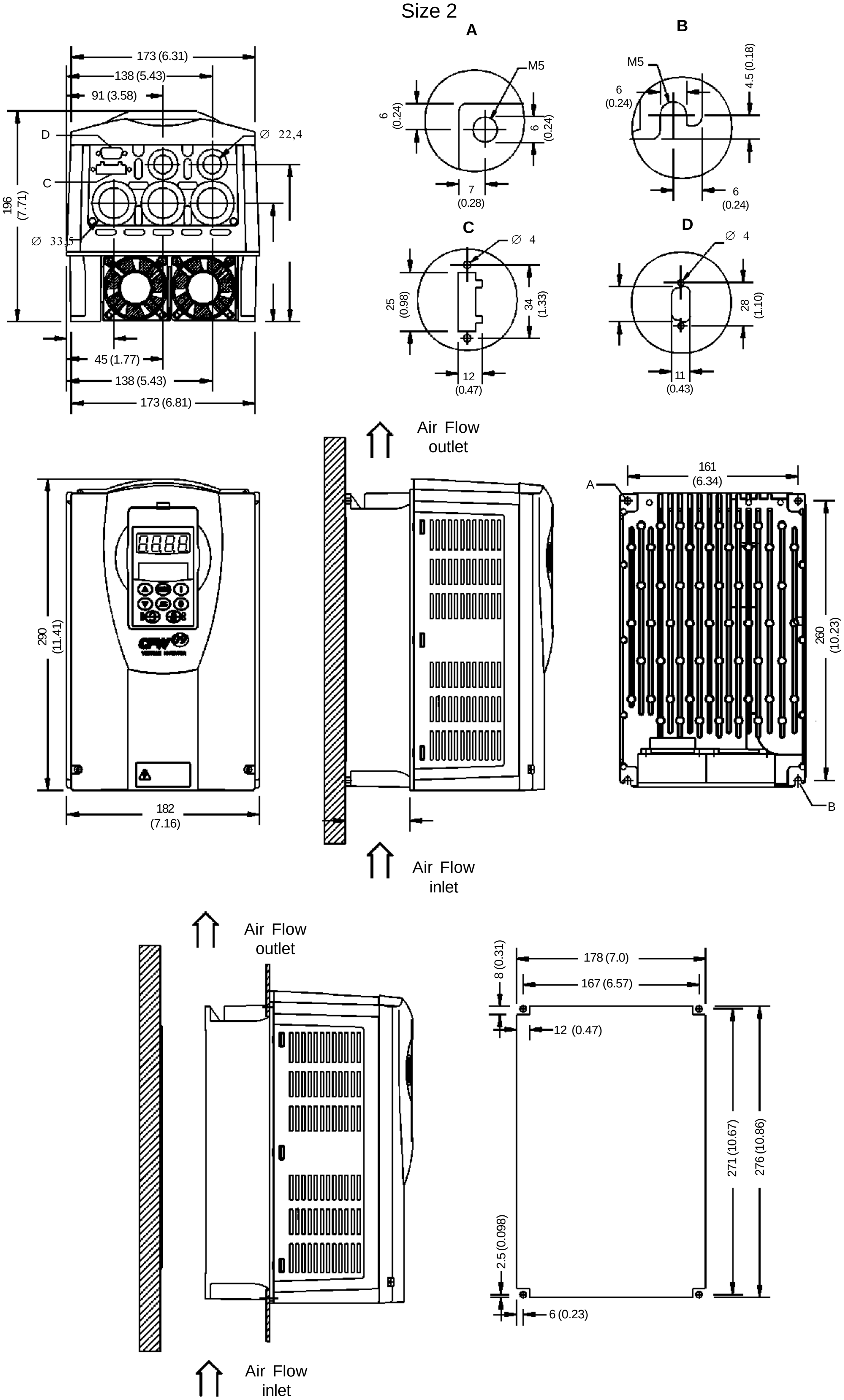






Dimensions in mm (inch)

Size 2



Dimensions in mm (inch)

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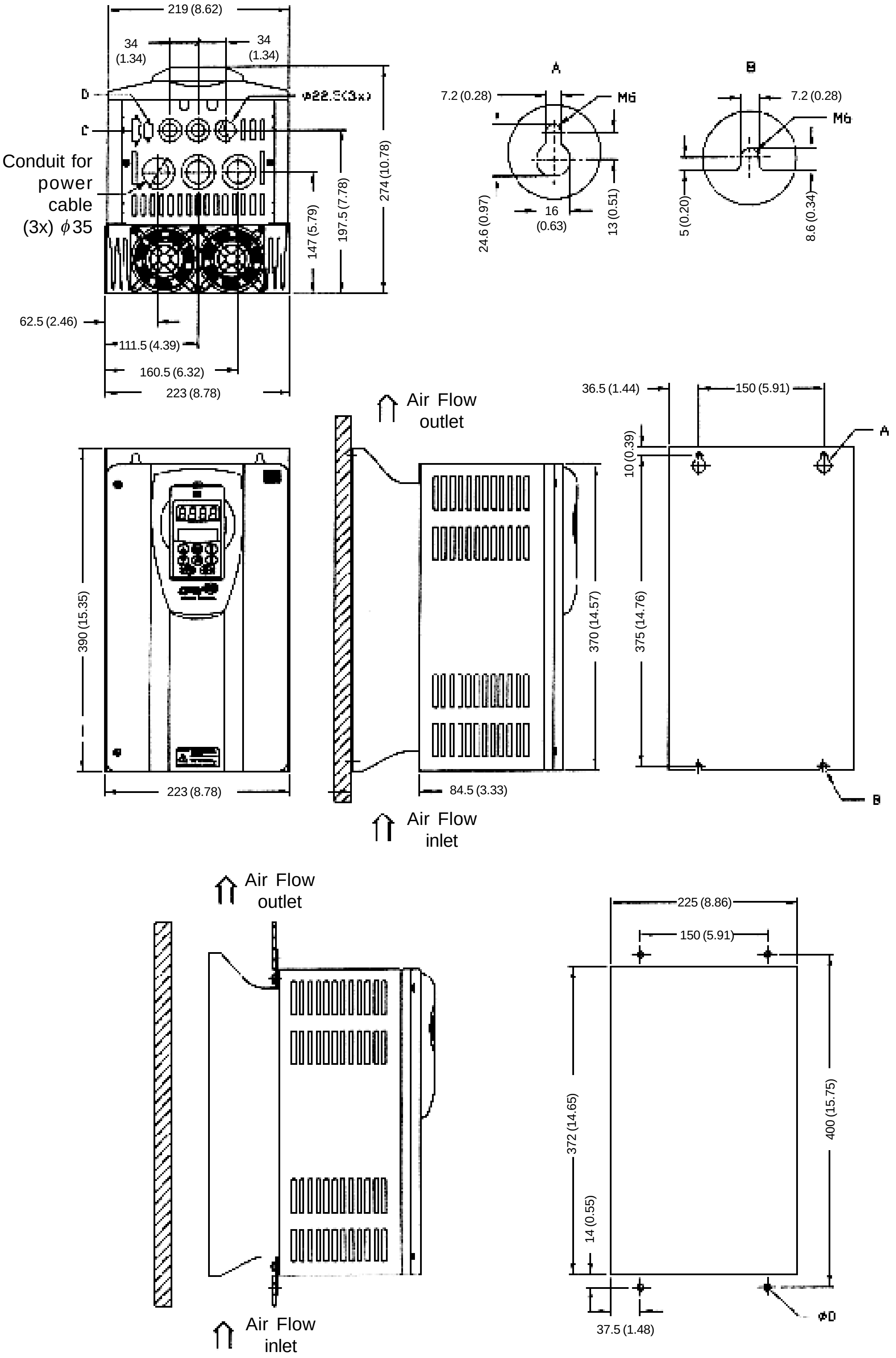

