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Servo Drive
Servoconvertidor
Servoconversor

SCA05



User´s Guide

Guia del Usuario

Manual do usuário

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SERVODRIVE MANUAL

Series: SCA-05

Software: version 2.4X

0899.5304 E/3

10/2006



ATTENTION!

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

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Summary of Revisions

The table below describes all revisions made to this manual.

Revision	Description	Section
1	First Edition	-
2	General Review; Inclusion of Model 4/8 Increase of parameters range: P340 and P341 now support 4096 pulses; Hardware modification to support the use of the POS2 Board; Inclusion of CANopen and DeviceNet Protocols. Addition of Parameters P018, P019, P052, P053, P086, P087, P122, P123, P227, P228, P314, P315, P398, P428, P429; Inclusion of model 4/8 MF.	-
3	From version 2.4X, the MOVE function incorporates the following additional features: a) can be activated by a positive pulse; b) during the execution of the MOVE function, a complete positioning cycle is not interrupted if another positioning is activated at the same time and vice-versa. From version 2.4X, the key can be used to move from the last to the first servodrive parameter, and the key can be used to move from the first to the last servodrive parameter. Incorporation of three new errors: Error 10 (E0010), Error 49 (E0049), and Error 71 (E0071). Inclusion of a new option (26) for the analog outputs (P251 to P253) – PID Output; Incorporation of new functions for the analog inputs (P263 to P268); Incorporation of new functions for the digital and relay outputs (P275, P277 and P279); The STOP function does not follow the ramp set at parameter P220 anymore, but the exclusive deceleration ramp set at parameter P105; Parameter P310 has now 12 options.	-

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QUICK PARAMETER REFERENCE, FAULT AND STATUS MESSAGES

Software: V2.4X
Application:
Model:
Serial Number:
Responsible:
Date: / / .

I. Parameters

Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P000	Parameter Access	0 to 9999	0	-		69
	READ ONLY PARAMETERS	**P001 to P087**				
P002	Motor Speed	-9999 to +9999	-	rpm		70
P003	Motor Current	-999.9 to +999.9	-	A rms		70
P004	DC Link Voltage	0 to 999	-	V		70
P006	Servodrive Status	0 to 2	-	-		70
P012	Digital Inputs DI1 to DI6 Status	0 to 63	-	-		70
P013	Status of the Digital Inputs	0 to 7	-	-		71
P014	Last Fault	00 to 38	-	-		71
P015	Second Previous Fault	00 to 38	-	-		71
P016	Third Previous Fault	00 to 38	-	-		71
P017	Fourth Previous Fault	00 to 38	-	-		71
P018	Analog Input AI1' Value	-8192 to +8191	0	-		71
P019	Analog Input AI2' Value	-8192 to +8191	0	-		71
P022	Heat-sink Temperature	0 to 100.0	-	%		72
P023	Software Version	2.XX	-	-		72
P050	Shaft Position (by Resolver)	0 to 16383	-	pulses		72
P052	Angular Position: Fraction of Revolution	0 to 16383	-	pulses		73
P053	Angular Position: Number of Revolutions	-9999 to +9999	0	rev.		73
P056	Counter Value	0 to 32767	-	pulse		73
P059	Lag Error for the Master-Slave Function	0 to 16383	-	pulse		73
P061	Maximum Iq	-999.9 to +999.9	-	A rms		73
P070	Status of the CAN Controller	0=Disabled 1=Running Auto-Baud 2=Enabled Without Error 3=Warning 4=Error Passive 5=Bus-Off 6=Not Powered	-	-		73
P071	Number of Received CAN Telegrams	0 to 32767	-	-		74
P072	Number of Sent CAN Telegrams	0 to 32767	-	-		74
P073	Number of Bus-Off Errors	0 to 32767	-	-		74
P075	Status of the CANopen Network	0=Disabled 1=Reserved 2=CANopen Enabled 3=Node Guarding Enabled 4=Node Guarding Error	-	-		74

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P076	Status of the CANopen Node	0=Not Initialized 4=Stopped 5=Operational 127 =Pre-Operational	-	-		75
P080	Status of the DeviceNet Network	0 = Not Powered / Not On-line 1 = On-line, Not Connected 2 = Link OK, On-line Connected 3 = Connection Timed-out 4 = Critical Link Failure 5 = Autobaud Running	- - 	- - 		75
P081	Status of the DeviceNet Network Master	0 = Run 1 = Idle	-	-		75
P085	Status of the Fieldbus Communication Board	0 = Disabled 1 = Inactive Board 2 = Offline 3 = Online	-	-		75
P086	Number of Received Serial Telegrams	0 to 32767	0	-		76
P087	Number of Sent Serial Telegrams	0 to 32767	0	-		76
	REGULATION PARAMETERS	**P099 to P199**				
P099	Enable	0 to 2	0	-		76
	Ramps					
P100	Acceleration Ramp 1	1 to 32767	1	ms/krpm		76
P101	Deceleration Ramp 1	1 to 32767	1	ms/krpm		76
P102	Acceleration Ramp 2	1 to 32767	1	ms/krpm		76
P103	Deceleration Ramp 2	1 to 32767	1	ms/krpm		76
P105	STOP Function Deceleration Ramp	1 to 32767	1	ms/ krpm		77
	References					
P111	Direction of Rotation	0 to 1	0	-		77
P117	Position Reference via HMI	0 to 16383	0	pulses		77
P119	Current Reference (Torque) via HMI	-699.9 to +699.9	0	A		78
P121	Speed Reference	-699.9 to +699.9	0	rpm		78
P122	JOG1 Speed Reference	-699.9 to +699.9	10	rpm		78
P123	JOG2 Speed Reference	-699.9 to +699.9	-10	rpm		78
P124	MOVE: Speed/Current Ref. Pos. 1	-699.9 to +699.9	0	rpm		78
P125	MOVE: Speed/Current Ref. Pos. 2	-699.9 to +699.9	0	rpm		78
P126	MOVE: Speed/Current Ref. Pos. 3	-699.9 to +699.9	0	rpm		78
P127	MOVE: Speed/Current Ref. Pos. 4	-699.9 to +699.9	0	rpm		78
P128	MOVE: Speed/Current Ref. Pos. 5	-699.9 to +699.9	0	rpm		78
P129	MOVE: Speed/Current Ref. Pos. 6	-699.9 to +699.9	0	rpm		78
P130	MOVE: Speed/Current Ref. Pos. 7	-699.9 to +699.9	0	rpm		79
P131	MOVE: Speed/Current Ref. Pos. 8	-699.9 to +699.9	0	rpm		79
P132	MOVE: Speed/Current Ref. Pos. 9	-699.9 to +699.9	0	rpm		79
P133	MOVE: Speed/Current Ref. Pos. 10	-699.9 to +699.9	0	rpm		79
	Current Ratio					
P136	Idynamic/Inominal	1 to 4	3	-		79
	Gains					
P159	kp Position Regulator	0 to 32767	80	-		80
P161 (3)	kp PID Speed	0 to 32767	2500	-		80
P162 (3)	ki PID Speed	0 to 32767	15	-		80
P163	kd PID Speed	0 to 32767	0	-		80
P164	Speed Offset	-99.99 to +99.99	0	rpm		80
P165	Speed Filter	0 to 4000 (0=Without Filter)	0	Hz		80

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
	CONFIGURATION PARAMETERS	**P200 to P399**				
P200	Password	0=Inactive 1=Shows SCA and POS2 Parameters 2=Shows Only POS2 Parameters 3=User Password Change	1	-		80
P202	Operation Mode	1=Torque Mode 2=Speed Mode 3=Positioning Mode 4=Control via POS2	2	-		80
P204 (1)	Load/Save Parameters	0=Disabled 1 to 4=Not used 5=Load Factory Default	0	-		81
P207	Engineering Unit Multiplier	1 to 10000	1	-		81
P208	Engineering Unit Divisor	1 to 10000	1	-		81
P209	Engineering Unit Multiplier	1 to 10000	1	-		82
P210	Engineering Unit Divisor	1 to 10000	1	-		82
P215	COPY Function	0=Disabled 1=SCA-05 → Remote Keypad 2=Remote Keypad → SCA-05	0	-		82
P219 (*)	Error Reset	0=Disabled 1=Disabled 1→ 0=Error Reset	0	-		82
P227	Enable/Disable via Remote Keypad	0 to 1	0	-		82
P228	JOG1/JOG2 via Remote HMI	0 to 1	1	-		82
P229	Ramp Option	0=Without Ramp 1=Enable Ramp 1 2=Enable Ramp 2	0	-		82
P230	Option I x t	0=Generated E05 1=Limits Current	0	-		82
P231	Number of Rev./Pos. Ref.	1 to 30	1	rev.		83
	Analog Inputs					
P232	Analog Input AI1 Function	0=Disable 1=Current Ref. (Torque) 2=Speed Ref. 3=Position Ref. 4=Enabled (POS2, MOVE, or Sum of Analog Inputs)	0	-		83
P234	Analog Input AI1Gain	00.000 to 32.767	0.300	-		83
P235	Analog Input AI1 Signal	0=(-10 to +10)V / (0 to 20)mA 1=(4 to 20)mA	0	-		84
P236	Analog Input AI1 Offset	-9.999 to +9.999	0.000	-		84
P237	Analog Input AI2 Function	0=Disable 1=Current Ref. (Torque) 2=Speed Ref. 3=Position Ref. 4=Enabled (POS2, MOVE, or Sum of Analog Inputs)	0	-		84
P238	Analog Input AI2 Gain	00.000 to 32.767	0.300	-		84
P239	Analog Input AI2 Signal	0=(-10 to +10)V / (0 to 20)mA 1=(4 to 20)mA	0	-		85

(*) P219 resets the errors when a negative pulse is detected.

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P240	Analog Input AI2 Offset	-9.999 to +9.999	0.000	-		85
P241	Sum of the Analog Inputs	0=Disabled 1=Torque Reference 2=Speed Reference 3=Position Reference	0	**-**		
P248	Analog Input AI1 Filter	0 to 4000	1000	Hz		85
P249	Analog Input AI2 Filter	0 to 4000	1000	Hz		85
	Analog Outputs					
P251	Analog Output AO1 Function	0=Disable 1=Current Ref. 2=Speed Ref. 3=Position Ref. 4=Phase U Current 5=Phase V Current 6=Phase W Current 7=Real Speed 8=Angular Position 9=Reserved 10=iq 11=id 12=Vq 13=Vd 14=Phase U Voltage 15=Phase V Voltage 16=Phase W Voltage 17=AI1 Value 18=AI2 Value 19=Reserved 20=Reserved 21=Reserved 22=Reserved 23=Reserved 24=POS2 25=Full Scale Voltage 26=PID Output	0	-		85
P252	Analog Output AO1 Gain	00.00 to 327.67	1.00	-		85
P253	Analog Output AO2 Function	0=Disable 1=Current Ref. 2=Speed Ref. 3=Position Ref. 4=Phase U Current 5=Phase V Current 6=Phase W Current 7=Real Speed 8=Angular Position 9=Reserved 10=iq 11=id 12=Vq 13=Vd 14=Phase U Voltage 15=Phase V Voltage	0	-		86

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
		16=Phase W Voltage 17=AI1 Value 18=AI2 Value 19=Reserved 20=Reserved 21=Reserved 22=Reserved 23=Reserved 24=POS2 25=Full Scale Voltage 26=PID Output				
P254	Analog Output AO2 Gain	00.00 to 327.67	1.00	-		86
P259	Analog Output AO1 Offset	-9.999 to +9.999	0.000	-		87
P260	Analog Output AO2 Offset	-9.999 to +9.999	0.000	-		87
	Digital Inputs					
P263	Input DI1 Function	0=No Function	0	-		87
P264	Input DI2 Function	1=Enable/Disable				
P265	Input DI3 Function	2=Stop Function				
P266	Input DI4 Function	3= Stop Inverse Function				
P267	Input DI5 Function	4=Forward Limit Switch				
P268	Input DI6 Function	5=Reverse Limit Switch 6=Error Reset via Negative Pulse 7=Direction of Rotation 8=Torque/Speed Mode 9=Torque/Position Mode 10=Speed/Position Mode 11=MOVE Function: 1 Pos. Cycle 1 12=MOVE Function: 1 Pos. Cycle 2 13=MOVE Function: 1 Pos. Cycle 3 14=MOVE Function: 1 Pos. Cycle 4 15=MOVE Function: 1 Pos. Cycle 5 16=MOVE Function: 1 Pos. Cycle 6 17=MOVE Function: 1 Pos. Cycle 7 18=MOVE Function: 1 Pos. Cycle 8 19=MOVE Function: 1 Pos. Cycle 9 20=MOVE Function: 1 Pos. Cycle 10 21=MOVE Func.: Cycle 1 Complete 22=MOVE Func.: Cycle 2 Complete 23=MOVE Func.: Cycle 3 Complete 24=MOVE Func.: Cycle 4 Complete 25=MOVE Func.: Cycle 5 Complete 26=MOVE Func.: Cycle 6 Complete 27=MOVE Func.: Cycle 7 Complete 28=MOVE Func.: Cycle 8 Complete 29=MOVE Func.: Cycle 9 Complete 30=MOVE Func.: Cycle 10 Complete 31=Home Position Signal 32=Activation of the Home Function 33 and 36=No Function 34=JOG1 Function				

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
		35=JOG2 Function 37=Absolute Position Reset 38=Hardware Reset via Positive Pulse 39=Acceleration via Electronic Potentiometer 40=Deceleration via Electronic Potentiometer 41=Restarts MOVE Cycle 42 to 49=No Function 50=External Error				
P275	Digital Output DO1 Function (Optocoupled)	0=Not Used 1=Enable/Disable 2=Stop Function 3=Not Used 4=Not Used 5=Servo Ready 6=No Fault 7=Direction of Rotation 8=Whitten by POS2 9=MOVE Function 10=Home Function 11=Output Activated 12=N > Nx 13=N < Nx 14=N = N* 15=T>Tx 16=T<Tx	0	-		89
P277	Relay Output RL1 Function	0=Not Used 1=Enable/Disable 2=Stop Function 3=Not Used 4=Not Used 5=Servo Ready 6=No Fault 7=Direction of Rotation 8=Whitten by POS2 9=MOVE Function 10=Home Function 11=Output Activated 12=N > Nx 13=N < Nx 14=N = N* 15=T>Tx 16=T<Tx	0	-		89
P279	Relay Output RL2 Function	0=Not Used 1=Enable/Disable 2=Stop Function 3=Not Used 4=Not Used 5=Servo Ready 6=No Fault	0	-		89

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
		7=Direction of Rotation 8=Whitten by POS2 9=MOVE Function 10=Home Function 11=Output Activated 12=N > Nx 13=N < Nx 14=N = N* 15=T>Tx 16=T<Tx				
P287	Hysteresis for Nx and Tx	0 to 6999	0	rpm		90
P288	Keypad Speed Reference	0 to 6999	0	rpm		90
P293	Keypad Current Reference	0 to 699.9	0	A		90
	Data of the Servoconversor					
P295 (1)	Rated Current	0 to 999.9	-	A rms		90
	Serial Communication					
P308	Servodrive Serial Address	1 to 247	1	-		90
P310 (1)	Serial Bit Rate	0=4800 1=9600 2=14400 3=19200 4=24000 5=28800 6=33600 7=38400 8=43200 9=48000 10=52800 11=57600	1	bits/s		90
P311 (1)	Data Bits, Parity, Stop Bits	0=8bits, no Parity, 1 Stop bit 1=8bits, even Parity, 1 Stop bit 2=8bits, odd Parity, 1 Stop bit 3=8bits, no Parity, 2 Stop bits 4=8bits, even Parity, 2 Stop bits 5=8bits, odd Parity, 2 Stop bits 6=7bits, no Parity, 1 Stop bit 7=7bits, even Parity, 1 Stop bit 8=7bits, odd Parity, 1 Stop bit 9=7bits, no Parity, 2 Stop bits 10=7bits, even Parity, 2 Stop bits 11=7bits, odd Parity, 2 Stop bits	3	-		90
P312 (1)	Choose Serial Protocol	0=WEGBus 1=WEGTP 2=Modbus-RTU	2	-		90
P313 (1)	Action to Be Taken Upon Detection of to Communication Failure	0=Only Indicates the Fault 1=Cause to Fatal Error 2=Execute STOP Function 3=Disable	0	-		91
P314 (1)	Timeout for Communication	0 to 999.9	0	s		91
P315 (1)	Store Parameters in Non-Volatile Memory via Serial Interface	0 to 1	1	-		91

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P340 (1)	Number of Pulses of the Encoder Simulator	0 to 4096	1024	pulses		92
P341 (1)	Null Pulse Position	1 to 4096	1	-		92
P342 (1)	Selects Sequence A ⇔ B	0=Sequence A to B 1=Sequence B to A Auto-Tuning	0	-		92
P380 (1)	Self-Tuning Function: Speed and Position Loop	0=Disable 1=Auto-Tuning	0	-		93
P381	Number of Rev. - Auto-Tuning	1 to 30	8	rev.		93
P385 (1)	Servomotor Model	0=No Model Selected 1=Reserved 2=Reserved 3=SWA 56-2.5-20 4=SWA 56-3.8-20 5=SWA 56-6.1-20 6=SWA 56-8.0-20 7=SWA 71-9.3-20 8=SWA 71-13-20 9=SWA 71-15-20 10=SWA 71-19-20 11=SWA 71-22-20 12=SWA 71-25-20 13=Reserved 14=Reserved 15=Reserved 16=Reserved 17=Reserved 18=Reserved 19=Reserved 20=SWA 40-1,6-30 21=SWA 40-2,6-30 22=SWA 56-2,5-30 23=SWA 56-4,0-30 24=SWA 56-6,1-30 25=SWA 56-7,0-30 26=SWA 71-9,3-30 27=SWA 71-13-30 28=SWA 71-15-30 29=SWA 71-19-30 30=Reserved 31=Reserved 32=Reserved 33=Reserved 34=Reserved 35=Reserved 36=Reserved 37=SWA 40-1,6-60 38 = SWA 40-2,6-60 39 = SWA 56-2,5-60 40 = SWA 56-3,6-60 41 = SWA 56-5,5-60 42 = SWA 56-6,5-60	24	-		93
P390	Filter of the Torque Current Reference	0 to 4000 (0=Without Filter)	0	Hz		93

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P392 (2)	Iq Current PID - Proportional Gain (kp)	0 to 9999	70	-		94
P393 (2)	Iq Current PID - Integral Gain (ki)	0 to 9999	400	-		94
P395 (2)	Id Current PID - Proportional Gain (kp)	0 to 9999	70	-		94
P396 (2)	Id Current PID - Integral Gain (ki)	0 to 9999	400	-		94
P398	Resolver: Lag Compensation	0 to 32767	4350	rpm		94
P399 (2)	Resolver: Position Offset	0 to 16383	0	pulses		94
	MOTOR PARAMETERS	**P400 to P419**				
	Motor Nameplate Data					
P401 (2)	Rated Motor Current	0.0 to 999.9	8.50	A		94
P402 (2)	Rated Motor Speed	0 to 9999	3000	rpm		94
P407 (2)	p/2: Number of Pole Pairs of the Motor	1 to 100	4	-		94
P409 (2)	Rs - Stator Resistance	0.000 to 32.767	0.071	W		94
P414 (2)	Lq - Quadr. Shaft Inductance	0.00 to 327.67	3.87	m H		94
P415 (2)	Ld - Direct Shaft Inductance	0.00 to 327.67	3.26	m H		95
P416 (2)	Ke - Voltage Constant	0.00 to 327.67	47	V/krpm		95
P417 (2)	Kt -Torque Constant	0.000 to 32.767	0.718	Nm/A		95
P418 (2)	Motor Shaft Inertia	0.00 to 32.767	50	1.10^{-3} kgm²		95
	PARAMETERS OF THE SPECIAL FUNCTIONS - P420 to P541					
P420	Selection of the Operation Mode for the CAN Master/Slave Function	0=Disabled 1=Master 2=Slave (Master/Slave Function) - Absolute 3=Slave (Master/Slave Function) - Relative	0	-		95
P422	Numerator of the Master/Slave Ratio	1 to 9999	1	-		95
P423	Denominator of the Master/Slave Ratio	1 to 9999	1	-		95
P425	Direction of Rotation for the Master/Slave Function	0=Same 1=Opposite	0	-		95
P426	Position Shift for the Master/Slave Function	0 to 16383	0	-		95
P427	Phase Lag Compensation for the Master/Slave Function	0 to 9999	0	-		95
P428	Active JOG1 or JOG2	-1 to +1	0	-		96
P429	Reset Absolute Position: P052 and P053	0 to 1	0	-		96
P432	Starts STOP Function	0=Disable 1=Enable	0	-		96
P433	Automatic STOP Function Ref. Prog.	0.0 to 3276.7	0	rpm		97
P434	Restart MOVE Cycle	0 to 1	0	-		97
P435	Starts MOVE Function	0=Disable 1=Enable	0	-		97
P436	Positioning Cycle Selection to Enable the MOVE Function via Parameter	1=One Pos. of the Cycle 1 2=One Pos. of the Cycle 2 3=One Pos. of the Cycle 3 4=One Pos. of the Cycle 4 5=One Pos. of the Cycle 5 6=One Pos. of the Cycle 6 7=One Pos. of the Cycle 7 8=One Pos. of the Cycle 8 9=One Pos. of the Cycle 9 10=One Pos. of the Cycle 10 11=Cycle 1 Complete 12=Cycle 2 Complete	1	-		97

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
		13=Cycle 3 Complete 14=Cycle 4 Complete 15=Cycle 5 Complete 16=Cycle 6 Complete 17=Cycle 7 Complete 18=Cycle 8 Complete 19=Cycle 9 Complete 20=Cycle 10 Complete				
P437	Digital Output of MOVE Function Revolutions Fraction Before the End	0 to 16383	0	pulses		98
P438	Defines the Number of Revolutions (Reference) for the MOVE Function at the Digital Output	0 to 32767	0	rev.		98
P439	Automatic Cycle MOVE Function	0=Disable 1=Cycle 1 2=Cycle 2 3=Cycle 3 4=Cycle 4 5=Cycle 5 6=Cycle 6 7=Cycle 7 8=Cycle 8 9=Cycle 9 10=Cycle 10	0	-		98
P440	Activation Mode for the MOVE Function	0=Logic Level 1=Positive Pulse	0	-		98
P441 **P442** **P443** **P444** **P445** **P446** **P447** **P448** **P449** **P450**	MOVE: Defines the Cycle of Positioning 1 MOVE: Defines the Cycle of Positioning 2 MOVE: Defines the Cycle of Positioning 3 MOVE: Defines the Cycle of Positioning 4 MOVE: Defines the Cycle of Positioning 5 MOVE: Defines the Cycle of Positioning 6 MOVE: Defines the Cycle of Positioning 7 MOVE: Defines the Cycle of Positioning 8 MOVE: Defines the Cycle of Positioning 9 MOVE: Defines the Cycle of Positioning 10	0=Ref. Deactivated 1=Cycle 1 2=Cycle 2 3=Cycle 3 4=Cycle 4 5=Cycle 5 6=Cycle 6 7=Cycle 7 8=Cycle 8 9=Cycle 9 10=Cycle 10	0	-		99
P451 **P452** **P453** **P454** **P455** **P456** **P457** **P458** **P459** **P460**	MOVE: Operation Mode Positioning 1 MOVE: Operation Mode Positioning 2 MOVE: Operation Mode Positioning 3 MOVE: Operation Mode Positioning 4 MOVE: Operation Mode Positioning 5 MOVE: Operation Mode Positioning 6 MOVE: Operation Mode Positioning 7 MOVE: Operation Mode Positioning 8 MOVE: Operation Mode Positioning 9 MOVE: Operation Mode Positioning 10	1=Torque Ref. 2=Speed Ref. 3=Relative Position Reference (Ramps 1) 4=Relative Position Reference (Ramps 2) 5=Absolute Position Reference (Ramp 1) 6=Absolute Position Reference (Ramp 2)	3	-		100
P461	MOVE: Positioning 1 Timer	0 to 3276.7	0	ms		101
P462	MOVE: Positioning 2 Timer	0 to 3276.7	0	ms		101
P463	MOVE: Positioning 3 Timer	0 to 3276.7	0	ms		101
P464	MOVE: Positioning 4 Timer	0 to 3276.7	0	ms		101
P465	MOVE: Positioning 5 Timer	0 to 3276.7	0	ms		101

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P466	MOVE: Positioning 6 Timer	0 to 3276.7	0	ms		101
P467	MOVE: Positioning 7 Timer	0 to 3276.7	0	ms		101
P468	MOVE: Positioning 8 Timer	0 to 3276.7	0	ms		101
P469	MOVE: Positioning 9 Timer	0 to 3276.7	0	ms		102
P470	MOVE: Positioning 10 Timer	0 to 3276.7	0	ms		102
P471	MOVE: Fraction of Revolution Positioning 1	0 to 16383	0	pulses		102
P472	MOVE: Fraction of Revolution Positioning 2	0 to 16383	0	pulses		102
P473	MOVE: Fraction of Revolution Positioning 3	0 to 16383	0	pulses		102
P474	MOVE: Fraction of Revolution Positioning 4	0 to 16383	0	pulses		102
P475	MOVE: Fraction of Revolution Positioning 5	0 to 16383	0	pulses		102
P476	MOVE: Fraction of Revolution Positioning 6	0 to 16383	0	pulses		102
P477	MOVE: Fraction of Revolution Positioning 7	0 to 16383	0	pulses		102
P478	MOVE: Fraction of Revolution Positioning 8	0 to 16383	0	pulses		102
P479	MOVE: Fraction of Revolution Positioning 9	0 to 16383	0	pulses		102
P480	MOVE: Fraction of Revolution Positioning 10	0 to 16383	0	pulses		103
P481	MOVE: Number of Revolutions Positioning 1	0 to 32767	0	rev.		103
P482	MOVE: Number of Revolutions Positioning 2	0 to 32767	0	rev.		103
P483	MOVE: Number of Revolutions Positioning 3	0 to 32767	0	rev.		103
P484	MOVE: Number of Revolutions Positioning 4	0 to 32767	0	rev.		103
P485	MOVE: Number of Revolutions Positioning 5	0 to 32767	0	rev.		103
P486	MOVE: Number of Revolutions Positioning 6	0 to 32767	0	rev.		103
P487	MOVE: Number of Revolutions Positioning 7	0 to 32767	0	rev.		103
P488	MOVE: Number of Revolutions Positioning 8	0 to 32767	0	rev.		103
P489	MOVE: Number of Revolutions Positioning 9	0 to 32767	0	rev.		103
P490	MOVE: Number of Revolutions Positioning 10	0 to 32767	0	rev.		103
P491	Reset of MOVE Cycles and Errors	0=Only Errors are Reset 1=MOVE Cycles and Errors are Reset	1	-		105
P492	Maximum Stop Error for the MOVE Function	0 to 8192	0	pulse		105
P494	Activation of the Home Function	Positive Pulse = Activation	0	-		105
P496	Speed Reference for the Home Function	-6999 to +6999	10	rpm		105
P497	Zero Pulse Position for the Home Function	0 to 16383	0	pulse		105
P502	Count Mode for the CEP Board	0=Mode 1 1=Mode 2	0	-		105
P503	Count Direction	0=Same Direction as the Counter 1=Opposite Direction of the Counter	0	-		105
P505	Counter Mode - CEP Board	0=Disabled 1=Torque Reference 2=Speed Reference 3=Position Reference 4=Master/Slave	0	-		106
P507	Counter Gain - CEP Board	0 to 32.767	1.000	-		106
P509	Counter Filter Cut-off Frequency - CEP Board	0 to 4000	1000	Hz		106
P511	Denominator of the Master/Slave Ratio (Master Parameter) - CEP Board	0.001 to 32.767	0.001	-		106
P512	Numerator of the Master/Slave Ratio (Slave Parameter) - CEP Board	0.001 to 32.767	0.001	-		106
P513	Slave's Direction of Rotation with Respect to the Master - Master/Slave Function - CEP Board	0 to 1	0	-		107

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P520	PID Proportional Gain (Kp) - Analog Inputs	0 to 32767	2500	-		107
P521	PID Integral Gain (Ki) - Analog Inputs	0 to 32767	15	-		107
P522	PID Differential Gain (Kd) - Analog Inputs	0 to 32767	0	-		107
P524	PID Feedback	0=EA1 1=EA2	0	-		107
P525	PID Digital Set-point - Analog Inputs	-9999 to +9999	0	-		107
P527	PID Action – Analog Inputs	0=Direct 1=Reverse	0	-		107
P528	PID Digital Set-point Acceleration	1 to 32767	1	rpm/s		107
P538	Selection of the PID Reference	0=Digital Reference 1=Analog Input 1 2=Analog Input 2	0	-		108
P539	Selection of the PID Output	0=Null Output 1=Torque Reference 2=Speed Reference 3=Position Reference 4=Analog Output	0	-		108
P540	Lower Limit of the PID Output	-9999 to +16383 (P539=0) -9999 to +9999 (P539=1) -9999 to +9999 (P539=2) 0 to +16383 (P539=3) -8189 to +8191 (P539=4)	-9999	- mA rpm pulse -		108
P541	Upper Limit of the PID Output	-9999 to +16383 (P539=0) -9999 to +9999 (P539=1) -9999 to +9999 (P539=2) 0 to +16383 (P539=3) -8189 to +8191 (P539=4)	16383	- mA rpm pulse -		108
	NETWORK PARAMETERS FOR CAN/DEVICENET - P700 to P729					
P700 (1)	CAN Protocol	0=Disabled 1=CANopen 2=DeviceNet 3=MSCAN	0	-		108
P701 (1)	CAN Address	0 to 127	63	-		109
P702 (1)	Baud Rate	0=1 Mbit/s 1=Reserved 2=500 kbit/s 3=250 kbit/s 4=125 kbit/s 5=100 kbit/s 6=50 kbit/s 7=20 kbit/s 8=10 kbit/s	0	-		109
P703 (1)	Bus-off Reset	0= Manual 1= Automatic	0	-		109
P710 (1)	I/O Instances for DeviceNet	0=20 / 70 (2 I/O Words) 1=21 / 71 (2 I/O Words) 2=23 / 73 (3 I/O Words) 3=100 / 150 (4 I/O Words)	1	-		109
P711 (1)	DeviceNet Reading Word #1	-1 to +749	-1	-		110
P712 (1)	DeviceNet Reading Word #2	-1 to +749	-1	-		110
P713 (1)	DeviceNet Reading Word #3	-1 to +749	-1	-		110
P714 (1)	DeviceNet Writing Word #1	-1 to +749	-1	-		110
P715 (1)	DeviceNet Writing Word #2	-1 to +749	-1	-		110
P716 (1)	DeviceNet Writing Word #3	-1 to +749	-1	-		110

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Parameter	Description	Adjustable Range	Factory Setting	Unit	User´s Setting	Page
P720 (1)	Fieldbus Board Enable	0=Disabled 1=Profibus DP 2 I/O 2=Profibus DP 4 I/O 3=Profibus DP 8 I/O	0	-		110
P722 (1)	Fieldbus Reading Word #1	-1 to +899	-1	-		110
P723 (1)	Fieldbus Reading Word #2	-1 to +899	-1	-		110
P724 (1)	Fieldbus Reading Word #3	-1 to +899	-1	-		111
P725 (1)	Fieldbus Reading Word #4	-1 to +899	-1	-		111
P726 (1)	Fieldbus Writing Word #1	-1 to +899	-1	-		111
P727 (1)	Fieldbus Writing Word #2	-1 to +899	-1	-		111
P728 (1)	Fieldbus Writing Word #3	-1 to +899	-1	-		111
P729 (1)	Fieldbus Writing Word #4	-1 to +899	-1	-		111
	POS2 Watchdog Parameter					
P749	Disable E71 and E72	1 to 100	1	-		111
	Parameters of POS2 Board	**P750 to P899**				
P750 to P899 (4)	Parameters of POS2 Optional Board	0 to 32767	0	-		111

(1) The changes made at these parameters will be valid only after pressing the key "reset" (HMI).
(2) Indicates that the values may be changed as function of the servomotor model (P385).
(3) Indicates that the values may be changed as function of the self-tuning.
(4) This parameter discription can be found in the POS2 optional board user´s manual.

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II. Erros Messages

Display	Description	Page
E00	Output overcurrent/short-circuit	125
E01	DC link overvoltage	125
E02	DC link undervoltage	125
E04	Overtemperature at the power heatsink	125
E05	Output overload (Ixt function)	125
E06	External fault	125
E08	CPU error (watchdog)	126
E10	Software incompatibility (COPY function)	I26
E11	Output ground fault	126
E12	Dynamic braking resistor overload	126
E2X(*)	Serial communication error	126
E29	Inactive fieldbus communication	126
E30	Inactive fieldbus communication board	126
E31	Keypad connection fault	126
E32	Resolver fault/motor overtemperature	126
E33	CAN interface not powered on	126
E34	Bus off	126
E35	Slave node guarding error	126
E36	Master in IDLE state	126
E37	Timeout for I/O connections	127
E38	Timeout for master/slave function via CAN	127
E49	Lag error (MOVE function) too high	127
E71	POS2 watchdog error	127
E72	Error during the POS2 detection	127

(*) Refer to serial communication manual.

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SAFETY NOTICES

This Manual contains all necessary information for the correct installation and operation of the SCA-05.
The SCA-05 Instruction Manual has been written for qualified personnel with suitable training or technical qualifications to operate this type of equipment.

1.1 SAFETY NOTICES IN THE MANUAL

The following Safety Notices will be used in this Manual:



DANGER!
If the recommended Safety Instructions are not observed strictly, it can lead to serious or fatal injuries of personnel and/or equipment damage**.**



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



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

1.2 SAFETY NOTICES ON THE PRODUCT

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



High Voltages.



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



Mandatory connection to ground protection (PE).



Shield connection to ground.

1.3 PRELIMINARY RECOMMENDATIONS



DANGER!
Only qualified personnel should plan or implement the installation, startup, operation and maintenance of the servodrive SCA-05 and its associated equipment.

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



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

1. Install, ground, power up and operate the SCA-05 servodrive according to this Manual and the local required safety procedures;
2. Use of safety equipment according to the local regulations;
3. Give First Aid.



DANGER!
Always disconnect the power supply before touching any electrical component inside the inverter.
Many components may be charged with high voltages, or rotating, even after the incoming AC power supply has been disconnected or switched OFF. Wait at least 10 minutes for the total discharge of the power capacitors and stop of the fans.
Always connect the frame of the equipment to the ground (PE) at the suitable connection point.



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

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



NOTE!
Servodrives can interfere with other electronic equipment. In order to reduce this interference, adopt the measures recommended in section 3 - Installation and Connection.



NOTE!
Read this entire Manual carefully and completely before installing or operating the servodrive.

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GENERAL INFORMATION

This chapter defines the contents and purpose of this manual and describes the main characteristics of the SCA-05 servodrive. Additionally information about identification, receiving and storage requirements are also provided.

2.1 ABOUT THE MANUAL

This Manual is divided into 9 Chapters, providing information to the user on how to receive, install, start-up and operate the SCA-05:

Chapter 1 - Safety Notices;
Chapter 2 - General Information about the SCA-05;
Chapter 3 - Information about the installation of the SCA-05, how to make the electrical connections (power and control circuit), how to install the options and accessories;
Chapter 4 - Information about the startup, procedures to be adopted and information on how to use the HMI (Human-Machine-Interface) and basic application examples;
Chapter 5 - Detailed description of all SCA-05 programming parameters;
Chapter 6 - Description of the communication networks that were incorporated to the SCA-05;
Chapter 7 - Information about diagnostics and troubleshooting, cleaning procedures and preventive maintenance;
Chapter 8 - Description, technical characteristics and installation of the optional devices and accessories of the SCA-05;
Chapter 9 - Tables and technical characteristics about the different powers of the SCA-05 line.

This Manual provides information for the correct use of the SCA-05. As the SCA-05 can be applied in several ways, it is impossible to describe here all of the application possibilities. This manual does not intend to cover all possible applications of the SCA-05, and WEG is not responsible for the improper use of the SCA-05.

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

This user's guide is complemented by the communication user's guide for the SCA-05 presented in table 2.1. These user's guides are available in PDF format on the product CD and also at WEG website.
The compatibility of these user's guides and the product is directly related to the product software version. Hence, pay attention to the communication user's guide identification (P/1, P/2,...) when downloading it from the WEG website.

Manual \ SCA05 Version	V2.1X
CANopen Slave Communication User's Guide	P/2
DeviceNet Slave Communication User's Guide	P/2
Profibus DP Communication User's Guide	P/2
Serial Communication User's Guide	P/3

Table 2.1 *- Communication Manuals for the SCA-05*

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2.2 SOFTWARE VERSION

The software version used on the SCA-05 servodrive is indispensable, since all functions and programming parameters are defined inside it. This Manual refers to the Software version indicated on the inside cover. For example, the Version 1.0X applies to versions 1.00 to 1.09, where "X" means the software evolution that do not affect the content of this Manual.

The Software Version can be read at the Parameter P023.

2.3 ABOUT THE SCA-05

The SCA-05 is to high performance Servodrive that permits the speed, torque and position control of AC-servomotors.
The Servoconverter + Servomotor sets, also known as AC-Servodrives, are widely used around the world in the industry and military forces.
The "Auto-Tuning" function allows the automatic setting of the speed regulator parameters through the identification (also automatic) of the load characteristics. These parameters are automatically loaded according to the servomotor model set at parameter P385.
The connection of to braking resistor to the SCA-05 allows very short braking times, thus optimizing processes that require high performance.

The communication interfaces and protocols available on the SCA-05 allow its fast and precise operation, enabling the integration of the servodrive with different control and monitoring systems.
It is also possible to use the optional board POS2, which incorporates various positioning and PLCs (such as counters, PID, filters, etc.) functions programmable via ladder language, adding flexibility to the servodrive.

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For product line and technical infomation, refer to Chapter 8. The Block Diagram below gives to general view of the SCA-05:

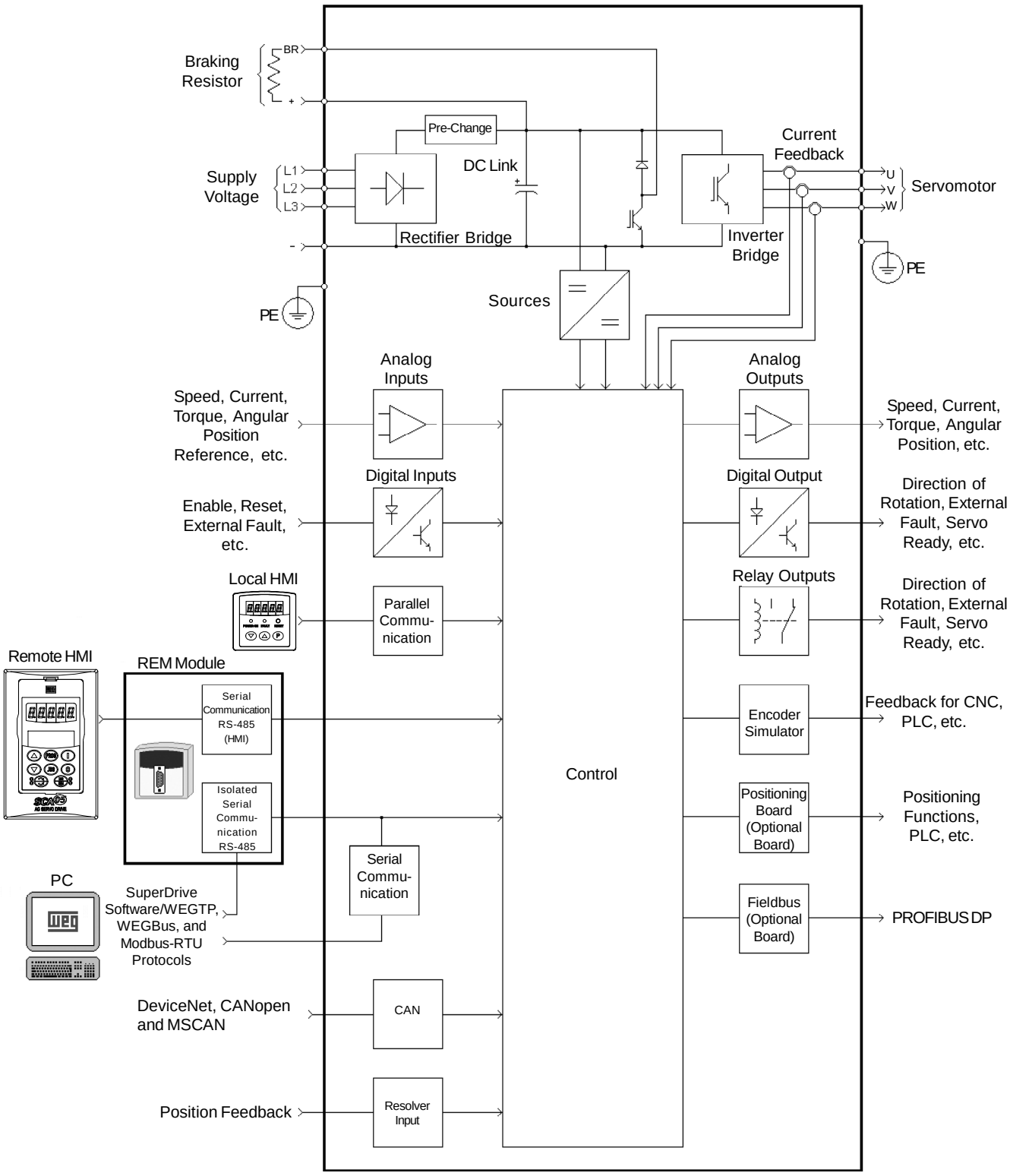


Figure 2.1 *– Block diagram of the SCA-05*

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2.4 SCA-05 IDENTIFICATION

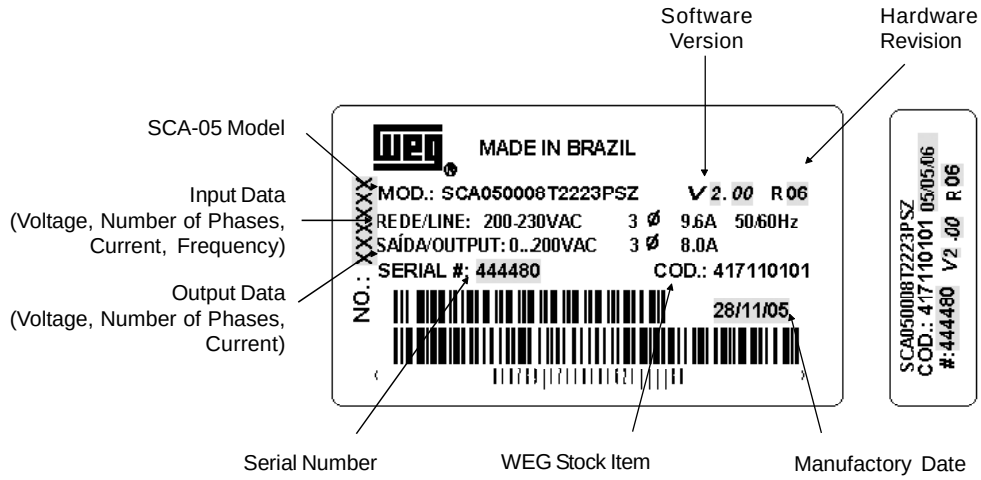


Figure 2.2 – *SCA-05 Identification*

Location of the SCA-05 Identification Nameplate:

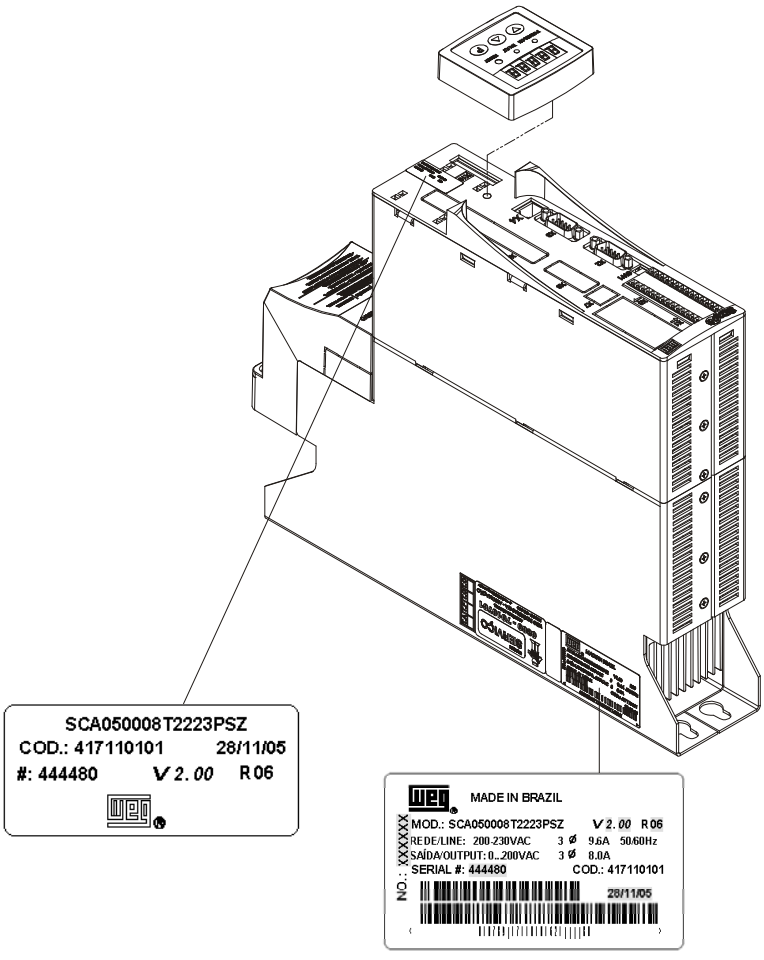


Figure 2.3 – *SCA-05 Nameplate Details*

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HOW TO SPECIFY THE SCA-05 MODEL

SCA-05	*0024*	*T*	*2223*	*P*	*O*	*_ _*	*_ _*	*_ _*	*_ _*	*_ _*	*_ _*	*_ _*	*Z*
Servodrive WEG Series SCA-05	Rated output current: 0004=4 A 0005=5.3A 0008=8A 0024=24A	Three-phase power supply	Input supply voltage: 2223 = 220V to 230V	Manual language: P= portuguese E= english S= spanish	Options: S= standard O= with options	Degree of protection: Blank= standard	Human Machine Interface: Blank= standard C= RS-485 (REM module)	Braking resistor: Blank= standard	Expansion boards: Blank= standard P2= POS.02 + WLP EP = CEP Board (pulse input)	Fieldbus communication board: Blank= standard PD=ProfibusDP	Special hardware: Blank= standard MF= Machine Tool	Special software: Blank= standard	End of code

☛NOTE!

☑ The option field (S or O) defines if the SCA-05 is to standard version or if it is equipped with any optional devices. If the standard version is required, the code ends here. The model number always has the letter Z at the end. For example:
SCA050008T2223ESZ = Standard 8A SCA-05 Servodrive with three phase input at 220V to 230V with the Manual in English.

If the SCA05 is equipped with any optional, fill out only the fields related to the required optional, in the correct sequence, and until the last required optional. Then, the product code ends with the 'Z' letter.
The fields on the ordering code will be left blank for the standard optionals or for those optionals that will not be used.
Thus, for instance, if to product of the example above is required with to kit Positioning card POS2 + WLP Software, indicate:
SCA050008T2223EOP2Z = 8A SCA-05 Servodrive - three-phase input at 220V to 230V, with the manual in English and with the optional Positioning POS2 kit.

