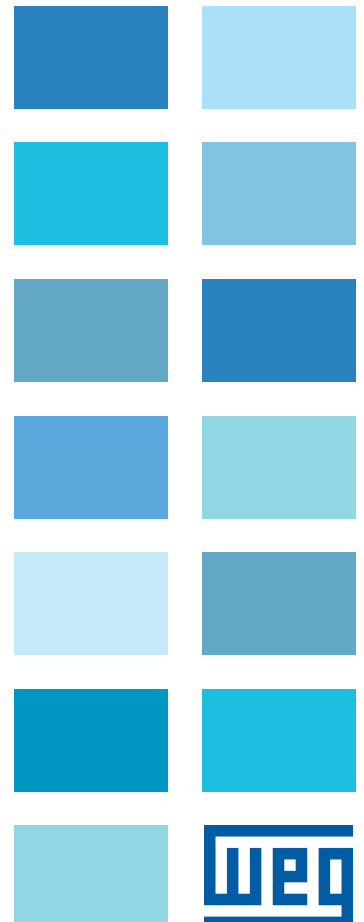


# Frequency Inverter

## CFW501 V1.8X

### Programming Manual







# **Programming Manual**

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The information below describes the reviews made in this manual.

<b>Version</b>	<b>Review</b>	<b>Description</b>
V1.5X	R00	First edition
V1.8X	R01	New options of the V/f and VVW Control Type included and modified
V1.8X	R02	General review
V1.8X	R03	General review

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**QUICK REFERENCE OF PARAMETERS, ALARMS AND FAULTS**

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0000	Access to Parameters	0 to 9999	0				5-2
P0001	Speed Reference	0 to 65535 rpm			ro	READ	15-1
P0002	Motor Speed	0 to 65535 rpm			ro	READ	15-1
P0003	Motor Current	0.0 to 200.0 A			ro	READ	15-1
P0004	DC Link Voltage (Ud)	0 to 2000 V			ro	READ	15-1
P0005	Motor Frequency	0.0 to 500.0 Hz			ro	READ	15-2
P0006	VFD Status	0 = Ready 1 = Run 2 = Undervoltage 3 = Fault 4 = Self-Tuning 5 = Configuration 6 = DC-Braking 7 = Reserved 8 = Fire Mode 9 = Bypass			ro	READ	15-2
P0007	Output Voltage	0 to 2000 V			ro	READ	15-3
P0009	Motor Torque	-1000.0 to 1000.0 %			ro	READ	15-3
P0010	Output Power	0.0 to 6553.5 kW			ro	READ	15-3
P0011	Power Factor	-1.00 to 1.00			ro	READ	15-4
P0012	DI8 to DI1 Status	Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8			ro	READ, I/O	12-16
P0013	DO5 to DO1 Status	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5			ro	READ, I/O	12-22
P0014	AO1 Value	0.0 to 100.0 %			ro	READ, I/O	12-7
P0015	AO2 Value	0.0 to 100.0 %			ro	READ, I/O	12-7
P0016	FO % Value	0.0 to 100.0 %			ro	READ, I/O	12-13
P0017	FO Hz Value	0 to 20000 Hz			ro	READ, I/O	12-13
P0018	AI1 Value	-100.0 to 100.0 %			ro	READ, I/O	12-1
P0019	AI2 Value	-100.0 to 100.0 %			ro	READ, I/O	12-1
P0020	AI3 Value	-100.0 to 100.0 %			ro	READ, I/O	12-1
P0021	FI % Value	-100.0 to 100.0 %			ro	READ, I/O	12-11
P0022	FI Hz Value	0 to 20000 Hz			ro	READ, I/O	12-11
P0023	Main SW Version	0.00 to 655.35			ro	READ	6-1
P0024	Sec. SW Version	0.00 to 655.35			ro	READ	6-1
P0027	Plug-In Mod. Config.	0 = No Plug-in 1 to 8 = Reserved 9 = CFW500-CRS485			ro	READ	6-1

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0029	Power HW Config.	0 = Not Identified 1 = 200-240 V / 1.6 A 2 = 200-240 V / 2.6 A 3 = 200-240 V / 4.3 A 4 = 200-240 V / 7.0 A 5 = 200-240 V / 9.6 A 6 = 380-480 V / 1.0 A 7 = 380-480 V / 1.6 A 8 = 380-480 V / 2.6 A 9 = 380-480 V / 4.3 A 10 = 380-480 V / 6.1 A 11 = 200-240 V / 7.3 A 12 = 200-240 V / 10.0 A 13 = 200-240 V / 16.0 A 14 = 380-480 V / 2.6 A 15 = 380-480 V / 4.3 A 16 = 380-480 V / 6.5 A 17 = 380-480 V / 10.0 A 18 = 200-240 V / 24.0 A 19 = 380-480 V / 14.0 A 20 = 380-480 V / 16.0 A 21 = 500-600 V / 1.7 A 22 = 500-600 V / 3.0 A 23 = 500-600 V / 4.3 A 24 = 500-600 V / 7.0 A 25 = 500-600 V / 10.0 A 26 = 500-600 V / 12.0 A 27 = 200-240 V / 28.0 A 28 = 200-240 V / 33.0 A 29 = 380-480 V / 24.0 A 30 = 380-480 V / 31.0 A 31 = 500-600 V / 17.0 A 32 = 500-600 V / 22.0 A 33 = 200-240 V / 47.0 A 34 = 200-240 V / 56.0 A 35 = 380-480 V / 39.0 A 36 = 380-480 V / 49.0 A 37 = 500-600 V / 27.0 A 38 = 500-600 V / 32.0 A			ro	READ	6-2
P0030	Heatsink Temperature	-20 to 150 °C			ro	READ	15-5
P0037	Motor Overload Ixt	0 to 100 %			ro	READ	14-3
P0042	Powered Time	0 to 65535 h			ro	READ	15-5
P0043	Enabled Time	0.0 to 6553.5 h			ro	READ	15-5
P0044	kWh Output Energy	0 to 65535 kWh			ro	READ	15-6
P0047	CONF State	0 to 999			ro	READ	15-6
P0048	Present Alarm	0 to 999			ro	READ	14-8
P0049	Present Fault	0 to 999			ro	READ	14-8
P0050	Last Fault	0 to 999			ro	READ	14-8
P0051	Current At Last Fault	0.0 to 200.0 A			ro	READ	14-9
P0052	DC Link At Last Fault	0 to 2000 V			ro	READ	14-9
P0053	Frequency At Last Fault	0.0 to 500.0 Hz			ro	READ	14-9
P0054	Temp. At Last Fault	-20 to 150 °C			ro	READ	14-10
P0055	Log. State Last Fault	0000h to FFFFh			ro	READ	14-10
P0060	Second Fault	0 to 999			ro	READ	14-8
P0061	Current at 2 <sup>nd</sup> Fault	0.0 to 200.0 A			ro	READ	14-9
P0062	DC Link at 2 <sup>nd</sup> Fault	0 to 2000 V			ro	READ	14-9
P0063	Frequency 2 <sup>nd</sup> Fault	0.0 to 500.0 Hz			ro	READ	14-9
P0064	Temp. 2 <sup>nd</sup> Fault	-20 to 150 °C			ro	READ	14-10
P0065	Log. State 2 <sup>nd</sup> Fault	0000h to FFFFh			ro	READ	14-10
P0070	Third Fault	0 to 999			ro	READ	14-9
P0071	Current at 3 <sup>rd</sup> Fault	0.0 to 200.0 A			ro	READ	14-9
P0072	DC Link 3 <sup>rd</sup> Fault	0 to 2000 V			ro	READ	14-9
P0073	Frequency 3 <sup>rd</sup> Fault	0.0 to 500.0 Hz			ro	READ	14-10
P0074	Temp. 3 <sup>rd</sup> Fault	-20 to 150 °C			ro	READ	14-10

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0075	Log. State 3 <sup>rd</sup> Fault	0000h to FFFFh			ro	READ	14-10
P0080	Last Fault in "Fire Mode"	0 to 999	0		ro	READ	14-11
P0081	Second Fault in "Fire Mode"	0 to 999	0		ro	READ	14-11
P0082	Third Fault in "Fire Mode"	0 to 999	0		ro	READ	14-11
P0100	Acceleration Time	0.1 to 999.0 s	10.0 s			BASIC	11-1
P0101	Deceleration Time	0.1 to 999.0 s	10.0 s			BASIC	11-1
P0102	2 <sup>nd</sup> Ramp Accel. Time	0.1 to 999.0 s	10.0 s				11-2
P0103	2 <sup>nd</sup> Ramp Decel. Time	0.1 to 999.0 s	10.0 s				11-2
P0104	S Ramp	0 = Inactive 1 = Active	0		cfg		11-2
P0105	1 <sup>st</sup> /2 <sup>nd</sup> Ramp Sel.	0 = 1 <sup>st</sup> Ramp 1 = 2 <sup>nd</sup> Ramp 2 = Dlx 3 = Serial/USB 4 = SoftPLC	2			I/O	11-3
P0106	3 <sup>rd</sup> Ramp Time	0.1 to 999.0 s	5.0 s				11-3
P0120	Speed Ref. Backup	0 = Inactive 1 = Active 2 = Backup by P0121	1				7-8
P0121	Keypad Reference	0 to 18000 rpm	90 rpm				7-9
P0122	JOG Reference	0 to 18000 rpm	150 (125) rpm				7-9
P0133	Minimum Speed	0 to 18000 rpm	90 (75) rpm			BASIC	7-8
P0134	Maximum Speed	0 to 18000 rpm	1800 (1500) rpm			BASIC	7-8
P0135	Max. Output Current	0.0 to 200.0 A	1.5x <sub>I<sub>nom</sub></sub>		V/f, VVW	BASIC, MOTOR	11-8
P0136	Manual Torque Boost	0.0 to 30.0 %	According to inverter model		V/f	BASIC, MOTOR	9-4
P0137	Autom. Torque Boost	0.0 to 30.0 %	0.0 %		V/f	MOTOR	9-6
P0138	Slip Compensation	-10.0 to 10.0 %	0.0 %		V/f	MOTOR	9-7
P0139	Output Current Filter	0 to 9999 ms	50 ms				8-1
P0140	Sleep Compensation Filter	0 to 9999 ms	500 ms		VVW		8-2
P0142	Max. Output Voltage	0.0 to 100.0 %	100.0 %		cfg, V/f		9-5
P0143	Interm. Output Voltage	0.0 to 100.0 %	66.7 %		cfg, V/f		9-5
P0144	Low Output Voltage	0.0 to 100.0 %	33.3 %		cfg, V/f		9-5
P0145	Field Weakening Speed	0 to 18000 rpm	1800 (1500) rpm		cfg, V/f		9-5
P0146	Intermediate Speed	0 to 18000 rpm	1200 (1000) rpm		cfg, V/f		9-5
P0147	Low Speed point	0 to 18000 rpm	600 (500) rpm		cfg, V/f		9-5
P0150	Ud Regul. Type V/f and Current Limitation	0 = hold_Ud and desac_LC 1 = acel_Ud and desac_LC 2 = hold_Ud and hold_LC 3 = acel_Ud and hold_LC	0		cfg, V/f, VVW	MOTOR	11-4
P0151	DC Regul. Level V/f	339 to 1200 V	400 V (P0296 = 0) 800 V (P0296 = 1) 1000 V (P0296 = 2)		V/f, VVW	MOTOR	11-5
P0152	DC Link Regul. P Gain	0.00 to 9.99	1.50		V/f, VVW	MOTOR	11-5
P0153	Dyn. Braking Level	339 to 1200 V	375 V (P0296 = 0) 750 V (P0296 = 1) 950 V (P0296 = 2)		V/f, VVW	MOTOR	13-1
P0156	Overl. Curr. 100 % Speed	0.0 to 200.0 A	1.1x <sub>I<sub>nom</sub></sub>			MOTOR	14-2
P0157	Overl. Curr. 50 % Speed	0.0 to 200.0 A	1.0x <sub>I<sub>nom</sub></sub>			MOTOR	14-2
P0158	Overl. Curr. 20 % Speed	0.0 to 200.0 A	0.8x <sub>I<sub>nom</sub></sub>			MOTOR	14-2
P0178	Rated Flux	0.0 to 150.0 %	100.0 %			MOTOR	10-4
P0200	Password	0 = Inactive 1 = Active 1 to 19999 = New password	0			HMI	5-3
P0202	Type of Control	0 to 2 = V/f 3 = VVW	0		cfg	STARTUP	8-1

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0204	Load/Save Parameters	0 to 2 = Not Used 3 = Reset P0043 4 = Reset P0044 5 = Load 60 Hz 6 = Load 50 Hz 7 = Load User 1 8 = Load User 2 9 = Save User 1 10 = Save User 2 11 = Load SoftPLC 12 to 15 = Reserved	0		cfg		5-11
P0205	Main Parameter Display	0 to 1079	2			HMI	5-3
P0206	Secondary Parameter Display	0 to 1079	1			HMI	5-3
P0208	Main Display Scale Factor	0.1 to 1000.0 %	100.0 %			HMI	5-4
P0209	Main Display Eng. Unit	0 = None 1 = V 2 = A 3 = rpm 4 = s 5 = ms 6 = None 7 = m 8 = None 9 = None 10 = % 11 = °C 12 = None 13 = Hz 14 = None 15 = h 16 = W 17 = kW 18 = None 19 = None 20 = min 21 = °F 22 = bar 23 = mbar 24 = psi 25 = Pa 26 = kPa 27 = MPa 28 = mwc 29 = mca 30 = gal 31 = l 32 = in 33 = ft 34 = m <sup>3</sup> 35 = ft <sup>3</sup> 36 = gal/s 37 = gal/min 38 = gal/h 39 = l/s 40 = l/min 41 = l/h 42 = m/s 43 = m/min 44 = m/h 45 = ft/s 46 = ft/min 47 = ft/h 48 = m <sup>3</sup> /s 49 = m <sup>3</sup> /min 50 = m <sup>3</sup> /h 51 = ft <sup>3</sup> /s 52 = ft <sup>3</sup> /min 53 = ft <sup>3</sup> /h 54 = According to P0510 55 = According to P0512 56 = None 57 = According to P0516	3			HMI	5-5

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0210	Main Display Decimal Point	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz 4 = According to P0511 5 = According to P0511 6 = Reserved 7 = According to P0511	0			HMI	5-4
P0211	Secondary Display Scale Factor	0.1 to 1000.0 %	100.0 %			HMI	5-4
P0212	Secondary Display Decimal Point	See options in P0210	0			HMI	5-4
P0216	HMI Display Illumination	0 = Inactive 1 = Active	1			HMI	5-6
P0220	LOC/REM Selection Src	0 = Always LOC 1 = Always REM 2 = HMI Key (LOC) 3 = HMI Key (REM) 4 = Dlx 5 = Serial/USB (LOC) 6 = Serial/USB (REM) 7 = SoftPLC LOC	2		cfg	I/O	7-5
P0221	LOC Reference Sel.	0 = Keypad 1 = AI1 2 = AI2 3 = AI3 4 = AI1 + AI2 > 0 5 = AI1 + AI2 6 = Serial/USB 7 = SoftPLC 8 = FI 9 = AI1 > 0 10 = AI2 > 0 11 = AI3 > 0 12 = FI > 0	0		cfg	I/O	7-5
P0222	REM Reference Sel.	See options in P0221	1		cfg	I/O	7-5
P0223	LOC FWD/REV Selection	0 = Always FWD 1 = Always REV 2 = HMI Key (FWD) 3 = HMI Key (REV) 4 = Dlx 5 = Serial/USB (FWD) 6 = Serial/USB (REV) 7 = SoftPLC	2		cfg	I/O	7-6
P0224	LOC Run/Stop Sel.	0 = HMI Keys 1 = Dlx 2 = Serial/USB 3 = SoftPLC	0		cfg	I/O	7-6
P0225	LOC JOG Selection	0 = Disable 1 = HMI Key 2 = Dlx 3 = Serial/USB 4 = SoftPLC	1		cfg	I/O	7-7
P0226	REM FWD/REV Selection	See options in P0223	0		cfg	I/O	7-6
P0227	REM Run/Stop Sel.	See options in P0224	1		cfg	I/O	7-6
P0228	REM JOG Selection	See options in P0225	2		cfg	I/O	7-7
P0229	Stop Mode Selection	0 = Ramp to Stop 1 = Coast to Stop 2 = Quick Stop	0		cfg	I/O	7-13
P0230	Dead Zone (AIs)	0 = Inactive 1 = Active	0		cfg	I/O	12-2

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0231	AI1 Signal Function	0 = Speed Ref. 1 = Not Used 2 = Not Used 3 = SoftPLC 4 = PTC 5 = Main PID Feedback 1 6 = Main PID Feedback 2 7 = Not Used 8 = External PID 1 Feedback 9 = Not Used	5		cfg	I/O	12-3
P0232	AI1 Gain	0.000 to 9.999	1.000			I/O	12-4
P0233	AI1 Signal Type	0 = 0 to 10 V / 20 mA 1 = 4 to 20 mA 2 = 10 V / 20 mA to 0 3 = 20 to 4 mA	0		cfg	I/O	12-5
P0234	AI1 Offset	-100.0 to 100.0 %	0.0 %			I/O	12-4
P0235	AI1 Filter	0.00 to 16.00 s	0.15 s			I/O	12-5
P0236	AI2 Signal Function	See options in P0231	8		cfg	I/O	12-3
P0237	AI2 Gain	0.000 to 9.999	1.000			I/O	12-4
P0238	AI2 Signal Type	0 = 0 to 10 V / 20 mA 1 = 4 to 20 mA 2 = 10 V / 20 mA to 0 3 = 20 to 4 mA	0		cfg	I/O	12-5
P0239	AI2 Offset	-100.0 to 100.0 %	0.0 %			I/O	12-4
P0240	AI2 Filter	0.00 to 16.00 s	0.15 s			I/O	12-5
P0241	AI3 Signal Function	All P0231 options except 4 = PTC	0		cfg	I/O	12-3
P0242	AI3 Gain	0.000 to 9.999	1.000			I/O	12-4
P0243	AI3 Signal Type	0 = 0 to 10 V / 20 mA 1 = 4 to 20 mA 2 = 10 V / 20 mA to 0 3 = 20 to 4 mA 4 = -10 to +10 V	0		cfg	I/O	12-6
P0244	AI3 Offset	-100.0 to 100.0 %	0.0 %			I/O	12-4
P0245	AI3 Filter	0.00 to 16.00 s	0.15 s			I/O	12-5
P0246	Freq. Input FI	0 = Inactive 1 = Active	0			I/O	12-11
P0247	FI Gain	0.000 to 9.999	1.000			I/O	12-12
P0248	Min. FI	10 to 20000 Hz	10 Hz			I/O	12-12
P0249	FI Offset	-100.0 to 100.0 %	0.0 %			I/O	12-12
P0250	Max. FI	10 to 20000 Hz	10000 Hz			I/O	12-12
P0251	AO1 Function	0 = Speed Ref. 1 = Not Used 2 = Real Speed 3 = Not Used 4 = Not Used 5 = Output Current 6 = Active Current 7 = Output Power 8 = Not Used 9 = Motor Torque 10 = SoftPLC 11 = Not Used 12 = Motor Ixt 13 = P0696 Value 14 = P0697 Value 15 = Not Used 16 = External PID Output 17 = Not Used 18 = P0698 Value	16			I/O	12-8

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0252	AO1 Gain	0.000 to 9.999	1.000			I/O	<a href="#">12-9</a>
P0253	AO1 Signal Type	0 = 0 to 10 V 1 = 0 to 20 mA 2 = 4 to 20 mA 3 = 10 V to 0 4 = 20 mA to 0 5 = 20 to 4 mA	0			I/O	<a href="#">12-9</a>
P0254	AO2 Function	All P0263 options except 25 = PTC	5			I/O	<a href="#">12-8</a>
P0255	AO2 Gain	0.000 to 9.999	1.000			I/O	<a href="#">12-9</a>
P0256	AO2 Signal Type	See options in P0253	0			I/O	<a href="#">12-9</a>
P0257	FO Function	0 = Speed Ref. 1 = Not Used 2 = Real Speed 3 = Not Used 4 = Not Used 5 = Output Current 6 = Active Current 7 = Output Power 8 = Not Used 9 = Motor Torque 10 = SoftPLC 11 = Not Used 12 = Motor Ixt 13 = P0696 Value 14 = P0697 Value 15 = Disable F.O. 16 = External PID Output 17 = Not Used 18 = P0698 Value	15			I/O	<a href="#">12-14</a>
P0258	FO Gain	0.000 to 9.999	1.000			I/O	<a href="#">12-15</a>
P0259	Min. FO	10 to 20000 Hz	10 Hz			I/O	<a href="#">12-15</a>
P0260	Max. FO	10 to 20000 Hz	10000 Hz			I/O	<a href="#">12-15</a>
P0263	DI1 Function	0 = Not Used 1 = Run/Stop 2 = General Enable 3 = Quick Stop 4 = FWD/REV 5 = LOC/REM 6 = JOG 7 = SoftPLC 8 = 2 <sup>nd</sup> Ramp 9 = Not Used 10 = Not Used 11 = Not Used 12 = No Ext. Alarm 13 = No Ext. Fault 14 = Reset 15 = Disab.FlyStart 16 = Not Used 17 = Progr. Off 18 = Load User 1 19 = Load User 2 20 = Auto/Manual Main PID 21 = Auto/Manual External PID 22 = Not Used 23 = Bypass Mode 24 = Activate Fire Mode 25 = PTC	1		cfg	I/O	<a href="#">12-17</a>
P0264	DI2 Function	All P0263 options except 25 = PTC	0		cfg	I/O	<a href="#">12-17</a>
P0265	DI3 Function	See options in P0263	20		cfg	I/O	<a href="#">12-17</a>
P0266	DI4 Function	See options in P0263	21		cfg	I/O	<a href="#">12-17</a>
P0267	DI5 Function	See options in P0263	0		cfg	I/O	<a href="#">12-17</a>
P0268	DI6 Function	See options in P0263	0		cfg	I/O	<a href="#">12-17</a>

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0269	DI7 Function	See options in P0263	0		cfg	I/O	<a href="#">12-17</a>
P0270	DI8 Function	See options in P0263	0		cfg	I/O	<a href="#">12-17</a>
P0271	DI1 Function	0 = (DI1..DI8)NPN 1 = DI1 PNP 2 = (DI1..DI2)PNP 3 = (DI1..DI3)PNP 4 = (DI1..DI4)PNP 5 = (DI1..DI5)PNP 6 = (DI1..DI6)PNP 7 = (DI1..DI7)PNP 8 = (DI1..DI8)PNP	0		cfg	I/O	<a href="#">12-15</a>
P0275	DO1 Function	0 = Not Used 1 = N* > Nx 2 = N > Nx 3 = N < Nx 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 F070 15 = Not Used 16 = No F0021/22 17 = No F0051 18 = No F072 19 = 4-20 mA OK 20 = P0695 Value 21 = Forward 22 = Ride-Through 23 = Pre-Charge OK 24 = Fault 25 = Time Enable > Hx 26 = SoftPLC 27 = Not Used 28 = F > Fx(1) 29 = F > Fx(2) 30 = Not Used 31 = Not Used 32 = No Alarm 33 = No Fault/Alarm 34 = Dry Pump Alarm/Fault 35 = Broken Belt Alarm/Fault 36 = Filter Mainten. Alarm/Fault 37 = Sleep Mode 38 = Not Used 39 = Drive Bypass Contactor 40 = Mains Bypass Contactor 41 = Fire Mode 42 = Self-tuning	11			I/O	<a href="#">12-22</a>
P0276	DO2 Function	See options in P0275	0			I/O	<a href="#">12-22</a>
P0277	DO3 Function	See options in P0275	24			I/O	<a href="#">12-22</a>
P0278	DO4 Function	See options in P0275	0			I/O	<a href="#">12-22</a>
P0279	DO5 Function	See options in P0275	0			I/O	<a href="#">12-22</a>
P0281	Fx Frequency	0.0 to 500.0 Hz	4.0 Hz			I/O	<a href="#">12-24</a>
P0282	Fx Hysteresis	0.0 to 15.0 Hz	2.0 Hz			I/O	<a href="#">12-24</a>
P0287	Nx/Ny Hysteresis	0 to 900 rpm	18 (15) rpm			I/O	<a href="#">12-24</a>
P0288	Nx Speed	0 to 18000 rpm	120 (100) rpm			I/O	<a href="#">12-24</a>



Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0289	Ny Speed	0 to 18000 rpm	1800 (1500) rpm			I/O	12-24
P0290	Ix Current	0.0 to 200.0 A	1.0x <sub>nom</sub>			I/O	12-24
P0291	Zero Speed	0 to 18000 rpm	18 (15) rpm			I/O	12-25
P0292	N = N* Band	0 to 18000 rpm	18 (15) rpm			I/O	12-25
P0293	Tx Torque	0 to 200 %	100 %			I/O	12-25
P0294	Hx Time	0 to 6553.5 h	432.0 h			I/O	12-25
P0295	Inverter Rated Current	0.0 to 200.0 A	According to inverter model		ro	READ	6-3
P0296	Line Rated Voltage	0 = 200 - 240 V 1 = 380 - 480 V 2 = 500 - 600 V	According to inverter model		ro	READ	6-3
P0297	Switching Frequency	2500 to 15000 Hz	5000 Hz			MOTOR	6-3
P0299	DC-Braking Start Time	0.0 to 15.0 s	0.0 s			MOTOR	11-10
P0300	DC-Braking Stop Time	0.0 to 15.0 s	0.0 s			MOTOR	11-11
P0301	DC-Braking Speed	0 to 18000 rpm	30 rpm			MOTOR	11-12
P0302	DC-Braking Voltage	0.0 to 100.0 %	20.0 %			MOTOR	11-12
P0303	Skip Speed 1	0 to 18000 rpm	600 rpm				11-13
P0304	Skip Speed 2	0 to 18000 rpm	900 rpm				11-13
P0306	Skip Band	0 to 18000 rpm	0 rpm				11-13
P0308	Serial Address	0 to 255	1			NET	16-1
P0310	Serial Baud Rate	0 = 9600 bits/s 1 = 19200 bits/s 2 = 38400 bits/s	1			NET	16-1
P0311	Serial Bytes Config.	0 = 8 bits, no, 1 1 = 8 bits, even,1 2 = 8 bits, odd, 1 3 = 8 bits, no, 2 4 = 8 bits, even,2 5 = 8 bits, odd, 2	1			NET	16-1
P0312	Serial Protocol(1)(2)	0 = HMI(1) 1 = Reserved 2 = Modbus RTU(1) 3 = BACnet(1) 4 = N2(1) 5 = Reserved 6 = HMI(1)/Modbus RTU(2) 7 = Modbus RTU(2) 8 = HMI(1)/BACnet(2) 9 = BACnet(2) 10 = HMI(1)/N2(2) 11 = N2(2)	2		cfg	NET	16-1
P0313	Comm. Error Action	0 = Inactive 1 = Ramp Stop 2 = General Disab. 3 = Go to LOC 4 = LOC Keep Enab. 5 = Cause Fault	1			NET	16-2
P0314	Serial Watchdog	0.0 to 999.0 s	0.0 s			NET	16-1
P0316	Serial Interf. Status	0 = Inactive 1 = Active 2 = Watchdog Error			ro	NET	16-1
P0320	FlyStart/Ride-Through	0 = Inactive 1 = Flying Start 2 = FS / RT 3 = Ride-Through	0		cfg		11-9
P0331	Voltage Ramp	0.2 to 60.0 s	2.0 s				11-9
P0340	Auto-Reset Time	0 to 255 s	0 s				14-11

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0343	Mask for Faults and Alarms	Bit 0 = F0074 Bit 1 = F0048 Bit 2 = F0078 Bit 3 = F0079 Bit 4 = F0076 Bit 5 = F0179 Bit 6 = Reserved Bit 7 = F700/A700 Bit 8 to 15 = Reserved	0003h		cfg		14-4
P0349	Ixt Alarm Level	70 to 100 %	85 %		cfg		14-3
P0397	Control Config	0000 to FFFFh Bit 0 = Slip Compens. Regen. Bit 1 = Dead Time Compens. Bit 2 = I <sub>o</sub> Stabilization Bit 3 = P0297 Reduction Temperature	000Bh		cfg		8-2
P0398	Motor Service Factor	1.00 to 1.50	1.00		cfg	MOTOR, STARTUP	10-4
P0399	Motor Rated Eff.	50.0 to 99.9 %	75.0 %		cfg, VVW	MOTOR, STARTUP	10-5
P0400	Motor Rated Voltage	200 to 600 V	220(230) V (P0296 = 0) 380(400) V (P0296 = 1) 575(525) V (P0296 = 2)		cfg	MOTOR, STARTUP	10-5
P0401	Motor Rated Current	0 to 200.0 A	1.0xI <sub>nom</sub>		cfg	MOTOR, STARTUP	10-6
P0402	Motor Rated Speed	0 to 30000 rpm	1710 (1425) rpm		cfg	MOTOR, STARTUP	10-6
P0403	Motor Rated Frequency	0 to 500 Hz	60 (50) Hz		cfg	MOTOR, STARTUP	10-6
P0404	Motor Rated Power	0 = 0.16 hp 0.12 kW 1 = 0.25 hp 0.19 kW 2 = 0.33 hp 0.25 kW 3 = 0.5 hp 0.37 kW 4 = 0.75 hp 0.55 kW 5 = 1 hp 0.75 kW 6 = 1.5 hp 1.1 kW 7 = 2 hp 1.5 kW 8 = 3 hp 2.2 kW 9 = 4 hp 3 kW 10 = 5 hp 3.7 kW 11 = 5.5 hp 4 kW 12 = 6 hp 4.5 kW 13 = 7.5 hp 5.5 kW 14 = 10 hp 7.5 kW 15 = 12.5 hp 9 kW 16 = 15 hp 11 kW 17 = 20 hp 15 kW 18 = 25 hp 18.5 kW 19 = 30 hp 22 kW	According to inverter model		cfg	MOTOR, STARTUP	10-6
P0407	Motor Rated Power Fac	0.50 to 0.99	0.80		cfg	MOTOR, STARTUP	10-7 18-2

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0408	Run Self-Tuning	0 = Inactive 1 = No Rotation	0		cfg, VWV	STARTUP	10-7
P0409	Stator Resistance	0.01 to 99.99	According to inverter model		cfg, VWV	MOTOR, STARTUP	10-7
P0510	Ref. Eng. Unit 1	0 = None 1 = V 2 = A 3 = rpm 4 = s 5 = ms 6 = None 7 = m 8 = None 9 = None 10 = % 11 = °C 12 = None 13 = Hz 14 = None 15 = h 16 = W 17 = kW 18 = None 19 = None 20 = min 21 = °F 22 = bar 23 = mbar 24 = psi 25 = Pa 26 = kPa 27 = MPa 28 = mwc 29 = mca 30 = gal 31 = l 32 = in 33 = ft 34 = m <sup>3</sup> 35 = ft <sup>3</sup> 36 = gal/s 37 = gal/min 38 = gal/h 39 = l/s 40 = l/min 41 = l/h 42 = m/s 43 = m/min 44 = m/h 45 = ft/s 46 = ft/min 47 = ft/h 48 = m <sup>3</sup> /s 49 = m <sup>3</sup> /min 50 = m <sup>3</sup> /h 51 = ft <sup>3</sup> /s 52 = ft <sup>3</sup> /min 53 = ft <sup>3</sup> /h	22			HMI	5-6

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0511	Indirect Indication Form 1	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	1			HMI	5-7
P0512	Ref. Eng. Unit 2	See options in P0510	11			HMI	5-7
P0513	Indirect Indication Form 2	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	1			HMI	5-9
P0516	Ref. Eng. Unit 4	See options in P0510	13			HMI	5-9
P0517	Indirect Indication Form 4	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	1			HMI	5-10
P0580	Fire Mode Configuration	0 = Inactive 1 = Active 2 = Active / P0134 3 = Active / P0581 4 = Active / Gen. Disable	0		cfg	HVAC	18-30
P0581	Setpoint PID fire Mode	-32768 to 32767	0			HVAC	18-30
P0582	Auto-reset configuration	0 = Limited 1 = Unlimited	0		cfg	HVAC	18-31
P0583	Bypass Mode Configuration	0 = Inactive 1 = Active/Dlx 2 = Active/Dlx+Failure	0		cfg	HVAC	18-34
P0584	Bypass Contactor time	0.00 to 300.00 s	0.30 s		cfg	HVAC	18-34
P0585	Short Cycle Protection Config.	0 = Inactive 1 = Active	0		cfg	HVAC	18-3
P0586	Minimum RUN Time	0 to 650.00 s	5.00 s		cfg	HVAC	18-4
P0587	Minimum STOP Time	0.00 to 650.00 s	5.00 s		cfg	HVAC	18-4
P0588	Energy Saving Max. Torque	0 to 85 %	60 %		cfg, V/f	HVAC	18-2
P0589	Energy Saving Min. Mag.	40 to 80 %	40 %		cfg, V/f	HVAC	18-2
P0590	Energy Saving Min. Speed	360 to 18000 rpm	600 (525) rpm		cfg, V/f	HVAC	18-3
P0591	Energy Saving Hysteresis	0 to 30 %	10 %		cfg, V/f	HVAC	18-3
P0680	Logical Status	Bit 0 = Not Used Bit 1 = Run Command Bit 2 = Fire mode Bit 3 = Bypass Bit 4 = Quick Stop Bit 5 = 2 <sup>nd</sup> Ramp Bit 6 = Config. Mode Bit 7 = Alarm Bit 8 = Running Bit 9 = Enabled Bit 10 = Forward Bit 11 = JOG Bit 12 = Remote Bit 13 = Subvoltage Bit 14 = Reserved Bit 15 = Fault			ro	READ, NET	16-2
P0681	Speed in 13 bits	-32768 to 32767			ro	NET	16-2

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P0682	Serial/USB Control	Bit 0 = Ramp Enable Bit 1 = General Enable Bit 2 = Run Forward Bit 3 = JOG Enable Bit 4 = Remote Bit 5 = 2 <sup>nd</sup> Ramp Bit 6 = Quick Stop Bit 7 = Fault Reset Bit 8...12 = Not Used Bit 13 = Intern PID Bit 14 = Extern PID Bit 15 = Reserved			ro	NET	7-12 16-2
P0683	Serial/USB Speed Ref.	-32768 to 32767			ro	NET	16-2
P0690	Logical Status 2	Bit 0...3 = Not Used Bit 4 = Force Low Fs Bit 5 = Sleep State Bit 6 = Deceleration Ramp Bit 7 = Acceleration Ramp Bit 8 = Freeze Ramp Bit 9 = Setpoint Ok Bit 10 = DC Link Regulation Bit 11 = 50Hz Config Bit 12 = Ride Through Bit 13 = Flying Start Bit 14 = DC-Braking Bit 15 = PWM			ro	READ, NET	7-11
P0695	DOx Value	Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5			ro	NET	16-2
P0696	AOx Value 1	-32768 to 32767			ro	NET	16-2
P0697	AOx Value 2	-32768 to 32767			ro	NET	16-2
P0698	AOx Value 3	-32768 to 32767			ro	NET	16-2
P0760	BACnet Dev Inst Hi	0 to 419	0			NET	16-2
P0761	BACnet Dev Inst Lo	0 to 9999	0			NET	16-2
P0762	Max Number of Master	0 to 127	127			NET	16-2
P0763	MS/TP Max info Frame	1 to 65535	1			NET	16-2
P0764	I-AM Msg transmission	0 = Power Up 1 = Continuous	0			NET	16-2
P0765	Token RX Qtde	0 to 65535			ro	NET	16-2
P1000	SoftPLC Status	0 = No Applicative 1 = Installing App. 2 = Incompatible App. 3 = Stopped App. 4 = App. Running			ro	HVAC	17-1
P1001	SoftPLC Command	0 = Stop Application 1 = Run Application 2 = Delete Application	1		cfg	HVAC	17-1
P1002	Scan Cycle Time	0 to 65535 ms			ro	HVAC	17-1
P1003	SoftPLC Application	0 = User 1 = HVAC	1		cfg	HVAC	17-2
P1010	HVAC Function Version	0.00 to 100.00			ro	HVAC	17-2
P1011	Main PID Aut. Setpoint	-32768 to 32767	0			HVAC	17-2 18-9
P1012	SoftPLC Parameter 3	-32768 to 32767	0			HVAC	17-2
P1013	SoftPLC Parameter 4	-32768 to 32767	0			HVAC	17-2
P1014	Main PID Man. Setpoint	0.0 to 100.0 %	0.0 %			HVAC	17-2 18-9
P1015	Main PID Feedback	-32768 to 32767			ro	HVAC	17-2 18-9

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P1016	Main PID Output	0.0 to 100.0 %			ro	HVAC	17-2 18-9
P1017	Main PID Action Control	0 = Disable PID 1 = Direct Mode 2 = Reverse Mode	0		cfg	HVAC	17-2 18-10
P1018	Main PID Operation Mode	0 = Always Automatic 1 = Always Manual 2 = A/M DI w/o bumpless 3 = A/M Net w/o bumpless 4 = A/M DI w/ bumpless 5 = A/M Net w/ bumpless	0			HVAC	17-2 18-11
P1019	Main PID Sampling Time	0.10 to 60.00 s	0.10 s			HVAC	17-2 18-12
P1020	Main PID P. Gain	0.000 to 32.767	1.000			HVAC	17-2 18-12
P1021	Main PID I. Gain	0.000 to 32.767	0.430			HVAC	17-2 18-12
P1022	Main PID D. Gain	0.000 to 32.767	0.000			HVAC	17-2 18-12
P1023	Main PID Output Min. Value	0.0 to 100.0 %	0.0 %			HVAC	17-2 18-13
P1024	Main PID Output Max. Value	0.0 to 100.0 %	100.0 %			HVAC	17-2 18-13
P1025	SoftPLC Parameter 16	-32768 to 32767	0			HVAC	17-2
P1026	Main PID Feedback Conf.	0 = Sum Feed. 1 and 2 1 = Difference Feed. 1 and 2 2 = Average Feed. 1 and 2	0		cfg	HVAC	17-2 18-13
P1027	Main PID Minimum Feedback	-32768 to 32767	0			HVAC	17-2 18-14
P1028	Main PID Maximum Feedback	-32768 to 32767	1000			HVAC	17-2 18-14
P1029	SoftPLC Parameter 20	-32768 to 32767	0			HVAC	17-2
P1030	Main PID Feedback Alarm Conf.	0 = Disable 1 = Enable Alarm 2 = Enable Fault	0		cfg	HVAC	17-2 18-15
P1031	Main PID Feedback Alarm Low V.	-32768 to 32767	50			HVAC	17-2 18-15
P1032	Main PID Feedback Alarm Low T.	0.00 to 650.00 s	5.00 s			HVAC	17-2 18-16
P1033	Main PID Feedback Alarm High V.	-32768 to 32767	900			HVAC	17-2 18-16
P1034	Main PID Feedback Alarm High T.	0.00 to 650.00 s	5.00 s			HVAC	17-2 18-17
P1035	SoftPLC Parameter 26	-32768 to 32767	0			HVAC	17-2
P1036	Sleep Mode Speed	0 to 18000	350			HVAC	17-2 18-17
P1037	Sleep Mode Time	0.00 to 650.00 s	5.00 s			HVAC	17-2 18-18
P1038	Wake up Mode Deviation	0.0 to 100.0 %	5.0 %			HVAC	17-2 18-18
P1039	Wake up Mode Time	0.00 to 650.00 s	10.00 s			HVAC	17-2 18-18
P1040	HVAC Func. Logical Status	0 to 65535			ro	HVAC	17-2 18-28
P1041	SoftPLC Parameter 32	-32768 to 32767	0			HVAC	17-2

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P1042	Dry Pump Config.	0 = Disable 1 = Enable Alarm 2 = Enable Fault	0		cfg	HVAC	17-2 18-4
P1043	Dry Pump Speed	0 to 18000	400			HVAC	17-2 18-5
P1044	Dry Pump Torque	0.0 to 350.0 %	20.0 %			HVAC	17-2 18-5
P1045	Dry Pump Time	0.00 to 650.00 s	20.00 s			HVAC	17-2 18-5
P1046	Broken Belt Conf.	0 = Disable 1 = Enable Alarm 2 = Enable Fault	0		cfg	HVAC	17-2 18-6
P1047	Broken Belt Speed	0 to 18000	400			HVAC	17-2 18-6
P1048	Broken Belt Torque	0.0 to 350.0 %	20.0 %			HVAC	17-2 18-7
P1049	Broken Belt Time	0.00 to 650.00 s	20.00 s			HVAC	17-2 18-7
P1050	Filter Mainten. Alarm Conf.	0 = Disable 1 = Enable Alarm 2 = Enable Fault	0		cfg	HVAC	17-2 18-7
P1051	Filter Mainten. Alarm Time	0 to 32000 h	5000 h			HVAC	17-2 18-8
P1052	Filter Mainten. Alarm Counter	0 to 32000 h				HVAC	17-2 18-8
P1053	SoftPLC Parameter 44	-32768 to 32767	0			HVAC	17-2
P1054	SoftPLC Parameter 45	-32768 to 32767	0			HVAC	17-2
P1055	SoftPLC Parameter 46	-32768 to 32767	0			HVAC	17-2
P1056	SoftPLC Parameter 47	-32768 to 32767	0			HVAC	17-2
P1057	SoftPLC Parameter 48	-32768 to 32767	0			HVAC	17-2
P1058	SoftPLC Parameter 49	-32768 to 32767	0			HVAC	17-2
P1059	SoftPLC Parameter 50	-32768 to 32767	0			HVAC	17-2
P1060	External PID Auto Setpoint	-32768 to 32767	0			HVAC	17-2 18-20
P1061	External PID Man. Setpoint	0.0 to 100.0 %	0.0 %			HVAC	17-2 18-20
P1062	External PID Feedback	-32768 to 32767			ro	HVAC	17-2 18-21
P1063	External PID Output	0.0 to 100.0 %			ro	HVAC	17-2 18-21
P1064	External PID Action Control	0 = Disable PID 1 = Direct Mode 2 = Reverse Mode	0		cfg	HVAC	17-2 18-21
P1065	External PID Operation Mode	0 = Always Automatic 1 = Always Manual 2 = A/M DI w/o bumpless 3 = A/M Net w/o bumpless 4 = A/M DI w/ bumpless 5 = A/M Net w/ bumpless	0			HVAC	17-2 18-22
P1066	External PID Sampling Time	0.10 to 60.00 s	0.10 s			HVAC	17-2 18-23
P1067	External PID P. Gain	0.000 to 32.767	1.000			HVAC	17-2 18-23
P1068	External PID I. Gain	0.000 to 32.767	0.430			HVAC	17-2 18-23

Param.	Description	Adjustable Range	Factory Setting	User Setting	Propr.	Groups	Pag.
P1069	External PID D. Gain	0.000 to 32.767	0.000			HVAC	<a href="#">17-2</a> <a href="#">18-23</a>
P1070	External PID Output Min. Value	0.0 to 100.0 %	0.0 %			HVAC	<a href="#">17-2</a> <a href="#">18-24</a>
P1071	External PID Output Max. Value	0.0 to 100.0 %	100.0 %			HVAC	<a href="#">17-2</a> <a href="#">18-24</a>
P1072	SoftPLC Parameter 63	-32768 to 32767	0			HVAC	<a href="#">17-2</a>
P1073	External PID Minimum Feedback	-32768 to 32767	0			HVAC	<a href="#">17-2</a> <a href="#">18-24</a>
P1074	External PID Maximum Feedback	-32768 to 32767	1000			HVAC	<a href="#">17-2</a> <a href="#">18-25</a>
P1075	External PID Feedback Alarm Conf.	0 = Disable 1 = Enable Alarm 2 = Enable Fault	0			HVAC	<a href="#">17-2</a> <a href="#">18-25</a>
P1076	External PID Feedback Alarm Low V.	-32768 to 32767	2			HVAC	<a href="#">17-2</a> <a href="#">18-26</a>
P1077	External PID Feedback Alarm Low T.	0.00 to 650.00 s	5.00 s			HVAC	<a href="#">17-2</a> <a href="#">18-26</a>
P1078	External PID Feedback Alarm High V.	-32768 to 32767	900			HVAC	<a href="#">17-2</a> <a href="#">18-27</a>
P1079	External PID Feedback Alarm High T.	0.00 to 650.00 s	5.00 s			HVAC	<a href="#">17-2</a> <a href="#">18-27</a>

