AC/DC Converter

CTW900

User's Manual

User's Manual

Series: CTW900

Language: English

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Revision	Description	Chapter
00	Initial Issue	-
01	Included information about field supply on Table 10.1	10
02	Modified dimension ‘b’of Size D on Figure 5.2.	5
03	Fix the unit of measurement of parameters P0090 and P0094. Change of maximum field current for Size D. Included references for fuses used inside Size D.	1, 4 and 5
04	Modified "L" and "P" measures of all mechanicals in figure 5.2	5
05	Change in the full scale for the functions “Armature Voltage” and “EMF” in table 7.9	7
06	Change in the “Inductance / Rated current” and “WEG Code” columns of table 5.6	5
07	Included note in the section 7.3.13	7

SUMMARY

1 QUICK PARAMETER REFERENCE

Software: V1.1X
Application:
Model:
Serial number:
Responsible:
Date: / /

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0000	Access to Parameters	0 to 9999	0				54
P0001	Speed Reference	0 to 10000 rpm			RO	09	128
P0002	Current Speed	0 to 10000 rpm			RO	09	128
P0003	Armature Current	0.0 to 5000.0 A			RO	09	128
P0004	Line Voltage	0 to 1000 V			RO	09	128
P0005	Line Frequency	0.0 to 100.0 Hz			RO	09	128
P0006	Drive Status	0 = Disabled			RO	09	129
		1 = Ready					
		2 = Run					
		3 = Undervoltage					
		4 = Fault					
		5 = Self-Tuning					
		6 = Configuration					
		7 = Blocked					
		8 = Up Ramp					
		9 = Down Ramp					
P0007	Armature Voltage	-2000 to 2000 V			RO	09	129
P0008	Field Current	0.0 to 55.0 A			RO	09	129
P0009	Motor Torque	-1000.0 to 1000.0 %			RO	09	129
P0010	Output Power	0.0 to 6553.5 kW			RO	09	130
P0011	Selected Bridge	0 = Bridge A			RO	09	130
		1 = Bridge B					
P0012	DI8 to DI1 Status	Bit 0 = DI1			RO	09, 34	130
		Bit 1 = DI2					
		Bit 2 = DI3					
		Bit 3 = DI4					
		Bit 4 = DI5					
		Bit 5 = DI6					
		Bit 6 = DI7					
		Bit 7 = DI8					
P0013	DO5 to DO1 Status	Bit 0 = DO1			RO	09, 35	130
		Bit 1 = DO2					
		Bit 2 = DO3					
		Bit 3 = DO4					
		Bit 4 = DO5					
P0014	AO1 Value	0.00 to 100.00 %			RO	09, 33	87
P0015	AO2 Value	0.00 to 100.00 %			RO	09, 33	87
P0016	AO3 Value	-100.00 to 100.00 %			RO	09, 33	87
P0017	AO4 Value	-100.00 to 100.00 %			RO	09, 33	87
P0018	AI1 Value	-100.00 to 100.00 %			RO	09, 32	84
P0019	A12 Value	-100.00 to 100.00 %			RO	09, 32	84
P0020	A13 Value	-100.00 to 100.00 %			RO	09, 32	84
P0021	A14 Value	-100.00 to 100.00 %			RO	09, 32	84
P0022	Tacho Voltage	-500.0 to 500.0 V			RO	09	131
P0023	Software Version	0.00 to 655.35			RO	09, 36	102

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0024	Armature Firing Angle	0.0 to 180.0 °			RO	09	131
P0025	Field Firing Angle	0.0 to 180.0 °			RO	09	131
P0026	EMF Voltage	-2000 to 2000 V			RO	09	131
P0027	Accessories Config. 1	0000h to FFFFh			RO	09, 36	103
P0028	Accessories Config. 2	0000h to FFFFh			RO	09, 36	103
P0030	Heatsink Temperature	-20.0 to 150.0 °C			RO	09, 38	106
P0033	R-S Line Voltage	0 to 1000 V			RO	09	131
P0034	S-T Line Voltage	0 to 1000 V			RO	09	131
P0035	T-R Line Voltage	0 to 1000 V			RO	09	131
P0038	Encoder Speed	0 to 65535 rpm			RO	09	131
P0039	Encoder Pulses Count	0 to 40000			RO	09	132
P0040	DC Tacho Speed	0 to 65535 rpm			RO	09	132
P0041	EMF Speed	0 to 65535 rpm			RO	09	132
P0042	Time Powered	0 to 65535 h			RO	09	132
P0043	Time Enabled	0 to 65535 h			RO	09	132
P0044	kWh Output Energy	0 to 65535 kWh			RO	09	132
P0046	Total Speed Reference	-10000 to 10000 rpm			RO	09	133
P0047	Auxiliary Torque Ref.	0.0 to 125.0 %			RO	09, 32	133
P0048	Present Alarm	0 to 999			RO	09	133
P0049	Present Fault	0 to 999			RO	09	133
P0050	Last Fault	0 to 999			RO	08	124
P0051	Last Fault Day/Month	00/00 to 31/12			RO	08	125
P0052	Last Fault Year	0 to 2099			RO	08	125
P0053	Last Fault Time	00:00 to 23:59			RO	08	126
P0054	Second Fault	0 to 999			RO	08	124
P0055	Second Fault Day/Month	00/00 to 31/12			RO	08	125
P0056	Second Fault Year	0 to 2099			RO	08	125
P0057	Second Fault Time	00:00 to 23:59			RO	08	126
P0058	Third Fault	0 to 999			RO	08	124
P0059	Third Fault Day/Month	00/00 to 31/12			RO	08	125
P0060	Third Fault Year	0 to 2099			RO	08	125
P0061	Third Fault Time	00:00 to 23:59			RO	08	126
P0062	Fourth Fault	0 to 999			RO	08	124
P0063	Fourth Fault Day/Month	00/00 to 31/12			RO	08	125
P0064	Fourth Fault Year	0 to 2099			RO	08	125
P0065	Fourth Fault Time	00:00 to 23:59			RO	08	126
P0066	Fifth Fault	0 to 999			RO	08	124
P0067	Fifth Fault Day/Month	00/00 to 31/12			RO	08	125
P0068	Fifth Fault Year	0 to 2099			RO	08	125
P0069	Fifth Fault Time	00:00 to 23:59			RO	08	126
P0070	Sixth Fault	0 to 999			RO	08	124
P0071	Sixth Fault Day/Month	00/00 to 31/12			RO	08	125
P0072	Sixth Fault Year	0 to 2099			RO	08	125
P0073	Sixth Fault Time	00:00 to 23:59			RO	08	126
P0074	Seventh Fault	0 to 999			RO	08	124
P0075	Seventh Fault Day/Month	00/00 to 31/12			RO	08	125
P0076	Seventh Fault Year	0 to 2099			RO	08	125
P0077	Seventh Fault Time	00:00 to 23:59			RO	08	126
P0078	Eighth Fault	0 to 999			RO	08	124
P0079	Eighth Fault Day/Month	00/00 to 31/12			RO	08	125
P0080	Eighth Fault Year	0 to 2099			RO	08	125
P0081	Eighth Fault Time	00:00 to 23:59			RO	08	126
P0082	Ninth Fault	0 to 999			RO	08	124

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0083	Ninth Fault Day/Month	00/00 to 31/12			RO	08	125
P0084	Ninth Fault Year	0 to 2099			RO	08	125
P0085	Ninth Fault Time	00:00 to 23:59			RO	08	126
P0086	Tenth Fault	0 to 999			RO	08	124
P0087	Tenth Fault Day/Month	00/00 to 31/12			RO	08	125
P0088	Tenth Fault Year	0 to 2099			RO	08	125
P0089	Tenth Fault Time	00:00 to 23:59			RO	08	126
P0090	Arm. Curr. Last Fault	0.0 to 5000.0 A			RO	08	126
P0091	Arm. Voltage Last Fault	0 to 2000 V			RO	08	126
P0092	Speed at Last Fault	0 to 10000 rpm			RO	08	126
P0093	Total Ref. Last Fault	-10000 to 10000 rpm			RO	08	126
P0094	Field Curr. Last Fault	0.0 to 60.0 A			RO	08	127
P0096	DIx Status Last Fault	Bit 0 = DI1			RO	08	127
		Bit 1 = DI2					
		Bit 2 = DI3					
		Bit 3 = DI4					
		Bit 4 = DI5					
		Bit 5 = DI6					
		Bit 6 = DI7					
		Bit 7 = DI8					
P0097	DOx Status Last Fault	Bit 0 = DO1			RO	08	127
		Bit 1 = DO2					
		Bit 2 = DO3					
		Bit 3 = DO4					
		Bit 4 = DO5					
P0098	Phase Sequence	0 = RST			RO	09	133
		1 = RTS					
P0100	Acceleration Time	0.0 to 999.0 s	20.0 s			04, 21	65
P0101	Deceleration Time	0.0 to 999.0 s	20.0 s			04, 21	65
P0102	Acceleration Time 2	0.0 to 999.0 s	20.0 s			21	65
P0103	Deceleration Time 2	0.0 to 999.0 s	20.0 s			21	65
P0104	S Ramp	0 = Inactive	0			21	66
		1 = 50 %					
		2 = 100 %					
P0105	1st/2nd Ramp Selection	0 = 1st Ramp	2		CFG1	21	67
		1 = 2nd Ramp					
		2 = DIx					
		3 = Serial/USB					
		4 = Anybus-CC					
		5 = SoftPLC					
P0120	Speed Ref.Backup	0 = Inactive	1			22	67
		1 = Active					
P0121	Keypad Reference	0 to 10000 rpm	90 rpm			22	67
P0122	JOG/JOG+ Reference	0 to 10000 rpm	150 rpm			22	68
P0123	JOG- Reference	0 to 10000 rpm	150 rpm			22	68
P0124	Multispeed Ref. 1	0 to 10000 rpm	90 rpm			31	83
P0125	Multispeed Ref. 2	0 to 10000 rpm	300 rpm			31	83
P0126	Multispeed Ref. 3	0 to 10000 rpm	600 rpm			31	83
P0127	Multispeed Ref. 4	0 to 10000 rpm	900 rpm			31	83
P0128	Multispeed Ref. 5	0 to 10000 rpm	1200 rpm			31	83
P0129	Multispeed Ref. 6	0 to 10000 rpm	1500 rpm			31	83
P0130	Multispeed Ref. 7	0 to 10000 rpm	1800 rpm			31	83
P0131	Multispeed Ref. 8	0 to 10000 rpm	1650 rpm			31	83

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0132	Max. Overspeed Level	0 to 100 %	10 %			23, 38	107
P0133	Minimum Speed	0 to 10000 rpm	0 rpm			04, 23	70
P0134	Maximum Speed	0 to 10000 rpm	1800 rpm			23	70
P0135	Max. Output Current	0 to 1.25x I_{rat}	1.0xI_{rat}			04, 23, 38	107
P0136	Current Limit at Nmax	2 to 125 %	125 %			23, 38	70
P0137	Stall Protection Time	0 to 100 s	2 s			38	107
P0138	Speed Limit at Max. Current	0 to 10000 rpm	1800 rpm			23, 38	70
P0139	Speed for Stall Protection	0 to 1000 rpm	18 rpm			38	107
P0156	Overload Current	0 to 1.25x I_{rat}	1.25x I_{rat}			38	108
P0157	Current without Overload	0 to 1.25xI_{rat}	1.0xI_{rat}			38	108
P0158	Time to Overload Protection	5 to 600 s	300 s			38	108
P0159	Speed Proportional Gain 1	0.0 to 63.9	4.0			100	73
P0160	Speed Integral Gain 1	0.00 to 9.99	0.40			100	73
P0161	Speed Proportional Gain 2	0.0 to 63.9	8.0			100	73
P0162	Speed Integral Gain 2	0.00 to 9.99	0.12			100	73
P0163	LOC Reference Offset	-999 to 999	0			22	68
P0164	REM Reference Offset	-999 to 999	0			22	68
P0165	Speed Filter	0.000 to 1.000 s	0.002 s			100	74
P0166	Speed Differential Gain	0.00 to 7.99	0.00			100	74
P0167	Current Proportional Gain	0.00 to 9.99	0.26			101	75
P0168	Current Intermittent I Gain	0.000 to 1.999	0.100			101	75
P0169	(+) Torque Current Limit	1.0 to 125.0 %	25.0 %			23, 101	71
P0170	(-) Torque Current Limit	1.0 to 125.0 %	25.0 %			23, 101	71
P0171	Current Continuous I Gain	0.000 to 1.999	0.050			101	75
P0172	Ia* Variation Rate	0 to 999 ms	20 ms			101	75
P0173	If* Variation Rate	0 to 3000 ms	200 ms			102	76
P0175	Field Proportional Gain	0.00 to 9.99	0.50			102	76
P0176	Field Integral Gain	0.00 to 3.99	0.25			102	76
P0177	Field Minimum Current	0.1 to 50.0 A	1.0 A			102	76
P0178	Field Save Current	0.0 to 50.0 A	0.6 A			102	76
P0179	Field Weakening Point	75 to 110 %	100 %		CFG1	102	77
P0185	Ua Signal Gain	0.001 to 2.500	1.000			103	77
P0186	EMF Proportional Gain	0.00 to 9.99	2.50			103	77
P0187	EMF Integral Gain	0.00 to 6.00	0.10			103	77
P0188	EMF Filter	0.000 to 9.999 s	0.011 s			103	78
P0193	Day of the Week	0 = Sunday	0			20	62
		1 = Monday					
		2 = Tuesday					
		3 = Wednesday					
		4 = Thursday					
		5 = Friday					
		6 = Saturday					
P0194	Day	01 to 31	01			20	62
P0195	Month	01 to 12	01			20	62
P0196	Year	2000 to 2099	2012			20	62
P0197	Hour	00 to 23	00			20	62
P0198	Minutes	00 to 59	00			20	62
P0199	Seconds	00 to 59	00			20	62
P0200	Password	0 = Inactive	1			20	62
		1 = Active					
		2 = Change password					
P0201	Language	0 = Português	0			20	63

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
		1 = English					
		2 = Español					
		3 = Deutsch					
P0202	Speed Feedback Selec.	0 = EMF	0		CFG1	24	71
		1 = DC Tacho					
		2 = Encoder					
P0204	Load/Save Parameters	0 = Not Used	0		CFG1	06	121
		1 = Reset P0043					
		2 = Reset P0044					
		3 = Load Default					
		4 = Load User 1					
		5 = Load User 2					
		6 = Load User 3					
		7 = Save User 1					
		8 = Save User 2					
		9 = Save User 3					
P0205	Reading Parameter 1 Sel.	0 = Inactive	1			20	63
		1 = Speed Ref. #					
		2 = Motor Speed #					
		3 = Arm. Curr. #					
		4 = Line Voltage #					
		5 = Line Freq. #					
		6 = Arm. Voltage #					
		7 = Field Curr. #					
		8 = Total Refer. #					
		9 = Output Power #					
		10 = Arm. Firing Angle #					
		11 = Heatsink Temp. #					
		12 = Speed Ref. -					
		13 = Motor Speed -					
		14 = Arm. Current -					
		15 = Arm. Voltage -					
		16 = Total Refer. -					
		17 = SoftPLC P1010#					
		18 = SoftPLC P1011#					
		19 = SoftPLC P1012#					
		20 = SoftPLC P1013#					
		21 = SoftPLC P1014#					
		22 = SoftPLC P1015#					
		23 = SoftPLC P1016#					
		24 = SoftPLC P1017#					
		25 = SoftPLC P1018#					
		26 = SoftPLC P1019#					
P0206	Reading Parameter 2 Sel.	See options in P0205	6			20	63
P0207	Reading Parameter 3 Sel.	See options in P0205	3			20	63
P0208	Reference Scale Factor	0.000 to 65.535	1.000			20	64
P0209	Reference Eng. Unit 1	32 to 127	114			20	64
P0210	Reference Eng. Unit 2	32 to 127	112			20	64
P0211	Reference Eng. Unit 3	32 to 127	109			20	64
P0212	Reference Decimal Point	0 = wxyz	0			20	64
		1 = wxy.z					
		2 = wx.yz					
		3 = w.xyz					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0213	Full Scale Reading 1	0.0 to 200.0 %	100.0 %			20	65
P0214	Full Scale Reading 2	0.0 to 200.0 %	100.0 %			20	65
P0215	Full Scale Reading 3	0.0 to 200.0 %	100.0 %			20	65
P0216	HMI Display Contrast	0 to 37	27			20	65
P0217	Zero Speed Disable	0 = Inactive	0		CFG2	30	81
		1 = Active					
P0218	Zero Speed Disable Out	0 = Ref. or Speed	0			30	82
		1 = Reference					
P0219	Zero Speed Time	0 to 999 s	0 s			30	82
P0220	LOC/REM Source Selection	0 = Always LOC	2		CFG1	27, 28, 110	78
		1 = Always REM					
		2 = LR Key (LOC)					
		3 = LR Key(REM)					
		4 = DIx					
		5 = LOC Serial/ USB					
		6 = REM Serial/ USB					
		7 = LOC Anybus-CC					
		8 = REM Anybus-CC					
		9 = LOC SoftPLC					
		10 = REM SoftPLC					
P0221	LOC Reference Selection	0 = Keypad (HMI)	0		CFG1	27, 110	79
		1 = AI1					
		2 = AI2					
		3 = AI3					
		4 = AI4					
		5 = Sum AIs > 0					
		6 = Sum AIs					
		7 = E.P.					
		8 = Multispeed					
		9 = Serial/USB					
		10 = Anybus-CC					
		11 = SoftPLC					
P0222	REM Reference Selection	See options in P0221	1		CFG1	28, 110	79
P0223	LOC FWD/REV Selection	0 = Always FWD	2		CFG1	27, 29, 110	79
		1 = Always REV					
		2 = FR Key (FWD)					
		3 = FR Key (REV)					
		4 = DIx					
		5 = Serial/USB (FWD)					
		6 = Serial/USB (REV)					
		7 = Anybus-CC (FWD)					
		8 = Anybus-CC (REV)					
		9 = AI4 Polarity					
		10 = SoftPLC (FWD)					
		11 = SoftPLC (REV)					
		12 = AI2 Polarity					
P0224	LOC Run/Stop Selection	0 = I, O Keys	0		CFG1	27, 29, 110	80
		1 = DIx					
		2 = Serial/USB					
		3 = Anybus-CC					
		4 = SoftPLC					
P0225	LOC JOG Selection	0 = Inactive	1		CFG1	27, 29, 110	80
		1 = JOG Key					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
		2 = DIx					
		3 = Serial/ USB					
		4 = Anybus-CC					
		5 = SoftPLC					
P0226	REM FWD/REV Selection	See options in P0223	4		CFG1	28, 29, 110	79
P0227	REM Run/Stop Selection	0 = I, O Keys	1		CFG1	28, 29, 110	80
		1 = DIx					
		2 = Serial/ USB					
		3 = Anybus-CC					
		4 = SoftPLC					
P0228	REM JOG Selection	See options in P0225	2		CFG1	28, 29, 110	80
P0229	Stop Mode Selection	0 = Ramp to Stop	0		CFG1	29	81
		1 = Coast Stop					
		2 = Quick Stop					
P0231	AI1 Signal Function	0 = Speed Ref.	0		CFG1	32	84
		1 = N* without Ramp					
		2 = I*aux					
		3 = Pos. Curr. Lim.					
		4 = Neg. Curr. Lim.					
		5 = I+/I- Curr. Lim.					
P0232	AI1 Gain	0.000 to 9.999	1.000			32	85
P0233	AI1 Signal Type	0 = 0 to 10 V/ 20mA	0		CFG1	32	86
		1 = 4 to 20 mA					
		2 = 10 V/ 20 mA to 0					
		3 = 20 to 4 mA					
P0234	AI1 Offset	-100.00 to 100.00 %	0.00 %			32	85
P0235	AI1 Filter	0.00 to 16.00 s	0.01 s			32	85
P0236	AI2 Signal Function	See options in P0231	0		CFG1	32	84
P0237	AI2 Gain	0.000 to 9.999	1.000			32	85
P0238	AI2 Signal Type	0 = 0 to 10 V/ 20 mA	0		CFG1	32	86
		1 = 4 to 20 mA					
		2 = 10 V/ 20 mA to 0					
		3 = 20 to 4 mA					
		4 = -10 to +10 V					
P0239	AI2 Offset	-100.00 to 100.00 %	0.00 %			32	85
P0240	AI2 Filter	0.00 to 16.00 s	0.01 s			32	85
P0241	AI3 Signal Function	See options in P0231	0		CFG1	32	84
P0242	AI3 Gain	0.000 to 9.999	1.000			32	85
P0243	AI3 Signal Type	0 = 0 to 10 V/ 20 mA	0		CFG1	32	86
		1 = 4 to 20 mA					
		2 = 10 V/ 20 mA to 0					
		3 = 20 to 4 mA					
P0244	AI3 Offset	-100.00 to 100.00 %	0.00 %			32	85
P0245	AI3 Filter	0.00 to 16.00 s	0.01 s			32	85
P0246	AI4 Signal Function	See options in P0231	0		CFG1	32	84
P0247	AI4 Gain	0.000 to 9.999	1.000			32	85
P0248	AI4 Signal Type	0 = 0 to 10 V/20 mA	0		CFG1	32	86
		1 = 4 to 20 mA					
		2 = 10 V/ 20 mA to 0					
		3 = 20 to 4 mA					
		4 = -10 to +10 V					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0249	AI4 Offset	-100.00 to 100.00 %	0.00 %			32	85
P0250	AI4 Filter	0.00 to 16.00 s	0.01 s			32	85
P0251	AO1 Function	0 = Speed Ref.	3			33	87
		1 = Ref. After Ramp					
		2 = Total Ref.					
		3 = Real Speed					
		4 = Speed Error					
		5 = Speed Reg. Output					
		6 = Current Ref.					
		7 = Armature Curr.					
		8 = Curr. Reg. Output					
		9 = Firing Angle					
		10 = Output Power					
		11 = Motor Torque					
		12 = SoftPLC					
		13 = Not Used					
		14 = Armature Voltage					
		15 = Encoder Speed					
		16 = Field current					
		17 = EMF					
		18 = P0696 Value					
		19 = P0697 Value					
		20 = P0698 Value					
		21 = P0699 Value					
P0252	AO1 Gain	0.000 to 9.999	1.000			33	88
P0253	AO1 Signal Type	0 = 0 to 10 V/ 20 mA	0		CFG1	33	89
		1 = 4 to 20 mA					
		2 = 10 V/ 20 mA to 0					
		3 = 20 to 4 mA					
P0254	AO2 Function	See options in P0251	7			33	87
P0255	AO2 Gain	0.000 to 9.999	1.000			33	88
P0256	AO2 Signal Type	0 = 0 to 10 V/ 20 mA	0		CFG1	33	89
		1 = 4 to 20 mA					
		2 = 10 V/ 20 mA to 0					
		3 = 20 to 4 mA					
P0257	AO3 Function	See options in P0251	2			33	87
P0258	AO3 Gain	0.000 to 9.999	1.000			33	88
P0259	AO3 Signal Type	0 = 0 to 20 mA	4		CFG1	33	89
		1 = 4 to 20 mA					
		2 = 20 to 0 mA					
		3 = 20 to 4 mA					
		4 = 0 to 10 V					
		5 = 10 to 0 V					
		6 = -10 to +10 V					
P0260	AO4 Function	See options in P0251	5			33	87
P0261	AO4 Gain	0.000 to 9.999	1.000			33	88
P0262	AO4 Signal Type	0 = 0 to 20 mA	4		CFG1	33	89
		1 = 4 to 20 mA					
		2 = 20 to 0 mA					
		3 = 20 to 4 mA					
		4 = 0 to 10 V					
		5 = 10 to 0 V					
		6 = -10 to +10 V					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0263	DI1 Function	0 = Not Used	2		CFG1	34	91
		1 = Run/ Stop					
		2 = General Enable					
		3 = Quick Stop					
		4 = Forward Run					
		5 = Reverse Run					
		6 = 3-Wire Start					
		7 = 3-Wire Stop					
		8 = FWD/REV					
		9 = LOC/ REM					
		10 = JOG					
		11 = Increase E.P.					
		12 = Decrease E.P.					
		13 = Not Used					
		14 = 2nd Ramp					
		15 = Speed/Torque					
		16 = JOG+					
		17 = JOG-					
		18 = No Ext. Alarm					
		19 = No Ext. Fault					
		20 = Reset					
		21 = Speed Reg. Gain					
		22 = Prog. Off					
		23 = Load User 1/2					
		24 = Load User 3					
		25 = Trace Function					
P0264	DI2 Function	See options in P0263	1		CFG1	34	91
P0265	DI3 Function	See options in P0263	8		CFG1	34	91
P0266	DI4 Function	0 = Not Used	0		CFG1	31, 34	91
		1 = Run/ Stop					
		2 = General Enable					
		3 =Quick Stop					
		4 = Forward Run					
		5 = Reverse Run					
		6 = 3-Wire Start					
		7 = 3-Wire Stop					
		8 = FWD/REV					
		9 = LOC/REM					
		10 = JOG					
		11 = Increase E.P.					
		12 = Decrease E.P.					
		13 = Multispeed					
		14 = 2nd Ramp					
		15 = Speed/Torque					
		16 = JOG+					
		17 = JOG-					
		18 = No Ext. Alarm					
		19 = No Ext. Fault					
		20 = Reset					
		21 = Speed Reg. Gains					
		22 = Prog. Off					
		23 = Load User 1/2					
		24 = Load User 3					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
		25 = Trace Function					
P0267	DI5 Function	See options in P0266	14		CFG1	31, 34	91
P0268	DI6 Function	See options in P0266	10		CFG1	31, 34	91
P0269	DI7 Function	See options in P0263	0		CFG1	34	91
P0270	DI8 Function	See options in P0263	0		CFG1	34	91
P0275	DO1 Function (RL1)	0 = Not Used	13		CFG1	35	97
		1 = N* > Nx					
		2 = N > Nx					
		3 = N < Ny					
		4 = N = N*					
		5 = Zero Speed					
		6 = Ia > Ix					
		7 = Ia < Ix					
		8 = Torque > Tx					
		9 = Torque < Tx					
		10 = Remote					
		11 = Run					
		12 = Ready					
		13 = Without Fault					
		14 = With F003					
		15 = With F072					
		16 = With F077					
		17 = 4-20mA OK					
		18 = P0695 Value					
		19 = Forward					
		20 = With Fault					
		21 = Time Enab > Hx					
		22 = SoftPLC					
		23 = N>Nx/Nt>Nx					
		24 = Without Alarm					
		25 = Without Alarm/ Fault					
		26 = Bridge A Conducting					
P0276	DO2 Function (RL2)	See options in P0275	2		CFG1	35	97
P0277	DO3 Function (RL3)	See options in P0275	1		CFG1	35	97
P0278	DO4 Function	See options in P0275	0		CFG1	35	97
P0279	DO5 Function	See options in P0275	0		CFG1	35	97
P0287	Nx/Ny Hysteresis	0 to 900 rpm	18 rpm			35	101
P0288	Nx Speed	0 to 10000 rpm	120 rpm			35	101
P0289	Ny Speed	0 to 10000 rpm	1800 rpm			35	101
P0290	Ix Current	0 to 1.25x I_{rat}	1.0x I_{rat}			35	102
P0291	Zero Speed Zone	0 to 10000 rpm	18 rpm			30, 35	82
P0292	N = N* Band	0 to 10000 rpm	18 rpm			35	102
P0293	Tx Torque	0 to 1000 %	100 %			35	102
P0294	Hx Time	0 to 6553 h	4320 h			35	102
P0295	Drive Rated Current	0 = 20 A			RO	09, 36	104
		1 = 50 A					
		2 = 90 A					
		3 = 125 A					
		4 = 180 A					
		5 = 260 A					
		6 = 480 A					
		7 = 640 A					
		8 = 1000 A					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
		9 = 1500 A					
		10 = 2000 A					
		11 = 1320 A (Rack)					
		12 = 1700 A (Rack)					
		13 = 1900 A (Rack)					
		14 = 2000 A (Rack)					
		15 = 2120 A (Rack)					
		16 = 3000 A (Rack)					
		17 = 3125 A (Rack)					
		18 = 3200 A (Rack)					
		19 = 1000 A (Rack)					
P0296	Rated Line Voltage	0 = 200-240 V	0		CFG2	36	104
		1 = 380 V					
		2 = 400-415 V					
		3 = 440-460 V					
		4 = 480 V					
		5 = 500-525 V					
		6 = 550-575 V					
		7 = 600 V					
		8 = 660-690 V					
		9 = 740-990 V					
P0297	Field Control Loop	0 = Enabled	0		CFG2	25	72
		1 = Disabled					
P0298	Converter Type	0 = Single Bridge	0		CFG2	36	105
		1 = Double Bridge					
P0299	Control Mode	0 = Speed +Torque	0		CFG1	25	72
		1 = Torque					
P0308	Serial Address	1 to 247	1		CFG1	112	114
P0310	Serial Baud Rate	0 = 9600 bits/s	0		CFG1	112	114
		1 = 19200 bits/s					
		2 = 38400 bits/s					
		3 = 57600 bits/s					
P0311	Serial Bytes Config.	0 = 8 bits, no, 1	3		CFG1	112	114
		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					
P0313	Communic. Error Action	0 = Inactive	0			111	114
		1 = Ramp Stop					
		2 = General Disable					
		3 = Go to LOC					
		4 = LOC Keeps Enab					
		5 = Cause Fault					
P0314	Watchdog Serial	0.0 to 999.0 s	0.0 s		CFG1	112	114
P0316	Serial Interface Status	0 = Off			RO	112	114
		1 = On					
		2 = Watchdog Error					
P0317	Oriented Start-up	0 = No	0		CFG2	02	120
		1 = Yes					
P0318	Copy Function MemCard	0 = Inactive	0		CFG1	06	122
		1 = Drive->MemCard					
		2 = MemCard->Drive					

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0319	Copy Function HMI	0 = Inactive	0		CFG1	06	123
		1 = Drive -> HMI					
		2 = HMI -> Drive					
P0340	Auto-Reset Time	0 to 600 s	0 s			38	108
P0348	Overload Protection Config.	0 = Inactive	1		CFG1	38	109
		1 = Fault/ Alarm					
		2 = Fault					
		3 = Alarm					
P0349	Ixt Alarm Level	70 to 100 %	85 %		CFG1	38	109
P0350	Ia > Ix Detector Config.	0 = Active	0			38	110
		1 = Except Accel/Brake					
P0352	Tacho Fault Protection	0 = Active	0		CFG1	38	110
		1 = Inactive					
P0353	EMF Level Tacho Fault	0 to 1000 V	50 V		CFG1	38	110
P0354	Speed Diff. Tacho Fault	0 to 100 %	25 %		CFG1	38	110
P0355	Torque for Stall Protection	0 to 100 %	5 %		CFG1	38	111
P0356	Delay Field Missing	0.1 to 10.0 s	2.0 s		CFG1	38	111
P0357	Line Phase Loss Time	0 to 60 s	3 s			38	111
P0358	Max. Armature Overvoltage	0 to 100 %	10 %			38	111
P0359	Max. Field Overcurrent	0 to 35 %	10 %			38	112
P0361	Max. Line Overvoltage	0 to 30 %	15 %		CFG1	38	112
P0362	Line Undervoltage Level	0 to 30 %	20 %		CFG1	38	112
P0363	Max. Line Unbalance	0 to 30 %	15 %		CFG1	38	113
P0364	Max. Line Freq. Variation	1 to 10 %	5 %		CFG1	38	113
P0400	Armature Rated Voltage	0 to 1200 V	400 V		CFG1	37	105
P0401	Armature Rated Current	0 to 3500 A	50 A		CFG1	37	106
P0402	Motor Rated Speed	10 to 6500 rpm	1800 rpm		CFG1	37	106
P0404	Field Rated Current	0.2 to 50.0 A	1.2 A		CFG1	37	106
P0405	Encoder Pulses Number	100 to 9999 ppr	1024 ppr		CFG1	24	71
P0406	Tacho Voltage 1000 rpm	0.0 to 300.0 V	60.0 V		CFG1	24	72
P0407	DC Tacho Gain Adjustment	0.000 to 1.999	1.000			24	72
P0409	Armature Resistance	0.000 to 0.999 ohm	0.000 ohm			37	106
P0550	Trace Trigger Signal Source	0 = Not selected	0			41	116
		1 = Total Reference					
		2 = Current Speed					
		3 = Armature Current					
		4 = Armature Voltage					
		5 = Field Current					
		6 = Motor Torque					
		7 = AI1					
		8 = AI2					
		9 = AI3					
		10 = AI4					
P0551	Trace Trigger Level	-100.0 to 150.0 %	0.0 %			41	116
P0552	Trace Trigger Condition	0 = P0550* = P0551	5			41	117
		1 = P0550* <>P0551					
		2 = P0550* > P0551					
		3 = P0550* < P0551					
		4 = Alarm					
		5 = Fault					
		6 = DIx					
P0553	Trace Sampling Period	1 to 65535	1			41	117
P0554	Trace Pre-Trigger	0 to 100 %	0 %			41	117

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0559	Trace Maximum Memory	0 to 100 %	0 %			41	118
P0560	Trace Available Memory	0 to 100 %			RO	41	118
P0561	CH1: Channel 1 of Trace	See options in P0550	1			41	119
P0562	CH2: Channel 2 of Trace	See options in P0550	2			41	119
P0563	CH3: Channel 3 of Trace	See options in P0550	3			41	119
P0564	CH4: Channel 4 of Trace	See options in P0550	0			41	119
P0571	Start Trace Function	0 = Off	0			41	119
		1 = On					
P0572	Trace Trigger Day/Month	00/00 to 31/12			RO	09, 41	119
P0573	Trace Trigger Year	00 to 99			RO	09, 41	119
P0574	Trace Trigger Time	00:00 to 23:59			RO	09, 41	119
P0575	Trace Trigger Seconds	00 to 59			RO	09, 41	120
P0576	Trace Function Status	0 = Off			RO	09, 41	120
		1 = Waiting					
		2 = Trigger					
		3 = Concluded					
P0642	Self-Diagnosis	0000h to FFFFh			RO	09, 36	105
P0680	Logical Status	Bit 0 = Quick Stop ON			RO	09, 111	114
		Bit 1 = Self-tuning					
		Bit 2 = Blocked					
		Bit 3 = Decelerating					
		Bit 4 = Accelerating					
		Bit 5 = 2nd Ramp					
		Bit 6 = Config. Mode					
		Bit 7 = Alarm					
		Bit 8 = Running					
		Bit 9 = Enabled					
		Bit 10 = Reverse					
		Bit 11 = JOG					
		Bit 12 = Remote					
		Bit 13 = Undervoltage					
		Bit 14 = FWD/REV Change					
		Bit 15 = Fault					
P0681	Speed in 13 bits	-32768 to 32767			RO	09, 111	114
P0682	Serial/USB Control	Bit 0 = Ramp Enable			RO	09, 111	114
		Bit 1 = General Enable					
		Bit 2 = Run Reverse					
		Bit 3 = JOG Enable					
		Bit 4 = Remote					
		Bit 5 = 2nd Ramp					
		Bit 6 = Quick Stop					
		Bit 7 = Fault Reset					
		Bit 8....15 = Not Used					
P0683	Serial/USB Speed Ref.	-32768 to 32767			RO	09, 111	114
P0686	Anybus-CC Control	See options in P0682			RO	09, 111	114
P0687	Anybus-CC Speed Ref.	-32768 to 32767			RO	09, 111	114
P0695	DOx Value	Bit 0 = DO1			RO	09, 111	114
		Bit 1 = DO2					
		Bit 2 = DO3					
		Bit 3 = DO4					
		Bit 4 = DO5					
P0696	AOx Value 1	-32768 to 32767			RO	09, 111	114
P0697	AOx Value 2	-32768 to 32767			RO	09, 111	114

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0698	AOx Value 3	-32768 to 32767			RO	09, 111	114
P0699	AOx Value 4	-32768 to 32767			RO	09, 111	114
P0723	Anybus Identification	0 = Disabled			RO	09, 113	114
		1 = RS232					
		2 = RS422					
		3 = USB					
		4 = Serial Server					
		5 = Bluetooth					
		6 = Zigbee					
		7 = Reserved					
		8 = Reserved					
		9 = Reserved					
		10 = RS485					
		11 = Reserved					
		12 = Reserved					
		13 = Reserved					
		14 = Reserved					
		15 = Reserved					
		16 = Profibus DP					
		17 = DeviceNet					
		18 = CANopen					
		19 = EtherNet/IP					
		20 = CC-Link					
		21 = Modbus TCP					
		22 = Modbus RTU					
		23 = PROFINET IO					
		24 = Reserved					
		25 = Reserved					
P0724	Anybus Comm.Status	0 = Disabled			RO	09, 113	114
		1 = Not Supported					
		2 = Access Error					
		3 = Offline					
		4 = Online					
P0725	Anybus Address	0 to 255	0		CFG1	113	114
P0726	Anybus Baud Rate	0 to 3	0		CFG1	113	114
P0728	Anybus Read Word #3	0 to 1499	0		CFG1	113	114
P0729	Anybus Read Word #4	0 to 1499	0		CFG1	113	114
P0730	Anybus Read Word #5	0 to 1499	0		CFG1	113	114
P0731	Anybus Read Word #6	0 to 1499	0		CFG1	113	114
P0732	Anybus Read Word #7	0 to 1499	0		CFG1	113	114
P0733	Anybus Read Word #8	0 to 1499	0		CFG1	113	114
P0734	Anybus Read Word #9	0 to 1499	0		CFG1	113	114
P0735	Anybus Read Word #10	0 to 1499	0		CFG1	113	114
P0736	Anybus Read Word #11	0 to 1499	0		CFG1	113	114
P0737	Anybus Read Word #12	0 to 1499	0		CFG1	113	114
P0738	Anybus Write Word #3	0 to 1499	0		CFG1	113	114
P0739	Anybus Write Word #4	0 to 1499	0		CFG1	113	114
P0740	Anybus Write Word #5	0 to 1499	0		CFG1	113	114
P0741	Anybus Write Word #6	0 to 1499	0		CFG1	113	114
P0742	Anybus Write Word #7	0 to 1499	0		CFG1	113	114
P0743	Anybus Write Word #8	0 to 1499	0		CFG1	113	114
P0744	Anybus Write Word #9	0 to 1499	0		CFG1	113	114
P0745	Anybus Write Word #10	0 to 1499	0		CFG1	113	114

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P0746	Anybus Write Word #11	0 to 1499	0		CFG1	113	114
P0747	Anybus Write Word #12	0 to 1499	0		CFG1	113	114
P1000	SoftPLC Status	0 = No Application			RO	09, 40	115
		1 = Install Application					
		2 = Incompatible Application					
		3 = Application Stopped					
		4 = Application Running					
P1001	SoftPLC Command	0 = Stop Program	0			40	115
		1 = Run Program					
		2 = Delete Program					
P1002	Scan Cycle Time	0 to 65535 ms			RO	09, 40	115
P1010	SoftPLC Parameter 1	-32768 to 32767	0			40	115
P1011	SoftPLC Parameter 2	-32768 to 32767	0			40	115
P1012	SoftPLC Parameter 3	-32768 to 32767	0			40	115
P1013	SoftPLC Parameter 4	-32768 to 32767	0			40	115
P1014	SoftPLC Parameter 5	-32768 to 32767	0			40	115
P1015	SoftPLC Parameter 6	-32768 to 32767	0			40	115
P1016	SoftPLC Parameter 7	-32768 to 32767	0			40	115
P1017	SoftPLC Parameter 8	-32768 to 32767	0			40	115
P1018	SoftPLC Parameter 9	-32768 to 32767	0			40	115
P1019	SoftPLC Parameter 10	-32768 to 32767	0			40	115
P1020	SoftPLC Parameter 11	-32768 to 32767	0			40	115
P1021	SoftPLC Parameter 12	-32768 to 32767	0			40	115
P1022	SoftPLC Parameter 13	-32768 to 32767	0			40	115
P1023	SoftPLC Parameter 14	-32768 to 32767	0			40	115
P1024	SoftPLC Parameter 15	-32768 to 32767	0			40	115
P1025	SoftPLC Parameter 16	-32768 to 32767	0			40	115
P1026	SoftPLC Parameter 17	-32768 to 32767	0			40	115
P1027	SoftPLC Parameter 18	-32768 to 32767	0			40	115
P1028	SoftPLC Parameter 19	-32768 to 32767	0			40	115
P1029	SoftPLC Parameter 20	-32768 to 32767	0			40	115
P1030	SoftPLC Parameter 21	-32768 to 32767	0			40	115
P1031	SoftPLC Parameter 22	-32768 to 32767	0			40	115
P1032	SoftPLC Parameter 23	-32768 to 32767	0			40	115
P1033	SoftPLC Parameter 24	-32768 to 32767	0			40	115
P1034	SoftPLC Parameter 25	-32768 to 32767	0			40	115
P1035	SoftPLC Parameter 26	-32768 to 32767	0			40	115
P1036	SoftPLC Parameter 27	-32768 to 32767	0			40	115
P1037	SoftPLC Parameter 28	-32768 to 32767	0			40	115
P1038	SoftPLC Parameter 29	-32768 to 32767	0			40	115
P1039	SoftPLC Parameter 30	-32768 to 32767	0			40	115
P1040	SoftPLC Parameter 31	-32768 to 32767	0			40	115
P1041	SoftPLC Parameter 32	-32768 to 32767	0			40	115
P1042	SoftPLC Parameter 33	-32768 to 32767	0			40	115
P1043	SoftPLC Parameter 34	-32768 to 32767	0			40	115
P1044	SoftPLC Parameter 35	-32768 to 32767	0			40	115
P1045	SoftPLC Parameter 36	-32768 to 32767	0			40	115
P1046	SoftPLC Parameter 37	-32768 to 32767	0			40	115
P1047	SoftPLC Parameter 38	-32768 to 32767	0			40	115
P1048	SoftPLC Parameter 39	-32768 to 32767	0			40	115
P1049	SoftPLC Parameter 40	-32768 to 32767	0			40	115
P1050	SoftPLC Parameter 41	-32768 to 32767	0			40	115
P1051	SoftPLC Parameter 42	-32768 to 32767	0			40	115

Param.	Function	Adjustable Range	Factory Setting	User's Setting	Proper.	Groups	Page
P1052	SoftPLC Parameter 43	-32768 to 32767	0			40	115
P1053	SoftPLC Parameter 44	-32768 to 32767	0			40	115
P1054	SoftPLC Parameter 45	-32768 to 32767	0			40	115
P1055	SoftPLC Parameter 46	-32768 to 32767	0			40	115
P1056	SoftPLC Parameter 47	-32768 to 32767	0			40	115
P1057	SoftPLC Parameter 48	-32768 to 32767	0			40	115
P1058	SoftPLC Parameter 49	-32768 to 32767	0			40	115
P1059	SoftPLC Parameter 50	-32768 to 32767	0			40	115

Notes:
RO = Read only parameter
CFG1 = Configuration parameter level 1: alteration not allowed with the converter Running
CFG2 = Configuration parameter level 2: alteration allowed with the converter Disabled only

2 FAULTS AND ALARMS

2.1 FAULTS

In order to avoid dangerous situations and damages to the motor, converter, and other materials, the protections of the CTW900 may actuate so that certain physical limits will not be exceeded.