Dimensions in mm (inch)

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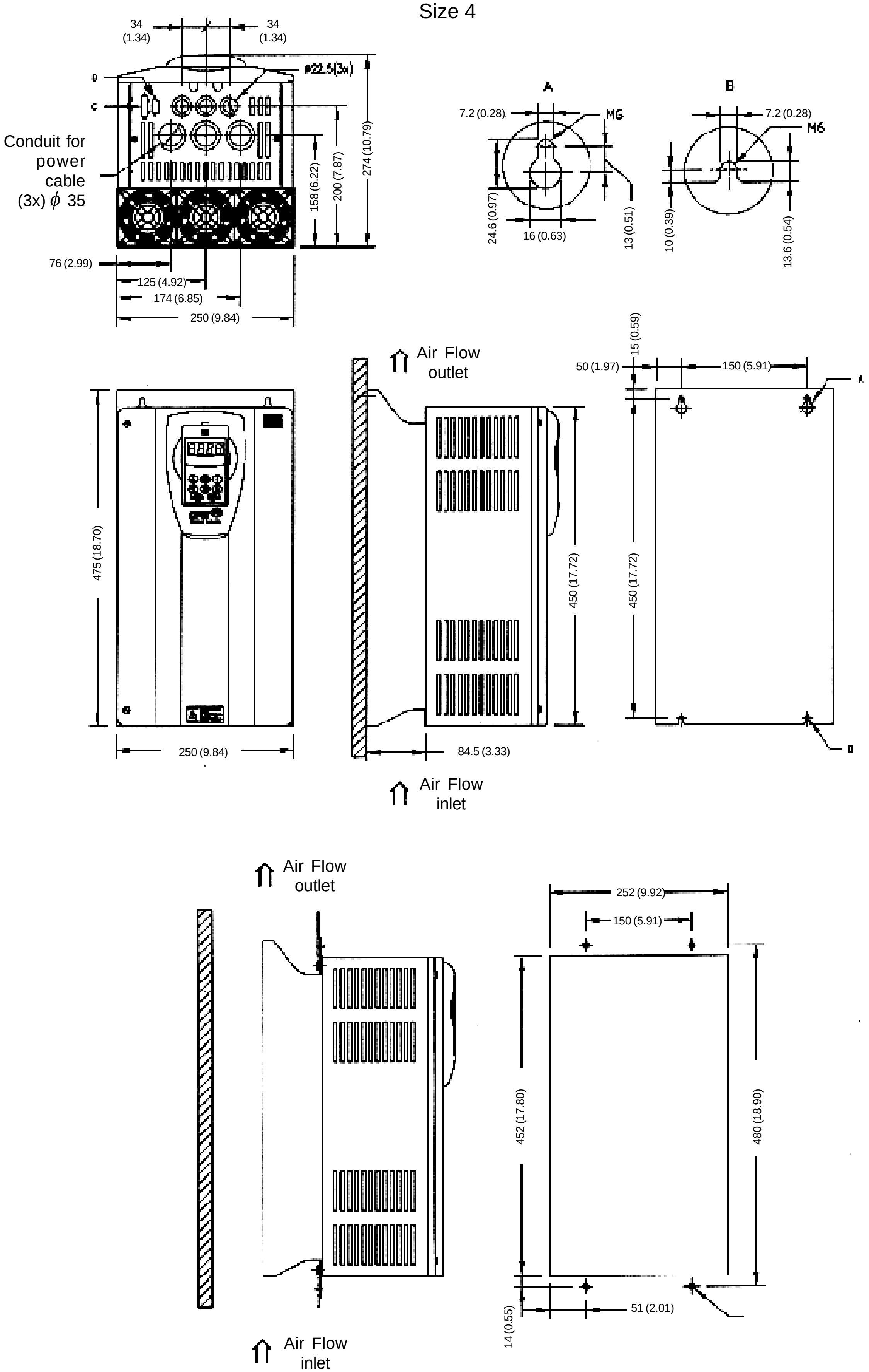

Dimensions in mm (inch)

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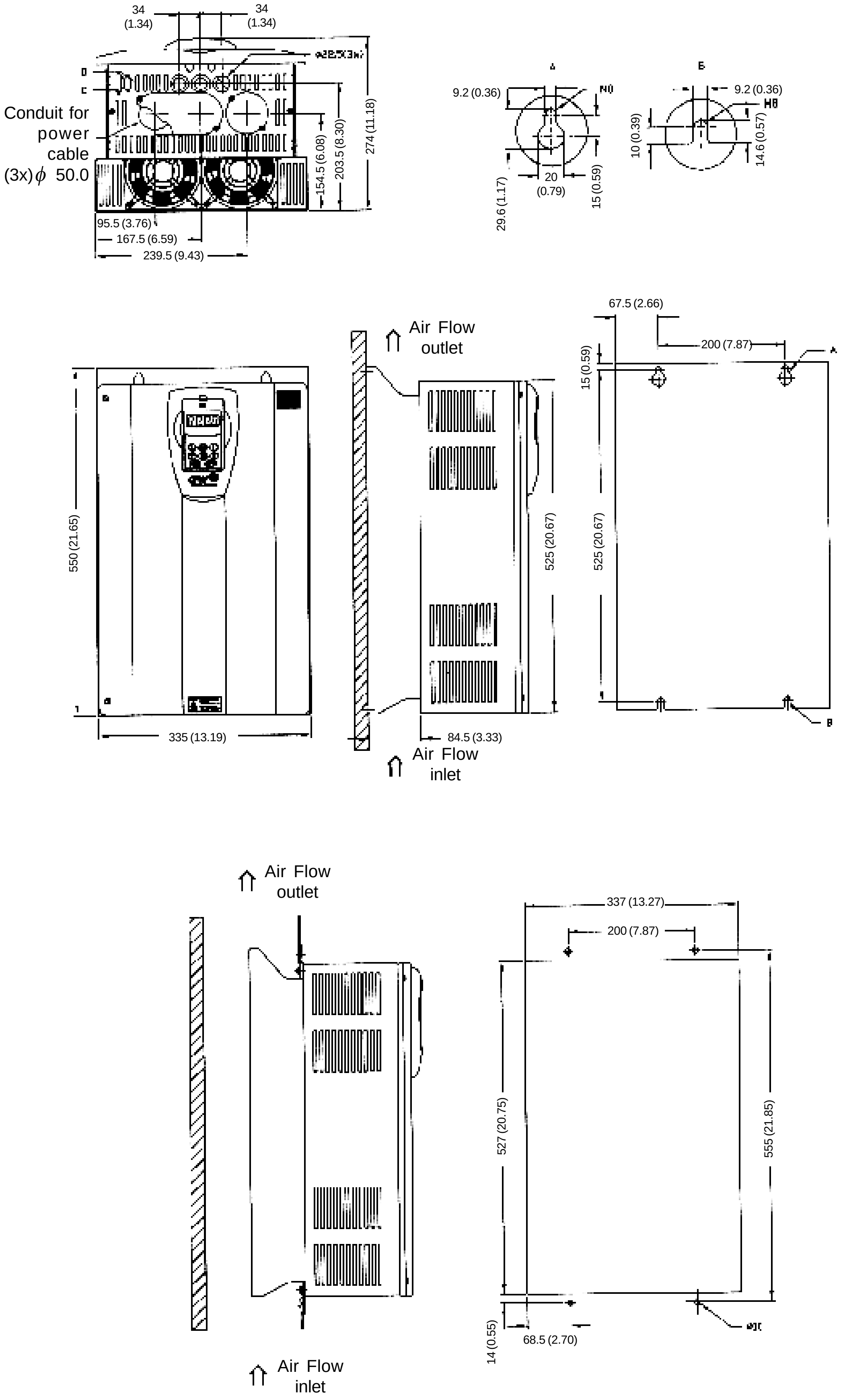