**ro** = Read only parameter.

**V/f** = Available when V/f control mode is chosen.

**cfg** = Configuration parameter, value can be programmed only with motor stopped.

**VVW** = Available when VVW control mode is chosen.



Fault / Alarm	Description	Possible Causes
<b>A0046</b> Motor overload	Motor overload alarm.	<ul style="list-style-type: none"> <li>Settings of P0156, P0157, and P0158 are too low for the used motor.</li> <li>Overload on the motor shaft.</li> </ul>
<b>A0047</b> IGBT overload	Overload alarm on the power pack with IGBTs.	<ul style="list-style-type: none"> <li>Inverter output overcurrent.</li> </ul>
<b>A0050</b> Power module overtemperature	Overtemperature alarm from the power module temperature sensor (NTC).	<ul style="list-style-type: none"> <li>High ambient temperature around the inverter (&gt;50 °C (&gt; 122 °F)) and high output current.</li> <li>Blocked or defective fan.</li> <li>Heatsink is too dirty, preventing the air flow.</li> </ul>
<b>A0090</b> External alarm	External alarm via DIx (option "Without External Alarm" in P0263 to P0270).	<ul style="list-style-type: none"> <li>Wiring on DI1 to DI8 inputs are open or have poor contact.</li> </ul>
<b>A0128</b> Telegram reception timeout	Alarm that indicates serial communication fault. It indicates the equipment stopped receiving valid serial telegrams for a period longer than the setting in P0314.	<ul style="list-style-type: none"> <li>Check network installation, broken cable or fault/poor contact on the connections with the network, grounding.</li> <li>Ensure the master always sends telegrams to the equipment in a time shorter than the setting in P0314.</li> <li>Disable this function in P0314.</li> </ul>
<b>A0211</b> Drive in Fire Mode	Indicates that the drive is in Fire Mode.	<ul style="list-style-type: none"> <li>The digital input programmed for activating the Fire Mode is active.</li> </ul>
<b>A0213</b> Protection Against Short Cycles	Alarm that indicates the short cycle protection occurred.	<ul style="list-style-type: none"> <li>The STAR command occurred during the time count defined by P0587.</li> <li>The STOP command occurred during the time count defined by P0586.</li> </ul>
<b>A0700</b> Communication fault with remote HMI	No communication with remote HMI, but there is no speed command or reference for this source.	<ul style="list-style-type: none"> <li>Check if the communication interface with the HMI is properly configured in parameter P0312.</li> <li>HMI cable disconnected.</li> </ul>
<b>A0702</b> Inverter disabled	This failure occurs when there is a SoftPLC movement block (REF block) active and the "General Enable" command is disabled.	<ul style="list-style-type: none"> <li>Check if the drive general enable command is active.</li> </ul>
<b>A0704</b> Two movem. enabled	It occurs when 2 or more SoftPLC movement blocks (REF Block) are enabled at the same time.	<ul style="list-style-type: none"> <li>Check the user's program logic.</li> </ul>
<b>A0706</b> Refer. Not Progr. SPLC	This failure occurs when a SoftPLC movement block is enabled and the speed reference is not programmed for the SoftPLC.	<ul style="list-style-type: none"> <li>Check the programming of the references in the local and/or remote mode (P0221 and P0222).</li> </ul>
<b>A0710</b> SPLC Progr. Bigger than 8 KB	It occurs when you try to download to the inverter a SoftPLC Program that is too large (larger than 8 KB).	<ul style="list-style-type: none"> <li>Extension of the SoftPLC Prog. exceeded 8 KBytes.</li> </ul>
<b>A0750</b> Program Alx for Process Variable of Main PID Controller	Alarm that indicates an analog input was not programmed for the process variable of the main PID controller.	<ul style="list-style-type: none"> <li>Parameter P0231 or P0236 was not programmed for 5 or 6.</li> </ul>
<b>A0752</b> Program DIx for Automatic / Manual Selection of the Main PID Controller	Alarm that indicates a digital input was not programmed for automatic / manual selection of the main PID controller.	<ul style="list-style-type: none"> <li>Parameter P0263 or P0264 or P0265 or P0266 was not programmed for 20.</li> </ul>
<b>A0754</b> Program LOCAL Reference (P0221) for SoftPLC	Alarm that indicates the origin of the speed reference in LOCAL mode was not programmed for SoftPLC.	<ul style="list-style-type: none"> <li>Main PID controller is enabled (P1017 in 1 or 2) and the CFW501 frequency inverter is running the motor in LOCAL mode and parameter P0221 is not programmed for 7.</li> </ul>
<b>A0756</b> Program REMOTE Reference (P0222) for SoftPLC	Alarm that indicates the origin of the speed reference in REMOTE mode was not programmed for SoftPLC.	<ul style="list-style-type: none"> <li>Main PID controller is enabled (P1017 in 1 or 2) and the CFW501 frequency inverter is running the motor in REMOTE mode and parameter P0222 is not programmed for 7.</li> </ul>

Fault / Alarm	Description	Possible Causes
<b>A0758</b> Program Indirect Engineering Unit 4 (P0516) for Hz or rpm	Alarm that indicates the parameter for engineering unit of the motor speed was not programmed for Hz or rpm.	<ul style="list-style-type: none"> <li>Parameter P0516 was not programmed for 13 (Hz) or 3 (rpm).</li> </ul>
<b>A0760</b> Low Level of the Process Variable of the Main PID Controller	Alarm that indicates the process variable of the main PID controller has a low value.	<ul style="list-style-type: none"> <li>Parameter P1030 is programmed for 1 and the value of the process variable of the main PID controller remained below the value programmed in P1031 for the time programmed in P1032.</li> </ul>
<b>A0762</b> High Level in the Process Variable of the Main PID Controller	Alarm that indicates the process variable of the main PID controller has a high value.	<ul style="list-style-type: none"> <li>Parameter P1030 is programmed for 1 and the value of the process variable of the main PID controller remained above the value programmed in P1033 for the time programmed in P1034.</li> </ul>
<b>A0764</b> Frequency Inverter in Sleep Mode	Alarm that indicates the CFW501 frequency inverter is in the sleep mode.	<ul style="list-style-type: none"> <li>Main PID controller is enabled and in automatic mode, and the motor speed remained below the speed programmed in P1036 for the time programmed in P1037.</li> </ul>
<b>A0766</b> Dry Pump Detected	Alarm that indicates the dry pump condition was detected for the pump driven by the CFW501 frequency inverter.	<ul style="list-style-type: none"> <li>Parameter P1042 is programmed for 1 and the pump driven by the CFW501 frequency inverter is running with speed above the speed programmed in P1043 and the motor torque remained below the value programmed in P1044 for the time programmed in P1045.</li> </ul>
<b>A0768</b> Broken Belt Detected	Alarm that indicates the broken belt condition was detected for the motor driven by the CFW501 frequency inverter.	<ul style="list-style-type: none"> <li>Parameter P1046 is programmed for 1 and the motor driven by the CFW501 frequency inverter is running with speed above the speed programmed in P1047 and the motor torque remained below the value programmed in P1048 for the time programmed in P1049.</li> </ul>
<b>A0770</b> Filter Maintenance	Alarm that indicates the need of replacing the system filter.	<ul style="list-style-type: none"> <li>Parameter P1050 is programmed for 1 and the operation time of the motor driven by the CFW501 frequency inverter shown in P1052 is above the value programmed in P1051.</li> </ul>
<b>A0780</b> Program AIx for Process Variable of the External PID Controller	Alarm that indicates an analog input was not programmed for the process variable of the external PID controller.	<ul style="list-style-type: none"> <li>Parameter P0231 or P0236 was not programmed for 8.</li> </ul>
<b>A0782</b> Program DIx for Automatic / Manual Selection of the External PID Controller	Alarm that indicates a digital input was not programmed for automatic / manual selection of the external PID controller.	<ul style="list-style-type: none"> <li>Parameter P0263 or P0264 or P0265 or P0266 was not programmed for 21.</li> </ul>
<b>A0784</b> Program AOx for Output of the External PID Controller	Alarm that indicates an analog output was not programmed for output of the external PID controller.	<ul style="list-style-type: none"> <li>Parameter P0251 or P0254 was not programmed for 16.</li> </ul>
<b>A0786</b> Low Level of the Process Variable of the External PID Controller	Alarm that indicates the process variable of the external PID controller has a low value.	<ul style="list-style-type: none"> <li>Parameter P1075 is programmed for 1 and the value of the process variable of the external PID controller remained below the value programmed in P1076 for the time programmed in P1077.</li> </ul>
<b>A0788</b> High Level of the Process Variable of the External PID Controller	Alarm that indicates the process variable of the external PID controller has a high value.	<ul style="list-style-type: none"> <li>Parameter P1075 is programmed for 1 and the value of the process variable of the external PID controller remained above the value programmed in P1078 for the time programmed in P1079.</li> </ul>
<b>F0021</b> Undervoltage on the DC Link	Undervoltage fault on the intermediate circuit.	<ul style="list-style-type: none"> <li>Wrong voltage supply; check if the data on the inverter label comply with the power supply and parameter P0296.</li> <li>Supply voltage too low, producing voltage on the DC link below the minimum value (in P0004):  <ul style="list-style-type: none"> <li>Ud &lt; 200 Vdc in 200-240 Vac (P0296 = 0).</li> <li>Ud &lt; 360 Vdc in 380-480 Vac (P0296 = 1).</li> <li>Ud &lt; 500 Vdc in 500-600 Vac (P0296 = 2).</li> </ul> </li> <li>Phase fault in the input.</li> <li>Fault in the pre-charge circuit.</li> </ul>

Fault / Alarm	Description	Possible Causes
<b>F0022</b> Overvoltage on the DC Link	Overvoltage fault on the intermediate circuit.	<ul style="list-style-type: none"> <li>■ Wrong voltage supply; check if the data on the inverter label comply with the power supply and parameter P0296.</li> <li>■ Supply voltage is too high, producing voltage on the DC link above the maximum value (in P0004):            Ud &gt; 410 Vdc in 200-240 Vac (P0296 = 0).            Ud &gt; 810 Vdc in 380-480 Vac (P0296 = 1).            Ud &gt; 1000 Vdc in 500-600 Vac (P0296 = 2).</li> <li>■ Load inertia is too high or deceleration ramp is too fast.</li> <li>■ P0151 or P0153 setting is too high.</li> </ul>
<b>F0031</b> Communication fault with Plug-In module	Main control cannot set a communication link with the Plug-In module.	<ul style="list-style-type: none"> <li>■ Plug-In module is damaged.</li> <li>■ Plug-In module is not properly connected.</li> <li>■ Problem in the identification of the Plug-In module; refer to P0027 for further information.</li> </ul>
<b>F0033</b> VVW self-tuning fault	Stator resistance setting fault P0409.	<ul style="list-style-type: none"> <li>■ Stator resistance value in P0409 does not comply with the inverter power.</li> <li>■ Motor connection error; turn off the power supply and check the motor terminal box and the connections with the motor terminals.</li> <li>■ Motor power too low or too high in relation to the inverter.</li> </ul>
<b>F0048</b> Overload on the IGBTs	Overload fault on the power pack with IGBTs (3 s in 1.5xInom). <b>Note:</b> This failure may be disabled, by setting P0343 = 0 or 1.	<ul style="list-style-type: none"> <li>■ Inverter output overcurrent (&gt;2xInom).</li> </ul>
<b>F0051</b> IGBTs overtemperature	Overtemperature fault measured on the temperature sensor of the power pack.	<ul style="list-style-type: none"> <li>■ High ambient temperature around the inverter (&gt;50 °C (&gt;122 °F)) and high output current.</li> <li>■ Blocked or defective fan.</li> <li>■ Heatsink is too dirty, preventing the air flow.</li> </ul>
<b>F0070</b> Overcurrent/Short- circuit	Overcurrent or short- circuit on the output, DC link or braking resistor.	<ul style="list-style-type: none"> <li>■ Short- circuit between two motor phases.</li> <li>■ Short- circuit of the rheostatic braking resistor connecting cables.</li> <li>■ IGBTs module in short- circuit or damaged.</li> <li>■ Start with too short acceleration ramp.</li> <li>■ Start with motor spinning without the flying-start function.</li> </ul>
<b>F0072</b> Motor overload	Motor overload fault (60 s in 1.5xInom)	<ul style="list-style-type: none"> <li>■ P0156, P0157 and P0158 setting is too low in relation to the motor operating current.</li> <li>■ Overload on the motor shaft.</li> </ul>
<b>F0074</b> Ground fault	Ground overcurrent fault. <b>Note:</b> It can be disabled by setting bit 0 of P0343 to 0.	<ul style="list-style-type: none"> <li>■ Short-circuit to the ground in one or more output phases.</li> <li>■ Motor cable capacitance too high, causing current peaks in the output.</li> </ul>
<b>F0076</b> Output Phase Current Fault	This fault indicates the motor presents phase loss, imbalanced phase current or is disconnected.	<ul style="list-style-type: none"> <li>■ Motor wiring or connection error.</li> <li>■ Loss of motor connection with the drive or broken wire.</li> </ul>
<b>F0078</b> Motor overtemperature	Overtemperature fault measured on the motor temperature sensor (Triple PTC) via analog input Alx or digital input Dlx.	<ul style="list-style-type: none"> <li>■ Overload on the motor shaft.</li> <li>■ Load cycle is too high (high number of starts and stops per minute).</li> <li>■ High ambient temperature around the motor.</li> <li>■ Poor contact or short circuit.</li> <li>■ Motor thermistor not installed.</li> <li>■ Motor shaft is stuck.</li> </ul>
<b>F0080</b> CPU fault (Watchdog)	Fault related to the supervision algorithm of the inverter main CPU.	<ul style="list-style-type: none"> <li>■ Electric noise.</li> <li>■ Inverter firmware fault.</li> </ul>
<b>F0084</b> Auto-diagnosis fault	Fault related to the automatic identification algorithm of the inverter hardware and Plug-In module.	<ul style="list-style-type: none"> <li>■ Poor contact in the connection between the main control and the power pack.</li> <li>■ Hardware not compatible with the firmware version.</li> <li>■ Defect on the internal circuits of the inverter.</li> </ul>
<b>F0091</b> External fault	External fault via Dlx ("No External Fault" option in P0263 to P0270).	<ul style="list-style-type: none"> <li>■ Wiring on DI1 to DI8 inputs are open or have poor contact.</li> </ul>
<b>F0182</b> Pulse feedback fault	Pulse feedback circuit fault of the output voltage. Note: it may be turned off in P0397.	<ul style="list-style-type: none"> <li>■ Hardware identification fault; compare P0295 and P0296 to the inverter identification label.</li> <li>■ Inverter internal circuits fault.</li> </ul>


Fault / Alarm	Description	Possible Causes
<b>F0228</b> Telegram reception timeout	Serial communication timeout. It indicates the equipment stopped receiving valid serial telegrams for a period longer than the setting in P0314.	<ul style="list-style-type: none"> <li>■ Check network installation, broken cable or fault/poor contact on the connections with the network, grounding.</li> <li>■ Ensure the master always sends telegrams to the equipment in a time shorter than the setting in P0314.</li> <li>■ Disable this function in P0314.</li> </ul>
<b>F0700</b> Remote HMI communication fault	No communication with remote HMI, but there is speed command or reference for this source.	<ul style="list-style-type: none"> <li>■ Check if the communication interface with the HMI is properly configured in parameter P0312.</li> <li>■ HMI cable disconnected.</li> </ul>
<b>F0711</b> The upload of the SoftPLC application failed	The upload or the SoftPLC application failed.	<ul style="list-style-type: none"> <li>■ Fault in the HVAC plug-in connection.</li> <li>■ Fault in the communication between the HVAC plug-in board and the main control board.</li> <li>■ Fault in the SoftPLC boot by the CPU.</li> </ul>
<b>F0761</b> Low Level of the Process Variable of the Main PID Controller	Fault that indicates the process variation of the main PID controller has a low value.	<ul style="list-style-type: none"> <li>■ Parameter P1030 is programmed for 2 and the value of the process variation of the main PID controller remained below the value programmed in P1031 for the time programmed in P1032.</li> </ul>
<b>F0763</b> High Level in the Process Variable of the Main PID Controller	Fault that indicates the process variation of the main PID controller has a high value.	<ul style="list-style-type: none"> <li>■ Parameter P1030 is programmed for 2 and the value of the process variation of the main PID controller remained above the value programmed in P1033 for the time programmed in P1034.</li> </ul>
<b>F0767</b> Dry Pump Detected	Fault that indicates the dry pump condition was detected for the pump driven by the CFW501 frequency inverter.	<ul style="list-style-type: none"> <li>■ Parameter P1042 is programmed for 2 and the pump driven by the CFW501 frequency inverter is running with speed above the speed programmed in P1043 and the motor torque remained below the value programmed in P1044 for the time programmed in P1045.</li> </ul>
<b>F0769</b> Broken Belt Detected	Fault that indicates the broken belt condition was detected for the motor driven by the CFW501 frequency inverter.	<ul style="list-style-type: none"> <li>■ Parameter P1046 is programmed for 2 and the motor driven by the CFW501 frequency inverter is running with speed above the speed programmed in P1047 and the motor torque remained below the value programmed in P1048 for the time programmed in P1049.</li> </ul>
<b>F0771</b> Filter maintenance	Fault that indicates the need of replacing the system filter.	<ul style="list-style-type: none"> <li>■ Parameter P1050 is programmed for 2 and the operation time of the motor driven by the CFW501 frequency inverter shown in P1052 is above the value programmed in P1051.</li> </ul>
<b>F0773</b> HVAC Plug-in Module not Detected	“Installed plug-in module does not correspond to the plug-in module specific for the HVAC function (CFW500-CRS485).”	<ul style="list-style-type: none"> <li>■ HVAC application active (P1003 = 1) without the standard plug-in CFW500-CRS485.</li> </ul>
<b>F0787</b> Low Level of the Process Variable of the External PID Controller	Fault that indicates the feedback of the external PID controller has a low value.	<ul style="list-style-type: none"> <li>■ Parameter P1075 is programmed for 2 and the value of the process variation of the external PID controller remained below the value programmed in P1076 for the time programmed in P1077.</li> </ul>
<b>F0789</b> High Level of the Process Variable of the External PID Controller	Fault that indicates the feedback of the external PID controller has a high value.	<ul style="list-style-type: none"> <li>■ Parameter P1075 is programmed for 2 and the value of the process variation of the external PID controller remained above the value programmed in P1078 for the time programmed in P1079.</li> </ul>

# 1 SAFETY INSTRUCTIONS


This manual contains the information necessary for the correct setting of the frequency inverter CFW501.

It was developed to be used by people with proper technical training or qualification to operate this kind of equipment. These people must follow the safety instructions defined by local standards. The noncompliance with the safety instructions may result in death risk and/or equipment damage.


## 1.1 SAFETY WARNINGS IN THIS MANUAL



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



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




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

## 1.2 SAFETY WARNINGS IN THE PRODUCT


The following symbols are fixed to the product, as a safety warning:




High voltages present.



Components sensitive to electrostatic discharges.  
Do not touch them.



Mandatory connection to the protection grounding (PE).



Connection of the shield to the grounding.



Hot surface.

### 1.3 PRELIMINARY RECOMMENDATIONS



**DANGER!**

Only qualified personnel, familiar with the CFW501 inverter and related equipment must plan or perform the installation, commissioning, operation and maintenance of this equipment. The personnel must follow the safety instructions described in this manual and/or defined by local standards. The noncompliance with the safety instructions may result in death risk and/or equipment damage.



**NOTE!**

For the purposes of this manual, qualified personnel are those trained in order to be able to:

1. Install, ground, power up and operate the CFW501 in accordance with this manual and the safety legal procedures in force.
2. Use the protective equipment in accordance with the relevant standards.
3. Give first aid.



**DANGER!**

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



**ATTENTION!**

Electronic boards have components sensitive to electrostatic discharge. Do not touch directly the component parts or connectors. If necessary, first touch the grounded metallic frame or use proper grounding strap.

**Do not execute any applied potential test on the inverter!  
If necessary, contact WEG.**



**NOTE!**

Frequency inverters may interfere in other electronic equipments. Observe the recommendations of chapter 3 - Installation and Connection of the user's manual in order to minimize these effects.

Read the user's manual completely before installing or operating this inverter.



**NOTE!**

The operations to copy the inverter parameters by means of the CFW500-MMF accessory must be preceded by a power-up cycle. That is, after the modification of one or more parameters, it will be available for copy on the plug-in module after the next power-up of the CFW501.

## 2 GENERAL INFORMATION

### 2.1 ABOUT THE MANUAL

This manual presents information necessary for the configuration of all the functions and parameters of the frequency inverter CFW501. This manual must be used together with the user’s manual of the CFW501.

The text provides additional information so as to make the use and programming of the CFW501 easier in certain applications.

The standard value for the parameters related to speed described in this manual assumes a standard 4-pole motor, that is, with synchronous speed of 1500 rpm (50 Hz) or 1800 rpm (60 Hz). [Table 2.1: Setting of the speed parameters on page 2-1](#) shows the setting suggested of those parameters for other number of poles. Furthermore, parameter P0402 must be set with the data on the motor nameplate; if not available, use the rated speed.

Table 2.1: Setting of the speed parameters

Number of Poles	P0133	P0134 and P0145		P0146		P0147	
		50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
2	180 rpm	3000 rpm	3600 rpm	2000 rpm	2400 rpm	1000 rpm	1200 rpm
4	90 rpm	1500 rpm	1800 rpm	1000 rpm	1200 rpm	500 rpm	600 rpm
6	60 rpm	1000 rpm	1200 rpm	667 rpm	800 rpm	333 rpm	400 rpm
8	45 rpm	750 rpm	900 rpm	500 rpm	600 rpm	250 rpm	300 rpm

**NOTE!** "The specific HVAC functions present on the CFW501 can only be activated with the connection of the HVAC plug-in module (CFW500-CRS485). Other plug-in modules can be used, but in this case the HVAC application must be turned off by means of parameter P1001."

### 2.2 TERMINOLOGY AND DEFINITIONS

#### 2.2.1 Terms and Definitions Used

**I<sub>nom</sub>**: inverter rated current by P0295.

**Overload Duty:** in the CFW501 there is no difference in the operating duty between "Light - Normal Duty" (ND) and "Heavy - Heavy Duty" (HD). Thus, the overload duty adopted for the CFW501 is equivalent to the HD standard, that is, the maximum overload current is 1.5 x I<sub>nom</sub> for one minute of continuous operation.

**Rectifier:** input circuit of the inverters that transforms the input AC voltage into DC. It is formed by high-power diodes.

**IGBT:** insulated Gate Bipolar Transistor - basic component part of the output inverter bridge. It works as an electronic switch in the saturated (closed switch) and cut-off (open switch) modes.

**DC Link:** intermediary circuit of the inverter; voltage in direct current obtained by rectifying the power supply alternate voltage or external supply; it supplies the output inverter bridge with IGBTs.

**Pre-Charge Circuit:** charges the capacitors of the DC link with limited current, avoiding current peaks in the inverter power-up.

**Braking IGBT:** it works as a switch to turn on the braking resistor. It is controlled by the DC link level.

**PTC:** resistor whose resistance value in ohms increases proportionally to the temperature; it is used as a temperature sensor in motors.

**NTC:** resistor whose resistance value in ohms decreases proportionally to the increase of the temperature; it is used as a temperature sensor in power packs.

**HMI:** "Human-Machine Interface"; device which allows controlling the motor, viewing and changing the inverter parameters. It features keys to control the motor, navigation keys and graphic LCD display.

**PE:** protective earth.

**PWM:** pulse Width Modulation - modulation by pulse width; pulsed voltage that supplies the motor.

**Switching frequency:** commutating frequency of the inverter bridge IGBTs, normally expressed in kHz.

**General Enable:** when activated, it accelerates the motor by acceleration ramp and Run/Stop=Run. When disabled, the PWM pulses will be immediately blocked. It may be controlled by digital input set for this function or via serial.

**Run/Stop:** inverter function which, when activated (run), accelerates the motor by acceleration ramp up to the reference speed and, when deactivated (stop), decelerates the motor by deceleration ramp. It may be controlled by digital input set for this function or via serial.

**Heatsink:** metal part designed to dissipate the heat produced by power semiconductors.

**Amp, A:** ampere.

**°C:** celsius degrees.

**°F:** fahrenheit degree.

**CA:** alternate current.

**DC:** direct current.

**CV:** cavalo-vapor = 736 Watts (Brazilian unit of measurement of power, normally used to indicate mechanical power of electric motors).

**hp:** horse power = 746 Watts (unit of measurement of power, normally used to indicate mechanical power of electric motors).

**Fmin:** minimum frequency or speed (P0133).

**Fmáx:** maximum frequency or speed (P0134).

**Dlx:** digital input "x".

**AIx:** analog input "x".

**AOx:** analog output "x".

**DOx:** digital output "x".

**Io:** output current.

**Iu:** current on phase u (RMS).

**Iv:** current on phase v (RMS).



**I<sub>w</sub>**: current on phase w (RMS).

**I<sub>a</sub>**: output active current (RMS).

**Hz**: hertz.

**kHz**: kilohertz = 1000 hertz.

**mA**: milliampere = 0.001 ampere.

**min**: minute.

**ms**: millisecond = 0.001 seconds.

**Nm**: newton meter; unit of torque.

**rms**: root mean square; effective value.

**rpm**: revolutions per minute; unit of measurement of rotation.

**s**: second.

**V**: volts.

**Ω**: ohms.

### 2.2.2 Numerical Representation

The decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter "h" after the number.

### 2.2.3 Symbols to Describe Parameter Properties

**ro** Read only parameter.

**cfg** Parameter that can be changed only with a stopped motor.

**V/f** Parameter visible on the HMI only in the V/f mode: P0202 = 0, 1 or 2.

**VVW** Parameter visible on the HMI only in the VVW mode: P0202 = 3.

### 3 ABOUT THE CFW501

The frequency inverter CFW501 is a high performance product which enables speed and torque control of three-phase induction motors. This product provides the user with the options of vector (VVW) or scalar (V/f) control, both programmable according to the application.

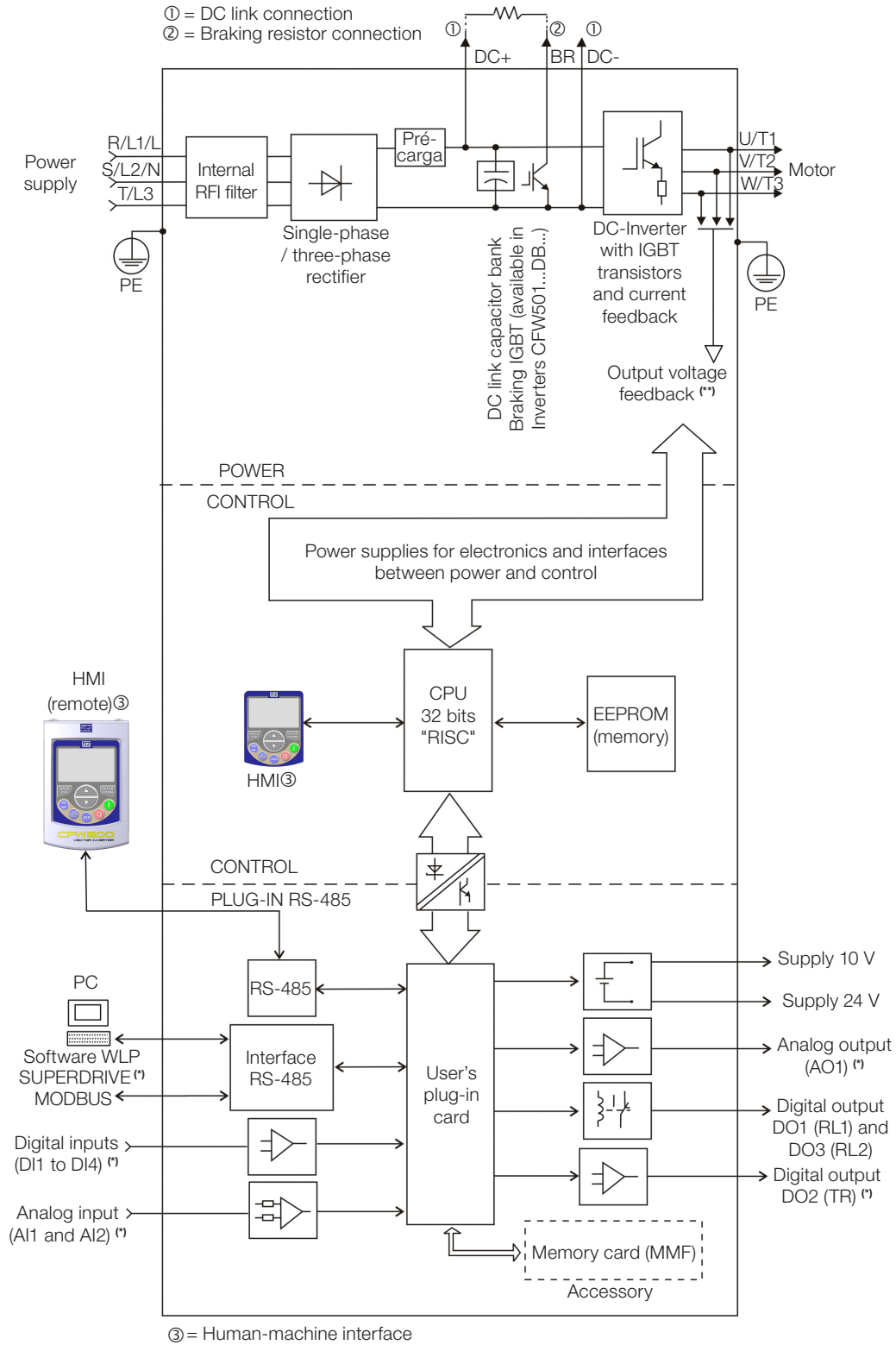
In the vector mode, the operation is optimized for the used motor, providing a better performance in terms of speed control torque. The "Self-Tuning" function, available for the vector control, allows the automatic setting of control parameters and controllers based on the identification (also automatic)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

The scalar mode (V/f) is recommended for simpler applications, such as the activation of most pumps and fans. In those cases, it is possible to reduce the motor and inverter losses by adjusting the V/f curve using the parameters based on quadratic curve approximation of the V/f relationship, which results in energy saving. The V/f mode is used when more than a motor is activated by an inverter simultaneously (multimotor applications).

The main components of the CFW501 can be viewed in the block diagram of [Figure 3.1: CFW501 block diagram on page 3-2](#) and [Figure 3.2: Main components of the CFW501 on page 3-3](#). The mechanical project was designed to simplify the connection and maintenance, as well as to ensure the safety of the product.

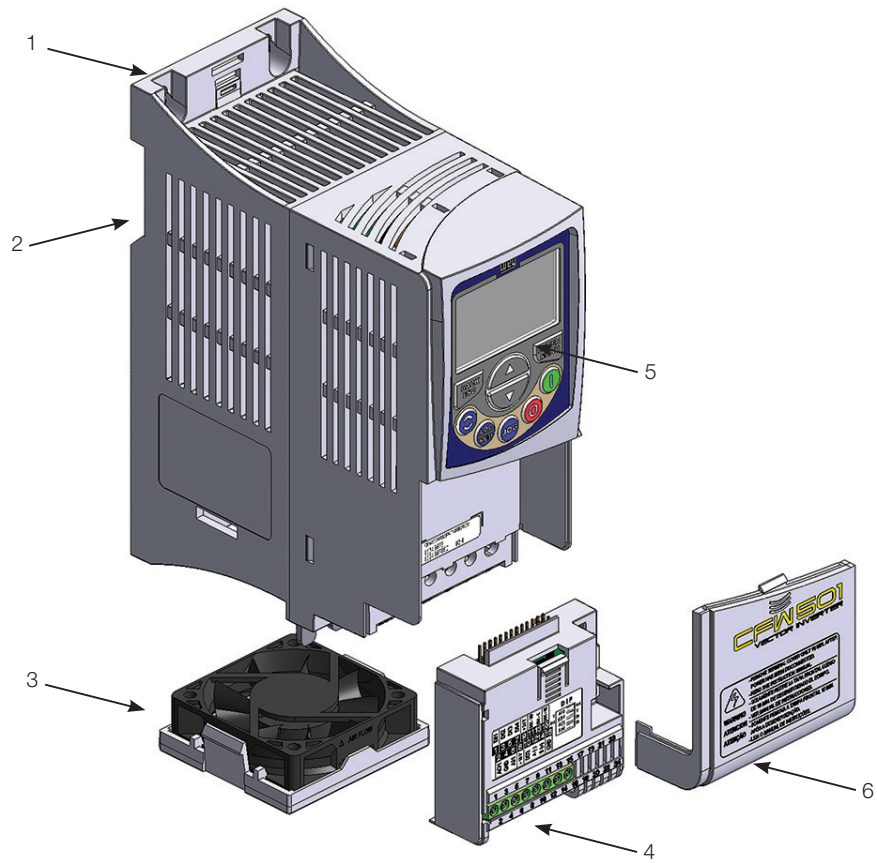
Developed to meet the main technological requirements of the market, the CFW501 has a plug-in modular interface which adapts to the application. As shown in item 4 of [Figure 3.2: Main components of the CFW501 on page 3-3](#), the plug-in allows the CFW501 to meet the requirements of different applications.

All CFW501 interface models feature communication in physical media RS485 with Modbus RTU and resources for data transfer via memory card.



(\*) The number of inputs and outputs (analog and digital) may vary according to the used plug-in module. For further information, refer to the installation, configuration and operation guide of the accessory with plug-in module used.  
(\*\*) Not available in mechanics A.

Figure 3.1: CFW501 block diagram



- 1 – Fixing support (for surface mounting)
- 2 – Fixing support (for Din-rail mount)
- 3 – Fan with fixing support
- 4 – Plug-in module
- 5 – HMI
- 6 – Front cover

**Figure 3.2:** Main components of the CFW501

## 4 HMI AND BASIC PROGRAMMING

### 4.1 USE OF THE HMI TO OPERATE THE INVERTER

Through the HMI, it is possible to view and set all the parameters. The HMI features two operating modes: monitoring and parameterization. The functions of the keys and the active fields on the HMI display vary according to the operating mode. The setting mode is composed of three levels.

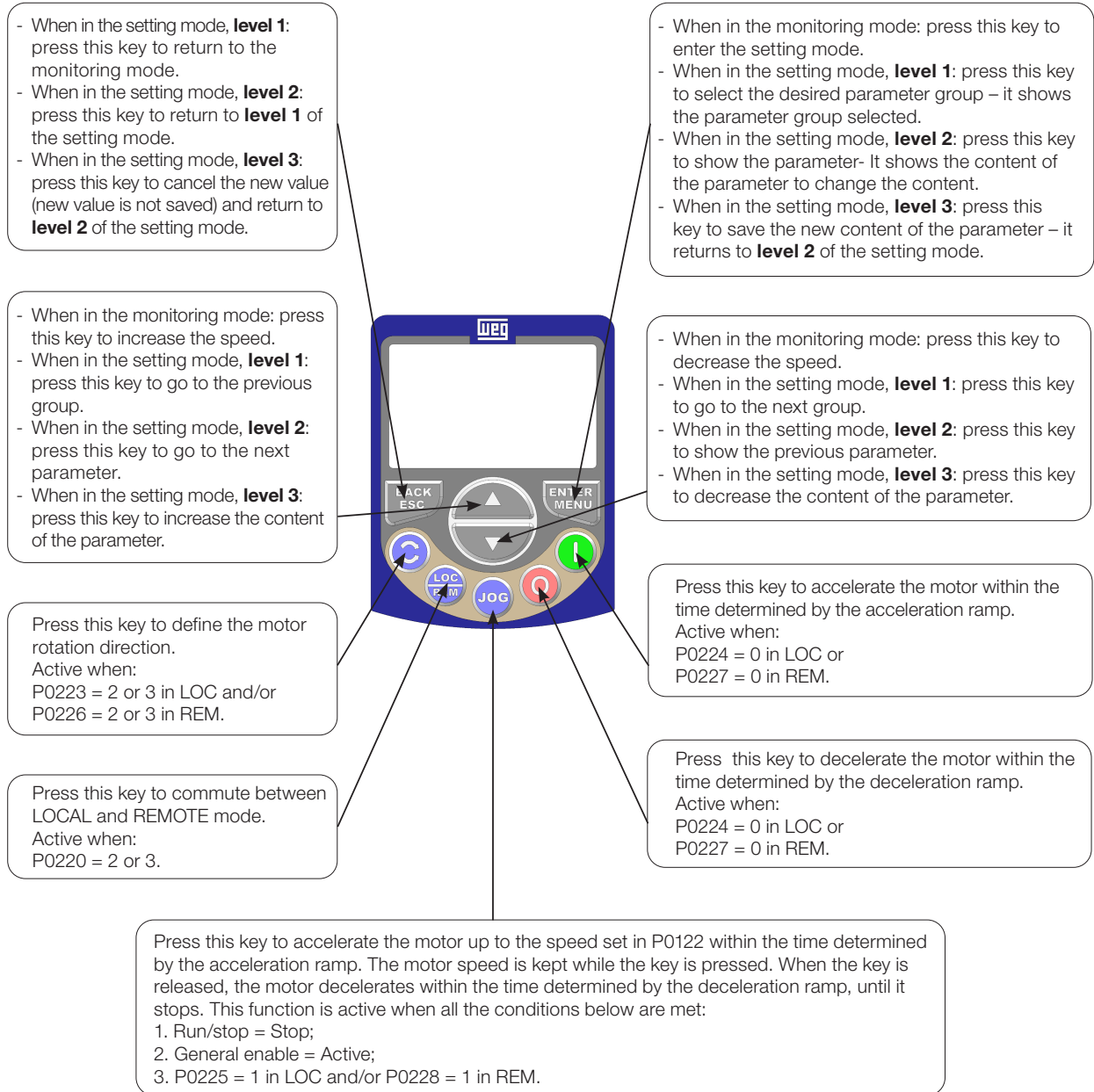


Figure 4.1: HMI Keys

## 4.2 INDICATIONS ON THE HMI DISPLAY

The information shown on the HMI LCD display is divided into five fields: menu, status, secondary display, unit, and main display. Those fields are defined in [Figure 4.2: Display areas on page 4-2](#). The main and secondary display set allows alternating the focus to scroll the parameter number or parameter value according to levels 2 and 3 of the parameterization mode, respectively.

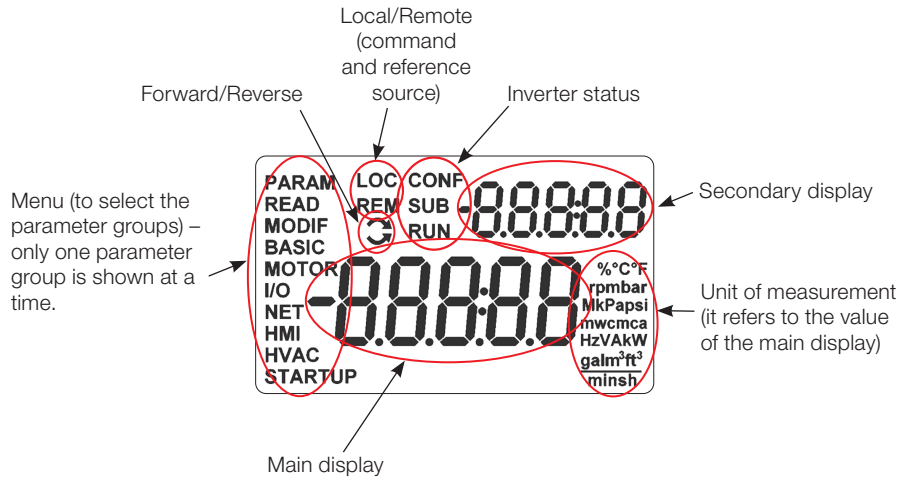


Figure 4.2: Display areas

Parameter groups available in the field Menu:

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

Status of the inverter:

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

### 4.3 OPERATING MODES OF THE HMI

The monitoring mode allows the user to view up to two variables of interest, one on the main display, and another on the secondary display. Such fields of the display are defined in [Figure 4.2: Display areas on page 4-2](#).

**Level 1** allows the user to select the menu items to direct the browsing of the parameters.

**Level 2** allows browsing the parameters of the group selected by **level 1**.

**Level 3**, in turn, allows the modification of the parameter selected in **level 2**. At the end of this level, the modified value is saved or not if the key ENTER or ESC is pressed, respectively.

The [Figure 4.3: HMI operating modes on page 4-3](#) illustrates the basic browsing of the operating modes of the HMI.

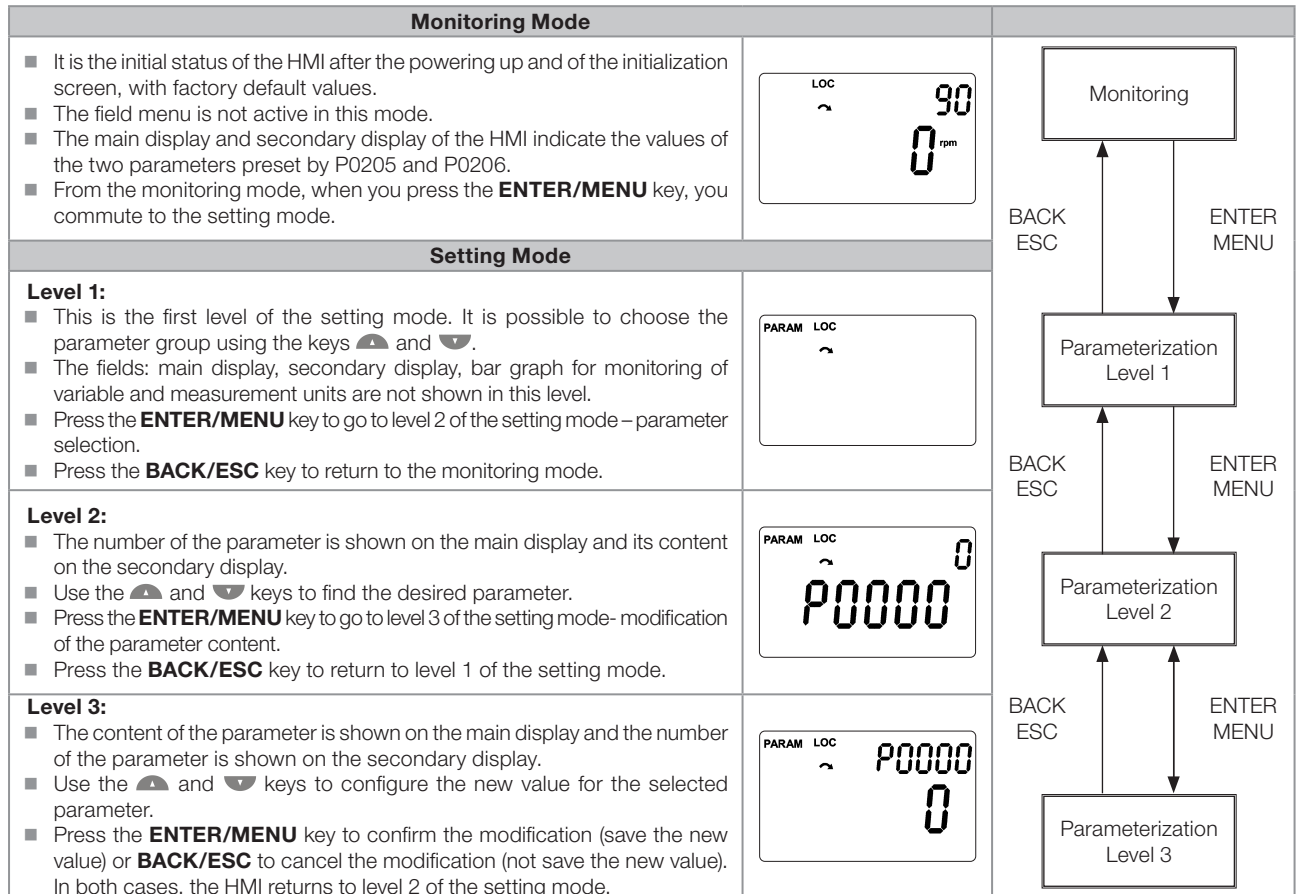


Figure 4.3: HMI operating modes



**NOTE!**

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



**NOTE!**

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

## 5 BASIC INSTRUCTIONS FOR PROGRAMMING AND SETTINGS

### 5.1 PARAMETER STRUCTURE

Aiming at simplifying the parameterization process, the CFW501 parameters were classified into ten groups which can be individually selected in the Menu area of the HMI display. When the enter/menu key of the HMI is pressed in the monitoring mode, you enter the setting mode level 1. In this mode, it is possible to select the desired parameter group by browsing with the "▲" and "▼" keys. For further details on the use of the HMI, refer to [chapter 4 HMI AND BASIC PROGRAMMING on page 4-1](#).



**NOTE!**

The inverter comes from the factory with the frequency (V/f 50/60 Hz mode) and voltage adjusted according to the market.

The reset to factory default may change the content of the parameters related to frequency as per P0204. In the detailed description, some parameters have values between brackets, which represents the default value for operation in 50 Hz; thus the value without brackets is the default for operation in 60 Hz.

### 5.2 PARAMETERS SELECTED BY THE HMI MENU

In the first level of the setting mode, select the group to browse the next levels according to the table below.

*Table 5.1: Parameter group accessed by the HMI MENU*

Group	Contained Parameters
<b>PARAM</b>	<b>All parameters.</b>
<b>READ</b>	<b>Read only parameters:</b> P0001, P0002, P0003, P0004, P0005, P0006, P0007, P0009, P0010, P0011, P0012, P0013, P0014, P0015, P0016, P0017, P0018, P0019, P0020, P0021, P0022, P0023, P0024, P0027, P0029, P0030, P0037, P0042, P0043, P0044, P0047, P0048, P0049, P0050, P0051, P0052, P0053, P0054, P0055, P0060, P0061, P0062, P0063, P0064, P0065, P0070, P0071, P0072, P0073, P0074, P0075, P0080, P0081, P0082, P0295, P0296, P0680, P0690.
<b>MODIF</b>	<b>Only parameters whose contents are different from the factory settings.</b>
<b>BASIC</b>	<b>Parameters for simple application: ramps, minimum and maximum speed, maximum current and torque boost:</b> P0100, P0101, P0133, P0134, P0135, P0136.
<b>MOTOR</b>	<b>Parameter related to the motor data control:</b> P0135, P0136, P0137, P0138, P0150, P0151, P0152, P0153, P0156, P0157, P0158, P0178, P0297, P0299, P0300, P0301, P0302, P0398, P0399, P0400, P0401, P0402, P0403, P0404, P0407, P0409.
<b>I/O</b>	<b>Groups related to digital and analog inputs and outputs:</b> P0012, P0013, P0014, P0015, P0016, P0017, P0018, P0019, P0020, P0021, P0022, P0105, P0220, P0221, P0222, P0223, P0224, P0225, P0226, P0227, P0228, P0229, P0230, P0231, P0232, P0233, P0234, P0235, P0236, P0237, P0238, P0239, P0240, P0241, P0242, P0243, P0244, P0245, P0246, P0247, P0248, P0249, P0250, P0251, P0252, P0253, P0254, P0255, P0256, P0257, P0258, P0259, P0260, P0263, P0264, P0265, P0266, P0267, P0268, P0269, P0270, P0271, P0275, P0276, P0277, P0278, P0279, P0281, P0282, P0287, P0288, P0289, P0290, P0291, P0292, P0293, P0294.
<b>NET</b>	<b>Parameter related to the communication networks:</b> P0308, P0310, P0311, P0312, P0313, P0314, P0316, P0680, P0681, P0682, P0683, P0690, P0695, P0696, P0697, P0698, P0760, P0761, P0762, P0763, P0764, P0765.
<b>HMI</b>	<b>Parameter to configure the HMI:</b> P0200, P0205, P0206, P0208, P0209, P0210, P0211, P0212, P0216, P0510, P0511, P0512, P0513, P0516, P0517.
<b>HVAC</b>	<b>Parameter related to the HVAC function:</b> P0580, P0581, P0582, P0583, P0584 P0585, P0586, P0587, P0588, P0589, P0590, P0591, P1000, P1001, P1002, P1003, P1010, P1011, P1012, P1013, P1014, P1015, P1016, P1017, P1018, P1019, P1020, P1021, P1022, P1023, P1024, P1025, P1026, P1027, P1028, P1029, P1030, P1031, P1032, P1033, P1034, P1035, P1036, P1037, P1038, P1039, P1040, P1041, P1042, P1043, P1044, P1045, P1046, P1047, P1048, P1049, P1050, P1051, P1052, P1053, P1054, P1055, P1056, P1057, P1058, P1059, P1060, P1061, P1062, P1063, P1064, P1065, P1066, P1067, P1068, P1069, P1070, P1071, P1072, P1073, P1074, P1075, P1076, P1077, P1078, P1079.
<b>STARTUP</b>	<b>Parameter to enter the VVW - oriented Start-up mode:</b> P0202, P0398, P0399, P0400, P0401, P0402, P0403, P0404, P0407, P0408, P0409.