In this regard, a fault is a condition that requires immediate stop of the converter so as to prevent possible losses. When a fault occurs, the CTW900 is automatically disabled and cannot be restarted until the cause of the fault is removed.

The actuation of the faults occurs as follows:

- The converter is disabled by removing the firing from the armature;
- The converter status becomes “Fault” and it is displayed in the status word (P0680);
- The “Status” LED flashes red;
- The fault code is displayed on the keypad (HMI) and also on parameter P0049;
- The relays set for “Without Fault” are switched off.

In order to enable the CTW900 again and operate it normally, it is necessary to reset it, which can be done the following ways:

- Switching off the electronics power supply (XC5) and switching it back on (power-on reset);
- Pressing the key or the “Reset” soft key (manual reset);
- Automatically by means of the P0340 setting (auto-reset);
- Via digital input set for the “Reset” function (P0263...P0270=20).

2.2 ALARMS

Alarms are warning messages that indicate a condition occurred and which may lead to a dangerous situation. They do not stop the converter, but can lead to a fault condition if not removed.

The actuation of the alarms occurs as follows:

- The alarm code is displayed on the keypad (HMI) and also on parameter P0048;
- The “Status” LED becomes yellow;
- The “Alarm” indication becomes active in the status word (P0680).

The alarms are automatically removed as soon as their causes disappear.

Fault/Alarm	Description	Possible Causes
F003: Line Undervoltage	■ Actuates when the line voltage remains below the value defined in P0362 (in percentage of P0296) for a period longer than the time set in P0357. $Line\ Undervoltage\ Level\ (V) = (100\% - P0362) \times P0296$	■ Setting of P0296 in a range above the rated line voltage. ■ Input fuses open. ■ Loss of a line phase.
F004: Line Overvoltage	■ Actuates when the line voltage remains above the value defined in P0361 (in percentage of P0296) for over 5 seconds. $Line\ Overvoltage\ Level\ (V) = (100\ \% + P0361) \times P0296$	■ Power supply above the maximum value. ■ Setting of P0296 in a range below the rated line voltage.
F006: Unbalance of the Line Voltages	■ Actuates when the difference between the line voltage values (P0033, P0034 and P0035) remain above the value set in P0363 for over 2 seconds (value of P0363 in percentage of P0296). $Line\ Unbalance\ (\%) = \frac{\lvert P0033 - P0034 \rvert}{P0296} \times 100\ \%$ $Line\ Unbalance\ (\%) = \frac{\lvert P0034 - P0035 \rvert}{P0296} \times 100\ \%$ $Line\ Unbalance\ (\%) = \frac{\lvert P0033 - P0035 \rvert}{P0296} \times 100\ \%$	■ The line voltage unbalance is above the setting. ■ System unbalanced. ■ One of the input fuses open. ■ Loss of a line phase.
F008: Line Under/Over Frequency	■ Actuates when the line frequency is above or below the maximum variation set in P0364 (in percentage of the rated frequency). $Line\ Max.Freq.(Hz) = (100\ \% + P0364) \times Freq_{Rat}(50\ /\ 60Hz)$ $Line\ Max.Freq.(Hz) = (100\ \% - P0364) \times Freq_{Rat}(50\ /\ 60Hz)$	■ Line frequency above or below the maximum acceptable variation. ■ One of the input fuses open. ■ Loss of a line phase.
F009: Field Supply Under/Over Frequency	■ Actuates when the field supply frequency is above or below the maximum variation set in P0364 (in percentage of the rated frequency). $Field\ Supply\ Max.Freq.(Hz) = (100\ \% + P0364) \times Freq_{Rat}(50\ /\ 60Hz)$ $Field\ Supply\ Mix.Freq.(Hz) = (100\ \% - P0364) \times Freq_{Rat}(50\ /\ 60Hz)$ Note: Relevant fault only when the field is supplied externally by means of connector X3. Otherwise, the field frequency will be the same as the converter main supply (R/S/T).	■ Field supply frequency above or below the maximum acceptable variation. ■ One of the field supply fuses open.
F022: Armature Overvoltage	■ Actuates when the armature voltage exceeds the maximum level defined by P0358 (in percentage of P0400) for over 2 seconds. $Armature\ Overvoltage\ Level\ (V) = (100\ \% + P0358) \times P0400$	■ Motor is being accelerated by the load. ■ Incorrect value set in P0400. ■ Overvoltage level set too low (P0358). ■ Incorrect field current setting (P0404 and P0177). ■ Incorrect speed feedback configuration (tacho / encoder).
A046: High Load on the Motor	■ Signals when the armature current (P0003) is above the overload level defined by P0349 (in percentage of P0156). $Motor\ Overload\ Level\ (A) = P0349 \times P0156$ Note: This alarm will be active if the following conditions are met: ■ P0156 > P0157 and ■ P0348 = 1 or P0348 = 3.	■ High load on the motor shaft. ■ Rotor locked. ■ Overload level set too low (P0156).
A050: High Temperature on Heatsink	■ Signals when the temperature measured on the heatsink is above 85°C. Note: The alarm will be removed when the temperature fall below 82°C.	■ Load requiring a constant current close to the converter rated capacity. ■ Fault on the fans of product. ■ Improper installation with obstruction of the inlets and/or outlets of the product.
F051: Converter Overtemperature	■ Actuates when the temperature measured on the heatsink reaches 90°C. Note: Fault can only be reset when the temperature is below 82°C.	■ Load cycle incompatible with the converter rated current. ■ Ambient temperature above the maximum acceptable (40°C). ■ Fault on the fans of product. ■ Improper installation with obstruction of the inlets and/or outlets of the product.

Fault/Alarm	Description	Possible Causes
F067: Incorrect Polarity of the Tacho or Encoder	■ Actuates when the polarity of the feedback by DC tacho or encoder is different from the output voltage signal (EMF). Note: This fault will be active only if the converter is configured as Antiparallel (P0298=1) and the feedback is not set for EMF (P0202≠0). It is also possible to disable the protection setting P0352=1.	■ Wiring of the tacho or encoder cables inverted.
F070: Field Overcurrent	■ Actuates when the field circuit current remains above the value defined in P0359 (in percentage of P0404) for over 2 seconds. $Field\ Overcurrent\ Level\ (A) = (100\ \% + P0359)\ \times\ P0404$	■ Field regulator gains too high (P0175 and P0176). ■ Overcurrent level set too low (P0359).
F071: Armature Overcurrent	■ Actuates when the armature circuit current remains above the value defined in P0135 for over 2 seconds.	■ Current regulator gains too high (P0167 and P0171). ■ Maximum output current set too low (P0135). ■ Fault on some of the thiristors of the armature.
F072: Motor Overload	■ Actuates when the output current exceeds the limit defined in P0156 for a period longer than the setting in P0158. Note: In case the output current is below the value of P0156, but above the value of P0157, the actuation time will be give by: $Actuation\ Time\ F072\ (s) = (P0156 \div P0003)\ \times\ P0158$	■ Settings of P0156, P0157 and P0158 too low for the load used. ■ Overload on the motor shaft.
F074: Field Missing	■ Actuates when field current remains below the value defined in P0177 for a period longer than the time set in P0356.	■ Motor field not connected. ■ Field input fuses open. ■ Setting of P0177 incompatible with the motor field. ■ Fault in the field supply when supplied externally by means of connector X3.
F077: Motor Stalled	■ Actuates when the armature current remains above the limit defined in P0355 (in percentage of P0295) and speed below P0139 for a period longer than the time set in P0137. $Level\ for\ Motor\ Stalled\ (A) = P0355\ \times\ P0295$ Note: If P0355 is set for 0, the protection will be disabled.	■ Motor shaft locked. ■ Incorrect settings of P0355 and/or P0139.
F079: Fault in the Encoder Signals	■ Actuates when a fault in the encoder pulses occurs.	■ Wiring between the encoder and interface accessory broken. ■ Encoder defective.
F080: CPU Fault (Watchdog)	■ Actuation of the microcontroller watchdog timer.	■ Electric noise. ■ Converter not grounded.
F082: Copy Function Fault	■ Actuates when a fault in the copy of parameters by the keypad (HMI) occurs.	■ Attempt to copy parameters from the keypad (HMI) to a converter with a different software version.
F084: Self-Diagnose Fault	■ Actuates when an internal fault is detected on the converter.	■ Defect on the internal circuits of the product. ■ Accessory modules poorly connected.
A088: Communication with keypad (HMI) Fault	■ Signals when the communication between the keypad (HMI) and the control board is interrupted.	■ Poor contact on the keypad (HMI) cable. ■ Electric noise on the installation.
A090: External Alarm	■ Signals an external alarm through a digital input (DI). Note: It is necessary to set some DI for "Without External Alarm"	■ Digital input set for "Without External Alarm" is open (0V).
F091: External Fault	■ Actuates when some digital input set for "Without External Fault" is open.	■ Digital input set for "Without External Fault" is open (0V).
F098: Invalid Offset Ia/If	■ Actuates when the measurement circuit of the armature current (Ia) or field current (If) displays an abnormal value during the converter initialization.	■ Defect on the measurement circuits of armature current or field current.
F099: Invalid Offset Ua/Tacho	■ Actuates when the measurement circuit of the armature voltage (Ua) or tacho voltage displays an abnormal value during the converter initialization.	■ Power-up of the converter with the motor running. ■ Defect on the measurement circuits of armature or tacho voltage.
A128: Serial Communication Timeout	■ Signals when the converter stops receiving valid telegrams within a certain period. Note: It may be disable by setting P0314 = 0.0s.	■ Poor installation of the communication and/or ground cables. ■ Master sending new telegrams in a period longer than the setting in P0314.

Fault/Alarm	Description	Possible Causes
A129: Anybus Offline	■ Signals that the Anybus-CC communication was interrupted.	■ PLC master went to idle status (Idle or Prog.). ■ Programming error (number of I/O words programmed on the slave differs from the setting on the master). ■ Loss of communication with the master (broken cable, connector disconnected, etc.).
A130: Anybus Access Error	■ Signals error of access to the Anybus-CC communication module.	■ Anybus-CC module defective, not recognized or incorrectly installed. ■ Conflict with WEG option board.
F148: Change Bridge Fault	■ Occurs when the measurement of armature current doesn't become discontinuous during the Exchange Bridge routine.	■ Problem in measuring circuit of the armature current. ■ Defective thyristor(s).
F149: Incompatible PLD Firmware	■ The firmware recorded on the PLD of the control board is not compatible with the firmware of the CTW900.	■ PLD not recorded. ■ PLD with firmware of another product.
F150: Motor Overspeed	■ Actuates when the motor speed exceeds the value of P0132 (in percentage of P0134) for over 2 seconds. $Overspeed\ Level\ (rpm) = (100\% + P0132) \times P0134$	■ P0132 set too low.
F151: Flash Memory Module Fault	■ Actuates when a fault is present in the FLASH Memory Module (MMF-03).	■ FLASH memory module defective. ■ FLASH Memory Module not well fitted.
F154: Speed Feedback Fault	■ Actuates when the difference between the DC Tacho or Encoder speed and the EMF exceeds the value of P0354 (in percentage of P0402). $Speed\ Feedback\ Fault\ Level\ (rpm) = P0354 \times P0402$ Note: The monitoring of this fault is only started when the EMF exceeds the level defined in P0353. It is also possible to disable the protection setting P0352=1.	■ Disconnection of the tacho or encoder cable. ■ Setting of P0405 incompatible with the encoder used. ■ Setting of P0406 incompatible with the tacho used or incorrect wiring of the tacho cables to connector XC4. ■ Armature circuit is open.
F156: Under temperature	■ Signals when the temperature measured on the heatsink is below -5°C.	■ Temperature sensor cable disconnected (XC8). ■ Ambient temperature below -5°C.
F158: Thermostat of Armature Open	■ Actuates when one of the thermostats assembled in the armature bridge is open. Note: This fault will only be active in converters of Frame Size D, which are equipped with thermostats in the armature bridge.	■ High temperature at the armature bridge (over 88°C). ■ Cable of the thermostat disconnected (XC6).
F159: Armature Fuse Fault	■ Actuates when one of the armature fuses is open. Note: This fault will only be active in converters of Frame Size D, which are equipped with internal fuses.	■ Some armature fuse break sensors open. ■ Cable of the fuse break sensor disconnected (XC7).
A163: Broken wire in AI1	■ Signals that the reference in current (4-20mA or 20-4mA) of the analog input 1 (AI1) is out of the correct range.	■ Cable of AI1 broken. ■ Poor contact in the signal connection on the control board terminals (connector XC1 of board CC900).
A164: Broken wire in AI2	■ Signals that the reference in current (4-20mA or 20-4mA) of the analog input 2 (AI2) is out of the correct range.	■ Cable of AI2 broken. ■ Poor contact in the signal connection on the control board terminals (connector XC1 of board CC900).
A165: Broken wire in AI3	■ Signals that the reference in current (4-20mA or 20-4mA) of the analog input 3 (AI3) is out of the correct range.	■ Cable of AI3 broken. ■ Poor contact in the signal connection on the control board terminals (connector XC1 of board CC900).
A166: Broken wire in AI4	■ Signals that the reference in current (4-20mA or 20-4mA) of the analog input 4 (AI4) is out of the correct range.	■ Cable of AI4 broken. ■ Poor contact in the signal connection on the control board terminals (connector XC1 of board CC900).
A181: Clock with Invalid Value	■ Signals that the keypad (HMI) clock has an invalid date or time.	■ Necessary to set the date and time in P0194 to P0199. ■ Keypad (HMI) battery low, defective or not installed.
F229: Anybus Offline	■ Actuates when an interruption in the Anybus-CC communication occurs.	■ PLC master went to idle status (Idle or Prog.). ■ Programming error (number of I/O words programmed on the slave differs from the setting on the master). ■ Loss of communication with the master (broken cable, connector disconnected, etc.).

Fault/Alarm	Description	Possible Causes
A700: Keypad (HMI) Disconnected	■ Check the SoftPLC User's Manual of the CTW900.	
F701: Keypad (HMI) Disconnected		
A702: Converter Disabled		
A704: Two Movements Enabled		
A706: Reference Not Set SoftPLC	■ Check the SoftPLC User's Manual of the CTW900.	
F750 / A750 to F799 / A799: SoftPLC Faults and Alarms		

3 SAFETY INSTRUCTIONS

This manual contains information necessary for the correct programming of the converter CTW900.

It was written to be used by people with proper technical training or qualification to operate this kind of equipment.

3.1 SAFETY WARNINGS IN THE MANUAL

In this manual are used the following safety warnings:

DANGER!
The not following of the procedures recommended in this warning can lead to death, serious injuries and considerable material damages.

ATTENTION!
The not following of the procedures recommended in this warning can lead to material damages.

NOTE!
The text aims at providing important information for the full understanding and proper operation of the product.

3.2 SAFETY WARNINGS ON 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 ground (PE).

Connection of the shield to the ground.

3.3 PRELIMINARY RECOMENDATIONS

DANGER!
Only qualified personnel, familiar with the CTW900 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 CTW900 in accordance with this manual and the safety legal procedures in force.
2. Use the protective equipment according to the standards in force;
3. Give first aid.

DANGER!
Always disconnect the general power supply before touching any electrical component in connection with the product.
High voltages and spinning parts (fans) may still be present even after disconnecting the power supply. Wait for at least one minute for the full discharge of the power capacitors and stop of the fans.
Always connect the equipment frame to the protective ground (PE). Use the adequate connection terminal at the converter.

ATTENTION!
Electronic boards have components sensitive to electrostatic discharges. Do not touch the components or connectors directly. If necessary, first touch the grounded metallic frame or wear a ground strap.

Do not carry out any applied potential test on the converter!
If necessary, consult the manufacturer.

NOTE!
AC/DC converters may interfere in other electronic equipment. Observe the recommendations of the Chapter 5 – Installation and Connection of this manual in order to minimize these effects.

NOTE!
Read this manual thoroughly before installing or operating the converter.

4 ABOUT THE CTW900

4.1 MANUAL INFORMATION

This manual presents the information necessary for the configuration of all the functions and parameters of the CTW900.

Due to the wide range of functions of this product, it may be used in applications different from those presented hereby. Neither does this manual aim at presenting all the possible applications of the CTW900, nor can the manufacturer take any liability for the use of the converter which is not based on this manual.

In order to obtain more detailed information on the SoftPLC function or the expansion and communication accessories, refer to the following manuals:

- Manual of the SoftPLC;
- Manual of the interface modules for Incremental Encoder;
- Manual of the I/O expansion modules;
- Manual of the Modbus RTU communication;
- Manual of the Anybus-CC communication.

Those manuals are supplied in electronic file in the CD-ROM that comes with the product, or can be downloaded at WEG website – www.weg.net.

4.2 SOFTWARE VERSION

The software version used on the CTW900 is important, since it defines the functions and programming parameters.

This manual refers to the software version as indicated on the back cover. For instance, the version 1.0X means from 1.00 to 1.09, where "X" are the evolutions in the software that do not affect the content of this manual.

You can check the software version in parameter P0023.

4.3 CHARACTERISTICS

The AC/DC Converter CTW900 is a high performance product intended to drive and control DC motors with independent excitation for speed variation and control in one or four quadrants of the Torque x Speed curve.

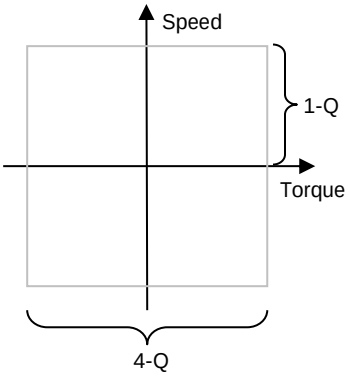


Figure 4.1 – Torque x Speed curve for a mechanical drive

Among its main characteristics, we may point out:

- Keypad with 2.5" LCD which allows viewing different kinds of information simultaneously;
- USB for serial communication and firmware update;
- Memory card for backup of parameters and software applications;
- Log of the ten last faults;
- SoftPLC function to create specific programs;

- Trace function for graphic monitoring of variables;
- Expansion and communication accessories shared with the CFW-11 line;
- Single model for voltages from 200 to 500 Vac;
- Simplified connections for power and control;
- Internal supply for field bridge.

The block diagram below provides a general view of the CTW900 set:

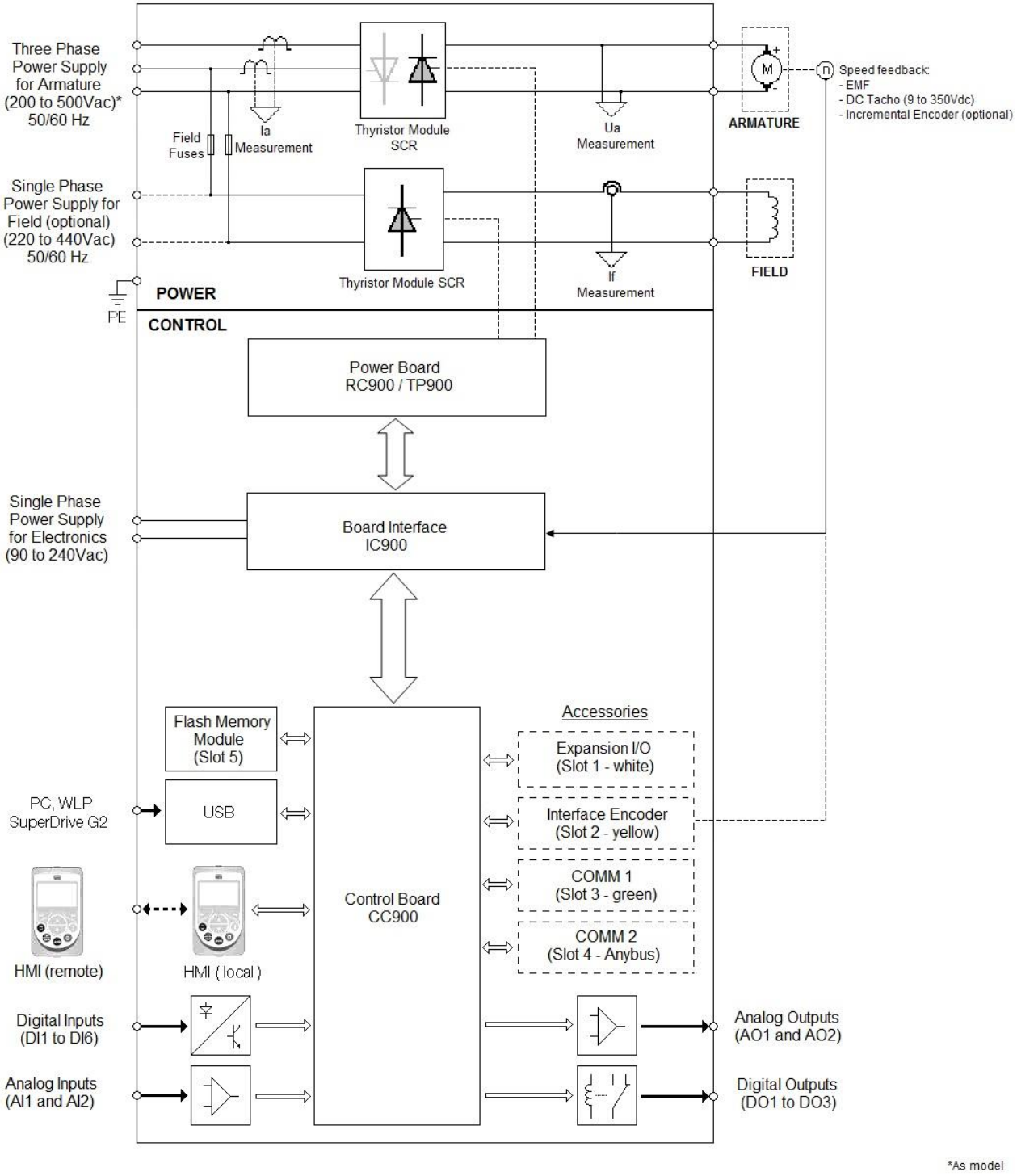


Figure 4.2 – Simplified block diagram of the CTW900

4.4 MODELS AND VERSIONS

The CTW900 converter family is divided into four frame sizes (A, B, C and D), which encompass a wide range of voltage and current, as shown in Table 4.1:

Table 4.1 – Models and versions of the CTW900

Frame Size	Rated Current (Adc)	Power Supply (Vac) 500V	600V	990V	Maximum Field Current (Adc)
A	20A 50A 90A 125A	● ● ● ●			15A
B	180A 260A	● ●			18A
C	480A 640A 1000A	● ● ●	○[1] ● ○[1]		25A
D	1500A 2000A	● ●		● ●	45A

○[1]: Under consultation

4.5 NAMEPLATE AND IDENTIFICATION CODE

The product main nameplate, located on the side of the converter, contains important information about the model, such as voltage and current ranges allowed for operation.

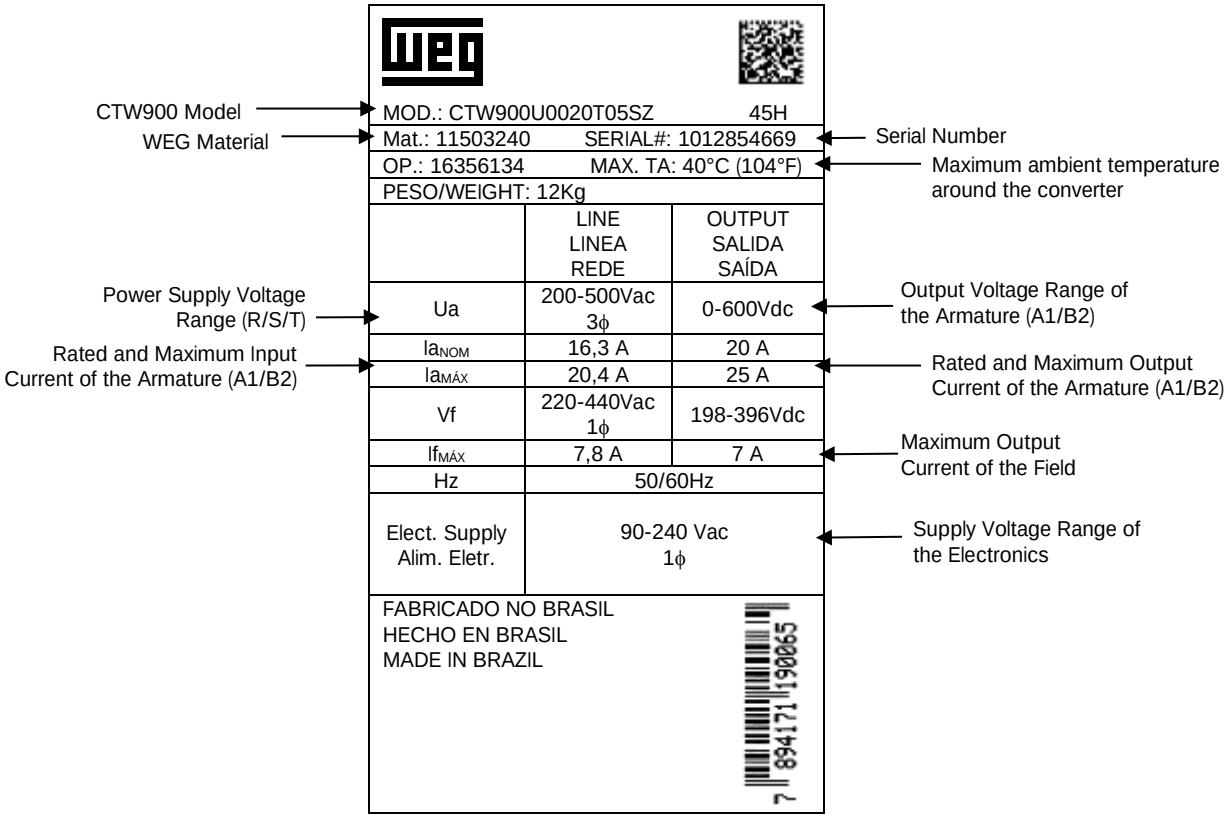


Figure 4.3 – Main nameplate of the CTW900

There is also a second identification, located under the keypad (HMI), which contains summarized information about the product, but which allows the identification of its most important characteristics.

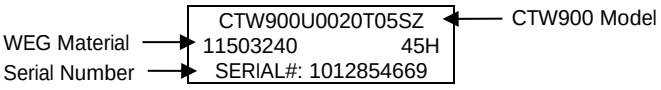


Figure 4.4 – Nameplate under the keypad (HMI)

For the proper specification of the converter model, use the product smart code. It is composed of several parts, which are described below:

CTW900	U	0640	T	05	S	Z
1	2	3	4	5	6	7

1 –	WEG Three-Phase AC/DC Converter, series CTW900
2 –	Type of Armature Bridge U = Unidirectional (1-Q) A = Antiparallel (4-Q)
3 –	Rated Output Current ex.: 0640 = 640A
4 –	Armature Power Supply Line T = Three Phase
5 –	Armature Power Supply 05 = 200...500 Vac 06 = 200...600 Vac 07 = 200...690 Vac 10 = 200...990 Vac
6 –	Power Supply of the Fans S = Standard Size A and B: 115/ 230 V (automatic selection) Size C and D: 230 V
7 –	End of the code (Z)

4.6 HUMAN MACHINE INTERFACE (HMI)

By means of the product HMI (keypad) it is possible to control the converter and view the setting of all parameters. The navigation is intuitive with the option of sequential access to the parameters or by means of groups (menu).

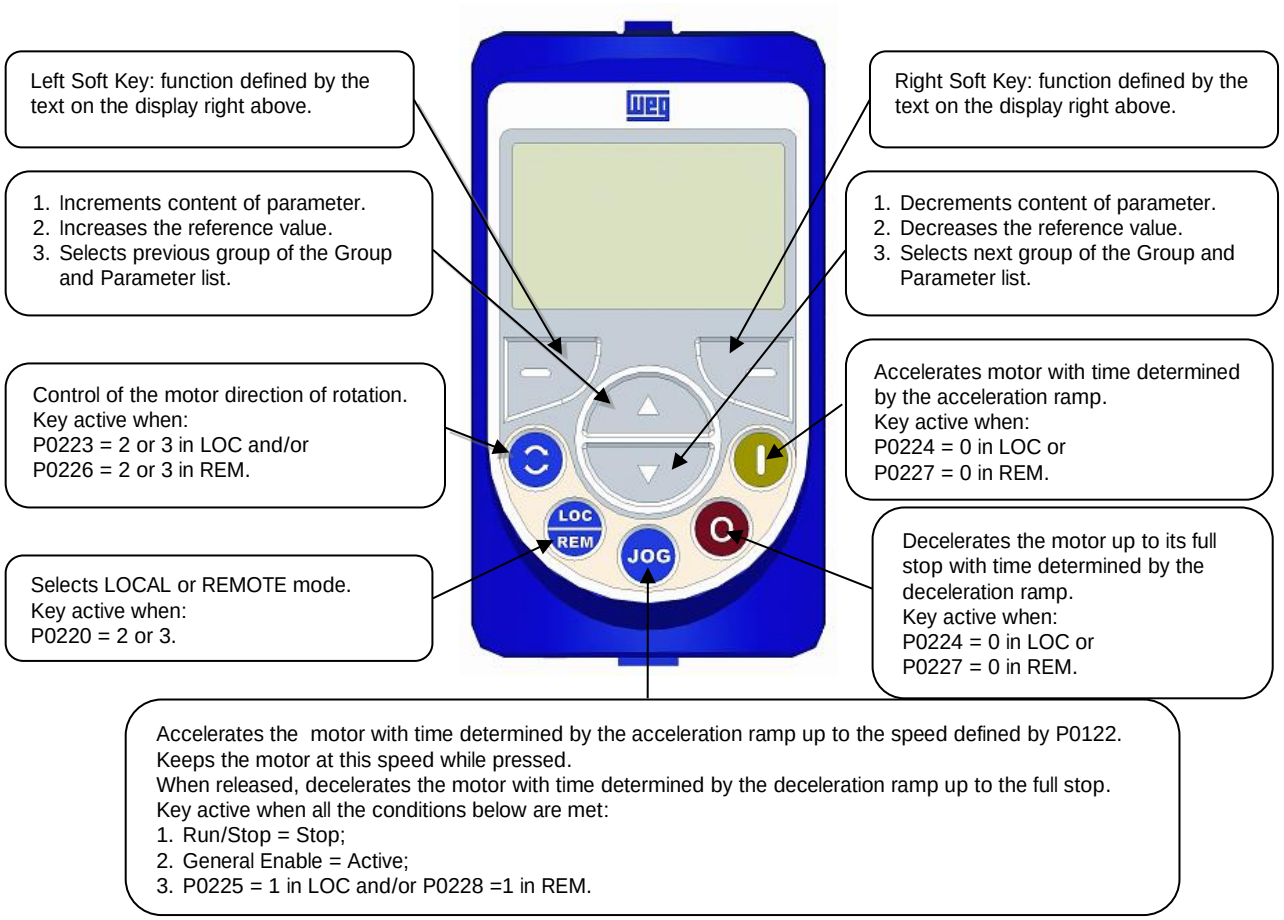


Figure 4.5 – Keys of the keypad (HMI)

Whenever the converter is powered up, the keypad (HMI) display goes into the Monitoring mode.
With the factory setting, a screen similar to Figure 4.6 should be displayed.

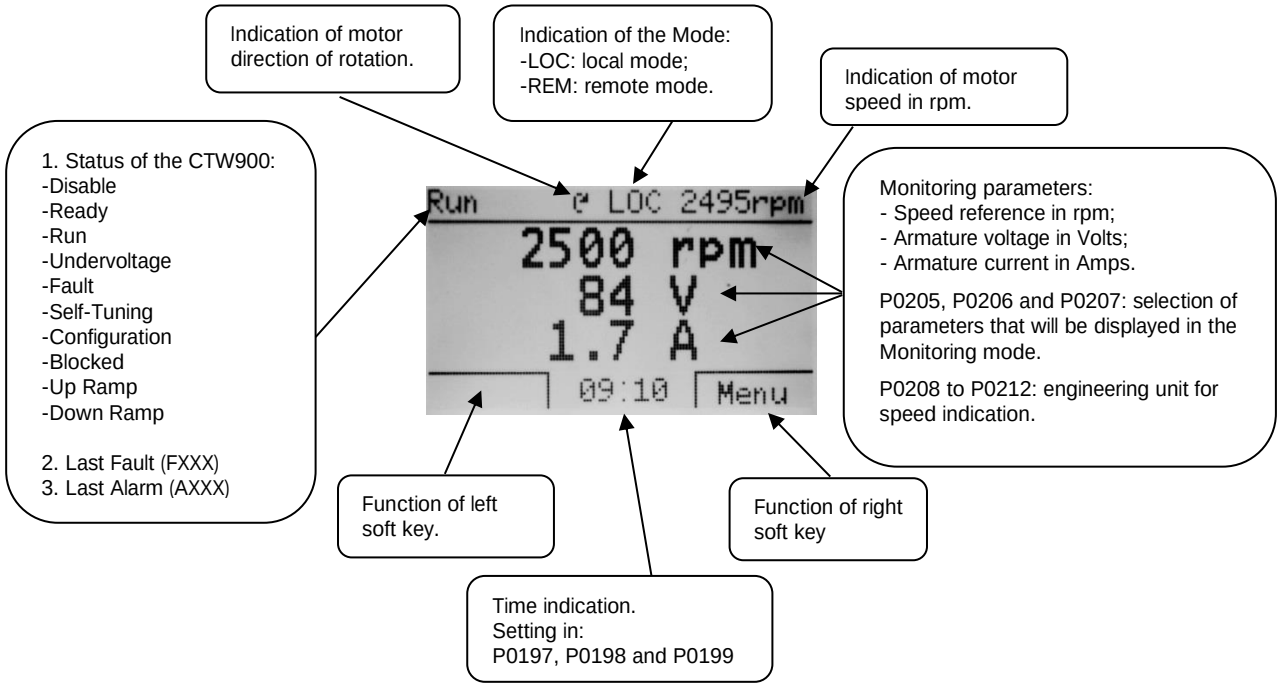


Figure 4.6 – Monitoring mode screen in factory standard

Additionally, by means of the configuration of the viewing parameters (P0205 to P0207), it is possible to display the variables of the Monitoring mode in the form of a bar graph or also in a bigger font, as shown in Figure 4.7 and Figure 4.8.

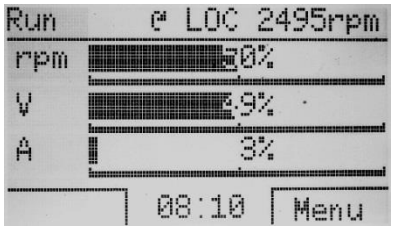


Figure 4.7 – Monitoring mode screen by bar graph

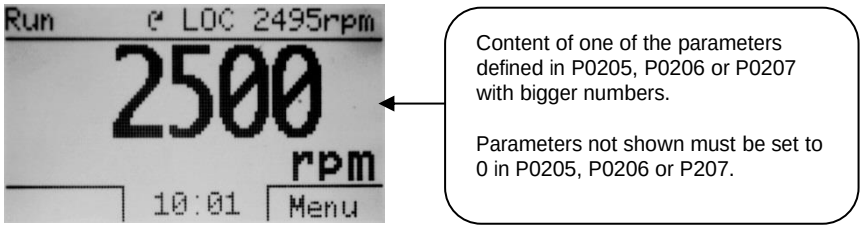


Figure 4.8 – Example of screen of the Monitoring mode with a variable in bigger font

NOTE!
When a number is displayed on the keypad (HMI) with the letter 'h' at the end ("0040h", for example), it means its representation is in hexadecimal.

4.6.1 Installation

The keypad (HMI) can be installed or removed with the converter powered up or down.

It can also be used for remote control of the product through specific cable.
For this connection mode, use:

- cable with D-Sub9 (DB9) male and female connectors with pin to pin connection (mouse extension or Null-Modem type, market standard);
- maximum length of 10 meters.

4.6.2 Battery

In order to keep the operation of the internal clock while the converter is powered down, the keypad (HMI) of the CTW900 has a battery.
If the battery is low, or not installed on the keypad (HMI), the clock time will be incorrect and the indication "A181 – "Clock with invalid value" will occur every time the converter is powered up.

In this case, replace the battery for a new one of the same model (CR2032), according to the procedure presented in Figure 4.9.

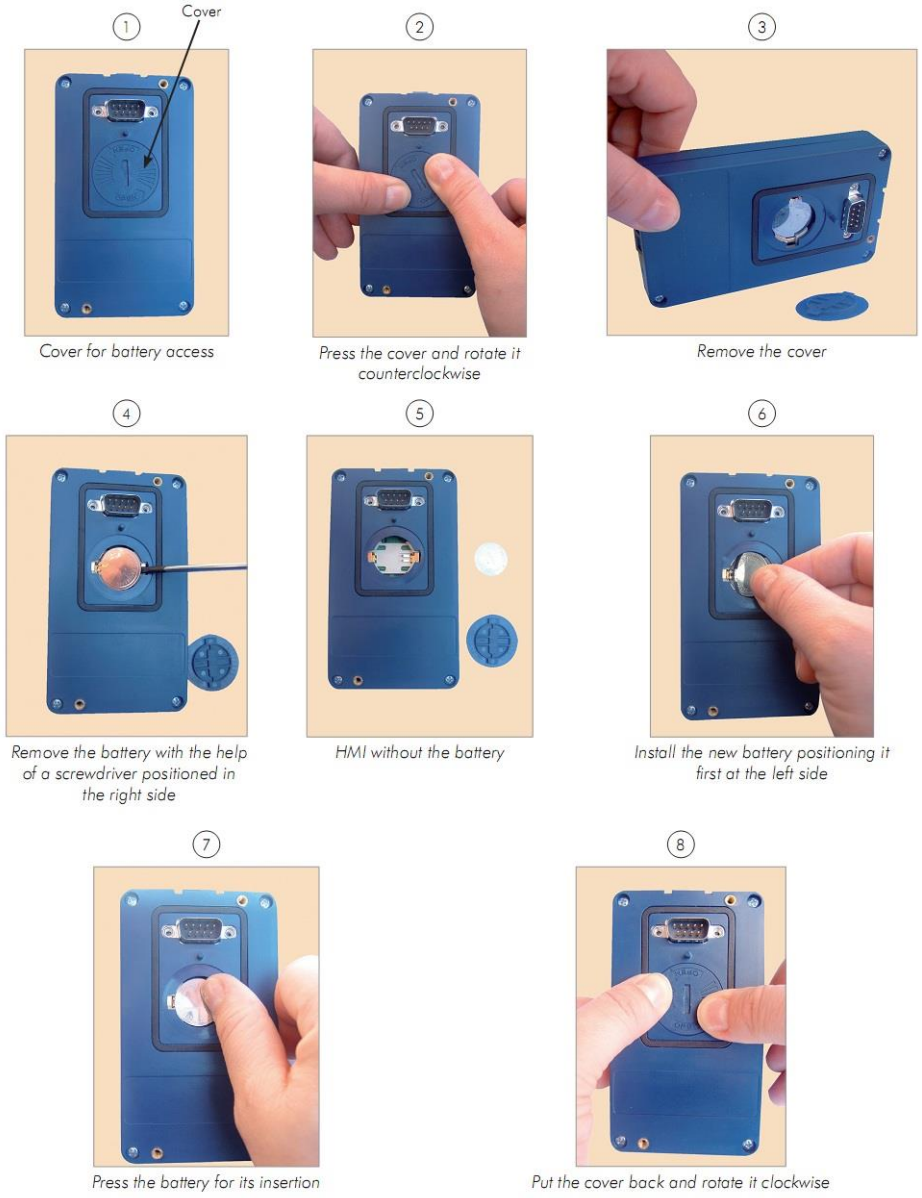


Figure 4.9 – HMI battery replacement

NOTE!
The life expectation of the battery is of approximately 10 years. At the end of the useful life, do not dispose of the battery in common garbage, but in a proper place for batteries.

5 INSTALLATION AND CONNECTION

5.1 RECEIVING AND STORING

When receiving the CTW900, check on the label on the external part of the package if the smart code corresponds to the model ordered.

Then, confirm on the product nameplate (attached to the side of the converter) if the model received matches the description on the package, and if any damages occurred during transportation.
If any problems are detected, contact the carrier immediately.

If the CTW900 is not installed soon, store it in a clean and dry location (temperature between -25ºC and 60ºC), with a cover to prevent dust accumulation inside it.

5.2 MECHANICAL INSTALLATION

5.2.1 Environmental Conditions

The location of the converter is determinant for its proper operation and normal useful life of its parts.
Thus, it is recommended to avoid installing it in the following conditions:

- direct exposure to sunlight, rain, high humidity or sea-air;
- explosive or corrosive liquids or gases;
- excessive vibration;
- dust, metallic particles or oil mist.

Accepted operating and environmental conditions:

- *Temperature:*
  - 0 °C to 40 °C – rated conditions;
  - 40 ºC to 50 ºC – 2 % of current derating for each Celsius degree above 40 ºC;
- Air relative humidity: 10 % to 90 % non-condensing;
- *Altitude:*
  - 0 to 1000 m – rated conditions;
  - 1000 m to 4000 m – 1 % current derating for each 100 m above 1000 m;
- *Pollution degree:* 2 (according to EN50178 and UL508C), with non-conductive pollution. Condensation must not originate conduction through accumulated residues.

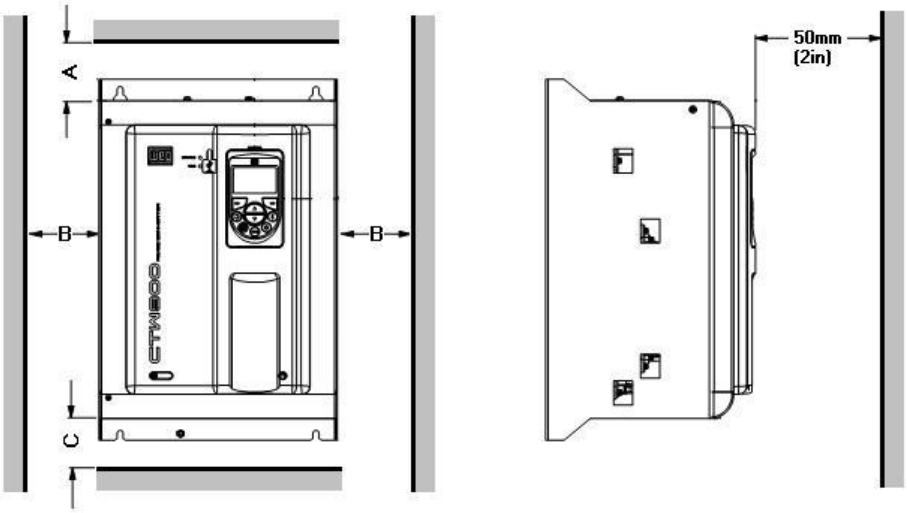
5.2.2 Positioning and Mounting

For the proper operation and heat dissipation, the CTW900 must be installed only in the vertical position on a flat surface.