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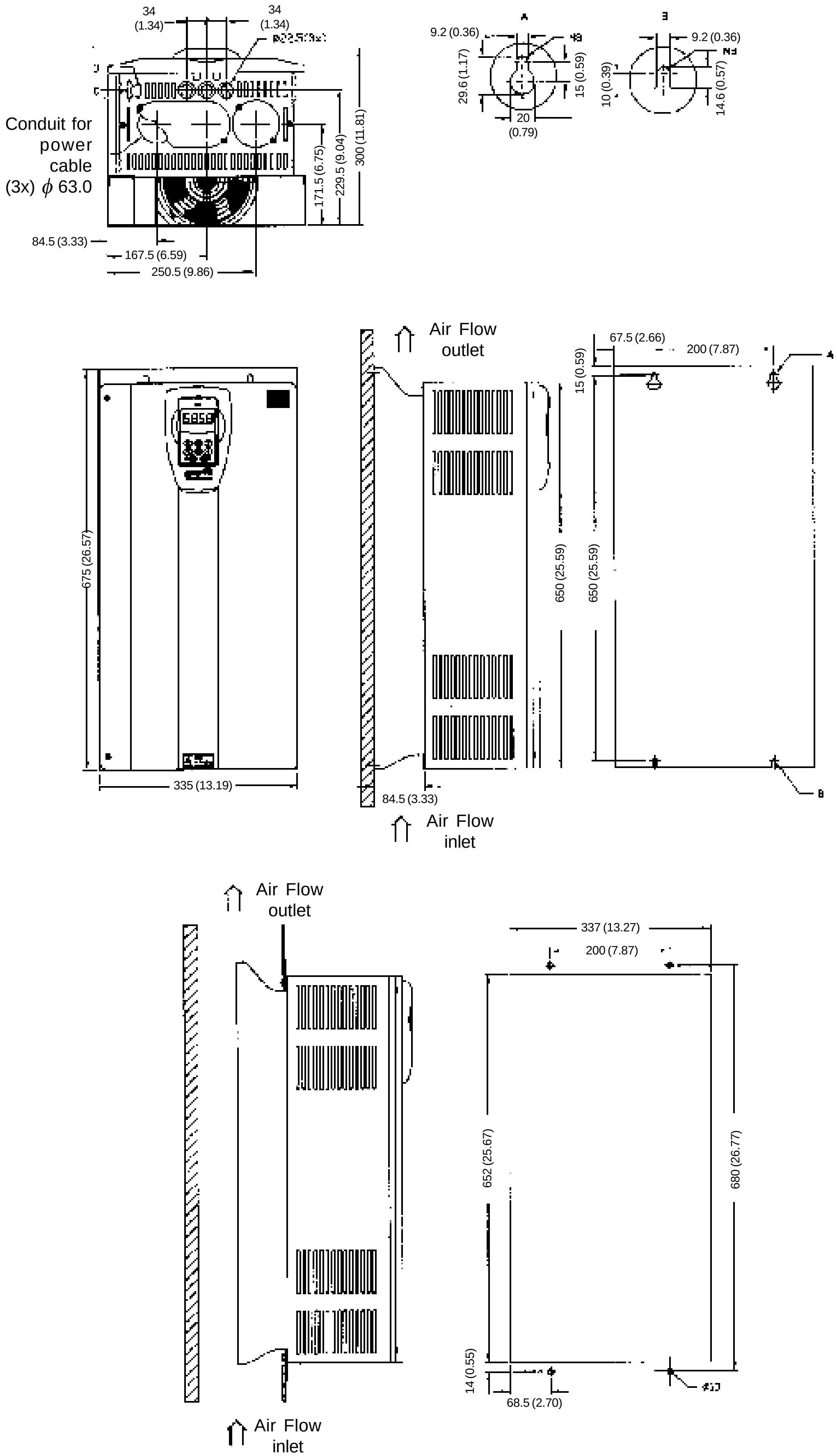

Dimensions in mm (inch)