**NOTE!**

Besides the selected group in the menu field of the HMI, the view of the parameters on the HMI depends on the hardware installed and on the operating mode of the CFW501. Therefore, observe the connected plug-In module, as well as the motor control mode: VVW or V/f. For example, if the plug-in module only features the analog input AI1, the parameters related to the other analog inputs are not shown. The same occurs with the parameters exclusively related to the VVW and V/f modes.

### 5.3 HMI

In the HMI group, you find parameters related to the showing of information on the display, backlight and password of the HMI. See detailed description below of the possible settings of the parameters.

#### P0000 – Access to the Parameters

5

<b>Adjustable Range:</b>	0 to 9999	<b>Factory Setting:</b>	0
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**Description:**

Password input to release the access to the parameters. Once a password is saved in P0200, the access to the parameters is only allowed if this password is set in P0000.

After setting P0000 with a password value, P0000 will show "1" or "0", keeping the set password value hidden. Where "1" releases the access to parameters and "0" locks the access to the parameters.



**NOTE!**

The access to the parameters and P0000 is cleared together with the powering down of the inverter.

## P0200 – Password

**Adjustable Range:** 0 = Inactive  
1 = Active  
1 to 9999 = New Password

**Factory Setting:** 0 = Inactive

**Properties:**

**Access groups via HMI:**

**Description:**

It allows activating the password (by inserting a new value) or disabling it. For further details regarding the use of this parameter, refer to [Table 5.2: Required procedure for each kind of action on page 5-3](#).

*Table 5.2: Required procedure for each kind of action*

Action	Procedure
Activate password	<ol style="list-style-type: none"> <li>1. Set P0200 with the desired value for the password (P0200 = password);</li> <li>2. After this procedure, the new password is active and P0200 is automatically adjusted for 1 (password active) <sup>(1)</sup>.</li> </ol>
Change password	<ol style="list-style-type: none"> <li>1. Set the current value of the password (P0000 = password);</li> <li>2. Set the desired value for the new password in P0200 (P0200 = new password);</li> <li>3. After this procedure, the new password is active and P0200 is automatically adjusted for 1 (password active) <sup>(1)</sup>.</li> </ol>
Disable password	<ol style="list-style-type: none"> <li>1. Set the current value of the password (P0000 = password);</li> <li>2. Set inactive password (P0200 = 0);</li> <li>3. After this procedure, the password is disabled <sup>(2)</sup>.</li> </ol>
Disable password	<ol style="list-style-type: none"> <li>1. Activate a factory default by means of P0204;</li> <li>2. After this procedure, the password is disabled <sup>(2)</sup>.</li> </ol>

**Notes:**

- (1) It only allows changing the content of the parameters when P0000 is equal to the value of the password.
- (2) It is allowed to change the content of the parameters and P0000 is inaccessible.

## P0205 – Main Display Parameter Selection

## P0206 – Secondary Display Parameter Selection

**Adjustable Range:** 0 to 1079

**Factory Setting:** P0205 = 2  
P0206 = 1

**Properties:**

**Access groups via HMI:**

**Description:**

These parameters define which parameters are shown on the HMI display in the monitoring mode. More details of this programming can be found in [section 5.6 SETTING OF DISPLAY INDICATIONS IN THE MONITORING MODE on page 5-12](#).

**P0208 – Main Display Scale Factor**

**P0211 – Secondary Display Scale Factor**

<b>Adjustable Range:</b>	0.1 to 1000.0 %	<b>Factory Setting:</b>	100.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HMI"/>		

**P0210 – Indication Form of the Main Display**

**P0212 – Indication Form of the Second Display**

5

<b>Adjustable Range:</b>	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz 4 = According to P0511 5 = According to P0513 6 = Reserved 7 = According to P0517	<b>Factory Setting:</b>	0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HMI"/>		

**Description:**

These parameters allow setting the main and secondary display scale so as to convert motor variables, such as speed (rpm) into HVAC application unit, such as meters/min or cubic feet/min, for instance.

**P0209 – Main Display Engineering Unit**

<b>Adjustable Range:</b>	0 = none 1 = V 2 = A 3 = rpm 4 = s 5 = ms 6 = none 7 = m 8 = none 9 = none 10 = % 11 = °C 12 = none 13 = Hz 14 = none 15 = h 16 = W 17 = kW 18 = none 19 = none 20 = min 21 = °F 22 = bar 23 = mbar 24 = psi 25 = Pa 26 = kPa 27 = MPa 28 = mwc 29 = mca 30 = gal 31 = l 32 = in 33 = ft 34 = m <sup>3</sup> 35 = ft <sup>3</sup> 36 = gal/s 37 = gal/min 38 = gal/h 39 = l/s 40 = l/min 41 = l/h 42 = m/s 43 = m/min 44 = m/h 45 = ft/s 46 = ft/min 47 = ft/h 48 = m <sup>3</sup> /s 49 = m <sup>3</sup> /min 50 = m <sup>3</sup> /h 51 = ft <sup>3</sup> /s 52 = ft <sup>3</sup> /min 53 = ft <sup>3</sup> /h 54 = According to P0510 55 = According to P0512 56 = none 57 = According to P0516	<b>Factory Setting:</b> 3
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter selects the engineering unit to be presented in the main display. The content of this parameter is automatically adjusted to match the unit of the parameter selected by P0205 when its value is changed by the HMI.

### P0216 – HMI Display Light

<b>Adjustable Range:</b>	0 = Inactive 1 = Active	<b>Factory Setting:</b> 1
<b>Properties:</b>		
<b>Access groups via HMI:</b>	HMI	

**Description:**

The function of this parameter is to turn on or off the backlight of the HMI display.

**NOTE!** When the remote HMI is connected and activated by P0312, the light of the CFW501 local HMI is cut off and parameter P0216 starts to control the remote HMI.

5

### 5.4 INDIRECT ENGINEERING UNITS

This parameter group allows the user to configure the engineering units for the user's parameters of the SoftPLC function.

#### P0510 – Indirect Engineering Unit 1

<b>Adjustable Range:</b>	0 = none 1 = V 2 = A 3 = rpm 4 = s 5 = ms 6 = none 7 = m 8 = none 9 = none 10 = % 11 = °C 12 = none 13 = Hz 14 = none 15 = h 16 = W 17 = kW 18 = none 19 = none 20 = min 21 = °F 22 = bar 23 = mbar 24 = psi 25 = Pa 26 = kPa 27 = MPa 28 = mwc (meter of water column) 29 = mca (metro de columna d'água) 30 = gal 31 = l (litro) 32 = in 33 = ft 34 = m <sup>3</sup> 35 = ft <sup>3</sup> 36 = gal/s 37 = gal/min (= GPM)	<b>Factory Setting:</b> 22
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- 38 = gal/h
- 39 = l/s
- 40 = l/min
- 41 = l/h
- 42 = m/s
- 43 = m/min
- 44 = m/h
- 45 = ft/s
- 46 = ft/min
- 47 = ft/h
- 48 = m<sup>3</sup>/s
- 49 = m<sup>3</sup>/min
- 50 = m<sup>3</sup>/h
- 51 = ft<sup>3</sup>/s
- 52 = ft<sup>3</sup>/min
- 53 = ft<sup>3</sup>/h

**Properties:**
**Access groups via HMI:**

**Description:**

This parameter selects the engineering unit that will be viewed in the user's parameter of the SoftPLC which is associated to it, that is, any user's parameter of the SoftPLC that is associated to the indirect engineering unit 1 will be viewed in this format on the CFW501 HMI.


**NOTE!**

Parameters P1011, P1015, P1027, P1028, P1031 and P1033 of the main PID controller (HVAC functions) are associated to the indirect engineering unit 1.

## P0511– Indirect Indication Form 1

**Adjustable Range:**

- 0 = wxyz
- 1 = wxy.z
- 2 = wx.yz
- 3 = w.xyz

**Factory Setting:** 1

**Properties:**
**Access groups via HMI:**

**Description:**

This parameter selects the decimal point that will be viewed in the user's parameter of the SoftPLC which is associated to it, that is, any user's parameter of the SoftPLC that is associated to the indirect indication form 1 will be viewed in this format on the CFW501 HMI.


**NOTE!**

Parameters P1011, P1015, P1027, P1028, P1031 and P1033 of the main PID controller (HVAC functions) are associated to the indirect indication form 1.

## P0512 – Indirect Engineering Unit 2

**Adjustable Range:**

- 0 = none
- 1 = V
- 2 = A
- 3 = rpm
- 4 = s

**Factory Setting:** 11

- 5 = ms
- 6 = none
- 7 = m
- 8 = none
- 9 = none
- 10 = %
- 11 = °C
- 12 = none
- 13 = Hz
- 14 = none
- 15 = h
- 16 = W
- 17 = kW
- 18 = none
- 19 = none
- 20 = min
- 21 = °F
- 22 = bar
- 23 = mbar
- 24 = psi
- 25 = Pa
- 26 = kPa
- 27 = MPa
- 28 = mwc (meter of water column)
- 29 = mca (metro de columna d'água)
- 30 = gal
- 31 = l (litro)
- 32 = in
- 33 = ft
- 34 = m<sup>3</sup>
- 35 = ft<sup>3</sup>
- 36 = gal/s
- 37 = gal/min (= GPM)
- 38 = gal/h
- 39 = l/s
- 40 = l/min
- 41 = l/h
- 42 = m/s
- 43 = m/min
- 44 = m/h
- 45 = ft/s
- 46 = ft/min
- 47 = ft/h
- 48 = m<sup>3</sup>/s
- 49 = m<sup>3</sup>/min
- 50 = m<sup>3</sup>/h
- 51 = ft<sup>3</sup>/s
- 52 = ft<sup>3</sup>/min
- 53 = ft<sup>3</sup>/h

**Properties:**

**Access groups via HMI:**

HMI

**Description:**

This parameter selects the engineering unit that will be viewed in the user's parameter of the SoftPLC which is associated to it, that is, any user's parameter of the SoftPLC that is associated to the indirect engineering unit 2 will be viewed in this format on the CFW501 HMI.



**NOTE!**

Parameters P1060, P1062, P1073, P1074, P1076 and P1078 of the external PID controller (HVAC functions) are associated to the indirect engineering unit 2.

**P0513 – Indirect Indication Form 2**

<b>Adjustable Range:</b>	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	<b>Factory Setting:</b> 1
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter selects the decimal point that will be viewed in the user's parameter of the SoftPLC which is associated to it, that is, any user's parameter of the SoftPLC that is associated to the indirect indication form 2 will be viewed in this format on the CFW501 HMI.



**NOTE!**

Parameters P1011, P1015, P1027, P1028, P1031 and P1033 of the main PID controller (HVAC functions) are associated to the indirect indication form 2.

**P0516 – Indirect Engineering Unit 4**

<b>Adjustable Range:</b>	0 = none 1 = V 2 = A 3 = rpm 4 = s 5 = ms 6 = none 7 = m 8 = none 9 = none 10 = % 11 = °C 12 = none 13 = Hz 14 = none 15 = h 16 = W 17 = kW 18 = none 19 = none 20 = min 21 = °F 22 = bar 23 = mbar 24 = psi 25 = Pa 26 = kPa 27 = MPa 28 = mwc (meter of water column) 29 = mca (metro de coluna d'água) 30 = gal 31 = l (litro) 32 = in 33 = ft	<b>Factory Setting:</b> 13
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- 34 = m<sup>3</sup>
- 35 = ft<sup>3</sup>
- 36 = gal/s
- 37 = gal/min (= GPM)
- 38 = gal/h
- 39 = l/s
- 40 = l/min
- 41 = l/h
- 42 = m/s
- 43 = m/min
- 44 = m/h
- 45 = ft/s
- 46 = ft/min
- 47 = ft/h
- 48 = m<sup>3</sup>/s
- 49 = m<sup>3</sup>/min
- 50 = m<sup>3</sup>/h
- 51 = ft<sup>3</sup>/s
- 52 = ft<sup>3</sup>/min
- 53 = ft<sup>3</sup>/h

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter selects the engineering unit that will be viewed in the user's parameter of the SoftPLC which is associated to it, that is, any user's parameter of the SoftPLC that is associated to the indirect engineering unit 4 will be viewed in this format on the CFW501 HMI.

**NOTE!** Parameters P1036, P1043 and P1047 are related to speed limits (Hz or rpm) in the HVAC functions and are associated to the indirect engineering unit 4.

**P0517 – Indirect Indication Form 4**

<b>Adjustable Range:</b>	0 = wxyz 1 = wxy.z 2 = wx.yz 3 = w.xyz	<b>Factory Setting:</b> 1
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter selects the decimal point that will be viewed in the user's parameter of the SoftPLC which is associated to it, that is, any user's parameter of the SoftPLC that is associated to the indirect indication form 4 will be viewed in this format on the CFW501 HMI.

**NOTE!** Parameters P1036, P1043 and P1047 are related to speed limits (Hz or rpm) in the HVAC functions and are associated to the indirect indication form 4.

## 5.5 BACKUP PARAMETERS

The CFW501 BACKUP functions allow saving the inverter current parameter contents in a specific memory (EEPROM), or vice-versa overwrite the current parameters with the content of the specified memory.

### P0204 – Load / Save Parameters

<b>Adjustable Range:</b>	0...2 = Not Used 3 = Reset P0043 4 = Reset P0044 5 = Load WEG 60 Hz 6 = Load WEG 50 Hz 7 = Load user 1 8 = Load user 2 9 = Save user 1 10 = Save user 2 11 = Load Standard SoftPLC 12...15 = Reserved	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	

#### Description:

It allows saving the inverter present parameters in a non-volatile memory (EEPROM) of the control module or the opposite, loading the parameters with the content of this area. [Table 5.3: Option of parameter P0204 on page 5-11](#) describes the actions performed by each option.

*Table 5.3: Option of parameter P0204*

P0204	Action
0...2	<b>Not Used:</b> No action.
3	<b>Reset P0043:</b> resets the enabled hours counter.
4	<b>Reset P0044:</b> resets the kWh counter.
5	<b>Load WEG 60 Hz:</b> It loads the default parameters on the inverter with the factory default for 60 Hz.
6	<b>Load WEG 50 Hz:</b> It loads the default parameters on the inverter with the factory default for 50 Hz.
7	<b>Load user 1:</b> It transfers the content of the memory of parameters 1 to the inverter current parameters.
8	<b>Load user 2:</b> It transfers the content of the memory of parameters 2 to the inverter current parameters.
9	<b>Saver user 1:</b> It transfers the current content of the parameters to the memory of parameters 1.
10	<b>Saver user 2:</b> It transfers the current content of the parameters to the memory of parameters 2.
11	<b>Load Standard SoftPLC:</b> It loads the default values of the parameters SoftPLC applicative parameters.
12...15	<b>Reserved:</b> No Action

In order to load the parameters of user 1 and/or user 2 to the CFW501 operating area (P0204 = 7 or 8), it is necessary that those areas be previously saved.

The operation of loading one of those memories (P0204 = 7 or 8) can also be done via digital inputs (DIx). For further details referring to this programming, refer to [section 12.5 DIGITAL INPUTS on page 12-15](#).



#### NOTE!

When P0204 = 5 or 6, parameters P0296 (Rated voltage), P0297 (Switching frequency) P0312 (Serial Protocol) and P0308 (Serial address) are not changed to the factory default.

### 5.6 SETTING OF DISPLAY INDICATIONS IN THE MONITORING MODE

Whenever the inverter is powered up, the HMI display goes to the monitoring mode. In order to simplify the reading of the inverter parameters, the display was designed to indicate two parameters simultaneously, at the user's discretion. The selection of those parameters is done via P0205 and P0206 as indicated in [Figure 5.1: Screen on initialization and display fields on page 5-12](#).

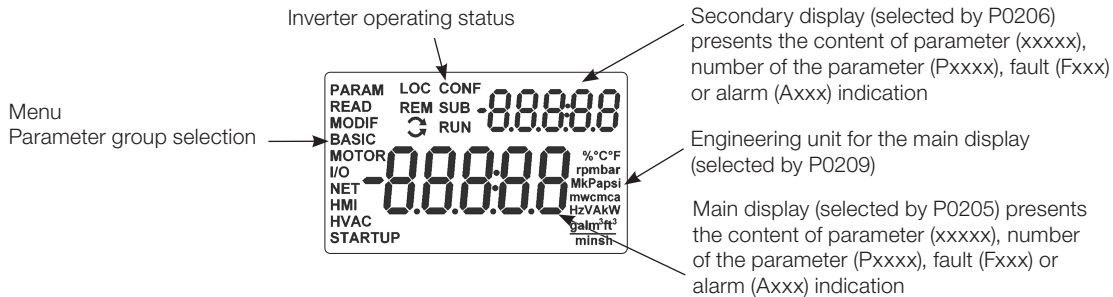


Figure 5.1: Screen on initialization and display fields

5

### 5.7 SITUATIONS FOR CONFIG STATUS

The CONFIG status is indicated by the HMI "CONF" status, as well as in parameters P0006 and P0680. Such status indicates that the CFW501 cannot enable the output PWM pulses because the inverter configuration is incorrect or incomplete.

The table below shows the situations of CONFIG status, where the user can identify the origin condition through parameter P0047.

Table 5.4: Situations for CONFIG status

P0047	Origin Situation of CONFIG Status
0	Out of CONFIG status, HMI, P0006 and P0680 must not indicate CONF.
5	Two or more Dlx (P0263...P0270) programmed for direction of rotation (4).
6	Two or more Dlx (P0263...P0270) programmed for LOC/REM selection (5).
9	Two or more Dlx (P0263...P0270) programmed for 2 <sup>nd</sup> ramp (8).
11	Two or more Dlx (P0263...P0270) programmed for disable Flying-Start (15).
12	Two or more Dlx (P0263...P0270) programmed for lock programming (17).
13	Two or more Dlx (P0263...P0270) programmed for load user 1 (18).
14	Two or more Dlx (P0263...P0270) programmed for load user 2 (19).
19	Run-Stop command (P0224 or P0227) programmed for Dlx (1) without Dlx (P0263...P0270) programmed for (1 = Run/Stop) and without Dlx (P0263...P0270) programmed for general enable (2) and without Dlx (P0263...P0270) programmed for quick stop (3) and without Dlx (P0263...P0270) programmed for advance(4) and without Dlx (P0263...P0270) programmed for start (6).
20	Digital input DI2 (P0264) programmed for PTC (29) or analog input AI3 (P0241) programmed for PTC (4).
25	Reference (P0221 or P0222) programmed for AI2 (2) or AI3 (3) and the plug-In module has no AI2 and AI3.
26	P0312 programmed for REMOTE HMI (0 or 6) without HMI connected.
27	Poor configuration of the V/f curve (P0142 to P0147) causes voltage step in the output).
28	Bypass mode configured (P0583) without any digital input configured for "Activate bypass"; Bypass mode configured with more than one digital input configured for "Activate bypass"; Bypass mode configured without a digital output configured for "Contactor bypass drive" and a digital output configure to "Mains bypass contactor"; Bypass mode configured and either of the two bypass digital outputs with duplicated configuration.
29	"Fire Mode" configured without a digital input configured for "Activate Fire Mode"; More than one digital input configured for "Activate Fire Mode"; More than one digital output configured for "Fire Mode active"; Digital input configured for "Fire Mode" with the "Fire Mode" function disabled; Digital output configured for "Fire Mode" with the "Fire Mode" function disabled.

## 6 IDENTIFICATION OF THE INVERTER MODEL AND ACCESSORIES

To verify the inverter model, check the code on the product identification labels: the complete one, on the side of the inverter, or the summarized one, under the HMI.

Once the inverter model identification code is checked, it is necessary to interpret it in order to understand its meaning. Refer to chapter 2 - General Information of the CFW501 user's manual.

Below are the parameters related to the inverter model which change according to the inverter model and version.

Those parameters must comply with the data read on the product identification label.

### 6.1 INVERTER DATA

#### P0023 – Main Software Version

#### P0024 – Secondary Software Version

<b>Adjustable Range:</b>	0.00 to 655.35	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

These parameters indicate the software versions of the microprocessor: main one, on the control board of the CFW501 and secondary one, on the plug-in module. Those data are on the EEPROM memory located on the control board.

#### P0027 – Plug-in Module Configuration

<b>Adjustable Range:</b>	0 to 9	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

This parameter identifies the plug-in which is connected to the control module. [Table 6.1: Identification of the plug-in modules of the CFW501 on page 6-1](#) presents all plug-in modules recognized by the inverter firmware, but only the CFW500-CRS485 is available for the CFW501.

*Table 6.1: Identification of the plug-in modules of the CFW501*

Name	Description	P0027
	No plug-in module connected.	0
CFW500-IOS	Standard plug-in module (I/O Standard).	1
CFW500-IOD	Plug-in module with addition of digital inputs and outputs (Digital I/O).	2
CFW500-IOAD	Plug-in module with addition of analog and digital inputs and analog and digital outputs (Analog and Digital I/O).	3
CFW500-IOR	Plug-in module with addition of relay digital outputs (I/O Relay).	4
CFW500-CUSB	Plug-in module with addition of a USB communication port.	5
CFW500-CRS232	Plug-in module with addition of a RS232 communication port.	7
CFW500-CRS485	Plug-in module with addition of a RS485 communication port.	9

**Note:** \*CFW501 does not support CAN and Profibus communication.

**P0029 – Power Hardware Configuration**

<b>Adjustable Range:</b>	0 to 38	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

This parameter identifies the inverter model, distinguishing frame, supply voltage and rated current as per [Table 6.2: Identification of the CFW501 models for frames A, B, C, D and E on page 6-2](#).

From P0029, the CFW501 determines the current and voltage parameters which depend on the identification of the model. On the other hand, this action is only executed at the moment the factory default is loaded (P0204 = 5 or 6).

*Table 6.2: Identification of the CFW501 models for frames A, B, C, D and E*

Voltage	Power Supply	Current	Frame	P0029
-	-	-	-	0
200-240 V	Single-Phase or Mono/Tri	1.6 A	A	1
200-240 V	Single-Phase or Mono/Tri	2.6 A	A	2
200-240 V	Single-Phase or Mono/Tri	4.3 A	A	3
200-240 V	Single-Phase or Three-Phase	7.0 A	A	4
200-240 V	Three-Phase	9.6 A	A	5
380-480 V	Three-Phase	1.0 A	A	6
380-480 V	Three-Phase	1.6 A	A	7
380-480 V	Three-Phase	2.6 A	A	8
380-480 V	Three-Phase	4.3 A	A	9
380-480 V	Three-Phase	6.1 A	A	10
200-240 V	Single-Phase or Three-Phase	7.3 A	B	11
200-240 V	Single-Phase or Three-Phase	10.0 A	B	12
200-240 V	Three-Phase	16.0 A	B	13
380-480 V	Three-Phase	2.6 A	B	14
380-480 V	Three-Phase	4.3 A	B	15
380-480 V	Three-Phase	6.5 A	B	16
380-480 V	Three-Phase	10.0 A	B	17
200-240 V	Three-Phase	24.0 A	C	18
380-480 V	Three-Phase	14.0 A	C	19
380-480 V	Three-Phase	16.0 A	C	20
500-600 V	Three-Phase	1.7 A	C	21
500-600 V	Three-Phase	3.0 A	C	22
500-600 V	Three-Phase	4.3 A	C	23
500-600 V	Three-Phase	7.0 A	C	24
500-600 V	Three-Phase	10.0 A	C	25
500-600 V	Three-Phase	12.0 A	C	26
200-240 V	Three-Phase	28.0 A	D	27
200-240 V	Three-Phase	33.0 A	D	28
380-480 V	Three-Phase	24.0 A	D	29
380-480 V	Three-Phase	31.0 A	D	30
500-600 V	Three-Phase	17.0 A	D	31
500-600 V	Three-Phase	22.0 A	D	32
200-240 V	Three-Phase	47.0 A	E	33
200-240 V	Three-Phase	56.0 A	E	34
380-480 V	Three-Phase	39.0 A	E	35
380-480 V	Three-Phase	49.0 A	E	36
500-600 V	Three-Phase	27.0 A	E	37
500-600 V	Three-Phase	32.0 A	E	38

## P0295 – Inverter Rated Current

<b>Adjustable Range:</b>	0.0 to 200.0 A	<b>Factory Setting:</b>	According to inverter model
<b>Properties:</b>	ro		
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>		

### Description:

This parameter presents the inverter rated current as per [Table 6.2: Identification of the CFW501 models for frames A, B, C, D and E on page 6-2](#).

## P0296 – Power Supply Rated Voltage

<b>Adjustable Range:</b>	0 = 200 - 240 V 1 = 380 - 480 V 2 = 500 - 600 V	<b>Factory Setting:</b>	According to inverter model
<b>Properties:</b>	ro		
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>		

### Description:

This parameter presents the inverter rated power supply as shown in [Table 6.2: Identification of the CFW501 models for frames A, B, C, D and E on page 6-2](#).

## P0297 – Switching Frequency

<b>Adjustable Range:</b>	2500 to 15000 Hz	<b>Factory Setting:</b>	5000 Hz
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR"/>		

### Description:

You can use this parameter to define the inverter IGBT switching frequency.

The inverter switching frequency may be adjusted according to the application needs. Higher switching frequencies imply less acoustic noise in the motor. However, the switching frequency choice results in a compromise among the acoustic noise in the motor, the inverter IGBT losses and the maximum permitted currents.

The reduction of the switching frequency reduces the effects related to the motor instability, which occurs in certain application conditions. Besides, it reduces the earth leakage current, preventing the actuation of the faults F0074 (earth fault) or F0070 (output overcurrent or short-circuit).



### ATTENTION!

Check the output current data considering the switching frequency when it is different from the default in table B.4 available in annex B - Technical Specifications of the CFW501 user's manual.

## 7 LOGICAL COMMAND AND SPEED REFERENCE

The drive of the electric motor connected to the inverter depends on the logical command and on the reference defined by one of the several possible sources, such as: HMI keys, digital inputs (Dix), analog inputs (Aix), serial/ USB interface, SoftPLC, etc.

The command via HMI is limited to a set of functions pre-defined for the keys according to [chapter 4 HMI AND BASIC PROGRAMMING on page 4-1](#), similarly to the digital inputs (Dix), with the functions implemented in parameter P0263 to P0270.

On the other hand, the command via digital interfaces, such as communication network and SoftPLC, act directly on the inverter control word by means of control parameters and system markers of the SoftPLC, respectively.

The speed reference, in turn, is processed inside the CFW501 in 16 bits with signal (-32768 to +32767) for a range from -18000 rpm to 18000 rpm and, therefore, minimum resolution of 0.55 rpm. On the other hand, the unit factor, range and resolution of the reference depend on the used source, as described in [section 7.2 SPEED REFERENCE on page 7-7](#).

### 7.1 SELECTION FOR LOGICAL COMMAND AND SPEED REFERENCE

The inverter command and reference source is defined by the inverter parameters for two different situations: local and remote, which can be switched dynamically during the inverter operation. Thus, for a certain parameterization, the inverter has two sets for command and reference, according to block diagram of [Figure 7.1: General block diagram for commands and references on page 7-2](#).

Parameter P0220 determines the source of commands between the Local and Remote situations.

Parameters P0223, P0224 and P0225 define the commands in the Local situation; parameters P0226, P0227 and P0228 define the commands in the Remote situation, and parameter P0105 determines the source for selection between 1<sup>st</sup> and 2<sup>nd</sup> ramp. This structure for the selection of the command source is shown in [Figure 7.2: Command selection structure on page 7-3](#), where parameter P0312 directs the serial communication source for the plug-in modules with two ports.

Parameters P0221 and P0222 define the speed reference in the Local and Remote situations, respectively. This structure for the selection of the reference source is shown in [Figure 7.3: Structure to select the speed reference on page 7-4](#), where parameter P0312 directs the serial communication source to the plug-in modules with two ports.

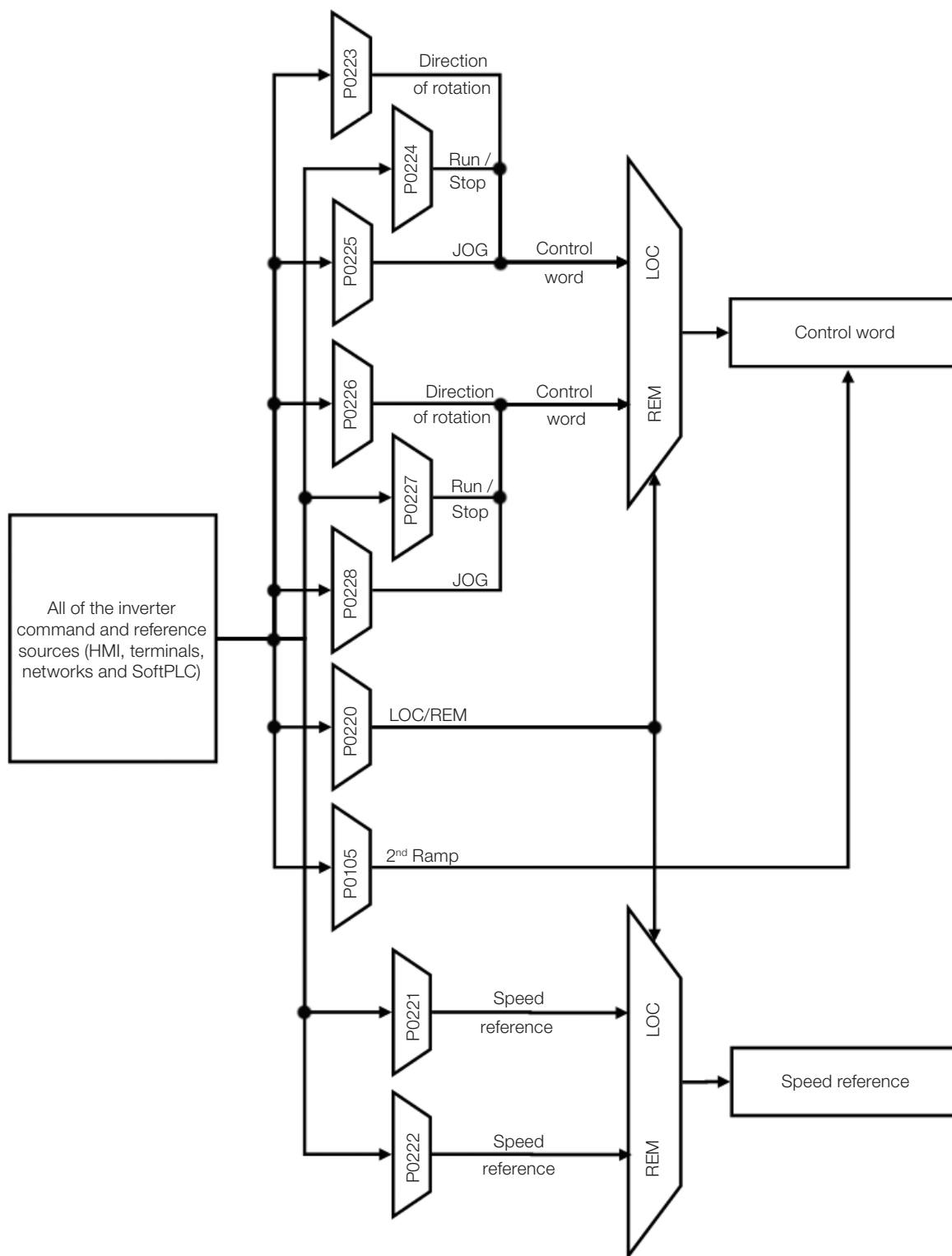


Figure 7.1: General block diagram for commands and references



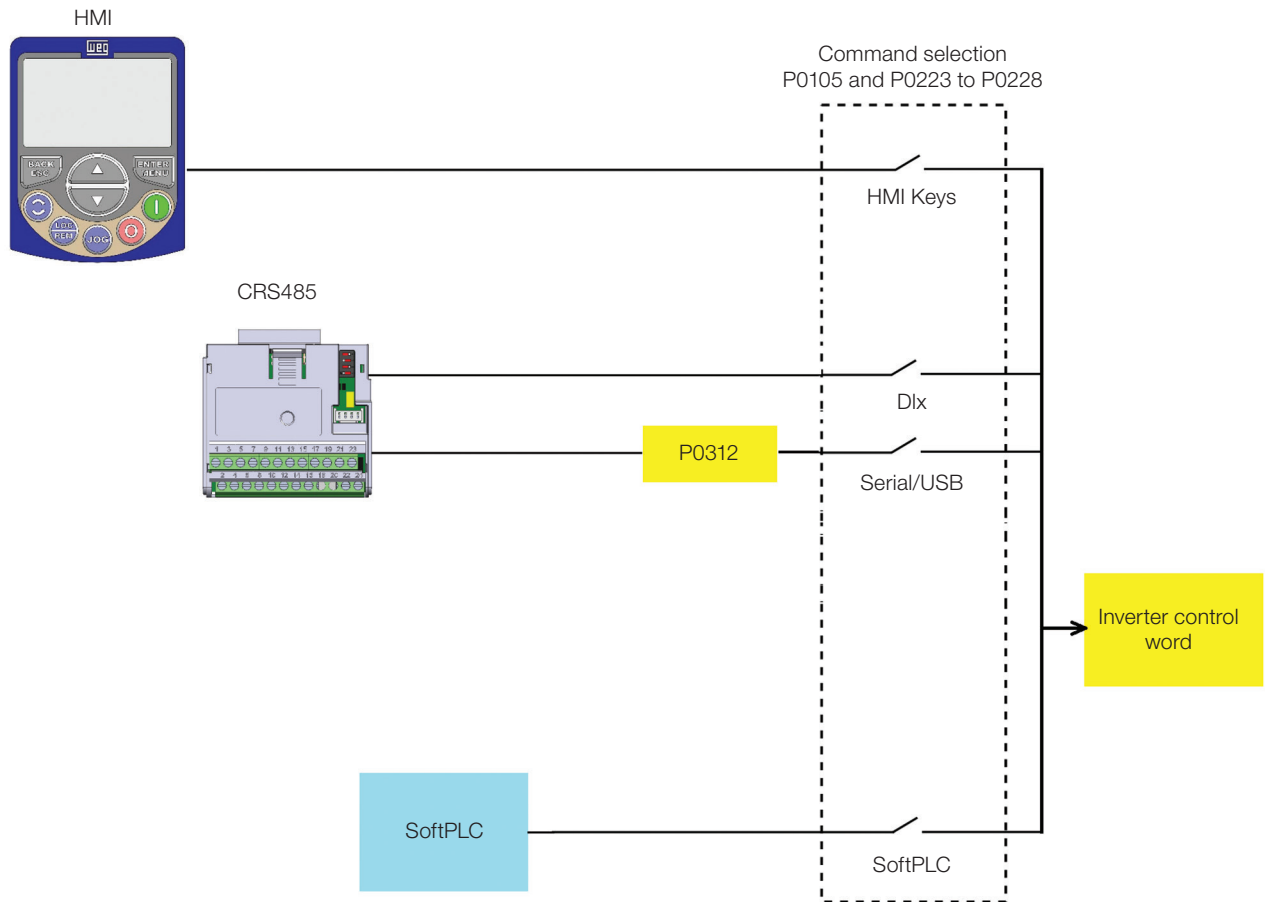


Figure 7.2: Command selection structure

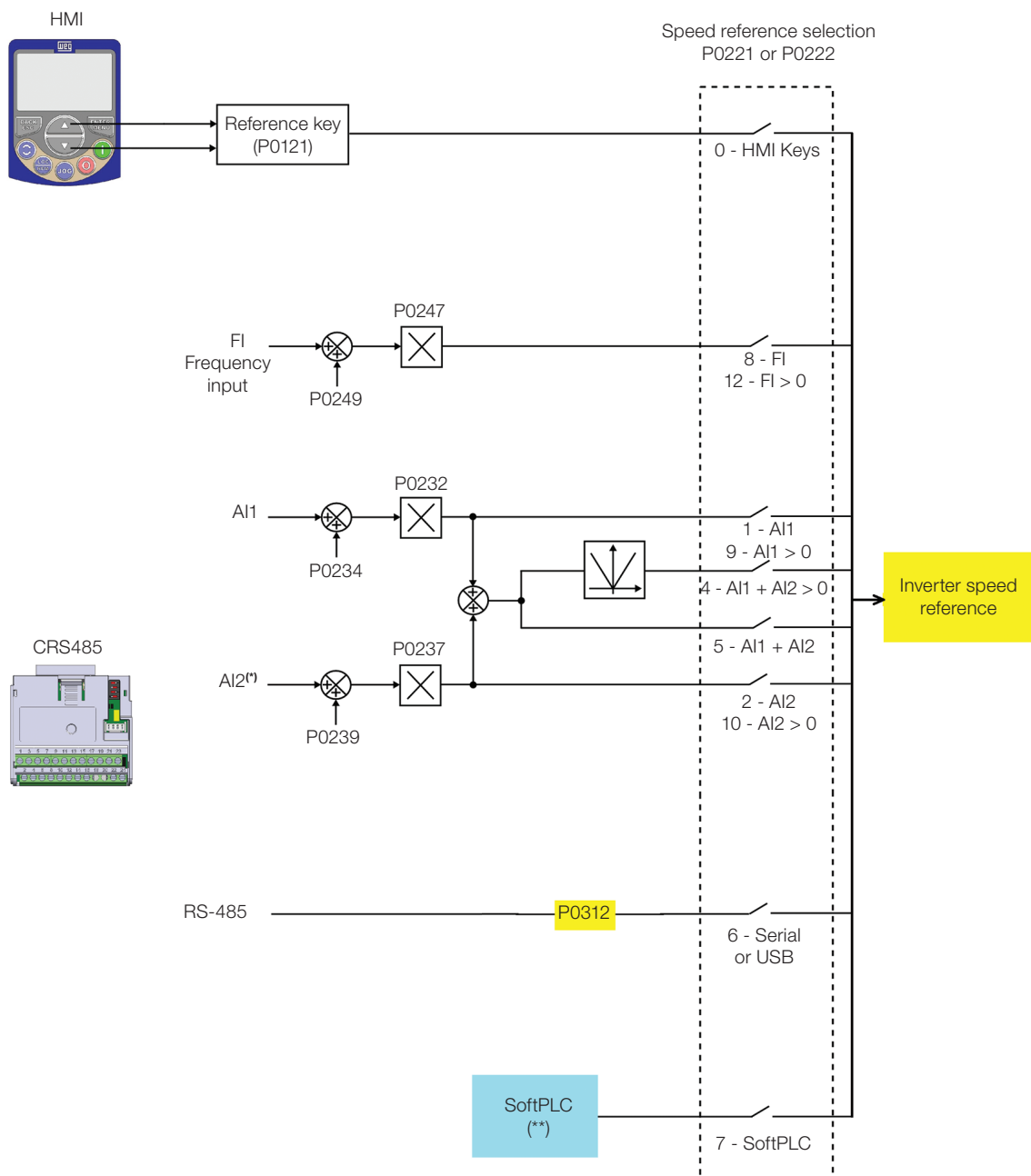


Figure 7.3: Structure to select the speed reference

### P0220 – Local/Remote Selection

<b>Adjustable Range:</b>	0 = Always Local 1 = Always Remote 2 = Local / Remote HMI Key (LOC) 3 = Local / Remote HMI Key (REM) 4 = Digital Input (DIx) 5 = Serial / USB (LOC) 6 = Serial / USB (REM) 7 = SoftPLC	<b>Factory Setting:</b> 2
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>	

#### Description:

It defines the command origin source which will select between Local situation and Remote situation, where:

- LOC: means Local situation default.
- REM: means Remote situation default.
- DIx: according to function programmed for digital input in P0263 to P0270.

### P0221 – Speed Reference Selection – LOCAL Situation

### P0222 – Speed Reference Selection – REMOTE Situation

<b>Adjustable Range:</b>	0 = HMI Keys 1 = AI1 2 = AI2 3 = AI3 4 = AI1 + AI2 > 0 (Sum AIs > 0) 5 = AI1 + AI2 (Sum AIs) 6 = Serial / USB 7 = SoftPLC 8 = Frequency input (FI) 9 = AI1 > 0 10 = AI2 > 0 11 = AI3 > 0 12 = FI > 0	<b>Factory Setting:</b> P0221 = 0 P0222 = 1
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>	

#### Description:

These parameters define the origin source for the speed reference in the Local situation and Remote situation. Some comments on the options of this parameter:

- **AIx**: it refers to the analog input signal according to [section 12.1 ANALOG INPUTS on page 12-1](#).
- **HMI**: the reference value set by the keys and contained in parameter P0121.
- **AIx > 0**: the negative values of the AIx reference are zeroed.

**P0223 – Direction of Rotation Selection – LOCAL Situation**

**P0226 – Direction of Rotation Selection – REMOTE Situation**

<b>Adjustable Range:</b>	0 = Clockwise 1 = Counterclockwise 2 = HMI Key (H) 3 = HMI Keys (AH) 4 = Dlx 5 = Serial / USB (H) 6 = Serial / USB (AH) 7 = SoftPLC	<b>Factory Setting:</b> P0223 = 2 P0226 = 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>	

**Description:**

These parameters define the origin source for the "Direction of Rotation" command in the Local and Remote situation, where:

- **H:** it means clockwise default at the inverter power-up.
- **AH:** means counterclockwise default at the inverter power-up.
- **Dlx:** refer to [section 12.5 DIGITAL INPUTS on page 12-15](#).

7

**P0224 – Run / Stop Selection – LOCAL Situation**

**P0227 – Run / Stop Selection – REMOTE Situation**

<b>Adjustable Range:</b>	0 = HMI Keys 1 = Dlx 2 = Serial / USB 3 = SoftPLC	<b>Factory Setting:</b> P0224 = 0 P0227 = 1
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>	

**Description:**

These parameters define the origin source for the "Run/Stop" command in the Local and Remote situation. This command corresponds to the functions implemented in any of the command sources able to enable the motor movement, that is, general enable, ramp enable, turn on, turn off, JOG, etc.

**P0225 – JOG Selection – LOCAL Situation**
**P0228 – JOG Selection – REMOTE Situation**

<b>Adjustable Range:</b>	0 = Inactive 1 = HMI Keys 2 = DIx 3 = Serial / USB 4 = SoftPLC	<b>Factory Setting:</b>	P0225 = 1 P0228 = 2
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

**Description:**

These parameters define the origin source for the JOG function in the Local and Remote situation. The JOG function means a run/stop command added to the reference defined by P0122 – see [item 7.2.3 Speed Reference Parameters on page 7-9](#).

**7.2 SPEED REFERENCE**

The speed reference is the value applied to the input of the acceleration ramp module (P0001) to control the frequency control applied to the inverter output (P0002) and consequently the motor shaft speed.

Internally, the inverter CPU uses 16-bit variables with signal to treat the speed references. Besides, the full scale of the reference, output frequency and related variables is defined in 1800 rpm. On the other hand, depending on the source, this scale is conveniently modified considering the interface with the user by standardization or application requirements.

In general, the digital references defined by parameters such as: HMI keys (P0121), and JOG have a scale from 0 to 18000 rpm with resolution of 1 rpm. On the other hand, the reference via analog input uses the 16-bit internal scale with signal with a full scale in 18000 rpm and resolution of 0.55 rpm.

The speed reference via HMI can be the JOG key of the keys "▲" and "▼" on parameter P0121.

In digital inputs (DIx), on the other hand, the reference is defined according to the function predefined for P0263 to P0270.

The speed reference via analog inputs and frequency input is according to the signal, gain and offset parameters P0230 to P0250. The full scale of the reference is always by P0134, that is, maximum value in AIx is equivalent to the speed reference equal to P0134.

The digital references Serial/USB and SoftPLC act on a standardized scale called "13-bit Speed", where the value 8192 (2<sup>13</sup>) is equivalent to the motor rated frequency given by P0403. Those references are accessed by parameter P0683 and system marker of the SoftPLC, respectively.

Although the digital references have a different scale and speed reference parameters with their range from 0 to 18000 rpm, as previously informed, the speed value on the ramp input (P0001) is always limited by P0133 and P0134. For example, the JOG reference is given by P0122; this parameter may be set to up to 18000 rpm, but the value applied to the ramp input as reference will be limited by P0134 when the function is executed.

**Table 7.1:** Summary of the scales and resolutions of the speed references

Reference	Full Scale	Resolution
Analog inputs (AIx)	- P0134 to P0134	10 bits or (P0134 / 1024)
Communication networks and SoftPLC	-18000 rpm to 18000 rpm	Speed 13 Bits (P0403 / 8192)
HMI Parameters	-18000 rpm to 18000 rpm	1 rpm

### 7.2.1 Speed Reference Limits

Although the parameters to adjust the reference have a wide range of values (0 to 18000), the value applied to the ramp is limited by P0133 and P0134. Therefore, the values in module out of this range will have no effect on the reference.

#### P0133 – Minimum Speed Reference

<b>Adjustable Range:</b>	0 to 18000 rpm	<b>Factory Setting:</b>	90 (75) rpm
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="BASIC"/>		

#### P0134 – Maximum Speed Reference

<b>Adjustable Range:</b>	0 to 18000 rpm	<b>Factory Setting:</b>	1800 (1500) rpm
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="BASIC"/>		

**Description:**

Limits for the inverter speed reference. Those limits are applied to any reference source, even in the case of 13-bit speed reference.