Furthermore, we recommend following the instructions below:

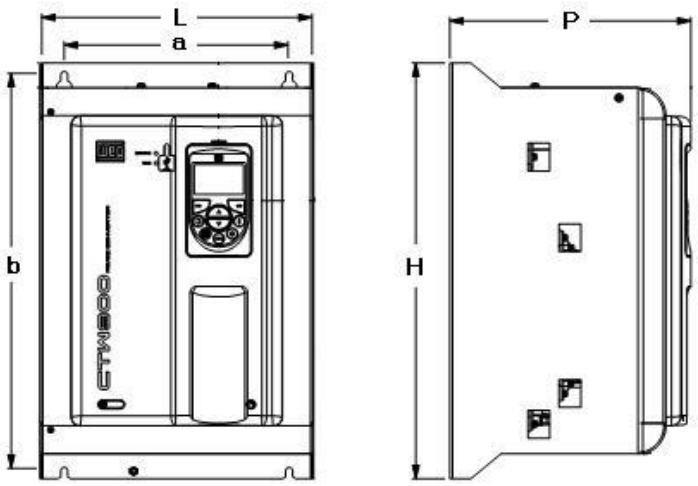
- keep the minimum clearances indicated in Figure 5.1;
- do not put sensitive component parts right above the converter;
- if mounting a converter next to another, use the minimum distance 2xB;
- if mounting a converter above another, use the minimum distance A+C and deflect the hot air coming from the lower converter so as not to hit the upper converter;
- drill the mounting holes according to Figure 5.2;
- provide independent conduits or gutters for physical separation of the signal, control and power conductors (refer to section 5.3 – Electrical Installation), also separating the motor cables from the other cables.

NOTE!
For converters installed inside cabinets or metal boxes, provide proper exhaustion, so that the temperature remains within the allowed range.



Model	Dimension		
	A	B	C
	mm (in)	mm (in)	mm (in)
Size A	60 (2,36)	30 (1,18)	100 (3,94)
Size B	100 (3,94)	30 (1,18)	130 (5,12)
Size C	100 (3,94)	100 (3,94)	130 (5,12)
Size D	300 (11,81)	100 (3,94)	300 (11,81)

Figure 5.1 – Necessary clearances for ventilation of the converter



Model	Dimension					Fastening Screw	Weight
	L	H	P	a	b		
	mm (in)	mm (in)	mm (in)	mm (in)	mm (in)		
Size A	276 (10,8)	420 (16,5)	244 (9,6)	225 (8,9)	400 (15,7)	M6	13 Kg
Size B	275 (10,8)	420 (16,5)	300 (11,8)	225 (8,9)	400 (15,7)	M6	20 Kg
Size C	277 (10,9)	650 (25,5)	428 (16,8)	225 (8,9)	625 (24,6)	M8	47 Kg
Size D	650 (25,5)	1285 (50,5)	427 (16,8)	450 (17,7)	1225 (48,2)	M10	150 Kg

Figure 5.2 – Main measures for mechanical installation

5.3 ELECTRICAL INSTALLATION

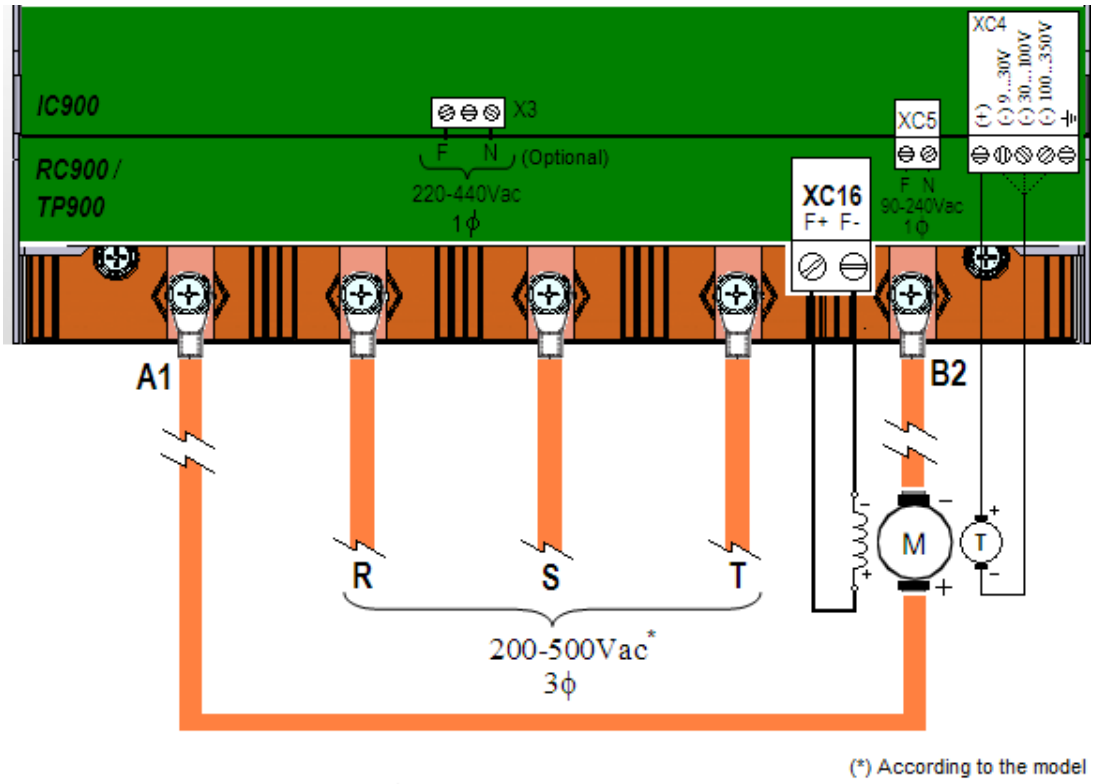
5.3.1 Power Connections

DANGER!
A device must be provided to disconnect the power supply from the converter, and it must be open before beginning any connections.

DANGER!
The CTW900 must not be used as an emergency stop device.

ATTENTION!
The following information is merely a guide for proper installation. Comply with applicable local regulations for electrical installations.

ATTENTION!
For technical information and dimensioning of the CTW900, refer to chapter 10.



Connection	Local	Description
R / S / T	Terminal Strip	Input of the Three-Phase AC Power Supply
A1(+) B2(–)	Terminal Strip	DC voltage output for the motor Armature
XC16	TP900 or RC900 Electronic Board	DC voltage output for the motor field (F+ / F-)
XC5	IC900 Electronic Board	Single-phase AC power supply of the Electronics
XC4	IC900 Electronic Board	Input for DC Tachogenerator
X3	IC900 Electronic Board	Single-phase AC power supply input for the Field (optional)

Figure 5.3 – Power connections of the CTW900

NOTE!
The line voltage must be compatible with the converter power supply range. Check the product nameplate for the allowed operation.

NOTE!
Power factor correction capacitors are not needed at the input (R/S/T) and must not be installed at the output (A1/B2).

5.3.2 External Supply for the Field

The CTW900 comes from the factory with the field bridge internally supplied by the same power supply circuit of the armature (R/S/T). In case the input voltage of the armature is too high for the motor field, it is possible to supply the field circuit with a different source, by means of connector X3.

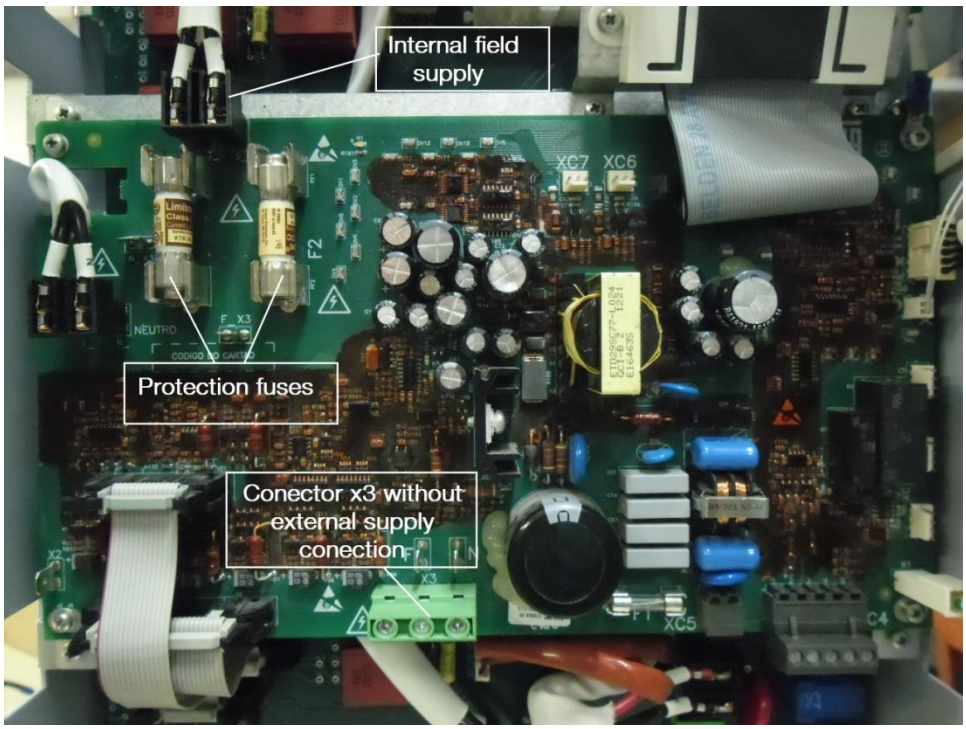


Figure 5.4 - Field supplied internally

For supply the field externally :

- with the converter powered down, remove the field protection fuses located on the electronic interface board IC900 (F2 and F3);
- connect the specific cable for the field external supply (supplied together with the converter) between connector X3 and terminals F_X3 and N_X3, located on the side of the field fuse holder.

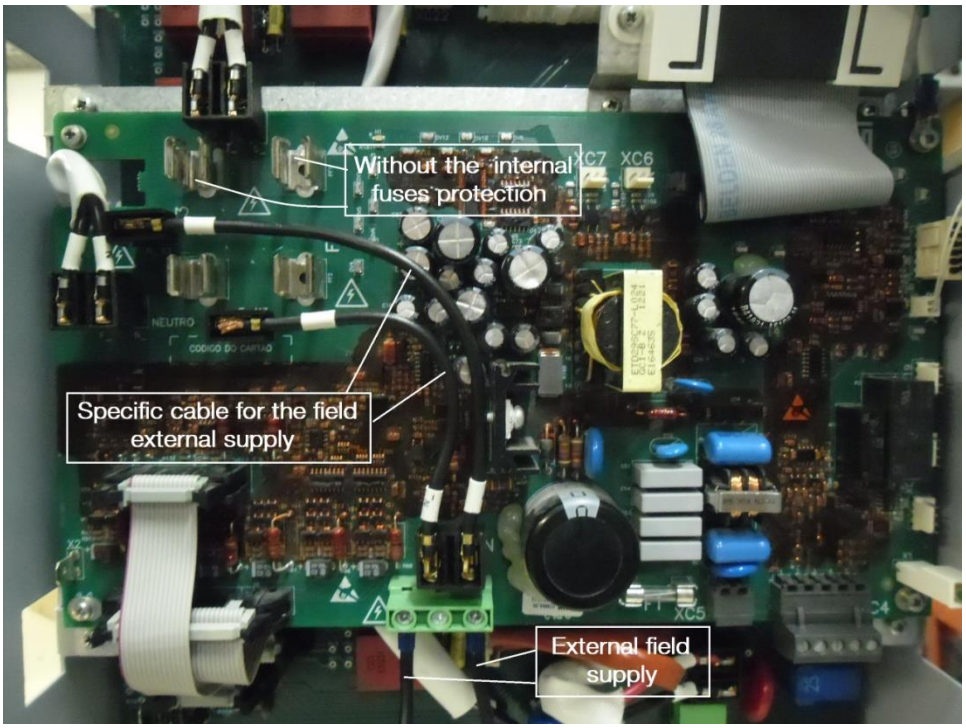


Figure 5.5 – Field supplied externally

ATTENTION!
By supplying the field circuit by means of connector X3, the protection provided by the internal fuses (F2 and F3) is lost.
In this case, it is necessary to protect the field circuit with external fuses between the X3 connector and the power supply.
It is recommended to use ultra fast fuses dimensioned according to the maximum current allowed by the converter (see the Table 5.5).

DANGER!
Before touching the internal fuses of field protection (F2 and F3), make sure voltage is not present at the R/S/T terminals and also the power supply of the electronics is disconnected.

5.3.3 Power and Grounding Wiring

The use of wiring with gauges suitable for the converter model is essential to prevent damages to the installation and equipment.

Thus, the following Table 5.1 presents the minimum recommended values for cables or busbars to connect the armature circuit and also for the protection conductor (PE), based on NBR 5410 standard.

ATTENTION!
When flexible cables are used for the power and grounding connections, proper terminals must be used.

ATTENTION!
Sensitive equipment, such as PLCs, temperature controllers and thermocouple cables must be placed at least 25 cm away from the cables between the converter and the motor.

Table 5.1 – Recommended Wiring for Power and Grounding Connection, as per NBR 5410

	Armature Input Connection (R/S/T)		Armature Output Connection (A1/B2)			
Model CTW900	Cables [mm²]	Busbars [mm x mm]	Cables [mm²]	Busbars [mm x mm]	Field Wiring [mm²]	Grounding Wiring (PE) [mm²]
20A	4	12 x 2	4	12 x 2	1.0	4
50A	10	12 x 2	10	12 x 2	1.0	10
90A	25	12 x 2	25	12 x 2	1.0	16
125A	35	12 x 2	35	12 x 2	1.0	16
180A	70	20 x 3	70	20 x 3	2.5	35
260A	95	20 x 3	95	20 x 3	2.5	50
480A	2 x 95	30 x 5	2 x 120	30 x 10	4.0	95
640A	2 x 150	30 x 5	3 x 120	30 x 10	4.0	150
1000A	3 x 185	30 x 10	4 x 150	40 x 10	4.0	185
1500A	4 x 240	80 x 10	5 x 185	80 x 10	4.0	2 x 240
2000A	5 x 240	100 x 10	6 x 240	100 x 10	4.0	2 x 240

NOTE!
The values of Table 5.1 are only valid in the following conditions:
- copper cables with PVC 70°C insulation or
- silver or bare copper busbars and with rounded edges of 1-mm radius;
- maximum ambient temperature of 40°C;
- installation in vertical or horizontal perforated channels;
- arrangement of the cables in a single layer.

For installation in other conditions, refer to NBR 5410.

NOTE!
The converter output wiring (A1/B2) must be installed separately from the line input wiring (R/S/T), as well as from the control and signal wiring.

5.3.4 Protection Fuses

In order to protect the product against short circuit, ultra fast fuses must be used at the converter input, dimensioned according to the current and to the maximum of the power I^2t semiconductors.

For Antiparallel converters (4-Q), it is also necessary to install fuses at the converter output (A1/B2), as shown in Figure 5.6.

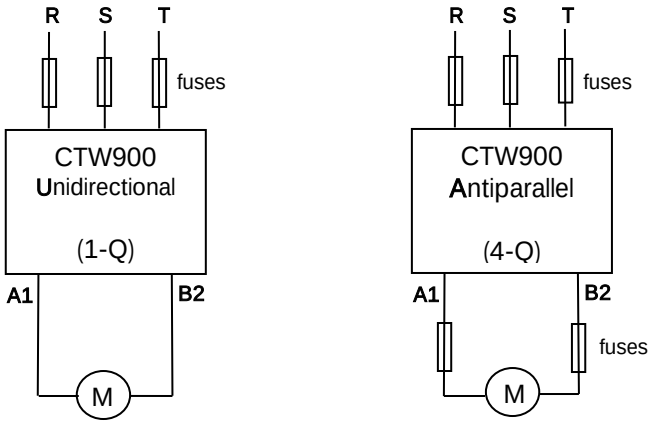


Figure 5.6 – Configuration of the elements for the protection of the armature circuit of the CTW900

Table 5.2 – Recommended Fuses for the Protection of the Armature Input Circuit (AC side)

CTW900 Model	Fuse			
	Rated Current [A]	I^2t Maximum [A^2s]	WEG Model	
			Reference	Code
20A	25	6,000	FNH00-25K-A	10701722
50A	63	6,000	FNH00-63K-A	10705764
90A	125	8,000	FNH00-125K-A	10707231
125A	160	11,000	FNH00-160K-A	10701724
180A	250	73,000	FNH00-250K-A	10711445
260A	350	63,000	FNH1-350K-A	10814896
480A	710	240,000	FNH2-710K-A	11393547
640A	800	300,000	FNH3-800K-A[1]	10833726
1000A	1250	900,000	–	
1500A	(Circuit Breaker)		–	
2000A	(Circuit Breaker)		–	

Table 5.3 – Recommended Fuses for the Protection of the Armature Output Circuit (for 4-Q converter)

CTW900 Model	Fuse			
	Rated Current [A]	I^2t maximum [A^2s]	WEG Model	
			Reference	Code
20A	35	6,000	FNH00-35K-A	10701721
50A	63	6,000	FNH00-63K-A	10705764
90A	125	8,000	FNH00-125K-A	10707231
125A	200	11,000	FNH1-200K-A	10809133
180A	315	73,000	FNH1-315K-A	10809575
260A	400	63,000	FNH3-400K-A	10831217
480A	710	240,000	FNH3-710K-A[1]	10833591
640A	900	300,000	–	
1000A	1250	900,000	–	
1500A	(Circuit Breaker)		–	
2000A	(Circuit Breaker)		–	

NOTE!
On the 1500A and 2000A models, circuit breakers must be used to protect the installation, because the converter already has internal fuses in each arm of the armature bridge (no additional external fuses are needed).

Follow the list of fuses used inside the models of Size D (1500A and 2000A).

Table 5.4 – Fuses Used Inside Converters of Size D

CTW900 Model	Fuse			
	Rated Current [A]	Rated Voltage [V]	Reference	WEG Code
1500A / 500Vac	1100	690	FNH3FEM-1100Y-A (WEG)	12661664
2000A / 500Vac	1100	690	FNH3FEM-1400Y-A (WEG)	12661666
1500A / 990Vac	1250	1250	170M6499 (Cooper Bussman)	12943531
2000A / 990Vac	1250	1250	170M6501 (Cooper Bussman)	12943530

When the field bridge is supplied externally as described in section 5.3.2, ultra fast fuses must be used at the circuit input, dimensioned according to Table 5.5.

[1] In order to prevent unintentional actuation, these models must not be mounted on disconnecting switch.

Table 5.5 – Recommended Fuses for the Protection of the Field Circuit

CTW900 Model	Fuse			
	Rated Current [A]	I^2t maximum [A^2s]	WEG Model	
			Reference	Code
20A 50A 90A 125A 180A 260A	20	435	FNH00-20K-A	10687494
480A 640A 1000A	35	510	FNH00-35K-A	10701721
1500A 2000A	50	2700	FNH00-50K-A	10701718

ATTENTION!
Fuses must not be used in the field output circuit (F+ / F-).

5.3.5 Line Reactance

The AC/DC converters, especially those that use thyristors for rectifying the voltage and the current, must be supplied by lines without great voltage oscillations so that they can operate properly.

Therefore, the use of a line reactance together with the CTW900 is essential in order to ensure a supply without transients for the converter, the same way its use reduces the influence generated by the commutation of the thiristors on the supply line.

The line reactance must be installed at the converter input (R/S/T), as shown in Figure 5.7.

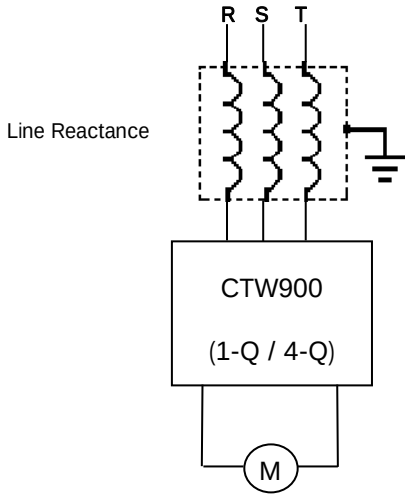


Figure 5.7 – Position for the installation of the line reactance

The calculation for the dimensioning of the line reactance must be done taking into account, besides the drive rated current, the voltage and frequency of the supply line. The relationship between those variables is expressed by the following equation:

$$L = \frac{V_{line}}{223.1 \times f_{line} \times I_{rated}}$$

where,

L = inductance in Henry (H);

V_{line} = line voltage of the supply line, in Volts (V);
F_{line} = frequency of the supply line, in Hertz (Hz);
I_{rated} = rated current of the drive on the DC side, in Amps (A).

For 60Hz lines and voltages up to 500Vac, the recommended reactances for each model of the CTW900 are presented in Table 5.6. For other voltages or frequencies, contact WEG to check the most suitable reactance.

Table 5.6 – Recommended Reactances for Supply Lines up to 500 Vac and Frequency of 60Hz

		Reactance	
CTW900 Model	Power Supply	Inductance / Rated Current	WEG Code
20A	200 to 500Vac	1.820µH @ 25A	14835521
50A		740µH @ 100A	14835570
90A		400µH @ 100A	14835571
125A		254µH @ 100A	14835572
180A		160µH @ 182A	14835574
260A		103µH @ 214A	14835662
480A		72µH @ 411A	14835663
640A		54µH @ 542A	14835665
1000A		52µH @ 811A	14835667
1500A		27µH @ 1251A	14835717
2000A		25µH @ 1622A	14835798

5.3.6 Grounding Connection

The CTW900 must be connected to a protection grounding (PE).
In order to do so, observe the following:

- use a minimum wire gauge equal to the indicated in Table 5.1. If local standards require different gauges, they must be observed;
- connect the converter grounding point to a specific ground rod, or to the exclusive or general grounding point of the installation (resistance ≤ 10 ohms).

The supply lines allowed for use with the CTW900 are those of the TN or TT (IEC) type.
The connection of lines of the IT type is also possible, since it is grounded via impedance.

ATTENTION!
The neutral conductor of the line that feeds the converter must be solidly grounded; however, it must not be used to ground the product.

DANGER!
Do not share the grounding wiring with other equipment that operate at high currents (e.g., high power motors, welding machines, etc.). When several converters are used, follow the procedure shown in Figure 5.8 for the grounding connection.

NOTE!
The frame of the motor driven by the CTW900 must always be grounded. The motor must be grounded in the panel where the converter is installed, or on the converter itself.

NOTE!
When the electromagnetic interference generated by the converter is an issue for the other equipment, use shielded wires or wires protected by metal conduit for the output connection of the product (A1/B2), connecting the shield at each end to the grounding point of the converter and to the motor frame.

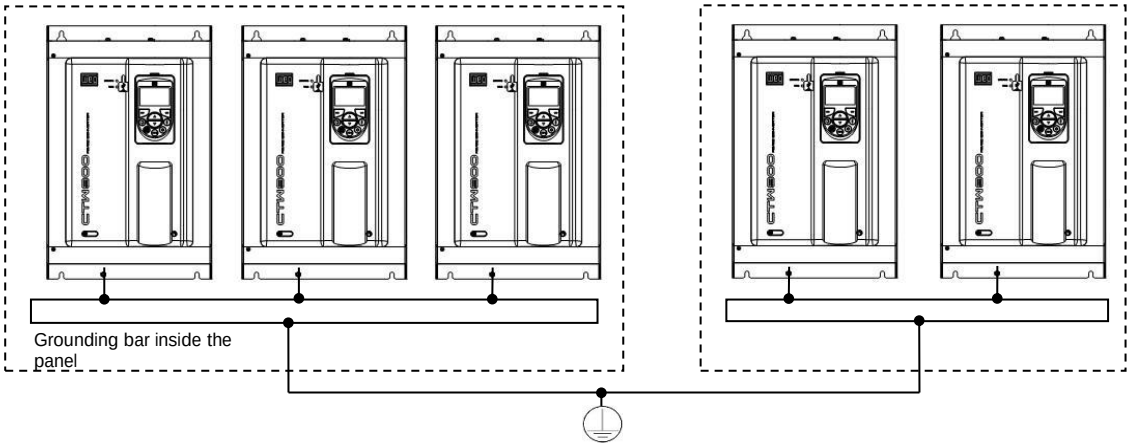
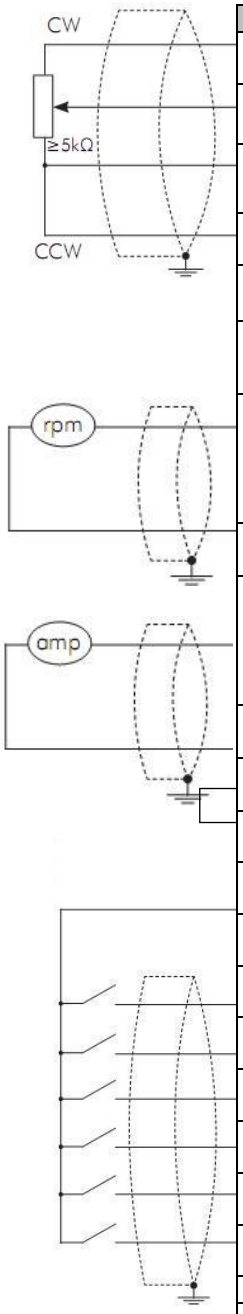


Figure 5.8 – Grounding connection for more than one converter

5.3.7 Control Connections

The control connections of the CTW900 (analog inputs/outputs, digital inputs/outputs) are made at connector XC1, located on the CC900 control electronic board.
In order to access it, remove the product front plastic cover by loosening the two fastening screws in the lower part of the cover.

The typical control functions and connections are shown in Figure 5.9.

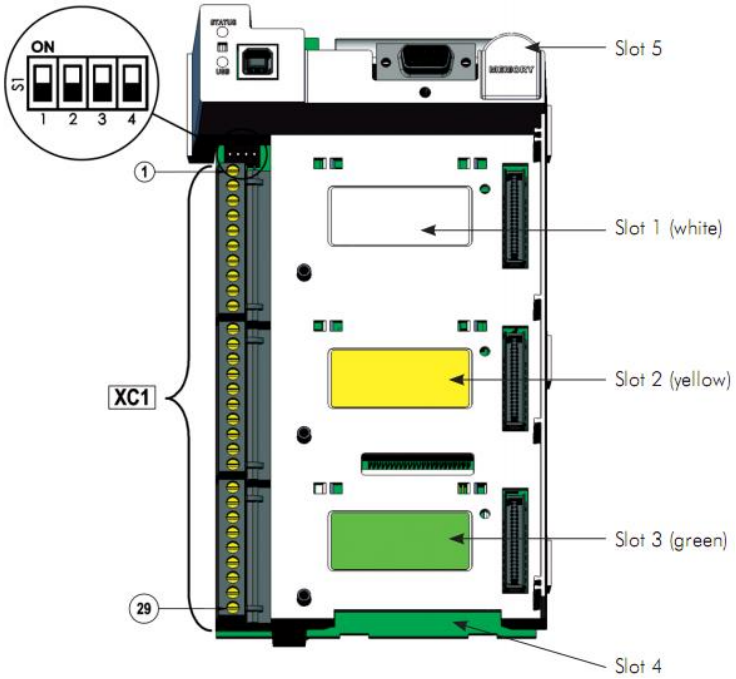


Connector XC1		Factory Default Function	Specifications
1	+REF	Positive reference for potentiometer	Output voltage: +5.4 V, ±5 % Maximum output current: 2 mA
2	AI1+	Analog Input 1: Speed reference (remote)	Differential analog input Resolution: 12 bits Signal: 0 to +10 V (R_{IN} = 400 kΩ) 0 to 20 mA / 4 to 20 mA (R_{IN} = 500 Ω) Maximum voltage: ±30 V
3	AI1-		
4	REF-	Negative reference for potentiometer	Output voltage: -4.7 V, ±5 % Maximum output current: 2 mA
5	AI2+	Analog Input 2: Speed reference (remote)	Differential analog input Resolution: 11 bits + signal Signal: 0 to ±10 V (R_{IN} = 400 kΩ) 0 to 20 mA / 4 to 20 mA (R_{IN} = 500 Ω) Maximum voltage: ±30 V
6	AI2-		
7	AO1	Analog output 1: Effective Speed	Analog output with galvanic isolation Resolution: 11 bits Signal: 0 to +10 V (R_L≥ 10 kΩ) 0 to 20mA / 4 to 20 mA (R_L≤ 500 Ω) Protected against short circuit
8	AGND (24V)	Reference 0 V for the analog outputs	Connected to ground (frame) via impedance: Resistor of 940 kΩ in parallel with capacitor of 22 nF
9	AO2	Analog output 2: Armature Current	Analog output with galvanic isolation Resolution: 11 bits Signal: 0 to +10 V (R_L≥ 10 kΩ) 0 to 20 mA / 4 to 20 mA (R_L≤ 500 Ω) Protected against short circuit
10	AGND (24 V)	Reference 0V for the analog outputs	Connected to ground (frame) via impedance: Resistor of 940 kΩ in parallel with capacitor of 22 nF
11	DGND	Reference 0V of the 24 Vdc power supply	Connected to ground (frame) via inductor of 100 µH (impedance 1.6 Ω)
12	COM	Common point of the digital inputs	
13	24 Vdc	24Vdc Power supply	24 Vdc Power supply, ±8 % Capacity: 500mA
14	COM	Common point of the digital inputs	
15	DI1	Digital input 1: General Enable	6 Isolated digital inputs High level: ≥18 V Low level: ≤3 V Maximum input voltage: 30 V Input current: 11 mA @ 24 Vdc
16	DI2	Digital input 2: Run/Stop	
17	DI3	Digital input 3: Not Used	
18	DI4	Digital input 4: Not Used	
19	DI5	Digital input 5: JOG (remote)	
20	DI6	Digital input 6: 2nd Ramp	
21	NF1	Digital output 1 DO1 (RL1): No Fault	Maximum voltage of the contacts: 240 Vac Maximum current: 1 A NC: normally closed contact C: common NO: normally open contact
22	C1		
23	NA1		
24	NF2	Digital output 2 DO2 (RL2): N > N_x	
25	C2		
26	NA2		
27	NF3	Digital output 3 DO3 (RL3): N* > N_x	
28	C3		
29	NA3		

Figure 5.9 – Signals of connector XC1 and connection of the digital inputs as active high

NOTE!
In order to use the digital inputs as active low, it is necessary to remove the jumper between XC1: 11 and 12 and change it to XC1: 12 and 13.

As default, the analog inputs and outputs come from the factory selected for the range 0 to +10V.
In order to change its operation range, you can change the position of switch S1, located on the upper left corner of the CC900 electronic board.



Signal	Setting Element	Selection	Factory Setting
AI1	S1:4	OFF: 0 a +10 V (factory setting) ON: 4 to 20 mA / 0 to 20 mA	OFF
AI2	S1:3	OFF: 0 to ±10 V (factory setting) ON: 4 to 20 mA / 0 to 20 mA	OFF
AO1	S1:1	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 a +10 V (factory setting)	ON
AO2	S1:2	OFF: 4 to 20 mA / 0 to 20 mA ON: 0 a +10 V (factory setting)	ON

Figure 5.10 – Location and configurations of S1 switch to select the type of the analog input and output signals

NOTE!
The parameters related to AI1, AI2, AO1 and AO2 must also be set according to the selection of the S1 switch and the desired values.

For the correct installation of the control wiring, use:

- cables from 0.5 mm² (20 AWG) to 1.5 mm² (14 AWG);
- maximum torque of 0.5 N.m (4.50 lbf.in);
- shielded cables separate from the other wiring (power, control in 110Vac/220Vac, etc.) according to Table 5.7. If the crossing of those cables cannot be avoided, it must be done perpendicularly between them, keeping the minimum separation distance of 5 cm at the crossing point.

The shield connection of the cables must also observe the form presented in Figure 5.11 (see example of connection in Figure 5.12).

Table 5.7 – Separation distances between control wiring and other wiring

Wiring Length	Minimum Separation Distance
≤ 30 m	≥10 cm
> 30 m	≥25 cm

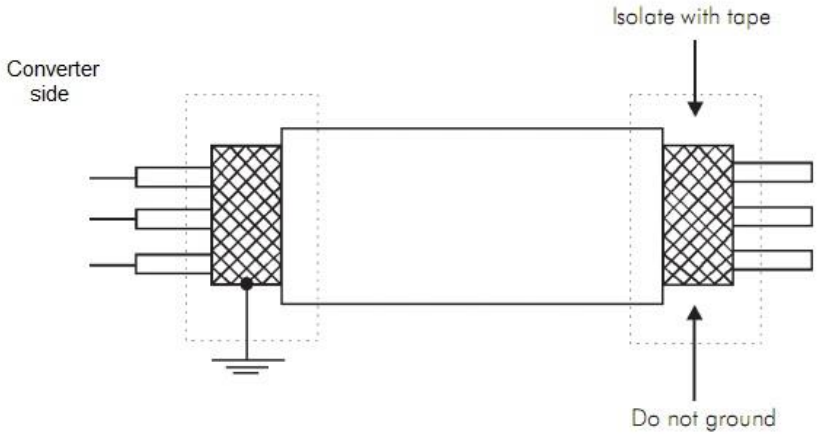


Figure 5.11 – Correct form of connection of the control cable shield

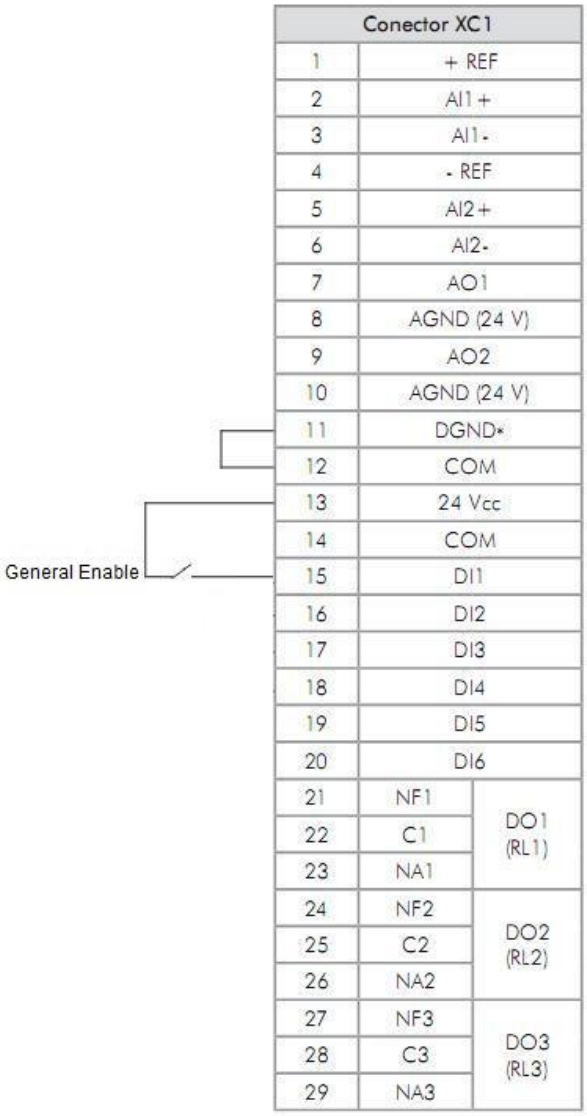
Figure 5.12 – Example of control cable shield connection

NOTE!
Relays, contactors, solenoids or coils of electromechanical brakes installed close to the converter may occasionally generate interference in the control circuit. In order to eliminate this effect, RC suppressors must be connected in parallel to the coils of those devices (in case of DC power supply, make the connection in parallel with the freewheel diodes).

5.4 TYPICAL CONFIGURATIONS

Configuration 1 – Run/Stop function with control via keypad (Local Mode)

With the factory default setting, it is possible to operate the converter in the local mode; you just have to connect a switch in the digital input DI1 preset as General Enable.
This mode of operation, without additional control connection, is recommended for users who are using the converter for the first time as a form of learning.



Conector XC1		
1	+ REF	
2	AI1 +	
3	AI1-	
4	- REF	
5	AI2 +	
6	AI2-	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vcc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 5.13 – Connections in XC1 for configuration 1

For the start-up of this operating mode, refer to chapter 6.

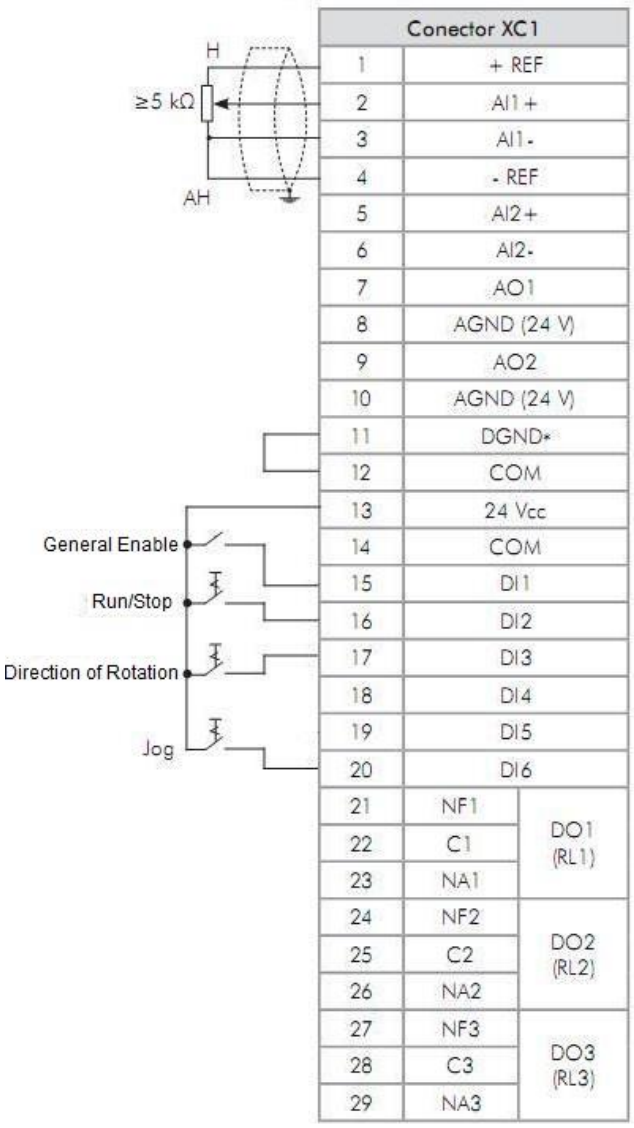
NOTE!
It is not necessary that the “General Enable” function be configured in some of the digital inputs. In case it is not set in any of the DIs, the converter is already enabled right after the power-up.
This condition requires greater care in the operation of the product, because the motor can only be driven with the application of the Run command.

Configuration 2 – Run/Stop function with two-wire control (Remote Mode)

Valid for factory default setting and converter operating in the remote mode.

In the factory default, the selection of the operating mode (local/ remote) is done by the key LOC REM, and the selected mode at power-up is Local.

In order to define the selected mode after the power-up as Remote, you must set P0220 = 3.



Conector XC1		
1	+ REF	
2	AI1 +	
3	AI1 -	
4	- REF	
5	AI2 +	
6	AI2-	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vcc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 5.14 – Connections in XC1 for configuration 2

Configuration 3 – Run/Stop function with three-wire control

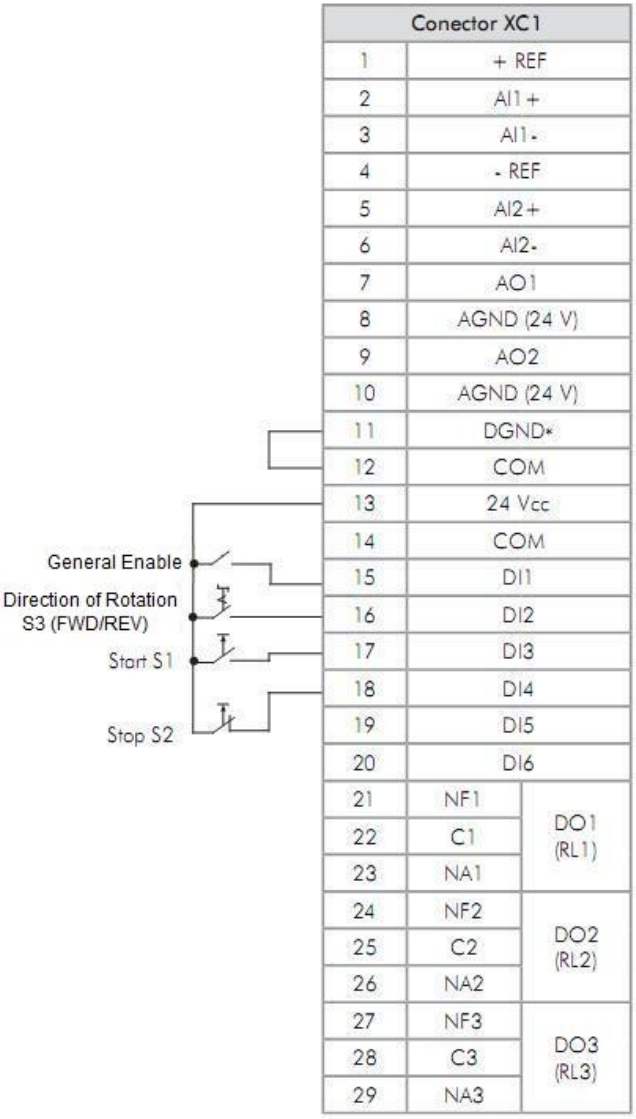
Enabling of the Run/Stop function with three-wire control.

Parameters to be set:

- P0264 = 8 (DI2 for Direction of Rotation);
- P0265 = 6 (DI3 for Start);
- P0266 = 7 (DI4 for Stop);
- P0223 = 4 and P0224 = 1 (DIx), in case the three-wire control in Local mode is desired or;
- P0226 = 4 and P0227 = 1 (DIx), in case the three-wire control in Remote mode is desired.

S1 and S2 are pulsing push-buttons for 'Turn ON' (NO contact) and 'Turn OFF' (NC contact), respectively.

The speed reference can be supplied by and analog input (like in Configuration 2), by the keypad (like in Configuration 1) or also another source defined by parameters P0221/ P0222.



Conector XC1		
1	+ REF	
2	AI1 +	
3	AI1 -	
4	- REF	
5	AI2 +	
6	AI2 -	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vcc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 5.15 – Connections in XC1 for configuration 3

Configuration 4 – Forward/ Reverse

Enabling of the Forward/ Reverse function.