☑ The special hardware option "Machine Tool = MF" is available only for models 4/8 and 5/8. The dimensions of these servodrives are presented in figure 3.3 a).

☑ The special hardware option "Machine Tool = MF" cannot be used along with the POS2 expansion board, with the Profibus DP communication board, with or the CEP1 board.

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2.5 RECEIVING AND STORAGE

The SCA-05 is supplied in cardboard boxes.
The outside of the packing has an identification nameplate that is identical to that fixed on the SCA-05. Please check if the nameplate data matches the ordered ones. The packing must be placed and opened on to table. Open the packing, remove the protection material and remove the SCA-05.

Check if:

☑ The SCA-05 nameplate data matches the purchase order.

☑ The equipment has not been damaged during transport. If any problem is detected, contact the carrier immediately.

☑ If the SCA-05 is not installed immediately, store it again within its delivery packing well closed and store it in to clean and dry room (storage temperatures between -10°C (-50°F) and +65°C (+149°F)).

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INSTALLATION AND CONNECTION

This chapter describes the procedures for the electrical and mechanical installation of the SCA-05.
These guidelines must be followed for proper Servodrive operation.

3.1 MECHANICAL INSTALLATION

3.1.1 Environment

The location of the CFW-09 installation is an important factor to assure good performance and high product reliability.
For proper installation of the inverter, we make the following recommendations:

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

Environmetal Condition:

- ☑ Surrounding Air Temperature: 0ºC to 45ºC (32ºF to 113ºF) - nominal condutions. 45ºC to 50ºC (113ºF to 122ºF) - with 2% current derating for each 1ºC (1.8ºF) degree above 45ºC (113ºF). Figure 3.1 shows the current reduction as a function of the ambient temperature rise.

- ☑ Relative Air Humidity: 20% to 90%, non-condensing.

- ☑ Maximum Altitude: 1000m (3,300ft) nominal condutions.
From 1000m to 4000m (3,300ft to 13,200ft) above sea level - with 1% current reduction for each 100m (330ft) above 1000m (3,300ft). Figure 3.2 shows the current derating to be considered as function of higher installation altitude in the air.

- ☑ Pollution Degree: 2 (according to EN50178 and UL508C). It is not allowed to have water, condensation or conductive dust/particles in the air.

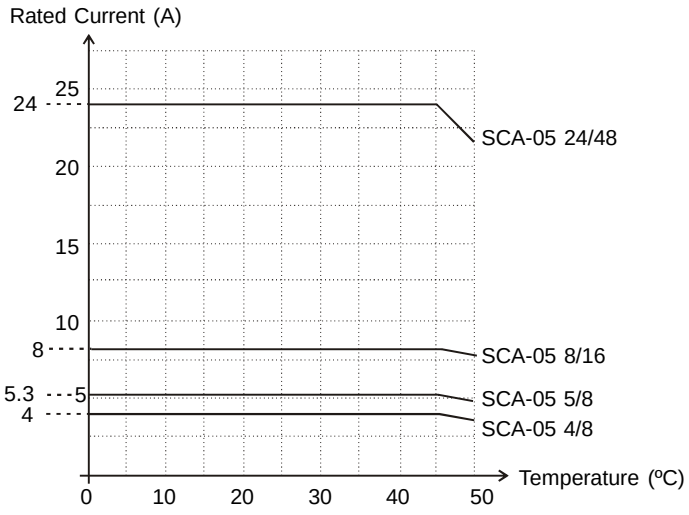


***Figure 3.1** - Current Derating for temperatures above 45°C (113ºF)*

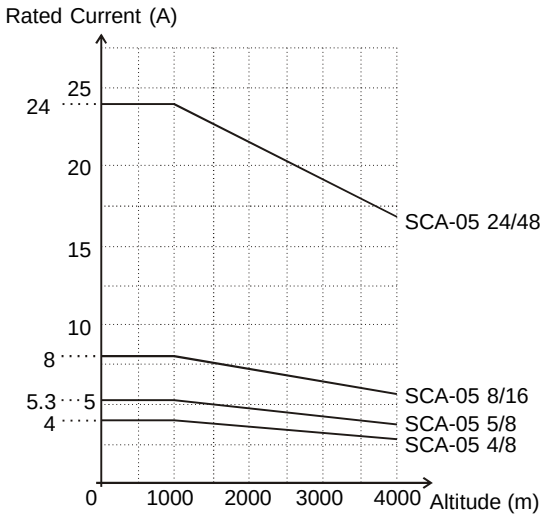


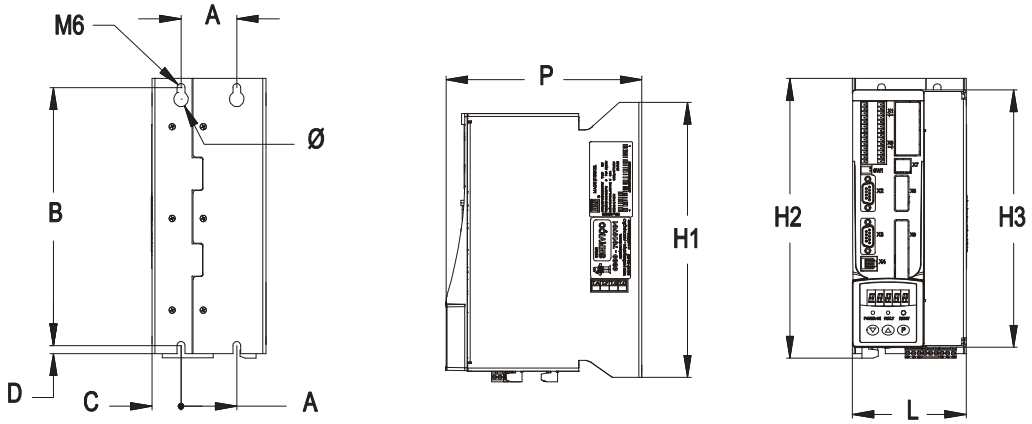
***Figure 3.2** - Current Derating for altitudes higher than 1000m (3.300 ft)*

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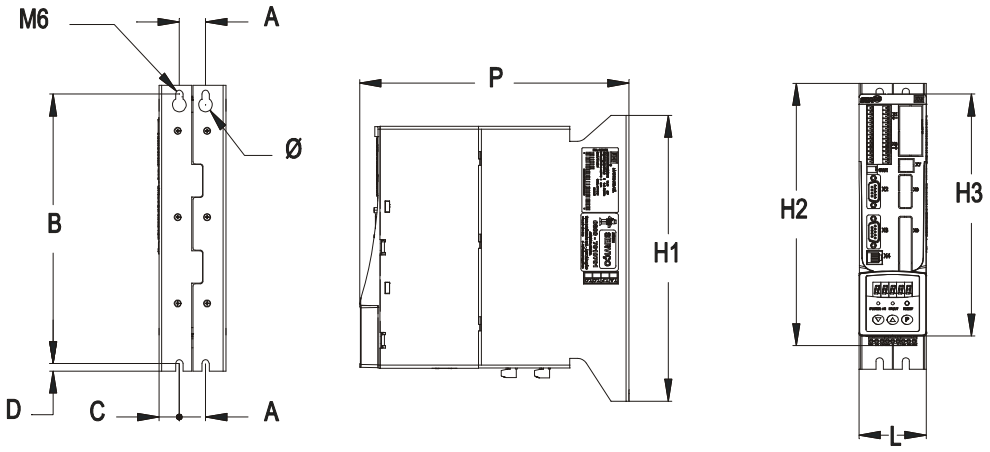
3.1.2 Servodriver Dimensions

Depending on the current specification, the SCA-05 servodrives series has the following models: 4/8MF, 4/8, 8/16 and 24/48, as presented in Figure 3.3. External dimensions, mounting holes and weight for each model are described in Table 3.1.

a) Model 4/8MF and 5/8MF



b) 4/8 Model



c) 8/16 and 24/48 Models

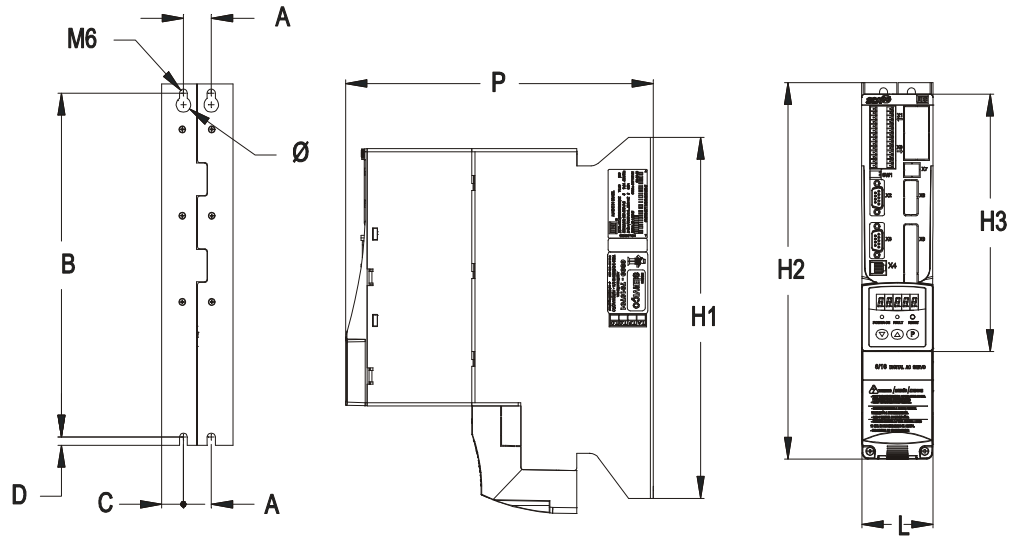


Figure 3.3 a) to c) - *Dimensional drawings for SCA-05*

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Model	A mm (in)	B mm (in)	C mm (in)	D mm (in)	H1 mm (in)	H2 mm (in)	H3 mm (in)	L mm (in)	P mm (in)	ϕ mm (in)	Weight kg
SCA 4/8 MF	50 (1.97)	225 (8.86)	26 (1.02)	7 (0.28)	240 (9.45)	243.8 (9.6)	224.3 (8.83)	102 (4.02)	172.3 (6.78)	13 (0.51)	3.7
SCA 5/8 MF	50 (1.97)	225 (8.86)	26 (1.02)	7 (0.28)	240 (9.45)	243.8 (9.6)	224.3 (8.83)	102 (4.02)	172.3 (6.78)	13 (0.51)	4.0
SCA 4/8	25 (0.98)	250 (9.84)	19.5 (0.77)	7 (0.28)	265 (10.43)	234.3 (9.22)	224.3 (8.83)	64 (2.52)	256 (10.08)	13 (0.51)	3.0
SCA 8/16	25 (0.98)	300 (11.81)	19.5 (0.77)	7 (0.28)	315 (12.4)	328 (12.91)	224.3 (8.83)	64 (2.52)	276 (10.87)	13 (0.51)	4.6
SCA 24/48	50 (1.97)	300 (11.81)	21 (0.83)	7 (0.28)	315 (12.4)	328 (12.91)	224.3 (8.83)	92 (3.62)	276 (10.87)	13 (0.51)	5.85

Table 3.1 *- Installation data - Dimensions in mm (in)*

3.1.3 Positioning and Fastening

When installing the SCA-05, leave free space around the servodrive as indicated in Figure 3.4 below. Minimum dimensions for free space are listed in Table 3.2.

Install the servodrive in the upright position, following the recommendations below:

1) Do not install heat sensitive components immediately above the servodrive;

2) Install the servodrive on to flat surface;

3) Install the 2 bottom mounting bolts first, rest the servodrive on the base and then mount the 2 top bolts.

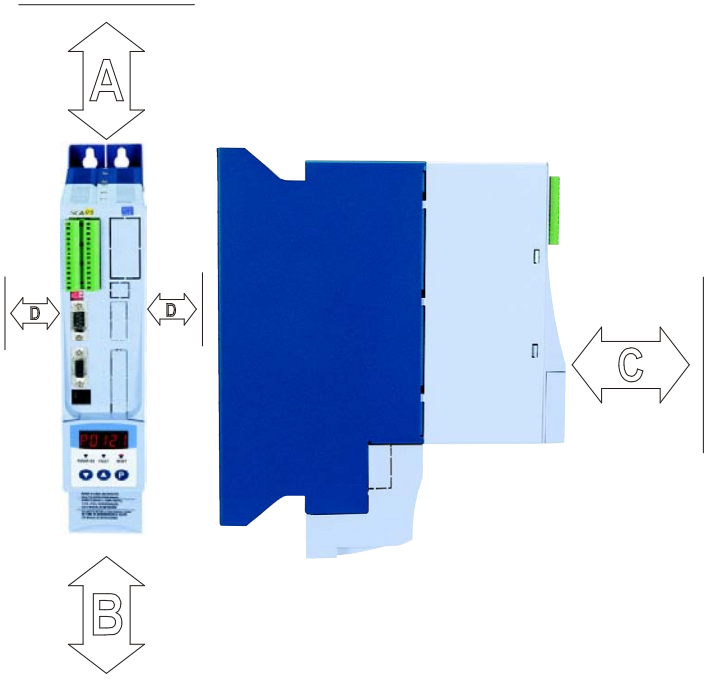


Figure 3.4 *- Free Space for cooling*

Model SCA-05	A mm (in)	B mm (in)	C mm (in)	D
All	200 (8.87)	100 (3.94)	100 (3.94)	0 (0)

Table 3.2 *- Recommended free spaces*

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ATTENTION!

There is no restriction for mounting the servodrives side by side. When inverters are installed top and bottom, maintain the minimum recommended distances for A + B, and deflect the hot air coming from servodrive below.

Installation inside panels:

When servodrives are installed in panels or closed metallic boxes, adequate cooling is required to ensure that the temperature around the servodrive will not exceed the maximum allowed temperature. See Dissipated Power in Section 9.1.1.

When the SCA-05 is installed inside panels or enclosures, the minimum dimensions and cooling requirements presented in table 3.3 are recommended.

SCA-05 Model	Panel Dimensiones						Cooling
	Width		Height		Depth		CFM (l/s)
	mm	in	mm	in	mm	in	
All	500	19.7	600	23.6	450	17.7	32 (15)

Tabele 3.3 *- Dimensions and cooling of panels*

ATTENTION!

Provide conduits or independent wireways for the physical separation of signal (control) and power cables (refer to electrical installation section).

Figure 3.5 shows the installation of the SCA-05 on the surface of to mounting plate.

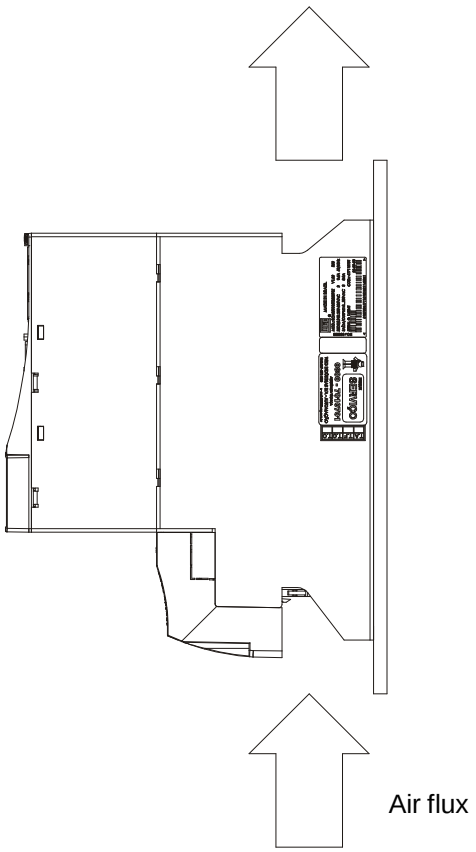
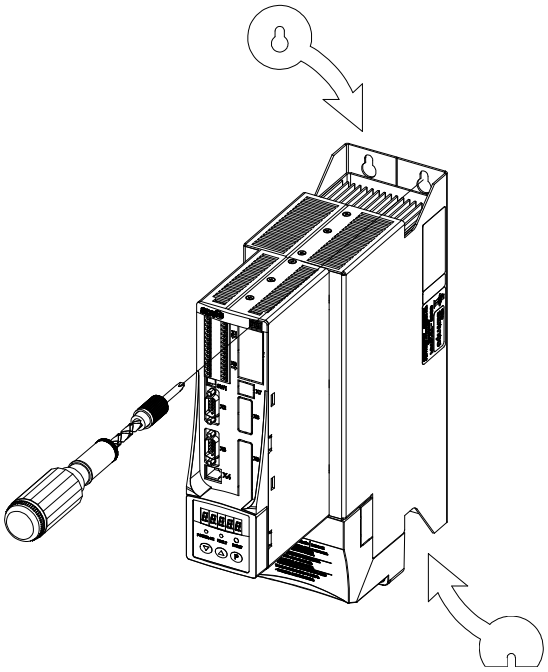


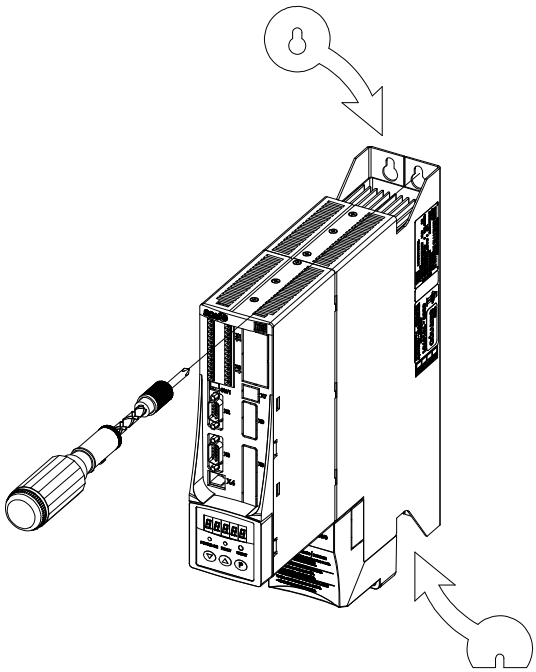
Figure 3.5 - *Installation of the SCA-05 on to mounting plate*

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a) 24/48 Model



b) 8/16 Model



c) 4/8MF and 5/8MF Model

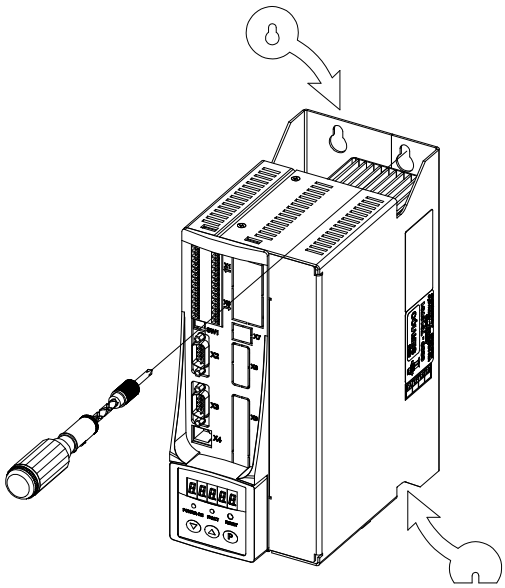


Figure 3.6 a) to c) - *Mounting procedures for the SCA-05 on to surface*

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3.2 ELECTRICAL CONNECTIONS

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

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

DANGER!
The SCA-05 servodrive shall not be used as an emergency stop device. Use additional devices proper for this purpose.

ATTENTION!
Sensitive equipment (PLC's, temperature controllers, thermocouples, etc.) and its wiringmust stay at aminimum distance of 0.25m (10in) from the frequency inverters, the reactors and from the input and motor power cables.

3.2.1 Power and Grounding Terminals

The power connection terminals are located at the bottom side of the SCA-05 servodrive and protected by screwed plastic cover (Figure 3.7), this preventing accidents while equipment is ON. .
The Terminal protecting cover allows two removable lateral access and one removable bottom access. These accesses may be used for improving connection cable installation. (See figures 3.8 and 3.9).

DANGER!
Never operate the servodrive when terminal protection cover has been removed.

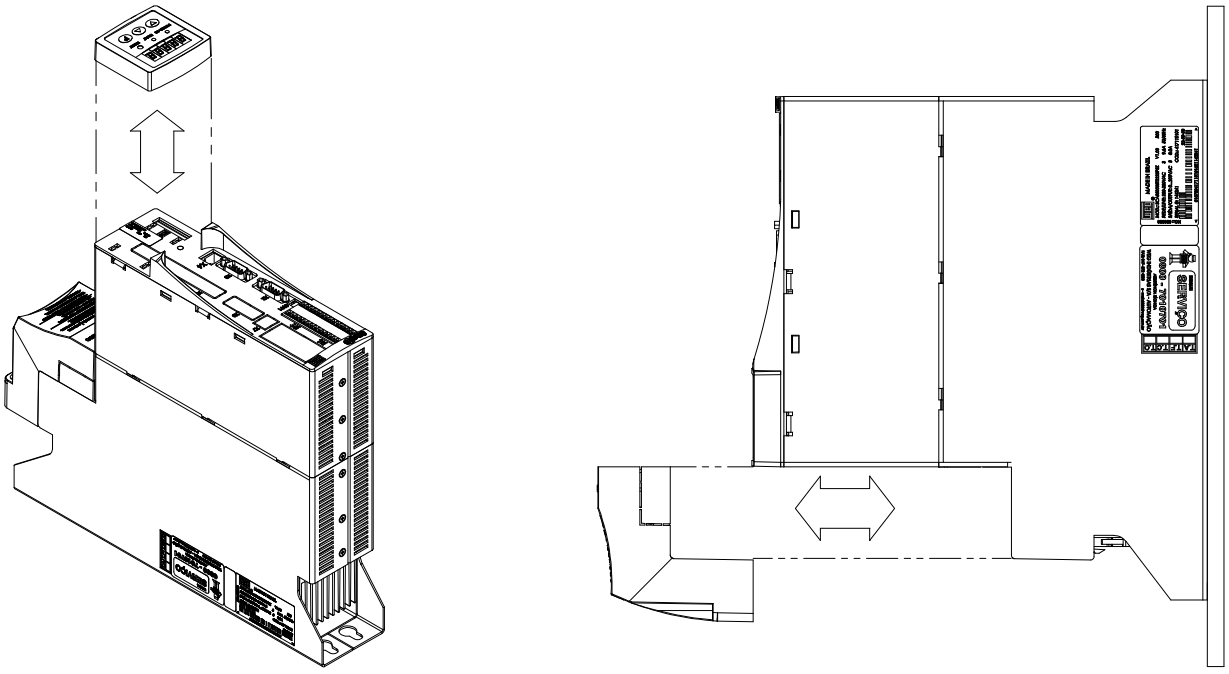


Figure 3.7 *- Procedures for HMI and protection cover removal of the power connections*

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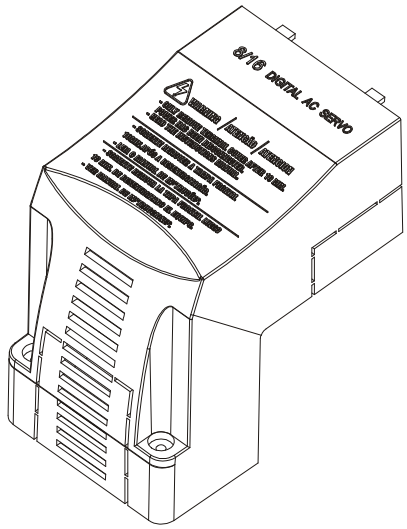


Figure 3.8 - *Power terminal protection cover (8/16 and 24/48 models)*

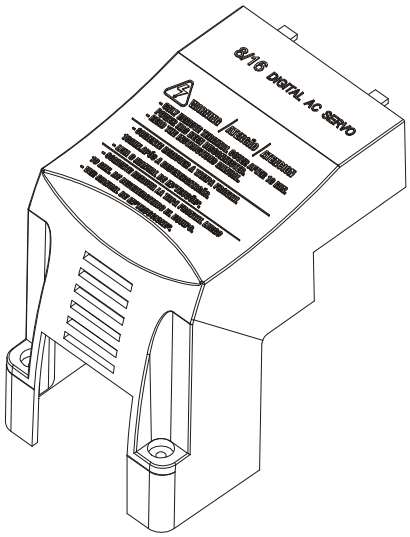


Figure 3.9 - *Power terminal protection cover with lateral accesses and bottom access removed (8/16 and 24/48 models)*

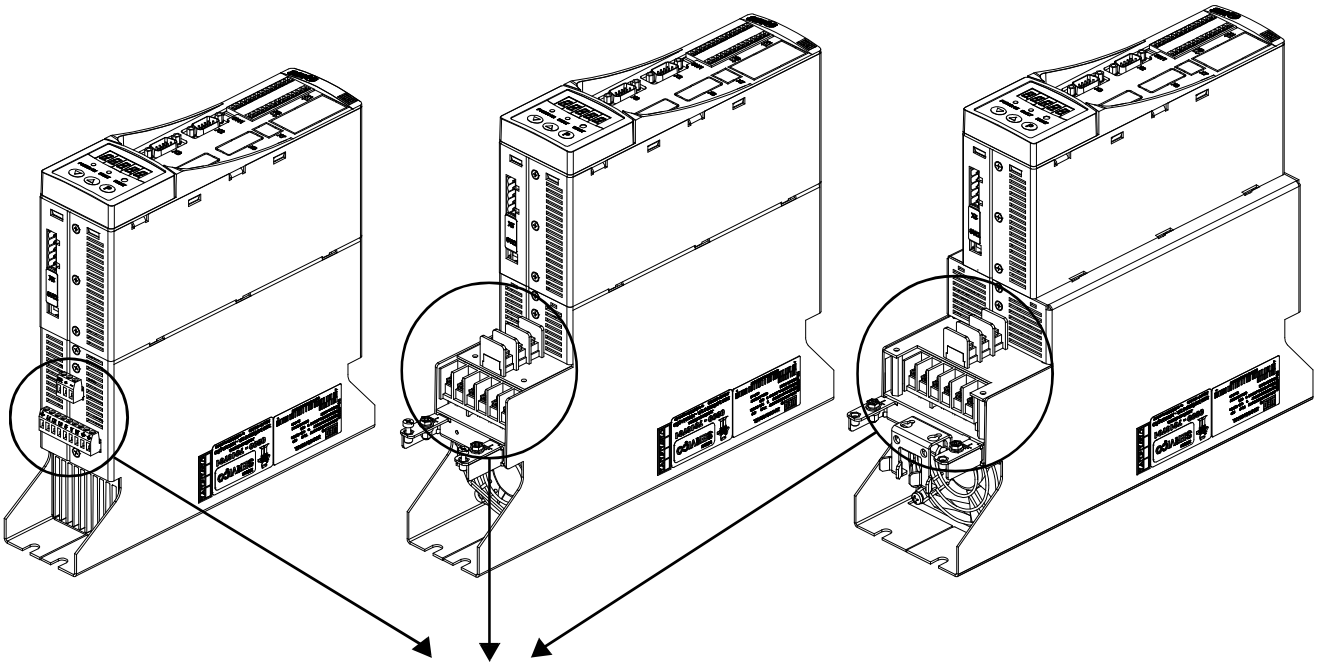


Figure 3.10 - *Power Connections*

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Terminals:

L1, L2, L3 (Line): AC supply line.
U, V, W (Motor): Servomotor connection.
BR: Dynamic braking resistor connection.

-UD: Negative pole of the DC link circuit.
+UD: Positive pole of the DC link circuit.
PE: Grounding.

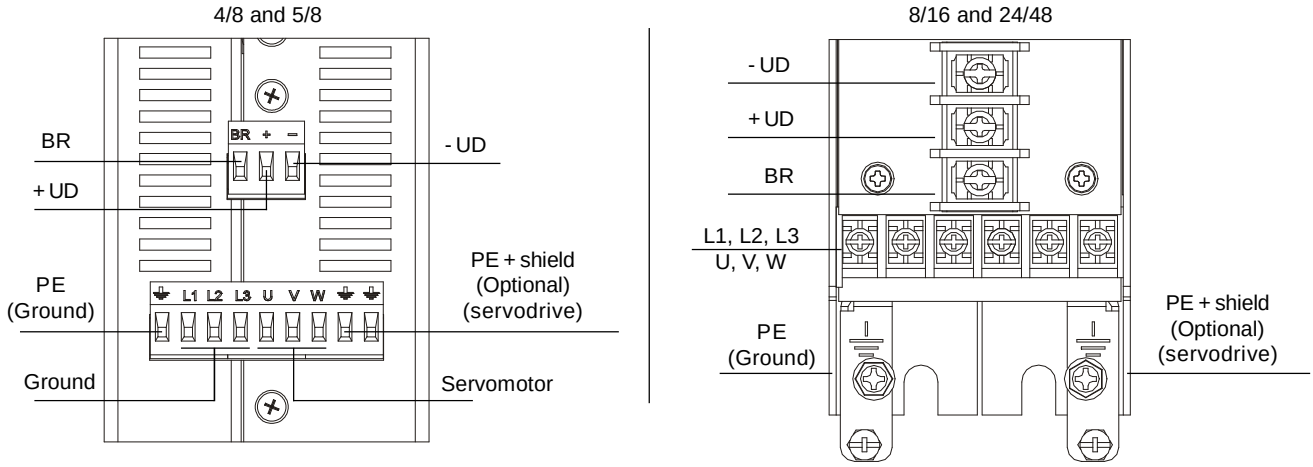


Figure 3.11 - *Ground and power connection terminals for the SCA-05*

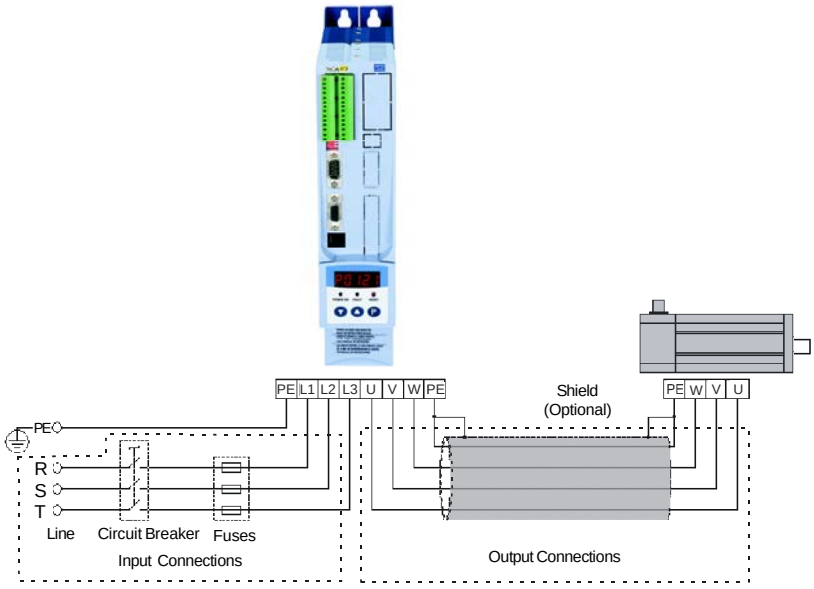


Figure 3.12 *- Power/Grounding Connections*

3.2.2 Input Connections

DANGER!
Provide to circuit-breaker to disconnect the power supply. This circuitbreaker must disconnect the servodrive power supply always when required (for instance, during maintenance or repairs).

Power Supply

☑ Supply line capacity:
The SCA-05 is suitable for use in circuits capable of supplying not more than 30kArms symmetric and 240 volts maximum.

ATTENTION!
The neutral conductor of the AC input power supply must be solidly grounded. However, you must not use this neutral conductor to ground the drive(s).

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ATTENTION!

The AC input voltage must be compatible with the servodrive rated voltage. If this rated voltage is not available, use an autotransformer compatible with the installed servodrive or servodrive group (see chapter 8, Item 8.1).

Sizing the Power Cables

For safety purposes (for the device and installation), use the minimum wire gauge and fuses as recommended in table 3.4. The wire gauge presented in table 3.4 is for reference only. The installation conditions and the maximum acceptable voltage drop shall be considered when sizing the wire gauge.

SCA-05	Power Cables mm^2 (AWG)	Grounding Cables / mm^2 (AWG)	Ultra Fast Fuse [A] Amps	Fuse I^2t A^2s @25°C	Circuit-breaker WEG Model
4/8 and 5/8	1.5 (14)	1.5 (14)	16	125	MBW-C6-3N
8/16	1.5 (14)	1.5 (14)	25	260	MBW-C10-3N
24/48	4.0 (10)	4.0 (10)	35	800	MBW-C25-3N

Table 3.4 *- Recommended Wiring/Fuses - Use only copper wires (70° C)*

The recommended connector's tightening torque is indicated in Table 3.5. Use only copper cables (70ºC minimum).

SCA-05	Power Cables N.m (lbf.in)	Grounding Wiring N.m (lbf.in)
4/8 and 5/8	0.5 (4.43)	0.5 (4.43)
8/16	1.76 (15.58)	1.0 (8.85)
24/48	1.76 (15.58)	1.0 (8.85)

Table 3.5 *- Recommended tightening torque for power and grounding connections*

Fuses

We recommend the installation of input ultra fast fuses with i^2t equal or lower than indicated in Table 3.4. At the input can also be installed standard fuses with current rating as indicated in table 3.4 for the ultra fast fuses.
In this case, only the installation will be protected against short-circuit, whereas the diodes of the rectifier bridge at the servodrive input are not protected.
As option, you can also replace the standard fuses by circuit breakers. Consider please SCA duty when circuit breaker is dimensioned. Table 3.4 indicates circuit-breaker dimensioning of WEG MBW line.

Line Reactor

The requirements for the use of line reactors depend on several application factors. Refer to Chapter 8 - Item 8.4.

NOTE!

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

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3.2.3 Grounding Connections

DANGER!
The servodrives shall be mandatorily grounded to a protection ground (PE). The grounding connection shall follow the local standard recommendations. Use cross section cables as indicated in Table 3.4. The ground connection shall be connected to a grounding bar or to a specific / general grounding point (resistance < 10 ohms).

DANGER!
Do not share the ground wiring with other equipment that operate with high current (for instance, high voltage motors, welding machines, etc). If several servodrives are used together, refer to Figure 3.13.

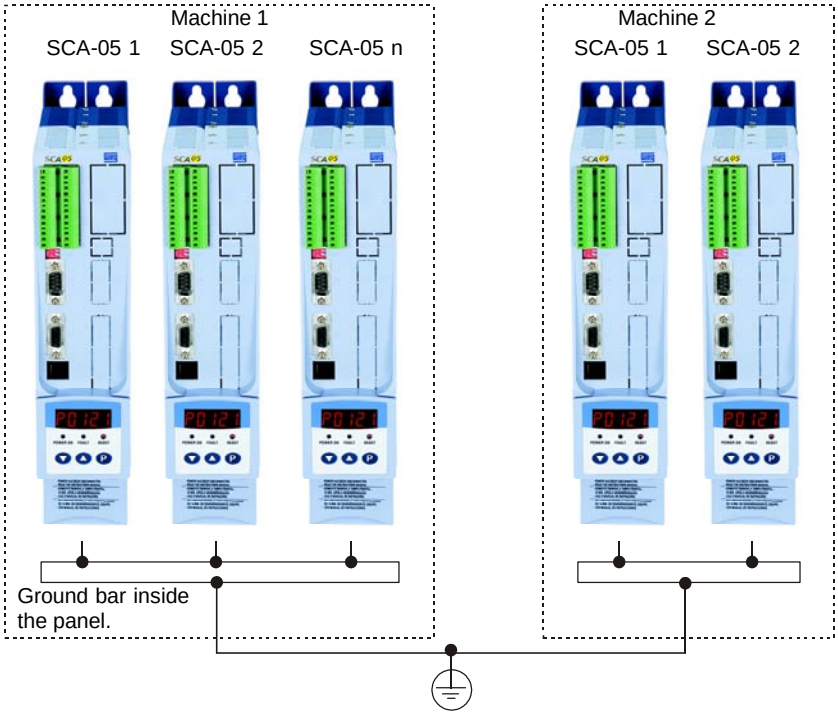


Figure 3.13 *– Grounding connections for more than one inverter*

ATTENTION!
Do not use the neutral conductor of the AC input power supply to ground the servodrive.

ATTENTION!
Always ground the motor frame. Ground the motor in the panel where the inverter is installed or ground it to the servodrive.

Electromagnetic Interference
When the electromagnetic interference caused by the servodrive may interfere in the operation of other equipment, shielded cables or conduits shall be used to connect the servodrive to the servomotor. Connect both shield ends to the servodrive grounding point and to the motor frames as well.

3.2.4 Output Connections

Servomotor
The output connection terminals are presented in item 3.2.1.
WEG offers to complete line of power cables and resolvers (for servodrive connection to motor). For more details, refer to Chapter 8, Item 8.2.

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ATTENTION!

☑ Run the servodrive output wiring separate from the input line wiring as well as the control and signal wiring.

☑ The servodrive is provided with electronic protection against motor overload. This protection must be set according the specific motor. If to disconnecting switch or to contactor is inserted in the motor supply line, DO NOT operate the disconnecting switch with running motor or when servodrive is enabled.

☑ It is necessary to maintain the electrical continuity of the motor cable shield.

Link DC

The access terminals to the DC link must be used only for the servodrive interconnection when only one braking resistor is used for two or more servodrives.



ATTENTION!

Do not change the connection of these terminals. This may cause permanent damage to the servodrive.

DB Resistor

The DB resistor is mounted externally to the servodrive. Its resistance shall not be lower than 15 ohms. The SCA-05 line may be supplied with DB resistor of independent construction (RF-200) thus meeting the most applications. Refer to the item 8.5 for further information and follow the recommendations listed below:

- Always use a twisted cable for interconnecting the servodrive and the braking resistor;
- Provide physical separation between this cable and the control cables;
- If the braking resistor is mounted inside the panel, consider the heating generated by this device when sizing the panel ventilation.

The signal connections (analog inputs/outputs) and control connections (digital inputs/outputs and relay outputs) are made on the front side of the SCA-05, as shown below:

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3.2.5 Signal and Control Wiring

The signal connections (analog inputs/outputs) and control connections (digital inputs/outputs and relay outputs) are made on the front side of the SCA-05, as shown below:

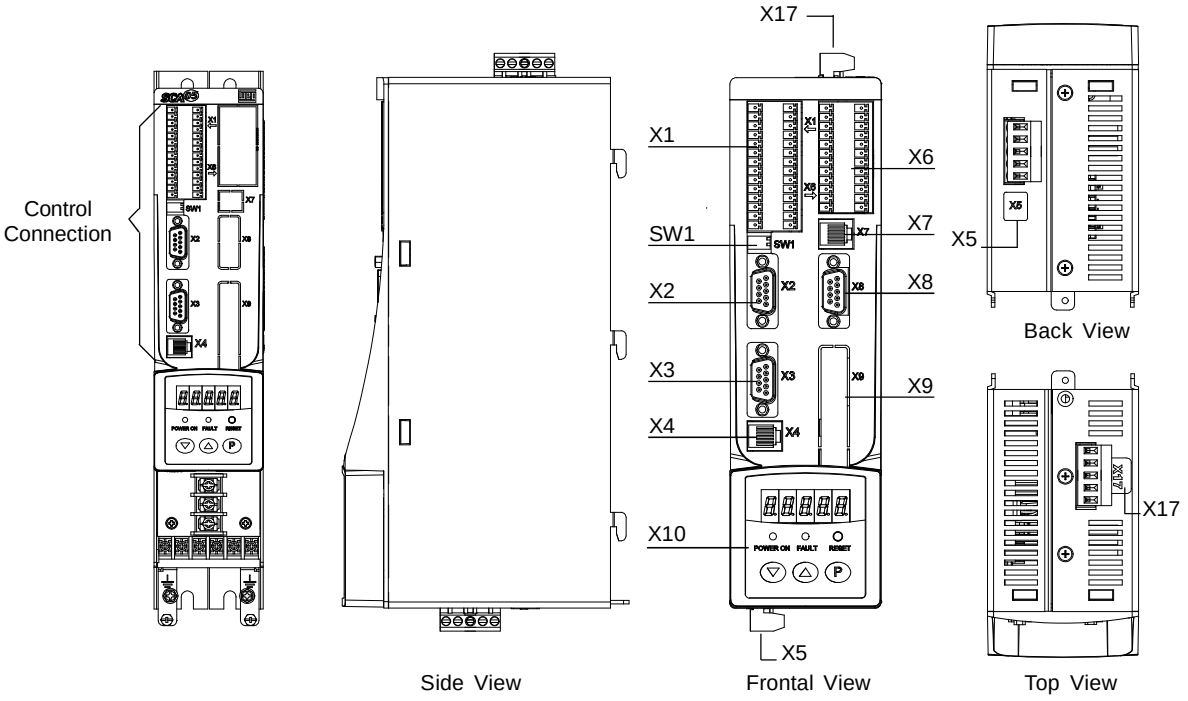


Figure 3.14 - *Control connections*

X1 : Analog inputs/outputs, digital inputs/outputs
X2 : Resolver input
X3 : Encoder Simulator output
X4 : Serial RS 232 (Servodrive)
X5 : CAN Communication network (Servodrive)
X6: Analog Inputs/Outputs, Digital Inputs/Outputs (POS2 Board, (optional), refer to the POS2 Board manual)
X7: RS-232 Serial Interface (POS2 Board, (optional), refer to the POS2 Board manual)/Power Supply (CEP1 Board, (optional), refer to the CEP1 Board manual)
X8: Encoder Input (POS2 Board, (optional), refer to the POS2 Board manual)
X9 : Fieldbus Communication network
X10 : HMI Module or Module for remote HMI connection (refer to Chapter 8, item 8.3)
X17: CAN communication network (POS2 Optional Board, refer to the POS2 Board manual)
SW1: Analog input selector (on = Current, off = Voltage)

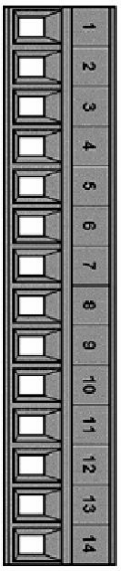
Detailed description of the connectors:

☑ **X1 : Analog Input / Output, Digital Input / Output**

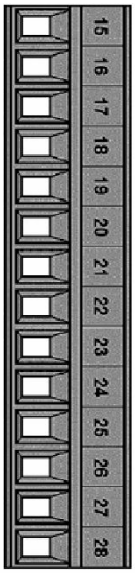
Connect the SCA-05 control wiring to this connector as follows:
- Digital inputs for receiving enable/disable commands, error Reset, etc.
- Digital outputs for signaling of Error, Enable/Disable, etc.
- Analog input for receiving speed reference, torque or position signals.
- Analog outputs for providing proportional signals for speed, torque, position, etc.

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NOTE!
The functions of the analog input/output and digital input/ output may be programmed via parameters. For more details about each function, refer to Chapter 5.



PIN	GROUP	DESCRIPTION	SPECIFICATIONS
1	Digital Outputs (Relay DO)	Relay Output 1 (NO)	Contact Capacity: 1A, 240Vac
2		Relay Output 1(NC)	
3		Relay Output 2 (NO)	
4		Relay Output 2 (NC)	
5	Digital Inputs (DI)	Common	Common point of DI
6		Common	
7		DI6	Minimum High Level: + 18Vdc Maximum Low Level: +3Vdc
8		DI4	
9		DI2	
10	Sources	+15Vdc (Reference pin 11)	Analog Input Sources: 15Vdc@100mA, grounded
11	Analog Outputs (AO)	GND (+15Vdc and -15Vdc)	Analog output reference, grounded
12		Analog Output 2	(-10 to +10)Vdc RL ≥ 10kΩ Resol: 12bits
13	Digital Inputs (AI2)	Analog Input 2 (+)	Differential, resol: 10bits (-10 to +10)Vdc or (0 to 20)mA or (4 to 20)mA Impedance: 400kΩ (10V) and 500Ω (20mA)
14		Analog Input 2 (-)	



PIN	GROUP	DESCRIPTION	SPECIFICATIONS
15	Digital Output relay (DO)	Relay output 1 - Common	Contact Capacity: 1A, 240Vac
16		Relay output 2 - Common	
17	Digital transistor output (DO)	Transistor output emitter	Isolated, open collector, Max. Voltage: +24Vdc, Max. Current: 50mA
18		Transistor output collector	
19	Sources	+24Vdc (Reference pin 20)	DI Supply: Capacity: 140mA Grounded via resistor 249Ω
20		GND (24Vdc)	
21	Digital Inputs DI	DI5	Minimum High Level: + 18Vdc Maximum Low Level: +3Vdc
22		DI3	
23		DI1	
24	Sources	-15Vdc (Reference pin 11)	Analog Input Sources: -15Vdc@100mA, grounded
25	Analog Outputs (AO)	Analog Output 1	(-10 to +10)Vdc RL ≥ 10kΩ Resol: 12bits
26	Analog Input (AI1)	Analog Input 1 (+)	Differential, resol: 14bits (-10 to +10)Vdc or (0 to 20)mA or (4 to 20)mA Impedance: 400kΩ (10V) and 500Ω (20mA)
27		Analog Input 1 (-)	
28		Ground	Grounding Point

Figure 3.15 *– Description, Technical specification of XC1 connector*

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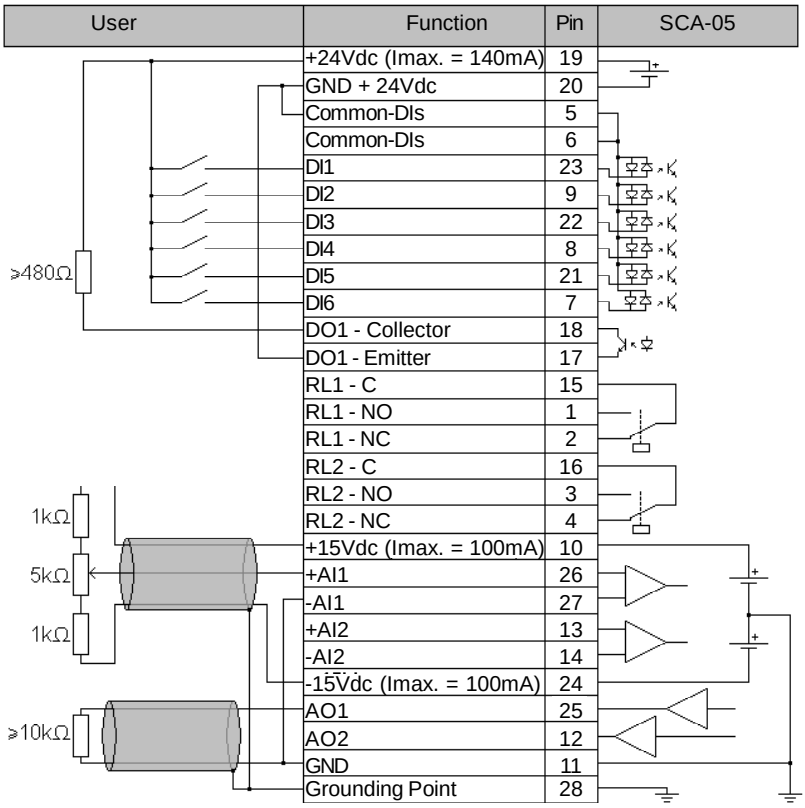


Figure 3.16 *– X1 Connector*

X2 : Resolver Input

This connector receives the feedback signals transmitted by the servomotor resolver. The resolver has the function to inform to the servodrive the exact position of the servomotor shaft. This connection must be always carried out. Otherwise the SCA-05 will display the error E32.