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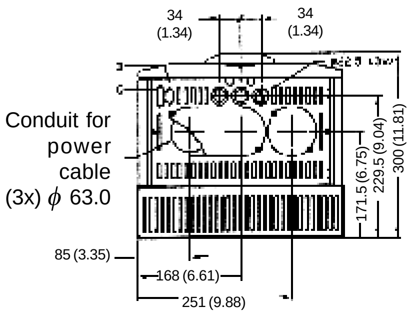
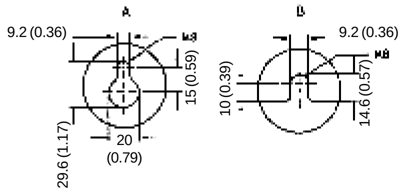
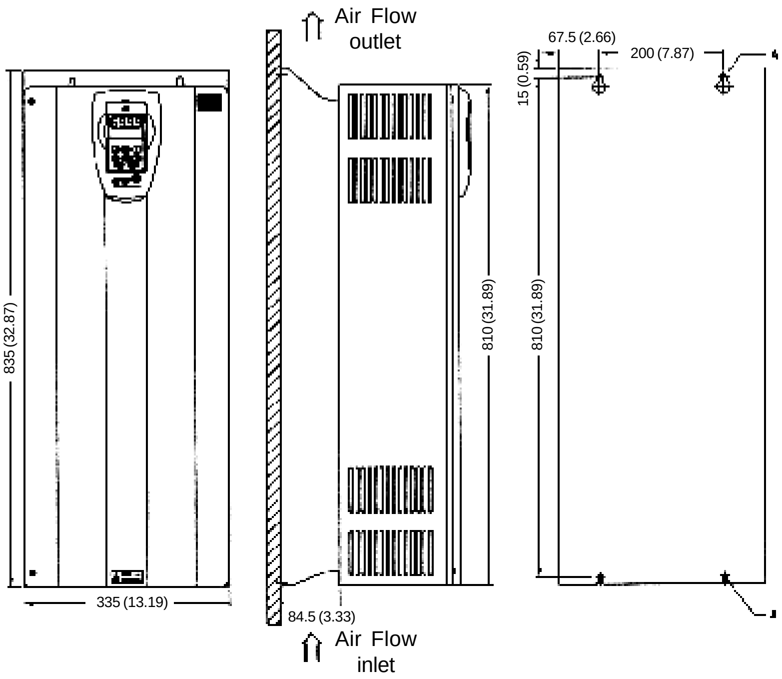
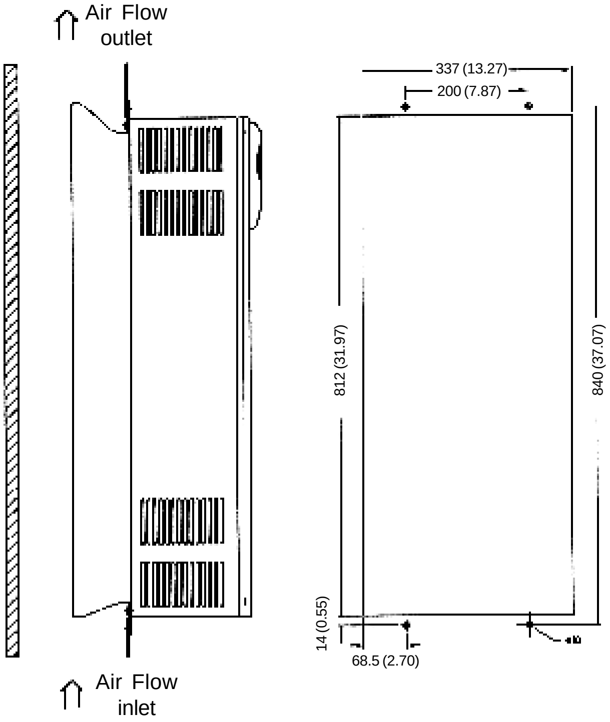