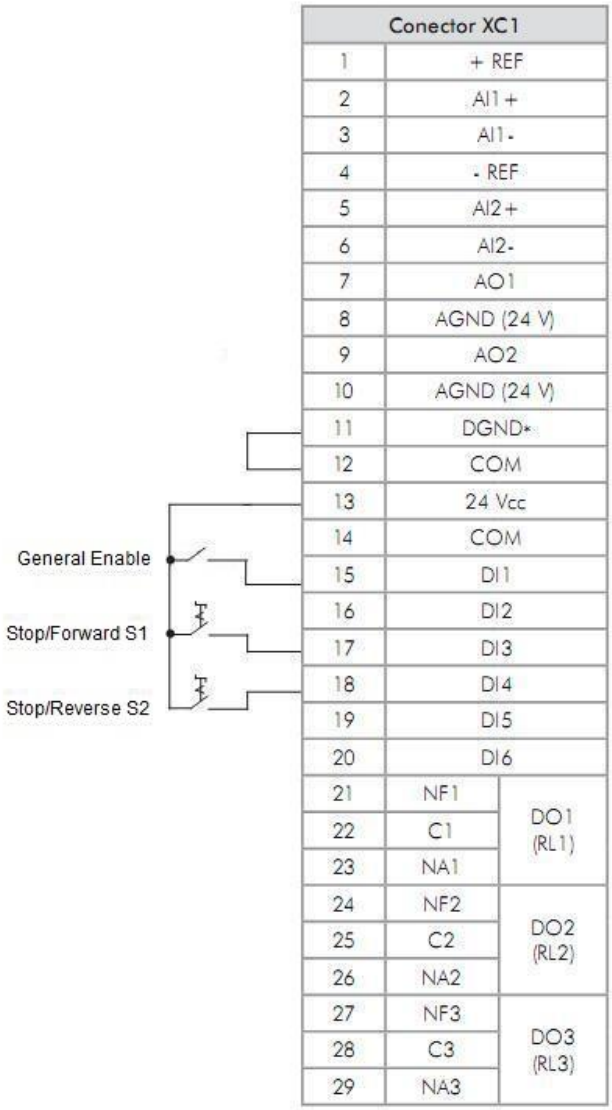
Parameters to be set:

- P0264 = 0 (DI2 for Not Used);
- P0265 = 4 (DI3 for Forward);
- P0266 = 5 (DI4 for Reverse).

The direction of rotation in this function is defined by the 'Forward' and 'Reverse' inputs:

- direct rotation for 'Forward' and;
- reverse rotation for 'Reverse'.

The speed reference can come from any source (like in Configuration 3).



Conector XC1		
1	+ REF	
2	AI1 +	
3	AI1 -	
4	- REF	
5	AI2 +	
6	AI2-	
7	AO1	
8	AGND (24 V)	
9	AO2	
10	AGND (24 V)	
11	DGND*	
12	COM	
13	24 Vcc	
14	COM	
15	DI1	
16	DI2	
17	DI3	
18	DI4	
19	DI5	
20	DI6	
21	NF1	DO1 (RL1)
22	C1	
23	NA1	
24	NF2	DO2 (RL2)
25	C2	
26	NA2	
27	NF3	DO3 (RL3)
28	C3	
29	NA3	

Figure 5.16 – Connections in XC1 for configuration 4

6 START-UP

For a safe start-up of the CTW900, it is really important to observe the instructions of this chapter.

Before, however, the converter must have already been installed according to the previous chapter.

NOTE!
Even if the drive project is different from the typical drives suggested, the steps below must also be followed.

6.1 PREPARATION AND POWER-UP OF THE ELECTRONICS

Before energizing the power supply of the CTW900 (R/S/T), it is advisable to perform the following steps.

1. Check if the power, grounding and control connections are correct and firm.
2. Remove all materials left from the inside of the converter or drive.
3. Check if the motor current and voltage match the converter.
4. Mechanically uncouple the motor from the load. If the motor cannot be uncoupled, make sure that the spinning in any direction will not cause damages to the machine and that no risks of accident are present.
5. Close the converter or drive covers.
6. Measure the line voltage and check that it is within the permitted range, according to the CTW900 model.
7. Energize the electronics (XC5) and confirm the success of the power-up: the display must show the standard monitoring screen (Figure 6.1 a)) and the status LED must turn on and remain on in green.
8. Finally, check the correct operation of the fans of the product (exhaustion of the internal air).

6.2 CONFIGURATION OF THE APPLICATION PARAMETERS

Once the electronics is powered up and no faults are present, the application parameters must be set.

That can be easily performed on the CTW900 by using the easy programming feature with the **Oriented Start-Up** and **Basic Application** parameters.

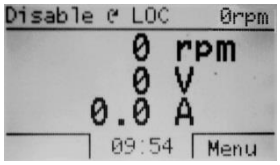
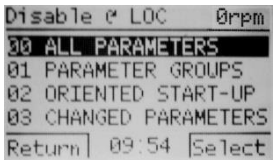
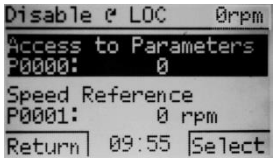
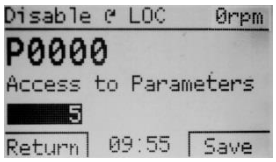
In order to use this form of parameterization, just follow the sequence below:

1. Insert the password for parameter modification;
2. Execute the **Oriented Start-up** routine;
3. Set the parameters of the **Basic Application** group.

ATTENTION!
The configuration of the application parameters is essential for the proper operation of the product, since the conversion of some readings performed by the CTW900 is based on the values defined by those parameters.

6.2.1 Password Setting in P0000

In order to change the content of the parameters, it is necessary to set correctly the password in P0000, as indicated below. Otherwise, the content of the parameters will be available only for viewing.

Seq.	Action/Result	Indication on the display
1	- Monitoring Mode - Press **"Menu"** (left soft key).	
2	- The group "00 ALL PARAMETERS" is already selected. - Press **"Select"**.	
3	- The parameter "Access to Parameters" is already selected. - Press **"Select"**.	
4	- In order to set the password, press **"▲"** until number **5** shows on the display - When number 5 shows, press **"Save"**.	

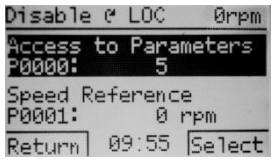
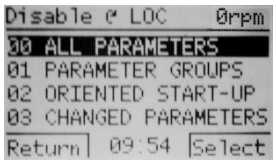
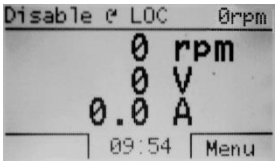
Seq.	Action/Result	Indication on the display
5	- If the setting is correct, the display will show "Access to Parameters P0000: 5". - Press **"Return"** (left soft key)	
6	- Press **"Return"**.	
7	- The display returns to the Monitoring Mode.	

Figure 6.1 – Sequence for allowing parameter change via P0000

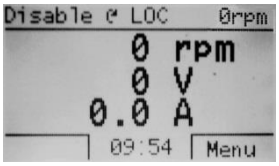
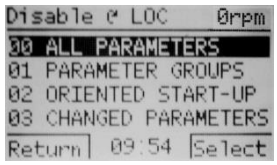
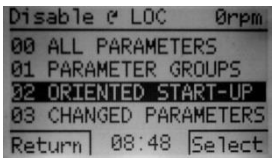
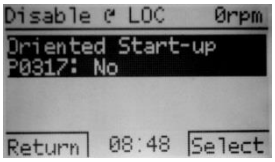
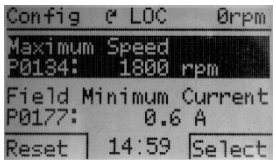
It is possible to personalize the password by means of P0200. In order to do so, refer to the detailed description of P0200 in Chapter 7.

6.2.2 Oriented Start-up

Aiming at facilitating the configuration of the application, the CTW900 offers an Oriented Start-up routine, which displays on the keypad a sequence of the main parameters to be set.

In order to enter the Oriented Start-up routine, follow the sequence presented in Figure 6.2, first setting P0317=1 and then the other parameters as they are displayed on the keypad.

During the Oriented Start-up routine the "Config" (Configuration) status will be displayed on the top left corner of the keypad, which prevents the operation of the converter while the settings are not finished.

Seq.	Action/Result	Indication on the display
1	- Monitoring Mode - Press **"Menu"** (left soft key).	
2	- The group "**00 ALL PARAMETERS**" is selected. - Press **"▼"** until selecting the group **"02 ORIENTED START-UP"**.	
3	- The group **"02 ORIENTED START-UP"** is then selected. - Press **"Select"**.	
4	- The **"Oriented Start-up"** is already selected. - Press **"Select"**.	
5	- The content of **"P0317 = [000] No"** is displayed. - Press **"▲"**.	
6	- The content of the parameter changes to **"P0317 = [001] Yes"**. - Press **"Save"**.	
7	- At this moment, the Oriented Start-up routine starts and the "Config" status is displayed on the upper left corner of the keypad (HMI). - The parameter **"Maximum Speed"** is already selected. - If necessary, change it to another value, according to the application, by pressing **"Selec."**,**"▲"** or **"▼"** and then **"Save"**. - Also set the value of the **Field Minimum Current** (P0177) according to the motor.	

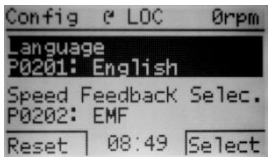
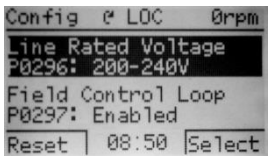
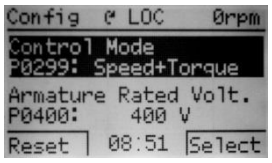
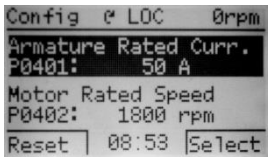
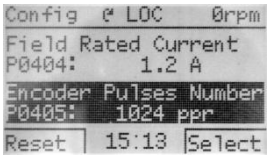
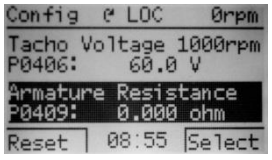
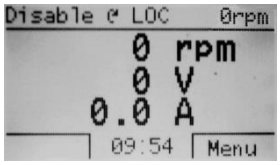
Seq.	Action/Result	Indication on the display
8	- Change the content of P0201 (**Language**) and P0202 (**Speed Feedback Selection**) if necessary.	
9	- Set the value of P0296 (**Line Rated Voltage**) and P0297 (**Field Control Loop**) according to the line and application.	
10	- Choose the **Control Mode** in P0299 and the **Armature Rated Voltage** in P0400.	
11	- Configure the **Armature Rated Current** in P0401 and the **Motor Rated Speed** in P0402.	
12	- Set the value of the **Field Rated Current** (P0404) and the **Number of Encoder Pulses** (P0405) according to the application. Note: Parameter P0405 will only be displayed if the accessory board ENC-01 or ENC-02 is connected to the converter.	
13	- Change, if necessary, the value of the **Tacho Voltage for 1000 rpm** (P0406) and of the **Armature Resistance** (P0409). - In order to finish the Oriented Start-up routine, press **"Reset"** (left soft key) or  .	
14	- After some seconds, the display returns to the Monitoring Mode.	

Figure 6.2 – Sequence of the Oriented Start-up routine

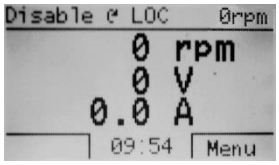
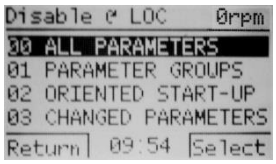
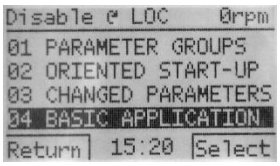
6.2.3 Setting the Parameters of the Basic Application

After executing the Oriented Start-up routine and the proper setting of its parameters, the converter will be ready to operate with the configured line and motor.

However, the CTW900 has a series of other parameters that allow its adaptation to a variety of applications.

This section presents some basic parameters whose setting is necessary in most cases. In order to set them, you can use the Basic Application parameter group, as shown in Figure 6.3.

More details on each parameter available on the CTW900 can be seen in Chapter 7 of this manual.

Seq.	Action/Result	Indication on the display
1	- Monitoring Mode - Press **"Menu"** (left soft key).	
2	- The group "**00 ALL PARAMETERS**" is selected. - Press **"▼"** until selecting the group **"04 BASIC APPLICATION"**.	
3	- The group **"04 BASIC APPLICATION"** is selected then. - Press **"Select"**.	
4	- The parameter **"Acceleration Time"**(P0100) is already selected. - If necessary, set P0100 and P0101 to another value, according to the desired time. In order to do so, press **"Select"**,**"▲"** or **"▼"** and then **"Save"**.	

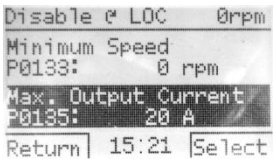
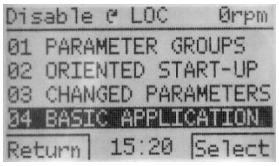
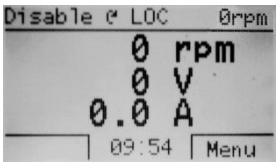
Seq.	Action/Result	Indication on the display
5	- Proceed in a similar way until setting all the parameters contained in the Basic Application group.	
6	- Press "**Return**".	
7	- The display returns to the Monitoring Mode and the converter is ready to operate.	

Figure 6.3 – Setting the parameters of the Basic Application group

6.2.4 Disabling the Parameter Modification

In case you want to prevent non-authorized people from changing parameters, just change the content of P0000 to a value different from 5.
Follow basically the same procedure presented in item 6.2.1.

6.3 SETTING THE SPEED FEEDBACK

Depending on the motor or sensor used for the speed feedback, some parameter setting may be necessary for the motor speed displayed on the keypad to have the smallest possible error.

Therefore, follow one of the procedures below according to the type of speed feedback used.

6.3.1 Feedback by EMF (P0202 = EMF)

1. Keep the motor uncoupled from the load if possible.
2. Release the firing of the armature bridge by closing the switch connected to the digital input configured as General Enable.
3. Set the speed reference for the motor rated speed (P0001 = P0402).
4. Apply the 'Run' ( ) command.
5. With a hand tachometer, measure the motor speed and compare to the value displayed on the upper right corner of the keypad.

In case the speed displayed on the keypad (HMI) does not match the reading on the tachometer, change the value of P0185 (Gain of the Ua Signal) until the value displayed on the keypad is close to the speed read by the tachometer. Path to access P0185: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 103 EMF Reg.

6. Stop the motor ( ) and apply load.
7. Accelerate the motor again up to the rated speed and measure the speed with the hand tachometer.
8. In case the speed did not reach the rated speed, set the value of P0409 (Armature Resistance), monitoring the speed with the tachometer until obtaining the rated value. Path to access P0409: Menu → 01 PARAMETER GROUPS → 37 Motor Data.

6.3.2 Feedback by DC Tacho (P0202 = DC Tacho)

In case of feedback by DC Tacho, before making the settings described below, make sure the tacho is connected to the correct input, according to the voltage characteristic of the tacho and the maximum operating speed of the motor.

Example:

For a DC tacho that supplies 60V for 1000 rpm (P0406 = 60V) and a maximum motor speed of 2100 rpm (P0134 = 2100 rpm), the voltage generated by the DC tacho when the motor is at maximum speed will be:

$$60V = 1000\ rpm$$
$$V_{tacho} = 2100\ rpm$$

$$V_{tacho} = \frac{2100 \times 60}{1000} \Rightarrow V_{tacho} = 126V$$

Thus, considering the reading range of the terminals of connector XC4,

XC4:1 → (+)
XC4:2 → (–) 9 to 30 Vdc
XC4:3 → (–) 30 to 100 Vdc
XC4:4 → (–) 100 to 350 Vdc

the cables of the tacho in this case must be connected to the input XC4:1(+) and XC4:4 (-).

Procedure to set the DCTacho:

1. In case the motor operates in the field weakening area, temporarily change the speed feedback to EMF (P0202 = EMF) and execute the procedure of item 6.3.1. Then return the setting of P0202 to DC Tacho. Path to access P0202: Menu → 01 PARAMETER GROUPS → 24 Speed Feedback.
2. Enable the firing of the armature bridge by closing the switch connected to the digital input configured as General Enable.

3. Set the speed reference for the motor maximum speed (P0001 = P0134).

4. Apply the 'Run' ( ) command.

5. With a hand tachometer, measure the motor speed and compare to the value displayed on the upper right corner of the keypad (HMI).

6. In case the speed displayed on the keypad does not match the reading on the tachometer, change the value of P0407 (Gain of the DC Tacho) until the value displayed on the keypad is close to the speed read by the tachometer. Path to access P0407: Menu → 01 PARAMETER GROUPS → 24 Speed Feedback.

6.3.3 Feedback by Encoder (P0202 = Encoder)

For motors with feedback by encoder, setting is only needed if the motor operates in the field weakening area.

In this case, temporarily change the speed feedback to EMF (P0202 = EMF), ensure the Number of Pulses per Rotation of the Encoder is correct (P0405) and execute the procedure of item 6.3.1. Then return the setting of P0202 to Encoder.

Path to access P0202 and P0405: Menu → 01 PARAMETER GROUPS → 24 Speed Feedback.

6.4 OPTIMIZATION OF THE REGULATORS

For a better performance of speed and current regulation of the CTW900, it is recommended to set the gains of the product control loops.

Therefore, execute the steps described in the following topics for a proper setting of each of the regulators.

6.4.1 Optimization of the Speed Regulator (Static)

1. Set the speed reference for half the motor maximum speed (P0001 = P0134÷2).

2. Check that the Analog Output 1 is set to the 'Effective Speed' function (P0251 = 3) and connect an oscilloscope to the terminals XC1:7 and 8. Path to access P0251: Menu → 07 I/O CONFIGURATION → 33 Analog Outputs.

3. Enable firing of the armature bridge by closing the switch connected to the digital input configured as General Enable and apply the 'Run' ( ) command.

4. Observe the stability of the signal on the oscilloscope and, if it is not stable, vary the Speed Proportional Gain (P0159) until obtaining a signal without oscillations. Path to access P0159: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 100 Speed Reg.

6.4.2 Optimization of the Current Regulator

1. With the converter disabled ('General Enable' switch open), set the Field Control as disabled (P0297 = Disabled). Path to access P0297: Menu → 01 PARAMETER GROUPS → 25 Control Options.

2. Set the Local Run/Stop command by the digital inputs, by setting P0224 = DIx. Path to access P0224: Menu → 01 PARAMETER GROUPS → 27 Local Control.

3. Disable the stall protection by setting P0355 = 0 %. Path to access P0355: Menu → 01 PARAMETER GROUPS → 38 Protections.

4. Set the Positive Torque Current Limit to 100 % (P0169 = 100 %). Path to access P0169: Menu → 01 PARAMETER GROUPS → 23 Limits.

5. Set the speed reference for the maximum value (P0001 = P0134).

6. Monitor with the oscilloscope the "IA" test point on the IC900 electronic interface board. Use as reference one of the GND points of this board ("GND8", for example).

7. Close the switch connected to the Digital Input 2 (DI2), which must be set to the 'Run/Stop' function.

8. Close the switch connected to the digital input configured as General Enable for a **period shorter than three seconds.**

9. Check the measured signal:

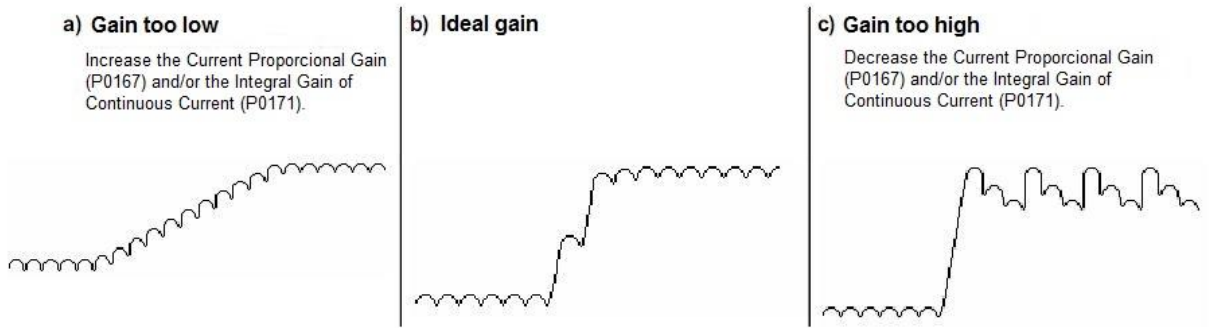


Figure 6.4 – Possible outputs to *measure the "IA" signal in the setting of the current regulator*

10. Set P0167 and P0171 until obtaining a wave form similar to that shown in Figure 6.4 **b)**. Path to access P0167 and P0171: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 101 Current Reg.

11. Set the speed reference for the minimum value (P0001 = P0133).

12. Close the switch connected to the digital input configured as General Enable and set the speed reference so as to obtain an intermittent current on the oscilloscope.

13. Open the switch connected to the digital input configured as General Enable, wait for a few seconds and close it again.

14. Check the measured signal:

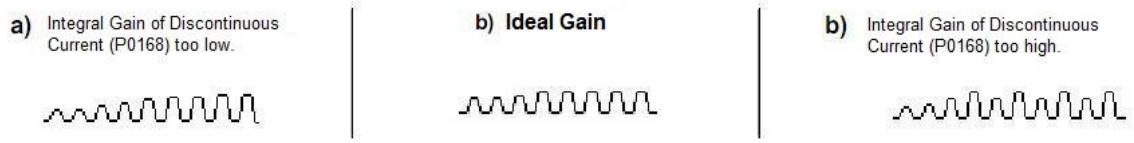


Figure 6.5 – *Wave form for the "IA" signal with intermittent current*

15. Set P0168 until obtaining a wave form similar to that shown in Figure 6.5 **b)**. Path to access P0168: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 101 Current Reg.

16. Remove the 'Run' command (open the DI2 switch) and disable the converter (open the 'General Enable' switch).

17. Enable the Field Control again (P0297 = Enabled) and the Stall protection (P0355 > 0 %). Also set the Positive Torque Current Limit (P0169) according to the application (factory setting: P0355 = 5 % and P0169 = 25 %).

6.4.3 Optimization of the Speed Regulator

1. Set the speed reference for 75 % of the motor maximum speed.

2. Set the acceleration (P0100) and deceleration (P0101) times according to the application. Path to access P0100 and P0101: Menu → 01 PARAMETER GROUPS → 21 Ramps.

3. Monitor with the oscilloscope the Analog Output 1 (XC1:7 and 8) configured as 'Effective Speed' (P0251 = 3).

4. Enable the firing of the armature (close the 'General Enable' switch) and apply the 'Run' command.

5. Check the measured signal:

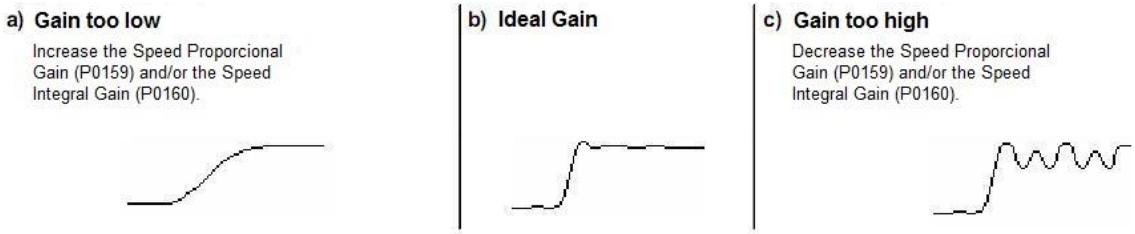


Figure 6.6 – *Wave form for the "Effective Speed" analog output in the setting of the speed regulator*

6. Set P0159 and P0160 until obtaining a wave form similar to that shown in Figure 6.6 **b)**. Path to access P0159 and P0160: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 100 Speed Reg.

6.4.4 Optimization of the Field Regulator

1. Monitor with the oscilloscope the "IF" test point on the IC900 electronic interface board.

2. Enable the firing of the armature ('General Enable' switch = closed) and check the stability of the signal.

3. If the signal is not stable, vary the Field Proportional Gain (P0175) and/or Field Integral Gain (P0176). Path to access P0175 and P0176: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 102 Field Reg.

6.4.5 Optimization of the EMF Regulator

The optimization of the EMF regulator is only needed for motors that operate in the field weakening area.

Normally the factory settings are enough for most applications. However, if the motor deceleration is too slow (not responding to the value set in P0101), it is recommended to increase the EMF Proportional Gain (P0186).

Path to access P0186: Menu → 01 PARAMETER GROUPS → 26 REGULATORS → 103 EMF Reg.

7 DETAILED DESCRIPTION OF THE PARAMETERS

7.1 PARAMETER STRUCTURE

In order to facilitate the setting and monitoring tasks, the CTW900 parameters are arranged in groups divided into up to three different levels.

Thus, when the right soft key is pressed in the monitoring mode (“Menu”), the first four groups are shown on the display, and it is possible to browse the other groups with the “▲” and “▼” keys. One example[2] of the parameter group structure of the CTW900 is shown in Table 7.1.

Table 7.1 – Parameter group structure of the CTW900

Level 0	Level 1		Level 2		Level 3	
Monitoring	00	ALL PARAMETERS				
	01	**PARAMETER GROUPS**	20	HMI		
			21	Ramps		
			22	Speed References		
			23	Limits		
			24	Speed Feedback		
			25	Control Options		
			26	REGULATORS	100	Speed Regulator
					101	Current Regulator
					102	Field Regulator
					103	EMF Regulator
			27	Local Command		
			28	Remote Command		
			29	Run/JOG Config.		
			30	Zero Speed Logic		
			31	Multispeed		
			32	Analog Inputs		
			33	Analog outputs		
			34	Digital inputs		
			35	Digital Outputs		
			36	Drive Data		
			37	Motor Data		
			38	Protections		
			39	COMMUNICATION	110	Local/Rem Config.
					111	Status/Commands
					112	Serial RS232/485
					113	Anybus
			40	SoftPLC		
			41	Trace Function		
	02	ORIENTED START-UP				
	03	CHANGED PARAMETERS				
	04	BASIC APPLICATION				
	05	SELF-TUNING				
	06	BACKUP PARAMETERS				
	07	**I/O CONFIGURATION**	32	Analog Inputs		
			33	Analog Outputs		
			34	Digital Inputs		
			35	Digital Outputs		
	08	FAULT HISTORY				
	09	READ ONLY PARAMS.				

7.2 PROPERTIES OF THE PARAMETERS

In order to describe the parameters in this manual, some abbreviations are used to represent their properties:

[2] The number and name of groups may change depending on the software version used.

RO: Read only parameter;
CFG1: Configuration parameter level 1: change not allowed with the converter Running;
CFG2: Configuration parameter level 2: change only allowed with the converter Disabled.

7.3 PARAMETER GROUPS [01]

7.3.1 HMI [20]

In the "20 HMI" group are the parameters related to the presentation of information on the keypad (HMI) display. See detailed description below of the possible settings of those parameters.

P0193 – Day of the Week

Adjustable Range: 0 = Sunday
1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday
Factory Setting: 0

P0194 – Day

Adjustable Range: 01 to 31
Factory Setting: 01

P0195 – Month

Adjustable Range: 01 to 12
Factory Setting: 01

P0196 – Year

Adjustable Range: 2000 to 2099
Factory Setting: 2012

P0197 – Hour

Adjustable Range: 00 to 23
Factory Setting: 00

P0198 – Minutes

Adjustable Range: 00 to 59
Factory Setting: 00

P0199 – Seconds

Adjustable Range: 00 to 59
Factory Setting: 00
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 20 HMI

Description:
These parameters set the date and time of the real time clock of the CTW900. It is important to set them with the correct date and time so that the fault and alarm log occurs with real date and time information.

P0200 – Password

Adjustable Range: 0 = Inactive
1 = Active
2 = Change Password
Factory Setting: 1
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 20 HMI

Description:
It allows changing the password status, configuring it as active or inactive, and also setting its value. The table below describes the details of each option.

Table 7.2 – Options of parameter P0200

P0200	Type of Action
0 (Inactive)	Allows changing the content of the parameters regardless of P0000.
1 (Active)	Only allows changing the content of the parameters when P0000 is equal to the value of the password.
2 (Change Password)	Opens a window for changing the password.

When option 2 is selected (Change Password), the converter opens a window for changing the password, allowing the selection of a new value for it.

P0201 – Language

Adjustable Range: 0 = Português
1 = English
2 = Español
3 = Deutsch

Factory Setting: 0

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 20 HMI

Description:

It determines the language in which information will be presented on the keypad (HMI).

P0205 – Reading Parameter Selection 1

P0206 – Reading Parameter Selection 2

P0207 – Reading Parameter Selection 3

Adjustable Range: 0 = Inactive
1 = Speed Reference #
2 = Motor Speed #
3 = Armature Current #
4= Power Line Voltage #
5 = Power Line Frequency #
6 = Armature Voltage #
7 = Field Current #
8 = Total Reference #
9 = Output Power #
10 = Armature Firing Angle #
11 = Heatsink Temperature #
12 = Speed Reference –
13 = Motor Speed –
14 = Armature Current –
15 = Armature Voltage –
16 = Total Reference –
17 = SoftPLC P1010 #
18 = SoftPLC P1011 #
19 = SoftPLC P1012#
20 = SoftPLC P1013#
21 = SoftPLC P1014#
22 = SoftPLC P1015#
23 = SoftPLC P1016#
24 = SoftPLC P1017#
25 = SoftPLC P1018 #
26 = SoftPLC P1019 #

Factory Setting: P0205 = 1
P0206 = 6
P0207 = 3

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 20 HMI

Description:

These parameters define which variables and in how they will be shown on the keypad (HMI) in the monitoring mode.

The options that present the symbol "#" at the end indicate that the variable will be displayed in absolute numerical values. The options ended with the symbol "–", configure the variable to be displayed as a bar graph, in percentage values. More details on this programming can be seen in section 4.6.

P0208 – Reference Scale Factor

Adjustable Range: 0 to 65.535 Factory Setting: 1.000

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 20 HMI

Description:

It defines the multiplier that will be applied on the Speed Reference values (P0001) and Motor speed (P0002).

This parameter is normally used together with P0209 to P0212 for the presentation of the Speed Reference in other engineering units.

P0209 – Reference Engineering Unit 1

P0210 – Reference Engineering Unit 2

P0211 – Reference Engineering Unit 3

Adjustable Range: 32 to 127 Factory Setting: P0209 = 114 (r)
P0210 = 112 (p)
P0211 = 109 (m)

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 20 HMI

Description:

These parameters define the characters that will be used to compose the engineering unit of P0001 and P0002. The user can change the "rpm" characters to those he wishes, such as "L/s" (liters per second) or "CFM" (cubic feet per minute).

The reference engineering unit is composed of three characters: P0209 defines the character at the left end, P0210 the middle one and P0211 the one at the right end.

The characters that can be chosen correspond to the ASCII code from 32 to 127.

Examples:

A, B, ..., Y, Z, a, b, ..., y, z, 0, 1, ..., 9, #, $, %, (,), *, +, ...

To display "L/s":
P0209="L" (76)
P0210="/" (47)
P0211="s" (115)

To display "CFM":
P0209="C" (67)
P0210="F" (70)
P0211="M" (77)

P0212 – Reference Decimal Point

Adjustable Range: 0 = wxyz
1 = wxy.z
2 = wx.yz
3 = w.xyz
Factory Setting: 0

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 20 HMI

Description:

It defines the number of decimal places to show P0001 and P0002 on the display.

P0213 – Full Scale Reading Parameter 1

P0214 – Full Scale Reading Parameter 2

P0215 – Full Scale Reading Parameter 3

Adjustable Range: 0 to 200.0 % Factory Setting: 100.0 %
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 20 HMI

Description:
These parameters configure the full scale of the reading variables 1, 2 and 3 (selected through P0205, P0206 and P0207), when they are programmed to be presented as bar graphs.

P0216 – HMI Display Contrast

Adjustable Range: 0 to 37 Factory Setting: 27
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 20 HMI

Description:
It allows setting the keypad (HMI) display contrast level. Higher values configure a higher contrast level.

7.3.2 Ramps [21]

The inverter Ramp functions allow the motor to accelerate or decelerate faster or slower, or also according to a specific profile.

P0100 – Acceleration Time

P0101 – Deceleration Time

Adjustable Range: 0 to 999.0 s Factory Setting: 20.0 s
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 21 Ramps

Description:
These parameters define the time to accelerate (P0100) linearly from zero to the maximum speed (defined in P0134) and decelerate (P0101) linearly from the maximum speed to zero.

Note: The setting in 0.0s means the ramp is disabled.

P0102 – Acceleration Time of the 2nd Ramp

P0103 – Deceleration Time of the 2nd Ramp

Adjustable Range: 0 to 999.0 s Factory Setting: 20.0 s
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 21 Ramps

Description:
These parameters allow configuring a second motor acceleration (P0102) or deceleration (P0103) ramp, which is activated via external digital command (defined by P0105). Once this command is activated, the converter ignores the time of the first ramp (P0100 or P0101) and follows the value set for the second ramp (see example for external command via Dix in Figure 7.1 below).

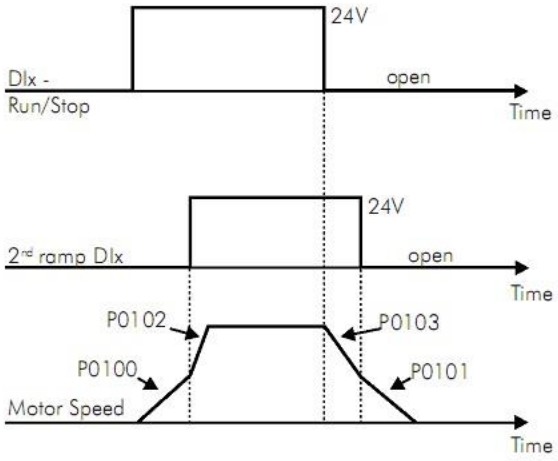


Figure 7.1 – Actuation of the second ramp

In this example, the commutation to the second ramp (P0102 or P0103) is done by means of one of the digital inputs DI1 to DI8, as long as it is set for the second ramp function (see the description of parameters P0263 to P0270 for further details).

Note: The setting to 0.0s means the ramp is disabled.

P0104 – S Ramp

Adjustable Range: 0 = Inactive 1 = 50 % 2 = 100 %	Factory Setting: 0
Properties:	
Groups of 01 PARAMETER GROUPS	
Access via HMI: ↳ 21 Ramps	

Description:
This parameter allows the acceleration and deceleration ramps to have a non-linear profile, similar to an "S", as shown in Figure 7.2 below.

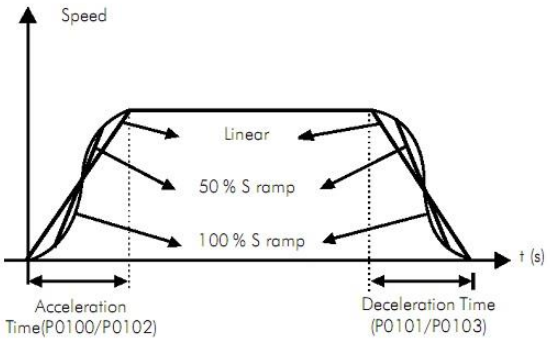


Figure 7.2 – S or linear Ramp

The objective of the S function Ramp is to reduce mechanical shocks during accelerations and decelerations.

P0105 – 1st/2nd Ramp Selection

Adjustable Range: 0 = 1st Ramp
1 = 2nd Ramp
2 = DIx
3 = Serial/USB
4 = Anybus-CC
5 = SoftPLC
Factory Setting: 2

Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 21 Ramps

Description:
It defines the origin source of the command that will select between the first and second Ramp.

Notes:

- The option "0"(1st Ramp) means the converter will always follow the values set in P0100 and P0101;
- The option "1"(2nd Ramp) means the converter will always follow the values set in P0102 and P0103;
- You can monitor the ramp setting used in a certain moment in parameter P0680 (Logical Status).

7.3.3 Speed References [22]

This parameter group allows setting the reference values for the motor speed and for the JOG, JOG+ and JOG- functions. It is also possible to define if the reference value will be maintained when the converter is shut down.

P0120 – Speed Reference Backup

Adjustable Range: 0 = Inactive
1 = Active
Factory Setting: 1

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 22 Speed References

Description:
This parameter defines if the speed reference backup function is active or inactive.

If P0120 = Inactive, the converter will not save the speed reference value when it is shut down. Thus, when the converter is powered up again, the speed reference value will become the minimum speed limit value (P0133).

This backup function applies only to the references via keypad (HMI) and Electronic Potentiometer (E.P.).

P0121 – Speed Reference by the Keypad (HMI)

Adjustable Range: 0 to 10000 rpm
Factory Setting: 90 rpm

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 22 Speed References

Description:
When the "▲" and "▼" keys are active (P0221 = 0 or P0222 = 0), this parameter sets the motor speed reference value.

The value of P0121 will be maintained with the last value set even when the converter is disabled or powered down, as long as parameter P0120 is configured as Active.

P0122 – Speed Reference for JOG

Adjustable Range: 0 to 10000 rpm — Factory Setting: 150 rpm
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 22 Speed References

Description:
During the JOG command, the motor accelerates up to the value defined in P0122, following the acceleration ramp set.

The command source of JOG is defined in parameters P0225 (Local Status) or P0228 (Remote Status).

If the command source of JOG is set for Digital Input (P0225/P0228=DIx), the selected input must be set for the "JOG" function (P0263...P0270 = 10) so that the command can be accepted.

For further details, refer to figures 7.3 and 7.9.

Notes:

- The direction of rotation is defined by parameters P0223 or P0226;
- The JOG command is only effective with the motor stopped;
- For the "JOG+" option, check the description of the following parameter.

P0122 – Speed Reference for JOG+

P0123 – Speed Reference for JOG-

Adjustable Range: 0 to 10000 rpm — Factory Setting: 150 rpm
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 22 Speed References

Description:
The JOG+ and JOG− commands are always done via digital inputs. Therefore, the selected inputs must be set for the "JOG+" and "JOG−" functions, as presented in Table 7.3 below:

Table 7.3 – Selection of the JOG+ or JOG- command via digital input

Digital Input	Function	
	JOG+	JOG−
DI1	P0263=16	P0263=17
DI2	P0264=16	P0264=17
DI3	P0265=16	P0265=17
DI4	P0266=16	P0266=17
DI5	P0267=16	P0267=17
DI6	P0268=16	P0268=17
DI7	P0269=16	P0269=17
DI8	P0270=16	P0270=17

During the JOG+ and JOG- commands, the values of P0122 and P0123 are respectively added to or subtracted from the speed reference in order to generate the total reference (check representation in Figure 7.3).

P0163 – Local Reference Offset

P0164 – Remote Reference Offset

Adjustable Range: –999 to 999 — Factory Setting: 0
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 22 Speed References

Description:
Set the speed reference offset of the analog inputs (AIx). Refer to Figure 7.3.

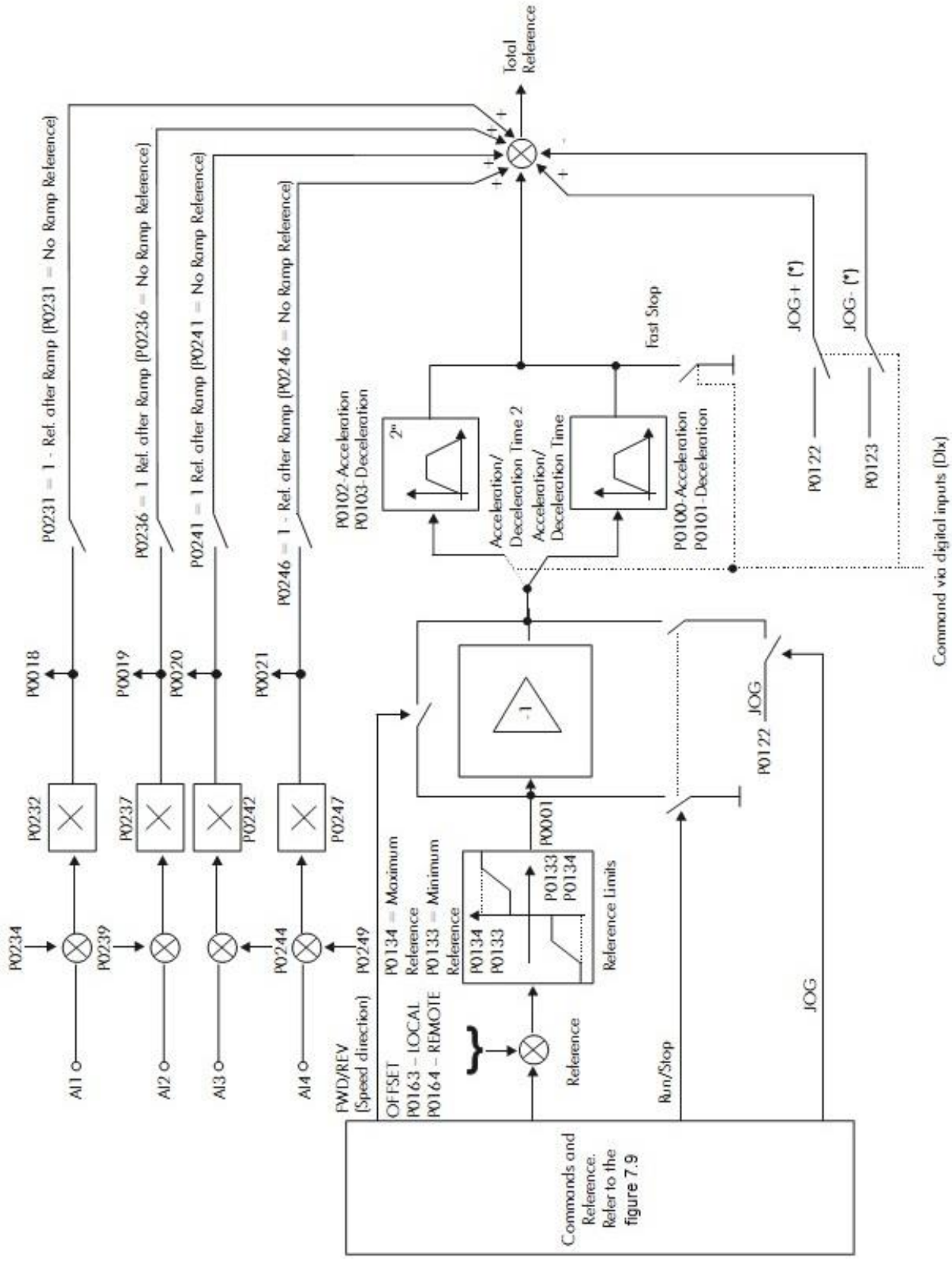


Figure 7.3 – Block diagram of the speed reference

7.3.4 Limits [23]

The parameters of this group function as the motor speed or current limiters.

P0133 – Minimum Speed

Adjustable Range: 0 to 10000 rpm — Factory Setting: 0 rpm
Properties:
Groups of: 01 PARAMETER GROUPS or 04 BASIC APPLICATION
Access via HMI: ↳ 23 Limits

P0134 – Maximum Speed

Adjustable Range: 0 to 10000 rpm — Factory Setting: 1800 rpm
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 23 Limits

Description:
They define the maximum/minimum limit values of the motor speed reference when the converter is enabled, and are valid for any kind of reference signal.