X2 Connector	
Pin	Function
1	- COS
2	+ 5V
3	- SEN
4	GND
5	+ OSC
6	PTC
7	+ COS
8	+ SEN
9	GND

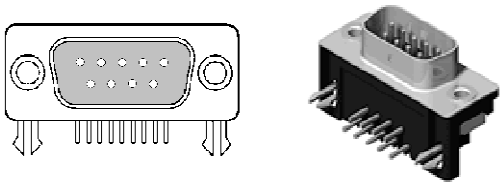


Figure 3.17 *- X2 Connector*

NOTE!

The positioning accuracy is limited to the number of pulses of the resolver (device for position feedback) and it is of ±10 arc minutes (1° = 60 arc minutes).

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X3 : Encoder Simulator Output

The servodrive simulates an encoder coupled to the servomotor shaft. The use of this signal is very common in CNCs. This circuit is optically isolated and needs an exclusive external power supply (5V to 15V), which must be connected between pins 4 and 6. The circuit generates a differential signal that may be disabled through the enabling pin (if it is not connected, the signals are enabled).

X3 Connector		
Pin	Function	
1	B	
2	$\overline{A}$	
3	A	
4	V+ (5 to 15Vdc)	
5	Enabling	0V enabled V+ disabled (5 to 15Vdc)
6	V- (0V)	
7	$\overline{N}$	
8	N	
9	$\overline{B}$	

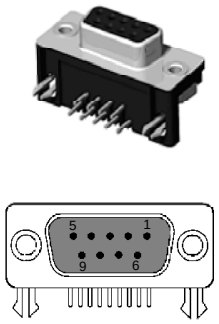


Figure 3.18 *- X3 Connector*



NOTE!

Spurious pulses may appear at the output X3 (if it is enabled) right after powering the drive on or if the resolver cable is missing.

X4 : Serial RS-232

This connector is used for the connection of to standard RS-232 communication network between servodrive and PC and/or PLC. See item 6.1.

X4 Connector	
Pin	Function
1	+ 5V
2	RTS
3	0V
4	RX
5	0V
6	TX

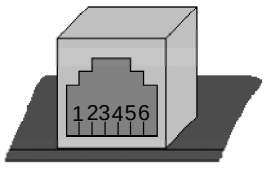


Figure 3.19 *- X4 Connector*

X5: CAN Communication Network

Connector for the CAN (Controller Area Network) bus interface. This connector allows the servodrive to be connected to CAN-based networks such as CANopen and DeviceNet.

X5 Connector	
Pin	Function
1	GND
2	CANL
3	Shield
4	CANH
5	Vdc

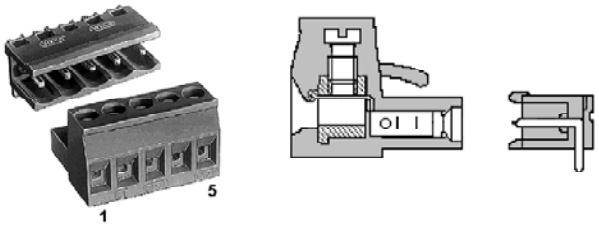


Figure 3.20 *- X5 Connector*

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SW1 : Analog Input Selector (on = Current , off = Voltage)
This Dip Switch must be used to define the signal type that shall be connected to the analog input (-10 to +10)V or (0 to 20)mA / (4 to 20)mA. As to default the analog inputs are selected as (-10 to +10)V. Note: Do not forget to program P235.

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

1) Cable Cross Section: 0.5mm² (20 AWG) to 1.5mm² (14 AWG).

2) Max. Torque: 0.50 N.m (4.50 lbf.in).

3) Control wiring must be connected with shielded cables and installed separately from other wiring (power, control at 110/220Vac, etc.). For wiring distances up to 100m, ensure to minimum distance of 10cm (3,94in) between cables. For wiring distances longer than 100m, ensure to minimum distance of 25cm (9,84in) between cables.
If the crossing of these cables is unavoidable, install them perpendicular, maintaining to minimum separation distance of 5cm (1.97in) at the crossing point.

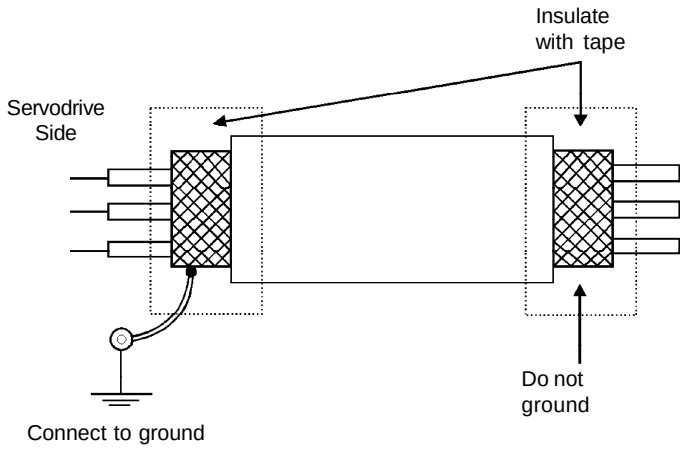


Figure 3.21 *- Shield connection*

4) For wiring distances longer than 50m (150ft), it is necessary to use galvanic isolators for the X1:1 to 28 analog signals.

5) Relays, contactors, solenoids or electromagnetic braking coils installed near inverters can generate interference in the control circuit. In order to eliminate this interference, connect RC suppressors in parallel with the coils of AC relays. Connect to free - wheeling diode in case of DC relays/coils.

6) When an external keypad (HMI) is used (Refer to Chapter 8), separate the cable that connects the servodrive from the other cables, maintaining to minimum distance of 10cm (4in) each other.

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HMI USE (LOCAL MODE) / PRE-POWER / START-UP

This chapter provides following information:

- ☑ General description of the Human-Machine Interface;
- ☑ Use of the HMI;
- ☑ How to check and prepare the servodrive before power-up;
- ☑ How to power-up and check for proper operation;
- ☑ How to start to checking/changing process of parameter programming.

4.1 GENERAL DESCRIPTION OF THE HUMAN-MACHINE-INTERFACE (HMI)

The SCA-05 standard HMI contains 5 digits, 7 segment LED displays, two signaling LED´s and 4 keys. Figure 4.1 shows the HMI as well as the display, LED´s and keys location.

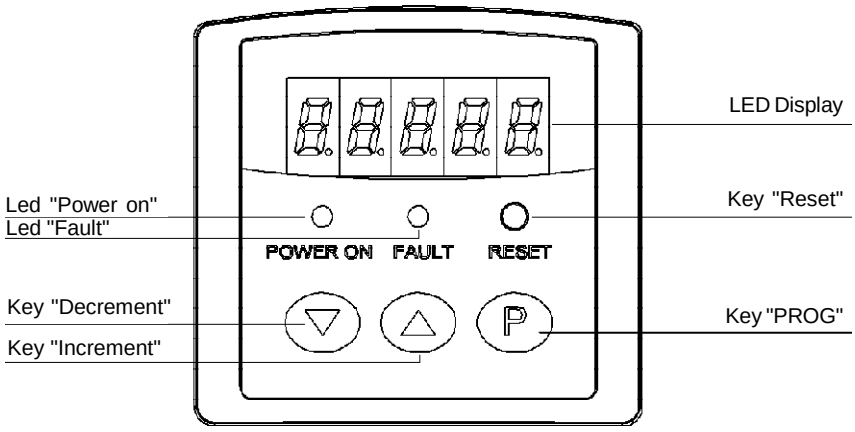


Figure 4.1 *- SCA-05 standard HMI*

LED Display Functions:
The LED display shows the error and status messages (see Quick Parameter Reference, Fault and Status Message) the Parameter number or its content. The Unit display (at right corner) shows the unit of the indicated variable:

A → current
U → voltage
H → frequency
Nothing → speed and other parameters

Function of the "Power on" LED:
It displays that the servodrive has been powered-up.

Function of the "Fault" LED:
It indicates that the servodrive has some internal or external error.

Function of the "Reset" key:
This key is used for error and servodrive reset. Please note that the error reset is only accepted when the condition generating these errors is not more present when reset is made.

The PROG key is used for accessing the programming parameters. Whenever you want to change a parameter value, press the "P" key to access its content. Once it has been modified, press the "P'' key once again to exit the programming of that parameter. This operation automatically saves the new parameter value as well.

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This key is used to move to the next parameter and/or to increase the parameter value. From this version on, this key can be used to move from the last to the first servodrive parameter.

This key is used to move to the previous parameter and/or to decrease the parameter value. From this version on, this key can be used to move from the first to the last servodrive parameter.

Refer to item 4.2 for a better understanding of the keypad operation.

4.2 PARAMETER DISPLAY / CHANGE

All SCA-05 servodrive settings are made through parameters. The parameters are shown on the Display by means of the letter P followed by to number:
Example: Parameter 121



Each parameter has an associated numerical value (parameter content), which corresponds to the option chosen (among the available options) for that parameter.

The parameter values define the servodrive programming and/or the value of to variable (ex.: current, frequency, voltage, etc.). For the servodrive programming, you must change the parameter content(s).

Notes:

☑ Parameters that can be changed with running servomotor will be assumed immediately by servodrive as new set value. Parameters that can be changed only with stopped servomotor will be assumed by servodrive as new set value only after pressing key P .

☑ By pressiong key P after setting the parameter, the last set value is saved automatically in the servodrive non-volatile memory and remains stored till next change is made.

☑ To change to parameter, set P000 = password value. The password default is 5. Otherwise you are able to display the parameters only, but unable to change them. For more details, see P000 description in Chapter 5.

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4.3 CONTROL TYPES

4.3.1 Torque Mode

In torque mode, servodrives controls only the torque present at the servomotor shaft, disregarding it speed and position. The servodrive supplies to constant current (the torque is proportional to the current) as set at the current reference. The current reference may be supplied by Parameter P119 or any analog input, etc.
The speed will change as function of the load, without control of the servodrive.

4.3.2 Speed Mode

In the speed mode, the servodrive maintains to constant speed, as set at the speed reference (set at Parameter P121, or set at analog input, etc). In this case, the current (torque) will vary as function of the load.

4.3.3 Positioning Mode

In the positioning mode, the servodrive maintains the position constant, as set at the positioning reference (set at Parameter P117, or analog input, etc.). The positioning accuracy is limited to the number of pulses of the resolver (device for position feedback) and it is of ±10 arc minutes (1° = 60 arc minutes).

4.3.4 Control via POS2

The speed / position control is performed by the optional board POS2.

4.4 PRE-POWER CHECKS

The drive shall be installed according to the instructions presented in Chapter 3 - Installation and Connection. Even if your application is not presented in the typical connections section, the following recommendations are still applicable.



DANGER!
Disconnect the AC input power before making any connection.

1) **Check all connections;**
   Check if the power, grounding and control connections are correct and well tightened. Remove all shipping material from the inside of the equipment that may cause eventual short-circuit. Check if all current carrying components are isolated and/or protected properly for avoiding accidental personnel contact.

2) **Check the supply voltage;**
   Check if supply voltage matches the servodrive voltage. If possible, measure line voltage with voltmeter and check if read data matches the rated servodrive voltage data. The servodrive voltage data are indicated on the servodrive nameplate.

3) **Check motor;**
   Check if motor connections are correct and well tightened and if the motor voltage matches the servodrive ones.

4) **Uncouple the load from the motor;**
   If the motor cannot be uncoupled, be sure that the direction of rotation (FWD/REV) cannot damage the machine or cause personal injuries.

5) **Close the servodrive or drive covers.**

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4.5 POWER-UP

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

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

2) **Power-up the AC input;**
   Close the input circuit breaker.

3) **Check if the power-up has been successful;**
   Check if HMI is ON.

The programming examples presented in items 4.6.1 and 4.6.2 are based on a servodrive and on a servomotor with the following characteristics:

Servodrive
SCA050008T2223PSZ

Motor
WEG – SWA – 56 – 2.5 – 60
Mo: 2.5Nm
Speed: 6000 rpm
Rated Voltage: 200V
Rated Current: 7.5A

4.6 EXAMPLES OF TYPICAL CONNECTIONS

4.6.1 Typical Connection #1

Run servomotor shaft at determined speed and at determined direction of rotation by using the HMI.

4.6.1.1 Installation

Please find below the most basic possible electrical installation. Also the SCA-05 parameter setting procedures will be the most basic possible and the whole servomotor control will be realized through the SCA-05 HMI. These procedures are recommended to people that are not acquainted with SCA-05 servodrive operation and so gain their first experiences with this product.

For installation an connection, read Chapter 3 - Installation and Connection. Proceed as shown in Figure 4.2.

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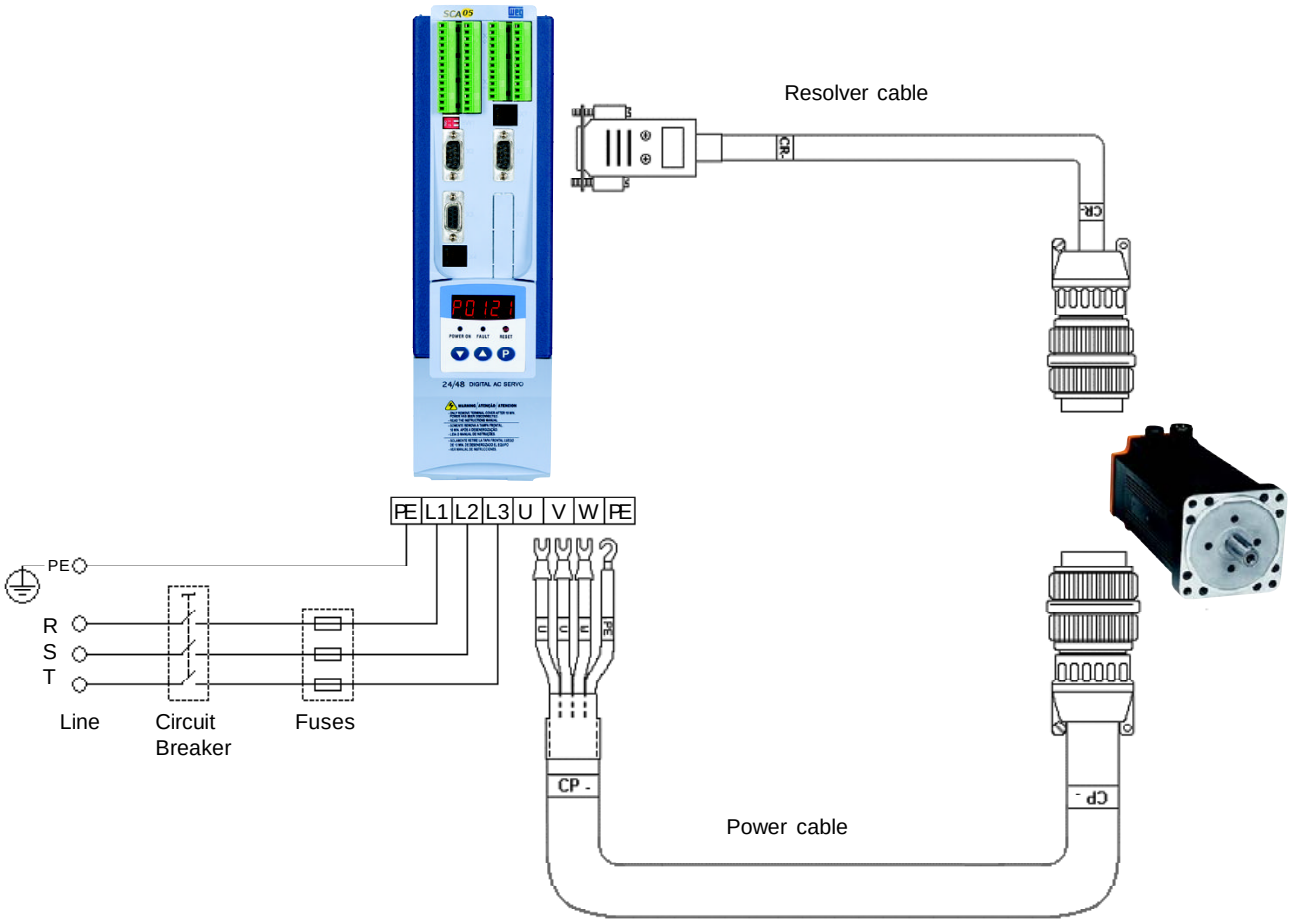


Figure 4.2 *– Electrical installation for typical connection #1*

4.6.1.2 Programming

ACTION	LOCAL HMI DISPLAY	DESCRIPTION
After power-up, the display shows the following message		This is Parameter 0. It has the access password function that enables you to change the other servodrive parameters
Press key (P) to enter in the programming mode		You enter in the programming mode of this parameter
Use the key (▲) and (▼) to program the password (password = 5 (default))		Value of the selected password
Press key (P) to effect the password input and to release the access for changing the other parameters		Value of the set password
Press key (▲) and (▼) till motor parameter is reached. Now this parameter can be set according to the used motor		Parameter P385 (servomotor type)

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
Press key (P) to enter into the programming mode		You enter into the programming mode of this parameter
Press key (▲) and (▼) to select the value that corresponds to the serrvomotor model		Existing servomotor models: 1 = Reserved 2 = Reserved 3 = SWA 56-2.5-20 4 = SWA 56-3.8-20 5 = SWA 56-6.1-20 6 = SWA 56-8.0-20 7 = SWA 71-9.3-20 8 = SWA 71-13-20 9 = SWA 71-15-20 10 = SWA 71-19-20 11 = SWA 71-22-20 12 = SWA 71-25-20 13 = Reserved 14 = Reserved 15 = Reserved 16 = Reserved 17 = Reserved 18 = Reserved 19 = Reserved 20 = SWA 40-1.6-30 21 = SWA 40-2.6-30 22 = SWA 56-2.5-30 23 = SWA 56-4.0-30 24 = SWA 56-6.1-30 25 = SWA 56-7.0-30 26 = SWA 71-9.3-30 27 = SWA 71-13-30 28 = SWA 71-15-30 29 = SWA 71-19-30 30 = Reserved 31 = Reserved 32 = Reserved 33 = Reserved 34 = Reserved 35 = Reserved 36 = Reserved 37 = SWA 40-1.6-60 38 = SWA 40-2.6-60 39 = SWA 56-2.5-60 40 = SWA 56-3.6-60 41 = SWA 56-5.5-60 42 = SWA 56-6.5-60
Press key (P) to confirm the servomotor model		Servomotor model has been set
Press key (▲) and (▼) till Auto-tuning (P380) is reached and so the servodrive can set the Loop and Speed gains		Parameter P380 (Auto-tuning)

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
Press key (P) to enter in the programming mode		You enter into the programming mode of this parameter
Press key (▲) to change the parameter value from 0 to 1		Auto-tuning enabled
Press key (P) to exit the programming mode		Exit the programming mode
Press key "Reset" to start the Auto-tuning **ATTENTION!** At this moment motor will run for to little while. Be sure that it does not damage any equipment.		Starts Auto-tuning
When the Auto-tuning is finished, the display shows:		
Press key (▲) and (▼) till Speed Reference (P121) is reached and so this reference can be set to the desired speed		Parameter P121 (Speed Reference via HMI)
Press key (P) to enter the programming mode		Factory standard value is 0rpm
Press key (▲) and (▼) till desired speed has been selected		Selected speed: 100rpm
Press key (P) to save the selected speed and exit the programming mode		Exit the programming mode

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4.6.1.3 Execution

ACTION	LOCAL HMI DISPLAY	DESCRIPTION
Press key ▲ and ▼ till till servomotor Enable parameter has been reached (P099)		Parameter P099 (Enable via HMI)
Press key P to enter the programming mode		The factory standard value is 0. (Disable)
Press key ▲ to enable the servomotor. **ATTENTION!** At this moment motor starts running at 100rpm. Be sure that this speed does not damage any equipment.		Servomotor is enabled (shaft is running)
Press key P to exit the programming mode		Exit the programming mode
Press key ▲ and ▼ till servomotor Direction of Rotation parameter has been reached (P111)		Parameter P111 (Direction of Rotation via HMI)
Press key P to enter the programming mode		The factory standard value is 0. (clockwise Direction of Rotation)
Press key ▲ to reverse servomotor direction of rotation **ATTENTION!** At this moment motor starts running at counter-clockwise direction of rotation. Be sure that this speed does not damage any equipment.		Servomotor runs in counter-clockwise direction of rotation
Press key ▲ and ▼ till servomotor Enable Parameter has been reached (P099)		Parameter P099 (Enable via HMI)
Press key P to enter programming mode		Motor enabled (shaft is running)
Press key ▲ to enable servomotor		Servomotor disabled (shaft is stopped)

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4.6.2. Typical Connection #2

The typical connection #2 represents an application where the servomotor runs in a specific direction of rotation with a certain speed (following the acceleration and deceleration ramps) and it is controlled through the Keypad/Digital Inputs.

4.6.2.1 Installation

The following example presents the electrical installation of the servo-drive using the Digital Inputs resources. This installation is recommended for users with a previous knowledge of the SCA-05 servodrive, or for users that accomplished and understood the typical connection #1.

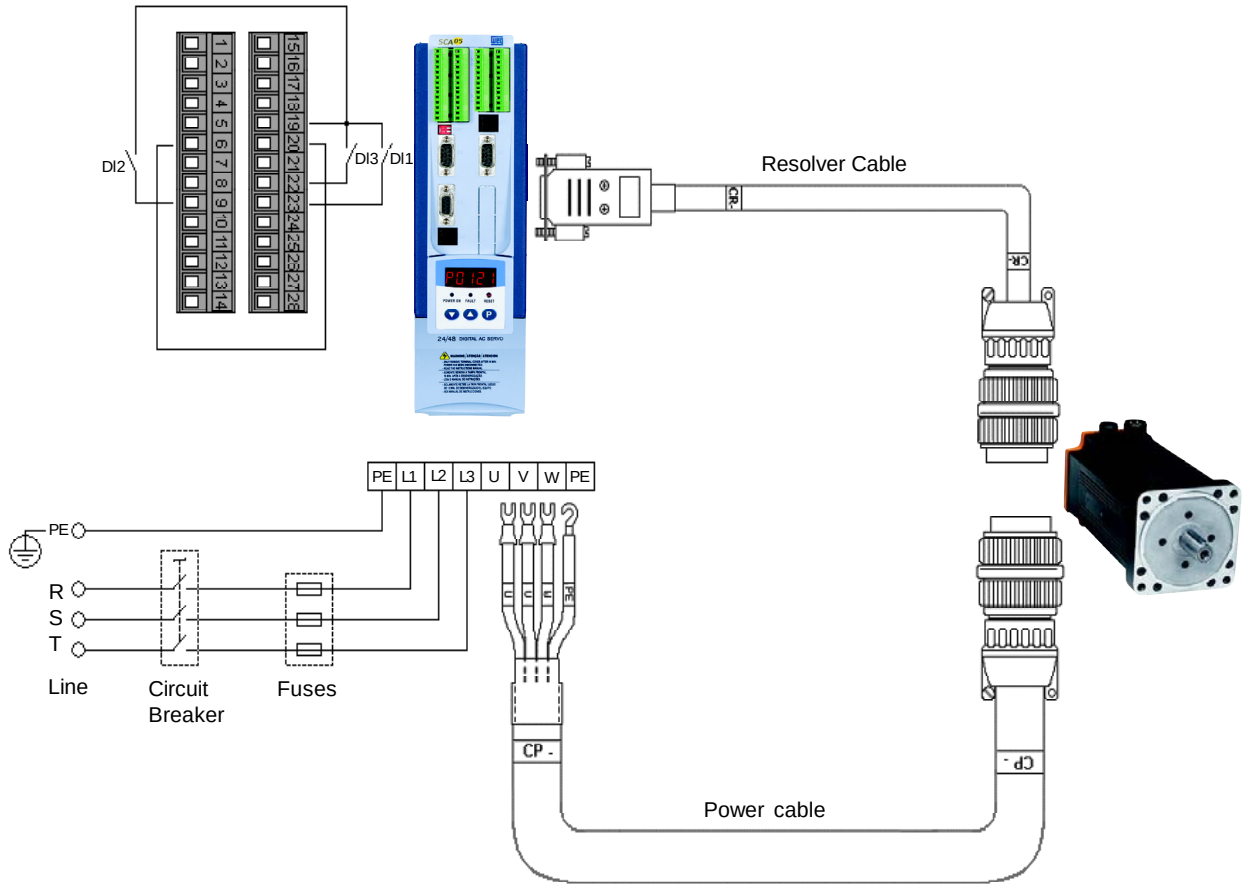


Figure 4.3 - *Electrical installation for typical connection #2*

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4.6.2.2 Programming

ACTION	LOCAL HMI DISPLAY	DESCRIPTION
After power-up, the display shows the following message		This is Parameter 0. It has the access password function that enables you to change the other servodrive parameters
Press key (P) to enter in the programming mode		You enter in the programming mode of this parameter
Use the key (▲) and (▼) to program the password (password = 5 (default))		Value of the selected password
Press key (P) to effect the password input and to release the access for changing the other parameters		Value of the set password
Press key (▲) and (▼) till motor parameter is reached. Now this parameter can be set according to the used motor		Parameter P385 (servomotor model)
Press key (P) to enter into the programming model		You enter into the programming mode of this parameter
Press key (▲) and (▼) to select the value that corresponds to the servomotor model		Existing servomotor models: 1 = Reserved 2 = Reserved 3 = SWA 56-2.5-20 4 = SWA 56-3.8-20 5 = SWA 56-6.1-20 6 = SWA 56-8.0-20 7 = SWA 71-9.3-20 8 = SWA 71-13-20 9 = SWA 71-15-20 10 = SWA 71-19-20 11 = SWA 71-22-20 12 = SWA 71-25-20 13 = Reserved 14 = Reserved 15 = Reserved 16 = Reserved 17 = Reserved 18 = Reserved 19 = Reserved 20 = SWA 40-1.6-30 21 = SWA 40-2.6-30 22 = SWA 56-2.5-30 23 = SWA 56-4.0-30 24 = SWA 56-6.1-30 25 = SWA 56-7.0-30

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
		26 = SWA 71-9.3-30 27 = SWA 71-13-30 28 = SWA 71-15-30 29 = SWA 71-19-30 30 = Reserved 31 = Reserved 32 = Reserved 33 = Reserved 34 = Reserved 35 = Reserved 36 = Reserved 37 = SWA 40-1.6-60 38 = SWA 40-2.6-60 39 = SWA 56-2.5-60 40 = SWA 56-3.6-60 41 = SWA 56-5.5-60 42 = SWA 56-6.5-60
Press key (P) to confirm the the servomotor model		Servomotor model has been set
Press key (▲) and (▼) till Speed Reference (P121) so this reference can be set to the desired speed		Parameter P121 (Speed Reference via HMI)
Press key (P) to enter the programming mode		Dafult is 0rpm
Press key (▲) and (▼) till desired speed can be selected		Selected speed: 1000rpm
Press key (P) to save the selected speed and exit the programming mode		Exit the programming mode
Press key (▲) and (▼) till programming parameter of the Acceleration Ramp has been reached (P100)		Parameter P100 (Acceleration Ramp 1)
Press key (P) to enter in the programming mode		Factory standard value: 1ms/krpm. This means that servomotor reaches the speed of 1000rpm within 1ms

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
Press key ▲ and ▼ to set the desired acceleration time		Selected acceleration time: 500ms/krpm
Press key P to exit the programming mode		Exit programming mode
Press key ▲ and ▼ till Deceleration Ramp Programming parameter is reached (P101)		Parameter P101 (deceleration ramp 1)
Press key P to enter programming mode		Factory standard value: 1ms/krpm. This means that servomotor decelerates from 1000rpm to 0rpm within 1ms
Press key ▲ and ▼ till the desired deceleration time has been set		Selected deceleration time: 500ms/krpm
Press key P to exit the programming mode		Exit programming mode
Press key ▲ and ▼ until it reaches the ramp enable parameter (P229)		Parameter P229 (Ramp Option)
Press key P to enter programming mode		The factory default value is 0 (No ramp) which means that the ramps are not being used
Press key ▲ once		When parameter is programmed to 1 it means that the Ramp 1 will be used (P100 for acceleration and P101 for deceleration)
Press key P to save the set value and to exit the programming mode		Exit the programming mode
Press key ▲ and ▼ till the Programming Parameter of the Digital Input 1 (DI1) has been reached (P263)		Parameter P263 (Function DI1)
Press key P to enter programming mode		The programmable functions are: 0=Not used 1=Enable/Disable 2=Stop Function 3=Clockwise stroke end 4= Counter-clockwise stroke end 5=Error reset 6=No external fault

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
		7=Direction of rotation 8=Torque/Speed Mode 9=Torque/Position Mode 10=Speed/Position Mode 11=MOVE F: Executes one pos. of cycle 1 12=MOVE F.: Executes one pos. of cycle 2 13=MOVE F.: Executes one pos. of cycle 3 14=MOVE F.: Executes one pos. of cycle 4 15=MOVE F.: Executes one pos. of cycle 5 16=MOVE F.: Executes one pos. of cycle 6 17=MOVE F.: Executes one pos. of cycle 7 18=MOVE F.: Executes one pos. of cycle 8 19=MOVE F.: Executes one pos. of cycle 9 20=MOVE F.: Executes one pos. of cycle 10 21=MOVE F.: Executes the complete cycle 1 22=MOVE F.: Executes the complete cycle 2 23=MOVE F.: Executes the complete cycle 3 24=MOVE F.: Executes the complete cycle 4 25=MOVE F.: Executes the complete cycle 5 26=MOVE F.: Executes the complete cycle 6 27=MOVE F.: Executes the complete cycle 7 28=MOVE F.: Executes the complete cycle 8 29=MOVE F.: Executes the complete cycle 9 30=MOVE F.: Executes the complete cycle 10
Press key ▲ one time to set function 1 (Enable / Disable)		Parameter P263 (Function DI1) programmed to "Enable/Disable"
Press key P to exit the programming mode		Exit the programming mode
Press key ▲ and ▼ till the Programming Parameter of the Digital Input 2 (DI2) has been reached (P264)		Parameter P264 (Function DI2)
Press key P to enter the programming mode		The programmable functions are: 0=Not used 1=Enable/Disable 2=Stop Function 3=Clockwise stroke end 4= Counter-clockwise stroke end 5=Error reset 6=No external fault 7=Direction of rotation 8=Torque/Speed Mode 9= Torque/Position Mode 10=Speed/Position Mode 11=MOVE F: Executes one Pos. of cycle 1 12=MOVE F.: Executes one Pos. of cycle 2 13=MOVE F.: Executes one Pos. of cycle 3 14=MOVE F.: Executes one Pos. of cycle 4 15=MOVE F.: Executes one Pos. of cycle 5 16=MOVE F.: Executes one Pos. of cycle 6 17=MOVE F.: Executes one Pos. of cycle 7 18=MOVE F.: Executes one Pos. of cycle 8

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
		19=MOVE F.: Executes one Pos. of cycle 9 20=MOVE F.: Executes one Pos. of cycle 10 21=MOVE F.: Executes the complete cycle 1 22=MOVE F.: Executes the complete cycle 2 23=MOVE F.: Executes the complete cycle 3 24=MOVE F.: Executes the complete cycle 4 25=MOVE F.: Executes the complete cycle 5 26=MOVE F.: Executes the complete cycle 6 27=MOVE F.: Executes the complete cycle 7 28=MOVE F.: Executes the complete cycle 8 29=MOVE F.: Executes the complete cycle 9 30=MOVE F.: Executes the complete cycle 10
Press key ▲ and ▼ till the value 7 has been reached (Direction of rotation)		Parameter P264 (Function DI2) programmed to "Direction of Rotation"
Press key P to exit the programming mode		Exit the programming mode
Press key ▲ and ▼ till the Programming Parameter of the Digital Input 3 (DI3) has been reached (P265)		Parameter P265 (Function DI3)
Press key P to enter the programming mode		The programmable functions are: 0=Not used 1=Enable/Disable 2=Stop Function 3=Clockwise stroke end 4= Counter-clockwise stroke end 5=Error reset 6=No external fault 7=Direction of rotation 8=Torque/Speed Mode 9= Torque/Position Mode 10=Speed/Position Mode 11=MOVE F: Executes one Pos. of cycle 1 12=MOVE F.: Executes one Pos. of cycle 2 13=MOVE F.: Executes one Pos. of cycle 3 14=MOVE F.: Executes one Pos. of cycle 4 15=MOVE F.: Executes one Pos. of cycle 5 16=MOVE F.: Executes one Pos. of cycle 6 17=MOVE F.: Executes one Pos. of cycle 7 18=MOVE F.: Executes one Pos. of cycle 8 19=MOVE F.: Executes one Pos. of cycle 9 20=MOVE F.: Executes one Pos. of cycle 10 21=MOVE F.: Executes the complete cycle 1 22=MOVE F.: Executes the complete cycle 2 23=MOVE F.: Executes the complete cycle 3 24=MOVE F.: Executes the complete cycle 4 25=MOVE F.: Executes the complete cycle 5 26=MOVE F.: Executes the complete cycle 6 27=MOVE F.: Executes the complete cycle 7 28=MOVE F.: Executes the complete cycle 8 29=MOVE F.: Executes the complete cycle 9 30=MOVE F.: Executes the complete cycle 10

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ACTION	LOCAL HMI DISPLAY	DESCRIPTION
Press key ▲ till value 2 has been reached (Stop Function)		Parameter P265 (Function DI3) programmed to “Stop Function”
Press key P to exit the programming mode		Exit the programming mode
Press key ▲ and ▼ till the Programming Parameter of the motor speed read has been reached (P002)		Parameter P002 (motor speed read)
Press key P to enter the programming mode		Speed at this moment = 0rpm (servomotor stopped)

4.6.2.3 Execution

ACTION	LOCAL HMI DISPLAY	DESCRIPTION
Close switch DI1		Motor starts to run at speed of 1000rpm
Close switch DI2		Motor decelerates up to stop, reverses direction of rotation and accelerates up to -1000 rpm
Open switch DI1		The control on the servomotor shaft is disabled and motor stops by inertia
Close switch DI1		Motor starts to run at speed of -1000 rpm
Close switch DI3		Motor decelerates up to stop. This operation lasts 0.5s, i.e., during the time programmed at Parameter P101 (Deceleration Ramp 1) Notes: Notice that the shaft stopped after 0.5s, since the motor was running at 1000rpm. If the motor was running at 2000rpm, the shaft would have taken 1s to stop. This occurs because the unit of parameter P101 is ms/krpm, i.e., this parameter sets the time the motor will take to reduce the speed by 1000rpm. For example, if the motor was running at 6000rpm, we would have 500ms * 6 = 3000ms= 3s
Open switch DI3		The motor shaft accelerates up to -1000rpm. This operation also takes 0.5s, in other words, the time programmed in the parameter P100 (Acceleration Ramp 1)

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4.6.3 MOVE Function - Positioning

Executing to Positioning by using the MOVE Function.

4.6.3.1 Installation

Examples below are more sophisticated and aim at to describe typical application frequency used in the industry. The programming will be no longer detailed. Only parameters and their contents will be presented and the user shall set them before executing the example.
Is condition for this example execution that the user has already executed the two first examples and he is acquainted with servodrive operation.

The example below may be used in applications that require servomotor running to determined number of revolutions, then is stopped and after certain time (determined by user) realizes other identical movement.

Fractions of revolution are also accepted. In this case, consider please that to complete revolution, 360°, corresponds to 16384 resolver pulses. For determining the required number of pulses for determined angle, apply following formula:

$$N_{Pulses} = \frac{16384 \cdot \theta}{360}$$

where :

N_{Pulses} : Number of pulses to be programmed on parameter

θ : Desired Angle

Example 1: The motor shaft shall run only 3/4 revolution, i. e., 270°. By using the formula, we will have:

$$N_{Pulses} = \frac{16384 \cdot \theta}{360}$$

$$N_{Pulses} = \frac{16384 \cdot 270}{360}$$

$$N_{Pulses} = 12288$$

This number (12288) must be programmed directly in the parameter that defines the fraction of revolution. This procedure will be shown below.

Example 2: The motor shaft shall run only $^{5}/_{6}$ revolution, i. e., 300°. By using the formula, we will have:

$$N_{Pulses} = \frac{16384 \cdot \theta}{360}$$

$$N_{Pulses} = \frac{16384 \cdot 300}{360}$$

$$N_{Pulses} = 13653{,}333$$

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In this case you can program two values, 13653 o 13654. For calculating the error in each option, apply following formula:

a) Programmed value: 13653 pulses

$$Error_{Pulses} = | N_{Pulses_calculated} - N_{Pulses_programmed} |$$

$$Error_{Pulses} = | 13653.333 - 13653 |$$

$$Error_{Pulses} = 0.333 pulses$$

For calculating the error in degree (°), apply following formula:

$$Error_{(°)} = \frac{360 \cdot Error_{Pulses}}{16384}$$

$$Error_{(°)} = \frac{360 \cdot 0.333}{16384}$$

$$Error_{(°)} = 0.00732421801758°$$

This error occurs at each positioning

b) Programmed value: 13654 pulses

$$Error_{Pulses} = | N_{Pulses_calculated} - N_{Pulses_programmed} |$$

$$Error_{Pulses} = | 13653.333 - 13654 |$$

$$Error_{Pulses} = 0.667 pulses$$

For calculating the error in degree (°), apply following formula:

$$Error_{(°)} = \frac{360 \cdot Error_{Pulses}}{16384}$$

$$Error_{(°)} = \frac{360 \cdot 0{,}667}{16384}$$

$$Error_{(°)} = 0.0146484382324°$$

This error occurs at each positioning

Through analysis of the shown errors, you must select always the option that shows the smallest possible error. In case of example 2, we recommend to program 13653 pulses.

These applications are very common in:
- ☑ Dosing machines (packing machines);
- ☑ Turntables;
- ☑ Press feeders;
- ☑ Conveyors with programmed stops.

NOTE!
Each application has its own particularity that must be considered when this example should be applied.

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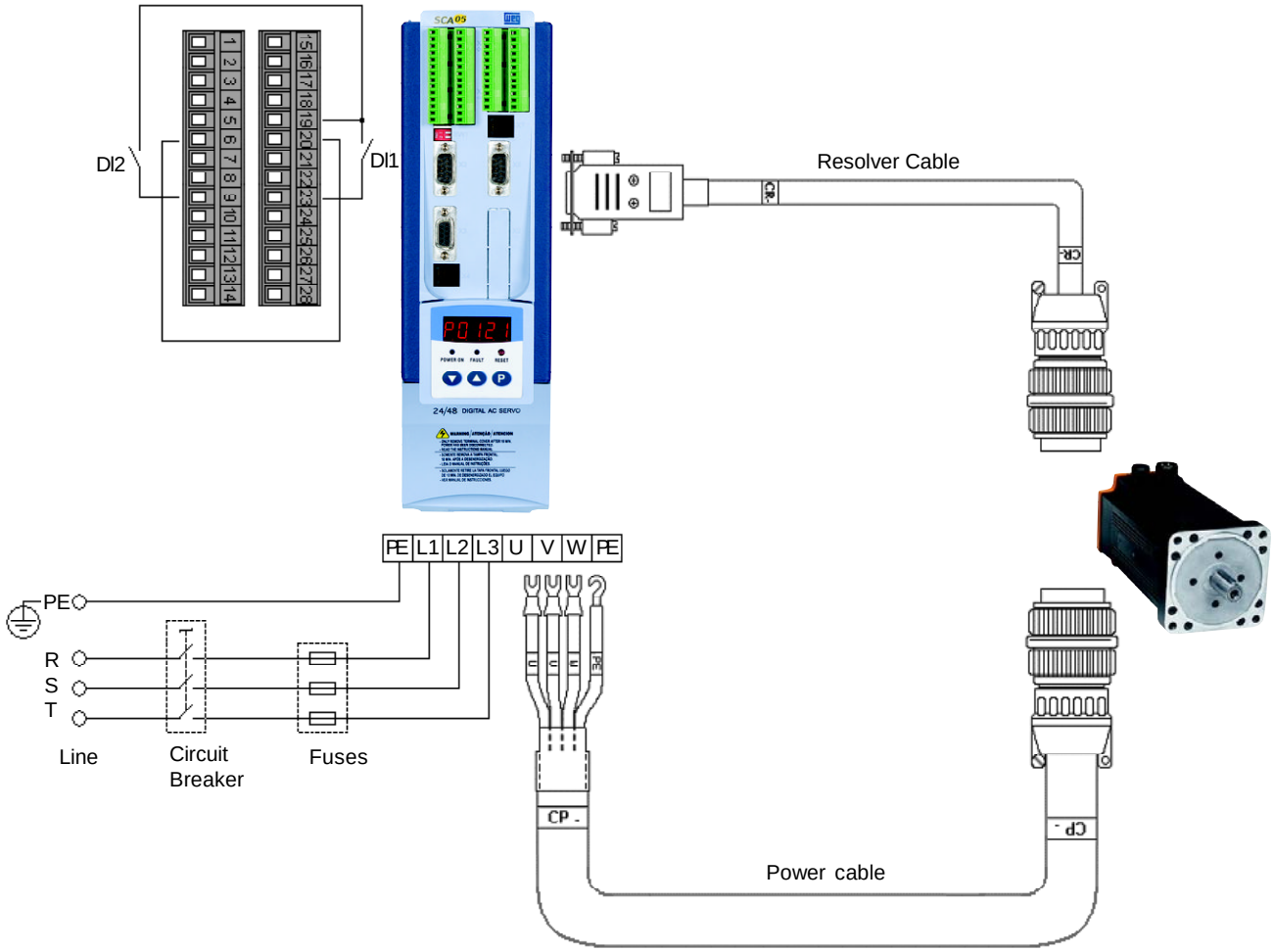


Figure 4.4 *- Electrical installation for accomplishment of the example MOVE function – Positioning*

4.6.3.2 Programming

Table 4.1 presents the settings of parameters for the example MOVE function - Positioning.

Parameter	Value	Description
P000	5	Access Password
P100	2000	Acceleration Ramp 1
P101	2000	Deceleration Ramp 1
P124	500	MOVE Function: Speed Reference of positioning 1
P202	3	Operation mode = Positioning
P229	1	Ramp Option = Ramp 1
P263	1	Enable / Disable
P264	21	Executes Cycle #1 completely
P441	1	Defines the cycle for the Reference 1 (P124) of the positioning 1
P451	3	Executes the positioning by using ramp 1
P471	8192	Fraction of revolution of Positioning 1
P481	200	Number of revolution of Positioning 1

Table 4.1*- Settings of parameters for the example MOVE function - Positioning*

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4.6.3.3 Executing

Follow steps below to the this example:

1) Enable servomotor by closing DI1.

2) Close DI2 and open it right after. Now motor shaft starts positioning, comprising 200 revolutions of the motor shaft (P481) + ½ revolution (P471), at 500rpm. Then it stops automatically.

3) Close and open again DI2 and check if motor shaft performs the same positioning, comprising 200 revolutions of the motor shaft (P481) + ½ revolution. Consider, for instance, as shaft reference the shaft key.

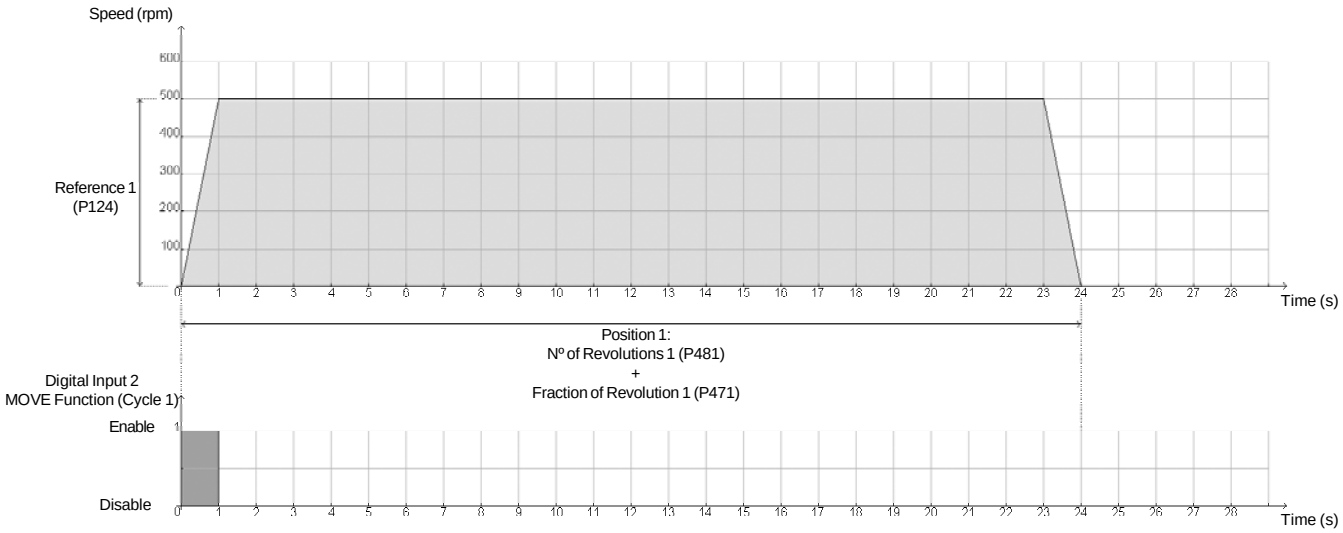


Figure 4.5 *- Behavior of the shaft and digital input for the MOVE function – Positioning*

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4.6.4 MOVE Function - Automatic Cycle

Use MOVE function, with automatic cycle with 3 positionings.

4.6.4.1 Installation

In this example, when properly programmed, servomotor shaft executes to positioning as shown in Figure 4.7.