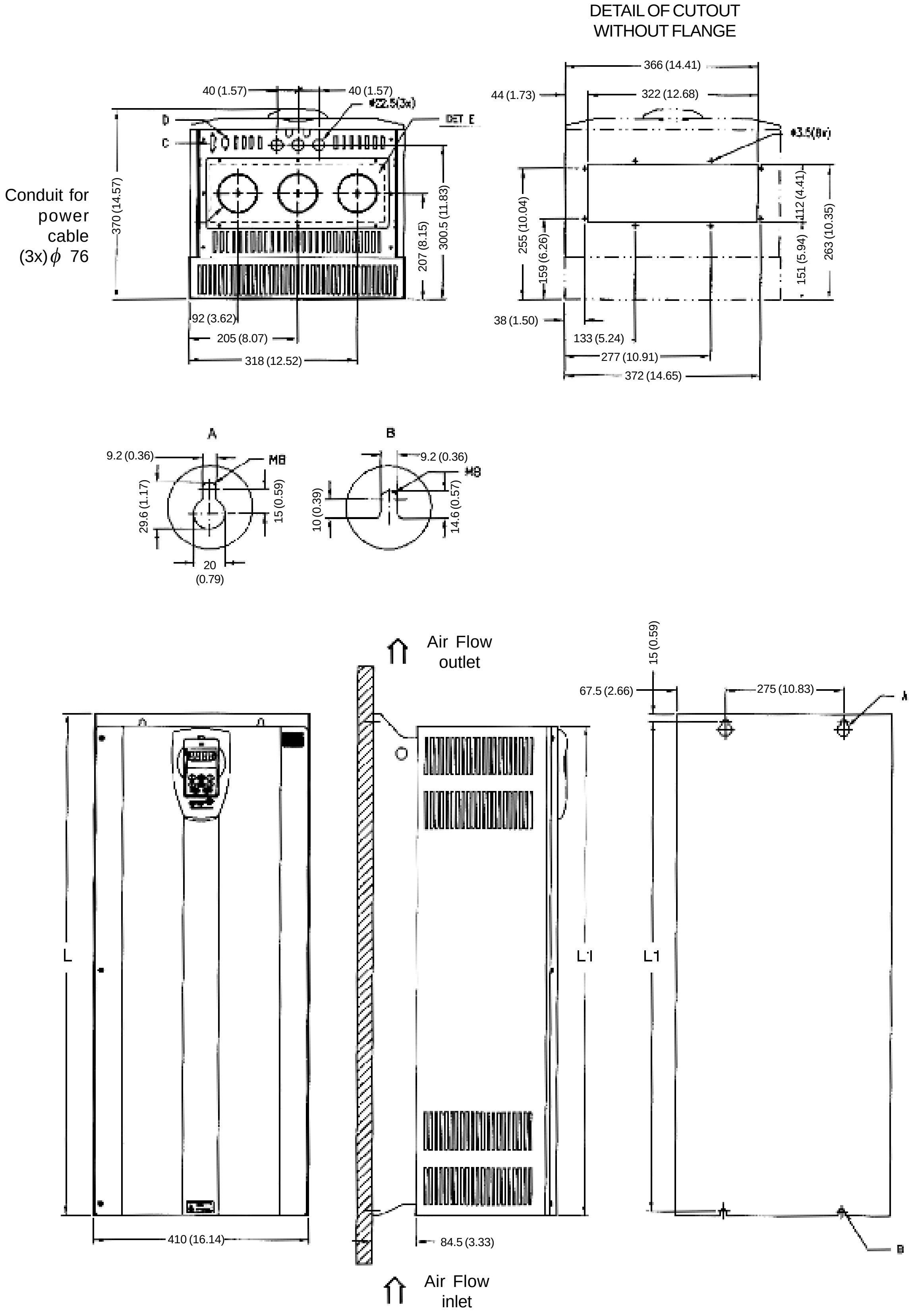




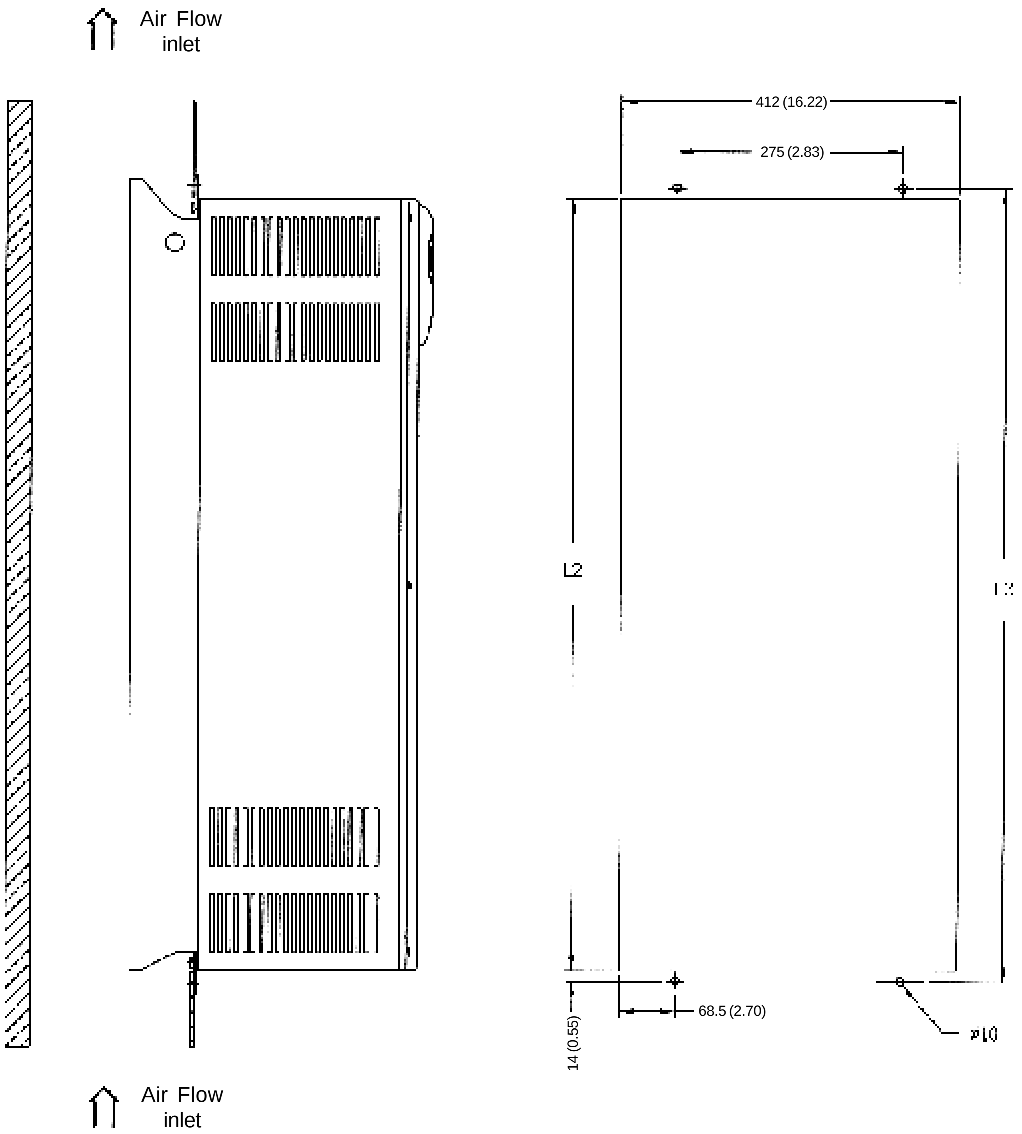


Dimensions in mm (inch)

Size 8 and 8E



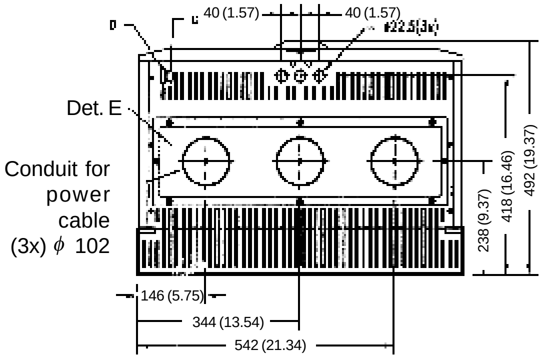
Dimensions in mm (inch)

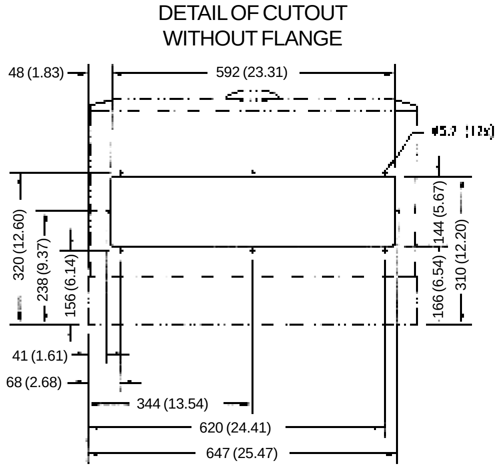


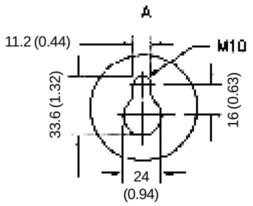
Length	L		L1		L2		L3	
Dimensions	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)
Size 8	975	38.38	950	37.4	952	37.48	980	38.58
Size 8E	1145	45.08	1122.5	44.19	1124.5	44.27	1152.5	45.37

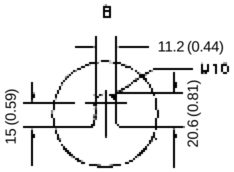
Dimensions in mm (inch)