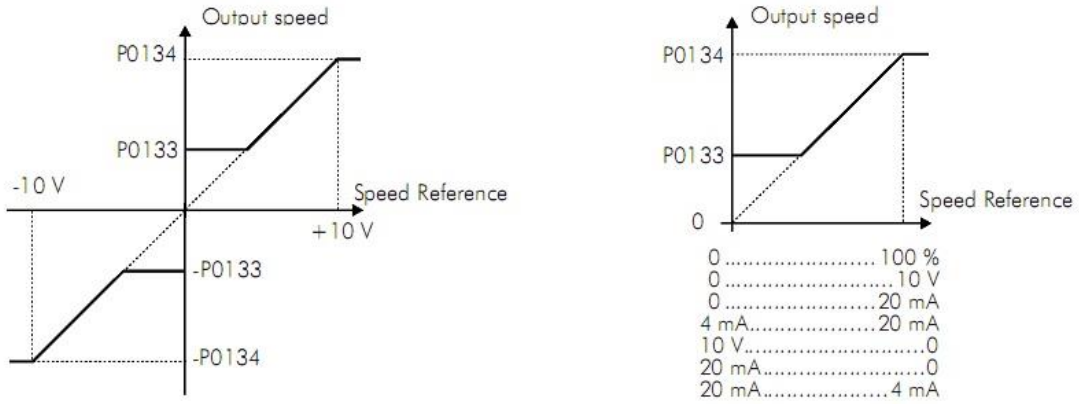


Figure 7.4 – Actuation of the limits P0133 and P0134 in the speed reference

P0136 – Current Limit for Maximum Speed

Adjustable Range: 2 to 125 % — Factory Setting: 125 %
Properties:

P0138 – Speed Limit for Maximum Current

Adjustable Range: 0 to 10000 rpm — Factory Setting: 1800 rpm
Properties:
Groups of: 01 PARAMETER GROUPS or 01 PARAMETER GROUPS
Access via HMI: ↳ 23 Limits ↳ 38 Protections

Description:
These parameters allow decreasing the current limitation value for speeds above the specification in P0138, according to the curve of Figure 7.5:

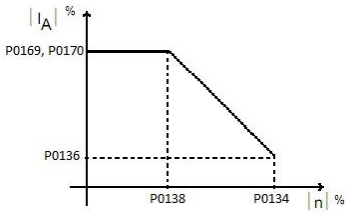


Figure 7.5 – Current limitation considering the speed

This function will be inactive if some of the conditions below occurs:

- P0138 ≥ P0134 or
- P0136 ≥ P0169 (or P0170).

P0169 – Torque Current Limit Forward Direction (+)

P0170 – Torque Current Limit Reverse Direction (-)

Adjustable Range: 1.0 to 125.0 % Factory Setting: 25.0 %
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 23 Limits

Description:
Parameters responsible for limiting the armature current value which produces the forward (P0169) or reverse (P0170) torque on the motor. The setting is expressed in percentage of the converter rated current (P0295).

In case some Analog Input (AIx) is set for the "External Current Limitation" (P0231/P0236/P0241/P0246 = 3, 4 or 5), these parameters become read only, and the limitation value will be given by the AIx.

Note: the value of P0170 only has effect for converters of the Antiparallel type (CTW900**A**).

7.3.5 Speed Feedback [24]

In this group are the parameters that define the speed feedback to be used and the rated values for the sensors of the DC tacho and encoder type.

P0202 – Speed Feedback

Adjustable Range: 0 = EMF Factory Setting: 0
1 = Tacho DC
2 = Encoder
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 24 Speed Feedback

Description:
The CTW900 can use three types of speed feedback:

- EMF (Electromotive Force of the Armature);
- DC tacho;
- Encoder.

Depending on the type of feedback chosen, it may be necessary to set additional parameters for the speed to be correctly calculated by the converter.
Refer to Section 6.3 in order to check the additional configurations for each kind of feedback.

P0405 – Number of Pulses of the Encoder

Adjustable Range: 100 to 9999 ppr Factory Setting: 1024 ppr
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 24 Speed Feedback

Description:
When the feedback is done by the encoder, this parameter sets the number of pulses per rotation (ppr) of the incremental encoder.

Note: This parameter is only visible if the accessory to connect the encoder (ENC-01 or ENC-02) is installed on the converter.

P0406 – Tacho Voltage at 1000 rpm

Adjustable Range: 0.0 to 300.0 V — Factory Setting: 60.0 V
Properties: CFG1
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 24 Speed Feedback

Description:
It defines the voltage generated by the DC tacho when it is spinning at 1000 rpm.

It must be set with the value informed on the nameplate of the DC tacho.

P0407 – Gain Setting of the DC Tacho

Adjustable Range: 0.000 to 1.999 — Factory Setting: 1.000
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 24 Speed Feedback

Description:
It allows a fine tuning of the speed measured by the DC tacho so as to correct the value calculated when compared to the measurement of the external tachometer.

Refer to section 6.3.2 for further details about the most suitable way to make this adjustment.

7.3.6 Control Options [25]

Using this group it is possible to disable the field control and also configure the regulation mode of the armature circuit.

P0297 – Field Control

Adjustable Range: 0 = Enabled — Factory Setting: 0
1 = Disabled
Properties: CFG2
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 25 Control Options

Description:
It defines if the field control is enabled or disabled.

By configuring P0297 = 1 (Disable), the field firing pulses are disabled, and the converter will not monitor the field current.

ATTENTION!
With P0297 = 1 the protection of field loss (F074) will be inactive.

P0299 – Control Mode

Adjustable Range: 0 = Speed + Torque — Factory Setting: 0
1 = Torque
Properties: CFG1
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 25 Control Options

Description:
In some applications in which you want to control only the motor torque, the CTW900 can be configured to regulate only the armature current, ignoring the speed feedback value. In order to do so, you must set P0299 = 1 (Torque Mode).

In this condition, the Speed Reference (P0001) becomes the Torque Reference, and its unit displayed in the monitoring mode of the HMI changes to "%", and this percentage is expressed in relation to the converter rated current (P0295).
Besides that, the value displayed on the upper right corner of the HMI becomes the armature current (P0003), replacing the present speed value.

Note: The ramps remain active in the Torque Mode.

ATTENTION!
With P0299 = 1 the overspeed protection (F150) will be inactive.

7.3.7 Regulators [26]

This group contains parameters related to the regulators of the CTW900, which define the dynamic behavior of all control loops of the converter.

All the regulators are implemented in the parallel configuration, where the gains are independent from each other.

Speed Regulator [100]

P0159 – Proportional Gain 1 of the Speed Regulator

Adjustable Range: 0.0 to 63.9 Factory Setting: 4.0

P0160 – Integral Gain 1 of the Speed Regulator

Adjustable Range: 0.00 to 9.99 Factory Setting: 0.40
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 100 Speed Regulator

Description:
Main gains of the speed regulator, which must be set so as to optimize the dynamic response of the speed loop.

In a general way, we can say the Proportional gain (P0159) stabilizes sudden speed changes, whereas the Integral gain (P0160) corrects the error between the reference and effective speed, as well as improves the response in torque at low speeds.

In order to set these gains properly, follow the procedures described in sections 6.4.1 and 6.4.3.

Note: In case there are some digital input set for the "Speed Reg. Gains" function, the CTW900 will use the second gain set (P0161 and P0162) when this Dix is active (24V).

P0161 – Proportional Gain 2 of the Speed Regulator

Adjustable Range: 0.0 to 63.9 Factory Setting: 8.0

P0162 – Integral Gain 2 of the Speed Regulator

Adjustable Range: 0.00 to 9.99 Factory Setting: 0.12
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 100 Speed Regulator

Description:
Secondary gains of the speed regulator. They work the same way as the main gains (P0159 and P0160), but are only used when some digital input is set and activated (24V) for the "Speed Reg. Gains" function (P0263...P0270 = 21).
See the representation of the speed regulator in Figure 7.6.

P0165 – Speed Filter

Adjustable Range: 0.000 to 1.000 s — Factory Setting: 0.002 s
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 100 Speed Regulator

Description:
It sets the time constant of the speed filter, when the feedback is by DC Tacho or Encoder.

For the feedback by EMF, the filter time is determined by parameter P0188.

NOTE!
The factory default setting (0.002 s) is suitable for a feedback by DC Tacho.
With feedback by Encoder, in general should make the adjustment between 0.010 is 0.012 s.

Very high values in this parameter make the system response slower.

P0166 – Speed Differential Gain

Adjustable Range: 0.00 to 7.99 — Factory Setting: 0.00
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 100 Speed Regulator

Description:
The differential action can minimize the effects on the motor speed arising out of the application or of the removal of load.

Form of actuation of the speed differential gain (Gd):

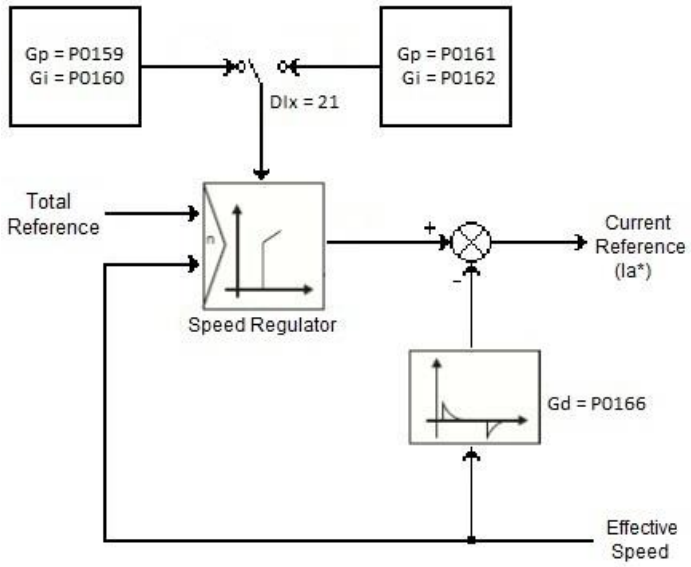


Figure 7.6 – Structure of the speed regulator and form of actuation of the differential gain

Current Regulator [101]

P0167 – Proportional Gain of the Current Regulator

Adjustable Range: 0.00 to 3.99 Factory Setting: 0.26

P0168 – Integral Gain of the Current Regulator (Intermittent)

P0171 – Integral Gain of the Current Regulator (Continuous)

Adjustable Range: 0.000 to 1.999 Factory Setting: P0168 = 0.100
P0171 = 0.050

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 26 REGULATORS
↳ 101 Current Regulator

Description:
Gains of the current regulator, which must be set so as to optimize the dynamic response of the current loop.

In a general way, we can say the Proportional gain (P0167) stabilizes sudden current changes, whereas the Integral gain (P0168/P0171) corrects the error between the torque reference and the effective current.

The use of each of the integral gains will be done automatically by the CTW900, according the output current level:

- for an intermittent armature current (motor with no load), the control will use the gain P0168;
- for a continuous armature current (motor with load), the control will use the gain P0171;

In order to set these gains properly, follow the procedures described in sections 6.4.2.

P0172 – Variation Rate of the Torque Reference (Ia*)

Adjustable Range: 0 to 999 ms Factory Setting: 20 ms

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 26 REGULATORS
↳ 101 Current Regulator

Description:
It defines the time for the torque reference (Ia* signal) to vary from zero to the maximum value, determined by P0169/P0170 = 125 %.

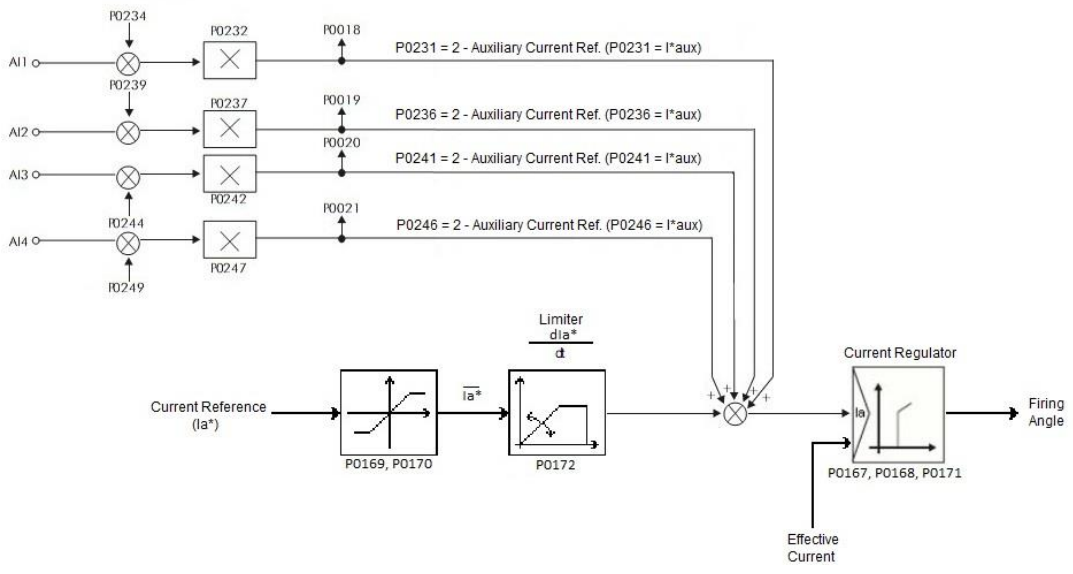


Figure 7.7 – Current regulator structure and actuation form of the torque reference rate

P0173 – Variation Rate of the Field Reference (If*)

Adjustable Range: 0 to 3000 ms Factory Setting: 200 ms
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 102 Field Regulator

Description:
It defines the time for the field current reference (If* signal) to vary from zero to the maximum value.

P0175 – Proportional Gain of the Field Regulator

Adjustable Range: 0.00 to 9.99 Factory Setting: 0.50

P0176 – Integral Gain of the Field Regulator

Adjustable Range: 0.00 to 3.99 Factory Setting: 0.25
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 102 Field Regulator

Description:
Gains of the field current regulator, which must be set so as to optimize the dynamic response of the field loop.

In order to set these gains properly, follow the procedures described in sections 6.4.4.

P0177 – Minimum Field Current

Adjustable Range: 0.0 to 50.0 A Factory Setting: 1.0 A
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 102 Field Regulator

Description:
Minimum limit for the field current. It must be set with the value informed on the motor nameplate for the maximum speed condition (for motors that operate in the field weakening area).

It also defines the value for actuation of the Field Loss protection (F074), which will be activated when the current measured by the converter falls below 50 % of the value in P0177.

NOTE!
Is not possible adjust the value of parameter P0177 over the configured value on the parameter P0404 (Nominal Field Current).

P0178 – Field Economy Current

Adjustable Range: 0.0 to 50.0 A Factory Setting: 0.6 A
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 102 Field Regulator

Description:
Value of the current applied to the motor field when the converter is Disabled or with Faults present.

It must be set with a value around 30 % of the Field Rated Current (P0404) so as to keep the field winding warm even with the motor stopped.

NOTE!
Is not possible adjust the value of parameter P0178 over the configured value on the parameter P0177 (Minimum Field Current).

EMF Regulator [103]

P0179 – Field Weakening Point

Adjustable Range: 75 to 110 % Factory Setting: 100 %
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 103 EMF Regulator

Description:
It defines the point at which the reduction of the motor field current will start, expressed in percentage of the armature rated current (P0400).

This setting is relevant for motors that operate in the field weakening area, which allows reaching speeds above the rated speed (P0402).

NOTE!
For P0202 = 0 (Feedback by EMF) or P0299 = 1 (Torque Control), it is not possible to operate in the field weakening area.

P0185 – Gain of the Armature Voltage Signal (Ua)

Adjustable Range: 0.001 to 2.500 Factory Setting: 1.000
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 103 EMF Regulator

Description:
It defines a multiplier to be applied to the Armature Voltage signal (Ua), and which allows correcting the speed value of the motor when it runs in the no load condition and the feedback is done by the EMF (P0202 = 0).

For the proper setting of this parameter, follow the procedure described in section 6.3.1.

P0186 – Proportional Gain of the EMF Regulator

Adjustable Range: 0.00 to 9.99 Factory Setting: 2.50

P0187 – Integral Gain of the EMF Regulator

Adjustable Range: 0.00 to 6.00 Factory Setting: 0.03
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 26 REGULATORS
↳ 103 EMF Regulator

Description:
Gains of the EMF regulator, responsible for the dynamic response of the EMF loop.

In general these gains do not require changing, since the factory settings are suitable for most applications. However, if the motor deceleration is too slow (not responding to the value set in P0101), it is recommended to increase the value of P0186.

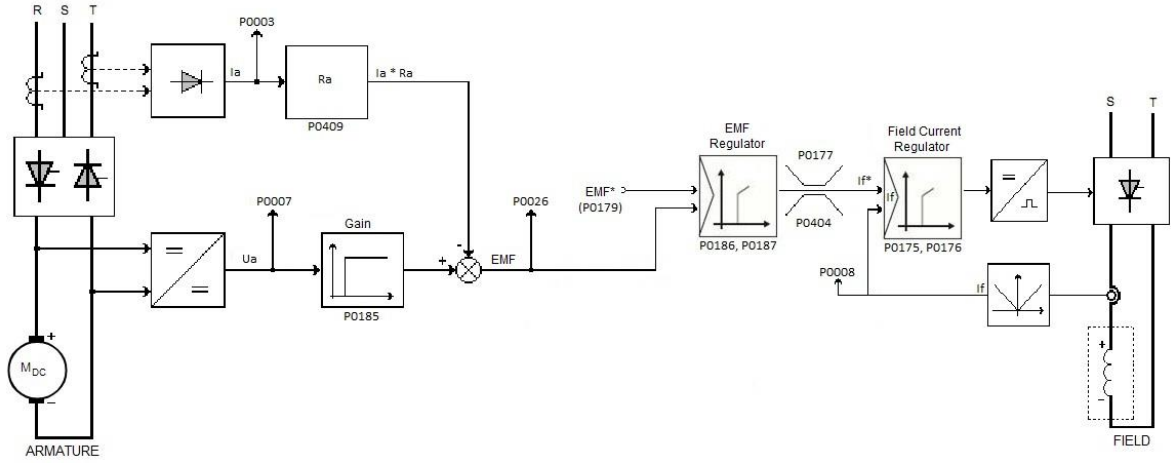


Figure 7.8 – Configuration of the EMF and Field Current regulators

P0188 – EMF Filter

Adjustable Range: 0.000 to 9.999 s — Factory Setting: 0.011 s

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 26 REGULATORS

↳ 103 EMF Regulator

Description:

It sets the time constant of the filter to calculate the EMF value (P0026).

> NOTE!
> Unless there is instability in the speed regulation when the feedback is done by EMF (P0202 = 0), this parameter must not be changed.

7.3.8 Local Control [27] / Remote Control [28]

In these parameter groups, you can configure the origin source of the converter main commands as Local or Remote, such as Speed Reference, FWD/REV Selection, Run/Stop and JOG.

P0220 – Selection of Local / Remote Source

Adjustable Range: 0 = Always Local — Factory Setting: 2
1 = Always Remote
2 = LOC/ REM Key of the HMI (Local)
3 = LOC/ REM of the HMI (Remote)
4 = DIx
5 = Serial/ USB (Local)
6 = Serial/ USB (Remote)
7 = Anybus-CC (Local)
8 = Anybus-CC (Remote)
9 = SoftPLC (Local)
10 = SoftPLC (Remote)

Properties: CFG1

Groups of: 01 PARAMETER GROUPS or 01 PARAMETER GROUPS

Access via HMI: ↳ 27 Local Control ↳ 28 Remote Control

Description:

It defines the origin source of the command that will select between Local or Remote status so that the mode indicated at the end of each option specifies the default selection adopted at the power-up of the CTW900.

For option 4 (DIx), the mode to be selected will depend on the status of the digital input, as follows:

- DIx open (0V): Local mode;
- DIx closed (24V): Remote mode.

P0221 – Selection of the Speed Reference Source (Local Situation)

P0222 – Selection of the Speed Reference Source (Remote Situation)

Adjustable Range: 0 = HMI
1 = AI1
2 = AI2
3 = AI3
4 = AI4
5 = AI1 + AI2 > 0 (Sum AIs > 0)
6 = AI1 + AI2 (Sum AIs)
7 = Electronic Potentiometer (E.P.)
8 = Multispeed
9 = Serial/USB
10 = Anybus-CC
11 = SoftPLC

Factory Setting: P0221 = 0
P0222 = 1

Properties: CFG1

Groups of Access via HMI:	01 PARAMETER GROUPS → 27 Local Control	or	01 PARAMETER GROUPS → 28 Remote Control

Description:
They define the origin source for the Speed Reference in the Local situation and Remote situation.

Some comments on the options of these parameters:

- When an analog input (AIx) is selected as reference source, the value to be used by the control will be the result of the analog signal applied to the input added to its offset and multiplied by the input gain (see details in Figure 7.11);
- The reference value set by the keys "▼"and "▼" is defined by parameter P0121;
- When option 7 (E.P. – Electronic Potentiometer) is selected, it is also necessary to set one of the digital inputs with option 11 (Accelerates E.P.) and the other with option 12 (Decelerates E.P.). For further details, refer to section 7.3.14;
- When option 8 (Multispeed) is selected, it will be necessary to set P0266 and/or P0267 and/or P0268 for option 13 (Multispeed). For information on this function, refer to section 7.3.11.

P0223 – FWD/REV Selection (Local Situation)

P0226 – FWD/REV Selection (Remote Situation)

Adjustable Range: 0 = Forward
1 = Reverse
2 = FWD/REV Key (Forward)
3 = FWD/REV Key (Reverse)
4 = DIx
5 = Serial/ USB (Forward)
6 = Serial/ USB (Reverse)
7 = Anybus-CC (Forward)
8 = Anybus-CC (Reverse)
9 = Polarity AI4
10 = SoftPLC (Forward)
11 = SoftPLC (Reverse)
12 = Polarity AI2

Factory Setting: P0223 = 2
P0226 = 4

Properties: CFG1

Groups of Access via HMI:	01 PARAMETER GROUPS → 27 Local Control	or	01 PARAMETER GROUPS → 28 Remote Control

Description:
They define the origin source of the 'Direction of Rotation' command in the Local or Remote situation so that the direction indicated at the end of each option specifies the default selection adopted at the power-up of the CTW900.

For option 4 (DIx), the direction to be selected will depend on the status of the digital input, as follows:

- DIx open (0V): Forward direction;
- DIx closed (24V): Reverse direction.

For options 9 (Polarity AI4) and 12 (Polarity AI2), the direction of rotation will be defined according to the polarity of the analog input signal:

- Positive Signal (+): forward Direction;
- Negative Signal (-): Reverse direction.

P0224 – Selection of Run/Stop (Local Situation)

P0227 – Selection of Run/Stop (Remote Situation)

Adjustable Range:	0 = Keys , 1 = DIx 2 = Serial/ USB 3 = Anybus-CC 4 = SoftPLC		Factory Setting: P0224 = 0 P0227 = 1
Properties: CFG1			
Groups of Access via HMI:	01 PARAMETER GROUPS ↳ 27 Local Control	or	01 PARAMETER GROUPS ↳ 28 Remote Control

Description:
They define the origin source for the 'Run/Stop' command in the Local and Remote situation.

P0225 – Selection of JOG (Local Situation)

P0228 – Selection of JOG (Remote Situation)

Adjustable Range:	0 = Inactive 1 = JOG key 2 = DIx 3 = Serial/ USB 4 = Anybus-CC 5 = SoftPLC		Factory Setting: P0225 = 1 P0228 = 2
Properties: CFG1			
Groups of Access via HMI:	01 PARAMETER GROUPS ↳ 27 Local Control	or	01 PARAMETER GROUPS ↳ 28 Remote Control

Description:
They define the origin source for the 'JOG' command in the Local and Remote situation.

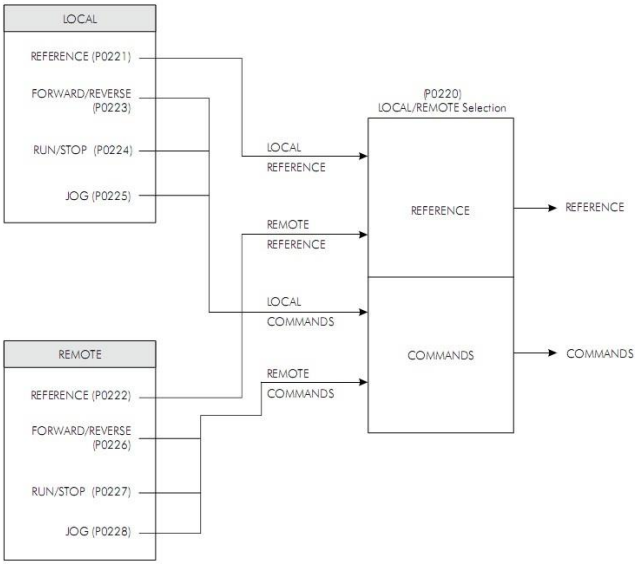


Figure 7.9 – Block diagram of the Local / Remote status

7.3.9 Run/JOG Configuration [29]

For the configuration of just the source command of the 'Run/Stop', 'FWD/REV Selection' and 'JOG' commands, you can use directly this parameter group. It groups the parameters P0223 and P0228, already described previously, besides parameter P0229.

P0229 – Selection of the Stop Mode

Adjustable Range: 0 = Ramp Stop
1 = Coast Stop
2 = Quick Stop
Factory Setting: 0

Properties: CFG1
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 29 Run/JOG Config

Description:
It defines the motor stop mode when the converter receives the 'Stop' command. Table 7.4 below describes in details the options of this parameter.

Table 7.4 – Selection of the Stop Mode

P0229	Description
0 = Ramp Stop	The converter will apply the stop ramp set in P0101 and/or P0103.
1 = Coast Stop	The motor will run free until it stops.
2 = Quick Stop	The converter will apply a zero deceleration ramp (time=0.0s) so as to stop the motor is the shortest possible time.

7.3.10 Zero Speed Logic [30]

This function allows the configuration of the speed at which the converter will go into a disable condition, disabling the armature firing pulses.

P0217 – Zero Speed Disable

Adjustable Range: 0 = Inactive
1 = Active
Factory Setting: 0

Properties: CFG2
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 30 Zero Speed Logic

Description:
When active, it blocks the armature firing pulses after the speed reference (N*) and the effective speed (N) are below the value set in parameter P0291.

The armature firing will be enabled again when one of the conditions defined by parameter P0218 is met.

DANGER!
Be careful when you get close to the motor when the CTW900 is in the Blocked condition. It may start spinning at any moment due to the process conditions. If you wish to handle the motor or execute any kind of maintenance, power down the converter.

NOTE!
As soon as the conditions for the disabling are met, the converter status will change to "Blocked" (P0006 = 7), and it will also be indicated on the upper left corner of the HMI.

P0218 – Zero Speed Disable Output

Adjustable Range: 0 = Reference or Effective Speed
1 = Reference
Factory Setting: 0

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 30 Zero Speed Logic

Description:

With P0217 = 1 (Active), it is specified if the condition for the zero speed disable output will be just by the speed reference or also by the effective speed.

Table 7.5 – Output of the disable by N = 0

P0218	Condition for the disable output by N = 0
0 = Reference or Effective Speed	P0001 (N*) > P0291 or P0002 (N) > P0291
1 = Reference	P0001 (N*) > P0291

P0219 – Time with Zero Speed

Adjustable Range: 0 to 999 s
Factory Setting: 0 s

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 30 Zero Speed Logic

Description:

It defines if the Stop Logic function will be timed.

If P0219 = 0, the function will be without timing.

If P0219 > 0, the function will be configured with timing, and the counting of the time set in this parameter will begin after the Speed Reference and the Motor Speed fall below the value set in P0291. When the count reach the value set in P0219, the armature pulses will be disabled.

If during the time counting some of the conditions that generate the Zero Speed Disable stop being met, then the count will restart and the converter will remain enabled.

P0291 – Zero Speed

Adjustable Range: 0 to 10000 rpm
Factory Setting: 18 rpm

Properties:

Groups of: 01 PARAMETER GROUPS or 01 PARAMETER GROUPS

Access via HMI: ↳ 30 Zero Speed Logic ↳ 35 Digital Outputs

Description:

It specifies the value, in rpm, below which the Effective Speed (P0002) will be considered zero for the purpose of the Stop Logic function.

This parameter is also used by the digital and relay output functions (see section 7.3.15).

7.3.11 Multispeed [31]

The Multispeed function is used when up to eight fixed preset speeds are desired, being controlled by means of the digital inputs (DI4, DI5 e DI6).

P0124 – Multispeed Reference 1
P0125 – Multispeed Reference 2
P0126 – Multispeed Reference 3
P0127 – Multispeed Reference 4
P0128 – Multispeed Reference 5
P0129 – Multispeed Reference 6
P0130 – Multispeed Reference 7
P0131 – Multispeed Reference 8

Adjustable Range: 0 to 10000 rpm

Factory Setting: P0124 = 90 rpm
P0125 = 300 rpm
P0126 = 600 rpm
P0127 = 900 rpm
P0128 = 1200 rpm
P0129 = 1500 rpm
P0130 = 1800 rpm
P0131 = 1650 rpm

Properties:

Groups of: 01 PARAMETER GROUPS

Access via HMI: ↳ 31 Multispeed

Description:

The Multispeed function provides the advantages of stability of the fixed preset references and immunity against electric noises (isolated digital inputs).

In order to activate this function, configure parameter P0221 = 8 and/or P0222 = 8 (Reference Selection) and also P0266/P0267/P0268 = 13 (Function of the Inputs DI4/DI5/DI6).

In order to use just two or four speeds, any combination of the inputs DI4, DI5 and DI6 can be used.
Check the Multispeed Reference parameters used according to the status of the DIs in Table 7.6.

Table 7.6 – Multispeed references selected according to the status of the DIs

8 Speeds			
	4 Speeds		
		2 Speeds	
DI6	DI5	DI4	Speed Ref.
0 V	0 V	0 V	P0124
0 V	0 V	24 V	P0125
0 V	24 V	0 V	P0126
0 V	24 V	24 V	P0127
24 V	0 V	0 V	P0128
24 V	0 V	24 V	P0129
24 V	24 V	0 V	P0130
24 V	24 V	24 V	P0131

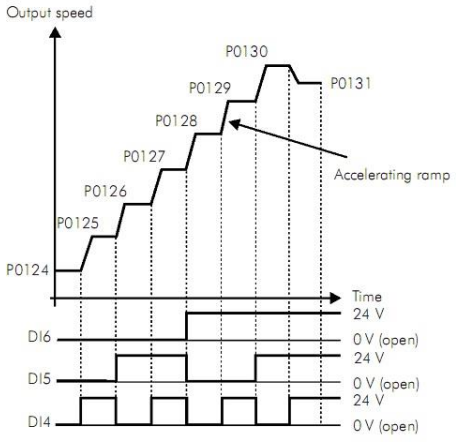


Figure 7.10 – Multispeed function operation

NOTE!
If some of the inputs DI4, DI5 or DI6 are set for a function different from "Multispeed" (P0266/P0267/P0268 ≠ 13), it will be considered as 0V for the selection of the reference in this function.

7.3.12 Analog Inputs [32]

On the control board of the CTW900 (CC900) are two analog inputs (AI1 and AI2), normally enough for most applications. If necessary, however, other two inputs (AI3 and AI4) can be added by means of the available accessories[3].

With those inputs, it is possible, for instance, to use an external speed reference or to control the torque current limitation.

The following parameters present the details for these configurations.

P0018 – AI1 Value

P0019 – AI2 Value

P0020 – AI3 Value

P0021 – AI4 Value

Adjustable Range: –100.00 to 100.00 % Factory Setting:
Properties: RO
Groups of 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
Access via HMI: ↳ 32 Analog Inputs ↳ 32 Analog Inputs

Description:
Those read-only parameters indicate the value of the analog outputs AI1 to AI4 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 the parameters P0231 to P0250.

P0231 – Signal AI1 Function

P0236 – Signal AI2 Function

P0241 – Signal AI3 Function

P0246 – Signal AI4 Function

Adjustable Range: 0 = Speed Reference Factory Setting: 0
1 = Speed Reference (N*) after the Ramp
2 = Current Auxiliary Reference (I*)
3 = Direct Torque Current Limit (I+)
4 = Reverse Torque Current Limit (I-)
5 = Direct and Reverse Torque Current Limit (I+/I-)
Properties: CFG1
Groups of 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
Access via HMI: ↳ 32 Analog Inputs ↳ 32 Analog Inputs

Description:
Those 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.

[3] Input AI3 available only in accessory IOB-01 and input AI4 only in accessory IOA-01.

Option 1 (Speed Reference after the Ramp) is generally used as an additional reference signal; for example, in applications using rocker arm (see the actuation form of this option in Figure 7.3).

Option 2 (Current Auxiliary Reference) can be used to increment the torque current reference, like in processes with load division.

Options 3, 4 and 5 (Torque Limitation Current) allow the analog input to be used to control the converter current limit (P0169/P0170), seeing that this can be applied for the Forward Direction only (option 3), for Reverse Direction only (option 4) or both (option 5).

NOTE!
When options 3, 4 or 5 are chosen, parameters P0169 and/or P0170 become read only parameters, with the value defined by the analog input.

P0232 – Input AI1 Gain
P0237 – Input AI2 Gain
P0242 – Input AI3 Gain
P0247 – Input AI4 Gain

Adjustable Range: 0.000 to 9.999 Factory Setting: 1.000

P0234 – Input AI1 Offset
P0239 – Input AI2 Offset
P0244 – Input AI3 Offset
P0249 – Input AI4 Offset

Adjustable Range: –100.00 to 100.00 % Factory Setting: 0.00 %

P0235 – Input AI1 Filter
P0240 – Input AI2 Filter
P0245 – Input AI3 Filter
P0250 – Input AI4 Filter

Adjustable Range: 0.00 to 16.00 s Factory Setting: 0.01 s
Properties:
Groups of 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
Access via HMI: ↳ 32 Analog Inputs ↳ 32 Analog Inputs

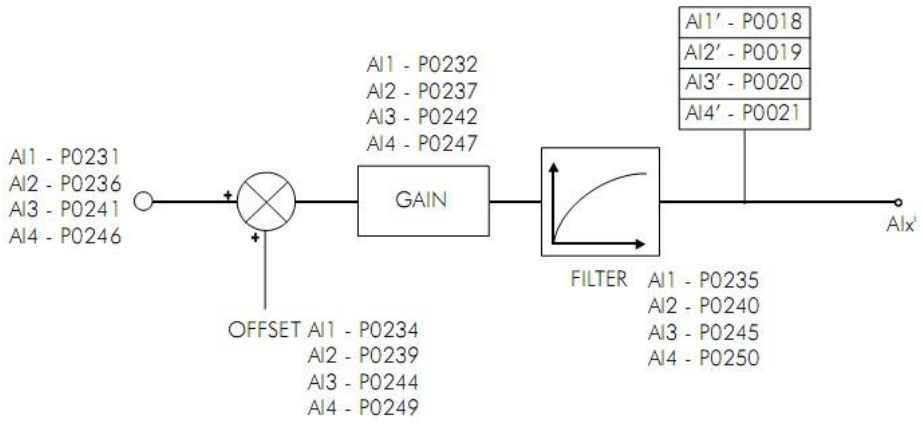


Figure 7.11 – Block diagram of the analog inputs

The internal value AIx' is the result of the following equation:

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

Example: AIx = 5V, Offset = –70 % and Gain = 1.000:

$$AIx' = \left(5 + \frac{(-70)}{100} \times 10\ V \right) \times 1 = -2\ V$$

A value of AIx' = –2 V means that the motor will spin in the reverse direction with a reference in module equal to 2V, in case the analog input function is configured for "Speed Reference". For the Torque Current Limitation, the values are considered only in module, and for the function "Current Auxiliary Reference", negative values are considered as 0.0 %.

In the case of the filter parameters (P0235, P0240, P0245 and P0250), the value set corresponds to the RC used to filter the signal read at the input.

P0233 – Input AI1 Signal

P0243 – Input AI3 Signal

Adjustable Range: 0 = 0 to 10 V/ 20 mA
1 = 4 to 20 mA
2 = 10 V/ 20 mA to 0
3 = 20 to 4 mA

Factory Setting: 0

P0238 – Input AI2 Signal

P0248 – Input AI4 Signal

Adjustable Range: 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

Factory Setting: 0

Properties: CFG1

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 32 Analog Inputs ↳ 32 Analog Inputs

Description:

Those parameters configure the signal type (if current or voltage) that will be read in each analog input, as well as its variation range. See the details regarding this configuration in Table 7.7 and Table 7.8.

Table 7.7 – DIP Switches related to the analog inputs

Parameter	Input	Switch	Location
P0233	AI1	S1.4	Control Board CC900
P0238	AI2	S1.3	Control Board CC900
P0243	AI3	S3.1	IOB
P0248	AI4	S3.1	IOA

Table 7.8 – Configuration of the analog input signals

P0233, P0243	P0238, P0248	Input Signal	Switch Position
0	0	(0 to 10) V / (0 to 20) mA	Off / On
1	1	(4 to 20) mA	On
2	2	(10 to 0) V / (20 to 0) mA	Off / On
3	3	(20 to 4) mA	On
-	4	(-10 to +10) V	Off

When current signals are used in the inputs, the switch corresponding to the desired output must be set in the "ON" position.

For options 2 and 3, the signal is treated the opposite way, that is, with the minimum value in the input you have the maximum reference (or limitation).

7.3.13 Analog Outputs [33]

The CTW900 provides two analog outputs (AO1 and AO2) directly on its control board, with galvanic isolation and resolution of 11 bits. In case more outputs or a greater resolution is needed, other two outputs (AO3 and AO4) of 14 bits can be added by means of the accessory IOA-01.

Below is the detailed description of the parameter related to these outputs.

P0014 – AO1 Value

P0015 – AO2 Value

Adjustable Range: 0.00 to 100.00 % Factory Setting:

P0016 – AO3 Value

P0017 – AO4 Value

Adjustable Range: –100.00 to 100.00 % Factory Setting:
Properties: RO
Groups of 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
Access via HMI: ↳ 33 Analog Outputs ↳ 33 Analog Outputs

Description:
Those read-only parameters indicate the value of the analog outputs AO1 to AO4 in percentage of the full scale. The indicated values are those obtained after the multiplication by the gain.

Check the description of the parameters P0251 to P0262.

NOTE!
The control board analog outputs AO1 and AO2 can present a residual voltage around 30mV even when the output value be in 0%. For applications that demand a residual voltage under this value it must be used the analog outputs present in the accessory IOA-01.

P0251 – Output AO1 Function

P0254 – Output AO2 Function

P0257 – Output AO3 Function

P0260 – Output AO4 Function

Adjustable Range
0 = Speed Reference
1 = Reference after the Ramp
2 = Total Reference
3 = Effective Speed
4 = Speed Error
5 = Speed Regulator Output
6 = Current Reference
7 = Armature Current
8 = Current Regulator Output
9 = Firing Angle
10 = Output Power
11 = Motor Torque
12 = SoftPLC
13 = Not used
14 = Armature Voltage
15 = Encoder Speed
16 = Field Current

Factory Setting: P0251 = 3
P0254 = 7
P0257 = 2
P0260 = 5

17 = EMF
18 = Content of P0696
19 = Content of P0697
20 = Content of P0698
21 = Content of P0699

Properties:

Groups of 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 33 Analog Outputs ↳ 33 Analog Outputs

Description:

These parameters set the analog output functions, defining the signal that will be used for the writing in the output.

The magnitude of the generated analog value depends on the full scale of each variable, as presented in Table 7.9.

Table 7.9 – Full scale of the analog outputs

Variable	Full Scale (10V or 20mA)*
Speed reference	P0402, for P0202 = 0 (EMF) P0134, for P0202 > 0 (Tacho or Encoder)
Reference after the Ramp	
Total Reference	
Effective Speed	
Speed Error	
Speed Regulator Output	
Encoder Speed	
Current Reference	1.25 x P0295
Armature Current (with filter of 0.1s)	
Current Regulator Output	
Firing Angle	180°
Output Power (with filter of 1.0s)	P0400 x P0401
Motor Torque (with filter of 0.5s)	100 %
Armature Voltage	P0400
EMF	
SoftPLC	32767
Content of P0696	
Content of P0697	
Content of P0698	
Content of P0699	

(*) When the signal is inverse (10 to 0 V, 20 to 0 mA or 20 to 4 mA) the values in the table become the beginning of the scale.

P0252 – Output AO1 Gain

P0255 – Output AO2 Gain

P0258 – Output AO3 Gain

P0261 – Output AO4 Gain

Adjustable Range 0.000 to 9.999 Factory Setting: 1.000

Properties:

Groups of 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 33 Analog Outputs ↳ 33 Analog Outputs

Description:

They set the gain of the analog outputs by multiplying the value of the selected variable so as to generate the output signal.

See the representation of gain application in Figure 7.12

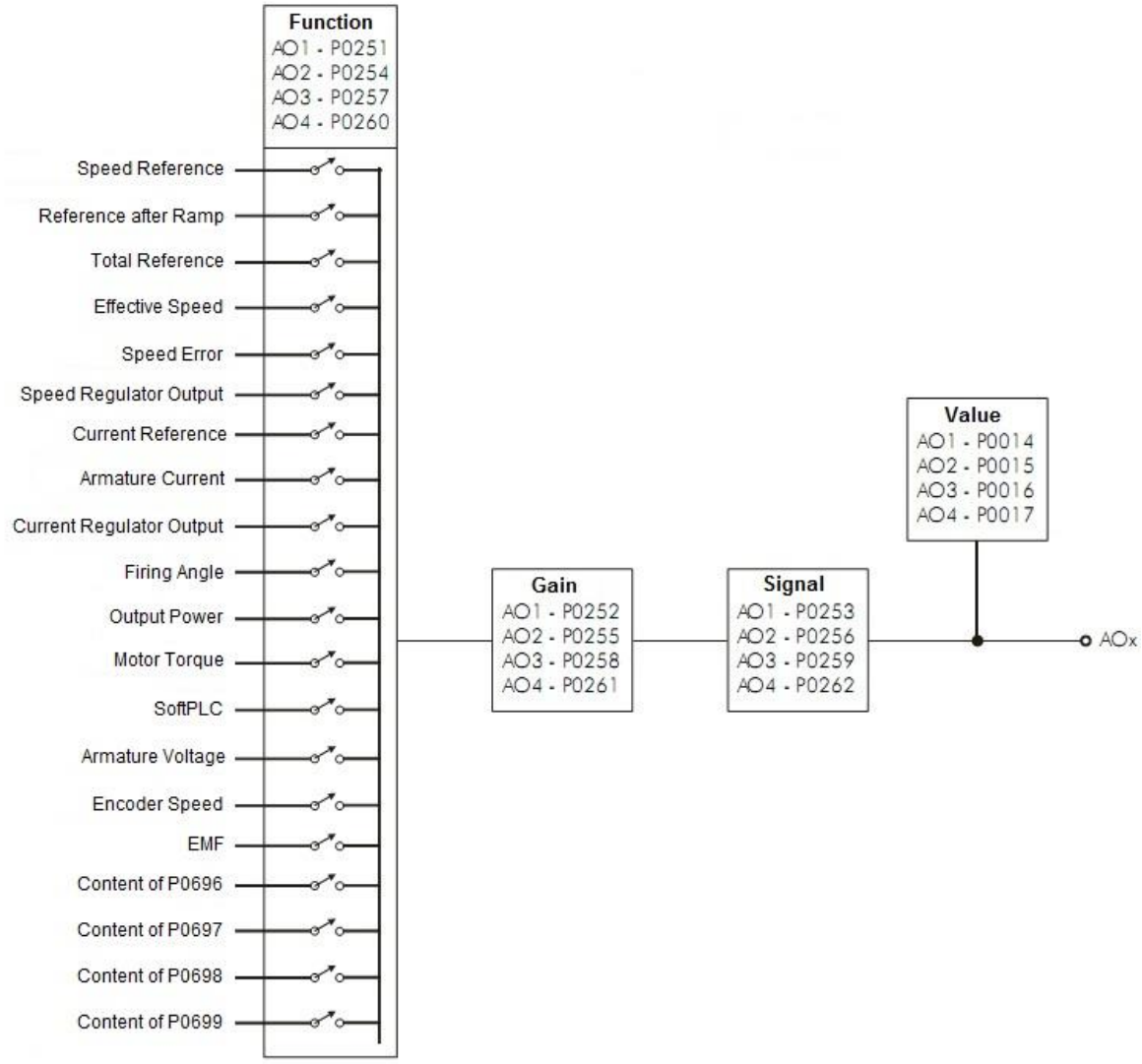


Figure 7.12 – Block diagram of the analog outputs

P0253 – Output AO1 Signal

P0256 – Output AO2 Signal

Adjustable Range: 0 = 0 to 10 V/ 20 mA
1 = 4 to 20 mA
2 = 10 V/ 20 mA to 0
3 = 20 a 4 mA

Factory Setting: 0

P0259 – Output AO3 Signal

P0262 – Output AO4 Signal

Adjustable Range: 0 = 0 to 20 mA
1 = 4 to 20 mA
2 = 20 mA to 0
3 = 20 to 4 mA
4 = 0 to 10 V
5 = 10 to 0 V
6 = -10 to +10 V

Factory Setting: 4

Properties: CFG1
Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION
Access via HMI: ↳ 33 Analog Outputs ↳ 33 Analog Outputs

Description:
Those parameters configure if the analog output signal will be in current or voltage with direct or reverse reference.