### 7.2.2 Speed Reference Backup

#### P0120 – Speed Reference Backup

<b>Adjustable Range:</b>	0 = Inactive 1 = Active 2 = Backup by P0121	<b>Factory Setting:</b>	1
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**Description:**

This parameter defines the operation of the speed reference backup function between the options active (P0120 = 1), inactive (P0120 = 0) and by P0121 (P0120 = 2). This function determines the form of backup of digital references and sources: HMI (P0121), Serial/USB (P0683) and SoftPLC according to [Table 7.2: Options of parameter P0120 on page 7-8](#).

*Table 7.2: Options of parameter P0120*

P0120	Reference Initial Values at the Enabling or Power-Up
0	Value of P0133
1	Last adjusted value
2	Value of P0121

If P0120 = Inactive, the inverter will not save the speed reference value when it is disabled. Thus, when the inverter is enabled again, the speed reference value will become the speed minimum limit value (P0133).

If P0120 = Active, the value set in the reference is not lost when the inverter is disabled or powered down.

If P0120 = Backup by P0121, the reference Initial value is fixed by P0121 at the enabling or power-up of the inverter.

7.2.3 Speed Reference Parameters

**P0121 – Speed Reference via HMI**

**Adjustable Range:** 0 to 18000 rpm

**Factory Setting:** 90 rpm

**Description:**

Parameter P0121 stores the speed reference via HMI (P0221 = 0 or P0222 = 0). When the keys "▲" and "▼" are active and the HMI in the view mode of the HMI, the value of P0121 is increased and shown on the HMI main display. Besides, the P0121 is used as input for the reference backup function.

The direction of rotation is defined by parameters P0223 (LOCAL) or P0226 (REMOTE).



**NOTE!**

The maximum setting value of parameter P0121 via HMI is limited by P0134.

**P0122 – Speed Reference for JOG**

**Adjustable Range:** 0 to 18000 rpm

**Factory Setting:** 150 (125) rpm

**Description:**

During the JOG command, the motor accelerates up to the value defined in P0122, following the acceleration ramp set according to P0105. This command may be activated by any of the sources, as per [section 7.1 SELECTION FOR LOGICAL COMMAND AND SPEED REFERENCE on page 7-1](#).

The direction of rotation is defined by parameters P0223 (LOCAL) or P0226 (REMOTE). The JOG command is only effective with the motor stopped.

7.2.4 Analog Input AIx and Frequency Input FI

The behaviors of the analog and frequency inputs are described in details in [section 12.1 ANALOG INPUTS on page 12-1](#). Thus, after the proper signal treatment, it is applied to the ramp input according to the [section 7.1 SELECTION FOR LOGICAL COMMAND AND SPEED REFERENCE on page 7-1](#).

7.2.5 13-Bit Speed Reference

The 13-bit speed reference is a scale based on the motor rated speed (P0403). In the CFW501, parameter P0403 is taken as the base to determine the speed reference. Thus, the 13-bit speed value has a range of 16 bits with signal, that is, -32768 to 32767; however, the rated frequency in P0403 is equivalent to the value 8192. Therefore, the maximum value in the range 32767 is equivalent to four times P0403.

The 13-bit speed reference is used in parameters P0681 or P0685 and system marker for the SoftPLC, which are related to the interfaces with communication networks and SoftPLC function of the product.

### 7.3 CONTROL WORD AND INVERTER STATUS

The inverter control word is the grouping of a set of bits to determine the commands received by the inverter from an external source. On the other hand, the status word is another set of bits that define the inverter status. This way, the control and status words establish an interface for the exchanging of information between the inverter and an external module, such as a communication network or a controller.

#### P0680 – Logical Status

<b>Adjustable Range:</b>	0000h to FFFFh	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	NET, READ	

**Description:**

The inverter status word is unique for all the sources and can only be accessed for reading. It indicates all the relevant operating status and modes of the inverter. The function of each bit of P0680 is described in [Table 7.3: Status word \(P0680\) on page 7-10](#).

Table 7.3: Status word (P0680)

BIT	Function	Description
0	Not Used	
1	CMD Status Run/Stop	<b>0:</b> There was no Run command. <b>1:</b> There was Run command.
2	Fire mode	<b>0:</b> Fire mode Inactive. <b>1:</b> Fire mode Active.
3	Bypass	<b>0:</b> Bypass Inactive. <b>1:</b> Bypass Active.
4	Quick Stop	<b>0:</b> Quick stop inactive. <b>1:</b> Quick stop active.
5	2 <sup>nd</sup> Ramp	<b>0:</b> 1 <sup>st</sup> Acceleration and deceleration ramp by P0100 and P0101. <b>1:</b> 2 <sup>nd</sup> Acceleration and deceleration ramp by P0102 and P0103.
6	Config. status	<b>0:</b> Inverter operating in normal conditions. <b>1:</b> Inverter in configuration state. It indicates a special condition in which the inverter cannot be enabled, because it has parameterization incompatibility.
7	Alarm	<b>0:</b> Inverter is not in alarm state. <b>1:</b> Inverter is in alarm state.
8	Running	<b>0:</b> Motor is stopped. <b>1:</b> Inverter is running according to reference and command.
9	Enabled	<b>0:</b> Inverter is general disable. <b>1:</b> Inverter is general enable and ready to run motor.
10	Clockwise	<b>0:</b> Motor spinning counter clockwise. <b>1:</b> Motor spinning clockwise.
11	JOG	<b>0:</b> JOG function inactive. <b>1:</b> JOG function active.
12	Remote	<b>0:</b> Inverter in local mode. <b>1:</b> Inverter in remote mode.
13	Undervoltage	<b>0:</b> No undervoltage. <b>1:</b> With undervoltage.
14	Reserved	
15	Fault	<b>0:</b> Inverter is not in fault state. <b>1:</b> Some fault registered by the inverter.



**P0690 – Logical Status 2**

<b>Adjustable Range:</b>	0000h to FFFFh	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	NET, READ	

**Description:**

Parameter P0690 presents other signaling bits for functions exclusively implemented in the CFW501. The function of each bit of P0690 is described in [Table 7.4: Status word \(P0680\) on page 7-11](#).

**Table 7.4: Status word (P0680)**

BIT	Function	Description
0 to 3	Reserved	
4	Fs reduction	<b>0:</b> Output frequency reduction inactive. <b>1:</b> Output frequency reduction active.
5	Sleep State	
6	Deceleration Ramp	<b>0:</b> No deceleration. <b>1:</b> Inverter decelerating.
7	Acceleration Ramp	<b>0:</b> No acceleration. <b>1:</b> Inverter accelerating.
8	Freeze Ramp	<b>0:</b> Ramp operating in normal conditions. <b>1:</b> The path of the ramp is frozen by some command source or internal function..
9	Setpoint Ok	<b>0:</b> Output frequency has not reached reference yet. <b>1:</b> Output frequency reached reference.
10	DC link regulation	<b>0:</b> DC link regulation or current limitation inactive. <b>1:</b> DC link regulation or current limitation active (P0150).
11	Configuration in 50 Hz	<b>0:</b> Factory default loaded in 1800 rpm / 60 Hz (P0204 = 5). <b>1:</b> Factory default loaded in 1500 rpm / 50 Hz (P0204 = 6).
12	Ride-Through	<b>0:</b> No execution of Ride-Through. <b>1:</b> Executing Ride-Through.
13	Flying-Start	<b>0:</b> No execution of Flying Start. <b>1:</b> Executing Flying Start.
14	DC Braking	<b>0:</b> DC braking inactive. <b>1:</b> DC braking active.
15	PWM Pulses	<b>0:</b> PWM voltage pulses in the output disabled. <b>1:</b> PWM voltage pulses in the output enabled.

**P0682 – Serial / USB Control**

<b>Adjustable Range:</b>	0000h to FFFFh	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	NET	

**Description:**

The inverter control word for a certain source is accessible for reading and writing, but read only access is permitted for the other sources. The inverter has a common word for interface, which is defined by the function of its bits separately as per [Table 7.5: Control word \(P0682\) on page 7-12](#).

*Table 7.5: Control word (P0682)*

BIT	Function	Description
0	Enable Ramp	<b>0:</b> Stops the motor by deceleration ramp. <b>1:</b> Turn the motor according to the acceleration ramp until reaching the speed reference value.
1	Enable General	<b>0:</b> Disable the inverter completely, interrupting the power supply to the motor. <b>1:</b> Enable completely the inverter, allowing the operation of the motor.
2	Run Clockwise	<b>0:</b> Run the motor in the opposite direction of the reference signal (counter clockwise). <b>1:</b> Run the motor in direction of the reference signal (clockwise).
3	JOG Enable	<b>0:</b> Disable JOG function. <b>1:</b> Enable JOG function.
4	Remote	<b>0:</b> Inverter goes into local mode. <b>1:</b> Inverter goes into remote mode.
5	2 <sup>nd</sup> Ramp	<b>0:</b> Acceleration and deceleration ramp by P0100 and P0101. <b>1:</b> Acceleration and deceleration ramp by P0102 and P0103.
6	Quick Stop	<b>0:</b> It does not execute the fast stop command. <b>1:</b> It executes the fast stop command.
7	Fault Reset	<b>0:</b> No function. <b>1:</b> If in fault state, reset the fault.
8 to 12	Reserved	
13	Internal PID Controller	<b>0:</b> Automatic. <b>1:</b> Manual.
14	External PID Controller	<b>0:</b> Automatic. <b>1:</b> Manual.
15	Reserved	

## P0229 – Stop Mode

<b>Adjustable Range:</b>	0 = Ramp to Stop 1 = Coast to Stop 2 = Quick Stop	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	I/O	

**Description:**

This parameter defines the motor stop mode when the inverter receives the "Stop" command. [Table 7.6: Selection of stop mode on page 7-13](#) describes the options of this parameter.

*Table 7.6: Selection of stop mode*

P0229	Description
0	The inverter will apply the stop ramp programmed in P0101 and/or P0103.
1	The motor will run free until it stops.
2	The inverter will apply the stop ramp programmed in P0106.

**NOTE!** When the stop by inertia mode is programmed and the Flying-Start function is disabled, only activate the motor if it is stopped.

**NOTE!** This parameter is applied to all the inverter command sources, but it was created aiming at allowing the command P0229 via HMI to be able to disable the motor by inertia instead of deceleration ramp. In this way, when P0229 = 1, bit 0 of the control word (Ramp Enable) has a function similar to bit 1 (General Enable). The same way, the digital input functions such as: Run-Stop, forward/reverse run and command with three wires turn off the motor by inertia in this condition of P0229.

### 7.3.1 Control via HMI Inputs

Contrary to the network interfaces and SoftPLC, the HMI commands do not access the inverter control word directly, because of limitations of key functions and HMI behavior. The HMI behavior is described in [chapter 4 HMI AND BASIC PROGRAMMING on page 4-1](#).

### 7.3.2 Control via Digital Inputs

Contrary to the network interfaces and SoftPLC, the digital inputs do not access the inverter control word directly, because there are several functions for the DIx that make the envelopment according to the application. Such digital input functions are described in details in [chapter 12 DIGITAL AND ANALOG INPUTS AND OUTPUTS on page 12-1](#).

## 8 AVAILABLE MOTOR CONTROL TYPES

The inverter feeds the motor with variable voltage, current and frequency, providing control of the motor speed. The values applied to the motor follow a control strategy, which depends on the selected type of motor control and on the inverter parameter settings.

The selection of the proper control type for the application depends on the static and dynamic requirements of torque and speed of the driven load, that is, the control type is directly connected to the required performance. Besides, the setting of the parameters involved is essential to reach such performance.

The CFW501 is equipped with two control modes for the three-phase induction motor, that are:

- **V/f Scalar Control:** for basic applications without output speed control.
- **VVW Sensorless Vector Control:** for applications that need high performance in the control of the output speed.

In [chapter 9 V/f SCALAR CONTROL on page 9-1](#) and [chapter 10 VVW VECTOR CONTROL on page 10-1](#), each of these kinds of control, related parameters and directions regarding the use of each of these modes are described in details.

### P0202 – Control Type

<b>Adjustable Range:</b>	0 to 2 = V/f 3 = VVW	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="STARTUP"/>		

#### Description:

This parameter selects the kind of three-phase induction motor control used.



#### NOTE!

When the VVW mode is programmed via HMI (P0202 = 3), the STARTUP menu is activated automatically, forcing an oriented start-up for vector mode setting. See [chapter 10.2 START-UP IN VVW MODE on page 10-8](#).

### P0139 – Output Current Filter

<b>Adjustable Range:</b>	0 to 9999 ms	<b>Factory Setting:</b>	50 ms
<b>Properties:</b>	V/f, VVW		

#### Description:

Time constant of the filter for the total and active output current. You must consider a filter response time equal to three times the time constant set in P0139 (50 ms).

## P0140 – Sleep Compensation Filter

<b>Adjustable Range:</b>	0 to 9999 ms	<b>Factory Setting:</b>	500 ms
<b>Properties:</b>	VVW		

### Description:

Time constant of the filter for slip compensation in the output frequency. You must consider a filter response time equal to three times the time constant set in P0140 (500 ms).

## P0397 – Control Configuration

<b>Adjustable Range:</b>	0000h to 000Fh	<b>Factory Setting:</b>	000Bh
<b>Properties:</b>	cfg		

### Description:

The bits of parameter P0397, as shown in [Table 8.1: Options available to configure the control \(P0397\) on page 8-3](#), enable a series of internal options to configure the control of the induction motor, such as:

#### ■ Slip Compensation during the Regeneration (Bit 0)

The regeneration is an operating mode of the inverter which occurs when the power flux goes from the motor to the inverter. The bit 0 of P0397 (set in 0) allows the slip compensation to be turned off in this situation. This option is particularly useful when the compensation during the motor deceleration is necessary.

#### ■ Dead Time Compensation (Bit 1)

The dead time is a time interval introduced in the PWM necessary for the commutation of the power inverter bridge. On the other hand, the dead time generates distortions applied to the motor, which can cause torque reduction at low speeds and current oscillation in motors above 5 HP running with no load. Thus, the dead time compensation measures the voltage pulse width in the output and compensates this distortion introduced by the dead time.

Bit 1 of P0397 (set in 0) allows deactivating this compensation. This feature is useful when there is a problem related to the inverter internal circuit for pulse feedback causing fault F0182. Thus, the compensation, and consequently the fault, can be disabled.

#### ■ Output Current Stabilization (Bit 2)

High-performance motors with power above 5 HP are marginally stable when driven by frequency inverters and at operation with no load. Therefore, in this situation a resonance may occur in the output current which may reach the overcurrent level F0070. Bit 2 of P0397 (set to 1) activates an algorithm for regulation of the output current in closed loop which neutralizes the oscillations of resonant output current.

#### ■ Reduction of P0297 at high temperature (Bit 3)

Bit 3 of P0397 controls the overtemperature protection action according to [section 14.4 IGBTs OVERTEMPERATURE PROTECTION \(F0051 AND A0050\) on page 14-6](#).



### ATTENTION!

The default setting of P0397 meets most application needs of the inverter. Therefore, avoid modifying its content without knowing the related consequences. If you are not sure, contact WEG Technical Assistance before changing P0397.

*Table 8.1: Options available to configure the control (P0397)*

P0397	Bit 3	Bit 2	Bit 1	Bit 0
	Reduction of P0297 in A0050	Output Current Stabilization	Compensation of Dead Time	Slip Compensation During Regeneration
0000h	Disabled	Disabled	Disabled	Disabled
0001h	Disabled	Disabled	Disabled	Enabled
0002h	Disabled	Disabled	Enabled	Disabled
0003h	Disabled	Disabled	Enabled	Enabled
0004h	Disabled	Enabled	Disabled	Disabled
0005h	Disabled	Enabled	Disabled	Enabled
0006h	Disabled	Enabled	Enabled	Disabled
0007h	Disabled	Enabled	Enabled	Enabled
0008h	Enabled	Disabled	Disabled	Disabled
0009h	Enabled	Disabled	Disabled	Enabled
000Ah	Enabled	Disabled	Enabled	Disabled
000Bh	Enabled	Disabled	Enabled	Enabled
000Ch	Enabled	Enabled	Disabled	Disabled
000Dh	Enabled	Enabled	Disabled	Enabled
000Eh	Enabled	Enabled	Enabled	Disabled
000Fh	Enabled	Enabled	Enabled	Enabled

## 9 V/f SCALAR CONTROL

This is the classical control method for three-phase induction motors, based on a curve that relates output frequency and voltage. The inverter works as a variable frequency voltage source, generating a combination of voltage and frequency according to the configured curve. It is possible to adjust this curve for standard 50 HZ or 60 HZ or special motors.

According to the block diagram of [Figure 9.1: Block diagram of V/f scale control on page 9-2](#), the speed reference  $f^*$  is limited by P0133 and P0134 and applied to the input of "V/f CURVE" block input, where the output voltage amplitude and frequency imposed to the motor are obtained. For further details on the speed reference, refer to [chapter 7 LOGICAL COMMAND AND SPEED REFERENCE on page 7-1](#).

By monitoring the total and active output current, and the DC link voltage, compensators and controllers which help protect the V/f control performance are implemented. The operation and parameterization of those blocks are detailed in [section 11.2 DC LINK VOLTAGE AND OUTPUT CURRENT LIMITATION on page 11-3](#).

The advantage of the V/f control is its simplicity and the need of few settings. The start-up is quick and simple and the factory default, and the factory default normally requires little or no modification. Besides, in cases where the application allows the proper adjustments of the V/f curve, you save energy.

The V/f or scalar Control is recommended for the following cases:

- Drive of several motors with the same inverter (multi-motor drive).
- Energy saving in the drive of loads with quadratic torque/speed relationship.
- Motor rated current lower than 1/3 of the inverter rated current.
- For test purposes, the inverter is turned on without motor or with a small motor with no load.
- Applications where the load connected to the inverter is not a three-phase induction motor.

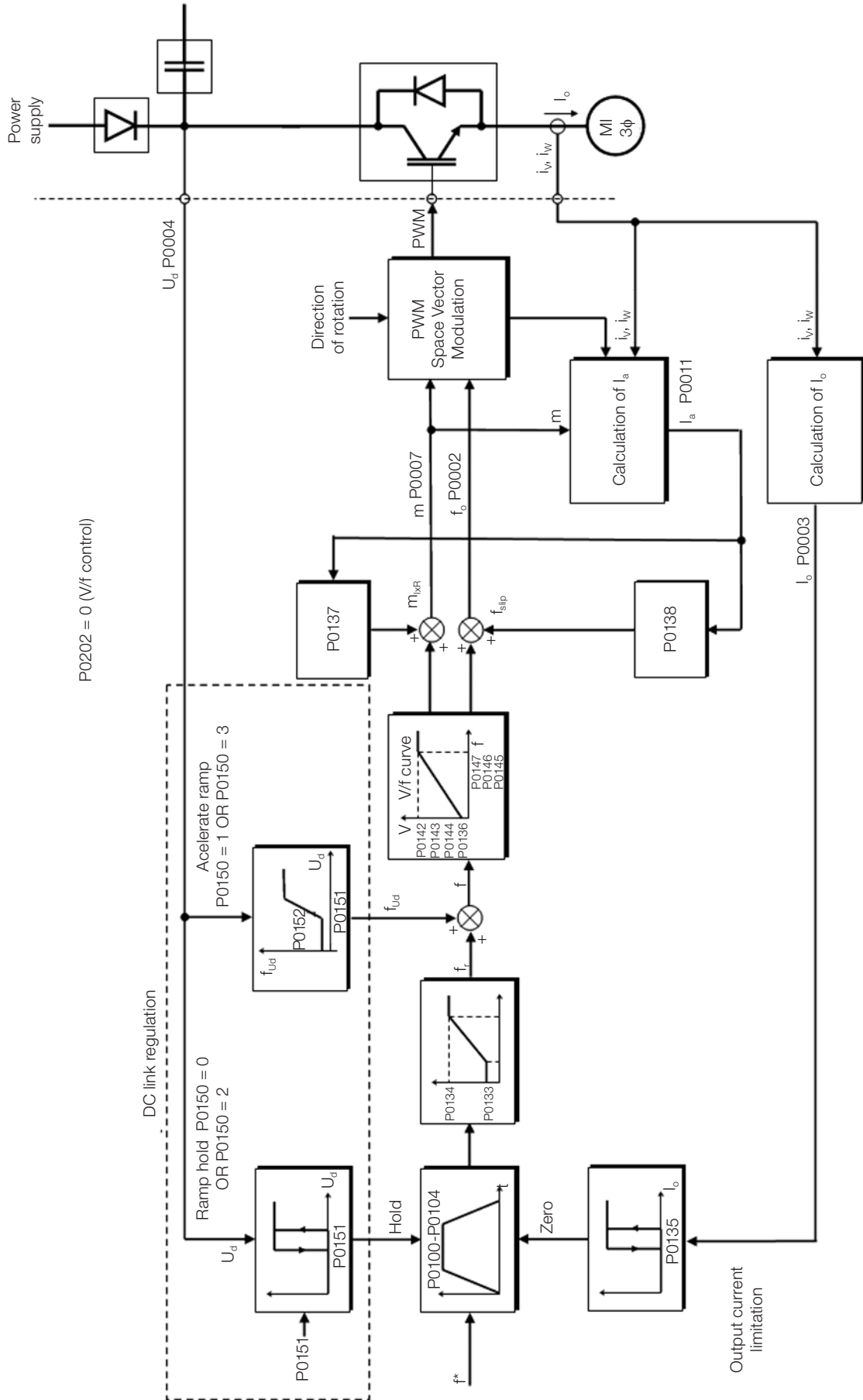


Figure 9.1: Block diagram of V/f scale control

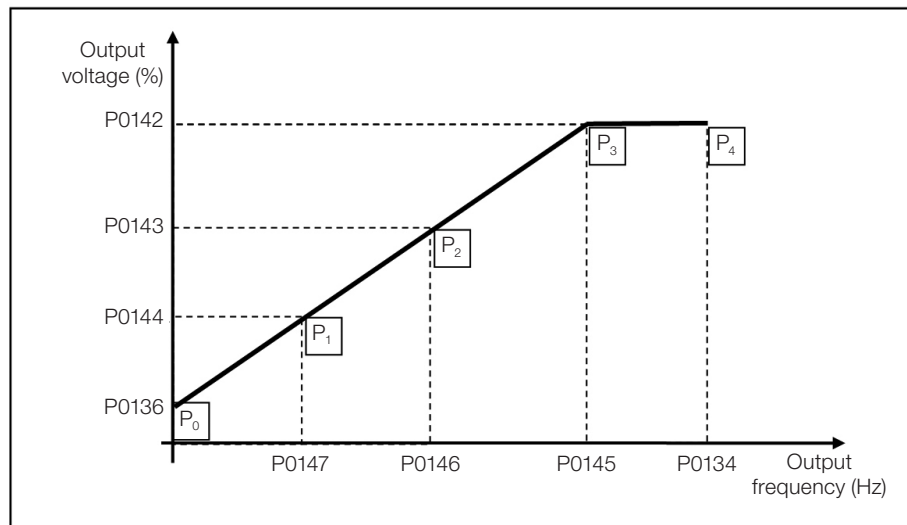


## 9.1 PARAMETERIZATION OF THE V/f SCALAR CONTROL

The scalar control is the inverter factory default control mode for its popularity and because it meets most applications of the market. However, parameter P0202 allows the selection of other options for the control mode, as per [chapter 8 AVAILABLE MOTOR CONTROL TYPES](#) on page 8-1.

The V/f curve is completely adjustable in five different points as shown in [Figure 9.2: Curve V/f](#) on page 9-3, although the factory default

defines a preset curve for motors (1500 rpm / 50 Hz) ou (1800 rpm / 60 Hz), as per options of P0204. In this format, point P0 defines the amplitude applied at 0 rpm, while P3 defines the rated amplitude and frequency and beginning of field weakening. Intermediate points P1 and P2 allow the setting of the curve for a non-linear relationship between torque and speed, for instance, in fans where the load torque is quadratic in relation to the speed. The field weakening region is determined between P<sub>3</sub> and P<sub>4</sub>, where the amplitude is maintained in 100 %.



**Figure 9.2:** Curve V/f

The CFW501 factory default settings define a linear relationship of the torque with the speed, overlapping points P1, P2 and P3 at 1500 rpm (50 Hz) or 1800 rpm (60 Hz); refer to the description of P0204. In this way, V/f curve is a straight line defined by just two points, P0136 which is the constant term or voltage in 0 Hz and the rated frequency and voltage operation point 1500 rpm (50 Hz) or 1800 rpm (60 Hz) and 100 % of maximum output voltage).

The points **P**<sub>0</sub>[P0136, 0 Hz], **P**<sub>1</sub>[P0144, P0147], **P**<sub>2</sub>[P0143, P0146], **P**<sub>3</sub>[P0142, P0145] and **P**<sub>4</sub>[100 %, P0134] can be adjusted so that the voltage and frequency relationship imposed to the output approximates the ideal curve for the load. Therefore, for loads in which the torque behavior is quadratic in relation to the speed, such as in centrifugal pumps and fans, the points of the curve can be adjusted so energy saving is obtained.



**NOTE!**

A V/f quadratic curve can be approximated by: P0136 = 0; P0144 = 11.1 % and P0143 = 44.4 %.



**NOTE!**

If P0147 ≥ P0146 or P0146 ≥ P0145 or the V/f curve results in a segment with slope (rate) above 10 % / Hz, CONFIG (CONF) status is activated.



**NOTE!**

In frequencies below 0.1 Hz, the output PWM pulses are cut, except when the inverter is in DC braking.

**P0136 – Manual Torque Boost**

<b>Adjustable Range:</b>	0.0 to 30.0 %	<b>Factory Setting:</b>	According to inverter model
<b>Properties:</b>	V/f		
<b>Access groups via HMI:</b>	BASIC, MOTOR		

**Description:**

This parameter actuates in low speeds, that is, in the range from 0 to P0147, increasing the inverter output voltage to compensate the voltage drop in the motor stator resistance so as to keep the torque constant.

The optimum setting is the smallest value of P0136 which allows the motor satisfactory start. A value greater than necessary will excessively increase the motor current at low speeds, which may lead the inverter to a fault condition (F0048, F0051 or F0070) or alarm condition (A0046, A0047 or A0050), as well as motor overheating. [Figure 9.3: Torque boost region on page 9-4](#) shows the region of actuation of the Torque Boost between points P<sub>0</sub> and P<sub>1</sub>.

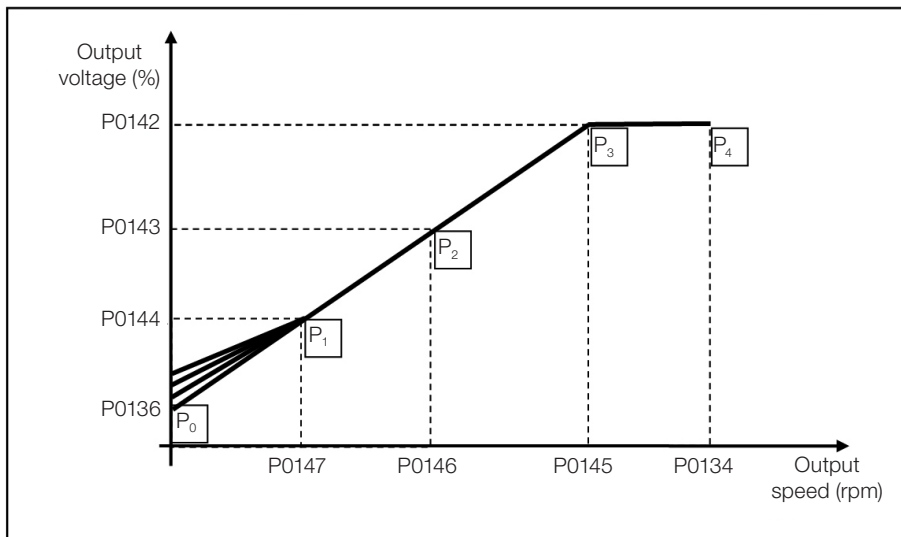


Figure 9.3: Torque boost region

**P0142 – Maximum Output Voltage**
**P0143 – Intermediate Output Voltage**
**P0144 – Minimum Output Voltage**

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	P0142 = 100.0 % P0143 = 66.7 % P0144 = 33.3 %
<b>Properties:</b>	cfg, V/f		

**Description:**

These parameters allow adjusting the inverter V/f curve together with its orderly pairs P0145, P0146 and P0147.

**P0145 – Field Weakening Start Speed**
**P0146 – Intermediate Output Speed**
**P0147 – Minimum Output Speed**

<b>Adjustable Range:</b>	0.0 to 18000	<b>Factory Setting:</b>	P0145 = 1800 (1500) rpm P0146 = 1200 (1000) rpm P0147 = 600 (500) rpm
<b>Properties:</b>	cfg, V/f		

**Description:**

These parameters allow adjusting the inverter V/f curve together with its orderly pairs P0142, P0143 and P0144.

The V/f curve can be adjusted in applications where the motor rated voltage is smaller than the power supply voltage, for instance, in a 440 V power supply with 380 V motor.

The adjustment of the V/f curve is necessary when a quadratic approximation is desired for energy saving in centrifugal pumps and fans, or in special applications: when a transformer is used between the inverter and the motor or the inverter is used as a power supply.

**P0137 – Automatic Torque Boost**

<b>Adjustable Range:</b>	0.0 to 30.0 %	<b>Factory Setting:</b>	0.0 %
<b>Properties:</b>	V/f		
<b>Access groups via HMI:</b>	MOTOR		

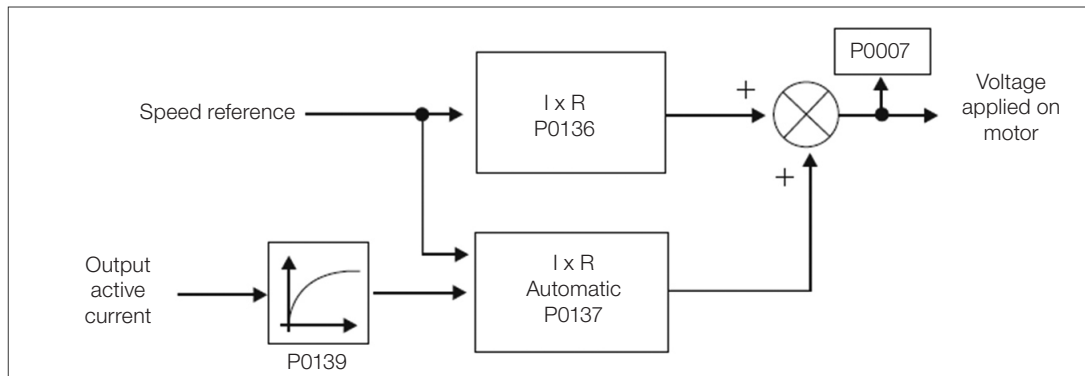
**Description:**

The automatic torque boost compensates the voltage drop in the stator resistance because of active current. Look at [Figure 9.1: Block diagram of V/f scale control on page 9-2](#), where variable  $m_{I \times R}$  corresponds to the automatic torque boost action on the modulation index defined by V/f curve.

P0137 actuates similarly to P0136, but the value set is applied proportionally to the output active current in relation to the maximum current ( $2 \times P0295$ ).

The setting criteria of P0137 are the same as those of P0136, that is, set the value as low as possible for the motor start and operation at low frequencies, because values above those increase the losses, heating and overload of the motor and inverter.

The block diagram of [Figure 9.4: Block diagram of the automatic torque boost on page 9-6](#) shows the automatic compensation action  $I \times R$  responsible for the increment of the voltage in the ramp output according to the increase of the active current.



*Figure 9.4: Block diagram of the automatic torque boost*

**P0138 – Slip Compensation**

<b>Adjustable Range:</b>	-10.0 % to 10.0 %	<b>Factory Setting:</b>	0.0 %
<b>Properties:</b>	V/f		
<b>Access groups via HMI:</b>	MOTOR		

**Description:**

Parameter P0138 is used in the motor slip compensation function, when set for positive values. In this case, it compensates the speed drop due to application of the load on the shaft and, consequently, the slip. In this way, it increments the output frequency ( $\Delta v$ ) considering the increase of the motor active current as shown in Figure 9.5: Slip compensation in an operation point of the standar V/f curve on page 9-7. In Figure 9.1: Block diagram of V/f scale control on page 9-2 this compensation is represented in the variable  $f_{slip}$ .

The setting in P0138 allows regulating with good accuracy the slip compensation by moving the operation point on the V/f curve, as shown in Figure 9.5: Slip compensation in an operation point of the standar V/f curve on page 9-7. Once P0138 is set, the inverter is able to keep the speed constant even with load variations.

Negative values are used in special applications where you wish to reduce the output speed considering the increase of the motor current.

E.g.: load distribution in motors driven in parallel.

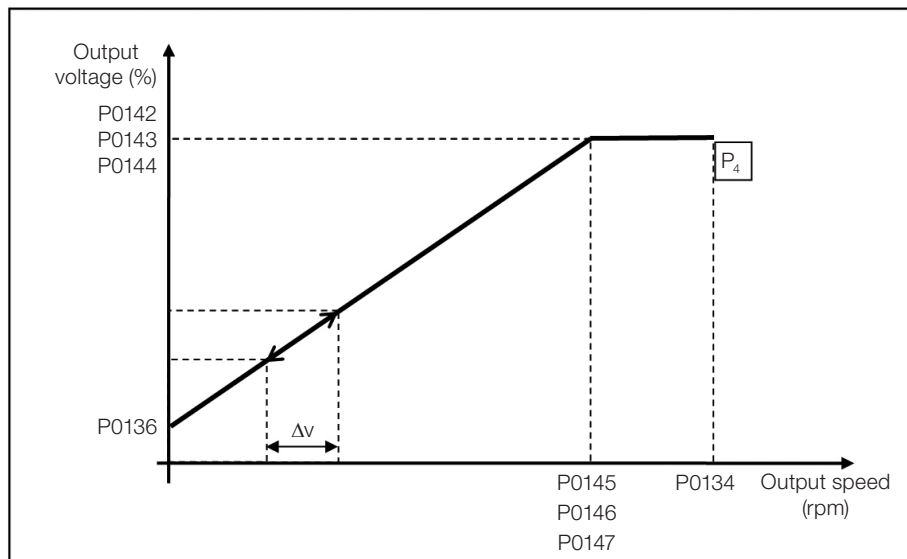


Figure 9.5: Slip compensation in an operation point of the standar V/f curve

## 9.2 START-UP IN V/f MODE

**NOTE!**

Read chapter 3 - Installation and Connection of the user's manual before installing, powering up or operating the inverter.

Sequence for installation, verification, power up and start-up.

1. Install the inverter: according to chapter 3 - Installation and Connection of the user's manual, making all the power and control connections.
2. Prepare and power up the inverter according to section 3.2 - Electric Installation of the user's manual of the CFW501.
3. Load the factory default with  $P0204 = 5$  (1800 rpm / 60 Hz) or  $P0204 = 6$  (1500 rpm / 50 Hz), according to the input rated frequency (power supply) of the inverter used.
4. In order to set a V/f curve different from the default, set the V/f curve using parameters P0136 to P0147.
5. Setting of specific parameters and functions for the application: program the digital and analog inputs and outputs, HMI keys, etc., according to the application requirements.

**For applications:**

- Simple applications that can use the factory default programming of the analog and digital inputs and outputs, use the HMI "BASIC" menu.
- Applications that require just the analog and digital inputs and outputs with programming different from the factory default, use the HMI "I/O" menu.
- Applications that require functions such as flying start, ride-through, DC braking, rheostatic braking, etc., access and modify the parameter of those functions in the HMI "PARAM" menu.

## 10 VVW VECTOR CONTROL

The VVW vector control mode (Voltage Vector WEG) uses a control method with a much higher performance than the V/f control because of the load torque estimation and of the control of the magnetic flux in the air gap, as per scheme of [Figure 10.1: VVW control flow on page 10-2](#). In this control strategy, losses, efficiency, rated slip and power factor of the motor are considered in order to improve the control performance.

The main advantage compared to the V/f control is the best speed regulation with greater torque capacity at low speeds (frequencies below 5 Hz), allowing a relevant improvement in the drive performance in permanent duty. Besides, the VVW control has a quick and simple setting and it is suitable for most medium-performance applications in the control of three-phase induction motor.

By just measuring the output current, the VVW control instantly obtains the motor torque and slip. Thus, the VVW actuates in the output voltage compensation and slip compensation. Therefore, the VVW controller action replaces the classical V/f functions in P0137 and P0138, but with a calculation model much more sophisticated and accurate, meeting several load conditions or operation points of the application.

In order to achieve a good speed regulation in permanent duty, the parameter setting in the range from P0399 to P0407 and the stator resistance in P0409 are essential for the good operation of the VVW control. Those parameters can easily be obtained on the motor nameplate and in the self-tuning routine activated by P0408.

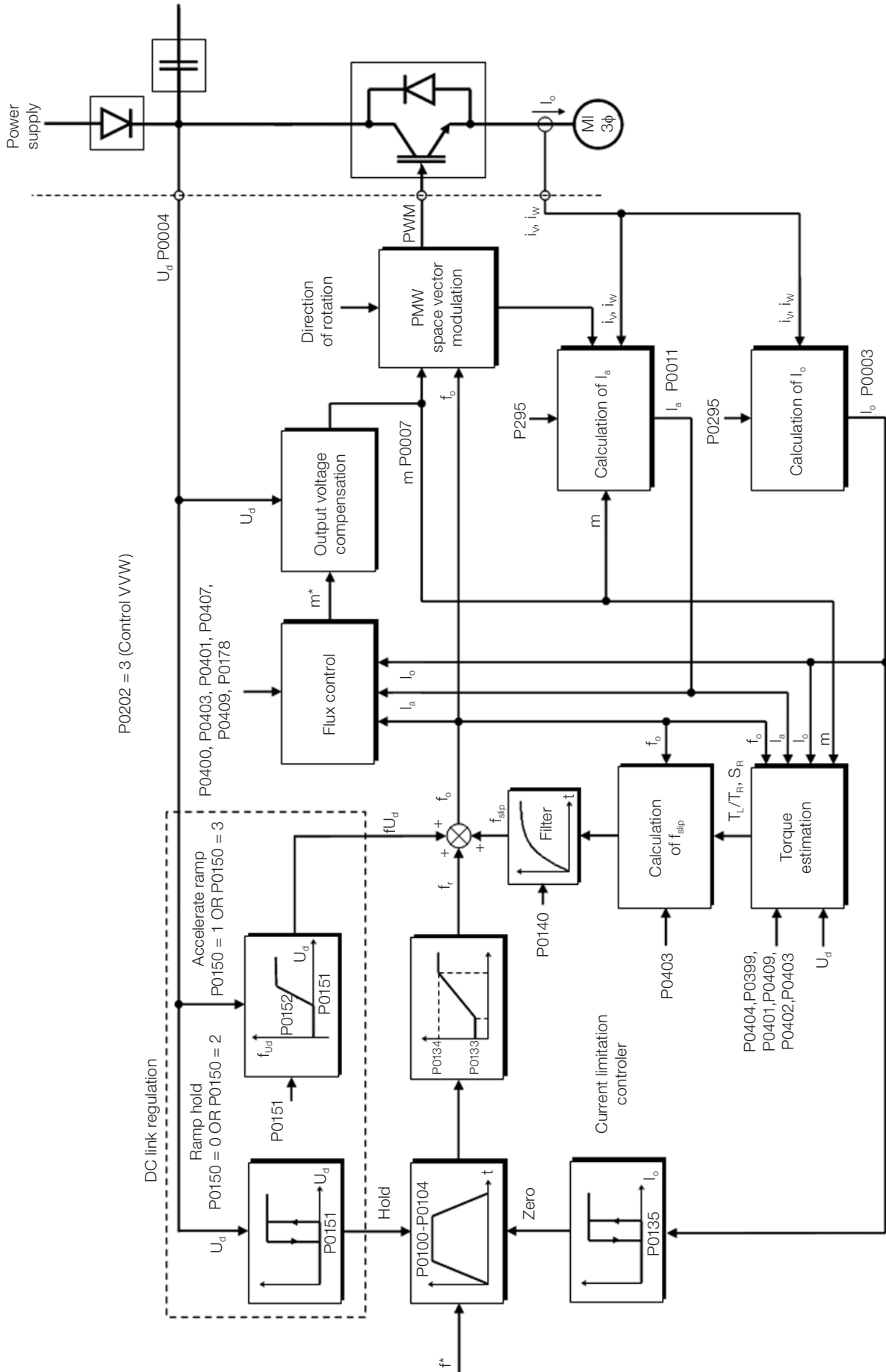


Figure 10.1: VVW control flow



## 10.1 VVW VECTOR CONTROL PARAMETERIZATION

The VVW control mode is selected by parameter P0202, control mode selection, as described in [chapter 8 AVAILABLE MOTOR CONTROL TYPES](#) on page 8-1.

Opposite to the V/f scalar control, the VVW control requires a series of data from the motor nameplate and a self-tuning for its proper operation. Besides, it is recommended that the driven motor match the inverter, that is, the motor and inverter power be as close as possible.

The VVW control setting process is simplified by the HMI "STARTUP" menu, where the relevant parameters for the configuration of the VVW are selected for browsing the HMI.

Below are described the parameters to configure the VVW vector control setting. Those data are easily obtained on the nameplate of WEG motors; however, in old motors or motor of other manufacturers, this information may not be available. In those cases, it is recommended first contact the motor manufacturer, measure or calculate the desired parameter, or, still, make a relationship with [Table 10.1: Characteristics of IV pole WEG standard motors](#) on page 10-3 and use the equivalent or approximate WEG standard motor parameter.


**NOTE!**

The correct setting of the parameters directly contributes to the VVW control performance.

*Table 10.1: Characteristics of IV pole WEG standard motors*

Power [P0404]		Frame	Voltage [P0400] (V)	Current [P0401] (A)	Frequency [P0403] (Hz)	Speed [P0402] (rpm)	Efficiency [P0399] (%)	Power Factor [P0407]	Stator Resistance [P0409] (Ω)
(CV)	(kW)								
0.16	0.12	63	220	0.85	60	1720	56.0	0.66	21.77
0.25	0.18	63		1.12		1720	64.0	0.66	14.87
0.33	0.25	63		1.42		1720	67.0	0.69	10.63
0.50	0.37	71		2.07		1720	68.0	0.69	7.37
0.75	0.55	71		2.90		1720	71.0	0.70	3.97
1.00	0.75	80		3.08		1730	78.0	0.82	4.13
1.50	1.10	80		4.78		1700	72.7	0.83	2.78
2.00	1.50	90S		6.47		1720	80.0	0.76	1.55
3.00	2.20	90L		8.57		1710	79.3	0.85	0.99
4.00	3.00	100L		11.6		1730	82.7	0.82	0.65
5.00	3.70	100L		13.8		1730	84.6	0.83	0.49
6.00	4.50	112M		16.3		1730	84.2	0.86	0.38
7.50	5.50	112M		20.0		1740	88.5	0.82	0.27
10.0	7.50	132S		26.6		1760	89.0	0.84	0.23
12.5	9.20	132M	33.0	1755	87.7	0.86	0.16		
0.16	0.12	63	380	0.49	60	1720	56.0	0.66	65.30
0.25	0.18	63		0.65		1720	64.0	0.66	44.60
0.33	0.25	63		0.82		1720	67.0	0.69	31.90
0.50	0.37	71		1.20		1720	68.0	0.69	22.10
0.75	0.55	71		1.67		1720	71.0	0.70	11.90
1.00	0.75	80		1.78		1730	78.0	0.82	12.40
1.50	1.10	80		2.76		1700	72.7	0.83	8.35
2.00	1.50	90S		3.74		1720	80.0	0.76	4.65
3.00	2.20	90L		4.95		1710	79.3	0.85	2.97
4.00	3.00	100L		6.70		1730	82.7	0.82	1.96
5.00	3.70	100L		7.97		1730	84.6	0.83	1.47
6.00	4.50	112M		9.41		1730	84.2	0.86	1.15
7.50	5.50	112M		11.49		1740	88.5	0.82	0.82
10.0	7.50	132S		15.18		1760	89.0	0.84	0.68
12.5	9.20	132M		18.48		1755	87.7	0.86	0.47
15.0	11.0	132M		22.7		1755	88.5	0.83	0.43
20.0	15.0	160M		30.0		1760	90.2	0.83	0.23

Power [P0404]		Frame	Voltage [P0400] (V)	Current [P0401] (A)	Frequency [P0403] (Hz)	Speed [P0402] (rpm)	Efficiency [P0399] (%)	Power Factor [P0407]	Stator Resistance [P0409] (Ω)
(CV)	(kW)								
0.16	0.12	63	230	0.73	50	1375	57.0	0.72	30.62
0.25	0.18	63		1.05		1360	58.0	0.74	20.31
0.33	0.25	71		1.4		1310	59.0	0.76	14.32
0.50	0.37	71		1.97		1320	62.0	0.76	7.27
0.75	0.55	80		2.48		1410	68.0	0.82	5.78
1.00	0.75	80		3.23		1395	72.0	0.81	4.28
1.50	1.10	90S		4.54		1420	77.0	0.79	2.58
2.00	1.50	90L		5.81		1410	79.0	0.82	1.69
3.00	2.20	100L		8.26		1410	81.5	0.82	0.98
4.00	3.00	100L		11.3		1400	82.6	0.81	0.58
5.00	3.70	112M	14.2	1440	85.0	0.83	0.43		
7.50	5.50	132S	19.1	1450	86.0	0.84	0.25		
10.0	7.50	132M	25.7	1455	87.0	0.84	0.20		
0.16	0.12	63	400	0.42	50	1375	57.0	0.72	91.85
0.25	0.18	63		0.60		1360	58.0	0.74	60.94
0.33	0.25	71		0.80		1310	59.0	0.76	42.96
0.50	0.37	71		1.13		1320	62.0	0.76	21.81
0.75	0.55	80		1.42		1410	68.0	0.82	17.33
1.00	0.75	80		1.86		1395	72.0	0.81	12.85
1.50	1.10	90S		2.61		1420	77.0	0.79	7.73
2.00	1.50	90L		3.34		1410	79.0	0.82	5.06
3.00	2.20	100L		4.75		1410	81.5	0.82	2.95
4.00	3.00	100L		6.47		1400	82.6	0.81	1.75
5.00	3.70	112M		8.18		1440	85.0	0.83	1.29
7.50	5.50	132S		11.0		1450	86.0	0.84	0.76
10.0	7.50	132M		14.8		1455	87.0	0.84	0.61
15.0	11.0	160M		22.1		1455	88.5	0.81	0.35
20.0	15.0	160L		29.1		1460	89.7	0.83	0.24

### P0178 – Rated Flux

**Adjustable Range:** 0.0 to 150.0 % **Factory Setting:** 100.0 %

**Properties:**

**Access groups via HMI:**

**Description:**

It defines the desired flux in the motor air gap in percentage (%) of the rated flux. In general, it is not necessary to modify the value of P0178 of the standard value of 100 %. However, some specific situations may use values slightly above to increase the torque, or below to reduce the energy consumption.