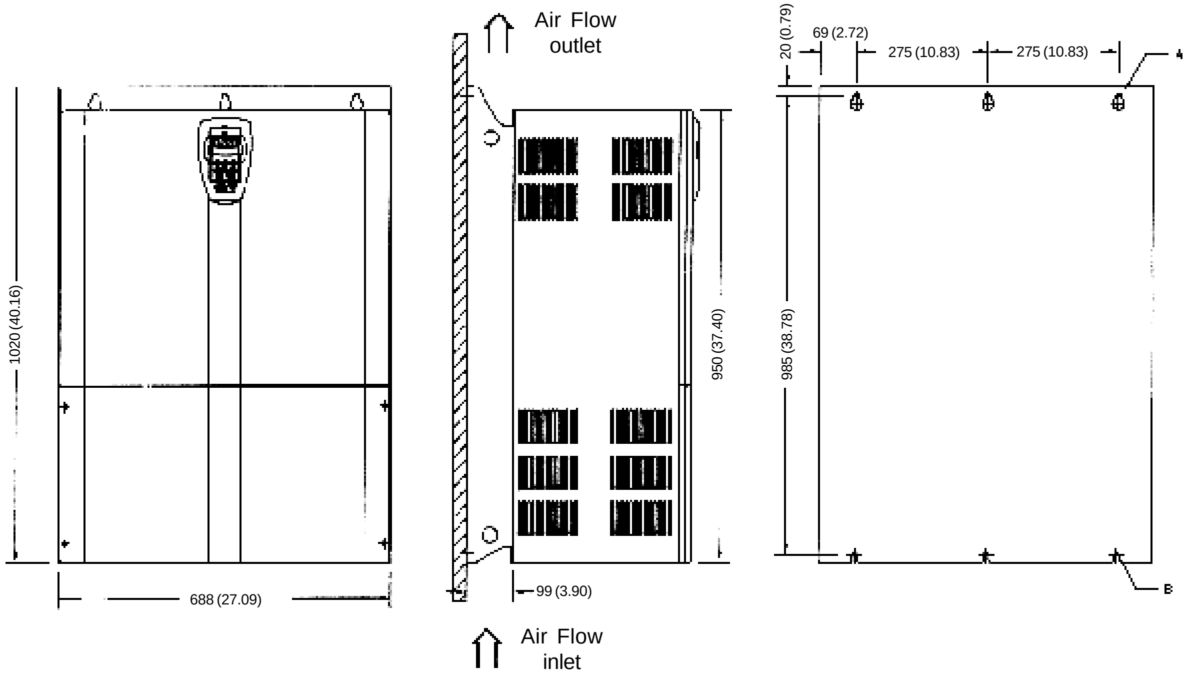
Size 9





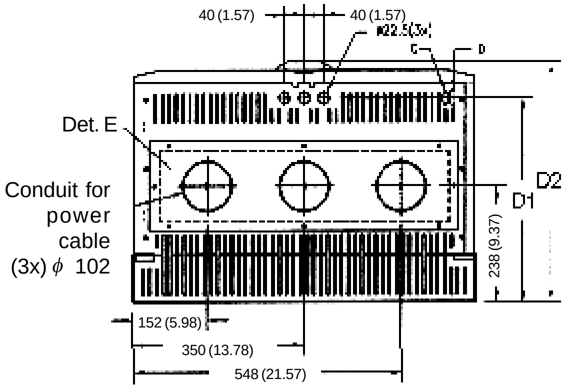




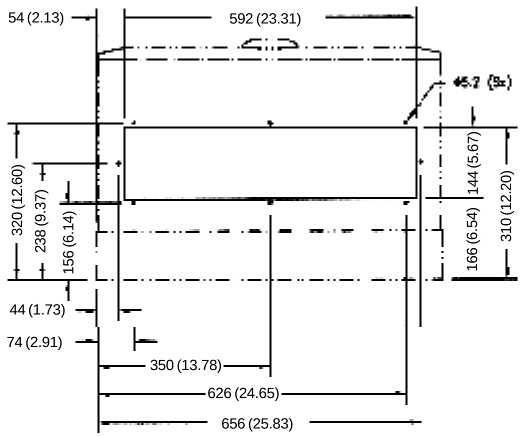


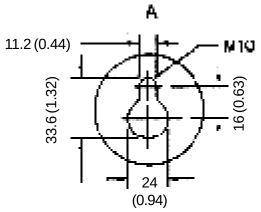
Dimensions in mm (inch)