Besides the setting of these parameters, it is necessary to position correctly the DIP switches on the Control Board or Accessory Board IOA-01, as shown in tables 7.10, 7.11 and 7.12.

Table 7.10 – DIP switches related to the analog outputs

Parameter	Output	Switch	Location
P0253	AO1	S1.1	Control Board CC900
P0256	AO2	S1.2	Control Board CC900
P0259	AO3	S2.1	Accessory Board IOA-01
P0262	AO4	S2.2	Accessory Board IOA-01

Table 7.11 – Configuration of the signals of analog outputs AO1 and AO2

P0253, P0256	Output Signal	Switch Position
0	(0 to 10) V / (0 to 20) mA	On / Off
1	(4 to 20) mA	Off
2	(10 to 0) V / (20 to 0) mA	On / Off
3	(20 to 4) mA	Off

Table 7.12 – Configuration of the signals of analog outputs AO3 and AO4

P0253, P0256	Output Signal	Switch Position
0	0 to 20 mA	Off
1	4 to 20 mA	Off
2	20 to 0 mA,	Off
3	20 to 4 mA,	Off
4	0 to 10 V	Off
5	10 to 0 V	Off
6	-10 to +10V	On

For outputs AO1 and AO2, when current signals are used, the switch corresponding to the desired output must be set to the "OFF" position.

For outputs AO3 and AO4, when current signals are used, the terminals AO3 (I) and AO4 (I) must be used. For voltage signals, use the terminals AO3(V) and AO4(V). The switch corresponding to the desired output must be set to "ON" only in order to use the range -10 to +10 V.

7.3.14 Digital Inputs [34]

For the drive and control of the converter by means of external physical commands, the standard version of the CTW900 has six digital inputs, and two more can be optionally added with the accessories IOA-01 and IOB-01. The parameters that configure these inputs are presented below.

P0012 – Status of Digital Inputs DI8 to DI1

Adjustable Range: Bit 0 = DI1 — Factory Setting:
Bit 1 = DI2
Bit 2 = DI3
Bit 3 = DI4
Bit 4 = DI5
Bit 5 = DI6
Bit 6 = DI7
Bit 7 = DI8

Properties: RO

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 34 Digital Inputs ↳ 34 Digital Inputs

Description:

By means of this parameter it is possible to visualize the status of the six control board digital inputs (DI1 to DI6) and of the two accessory board digital inputs (DI7 and DI8).

The indication is done by means of the numbers 1 and 0, representing, respectively, the "Active" and "Inactive" status of the inputs. The status of each input is considered as one digit in the sequence, where DI1 represents the least significant digit.

Example: In case the sequence 10100010 is displayed on the keypad (HMI), it will correspond to the following status of the DIs:

Table 7.13 – Status of the digital inputs

DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1
Active (+24 V)	Inactive (0 V)	Active (+24 V)	Inactive (0 V)	Inactive (0 V)	Inactive (0 V)	Active (+24 V)	Inactive (0 V)

P0263 – Input DI1 Function

P0264 – Input DI2 Function

P0265 – Input DI3 Function

P0266 – Input DI4 Function

P0267 – Input DI5 Function

P0268 – Input DI6 Function

P0269 – Input DI7 Function

P0270 – Input DI8 Function

Adjustable Range: 0 = Not used
1 = Run/ Stop
2 = General Enable
3 = Quick Stop
4 = Forward Run
5 = Reverse Run
6 = 3-Wire Start
7 = 3-Wire Stop
8 = FWD/REV
9 = Local/ Remote
10 = JOG
11 = Increase E.P.
12 = Decrease E.P.
13 = Multispeed[4]
14 = 2nd Ramp
15 = Speed/Torque
16 = JOG+
17 = JOG-
18 = Without External Alarm
19 = Without External Fault
20 = Reset
21 = Speed Regulator Gains
22 = Paramet. Off
23 = Load User 1/2
24 = Load User 3
25 = Trace Function

Factory Setting: P0263 = 2
P0264 = 1
P0265 = 8
P0266 = 0
P0267 =14
P0268 = 10
P0269 = 0
P0270 = 0

Properties: CFG1

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 34 Digital Inputs ↳ 34 Digital Inputs

Description:
These parameters allow configuring the digital input function, according to the related adjustable range.

For further details about the form of actuation of the digital inputs, refer to Figure 7.14 and/or the notes below.

Run/Stop: In order to ensure the proper operation of this function, it is necessary to set P0224 and/or P0227 to 1.

Local/Remote: When set, this functions actuates in "Local" with the application of 0V to the input, and in "Remote" with the application of +24V. It is also necessary to set P0220=4 (DIx).

[4] Option available only in parameter P0266, P0267 and P0268 (DI4, DI5 and DI6).

Increase E.P. and Decrease E.P. (Electronic Potentiometer): They are active when +24 V is applied (for Increase E.P.) or 0 V (for Decrease E.P.) to the respective input configured for this function. It is also necessary to set P0221 and/or P0222 in 7.

Multispeed: The setting of parameters P0266 and/or P0267 and/or P0268 to 13 requires parameters P0221 and/or P0222 to be set to 8. Refer to section 7.3.11 for the description of parameters P0124 to P0131.

Speed/Torque: This function selects the "Speed+Torque" control mode (P0299 = 0) with the application of 0 V to the input, and the "Torque" control mode (P0299 = 1) with the application of 24 V.

Without External Alarm: This function will display "External Alarm" (A090) on the keypad when the programmed digital input is open (0 V). If +24 V is applied to the input, the alarm message will be automatically removed from the keypad display. The converter continues operating normally, regardless the status of this input.

Without External Fault: This function will make the converter disable the armature firing pulses and display "External Fault" (F091) on the keypad when the programmed digital input is open (0 V). In order to be able to enable the converter again, it is necessary to close the corresponding digital input (24 V) and reset it.

Speed Regulator Gains: When this function is programmed and the input DIx is in +24 V, the speed regulator will use the values of Proportional and Integral gains set in parameters P0161 and P0162. Otherwise, the gains set in parameters P0159 and P0160 will be used.

Parameterization Off: When this function is programmed and the DIx input is +24 V, parameters cannot be changed, no matter the values set in P0000 to P0200. When the DIx input is 0V, the modification of parameters will depend on the values set in P0000 and P0200

Load User 1/2: This function allows selecting the user's memory 1 or 2 from a transition in DIx programmed for this option.

When the status of the DIx changes from low level to high level (transition from 0V to 24V), the user's memory 1 will be loaded, since the content of the present parameters of the converter has been previously transferred to the parameter memory 1 (P0204 = 7).

When the status of the DIx changes from high level to low level (transition from 24 V to 0 V), the user's memory 2 will be loaded, since the content of the present parameters of the converter has been previously transferred to the parameter memory 2 (P0204 = 8).

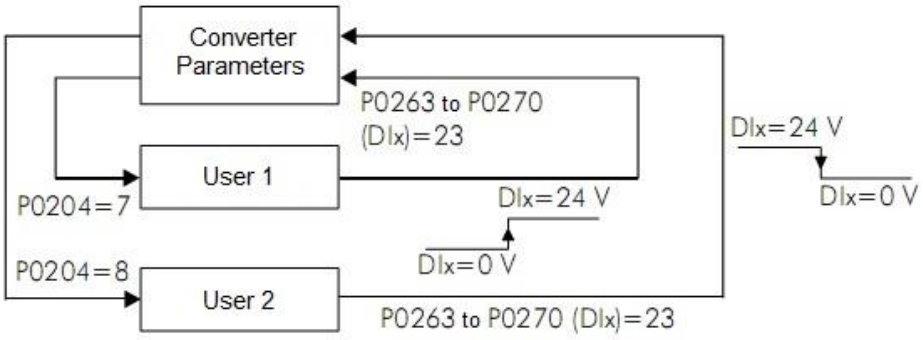


Figure 7.13 – Operation of the function Load User 1/2 via DIx

Load User 3: This function allows selecting the user's memory 3 from a transition in DIx programmed for this option.

When the status of the Dix changes from low level to high level (transition from 0 V to 24 V), the user's memory 3 will be loaded, since the content of the present parameters of the converter has been previously transferred to the parameter memory 3 (P0204 = 9).

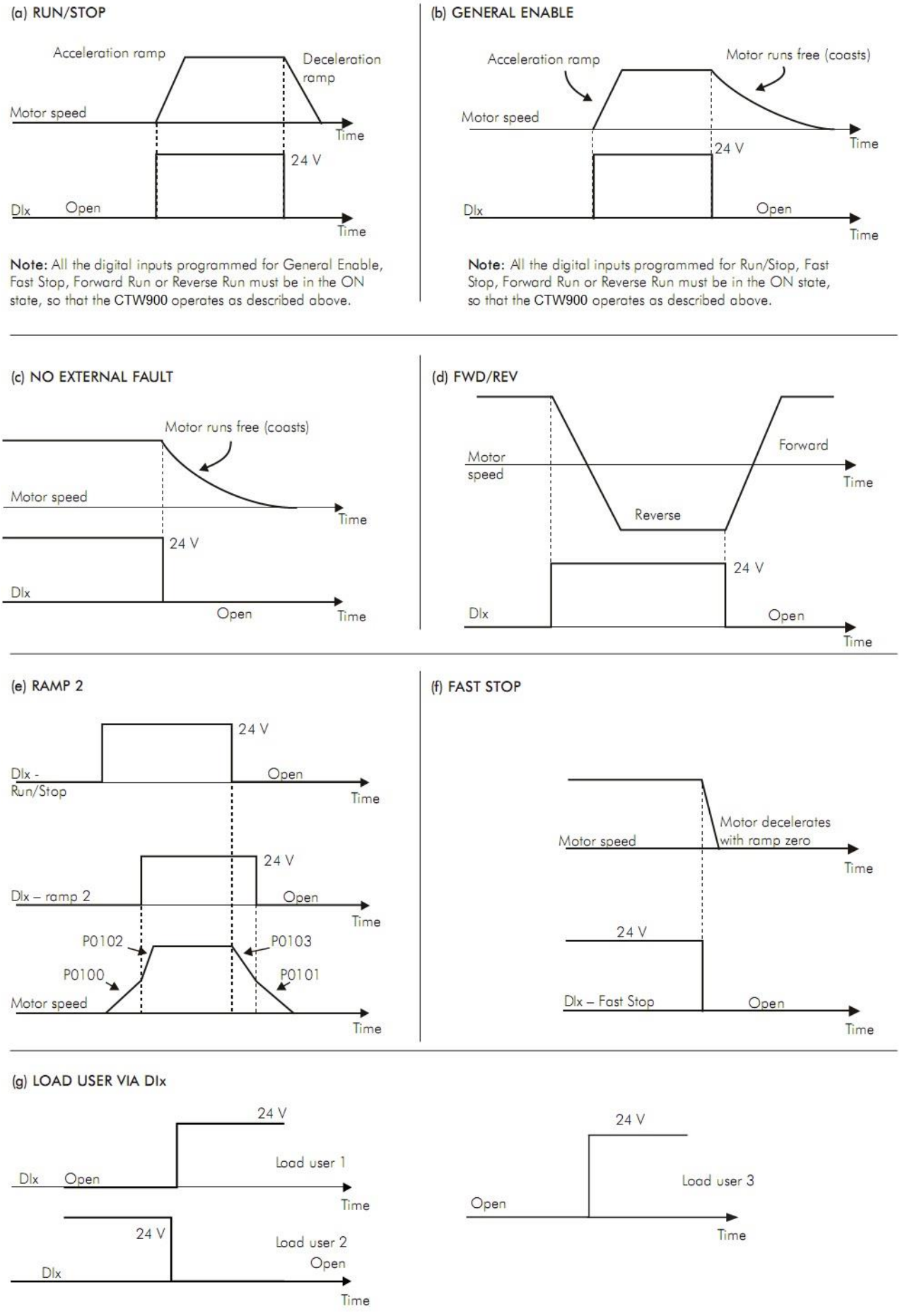
Notes:

- Make sure that when using these functions, the parameter groups (User's Memory 1, 2 and 3) are totally compatible with the application (motors, command Start/Stop, etc);
- With the converter running ("Run", "Up Ramp" or "Down Ramp" status) it will be not possible to load the user's memory;
- If two or three different motor parameter groups are saved on the user's memory 1, 2 and/or 3, the correct current values must be set in parameters P0156 and P0157 for each user.

Trace Function: It triggers the data acquisition of the channels selected with this function when the three conditions below are met:

- DIx set to 24 V;
- trigger condition for the Trace configured for DIx (P0552 = 6);
- status of the Trace function in "Waiting" (P0576 = 1).

For further details, refer to section 7.3.21.

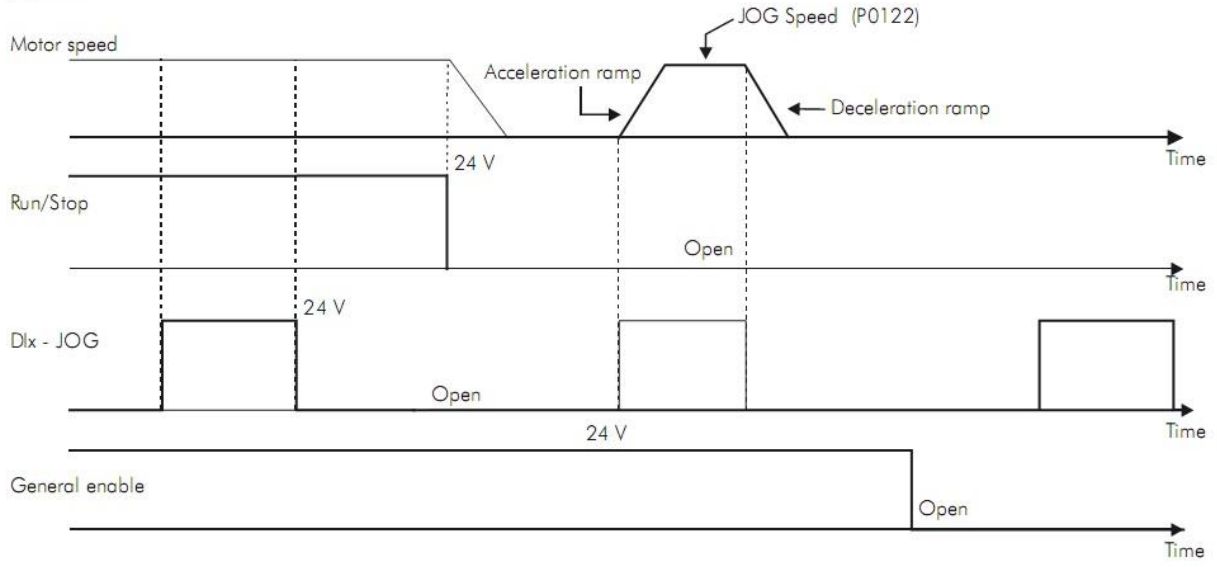


Note: All the digital inputs programmed for General Enable, Fast Stop, Forward Run or Reverse Run must be in the ON state, so that the CTW900 operates as described above.

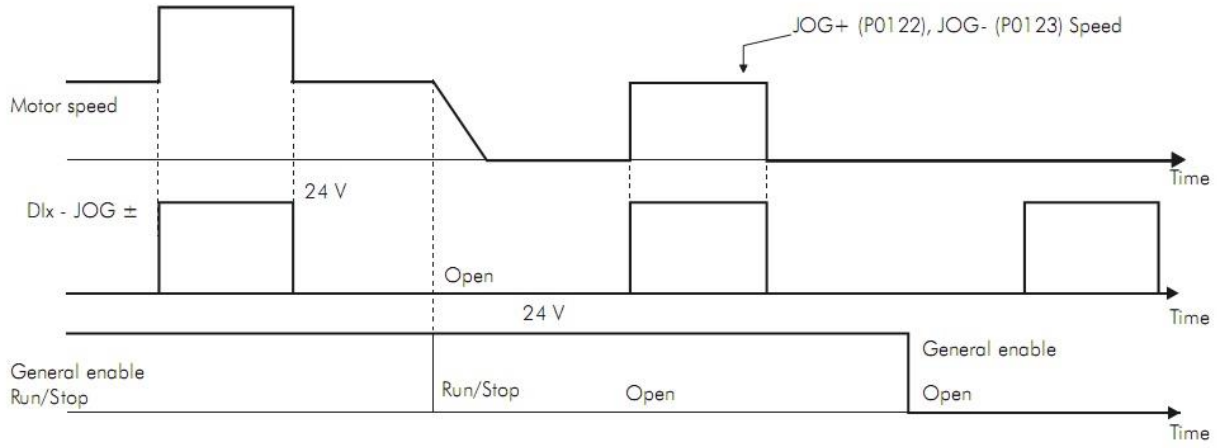
Note: All the digital inputs programmed for Run/Stop, Fast Stop, Forward Run or Reverse Run must be in the ON state, so that the CTW900 operates as described above.

Figure 7.14 a) to g) – Details about the operation of the functions of the digital inputs

(h) JOG



(i) JOG + and JOG -



(j) RESET

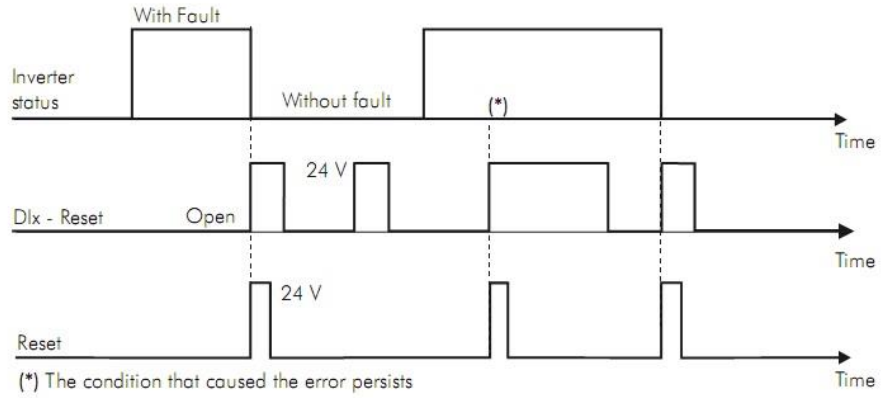
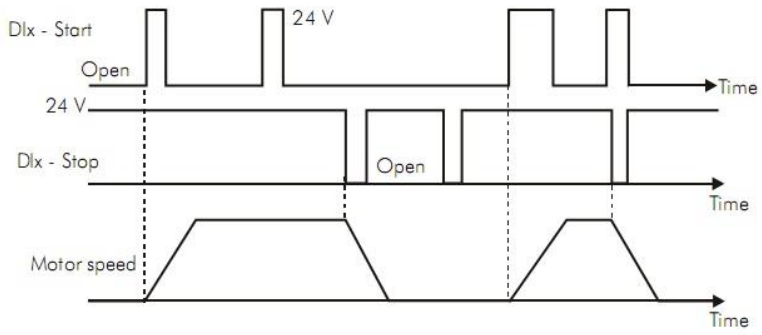
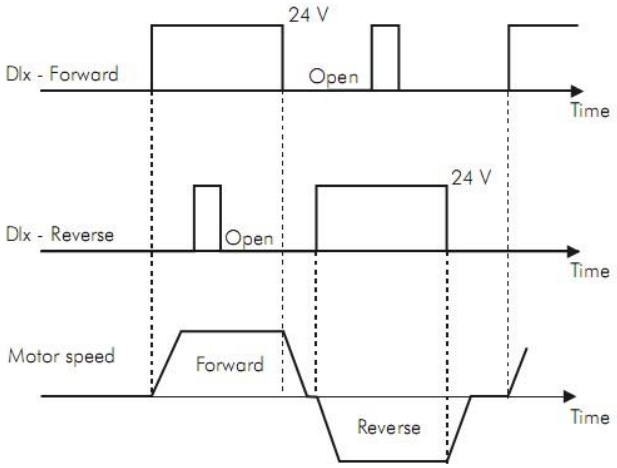


Figure 7.14 h) to j) – Details about the operation of the functions of the digital inputs (continued)

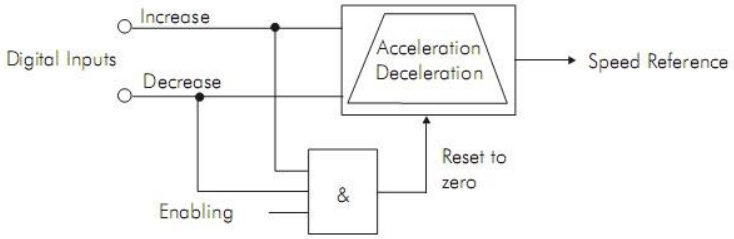
(k) 3-WIRE START / STOP



(l) FWD Run / REV Run



(m) ELECTRONIC POTENTIOMETER (E.P.)



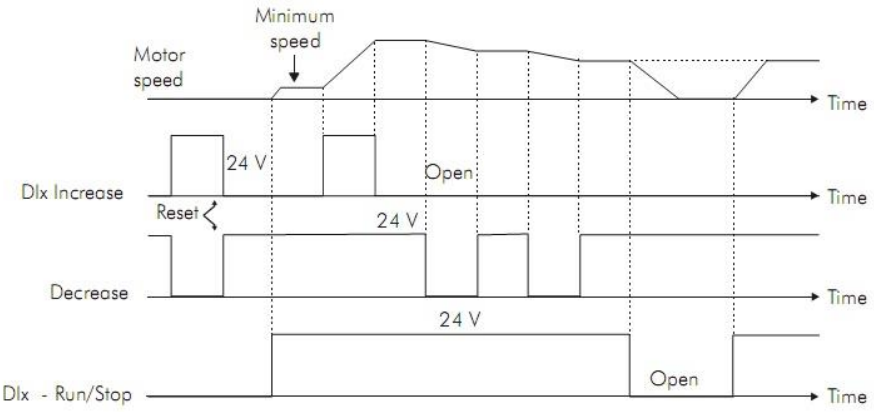


Figure 7.14 k) to m) – Details about the operation of the functions of the digital inputs (continued)

7.3.15 Digital / Relay Outputs [35]

For the implantation of the protection and interlock logics, the CTW900 has three digital relay outputs on its control board, and two more open collector outputs on the accessories IOA-01 and IOB-01.

Below is the detailed description of the parameters related to these outputs.

P0013 – Status of the Digital Outputs DO5 to DO1

Adjustable Range: Bit 0 = DO1
Bit 1 = DO2
Bit 2 = DO3
Bit 3 = DO4
Bit 4 = DO5
Factory Setting:

Properties: RO

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 35 Digital Outputs ↳ 35 Digital Outputs

Description:
By means of this parameter it is possible to view the status of the three control board digital outputs (DO1 to DO3) and of the two optional board digital outputs (DO4 and DO5).

The indication is done by means of the numbers "1" and "0", representing, respectively, the "Active" and "Inactive" status of the outputs. The status of each output is considered as one digit in the sequence, where DO1 represents the least significant digit.

Example: In case the sequence 00010010 is displayed on the keypad, it will correspond to the following status of the DOs:

Table 7.14 – Status of the digital outputs

DO5	DO4	DO3	DO2	DO1
Active (+24 V)	Inactive (0 V)	Inactive (deactivated coil)	Active (activated coil)	Inactive (deactivated coil)

P0275 – Output DO1 Function (RL1)

P0276 – Output DO2 Function (RL2)

P0277 – Output DO3 Function (RL3)

P0278 – Output DO4 Function

P0279 – Output DO5 Function

Adjustable Range: 0 = Not used
1 = N* > Nx
2 = N > Nx
3 = N < Ny
4 = N = N*
5 = Zero Speed
6 = Ia > Ix
7 = Ia < Ix
8 = Torque > Tx
9 = Torque < Tx
10 = Remote
11 = Run
12 = Ready
13 = Without Fault
14 = With F003
15 = With F072
16 = With F077
17 = 4 to 20mA Ok
18 = Content of P0695
19 = Forward Direction
20 = With Fault

Factory Setting: P0275 =13
P0276 = 2
P0277 = 1
P0278 = 0
P0279 = 0

21 = Time Enabled > Hx
22 = SoftPLC
23 = N > Nx / Nt > Nx
24 = Without Alarm
25 = Without Alarm/Fault
26 = Bridge A in Conduction

Properties: CFG1

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 35 Digital Outputs ↳ 35 Digital Outputs

Description:
They program the function of the digital outputs, according to the options presented previously. When the condition declared by the function is true, the digital output will be activated.

Example: Function **Ia > Ix**

When the armature current (Ia) is higher that the value set in P0290 (Ix), we will have the DOx programmed for this function activated (saturated transistor and/or relay with coil energized). Otherwise, the DOx will be deactivated (transistor cut off and/or relay with coil de-energized).

Below are some additional notes regarding the digital and relay output functions.

Not used: Digital outputs programmed for "Not Used" will remain indefinitely in the idle status, that is, with the transistor cut off and/or relay with the coil de-energized.

Zero Speed: Function that indicates if the motor speed is below the value set in P0291.

Torque > Tx and Torque < Tx: It actuates according to the value of P0009 (Motor Torque) and P0293 (Torque Tx)

Remote: Function that will activate the digital output programmed when the converter is operating in the Remote status.
Run: Indicates if the CTW900 is operating with programmed reference (even if that is zero), and is equivalent to the 'Run', 'Accelerating' and 'Decelerating' status of the converter.

Ready: Activates the digital output when the converter status is 'Ready'.

Without Fault: Keeps the output activated while no faults are present on the converter.

With F003: Signals the occurrence of undervoltage in the line (fault F003).

With F072: Signals the occurrence of overload on the motor (fault F072).

With F077: Signals the occurrence of the Stall Protection (fault F077).

Reference 4 to 20 mA Ok: It means the reference in current (option 4 to 20 mA) of the analog inputs is within the correct range.

Content of P0695: Allows the digital output status to be controlled by parameter P0695, which is written via network. For further details about this function, refer to the Modbus Communication Manual

Forward Direction: Function that will activate the digital output while the motor is spinning in the forward direction.

With Fault: Function that will activate the digital output when any fault is present on the converter.

Time Enabled > Hx: Activates the digital output when the value of P0043 exceeds the value set in P0294.

SoftPLC: Allows the digital output status to be controlled by the programming made in the memory area reserved for the SoftPLC function. For further details, refer to the SoftPLC Manual.

N > Nx and Nt > Nx: In this function, the two conditions must be met so that the output is activated. Therefore, it is necessary that the present speed (N – P0002) and the total reference (Nt – P0046) be above the value of Nx (P0288) so that the transistor will be saturated and/or the relay coil will be energized.

Without Alarm: Keeps the output activated if no alarms are present on the converter.

Without Alarm and Without Fault: If no faults or alarms are present on the converter, the output set for this function will remain activated.

Bridge A in Conduction: Indicates the operation of the bridge responsible for the spinning in the forward direction (Bridge A).

Table 7.15 –Definitions of the symbols used in the digital output functions

Symbol	Corresponding Parameter	Description
N	P0002	Present Speed
N*	P0001	Speed Reference
Nx	P0288	Speed Nx (Speed reference point selected by the user)
Ny	P0289	Speed Ny (Speed reference point selected by the user)
Ia	P0003	Armature Current
Ix	P0290	Current Ix (Current reference point selected by the user)
Torque	P0009	Motor Torque
Tx	P0293	Torque Tx (Torque reference point selected by the user)
Hx	P0294	Time Hx (Time reference point selected by the user)
Nt	P0046	Total Speed Reference

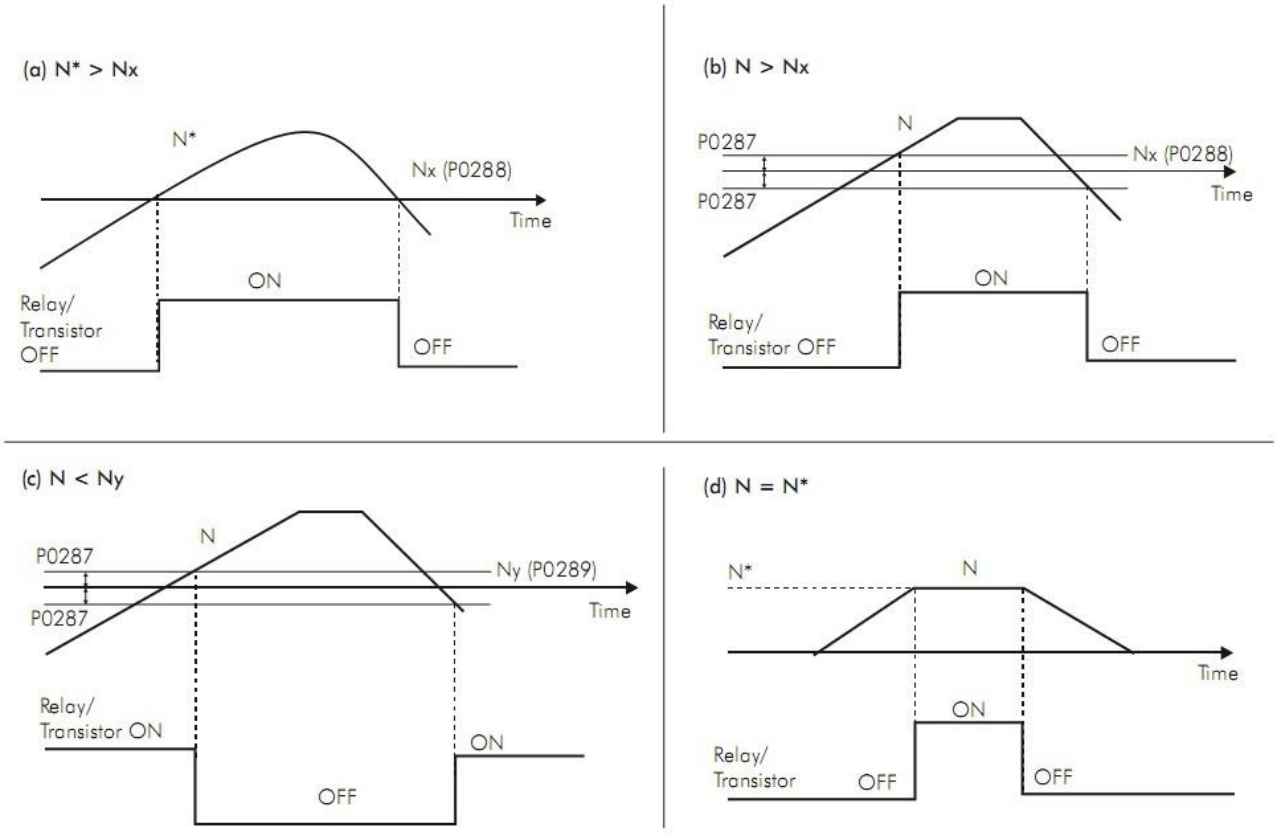


Figure 7.15 a) to d) – Details about the operation of the functions of the digital and relay outputs

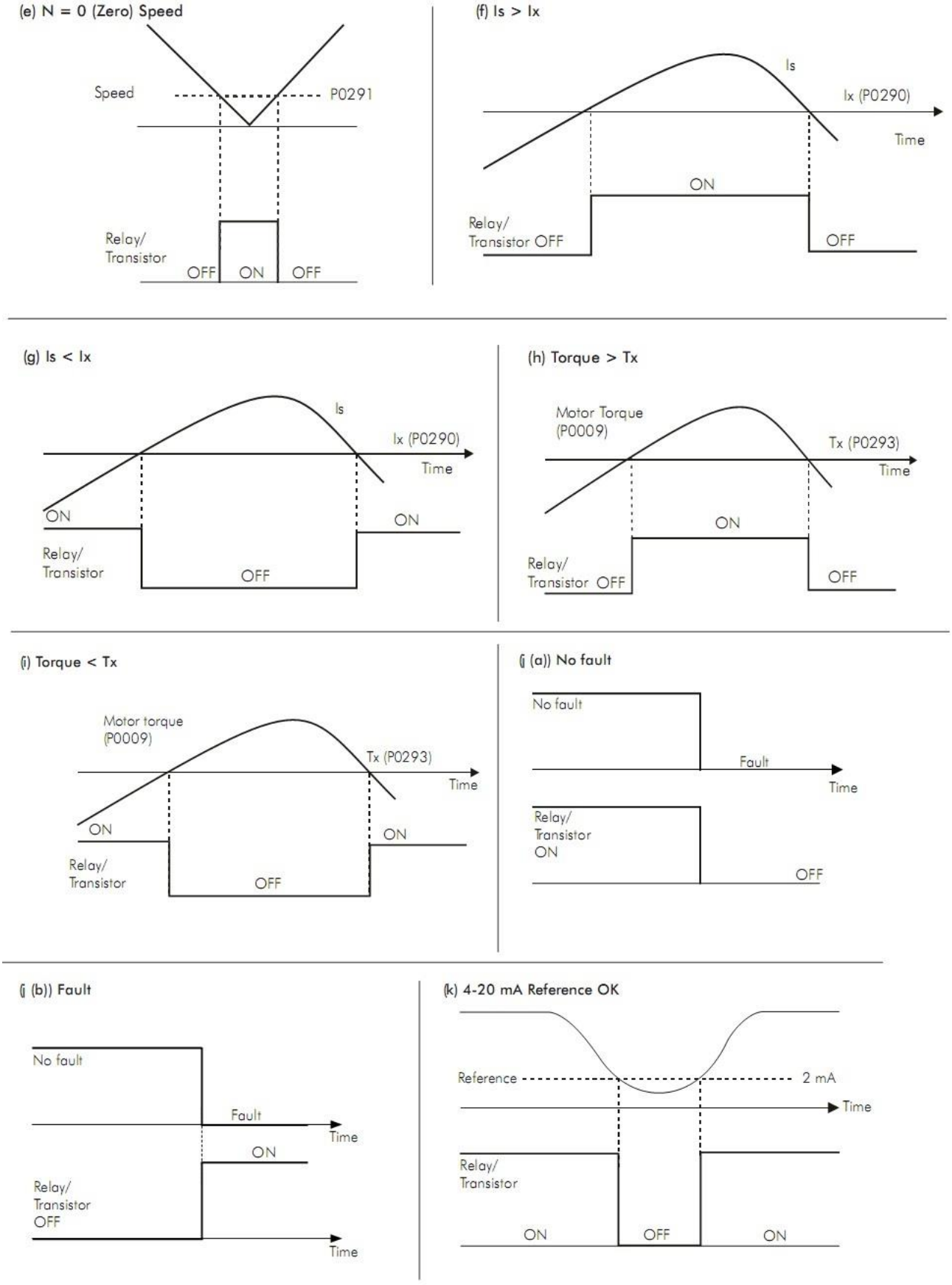


Figure 7.15 e) to k) – Details about the operation of the functions of the digital and relay outputs (continued)

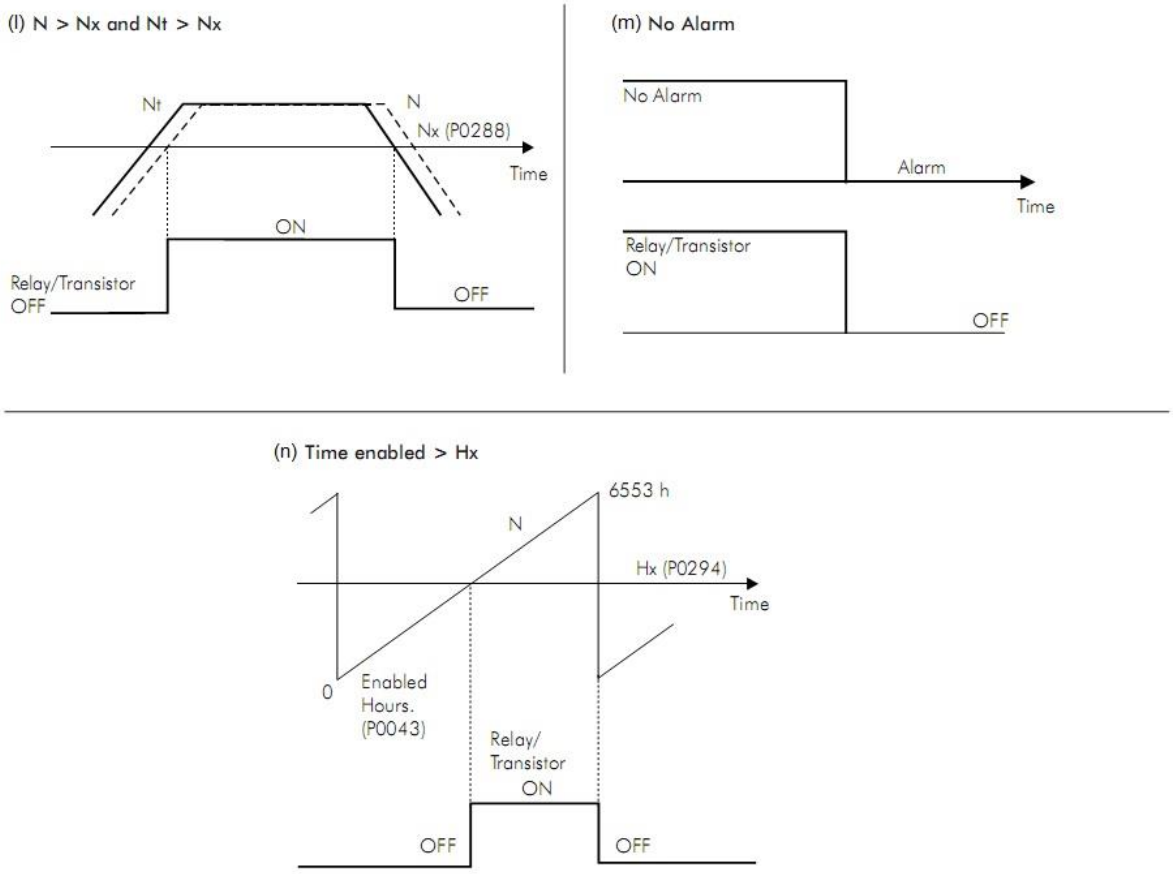


Figure 7.15 l) to n) – Details about the operation of the functions of the digital and relay outputs (continued)

P0287 – Hysteresis Nx / Ny

Adjustable Range: 0 to 900 rpm — Factory Setting: 18 rpm

Properties:

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 35 Digital Outputs ↳ 35 Digital Outputs

Description:

Used in the functions **N > Nx** and **N <Ny** of the digital and relay outputs, this parameter defines the hysteresis range in which the speed (N) is considered above or below the reference points Nx and Ny.

Check the graphic representation of this parameter in Figure 7.15 b) and c).

P0288 – Speed Nx

P0289 – Speed Ny

Adjustable Range: 0 to 10000 rpm — Factory Setting: P0288 = 120 rpm, P0289 = 1800 rpm

Properties:

Groups of: 01 PARAMETER GROUPS or 07 I/O CONFIGURATION

Access via HMI: ↳ 35 Digital Outputs ↳ 35 Digital Outputs

Description:

They define the speed reference points used in the functions **N*> Nx**, **N > Nx** and **N <Ny** of the digital and relay outputs.

P0290 – Current Ix

Adjustable Range: 0 to 1.25xI_{rat}			Factory Setting: 1.0xI_{rat}
Properties:			
Groups of	01 PARAMETER GROUPS	or	07 I/O CONFIGURATION
Access via HMI:	↳ 35 Digital Outputs		↳ 35 Digital Outputs

Description:
It defines the current reference point used in the functions **Ia>Ix** and **Ia< Ix** of the digital and relay outputs.

P0292 – Range for N = N*

Adjustable Range: 0 to 10000 rpm			Factory Setting: 18 rpm
Properties:			
Groups of	01 PARAMETER GROUPS	or	07 I/O CONFIGURATION
Access via HMI:	↳ 35 Digital Outputs		↳ 35 Digital Outputs

Description:
It specifies the value, in rpm, below which the difference between the effective speed (N) and the reference (N*) will be considered equal for the purpose of the function **N=N*** of the digital and relay output.

P0293 – Torque Tx

Adjustable Range: 0 to 1000 %			Factory Setting: 100 %
Properties:			
Groups of	01 PARAMETER GROUPS	or	07 I/O CONFIGURATION
Access via HMI:	↳ 35 Digital Outputs		↳ 35 Digital Outputs

Description:
It defines the torque reference point used in the functions of the digital and relay outputs.

In these functions, the motor torque displayed in parameter P0009 is compared to the value set in P0293.

The setting of this parameter is expressed in percentage of the armature rated current (P0401 = 100 %).

P0294 – Time Hx

Adjustable Range: 0 to 6553 h			Factory Setting: 4320 h
Properties:			
Groups of	01 PARAMETER GROUPS	or	07 I/O CONFIGURATION
Access via HMI:	↳ 35 Digital Outputs		↳ 35 Digital Outputs

Description:
It defines the time reference point used in the function **Time Enabled>Hx** of the digital and relay outputs.

7.3.16 Drive Data [36]

In this group are the parameters related of the information and characteristics of the CTW900, such as model, accessories present, software version, etc.