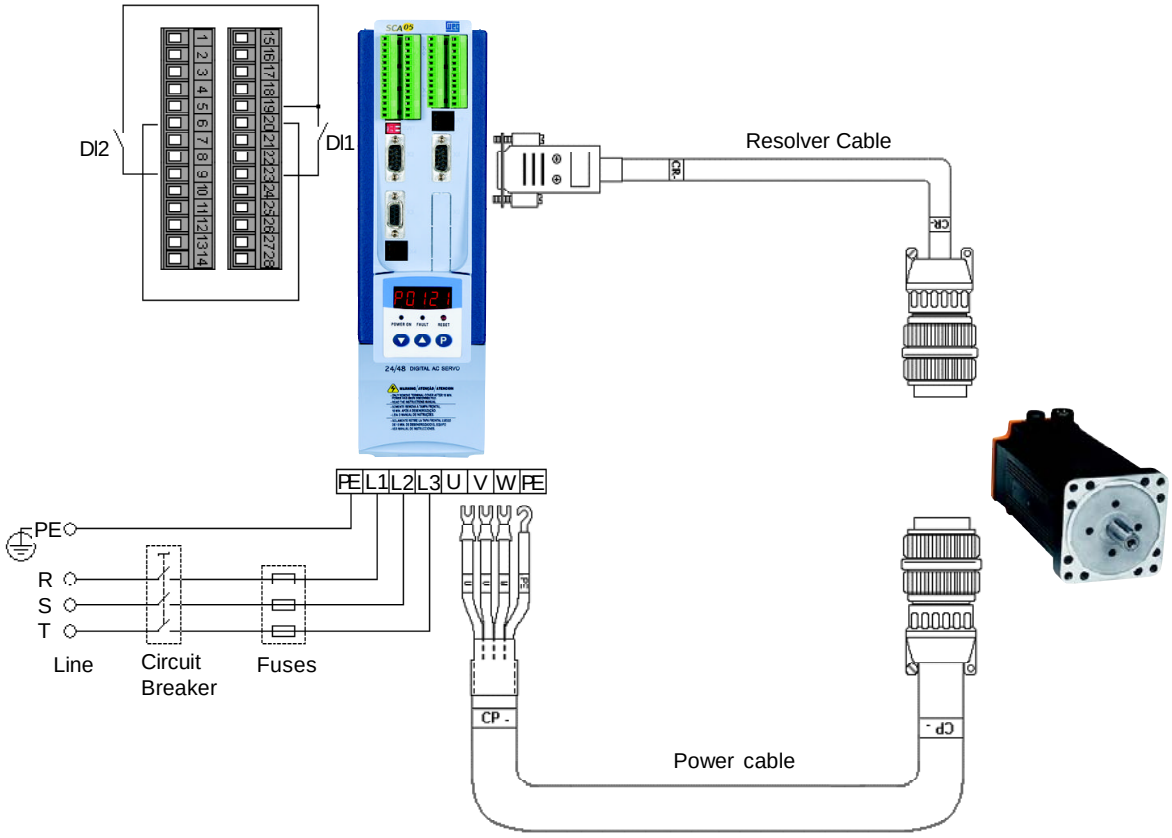


Figure 4.6 *- Electrical installation for accomplishment of the example MOVE function – Automatic Cycle*

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4.6.4.2 Programming

Table 4.2 shows the settings of parameters for the example MOVE function with an automatic cycle of three (03) positioning.

Parameter	Value	Description
P000	5	Access password
P100	1000	Acceleration ramp 1
P101	1000	Deceleration ramp 1
P124	1000	MOVE function: Speed reference of Positioning 1
P125	500	MOVE function: Speed reference of Positioning 2
P126	2500	MOVE function: Speed reference of Positioning 3
P202	3	Operation mode = Positioning
P229	1	Ramp Option = Ramp 1
P263	1	Enable/Disable
P264	21	MOVE function: Executes Cycle #1 completely
P441	1	MOVE function : Defines the cycle for Reference 1 (P124) of the Positioning 1
P442	1	MOVE function : Defines the cycle for Reference 2 (P125) of the Positioning 2
P443	1	MOVE function : Defines the cycle for Reference 3 (P126) of the Positioning 3
P451	3	Executes the positioning by using the ramp set 1
P452	3	Executes the positioning by using the ramp set 1
P453	3	Executes the positioning by using the ramp set 1
P461	3000	Timer of the Positioning 1 (ms)
P462	1000	Timer of the Positioning 2 (ms)
P463	1000	Timer of the Positioning 3 (ms)
P471	10977	Fraction of revolution of the Positioning 1
P472	8192	Fraction of revolution of the Positioning 2
P473	2785	Fraction of revolution of the Positioning 3
P481	66	Number of revolutions of the Positioning 1
P482	37	Number of revolutions of the Positioning 2
P483	229	Number of revolutions of the Positioning 3

Table 4.2 *- Settings of parameters for the example MOVE function with an automatic cycle of three (03) positioning*

4.6.4.3 Execution

Follow steps below to test this example:

1) Close DI1 to enable servodrive.

2) Close and right after open DI2 (pulse), i. e., after Digital Input 2 has been enabled, the motor shaft executes following operations:

1st positioning:
After 3s the switch DI2 has been closed, the motor shaft accelerates within 1s from 0 to 1000rpm and maintains this speed during 3s. Then it decelerates from 1000rpm to 0rpm within 1s, realizing 66.67 revolutions and now starts the 2nd positioning.

2nd positioning:
The servomotor waits 1s, then accelerates to 500rpm within 0.5s, maintains this speed during 4s and then decelerates till stopping within 0.5s (realizing 37.5 revolutions). Now starts the 3rd positioning.

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3rd positioning:
The servomotor waits 1s, then accelerates to 2500rpm within 2.5s, maintains this speed during 3s and then decelerates till stopping within 2.5s (realizing 229.17 revolutions). After stopping, servomotor waits for the next pulse at switch DI2 to restart the positioning.

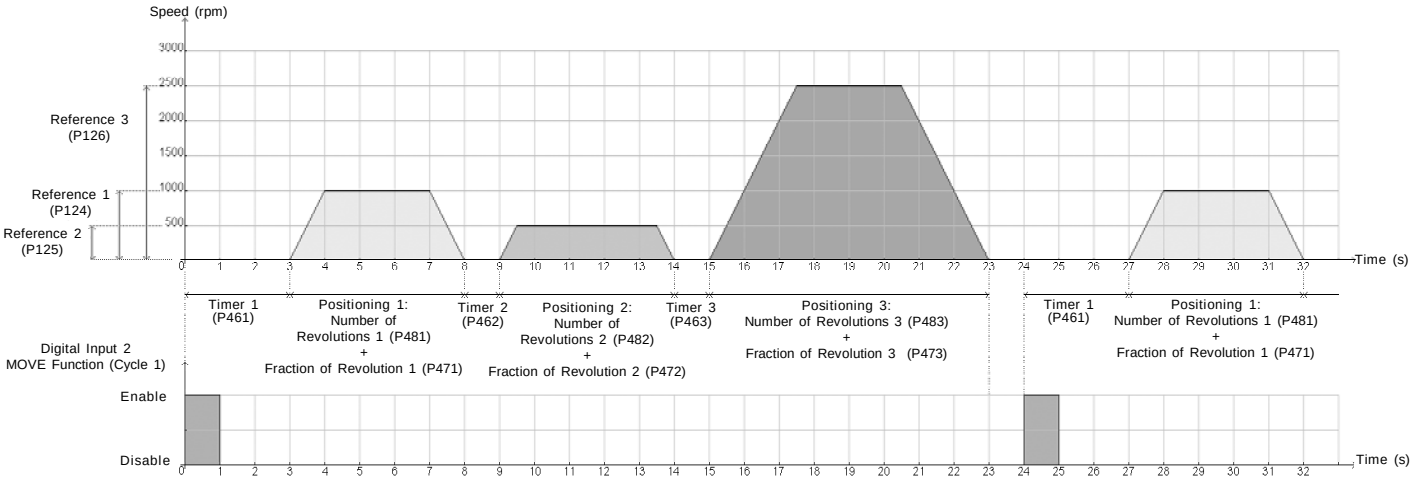


Figure 4.7 *- Behavior of the shaft and digital input for the MOVE function – Automatic Cycle*

NOTE!
For executing this cycle automatically during to determined time (loop), maintain switch DI2 closed.

4.6.5 Master-Slave Control

The example presented in this item refers to the load sharing between two servodrives by using the Master-Slave control.

4.6.5.1 Installation

This type of application allows that two servomotors can drive to load with higher torque than the rated torque of each servomotor individually.
This is possible by sharing the load on the two motor shafts. The servomotor control is realized by to servodrive, operating as Master, receiving the reference signal from to PLC or CNC and providing feedback of this signal through the encoder Simulator, while the other servodrive operates as Slave, having as reference to signal coming from the Master.

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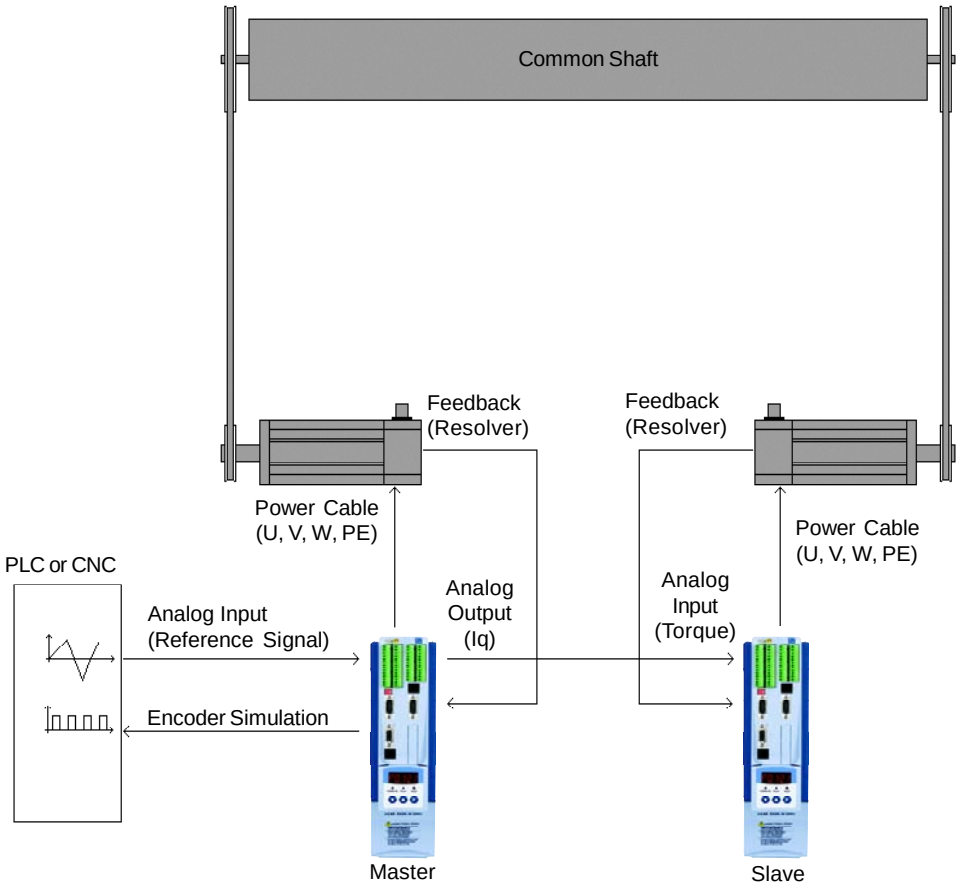


Figure 4.8 *- Electrical / mechanical installation for the Master-Slave control example*

4.6.5.2 Programming

Tables 4.3 and 4.4 show the settings of parameters for the example 'Master-Slave control'.

Parameter	Value	Description
P202	2	Speed mode
P229	0	Ramp option disabled
P232	2	Speed reference
P251	10	Function of the Analog Output AO1
P263	1	Enable/Disable

Table 4.3 *- Settings of parameters for the servodrive running as the Master*

Parameter	Value	Description
P202	1	Torque mode
P229	0	Ramp option disabled
P232	1	Current reference (torque)
P263	1	Enable/Disable

Table 4.4 *- Settings of parameters for the servodrive running as the Slave*

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DETAILED PARAMETER DESCRIPTION

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

Read Only Parameters	Variables that can only be viewed on the display but not changed by the user.
Regulation Parameters	Programmable values used by the Servodrive functions.
Configuration Parameters	Define the servodrive characteristics, the functions to be executed, as well as the functions of the inputs/output of the control board.
Servomotor Parameters	Are the data of the used servomotor: information indicated on the motor nameplate obtained by auto-tuning.
Special Function Parameters	It includes parameters related to special functions.



NOTE!
The value of each parameter is valid as soon as it has been changed (on line), excepting those marked by the symbols **'(1)'**.

Symbols and definitions used in the text below:

(1) The changes made with this parameter will be valid only after the "RESET" of the HMI has been pressed.
(2) Indicates that the values can change as function of the Servomotor model (P385).
(3) Indicates that the values can change as function of the auto-tuning.
(4) This parameter discription can be found in the POS2 optional board user´s manual.

5.1 ACCESS AND READ ONLY PARAMETERS - P000 to P087

Parameter	Range [Factory Setting] Unit	Description / Notes
P000 Parameter Access	0 to 9999 [0] -	☑ This parameter opens the access for changing the parameter values. As factory default, the password is enabled P200 = 1 (Password active). So , it is necessary to set P000 = 5 to change parameter values, i.e, the Password is 5.

P000	Function
1	Only P234, P236, P238, and P240 are enabled for user modification.
5	Enables the access to the content of all parameters.
6	Only parameters with non-factory default values are shown.
10	Only parameters P000, P124 to P133, and P481 to P490 are shown.

Table 5.1 - *Access to parameters*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P002 Motor Speed	-9999 to +9999 [-] 1rpm	☑ Indicates the effective speed in rpm (Factory Setting).
P003 Motor Current	-999.9 to +999.9 [-] 0.1A	☑ Indicates the servodrive output current in Ampère (A rms).
P004 DC Link Voltage	0 to 999 [-] 1V	☑ Indicates the current DC-link voltage in Volt (V). ☑ Range: (252 to 358)Vdc (Normal Use).
P006 Servodrive Status	0 to 2 [-] -	☑ Indicates the current servodrive status, see table 5.2.

P006	Function
0	Servodrive is disabled and with no fault.
1	Servodrive is ready (enabled and with no fault).
2	Servodrive is under an error condition. The keypad shows the Error Code.

Table 5.2 - *Selection of the servodrive status*

P012 Digital Inputs DI1 to DI6 Status	0 to 63 [-] -	☑ The HMI Display shows to decimal value, which binary equivalent indicates the status of the Digital Inputs (DIs). LSB (less significant bit) is the Digital Input 1 and MSB (most significant bit) is the Digital Input 6. The value 1 (in binary) means "Digital Input active" and the value 0 (in binary) means "Digital Input inactive". Example: The keypad display shows:  Transforming the number 22 in decimal base to to equivalent number in binary base, we will have: $22_{10} \rightarrow 010110_2$ Digital Input 1 Digital Input 2 Digital Input 3 Digital Input 4 Digital Input 5 Digital Input 6

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Parameter	Range [Factory Setting] Unit	Description / Notes

In this case, the Digital Inputs 2, 3 and 5 will be active.
Table below shows all possible combinations:

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
0	000000	11	001011	22	010110	33	100001	44	101100	55	110111
1	000001	12	001100	23	010111	34	100010	45	101101	56	111000
2	000010	13	001101	24	011000	35	100011	46	101110	57	111001
3	000011	14	001110	25	011001	36	100100	47	101111	58	111010
4	000100	15	001111	26	011010	37	100101	48	110000	59	111011
5	000101	16	010000	27	011011	38	100110	49	110001	60	111100
6	000110	17	010001	28	011100	39	100111	50	110010	61	111101
7	000111	18	010010	29	011101	40	101000	51	110011	62	111110
8	001000	19	010011	30	011110	41	101001	52	110100	63	111111
9	001001	20	010100	31	011111	42	101010	53	110101	-	-
10	001010	21	010101	32	100000	43	101011	54	110110	-	-

Table 5.3 *- Possible combinations at digital inputs DI1 to DI6*

P013
Status of the Digital Inputs
0 to 7
[-]
-

☑ Indicates the status of the digital inputs.

P014
Last Fault
00 to 38
[-]
-

P015
Second Previous Fault
00 to 38
[-]
-

P016
Third Previous Fault
00 to 38
[-]
-

P017
Fourth Previous Fault
00 to 38
[-]
-

☑ Indicate the code of the last, second, third and fourth previous Faults.
Fault Sequence:
Exy → P014 → P015 → P016 → P017

P018
Analog Input AI1' Value
-8192 to +8191
[0]
-

☑ Indicates the value of the analog input AI1, which has a resolution of 14bits.
☑ For a gain of 1000 (P234), the range of this parameters varies from -8192 to +8191, representing a value at the input from –100% to +100% (-10 to +10)V or (-20 to +20)mA.
☑ AI1 reading will be active only if any function is set at parameter P232.

P019
Analog Input AI2' Value
-8192 to +8191
[0]
-

☑ Indicates the value of the analog input AI2, which has a resolution of 10bits.
☑ For a gain of 1000 (P238), the range of this parameters varies from -8192 to +8191, representing a value at the input from -100% to +100% (-10 to +10)V or (-20 to +20)mA.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P022 Heat-sink Temperature	0 to 100.0 [-] %	☑ Indicates the heat-sink temperature as a percentage. The internal thermostat signal varies from 0V to 5V, which corresponds from 0% to 100% in P022. ☑ The higher the temperature, the greater the voltage signal measured by the thermostat, and also the percentage value indicated. ☑ When this parameter indicates approximately 59%, the servodrive trips with E004 error (over temperature).
P023 Software Version	2.XX [-] -	☑ Indicates the software installed microcontroller memory of the control board.
P050 Shaft Position (From the Resolver)	0 to 16383 [-] 1 pulse	☑ Indicates the instantaneous position of the shaft with respect to the absolute zero position read by the resolver. ☑ One complete revolution, i.e., 360°, corresponds to 16384 pulses. To calculate the corresponding angle, use following formula: $\theta = \frac{N_{Pulses} \cdot 360}{16384}$ $where:$ $N_{Pulses}: \text{Number of Pulses}$ $\theta: \text{Angle in °}$ Example: The HMI indicates 8000 pulses, to obtain the equivalent angle in °, by using the formula above we will have: $\theta = \frac{N_{Pulses} \cdot 360}{16384}$ $\theta = \frac{8000 \cdot 360}{16384}$ $\theta = 175.78°$ Some illustrative are shown below:

Angle	Pulses	Angle	Pulses	Angle	Pulses	Angle	Pulses
0º	0	105º	4779	210º	9557	315º	14336
15º	682	120º	5461	225º	10240	330º	15019
30º	1365	135º	6144	240º	10923	345º	15701
45º	2048	150º	6827	255º	11605	360º	0
60º	2731	165º	7509	270º	12288	-	-
75º	3413	180º	8192	285º	12971	-	-
90º	4096	195º	8875	300º	13653	-	-

Table 5.4 *- Demonstrative values for the shaft position (Angle x Pulses)*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P052 Angular Position: Fraction of Revolutions	0 to 16383 [-] 1 pulse	☑ Indicates the instantaneous shaft position (fraction of revolution) that is used on the absolute mode positioning. This position can be reset (set to zero) via parameter P429 or via digital input. ☑ This fraction of revolutions is given in number of pulses (16384 pulses correspond to 1 complete revolution or 360°).
P053 Angular Position: Number of Revolutions	-9999 to +9999 [-] 1 revolution	☑ Indicates the instantaneous shaft position (the number of revolutions) that is used on the absolute mode positioning. This position can be reset (set to zero) via parameter P429 or via digital input. Examples involving parameters P052 and P053: 1- Increasing position from initial position: revolution -1 **P052:** 00000 ... 12000 ... 16383 ... 00000 ... 12000 ... 16383 ... 00000 ... **P053:** -0001 ... -0001 ... -0001 ... 00000 ... 00000 ... 00000 ... 00001 ... 2- Decreasing position from initial position: revolution 1 **P052:** 00000 ... 16383 ... 08000 ... 00000 ... 16383 ... 08000 ... 00000 ... **P053:** 00001 ... 00000 ... 00000 ... 00000 ... -0001 ... -0001 ... -0001 ... **NOTE!** This parameter is set to zero when the servodrive is powered up or reset.
P056 Counter Value	0 to 32767 [-] 1 pulse	☑ Shows the counter value (CEP board - refer to item 5.7.4).
P059 Lag Error for the Master-Slave Function	0 to 16383 [-] 1 pulse	☑ Shows the lag error for the Master-Slave function (CEP Board - refer to item 5.7.4).
P061 Maximum Iq	-999.9 to +999.9 [-] 1 A rms	☑ Shows the maximum value, with signal, of the Iq current.
P070 Status of the CAN Controller	0 to 6 [-] -	☑ Reading parameter. ☑ Indicates the status of the CAN controller, responsible for sending and receiving CAN telegrams used by the DeviceNet, CANopen and MSCAM protocols.

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Parameter	Range [Factory Setting] Unit	Description / Notes

P070	Description	Notes
0	Disabled	The CAN interface is disabled.
1	Running Auto-baud	Running the routine for automatic baud rate detection (communication rate). Only used by the DeviceNet protocol.
2	Enabled without error	The CAN interface was enabled and the drive is able to communicate through the CAN bus.
3	Warning	The CAN controller has detected a reasonable quantity of communication errors.
4	Error passive	The CAN controller has detected too many communication errors, or it is the only device connected to the bus.
5	Bus-off	After going through the warning and error passive states, communication errors continued to happen, which took the CAN controller to the bus-off state, where it stops accessing the network bus.
6	Not powered	Missing 24Vdc power supply. This shall be provided via the network connector.

Table 5.5 *- Status of the CAN controller*

☑ Refer to the specific communication protocol user's guide to obtain additional information.

P071
Number of Received CAN Telegrams

0 to 32767
[-]
-

☑ Reading parameter.
☑ Indicates the number of correct CAN telegrams received by the drive. This number returns to zero automatically after power up, reset or when it reaches the maximum limit.

P072
Number of Sent CAN Telegrams

0 to 32767
[-]
-

☑ Reading parameter.
☑ Indicates the number of correct CAN telegrams sent by the drive. This number returns to zero automatically after power up, reset or when it reaches the maximum limit.

P073
Number of bus-off Errors

0 to 32767
[-]
-

☑ Reading parameter.
☑ Indicates the number of bus-off errors that occurred with the drive. This number returns to zero automatically after power up, reset or when it reaches the maximum limit.

P075
Status of the CANopen Network

0 to 4
[-]
-

☑ Reading parameter.
☑ Indicates the status of the CANopen communication, informing if the protocol was initialized correctly and the state of the slave node guarding service.

P075	Description	Notes
0	Disabled	The CANopen protocol was not set at parameter P700 and it is disabled.
1	Reserved	-
2	CANopen Enabled	The CANopen protocol was initialized correctly.
3	Node guarding enabled	Node guarding service was started by the master and it is working properly.
4	Node guarding fault	Timeout for the node guarding service. This event results in an E35 drive fault.

Table 5.6 - *Status of the CANopen Communication*

☑ Refer to CANopen communication user's guide in order to obtain detailed description about the protocol.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P076 Status of the CANopen Node	0 to 127 [-] -	☑ Reading parameter. ☑ Each device on the CANopen network has an associated status. This parameter presents the actual drive status.

P076	Description	Notes
0	Not initialized	The CANopen protocol was not set at parameter P700 and it is disabled.
4	Stopped	Data transfer between master and slave is not possible.
5	Operational	All CANopen communication services are available.
127	Pre-operational	Only some CANopen communication services are available.

Table 5.7 *- Status of the CANopen Node*

☑ Refer to CANopen communication user's guide to obtain detailed description about the protocol.

Parameter	Range [Factory Setting] Unit	Description / Notes
P080 Status of the DeviceNet Network	0 to 5 [-] -	☑ Reading parameter. ☑ Indicates the status of the drive regarding the DeviceNet network.

P080	Description
0	Not Powered / Not online
1	Online / Not connected
2	Link OK / Online and Connected
3	Connection Timeout
4	Critical Link Failure
5	Running Auto-baud

Table 5.8 - *Status of the DeviceNet network*

☑ Refer to DeviceNet communication user's guide in order to obtain detailed description about these items.

Parameter	Range [Factory Setting] Unit	Description / Notes
P081 Status of the DeviceNet Network Master	0 to 1 [-] -	☑ Reading parameter. ☑ Indicates the status of the DeviceNet network master.

P081	Description
0	Master in the "Run mode"
1	Master in the "Idle mode"

Table 5.9 - *Status of the DeviceNet network Master*

☑ Refer to DeviceNet communication user's guide in order to obtain detailed description about the protocol.

Parameter	Range [Factory Setting] Unit	Description / Notes
P085 Status of the Fieldbus Communication Board	0 to 3 [0] -	☑ Reading parameter. ☑ Indicates the status of the optional fieldbus communication board.

P085	Description	Notes
0	Disabled	The Fieldbus communication board was not enabled at parameter P720.
1	Inactive Board	It was not possible to run the initialization routine for the communication board at drive boot-up. Or it was not possible to access the communication board during drive operation.
2	Offline	The communication board is enabled and offline.
3	Online	The communication board is enabled and online.

Table 5.10 - *Status of the Fieldbus Communication Board*

☑ Refer to Fieldbus communication user's guide to obtain detailed description about the board operation.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P086 Number of Received Serial Telegrams	0 to 32767 [0] -	☑ This counter is incremented when to telegram is successfully received via any serial protocol available for the SCA-05. This counter is incremented only if the received telegram has no parity, checksum or CRC error. ☑ In case the number of received telegrams reaches the maximum limit (32767), this counter is reset and the count is restarted. This is also true when the drive is reset.
P087 Number of Sent Serial Telegrams	0 to 32767 [0] -	☑ This counter is incremented when to telegram is successfully processed and the acknowledgment is sent to the master via any serial protocol available for the SCA-05. Erroneous acknowledgments are not considered on this parameter. ☑ In case the number of sent telegrams reaches the maximum limit (32767), this counter is reset and the count is restarted. This is also true when the drive is reset.

5.2 REGULATION PARAMETERS - P099 to P199

P099
Enable

0 to 2
[0]
-

☑ Enables the servomotor.

P099	Function
0	Disabled (servomotor is not powered).
1	Enabled (servomotor is powered).
2	Enables the servodrive, but does not save the parameter. It means that when the servodrive is powered down, the parameter is not saved and when it is powered up again, the value of the parameter P099 will be 0 (disabled).

Table 5.11 - *Selection of the function enable/disable servomotor*

P100
Acceleration Ramp 1

P101
Deceleration Ramp 1

P102
Acceleration Ramp 2

P103
Deceleration Ramp 2

1 to 32767
[1]
1 ms/krpm

☑ Defines the time to accelerate linearly from 0rpm to 1000rpm or decelerate linearly from 1000rpm to 0rpm.
Example: When P100 programmed to 1000, the servodrive will accelerate from 0 to 1000rpm within 1000ms, i.e., within 1s. If the final speed should be 6000rpm, the servodrive will accelerate up to this speed within 6s.

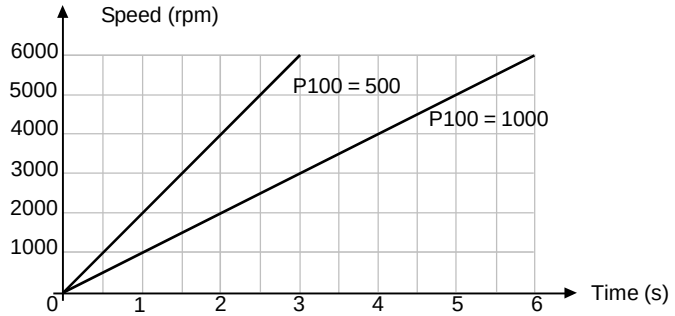


Figure 5.1 - *Servomotor acceleration time for different values of P100*

☑ The commutation to the 2nd ramp can be made by setting P229 = 2 (Enable ramp 2).
☑ When parameter P229 is set to 0, ramps are disabled.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P105 STOP Function Deceleration Ramp	1 to 32767 [1] 1ms/krpm	☑ Refer to the definition of the ramp operation for parameters P101 and P103.
P111 Direction of Rotation	0 to 1 [0] -	☑ Determines the direction of rotation of the servomotor shaft.
P117 Position Reference via HMI	0 to 16383* [0] 1 pulse	☑ This parameter value will be used to position the motor shaft when servodrive is operating in Positioning Mode. This value is always related to the Absolute Zero position of the motor shaft. ☑ One complete revolution, i.e., 360°, corresponds to 16384 pulses. To calculate the corresponding angle, use following formula: $N_{Pulses} = \frac{\theta \cdot 16384}{360}$ *where*: N_{Pulses} : Number of Pulses θ : Angle in° Example: To 45° reference, by using the formula, we will have: $N_{Pulses} = \frac{\theta \cdot 16384}{360}$ $N_{Pulses} = \frac{45 \cdot 16384}{360}$ $N_{Pulses} = 2048\, pulses$ (*)The value of P117 will be maintained in the last set value (backup), even when servodrive is switched off or disabled. The parameter operates as loop, i. e., after to revolution is completed (16384 pulses), this value returns to zero and to new revolution is started. The motor shaft will search its new position reference when this parameter is changed. The shortest motion defines the direction of rotation.

P111	Reference	Direction of Rotation
0	Positive	Forward
	Negative	Reverse
1	Positive	Reverse
	Negative	Forward

Table 5.12 - *Selection of the motor direction of rotation*

☑ For determining the direction of rotation, look on the servomotor shaft frontally.

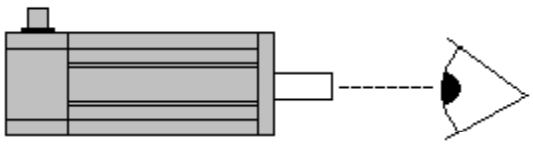


Figure 5.2 - *Checking the direction of rotation of the motor shaft*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P119 Current Reference (Torque) via HMI	-699.9 to +699.9 [0] 0.1A	☑ This is the current reference when servodrive is operating in Torque mode. ☑ The value of P119 will be maintained in the last set value (backup), even when servodrive is switched off or disabled.
P121 Speed Reference via HMI	-699.9 to +699.9 [0] 1rpm	☑ This is the speed reference when servodrive is operating in Speed mode. The full scale value is limited internally up to the rated servomotor speed. ☑ When the reference changes the signal (positive to negative, or negative to positive), the direction of rotation is reversed. ☑ The value of P121 will be maintained in the last set value (backup), even when servodrive is switched off or disabled.
P122 JOG1 Speed Reference	-699.9 to +699.9 [10] rpm	☑ It is the speed reference for the servodrive when the JOG1 function is activated (see P428).
P123 JOG2 Speed Reference	-699.9 to +699.9 [-10] rpm	☑ It is the speed reference for the servodrive when the JOG2 function is activated (see P428).
P124 MOVE Function: Speed/Current Ref. of Positioning 1 **P125** MOVE Function: Speed/Current Ref. of Positioning 2 **P126** MOVE Function: Speed/Current Ref. of Positioning 3 **P127** MOVE Function: Speed/Current Ref. of Positioning 4 **P128** MOVE Function: Speed/Current Ref. of Positioning 5 **P129** MOVE Function: Speed/Current Ref.	-699.9 to +699.9 [0] 1rpm -699.9 to +699.9 [0] 1rpm -699.9 to +699.9 [0] 1rpm -699.9 to +699.9 [0] 1rpm -699.9 to +699.9 [0] 1rpm -699.9 to +699.9 [0] 1rpm	☑ These parameters are used jointly the parameters P441 to P490 (Positioning Parameters / MOVE Function). ☑ The reference type (Speed or Current) is defined, respectively, on the parameters P451 to P460. Ex.1: P451=1 (Torque Reference) In this case P124 will be the current reference (Torque). Ex.2: P451=2 (Speed Reference) In this case P124 will be the speed reference. Ex.3: P451=3 (Positioning with Ramps 1) or 4 (Positioning with Ramps 2) In this case P124 will be the speed reference for the positioning execution.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P130 MOVE Function: Speed/Current Ref. of Positioning 7	-699.9 to +699.9 [0] 1rpm	
P131 MOVE Function: Speed/Current Ref. of Positioning 8	-699.9 to +699.9 [0] 1rpm	
P132 MOVE Function: Speed/Current Ref. of Positioning 9	-699.9 to +699.9 [0] 1rpm	
P133 MOVE Function: Speed/Current Ref. of Positioning 10	-699.9 to +699.9 [0] 1rpm	
P136 Idynamic/Inominal	1 to 4 [3] -	☑ This parameter determines the current that servomotor may reach in dynamic operation rate. As to servomotor is driven, the maximum dynamic current that can be reached is 4x its own rated current. To prevent an eventual demagnetization of the servomotor magnets, limit the dynamic current to this value. The value programmed at P136 is concerned the value programmed at P401 (rated motor current). Ex.: Idynamic = P401 x P136 When the programmed value of the dynamic servomotor current is higher than the dynamic servodrive current, this value will be limited by the dynamic servodrive current. Example: A servomotor SWA 56-4,0-30, which rated current is 5.7A, is controlled by to servodrive SCA-05 8/16. In this case, the parameter P136 could be set to 3, resulting theoretically in dynamic current of 17.1A (P136 x 5.7A). However in practice this value will be limited by the servodrive to 16A which represents the dynamic current of the SCA-05 8/16.

P136	Value of Idynamic
1	Idynamic = Irated
2	Idynamic = 2x Irated
3	Idynamic = 3x Irated
4	Idynamic = 4x Irated

Table 5.13 - *Selection of the Idynamic*

NOTE!

For P136 > 1, has been set, the servodrive can suplly the dynamic current up to 3s. For times longer that 3s, the rms value should not exceed the rated servodrive current. If this condition is not met, parameter P230 (I x t) will define the measure that should be adopted. See P230.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P159 kp Position Regulator	0 to 32767 [80] -	☑ For optimizing the dynamic speed response, these gains may be set manually. For achieving to faster response, increase this gains. Reduce the gains if you notice speed oscillations.
P161 (3) kp PID Speed	0 to 32767 [2500] -	
P162 (3) ki PID Speed	0 to 32767 [15] -	
P163 kd PID Speed	0 to 32767 [0] -	
P164 Speed Offset	-99.99 to +99.99 [0] 1rpm	☑ By means of this parameter you can add an offset (positive or negative) directly to the speed reference. This may be carried out via HMI (Parameter P121), via analog input, serial, etc.
P165 Speed Filter	0 to 4000 [0] 1Hz	☑ This parameter sets the time of the Speed Filter. This filter reduces the sharp speed signal changes, which eventually may be generated by noisy reference signals. Please note that the higher the value of the filter time constant, the slower will be the response to the reference signal. When this value is set to zero (factory setting), this means that the signal is not filtered.

5.3 CONFIGURATION PARAMETERS - P200 to P399

Parameter	Range [Factory Setting] Unit	Description / Notes
P200 Password	0 to 3 [1] -	☑ This parameter defines if it is necessary to enter the password (P000=5) to change servodrive parameters. ☑ POS2 parameters will be shown only when P202 = 4.
P202 Operation Mode	1 to 4 [2] -	☑ This parameter defines the servodrive operation mode, i.e., which variable should be controlled: Torque, Speed or Position. For more information about the characteristics of each Operation Mode, refer to Item 4.3.

P200	Function
0	Inactive.
1	Shows SCA and POS2 parameters.
2	Shows only POS2 parameters.
3	User password change.

Table 5.14 - *Selection of the password option*

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Parameter	Range [Factory Setting] Unit	Description / Notes

P202	Operation Mode
1	Torque Mode
2	Speed Mode
3	Positioning Mode
4	Control via POS2

Table 5.15 - *Selection of the operation mode*

P204 (1)
Load/Save Parameters

0 to 5
[0]
-

☑ The option P204=5 loads factory defaults to all parameters.
☑ Changes are valid only after resetting the servodrive via keypad.

P204	Function
0	Disabled
1 to 4	Not used
5	Load factory defaults

Table 5.16 - *Loading/Saving parameters*

P207
Engineering Unit Multiplier

1 to 10000
[1]
-

P208
Engineering Unit Divisor

1 to 10000
[1]
-

☑ The position reference parameters of the MOVE function (P471 to P480 and P481 to P490) are multiplied by the Engineering Unit Multiplier (P207) and divided by the Engineering Unit Multiplier (P208) in order to determine the number of revolutions the motor will rotate, that is: positioning reference = P48X, P47X * P207/P208

Examples:
P207=1, P208=1
P481=3, P471=8192 (note: P471=16384 pulses is equivalent to 1 revolution, that is, 360°)
The motor will rotate 3,5 revolutions: 3,5 * 1 / 1 = 3,5 (3 revolutions and 8192 pulses).

P207=9, P208=2
P481=3, P471=4096 (4096 pulses = 0,25 revolutions)
The motor will rotate 14,625 revolutions: 3,25 * 9 / 2 = 14,625 (14 revolutions and 10240 pulses).

P207=39, P208=8
P481=3, P471=0
The motor will rotate 14,625 revolutions: 3,0 * 39 / 8 = 14,625 (14 revolutions and 10240 pulses).

NOTE!

☑ When using to scale factor different of 1, it is recommended to use only parameters P481 to P490 as the positioning reference of the MOVE function and program parameters P471 to P480 to zero (0).
☑ The values may not be exact due to rounding errors.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P209 Engineering Unit Multiplier **P210** Engineering Unit Divisor	1 to 10000 [1] - 1 to 10000 [1] -	☑ The speed reference parameters for the MOVE function (P124 to P133) are multiplied by the engineering unit multiplier (P209) and divided by the engineering unit divisor (P210) to define the speed the motor will use to perform a specified cycle. Example: If the cycle #1 of a MOVE function is activated with P124 = 100, P209 = 1 and P210 = 2, the motor will perform the cycle with a speed value of: 100*1/2 = 50rpm.
P215 COPY Function	0 to 2 [0] -	☑ Defines the source and the destination of the parameters to be copied.
P219 Error Reset	0 to 1 [0] -	☑ Resets the error when a negative pulse is detected.
P227 Enable/Disable via Remote Keypad	0 to 1 [0] -	☑ Enable (P227 =1) or disable (P227 = 0) the use of the I/O keys of the Remote Keypad. ☑ The key (I) of the Remote Keypad enables the drive. ☑ The key (0) of the Remote Keypad disables the drive.
P228 JOG1/JOG2 via Remote Keypad	0 to 1 [1] -	☑ Enable (P228 = 1) or disable (P228 = 0) the use of the JOG key of the Remote Keypad. ☑ The key (JOG) of the Remote Keypad executes the JOG function. ☑ The selection of JOG1 or JOG2 is done by the (JOG) key.
P229 Ramp Option	0 to 2 [0] -	☑ Define if the acceleration and deceleration ramps will or will not affect the speed reference, independently of the source of the reference signal (parameter, analog input, etc.). ☑ This parameter is valid for the three types of reference (Torque, Speed and Position).
P230 Option I x t	0 to 1 [0] -	☑ This parameter is activated when the servodrive rms output current is greater than the servodrive rated current for more than 3s, and may function in two different modes (refer to table 5.19).

P215	Function
0	COPY function disabled
1	SCA-05 → Remote keypad
2	Remote keypad → SCA-05

Table 5.17 - *COPY function description*

P229	Function
0	Without Ramp
1	Enable Ramp 1 (P100 and P101)
2	Enable Ramp 2 (P102 and P103)

Table 5.18 - *Selection of the ramp option*

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Parameter	Range [Factory Setting] Unit	Description / Notes

P230	Output Current - Is rms	Time	Servodrive
0	Is rms > Irated	>3s	Generates E05 (Overload)
1	Is rms > Irated	>3s	Limits Is rms = Irated (*)

(*) With this setting (P230 = 1), the drive will not trip with E05. In order to increase the output current again (to perform an acceleration), it will be necessary to reduce the output current (make the rms output current lower than the rated current). The use of this option may cause longer acceleration times.

Table 5.19 - *Selection of the 'I x t' option*

P231
Number of Revolutions/Position Reference via Analog Input (AI)

1 to 30
[1]
revolutions

☑ This Parameter defines how many complete revolutions the motor shaft realizes during the variation of the analog input from its minimum value (-10V or 0mA or 4mA) to its maximum value (+10V or +20mA).

P232
Analog Input AI1 Function

0 to 4
[0]
-

☑ Function of the Analog Inputs AI1 and AI2.

P232/ P237	Function	Range
0	Disable	-
1	Current Reference (*)	Mod. 4/8 : -10V to +10V ⇔ -9,5A to +95A rms Mod. 8/16: -10V to +10V ⇔ -19A to +19A rms Mod. 24/48: -10V to +10V ⇔ -57A to +57A rms
2	Speed Reference	-10V to +10V⇔ -10.000rpm to +10.000rpm (-10.000rpm = reverse direction of rotation)
3	Position Reference	-10V to +10V ⇔ -180º to +180º
4	Enabled	It may be the speed reference for the MOVE function (refer to item 5.7.2), it may be used for the POS2 optional board, or it may be used to enable the sum of analog inputs.

(*) The option 1 is still used as Torque Limit (Maximum Current Reference) for the Positioning and Speed Operation Mode.

Table 5.20 - *Functions and ranges of the analog inputs AI1 and AI2*

NOTE!
On table 5.20 the options 1, 2 and 3 are normally set to the same function of the parameter P202.

Note: The ranges presented on table 5.20 are valid for the conditions of gain and offset described on table 5.21.

P234
Analog Input AI1 Gain

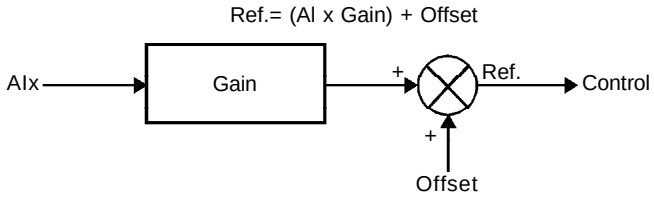
0.000 to 32.767
[0.300]
-

☑ Gain and Offset of the Analog Inputs AI1 and AI2.

	AI1	AI2
Gain	P234=1	P238=1
Offset	P236=0	P240=0

Table 5.21 *- Standard Configuration for the Gain and Offset of the Analog Inputs (Valid for the ranges of table 5.20)*

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Parameter	Range [Factory Setting] Unit	Description / Notes
		 ***Figure 5.3 -*** *Block Diagram of the Analog Inputs* The signal at the analog input is multiplied by the gain and the resulting value is added to the offset. This final value (Ref.) is sent to the controller. Example: Data: Signal in AIx = 10V Gain = 0.3 It is known that: Ref.= (AI Signal x Gain) + Offset Therefore: Ref. = 10 x 0.3 = 3V Ref. = 3V, is equivalent to 3000rpm for the speed reference. In this case, the control action will be taken over a reference signal of +4.5V.
P235 Analog Input AI1 Signal	0 to 1 [0] -	☑ Type of input signal for the Analog Inputs AI1 and AI2. P235/P239 | Type of Input Signal 0 | (-10 to +10)V/ (0 to 20)mA 1 | (4 to 20)mA ***Table 5.22 -*** *Configuration of the type of input signal for AI1 and AI2* **NOTE!** ☑ Set the SW1.1 dipswitch on the control board to "ON" when using current signals at analog input AI1. See SW1 dipswitch location in figure 3.14. ☑ Set the SW1.2 dipswitch on the control board to "ON" when using current signals at analog input AI2. See SW1 dipswitch location in figure 3.14.
P236 Analog Input AI1 Offset	-9.999 to +9.999 [0.0] 0.1	☑ See parameter P234.
P237 Analog Input AI2 Function	0 to 4 [0] -	☑ See parameter P232.
P238 Analog Input AI2 Gain	0.000 to 32.767 [0.300] -	☑ See parameter P234.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P239 Analog Input AI2 Signal	0 to 1 [0] -	☑ See parameter P235.
P240 Analog Input AI2 Offset	-9.999 to +9.999 [0.0] 0.1	☑ See parameter P234.
P241 Sum of the Analog Inputs	0 to 3 [0] -	☑ The analog inputs are added after they have been multiplied by their respective gains and summed to the offsets. The result can be used as a reference of torque, speed, or position, depending on the value of P241 (refer to table 5.23). ☑ The parameters of the analog input function (P232 and P237) must be set to 4 in order to make the sum of the analog inputs as the reference for the servodrive (according to table 5.23). Example**:** Setting P232 = 4, P237 = 4, and P241 = 2, makes the sum of analog inputs 1 and 2 as the servodrive speed reference.
P248 Analog Input AI1Filter	0 to 4000 [1000] 1Hz	☑ This Parameter sets the Time Constant of the Analog Input filter. This filter reduces the sharp speed signal changes, which eventually may be generated by noisy reference signals. Please note that the higher the value of the filter time constant, the slower will be the response to the reference signal. When this value is set to zero (factory setting), this means that the signal is not filtered.
P249 Analog Input AI2 Filter	0 to 4000 [1000] 1Hz	☑ See Parameter P248.
P251 Analog Output AO1 Function **P252** Analog Output AO1 Gain	0 to 26 [0] - 00.00 to 327.67 [1.00] 0.01	☑ Function and scale of Analog Outputs AO1 and AO2.

P241	Function
0	Disabled
1	Torque Reference
2	Speed Reference
3	Position Reference

Table 5.23 - *Description of the function 'Sum of the Analog Inputs'*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P253 Analog Output AO2 Function	0 to 26 [0] -	
P254 Analog Output AO2 Gain	00.00 to 327.67 [1.00] 0.01	

P251/ P253	Function	Description	Range
0	Disabled	-	-
1	Current Reference	Indicates the reference value, already considering the analog output gain and offset.	Mod.4/8: -10V to +10V ⇔ -9,5A to +9,5A rms Mod.8.16: -10V to +10V ⇔ -19A to +19A rms Mod. 24/48: -10V to +10V ⇔ -57A to +57A rms
2	Speed Reference		-10V to +10V ⇔ -10.000rpm to +10.000rpm (-10.000rpm = reverse direction of rotation)
3	Position Reference		-10V to +10V ⇔ -180° to +180°
4	Current of Phase U	Phase Current read from the current feedback.	Mod. 4/8: -10V to +10V ⇔ -9,5A to +9,5A rms Mod. 8/16: -10V to +10V ⇔ -19A to +19A rms Mod. 24/48: -10V to +10V ⇔ -57A to +57A rms
5	Current of phase V		
6	Current of Phase W		
7	Real Speed	Speed of the Servomotor Shaft, calculated by the speed estimator.	-10V to +10V ⇔ -10.000rpm to +10.000rpm (-10.000rpm = reverse direction of rotation)
8	Angular Position	Indicates the real angular position of the motor shaft.	-10V to +10V ⇔ -180° to +180° (for P231 set to 1 (1 revolution))
10	iq	Current value proportional to the torque.	Mod. 4/8: -10V to +10V ⇔ -9,5A to +9,5A rms Mod. 8/16: -10V to +10V ⇔ -19A to +19A rms Mod. 24/48: -10V to +10V ⇔ -57A to +57A rms
11	id	Current value proportional to the magnetic flux.	
12	Vq	Voltage value that generates the Iq current.	-10V to +10V ⇔ -Voltage of the Link DC ÷ 2 to +Voltage of the Link DC ÷ 2
13	Vd	Voltage value that generates the Id current.	
14	Voltage of phase U	Phase Voltage	
15	Voltage of phase V		
16	Voltage of phase W		
17	Value of the AI1	Value read from the analog input, already considering the analog input gain, offset and filter.	-10V to +10V
18	Value of the AI2		
19	Reserved	-	-
24	POS2	-	-
25	Full scale voltage	-	Generates the full scale voltage and allows the user to calibrate another equipment that needs to know this value.
26	PID Output	The PID output value is written to the analog input.	-

Table 5.24 *- Function and ranges of the analog outputs AO1 and AO2*



NOTE!

The ranges of the analog outputs presented in table 5.24 are valid for to unitary gain=1 and to zero offset=0.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P259 Analog Output AO1 Offset	-9.999 to +9.999 [0.000] 0.001	☑ Gain for the Analog Outputs AO1 and AO2. ☑ Parameters P252 and P254 define the gain for the analog output. The block diagram of Figure 5.4 describes its operation.
P260 Analog Output AO2 Offset	-9.999 to +9.999 [0.000] 0.001	

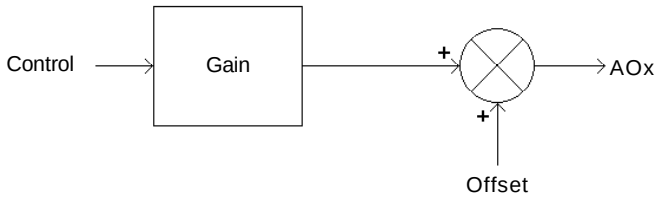


Figure 5.4 - *Block diagram of the Analog Outputs*

☑ The signal of the analog output sent by the control is multiplied by the gain and added to the offset signal. The resulting value is available at the analog output.