### P0398 – Motor Service Factor

**Adjustable Range:** 1.00 to 1.50 **Factory Setting:** 1.00

**Properties:** cfg

**Access groups via HMI:**

**Description:**

It is the continuous overload capability, i.e., a reserve of power that gives the motor the capability to withstand working in adverse conditions.

Set it according to the value informed on the motor nameplate.

It affects the motor overload protection.

### P0399 – Motor Rated Efficiency

<b>Adjustable Range:</b>	50.0 to 99.9 %	<b>Factory Setting:</b>	75.0 %
<b>Properties:</b>	cfg, VVW		
<b>Access groups via HMI:</b>	MOTOR, STARTUP		

**Description:**

This parameter is important for the precise operation of the VVW control. The imprecise setting will cause the incorrect calculation of the slip compensation and consequent speed control imprecision.

### P0400 – Motor Rated Voltage

<b>Adjustable Range:</b>	200 to 600 V	<b>Factory Setting:</b>	According to <a href="#">Table 10.2: Default setting of P0400 according to the identified inverter model on page 10-5</a>
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	MOTOR, STARTUP		

**Description:**

Set according to the data on the motor nameplate and the wire connection on the motor terminal box. This value cannot be above the rated voltage value set in P0296 (power supply rated voltage).



**NOTE!**

In order to validate a new setting of P0400 out of the HMI "STARTUP" menu, it's necessary to power cycle the inverter.

*Table 10.2: Default setting of P0400 according to the identified inverter model*

P0296	P0145 (Hz)	P0400 (V)
0	50.0	230
	60.0	220
1	50.0	400
	60.0	380
2	50.0	525
	60.0	575

For further information on model identification, refer to [Table 6.2: Identification of the CFW501 models for frames A, B, C, D and E on page 6-2.](#)

### P0401 – Motor Rated Current

<b>Adjustable Range:</b>	0 to 200.0 A	<b>Factory Setting:</b>	$1.0 \times I_{nom}$
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

### P0402 – Motor Rated Speed

<b>Adjustable Range:</b>	0 to 30000 rpm	<b>Factory Setting:</b>	1710 rpm (1425 rpm)
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

### P0403 – Motor Rated Frequency

<b>Adjustable Range:</b>	0 to 500 Hz	<b>Factory Setting:</b>	60 Hz (50 Hz)
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

### P0404 – Motor Rated Power

<b>Adjustable Range:</b>	0 = 0.16 hp (0.12 kW) 1 = 0.25 hp (0.19 kW) 2 = 0.33 hp (0.25 kW) 3 = 0.50 hp (0.37 kW) 4 = 0.75 hp (0.55 kW) 5 = 1.00 hp (0.75 kW) 6 = 1.50 hp (1.10 kW) 7 = 2.00 hp (1.50 kW) 8 = 3.00 hp (2.20 kW) 9 = 4.00 hp (3.00 kW) 10 = 5.00 hp (3.70 kW) 11 = 5.50 hp (4.00 kW) 12 = 6.00 hp (4.50 kW) 13 = 7.50 hp (5.50 kW) 14 = 10.00 hp (7.50 kW) 15 = 12.50 hp (9.00 kW) 16 = 15.00 hp (11.00 kW) 17 = 20.00 hp (15.00 kW) 18 = 25.00 hp (18.50 kW) 19 = 30.00 hp (22.00 kW)	<b>Factory Setting:</b>	According to inverter model
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

### P0407 – Motor Rated Power Factor

<b>Adjustable Range:</b>	0.50 to 0.99	<b>Factory Setting:</b>	0.80
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

**Description:**

The setting of parameters P0398, P0399, P0401, P0402, P0403, P0404 and P0407 must be according to the nameplate data of the used motor, taking into account the motor voltage.

### P0408 – Self-tuning

<b>Adjustable Range:</b>	0 = Inactive 1 = No Rotation	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg, VVW		
<b>Access groups via HMI:</b>	<input type="text" value="STARTUP"/>		

**Description:**

Parameter P0408 in 1 activates the self-tuning of the VVW mode, where the motor stator resistance is measured. The self-tuning can only be activated via HMI, and it can be interrupted at any time with the key.

During the self-tuning, the motor remains still, because a direct current signal is sent to measure the stator resistance.

If the estimated value of the motor stator resistance is too high for the inverter used (for example: motor not connected or motor too small for the inverter) the inverter indicates fault F0033.

At the end of the self-tuning process, the measured motor stator resistance is saved in P0409.

### P0409 – Stator Resistance

<b>Adjustable Range:</b>	0.01 to 99.99 Ω	<b>Factory Setting:</b>	According to inverter model
<b>Properties:</b>	cfg, VVW		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

**Description:**

Motor phase stator resistance in ohms (Ω), assuming a star (Y) motor connection.

If the value adjusted in P0409 is too high or too low for the inverter used, the inverter indicates fault F0033. In order to exit this condition, just perform a reset by using the key. In this case, P0409 will be loaded with the factory default value which is equivalent to WEG IV pole standard motor stator resistance with power matched to the inverter, as per [Table 10.1: Characteristics of IV pole WEG standard motors on page 10-3](#).


## 10.2 START-UP IN VVW MODE



**NOTE!**

Read chapter 3 - Installation and Connection of the user's manual before installing, powering up or operating the inverter.

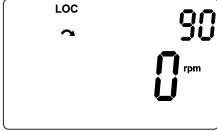







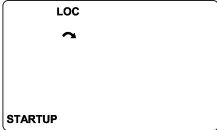







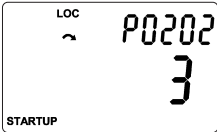
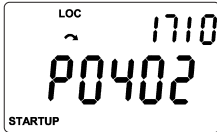









Sequence for installation, verification, power up and start-up.

1. Install the inverter according to chapter 3 - Installation and Connection of the user's manual, making all the power and control connections.
2. Prepare and power up the inverter according to section 3.2 - Electric Installation of the user's manual.
3. Load the correct factory default in P0204 based on the motor rated frequency (set P0204 = 5 for 1800 rpm (60 Hz) or P0204 = 6 to 1500 rpm (50 Hz).
4. Parameter and function setting specific for the application: program the digital and analog inputs and outputs, HMI keys, etc., according to the application requirements;
5. Activation of the VVW control: using the HMI "STARTUP" menu, the browsing is limited to the relevant parameters to set the control mode. Set P0202 = 3; then the "STARTUP" menu will browse the relevant parameters to set the VVW;
6. Parameterization of the VVW control: browsing the "STARTUP" menu, set parameters P0398, P0399, P0400, P0401, P0402, P0403, P0404 and P0407 according to the data on the motor nameplate. If some of those data are not available, insert the approximate value by calculation or similarity to WEG standard motor – see [Table 10.1: Characteristics of IV pole WEG standard motors on page 10-3](#).
7. Self-Tuning of the VVW control: The self-tuning is activated by setting P0408 = 1. In this process, the inverter applies DC to the motor to measure the stator resistance, while the HMI bar graph shows the progress of the self-tuning. The self-tuning process can be interrupted at any time by pressing the  key.
8. End of the Self-Tuning: at end of the self-tuning, the HMI returns to the browsing menu, the bar displays the parameter programmed by P0207 again and the stator resistance measured is stored in P0409. On the other hand, if the self-tuning fails, the inverter will indicate a fault. The most common fault in this case is F0033, which indicates error in the estimated stator resistance. Refer to [chapter 14 FAULTS AND ALARMS on page 14-1](#).

**For applications:**

- That can use the factory default programming of the analog and digital inputs and outputs, use the HMI "BASIC" menu.
- That require just the analog and digital inputs and outputs with programming different from the factory default, use the HMI "I/O" menu.
- That require functions such as flying start, ride-through, DC braking, rheostatic braking, etc., access and modify the parameter of those functions in the HMI "PARAM" menu. For further information on the HMI menus, refer to [chapter 5 BASIC INSTRUCTIONS FOR PROGRAMMING AND SETTINGS on page 5-1](#).

For better visualization of the start-up in the VVW mode, check [Figure 10.2: Start-up of the VVW mode on page 10-10](#), below.

Seq	Action/Indication on the Display	Seq	Action/Indication on the Display
1	 <ul style="list-style-type: none"> <li>Monitoring mode.</li> <li>Press the <b>ENTER/MENU</b> key to enter the 1<sup>st</sup> level of the programming mode.</li> </ul>	6	 <ul style="list-style-type: none"> <li>Press the  key to proceed with the Startup of the VVW.</li> </ul>
2	 <ul style="list-style-type: none"> <li>The <b>PARAM</b> group is selected; press the  or  key until selecting the <b>STARTUP</b> group.</li> </ul>	7	 <ul style="list-style-type: none"> <li>If necessary, modify the content of P0399 – Motor rated efficiency, or press the  key for the next parameter.</li> </ul>
3	 <ul style="list-style-type: none"> <li>When the <b>STARTUP</b> group is selected, press the <b>ENTER/MENU</b> key.</li> </ul>	8	 <ul style="list-style-type: none"> <li>If necessary, modify the content of P0400 – Motor rated voltage or press the  key for the next parameter.</li> </ul>
4	 <ul style="list-style-type: none"> <li>Press <b>ENTER/MENU</b> and with the  and  keys set the value 3, which activates VVW control mode.</li> </ul>	9	 <ul style="list-style-type: none"> <li>If necessary, modify the content of P0401 – Motor rated current, or press the  key for the next parameter.</li> </ul>
5	 <ul style="list-style-type: none"> <li>Press <b>ENTER/MENU</b> to save the modification of P0202.</li> </ul>	10	 <ul style="list-style-type: none"> <li>If necessary, modify the content of P0402 – Motor rated speed, or press the  key for the next parameter.</li> </ul>
11	 <ul style="list-style-type: none"> <li>If necessary, modify the content of P0403 – Motor rated frequency, or press the  key for the next parameter.</li> </ul>	16	 <ul style="list-style-type: none"> <li>At the end of the Self-Tuning. The values of P0408 automatically return to “0”, as well as the “<b>RUN</b>” and “<b>CONF</b>” status are erased.</li> <li>Press the  key for the next parameter.</li> </ul>
12	 <ul style="list-style-type: none"> <li>If necessary, modify the content of P0404 – Motor rated power, or press the  key for the next parameter.</li> </ul>	17	 <ul style="list-style-type: none"> <li>The result of the Self-Tuning is the value in ohms of the stator resistance shown in P0409. This is the last parameter of the Self-Tuning of the VVW control mode. Pressing the  key returns to the initial parameter P0202.</li> </ul>



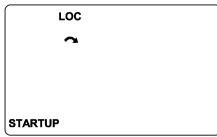

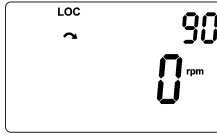


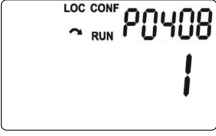
Seq	Action/Indication on the Display	Seq	Action/Indication on the Display
13	 <ul style="list-style-type: none"> <li>■ If necessary, modify the content of P0407 – Motor rated power factor, or press the  key for the next parameter.</li> </ul>	18	 <ul style="list-style-type: none"> <li>■ To exit the <b>STARTUP</b> menu, just press <b>BACK/ESC</b>.</li> </ul>
14	 <ul style="list-style-type: none"> <li>■ At this point, the HMI shows the option to do the <b>Self-Tuning</b>. Whenever possible, execute the self-tuning. To activate the self-tuning, change the value of P0408 to 1.</li> </ul>	19	 <ul style="list-style-type: none"> <li>■ By means of the  and  keys, select the desired menu or press <b>BACK/ESC</b> again to return directly to the HMI monitoring mode.</li> </ul>
15	 <ul style="list-style-type: none"> <li>■ During the self-tuning, the HMI will simultaneously indicate the <b>“RUN”</b> and <b>“CONF”</b> status. And the bar indicates the operation progress.</li> </ul>		

Figure 10.2: Start-up of the VVW mode



## 11 FUNCTIONS COMMON TO ALL THE CONTROL MODES

This chapter describes the functions common to all the inverter control modes V/f and VVW, but which interferes in the drive performance.

### 11.1 RAMPS

The inverter ramp functions allow the motor to accelerate or decelerate faster or slower. They are adjusted by parameters that define the linear acceleration time between zero and the maximum speed (P0134) and the time for a linear deceleration from the maximum speed to zero.

In the CFW501, three ramps with different functions were implemented:

- 1<sup>st</sup> Ramp – standard for most functions.
- 2<sup>nd</sup> Ramp – it may be activated by the user, according to the drive requirement, by means of the inverter command word or by a digital input.
- 3<sup>rd</sup> Ramp – it is used for the inverter protection functions, such as: current limitation, DC link control, quick stop, etc. The 3<sup>rd</sup> Ramp has priority over the other ramps.



**NOTE!**

The setting with too short ramp time may cause overcurrent in the output (F0070), undervoltage (F0021) or overvoltage (F0022) of the DC link.

#### P0100 – Acceleration Time

<b>Adjustable Range:</b>	0.1 to 999.0 s	<b>Factory Setting:</b>	10.0 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="BASIC"/>		

**Description:**

Acceleration time from zero to maximum speed (P0134).

#### P0101 – Deceleration Time

<b>Adjustable Range:</b>	0.1 to 999.0 s	<b>Factory Setting:</b>	10.0 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="BASIC"/>		

**Description:**

Deceleration time from maximum speed (P0134) to zero.

### P0102 – Acceleration Time 2<sup>nd</sup> Ramp

<b>Adjustable Range:</b>	0.1 to 999.0 s	<b>Factory Setting:</b>	10.0 s
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**Description:**

Acceleration time from zero to maximum speed (P0134) when the 2<sup>nd</sup> ramp is active.

### P0103 – Deceleration Time 2<sup>nd</sup> Ramp

<b>Adjustable Range:</b>	0.1 to 999.0 s	<b>Factory Setting:</b>	10.0 s
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**Description:**

Deceleration time from maximum speed (P0134) to zero when the 2<sup>nd</sup> ramp is active.

### P0104 – S Ramp

<b>Adjustable Range:</b>	0 = Inactive 1 = Active	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		

**Description:**

This parameter allows the inverter acceleration and deceleration ramps to have a non-linear profile, similar to an "S", aiming at reducing the mechanical shocks on the load, as shown in [Figure 11.1: S or linear ramp on page 11-2](#).

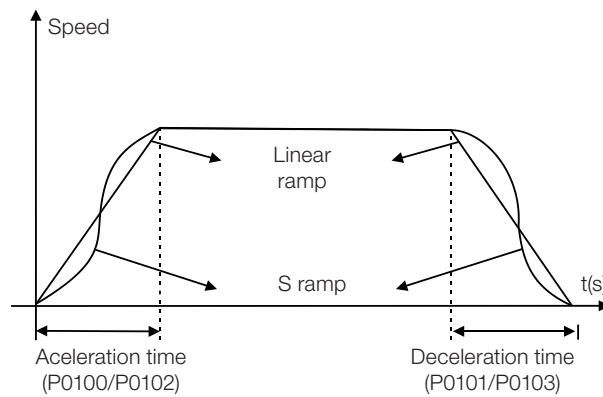


Figure 11.1: S or linear ramp

**P0105 – 1<sup>st</sup> / 2<sup>nd</sup> Ramp Selection**

<b>Adjustable Range:</b>	0 = 1 <sup>st</sup> Ramp 1 = 2 <sup>nd</sup> Ramp 2 = DIx 3 = Serial/ USB 4 = SoftPLC	<b>Factory Setting:</b> 2
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**Properties:**

**Access groups via HMI:**

**Description:**

It defines the command origin source to activate the 2<sup>nd</sup> Ramp.

Note: Parameter P0680 (Logical Status) indicates if the 2<sup>nd</sup> Ramp is active or not. For further information on this parameter, refer to [section 7.3 CONTROL WORD AND INVERTER STATUS on page 7-10](#).


**NOTE!**

The inactive status of any of the active sources activates the 1<sup>st</sup> ramp. The same occurs in option 2 (DIx) and there is no digital input for the 2<sup>nd</sup> ramp.

**P0106 – Time of the 3<sup>rd</sup> Ramp**

<b>Adjustable Range:</b>	0.1 to 999.0 s	<b>Factory Setting:</b> 5.0 s
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**Description:**

Acceleration time from zero to maximum speed (P0134) or deceleration from maximum speed (P0134) to zero when the 3<sup>rd</sup> Ramp is active.

**11.2 DC LINK VOLTAGE AND OUTPUT CURRENT LIMITATION**

The DC Link voltage and output current limitation are protection functions of the inverter which act on the ramp control according to the P0150 options, aiming at containing the voltage increase in the DC link and output current. In this way, the following of the reference by the ramp is blocked and the output speed follows the 3<sup>rd</sup> ramp for P0133 or P0134.

When the DC link voltage is too high, the inverter may freeze the deceleration ramp or increase the output speed in order to contain this voltage. On the other hand, when the output current is too high, the inverter may decelerate or hold the acceleration ramp in order to reduce this current. Those actions prevent the occurrence of faults F0022 and F0070, respectively.

Both protections normally occur at different moments of the inverter operation, but in case of occurrence at the same time, by definition, the DC link limitation has higher priority than the output current limitation.

There are two modes to limit the DC link voltage during the motor braking: "Ramp Holding" (P0150 = 0 or 2) and "Accelerate Ramp" (P0150 = 1 or 3). Both actuate limiting the braking torque and power, so as to prevent the shutting down of the inverter by overvoltage (F0022). This situation often occurs when a load with high moment of inertia is decelerated or when short deceleration time is programmed.


**NOTE!**

The inverter protection functions use the 3<sup>rd</sup> ramp defined by P0106 for both acceleration and deceleration.

### 11.2.1 DC Link Voltage Limitation by "Ramp Hold" P0150 = 0 or 2

- It has effect during deceleration only.
- Actuation: when the DC link voltage reaches the level set in P0151, a command is set to the "ramp" block, which inhibits the motor speed variation according to [Figure 9.1: Block diagram of V/f scale control on page 9-2 of chapter 9 V/f SCALAR CONTROL on page 9-1](#) and [Figure 10.1: VVW control flow on page 10-2 of chapter 10 VVW VECTOR CONTROL on page 10-1](#).
- Use recommended in the drive of loads with high moment of inertia referred to the motor shaft or loads that require short deceleration ramps.

### 11.2.2 DC Link Voltage Limitation by "Accelerate Ramp" P0150 = 1 or 3

- It has effect in any situation, regardless the motor speed condition: accelerating, decelerating or constant speed.
- Actuation: the DC link voltage is measured (P0004) and compared to the value set in P0151; the difference between those signals (error) is multiplied by the proportional gain (P0152); the result is then added to the ramp output, as per [Figure 11.4: Block diagram of DC link voltage limitation – Accelerate Ramp \(P0152 = 1 or P0152 = 3\) on page 11-6](#) and [Figure 11.5: Example graph of the DC link voltage limitation – Accelerate Ramp \(P0152 = 1 or P0152 = 3\) on page 11-7](#).
- Use recommended in the drive of loads that require braking torques at constant speed situation in the inverter output. For example, drive of loads with eccentric shaft as in sucker rod pumps; another application is the load handling with balance like in the translation in overhead cranes.



#### NOTE!

When using rheostatic braking, the function "Ramp Hold" or "Accelerate Ramp" must be disabled. Refer to description of P0151.

## P0150 – Ud Controller Type and Current Limitation

<b>Adjustable Range:</b>	0 = hold_Ud and decel_LC 1 = acel_Ud and decel_LC 2 = hold_Ud and hold_LC 3 = acel_Ud and hold_LC	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg, V/f, VVW	
<b>Access groups via HMI:</b>	MOTOR	

#### Description:

P0150 configures the behavior of the ramp for the limitation functions of the DC link voltage and current limitation. In those cases, the ramp ignores the reference and takes an action of accelerating (acel), decelerating (decel) or freezing (freeze) the normal path of the ramp. That occurs because of the limit pre-defined in P0151 and P0135 for the DC link (Ud) limitation and for current (LC) limitation, respectively.

**P0151 – Actuation Level of the DC Link Voltage Regulation**

<b>Adjustable Range:</b>	339 to 1200 V	<b>Factory Setting:</b>	400 V (P0296 = 0) 800 V (P0296 = 1) 1000 V (P0296 = 2)
<b>Properties:</b>	V/f, VVW		
<b>Access groups via HMI:</b>	MOTOR		

**Description:**

Voltage level to activate the DC Link Voltage regulation.

**P0152 – Gain Proportional to the DC Link Voltage Controller**

<b>Adjustable Range:</b>	0.00 to 9.99	<b>Factory Setting:</b>	1.50
<b>Properties:</b>	V/f, VVW		
<b>Access groups via HMI:</b>	MOTOR		

**Description:**

Gain proportional to the DC link voltage controller.

When the option of P0150 is 1 or 3, the value of P0152 is multiplied by the "error" of the DC link voltage, seeing that the error results from the difference between the actual DC link voltage (P0004) and the actuation level of the DC link voltage regulation (P0151). The result is added directly to the inverter output speed in rpm. This resource is normally used to prevent overvoltage in applications with eccentric loads.

Figure 11.2: Block diagram DC link voltage limitation – Ramp Hold (P0152 = 0 or P0152 = 2) on page 11-5 to Figure 11.5: Example graph of the DC link voltage limitation – Accelerate Ramp (P0152 = 1 or P0152 = 3) on page 11-7 show the block diagrams and example graphs.

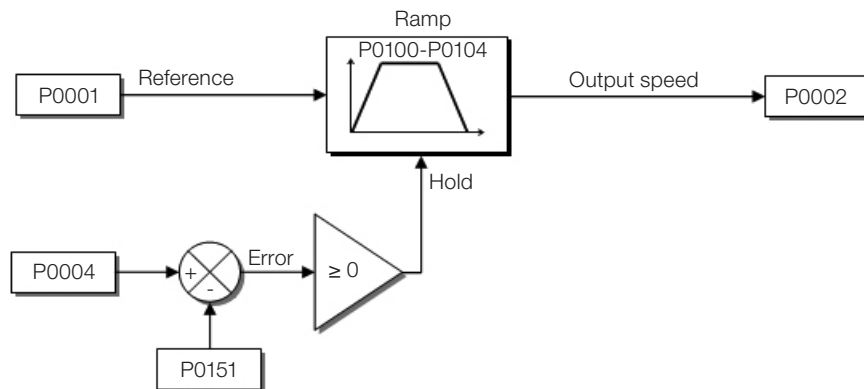


Figure 11.2: Block diagram DC link voltage limitation – Ramp Hold (P0152 = 0 or P0152 = 2)

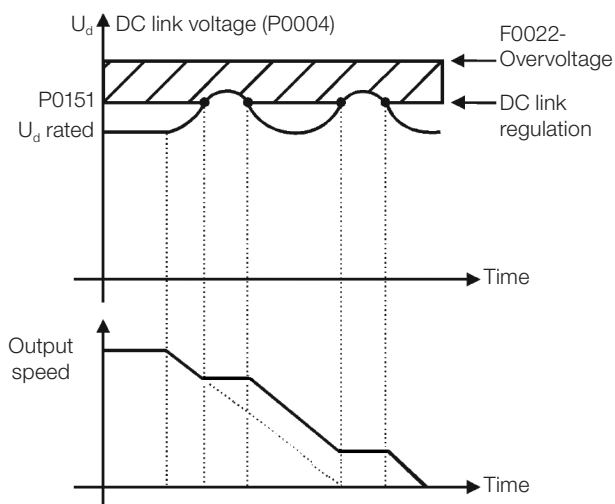


Figure 11.3: Example graph of DC link voltage limitation – Ramp Hold (P0152 = 0 or P0152 = 2)

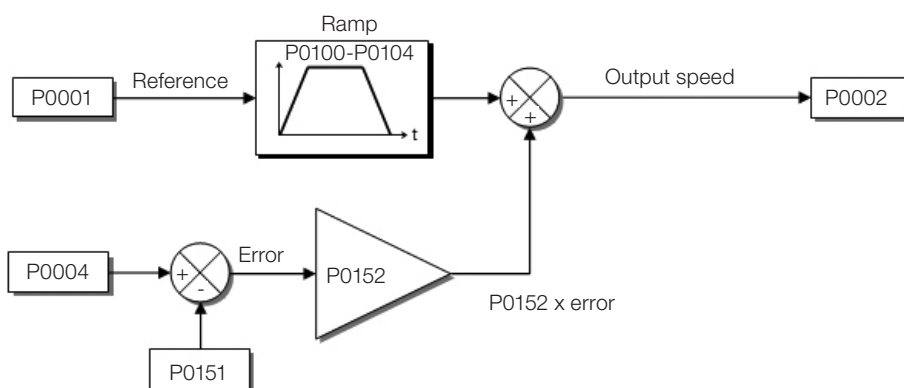
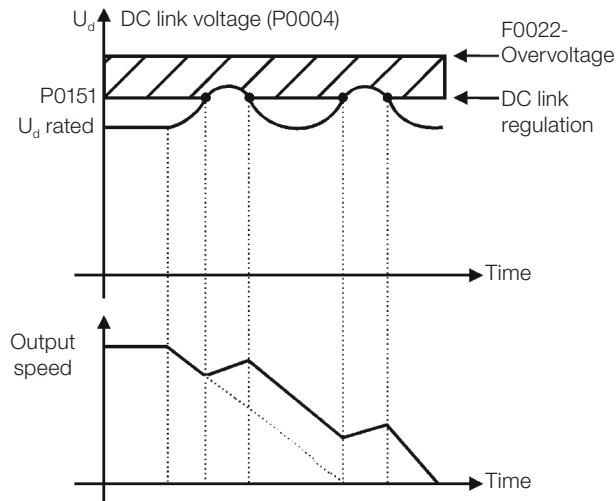


Figure 11.4: Block diagram of DC link voltage limitation – Accelerate Ramp (P0152 = 1 or P0152 = 3)



**Figure 11.5:** Example graph of the DC link voltage limitation – Accelerate Ramp (P0152 = 1 or P0152 = 3)

Like in the DC link voltage regulation, the output current regulation also has two operating modes: "Ramp Holding" (P0150 = 2 or 3) and "Decelerate Ramp" (P0150 = 0 or 1). Both actuate limiting the torque and power delivered to the motor, so as to prevent the shutting down of the inverter by overcurrent (F0070). This situation often occurs when a load with high moment of inertia is accelerated or when short acceleration time is programmed.

### 11.2.3 Output Current Limitation by "Ramp Hold" P0150 = 2 or 3

- It prevents the motor from collapsing during torque overload in the acceleration or deceleration.
- Actuation: if the motor current exceeds the value set in P0135 during acceleration or deceleration, the speed will not be incremented (acceleration) or decremented (deceleration). When the motor current reaches a value below P0135, the motor accelerates or decelerates again. Refer to [Figure 11.6: \(a\) and \(b\) Actuation modes of current limitation via P0135 on page 11-8.](#)
- It has a faster action than the "Decelerate Ramp" mode.
- It acts in the motorization and regeneration modes.

### 11.2.4 Current Limitation Type "Decelerate Ramp" P0150 = 0 or 1

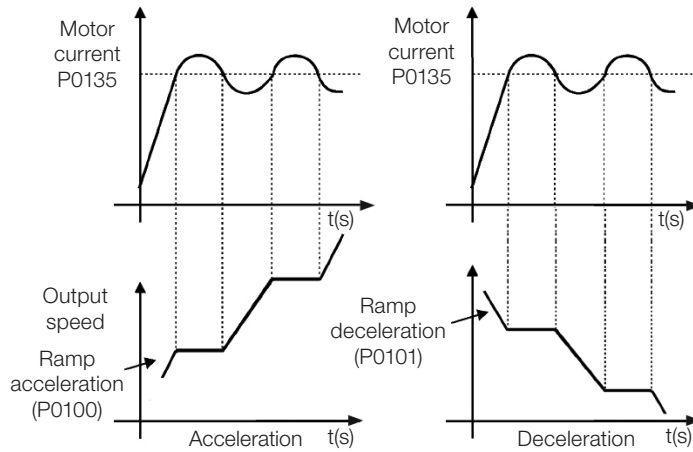
- It prevents the motor from collapsing during torque overload in the acceleration or constant speed.
- Actuation: if the motor current exceeds the value set in P0135, a null value is forced for the speed ramp input forcing the motor deceleration. When the motor current reaches a value below P0135, the motor accelerates again. Look at [Figure 11.6: \(a\) and \(b\) Actuation modes of current limitation via P0135 on page 11-8.](#)

**P0135 – Maximum Output Current**

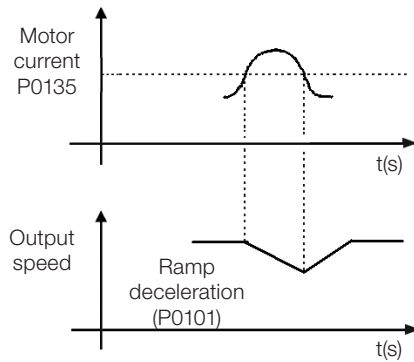
<b>Adjustable Range:</b>	0.0 to 200.0 A	<b>Factory Setting:</b>	$1.5 \times I_{nom}$
<b>Properties:</b>	V/f, VVW		
<b>Access groups via HMI:</b>	BASIC, MOTOR		

**Description:**

Current level to activate the current limitation for the ramp hold and decelerate ramp modes, as per [Figure 11.6: \(a\) and \(b\) Actuation modes of current limitation via P0135 on page 11-8](#), respectively.



(a) "Ramp Hold "



(b) "Ramp Deceleration"

**Figure 11.6:** (a) and (b) Actuation modes of current limitation via P0135



### 11.3 FLYING-START / RIDE-THROUGH

The Flying Start function allows driving a motor that is in free spinning, accelerating it from the rotation in which it is. The Ride-Through function allows recovering the inverter, with no locking by undervoltage, when there is an instant drop in the power supply.

Both functions have as a premise the special case in which the motor is spinning in the same direction and at a speed close to the speed reference, and, thus, immediately applying to the output the speed reference and increasing the output voltage in ramp, the slip and the starting torque are minimized.

#### P0320 – Flying Start (FS) / Ride Through (RT)

<b>Adjustable Range:</b>	0 = Inactive 1 = Flying Start 2 = Flying Start / Ride-Through 3 = Ride-Through	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	

**Description:**

Parameter P0320 selects the use of the Flying Start and Ride-Through functions. More details in the following sections.

#### P0331 – Voltage Ramp for FS and RT

<b>Adjustable Range:</b>	0.2 to 60.0 s	<b>Factory Setting:</b> 2.0 s
--------------------------	---------------	-------------------------------

**Description:**

This parameter determines the rising time of the output voltage during the execution of the Flying Start and Ride-Through functions.

#### 11.3.1 Flying Start Function

In order to activate this function, just program P0320 in 1 or 2; thus the inverter will impose a fixed frequency at the start, defined by the speed reference, and apply the voltage ramp defined in parameter P0331. In this way, the start current is reduced. On the other hand, if the motor is at rest, the speed reference and the real speed of the motor are very different or the direction of rotation is inverted; the result in such cases may be worse than the conventional start without Flying Start.

The Flying Start function is applied on loads with high inertia or systems that require start with the motor spinning. Besides, the function may be deactivated dynamically by a digital input P0263 to P0270 programmed for "15 = Disable Flying Start". In this way, the user may activate the function in a convenient way according to the application.

### 11.3.2 Ride-Through Function

The Ride-Through function will disable the inverter output pulses (IGBT) as soon as the supply voltage reaches a value below the undervoltage value. A fault due to undervoltage (F0021) does not occur and the DC link voltage will slowly drop until the supply voltage returns. In case it takes the supply voltage too long to return (over 2 seconds), the inverter may indicate F0021 (undervoltage on the DC link). If the supply voltage returns before, the inverter will enable the pulses again, imposing the speed reference instantly (like in the Flying Start function) and making a voltage ramp with time defined by parameter P0331. Refer to [Figure 11.7: Actuation of the Ride-Through function on page 11-10](#).

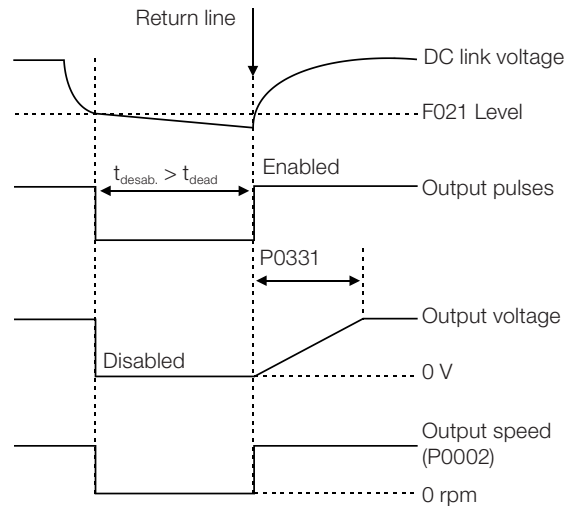


Figure 11.7: Actuation of the Ride-Through function

The Ride-Through function allows recovering the inverter without locking by undervoltage F0021 for momentary power supply drops. The time interval accepted during a fault is at most two seconds.

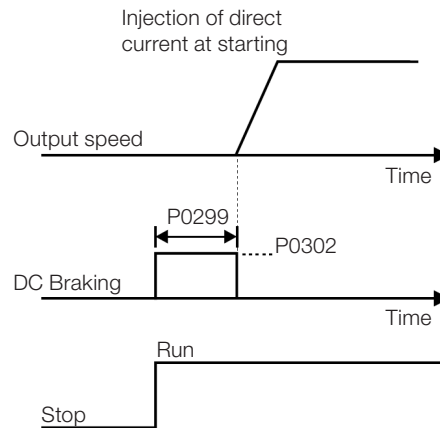
### 11.4 DC BRAKING

The DC braking allows stopping the motor by applying direct current to it. The current applied at the DC braking is proportional to the braking torque and may be set in P0302. It is set in percentage (%) of the inverter rated current considering the motor of power compatible with the inverter.

#### P0299 – DC Braking Time at Start

<b>Adjustable Range:</b>	0.0 to 15.0 s	<b>Factory Setting:</b>	0.0 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR"/>		

**Description:**  
DC braking duration at the start.



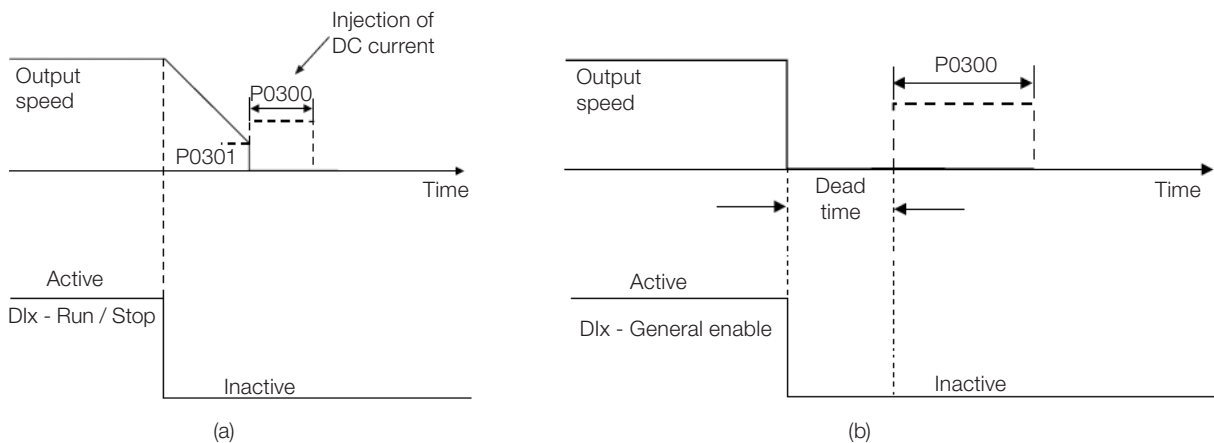
**Figure 11.8:** DC braking actuation at start

### P0300 – DC Braking Time at Stop

<b>Adjustable Range:</b>	0.0 to 15.0 s	<b>Factory Setting:</b>	0.0 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	MOTOR		

**Description:**

DC braking duration at the start. [Figure 11.9: \(a\) and \(b\): Actuation of DC braking at command stop \(a\) Run/Stop \(b\) General Enable on page 11-11](#) shows the braking behavior at the stop, where the dead time for the de-magnetization of the motor can be observed. This time is proportional to the speed at the moment of the injection of direct current.



**Figure 11.9:** (a) and (b): Actuation of DC braking at command stop (a) Run/Stop (b) General Enable

During the braking process, if the inverter is enabled, the braking is interrupted and the inverter will start operating normally.



**ATTENTION!**

The DC braking can continue acting even if the motor has already stopped. Be careful with the thermal dimensioning of the motor for short-period cyclic braking.

**P0301 – Speed to Begin DC Braking at Stop**

<b>Adjustable Range:</b>	0 to 18000 rpm	<b>Factory Setting:</b>	30 rpm
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter establishes the initial point to apply the DC braking at the stop when the inverter is disabled by ramp, as per [Figure 11.9: \(a\) and \(b\): Actuation of DC braking at command stop \(a\) Run/Stop \(b\) General Enable on page 11-11](#).

**P0302 – Voltage Applied to the DC Braking**

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	20.0 %
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter sets the DC voltage (DC braking torque) applied to the motor during the braking.

The setting must be done by gradually increasing the value of P0302, which varies from 0.0 to 100.0 % of the rated braking voltage, until the desired braking is obtained.

The 100 % braking voltage is the DC voltage value, which results in two times the rated current for the motor with power matched to the inverter. Therefore, if the inverter has a power too much higher than the motor, the braking torque will be too low; however, if the opposite occurs, there might be overcurrent during the braking, as well as motor overheating.

### 11.5 AVOIDED SPEED

This inverter function prevents the motor from operating permanently at speed values in which, for example, the mechanical system goes into resonance (causing excessive vibration or noises).

#### P0303 – Skip Speed 1

#### P0304 – Skip Speed 2

#### P0306 – Skip Band

**Adjustable Range:** 0 to 18000 rpm

**Factory Setting:** P0303 = 600 rpm  
P0304 = 900 rpm  
P0306 = 0 rpm

**Properties:**

**Description:**

The actuation of those parameters is done as presented in [Figure 11.10: Actuation of the avoided frequency on page 11-13](#) below.

The passage by the avoided speed band ( $2 \times P0306$ ) is done through acceleration/deceleration ramp.

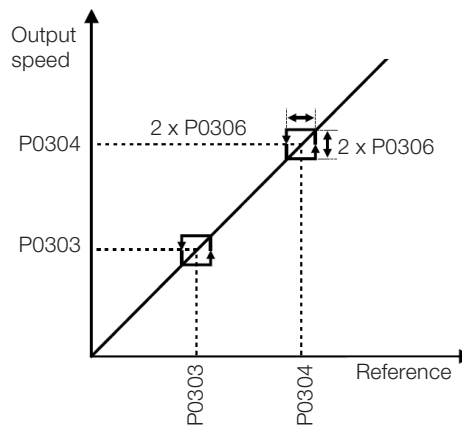


Figure 11.10: Actuation of the avoided frequency

## 12 DIGITAL AND ANALOG INPUTS AND OUTPUTS

This section presents the parameters to configure the CFW501 inputs and outputs.

*Table 12.1: I/O Configurations of the CFW501*

Functions										Plug-In Module
DI	AI	AO	DOR	DOT	USB	RS-232	RS-485	Sup 10 V	Sup 24 V	
4	2	1	2	1	-	-	2	1	1	CFW500-CRS485

DI – Digital input    DOR – Relay digital output    AI – Analog input    AO – Analog output    DOT – Transistor digital output



**NOTE!**

CFW501 HMI shows just the parameters related to the resources available in the plug-in module connected to the product.

### 12.1 ANALOG INPUTS

With the analog inputs, it is possible, for instance, to use an external speed reference or to connect a sensor in order to measure temperature (PTC). Details for those configurations are described in the parameters below.

#### P0018 – Analog Input Value AI1

#### P0019 – Analog Input Value AI2

#### P0020 – Analog Input Value AI3

<b>Adjustable Range:</b>	-100.0 to 100.0 %	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

**Description:**

Those read-only parameters indicate the value of the analog inputs AI1, AI2 and AI3 in percentage of the full scale. The indicated values are those obtained after the offset action and multiplication by the gain. Check the description of parameters P0230 to P0245.

**P0230 – Dead Zone of the Analog Inputs**

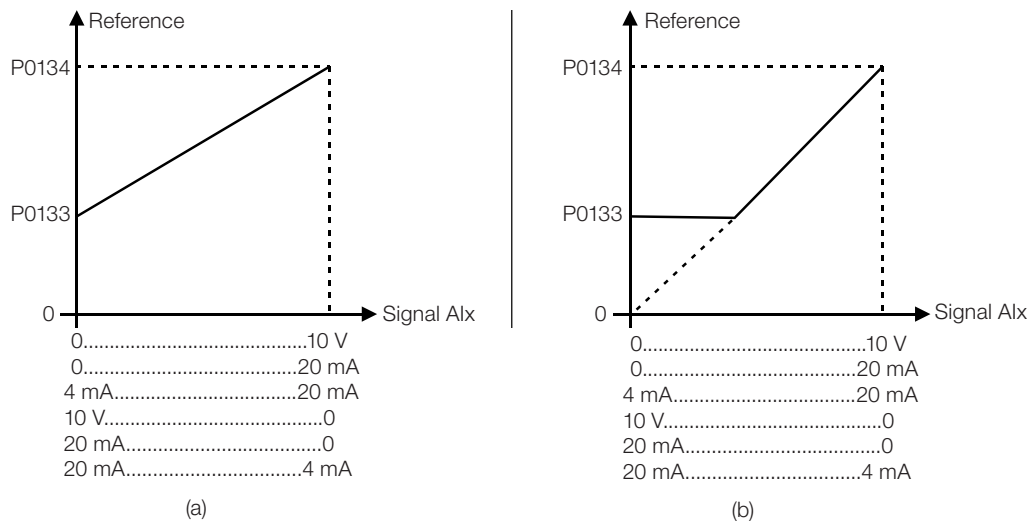
<b>Adjustable Range:</b>	0 = Inactive 1 = Active	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	I/O		

**Description:**

This parameter acts just for the analog inputs(AIx) programmed as frequency reference, and defines if the dead zone in those inputs is Active (1) or Inactive (0).

If the parameter is configured as Inactive (P0230 = 0), the signal in the analog inputs will actuate on the frequency reference from the minimum point (0 V / 0 mA / 4 mA or 10 V / 20 mA), and it will be directly related to the minimum speed set in P0133. Check [Figure 12.1: \(a\) and \(b\) Actuation of the analog inputs with inactive dead zone \(a\) and active dead zone \(b\) on page 12-2.](#)

If the parameter is configured as Active (P0230 = 1), the signal in the analog inputs will have a dead zone, where the speed reference remains at the Minimum Speed value (P0133), even with the variation of the input signal. Check [Figure 12.1: \(a\) and \(b\) Actuation of the analog inputs with inactive dead zone \(a\) and active dead zone \(b\) on page 12-2.](#)



**Figure 12.1:** (a) and (b) Actuation of the analog inputs with inactive dead zone (a) and active dead zone (b)

In the case of analog inputs AI3 set for -10 V to +10 V (P0243 = 4), we will have curves similar to [Figure 12.1: \(a\) and \(b\) Actuation of the analog inputs with inactive dead zone \(a\) and active dead zone \(b\) on page 12-2;](#) except that when AI3 is negative, the direction of rotation will be the opposite.

**P0231 – Signal Function AI1**
**P0236 – Signal Function AI2**
**P0241 – Signal AI3 Function**

<b>Adjustable Range:</b>	0 = Speed Reference 1 = Not Used 2 = Not Used 3 = SoftPLC 5 = Feedback 1 Main PID 6 = Feedback 2 Main PID 7 = Not Used 8 = Feedback External PID 9 = Not Used	<b>Factory Setting:</b>	P0231 = 5 P0236 = 8 P0241 = 0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

**Description:**

These parameters define the analog input functions.

When the 0 option is selected (Speed Reference), the analog inputs can provide the reference for the motor, subject to the specified limits (P0133 and P0134) and to the action of the ramps (P0100 to P0103). However, in order to do so, it is also necessary to configure parameters P0221 and/or P0222 by selecting the use of the desired analog input. For further detail, refer to the description of those parameters in [chapter 7 LOGICAL COMMAND AND SPEED REFERENCE on page 7-1](#).

**Option 3 (SoftPLC)** configures the input to be used by the programming done in the memory area reserved for the SoftPLC function. For further details, refer to the SoftPLC user's manual.

**Option 4 (PTC)** configures the input for motor temperature monitoring by means of the reading of a PTC type sensor, when this sensor is present in the motor. In order to do so, it is also necessary to configure one analog output (AO) as current source to feed the PTC. More details on this function are presented in [section 14.3 MOTOR OVERTEMPERATURE PROTECTION \(F0078\) on page 14-5](#).


**NOTE!**

AI3 cannot be set with the PTC function, as it is a bipolar analog input. Therefore, if input AI3 is set to PTC (P0241 = 4), the inverter goes into the configuration state (CONF).



**Option 5 (Feedback 1 of Main PID)** configures the input to be used as the feedback 1 of the Main PID Controller. The parameter P1026 defines its functionality in the feedback of the Main PID Controller.