P0023 – Software Version

Adjustable Range: 0.00 to 655.35		Factory Setting:
Properties: RO		
Groups of	01 PARAMETER GROUPS	
Access via HMI:	↳ 36 Drive Data	

Description:
It indicates the software version installed on the FLASH memory of the microcontroller located on the control board.

P0027 – Configuration of Accessories 1

P0028 – Configuration of Accessories 2

Adjustable Range: 0000h to FFFFh Factory Setting:
Properties: RO
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 36 Drive Data

Description:
These parameters identify, by means of a hexadecimal code, the accessories that are installed on the control module.

For the accessories installed in the slots 1 and 2, the identification code is informed in parameter P0027. In case of modules connected to slots 3, 4 or 5, the code will be shown through parameter P0028.

The following table shows the codes informed in these parameters regarding the accessories of the CTW900.

Table 7.16 – Identification codes for the accessories of the CTW900

Name	Description	Slot	Identification Code	
			P0027	P0028
IOA-01	Module with 1 analog input of 14 bits, 2 digital inputs, 2 analog outputs of 14 bits in voltage or current, 2 digital outputs of the open connector type.	1	FD--	----
IOB-01	Module with 2 isolated analog inputs, 2 digital inputs, 2 isolated analog outputs in voltage and current, 2 open collector digital outputs.	1	FA--	----
ENC-01	Incremental encoder module, 5 to 12 Vdc, 100kHz, with repeater of the encoder signals.		--C2	----
ENC-02	Incremental encoder module, 5 to 12 Vdc, 100 kHz.		--C2	----
RS-485-01	RS-485 serial communication module.	3	----	CE--
RS-232-01	RS-232C serial communication module.	3	----	DC--
RS-232-02	RS-232C serial communication module with switch to program the microcontroller FLASH memory.	3	----	CC--
PROFIBUS DP-05	Profibus DP interface module.	4	----	----(2)
DEVICENET-05	Devicenet interface module.	4	----	----(2)
ETHERNET IP-05	EtherNet interface module.	4	----	----(2)
RS-232-05	RS-232 interface module.	4	----	----(2)
RS-485-05	RS-485 interface module.	4	----	----(2)
MMF-03	Flash memory module.	5	----	----(1)

For the Anybus-CC communication modules (slot 4) and for the FLASH memory module, the identification code in P0028 will depend on the combination of these accessories, as shown in the following table.

Table 7.17 – Formation of the two first codes of parameter P0028

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	FLASH Memory Module	Anybus-CC Modules 01 = Active Module 10 = Passive Module		0	0	0	0
2nd Hexa Code				1st Hexa Code			

(1) Bit 6: indicates the presence of the FLASH memory module (0 = without memory module, 1 = with memory module).
(2) Bit 5 and 4: indicate the presence of active or passive Anybus-CC modules (see the classification in the Table 7.18).

Table 7.18 – Types of Anybus-CC modules

Bit 5	Bit 4	Module Type	Name
0	1	Active	PROFIBUS DP-05, DEVICENET-05, ETHERNET IP-05
1	0	Passive	RS-232-05, RS-485-05

Bits 3, 2, 1 and 0: are fixed at 0000, and always form the code "0" in hexadecimal.

Example: For a converter equipped with the modules IOA-01 ENC-02, RS485-01, PROFIBUS DP-05 and FLASH memory module, the hexadecimal code presented in parameters P0027 and P0028 must be FDC2 and CE50 (Table 7.19).

Table 7.19 – Example of the first characters of the code P0028 for PROFIBUS DP-05 and FLASH memory module

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	1	0	0	0	0
5				0			

P0295 – Drive Rated Current

Adjustable Range: 0 = 20 A
1 = 50 A
2 = 90 A
3 = 125 A
4 = 180 A
5 = 260 A
6 = 480 A
7 = 640 A
8 = 1000 A
9 = 1500 A
10 = 2000 A
11 = 1320 A (Rack)
12 = 1700 A (Rack)
13 = 1900 A (Rack)
14 = 2000 A (Rack)
15 = 2120 A (Rack)
16 = 3000 A (Rack)
17 = 3125 A (Rack)
18 = 3200 A (Rack)
19 = 1000 A (Rack)

Factory Setting:

Properties: RO
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 36 Drive Data

Description:
Read only parameter that defines the converter rated current (factory preset).

NOTE!
In cases of replacement of the control board, it is possible to change the value of the parameter P0295 manually, adjusting it to the rated current indicated on the product label.
For that, it is necessary to program the parameter 0000 with the special password 1734.

P0296 – Line Rated Voltage

Adjustable Range: 0 = 200-240 V
1 = 380 V
2 = 400-415 V
3 = 440-460 V
4 = 480 V
5 = 500-525 V
6 = 550-575 V
7 = 600 V
8 = 660-690 V
9 = 740-990 V

Factory Setting: 0

Properties: CFG2
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 36 Drive Data

Description:
It defines the converter power supply, and it must be set according to the power supply to which the CTW900 is connected.

NOTE!
In case the options 6 to 9 are selected for a converter class 05 (200 to 500 V), the message "Hardware incompatible with this option" will be displayed, and the configuration will be disabled.

P0298 – Converter Type

Adjustable Range: 0 = Single Bridge 1 = Double Bridge	Factory Setting: According to model of the converter
Properties: CFG2	
Groups of 01 PARAMETER GROUPS	
Access via HMI: ↳ 36 Drive Data	

Description:
It defines the type of the CTW900 in relation to the configuration of the armature bridge:

- option 0 (Single Bridge) = converter Unidirectional (1-Q);
- option 1 (Double Bridge) = converter Antiparallel (4-Q).

Antiparallel converters enable the operation of the motor in the four quadrants of the curve Torque x Speed (Figure 4.1), while Unidirectional converters allow the operation of the motor only in the first quadrant.

NOTE!
For converters of the Antiparallel type (CTW900A), it is possible to configure them to operate just in the Unidirectional mode by changing the setting of P0298 to option 0.

P0642 – Self-Diagnose

Adjustable Range: 0000h to FFFFh	Factory Setting:
Properties: RO	
Groups of 01 PARAMETER GROUPS	
Access via HMI: ↳ 36 Drive Data	

Description:
It informs the failure code when the "Self-Diagnose" fault (F084) is identified.

In case this fault occurs after the power-up, check the value contained in this parameter and contact WEG for further details.

7.3.17 Motor Data [37]

In this group are the parameters for the setting of the characteristics of the motor used. They must be configured according to the data on the motor nameplate or on its data sheet (if available).

P0400 – Armature Rated Voltage

Adjustable Range: 0 to 1200 V	Factory Setting: 400 V
Properties: CFG1	
Groups of 01 PARAMETER GROUPS	
Access via HMI: ↳ 37 Motor Data	

Description:
Rated voltage of the motor armature, at which the motor reaches its rated speed (for full field).

Set according to the data on the motor nameplate.

P0401 – Armature Rated Current

Adjustable Range: 0 to 3500 A — Factory Setting: 50 A
Properties: CFG1
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 37 Motor Data

Description:
Armature rated current of the motor. Set according to the data on the motor nameplate.

P0402 – Motor Rated Speed

Adjustable Range: 10 to 6500 rpm — Factory Setting: 1800 rpm
Properties: CFG1
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 37 Motor Data

Description:
Motor rated speed, reached with the application of the armature rated voltage (at full field).
Setting according to the information on the motor nameplate.

For motors that operate in the field weakening area, the value of the maximum speed must be set in P0134.

P0404 – Field Rated Current

Adjustable Range: 0.2 to 50.0 A — Factory Setting: 1.2 A
Properties: CFG1
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 37 Motor Data

Description:
Motor field rated current. It must be set according to the value informed by the manufacturer.

P0409 – Armature Resistance

Adjustable Range: 0.000 to 0.999 ohm — Factory Setting: 0.000 ohm
Properties:
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 37 Motor Data

Description:
Value of the armature resistance in Ohms.

Used to correct the EMF value when the motor is under rated load, it must be set during the Start-up procedure. For further details, refer to section 6.3.1.

7.3.18 Protections [38]

The parameters regarding the motor and the converter protections are in this group.

P0030 – Heatsink Temperature

Adjustable Range: -20.0 to 150.0 °C — Factory Setting:
Properties: RO
Groups of: 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It indicates the present temperature of the power heatsink in Celsius. Its value is also used to monitor the alarm of the converter overtemperature protection (A050 and F051).

NOTE!
For converters of Size D (1500A and 2000A), the indication in P0030 will correspond to the temperature of the field bridge heatsink.

P0132 – Maximum Overspeed Level

Adjustable Range: 0 to 100 % Factory Setting: 10 %
Properties:
Groups of 01 PARAMETER GROUPS or 01 PARAMETER GROUPS
Access via HMI: ↳ 23 Limits ↳ 38 Protections

Description:
This parameter establishes the highest speed value at which the motor can operate, and it must be set with a percentage of the maximum speed limit (P0134).

Therefore, when the effective speed exceeds the value of P0134+P0132 for over two seconds, the CTW900 will disable the armature firing and will indicate the Overspeed fault (F150).

If you wish to disable this protection, set P0132 = 0 %.

Note: Function active only in the control mode "Speed+Torque" (P0299 = 0).

P0135 – Maximum Output Current

Adjustable Range: 0 to 1.25x I_{rat} Factory Setting: 1.0x I_{rat}
Properties:
Groups of 01 PARAMETER GROUPS or 01 PARAMETER GROUPS
Access via HMI: ↳ 23 Limits ↳ 38 Protections

Description:
It establishes the maximum level that the output current can reach without the actuation of the Overcurrent.

In case the effective current (P0003) exceeds the value defined in P0135 for over two seconds, the CTW900 will disable the armature firing and will display the fault F071.

P0137 – Time for Stall Protection

Adjustable Range: 0 to 100 s Factory Setting: 2 s
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It defines the time for the actuation of the Stall protection (F077), which monitors the motor speed and current according to the values defined in P0139 and P0355.

Thus, when the conditions of P0139 and P0355 are met, the protection will actuate after the time set in P0137 has elapsed.

P0139 – Speed for Stall Protection

Adjustable Range: 0 to 1000 rpm Factory Setting: 18 rpm
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It establishes the speed below which the motor shaft will be considered locked so as to enable the Stall Protection (F077).

Therefore, if the torque is above the setting in P0355 and the motor speed is below the value of P0139, the converter may be disabled with fault F077 if it remains in this condition for a period longer than the setting in P0137.

P0156 – Overload Current

P0157 – Current without Overload

Adjustable Range: 0 to 1.25x I_{rat} Factory Setting: P0156 = 1.25 x I_{rat}
P0157 = 1.0 x I_{rat}

P0158 – Overload Protection Time

Adjustable Range: 5 to 600 s Factory Setting: 300 s
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
These parameters are used for the protection against motor overload (Ixt – F072).

The current without overload (P0157) defines the value of the armature current after which the Ixt protection will start actuating. The overload current (P0156) establishes the current level for the protection to actuate in the time set in P0158.

For armature current values (P0003) lower than P0156 and higher than P0157, the actuation time of the protection Ixt will be calculated by the following relation:

$$Actuation\ Time\ F072\ (s) = (P0156 \div P0003) \times P0158$$

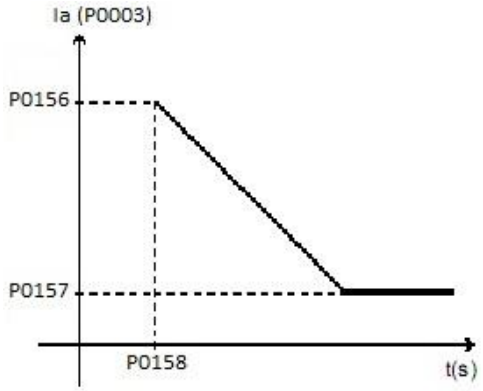


Figure 7.16 – Curve of actuation of the protection Ixt

Note:

- The factory settings are calculated to protect the converter. For the protection of the motor, check the levels of rated current and overload in the motor data sheet.

NOTE!
The protection will be inactive if the setting of P0156 is smaller or equal to P0157, or if P0348 is configured for 0 (Inactive) or 3 (Alarm).

P0340 – Auto-Reset Time

Adjustable Range: 0 to 600 s Factory Setting: 0 s
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
When a fault occurs (except for F074, F084, F099 and F149), the CTW900 may automatically reset after the time set in P0340 has elapsed.
After the auto-reset, if the same fault occurs again for three times consecutively, the auto-reset function will be disabled. A fault is considered consecutive if it happens again within 30 seconds after the auto-reset.

Therefore, if a fault occurs four times consecutively, the converter will remain disabled and the fault will continue being displayed until the CTW900 is re-energized.

Note:

- If P0340 ≤ 2s, the auto-reset function will be disabled.

NOTE!
Faults F051 and F156 allow the conditional reset, that is, the automatic reset will only occur if the temperature returns to the normal operating range.

P0348 – Configuration of the Overload Protection

Adjustable Range: 0 = Inactive
1 = Fault/ Alarm
2 = Fault
3 = Alarm
Factory Setting: 1

Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
This parameter allows configuring the desired form of actuation for the motor overload protection (Ixt).

Check the table below with the details of the actions of each of the available options.

Table 7.20 – Actions for the options of parameter P0348

P0348	Action
0 = Inactive	The overload protection is disabled. Neither faults, nor alarms will be generated for the motor operation in the overload condition.
1 = Fault/ Alarm	The converter will display an alarm (A046) when the motor reaches the level set in P0349, and it will generate a fault (F072) when the motor reaches the actuation value of the overload protection. Once the fault is generated, the converter is disabled.
2 = Fault	When the motor reaches the actuation level of the overload protection, fault F072 will be generated and the converter will be disabled.
3 = Alarm	The alarm will be generated (A046) only when the motor reaches the value set in P0349, and the converter will continue operating.

P0349 – Overload Alarm Level

Adjustable Range: 70 to 100 %
Factory Setting: 85 %

Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
This parameter defines the level for alarm actuation of the motor overload protection (A0046), and it is expressed in percentage of the overload integrator limit value.

It will only be effective when P0348 is set to 1 (Fault/Alarm) or to 3 (Alarm).

P0350 – Configuration of the Ia > Ix Detector

Adjustable Range: 0 = Active
1 = Inactive during the acceleration or braking
Factory Setting: 0

Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It allows deactivating the Ia > Ix function of the digital inputs during accelerations or braking.

P0352 – Configuration of the Protection against Tacho/ Encoder Loss

Adjustable Range: 0 = Active
1 = Inactive
Factory Setting: 0

Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It allows deactivating the protection against Tachogenerator or Encoder Loss.

It will be only effective when P0202 is set to 1 (Tacho DC) or 2 (Encoder).

DANGER!
By setting P0352 = 1, the protection against Tacho/Encoder loss will be inactive, and the motor can accelerate up to the maximum speed in case the speed feedback signal is disconnected or is interrupted.

P0353 – EMF Level for the Protection against Tacho/ Encoder Loss

Adjustable Range: 0 to 1000 V
Factory Setting: 50 V

P0354 – Speed Difference for the Protection against Tacho/ Encoder Loss

Adjustable Range: 0 to 100 %
Factory Setting: 25 %

Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
These parameters define the actuation level of the protection against Tacho/Encoder loss (F154).

The value of P0353 specifies the EMF voltage from which the protection against Tacho/ Encoder loss will be enabled to actuate, while the value of P0354 determines the maximum acceptable difference between the EMF and the speed feedback signal.

Example: For the default factory settings and a motor of rated voltage of 460 V (P0400), the application of the command 'Run' without the feedback signal connected will make the protection F154 actuate when the EMF value reaches 115 V, meeting the conditions of P0353 (> 50 V) and of P0354 (|P0002 – P0041|> 25 %).

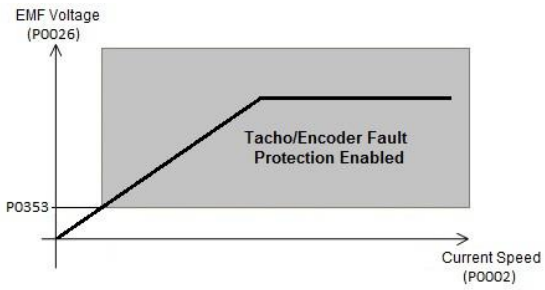


Figure 7.17 – Monitoring area of the protection against Tacho/ Encoder Loss according to the value in P0353

P0355 – Torque for Stall Protection

Adjustable Range: 0 to 100 % Factory Setting: 5 %
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
This parameter establishes the current level above which the converter can be disabled by the Stall protection (F077). Its value is expressed in percentage of the converter rated current (P0295).

The actuation of this protection depends on the settings of P0137 and P0139. Check the descriptions of these parameters for further details.

NOTE!
The protection will be disabled if P0355 is set to 0 %.

P0356 – Delay for Field Missing

Adjustable Range: 0.1 to 10.0 s Factory Setting: 2.0 s
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It defines the time for the actuation of the Field Loss protection (F074), which monitors the field current value in relation to the setting of P0177.

Therefore, if the field current (P0008) remains below the value set in P0177 for a period longer than the setting in P0356, the converter is disabled by fault F074.

NOTE!
Fault F074 can only be reset if the command of General Enable is not present.

P0357 – Time for Line Phase Loss

Adjustable Range: 0 to 60 s Factory Setting: 3 s
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It establishes the time for the actuation of the Line Undervoltage protection (F003) when the line voltage value (P0004) fall below the limit defined by P0362.

NOTE!
The protection will be disable if P0357 is set to 60s.

P0358 – Maximum Armature Overvoltage

Adjustable Range: 0 to 100 % Factory Setting: 10 %
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It defines the maximum overvoltage level in the armature in relation to the motor rated voltage (P0400).

With this setting, when the armature voltage (P0007) exceeds the value of [(100 % + P0358) x P0400] for more than two seconds, the converter will be disabled by fault F022.

NOTE!
The protection will be disabled if P0358 is set to 0 %.

P0359 – Maximum Overcurrent in the Field

Adjustable Range: 0 to 35 % Factory Setting: 10 %
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It determines the maximum overcurrent level in the field in relation to the rated current set in P0404.

Thus, when the field current (P0008) exceeds the value of [(100 % + P0359) x P0404] for a more than two seconds, the converter will be disabled by fault F070.

NOTE!
The protection will be disabled if P0359 is set to 0 %.

P0361 – Maximum Overvoltage in the Line

Adjustable Range: 0 to 30 % Factory Setting: 15 %
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It defines the maximum overvoltage level in the line in relation to the rated voltage configured in P0296.

With this protection, when the line voltage (P0004) exceeds the value of [(100 % + P0361) x P0296] for more than five seconds, the converter will be disabled by fault F004.

NOTE!
The protection will be disabled if P0361 is set to 0 %.

P0362 – Undervoltage Level in the Line

Adjustable Range: 0 to 30 % Factory Setting: 20 %
Properties: CFG1
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 38 Protections

Description:
It establishes the level for the actuation of the protection against undervoltage in the line (F003) in relation to the rated voltage configured in P0296.

With this protection, when the line voltage (P0004) falls below the value of [100 % – P0362) x P0296] for a period over the setting in P0357, the converter will be disabled by fault F003.

P0363 – Maximum Line Unbalance

Adjustable Range: 0 to 30 %	Factory Setting: 15 %
Properties: CFG1	
Groups of 01 PARAMETER GROUPS	
Access via HMI: ↳ 38 Protections	

Description:
It determines the maximum limit of unbalance between the line voltages (P0033, P0034 and P0035) for the actuation of the protection against line voltage unbalance (F006). Its value is expressed in percentage of the rated voltage configured in P0296.
Thus, if the difference between the values of the line voltages remains above the value set in P0363 for more than two seconds, the converter will be disabled by fault F006.

For the percentage calculation of the difference between the line voltages, the following relations are used:

$$Differ.R-S(\%)=\frac{|P0033-P0034|}{P0296}.100\%, Differ.S-T(\%)=\frac{|P0034-P0035|}{P0296}.100\%, \text{Differ. R}-\text{T}(\%)=\frac{|\text{P0033}-\text{P0035}|}{\text{P0296}}.100\ \%$$

NOTE!
The protection will be disabled if P0363 is set to 0 %.

P0364 – Maximum Variation of the Line Frequency

Adjustable Range: 1 to 10 %	Factory Setting: 5 %
Properties: CFG1	
Groups of 01 PARAMETER GROUPS	
Access via HMI: ↳ 38 Protections	

Description:
It defines the limits of the variation in the line frequency (P0005) for the actuation of the protections against frequency out of range (F008). Its value is expressed in percentage of the rated frequency of the supply line (50 Hz or 60 Hz).

With this protection, when the line frequency (P0005) is below or above the maximum variation set in P0364, the converter will be disabled by fault F008.

The upper and lower limits for the actuation of the protection can be obtained from the equation below:

$$Maximum\ Frequency\ (Hz)=(100\ \%+P0364)\times Freq_{Rat}(50\ /\ 60\ Hz)$$

$$Minimum\ Frequency\ (Hz)=(100\ \%-P0364)\times Freq_{Rat}(50\ /\ 60Hz)$$

Note:

- Parameter P0364 also defines the maximum variation allowed for the field supply frequency when it is supplied externally (through connector X3). In this case, if the field supply frequency is out of the accepted range, the converter will be disabled by fault F009.

7.3.19 Communication [39]

In order to exchange information via communication network, the CTW900 features several standardized communication protocols, such as MODBUS, Profibus, CANopen, DeviceNet, EtherNet/IP and PROFINET.

For further details regarding the inverter configuration to operate in those protocols, refer to the Modbus and Anybus Communication Manual of the CTW900.

Local/ Remote Configuration [110]

In this group are the same parameter as those of the Local Control [27] and Remote Control [28], described in section 7.3.8.

Status / Commands [111]

P0313 – Action for Communication Error
P0680 – Logical Status
P0681 – Speed in 13 bits
P0682 – Control Word via Serial/USB
P0683 – Speed Reference via Serial/USB
P0686 – Control Word via Anybus-CC
P0687 – Speed Reference via Anybus-CC
P0695 – Value for Digital Outputs
P0696 – Value 1 for Analog Outputs
P0697 – Value 2 for Analog Outputs
P0698 – Value 3 for Analog Outputs
P0699 – Value 4 for Analog Outputs

Parameters used to monitor and control the CTW900 when it operates by communication networks.

For further details on these parameters, refer to the Communication Manuals of the CTW900, supplied in the CD-ROM that comes with the product.

Serial RS232 / 485 [112]

P0308 – Serial Address
P0310 – Serial Baud Rate
P0311 – Configuration of the Serial Interface Bytes
P0314 – Serial Watchdog
P0316 – Serial Interface Status

Parameters for the configuration and operation of the serial interface RS-232 and RS-485.

For further details on these parameters, refer to the Modbus Communication Manuals of the CTW900, supplied in the CD-ROM that comes with the product.

Anybus [113]

P0723 – Anybus Identification
P0724 – Anybus Communication Status
P0725 – Anybus Address
P0726 – Anybus Baud Rate
P0728 to P0737 – Anybus Reading #3 to #12
P0738 to P0747 – Anybus Writing #3 to #12

Parameters for the configuration and operation of the Anybus-CC interface.

For further details on these parameters, refer to the Anybus Communication Manuals of the CTW900, supplied in the CD-ROM that comes with the product.

7.3.20 SoftPLC [40]

The SoftPLC function allows the CTW900 to execute functions that are characteristic of a PLC. Using this function you can create interlock logics between inputs and outputs, enabling the execution of specific motor drive sequences.

P1000 – SoftPLC Status

Adjustable Range: 0 = Without Application
1 = Installing Application
2 = Incompatible Application
3 = Application Stopped
4 = Application Running
Factory Setting:
Properties: RO

P1001 – Command for SoftPLC

Adjustable Range: 0 = Stop Application
1 = Run Application
2 = Delete Application
Factory Setting: 0
Properties:

P1002 – Scan Cycle Time

Adjustable Range: 0 to 65535 ms
Factory Setting:
Properties: RO

P1010 up to P1059 – SoftPLC Parameters

Adjustable Range: -32768 to 32767
Factory Setting: 0
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 40 SoftPLC

Description:
These parameters define the functions and form of execution of the SoftPLC application.

For further details regarding the programming of these parameters, refer to the SoftPLC Manual of the CTW900.

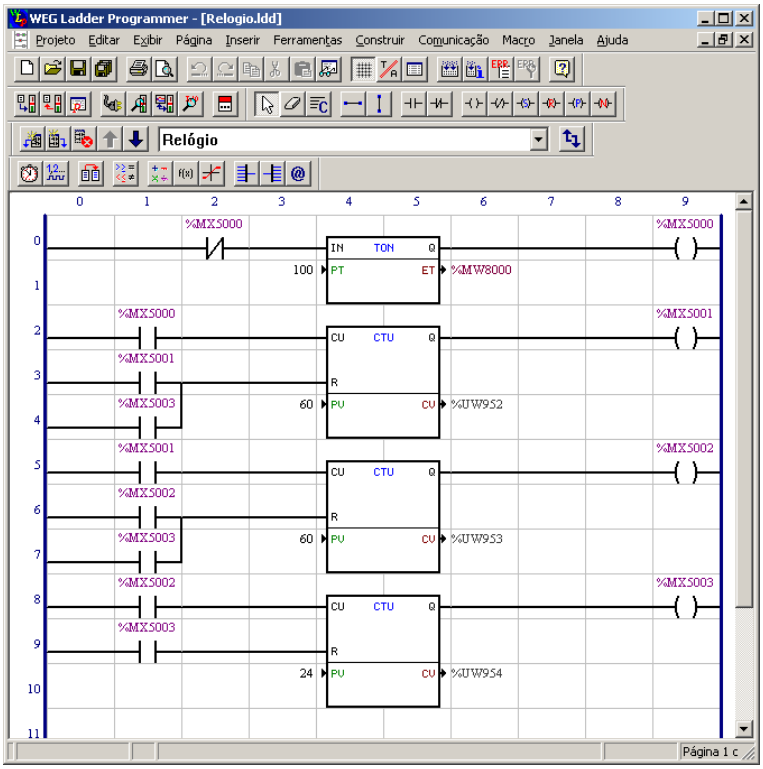


Figure 7.18 – Example o an application for the SoftPLC made on the WLP software

7.3.21 Trace Function [41]

The trace function is used to register variables of interest of the CTW900 (such as current, voltage, speed) when a certain event occurs in the system (alarm/ fault, high current, for instance). This event, for triggering the data storage process, is called trigger in this manual.

Once collected, the variables stored can be viewed as graphics by using the SuperDrive G2 software.

P0550 – Trigger Source for Trace

Adjustable Range: 0 = Inactive
1 = Total Reference
2 = Present Speed
3 = Armature Current
4 = Armature Voltage
5 = Field Current
6 = Motor Torque
7 = AI1
8 = AI2
9 = AI3
10 = AI4

Factory Setting: 0

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 41 Trace Function

Description:
It selects the variable that will be used as trigger source for the Trace function.

These variables can be also used as signal to be collected by means of parameters P0561 to P0564.

NOTE!
This parameter has no effect when P0552 = “Alarm”, “Fault” or “DIx”.

P0551 – Trigger Value for Trace

Adjustable Range: -100.0 to 150.0 %

Factory Setting: 0.0 %

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 41 Trace Function

Description:
It defines the comparison value for the variable selected on P0550.

The full scale of the variables selectable as trigger is shown in the following table:

Table 7.21 – Full scale of the variables selectable as trigger for the Trace function

Variable	Full Scale
Total Reference	100 % = P0134
Present Speed	100 % = P0134
Armature Current	100 % = P0401
Armature Voltage	100 % = P0400
Field Current	100 % = P0404
Motor Torque	100 % = P0401
AI1	100 % = 10 V / 20 mA
AI2	100 % = 10 V / 20 mA
AI3	100 % = 10 V / 20 mA
AI4	100 % = 10 V / 20 mA

NOTE!
This parameter has no effect when P0552 = “Alarm”, “Fault” or “Dlx”.

P0552 – Trigger condition for Trace

Adjustable Range: 0 = P0550* = P0551
1 = P0550* ≠ P0551
2 = P0550* > P0551
3 = P0550* < P0551
4 = Alarm
5 = Fault
6 = Dlx

Factory Setting: 5

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳41 Trace Function

Description:
It defines the condition to start the collection of the signals. Table 7.22 details the available options.

Table 7.22 – Options available for the trigger condition of the Trace function

Option of P0552	Condition to start the Collection
P0550* = P0551	Variable selected in P0550 with value equal to the setting in P0551.
P0550* ≠ P0551	Variable selected in P0550 with value different from the setting in P0551.
P0550* > P0551	Variable selected in P0550 with value higher than the setting in P0551.
P0550* < P0551	Variable selected in P0550 with value lower than the setting in P0551.
Alarm	Detection of an alarm condition on the converter.
Fault	Occurrence of a fault on the converter.
Dlx	Digital input active.

For P0552 = 6 (option “Dlx”), it is necessary to select the option “Trace Function” in the parameter related to the digital input used for this function. You can find more details in section 7.3.14, in the description of parameters P0263 to P0270.

Notes:

- If P0552 = 6 and none of the DIs is configured for the “Trace Function”, the trigger will not occur;
- If P0552 = 6 and multiple DIs are configures for the “Trace Function”, it is just necessary that one of them be active for the trigger to occur;
- If P0552 ≠ 6 and some DI is configured for “Trace Function”, the trigger will never occur by the activation of the DI.

P0553 – Trace Sampling Period

Adjustable Range: 0 to 65535

Factory Setting: 1

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳41 Trace Function

Description:
It defines the Trace sampling period (time between two sample points) in multiples of 200µs.

P0554 – Trace Pre-Trigger

Adjustable Range: 0 to 100 %

Factory Setting: 0 %

Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳41 Trace Function

Description:
Percentage of data that will be recorded before the occurrence of the trigger event.

P0559 – Maximum Trace Memory

Adjustable Range: 0 to 100 % Factory Setting: 0 %
Properties:
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 41 Trace Function

Description:
It defines the quantity of memory the user wishes to set aside for points of the Trace function. The adjustable range, from 0 to 100 %, corresponds to requesting the reservation of 0 to 15 Kbytes for the Trace Function.

Each point stored by the function takes two bytes in the memory of the CTW900. This parameter defines, indirectly, the maximum number of points the user can store by means of this function.

The memory area used by the Trace function is shared with the memory for the SoftPLC application. When there is an application of the SoftPLC on the converter, the quantity of memory really available for the Trace function can be smaller than the value set in P0559. The indication of the quantity of memory effectively available is done in the reading parameter P0560.

NOTE!
As factory setting, the memory available for the Trace function is totally directed to the SoftPLC applications (P0559 = 0 %). Therefore, when you wish to use this function, it is necessary to set P0559 to a value different from 0 %.

P0560 – Memory Available for Trace

Adjustable Range: 0 to 100 % Factory Setting: 0 %
Properties: RO
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 41 Trace Function

Description:
It shows the quantity of memory available to store points of the Trace function. The variation range, from 0 to 100 %, indicates that from 0 to 15 Kbytes are available for this function.

Sharing of the memory with the SoftPLC

The memory for the Trace function is shared with the memory for the SoftPLC applications. Thus:

- if P1000 = 0 (without SoftPLC application), it is possible to use all the memory area for the Trace function. In this case, P0559 = P0560;
- if P1000 > 0 (with SoftPLC application on the converter), P0560 will show the remaining area to store data of the Trace function, discounting the area taken by the SoftPLC application.

NOTE!
If the value of P0560 is smaller than the setting of P0559 and the user wishes to use more memory for the Trace function, the SoftPLC application must be erased by means of parameter P1001.

P0561 – CH1: Channel 1 of Trace

P0562 – CH2: Channel 2 of Trace

P0563 – CH3: Channel 3 of Trace

P0564 – CH4: Channel 4 of Trace

Adjustable Range: 0 = Inactive
1 = Total Reference
2 = Present Speed
3 = Armature Current
4 = Armature Voltage
5 = Field Current
6 = Motor Torque
7 = AI1
8 = AI2
9 = AI3
10 = AI4

Factory Setting: P0561 = 1
P0562 = 2
P0563 = 3
P0564 = 0

Properties:

Groups of 01 PARAMETER GROUPS

Access via HMI: ↳ 41 Trace Function

Description:

They select the signals that will be recorded on channels 1 to 4 of the Trace function.

The options for these parameters are the same as those presented in P0550. By selecting the option “Inactive”, the total memory available for the Trace function is distributed among the other active channels.

P0571 – Start Trace

Adjustable Range: 0 = Inactive
1 = Active

Factory Setting: 0

Properties:

Groups of 01 PARAMETER GROUPS

Access via HMI: ↳ 41 Trace Function

Description:

It starts the waiting for the trigger of the Trace function.

Since this is a parameter that can be changed with the converter running, it is not necessary to press “Save” on the keypad for the waiting for the trigger to start.

Notes:

- This parameter has no effect if there are no active channels, or if there is no available memory for the Trace function (P0560 = 0).
- P0571 returns automatically to 0, for safety, in case any of the parameters between P0550 and P0564 is changed.

P0572 – Day/ Month of the Trace Trigger

Adjustable Range: 00/00 to 31/12

Factory Setting:

P0573 – Year of the Trace Trigger

Adjustable Range: 00 to 99

Factory Setting:

P0574 – Hour of the Trace Trigger

Adjustable Range: 00:00 to 23:59

Factory Setting:

P0575 – Second of the Trace Trigger

Adjustable Range: 00 to 59 Factory Setting:
Properties: RO
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 41 Trace Function

Description:
P0572 to P0575 record the date and time of the occurrence of the trigger. These parameters and the points collected by the Trace function are not saved when the converter is powered down.

In case the values of P0572 to P0575 are null, that indicates that no collections were made after the powering up of the converter or that the Trace was done without the keypad connected to the converter (without RTC).

P0576 – Trace Function Status

Adjustable Range: 0 = Inactive Factory Setting:
1 = Waiting
2 = Trigger
3 = Concluded
Properties: RO
Groups of 01 PARAMETER GROUPS
Access via HMI: ↳ 41 Trace Function

Description:
It indicates if the Trace function was started, if a trigger has already occurred and if the signals have already been completely collected.

7.4 ORIENTED START-UP [02]

P0317 – Oriented Start-Up

Adjustable Range: 0 = No Factory Setting: 0
1 = Yes
Properties: CFG2
Groups of Acess via HMI: 02 ORIENTED START-UP

Description:
The objective of the Start-Up function is to present a sequence minimally necessary to put the converter into operation.

The parameters to be set and the sequence in which they are displayed are shown in Figure 6.2 of section 6.2.2.

The exit of Oriented Start-up routine can be done by means of the 'Reset' soft key or key.

7.5 CHANGED PARAMETERS [03]

Groups of Access via HMI: 03 CHANGED PARAMEERS

All parameters with content different from the factory setting can be viewed in sequence in this menu.

7.6 BASIC APPLICATION [04]

Groups of Access via HMI: 04 BASIC APPLICATION

In this group are the parameters common to most applications.

For further details, refer to section 6.2.3.

7.7 SELF-TUNING [05]

Groups of Access via HMI: 05 SELF-TUNING

Function not implemented in this version.

7.8 BACKUP PARAMETERS [06]

The CTW900 Backup functions allow saving the converter present contents in a specific memory, or the opposite, that is, overwriting the converter present parameters with the memory content).

P0204 – Load/ Save Parameters

Adjustable Range: 0 = Not used
1 = Reset P0043
2 = Reset P0044
3 = Load Default
4 = Load User 1
5 = Load User 2
6 = Load User 3
7 = Saver User 1
8 = Saver User 2
9 = Saver User 3

Factory Setting: 0

Properties: CFG1

Groups of Acess via HMI: 06 BACKUP PARAMETERS

Description:

It allows saving the present parameters of the CTW900 in an area of the EEPROM memory of the control module or the opposite, that is, loading the parameters with the content of this area. It also allows resetting the Time Enabled (P0043), and kWh (P0044) counters. Table 7.23 describes the actions performed by each option.

Table 7.23 – Options of parameter P0204.

P0204	Action
0	**Not used:** no action.
1	**Reset P0043:** resets the time enabled counter.
2	**Reset P0044:** resets the kWh counter.
3	**Load default:** loads the present parameters of the CTW900 with the factory settings.
4	**Load User 1:** loads the present parameters of the CTW900 with the content of the parameter memory 1.
5	**Load User 2:** loads the present parameters of the CTW900 with the content of the parameter memory 2.
6	**Load User 3:** loads the present parameters of the CTW900 with the content of the parameter memory 3.
7	**Save User 1:** transfers the content of the present parameters of the CTW900 to the parameter memory 1.
8	**Save User 2:** transfers the content of the present parameters of the CTW900 to the parameter memory 2.
9	**Save User 3:** transfers the content of the present parameters of the CTW900 to the parameter memory 3.

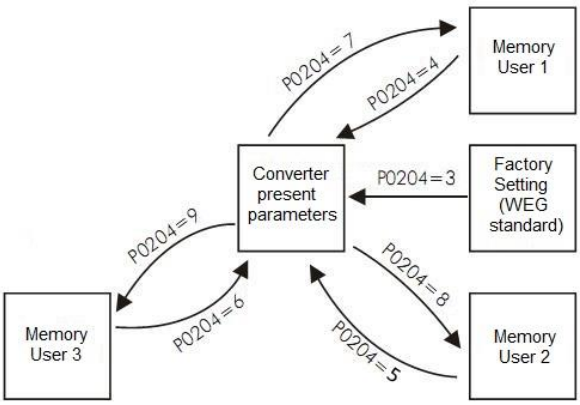


Figure 7.19 – Transfer of parameters by means of P0204

In order to load the parameters of User 1, User 2 and/or User 3 to the CTW900 operating area (P0204=4, 5 or 6), it is necessary that those areas be previously saved.

The operation of loading one of those memories can also be done via digital inputs (DIx). For further details on programming, refer to the item 7.3.14.

NOTE!
When P0204 = 3, parameters P0201 (Language), P0296 (Line Rated Voltage) and P0308 (Serial Address) are not changed to the factory settings.

P0318 – Copy Function of Memory Card

Adjustable Range: 0 = Inactive
1 = CTW900 → Memory Card
2 = Memory Card → CTW900
Factory Setting: 0

Properties: CFG1

Groups of Acess via HMI: 06 BACKUP PARAMETERS

Description:
This function allows saving the content of the writing parameters of the CTW900 to the FLASH Memory Module (MMF), and vice-versa, and can be used to transfer the content of the parameters from one CTW900 to another.

Table 7.24 – Options of parameter P0318

P0318	Action
0	Inactive: no action.
1	CTW900 → Memory Card: transfers the present content of the CTW900 parameters to the Flash memory.
2	Memory Card → CTW900: transfers the content of the parameters stored in the Flash memory to the control board of the CTW900.

After storing the parameters of the CTW900 in a FLASH Memory Module, it is possible to transfer them to another CTW900 using this function. However, if the converters have incompatible software versions, the keypad will display the message: "FLASH Memory Module with invalid parameters" and the copy will not be done.

Note: This parameter will only be visible if the FLASH memory module is installed on the converter.

NOTE!
During the operation of the CTW900, the modified parameters are saved on the FLASH Memory Module, regardless of the user's command. This ensures that the flash memory module will always have an updated copy of the converter parameters.

NOTE!
When the CTW900 is powered and the memory module is present, the present parameter contents are compared to the contents of the parameters saved on the flash memory module and, in case they are different, the keypad (HMI) will display the message "FLASH Memory Module with different parameters" and, after 3 seconds, the message is replaced by P0318 parameter menu. The user has the option of overwriting the contents of the memory module (choosing P0318 = 1) or overwriting the converter parameters (choosing P0318 = 2), or even ignoring the message by choosing P0318 = 0.

NOTE!
When using the network communication board or SoftPLC function, it is recommended to set the parameter P0318 = 0.

P0319 – Copy Function of Keypad (HMI)

Adjustable Range: 0 = Inactive
1 = CTW900 → HMI
2 = HMI → CTW900

Factory Setting: 0

Properties: CFG1

Groups of Acess via HMI: 06 BACKUP PARAMETERS

Description:

The Copy Function of Keypad is similar to the previous function, and is also used to transfer the content of the parameters from one CTW900 to another (others). The converters must have the same software version for the transfer to be effected.

Table 7.25 – Options of parameter P0319

P0319	Action
0	Inactive: no action
1	CTW900 → HMI: transfers the present content of the parameters of the CTW900 and of the user's memories 1/2/3 to the nonvolatile memory of the keypad (EEPROM). The present parameters of the parameter remain unchanged.
2	HMI → CTW900: transfers the content of the nonvolatile memory of the keypad (EEPROM) to the present parameters of the CTW900 and to the user's memories 1/2/3.

NOTE!
In case the keypad (HMI) had been previously loaded with parameters from a version "different" from that of the CTW900 where you are trying to copy the parameters to, the operation will not be effected and the keypad (HMI) will display fault F082 (Copy Function Fault). It is understood as a "different" version those which are different in "x" or "y", assuming that the software version numbering is described as Vx.yz.

Examples: Keypad Version→V1.60 (x=1, y=6 and z=0).

a) CTW900 Version→ V1.75 (x'=1, y'=7 and z'=5)
Action: P0319=2
Result: Fault F082 (y ≠ y')

b) CTW900 Version→ V1.62 (x'=1, y'=6 and z'=2)
Action: P0319=2
Result: Normal copy (y = y' and x= x')

In order to copy the parameters from one CTW900 to another, you must proceed as follows:

1. Connect the keypad (HMI) to the CTW900 from which you wish to copy the parameters (CTW900 n.1);
2. Set P0319=1 (Conv. → Keypad) to transfer the parameters of the CTW900 n.1 to the keypad;
3. Press the key right soft key "Save". P0319 returns automatically to 0 (Inactive) as soon as the transfer is finished;
4. Disconnect the keypad from the CTW900 n.1;
5. Connect the same keypad (HMI) to the CTW900 to which you want to transfer the parameters (CTW900 n.2);
6. Set P0319=2 (Keypad → Conv.) in order to transfer the content of the nonvolatile memory of the keypad (EEPROM) to the CTW900 n.2;
7. Press the key right soft key "Save". When P0319 returns to 0 the transfer of the parameters has been finished. From that moment on the CTWs 1 and 2 will have the same parameter content;
8. In order to copy the parameter content from the CTW9001 to other CTWs, repeat the same steps 5 to 7 described above.

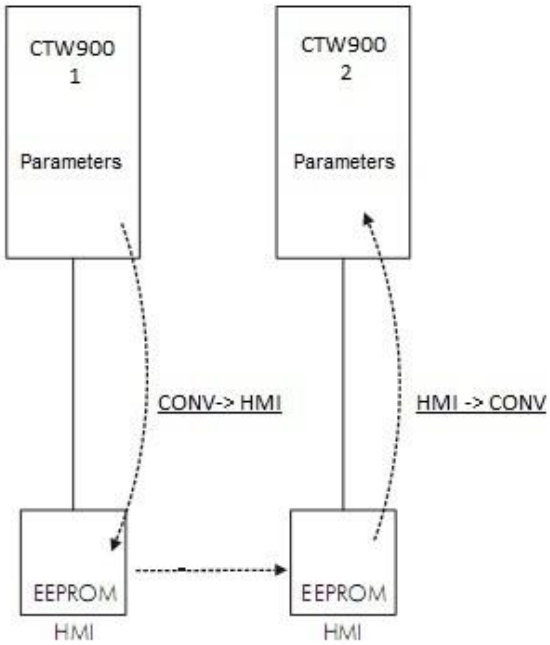


Figure 7.20 – Copy of parameters between converters by means of the Copy Keypad function

NOTE!
While the keypad (HMI) is performing the reading or writing procedure, it will not be possible to operate it.