P263 Digital Input 1 (DI1) Function	0 to 40 [0] -	☑ Defines the function of the Digital Inputs (among the available options). ☑ Programmable functions for the Digital Inputs - DI1 to DI6.
P264 Digital Input 2 (DI2) Function	0 to 40 [0] -	
P265 Digital Input 3 (DI3) Function	0 to 40 [0] -	
P266 Digital Input 4 (DI4) Function	0 to 40 [0] -	
P267 Digital Input 5 (DI5) Function	0 to 40 [0] -	
P268 Digital Input 6 (DI6) Function	0 to 40 [0] -	

P263 to P268	Function	Operation Mode	Description
0	No function	-	-
1	Enable/Disable	Closed = Enable Open = Disable	See P099
2	Stop Function	Closed = Stop Open = Release	See P432
3	Stop Inverse Function	Closed = Release Open = Stop	
4	Forward limit switch	Closed = Disable Open = Enable	When it is activated, blocks the motion on the forward direction.
5	Clockwise strock end		When it is activated, blocks the motion on the reverse direction.
6	Error Reset	Positive pulse = reset of errors.	Errors are reset if a positive pulse is detected at the digital input (transition from 0 to 1).
7	Direction of rotation	Closed = Reverse Open = Forward	See P111
8	Torque/Speed Mode	Closed = Speed Open = Torque	See P202
9	Torque/Position Mode	Closed = Position Open = Torque	
10	Speed/Position Mode	Closed = Position Open = Speed	
11	Move - 1 Pos. Cycle 1	Closed = Executes one positioning of the cycle. Open = No function.	See item 5.7.2
12	Move - 1 Pos. Cycle 2		
13	Move - 1 Pos. Cycle 3		
14	Move - 1 Pos. Cycle 4		
15	Move - 1 Pos. Cycle 5		
16	Move - 1 Pos. Cycle 6		
17	Move - 1 Pos. Cycle 7		
18	Move - 1 Pos. Cycle 8		
19	Move - 1 Pos. Cycle 9		
20	Move - 1 Pos. Cycle 10		

Table 5.25 *- Functions of Digital Inputs DI1 to DI6*

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Parameter	Range [Factory Setting] Unit	Description / Notes

P263 to P268	Function	Operation Mode	Description
21	Move: Cycle 1 complete	Closed = Executes the whole positioning cycle. Open = No function.	
22	Move: Cycle 2 complete		
23	Move: Cycle 3 complete		
24	Move: Cycle 4 complete		
25	Move: Cycle 5 complete		
26	Move: Cycle 6 complete		
27	Move: Cycle 7 complete		
28	Move: Cycle 8 complete		
29	Move: Cycle 9 complete		
30	Move: Cycle 10 complete		
31	Home Position Detected	Closed = Home position has been detected. Open = Home position has not been detected.	If the digital input is closed, the Home Function understands as the home position has been detected.
32	Activation of the Home Function	Positive pulse = Activates the Home Function.	The Home Function is activated by a transition from 0 to 1 at the digital input.
33	No Function	-	-
34	JOG 1	Closed = Executes the JOG function Open = No function	See P428
35	JOG 2		
36	No Function	-	-
37	Absolute Position Reset	On the open to closed transition, it executes the absolute position reset.	See P429
38	Hardware Reset	Negative pulse = Hardware reset.	Hardware is reset by a transition from 1 to 0 at the digital input.
39	Acceleration of the Digital Potentiometer	Closed = Acceleration enabled. Open = Acceleration disabled.	When the digital input is closed, the acceleration of the digital potentiometer is enabled. If the DI is open, the acceleration is disabled.
40	Deceleration of the Digital Potentiometer	Closed = Deceleration disabled. Open = Deceleration enabled.	When the digital input is closed, the deceleration of the digital potentiometer is disabled. If the DI is open, the deceleration is enabled.
41	Restart MOVE Cycle	Closed = MOVE cycle is restarted. Open = MOVE cycle is not restarted.	The MOVE cycles are continuously restarted while the digital input is closed. If the DI is open, the MOVE cycle is not restarted.
42 to 49	No Function	No function	
50	External Error	Closed = Error is not generated. Open = Generates error E06.	

Table 5.25 (cont.) *- Functions of Digital Inputs DI1 to DI6*

ATTENTION!

The setting of a specific function for an analog input is valid only after pressing the P key.

☑ The status of digital inputs can be monitored through parameter P012.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P275 Digital Output 1 (DO1) Function	0 to 10 [0] -	☑ It determines the function of the Digital Outputs. Available options are:
P277 Relay Output 1 (RL1) Function	0 to 10 [0] -	
P279 Relay Output 2 (RL2) Function	0 to 10 [0] -	

P275/P277/P279	Function	Notes
0	No Function	See P099
1	Enabled/Disabled	See P432
2	STOP Function	-
3	No Function	-
4	No Function	-
5	Servodrive Ready	-
6	No Fault	-
7 (*)	Direction of rotation (NC = Forward and NO = Reverse)	See P111
8	Whitten by POS2	-
9	MOVE Function	See item 5.7.2
10	Home Function	The digital output is activated while the Home Function is performed.
11	Output activated	-
12	N > Nx	Refer to P287 and P288
13	N < Nx	Refer to P287 and P288
14	N = N*	Refer to P287 and P288
15	T>Tx	Refer to P287 and P293
16	T<Tx	Refer to P287 and P293

(*) Note:
ON = NO contact activated for the relay output.
OFF = NC contact activated for the digital output.

Table 5.26 - *Functions of the Digital Outputs DO1, RL1 and RL2*

N > Nx, N < Nx, N = N^*, T > Tx, T < Tx

Notation:
H = current and speed hysteresis (P287)
N = motor speed
Nx = speed reference point (P288)
N^* = speed reference (P121)
T = motor current
Tx = current reference point (P293)

MOVE function: Activates the digital output in the following situations:
- While the servodrive is performing a positioning (for the MOVE function with Positioning option);
- While the servodrive is performing a cycle (for the MOVE function with Cycle option);
- Idem for previous options, however, the digital output status changes before the effective stop of the shaft (refer to parameters P437 and P438).

N > Nx: The digital output is activated when N > (Nx + H) and deactivated when N < (Nx – H).

N < Nx: The digital output is activated when N < (Nx – H) and deactivated when N > (Nx + H)

N = N^*: The digital output is activated when N = N^* and deactivated when N ≠ N^*

T > Tx: The digital output is activated when T > (Tx + H) and deactivated when T < (Tx – H)

T < Tx: The digital output is activated when T < (Tx – H) and deactivated when T > (Tx + H)

☑ Refer to item 5.7 - Description of the Special Functions.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P287 Hysteresis for Nx and Tx	0 to 6999 [0] -	☑ Defines the lower and the upper values of the hysteresis for Nx and Tx (Nx / Tx ± Hysteresis).
P288 Keypad Speed Reference	0 to 6999 [0] rpm	☑ Reference point where functions N > Nx and N < Nx work.
P293 Keypad Current Reference	0 to 699.9 [0] A	☑ Reference point where functions T > Tx and T < Tx work.
P295 (1) Rated Current	0 to 999.9 [-] A rms	☑ Shows the servodrive nominal current, automatically identified during initialization.
P308 Address of the Servodrive in the Serial Communication	1 to 247 [1] -	☑ This Parameter sets the address of the servodrive for the Serial Communication. ☑ WEGBUS or WEGTP Protocols → Range from 1 to 30. ☑ MODBUS-RTU Protocol → Range from 1 to 247.
P310 (1) Selects Bit Rate of the Serial Communication	0 to 3 [1] -	
P311 (1) Configures serial: Data Bits, Parity and Stop Bits	0 to 11 [3] -	
P312 (1) Choose Serial Protocol	0 to 2 [2] -	☑ Defines the protocol to be used at the RS-232/RS-485 serial port: ☑ For additional information, please, refer to Communication User's Guide for the SCA-05 Servodrive included in the product CD.

P310	Bit rate	P310	Bit rate
00	4800 bits/s	06	33600 bits/s
01	9600 bits/s	07	38400 bits/s
02	14400 bits/s	08	43200 bits/s
03	19200 bits/s	09	48000 bits/s
04	24000 bits/s	10	52800 bits/s
05	28800 bits/s	11	57600 bits/s

Table 5.27 - *Selection of the baud-rate for the serial communication*

P311	Data Bits	Parity	Stop Bit
0	8	No parity	1
1	8	Even parity	1
2	8	Odd parity	1
3	8	No parity	2
4	8	Even parity	2
5	8	Odd parity	2
6	7	No parity	1
7	7	Even parity	1
8	7	Odd parity	1
9	7	No parity	2
10	7	Even parity	2
11	7	Odd parity	2

Table 5.28 - *Selection of the parameters for the serial communication*

P312	Serial Protocol
0	WEGBUS protocol
1	WEGTP protocol
2	Modbus-RTU protocol

Table 5.29 - *Selection of the serial protocol*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P313 (1) Action to be Taken upon Detection of to Communication Failure	0 to 3 [0] -	☑ It allows selecting which action the drive should take upon detection of to communication failure. ☑ Communication errors include CAN interface errors (CANopen and DeviceNet protocols), serial communication errors and fieldbus communication errors.
P314 (1) Timeout for Communication	0 to 999.9 [0] -	☑ It allows setting the timeout for the serial communication. If set to “0” (zero), this function is disabled. ☑ If the drive is being controlled via the serial interface and to communication problem with the network master occurs (cable disruption, loss of power supply, etc.) it will not be possible to send serial commands to disable the equipment connected to the network. In applications where this scenario represents to problem, it is possible to set in parameter P314 the maximum interval of time the drive is supposed to receive to valid serial telegram. If the drive does not receive any telegram within this period of time, it will consider that to communication failure occurred. ☑ Once the timeout is set, the drive will start counting the time when the first serial telegram is received. If the drive does not receive to valid serial telegram within the specified time, it will indicate an E28 error and the action set in parameter P313 will be taken. ☑ The error code ‘E28’ disappears if the communication is reestablished (if P313 is set to 1, it will be necessary to manually reset the error). ☑ When this function is enabled it is necessary to guarantee that the network master will periodically send telegrams to the slave, respecting the time set, so that to communication timeout error does not occur.
P315 (1) Store Parameters in Non-Volatile Memory via Serial Interface	0 to 1 [1] -	☑ It allows selecting if the writing of parameters via serial interface shall or shall not store the parameters content on to non-volatile memory (EEPROM).

P313	Description	Note
0	Only indicate the fault code	In case of a communication error, only the fault code will be displayed on the drive keypad.
1	Cause a fault on the drive	A communication error will cause a fatal error on the drive, which will just work again after the error is reset.
2	Executes the STOP function	Executes the STOP function by automatically setting P432 to “1”.
3	Disable	Disables the drive by automatically setting P099 to “0”.

Table 5.30 *- Action to be taken upon detection of to communication failure*

☑ Communication errors may be different depending on the communication protocol. For further information, refer to the communication manual specific for the protocol used.

P315	Function
0	Do not save parameters in the non-volatile memory.
1	Save parameters in the non-volatile memory.

Table 5.31 - *Selection of saving parameters in the non-volatile memory*

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Parameter	Range [Factory Setting] Unit	Description / Notes
		☑ After storing the parameter content on the non-volatile memory, it is recovered when the drive is reset or powered up again. ☑ This memory, however, has to limited number of writings (100.000 times). Depending on the application, this limit can be achieved if some parameters are cyclic written via serial interface (speed reference, torque reference, commands, etc.). In these cases, it may be interesting that the writing via serial interface does not store the parameters content on the non-volatile memory, in order to not achieve the limit of the memory. ☑ This parameter is valid only for the WEGBUS and Modbus-RTU protocols. For the WEGTP protocol, the type of telegram is that determines if the parameter shall or shall not be stored on the non-volatile memory.
P340 (1) Number of Pulses of Encoder Simulator	0 to 4096 [1024] pulses	☑ Defines the number of pulses supplied at the encoder simulator output by the servodrive per revolution. ☑ Max. value: 4096 pulses for speeds up to 3000rpm (servomotor); 1024 pulses for speeds higher than 3000rpm.
P341 (1) Null pulse Position	1 to 4096 [1] -	☑ It determines the position of the Null pulse (N) at the encoder simulator output. ☑ Max. value: equal to the programmed number of pulses (P340).
P342 (1) Selects sequence: A ⇔ B	0 to 1 [0] -	☑ Determines the pulse sequence at the encoder simulator output.

P342	Pulse Sequence
0	Sequence from A to B
1	Sequence from B to A

Table 5.32 - *Selection of the pulse sequence at the encoder simulator output*

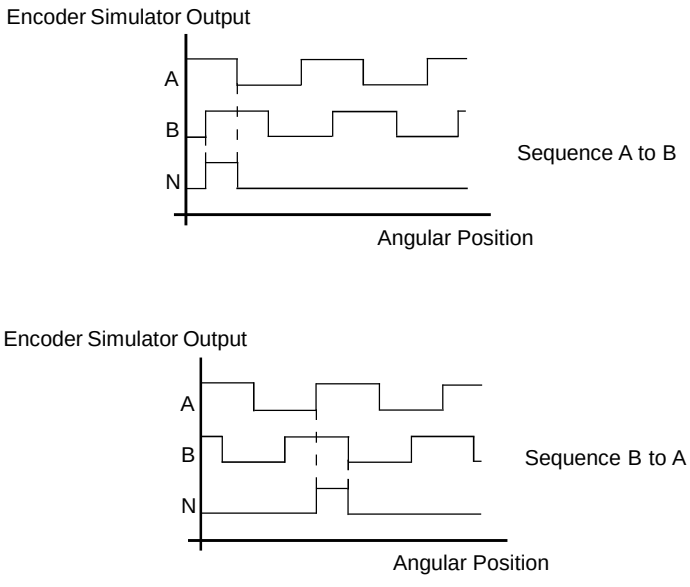


Figure 5.5 - *Pulse sequence at the encoder simulator output*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P380 (1) Self-Tuning Function: Speed and Position Loop	0 to 1 [0] -	☑ When this function has been set, starts the Auto-tuning for determining the set gains of the servodrive. ☑ Procedures for Auto-tuning starting: Set parameter P380 = 1, press key P and reset servodrive by pressing HMI key "Reset" or switch Off/On servodrive. ☑ For more details about operation, refer to Item 5.7.1.
P381 Max. number of revolutions as Auto-tuning function	1 to 30 [8] revolutions	☑ This is the maximum number of revolutions that the servomotor will run to perform the auto-tuning. The higher the number of revolutions, the finer will be the settings performed by the servodrive. **NOTE!** The servodrive will run the servomotor shaft only the number of turns necessary to perform the auto-tunning, respecting the maximum number of turns programmed.
P385 (1) Servomotor Model	0 to 42 [24] -	See table below. **NOTE!** These changes are valid only after “RESET” key is pressed on the keypad (HMI).
P390 iq Reference Filter (Torque current)	0 to 4000 [0] 1Hz	☑ It sets the time constant of the torque current reference filter. ☑ This filter reduces the sharp oscillations of the torque current reference signal eventually caused by noisy reference signals our due to sharp oscillations. ☑ Please note that the higher the filter time constant, the slower the reference signal response. When programmed to zero (factory setting), this means that the signal is not filtered.

P385	Servomotor Model	P385	Servomotor Model
0	No model selected	22	SWA 56-2,5-30
1	Reserved	23	SWA 56-4,0-30
2	Reserved	24	SWA 56-6,1-30
3	SWA 56-2,5-20	25	SWA 56-7,0-30
4	SWA 56-3,8-20	26	SWA 71-9,3-30
5	SWA 56-6,1-20	27	SWA 71-13-30
6	SWA 56-8,0-20	28	SWA 71-15-30
7	SWA 71-9,3-20	29	SWA 71-19-30
8	SWA 71-13-20	30	Reserved
9	SWA 71-15-20	31	Reserved
10	SWA 71-19-20	32	Reserved
11	SWA 71-22-20	33	Reserved
12	SWA 71-25-20	34	Reserved
13	Reserved	35	Reserved
14	Reserved	36	Reserved
15	Reserved	37	SWA 40-1,6-60
16	Reserved	38	SWA 40-2,6-60
17	Reserved	39	SWA 56-2,5-60
18	Reserved	40	SWA 56-3,6-60
19	Reserved	41	SWA 56-5,5-60
20	SWA 40-1,6-30	42	SWA 56-6,5-60
21	SWA 40-2,6-30	-	-

Table 5.33 - *Selection of the servomotor model*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P392 (2) Iq Current PID - Proportional Gain (kp)	0 to 9999 [70] -	☑ These gains are automatically ajusted when the servomotor is choosed on P385.
P393 (2) Iq Current PID - Integral Gain (ki)	0 to 9999 [400] -	
P395 (2) Id Current PID - Proportional Gain (kp)	0 to 9999 [70] -	
P396 (2) Id Current PID - Integral Gain (ki)	0 to 9999 [400] -	
P398 Resolver: Lag Compensation	0 to 32767 [4350] rpm	☑ It is to compensation for the phase lag due to the speed. **NOTE!** The value of P398 must not be changed. It is automatically loaded when the servomotor model is selected in P385.
P399 (2) Resolver: Position Offset	0 to 16383 [0] 1 pulse	☑ It Compensates eventual differences between the resolver Zero position and the servomotor Zero position.

5.4 MOTOR PARAMETERS - P400 to P419

P401 (2) Rated Motor Current (In)	0.0 to 999.9 [8.50] 0.1A	☑ Set it according to the used motor nameplate data.
P402 (2) Rated Motor Speed (ωn)	0 to 9999 [3000] 1rpm	☑ Set it according to the used motor nameplate data.
P407 (2) p/2: Number Pole Pairs for the Motor	1 to 100 [4] -	☑ It defines the number of pole pairs for the servomotor used (number of poles / 2).
P409 (2) Rs - Motor Stator Resistance	0.000 to 32.767 [0.071] 1Ω	☑ Parameter set during auto-tuning.
P414 (2) Lq - Inductance of the Motor Shaft	0.00 to 327.67 [3.87] 1mH	

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Parameter	Range [Factory Setting] Unit	Description / Notes
P415 (2) Ld - Direct Shaft Indutance	0.00 to 327.67 [3.26] 1mH	
P416 (2) ke - Voltage Constant	0.00 to 327.67 [47] 1V/krpm	
P417 (2) kt - Torque Constant	0.000 to 32.767 [0.718] 1Nm/A	
P418 (2) J - Motor Sharf Inertia	0.000 to 32.767 [50] $1.10^{-3}kgm^2$	

5.5 PARAMETERS OF THE SPECIAL FUNCTIONS - P420 to P541

P420 Selection of the operation mode for the CAN network master/slave function	0 to 3 [0] -	☑ It allows selecting the operation mode for the CAN network master/slave function, where the slave servodrive follows the master servodrive in position and speed. ☑ Set P700=3 to activate the CAN master/slave function.
P422 Numerator of the Master/Slave Ratio	1 to 9999 [1] -	
P423 Denominator of the Master/Slave Ratio	1 to 9999 [1] -	
P425 Direction of Rotation for the Master/Slave Function	0 to 1 [0] -	☑ P422/P423 results in the master/slave ratio, where P422 is the numerator of the ratio and P423 is the denominator of the ratio. For instance: The slave runs at the same speed as the master: P422=1, P423=1 => 1/1=1 The slave runs at double speed of the master. While the master rotates 1 revolution, the slave rotates 2 revolutions: P422=2, P423=1 => 2/1=2 The slave runs at half speed of the master. While the master rotates 2 revolutions, the slave rotates 1 revolution: P422=1,P423=2 => 1/2=0.5 **OBS:** Reset the SCA-05 in order to update the content of parameters P422 and P423.
P426 Position Shift for the Master/Slave Function	0 to 16383 [0] -	
P427 Phase Lag Compensation for the Master/Slave Function	0 to 9999 [0] -	

P420	Function
1	The servodrive is configured as the master (the servodrive sends position and speed references to the slave).
2	The servodrive is configured as the slave (receives the position and speed references from the master, and consequently, follows it).
3	The servodrive is configured as the slave, but does not take the master position at the function activation (the slave keeps its initial position).

Table 5.34 - *Selection of the operation mode for the master/slave function*

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Parameter	Range [Factory Setting] Unit	Description / Notes

P425	Slave's Direction of Rotation
0	Same direction as the master.
1	Opposite direction of the master.

Table 5.35 - *Selection of the slave's direction of rotation with respect to the master*

☑ P426 defines to position offset for the slave with respect to the master.
☑ P427 is the compensation for the lag on the slave. The value of parameter P427 is multiplied by the speed and added to the position reference. Therefore, P427 consists on the position offset that varies according to the speed.

P428
Active JOG1 or JOG2

-1 to +1
[0]
-

☑ Activates the JOG function. This function consists on to temporary activation (while the function is active) of the servomotor in to predefined speed.
☑ Table 5.36 presents all possible settings.

P428 (*)	Description
0	Disables the JOG function.
1	Enables JOG1 (servomotor runs at the speed set at P122).
-1	Enables JOG2 (servomotor runs at the speed set at P123).

(*) Note: The functions JOG1 or JOG2 may be enabled through digital inputs as well. Refer to the digital inputs settings.

Table 5.36 - *Activates JOG1 or JOG2 functions*

P429
Reset Absolute Position:
P052 and P053

0 to 1
[0]
-

☑ This function resets the position value used by the MOVE function when operating in absolute mode that is, it resets P052 and P053.
☑ This operation occurs when the value of P429 changes from 0 to 1, or when it is activated via digital input - refer to the digital inputs settings.

P432
Starts STOP Function

0 to 1
[0]
-

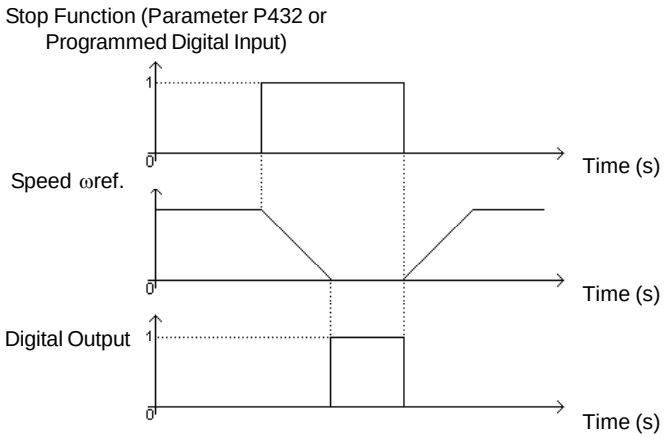
P432	Select STOP Function
0	Stop Function is disabled
1	Stop Function is enabled

Table 5.37 - *Selection of the STOP function*

☑ When the STOP function is enabled (P432=1), the servomotor decelerates (using the deceleration ramp set at P101 or P103) and stops. At this point, the servomotor shaft is locked in that position.
☑ When the STOP function is disabled (P432 = 0), the servomotor accelerates (using the acceleration ramp set at P100 or P102) up to the speed reference.
☑ The STOP function cancels the MOVE function.
☑ The STOP function can be used only in the Speed Mode (P202=1) and in the Positioning Mode (P202 = 2).
☑ The STOP function uses the ramps set in parameter P229. If P229 = 0, than the Ramp#1 is used (P100 and P101).

☑ Gain settings:
- While the servomotor shaft is not locked, the servodrive operates in speed mode. Therefore, the speed mode gains must be set properly.
- Once the servomotor shaft is locked, the servodrive immediately enters into the position mode. Therefore, the position mode gains must be set properly as well.

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Parameter	Range [Factory Setting] Unit	Description / Notes
		 ***Figure 5.6 -*** *Behavior of the STOP function*
P433 Automatic STOP Function Reference Programs	0 to 3276.7 [0] 0.1rpm	☑ The servodrive enables the STOP function automatically each time the speed reference is ≤ to the value programmed at P433. ☑ The STOP function is disabled automatically each time the speed reference becomes higher than the value programmed at 433.
P434 Restart MOVE Cycle	0 to 1 [0] -	☑ When this function is activated (P434=1), the specified cycle (MOVE function) will restart from the first positioning, regardless of the last positioning accomplished before the activation of P434. For example, if the user has set cycle #1 with three (03) positioning (P1, P2 and P3) and parameter P434 is activated right after accomplishment of positioning P2, then the next positioning to be performed will be P1 (restarting the cycle) and not P3, as it usually would be.
P435 Starts MOVE Function	0 to 1 [0] -	☑ For more details about the operation, refer to item 5.7.2. P435 | Choose MOVE Function 0 | MOVE function not enabled 1 | MOVE function enabled ***Table 5.38 -*** *Selection of the MOVE function*
P436 Positioning Cycles Selection to Enable the MOVE Function via Parameter	1 to 20 [1] -	☑ For more details about operation, refer to item 5.7.2. P436 | Selects Positioning | P436 | Selects Positioning 1 | One positioning of the cycle 1 | 11 | Complete cycle 1 2 | One positioning of the cycle 2 | 12 | Complete cycle 2 3 | One positioning of the cycle 3 | 13 | Complete cycle 3 4 | One positioning of the cycle 4 | 14 | Complete cycle 4 5 | One positioning of the cycle 5 | 15 | Complete cycle 5 6 | One positioning of the cycle 6 | 16 | Complete cycle 6 7 | One positioning of the cycle 7 | 17 | Complete cycle 7 8 | One positioning of the cycle 8 | 18 | Complete cycle 8 9 | One positioning of the cycle 9 | 19 | Complete cycle 9 10 | One positioning of the cycle 10 | 20 | Complete cycle 10 ***Table 5.39 -*** *Positioning Cycles Selection*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P437 Digital Output of MOVE Function Revolutions Fraction Before the end	0 to 16383 [0] 1 pulse	☑ These parameters define the number of revolutions or the fraction of revolution (or both) before the effective stop of the motor shaft (locked shaft) as the Digital Output (programmed as MOVE function) changes the status. This function may be used when some other operation in the process before the stop of the servomotor shaft is desired.
P438 Sets the Number of Revolutions Reference for the MOVE Function at the Digital Output	0 to 32767 [0] 1 revolution	

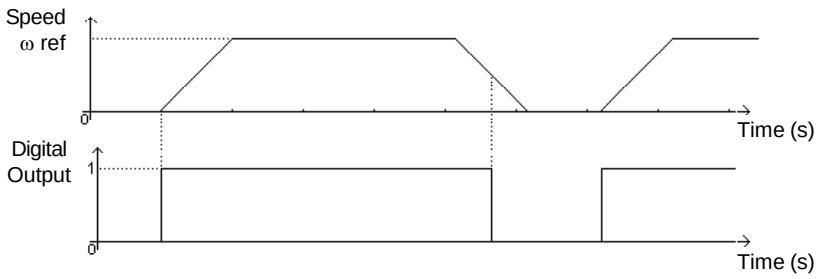


Figure 5.7 - *Status change of the digital output (programmed as MOVE function) before stop of the motor shaft*

Parameter	Range [Factory Setting] Unit	Description / Notes
P439 Option of Automatic Cycle of the MOVE Function	0 to 10 [0] -	☑ This parameter, when set, enables servodrive to execute continuously (in loop form) the chosen cycle.

P439	Automatic Cycle
0	Disabled
1 to 10	Executes the automatic cycle according to the programmed cycle.

Table 5.40 - *Selects the 'Automatic Cycle' option for the MOVE function*

Parameter	Range [Factory Setting] Unit	Description / Notes
P440 Activation Mode for the MOVE Function	0 to 1 [0] -	☑ This parameter defines the activation mode for the MOVE function.

P440	MOVE Function Activation Mode
0	By logic level
1	By positive pulse

Table 5.41 - *MOVE function activation mode*

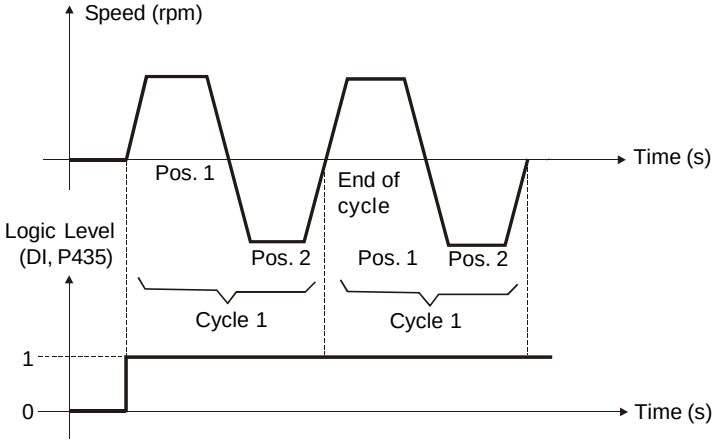


Figure 5.8 a) *- Activation of the MOVE function by logic level*

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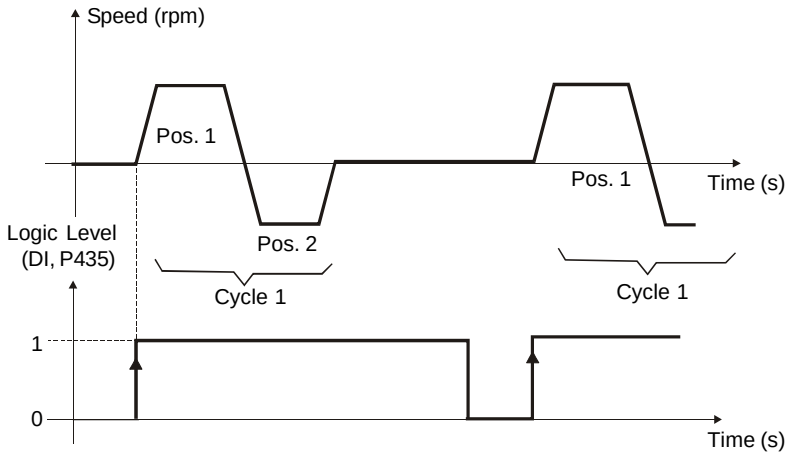
Parameter	Range [Factory Setting] Unit	Description / Notes
		

Figure 5.8 b) *- Activation of the MOVE function by positive pulse*

P441 MOVE function: Defines the cycle for the Positioning 1	0 to 10 [0] -	☑ The parameters P441 to P450 define to which cycle belongs each individual reference (Positioning). ☑ Programming Example: P441 = 1 (Cycle 1) P442 = 1 (Cycle 1) P443 = 1 (Cycle 1) P444 = 1 (Cycle 1) P445 = 0 P446 = 0 P447 = 0 P448 = 0 P449 = 0 P450 = 0 ☑ The previous example shows that Cycle #1 will be composed of 4 positioning: positioning #1, positioning #2, positioning #3, and positioning #4. If parameters from P445 to P450 are set to 0, it means that these parameters do not belong to any cycle.
P442 MOVE function: Defines the cycle for the Positioning 2	0 to 10 [0] -	
P443 MOVE function: Defines the cycle for the Positioning 3	0 to 10 [0] -	
P444 MOVE function: Defines the cycle for the Positioning 4	0 to 10 [0] -	
P445 MOVE function: Defines the cycle for the Positioning 5	0 to 10 [0] -	
P446 MOVE function: Defines the cycle for the Positioning 6	0 to 10 [0] -	
P447 MOVE function: Defines the cycle	0 to 10 [0] -	

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Parameter	Range [Factory Setting] Unit	Description / Notes
P448 MOVE function: Defines the cycle for the Positioning 8	0 to 10 [0] -	
P449 MOVE function: Defines the cycle for the Positioning 9	0 to 10 [0] -	
P450 MOVE function: Defines the cycle for the Positioning 10	0 to 10 [0] -	
P451 MOVE function: Operation Mode for Positioning 1	1 to 6 [3] -	☑ Parameters P451 to P460 define the way each positioning is performed. Please, note that when values are set to 1 or 2, no positioning is executed. Only the torque or the speed is controlled. When the values are programmed to 3 or 4 it means that each positioning is executed by using the Ramp 1 (acceleration and deceleration) or the Ramp 2 (acceleration and deceleration). Further details are provided in the examples of items 4.6.3, 4.6.4, and 5.7.2.
P452 MOVE function: Operation Mode for Positioning 2	1 to 6 [3] -	
P453 MOVE function: Operation Mode for Positioning 3	1 to 6 [3] -	
P454 MOVE function: Operation Mode for Positioning 4	1 to 6 [3] -	
P455 MOVE function: Operation Mode for Positioning 5	1 to 6 [3] -	
P456 MOVE function: Operation Mode for Positioning 6	1 to 6 [3] -	
P457 MOVE function: Operation Mode for Positioning 7	1 to 6 [3] -	
P458 MOVE function: Operation Mode for Positioning 8	1 to 6 [3] -	

P451 to P460	Function
1	Torque Reference
2	Speed Reference
3	Relative Positioning by using Ramps 1
4	Relative Positioning by using Ramps 2
5	Absolute Positioning by using Ramps 1
6	Absolute Positioning by using Ramps 2

Table 5.42 - *Selection of the positioning operation mode*

1) Torque Reference: no positioning is performed. The servodrive applies the torque set at parameters P124 to P133 for the time set at parameters P461 to P470. Once this time has elapsed, the MOVE function is complete. The torque value set at parameters P124 to P133 has two decimal places. Therefore, set P124 to 650 in order to have a torque reference of 6.5A for positioning #1.

2) Speed Reference: no positioning is performed. The servodrive runs at the speed set at parameters P124 to P133 for the time set at parameters P461to P470. Once this time has elapsed, the MOVE function is complete.

3) Relative Positioning by using Ramps 1: the servo rotates, with respect to its actual position, the number of revolutions set at parameters P481 to P490 plus the fraction of revolution set at parameters P471 to P480 (where 16384 corresponds to 1 complete revolution, i.e., 360º). This option uses the set of ramps 1 (P100 and P101).

4) Relative Positioning by using Ramps 2: the servo rotates, with respect to its actual position, the number of revolutions set at parameters P481 to P490 plus the fraction of revolution set at parameters P471 to P480 (where 16384 corresponds to 1 complete revolution, i.e., 360º). This option uses the set of ramps 2 (P102 and P103).

5) Absolute Positioning by using Ramps 1: the servo will rotate (using set of ramps 1 - P100 and P101) until it reaches the position set at

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Parameter	Range [Factory Setting] Unit	Description / Notes
P459 MOVE function: Operation Mode for Positioning 9 **P460** MOVE function: Operation Mode for Positioning 10	1 to 6 [3] -	parameters P481 to P490 (for the number of revolutions) and P471 to P480 (fraction of revolution, where 16384 corresponds to 1 complete revolution, that is, 360º). The absolute positioning is indicated at parameters P052 (fraction of revolution) and P053 (number of revolutions) and can be reset via digital input or via parameter P429. If a negative speed reference is set (see item 5.7.2), the servo will move to a negative position. 6) Absolute Positioning by using Ramps 2: the servo will rotate (using the set of ramps 2 - P102 and P103) until it reaches the position set at parameters P481 to P490 (for the number of revolutions) and P471 to P480 (fraction of revolution, where 16384 corresponds to 1 complete revolution, that is, 360º). The absolute positioning is indicated at parameters P052 (fraction of revolution) and P053 (number of revolutions) and can be reset via digital input or via parameter P429. If a negative speed reference is set (see item 5.7.2), the servo will move to a negative position.
P461 MOVE function: Timer of the Positioning 1 **P462** MOVE function: Timer of the Positioning 2 **P463** MOVE function: Timer of the Positioning 3 **P464** MOVE function: Timer of the Positioning 4 **P465** MOVE function: Timer of the Positioning 5 **P466** MOVE function: Timer of the Positioning 6 **P467** MOVE function: Timer of the Positioning 7 **P468** MOVE function: Timer of the Positioning 8	0 to 3276.7 [0] 1ms	☑ The parameters P461 to P470 define the rest times before each positioning.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P469 MOVE function: Timer of the Positioning 9	0 to 3276.7 [0] 1ms	
P470 MOVE function: Timer of the Positioning 10	0 to 3276.7 [0] 1ms	
P471 MOVE function: Fraction of Revolution for Positioning 1	0 to 16383 [0] 1 pulse	☑ The Parameters P471 to P480 define the fraction of revolution for each programmed positioning. The fraction of revolution is used to execute the "fine setting" of the positioning. One complete revolution (360°) is formed by 16384 pulses. Further details are provided in item 4.6.3 - MOVE Function - Positioning.
P472 MOVE function: Fraction of Revolution for Positioning 2	0 to 16383 [0] 1 pulse	
P473 MOVE function: Fraction of Revolution for Positioning 3	0 to 16383 [0] 1 pulse	
P474 MOVE function: Fraction of Revolution for Positioning 4	0 to 16383 [0] 1 pulse	
P475 MOVE function: Fraction of Revolution for Positioning 5	0 to 16383 [0] 1 pulse	
P476 MOVE function: Fraction of Revolution for Positioning 6	0 to 16383 [0] 1 pulse	
P477 MOVE function: Fraction of Revolution for Positioning 7	0 to 16383 [0] 1 pulse	
P478 MOVE function: Fraction of Revolution for Positioning 8	0 to 16383 [0] 1 pulse	
P479 MOVE function: Fraction of Revolution for Positioning 9	0 to 16383 [0] 1 pulse	

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Parameter	Range [Factory Setting] Unit	Description / Notes
P480 MOVE function: Fraction of Revolution for Positioning 10	0 to 16383 [0] 1 pulse	
P481 MOVE function: Number of Revolutions for Positioning 1	0 to 32767 [0] 1 revolution	☑ The parameters P481 to P490 define the number o revolutions that the shaft of the servomotor must run for each programmed positioning. ☑ Example: Figures 5.9 and 5.10 present some examples of cycles composed of three (03) different positioning. In the first case, you must program the three speed references (one for each positioning, P124, P125 and P126); you must also program the number of revolutions that the servomotor must run for each positioning (P481, P482 and P483), and when required, you must also program the fraction of revolution for completing each cycle (P471, P472 and P473). In addition to these parameters, it will be necessary to set parameters P441, P442 and P443 to 1 so that the three positioning of the example can be defined as a cycle. Set the operation mode for each positioning (P451, P452 and P453) and the MOVE function (P435 or any Digital Input) to perform a positioning of Cycle #1. Thus each time the MOVE Function is enabled (via DI or parameter), the servomotor shaft will execute one Positioning (Figure 5.9). **NOTE!** In this case, the times between each positioning are defined and controlled externally (user, PLC, etc.). In the second case, you must program the three speed references (one for each positioning – P124, P125 and P126) and the number of revolutions that the servomotor should run for each positioning (P481, P482 and P483). When required, you should also program the fraction of revolution for accomplishing each cycle (P471, P472 and P473) and the three timers (P461, P462 and P463). The timers define the time interval between each positioning. In addition to these parameters, it will be necessary to set parameters P441, P442 and P443 to 1 so that the three positioning of the example can be defined as a cycle. Set the operation mode for each positioning (P451, P452 and P453) and the MOVE function (P435 or any Digital Input) to perform a positioning of Cycle #1. In this case, every time the MOVE Function is enabled (via DI or parameter), the servodrive will execute one complete cycle (Figure 5.10).
P482 MOVE function: Number of Revolutions for Positioning 2	0 to 32767 [0] 1 revolution	
P483 MOVE function: Number of Revolutions for Positioning 3	0 to 32767 [0] 1 revolution	
P484 MOVE function: Number of Revolutions for Positioning 4	0 to 32767 [0] 1 revolution	
P485 MOVE function: Number of Revolutions for Positioning 5	0 to 32767 [0] 1 revolution	
P486 MOVE function: Number of Revolutions for Positioning 6	0 to 32767 [0] 1 revolution	
P487 MOVE function: Number of Revolutions for Positioning 7	0 to 32767 [0] 1 revolution	
P488 MOVE function: Number of Revolutions for Positioning 8	0 to 32767 [0] 1 revolution	
P489 MOVE function: Number of Revolutions for Positioning 9	0 to 32767 [0] 1 revolution	
P490 MOVE function: Number of Revolutions for Positioning 10	0 to 32767 [0] 1 revolution	

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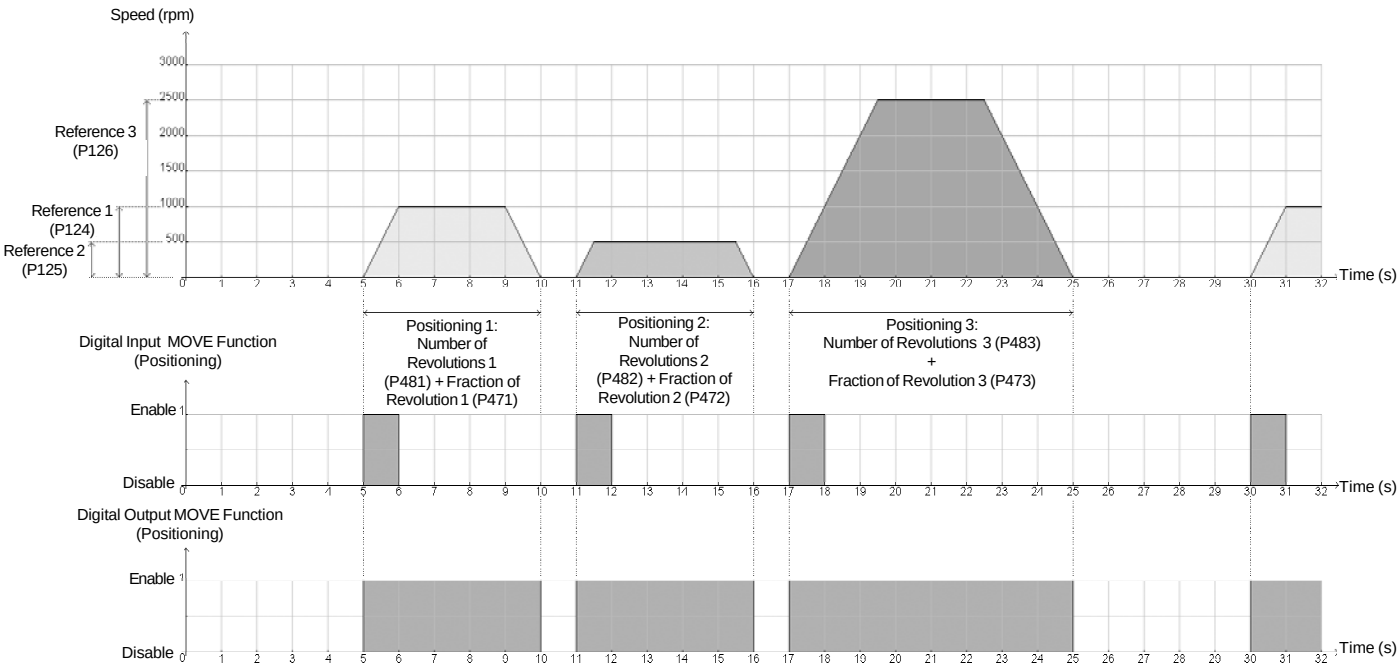


Figure 5.9 - *Example of Positioning Cycle, using the option of positioning execution*

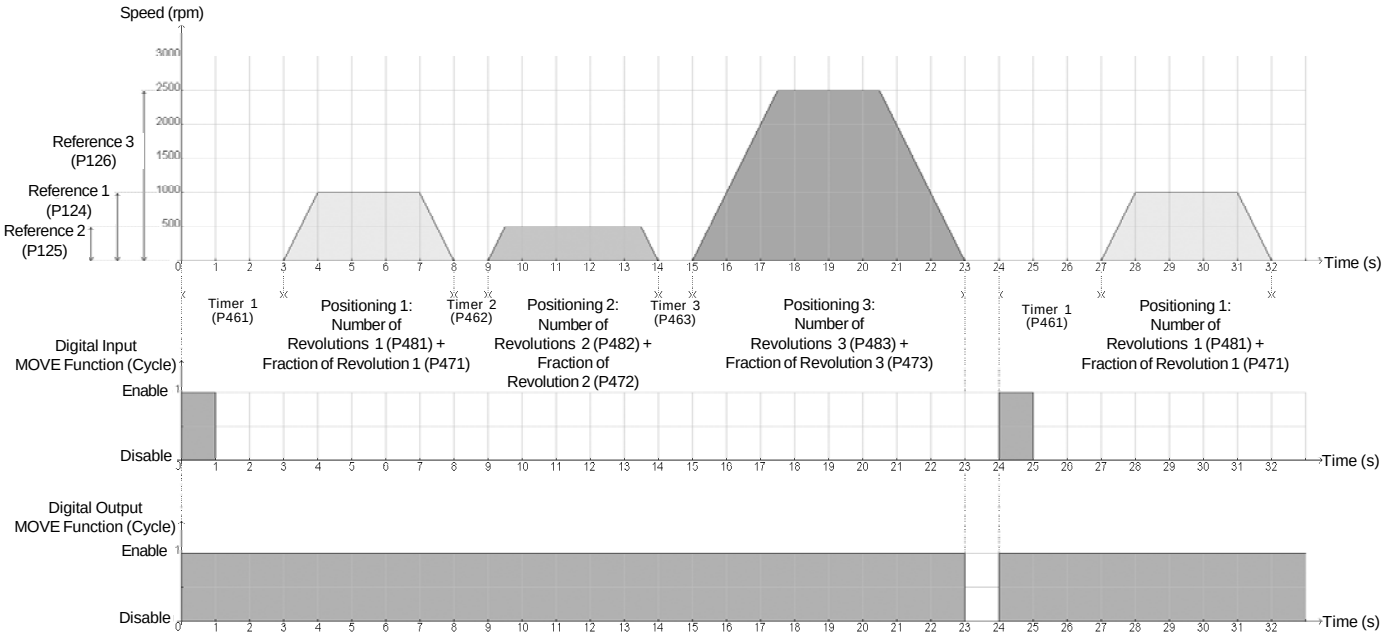


Figure 5.10 - *Example of positioning cycle, using the option of complete cycle execution*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P491 Reset of MOVE Cycles and Errors	0 to 1 [1] -	

P491	DI1, DI2, DI3, DI4, DI5 or DI6	Description
0	6	Only errors are reset.
1	6	The MOVE cycles as well as the errors are reset.

Table 5.43 - *Description of the function 'Reset of MOVE Cycles and Errors'*

P492 Maximum Stop Error for the MOVE Function	0 to 8192 [0] 1 pulse	☑ At the end of a MOVE function positioning, if the motor is in a different position of that specified (reference), and this difference (error) is greater than the value set at P492 (in pulses), the fatal error E49 occurs and it will be shown on the keypad.
P494 Activation of the Home Function	0 to 1 [0] -	☑ In the event of a positive pulse in parameter P494, the Home Function is activated. Refer to item 5.7.3 for a detailed operation description.
P496 Speed Reference for the Home Function	-6999 to +6999 [10] rpm	☑ Defines the speed for the Home Function. Refer to item 5.7.3 for a detailed operation description.
P497 Zero Pulse Position for the Home Function	0 to 16383 [0] 1 pulse	☑ The zero pulse (home position) for the Home function. Refer to item 5.7.3. ☑ The motor shaft stops at the position defined as the zero pulse position.

P497	Final Motor Shaft Position
0	Resolver zero position
≠ 0	Position relative to the offset value in the Resolver

Table 5.44 - *Final motor shaft position determined by the zero pulse position*

P502 Count Mode for the CEP Board	0 to 1 [0] -	☑ Defines the count mode for the CEP Board (refer to item 8.8.1).