**Option 6 (Feedback 2 of Main PID)** configures the input to be used as the feedback 2 of the Main PID Controller. The parameter P1026 defines its functionality in the feedback of the Main PID Controller.

**Option 8 (Feedback of External PID 1)** configures the input to be used as the feedback of the External PID controller.

**NOTE!**  
 In options 5 to 8, in case two or more analog inputs are selected for the same function, for instance, P0231 = 5 and P0236 = 5, only the analog input with higher priority will be valid, being AI1>AI2, that is, in this case the analog input AI1 will be the input used as feedback 1 of the Main PID Controller. Refer to [chapter 18 HVAC FUNCTIONS on page 18-1](#) for further information.

**P0232 – Input Gain AI1**

**P0237 – Input Gain AI2**

**P0242 – Input Gain AI3**

<b>Adjustable Range:</b>	0.000 to 9.999	<b>Factory Setting:</b>	1.000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input style="width: 100%;" type="text" value="I/O"/>		

**P0234 – Input Offset AI1**

**P0239 – Input Offset AI2**

**P0244 – Input Offset AI3**

<b>Adjustable Range:</b>	-100.0 to 100.0 %	<b>Factory Setting:</b>	0.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input style="width: 100%;" type="text" value="I/O"/>		

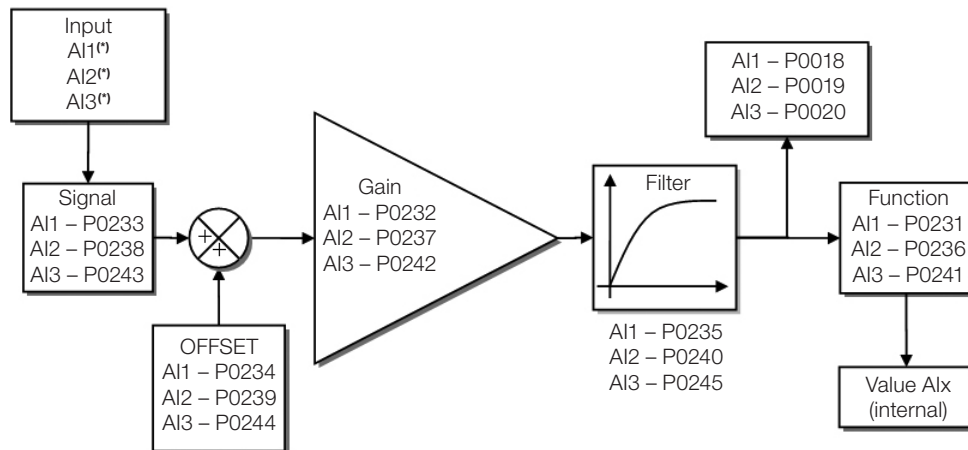
**P0235 – Input Filter AI1**
**P0240 – Input Filter AI2**
**P0245 – Input Filter AI3**

<b>Adjustable Range:</b>	0.00 to 16.00 s	<b>Factory Setting:</b>	0.15 s
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**Properties:**
**Access groups via HMI:**

**Description:**

Each analog input of the inverter is defined by the steps of calculation of signal, OFFSET, gain, filter, function and value  $A_{ix}$ , as shown in [Figure 12.2: Block diagram of the analog inputs –  \$A\_{ix}\$  on page 12-5](#).



(\*) Control terminals available in the Plug-in module.

*Figure 12.2: Block diagram of the analog inputs –  $A_{ix}$*

**P0233 – Input Signal AI1**
**P0238 – Input Signal AI2**

<b>Adjustable Range:</b>	0 = 0 to 10 V / 20 mA 1 = 4 to 20 mA 2 = 10 V / 20 mA to 0 3 = 20 to 4 mA	<b>Factory Setting:</b>	0
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**Properties:** cfg

**Access groups via HMI:**

**P0243 – Input Signal AI3**

<b>Adjustable Range:</b>	0 = 0 to 10 V / 20 mA 1 = 4 to 20 mA 2 = 10 V / 20 mA to 0 3 = 20 to 4 mA 4 = -10 V to +10 V	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>	

**Description:**

These parameters configure the signal type (if current or voltage) that will be read in each analog input, as well as its variation range. Note that only AI3 has option 4 (-10 V to +10 V). In options 2 and 3 of the parameters, the reference is inverted, that is, we have the maximum speed with the minimum signal in the AIx.

In the CFW500 plug-in module, DIP Switch S1:1 in ON configures input AI1 for signal in current. In the other cases, refer to the installation, configuration and operation guide of the plug-in used. [Table 12.2: AIx configuration and equation on page 12-6](#) below summarizes the configuration and equation of the analog inputs.

*Table 12.2: AIx configuration and equation*

Signal	P0233, P0238	P0243	DIP Switch	Equation AIx (%)
0 to 10 V	0	0	OFF	$AIx = \left( \frac{AIx(V)}{10 V} \times (100 \%) + \text{Offset} \right) \times \text{Gain}$
0 to 20 mA	0	0	ON	$AIx = \left( \frac{AIx(mA)}{20 mA} \times (100 \%) + \text{Offset} \right) \times \text{Gain}$
4 to 20 mA	1	1	ON	$AIx = \left( \left( \frac{AIx(mA) - 4 mA}{16 mA} \right) \times (100 \%) + \text{Offset} \right) \times \text{Gain}$
10 to 0 V	2	2	OFF	$AIx = 100 \% - \left( \frac{AIx(V)}{10 V} \times (100 \%) + \text{Offset} \right) \times \text{Gain}$
20 to 0 mA	2	2	ON	$AIx = 100 \% - \left( \frac{AIx(mA)}{20 mA} \times (100 \%) + \text{Offset} \right) \times \text{Gain}$
20 to 4 mA	3	3	ON	$AIx = 100 \% - \left( \left( \frac{AIx(mA) - 4 mA}{16 mA} \right) \times (100 \%) + \text{Offset} \right) \times \text{Gain}$
-10 to +10 V	-	4	OFF	$AIx = \left( \frac{AIx(V)}{10 V} \times (100 \%) + \text{Offset} \right) \times \text{Gain}$

For example: AIx = 5 V, Offset = -70.0 %, Gain = 1.000, with signal of 0 to 10 V, that is, AIx<sub>ini</sub> = 0 and AIx<sub>FE</sub> = 10.

$$AIx(\%) = \left( \frac{5}{10} \times (100 \%) + (-70 \%) \right) \times 1 = -20.0 \%$$

Another example: AIx = 12 mA, Offset = -80.0 %, Gain = 1.000, with signal of 4 to 20 mA, that is, AIx<sub>ini</sub> = 4 and AIx<sub>FE</sub> = 16.

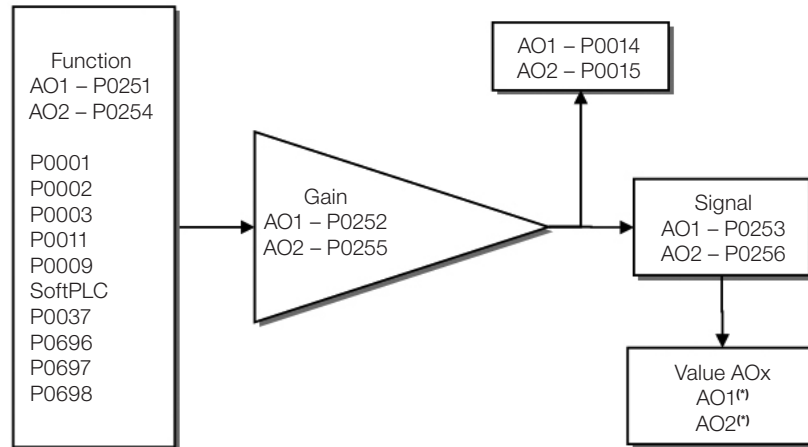
$$AIx(\%) = \left( \frac{12 - 4}{16} \times (100 \%) + (-80 \%) \right) \times 1 = -30.0 \%$$

AIx' = -30.0 % means that the motor will spin counterclockwise with a reference in module equal to 30.0 % of P0134 if the signal AIx function is "Speed Reference".

In the case of filter parameters (P0235, P0240 and P0245), the value set corresponds to the time constant used to filter the input signal read. Therefore, the filter response time is around three times the value of this time constant.

## 12.2 ANALOG OUTPUTS

The analog outputs (AOx) are configured by means of three types of parameters: function, gain and signal, as per block diagram of [Figure 12.3: Block diagram of Analog outputs – AOx on page 12-7](#).



(\*) Control terminals available in the Plug-In module.

**Figure 12.3:** Block diagram of Analog outputs – AOx

### P0014 – Analog Output AO1 Value

### P0015 – Analog Output AO2 Value

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="I/O, READ"/>	

**Description:**

Those read-only parameters indicate the value of the analog outputs AO1 and AO2 in percentage of the full scale. The indicated values are those obtained after the multiplication by the gain. Check the description of parameters P0251 to P0256.

**P0251 – Output Function AO1**

**P0254 – Output Function AO2**

<b>Adjustable Range:</b>	0 = Speed Ref. 1 = Not Used 2 = Real Speed 3 = Not Used 4 = Not Used 5 = Output Current 6 = Active Current 7 = Output Power 8 = Not Used 9 = Motor Torque 10 = SoftPLC 11 = Not Used 12 = Motor lxt 13 = P0696 Value 14 = P0697 Value 15 = Not Used 16 = External PID Output 17 = Not Used 18 = P0698 Value	<b>Factory Setting:</b>	P0251 = 16 P0254 = 5
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**Properties:**

**Access groups via HMI:**

**Description:**

These parameters set the analog output functions, according to function and scale presented in [Table 12.3: Full scale of analog outputs on page 12-8](#).

*Table 12.3: Full scale of analog outputs*

Function	Description	Full Scale
0	Speed reference in the ramp input (P0001)	P0134
2	Real speed in the inverter output (P0002)	P0134
5	Total output current in rms	2xP0295
6	Active current	2xP0295
7	Output Power	$1.5 \times \sqrt{3} \times P0295 \times K$
9	Torque on the motor in relation to the rated torque	200.0 %
10	SoftPLC scale for analog output	32767
12	Motor lxt overload (P0037)	100 %
13	Value of P0696 for analog output AOx	32767
14	Value of P0697 for analog output AOx	32767
16	External PID output (P1063)	100 %
18	Value of P0698 for analog output AOx	32767

Constant K is defined based on parameter P0296, according to the table below:

*Table 12.4: Constant K defined in parameter P0296*

P0296	Constant K
0	240
1	480
2	600

**P0252 – Output Gain AO1**
**P0255 – Output Gain AO2**

<b>Adjustable Range:</b>	0.000 to 9.999	<b>Factory Setting:</b>	1.000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

**Description:**

It determines the analog output gain according to the equation of [Table 12.3: Full scale of analog outputs on page 12-8](#).

**P0253 – Output Signal AO1**
**P0256 – Output Signal AO2**

<b>Adjustable Range:</b>	0 = 0 to 10 V 1 = 0 to 20 mA 2 = 4 to 20 mA 3 = 10 to 0 V 4 = 20 to 0 mA 5 = 20 to 4 mA	<b>Factory Setting:</b>	P0253 = 0 P0256 = 0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

**Description:**

Those parameters configure if the analog output signal will be in current or voltage with direct or reverse reference. Besides setting those parameters, it is also necessary to position the DIP switches. Refer to the installation, configuration and operation guide of the used plug-in module.

[Table 12.5: Characteristic configuration and equations of the AOx on page 12-9](#) below summarizes the configuration and equation of the analog outputs, where the relationship between the analog output function and the full scale is defined by P0251, as per [Table 12.3: Full scale of analog outputs on page 12-8](#).

**Table 12.5:** Characteristic configuration and equations of the AOx

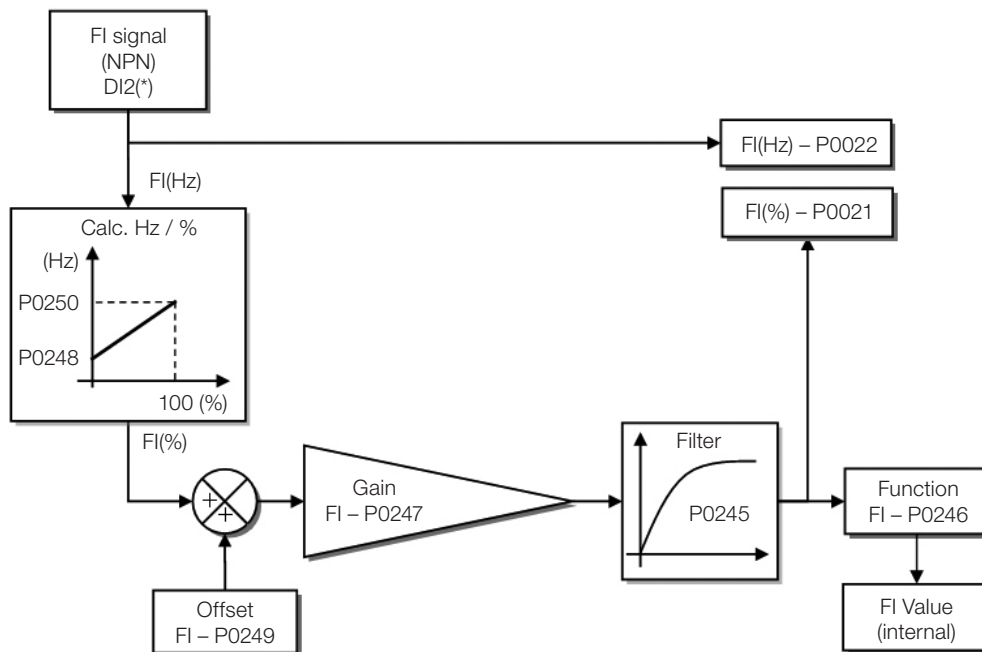
Signal	P0253	P0256	DIP Switch	Equation
0 to 10 V	0	0	ON	$AOx = \left( \frac{\text{Function}}{\text{Scale}} \times \text{Gain} \right) \times 10 \text{ V}$
0 to 20 mA	1	1	OFF	$AOx = \left( \frac{\text{Function}}{\text{Scale}} \times \text{Gain} \right) \times 20 \text{ mA}$
4 to 20 mA	2	2	OFF	$AOx = \left( \frac{\text{Function}}{\text{Scale}} \times \text{Gain} \right) \times 16 \text{ mA} + 4 \text{ mA}$
10 to 0 V	3	3	ON	$AOx = 10 \text{ V} - \left( \frac{\text{Function}}{\text{Scale}} \times \text{Gain} \right) \times 10 \text{ V}$
20 to 0 mA	4	4	OFF	$AOx = 20 \text{ mA} - \left( \frac{\text{Function}}{\text{Scale}} \times \text{Gain} \right) \times 20 \text{ mA}$
20 to 4 mA	5	5	OFF	$AOx = 20 \text{ mA} - \left( \frac{\text{Function}}{\text{Scale}} \times \text{Gain} \right) \times 16 \text{ mA}$

### 12.3 FREQUENCY INPUT

A frequency input consists of a fast digital input able to convert the frequency of the pulses in the input into a proportional signal with 10-bit resolution. After the conversion, this signal is used as an analog signal for speed reference, process variable, use of SoftPLC, etc.

According to the block diagram of [Figure 12.4: Block diagram of frequency input – FI \(DI2\)](#) on page 12-10, the signal in frequency is converted into a digital quantity in 10 bits by means of the block "calc. Hz%", where parameters P0248 and P0250 define the input signal frequency band, while parameter P0022 shows the frequency of the pulses in Hz. From this conversion step, the signal in frequency receives a treatment similar to that of a regular analog input; compare to [Figure 12.2: Block diagram of the analog inputs – Aix](#) on page 12-5.

**NOTE!** The frequency input signal at DI2 must be NPN regardless the setting in P0271 and it must not exceed the limit of 20 KHz.



(\*) Control terminal available in the Plug-In module.

**Figure 12.4:** Block diagram of frequency input – FI (DI2)

Digital input DI2 is pre-defined for frequency input with operating capacity in a wide band from 10 to 20.000 Hz.

The frequency input filter is the same as the one used for input AI3, that is, parameter P0245.

### P0021 – Value of Frequency Input FI in %

<b>Adjustable Range:</b>	-100.0 to 100.0 %	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

#### Description:

This read-only parameter indicates the value of the frequency input in percentage of full scale. The indicated values are those obtained after the offset action and multiplication by the gain. Check the description of parameters P0247 to P0250.

### P0022 – Value of Frequency Input FI in Hz

<b>Adjustable Range:</b>	0 to 20000 Hz	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

#### Description:

Value in hertz of the frequency input FI.



#### NOTE!

The operation of parameters P0021 and P0022, as well as of the frequency input, depends on the activation of P0246.

### P0246 – Frequency Input FI

<b>Adjustable Range:</b>	0 = Inactive 1 = Active	<b>Factory Setting:</b> 0
<b>Properties:</b>		
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>	

#### Description:

When in "1" this parameter activates the frequency input, making the digital input DI2 function in P0264 be ignored, as well as the value of bit "1" of P0012 is maintained in "0". On the other hand, when in "0" the frequency input is inactive keeping parameters P0021 and P022 in zero.



**P0247 – Input Gain in Frequency FI**

<b>Adjustable Range:</b>	0.000 to 9.999	<b>Factory Setting:</b>	1.000
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**P0248 – Minimum Frequency Input FI**

<b>Adjustable Range:</b>	10 to 20000 Hz	<b>Factory Setting:</b>	10 Hz
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**P0249 – Input Offset in Frequency FI**

<b>Adjustable Range:</b>	-100.0 to 100.0 %	<b>Factory Setting:</b>	0.0 %
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**P0250 – Maximum Frequency Input FI**

<b>Adjustable Range:</b>	10 to 20000 Hz	<b>Factory Setting:</b>	10000 Hz
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**Properties:**

<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>
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**Description:**

Those parameters define the behavior of the frequency input according to the equation:

$$FI = \left( \left( \frac{FI(\text{Hz}) - P0248}{P0250 - P0248} \right) \times (100\%) + P0249 \right) \times P0247$$

Parameters P0248 and P0250 determine the operation range of the frequency input(FI), while parameters P0249 and P0247 for offset and gain, respectively. For example, FI = 5000 Hz, P0248 = 10 Hz, P0250 = 10000 Hz, P0249 = -70.0 % and P0247 = 1.000, thus:

$$FI = \left( \left( \frac{5000 - 10}{10000 - 10} \right) \times (100\%) - 70\% \right) \times 1.000 = 20.05\%$$

*Table 18.1:AF 03/08-23*

The FI value = -20.05 % means that the motor will spin in the opposite direction with a module reference equal to 20.0 % of P0134 if the FI signal function is selected as Speed Reference (P0221 = 8 and/or P0222 = 8).

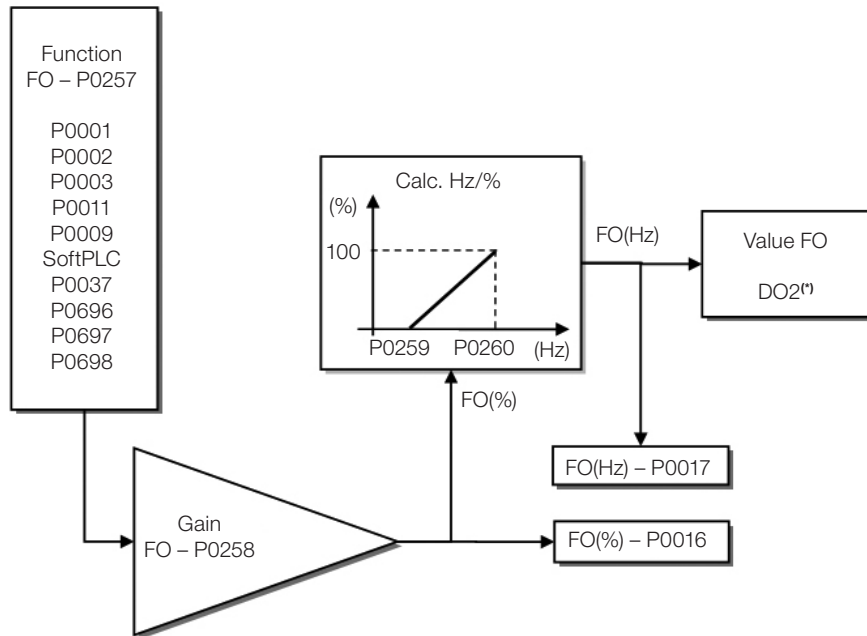
When P0246 = 1, the digital input DI2 is pre-defined for frequency input, regardless the value of P0264, with operating capacity in the band from 10 to 20.000 Hz in 10Vpp.

The time constant of the digital filter for the frequency input is shared with the analog input AI3 through parameter P0245.

## 12.4 FREQUENCY OUTPUT

Like the frequency input is implemented in the digital input DI2, the frequency output is fixed to the transistor digital output DO2.

The configuration and resources available in the frequency output are basically the same as those of analog outputs, as shown in [Figure 12.5: Block diagram of the output in frequency FO \(DO2\)](#) on page 12-13.



(\*) Control terminal available in the Plug-In module.

Figure 12.5: Block diagram of the output in frequency FO (DO2)

### P0016 – Frequency Output Value FO in %

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

#### Description:

The percentage value of the output frequency FO. This value is given in relation to the range defined by P0259 and P0260.

### P0017 – Frequency Output Value FO in Hz

<b>Adjustable Range:</b>	0 to 20000 Hz	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

#### Description:

The value in hertz of the output frequency FO.

**P0257 – Frequency Output Function FO**

<b>Adjustable Range:</b>	0 = Speed Reference 1 = Not Used 2 = Real Speed 3 = Not Used 4 = Not Used 5 = Output Current 6 = Active Current 7 = Output Power 8 = Not Used 9 = Motor Torque 10 = SoftPLC 11 = Not Used 12 = Ixt Motor 13 = P0696 Value 14 = P0697 Value 15 = Disable F.O. 16 = External PID Output 17 = Not Used 18 = P0698 Value	<b>Factory Setting:</b> 15
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter sets the frequency output function similarly to the setting of the analog outputs, like function and scale present in [Table 12.6: Full scale of frequency output on page 12-14](#).

The transistor digital output DO2 function is defined by P0276 when the frequency output function is inactive, that is, P0257 = 15. However, any other option of P0257 and the digital output DO2 becomes the frequency output ignoring the digital output function set in P0276.

*Table 12.6: Full scale of frequency output*

Function	Description	Full Scale
0	Speed reference in the ramp input (P0001)	P0134
2	Real speed in the inverter output (P0002)	P0134
5	Total output current in rms	2xP0295
6	Active current	2xP0295
7	Output Power	1.5 x $\sqrt{3}$ x P0295 x k
9	Torque on the motor in relation to the rated torque	200.0 %
10	SoftPLC scale for frequency output	32767
12	Motor Ixt overload (P0037)	100 %
13	Value of P0696 for analog output AOx	32767
14	Value of P0697 for analog output AOx	32767
15	Inactivates the frequency output – DO2 is digital output	-
16	External PID output (P1063)	100 %
18	Value of P0698 for analog output AOx	32767

Constant K is defined based on parameter P0296, according to the [Table 12.4: Constant K defined in parameter P0296 on page 12-8](#).

### P0258 – Frequency Output Gain FO

<b>Adjustable Range:</b>	0.000 to 9.999	<b>Factory Setting:</b>	1.000
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### P0259 – Minimum Frequency Output FO

<b>Adjustable Range:</b>	10 to 20000 Hz	<b>Factory Setting:</b>	10 Hz
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### P0260 – Maximum Frequency Output FO

<b>Adjustable Range:</b>	10 to 20000 Hz	<b>Factory Setting:</b>	10000 Hz
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**Properties:**

<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>
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**Description:**

Gain, minimum and maximum values for frequency output FO.

## 12.5 DIGITAL INPUTS

In order to use the digital inputs, the CFW501 features up to eight ports, depending on the plug-in module connected to the product. Check [Table 12.1: I/O Configurations of the CFW501 on page 12-1](#).

Below is a detailed description of the parameters for digital inputs.

### P0271 – Digital Input Signal

<b>Adjustable Range:</b>	0 = All DIx are NPN 1 = (DI1) - PNP 2 = (DI1..DI2) - PNP 3 = (DI1..DI3) - PNP 4 = (DI1..DI4) - PNP 5 = (DI1..DI5) - PNP 6 = (DI1..DI6) - PNP 7 = (DI1..DI7) - PNP 8 = All DIx are PNP	<b>Factory Setting:</b>	0
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**Properties:** cfg

<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>
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**Description:**

It configures the default for the digital input signal, that is, NPN and the digital input is activated with 0 V, PNP and the digital input is activated with +24 V.

**P0012 – Status of Digital Inputs DI8 to DI1**

<b>Adjustable Range:</b>	Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

**Description:**

Using this parameter, it is possible to view the status of the product digital inputs, according to the plug-in module connected. Refer to parameter P0027 in [section 6.1 INVERTER DATA on page 6-1](#).

The P0012 value is indicated in hexadecimal, where each bit of the number indicates the status of a digital input, that is, if BIT<sub>0</sub> is "0", DI1 is inactive; if BIT<sub>0</sub> is "1", DI1 is active, and so on, up to DI8. Besides, the determination of DI<sub>x</sub> active or inactive takes into account the signal type in the DI<sub>x</sub> defined by P0271.

The activation of DI<sub>x</sub> depends on the signal in the digital input and on P0271, as per [Table 12.7: Values of P0012 for x from 1 to 8 on page 12-16](#), which lists parameters P0271, threshold voltage for activation "V<sub>TH</sub>", threshold voltage for deactivation "V<sub>TL</sub>" and status indication of I<sub>x</sub> in parameter P0012.

*Table 12.7: Values of P0012 for x from 1 to 8*

Setting in P0271	Threshold Voltage in DI <sub>x</sub>	P0012
DI <sub>x</sub> = NPN	V <sub>TL</sub> > 9 V	BIT <sub>x-1</sub> = 0
	V <sub>TH</sub> < 5 V	BIT <sub>x-1</sub> = 1
DI <sub>x</sub> = PNP	V <sub>TL</sub> < 17 V	BIT <sub>x-1</sub> = 0
	V <sub>TH</sub> > 20 V	BIT <sub>x-1</sub> = 1

**NOTE!** Parameter P0012 requires the user to know the conversion between binary and hexadecimal numerical system.

**P0263 – Function of Digital Input DI1**
**P0264 – Function of Digital Input DI2**
**P0265 – Function of Digital Input DI3**
**P0266 – Function of Digital Input DI4**
**P0267 – Function of Digital Input DI5**
**P0268 – Function of Digital Input DI6**
**P0269 – Function of Digital Input DI7**
**P0270 – Function of Digital Input DI8**

<b>Adjustable Range:</b>	0 to 25	<b>Factory Setting:</b>	P0263 = 1 P0264 = 0 P0265 = 20 P0266 = 21 P0267 = 0 P0268 = 0 P0269 = 0 P0270 = 0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

**Description:**

These parameters allow configuring the digital input function, according to the adjustable range listed in [Table 12.8: Digital input functions on page 12-17](#).

**Table 12.8: Digital input functions**

Value	Description	Dependence
0	Not Used	-
1	Run/Stop Command	P0224 = 1 or P0227 = 1
2	General Enable Command	P0224 = 1 or P0227 = 1
3	Quick Stop Command	P0224 = 1 or P0227 = 1
4	Forward/Reverse	P0223 = 4 or P0226 = 4
5	Local/Remote Selection	P0220 = 4
6	JOG	P0225 = 2 or P0228 = 2
7	SoftPLC	Prog. SoftPLC
8	2 <sup>nd</sup> Ramp Selection	P0105 = 2
9	Not Used	-
10	Not Used	-
11	Not Used	-
12	No External Alarm	-
13	No External Fault	-
14	Reset	Active fault
15	Disab. Flying-Start	P0320 = 1 ou 3
16	Not Used	-
17	Lock Programming	-
18	Load User 1	Inverter disabled
19	Load User 2	Inverter disabled
20	Auto/Man main PID (1)	-
21	Auto/Man external PID (1)	-
22	Not Used	-
23	Activate Bypass	-
24	Activate Fire Mode	-
25	PTC	-

(1) For digital inputs DI5, DI6, DI7 and DI8, those options do not present associated functions.

a) RUN/STOP

It enables or disables the motor rotation through the acceleration and deceleration ramp.

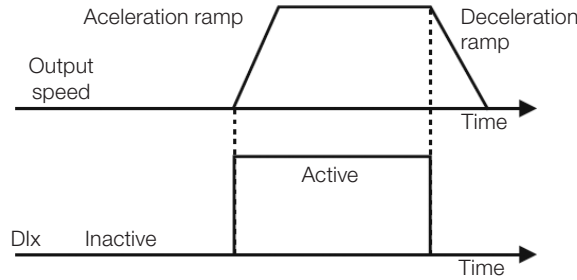


Figure 12.6: Example of the Run-Stop function

b) GENERAL ENABLE

It enables the inverter spin through the acceleration ramp and disables it by cutting off the pulses immediately, the motor stops by inertia.

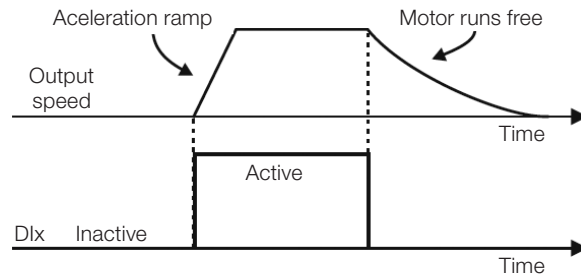


Figure 12.7: Example of the general enable function

c) QUICK STOP

When inactive, it disables the inverter by the 3<sup>rd</sup> Ramp by P0106.

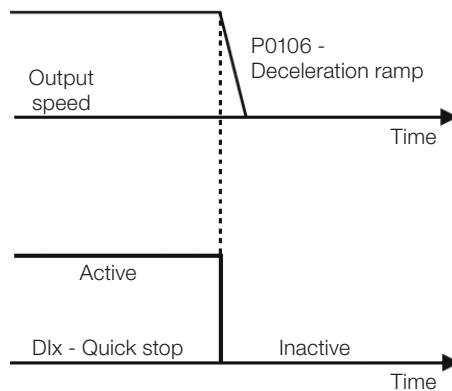
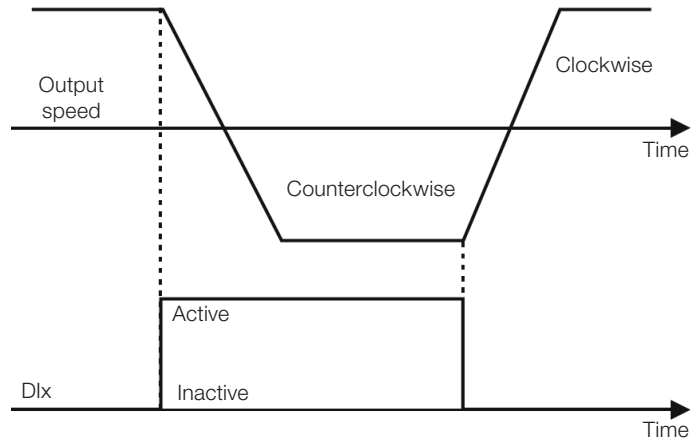


Figure 12.8: Example of the quick stop function

## d) DIRECTION OF ROTATION

If DIx is Inactive, the direction of rotation is clockwise; otherwise, the direction of rotation will be counterclockwise.



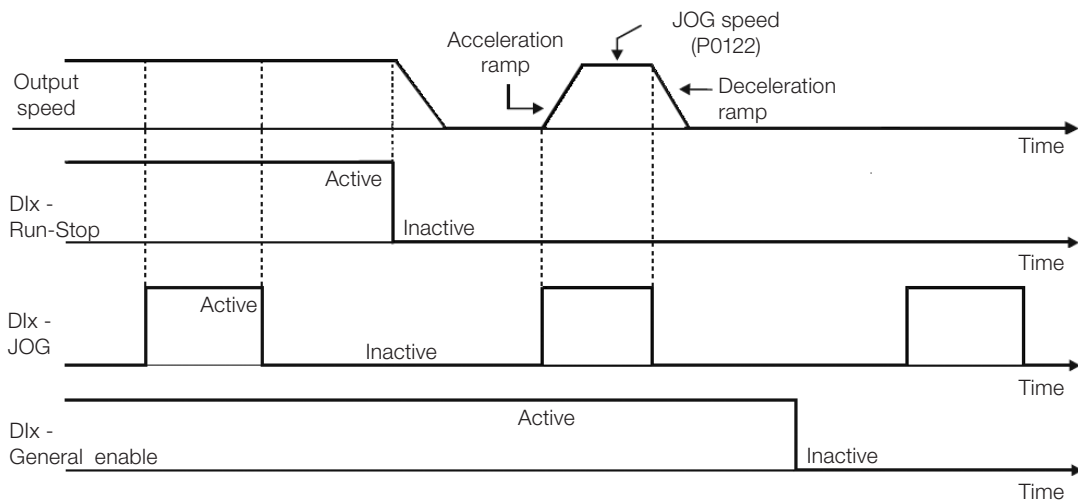
**Figure 12.9:** Example of the direction of rotation function

## e) LOCAL / REMOTE

If DIx is inactive, the local command is selected; otherwise, the remote command is selected.

## f) JOG

The JOG command is the combination of the Run / Stop command with a speed reference via parameter P0122.



**Figure 12.10:** Example of the JOG function



g) 2<sup>nd</sup> RAMP

If Dlx is inactive, the inverter uses the default ramp by P0100 and P0101; otherwise, it will use the 2<sup>nd</sup> ramp by P0102 and P0103.

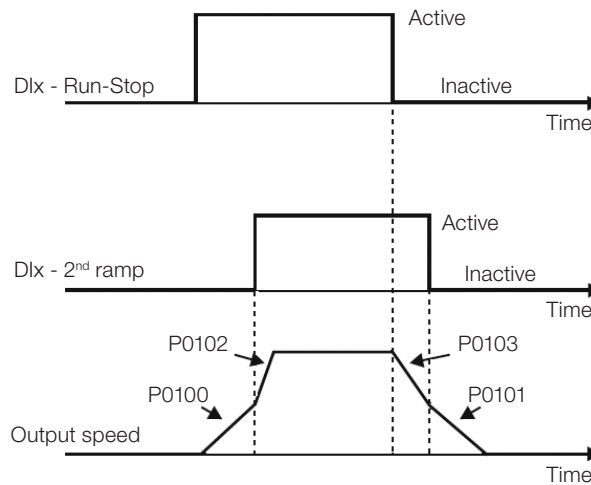


Figure 12.11: Example of the 2<sup>nd</sup> ramp function

h) NO EXTERNAL ALARM

If Dlx is inactive, the inverter will activate the external alarm A0090.

i) NO EXTERNAL FAULT

If Dlx is inactive, the inverter will activate the external fault F0091. In this case, the PWM pulses are disabled immediately.

j) FAULT RESET

Once the inverter is in the fault status and the fault origin condition is no longer active, the fault status will be reset in the transition of the Dlx programmed for this function.

k) USE OF SoftPLC

Only the digital input status Dlx in P0012 is used for the SoftPLC functions.

l) **Automatic / Manual for Main PID** configures the input to select the operating mode of the Main PID Controller, being automatic with the application of 0 V, or manual with the application of 24 V. Parameter P1018 defines its functionality in the operation of the Main PID Controller.

m) **Automatic / Manual for External PID** configures the input to select the operating mode of the External PID Controller, being automatic with the application of 0 V, or manual with the application of 24 V. Parameter P1065 defines its functionality in the operation of the External PID Controller.



**NOTE!**

In options 20 and 21, in case two or more analog inputs are selected for the same function, for instance, P0266 = 20 and P0267 = 20, only the analog input with higher priority will be valid, being DI1 > DI2 > DI3 > DI4, that is, in this case the digital input DI4 will be the input used as automatic/manual of the main PID controller. Refer to [chapter 18 HVAC FUNCTIONS on page 18-1](#) for further information.

n) DISABLE FLYING START

It allows the Dlx, when active, to disable the action of the Flying-Start function preset in parameter P0320 = 1 or 2. When the Dlx is inactive, the Flying-Start function operates normally again; Refer to [section 11.3 FLYING-START / RIDE-THROUGH on page 11-9](#).

o) LOCK PROG

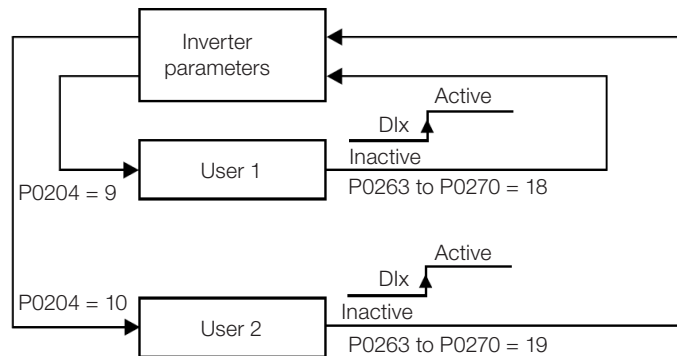
When the Dlx input is Active, parameters cannot be changed, no matter the values set in P0000 to P0200. When the Dlx input is Inactive, the modification of parameters will depend on the values set in P0000 and P0200.

p) LOAD Us. 1

This function allows selecting the user 1 memory, process similar to P0204 = 7, with the difference that the user is loaded from a transition in the Dlx programmed for this function.

q) LOAD Us. 2

This function allows selecting the user 2 memory, process similar to P0204 = 8, with the difference that the user is loaded from a transition in the Dlx programmed for this function.



**Figure 12.12:** Block diagram of the functions us. 1 and us. 2



**NOTES!**

Make sure that when using these functions, the parameter sets (User's Memory 1 or 2) are totally compatible with the application (motors, commands run/stop, etc).

With the motor enabled, it will not be possible to upload user's memory.

If two different motor parameter sets are saved on the user's memory 1 and 2, the correct current values must be set in parameters P0156, P0157 and P0158 for each user.

## 12.6 DIGITAL OUTPUT

The CFW501 can operate up to three digital outputs according to the selected interface plug-in module; refer to [Table 12.1: I/O Configurations of the CFW501 on page 12-1](#).

The DO1 digital output is always relay, while DO2 is always transistor; the other outputs can be relay or transistor according to the plug-in module. On the other hand, the digital output parameter configuration makes no distinction in this aspect, as detailed description below. Besides, the transistor digital outputs are always NPN, that is, in open collector (sink).

### P0013 – Digital Output Status DO5 to DO1

<b>Adjustable Range:</b>	Bit0 = DO1 Bit1 = DO2 Bit2 = DO3 Bit3 = DO4 Bit4 = DO5	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ, I/O"/>	

**Description:**

By using this parameter, it is possible to view the CFW501 digital output status.

The value of P0013 is indicated in hexadecimal, where each bit indicates the status of a digital output, that is, if the BIT0 is "0", DO1 is inactive; if the BIT0 is "1", DO1 is active, and so on up to DO5. Therefore, DOx active (1) means closed transistor or relay, inactive (0) means open transistor or relay.

**NOTE!** Parameter P0013 requires the user to know the conversion between binary and hexadecimal numerical system.

### P0275 – DO1 Output Function

### P0276 – DO2 Output Function

### P0277 – DO3 Output Function

### P0278 – DO4 Output Function

### P0279 – DO5 Output Function

<b>Adjustable Range:</b>	0 to 42	<b>Factory Setting:</b>	P0275 = 11 P0276 = 0 P0277 = 24 P0278 = 0 P0279 = 0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

**Description:**

These parameters define the DOx digital output function, as per [Table 12.9: Digital output functions on page 12-23](#).

**Table 12.9:** Digital output functions

Value	Output Function	Description
0	Not Used	Digital output inactive.
1	$N^* > N_x$	Active when the speed reference (P0001) is greater than $N_x$ (P0288).
2	$N > N_x$	Active when the motor speed (P0002) is above $N_x$ (P0288) plus a hysteresis value (P0287) and inactive when the motor speed (P0002) is below $N_x$ (P0288) minus a hysteresis value (P0287).
3	$N < N_y$	Active when the motor speed (P0002) is above $N_y$ (P0289) plus a hysteresis value (P0287) and inactive when the motor speed (P0002) is below $N_y$ (P0289) minus a hysteresis value (P0287).
4	$N = N^*$	Active when the motor speed (P0002) is equal to the seep set in P0292.
5	Zero Speed	Motor speed is below the value set in P0291.
6	$I_s > I_x$	Active if the output current $I_s$ (P0003) $> I_x$ (P0290).
7	$I_s < I_x$	Active if the output current $I_s$ (P0003) $< I_x$ (P0290).
8	Torque $> T_x$	Active if the motor torque $T$ (P0009) $> T_x$ (P0293).
9	Torque $< T_x$	Active if the motor torque $T$ (P0009) $< T_x$ (P0293).
10	Remote	Active if the command is the remote condition (REM).
11	Run	Active if the motor is running (active output PWM pulses) RUN status.
12	Ready	Active if the inverter has no fault.
13	No Fault	Active if the inverter has no fault.
14	No F0070	Active if the inverter has no overcurrent fault (F0070).
15	Not Used	Digital output inactive.
16	No F0021/22	Active if the inverter has no overvoltage or undervoltage fault (F0022 or F0021).
17	No F0051	Active if the inverter is without IGBT overtemperature fault (F0051).
18	No F0072	Active if the inverter is without motor overload fault (F0072).
19	4-20 mA OK	Active if $I_{Lx}$ is set for 4 to 20 mA (P0233 and/or P0238 and/or P0243 equal to 1 or 3) and $I_{Lx} < 2$ mA.
20	P0695 Value	Status of the bits 0 to 4 of P0695 activate digital outputs DO1 to DO5, respectively.
21	Clockwise	Active if the inverter direction of rotation is Clockwise.
22	Ride-Through	Active if the inverter is executing the Ride-Through function.
23	Pre-Load OK	Active if the pre-load relay of the DC link capacitors was already activated.
24	With Fault	Active if the inverter has a fault.
25	Hours Enab $> H_x$	Active when Time Enabled (P0043) is above $H_x$ (P0294).
26	SoftPLC	Activates DOx output according to the SoftPLC memory area. Read the SoftPLC User's Manual.
27	Not Used	Digital output inactive.
28	$F > F_x(1)$	Active when the output frequency $F$ (P0005) is above $F_x$ (P0281) plus a hysteresis value (P0282) and inactive when $F$ (P0005) is below $F_x$ (P0281) minus a hysteresis value (P0282).
29	$F > F_x(2)$	Active when the output frequency $F$ (P0005) is above $F_x$ (P0281) and inactive when $F$ (P0005) is below $F_x$ (P0281) minus a hysteresis value (P0282).
30	Not Used	Digital output inactive.
31	Not Used	Digital output inactive.
32	No Alarm	Active when the inverter has no alarm.
33	No F/A	Active when the inverter is without alarm and without fault.
34	F/A Dry Pump	Active when dry pump condition was detected (A0766/F0767).
35	F/A Broken Belt	Active when broken belt condition was detected (A0768 / F0769).
36	F/A Filter maintenance	Active when the filter maintenance condition was detected (A0770 / F0771).
37	Sleep Mode	Active when the inverter has the sleep mode active (A0764).
38	Not Used	Digital output inactive.
39	Drive Bypass Contactor	Digital output inactive.
40	Mains Bypass Contactor	Digital output inactive.
41	Fire Mode	Digital output inactive.
42	Self-tuning	Active when the inverter is performing the self-tuning function.



**NOTE!**

Refer to [chapter 18 HVAC FUNCTIONS](#) on page 18-1 for further information on options 34, 37, 39 and 41.

**P0281 – Fx Frequency**

<b>Adjustable Range:</b>	0.0 to 500.0 Hz	<b>Factory Setting:</b>	4.0 Hz
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**P0282 – Fx Hysteresis**

<b>Adjustable Range:</b>	0.0 to 15.0 Hz	<b>Factory Setting:</b>	2.0 Hz
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**Properties:**

**Access groups via HMI:**

**Description:**

These parameters set the hysteresis and actuation level on the Fx output frequency signal and on the F\* ramp of the relay digital outputs. In this way, the relay commutation levels are "P0281 + P0282" and "P0281 - P0282".

**P0287 – Nx/Ny Hysteresis**

<b>Adjustable Range:</b>	0 to 900 rpm	<b>Factory Setting:</b>	18 rpm (15 rpm)
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**P0288 – Nx Speed**

**P0289 – Ny Speed**

<b>Adjustable Range:</b>	0 to 18000 rpm	<b>Factory Setting:</b>	P0288 = 120 (100 rpm) P0289 = 1800 (1500 rpm)
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**Properties:**

**Access groups via HMI:**

**Description:**

These parameters set the hysteresis and actuation level on the Nx and Ny output speed signal in the N\* ramp input of the relay digital outputs. In this way, the relay commutation levels are "P0288 + P0287" and "P0288 - P0287", or "P0289 + P0287" and "P0289 - P0287".

**P0290 – Ix Current**

<b>Adjustable Range:</b>	0.0 to 200.0 A	<b>Factory Setting:</b>	1.0 x I <sub>nom</sub>
--------------------------	----------------	-------------------------	------------------------

**Properties:**

**Access groups via HMI:**

**Description:**

Current level to activate the relay output in the I<sub>s</sub> > I<sub>x</sub> (6) and I<sub>s</sub> < I<sub>x</sub> (7) functions. The actuation occurs on a hysteresis with upper level in P0290 and lower by: P0290 - 0.05 x P0295, that is, the equivalent value is Amperes for 5 % of P0295 below P0290.

## P0291 – Zero Speed

<b>Adjustable Range:</b>	0 to 18000 rpm	<b>Factory Setting:</b>	18 (15 rpm)
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

### Description:

It specifies the value, in rpm, below which the effective speed will be considered zero for the purpose of the Stop Logic function.

This parameter is also used by the functions of the digital and relay outputs.

## P0292 – N = N\* Band

<b>Adjustable Range:</b>	0 to 18000 rpm	<b>Factory Setting:</b>	18 (15 rpm)
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

### Description:

It is used in the  $N = N^*$  function of the digital and relay outputs.