7.9 FAULT HISTORY [08]

In this group are described the parameters that record the last faults occurred on the converter, together with other relevant information for the interpretation of the fault, such as date, time, motor current, etc.

NOTE!
If a fault occurs simultaneously with the power-up or reset of the converter, the parameters of date and time regarding this fault may contain invalid information.

P0050 – Last Fault
P0054 – Second Fault
P0058 – Third Fault
P0062 – Fourth Fault
P0066 – Fifth Fault
P0070 – Sixth Fault
P0074 – Seventh Fault
P0078 – Eighth Fault
P0082 – Ninth Fault
P0086 – Tenth Fault

Adjustable Range: 0 to 999	Factory Setting:
Properties: RO	
Groups of Access via HMI:	08 FAULT HISTORY

Description:
They display the codes of the ten last faults occurred.

The recording and overwriting system of the older faults is done the following way:

Fxxx → P0050 → P0054 → P0058 → P0062 → P0066 → P0070 → P0074 → P0078 → P0082 → P0086

P0051 – Last Fault Day/ Month
P0055 – Second Fault Day/ Month
P0059 – Third Fault Day/ Month
P0063 – Fourth Fault Day/ Month
P0067 – Fifth Fault Day/ Month
P0071 – Sixth Fault Day/ Month
P0075 – Seventh Fault Day/ Month
P0079 – Eighth Fault Day/ Month
P0083 – Ninth Fault Day/ Month
P0087 – Tenth Fault Day/ Month

Adjustable Range: 00/00 to 31/12 Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
They display the month of the ten last faults occurred.

P0052 – Last Fault Year
P0056 – Second Fault Year
P0060 – Third Fault Year
P0064 – Fourth Fault Year
P0068 – Fifth Fault Year
P0072 – Sixth Fault Year
P0076 – Seventh Fault Year
P0080 – Eighth Fault Year
P0084 – Ninth Fault Year
P0088 – Tenth Fault Year

Adjustable Range: 0 to 2099 Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
They display the year of the ten last faults occurred.

P0053 – Last Fault Time

P0057 – Second Fault Time

P0061 – Third Fault Time

P0065 – Fourth Fault Time

P0069 – Fifth Fault Time

P0073 – Sixth Fault Time

P0077 – Seventh Fault Time

P0081 – Eighth Fault Time

P0085 – Ninth Fault Time

P0089 – Tenth Fault Time

Adjustable Range: 00:00 to 23:59 Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
They display the time of the ten last faults occurred.

P0090 – Armature Current at the Moment of the Last Fault

Adjustable Range: 0 to 5000.0A Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
Record of the armature current supplied by the converter at the moment of the occurrence of the last fault.

P0091 – Armature Voltage at the Moment of the Last Fault

Adjustable Range: 0 to 2000 V Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
Record of the armature voltage at the converter output at the moment of the occurrence of the last fault.

P0092 – Speed at the Moment of the Last Fault

Adjustable Range: 0 to 10000 rpm Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
Record of the motor speed at the moment of the occurrence of the last fault.

P0093 – Total Reference at the Moment of the Last Fault

Adjustable Range: -10000 to 10000 rpm Factory Setting:
Properties: RO
Groups of 08 FAULT HISTORY
Access via HMI:

Description:
Record of the total speed reference at the moment of the occurrence of the last fault.

P0094 – Field Current at the Moment of the Last Fault

Adjustable Range: 0 to 60.0 A	Factory Setting:
Properties: RO	
Groups of 08 FAULT HISTORY	
Access via HMI:	

Description:
Record of the field current supplied by the converter at the moment of the occurrence of the last fault.

P0096 – DIx Status at the Moment of the Last Fault

Adjustable Range: Bit 0 = DI1 Bit 1 = DI2 Bit 2 = DI3 Bit 3 = DI4 Bit 4 = DI5 Bit 5 = DI6 Bit 6 = DI7 Bit 7 = DI8	Factory Setting:
Properties: RO	
Groups of 08 FAULT HISTORY	
Access via HMI:	

Description:
It indicates the status of the digital inputs at the moment of the last fault occurrence.

The indication is done by means of the numbers 1 and 0, representing, respectively, the "Active" and "Inactive" status of the inputs. The status of each input is considered as one digit in the sequence, where DI1 represents the least significant digit.

Example: If parameter P0096 contains the sequence 00010011, it means digital inputs 5, 2 and 1 were active at the moment of occurrence of the last fault.

P0097 – DOx Status at the Moment of the Last Fault

Adjustable Range: Bit 0 = DO1 Bit 1 = DO2 Bit 2 = DO3 Bit 3 = DO4 Bit 4 = DO5	Factory Setting:
Properties: RO	
Groups of 08 FAULT HISTORY	
Access via HMI:	

Description:
It indicates the status of the digital outputs at the moment of the occurrence of the last fault.

The indication is done by means of the numbers 1 and 0, representing, respectively, the "Active" and "Inactive" status of the outputs. The status of each output is considered as one digit in the sequence, where DO1 represents the least significant digit.

Example: If parameter P0097 contains the sequence 01001, it means digital outputs 4 and 1 were active at the moment of occurrence of the last fault.

7.10 READ ONLY PARAMETERS [09]

In order to simplify the view of the main reading variables of the do CTW900, you may directly access the group [09] – "Read Only Parameters".

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

P0001 – Speed Reference

Adjustable Range: 0 to 10000 rpm Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

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

The display unit can be changed by means of P0209, P0210 and P0211, as well as its scale by means of P0208 and P0212.

P0002 – Current Speed

Adjustable Range: 0 to 10000 rpm Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
This parameter indicates the present motor speed value in rpm (factory setting) with filter of 0.5 s.

The display unit can be changed means of P0209, P0210 and P0211, as well as its scale by means of P0208 and P0212.

P0003 – Armature Current

Adjustable Range: 0.0 to 5000.0 A Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the current of the motor armature circuit in Amps (A) with filter of 0.5 s.

P0004 – Power Line Voltage

Adjustable Range: 0 to 1000 V Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present power line voltage (R/S/T) in Volts (V).

P0005 – Power Line Frequency

Adjustable Range: 0.0 to 100.0 Hz Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
Actual value of the power line frequency (R/S/T) in Hertz (Hz).

P0006 – Converter Status

Adjustable Range: 0 = Disabled
1 = Ready
2 = Run
3 = Undervoltage
4 = Fault
5 = Self-Tuning
6 = Configuration
7 = Blocked
8 = Up Ramp
9 = Down Ramp

Factory Setting:

Properties: RO

Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates one of the ten possible status of the CTW900. See the description of each status in the following table.

Table 7.26 –Description of the status of the CTW900

Status	Description
Disabled	Indicates the converter is energized and without faults, but without the General Enable command.
Ready	Indicates the converter is enabled and with the field excited, ready to produce torque.
Run	Indicates the converter is running in the programmed reference.
Undervoltage	Indicates the converter has a insufficient voltage for the operation and it will not accept the enable command.
Fault	Indicates the converter is in the fault status.
Self-Tuning	Indicates the converter is executing the self-tuning routine (function not implemented).
Configuration	Indicates the converter is in the Oriented Start-up routine or with incompatible parameter setting (see Table 7.27).
Blocked	Indicates the converter is disabled by the Stop Logic function.
Up Ramp	Indicates the converter is executing the acceleration ramp.
Down Ramp	Indicates the converter is executing the deceleration ramp.

The converter status is also shown on the upper left corner of the keypad (see Figure 4.6). In some status, however, the status is shown abbreviated due to space.

P0007 – Armature Voltage

Adjustable Range: -2000 to 2000 V

Factory Setting:

Properties: RO

Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the present output voltage (A1/B2) for the motor armature circuit in Volts (V).

P0008 – Field Current

Adjustable Range: 0.0 to 55.0 A

Factory Setting:

Properties: RO

Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the current of the motor field circuit in Amps (A).

P0009 – Motor Torque

Adjustable Range: -1000.0 to 1000.0 %

Factory Setting:

Properties: RO

Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the torque developed by the motor in relation to its armature rated current (P0401).

$$P0009\ (\%) = \left(\frac{P0003}{P0401}\right) \times 100\ \%$$

For the case in which the motor is running above the rated speed, the calculation of torque must also take into account the motor speed:

$$P0009\ (\%) = \left(\frac{P0003}{P0401}\right) \times \left(\frac{P0402}{P0002}\right) \times 100\ \%$$

Note: The torque will be negative if the motor is running in the reverse direction.

P0010 – Output Power

Adjustable Range: 0.0 to 6553.5 kW — Factory Setting:
Properties: RO
Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the instant output power of the converter, in kilowatt (kW), calculated by multiplying the armature voltage (P0007) by the armature current (P0003).

NOTE!
The value indicated in this parameter must not be used to measure the energy consumption.

P0011 – Selected Bridge

Adjustable Range: 0 = Bridge A
1 = Bridge B — Factory Setting:
Properties: RO
Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the selected bridge for the triggering of the armature circuit. This selection is automatically done by the control circuit of the CTW900, according to the needs of reverse or braking.

Note: commutation to Bridge B only occurs in Antiparallel converter (CTW900 **A**).

P0012 – DI8 to DI1 Status

Refer to the section 7.3.14.

P0013 – DO5 to DO1 Status

Refer to the section 7.3.15.

P0014 – Value of AO1

P0015 – Value of AO2

P0016 – Value of AO3

P0017 – Value of AO4

Refer to the section 7.3.13.

P0018 – Value of AI1

P0019 – Value of AI2

P0020 – Value of AI3

P0021 – Value of AI4

Refer to the section 7.3.12.

P0022 – Tacho DC Voltage

Adjustable Range: -500.0 to 500.0 V Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present voltage of the motor DC tacho, in Volts (V).

P0023 – Software Version

Refer to section 7.3.16.

P0024 – Armature Firing Angle

P0025 – Field Firing Angle

Adjustable Range: 0.0 to 180.0 ° Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present firing angle of the armature bridges (P0024) and of the field (P0025) in electric degrees.

P0026 – EMF Voltage

Adjustable Range: -2000 to 2000 V Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present EMF voltage of the motor in Volts (V).

This parameter will only have value different from P0007 when the value of the armature resistance (P0409) is not null.

P0027 – Configuration of Accessories 1

P0028 – Configuration of Accessories 2

Refer to the section 7.3.16.

P0030 – Heatsink Temperature

Refer to the section 7.3.18.

P0033 – Line Voltage R-S

P0034 – Line Voltage S-T

P0035 – Line Voltage T-R

Adjustable Range: 0 to 1000 V Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
They indicate the voltages of the power line (R/S/T) in Volts (V).

P0038 – Encoder Speed

Adjustable Range: 0 to 65535 rpm Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present encoder speed in revolutions per minute (rpm) with filter of 0.5 s.

P0039 – Counter of Encoder Pulses

Adjustable Range: 0 to 40000 Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
These parameters show the count of the encoder pulses, which can be in the up (forward spinning) or down (reverse spinning) mode.

P0040 – Tacho DC Speed

Adjustable Range: 0 to 65535 rpm Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present motor speed in rpm through the feedback by Tacho DC (when connected).

P0041 – Speed by EMF

Adjustable Range: 0 to 65535 rpm Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the present motor speed in rpm calculated by the value of EMF.

P0042 – Time Powered

Adjustable Range: 0 to 65535 h Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the total number of hours that the converter remained powered.

This value is kept even when the converter is powered down.

P0043 – Time Enabled

Adjustable Range: 0 to 65535 h Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the total time the converter remained enabled ('Run', 'Up Ramp' or 'Down Ramp' status).
This value is maintained even when the converter is powered down. If you wish to reset this parameter, set P0204 = 1.

P0044 – kVAh Counter

Adjustable Range: 0 to 65535 h Factory Setting:
Properties: RO
Groups of 09 READ ONLY PARAMETERS
Access via HMI:

Description:
It indicates the energy consumed by the motor.

This value is kept even when the converter is powered down. If you wish to reset this parameter, set P0204 = 2.

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

P0046 – Total Speed Reference

Adjustable Range: -10000 to 10000 rpm Factory Setting:
Properties: RO
Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
This parameter displays the value of the total speed reference, which is the ramp output reference added to possible additional references via analog input and also with the JOG+ and JOG- references.

For further details, check the Speed Reference block diagram in Figure 7.3.

P0047 – Torque Auxiliary Reference

Adjustable Range: 0.0 to 125.0 % Factory Setting:
Properties: RO
Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
This parameter displays the value of the torque auxiliary reference when some analog input is configured for the "Current Auxiliary Reference" (P0231/P0236/P0241/P0246 = 2).

For further details, refer to Figure 7.7.

P0048 – Present Alarm

P0049 – Present Fault

Adjustable Range: 0 to 999 Factory Setting:
Properties: RO
Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the alarm (P0048) or the fault (P0049) number that may occasionally be present on the converter.

In order to understand the meaning of the codes used for the faults and alarms, refer to chapter 2 and/or section 7.3.18.

P0098 – Phase Sequence

Adjustable Range: 0 = RST Factory Setting:
1 = RTS
Properties: RO
Groups of Access via HMI: 09 READ ONLY PARAMETERS

Description:
It indicates the phase sequence of the power supply.

7.11 PARAMETER INCOMPATIBILITY

In order to prevent drive or control problems, the CTW900 identifies and signals parameterization combinations that can lead to an undefined operating situation.

Thus, in case some of the conditions of Table 7.27 occurs, the converter will signal the incompatibility on the display and will go into the Configuration status ("Config", on the keypad), preventing its enabling until the programming conflict is solved.

Table 7.27 – Parameter incompatibility

Incompatible Programming	Related Parameter Group	Parameters to Be Checked
Multiple AIs programmed for "Pos. Curr. Lim." (option 3) or "I+/I- Curr. Lim." (option 5).	[32] Analog Inputs	P0231, P0236, P0241, P0246
Multiple AIs programmed for "Neg. Curr. Lim." (option 4) or "I+/I- Curr. Lim." (option 5).		
Multiple DIs programmed for "Forward Run" function (option 4).	[34] Digital Inputs	P0263, P0264, P0265, P0266 P0267, P0268, P0269, P0270
Multiple DIs programmed for "Reverse Run" function (option 5).		
Multiple DIs programmed for "3-Wire Start" function (option 6).		
Multiple DIs programmed for "3-Wire Stop" function (option 7).		
Multiple DIs programmed for "FWD/REV" function (option 8).		
Multiple DIs programmed for "Local/Remote" function (option 9).		
Multiple DIs programmed for "Increase E.P." function (option 11).		
Multiple DIs programmed for "Decrease E.P." function (option 12).		
Multiple DIs programmed for "2nd Ramp" function (option 14).		
Multiple DIs programmed for "Speed/Torque" function (option 15).		
Multiple DIs programmed for "Speed Regulator Gains" function (option 21).		
Multiple DIs programmed for "Param. Setting Off" function (option 22).		
Multiple DIs programmed for "Load User 1/2" function (option 23).		
Multiple DIs programmed for "Load User 3" function (option 24).		
DIx programmed for the "Forward Run" function without DIx programmed for the "Reverse Run" function.		
DIx programmed for the "Reverse Run" function without DIx programmed for the "Forward Run" function.		
DIx programmed for the "Start" function without DIx programmed for the "Stop" function.		
DIx programmed for the "Stop" function without DIx programmed for the "Start" function.		
DIx programmed for the "Run/Stop" (option 1) + DIx programmed for the "3-Wire Start" function.		
DIx programmed for the "Run/Stop" (option 1) + DIx programmed for the "Forward Run" function.		
DIx programmed for the "FWD/REV" function (option 8) + DIx programmed for the "Reverse Run" function.		
DIx programmed for the "Increase E.P." function without DIx programmed for the "Decrease E.P.".		
DIx programmed for the "Decrease E.P." function without DIx programmed for the "Increase E.P.".		
P0221 and/or P0222 = E.P. (option 7) without DIx programmed for "Increase E.P." or "Decrease E.P.".		
P0224 and/or P0227 = DIx (option 1) without DIx programmed for "Run/Stop".		
P0223 and/or P0226 = DIx (option 1) without DIx programmed for "FWD/REV" or "Reverse Run".		
P0221 and/or P0222 = Multispeed (option 8) without DIx programmed for "Multispeed" (option 13).	[34] Digital Inputs	P0266, P0267, P0268
DIx programmed for "Increase E.P." or "Decrease E.P." without P0221 and/or P0222 programmed for "E.P.".	[27] Local Control [28] Remote Control [29] Run/JOG Config.	P0221, P0222, P0223, P0224, P0226, P0227
DIx programmed for "Multispeed" without P0221 and/or P0222 programmed for "Multispeed".		
DIx programmed for the "Forward Run" function without P0224 or P0227 programmed for "DIx".		
DIx programmed for the "Reverse Run" function without P0223 or P0226 programmed for "DIx".		

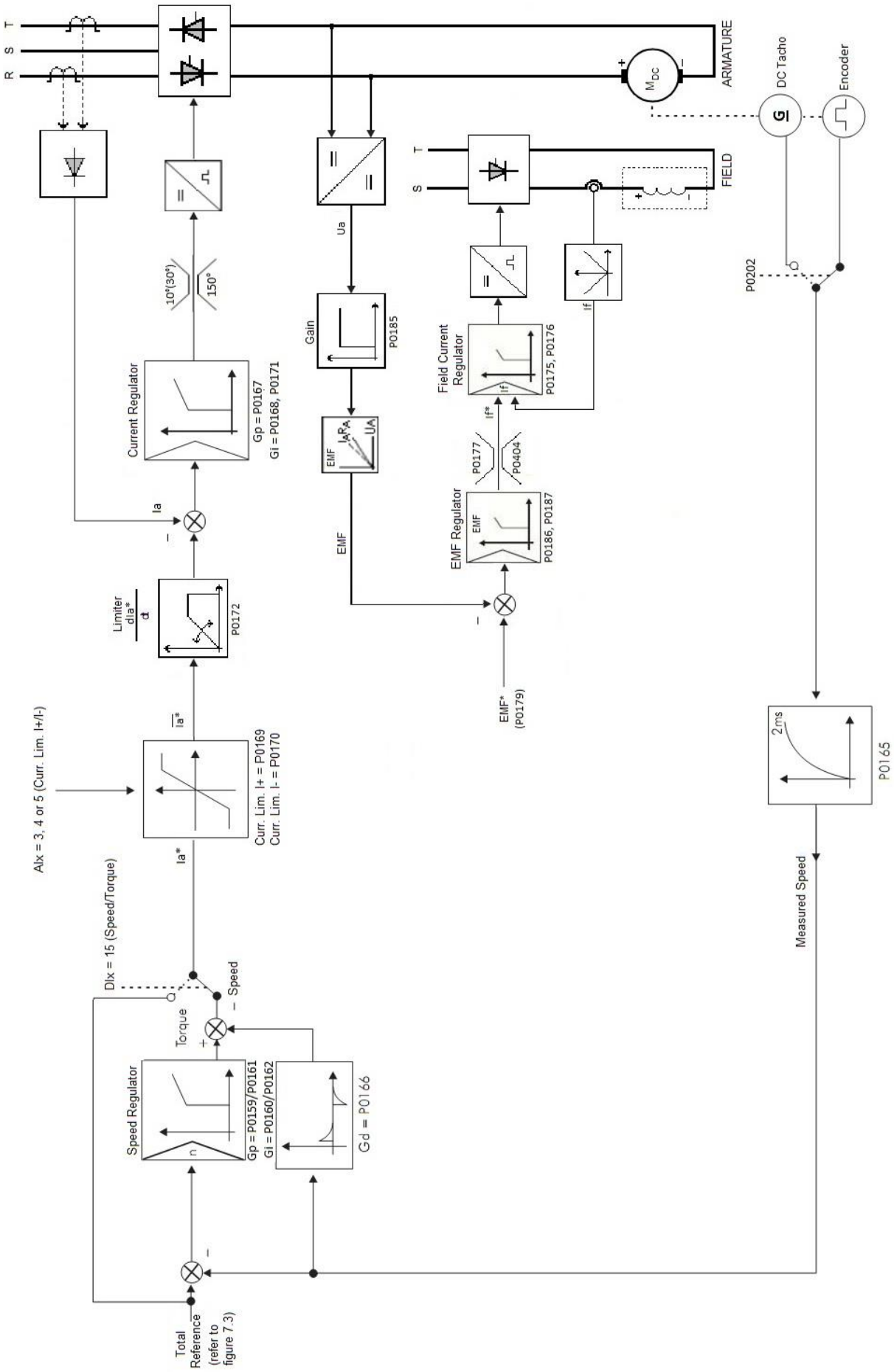


Figure 7.21 – Block diagram of the control of the CTW900

8 TROUBLESHOOTING AND MAINTENANCE

8.1 SOLVING THE MOST COMMON PROBLEMS

Problem	Point to Be Checked	Corrective Action
Motor will not spin	Wiring	■ Check all the power and control connections. If there are digital inputs programmed as Run/Stop, General Enable or Without External Fault, they must be connected to 24 Vdc or DGND (see Figure 5.9). ■ Check if there is no short circuit between terminals XC1:11 and 13 (short circuit in the 24 Vdc power supply).
	Speed Reference	■ Check the speed reference setting: If it is too low, the motor cannot start. ■ If an external signal is being used for reference, check the wiring and if it is properly connected.
	Programming	■ Check if the torque current limits (P0169 and P0170) are too low. ■ Check if the acceleration ramp time is too high (P0100 and P0102).
	Fault	■ Check if the converter is not disabled due to a fault condition.
	Armature Circuit	■ Check the ultrafast fuses of the armature output (for converter 4-Q). ■ Check the thermostat of the DC motor (if applicable).
	Locked Rotor	■ Check if the rotor is mechanically locked.
Burn of UF fuses at power-up	Armature Circuit	■ Check if the armature circuit is in short circuit (thyristor damaged).
	Fuses	■ Check if the fuses were specified correctly (Tables 5.2 and 5.3).
	Programming	■ Check if the parameterization is according to the application (especially the settings of P0169/P0170 and P0100/P0102).
	Ground Insulation	■ Check if the motor or converter have ground insulation problems.
Burn of the UR fuses in the braking (CTW900 4-Q)	Thyristors	■ Check if any thyristors are in short circuit.
	Power Line Voltage	■ Check if there are momentary faults in the line voltage.
	Armature Voltage	■ Check if the armature voltage is above the maximum rated speed.
Burn of UR fuses when the motor load varies or the motor accelerates/brakes (CTW900 4-Q)	Programming	■ Check if the current limits (P0169 and P0170) are too low. ■ Check if the dynamic of the current regulator is well set (see section 6.4.2).
Incorrect speed control	Feedback	■ If the feedback is by EMF, check if the setting of P0400 and P0402 is according to the data of the motor nameplate. ■ If the feedback is by tachogenerator, check if its connection is according to the desired operating range (see section 6.3.2) and if the setting of P0406 is correct. ■ If the feedback is by encoder, check if the setting of P0405 is correct.
	Armature Current	■ Check if the motor is operating in current limitation and, in this cases, set the value of P0169/P0170.
	Speed Reference	■ If an external signal is used for reference, check if the signal level is correct. Also check the programming of gains and offset (P0232 to P0249).
	Programming	■ Check if the setting of minimum speed (P0133) and maximum speed (P0134) is correct.
	Field Current	■ Check if the field current is oscillating.
Oscillation of the motor current and/or speed	Regulators	■ Check if the current and speed regulator are well set (see section 6.4).
	Tachogenerators	■ Check if the signal of the tachogenerator presents noise. ■ Check if the coupling of the tachogenerator is properly fastened. ■ Check if the cable of the tachogenerator is close to the power cables and, if so, if the cable used is shielded.
	Analog Reference	■ Check if the analog reference signal is varying. If the reason is electric noise, use shielded cables or move the cable away from the power or control wiring. ■ If a potentiometer is being used to generate the reference signal, check if it is working properly.
Motor will not go into field weakening	Feedback	■ Check if P0202 (Speed Feedback) is configured for Taco DC or Encoder, because it is not possible to operate in the field weakening area by EMF.
	Programming	■ Check if the value of P0177 (Minimum Field Current) is correct (smaller than P0404). ■ Check the setting of P0179 (Field Weakening Point) and P0400 (Rated Armature Voltage).
Display off	Keypad Connection	■ Check if the keypad connection to the converter is correct.
	Electronics Fuse	■ Check if fuse F1 of the electronics (located on the IC900 board) is burned. If so, replace it.

8.2 PREVENTIVE MAINTENANCE

When installed in proper environments and operating conditions, the CTW900 requires little maintenance. Table 8.1 provides the recommended inspections to be performed every 6 months after the start-up.

DANGER!
- Always disconnect the general power supply before touching any electrical component connected to the converter.
- High voltages may be present even after the disconnection of the power supply; wait for at least ten minutes for the full discharge of the capacitors.
- Always connect the equipment frame to the protective ground (PE). Use the adequate connection terminal at the inverter.

ATTENTION!
Electronic boards have components sensitive to electrostatic discharges.
Do not touch the components or connectors directly. If necessary, first touch the grounded metallic frame or wear a proper ground strap.

Do not carry out any applied potential test on the converter!
If necessary, consult WEG.

Table 8.1 – Periodic inspections every six months

Component	Abnormality	Corrective Action
Terminals, Connectors	Screws loose	Tighten
	Connectors loose	
Fans(1)	Dirt	Clean
	Abnormal noise	Replace fan
	Fan stopped	
	Abnormal vibration	
Printed Circuit Boards	Dust, oil, moisture buildup	Clean
	Smell	Replace
Power Module/Power Connections	Dust, oil, moisture buildup	Clean
	Connection screws loose	Tighten
Heatsink	Dust, dirt buildup	Clean

(1) It is recommended to replace the fans after 40,000 hours of operation. Check the number of time powered in P0042.

8.2.1 Cleaning Instructions

When you need to clean converter, follow the instructions below.

Ventilation system:

- Disconnect the converter power supply and wait for 10 minutes.
- Remove the dust from the cooling air inlets with a soft brush or cloth.
- Remove the dust from the heatsink fins and from the fan blades with compressed air.

Electronic boards:

- Disconnect the converter power supply and wait for 10 minutes.
- Remove the dust accumulated on the boards using and anti-static brush using and/or ion compressed air gun. Example: Charges Burtes Ion Gun (non nuclear, reference A6030-6DESCO).
- If necessary, remove the board from inside the converter, but always use a grounding strap.

8.3 TECHNICAL ASSISTANCE

If you have any questions about service, contact the manufacturer's technical assistance.
The contact channels are on the website http://www.weg.net, according to the country or region where the assistance is needed.

By before contacting, it is important to have the following data at hand:

- converter model;
- serial number informed on the product nameplate (see section 4.5);
- software version installed (see P0023);
- application and effected parameterization data.

9 DEVICES AND ACCESSORIES

The CTW900 has several accessories which can be added to the converter in a simple and fast way based on the plug and play concept.

Therefore, when an accessory is connected to the expansion slots, the control circuit identifies the model and informs the code of the accessory connected in P0027 and P0028.

The code for ordering and the kinds of available accessories are presented in Table 9.1 below. They may be ordered separately, and will be shipped in individual packages containing the components and the manuals with detailed instructions for the installation, operation and programming.

NOTE!
Only one accessory module can be used at a time in each slot, and they must be installed with the converter powered down.

Table 9.1 – Models of the accessories

WEG Item	Name	Description	Slot(1)	Identification Code	
				P0027	P0028
Control accessories to install in Slots 1, 2 and 3					
11008162	IOA-01	IOA Module: 1 analog input of 14 bits in voltage and current; 2 digital inputs; 2 analog outputs of 14 bits in voltage and current; 2 open collector digital outputs.	1	FD--	----
11008099	IOB-01	IOB Module: 2 isolated analog inputs in voltage and current; 2 digital inputs; 2 isolated analog outputs in voltage and current; 2 open collector digital outputs.	1	FA--	----
11008100	ENC-01	Incremental encoder module, 5 to 12 Vdc, 100 kHz, with repeater of the encoder signals.	2	--C2	----
11008101	ENC-02	Incremental encoder module, 5 to 12 Vdc, 100 kHz.	2	--C2	----
11008102	RS485-01	RS-485 serial communication module (Modbus).	3	----	CE--
11008103	RS232-01	RS-232C serial communication module (Modbus).	3	----	CC--
11008104	RS232-02	RS-232C serial communication module with switch to program the microcontroller FLASH memory.	3	----	CC--
Anybus-CC Accessories to install in Slots 4					
11008107	PROFDP-05	ProfibusDP interface module.	4	----	--x0(2)
11008158	DEVICENET-05	Devicenet interface module.	4	----	--x0(2)
10933688	ETHERNET/IP-05	EtherNet/IP interface module.	4	----	--x0(2)
11550476	MODBUSTCP-05	Modbus TCP interface module.	4	----	--x0(2)
11550548	PROFINETIO-05	PROFINET IO interface module.	4	----	--x0(2)
11008160	RS232-05	RS-232 interface module (passive - Modbus).	4	----	--x0(2)
11008161	RS485-05	RS-485 interface module (passive - Modbus).	4	----	--x0(2)
Flash memory module for installation in slot 5					
11719952	MMF-03	Flash memory module.	5	----	--x0(2)
Separate Keypad, Blind Cover, Frame for External Keypad and Cables for Remote Keypad					
11008913	HMI-01	Separate keypad.	Keypad	-	-
12127880	RHMIF-01	Frame kit for keypad (degree of protection IP56).	Keypad	-	-
11010298	HMID-01	Blind cover for slot of the keypad.	Keypad	-	-
10950192	HMI Cable 1 m	Cable set for serial remote keypad 1 meter.	-	-	-
10951226	HMI Cable 2 m	Cable set for serial remote keypad 2 meters.	-	-	-
10951223	HMI Cable 3 m	Cable set for serial remote keypad 3 meters.	-	-	-
10951227	HMI Cable 5 m	Cable set for serial remote keypad 5 meters.	-	-	-
10951240	HMI Cable 7.5 m	Cable set for serial remote keypad 7.5 meters.	-	-	-
10951239	HMI Cable 10 m	Cable set for serial remote keypad 10 meters.	-	-	-

(1) The location of each slot is shown in Figure 5.10.
(2) Refer to section 7.3.16 in order to check the logic of the identification code for these accessories.

10 TECHNICAL SPECIFICATIONS

10.1 POWER DATA

POWER SUPPLY	ARMATURE VOLTAGE	■ Three-phase power line with four possible ranges, according to the converter voltage class: – Class 05: 200 to 500 Vac; – Class 06: 200 to 600 Vac; – Class 07: 200 to 690 Vac; – Class 10: 200 to 990 Vac. ■ Tolerance: -15 % to +10 %
	FIELD VOLTAGE	■ 220 to 440 Vac, single phase (see Table 10.3 with the recommended voltages to supply the field) ■ Tolerance: -15 % to +10 %
	FREQUENCY	■ 50/ 60 Hz, ±10 %, self-adjusting.
	POWER	■ According to Table 10.2 (maximum values for input voltage of 500 Vac).
OPERATING CONDITIONS	TEMPERATURE	■ 0 to 40°C: rated conditions. ■ 40 to 50 °C: 2 % current derating for each Celsius degree above 40 ºC;
	AIR RELATIVE HUMIDITY	■ 10 % to 90 % non-condensing.
	ALTITUDE	■ 0 to 1000m: rated conditions. ■ 1000 to 4000m: 2 % current derating for each 100m above 1000m.
	POLLUTION DEGREE	■ Degree 2, according to EN50178 and UL508C.
MECHANICS	PROTECTION DEGREE	■ IP00.

Table 10.1 – Recommended input and output voltages and voltage class

Input Rated Voltage [R/S/T]	Maximum Recommended Output Voltage [A1/B2]		Recommended Voltage Class of the CTW900
	CTW900U [1-Q]	CTW900A [4-Q]	
220 V_{AC}	260 V_{DC}	230 V_{DC}	05
230 V_{AC}	270 V_{DC}	240 V_{DC}	05
380 V_{AC}	460 V_{DC}	400 V_{DC}	05
400 V_{AC}	480 V_{DC}	420 V_{DC}	05
415 V_{AC}	500 V_{DC}	440 V_{DC}	05
440 V_{AC}	520 V_{DC}	460 V_{DC}	05
460 V_{AC}	540 V_{DC}	480 V_{DC}	05
480 V_{AC}	570 V_{DC}	500 V_{DC}	05
500 V_{AC}	600 V_{DC}	520 V_{DC}	05
525 V_{AC}	630 V_{DC}	550 V_{DC}	06
575 V_{AC}	680 V_{DC}	600 V_{DC}	06
600 V_{AC}	710 V_{DC}	630 V_{DC}	06
660 V_{AC}	770 V_{DC}	690 V_{DC}	07
690 V_{AC}	810 V_{DC}	720 V_{DC}	07
800 V_{AC}	920 V_{DC}	830 V_{DC}	10
990 V_{AC}	1160 V_{DC}	1040 V_{DC}	10

Table 10.2 – Maximum driving powers of each model

Rated current	Maximum Driving Power for Input Voltage of 500Vac		Maximum Dissipated Power
	CTW900U [1-Q]	CTW900A [4-Q]	
20 A	12 kW	10 kW	52 W
50 A	30 kW	26 kW	121 W
90 A	54 kW	47 kW	234 W
125 A	75 kW	65 kW	303 W
180 A	108 kW	94 kW	400 W
260 A	156 kW	135 kW	600 W
480 A	288 kW	250 kW	1362 W
640 A	384 kW	333 kW	1575 W
1000 A	600 kW	520 kW	2343 W
1500 A	900 kW	780 kW	3900 W
2000 A	1200 kW	1040 kW	5300 W

10.2 ELECTRONICS/GENERAL DATA

POWER SUPPLY	SOURCE	■ Maximum consumption: ■ 90 to 240 Vac, single phase, in sizes: – Size A: 1.0 A; – Size B: 1.0 A; ■ 220 Vac ± 5%, single phase, in sizes: – Size C: 1.5 A; – Size D: 2.0 A.
CONTROL	REGULATORS	■ Execution rate according to the frequency of the line (50 Hz/ 60 Hz) – speed regulator: 3.33 ms / 2.77 ms; – current regulator: 3.33 ms / 2.77 ms; – field regulator 10 ms / 8.33 ms; – EMF regulator: 10 ms / 8.33 ms.
PERFORMANCE	SPEED CONTROL	Feedback by EMF ■ Speed variation range: 1:30; ■ Static precision of speed control: 2 to 5 % (variable with the motor). Feedback by DC Tachogenerator ■ Speed variation range: 1:100; ■ Static precision of speed control: 0.1 % of the maximum speed. Feedback by Encoder ■ Speed variation range: 1:100; ■ Static precision of speed control: – 0,05 % of the rated speed, with analog reference of 12 bits (AI1/AI2); – 0.01 % of the rated speed, with analog reference of 14 bits (AI4–IOA) or digital reference (keypad, serial, fieldbus, E.P., Multispeed).
INPUTS	ANALOG	■ 2 differential inputs isolated by differential amplifier, impedance 400 kΩ (voltage) or 500 Ω (current), programmable functions: – AI1: 0 to +10 V, 0 to 20 mA / 4 to 20 mA, resolution of 12 bits; – AI2: 0 to ±10 V, 0 to 20 mA / 4 to 20 mA, resolution 11 bits + signal.
	DIGITAL	■ 6 isolated digital inputs, 24 Vdc, programmable functions.
	DC TACHOGENERATOR:	■ 3 differential inputs for voltage of the DC tachogenerator, impedance 30 kΩ (9-30V), 100 kΩ (30-100 V) and 320 kΩ (100-350 V).
OUTPUTS	ANALOG	■ 2 isolated outputs, 0 to +10 V ($R_L \geq 10$ kΩ for max. load), 0 to 20 mA / 4 to 20 mA, ($R_L \leq 500$ Ω), resolution 11 bits, programmable functions.
	DIGITAL (RELAY)	■ 3 relays with NO/NC contacts, 240 Vac, 1A, programmable functions.
SAFETY	PROTECTIONS	■ Undervoltage and overvoltage in the line, with adjustable actuation levels; ■ Unbalance of the line voltages (adjustable); ■ Under/over frequency on the line (adjustable); ■ Overvoltage on the armature (adjustable); ■ Under temperature and over temperature on the converter; ■ Overcurrent on the armature and on the field (adjustable); ■ Overload on the motor (adjustable); ■ Field loss; ■ Stall protection (adjustable); ■ Overspeed (adjustable); ■ Detection of inversion and signal loss of the tachogenerator or encoder; ■ Fault detection on the armature fuses (for converters size D); ■ Fault detection on the CPU and flash memory module;
KEYPAD (HMI)	KEYPAD	■ 9 keys: Run, Stop, Increment, Decrement, Direction of Rotation, Jog, Local/Remote, right soft key and left Soft key; ■ Graphic LCD display; ■ It enables accessing/changing all the parameters; ■ Permanent indication of the operating status of the converter; ■ Indication of alarms, faults and programming incompatibility; ■ Possibility of external mount via serial cable up to 10m (see Table 9.1).
CONNECTION TO PC	USB SERIAL INTERFACE	■ USB standard Rev. 2.0 (basic speed); ■ USB plug type B ("device"); ■ Interconnecting cable: standard host/device shielded USB cable.
COMMUNICATION	NETWORKS	■ Modbus RTU; ■ Modbus TCP; ■ DeviceNet; ■ Profibus DP; ■ EtherNet/IP; ■ PROFINET IO.

10.3 DIMENSIONING OF THE CTW900

In order to dimension the converter CTW900 correctly, it is necessary to take into account the DC motor used, the load cycle characteristic and the environmental conditions of the application.

Thus, first you must check the rated voltage of the motor armature so as to determine the converter voltage class, as per Table 10.1.

Then you evaluate the most critical load cycle of the application for a period of ten minutes, and you calculate its effective current. With this value you determine the converter rated current, which must not be lower than the effective current of this cycle.
Furthermore, the maximum current peak during the critical load cycle must not be over 125 % of the CTW900 rated current.

Finally, the converter operating ambient temperature and the altitude must be taken into account. In case of operation at temperatures above 40°C and/or installation at altitudes higher than 1000m above sea level, you must apply the ratio-corrector factors to the output current of the CTW900, according to Figure 10.1

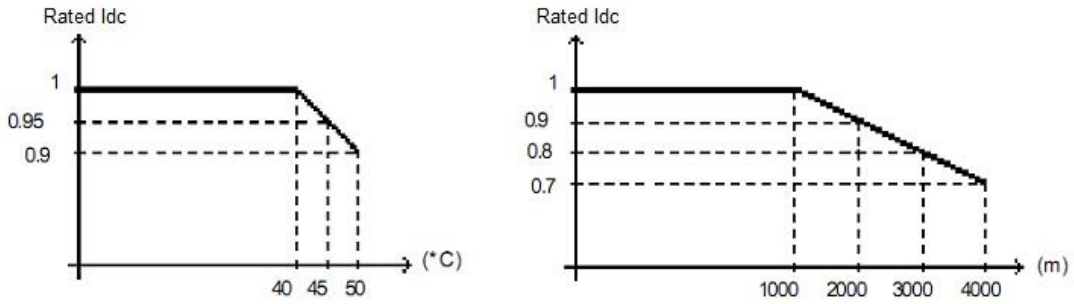


Figure 10.1 – Ratio-corrector factors of the output current considering the ambient temperature and altitude

Example:

Assuming a motor with armature rated voltage of 400V, ambient temperature of 35 °C, altitude of 500 m and load cycle as per Figure 10.2, determine the most suitable CTW900 for the application.

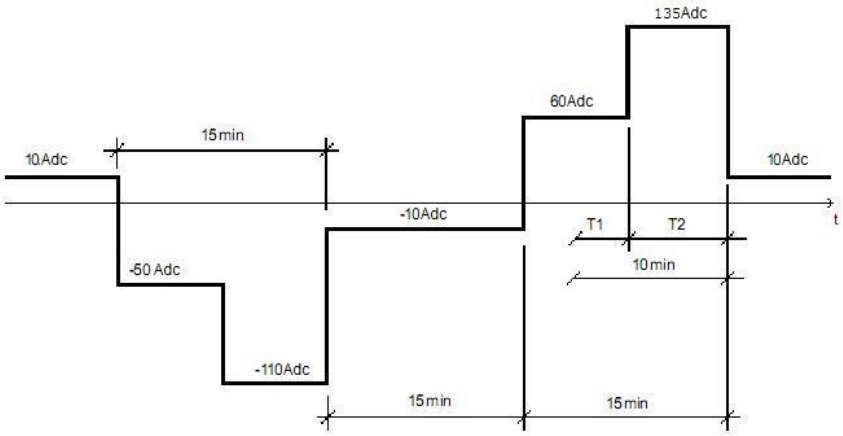


Figure 10.2 – Load cycle of the application

1. Considering the motor armature voltage (400 V), in Table 10.1 you can see that a converter class **05** is enough for the drive.

2. Analyzing the load cycle of the application, you can see that the motor must drive the load in both directions (forward and reverse). In this case, the converter must be able to operate in the four quadrants (4-Q), and thus the most suitable is the CTW900A.

3. According to the load cycle graph, the period of ten minutes with the highest current corresponds to periods T1 and T2, and the effective current in this period is calculated as follows:

$$I_{ef} = \sqrt{\frac{(60)^2 \times T1 + (135)^2 \times T2}{T1 + T2}}.$$

Since T1 = 2.5 minutes and T2 = 7.5 minutes, then I_{ef} = 120.7A.
Thus, the rated current of the converter output must be above 121A.

The closest converter to this value is the 125A. For this model, the maximum output current is 156.2A (125A x 1.25), and since the maximum current peak of the load cycle is below that (135A), the choice of the 125-A converter is correct.

4. Finally, once the ambient temperature and the altitude are below 40 °C and 1000m, it is not necessary to apply the ratio-corrector factors.

Therefore, the most suitable model for the relevant application would be the CTW900A0125T05SZ.

However, besides the converter model to be used, it is important to observe some other points:

- Check if the motor field current is smaller or equal to the maximum current accepted for the model, according to Table 4.1;
- Make sure the line voltage is compatible with the motor armature voltage, according to Table 10.1. If possible, use the lowest input voltage that allows obtaining the output voltage, because that improves the regulation;
- Confirm if the field supply can be maintained with the standard internal connection, derived from the input (R/S/T). If the armature supply voltage is too high for the field supply, make its feedback externally, as described in item 5.3.2. In order to do so, take into account the values of Table 10.3.

Table 10.3 – Recommended voltages for field feedback

Field Rated Voltage [U_f]	Field Supply Voltage
$U_f \leq 190\ V_{DC}$	220 V_{AC}
$190\ V_{DC} < U_f \leq 330\ V_{DC}$	380 V_{AC}
$330\ V_{DC} < U_f < 380\ V_{DC}$	440 V_{AC}

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