P502	Count Mode
0	Mode 1
1	Mode 2

Table 5.45 - *CEP Board - Count Mode*

P503 Count Direction	0 to 1 [0] -	☑ Defines the count direction for the CEP Board (refer to item 8.8.1).

P503	Count Direction
0	Same direction as the counter
1	Opposite direction from the counter

Table 5.46 - *Count Direction - CEP Board*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P505 Counter Mode - CEP Board	0 to 4 [0] -	☑ Defines the type of reference given by the counter frequency - CEP Board (refer to item 8.8.1).

P505	Counter Mode
0	Disabled
1	Torque reference
2	Speed reference
3	Position reference (1)
4	Master-Slave (2)

Table 5.47 - *Counter mode - CEP Board*

NOTES!

(1) In case of position reference, the motor angular position varies with the counter frequency, i.e., if the counter frequency is constant, the motor shaft position remains constant. For example, if the counter operates at 10kHz and the gains are set so that with this frequency the motor shaft should be in the position P052=02000, the motor will remain stopped until the counter frequency changes. If the counter frequency changes to 5kHz the new shaft position will be P052=01000.

(2) In order to use the master-slave function (P507 = 4), the drive must be set to positioning mode (P202 = 3). Refer to item 5.7.4.

P507 Counter Gain - CEP Board	0 to 32.767 [1.000] -	☑ Sets the counter frequency gain – CEP Board (refer to item 8.8.1). ☑ The counter frequency is multiplied by the value of P507 before the frequency value is sent as the torque, speed or position reference. **NOTE!** If a resolver with a resolution of 4096 pulses per revolution is used as the pulses input for the counter and P507 is set to 1.000, then the motor will have maximum speed, current and position reference values when the counter speed is equal to 10.000rpm, i.e., 40,960.000 pulses per minute.
P509 Counter Filter Cut-off Frequency - CEP Board	0 to 4000 [1000] 1 Hz	☑ Defines the cut-off frequency for the counter filter – CEP Board (refer to item 8.8.1). ☑ Before the counter frequency is multiplied by the gain, it is filtered with a first-order filter, which cut-off frequency is defined at parameter P509.
P511 Denominator of the Master/Slave ratio (master parameter) - CEP Board	0.001 to 32.767 [0.001] -	☑ With the master/slave function available at the CEP board (refer to item 5.7.4), the slave will follow the master according to the Master/ Slave ratio (P512/P511), i.e., if P511 = 2, P512 = 1, and the master has rotated 1000 counter pulses, the slave should have rotated 500 pulses (in case the gain in P507 is properly set).
P512 Numerator of the Master/Slave ratio (slave parameter) - CEP Board	0.001 to 32.767 [0.001] -	**NOTE!** If the counter pulses are sent via an encoder simulator with a resolution of 4096 pulses per revolution and parameters P507=1.000, P511 = 1, and P512 = 1, then the master/slave ratio is 1:1.

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Parameter	Range [Factory Setting] Unit	Description / Notes
		NOTE! The ratio between P512 and P511 is limited to 10 (amplification), i.e., if P512 = 12 and P511 = 1, the ratio will still be 10 and not 12.
P513 Slave's direction of rotation with respect to the master - Master/Slave Function - CEP Board	0 to 1 [0] -	☑ If P513 = 0, the slave follows the master with the same direction of rotation (refer to item 5.7.4). ☑ If P513 = 1, the slave follows the master with the opposite direction of rotation (refer to item 5.7.4).
P520 PID Proportional Gain (Kp) - Analog Inputs	0 to 32767 [2500] -	☑ Defines the proportional gain of the PID controller for the analog inputs (PID AI - refer to item 5.7.6) with a scale factor of 1/100 (if this parameter is set to 100, the proportional gain is equal to 1).
P521 PID Integral Gain (Ki) - Analog Inputs	0 to 32767 [15] -	☑ Defines the integral gain of the PID controller for the analog inputs (refer to item 5.7.6) with a scale factor of 1/50.000 (if this parameter is set to 500, the integral gain is equal to 0.01).
P522 PID Differential Gain (Kd) - Analog Inputs	0 to 32767 [0] -	☑ Defines the differential gain of the PID controller for the analog inputs (refer to item 5.7.6) with a scale factor of 1/100 (if this parameter is set to 100, the differential gain is equal to 1).
P524 PID Feedback	0 to 1 [0] -	☑ Defines which analog input is used for the PID feedback (refer to item 5.7.6).

P524	Analog Input for the PID Feedback
0	Analog Input 1 (P232 must be set to 4)
1	Analog Input 2 (P237 must be set to 4)

Table 5.48 - *Selection of the analog input for the PID Feedback*

P525 PID Digital Set-point - Analog Inputs	-9999 to +9999 [0] -	☑ Defines the PID digital set-point (refer to item 5.7.6). This parameter has a scale similar to parameter P018.
P527 PID Action - Analog Inputs	0 to 1 [0] -	☑ Defines the control action for the PID controller (refer to item 5.7.6) - direct or reverse.
P528 PID Digital Set-point - Acceleration	1 to 32767 [1] 1 rpm/s	☑ Defines the acceleration for the PID set-point when the digital potentiometer function is enabled.

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Parameter	Range [Factory Setting] Unit	Description / Notes
P538 Selection of the PID Reference	0 to 2 [0] -	☑ Defines the input reference to be used by the PID (refer to item 5.7.6).

P538	Function
0	Digital Reference
1	Analog Input 1 (P232 must be set to 4)
2	Analog Input 2 (P237 must be set to 4)

Table 5.49 - *Selection of the PID reference*

P539 Selection of the PID Output	0 to 4 [0] -	☑ Defines the reference type for the PID output (refer to item 5.7.6).

P539	Function
0	Null Output
1	Torque Reference
2	Speed Reference
3	Position Reference
4	Analog Output

Table 5.50 - *Selection of the PID output*

P540 Lower Limit of the PID Output **P541** Upper Limit of the PID Output	-9999 to +16383 [-9999] - -9999 to +16383 [16383] -	☑ Parameters P540 and P541 define the upper and lower limits for the PID output (non-natural saturation). ☑ If the control signal is outside of the specified limits, the signal is clamped and the *Anti-Windup* system controls the PID integral action (refer to item 5.7.6). ☑ The range of these parameters is related to the type of PID output (P539). Refer to table 5.51.

P539	P540/P541 Range	Unit
0	-9999 to +16383	-
1	-9999 to +9999	mA
2	-9999 to +9999	rpm
3	0 to 16383	pulse
4	-8189 to +8191	-

Table 5.51 - *Range for the PID output*

NOTE!
For example, if P541 is set to 16383 and P539 is set to 2 (before the PID is enabled), once the motor is enabled, the value of P541 is automatically changed to 9999, which is the upper limit for the speed reference.

5.6 PARAMETER FOR THE CAN/DEVICENET NETWORKS - P700 to P729

P700 (1) CAN Protocol	0 to 3 [0] -	☑ It allows selecting the communication protocol to be used through the CAN interface available on the drive.

P700	Description	Observation
0	Disabled	CANopen, DeviceNet and MSCAN protocols are disabled.
1	CANopen	The drive operates as a slave on the CANopen network.
2	DeviceNet	The drive operates as a slave on the DeviceNet network.
3	MSCAN	Enables the Master/Slave function for position synchronism via CAN interface.

Table 5.52 *- CAN Protocol*

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Parameter	Range [Factory Setting] Unit	Description / Notes
		☑ Refer to the CANopen and DeviceNet communication user's guide to obtain detailed description about the respective protocols. ☑ The change of this parameter will be valid only after drive reset or at next power up.
P701 (1) CAN Address	0 to 127 [63] -	☑ It allows selecting the PLC1 address on the CAN network. The range of valid addresses depends on the protocol selected: CANopen: addresses from 1 to 127. DeviceNet: addresses from 0 to 63. ☑ It is not necessary to define the drive address for the synchronism function via CAN interface (MSCAN). ☑ The change of the address on the CAN network will be valid only after drive reset or at next power up.
P702 (1) Baud Rate	0 to 8 [0] -	☑ It defines the communication baud-rate used by the CAN interface. ☑ The DeviceNet protocol only supports baud rates of 500kbps, 250kbps and 125kbps. If any other option is chosen the auto-baud function is selected. ☑ The change of the communication baud-rate will be valid only after drive reset or at next power up.
P703 (1) Bus-off Reset	0 to 1 [0] -	☑ Defines which action the drive shall take under to bus-off error on the CAN interface.
P710 (1) I/O Instances for DeviceNet	0 to 3 [1] -	☑ Specific parameter for the DeviceNet communication. ☑ It defines the data format presented to the user.

P702	Baud rate	Maximum cable length.
0	1 Mbit/s	25 m
1	Reserved	-
2	500 kbit/s	100 m
3	250 kbit/s	250 m
4	125 kbit/s	500 m
5	100 kbit/s	600 m
6	50 kbit/s	1000 m
7	20 kbit/s	1000 m
8	10 kbit/s	1000 m

Table 5.53 *- Baud-rate*

P703	Description	Note
0	Manual	In case of bus-off error, the drive shall remain in the error condition until the device is reset.
1	Automatic	The drive shall automatically restart the communication, without needing to reset the device.

Table 5.54 *- Bus-off Reset*

P710	Description	Note
0	20 / 70	2 I/O words
1	21 / 71	2 I/O words
2	23 / 73	3 I/O words
3	100 / 150	4 I/O words

Table 5.55 *- I/O Instances for DeviceNet*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P711 (1) Device Reading Word #1 **P712** (1) Device Reading Word #2 **P713** (1) Device Reading Word #3	-1 to +749 [-1] - -1 to +749 [-1] - -1 to +749 [-1] -	☑ Specific parameters for the DeviceNet communication. ☑ They are used to set any other address, which content should be available for reading via communication network. ☑ The value -1 disables the access to the corresponding word (the value received by the master is always zero).
P714 (1) DeviceNet Writing Word #1 **P715** (1) DeviceNet Writing Word #2 **P716** (1) DeviceNet Writing Word #3	-1 to +749 [-1] - -1 to +749 [-1] - -1 to +749 [-1] -	☑ Specific parameter for the DeviceNet communication. ☑ They are used to set any other address, which content should be available for writing via communication network. ☑ Setting it to -1 disables the correspondent word writing (the value received by the servodrive at this word is ignored).
P720 (1) Fieldbus Communication Board Enable	0 to 3 [0] -	☑ Specific parameter for the Fieldbus communication via optional communication board. ☑ Enables the board and selects the protocol and the number of words exchanged with the master. ☑ The change of this parameter will be valid only after drive reset or at next power up. ☑ Refer to the Fieldbus communication user's guide to obtain additional information about this communication interface.
P722 (1) Fieldbus Reading Word #1 **P723** (1) Fieldbus Reading Word #2	-1 to +899 [-1] - -1 to +899 [-1] -	☑ If the Fieldbus optional communication board is enabled, these parameters can be used to set any other address, which content should be available for reading via communication network. ☑ According to the value set in parameter P720 it is possible to program up to 4 parameters for the input area of the network master. ☑ The value -1 disables the access to the corresponding word (the value received by the master is always zero).

P720	Description	Note
0	Disabled	2 I/O words
1	Profibus DP2 I/O	Enables the Profibus DP communication board to exchange 2 input/output words with the network master.
2	Profibus DP4 I/O	Enables the Profibus DP communication board to exchange 4 input/output words with the network master.
3	Profibus DP8 I/O	Enables the Profibus DP communication board to exchange 8 input/output words with the network master.

Table 5.56 - *Fieldbus Communication Board Enable*

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Parameter	Range [Factory Setting] Unit	Description / Notes
P724 (1) Fieldbus Reading Word #3	-1 to +899 [-1] -	
P725 (1) Fieldbus Reading Word #4	-1 to +899 [-1] -	
P726 (1) Fieldbus Writing Word #1	-1 to +899 [-1] -	☑ If the Fieldbus optional communication board is enabled, these parameters can be used to set any other address, which content should be available for writing via communication network. ☑ According to the value set in parameter P720 it is possible to program up to 4 parameters for the output area of the network master. ☑ Setting it to -1 disables the correspondent word writing (the value received by the servodrive at this word is ignored).
P727 (1) Fieldbus Writing Word #2	-1 to +899 [-1] -	
P728 (1) Fieldbus Writing Word #3	-1 to +899 [-1] -	
P729 (1) Fieldbus Writing Word #4	-1 to +899 [-1] -	
P749 Disable E71 and E72	1 to 100 [1] -	☑ If P749 = 50, error codes 71 (POS2 watchdog error) and 72 (error during the POS2 detection) are not generated.
P750 to P899 (4) Parameters of POS2 Optional Board	0 to 32767 [0] -	☑ These parameters are used exclusively by the POS2 Board. ☑ Read the POS2 Board manual.

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5.7 DESCRIPTION OF THE SPECIAL FUNCTIONS

5.7.1 Auto-tuning

In some applications, the servomotor may show an unstable behavior. In this case we recommend adjusting the servodrive gains. This adjustment can be done in two manners: manual setting or automatic setting (Auto-tuning).
The manual setting requires from the operator a previous knowledge of the setting procedures. This setting is only recommended to experienced users.
The auto-tuning setting is performed by the servodrive. To estimate the proper gains, the servodrive will rotate the servomotor for a number of revolutions determined by the user (via parameter). In this case, the servomotor should be already coupled to the machine. During auto-tuning, the keypad shows a blinking message “AUTO”. Once the auto-tuning procedure has been accomplished, the servodrive can function normally.

5.7.2 MOVE Function

This function is used for executing one or more programmed positioning. When this function is enabled, the servomotor accelerates according to the acceleration ramp (P100 or P102) up to the speed reference. This speed is maintained until the next stop point is nearly reached.
At this point, the deceleration process takes place (also set via parameters - P101 or P103) so that the motor stops at the next programmed position. The direction of rotation of each positioning is set via parameter as well.
The positioning the servomotor will perform when the MOVE function is enabled is defined by the reference of the MOVE function, which is composed of two parameters: Number of Revolutions (P438) and Fraction of Revolution (P437). Therefore, the servomotor will rotate the number of revolutions and fraction of revolutions previously set. Notice that the reference parameters of the MOVE function may be changed via serial interface (as any other servodrive parameter). This allows any positioning reference to be set for the MOVE function, resulting in high flexibility for the system.

Positioning Cycles:
It is possible to program up to 10 positioning cycles with to maximum of 10 total positioning, which means:
It is possible to have 10 cycles with 1 positioning each;
It is possible to have 1 cycle with 10 positioning;
It is possible to have 5 cycles with 2 positioning each;
It is possible to have 1 cycle with 5 positioning + 2 cycles with 2 positioning each + 1 cycle with 1 positioning; etc.
Set parameters P441 to P450 in order to define the positioning and its respective cycle.

Activation of the MOVE Function:
This function can be activated via parameter (P435) or via digital input (set at parameters P263 to P268).
Depending on the settings, it is possible to execute all positioning cycles at once or one positioning at a time (see table 5.57).

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Settings for the Positioning of a Cycle		
Via	Range	Function
P263 to P268	11 to 20	Executes on positioning of the respective cycle at a time.
	21 to 30	Executes all positioning of the respective cycle at once.
P436 (*)	1 to 10	Executes on positioning of the respective cycle at a time.
	11 to 20	Executes all positioning of the respective cycle at once.

*Note: Set P435 = 1 to enable the MOVE function via parameter.

Table 5.57 - *Settings for the Positioning of a Cycle*

Type of positioning performed by the MOVE function:
It is defined at parameters P451 to P460 and the following options are available:

1) Torque reference: no positioning is performed. The servodrive applies the torque set at parameters P124 to P133 for the time set at parameters P461 to P470. Once this time has elapsed, the MOVE function is complete. The torque value set at parameters P124 to P133 has two decimal places. Therefore, set P124=650 in order to have a torque reference of 6.5A for positioning #1.

2) Speed Reference: no positioning is performed. The servodrive runs at the speed set at parameters P124 to P133 for the time set at parameters P461to P470. Once this time has elapsed, the MOVE function is complete.

3) Relative Positioning by using Ramps 1: the servo rotates, with respect to its actual position, the number of revolutions set at parameters P481 to P490 plus the fraction of revolution set at parameters P471 to P480 (where 16384 corresponds to 1 complete revolution, i.e., 360º). This option uses the set of ramps 1 (P100 and P101).

4) Relative Positioning by using Ramps 2: the servo rotates, with respect to its actual position, the number of revolutions set at parameters P481 to P490 plus the fraction of revolution set at parameters P471 to P480 (where 16384 corresponds to 1 complete revolution, i.e., 360º). This option uses the set of ramps 2 (P102 and P103).

5) Absolute Positioning by using Ramps 1: the servo will rotate (using set of ramps 1 - P100 and P101) until it reaches the position set at parameters P481 to P490 (for the number of revolutions) and P471 to P480 (fraction of revolution, where 16384 corresponds to 1 complete revolution, i.e., 360º). The absolute positioning is indicated at parameters P052 (fraction of revolution) and P053 (number of revolutions) and can be reset via digital input or via parameter P429. If a negative speed reference is set (see item 5.7.2), the servo will move to a negative position.

6) Absolute Positioning by using Ramps 2: the servo will rotate (using the set of ramps 2 - P102 and P103) until it reaches the position set at parameters P481 to P490 (for the number of revolutions) and P471 to P480 (fraction of revolution, where 16384 corresponds to 1 complete revolution, i.e., 360º). The absolute positioning is indicated at parameters P052 (fraction of revolution) and P053 (number of revolutions) and can be reset via digital input or via parameter P429. If a negative speed reference is set (see item 5.7.2), the servo will move to a negative position.

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Positioning Speed:
The positioning speed is set at parameters P124 to P133. If it is set to zero, then the analog input (set to a value different of zero) will be used as the positioning speed. In case both analog inputs are set, analog input 2 will be used. In the absolute positioning, a negative reference represents a positioning to a negative absolute position.
A negative value of position is considered only with respect to the number of revolutions. For example: positioning #1 is set as an absolute positioning, with P052 and P053 set to zero initially. The user sets parameters P481=1, P471=1500, and P124 with a positive value. When positioning #1 is activated, the motor will rotate until the absolute position corresponding to P052=1500 and P053=1 is reached.
If P124 is set to a negative value, the motor will rotate until the absolute position corresponding to P052=1500 and P053=-1 is reached. Therefore, if P481 had been set with a null value instead of a unitary value, the motor would stop at position P052=1500 and P053=0, regardless the value set at P124. In other words, the value set at P124 is not considered if the number of revolutions is set to zero.

Timer:
Once the MOVE function is activated the servodrive waits for the time set at parameters P461 to P470 before executing the positioning. When a whole positioning cycle is set, the servodrive waits for this time between two consecutive positioning of the cycle.

Parameters:
Parameters related to the MOVE function are:
- P100 to P103;
- P124 to P133;
- P263 to P268 (Digital inputs programming);
- P435 to P490.

5.7.3 Home Function

The digital input that will receive the external signal indicating the home position must be set to option 31.
When the Home function is activated (via parameter P494 or via a digital input set to option 32), the motor accelerates (P100 and P102) until the speed set at P496 is reached or until the external signal indicating the home position is detected.
Once the signal is detected, the motor immediately decelerates after the next zero pulse is observed. When the motor stops, the servodrive performs a positioning to return to the zero pulse position, and this position is chosen as the zero relative position (parameters P052 and P053 are reset once the motor concludes the function).
In a special case, the Home function may be activated while the zero pulse position is being detected. In this case, the motor rotates in the opposite direction from that set at P496 until the zero pulse is no longer detected. Then, the servodrive decelerates and executes the function normally. The following figures present the operation of the Home function for the normal and special cases.

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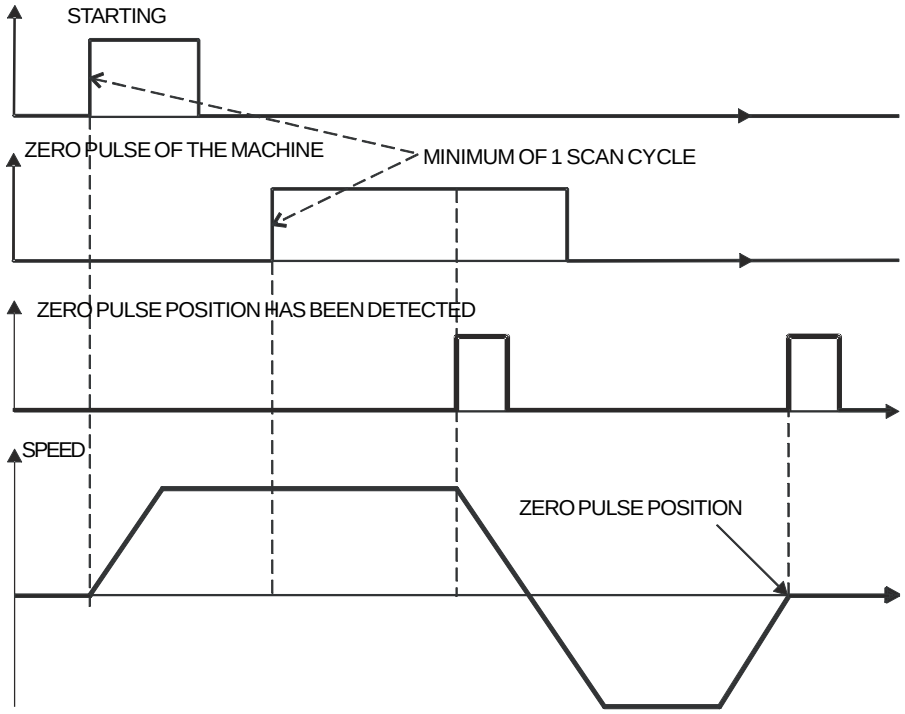


Figure 5.11 - *Normal functioning case - Homing (Zero Search Function)*

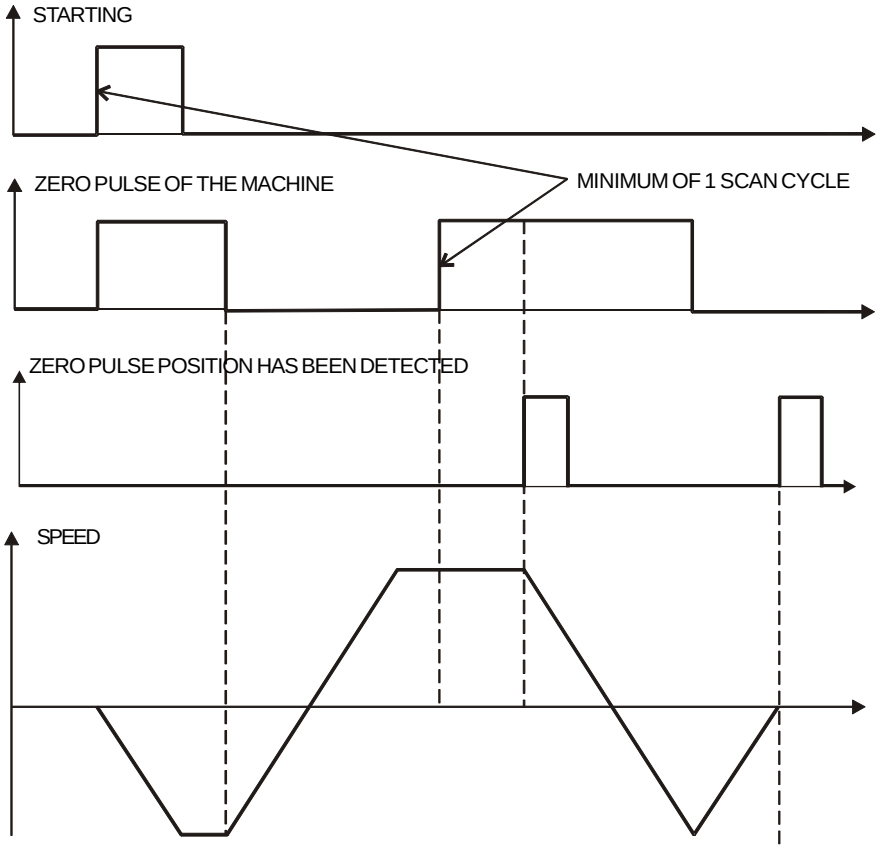


Figure 5.12 - *Special function - Home Function*

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5.7.4 Using the Master/Slave Function of the CEP1 Board

The Master/Slave function of the CEP1 board must be used in positioning mode (P202 = 3), since, at every counter increment, the position reference is incremented or decremented by a number of pulses that is a function of gains P507, P511, P512 and P513 (P513 defines the motor direction of rotation with respect to the count direction of the counter. If P513=0, one increment on the counter means an increment on the position reference. If P513=1, one increment on the counter means a decrement on the position reference). In order to set the remainder parameters, please, consider the count mode to be used:

Mode 1: At every positive or negative pulse at a channel (A or B), the counter value is incremented or decremented. Therefore, at every pulse at channel A, the counter value is incremented or decremented ***four times*****.**
The motor completes one revolution at every 16384 pulses that were incremented or decremented from the position reference. Hence, if the servodrive operates in mode #1, at every 4096 pulses at channel A, the position reference will be incremented or decremented by 16384 pulses, resulting in a complete motor revolution. In this case, if parameter P512 is set to 4096, parameter **P507 may be understood as the number of revolutions completed after Δ pulses have been sent and parameter P511 will be = Δ, where Δ is the desired number of pulses per revolution** (for example, if the user wants the motor to perform a complete revolution at every 5000 pulses at channel A, the following parameters should be set: P507 = 1.000, P512 = 4.096 and P511 = 5.000. If, instead of one revolution at every 5000 pulses, the user wants to perform 3 revolutions at every 5000 pulses, then parameters should be set like this: P507 = 3.000, P512 = 4.096 and P511 = 5.000). If the setting of P512 = 4.096 is not appropriate, the following relation may be used to adjust the gains:

$$4 \times P507 \times \left(\frac{P512}{P511} \right) \times \Delta = 16384$$

In case P507, P511 and P512 are programmed in a way that the ratio above is followed, the motor makes a complete rotation every Δ pulse.

Mode 2: The counter values changes when a negative pulse is detected at channel A. In this case, at every 4096 pulses at channel A, the counter value is incremented or decremented by 4096 pulses, and the motor will rotate only **¼ of revolution** (for one complete revolution, 16384 pulses are needed). Therefore, in this case, if parameter P512 is set to 4096, parameter **P507 may be understood as 4 times the number of revolutions completed at every Δ pulses and parameter P511 will be = Δ, where Δ is the desired number of pulses per revolution** (for example, if the user wants the motor to perform a complete revolution at every 5000 pulses at channel A, the following parameters should be set: P507 = 4.000, P512 = 4.096 and P511 = 5.000. If, instead of one revolution at every 5000 pulses, the user wants to perform 3 revolutions at every 5000 pulses, then parameters should be set like this: P507 =12.000, P512 = 4.096 and P511 = 5.000). If the setting of P512 = 4.096 is not appropriate, the following relation may be used to adjust the gains:

$$P507 \times \left(\frac{P512}{P511} \right) \times \Delta = 16384$$

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Where: Δ is the number of pulses per revolution. In case P507, P511 and P512 are programmed in a way that the ratio above is followed, the motor makes a complete rotation every Δ pulse.

Connections:
When using the count mode #2, it is important to consider that channel A of the CEP1 board does not have a pull-down resistor (for low logic level), although it has a pull-up resistor (for the high logic level). Therefore, if the train of pulses is connected to pin #3 of the X8 connector, there is risk of not detecting pulses (for a low level signal). One possible solution is to connect the train of pulses directly to pin #2 of connector X8 ($\overline{A}$), which has both, a pull-up and a pull-down resistor. Examples of hardware connections are presented below.

Example 1: The user wants to use a differential encoder to generate pulses for the CEP1 card and, using the Master-slave function, wants the motor to have a displacement of one complete revolution every 1,881 pulses sent by one of the encoder channels.

Solution: The encoder must be connected according to the pin scheme of connector X8, see item 8.8.1 (if the supply is given by the encoder itself through pins 4 and 6 of X8, it is not necessary to supply the card through connector X7. It is important to remember to certify that the Switcher key is correctly configured).
Parameters P202 = 3 (positioning mode), P502 = 0 (counting mode 1, that uses the pulses sent by channels A and B), P505 = 4 (Master-slave), P507 = 1,000, P511 = 1,881 and P512 = 4,096 must then be programmed. The rotational direction of the motor is defined by P513. The motor must then be habilitated with P099 = 1. The value of the counter can be observed in parameter P056.

Example 2: The user wants to use a PLC to send pulses to channel A of the counter using the Master-slave function to make the motor make a complete revolution, anti-clockwise, every 11,998 pulses sent by the CLP to the counter.

Solution: Using the same voltage levels of the pulses sent (0 to (5-24) Vdc), the card must be supplied through connector X7 or pins 4 and 6 of connector X8. The output of the pulses must be connected to pin 2 (channel $\overline{A}$) of X8. For a descending count of the counter in mode 2, that uses only one channel with pulse trains, pins 6 and 1 must be connected (channel B grounded). Parameters are given by P202 = 3, P502 = 1 (counting mode 2), P505 = 4 (Master-slave), P507 = 4.000, P511 = 11.998, P512 = 4.096, P513 = 0 (rotational direction of the motor is the same as the counting direction of the counter). The value of the counter can be observed in parameter P056. The connection scheme is shown below.

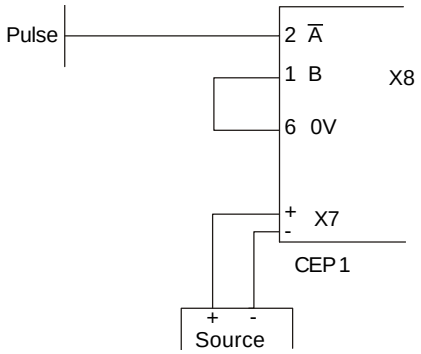


Figure 5.13 - *Connection diagram - CEP1 board receiving pulses from the PLC*

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Example 3: The user wants to use a double-pole switch digital output to send pulses to the CEP1 card using the Master-slave function to make the motor make a complete revolution, clockwise, every 2,000 pulses sent by the POS2 card to the counter.

Solution: The emitter of the double-pole switch digital output must be grounded and the collector must be connected to pin 3 of connector X8. In this way, when the switch is on, the voltage level will be null on pin 3. When it is off, the pull-up resistor will make the voltage level on pin 3 be +Vdc. The CEP1 card must be supplied with the same voltage levels of pulses (0 to (5-24)Vdc) through connector X7 or pins 4 (Vdc) and 6 (ground). Pin 1 of X8 must be connected to pin 4 (Vdc) so there may be an ascending count. Parameters are given by P202 = 3, P502 = 1 (counting mode 2), P505 = 4 (Master-slave), P507 = 4,000, P511 = 2,000, P512 = 4,096, P513 = 0 (rotational direction of the motor is the same as the counting direction of the counter), P099 = 1 (habilitated motor). The value of the counter can be observed in parameter P056. The connection scheme is shown below.

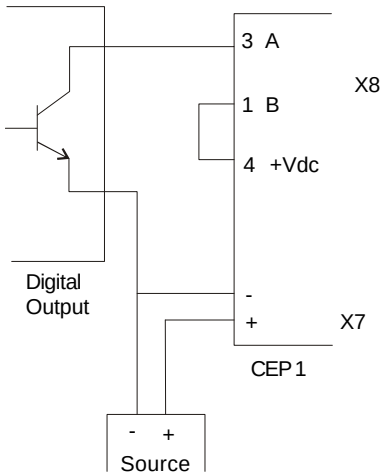


Figure 5.14 - *Connection diagram - CEP1 board receiving pulses from a bipolar switching digital output*

NOTE!
Refer to item 8.8 for further information on the count modes.

5.7.5 Digital Potentiometer

The digital potentiometer function is the variation of the speed reference through the two digital inputs, one of which is programmed to increase the reference value (option 39), and the other to decrease it (option 40). The increasing/decreasing rate or acceleration of the speed reference is defined by parameter P528. To accelerate the motor the digital inputs programmed with options 39 and 40 are started. While the inputs are operating there will be an increment in the speed reference. To decelerate the motor the digital input programmed with option 40 must be at a low logic level. The motor decelerates up to null speed following the programmed rotational direction (see table 5.58). In case the motor is accelerated when it is at a stop, the clockwise direction is taken as standard and it is necessary for the motor to already be rotating counter-clockwise so it may be accelerated negatively (counter-clockwise) by means of a digital potentiometer.

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Digital Input Settings (P263 to P268)	Accelerate	Maintain a Constant Speed	Decelerate
39 (accelerate)	ON	OFF	X (ON or OFF)
40 (decelerate)	ON	ON	OFF

Table 5.58 - *Accelerating/Decelerating/Maintaining the Speed via digital inputs*

5.7.6 PID for Analog Inputs

The PID for analog inputs (habilitated if P539 ≠ 0) may use the analog inputs AI1 and AI2 as reference (P538) or feedback (P524), besides a digital reference (given by P525 and habilitated programming P538 = 0). So that analog input 1 can be chosen as a reference or feedback, parameter P232 must be programmed with value 4. The same goes for analog input 2 with P237 programmed with value 4. The PID output can be inverted (P527 = 1) and used as a position, speed and torque (P539) reference or written in an analog output. The proportional gains, integral and derivative are, respectfully, determined by parameters P520, P521 and P522. The figure below shows the PID block diagram.

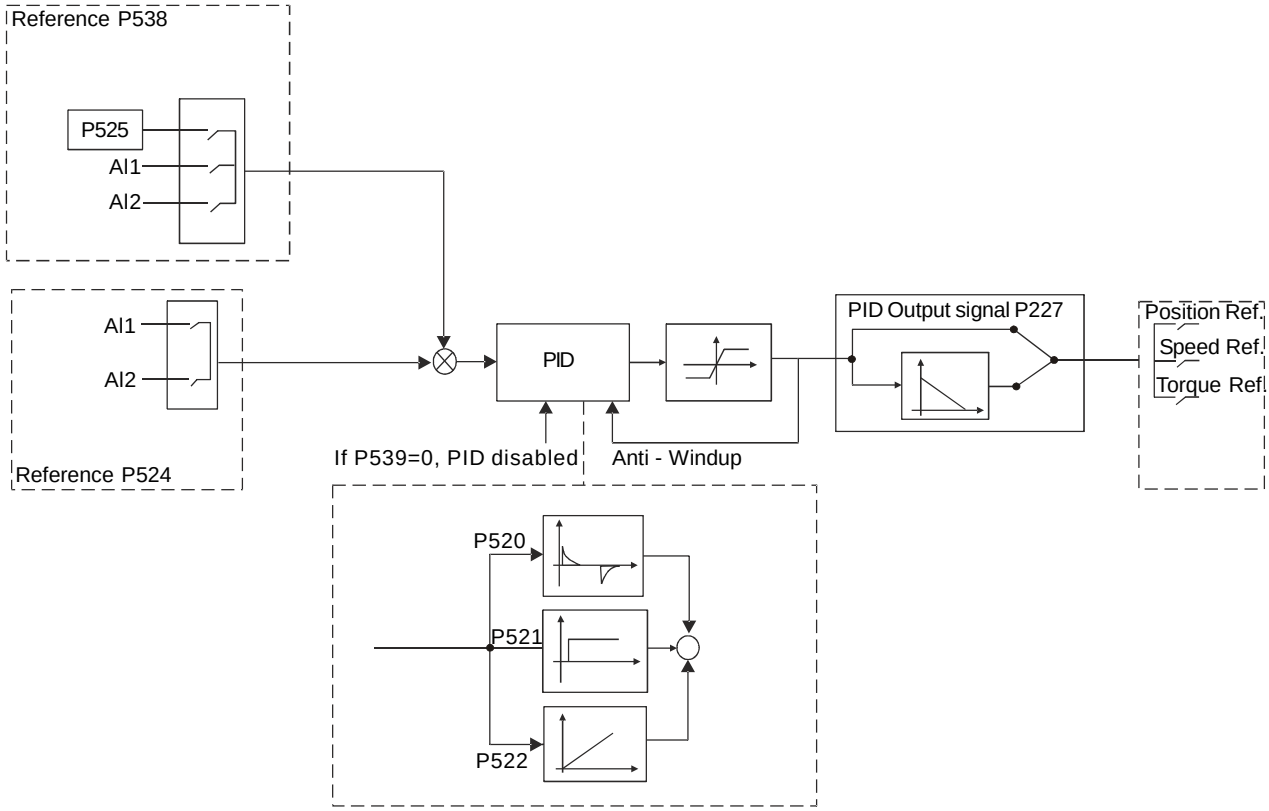


Figure 5.15 - *PID Block Diagram*

Function Example:
Programming parameters P524 = 0 (analog input 1 as feedback), P232 = 4, P538 = 0 (digital reference), P520 = 2500, P521 = 100, P522 = 100, P539 = 0 (PID output at analog output) the PID controller constants are Kp = 25, Ki = 0.002 and Kd = 1. Analog input 1 gives this controller feedback with the value of parameter P525 as a reference. The PID output, in this case, is written in analog output 1.

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5.7.7 COPY Function

The COPY function may be used only with the Remote Keypad (IHMR). When P215 is set to 1 or 2, as soon as the PROG key is pressed to return to the exhibition mode, the COPY function is activated. If P215 was set to 1, the SCA-05 parameters are copied to the remote keypad. While parameters are copied, the message “COPY” appears on the keypad display, and the message “***** COPY *****” flashes on the keypad LCD. All remote keypad LEDs flash as well while this function is activated.
If P215 was set to 2, the parameters stored on the remote keypad are transferred to parameters P100 to P729 of the SCA-05 and recorded in the EEPROM. While parameters are copied, the message “COPY” appears on the keypad display, and the message “***** COPY *****” appears on the keypad LCD. All LEDs are off during this operation. If the parameters to be transferred to the drive were copied from an incompatible version (not the version 2.4X), the error code “E10” will appear on the display and the message “Incompatible Version” will appear on the LCD, indicating that the COPY function cannot be used due to software incompatibility.

NOTE!

- ☑ In any case, the COPY function will be performed only if the drive is disabled (P099 = 0).
- ☑ At the end of the COPY function, the value of P215 is automatically set to 0.
- ☑ At the end of the COPY function (from the remote keypad to the SCA-05), the keypad LCD will briefly show the message “DATA NOT ACCEPTED” and the display will show E31.

5.7.8 Changing the Password - P000 and P200

The password to access the parameters may be modified by the user (default value = 5) for convenience. With P200 = 3, it is possible to define a new password in parameter P000. Once the ‘P’ key is pressed to return to the exhibition mode (show P000 again) the value of P200 is automatically changed to 1 and the new password is now effective. It is not recommended to the user to set the password to the following values: 1, 6, and 10. In case of user’s password is forgotten, set parameter P000 = 01234 and then, press simultaneously the following keys: P and ▲. In this manner, the password is reset to the default value (5).

5.7.9 Position Reference Ramp

If parameters P232 or P237 are set as position reference (option 3) and the ramp is enabled (P229 = 1 or 2), a change on the analog reference will make the motor follow the ramp set at parameter P100, which avoids a bump on the motor due to abrupt changes on the position analog reference.

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BUILT-IN COMMUNICATION NETWORKS

The SCA-05 servodrive has the following built-in communication protocols:
- Serial Communication Network (WEGBus, WEGTP, and Modbus-RTU Protocols);
- CAN Communication Network (CANopen and DeviceNet Protocols).

The configuration and operation manuals for these communication networks are available on the CD that comes with the product.

6.1 SERIAL COMMUNICATION

The servodrive SCA-05 has to RS-232 serial port (X4 connector). However, it is possible to convert it to RS-485 interface by using the optional module KCR SCA-05 (see item 8.3.1) or the optional module MIW-02.

Through this interface it is possible to use one of the protocols available for the SCA-05.

6.1.1 Interfaces Description

The physical interconnection between the servodrive and the network master shall use one of the following standards:
a. RS-232 (point-to-point up to 10m);
b. RS-485 (multi-drop, galvanically isolated, up to 1000m).

6.1.1.1 RS-485 Physical Connection

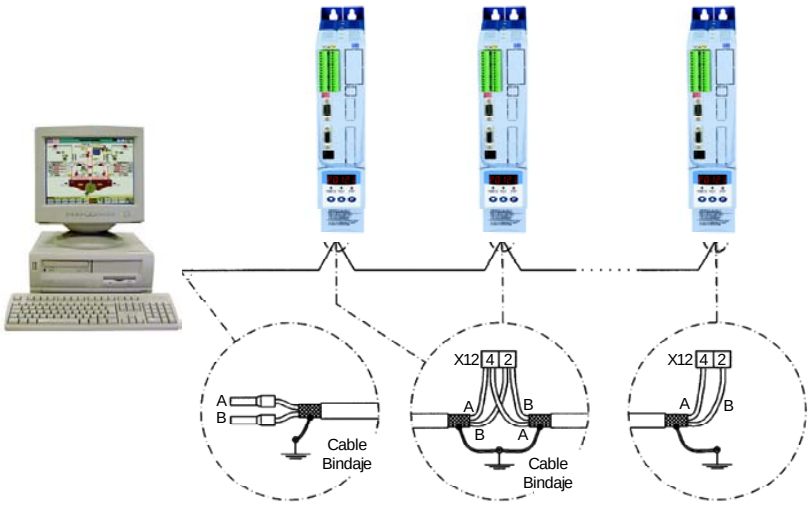


Figure 6.1 *– SCA-05 network connection using the RS-485 Serial Interface*

Notes:
LINE TERMINATION: provide a line termination (150Ω resistor) at both network ends, and only at the far ends. In order to do so, set DIP-switches SW3.1 and SW3.2 (REM module) to the “ON” position (refer to item 8.3.1).

GROUNDING CABLE SHIELD: connect the cable shield to the device enclosure that must be properly grounded.

RECOMMENDED CABLE: twisted pair, shielded. A suitable cable is available from RFS - AFS Series.

The RS-485 network wiring must be run separate from the power and control (110/220V) wiring.

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6.1.1.2 RS-232 Physical Connection

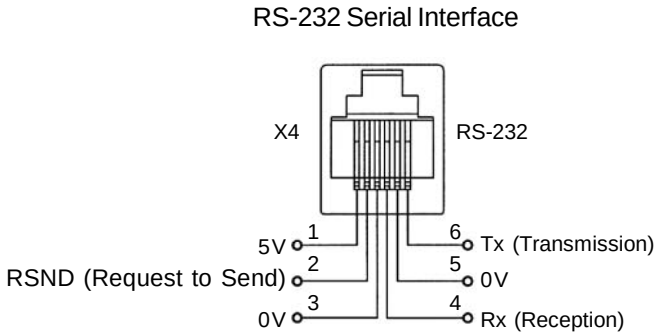
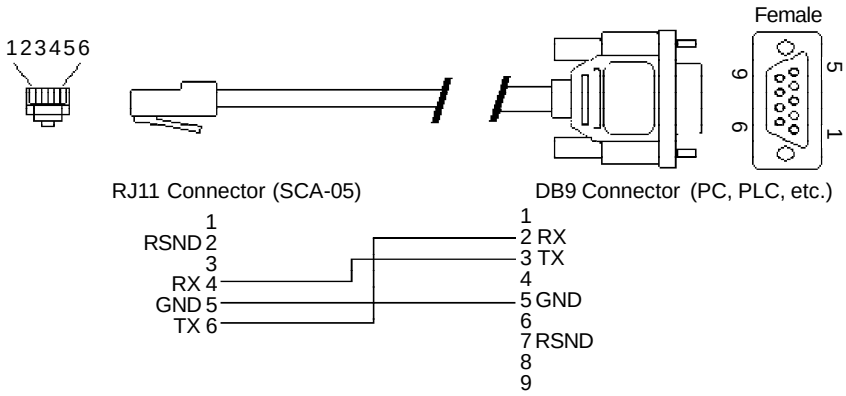


Figure 6.2 - *Description of the signals for the RS-232 serial interface connector X4 (RJ11)*



(*) The DB9 connector pinout presented in this figures exemplifies the connection with a PC.

Figure 6.3 *- Description of the signals for the RS-232 serial communication cable*

NOTE!

- ☑ The RS-232 network wiring must be run separate from the power and control (110/220V) wiring.
- ☑ It is not possible to use simultaneously the RS-232 and RS-485 interfaces.

6.1.2 WEGBus Protocol

WEGBus is a serial protocol that allows the access and modification of one parameter per message. The serial physical media is described in item 6.1.1. For further information, please, refer to the Serial Communication User's Guide for the SCA-05 included in the product CD.

6.1.3 WEGTP Protocol

WEGTP is a serial protocol that allows the access and modification of six (06) parameters per message. The serial physical media is described in item 6.1.1. For further information, please, refer to the Serial Communication User's Guide for the SCA-05 included in the product CD.

6.1.4 ModBus-RTU Protocol

Modbus-RTU is an open-source serial protocol widely used on the industry. This protocol allows the access and modification of any servodrive parameter by means of the physical media described in item 6.1.1. For further information on Modbus-RTU protocol, please, refer to the communication manual provided along with the product CD.

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6.2 CAN NETWORK

6.2.1 CANopen Protocol

CANopen is an open-source communication protocol designed for fast and reliable communication between the devices connected to the network. The CANopen protocol allows the operation and parametrization of the SCA-05 servodrive by using several types of telegrams for sending and receiving information. This protocol uses the CAN port of the drive (connector X5) as the physical connection mean.

For to complete description about the operation of the servodrive SCA-05 in to CANopen network, please, refer to the CANopen Slave user's guide provided along with the product CD. Besides the user's guide, the EDS configuration file describing the drive characteristics for the CANopen network is also provided.

6.2.2 DeviceNet Protocol

DeviceNet is an open protocol high used for controlling and monitoring industrial devices, such as soft-starters, variable frequency drives, input/output devices, sensors, etc. For the SCA-05 servodrive, the DeviceNet protocol allows executing operation and parametrization functions. This protocol uses the CAN port of the drive (X5 connector) as the physical connection mean.
For to complete description about the operation of the servodrive SCA-05 in to DeviceNet network, please, refer to the DeviceNet Slave user's guide provided along with the product CD. Besides the user's guide, the EDS configuration file describing the drive characteristics for the DeviceNet network is also provided.

6.2.3 MSCAN Protocol

The CAN master/slave protocol is to simple protocol designed to enable the position synchronism between two or more SCA-05 servodrives without needing to use an additional device (as to master on the network). This protocol uses the CAN port of the drive (connector X5) as the physical connection mean.

When using this protocol one drive must be set as the network master, which will be responsible for sending its position data via CAN network. All remaining devices connected to this network must be programmed as slaves, which will be responsible for receiving the position data from the master and follow it. No device on the network has an address and only one master must be present.

6.2.3.1 Network Interconnection

Use the X5 connector (located at the base of the drive control module) to interconnect the drives on the network. It is recommended to use shielded twisted pair cables. Provide also to 24Vdc power supply via the network connector, according to the X5 connector pinout. Besides, fit to termination resistor of 121Ω at the ends of the CAN bus. They must be connected between pins 2 and 4 of X5 connector.

6.2.3.2 Drive Parametrization

In order to have the slaves drives following the reference sent by the master drive, it is necessary that the slaves are set to operate in positioning mode, which is done by setting parameter P202. Find below other parameters that shall be set when programming this function:

P420: Selection of the operation mode for the CAN master/slave function
P422: Numerator of the master/slave ratio
P423: Denominator of the master/slave ratio

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P425: Direction of synchronism for the master/slave function
P426: Position shift for the master/slave function
P427: Phase Lag Compensation for the master/slave function
P700: CAN Protocol
P702: Baud-rate
P703: Reset de bus off

6.2.3.3 Timeout for the Master/ Slave Function via CAN - E38

To obtain further information about the drive parametrization, please, refer to the parameter detailed description.