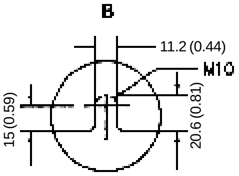
Size 10

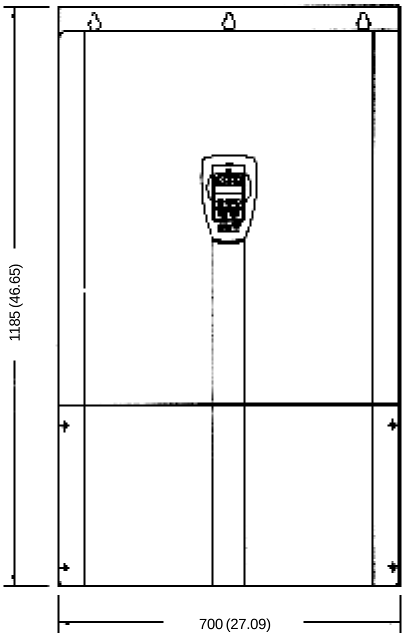


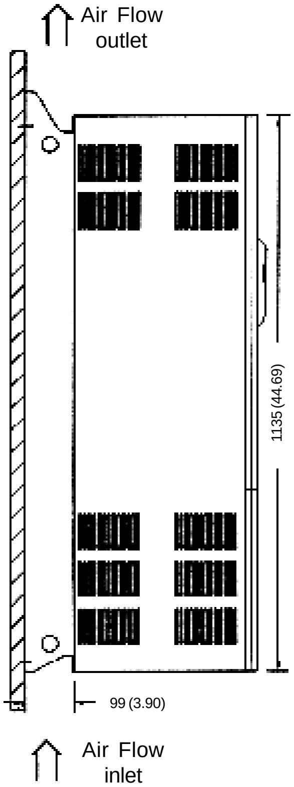
DETAIL OF CUTOUT WITHOUT FLANGE

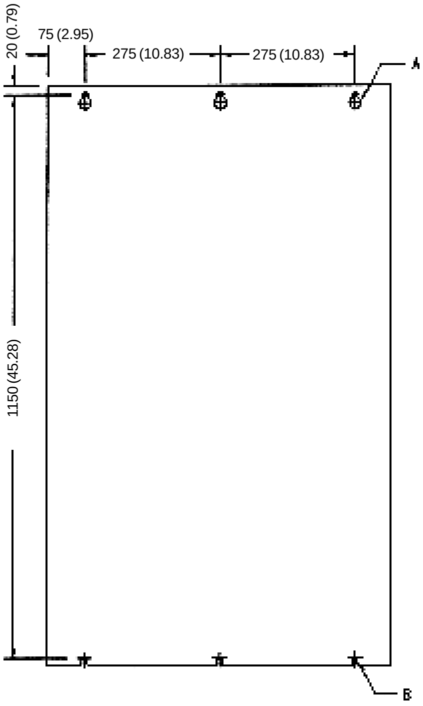








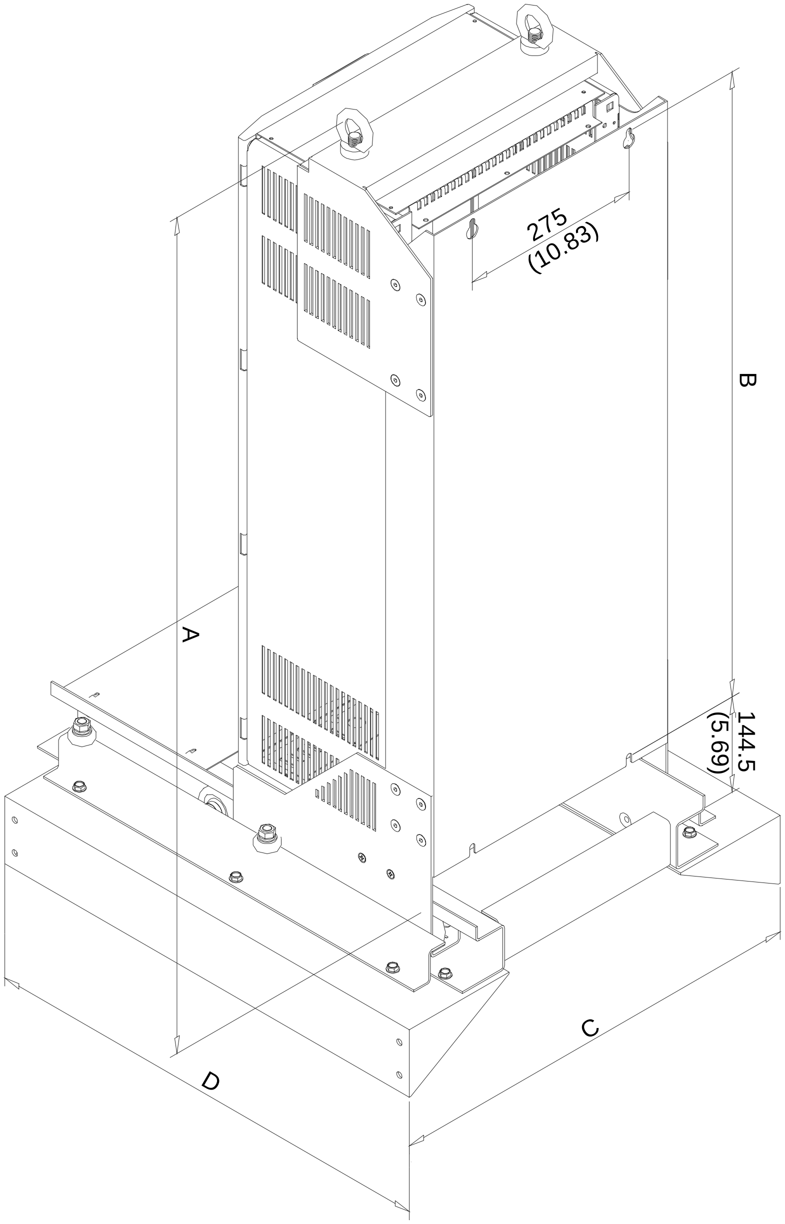




Length	D1		D2	
Dimensions	(mm)	(in)	(mm)	(in)
Size 10	418	16.45	492	19.37
Size 10E	508	20	582	22.91

Dimensions in mm (inch)

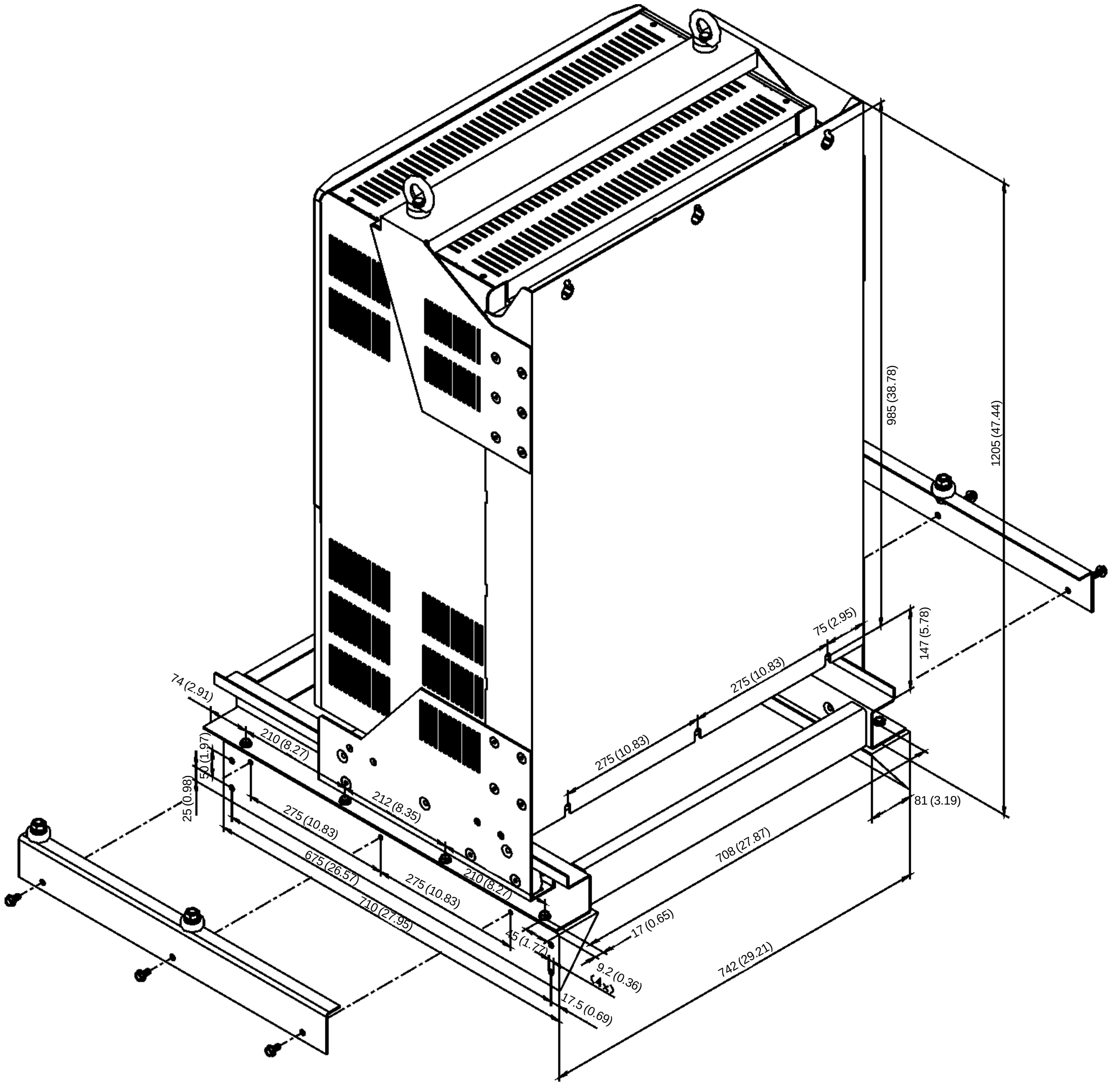
Inverter CFW-09 180-240A/380-480V (size 8), 107 to 211A/500-600V (size 8E) and 100 to 179A/660 to 690V (size 8E) with KIT-KME



	Panel Width	Dimensions			
		A	B	C	D
Size 8	600 (23.62)	1167.6 (45.67)	950 (37.40)	542 (21.34)	503 (19.80)
	800 (31.50)	1167.6 (45.67)	950 (37.40)	742 (29.11)	710 (27.95)
Size 8E	600 (23.62)	1340 (52.76)	1122.5 (44.19)	542 (21.34)	503 (19.80)
	800 (31.50)	1340 (52.76)	1122.5 (44.19)	742 (29.11)	710 (27.95)