## P0293 – Tx Torque

<b>Adjustable Range:</b>	0 to 200 %	<b>Factory Setting:</b>	100 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

### Description:

Torque percentage level to activate the relay output in the Torque > Tx (8) and Torque < Tx (9) functions. The actuation occurs on a hysteresis with upper level in P0293 and lower by: P0293 - 5 %. This percentage value is related to the motor rated torque matched to the inverter power.

## P0294 – Hx Time

<b>Adjustable Range:</b>	0 to 6553.5 h	<b>Factory Setting:</b>	432.0 h
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="I/O"/>		

### Description:

It is used in the Enabled Hours > Hx function of the digital and relay outputs.

### 13 RHEOSTATIC BRAKING

The braking torque that may be obtained by the application of frequency inverters, without rheostatic braking resistors, varies from 10 % to 35 % of the motor rated torque.

In order to obtain higher braking torques, resistors for rheostatic braking are used. In this case, the regenerated energy is dissipated in the resistor mounted outside the inverter.

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

The rheostatic braking function can only be used if a braking resistor is connected to the inverter, and if the parameters related to it are properly set.

**P0153 – Rheostatic Braking Level**

<b>Adjustable Range:</b>	339 to 1200 V	<b>Factory Setting:</b>	375 V (P0296 = 0) 750 V (P0296 = 1) 950 V (P0296 = 2)
<b>Properties:</b>	V/f, VVW		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR"/>		

**Description:**

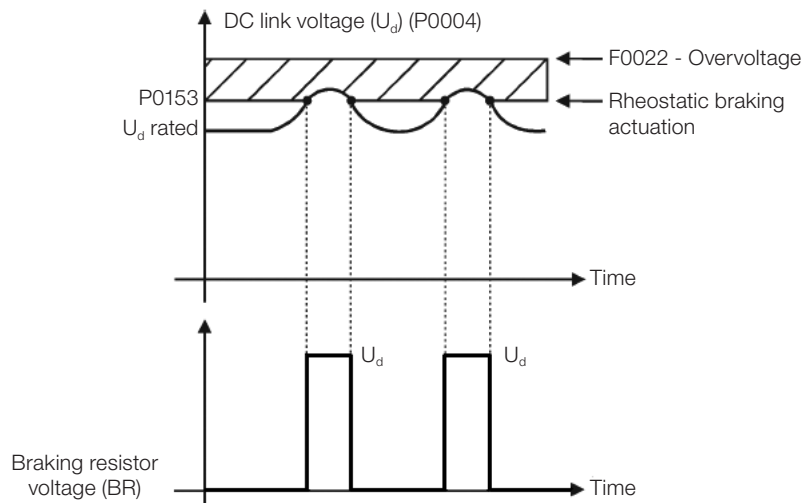
Parameter P0153 defines the voltage level to activate the braking IGBT, and it must be compatible with the power supply.

If P0153 is set at a level too close to the overvoltage actuation level (F0022), it may occur before the braking resistor can dissipate the motor regenerated energy. On the other hand, if the level is too lower than the overvoltage, the function limits the actuation at a maximum of 15 % of the overvoltage level. Thus, it is ensured that the braking resistor will not actuate in the DC link rated operating region; refer to [Table 13.1: Rheostatic braking actuation value on page 13-1](#). Therefore, although P0153 has a wide setting band (339 to 1200 V), only the values defined by the actuation band in [Table 13.1: Rheostatic braking actuation value on page 13-1](#) are effective, that is, values below the actuation band are internally limited in the execution of the function and values above naturally deactivate the function.

*Table 13.1: Rheostatic braking actuation value*

Input Voltage	Rated DC Link	P0153 Actuation Band	P0153 Factory Default
200 to 240 Vac	339 Vcc	349 to 410 Vcc	375 Vcc
380 to 480 Vac	678 Vcc	688 to 810 Vcc	750 Vcc
500 to 600 Vac	846 Vcc	850 to 1000 Vcc	950 Vcc

[Figure 13.1: Rheostatic braking actuation curve on page 13-2](#) shows an example of typical DC braking actuation, where it can be observed the hypothetical wave shapes of the voltage on the braking resistor and the voltage on the DC link. Thus, when the braking IGBT connects the link to the external resistor, the DC link voltage drops below the value set by P0153, keeping the level below fault F0022.



**Figure 13.1:** Rheostatic braking actuation curve

Steps to enable the rheostatic braking:

- With the inverter powered down, connect the braking resistor (refer to the user's manual, item 3.2 - Electric Installations).
- Setting P0151 for the maximum value: 410 V (P0296 = 0), 810 V (P0296 = 1) or 1200 V (P0296 = 2), according to the situation, in order to prevent the actuation of the DC link voltage regulation before the rheostatic braking.



**DANGER!**

Be sure the inverter is OFF before handling the electric connections and read carefully the installation instructions of the user's manual.



## 14 FAULTS AND ALARMS

The problem detection structure in the inverter is based on the fault and alarm indication.

In case of fault, the IGBTs will be locked and the motor will stop by inertia.

The alarm works as a warning for the user that critical operating conditions are taking place and that a fault may occur if the situation is not corrected.

Refer to chapter 6 - Troubleshooting and Maintenance of the CFW501 user's manual and [QUICK REFERENCE OF PARAMETERS, ALARMS AND FAULTS on page 0-1](#) contained in this manual to obtain more information regarding the faults and alarms.

### 14.1 MOTOR OVERLOAD PROTECTION (F0072 AND A0046)

The motor overload protection is based on the use of curves that simulate the heating and cooling of the motor in cases of overload. The motor overload protection fault and alarm codes are F0072 and A0046 respectively.

The motor overload is given considering the reference value  $I_n \times FS$  (motor rated current multiplied by the duty factor), which is the maximum value at which the overload protection must not actuate, because the motor can work continuously at that value without damages.

However, for that protection to actuate properly, the winding-temperature supervision (which corresponds to the time of heating and cooling of the motor) is estimated.

This thermal image is approximate by means of a function called  $I_{xt}$ , which integrates the output current value from a level previously defined by P0156, P0157 and P0158. When the accumulated value reaches the limit, an alarm and/or fault are indicated.

In order to ensure greater protection in case of restart, this function keeps the value integrated by the function  $I_{xt}$  in the inverter non-volatile memory. Thus, after the energizing, the function will use the  $I_{xt}$  value saved in this memory to perform a new evaluation of overload.

**P0156 – Overload Current at Rated Speed**

**P0157 – Overload Current 50 % of Rated Speed**

**P0158 – Overload Current 20 % of Rated Speed**

<b>Adjustable Range:</b>	0.0 to 200.0 A	<b>Factory Setting:</b>	P0156 = 1.1 x Inom P0157 = 1.0 x Inom P0158 = 0.8 x Inom
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR"/>		

**Description:**

These parameters define the motor overload current (Ixt - F0072). The motor overload current is the current value (P0156, P0157 and P0158) based on which the inverter will understand that the motor is operating in overload.

For self-ventilated motors, the overload current depends on the speed that is being applied to the motor. Therefore, for speeds below 20 % of the rated speed the overload current is P0158, while for speeds between 20 % and 50 % the overload current is P0157, and above 50 %, it is P0156.

The greater the difference between the motor current and the overload current (P0156, P0157 or P0158), the faster the actuation of fault F0072.

It is recommended that parameter P0156 (motor overload current at rated speed) be set at a value 10 % above the used motor rated current (P0401).

In order to deactivate the motor overload current function just set parameters P0156 to P0158 to values equal to or above two times the inverter rated current P0295.

Figure 14.1: Actuation of the motor overload on page 14-3 shows the overload actuation time considering the standard output current in relation to the overload current (P0156, P0157 or P0158), that is, for a constant output current with 150 % of overload, Fault F0072 occurs in 60 seconds. On the other hand, for output current values below P0156, P0157 or P0158, according to the output frequency, fault F0072 does not occur. Whereas for values above 150 % of P0156, P0157 or P0158 the fault actuation time is below 60 s.

**P0349 – Level for Alarm lxt**
**Adjustable Range:** 70 to 100 %

**Factory Setting:** 85 %

**Properties:** cfg

**Description:**

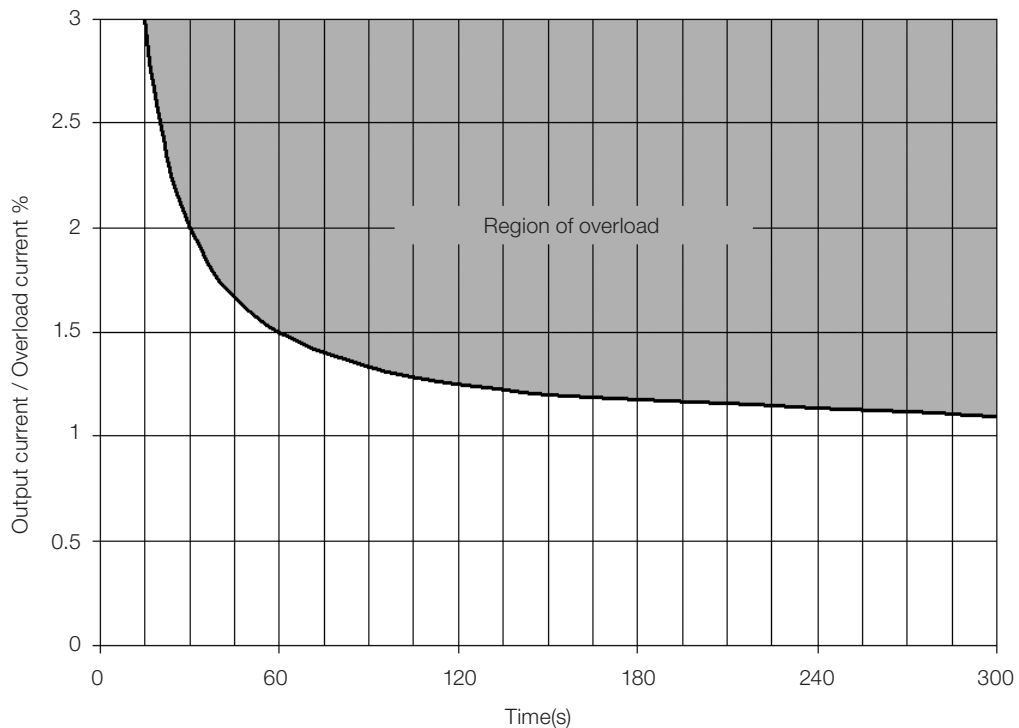
This parameter defines the level for alarm actuation of the motor overload protection (A0046 when P0037 > P0349). The parameter is expressed in percentage of the overload integrator limit value, where fault F0072 occurs. Therefore, by setting P0349 at 100 %, the overload alarm is inactive.

**P0037 – Overload of Motor lxt**
**Adjustable Range:** 0 to 100 %

**Factory Setting:**
**Properties:** ro

**Access groups via HMI:** 
**Description:**

This parameter indicates the present motor overload percentage or overload integrator level. When this parameter reaches the P0349 value the inverter will indicate the motor overload alarm (A0046). As soon as the value of the parameter is at 100 %, a motor overload fault (F0072) is raised.



**Figure 14.1:** Actuation of the motor overload

### 14.2 IGBTs OVERLOAD PROTECTION (F0048 AND A0047)

The CFW501 IGBTs overload protection uses the same motor protection format. However, the project point was modified for the fault F0048 to occur in three seconds for 200 % of overload in relation to the inverter rated current (P0295), as shown in [Figure 14.2: Actuation of the overload of the IGBTs on page 14-4](#). On the other hand, the IGBTs overload (F0048) has no actuation for levels below 150 % of the inverter rated current (P0295).

Before the actuation of fault F0048, the inverter can indicate alarm A0047 when the IGBTs overload level is above the value programmed in P0349.

The IGBTs overload protection can be disabled through parameter P0343.

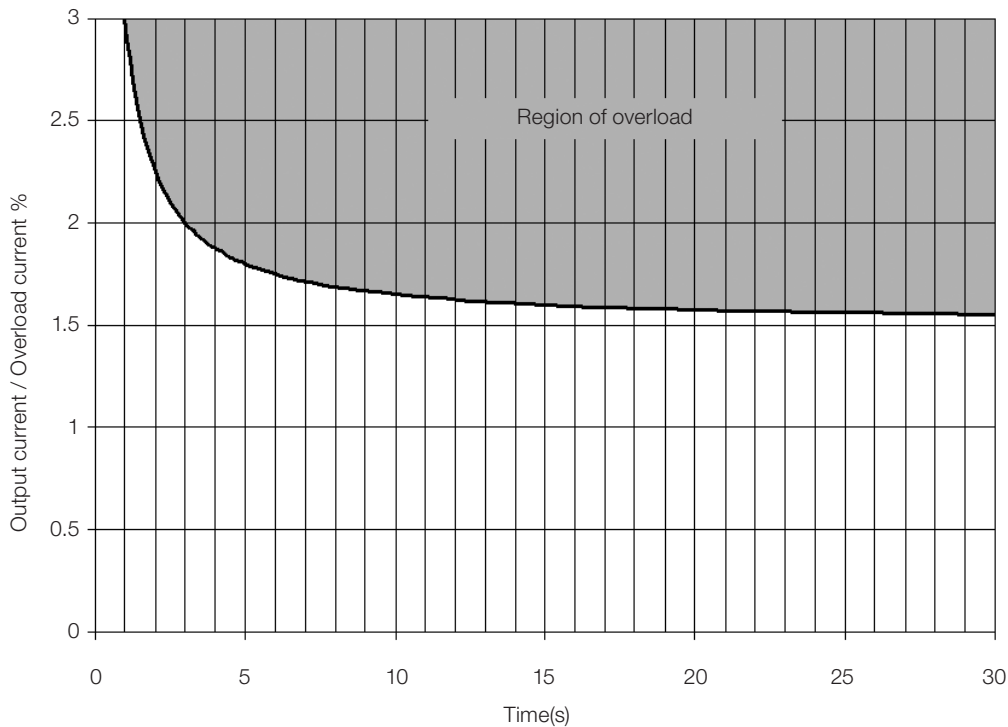


Figure 14.2: Actuation of the overload of the IGBTs

#### P0343 – Mask for Faults and Alarms

<b>Adjustable Range:</b>	Bit 0 = F0074	<b>Factory Setting:</b> 0003h
	Bit 1 = F0048	
	Bit 2 = F0078	
	Bit 3 = F0079	
	Bit 4 = F0076	
	Bit 5 = F0179	
	Bit 6 = Reserved	
	Bit 7 = F700/A700	
	Bit 8 to 15 = Reserved	
<b>Properties:</b>	cfg	

**Description:**

Parameter P0343 allows deactivating some faults and alarms specific of the inverter, by means of a bit mask, a binary number is formed, where the "Bit" equivalent to "0" disables the respective fault or alarm.

Note that the numeric representation of P0343 is hexadecimal.


**ATTENTION!**

Disabling the ground fault or overload protections may damage the inverter. Only do that under WEG technical directions.

### 14.3 MOTOR OVERTEMPERATURE PROTECTION (F0078)

This function protects the motor against overtemperature through indication of fault F0078.

The motor needs a temperature sensor of the triple PTC type. The reading of the sensor can be done in two different ways: through the analog input or through the digital input.

For the reading of the PTC via analog input, it is necessary to configure it for current input and select option "4 = PTC" in P0231 or P0236. Connect the PTC between source +10 Vdc and the analog input, as well as the A1x configuration DIP-Switch in "mA".

The analog input reads the PTC resistance and compares it to the limits values for the fault. When those values are exceeded, fault F0078 is indicated, as shown in [Table 14.1: Actuation level of fault F0078 PTC via analog input on page 14-5](#).


**ATTENTION!**

The PTC must feature reinforced insulation of the live parts of the motor and installation.

*Table 14.1: Actuation level of fault F0078 PTC via analog input*

PTC Resistance	A1x	Overtemperature
$R_{PTC} < 50 \Omega$	$V_{IN} > 9.1 \text{ V}$	F0078
$50 \Omega < R_{PTC} < 3.9 \text{ k}\Omega$	$9.1 \text{ V} > V_{IN} > 1.3 \text{ V}$	Standard
$R_{PTC} > 3.9 \text{ k}\Omega$	$V_{IN} < 1.3 \text{ V}$	F0078

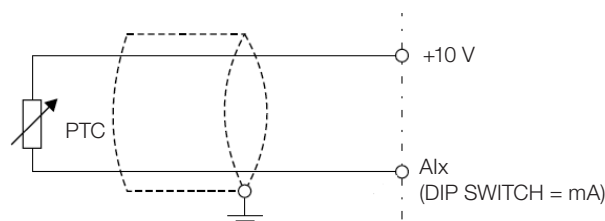

**NOTE!**

For this function to work properly, it is important to keep the gain(s) and offset(s) of the analog inputs at the standard values.


**NOTE!**

The DI2 is the only one that cannot be used as PTC input, because it has input circuit dedicated to frequency input (FI).

Figure 14.3: PTC connection to the CFW501 via analog input on page 14-5 shows the PTC connection to the inverter terminals.



*Figure 14.3: PTC connection to the CFW501 via analog input*

### 14.4 IGBTs OVERTEMPERATURE PROTECTION (F0051 AND A0050)

The power module is monitored and indicated in parameter P0030 in degrees Celsius. This value is constantly compared to the overtemperature fault and alarm trigger value of the power module F0051 and A0050, according to [Table 14.2: Overtemperature actuation levels of the power module F0051 on page 14-6](#). where the level for actuation of the alarm A0050 is fixed at 5 °C (41 °F) below the level of F0051.

**Table 14.2:** Overtemperature actuation levels of the power module F0051

Level F0051	P0029 Model
90 (194 °F)	1
90 (194 °F)	2
90 (194 °F)	3
105 (221 °F)	4
123 (253.4 °F)	5
108 (226.4 °F)	6
108 (226.4 °F)	7
108 (226.4 °F)	8
108 (226.4 °F)	9
120 (248 °F)	10
105 (221 °F)	11
115 (239 °F)	12
115 (239 °F)	13
108 (226.4 °F)	14
108 (226.4 °F)	15
105 (221 °F)	16
110 (230 °F)	17
120 (248 °F)	18
110 (230 °F)	19
110 (230 °F)	20
110 (230 °F)	21
110 (230 °F)	22
110 (230 °F)	23
110 (230 °F)	24
110 (230 °F)	25
110 (230 °F)	26
110 (230 °F)	27
110 (230 °F)	28
110 (230 °F)	29
110 (230 °F)	30
110 (230 °F)	31
110 (230 °F)	32
110 (230 °F)	33
110 (230 °F)	34
110 (230 °F)	35
105 (221 °F)	36
105 (221 °F)	37
105 (221 °F)	38

Besides the alarm indication A0050, the overtemperature protection automatically reduces the switching frequency (P0297) for the value of 2500 Hz when the temperature (P0030) reaches 80 % of the F0051 level and the output current (P0003) is above the rated current (P0295). This overtemperature protection function can be deactivated in the control configuration parameter P0397.



**ATTENTION!**

An improper change of P0397 may damage the inverter. Only do that under WEG technical directions.

### 14.5 OVERCURRENT PROTECTION (F0070 AND F0074)

The ground fault and output overcurrent protections act very fast by means of the hardware to instantly cut the output PWM pulses when the output current is high.

Fault F0070 corresponds to a current surge between output phases, while fault F0074 indicates surge of phase to the ground (PE).

The protection current level depends on the used power module so as the protection is effective, still this value is well above the inverter rated operating current (P0295).

### 14.6 LINK VOLTAGE SUPERVISION (F0021 AND F0022)

The DC link voltage is constantly compared to the maximum and minimum values according to the inverter power supply, as shown in [Table 14.3: Supervision actuation levels of the DC link voltage on page 14-7](#).

*Table 14.3: Supervision actuation levels of the DC link voltage*

Supply	Level F0021	Level F0022
200 to 240 Vac	200 Vdc	410 Vdc
380 to 480 Vac	360 Vdc	810 Vdc
500 to 600 Vac	500 Vdc	1000 Vdc

### 14.7 PLUG-IN MODULE COMMUNICATION FAULT (F0031)

It occurs when the inverter detects a plug-in module connected, but cannot communicate with it.

### 14.8 VVW CONTROL MODE SELF-TUNING FAULT (F0033)

At the end of the self-tuning process of the VVW mode (P0408 = 1), if the estimate motor stator resistance (P0409) is too high for the inverter in use, the inverter will indicate fault F0033. Besides, the manual modification of P0409 may also cause fault F0033.

### 14.9 REMOTE HMI COMMUNICATION FAULT ALARM (A0700)

After connecting the remote HMI to the CFW501 terminals and parameter P0312 being programmed for interface with remote HMI, a supervision of the communication with the HMI is activated so that alarm A0700 is activated whenever this communication link is broken.

### 14.10 REMOTE HMI COMMUNICATION ERROR ALARM (F0700)

The condition for fault F0700 is the same as that of alarm A0700, but it is necessary that the HMI be the source for some command or reference (HMI Keys option) in parameters P0220 to P0228.

### 14.11 AUTO-DIAGNOSIS FAULT (F0084)

Before starting loading the factory default (P0204 = 5 or 6), the inverter identifies the power hardware in order to obtain information on the power module voltage, current and trigger, as well as it verifies the inverter control basic circuits.

Fault F0084 indicates something wrong happened during the identification of the hardware: nonexistent inverter model, some loose connection cable or damaged internal circuit.



**NOTE!**

When this fault occurs, contact WEG.

### 14.12 FAULT IN THE CPU (F0080)

The execution of the inverter firmware is monitored at several levels of the firmware internal structure. When some internal fault is detected in the execution, the inverter will indicate F0080.



**NOTE!**

When this fault occurs, contact WEG.

### 14.13 INCOMPATIBLE MAIN SOFTWARE VERSION (F0151)

When the inverter is energized, the main software version stored in the non-volatile area (EEPROM) is compared to the version stored in the secondary microcontroller flash memory (plug-in module). This comparison is done to check the integrity and compatibility of the stored data. Those data are stored to allow copying the parameter configuration (standard user, 1 and 2) between inverters using the CFW500-MMF and with the inverter de-energized. If the versions are not compatible, fault F0151 will occur.

For further information on possible causes for the occurrence of fault F0151, refer to the CFW500-MMF accessory guide.

### 14.14 PULSE FEEDBACK FAULT (F0182)

When the dead time compensation is active in P0397 (refer to [chapter 8 AVAILABLE MOTOR CONTROL TYPES on page 8-1](#)) and the pulse feedback circuit has some defect, fault F0182 will occur.



**NOTE!**

When this fault occurs, contact WEG.

### 14.15 FAULT HISTORY

The inverter is able to store a set of data on the last three faults occurred, such as: fault number, current (P0003), DC link voltage CC (P0004), output frequency (P0005), power module temperature (P0030) and logical status (P0680).

#### P0048 – Present Alarm

#### P0049 – Present Fault

<b>Adjustable Range:</b>	0 to 999	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

They indicate the alarm number (P0048) or the fault (P0049) that may be present in the inverter.

#### P0050 – Last Fault

#### P0060 – Second Fault



**P0070 – Third Fault**

<b>Adjustable Range:</b>	0 to 999	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

They indicate the number of the occurred fault.

**P0051 – Output Current Last Fault**
**P0061 – Output Current Second Fault**
**P0071 – Output Current Third Fault**

<b>Adjustable Range:</b>	0.0 to 200.0 A	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

They indicate the output current at the moment of the occurred fault.

**P0052 – DC Link Last Fault**
**P0062 – DC Link Second Fault**
**P0072 – DC Link Third Fault**

<b>Adjustable Range:</b>	0 to 2000 V	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

They indicate the DC link voltage at the moment of the occurred fault.

**P0053 – Output Frequency Last Fault**
**P0063 – Output Frequency Second Fault**

**P0073 – Output Frequency Third Fault**

<b>Adjustable Range:</b>	0.0 to 500.0 Hz	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

They indicate the output frequency at the moment of the occurred fault.

**P0054 – Temperature in the IGBTs Last Fault**

**P0064 – Temperature in the IGBTs Second Fault**

**P0074 – Temperature in the IGBTs Third Fault**

<b>Adjustable Range:</b>	-20 to 150 °C	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

These parameters indicate the IGBTs temperature at the moment of the occurred fault.

**P0055 – Logical Status Last Fault**

**P0065 – Logical Status Second Fault**

**P0075 – Logical Status Third Fault**

<b>Adjustable Range:</b>	0000h to FFFFh	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It records the inverter logical status of P0680 at the moment of the occurred fault. Refer to [section 7.3 CONTROL WORD AND INVERTER STATUS](#) on page 7-10.

**P0080 – Last Fault in "Fire Mode"**
**P0081 – Second Fault in "Fire Mode"**
**P0082 – Third Fault in "Fire Mode"**

<b>Adjustable Range:</b>	0 to 9999	<b>Factory Setting:</b>	0
<b>Properties:</b>	ro		
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>		

**Description:**

These parameters indicate the last three faults that occurred on the inverter while the "Fire Mode" was active.

**14.16 FAULT AUTO-RESET**

This function allows the inverter to execute the automatic reset of a fault by means of the setting of P0340.


**NOTE!**

The auto-reset is locked if the same fault occurs three times in a row within 30 seconds after the reset.

**P0340 – Auto-Reset Time**

<b>Adjustable Range:</b>	0 to 255 s	<b>Factory Setting:</b>	0 s
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**Description:**

It defines the interval after a fault to activate the inverter auto-reset. If the value of P0340 is zero the fault auto-reset function is disabled.

## 15 READING PARAMETERS

In order to simplify the view of the main inverter reading variables, you may directly access the READ – "Reading Parameters" menu of the CFW501 Remote HMI.

It is important to point out that all the parameters of this group can only be viewed on the HMI display, and cannot be changed by the user.

### P0001 – Speed Reference

<b>Adjustable Range:</b>	0 to 65535 rpm	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

This parameter presents, regardless of the origin source, the speed reference value in rpm (factory setting).

### P0002 – Output Speed (Motor)

<b>Adjustable Range:</b>	0 to 65535 rpm	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

Parameter P0002 indicates the speed imposed on the inverter output in rpm (factory setting), with filter of 0.5 s.

### P0003 – Motor Current

<b>Adjustable Range:</b>	0.0 to 200.0 A	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the inverter output current in amperes rms (Arms).

### P0004 – DC Link Voltage (Ud)

<b>Adjustable Range:</b>	0 to 2000 V	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the DC link direct current voltage in Volts (V).

### P0005 – Output Frequency (Motor)

<b>Adjustable Range:</b>	0.0 to 500.0 Hz	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

Real frequency instantly applied to the motor in Hertz (Hz).

### P0006 – Inverter Status

<b>Adjustable Range:</b>	According to <a href="#">Table 15.1: Inverter status - P0006 on page 15-2</a>	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates one of the ten possible inverter status. In [Table 15.1: Inverter status - P0006 on page 15-2](#), a description of each status is presented, as well as the indication on the HMI.

*Table 15.1: Inverter status - P0006*

P0006	Status	HMI	Description
0	Ready		Indicates the inverter is ready to be enabled.
1	Run		Indicates the inverter is enabled.
2	Sub		Indicates the voltage in the inverter is too low for operation (undervoltage), and will not accept the enabling command.
3	Fault Fxxxx		Indicates the inverter is in the fault status.
4	Self-Tuning (conf RUN)		Indicates the inverter is executing the Self-Tuning routine.
5	Configuration (conf)		Indicates the inverter has incompatible parameter programming. Refer to <a href="#">section 5.7 SITUATIONS FOR CONFIG STATUS on page 5-12</a> .

P0006	Status	HMI	Description
6	DC Braking (RUN)		Indicates the inverter is applying DC braking to stop the motor.
7	Reserved	-	-
8	Fire Mode		Indicates that the inverter is in Fire Mode (A0211).
9	Bypass	-	Indicates that the inverter is in Bypass.

### P0007 – Output Voltage

<b>Adjustable Range:</b>	0 to 2000 V	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the line voltage in inverter output, in Volts (V).

### P0009 – Motor Torque

<b>Adjustable Range:</b>	-1000.0 % to 1000.0 %	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the torque developed by the motor in relation to the rated torque.

### P0010 – Output Power

<b>Adjustable Range:</b>	0.0 to 6553.5 kW	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the electric power in the inverter output. This power is determined through the formula:  
 $P0010 = \sqrt{3} \times P0003 \times P0007 \times P0011$ .

Where:

P0003 is the output current measured;

P0007 is the reference output voltage (or estimated);

P0011 is the value of the cosine [(vector angle of the reference output voltage) – (vector angle of the output current measured)].

### P0011 – Cos $\phi$ on the Output

<b>Adjustable Range:</b>	-1.00 to 1.00	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the power factor, that is, the relationship between the real power and the total power absorbed by the motor.

### P0012 – Digital Input Status

Refer to [section 12.5 DIGITAL INPUTS](#) on page 12-15.

### P0013 – Digital Output Status

Refer to [section 12.6 DIGITAL OUTPUT](#) on page 12-22.

### P0014 – Analog Output Values AO1

### P0015 – Analog Output Values AO2

Refer to [section 12.2 ANALOG OUTPUTS](#) on page 12-7.

### P0016 – Frequency Output Value FO in %

### P0017 – Frequency Output Value FO in Hz

Refer to [section 12.4 FREQUENCY OUTPUT](#) on page 12-13.

### P0018 – Analog Input Value AI1

### P0019 – Analog Input Value AI2

### P0020 – Analog Input Value AI3

Refer to [section 12.1 ANALOG INPUTS](#) on page 12-1.

### P0021 – Frequency Input Value FI in %

### P0022 – Frequency Input Value FI in Hz

Refer to [section 12.3 FREQUENCY INPUT](#) on page 12-10.

### P0023 – Version of Main Software

### P0024 – Version of Secondary Software

### P0027 – Plug-In Module Configuration

### P0029 – Power Hardware Configuration

Refer to [section 6.1 INVERTER DATA](#) on page 6-1.

### P0030 – Heatsink Temperature

<b>Adjustable Range:</b>	-20 to 150 °C	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

Temperature in °C measured inside the power module by the internal NTC.

### P0037 – Motor Overload Ixt

Refer to [section 14.1 MOTOR OVERLOAD PROTECTION \(F0072 AND A0046\)](#) on page 14-1.

### P0042 – Powered Time

<b>Adjustable Range:</b>	0 to 65535 h	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the total number of hours that the inverter remained powered.

This value is kept even when power is removed from the inverter.

### P0043 – Enabled Time

<b>Adjustable Range:</b>	0.0 to 6553.5 h	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the total number of hours that the inverter remained enabled.

It indicates up to 6553.5 hours, and then it gets back to zero.

By setting P0204 = 3, the value of the parameter P0043 is reset to zero.

This value is kept even when power is removed from the inverter.



### P0044 – kWh Output Energy

<b>Adjustable Range:</b>	0 to 65535 kWh	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

It indicates the energy consumed by the motor.

It indicates up to 65535 kWh, and then it gets back to zero.

By setting P0204 = 4, the value of the parameter P0044 is reset to zero.

This value is kept even when power is removed from the inverter.

**NOTE!** The value indicated in this parameter is calculated indirectly, and must not be used to measure the energy consumption.

### P0047 – CONF Status

<b>Adjustable Range:</b>	0 to 999	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="READ"/>	

**Description:**

This parameter shows the origin situation of the CONFIG mode. Refer to [section 5.7 SITUATIONS FOR CONFIG STATUS on page 5-12](#).

The reading parameters in the range from P0048 to P0075 are detailed in [section 14.15 FAULT HISTORY on page 14-8](#).

The reading parameters P0295 and P0296 are detailed in the [section 6.1 INVERTER DATA on page 6-1](#).

The reading parameters P0680 and P0690 are detailed in the [section 7.3 CONTROL WORD AND INVERTER STATUS on page 7-10](#).

## 16 COMMUNICATION

In order to exchange information via communication network, the CFW501 features several standardized communication protocols, such as Modbus, Bacnet and Metasys N2.

For further details referring to the inverter configuration to operate in those protocols, refer to the CFW501 user’s manual for communication with the desired network. Below are listed the parameters related to the communication.

### 16.1 SERIAL RS-485 INTERFACE

The CFW501 features has two simultaneous serial interfaces; however, only one of them can be source for commands or references; the other is mandatorily inactive or remote HMI according to the selection of P0312.

See the control interface CFW500-CRS485 plug-in module, as per the figures below:

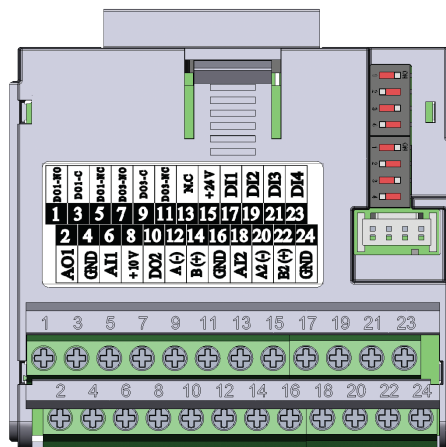


Figure 16.1: Plug-In Module CFW500-CRS485



**NOTE!**

The CFW500-CRS485 plug-in module has Serial (1) interface through RS485 port at terminals 12(A-) and 14(B+), as well as the Serial (2) interface through another RS485 port at terminals 20(A2+) and 22(B2+); see [Figure 16.1: Plug-In Module CFW500-CRS485 on page 16-1](#).

Parameters P0308 to P0316 together with P0682 and P0683 characterize the serial interface which is active for commands and/or reference.

**P0308 – Serial Address**

**P0310 – Serial Baud Rate**

**P0311 – Serial Interface Byte Configuration**

**P0312 – Serial Interface Protocol (1)(2)**

**P0314 – Watchdog Serial**

**P0316 – Serial Interface Status**

**Description:**

Parameters for the configuration and operation of the serial interface USB, RS-232 and RS-485. For detailed description, refer to the Modbus RTU user’s manual supplied on the CD-ROM that comes with the product.

## 16.2 BACNET COMMUNICATION

**P0760 – BACNET Equipment Instance - High Part**

**P0761 – BACNET Equipment Instance - Low Part**

**P0762 – Maximum Master Number**

**P0763 – Maximum MS/TP Frame Number**

**P0764 – I-AM Transmission**

**P0765 – Number of Received Tokens**

Parameters for configuration and operation of the BACnet communication. For detailed description, refer to the BACnet user's manual supplied on the CD-ROM that comes with the product.

## 16.3 METASYS N2 COMMUNICATION

For detailed description, refer to Metasys N2 user's manual supplied on the CD-ROM that comes with the product.

## 16.4 COMMUNICATION COMMANDS AND STATUS

**P0313 – Action for Communication Error**

**P0680 – Logical Status**

**P0681 – Speed in 13 bits**

**P0695 – Value for Digital Outputs**

**P0696 – Value 1 for Analog Outputs**

**P0697 – Value 2 for Analog Outputs**

**P0698 – Value 3 for Analog Outputs**

**P0682 – Control Word via Serial**

**P0683 – Speed Reference via Serial**

Parameters used for monitoring and controlling the CFW501 inverter by using the communication interfaces. For detailed description, refer to the communication manual according to the interface used. Those manuals are supplied in electronic format on the CD-ROM that comes with the product.

## 17 SOFTPLC

The SoftPLC function allows the inverter to assume PLC (Programmable Logical Controller). For further details regarding the programming of those functions in the CFW501, refer to the CFW501 SoftPLC manual. Below are described the parameters related to the SoftPLC.

### P1000 – SoftPLC Status

<b>Adjustable Range:</b>	0 = No App. 1 = Installing App. 2 = Incompat. App. 3 = App. Stopped 4 = App. Running	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

#### Description:

It allows the user to view the status in which the SoftPLC is. If there are no applications installed, the parameters P1001 to P1079 will not be shown on the HMI.

If this parameter presents the option 2 ("Incompat. App."), it indicates that the version that was uploaded to the flash memory board is not compatible with the present CFW501 firmware.

In this case, it is necessary that the user recompile the project on the WLP, considering the new CFW501 version and redo the download. The user can also upload the application from the inverter to a PC via WLP, provided that the application password is known, or that the application has no password associated.

### P1001 – Command for SoftPLC

<b>Adjustable Range:</b>	0 = For application 1 = Executes application 2 = Excludes application	<b>Factory Setting:</b> 1
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

#### Description:

This parameter allows stopping, running or excluding an application installed, but to do so, the motor must be disabled.

### P1002 – Scan Cycle Time

<b>Adjustable Range:</b>	0 to 65535 ms	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

#### Description:

These parameter sets the application scanning time. The larger the application, the longer is the scanning time.

### P1003 – SoftPLC Applicative Selection

<b>Adjustable Range:</b>	0 = User 1 = HVAC	<b>Factory Setting:</b>	1
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

It allows the user to select the CFW501 built in applications.

*Table 17.1: Parameter P1003 option description*

P1003	Description
0	It defines that the application to be executed on the SoftPLC is the one uploaded by the user by means of the “WLP” programming tool or flash memory module “CFW500-MMF”.
1	It defines that the application to be executed on the SoftPLC is the HVAC. Refer to <a href="#">chapter 18 HVAC FUNCTIONS on page 18-1</a> for further details.



**NOTE!**

One part of the HVAC functions is directly implemented on the CFW501 firmware and the other part on the SoftPLC program; in this case the related parameters are in the range starting from P1010. Thus, by setting P1003 = 0, those functions on SoftPLC will be discarded. For further information about the user’s application on the CFW501, refer to the SoftPLC manual.

### P1010 to P1079 – SoftPLC Parameters

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

They are composed of parameters with use defined by the application selected on parameter P1003.

### P1010 – Version of the HVAC Functions

<b>Adjustable Range:</b>	0.00 to 100.00	<b>Factory Setting:</b>	
<b>Properties:</b>	ro		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

It indicates the version of the HVAC applicative resident on the CFW501.

## 18 HVAC FUNCTIONS

The CFW501 frequency inverter is an optimized device for use in heating, ventilation and air conditioning applications, that is, the HVAC market. As a result, some common functionalities/protections for this market sector were added, such as:

- Automatic energy saving.
- Short cycle protection.
- Dry pump.
- Broken belt.
- Filter maintenance alarm.
- Main PID controller for motor control.
- Sleep mode for main PID.
- External PID controller.


**NOTE!**

The specific functions for HVAC present on the CFW501 can only be activated with the connection of the HVAC plug-in module (CFW500-CRS485). Other plug-in modules can be used, but in this case the HVAC application must be shut down by using parameter P1001.


**NOTE!**

The dry pump, broken belt, filter maintenance alarm, main PID controller, sleep mode for main PID and external PID controller functions are implemented on SoftPLC and will only be valid with the CFW500-CRS485 plug-in module. Otherwise, with the HVAC application active (P1003 = 1), the inverter will show fault F0773.


**NOTE!**

One part of the HVAC functions is directly implemented on the CFW501 firmware and the other part on the SoftPLC program; in this case the related parameters are in the range starting from P1010. Thus, by setting P1003 = 0, those functions on SoftPLC will be disregarded.

### 18.1 ENERGY SAVING

The efficiency of a machine is defined as being the ratio between the output mechanical power and the input electrical power. Remember that the mechanical power is the product between torque and rotor speed, and that the input electric power is the sum of the output mechanical power and the motor losses.

In the case of the three-phase induction motor, the optimized efficiency is achieved with  $\frac{3}{4}$  of the rated load. In the region below this point, the Energy Saving function has its best performance.

The Energy Saving function acts directly on the voltage applied on the inverter output; thus, the flux relationship delivered to the motor is changed so as to reduce the motor losses and enhance the efficiency, consequently reducing consumption and noise.

The function will be active when the motor load is below the maximum value (P0588) and the speed is above the minimum value (P0590). In addition, in order to prevent the stalling of the motor, the applied voltage is limited to a minimum acceptable value (P0589). The parameter group presented in the sequence defines those and other characteristics necessary for the energy saving function.

### P0407 – Motor Rated Power Factor

<b>Adjustable Range:</b>	0.50 to 0.99	<b>Factory Setting:</b>	0.80
<b>Properties:</b>	cfg, V/f, VVW		
<b>Access groups via HMI:</b>	<input type="text" value="MOTOR, STARTUP"/>		

**Description:**

Setting of the motor rated power factor.

In order to obtain the proper operation of the energy saving function, the motor power factor must be correctly set, according to the information on the motor nameplate.

**Note:**

With the motor nameplate data and for applications with constant torque, the motor optimum efficiency is normally obtained with the energy saving function active. In some cases, the output current may increase, and then it is necessary to gradually reduce the value of this parameter to the point in which the current value remains equal to or below the current value obtained with the function disabled.

For information regarding the actuation of P0407 in the VVW control mode, refer to [chapter 10 VVW VECTOR CONTROL on page 10-1](#).

### P0588 – Energy Saving Maximum Torque

<b>Adjustable Range:</b>	0 to 85 %	<b>Factory Setting:</b>	60 %
<b>Properties:</b>	cfg, V/f		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the torque value to activate the operation of the energy saving function. Setting this parameter to 0 % disables the function.

It is recommended to set this parameter to 60%, but it has to be set according the application requirements.

### P0589 – Level of Minimum Applied Voltage

<b>Adjustable Range:</b>	40 to 80 %	<b>Factory Setting:</b>	40 %
<b>Properties:</b>	cfg, V/f		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the minimum voltage value that will be applied to the motor when the energy saving function is active. This minimum value is relative to the voltage imposed by the V/f curve for a certain speed.

### P0590 – Energy Saving Minimum Speed

<b>Adjustable Range:</b>	360 to 18000 rpm	<b>Factory Setting:</b>	600 (525) rpm
<b>Properties:</b>	cfg, V/f		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines the minimum speed value at which the energy saving function will remain active.

The hysteresis for the minimum speed level is of 2 Hz.

### P0591 – Energy Saving Hysteresis

<b>Adjustable Range:</b>	0 to 30 %	<b>Factory Setting:</b>	10 %
<b>Properties:</b>	cfg, V/f		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

Hysteresis used to activate and deactivate the energy saving function.

If the function is active and the output current oscillates, it is necessary to increase the hysteresis value.



#### NOTE!

It is not possible to set those parameters, while the motor is spinning.

## 18.2 PROTECTION AGAINST SHORT CYCLES

The short cycle protection is intended to prevent the motor from starting and stopping in short periods of time. In order to do so, a minimum running time and a minimum stopped time is set, inhibiting occasional run or stop commands, except for disable general commands and/or external fault.

### P0585 – Configuration of the Short Cycle Protection

<b>Adjustable Range:</b>	0 = Inactive 1 = Active	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines if the short cycle protection is active or not on the CFW501.



### P0586 – Minimum Run Time

<b>Adjustable Range:</b>	0 to 650.00 s	<b>Factory Setting:</b>	5.00 s
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	HVAC		

**Description:**

It defines a minimum length of time the compressor will be kept running, not accepting a "Stop" command.

### P0587 – Minimum Stop Time

<b>Adjustable Range:</b>	0 to 650.00 s	<b>Factory Setting:</b>	5.00 s
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	HVAC		

**Description:**

It defines a minimum length of time the compressor will be kept stopped, not accepting a "Run" command.

## 18.3 DRY PUMP

This parameter group allows the user to configure the dry pump operation detection.

The dry pump detection is intended to avoid the pump driven by frequency inverter to operate at vacuum, i.e., without the liquid being pumped. This is done by detecting the operation speed in conjunction with the motor torque.

### P1042 – Dry Pump Detection Configuration

<b>Adjustable Range:</b>	0 = Disable 1 = Enable Alarm 2 = Enable Fault	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	HVAC		

**Description:**

This parameter defines how the dry pump detection functionality will go act in the CFW501 frequency inverter.

*Table 18.1: Description of dry pump detection configuration*

P1042	Description
0	It defines will not be done the dry pump detection.
1	It defines the dry pump detection will be enabled and only will generate the alarm message "A0766: Dry pump detected", i.e., the CFW501 frequency inverter will continue control the motor.
2	It defines the dry pump detection will be enabled and will generate the alarm message "A0766: Dry pump detected" during motor deceleration and the fault "F0767: Dry pump detected" in the CFW501 frequency inverter after stopping the motor.

### P1043 – Dry Pump Detection Speed

<b>Adjustable Range:</b>	0 to 18000	<b>Factory Setting:</b>	400
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines the speed above which will be enabling to compare the actual motor torque with the motor torque for dry pump detection set in P1044.



#### NOTE!

This parameter can be displayed in Hz or rpm as selection in the indirect engineering unit 4 parameters (P0516 and P0517):

- Set P0516 in 13 (Hz) and P0517 in 1 (wxy.z) for displaying in Hz.
- Set P0516 in 3 (rpm) and P0517 in 0 (wxyz) for displaying in rpm.

### P1044 - Torque for Detection of Dry Pump

<b>Adjustable Range:</b>	0.0 to 350.0 %	<b>Factory Setting:</b>	20.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines the motor torque below which the dry pump condition will be detected.

### P1045 – Dry Pump Detection Time

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	20.00 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines a time interval required on the dry pump condition active to generate the alarm (A0766) or fault (F0767) by dry pump.

### 18.4 BROKEN BELT

This parameter group allows the user to configure the broken belt operation detection.

The broken belt detection is intended to avoid the motor driven by frequency inverter to operate empty, i.e., to a mechanical problem between the motor and load, it continues to operate. This is done by detecting the operation speed in conjunction with the motor torque.

#### P1046 – Broken Belt Detection Configuration

<b>Adjustable Range:</b>	0 = Disable 1 = Enable Alarm 2 = Enable Fault	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines how the broken belt detection functionality will go act in the CFW501 frequency inverter.

*Table 18.2: Description of broken belt detection configuration*

P1046	Description
0	It defines will not be done the broken belt detection.
1	It defines the broken belt detection will be enabled and only will generate the alarm message "A0768: Broken belt detected", i.e., the CFW501 frequency inverter will continue control the motor.
2	It defines the broken belt detection will be enabled and will generate the alarm message "A0768: Broken belt detected" during motor deceleration and the fault "F0769: Broken belt detected" in the CFW501 frequency inverter after stopping the motor.

#### P1047 – Broken Belt Detection Speed

<b>Adjustable Range:</b>	0 to 18000	<b>Factory Setting:</b> 400
<b>Properties:</b>		
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines the speed above which will be enabling to compare the actual motor torque with the motor torque for broken belt detection set in P1048.