Once you have set the servodrive and established the communication between master and slaves, it is necessary that the slaves regularly receive to reference from the master; otherwise they will consider that to communication problem occurred. In this case, the slave that detects this fault condition will indicate an E38 error on the keypad and the action set in parameter P313 will be taken.

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DIAGNOSTICS AND TROUBLESHOOTING

7.1 FAULTS AND POSSIBLE CAUSES

This Chapter assists the user to identify and correct possible faults that may occur during the servodrive operation. Guidance on required periodical inspections and cleaning procedures.

When to fault is detected, the servodrive is disabled and the Fault Code is displayed on the readout in the EXY form, where XY is the actual Fault Code. To restart the servodrive after to fault has occurred, you must reset the servodrive .

The reset can be made as follows:
- ☑ disconnecting and reapplying AC power (power-on reset);
- ☑ by pressing the key “RESET” (manual reset);
- ☑ via digital input: DI1 (P263=5) or DI2 (P264=5) or DI6 (P268=5).

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

ERROR	RESET	POSSIBLE CAUSES
E00 Output overcurrent	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network	☑ Short-circuit between motor phases. ☑ IGBTs module is short-circuited. ☑ Overcurrent at the servomotor due to parameter setting.
E01 DC Link Overvoltage (Ud)	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network	☑ Ud>400V - Models 220-230V. ☑ Without braking resistor.
E02 DC Link Undervoltage (Ud)	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network	☑ Supply voltage is too low, generating voltages in the DC link circuit below the minimum permitted ones (read value at Parameter P004):Ud < 223V ☑ Phase loss at the input. ☑ Fault at the pre-charge circuit (only for models 24/48).
E04 (1) Overtemperature at the power or internal air	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network Note: SCA-05 accepts Reset only after temperature has dropped.	☑ Ambient temperature too high (>45°C). ☑ Output current too high. ☑ Blower locked or defective. ☑ Fan for internal cooling locked or defective.
E05 Overload at the output/motor, Ixt function	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network	☑ Load on Motor Shaft too high. ☑ Inertia too high.
E06 External Fault (Digital input programmed for no external fault)	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network	☑ Broken wiring at the inputs DI1 to DI6 (programmed for error) (not connected to +24V). ☑ XC14 connector on the control board is not connected. ☑ External Fault.

Table 7.1 *- Faults and possible causes*

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ERROR	RESET	POSSIBLE CAUSES
E08 CPU Error (watchdog)	☑ Power-on ☑ Manual (RESET key) ☑ DIx ☑ Network	☑ Electrical noise of equipment is defective.
E10 Software incompatibility (COPY function)	☑ Power-on ☑ Manual (RESET key) ☑ Digital Input ☑ Network	☑ This error occurs when a software incompatibility is detected when attempting to use the COPY function.
E11 Output Ground- Phase Short-Circuit	☑ Power-on ☑ Manual (key RESET) ☑ DIx ☑ Network	☑ Short-circuit between ground and one or more output phases. ☑ Motor cable capacitance to ground is too high, causing too high current peaks at the output (see note below).
E12 Braking Resistor Overload	☑ Power-on ☑ Manual (key RESET) ☑ DIx ☑ Network	☑ Load inertia too high, or deceleration ramp too short.
E2X Serial Communication Error	☑ This error disappears automatically when the communication between servodrive and PC or PLC is restored.	☑ Serial communication cable is defective. ☑ Refer to the communication manual for further information.
E29 Inactive Fieldbus Communication	☑ It automatically disappears when the servodrive and network master communication is reestablished.	☑ The fieldbus communication board is active, however, it is not able to communicate with the network master. ☑ For further information, please, refer to the Fieldbus communication manual included in the product CD.
E30 Inactive Fieldbus Communication Board	☑ Power on ☑ Manual (RESET key)	☑ Failure in accessing the optional Fieldbus communication board. ☑ For further information, please, refer to the Fieldbus communication manual included in the product CD.
E31 HMI connection Fault	☑ This error disappears automatically when the communication between servodrive and HMI is restored.	☑ Bad contact / HMI cable is defective. ☑ Electrical noises in the installation (electromagnetic interferences).
E32 (2) Without resolver Motor Overtemperature	☑ Power-on ☑ Manual (key RESET) ☑ DIx	☑ Resolver cable is defective or not installed. ☑ Servomotor Thermal Overload (excessive load/ improper duty cycle / improper current limit).
E33 CAN Interface not powered	☑ It automatically disappears when the CAN network interface is powered on.	☑ A protocol that uses the CAN interface is enabled, however this interface is not powered up via the network connector (24Vdc).
E34 Bus off	☑ Power-on ☑ Manual (RESET key)	☑ Devices connected to the CAN network with different communication baud-rates. ☑ Missing termination resistors. ☑ Short-circuit, bad contact or exchanged wiring at connecting cables. ☑ Excessive cable length for the communication baud-rate set. ☑ Incorrect device or shield grounding.
E35 Node guarding error	☑ It automatically disappears when the node guarding service is reestablished.	☑ Specific error for the CANopen communication. ☑ For further information, please, refer to the CANopen communication manual included in the product CD.
E36 Master in “IDLE mode”	☑ It automatically disappears when the DeviceNet master changes its state to RUN.	☑ Specific error for the DeviceNet communication. ☑ For further information, please, refer to the DeviceNet communication manual included in the product CD.

Table 7.1 (cont.) *- Faults and possible causes*

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ERROR	RESET	POSSIBLE CAUSES
E37 Timeout for I/O connections	☑ It automatically disappears when the connection with the DeviceNet network master is reestablished.	☑ Specific error for the DeviceNet communication. ☑ For further information, please, refer to the DeviceNet communication manual included in the product CD.
E38 Timeout for the master/slave function via CAN	☑ Power-on ☑ Manual (RESET key)	☑ Specific error for the master/slave function via CAN. ☑ After initializing the master/slave communication, the slave did not receive the master reference within the expected time. ☑ It may happen due to problems obstructing the communication, such as wrong bus installation, noise, reset or disconnection of the network master.
E49 Lag error (MOVE function) too high	☑ Power-on ☑ Manual (RESET key) ☑ Digital Input ☑ Network	☑ This error occurs at the end of the MOVE function in case the motor has stopped in a different position than specified.
E71 POS2 watchdog error	☑ Power-on ☑ Manual (RESET key) ☑ Digital Input ☑ Network	☑ This error occurs when a failure is detected on the POS2 Watchdog.
E72 Error during the POS2 detection	☑ Power-on ☑ Manual (RESET key) ☑ Digital Input ☑ Network	☑ This error occurs when the POS2 board is not properly detected.

Table 7.1 (cont.) *- Faults and possible causes*

NOTE!

(1) In case of E04 fault due to servodrive over temperature, allow the servodrive to cool before trying to reset it.

(2) In case of E32 fault due to motor over temperature, allow the servodrive to cool before trying to reset it.

NOTES!

☑ Errors E28, E29, E30, E33, E35, E36, E37, and E38 may be set (at P313) to cause fatal error on the servodrive. In this manner, its operation will be similar to the other errors. The fault condition can be reset via drive power-up, manual reset, digital input or communication network. Before that, the communication shall be reestablished.

☑ Long motor cables longer than 50m (150ft) can cause excessive capacitance to ground. This may cause the activation of the ground fault circuit, and, consequently, an E11 trip immediately after enabling the servodrive.

SOLUTION:

Connect a three-phase reactor in series with the motor power supply. Refer to item 8.4.

Drive Behavior Under Fault Condition:

E00, E01, E02, E04, E05, E06, E08, E11, E12, E2X and E32:

☑ Turns off the output relay or the digital output transistor set to “no fault”.

☑ Blocks PWM pulses.

☑ Indicates the fault code on the LED-display and turn on the “FAULT” led.

☑ Indicates the code and the description of the fault on the LCD display of the remote keypad.

☑ The following information is saved on the EEPROM memory:
- Fault code (shift the last three faults).
- Integrator status (function Ixt - current overload).

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7.2 TROUBLESHOOTING

PROBLEM	POINT TO BE CHECKED	CORRECTIVE ACTION
Servomotor does not run	Incorrect Wiring	1. Check all control and power connections. For instance, digital inputs (DIx) set to enable the drive or to external error shall be connected to the +24V.
	Analog Reference (if used)	1. Check if the external signal is properly connected. 2. Check the status of the control potentiometer (if used).
	Incorrect Programming	1. Check if the parameters are properly programmed for the application.
	Fault	1. Check if the servomotor is not locked due to detected fault condition (Refer to table 7.1). 2. Check for short-circuit in between terminals X1:10 and 12 (short-circuit at the 24Vdc power supply).
	Motor Stall	1. When servomotor with braking option are used, check the braking supply. 2. Check if machine shows mechanical problems.
Motor Speed varies (oscillates)	Loose connections	1. Disable the servodrive, switch OFF the supply voltage and tighten all connections.
	Reference Potentiometer is defective	1. Replace the speed potentiometer.
	Variation of the ext. analog reference	1. Identify the cause of the variation.
	Speed regulator gains too low	1. Check the setting the Speed regulator gains under effective load conditions.
Motor speed too high or too low	Programming error (servomotor model and reference limits)	1.Check if the contents of P385 (servomotor model) and P121 (speed) are according to the motor and the application.
	Signal of the reference control (if used)	1. Check the control signal level of the reference. 2. Check the programming (gains and offset) in P234 to P240.
	Motor Nameplate Data	1. Check if the used motor meets the application requirements.
Servomotor with excessive vibration	Programming error (servomotor model)	1. Check the programming of P385.
	Gains of the Speed regulator too high	1. Check the setting the Speed regulator gains under effective load conditions.
Encoder simulation output informs pulses even when servomotor is stopped	Programming error (servodrive model)	1. Check the programming of P385.
	Gains of the speed regulator are too high	1. Decrement the speed regulator gains (check the setting of the speed regulator).
Display Off	HMI connection	1. Check the HMI connections to the servodrive.
	Power supply	1. The rated values must be within following limits: Power supply 220-230V: - Min: 187V - Max: 253V
	Blown fuses	1. Replace the blown fuses.

Table 7.2 - *Troubleshooting*

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7.3 CONTACTING WEG (TELEPHONE / FAX / E-MAIL) (SERVICING)

NOTE!

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

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

For clarifications, training or service, please, contact our Service Department.

7.4 PREVENTIVE MAINTENANCE

DANGER!

Always disconnect the power supply voltage before touching any component of the servodrive.
Even after switching OFF the servodrive, high voltages may be present.
Wait 10 minutes to allow complete discharge of the power capacitors.
Always connect the equipment frame to suitable ground (PE) point.

ATTENTION!

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

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

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

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COMPONENT	PROBLEMS	CORRECTIVE ACTION
Terminal blocks, connectors	Loose screws	Tighten them (4)
	Loose connectors	
Blowers (1)/ Cooling System	Blowers are dirty	Clean them (4)
	Abnormal acoustic noise	Replace the blower
	Blower is not running	
	Abnormal vibration	
	Dust in the air filters	Clean or replace them (5)
Printed circuit boards	Dust, oil or moisture accumulation, etc.	Clean them (4)
	Smell	Replace them
Power module/ power connections	Dust, oil or moisture accumulation, etc.	Clean them (4)
	Connection screws are loose	Tighten them (4)
DC link capacitors (intermediate circuit) (2) (3)	Discoloration / smell / electrolyte leakage	Replace them
	Safety valve is expanded or broken	
	Deformation	
Power resistor	Discoloration	Replace them
	Smell	

Table 7.3 *- Periodic inspections after start-up*

NOTE!

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

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

(3) If the servodrive is stored for long periods, we recommend to power it up once to year during 1 hour. For all models, apply supply voltage of approx. 220Vac, three-phase or single-phase input, 50Hz or 60Hz, without connecting motor at output. After this energization, wait 24 hours before installing it. This procedure is required to ensure that the DC Link capacitors restore their original characteristics, before to new start-up.

(4) Check every 6 months.

(5) Check two times per month.

7.4.1 Cleaning Instructions

When necessary clean the servodrive following the instructions below:

a) Cooling system:

☑ Remove AC power from the servodrive and wait 10 minutes;

☑ Remove all dust from the ventilation openings by using to plastic bush or to soft cloth;

☑ Remove dust accumulated on the heat sink fins and from the blower blades with compressed air.

b) Electronic boards:

☑ Remove AC power from the servodrive and wait 10 minutes;

☑ Remove all dust from the printed circuit boards by using an anti-static soft brush or remove it with an ionized compressed air gun (for instance, Charges Burtes Ion Gun (non nuclear), Ref. A6030-6DESCO). If necessary, remove the PCBs from the inverter. Always use to ground strap.

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7.5 SPARE PART LIST

Models 220/230V

Name	Part Number	Specification	Models		
			4/8 and 5/8	8/16	24/48
			Units per Servodrive		
Fans	S50005031	External fan 60x60		1	
	S50005032	External fan 80x80			1
	S50005030	Internal fan 25x25		1	1
PSI1 Board	S40151004	Bottom power board			1
PSI2 Board	S40151008	Bottom power board		1	
PSI3 Board	S40151012	Bottom power board	1		
PSS1 Board	S40151006	Top power board			1
PSS2 Board	S40151010	Top power board		1	
PSS3 Board	S40151014	Top power board	1		
CCA5.20 Board	S40151051	Control board	1	1	1
SCA-05 Control	S417110087	SCA-05 Control Module with the CCA5.20 board	1	1	1
REM05 Board	S40151018	Interface board RS-485 (optional)	1	1	1
HMI05 Board	S40151020	Local HMI board	1	1	1
HMI SCA-05	S417110080	Local HMI SCA-05 module	1	1	1
KFB PD SCA-05	S417110088	Fieldbus Profibus DP network kit (optional)	1	1	1

Note: Use items S40151051 only for replacement on the SCA-05 4/8MF and 5/8MF. For the other models use item S417110087.

Table 7.4 *- Spare parts for the SCA-05*

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OPTIONAL DEVICES

This Chapter describes the optional devices that may be used with the servodrive: Auto-transformers, cables for interconnecting the Servodrive and the Servomotor, Remote Keypad, Line Reactor, Dynamic Braking, Servomotor, POS2 Positioning Board, CEP1 Board, and Profibus Communication Board.

8.1 AUTOTRANSFORMER

8.1.1 Autotransformer Dimensioning

When SCA-05 is supplied by line with voltages different than 220-230V, the use of to transformer is required. As no galvanic insulation against line is required, you can use an autotransformer which is cheaper than an isolator transformer.
The duty cycle of a servomotor is usually cyclical (accelerate – steady state – braking), therefore, the autotransformer power shall be equal to the servomotor rated power:

$P_{Transf.} = P_{Rated\ shaft}$

Example: Servomotor WEG SWA-56-6,1-20
- Rated output at shaft = 1,10 kW (catalog data)

$P_{Transf.} = P_{Rated\ shaft}$

$P_{Transf.} = 1,1kW$

- The nearest autotransformer (table 8.2) = 1,5kVA.

For continuous duties, where the required servomotor power is constant, you must consider the servodrive and servomotor efficiency for the autotransformer dimensioning:

$P_{Transf.} = P_{Rated\ shaft} \times 1,25$

When several servomotors are driven simultaneously, the value of the variable $P_{Rated\ shaft}$ should be the sum of the outputs of every motor shaft.

WEG maintains several autotransformer models in stock for prompt delivery. For more detail about different autotransformer types, refer to item 8.1.2 (Table 8.2). When autotransformer from other suppliers are used, ensure that its voltage drop is not higher than 3%, this will increase the line voltage oscillation (-15% to +10%).

8.1.2 Table of Autotransformers

Please find below three-phase autotransformers specifications as WEG standard supply scope. The autotransformers described in this manual have two primary voltages: 380V and 440V, with to secondary voltage of 220V and frequency of 50/60Hz. When 220-230V lines are available, no use of autotransformers is required (in some cases only the use of to line reactor is required).

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The following table presents the appropriate cable for the SCA-05 power connections.

Model	Power Cables - mm²
SCA-05 4/8	1,5
SCA-05 8/16	1,5 to 2,5
SCA-05 24/48	4

Table 8.1 *- Cables for power connection*

Recommendation: Anti-flammable cable BWF 750V, according to NBR-6148.

Power kVA	WEG Item	Max. Dimensions												Weight	
		a		b		c		d		e		f			
		mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	kg	lb
1.00	0307.1847	217	8.54	120	4.72	140	5.51	199	7.83	82	3.23	6x9	0.24x0.35	10.0	22.05
1.50	0307.1855	240	9.45	140	5.51	230	9.06	180	7.09	76	2.99	9x15	0.35x0.60	15.0	33.07
2.00	0307.1863	240	9.45	140	5.51	230	9.06	180	7.09	86	3.39	9x15	0.35x0.60	16.0	35.27
3.00	0307.1871	240	9.45	160	6.30	230	9.06	180	7.09	96	3.78	9x15	0.35x0.60	22.0	48.50
5.00	0307.1880	300	11.81	150	5.91	285	11.22	225	8.86	86	3.39	9x15	0.35x0.60	30.0	66.14
7.50	0307.1898	300	11.81	200	7.87	310(*)	12.20	225	8.86	136	5.35	9x15	0.35x0.60	49.5	109.13
10.00	0307.1901	360	14.17	200	7.87	360(*)	14.17	270	10.63	117	4.61	9x15	0.35x0.60	65.0	143.30

(*) For heights consider eyebolts.

Table. 8.2 - *Autotransformer powers and dimensions*

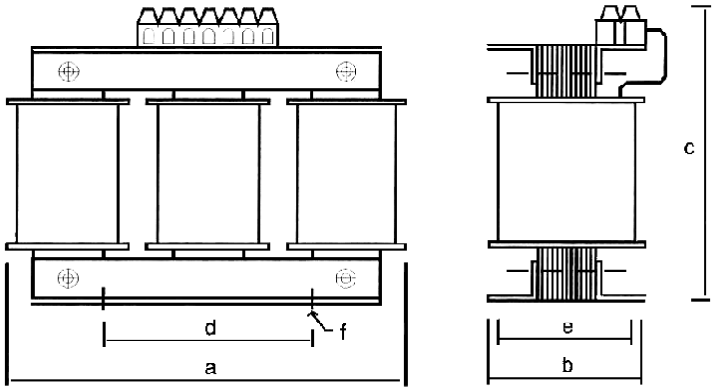


Figure 8.1 - *Autotransformer Dimensions*

8.2 CABLES TO SERVOMOTOR / RESOLVER

8.2.1 Table of Cables to Servomotor / Resolver

WEG supplies to complete line of cables for servomotor and servodrive linkage. The cables may be supplied in lengths from 3m (9.84ft) to 15m (49.21ft) as simple or shielded multipolar cables fitted with 180º or 90º connectors (servomotor and resolver power connectors).

Item	Reference	Description	Length		SCA-05 model
0307.8030	CP - 03 - 4x0.75	Power Cable - 4 conductors, 0.75mm² (18AWG)	3m	9.84ft	4/8 and 5/8
0307.8031	CP - 06 - 4x0.75		6m	19.68ft	
0307.8032	CP - 09 - 4x0.75		9m	29.53ft	
0307.8033	CP - 12 - 4x0.75		12m	39.37ft	
0307.8034	CP - 15 - 4x0.75		15m	49.21ft	
0307.8035	CP - 03 - 4x0.75 - B	Power Cable - 4 conductors, 0.75mm² (18AWG), shielded	3m	9.84ft	
0307.8036	CP - 06 - 4x0.75 - B		6m	19.68ft	
0307.8037	CP - 09 - 4x0.75 - B		9m	29.53ft	
0307.8038	CP - 12 - 4x0.75 - B		12m	39.37ft	
0307.8039	CP - 15 - 4x0.75 - B		15m	49.21ft	

Table 8.3 - *Cable table for servomotor / resolver*

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Item	Reference	Description	Length		SCA-05 model
0307.8040	CP - 03 - 4x0.75 - 90	Power Cable - 4 conductors, 0.75mm² (18AWG), 90°	3m	9.84ft	4/5 and 5/8
0307.8041	CP - 06 - 4x0.75 - 90		6m	19.68ft	
0307.8042	CP - 09 - 4x0.75 - 90		9m	29.53ft	
0307.8043	CP - 12 - 4x0.75 - 90		12m	39.37ft	
0307.8044	CP - 15 - 4x0.75 - 90		15m	49.21ft	
0307.8045	CP - 03 - 4x0.75 - B - 90	Power Cable - 4 conductors, 0.75mm² (18AWG), shielded, 90°	3m	9.84ft	
0307.8046	CP - 06 - 4x0.75 - B - 90		6m	19.68ft	
0307.8047	CP - 09 - 4x0.75 - B - 90		9m	29.53ft	
0307.8048	CP - 12 - 4x0.75 - B - 90		12m	39.37ft	
0307.8049	CP - 15 - 4x0.75 - B - 90		15m	49.21ft	
0307.7946	CP - 03 - 4x1.5	Power Cable - 4 conductors, 1.5mm² (14AWG)	3m	9.84ft	8/16
0307.7947	CP - 06 - 4x1.5		6m	19.68ft	
0307.7948	CP - 09 - 4x1.5		9m	29.53ft	
0307.7949	CP - 12 - 4x1.5		12m	39.37ft	
0307.7950	CP - 15 - 4x1.5		15m	49.21ft	
0307.7961	CP - 03 - 4x1.5 - B	Power Cable - 4 conductors, 1.5mm² (14AWG), shielded	3m	9.84ft	
0307.7962	CP - 06 - 4x1.5 - B		6m	19.68ft	
0307.7963	CP - 09 - 4x1.5 - B		9m	29.53ft	
0307.7964	CP - 12 - 4x1.5 - B		12m	39.37ft	
0307.7965	CP - 15 - 4x1.5 - B		15m	49.21ft	
0307.7986	CP - 03 - 4x1.5 - 90	Power Cable - 4 conductors, 1.5mm² (14AWG), 90°	3m	9.84ft	
0307.7987	CP - 06 - 4x1.5 - 90		6m	19.68ft	
0307.7988	CP - 09 - 4x1.5 - 90		9m	29.53ft	
0307.7989	CP - 12 - 4x1.5 - 90		12m	39.37ft	
0307.7990	CP - 15 - 4x1.5 - 90		15m	49.21ft	
0307.7971	CP - 03 - 4x1.5 - B - 90	Power Cable - 4 conductors, 1.5mm² (14AWG), shielded, 90°	3m	9.84ft	
0307.7972	CP - 06 - 4x1.5 - B - 90		6m	19.68ft	
0307.7973	CP - 09 - 4x1.5 - B - 90		9m	29.53ft	
0307.7974	CP - 12 - 4x1.5 - B - 90		12m	39.37ft	
0307.7975	CP - 15 - 4x1.5 - B - 90		15m	49.21ft	
0307.7951	CP - 03 - 4x4.0	Power Cable - 4 conductors, 4mm² (10AWG)	3m	9.84ft	24/48
0307.7952	CP - 06 - 4x4.0		6m	19.68ft	
0307.7953	CP - 09 - 4x4.0		9m	29.53ft	
0307.7954	CP - 12 - 4x4.0		12m	39.37ft	
0307.7955	CP - 15 - 4x4.0		15m	49.21ft	
0307.7966	CP - 03 - 4x4.0 - B	Power Cable - 4 conductors, 4mm² (10AWG), shielded	3m	9.84ft	
0307.7967	CP - 06 - 4x4.0 - B		6m	19.68ft	
0307.7968	CP - 09 - 4x4.0 - B		9m	29.53ft	
0307.7969	CP - 12 - 4x4.0 - B		12m	39.37ft	
0307.7970	CP - 15 - 4x4.0 - B		15m	49.21ft	
0307.7991	CP - 03 - 4x4.0 - 90	Power Cable - 4 conductors, 4mm² (10AWG), 90°	3m	9.84ft	
0307.7992	CP - 06 - 4x4.0 - 90		6m	19.68ft	
0307.7993	CP - 09 - 4x4.0 - 90		9m	29.53ft	
0307.7994	CP - 12 - 4x4.0 - 90		12m	39.37ft	
0307.7995	CP - 15 - 4x4.0 - 90		15m	49.21ft	
0307.7976	CP - 03 - 4x4.0 - B - 90	Power Cable - 4 conductors, 4mm² (10AWG), shielded, 90°	3m	9.84ft	
0307.7977	CP - 06 - 4x4.0 - B - 90		6m	19.68ft	
0307.7978	CP - 09 - 4x4.0 - B - 90		9m	29.53ft	
0307.7979	CP - 12 - 4x4.0 - B - 90		12m	39.37ft	
0307.7980	CP - 15 - 4x4.0 - B - 90		15m	49.21ft	
0307.7956	CR - 03m	Resolver Cable	3m	9.84ft	4/8 8/16 24/48
0307.7957	CR - 06m		6m	19.68ft	
0307.7958	CR - 09m		9m	29.53ft	
0307.7959	CR - 12m		12m	39.37ft	
0307.7960	CR - 15m		15m	49.21ft	
0307.7981	CR - 03m - 90	Resolver Cable, 90°	3m	9.84ft	
0307.7982	CR - 06m - 90		6m	19.68ft	
0307.7983	CR - 09m - 90		9m	29.53ft	
0307.7984	CR - 12m - 90		12m	39.37ft	
0307.7985	CR - 15m - 90		15m	49.21ft	
0307.8162	CSE – 02m	Encoder Simulator Cable	2m	6.56ft	

Table 8.3 (cont.) - *Cable table for servomotor / resolver*

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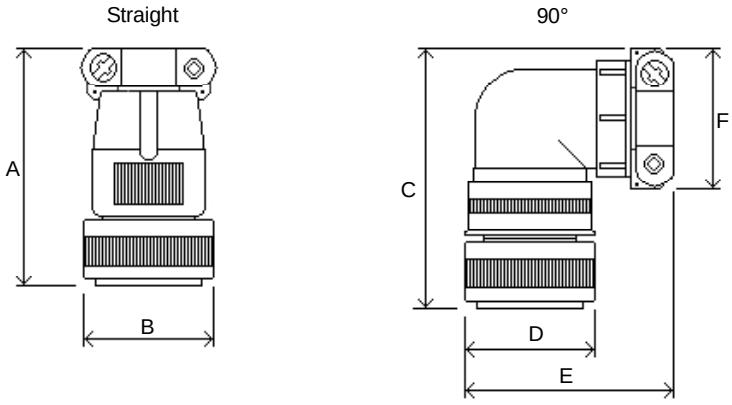


Figure 8.2 *- Connector sizes, refer to table 8.4*

Dimension	CR Series (Resolver) CP-_-4x0.75 (4/8 and 5/8) Series CP-_-4x1.5 (8/16) Series		CP-_-4x4.0(24/48) Series	
	mm	in	mm	in
A	65.94	2.596	67.41	2.654
B	33.86	1.333	40.34	1.588
C	69.30	2.728	77.61	3.055
D	33.86	1.333	40.34	1.588
E	61.61	2.425	70.79	2.787
F	31.22	1.229	33.57	1.479

Table 8.4 *- Connector sizes*

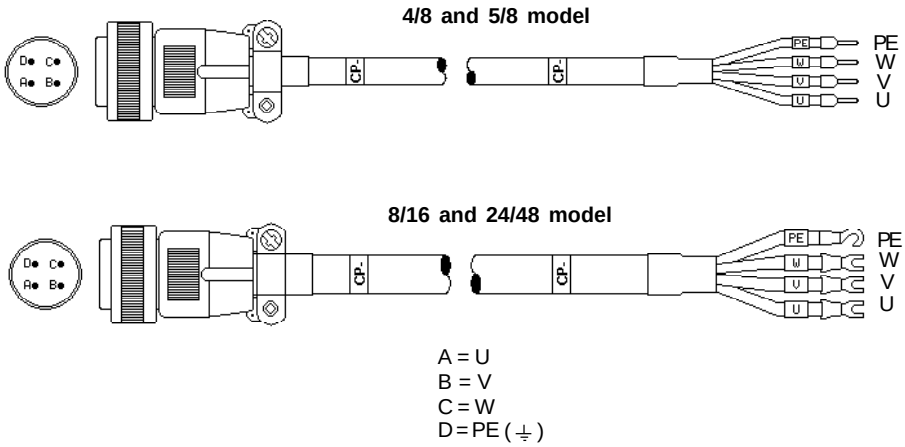


Figure 8.3 - *Drawing and pin location of the power cable with 180° connector*

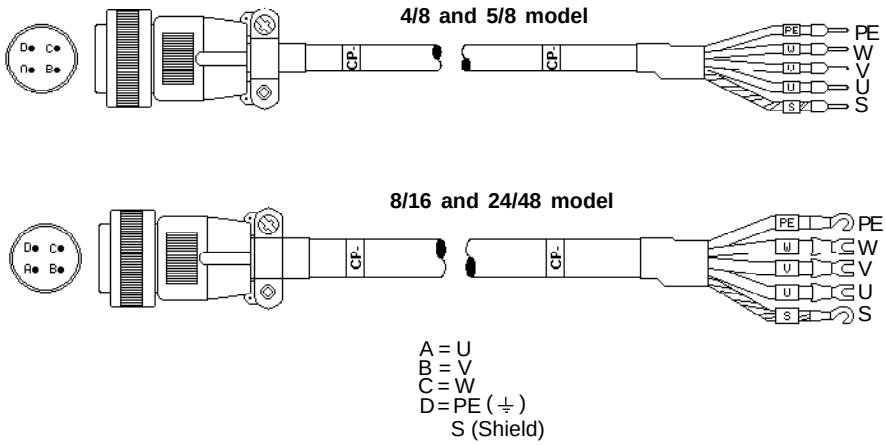


Figure 8.4 - *Drawing and pin location of the power cable with 180° connector, shielded*

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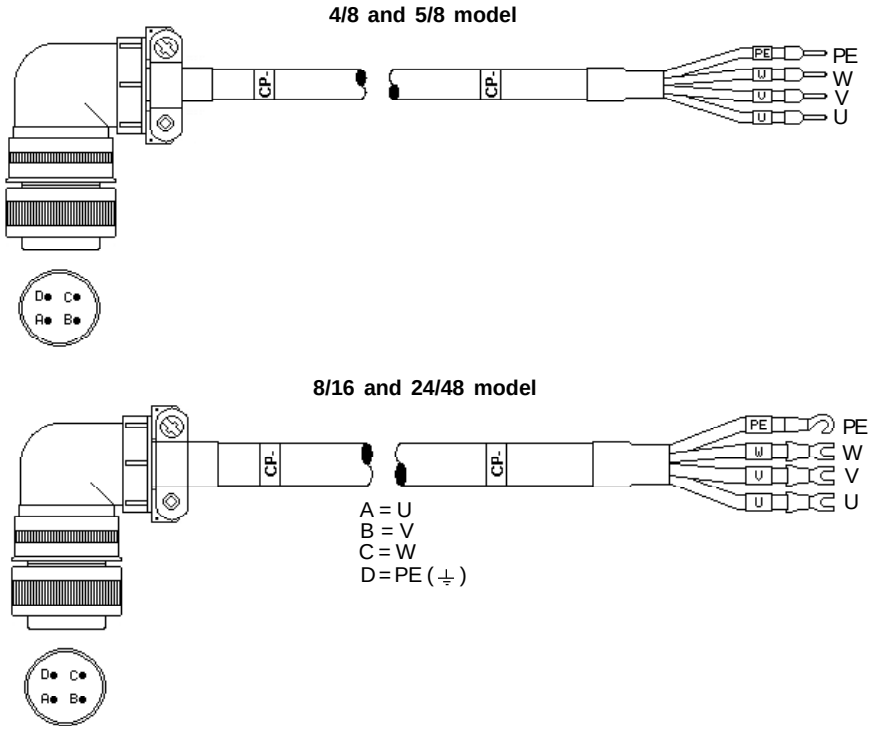


Figure 8.5 - *Drawing and pin location of the power cable with 90° connector*

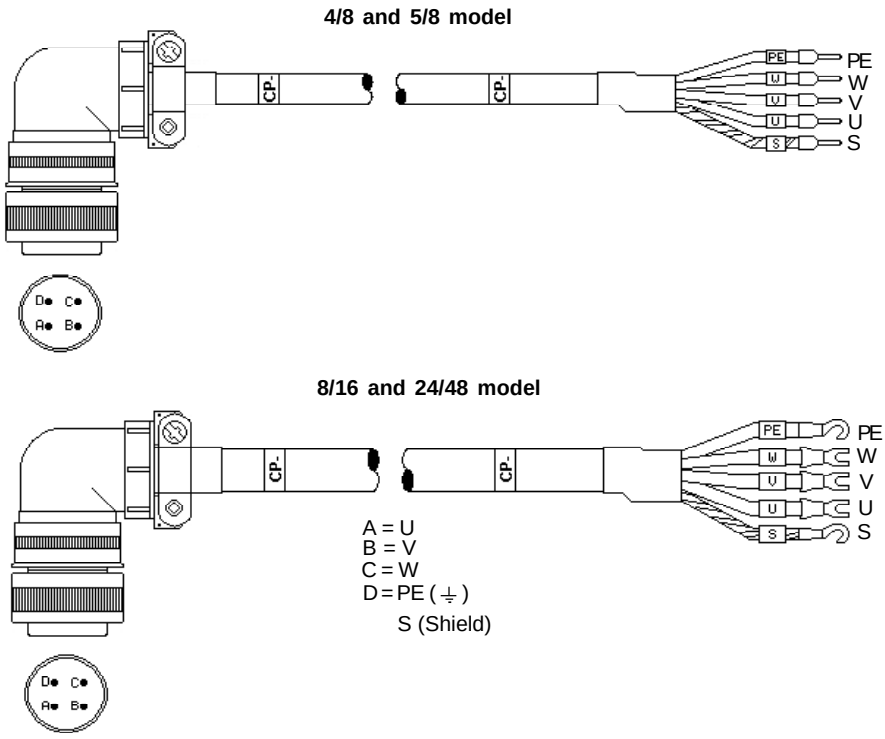


Figure 8.6 - *Drawing and pin location of the power cable with 90° connector, shielded*

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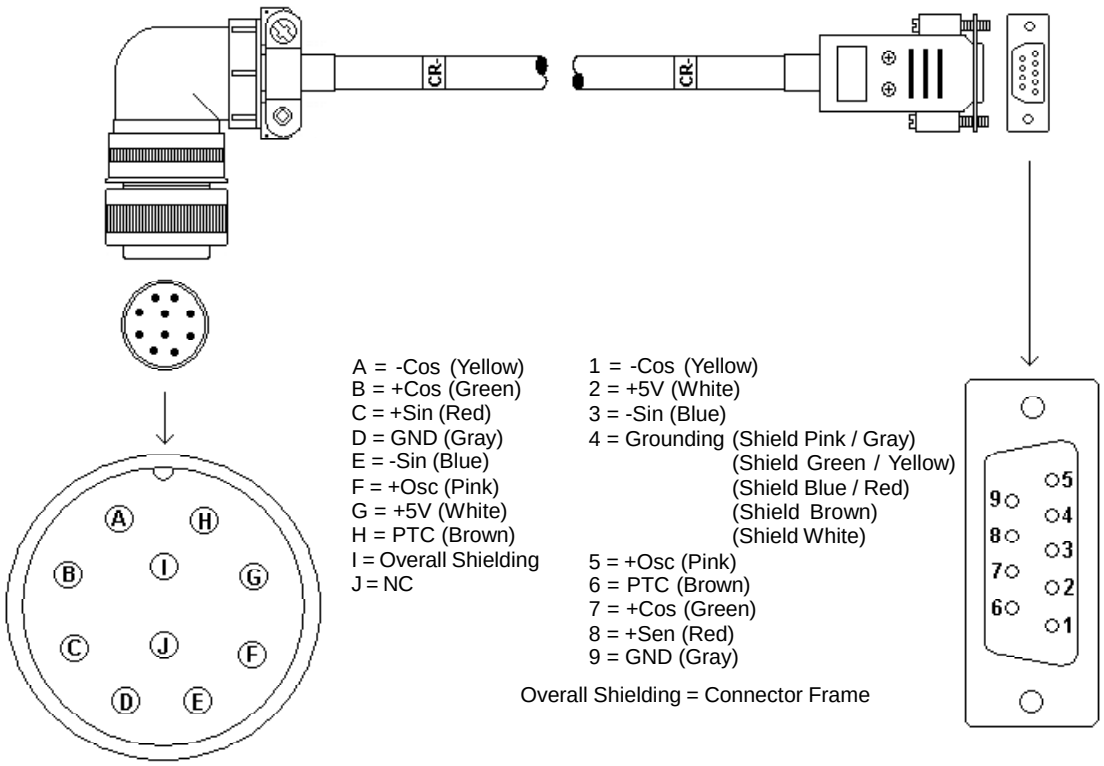


Figure 8.7 a) - *Drawing and pin location of the resolver cable with 180° connector*

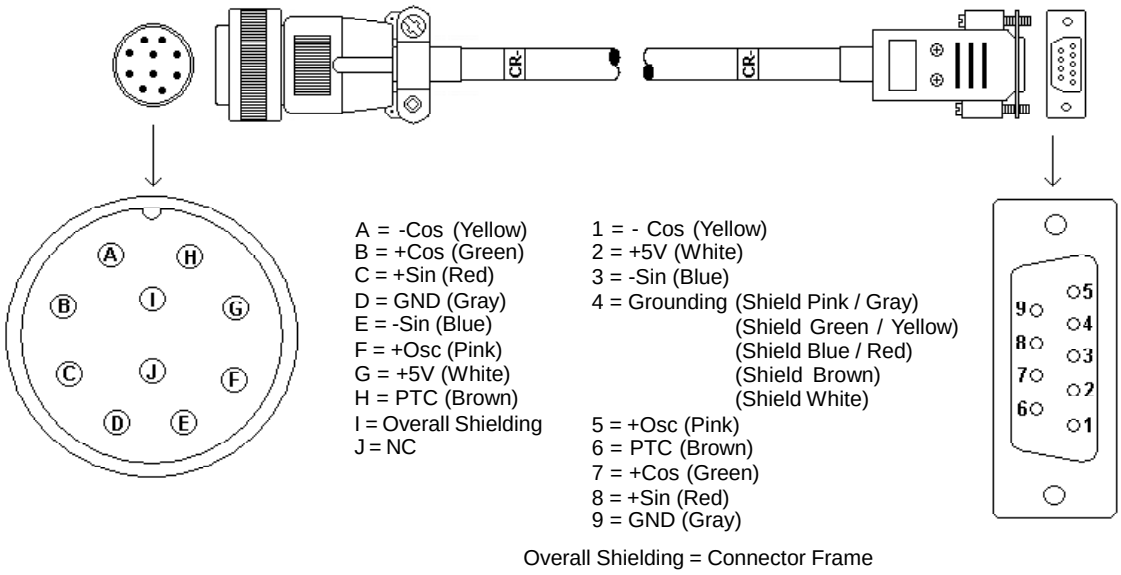


Figure 8.7 b) - *Drawing and pin location of the resolver cable with 90° connector*

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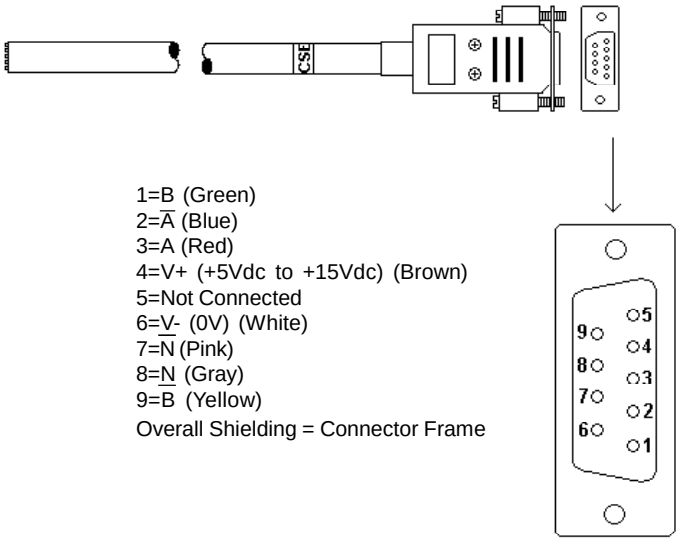


Figure 8.8 – *Drawing and pinout of the Encoder Simulator Cable*

8.3 REMOTE KEYPAD (HMI) AND CABLES

The Remote Keypad is used when it is necessary to have the keypad far away from the servodrive. An example of application is the mounting of the Remote keypad on the panel door.
In order to have a Remote Keypad it is necessary to replace the local keypad by the Remote Communication Kit. Refer to the following table to identify the correct part number for the remote keypad kits:

Remote Communication Kit KRC SCA-05 (REM05)	Cable length (Part number)	Remote HMI Kit + Frame KMR SCA-05
417110083	1m (0307.6890)	417110084 (to be used with cables up to 5m)
	2m (0307.6881)	
	3m (0307.6873)	
	5m (0307.6865)	
	7,5m (0307.6857)	417110085 (to be used with cables of 7,5m and 10m)
	10m (0307.6849)	

Table 8.5 - *HMI-SCA-05 and accessories*

The keypad cable must be installed separately from the power cables, following the same wiring recommendations as for the CCA5 board (Refer to Section 3.2.5).
For assembling, see details in figure 8.11.



Figure 8.9 - *Frame + HMI-Remote for assembling in switchgear*

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Figure 8.10 - *Cable for remote keypad connection*

Connection Cable	
Pins - SCA-05 Side	Pins - HMI Side
1	1
2	2
3	3
4	4
8	8
9=Shield	9=Shield

Table 8.6 *- Connection of the pins (DB9) for cable ≤ 5m (16.40ft)*

Connection Cable	
Pins - SCA-05 Side	Pins - HMI Side
2	2
3	3
4	4
8	8
9 = Shield	9 = Shield

Table 8.7 *- Connection of the pins (DB9) for cable > 5m (16.40ft) and ≤ 10m (32.80ft)*

Keypad Description:


Increases parameter number/value;


Decreases parameter number/value;



Enter/Exit parameter changing mode (blinking);



Enables the drive (if drive enable is not set for the digital input) (See P099 and P227);



Disables the drive (if drive enable is not set for the digital input) (See P099 and P227);



Executes the JOG function (See P228 and P428);


Defines if JOG1 or JOG2 is executed;



No function on this software version.

Note: The LED display (upper display) does not show the number and neither the value of the parameters. It only shows the errors, if any, and the following messages:
Run: servodrive is enabled;
Rdy: servodrive is disabled but with no error.

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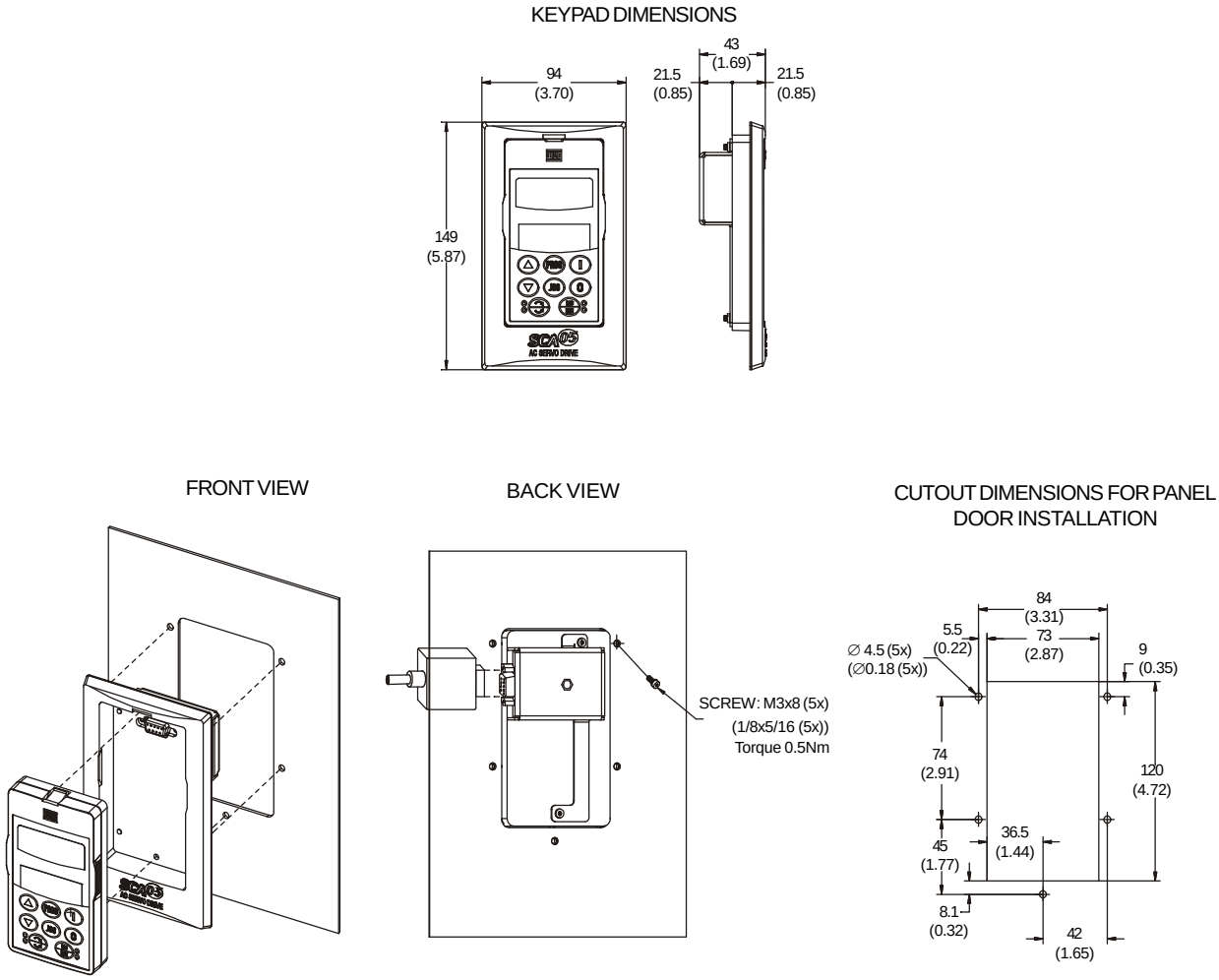


Figure 8.11 - *Keypad - Dimensions for panel installation - mm (in)*

8.3.1 KCR SCA-05

The remote communication kit KCR SCA-05 is composed of the REM05 (Figure 8.12) communication interface. Connect the communication cable of the remote keypad to X11 connector (DB9) and the isolated RS-485 serial communication signals to the X12 connector. This module replaces the local keypad. See item 6.1.
In order to use the RS-485 interface along with this module, feed it through pins 1 and 5 of X12 connector with to voltage between 12Vdc to 30Vdc.

X12 connector – Isolated RS-485



Pin	Function
1	GND
2	Data + (B)
3	Earth (for shieldings)
4	Data - (A)
5	+Vs (12 to 30)Vdc @ 50mA

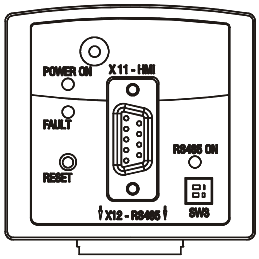


Figure 8.12 - *Module REM05*

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To connect and disconnect the module REM05, proceed in the same manner as indicated for the local HMI of the SCA-05 (figure 3.7), ensuring that the Module REM05 is fixed additionally by to screw that must be loosed before disconnection.