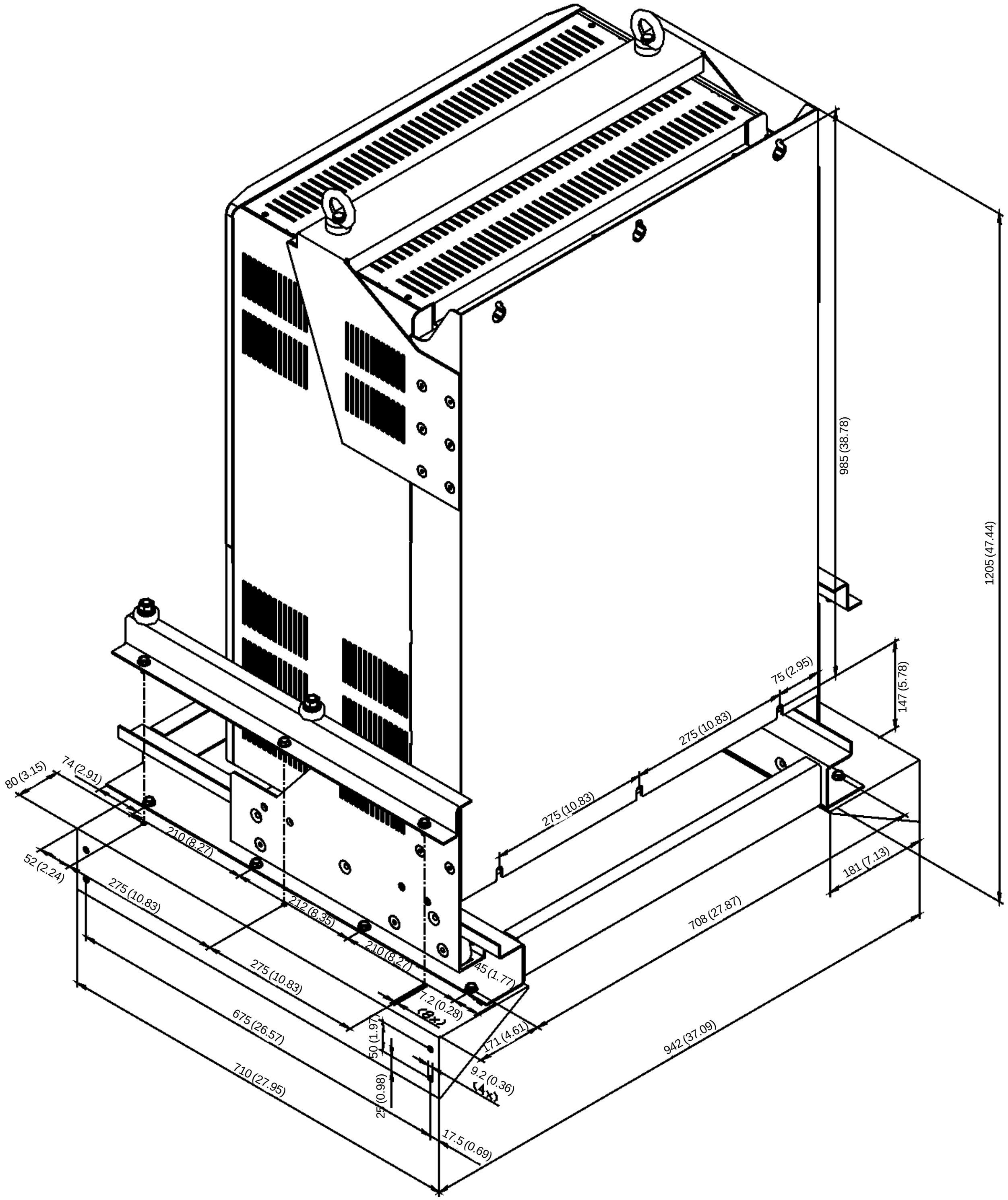
Dimensions in mm (inch)

Inverter CFW-09 312-361A/380-480V (size 9) with KIT-KME
for panel width = 800mm (31.50 in)
(417102522)



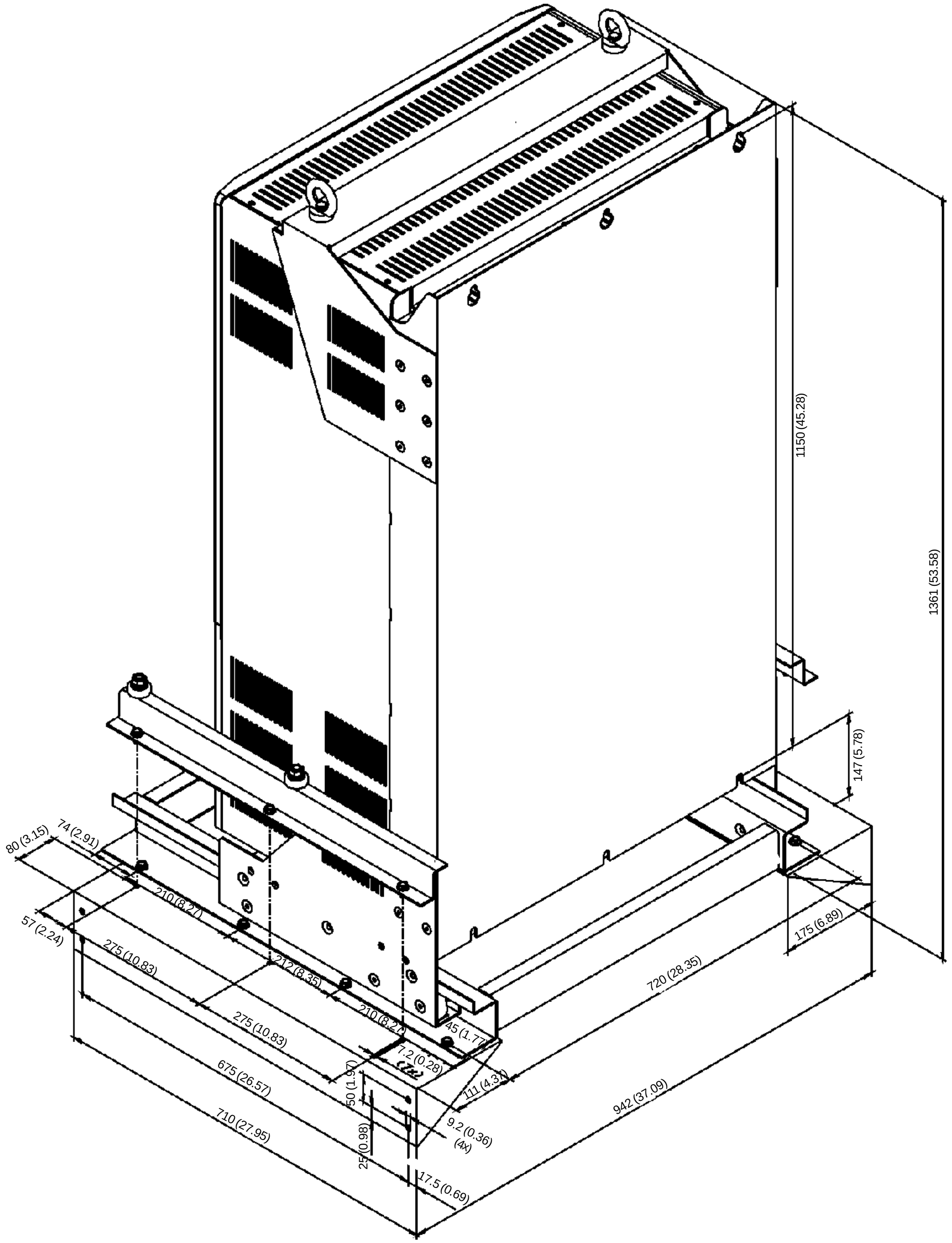
Dimensions in mm (inch)

Inverter CFW-09 312-361A/380-480V (size 9) with KIT-KME
for panel width = 1000mm (39.37 in)
(417102520)



Dimensions in mm (inch)

Inverter CFW-09 450-600A/380-480V (size 10), 247 to 472A/500-690V (size 10E) and 225 to 428A/660-690V (size 10E) with KIT-KME for panel width = 1000mm (39.37 in) (417102521)



Dimensions in mm (inch)

WARRANTY TERMS FOR FREQUENCY INVERTERS CFW-09

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, but limited to twenty four months from the manufacturing date, that is indicated on the product name plate.

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 equipments 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.

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 the 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.