**NOTE!** This parameter can be displayed in Hz or rpm as selection in the indirect engineering unit 4 parameters (P0516 and P0517):

- Set P0516 in 13 (Hz) and P0517 in 1 (wxy.z) for displaying in Hz.
- Set P0516 in 3 (rpm) and P0517 in 0 (wxyz) for displaying in rpm.

### P1048 – Broken Belt Detection Motor Torque

<b>Adjustable Range:</b>	0.0 to 350.0 %	<b>Factory Setting:</b>	20.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the motor torque value below which will be detected the broken belt condition

### P1049 – Broken Belt Detection Time

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	20.00 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines a time interval required on the broken belt condition active to generate the alarm (A0768) or fault (F0769) by broken belt.

## 18.5 FILTER MAINTENANCE ALARM

This parameter group allows the user to configure the filter maintenance alarm operation.

The filter maintenance alarm is intended to alert the user of the need to change the filter system. It has the preventive maintenance function in the filtration system.

### P1050 – Filter Maintenance Alarm Configuration

<b>Adjustable Range:</b>	0 = Disable 1 = Enable Alarm 2 = Enable Fault	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines how the filter maintenance alarm functionality will go act in the CFW501 frequency inverter.

*Table 18.3: Description of filter maintenance alarm configuration*

P1050	Description
0	It defines will not be done the counting of operation time for change the filter system. Also resets the operation time for filter maintenance alarm in P1052 parameter.
1	It defines the counting of operation time for filter maintenance alarm will be enabled and only will generate the alarm message "A0770: Filter maintenance", i.e., the CFW501 frequency inverter will continue control the motor.
2	It defines the counting of operation time for filter maintenance alarm will be enabled and will generate the alarm message "A0770: Filter maintenance" during the motor deceleration and the fault "F0771: Filter maintenance" in the CFW501 frequency inverter after stopping the motor.

### P1051 – Filter Maintenance Alarm Time

**Adjustable Range:** 0 to 32000 h **Factory Setting:** 5000 h

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the operation time of motor driven by CFW501 frequency inverter needed to be done changing the filter system. This value is compared with the operation time (P1052) to be generated the alarm (A0770) or fault (F0771) due to filter maintenance.

### P1052 – Operation Time for Filter Maintenance Alarm

**Adjustable Range:** 0 to 32000 h **Factory Setting:**

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter indicates the operation time of motor driven by CFW501 frequency inverter.

**NOTE!**  
Set P1050 in "0" to reset the operation time for filter maintenance alarm.

## 18.6 MAIN PID CONTROLLER

This parameter group allows the user to configure the Main PID controller operation.

The control of the motor speed driven by CFW501 frequency inverter is done by comparing the process variable control (feedback) with the required automatic setpoint.

The Main PID controller will be marked out to operate from 0.0 to 100.0 %, which 0.0 % equates to minimum speed programmed in P0133 and 100.0 % equals maximum speed programmed in P0134.

The process variable control is that the Main PID controller takes as return (feedback) of its control action being compared with the setpoint required to generate the control error.

The same is read via an analog input, so you will need to configure which of the analog inputs serve as feedback for the Main PID controller.

Is adopted the "Academic" structure for the Main PID controller, which obeys the following equation:

$$u(k) = u(K-1) + K_p \cdot [(1 + K_i \cdot T_s + (K_d/T_s)) \cdot e(k) - (K_d/T_s) \cdot e(k-1)]$$

where:

- u(k) = Main PID controller output;
- u(K-1) = Output in the last instant;
- Kp = Proportional gain;
- Ki = Integral gain;
- Kd = Derivative gain;
- Ts = Sampling time;
- e(k) = Error in the actual instant (setpoint – feedback);
- e(k-1) = Error in the last instant.

### P1011 – Main PID Controller Automatic Setpoint

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	0
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the value of Main PID controller setpoint in engineering unit when it is in automatic mode.



**NOTE!**

This parameter is displayed as the selection in the indirect engineering unit 1 parameters (P0510 and P0511).

### P1014 – Main PID Controller Manual Setpoint

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	0.0 %
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the value of Main PID controller setpoint when it is in manual mode.

### P1015 – Process Variable of the Main PID Controller

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	
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**Properties:** ro

**Access groups via HMI:**

**Description:**

This parameter shows the process variable actual value of the main PID controller in engineering unit.



**NOTE!**

This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (P0510 and P0511).

### P1016 – Main PID Controller Output

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	
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**Properties:** ro

**Access groups via HMI:**

**Description:**

This parameter indicates the actual value of Main PID controller output.

## P1017 – Main PID Controller Action Control

<b>Adjustable Range:</b>	0 = Disable PID 1 = Direct Mode 2 = Reverse Mode	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines how the action control or regulation of Main PID controller.

*Table 18.4: Description of Main PID controller action control*

P1017	Description
0	It defines the Main PID controller will be disabled to operation.
1	It defines the Main PID controller action control or regulation will be enabled in direct mode.
2	It defines the Main PID controller action control or regulation will be enabled in reverse mode.



**NOTE!**

In situations that, in order to increase the value of the process variable, it is necessary to increase the output of the PID controller, the control action of the PID controller must be set to direct mode. E.g.: Pump driven by an inverter and filling a tank. For the level of the tank (process variable) to increase, it is necessary that the flow increase, which is accomplished by increasing the speed of the motor. In situations that, in order to increase the value of the process variable, it is necessary to decrease the output of the PID controller, the control action of the PID controller must be set to reverse mode. E.g.: Fan driven by the inverter cooling down a cooling tower. When an increase in temperature is desired (process variable), it is necessary to reduce the ventilation by reducing the motor speed.

## P1018 – Main PID Controller Operation Mode

<b>Adjustable Range:</b>	0 = Always Automatic 1 = Always Manual 2 = Automatic or Manual selection via DIx and transition without bumpless 3 = Automatic or Manual selection via Network and transition without bumpless 4 = Automatic or Manual selection via DIx and transition with bumpless 5 = Automatic or Manual selection via Network and transition with bumpless	<b>Factory Setting:</b> 0
<b>Properties:</b>		
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines how the Main PID controller will work.

*Table 18.5: Description of Main PID controller operation mode*

P1018	Description
0	It defines the Main PID controller will be work always in automatic mode.
1	It defines the Main PID controller will be work always in manual mode.
2	It defines the digital input DIx programmed for Automatic / Manual will select the operation mode of Main PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done without bumpless.
3	It defines the bit 13 of serial control word (P0682) will select the operation mode of Main PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done without bumpless.
4	It defines the digital input DIx programmed for Automatic / Manual will select the operation mode of Main PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done with bumpless.
5	It defines the bit 13 of serial control word (P0682) will select the operation mode of Main PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done with bumpless.


**NOTE!**

Bumpless transfer is making the transition from Manual to Automatic Mode or Automatic to Manual Mode without causing variation in the output of the PID controller. When the transition occurs from Manual to Automatic Mode, the output value in Manual Mode is used to start the Integral portion of the PID controller. This ensures that the output will start at this value. When the transition occurs from Automatic to Manual Mode, the output value in Automatic Mode is used as the setpoint in Manual Mode.



**P1019 – Main PID Controller Sampling Time**

<b>Adjustable Range:</b>	0.10 to 60.00 s	<b>Factory Setting:</b>	0.10 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**  
 This parameter defines the sampling time of the Main PID controller.

**P1020 – Main PID Controller Proportional Gain**

<b>Adjustable Range:</b>	0.000 to 32.767	<b>Factory Setting:</b>	1.000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**  
 This parameter defines the value of the proportional gain of main PID controller.

**P1021 – Main PID Controller Integral Gain**

<b>Adjustable Range:</b>	0.000 to 32.767	<b>Factory Setting:</b>	0.430
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**  
 This parameter defines the integral gain of Main PID controller.

**P1022 – Main PID Controller Derivative Gain**

<b>Adjustable Range:</b>	0.000 to 32.767	<b>Factory Setting:</b>	0.000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**  
 This parameter defines the derivative gain of Main PID controller.

### P1023 – Main PID Controller Output Minimum Value

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	0.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the minimum output value of the Main PID controller.

### P1024 – Main PID Controller Output Maximum Value

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	100.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the maximum output value of the Main PID controller.

### P1026 – Configuration of the Process Variable of the Main PID Controller

<b>Adjustable Range:</b>	0 = Sum of the feedbacks 1 and 2 1 = Difference between the feedbacks 1 and 2 2 = Average value of the feedbacks 1 and 2	<b>Factory Setting:</b>	0
<b>Properties:</b>	cfg		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines some functionalities for the analog input(s) selected for the feedback 1 and 2 of the main PID controller.

*Table 18.6: Configuration of the Process Variable of the Main PID Controller*

P1026	Description
0	It defines that the process variable of the main PID controller will be the sum of feedbacks 1 and 2.
1	It defines that the process variable of the main PID controller will be the difference of feedbacks 1 and 2.
2	It defines that the process variable of the main PID controller will be the average of feedbacks 1 and 2.

**P1027 – Minimum Level for Process Variable of the Main PID Controller**

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the minimum value of the analog input sensor configured for process variable of the main PID controller according to its engineering unit.

**NOTE!** This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (P0510 and P0511).

**P1028 – Maximum Level for Process Variable of the Main PID Controller**

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	1000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the maximum value of the analog input sensor configured for process variable of the main PID controller according to its engineering unit.

**NOTE!** This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (P0510 and P0511).

Through the minimum and maximum sensor levels of the process variable and the value of analog input(s) Aix, we obtain the equation of the curve to convert the process variable of the main PID controller.

$$P1015 [(P1028 - P1027) \times (AIX)] + P1027$$

Where:

- P1015 = Process Variable of the main PID controller;
- P1027 = Minimum level for process variable of the main PID controller;
- P1026 = Maximum level for process variable of the main PID controller;
- AIX = Value of the analog input(s) according to P1026.

**P1030 – Main PID Feedback Alarm Conf.**

<b>Adjustable Range:</b>	0 = Disable 1 = Enable Alarm 2 = Enable Fault	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

**Description:**

This parameter defines how the low level and high level alarm conditions will be handled for the process variable of the main PID controller.

*Table 18.7: Configuration of the alarms for the main PID controller*

P1030	Description
0	It that defines the alarms for low level and high level of the process variable of the main PID controller will be disabled.
1	It defines that the alarms for low level and high level of the process variable of the main PID controller will be enabled and just the message of the respective alarm will be generated, while the main PID controller remains active and controlling the motor driven by the CFW501 frequency inverter.
2	It defines that the alarms for low level and high level of the process variable of the main PID controller will be enabled and a fault will be generated on the CFW501 frequency inverter. The message of the respective alarm will be generated during the deceleration of the motor and the respective fault after the shutdown of the motor.

**P1031 – Value for Low Level Alarm of the Process Variable of the Main PID Controller**

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b> 50
<b>Properties:</b>		
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

**Description:**

This parameter defines the value below which the process variable of the main PID controller will be considered low level according to its engineering unit.


**NOTE!**


This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (P0510 and P0511).

**P1032 – Time for Low Level Alarm of the Process Variable of the Main PID Controller**

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	5.00 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the time with the low level condition of the process variable of the main PID controller, so that the alarm message "A0760: Low level alarm of the process variable of the main PID controller" will be generated. With P1030 programmed for 2, the fault "F0761: Low level fault of the process variable of the main controller" will be generated after the motor driven by the CFW501 frequency inverter is decelerated and is no longer spinning.




**NOTE!**  
The value set to 0.00 s disables the alarm detection.

**P1033 – Value for High Level Alarm of the Process Variable of the Main PID Controller**

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	900
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the value above which the process variable of the main PID controller will be considered high level according to its engineering unit.



**NOTE!**  
This parameter will be viewed according to the selection of the parameters for the engineering unit 1 (P0510 and P0511).

### P1034 – Time for High Level Alarm of the Process Variable of the Main PID Controller

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	5.00 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines the time with the high level condition of the process variable of the main PID controller, so that the alarm message "A0762: High level alarm of the process variable of the main PID controller" will be generated. With P1030 programmed for 2, the fault "F0763: High level fault of the process variable of the main controller" will be generated after the motor driven by the CFW501 frequency inverter is decelerated and is no longer spinning.



#### NOTE!

The value set to 0.00s s disables the alarm detection.

#### 18.6.1 Sleep Mode

This parameter group allows the user to configure the sleep mode operation for Main PID controller.

**Sleep Mode** is a state of the controlled system where the control request is null or almost null, and may at this moment, stop the motor driven by CFW501 frequency inverter; that prevents the motor from continuing to run at a low speed which helps little or does not help at all the controlled system. However, the process variable continues to be monitored so that, when necessary (reaching a level below a required setpoint), the controlled system can start the motor again (wakeup mode).



#### NOTE!

The sleep mode works only if Main PID controller is enabled and in automatic mode.

### P1036 – Main PID Controller Sleep Mode Speed

<b>Adjustable Range:</b>	0 to 18000	<b>Factory Setting:</b>	350
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

#### Description:

This parameter defines the motor speed below which will be considered that the speed control is low, thus activating the sleep mode.



#### NOTE!

This parameter can be displayed in Hz or rpm as selection in the indirect engineering unit 4 parameters (P0516 and P0517):

- Set P0516 in 13 (Hz) and P0517 in 1 (wxy.z) for displaying in Hz.
- Set P0516 in 3 (rpm) and P0517 in 0 (wxyz) for displaying in rpm.



#### NOTE!

Value set to 0 disables the sleep mode.

### P1037 – Main PID Controller Sleep Mode Time

**Adjustable Range:** 0.00 to 650.00 s **Factory Setting:** 5.00 s

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines a time with the motor speed in low conditions for the controlled system is in sleep mode, will be generated the alarm message "A0764: Sleep Mode Active".

### P1038 – Main PID Controller Wake up Percentage Deviation

**Adjustable Range:** 0.0 to 100.0 % **Factory Setting:** 5.0 %

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines a percentage difference (deviation) between the control variable (feedback) and the Main PID controller automatic setpoint required for the controlled system to operate again (wake up). When the difference between control variable and Main PID controller automatic setpoint is greater than this percentage programmed, the wake up condition will be activated.

### P1039 – Main PID Controller Wake up Time

**Adjustable Range:** 0.00 to 650.00 s **Factory Setting:** 10.00 s

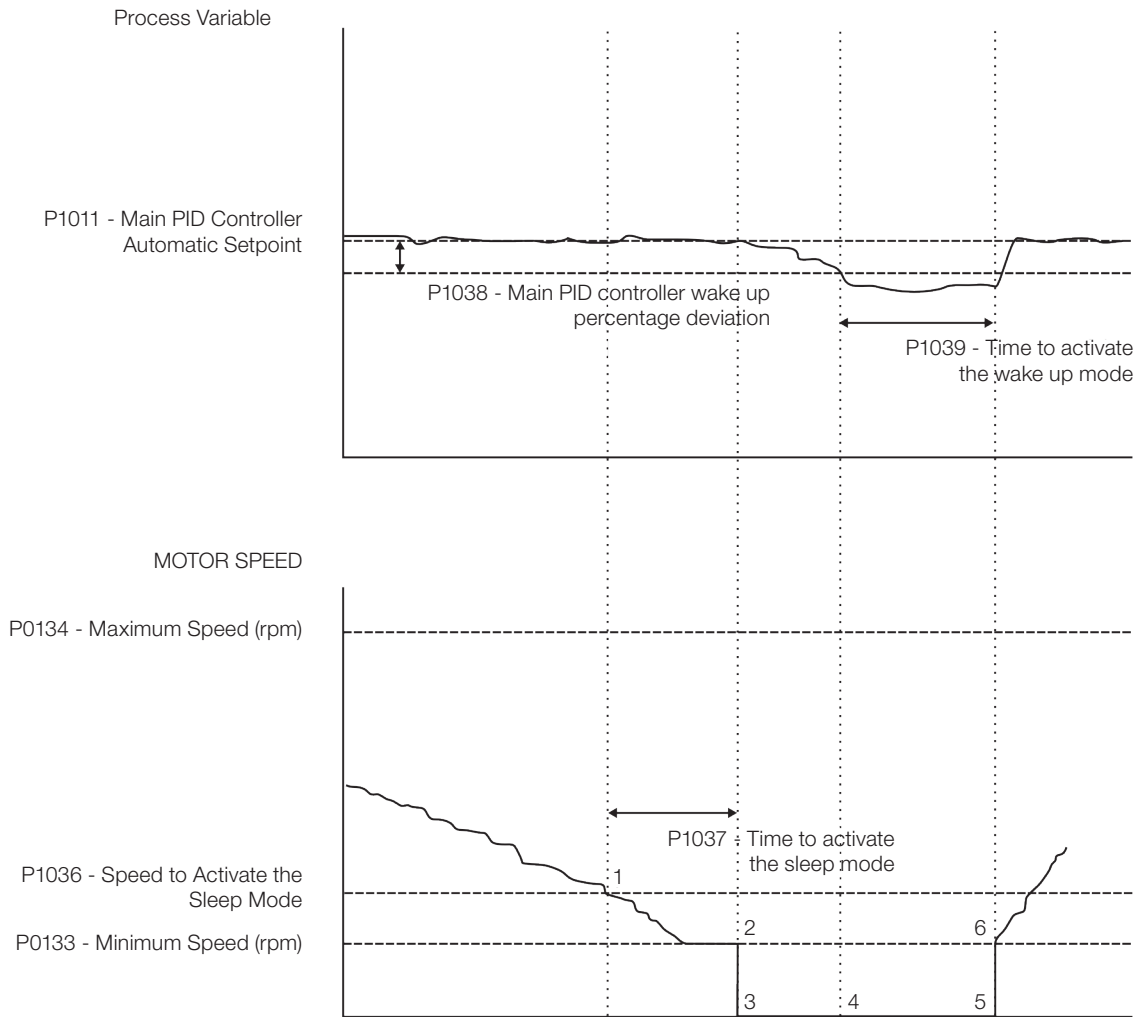
**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines a time with the wake up condition programmed activated for the CFW501 frequency inverter start the motor again.

See below the operation diagram of the motor driven by the CFW501 frequency inverter for the sleep and wake up operation.



**Figure 18.1:** Operation diagram of the sleep and wake up

The analysis of the identified moments follows below:

1. The Main PID controller is controlling the motor speed and begins to reduce its. The motor speed is below the value to activate the sleep mode (P1036) and the timing for the activation of the sleep mode (P1037) begins.
2. The motor stays with the speed lower than the programmed (P1036) and the sleep mode activation time (P1037) elapses. The sleep mode is then activated.
3. The command to stop the motor is executed; the system remains enabled and keeps monitoring the process variable.
4. The difference between the process variable and the automatic setpoint of the main PID controller is greater than the value set to activate the wake up mode (P1038) and the time count to activate the wake up mode (P1039) begins;
5. The difference between the process variable and the automatic setpoint of the main PID controller remains greater than the programmed value (P1038) and the time to activate the wake up mode (P1039) elapses; Then, the wake up mode is activated.
6. The command to run the motor is given, and the system controls the process variable again according to the control logic.



## 18.7 EXTERNAL PID CONTROLLER

This parameter group allows the user to configure the External PID controller operation.

The External PID controller allows controlling an external actuator to the CFW501 frequency inverter via analog output by comparing the process variable control (feedback) with the required setpoint.

The process variable is the one the PID controller uses as feedback of its control actions being compared to the required control setpoint, thus generating the error for the control.

It is read via analog input; therefore, it will be necessary to configure which analog input will be the feedback for the external PID controller.

Is adopted the "Academic" structure for the External PID controller, which obeys the following equation:

$$u(k) = i(k-1) + K_p \cdot [(1 + K_i \cdot T_s + (K_d/T_s)) \cdot e(k) - (K_d/T_s) \cdot e(k-1)]$$

where:

- u(k) = External PID controller output;
- i(k-1) = Integral part of the previous instant;
- K<sub>p</sub> = Proportional gain;
- K<sub>i</sub> = Integral gain;
- K<sub>d</sub> = Derivative gain;
- T<sub>s</sub> = Sampling time;
- e(k) = Error at the actual instant (control setpoint – process variable);
- e(k-1) = Error at the previous instant.

### P1060 – External PID Controller Automatic Setpoint

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the value of External PID controller setpoint in engineering unit when it is in automatic mode.

**NOTE!** This parameter will be viewed according to the selection of the parameters for the engineering unit 2 (P0512 and P0513).

### P1061 – External PID Controller Manual Setpoint

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>	0.0 %
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the value of External PID controller setpoint when it is in manual mode.

### P1062 – Process Variable of the External PID Controller

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

#### Description:

This parameter shows the actual value of the process variable of the main PID controller in engineering unit.



#### NOTE!

This parameter is displayed as the selection in the indirect engineering unit 2 parameters (P0512 and P0513).

### P1063 – External PID Controller Output

<b>Adjustable Range:</b>	0.0 to 100.0 %	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

#### Description:

This parameter indicates the actual value of External PID controller output.

### P1064 – External PID Controller Action Control

<b>Adjustable Range:</b>	0 = Disable PID 1 = Direct Mode 2 = Reverse Mode	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>	

#### Description:

This parameter defines how the action control or regulation of External PID controller.

*Table 18.8: Description of External PID controller action control*

P1064	Description
0	It defines the External PID controller 1 will be disabled to operation.
1	It defines the External PID controller 1 action control or regulation will be enabled in direct mode.
2	It defines the External PID controller 1 action control or regulation will be enabled in reverse mode.



#### NOTE!

In situations that, in order to increase the value of the process variable, it is necessary to increase the output of the PID controller, the control action of the external PID controller must be set to direct mode. E.g.: Valve installed in a tank water input. For the level of the tank (process variable) to increase, it is necessary that the flow increase, which is accomplished by opening the valve. In situations that, in order to increase the value of the process variable, it is necessary to decrease the output of the PID controller, the control action of the external PID controller must be set to reverse mode. E.g.: Valve installed in a tank water output. For the level of the tank (process variable) to increase, it is necessary that the flow decrease, which is accomplished by closing the valve.

**P1065 – External PID Controller Operation Mode**

**Adjustable Range:** 0 = Always Automatic  
 1 = Always Manual  
 2 = Automatic or Manual selection via Dlx and transition without bumpless  
 3 = Automatic or Manual selection via Network and transition without bumpless  
 4 = Automatic or Manual selection via Dlx and transition with bumpless  
 5 = Automatic or Manual selection via Network and transition with bumpless

**Factory Setting:** 0

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines how the External PID controller will work.

*Table 18.9: Description of external PID controller operation mode*

P1065	Description
0	It defines the External PID controller will be work always in automatic mode.
1	It defines the External PID controller will be work always in manual mode.
2	It defines the digital input Dlx programmed for Automatic / Manual will select the operation mode External PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done without bumpless.
3	It defines the bit 14 of serial control word (P0682) will select the operation mode of External PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done without bumpless.
4	It defines the digital input Dlx programmed for Automatic / Manual will select the operation mode of External PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done with bumpless.
5	It defines the bit 14 of serial control word (P0682) will select the operation mode of External PID controller in automatic (0) or manual (1). It also defines the transition from automatic to manual or manual to automatic will be done with bumpless.



**NOTE!**

Bumpless transfer is making the transition from Manual to Automatic Mode or Automatic to Manual Mode without causing variation in the output of the External PID Controller. When the transition occurs from Manual to Automatic Mode, the output value in Manual Mode is used to start the Integral portion of the External PID Controller. This ensures that the output will start at this value. When the transition occurs from Automatic to Manual Mode, the output value in Automatic Mode is used as the setpoint in Manual Mode.

### P1066 – External PID Controller Sampling Time

<b>Adjustable Range:</b>	0.10 to 60.00 s	<b>Factory Setting:</b>	0.10 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the sampling time of the External PID controller.

### P1067 – External PID Controller Proportional Gain

<b>Adjustable Range:</b>	0.000 to 32.767	<b>Factory Setting:</b>	1.000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the proportional gain of External PID controller.

### P1068 – External PID Controller Integral Gain

<b>Adjustable Range:</b>	0.000 to 32.767	<b>Factory Setting:</b>	0.430
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the integral gain of External PID controller.

### P1069 – External PID Controller Derivative Gain

<b>Adjustable Range:</b>	0.000 to 32.767	<b>Factory Setting:</b>	0.000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the derivative gain of External PID controller.

### P1070 – External PID Controller Output Minimum Value

**Adjustable Range:** 0.0 to 100.0 % **Factory Setting:** 0.0 %

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the minimum output value of the External PID controller.

### P1071 – External PID Controller Output Maximum Value

**Adjustable Range:** 0.0 to 100.0 % **Factory Setting:** 100.0 %

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the maximum output value of the External PID controller.

### P1073 – External PID Controller Feedback Minimum Level

**Adjustable Range:** -32768 to 32767 **Factory Setting:** 0

**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the minimum value of the analog input sensor of the External PID controller 1 feedback for conversion into engineering unit.



**NOTE!**

This parameter is displayed as the selection in the indirect engineering unit 2 parameters (P0512 and P0513).

### P1074 – Maximum Level for Process Variable of the External PID Controller

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	1000
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the maximum value of the analog input sensor configured for feedback of the external PID controller according to its engineering unit.

**NOTE!** This parameter will be viewed according to the selection of the parameters for the engineering unit 2 (P0512 and P0513).

Through the minimum and maximum sensor levels of the process variable and the value of analog input Aix, we obtain the equation of the curve to convert the process variable of the external PID controller:

$$P1062 [(P1074 - P1073) \times (AIX)] + P1073$$

Where:

- P1062 = Process Variable of the External PID Controller;
- P1073 = Minimum Level for Process Variable of the External PID Controller;
- P1074 = Maximum Level for Process Variable of the External PID Controller;
- AIX = Value of the Analog Input AI1 or AI2.

### P1075 – Configuration of the Alarms for Process Variables of the External PID Controller

<b>Adjustable Range:</b>	0 = Disable 1 = Enable Alarm 2 = Enable Fault	<b>Factory Setting:</b>	0
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines how the low level and high level alarm conditions will be handled for the process variable of the external PID controller.

*Table 18.10: Configuration of the alarms for the external PID controller*


P1075	Description
0	It defines that the alarms for low level and high level of the process variable of the external PID controller will be disabled.
1	It defines the alarms for low level and high level of the process variable of the external PID controller will be enabled and just the message of the respective alarm will be generated, while the external PID controller remains active and controlling the motor driven by the CFW501 frequency inverter.
2	It defines that the alarms for low level and high level of the process variable of the external PID controller will be enabled and a fault will be generated on the CFW501 frequency inverter. The message of the respective alarm will be generated during the motor deceleration and the respective fault after the shutdown of the motor.

### P1076 – Value for Low Level Alarm of the Process Variable of the External PID Controller

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	2
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the value below which it will be considered low level for the process variable of the external PID controller according to its engineering unit.


 **NOTE!** This parameter will be viewed according to the selection of the parameters for the engineering unit 2 (P0512 and P0513).

### P1077 – Time for Low Level Alarm of the Process Variable of the External PID Controller

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	5.00 s
<b>Properties:</b>			
<b>Access groups via HMI:</b>	<input type="text" value="HVAC"/>		

**Description:**

This parameter defines the time with the low level condition of the process variable of the external PID controller, so that the alarm message "A0786: Low level alarm of the process variable of the external PID controller" will be generated. With P1075 programmed for 2, the fault "F0787: Low level fault of the process variable of the external controller" will be generated after the motor driven by the CFW501 frequency inverter is decelerated and is no longer spinning.

 **NOTE!** The value set to 0.00 s disables the alarm detection.

### P1078 – Value for High Level Alarm of the Process Variable of the External PID Controller

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b>	900
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the value above which the process variable of the external PID controller will be considered high level according to its engineering unit.



**NOTE!**

This parameter will be viewed according to the selection of the parameters for the engineering unit 2 (P0512 and P0513).

### P1079 – Time for High Level Alarm of the Process Variable of the External PID Controller

<b>Adjustable Range:</b>	0.00 to 650.00 s	<b>Factory Setting:</b>	5.00 s
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**Properties:**

**Access groups via HMI:**

**Description:**

This parameter defines the time with the high level condition of the process variable of the external PID controller, so that the alarm message "A0788: High level alarm of the process variable of the external PID controller" will be generated. With P1075 programmed for 2, the fault "F0789: High level fault of the process variable of the external controller" will be generated after the motor driven by the CFW501 frequency inverter is decelerated and is no longer spinning.



**NOTE!**

Value in 0.00 s disables the alarm detection.



## 18.8 HVAC FUNCTIONS LOGICAL STATUS

This parameter group allows the user to monitoring the status of HVAC functions.

### P1040 – HVAC Functions Logical Status

<b>Adjustable Range:</b>	0000h to FFFFh	<b>Factory Setting:</b>
<b>Properties:</b>	ro	
<b>Access groups via HMI:</b>	HVAC	

#### Description:

This parameter allows the user to monitoring the logical status of HVAC functions. Each bit represents a specific status.

*Table 18.11: Description of the logical status 1 via communication networks (P1040)*

Bits	15 to 9	8	7	6	5	4	3	2	1	0
Function	Reserved	External PID in automatic / manual	Sleep mode	Main PID in automatic / manual	Filter maintenance	Broken belt	Dry pump	Short cycle protection	Bypass Mode	Fire Mode

Bits	Values
Bit 0 Fire Mode	<b>0:</b> The inverter is not in Fire Mode. <b>1:</b> The inverter is operated in Fire Mode.
Bit 1 Bypass Mode	<b>0:</b> The inverter is not in Bypass Mode. <b>1:</b> The inverter is operated in Bypass Mode.
Bit 2 Short Cycle Protection	<b>0:</b> Short cycle protection is not active. <b>1:</b> Short cycle protection is active.
Bit 3 Dry Pump	<b>0:</b> Dry pump condition was not detected. <b>1:</b> Dry pump condition was detected.
Bit 4 Broken Belt	<b>0:</b> Broken belt condition was not detected. <b>1:</b> Broken belt condition was detected.
Bit 5 Filter Maintenance	<b>0:</b> Filter maintenance alarm was not detected. <b>1:</b> Filter maintenance alarm was detected.
Bit 6 Main PID in Automatic / Manual	<b>0:</b> It indicates the main PID controller is in automatic mode. <b>1:</b> It indicates the main PID controller is in manual mode.
Bit 7 Sleep Mode	<b>0:</b> The inverter is not in Sleep Mode. <b>1:</b> The inverter is operated in Sleep Mode.
Bit 8 External PID in Automatic / Manual	<b>0:</b> It indicates the external PID controller is in automatic mode. <b>1:</b> It indicates the external PID controller is in manual mode.
Bits 9 to 15	Reserved.

## 18.9 FIRE MODE

The "Fire Mode" function is intended to make the frequency inverter continue to drive the motor even under adverse conditions, inhibiting most faults generated by the frequency inverter. The "Fire Mode" is selected by driving a digital input previously set to "Fire Mode" with logic level "0" (0 V) at the input terminals. When the drive enters the "Fire Mode", the alarm "A0211" will be generated on the HMI (keypad) and the status of the operation mode will be updated in parameter P0006.



### **DANGER!**

#### **"FIRE MODE" FUNCTION– RISK OF DEATH!**

Notice that the CFW501 is only one of the system components, and it is configurable for several functions that must be set in the design.

- Therefore, the full operation of the "Fire Mode" function, with the necessary safety, depends on the specification in the design, as it also requires the compatibility with all the other components of the system and installation environment.
- Ventilation systems that work on life safety applications must be approved by the Fire Department and/or another competent public authority.
- The activation of the "Fire Mode" function disables essential protection functions for the safety of the CFW501 and of the system as a whole.
- The non-interruption of the CFW501 operation resulting from the improper activation of the "Fire Mode" function is critical, because it may cause injuries or even death of people, damages to the CFW501 itself, to the other components of the system, and to the environment where it is installed.
- The operation in the "Fire Mode" function may result in fire under certain circumstances, since the protection devices will be disabled.
- Only personnel from engineering and safety must consider to activate the "Fire Mode" function of the equipment.
- It is extremely necessary to follow the aforementioned instructions before using the CFW501 in the "Fire Mode" function.

Under no circumstances shall WEG take any liability for deaths, damages, compensations and/or losses occurred in the improper programming or operation of the CFW501 in the "Fire Mode" functions.



### **NOTE!**

#### **IMPORTANT NOTE – RISK OF DEATH!**

When activating the "Fire Mode" function, the user must be aware of the fact that the protection functions of the CFW501 will be disabled, which may result in damages: to the inverter, to the components connected to it, to the environment where it is installed, to the people present in the place. Therefore, the operator who activates the "Fire Mode" function takes full liability for the resulting risks. The operation of the inverter with the "Fire Mode" function enabled voids the warranty of the product. The operation in this condition is internally registered by the CFW501, and it may be validated by an a professional from engineering and occupational safety duly qualified by the manufacturer.

### P0580 – Configuration "Fire Mode"

<b>Adjustable Range:</b>	0 = Disabled ("Fire Mode" inactive) 1 = Enabled (keeps speed reference/PID setpoint) 2 = Enabled (set speed reference to maximum [P0134]) 3 = Enabled (set PID setpoint to the value programmed in P0581) 4 = Enabled (general disable, motor will coast to stop)	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines how the Fire Mode functionality will work in the CFW501 frequency inverter.

*Table 18.12: Options for the parameter P0580*

P0580	Description
0	Fire Mode function is inactive.
1	Fire Mode function is active. When the Dlx set to Fire Mode is opened (0 V), "A0211" will be shown on the HMI but the Speed Reference or PID setpoint will not change. The motor will spin according to the Speed Reference or Reference defined by the PID.
2	Fire Mode function is active. When the Dlx set to Fire Mode is opened (0 V), "A0211" will be shown on the HMI and the Speed Reference will be set automatically to maximum (P0134) value. The motor will accelerate to this new reference.
3	Fire Mode function is active. When the Dlx set to Fire Mode is opened (0 V), "A211" will be shown on the HMI and the PID setpoint will be set automatically to the P0581 value. The motor will spin according to the reference defined by the PID for this new Setpoint.
4	Fire Mode function is active. When the Dlx set to Fire Mode is opened (0 V), "A211" will be shown on the HMI and the pulses in the output will be disabled. Motor will coast to stop.

### P0581 – Fire Mode PID Setpoint

<b>Adjustable Range:</b>	-32768 to 32767	<b>Factory Setting:</b> 0
<b>Properties:</b>		
<b>Access groups via HMI:</b>	HVAC	

**Description:**

It defines the setpoint to be used by PID when the "Fire Mode" is enabled and P0580 = 3. The indication of engineering unit and decimal point position of this parameter on the main display main is defined by parameters P0510 and P0511.

**P0582 – Fire Mode Auto-reset**

<b>Adjustable Range:</b>	0 = Limited 1 = Unlimited	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines how the auto-reset functionality will work in Fire Mode when a critical fault occur (DC Link Overvoltage (F0022) and Overcurrent/Short-circuit (F0070)).

*Table 18.13: Options for the parameter P0582*

P0582	Description
0	Limited. Auto-reset works as defined in P0340 parameter.
1	Unlimited. The auto-reset happens after 1s of a critical failure detection regardless of the value set in P0340.

**18.10 BYPASS MODE**

The Bypass Mode allows the motor controlled by the CFW501 to be directly driven by the three-phase power supply by means of an external contactor the will make the connection. To that end, it will be necessary to connect tow contactors: one between the inverter and the motor, and another between the power supply and the motor.

The contactors will be driven by two digital outputs (DOx) previously programmed for "Drive Bypass Contactor" and "Mains Bypass Contactor", and they will have an electric interlocking logic.

When entering Bypass Mode, the Alarm "A0210" will be generated and shown at the HMI. This state can also be verified in the Parameter P0006 and P0680.

The "Bypass" condition is identified by the inverter by means of a digital input (DIx) programmed for "Activate Bypass"; when in logic level "1" (24 V), it executes a "General Disable" command (the motor will coast to stop) and will signal that the Bypass Mode is active in both P0006 and P0680. Following that, the digital output DOx set to "Drive Bypass Contactor" is reset after a delay for demagnetizing the motor. This delay is given by the formula  $t_{des} = (\text{Speed} / \text{Rated Speed}) \times 3s$  for (Speed  $\leq$  Rated Speed) and is fixed at 3s for (Speed  $>$  Rated Speed). After this time elapses, the time programmed in P0584 is counted (in order to ensure that the drive output contactor is really open) to activate the digital output programmed for "Mains Bypass Contactor", and the drive goes to "Bypass" while the digital input programmed for "Activate Bypass" is active (24 V).

For the inverter to return to drive the motor, first the "Bypass" must be deactivated making the digital input programmed for "Activate Bypass" inactive (0 V). That makes the digital output programmed for "Mains Bypass Contactor" be deactivated instantly and the CFW501 remain with the two outputs deactivated, waiting for the "Run" command. After the "Run" command, the logical status of the digital input programmed for "Activate Bypass" is verified and, if it is in logical level "0" (0 V), the deactivation of the "Bypass Mode" is indicated in parameters P0006 and P0680, and the time count for the motor demagnetization to activate the digital output programmed for "Drive Bypass Contactor" starts. After this time elapses, the digital output programmed for "Drive Bypass Contactor" is activated, thus closing the contactor in the inverter output, and the count of a dead time defined by parameter P0584 to ensure the contactor is closed starts. After the end of the dead time, the inverter enables the pulses in order to enable the CFW501 to drive the motor again.

This activation logic is shown in [Figure 18.2: Bypass mode activation logic on page 18-32](#).

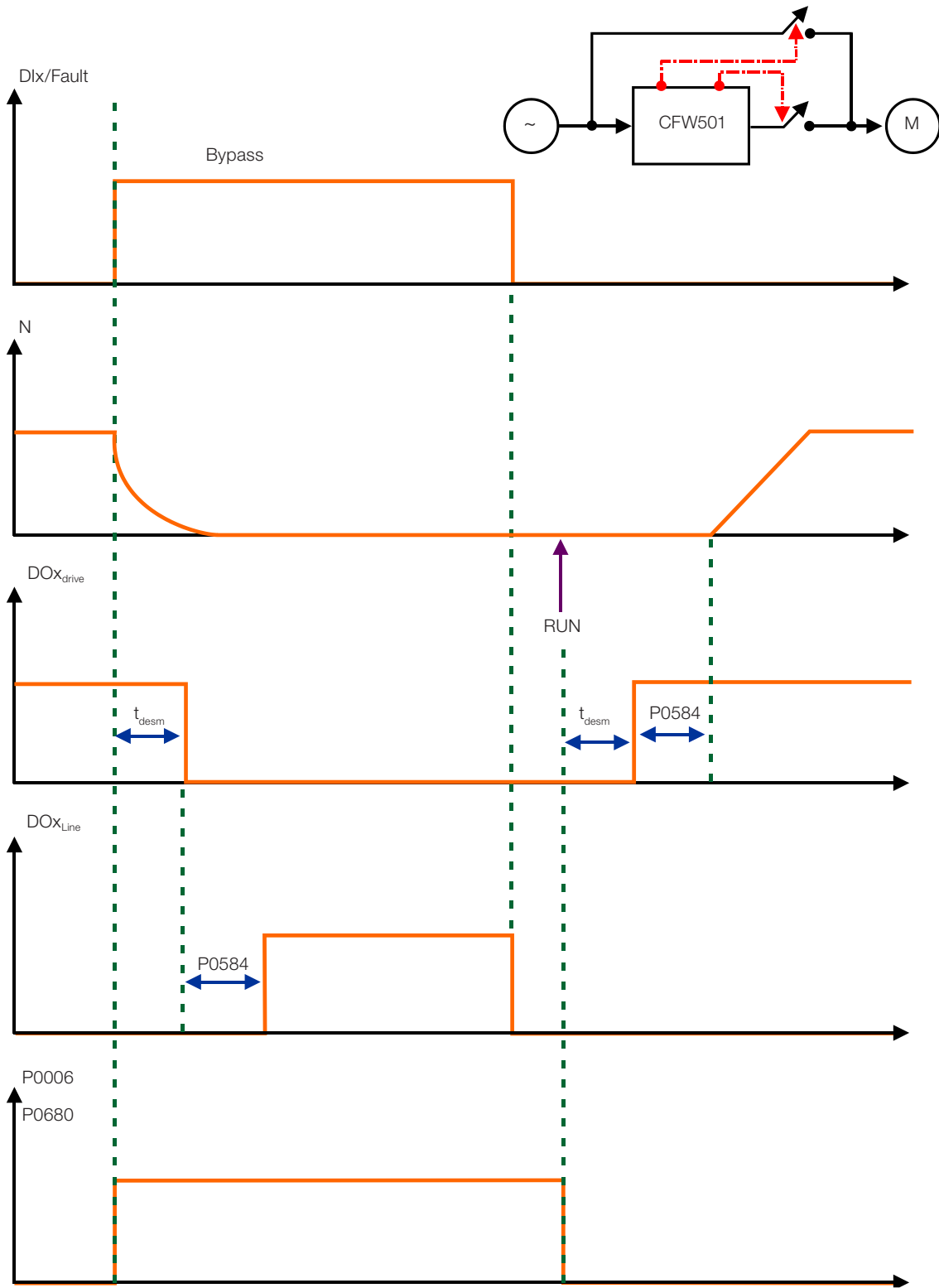


Figure 18.2: Bypass mode activation logic

An example of connecting the bypass can be seen in [Figure 18.3: Bypass mode example on page 18-33](#). Setting used in this example:

- P0268 = 23 (DI6 = Bypass Mode)
- P0275 = 39 (RL1 = Drive Bypass Contactor)
- P0276 = 40 (RL2 = Mains Bypass Contactor)
- P0583 = 1 (Bypass Enabled by Dlx)
- P0584 = 0.30 s

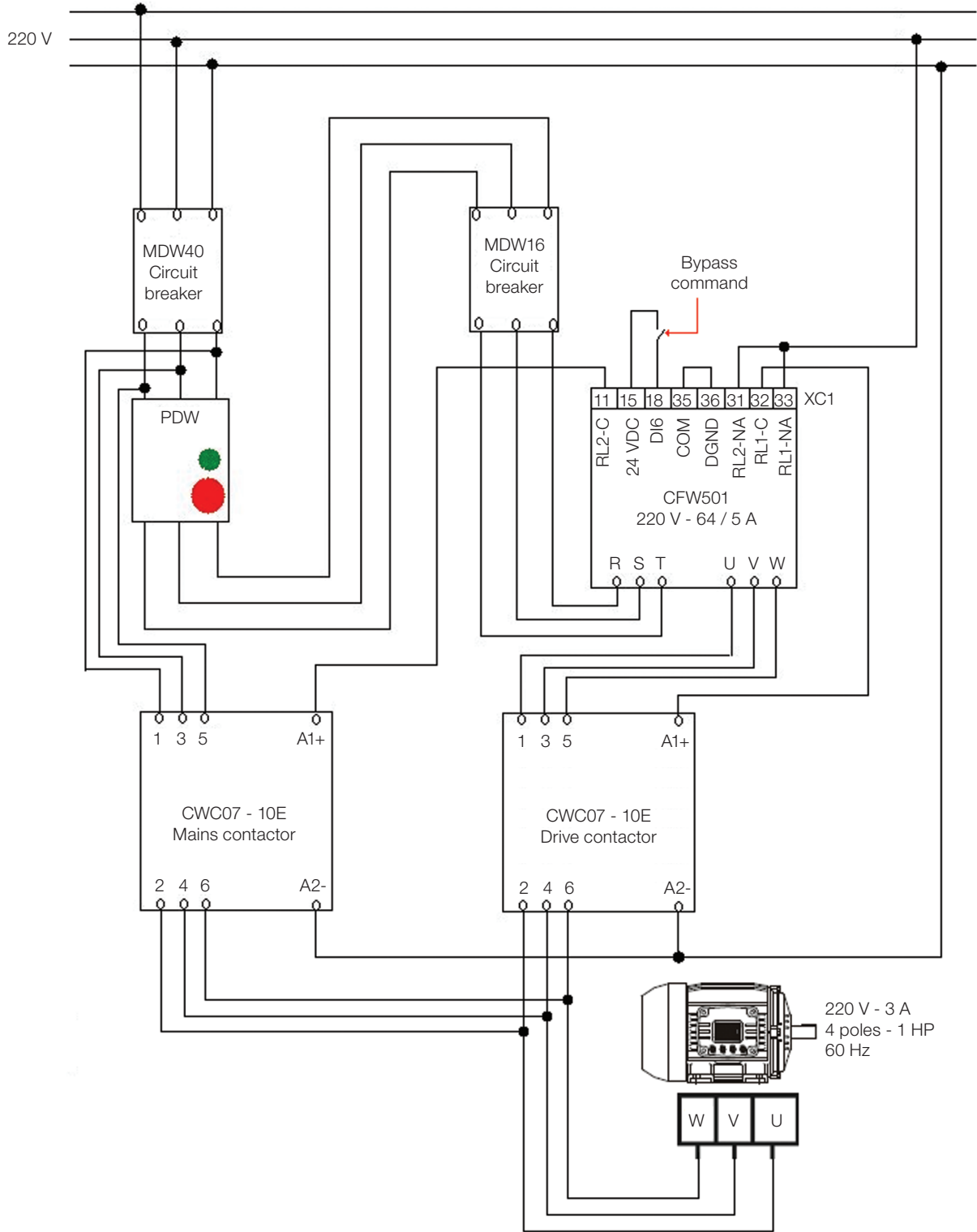


Figure 18.3: Bypass mode example

### P0583 – Mode Configuration "Bypass"

<b>Adjustable Range:</b>	0 = Inactive 1 = Active/Dlx 2 = Active/Dlx+Failure	<b>Factory Setting:</b> 0
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter configured the triggering event for the CFW501 entering the Bypass Mode.

*Table 18.14: Options for the parameter P0583*

P0583	Description
0	Bypass mode is always disabled.
1	Bypass mode is enabled by a digital input (Dlx) set to "Bypass".
2	Bypass mode is enabled either by a digital input (Dlx) set to "Bypass" or when a fault happens.

### P0584 – Bypass Contactor Time

<b>Adjustable Range:</b>	0.00 to 300.00 s	<b>Factory Setting:</b> 0.30 s
<b>Properties:</b>	cfg	
<b>Access groups via HMI:</b>	HVAC	

**Description:**

This parameter defines the delay between the opening of one contactor and the closing of the other contactor.