NOTE!

Ensure always that the module REM05 has been fastened by the screw, since an accidental touch against the connector DB9 of the remote HMI cable may disconnect the module REM05 and the Remote HMI will not operate properly.

8.4 LINE REACTOR

Due to the input circuit characteristic, common to all servodrives available on the market, which consists of to diode rectifier and filter capacitor bank, the input current (drained from the power supply line) has to non sinusoidal wave and contains harmonics of the fundamental frequency.
These harmonic currents circulate through the power supply line, causing harmonic voltage drops which distort the power supply voltage of the servodrive and other loads connected to this line. These harmonic current and voltage distortions may increase the electrical losses in the installation, overheating components (cables, transformers, capacitor banks, motors, etc.), as well as to lower power factor.
The harmonic input currents depend on the impedance values that are present in the rectifier input/output circuit. The inclusion of an input line reactor reduces the harmonic currents and provides the following advantages:

- ☑ Increased power factor at the servodrive input;
- ☑ Reduced rms input current;
- ☑ Reduced power supply voltage distortion;
- ☑ Increased life of the DC link capacitors.

As example we will show you to comparison of to servodrive SCA050024T2223 supplied by to 20kVA transformer, without line reactor and with to reactance of 2%.
The figures show what happens with the input current, supply voltage and THD (Total Harmonic Distortion) in both applications.

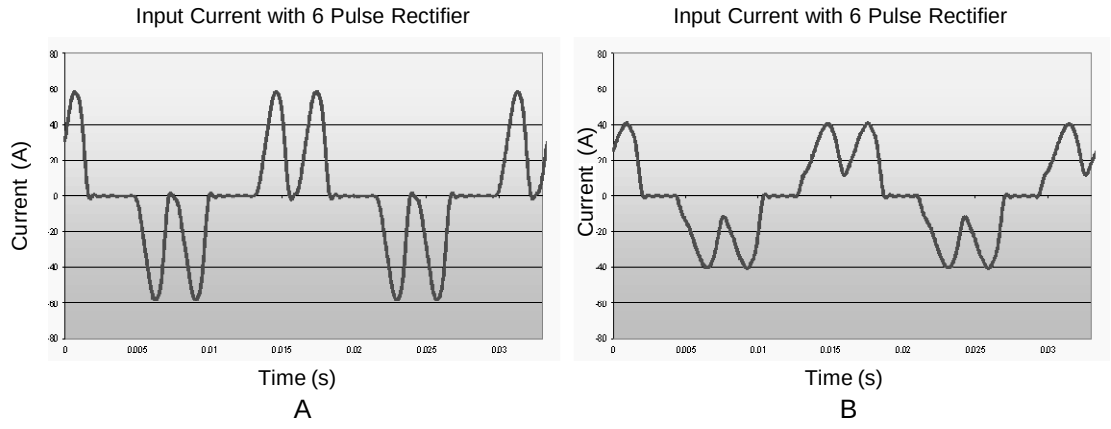
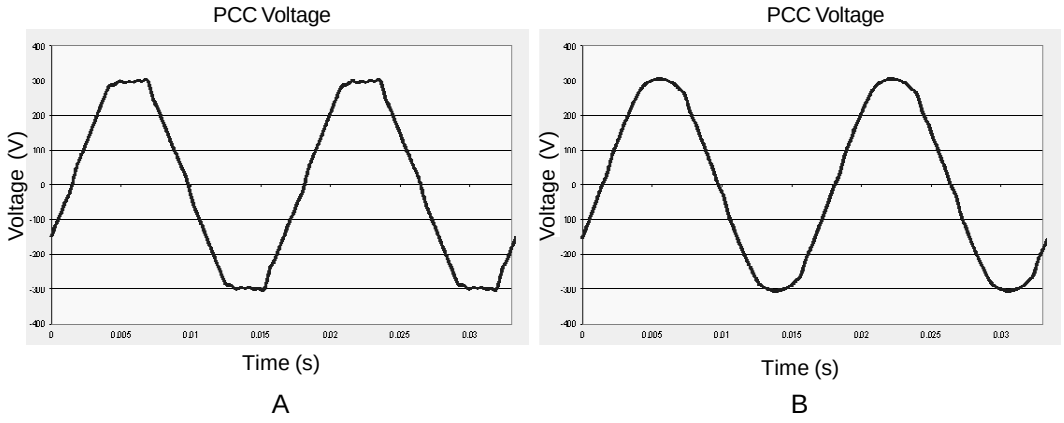


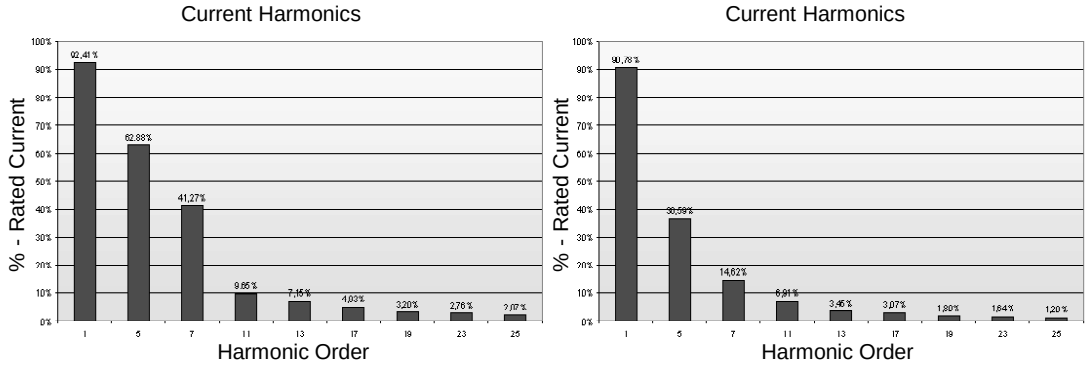
Figure 8.13 - *Servodrive input current without line reactor (A) and with line reactor (B)*

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A B

Figure 8.14 - *Servodrive input voltage without line reactor (A) and with line reactor (B)*



A B

Figure 8.15 - *THD at the servodrive input without line reactor (A) and with line reactor (B)*

As can be noticed, the use of a line reactor reduces the input current peaks, thus increasing the semiconductors life cycle. The reduction of the input current peaks also reduces the harmonic voltage drops, thus reducing the voltage distortion at the transformer output. In the same manner, the reduction of the input current peaks results in a reduction of the current harmonic distortion.

Note: The example above should be understood only as to case for illustration. Each effective application has peculiar characteristics and should be analyzed individually. Many other factors, such as transformer power, other loads coupled to the same line, the length of the cables which supply the servodrive, etc, may influence the whole system.

8.4.1 Application Criteria

In order to avoid damage to the servodrive and to increase the equipment life cycle, it is necessary to have a minimum line impedance that results in a voltage drop of 1% for the servodrive rated current. It is recommended to install an additional input line reactor (in addition to built-in servodrive reactor) that results in a final voltage drop of 2% to 4% (including transformers and cables).
This practice results in to reasonable compromise between motor voltage drop, improvement of the power factor and reduction of the harmonic current distortion. Add a line reactor whenever a power factor correction capacitor is installed in the same network or near to the servodrive.
As alternative criteria, add a line reactor when the transformer that feeds the servodrive has an output power greater than 125kVA.
To determine the line reactance and so obtain the required voltage drop in percent, use equation below:

$$L = \frac{Drop[\%] \cdot LineVoltage[V]}{\sqrt{3} \cdot 2 \cdot \pi \cdot Line\ \ Frequency[Hz] \cdot Inominal[A]} \quad [H]$$

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Figure 8.16 shows the connection of the line reactance at the input:

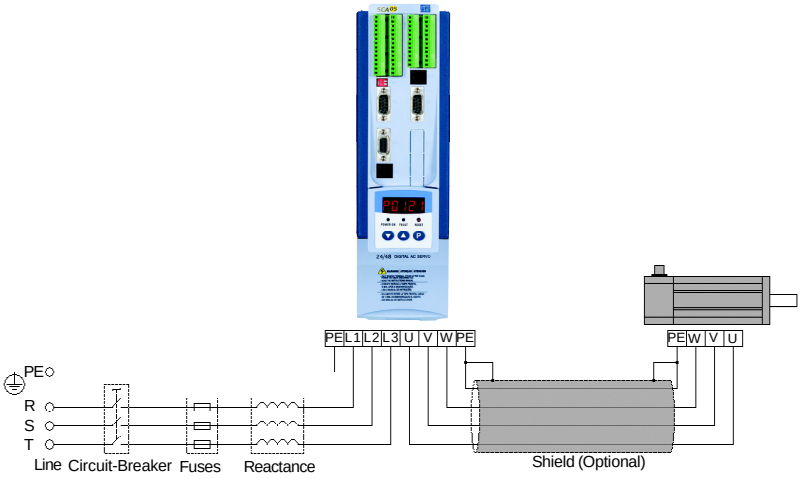


Figure 8.16 - *Connection of the power with the line reactance at the input*

8.5 DYNAMIC BRAKING

The dynamic braking is used in cases where short braking times are required or where high inertia loads are driven.

8.5.1 Dimensioning

During the deceleration process, the kinetic energy of the load is regenerated into the DC Link. This energy loads up the capacitors increasing the DC Link voltage. When this energy is not fully dissipated, it may generate to DC Link overvoltage trip (E01) and switching Off the servodrive.
To obtain higher braking torque, the use of Dynamic Braking, where the excess regenerated energy is dissipated in an external resistor, is recommended. The SCA-05 servodrives have incorporated braking modules, requiring only the installation of to resistor mounted externally to the servodrive (Module RF 200), connected to the terminals BR and +Ud of the power X21 connector.

For determining which braking resistor should be used, it is important that the value of the kinetic energy is known.

The kinetic load energy can be determined as follows:

$$Ec = \frac{1}{2} \cdot J \cdot \omega^2$$

or

$$Ec = \frac{1}{2} \cdot J \cdot \left(\frac{2 \cdot \pi \cdot n}{60} \right)^2$$

Where:
Ec: kinetic energy (Joule or W.s)
J: load inertia (kg.m²)
ω: angular speed (rad/s)
n: servomotor speed (rpm)

The inertia can be determined as follows:

$$J = \frac{L \cdot \left(R_2^{\,4} - R_1^{\,4} \right) \cdot \pi \cdot \sigma}{2}$$

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Where:
J: load inertia (kg.m²)
L: disk length (it may be to gear, pulley or cylinder) (m)
R_2: External radius of the disk (m)
R_1: Internal radius of the disk (m). If the disk is solid, consider please R1 = 0
σ: Constant that depends on the material

σ_{steel}: 7800kg/m³
σ_{brass}: 8600kg/m³
σ_{bronze}: 8700kg/m³
$\sigma_{aluminum}$: 2700kg/m³
σ_{copper}: 8900kg/m³

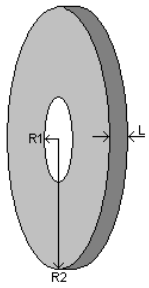


Figure 8.17 - *Disk data for inertia calculation*

Each RF 200 module may dissipate an energy up to 2200J. In the most applications only 1 RF 200 module is sufficient to dissipate the kinetic load energy. However, when load with high inertia are driven or servodrive are installed in parallel, up to 2 RF 200 module may be installed.

To ensure that the RF 200 module operates within its temperature limits, we recommend performing the braking process within these limits:

Max. continuous braking time: 0,41s
Max. duty cycle: 3,75%

Use always TAPE or WIRE type resistors with suitable insulation and capable of withstanding high instantaneous power with respect to the rated power. For critical applications, with very short braking times, high inertial loads, or severe duty cycles, contact WEG for proper braking resistor sizing.

8.5.2 RF 200 Module

WEG supplies the RF 200 module for dynamic braking, consisting in to vitrified wire resistor assembled on to fastening / protection support. Its resistance is 30Ω/200W.

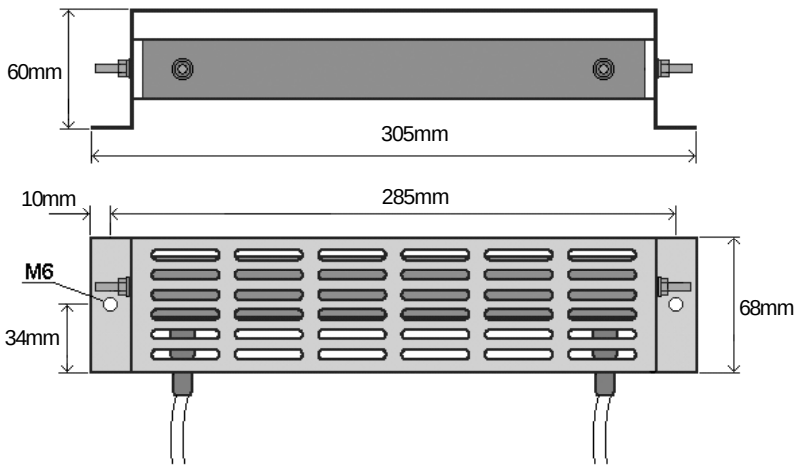


Figure 8.18 - *Sizing of the RF 200 module*

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There are two solutions in cases where the rotating energy of all shafts is higher than 2200J or repetition interval is very short:

- ☑ Install sufficient number of RF 200 modules for dissipating this energy or apply to non-inductive resistor with suitable power for the specific application;
- ☑ Reduce the number of servodrives grouped in parallel.

NOTE!

Braking resistors lower than 15Ω must not be connected between terminals BR and +Ud of the power connector (X21). This may cause serious damage to the servodrive.

DANGER!

The braking resistor and the transistor may be damaged if the resistor is not properly sized, if the parameters are not properly set, and /or if the line voltage exceeds the maximum permitted value.
In order to protect the installation in case of failure on the braking circuit and avoid the resistor damage or risk of fire, the only efficient method is to install a thermal overload relay in series with the braking resistor and/or a thermostat on the resistor body, and connect them in a manner that the input power supply is disconnected in case of failure, as follows:

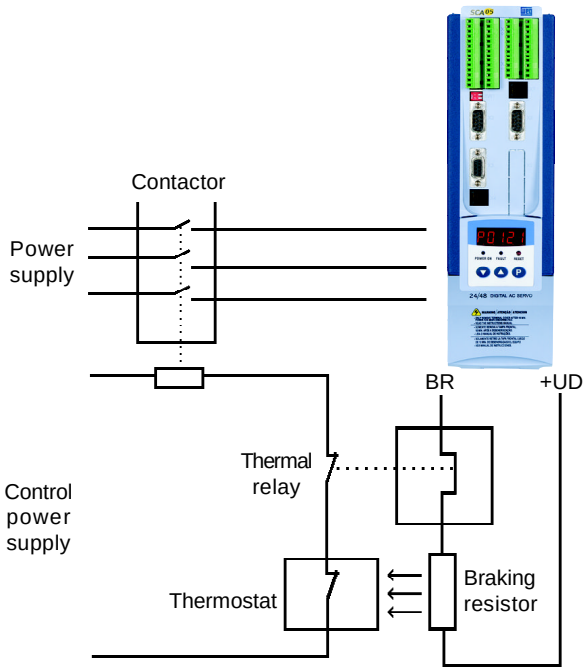


Figure 8.19 - *Braking resistor connection*

Overload Relay Adjustment			
Model	WEG Overload Relay	Current Adjustment	Trip Delay
SCA-05 4/8	RW 27D (1,8A to 2,8A)	2,5A	20s
SCA-05 8/16			
SCA-05 24/48	RW 27D (4A to 6,3A)	5A	

Table 8.8 - *Overload relay adjustment*

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8.5.3 Installation

- ☑ Connect the braking resistor between the power terminals +UD and BR (see figure 3.11).
- ☑ For connection of 1 Module RF 200, use to 2.5mm² (12AWG) twisted cable and for the connection of 2 Module RF 200, use to 4.0mm² (10AWG) twisted cable, when these modules share the same cable. Install these cables separately from the signal and control cables.
- ☑ When the braking resistor should be installed inside the servodrive panel, please consider the heat dissipation to provide suitable panel cooling.

ATTENTION!
Direct Current (DC) flows through the bimetallic power contacts of the thermal overload relay during the DC braking process.

8.6 SERVOMOTORS

The WEG servomotors – SWA line – are three-phase brushless permanent magnet motors, designed to meet the requirements of high dynamic applications, such as winders, machine tools, cutting and welding machines, and retrofitted machines.

8.6.1 Description

WEG servomotors – line SWA - are assembled in closed frames (Degree of Protection IP65), without forced cooling (natural cooling IC0041).
The servomotor are flanged and may be installed in horizontal position (mounting B5) or vertical (V1 or V3).
All SWA servomotors are provided with: “resolver” (for position feedback), stator thermistors (over temperature protection), and bearing seal to avoid oil penetration. The rotor is dynamically balanced with a half shaft key.

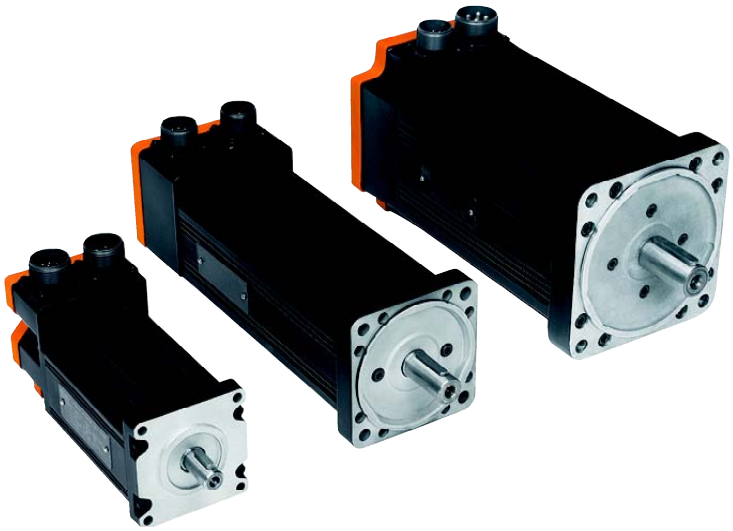


Figure 8.20 - *Servomotors*

8.6.2 Receiving / Storing

The servomotors are delivered in special wood / cardboard boxes. Upon receipt, check if they have not been damaged during transportation. Shaft end is protected by varnish to prevent rusting. In case the servomotor is not installed immediately, keep it in a dry, uniform temperature (10C° to 30C°), and clean ambient. Vibration may damage the bearings as well.

NOTE!
We recommend turning the shaft (by hand) at least once every three months to ensure grease protection on the bearing balls. If this procedure is not followed, the bearings shall be replaced immediately before running the servomotor.

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8.6.3 Installation

The servomotors shall be installed indoor under normal ambient conditions (maximum altitude of 1000m and ambient temperature below 40°C). Perform the installation so that the motor heat can be dissipated by irradiation or natural convection.
The motor surface may reach high temperatures. Therefore, avoid the physical contact with the motor by using an appropriate protection.

8.6.4 Coupling

The servomotor alignment shall be carefully performed in order to prevent excessive loads or vibration from damaging the shaft or the bearings. There is a threaded hole at the shaft end that may be used to install a coupling or gearbox. The coupling or gearbox may be installed by heating (80°C to 90°C) or by pressing as well. Never mount a coupling or gearbox by striking it against the motor shaft. This may damage the motor bearings.

8.6.5 Electrical Installation

The three-phase connections and grounding of the servomotor is made by to 4 pins circular connector. For more details about installation, refer to Chapter 3 and for more details about servomotor cables, see Item 8.2.
The power and resolver connectors are always present at the servomotor, while the electromechanical braking connector is optional.

DANGER!
Only qualified personnel should implement connections and maintenance of this equipment. Always disconnect the supply voltage, since due to the permanent magnet excitation there is to voltage at the motor terminal while motor is running.

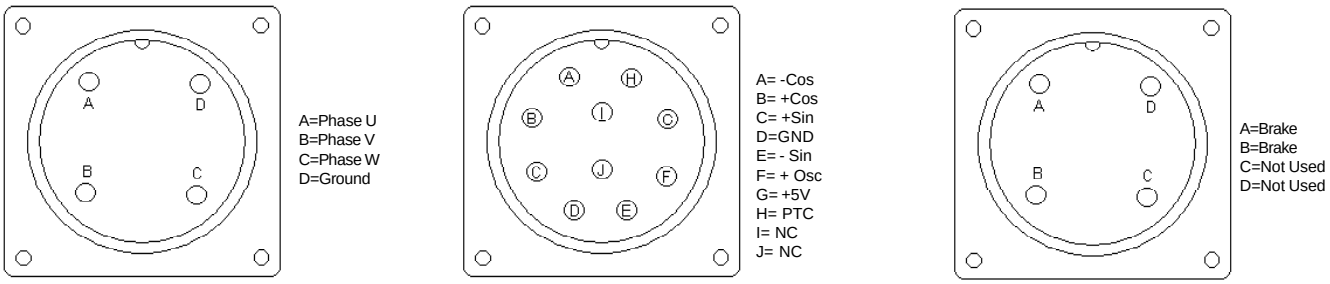


Figure 8.21 - *Power connector of the servomotor (A), of the resolver (B) and of the braking (C)*

Ensure that the peak current (Imax) indicated on the servomotor nameplate is not exceeded, even when only for short time, since this condition will demagnetize the permanent magnets.

8.6.6 Resolver

The resolver assembled on the NDE endshield of the servomotor sends signals to the servomotor speed and position control. The connection of the resolver to the servodrive shall be made through to circular connector, as shown in Figure 8.21. For more details about the resolver cable, see Item 8.2.
Servomotors can be driven only by servodrives of series SCA-V3, with the switch set to 10kHz or through servodrives of series SCA-04 and SCA-05.
This characteristic is shown on the servomotor nameplate, in the field “Resolver” . Example: 7V / 10kHz / 1:0.5.

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NOTE!
The positioning accuracy is limited to the resolver accuracy (device for position feedback) and it is of ±10 arc minutes (1° = 60 arc minutes).

ATTENTION!
The position of the resolver is set at factory and should not be changed, since this causes the loss of the servomotor synchronization. Always when servomotor is disassembled, this synchronization is lost.

8.6.7 General Servomotor Characteristics

- Sinusoidal back-Electromotive Force (E.M.F.);
- Smooth and uniform running at all speeds;
- Low noise and vibration level;
- Wide speed range with constant torque;
- Low maintenance requirements (brushless servomotors);
- High overload capacity;
- Low inertia;
- Quick dynamic answer.

8.6.8 Technical Specification

- Degree of Protection IP65 and IP54 for servomotors with braking capability;
- Natural cooling;
- Class F insulation;
- Resolver feedback (accuracy of ±10 arc minutes);
- Mounting: B5, V1 and V3;
- Thermal protector (PTC);
  Type: PTC
  Triggering temperature: 155°C (311ºF)
  Maximum voltage: 30V
- Shaft end with shaft key NBR 6375;
- Rare earths permanent magnets;
- Shielded bearings;
- Seals on shaft;
- Temperature rise under continuous duty: Δt = 100°C (212ºF);
- Circular connectors for motor and resolver.

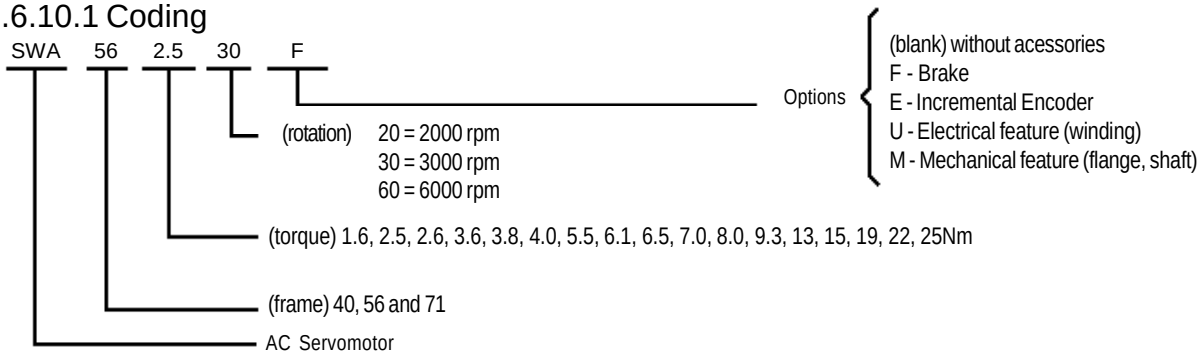
8.6.9 Options

- Electromagnetic brake (24Vdc, 1A (Line SWA56) and 1A (Line SWA71)).
The brake is mounted on the NDE endshield and operates in case of current fault, i.e., the brake is activated when switched off and release the motor shaft when supplied again by 24Vdc, ± 10%.
Excite the brake before switching on the servomotor.
The brake must not be used for dynamic braking purposes. It must be used only to hold the shaft in emergency situations or in case of power failure.
- Flange for incremental encoder type ROD.

8.6.10 Commercial Specification

The SWA servomotors are available with torques from 2,5Nm to 25Nm and maximum speeds of 2000rpm, 3000rpm and 6000rpm.

8.6.10.1 Coding



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8.6.11 Characteristic Curves

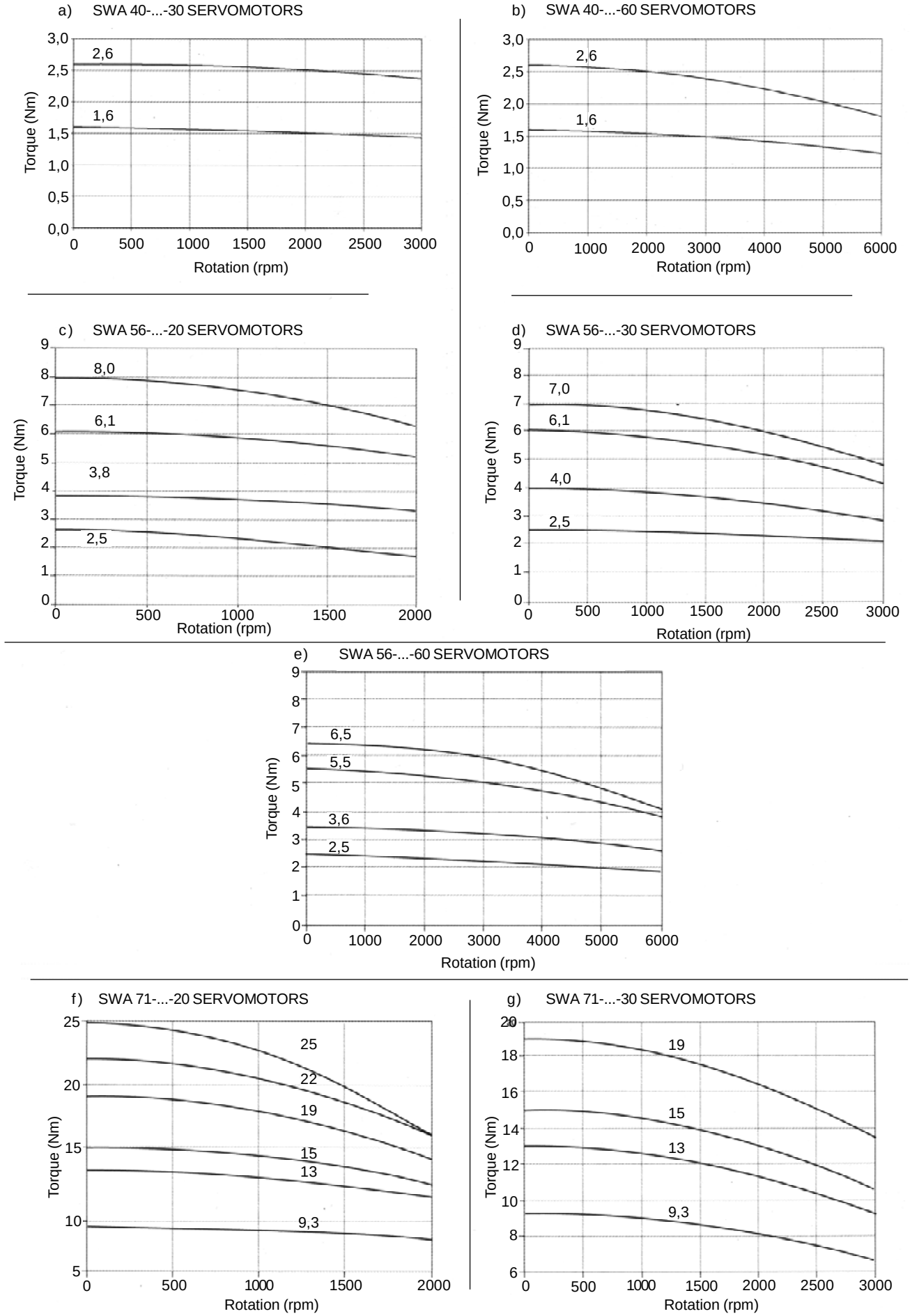


Figure 8.22 - *Servomotor torque curves for temperature rise upt to 100°C*

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8.6.12 Technical Data

Technical Specifications – Servomotor without Electromagnetic Braking										
Rotation	Code	Servomotor Model	Locked Rotor Torque M_0 (N.m)	Current I_0 (A) (rms)	Rated Power (kW)	Weight (Kg)	Inertia x 10^{-3} ($kg.m^2$)	Length "L"		SCA-05
								mm	in	
2000 rpm	1900.7006	SWA 56-2.5-20	2.5	2.5	0.36	4.6	0.22	250	9.84	4/8
	1900.7030	SWA 56-3.8-20	3.8	3.8	0.70	5.6	0.31	270	10.63	4/8
	1900.7057	SWA 56-6.1-20	6.1	5.2	1.10	7.5	0.50	310	12.20	8/16
	1900.7073	SWA 56-8.0-20	8.0	6.5	1.32	9.3	0.68	350	13.78	8/16
	1900.7090	SWA 71-9.3-20	9.3	8.0	1.60	12.0	1.63	270.5	10.65	8/16
	1900.7111	SWA 71-13-20	13	11.8	2.30	15	2.35	300.5	11.83	24/48
	1900.7138	SWA 71-15-20	15	13.0	2.50	17.0	3.06	330.5	13.01	24/48
	1900.7154	SWA 71-19-20	19	15.1	2.90	20.0	3.78	360.5	14.19	24/48
	1900.7170	SWA 71-22-20	22	18.5	3.40	22.0	4.50	390.5	15.37	24/48
	1900.7189	SWA 71-25-20	25	21.5	3.40	27.0	5.94	450.5	17.74	24/48
3000 rpm	1900.7540	SWA 40-1.6-30	1.6	2.0	0.45	2.8	0.084	216.7	8.53	4/8
	1900.7558	SWA 40-2.6-30	2.6	3.2	0.70	3.5	0.12	236.7	9.32	4/8
	1900.7014	SWA 56-2.5-30	2.5	3.8	0.66	4.6	0.22	250	9.84	4/8
	1900.7049	SWA 56-4.0-30	4.0	5.7	0.88	5.6	0.31	270	10.63	8/16
	1900.7065	SWA 56-6.1-30	6.1	8.5	1.30	7.5	0.50	310	12.20	8/16
	1900.7081	SWA 56-7.0-30	7.0	9.0	1.50	9.3	0.68	350	13.78	24/48
	1900.7103	SWA 71-9.3-30	9.3	12.0	2.05	12.0	1.63	270.5	10.65	24/48
	1900.7120	SWA 71-13-30	13	18.0	2.85	15.0	2.35	300.5	11.83	24/48
	1900.7146	SWA 71-15-30	15	20.0	3.30	17.0	3.06	330.5	13.01	24/48
	1900.7162	SWA 71-19-30	19	23.0	4.20	20.0	3.78	360.5	14.19	24/48
6000 rpm	1900.7566	SWA 40-1.6-60	1.6	4.0	0.70	2.8	0.084	216.7	8.53	4/8
	1900.7573	SWA 40-2.6-60	2.6	6.2	1.13	3.5	0.12	236.7	9.32	8/16
	1900.7022	SWA 56-2.5-60	2.5	7.5	1.13	4.6	0.22	250	9.84	8/16
	1900.7251	SWA 56-3.6-60	3.6	10.3	1.60	5.6	0.31	270	10.63	24/48
	1900.7260	SWA 56-5.5-60	5.5	15.5	2.40	7.5	0.50	310	12.20	24/48
	1900.7278	SWA 56-6.5-60	6.5	16.3	2.50	9.3	0.68	350	13.78	24/48

Table 8.9 *- Data of the servomotors without electromagnetic braking*

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Technical Specifications – Servomotor with Electromagnetic Braking										
Rotation	Code	Servomotor Model	Locked Rotor Torque M_0 (N.m)	Current I_0 (A) (rms)	Rated Power (kW)	Weight (Kg)	Inertia x 10^{-3} ($kg.m^2$)	Length "L"		SCA-05
								mm	in	
2000 rpm	1900.7280	SWA 56-2,5-20	2,5	2,5	0,36	6,5	0,35	323,5	12.73	4/8
	1900.7299	SWA 56-3,8-20	3,8	3,8	0,70	7,5	0,44	343,5	13.52	4/8
	1900.7302	SWA 56-6,1-20	6,1	5,2	1,10	9,4	0,63	383,5	15.09	8/16
	1900.7310	SWA 56-8,0-20	8,0	6,5	1,32	11,2	0,81	423,5	16.67	8/16
	1900.7329	SWA 71-9,3-20	9,3	8,0	1,60	16,1	2,10	367	14.44	8/16
	1900.7337	SWA 71-13-20	13	11,8	2,30	19,1	2,84	397	15.62	24/48
	1900.7345	SWA 71-15-20	15	13,0	2,50	21,1	3,55	427	16.81	24/48
	1900.7353	SWA 71-19-20	19	15,1	2,90	24,1	4,27	457	17.99	24/48
	1900.7361	SWA 71-22-20	22	18,5	3,40	26,1	4,99	487	19.17	24/48
	1900.7370	SWA 71-25-20	25	21,5	3,40	31,1	6,43	547	21.53	24/48
3000 rpm	1900.7388	SWA 56-2,5-30	2,5	3,8	0,66	6,5	0,35	323,5	12.73	4/8
	1900.7396	SWA 56-4,0-30	4,0	5,7	0,88	7,5	0,44	343,5	13.52	8/16
	1900.7400	SWA 56-6,1-30	6,1	8,5	1,30	9,4	0,63	383,5	15.09	8/16
	1900.7418	SWA 56-7,0-30	7,0	9,0	1,50	11,2	0,81	423,5	16.67	24/48
	1900.7426	SWA 71-9,3-30	9,3	12,0	2,05	16,1	2,10	367	14.44	24/48
	1900.7434	SWA 71-13-30	13	18,0	2,85	19,1	2,84	397	15.62	24/48
	1900.7442	SWA 71-15-30	15	20,0	3,30	21,1	3,55	427	16.81	24/48
	1900.7450	SWA 71-19-30	19	23,0	4,20	24,1	4,27	457	17.99	24/48
6000 rpm	1900.7469	SWA 56-2,5-60	2,5	7,5	1,13	6,5	0,35	323,5	12.73	8/16
	1900.7477	SWA 56-3,6-60	3,6	10,3	1,60	7,5	0,44	343,5	13.52	24/48
	1900.7485	SWA 56-5,5-60	5,5	15,5	2,40	9,4	0,63	383,5	15.09	24/48
	1900.7493	SWA 56-6,5-60	6,5	16,3	2,50	11,2	0,81	423,5	16.67	24/48

Note: In order to release the brake it is necessary to use a 24Vdc external power supply with minimum current capacity of 1A (24W) for frame 56 servomotors and 1.5A (36W) for frame 71 servomotors.

Table 8.10 *- Data of the servomotors with electromagnetic braking*

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Dimensions:

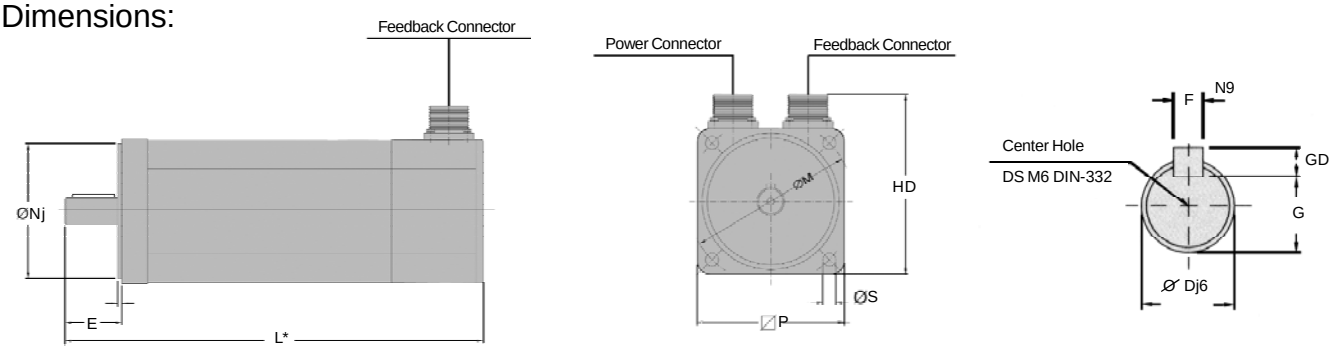


Figure 8.23 - *Servomotor dimensions*

Frame	HD mm (in)	P mm (in)	Flange ØM mm (in)	Flange ØN mm (in)	Flange ØS mm (in)	Flange T mm (in)	Shaft end ØD mm (in)	Shaft end E mm (in)	Shaft end F mm (in)	Shaft end G mm (in)	Shaft end GD mm (in)
40	110 (4.33)	80 (3.15)	95 (3.74)	50j6 (1.97j6)	6.5 (0.26)	2 (0.08)	14j6 (0.55j6)	29.5 (1.16)	5n9 (0.20n9)	11 (0.43)	5 (0.20)
56	127 (5.00)	102 (4.02)	115 (4.53)	95j6 (3.74j6)	9 (0.35)	3 (0.12)	19j6 (0.75j6)	40 (1.57)	6n9 (0.24n9)	15.5 (0.61)	6 (0.24)
71	166 (6.54)	142 (5.59)	165 (6.50)	130j6 (5.12j6)	11 (0.43)	3.5 (0.14)	24j6 (0.94j6)	50 (1.97)	8n9 (0.31n9)	20 (0.79)	7 (0.28)

* Dimension “L” vide table 8.9 and 8.10.

Table 8.11 *- Dimensions data*

8.6.13 Maintenance

Under normal operation conditions, bearings should be replaced at every 20.000 running hours.

ATTENTION!
Servomotor maintenance should be carried out by WEG or its authorized Repair Shop Network.

8.7 POS2 OPTIONAL BOARD

The POS2 board is an optional board to be used with the SCA-05 servodrive, which adds PLC, positioning and synchronism (electronic gear box) functions to the servodrive operation.
The programming is done by using to Windows-based graphical programming software for the Ladder language - WLP.

NOTE!
This board cannot be used with the SCA-05 4/8 MF model.

8.7.1 General Specification

POS2 Characteristics

- 9 digital inputs 24Vdc, isolated and bidirectional;
- 3 relay digital outputs with capacity for 250Vdc x 3A;
- 3 opto-coupled digital outputs, bidirectional, 24Vdc x 500mA;
- 1 analog input (-10 to +10)V or (-20 to +20)mA with 10 bits resolution;
- 1 isolated encoder input with 5V or 8V to 15V external power supply, selectable through parameter;
- 1 RS-232C serial communication interface with MODBUSRTU protocol;
- Built-in CANopen or DeviceNet network;
- Ladder programming with specific blocks for positioning, PLC functions and electronic-gear-box;
- Allows using the digital and analog inputs and outputs of the SCA-05;

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- Two types of synchronism are available: through encoder input or through CAN network.

Note:
In order to use the digital outputs, as well as the analog inputs and outputs of the SCA-05 servodrive in the POS2 board (via the ladder program), it is necessary to configure the drive parameters related to this functions (for further programming detail, please, refer to the POS2 board user's guide).

Software Characteristics:
- Parameters range from 750 to 899, totalizing 150 parameters. From these 150 parameters, 50 are reserved or predefined for writing and reading (system parameters) and 100 are for general use, accessible via user program (user parameters).
- Type of Registers: WORD, BIT (retentive or not retentive) and FLOAT (not retentive).
- Various units for positioning.

Software Functions:
The board programming is performed via Ladder Language, by using the WLP software (WEG Ladder Programmer).

8.7.2 Main Software Functions

COILS AND CONTACTS
NO and NC Contacts.
Normally open, normally closed, set, reset, positive transition, negative transition coils.
Contact: It can be to bit register, to user parameter or to digital input or output.
Coil: It can be to bit register, to user parameter or to digital output.

TIMER
This function turns on its output when to set timing is reached. The unit is milliseconds and the maximum timing is 65535ms.

COUNTER UP
It is an up counter capable of counting up to 65535 composed by one input for counting and other input for counter reset. Turns on the output when the preset value is reached and remains like this until to reset command is received.

FOLLOW
The slave drive follows the master drive in to relation that can be set on-the-fly (motor enabled). The source of information coming from the master can be selected between CAN network and encoder input. It is also possible to program an acceleration / deceleration ramp.

HOME
This function searches the zero position (home position). It starts searching the signal coming from the limit switch, and then it stops, reverses the direction of rotation, and stops again, now on the encoder null pulse. It is possible to program an offset, positive or negative.

INBWG
This function turns on the block output when the motor reaches to speed greater than or equal to the value set on the block, considering also the direction of rotation.

INPOS
This function turns on the output as soon as the motor reaches to specific position set on the INPOS block.

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TCURVE
This function executes to positioning by using to trapezoidal profile with parameters programmed by the user.

SCURVE
This function executes to positioning by using to 'S' profile with parameters programmed by the user.

SHIFT
This function allows having to position shift (certain quantity of grades per scan cycle) while the block input is enabled.

SETSPEED
This function has the same behavior of the 'multi-speed' function, that is, when the SETSPEED block is enabled, it sets the speed of the drive according to value defined inside it (the acceleration can also be set).

JOG
This function executes to motion in speed loop with acceleration ramp.

STOP
This function stops the motion by using the trapezoidal ramp and the acceleration defined by the user. Two operation modes are available: 'INTERRUPT', which continues the positioning after the block input is disabled, or 'CANCEL', which aborts the motion.

TRANSFER
This function copies to source data (SRC) to specific destination (DST). It accepts all data types, such as, bit registers, word registers, float registers, POS2 parameters, drive parameters, analog inputs and outputs, motor enable, etc.

INT2FL
This function converts an integer value to float point value. The integer part is divided into two WORDS, which represent the integer part and the fractional part of the number.

FL2INT
This function converts to float point value to an integer value. The integer part is divided into two WORDS, which represent the integer part and the fractional part of the number.

MATH
This function performs the four basic math operations (addition, subtraction, multiplication and division) by using two FLOAT arguments and returns to value of the same type.

COMP
Compares two FLOAT arguments, and depending on the result, false or true, it turns off or turns on the block output, respectively. Available comparison options are: greater than, less than, greater than or equal, less than or equal, equal to, and different from.

PID
Float point PID block, with reference input (set-point), feedback, minimum and maximum output values, Kp, Ki and Kd gains, besides the type, which can be academic (classic) or parallel. Two PID blocks can be used on the user program.

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SAT
Controls the saturation of to float-point variable (FLOAT register), that is, if the input value is out of the specified limits (MAX and MIN), the output is limited at the maximum and minimum values, respectively.

FUNC
This function performs float point math functions of only one operator. See below the available math functions:
- Absolute value
- Negative (inverts the signal)
- Square root
- Sine
- Cosine
- Tangent
- Arc sine
- Arc cosine
- Arc tangent

FILTER
First order filter, with float point input, output and filter time constant, high-pass or low-pass.
Detailed information can be obtained from the POS2 optional board user's guide.

8.8 CEP1 OPTIONAL BOARD

The CEP1 board allows the reception of pulse trains through connector X8 that will be used by an internal counter of the SCA-05 processor. The configuration of the sent pulses determine the mode and counting direction of the counter whose output is used to send torque, speed and position references to the motor and also as a following reference for the master-slave function.

NOTE!
Read item 5.7.4 of this manual before using the master/slave function of the CEP1 Board.

8.8.1 Connectors

Connector X7: Power Supply
Observe the silk screen printing on the CEP1 board to properly connect the power supply. The input power supply may be from 5Vdc to 24Vdc.

DANGER!
The improper configuration of the DIP-switches may result in components damage, which may compromise the correct operation of the CEP1 board.

Connector X7	
Pin	Function
1	V+ (5 to 24 Vdc)*
2	GND

Table 8.12 *- Description of the connector X7 signals*

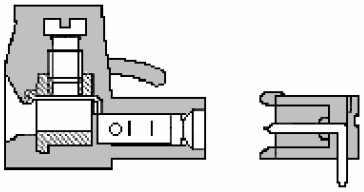


Figure 8.24 *- Conector X7*

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Connector X8: Pulse train input

This connector is used as an input for pulse trains and other signals used by the CEP1.

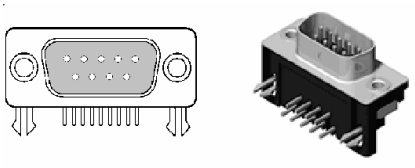


Figure 8.25 *- Conector X8*

Connector X8	
Pin	Function
1	B
2	$\overline{A}$
3	A
4	V+ (5 to 24Vdc)*
5	Not Connected
6	V- (0V)
7	$\overline{N}$
8	N
9	$\overline{B}$

* The voltage level depends on the configuration of the *switcher* key.

Table 8.13 - *Description of connector X8 signals*

Channel $\overline{A}$ has pull-up resistors for the level + Vdc and pull-down resistors for the ground. Channel A only has the pull-up resistor for the level + Vdc, as shown in the figure 8.26 which represents the electric scheme for both channels. This must be considered when the channels are supplied directly without the use of a differential encoder.

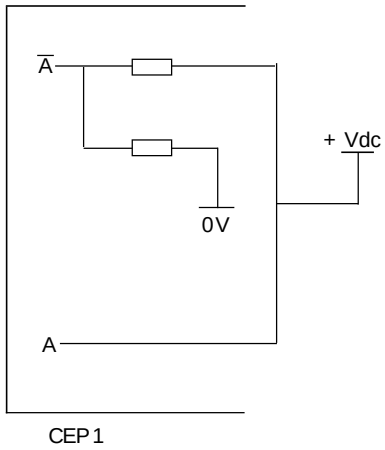


Figure 8.26 *- Electrical connection for channels A and* $\overline{A}$

DIP-switches:

It must be set according to the power supply used for the board. The figure 8.27 shows the DIP-switches configuration.

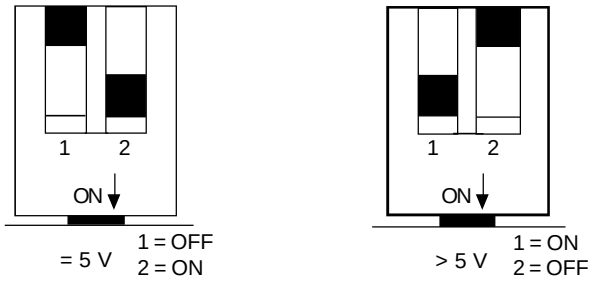


Figure 8.27 *– Configuration of the DIP-switches*

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The CEP1 board uses two of the counting modes given by the contactor:

Mode 1 - Two types of pulse trains, A and B, must be sent to the card through connector X8. The counting direction is determined by the delay between the pulse trains, as illustrated in the figure 8.28.

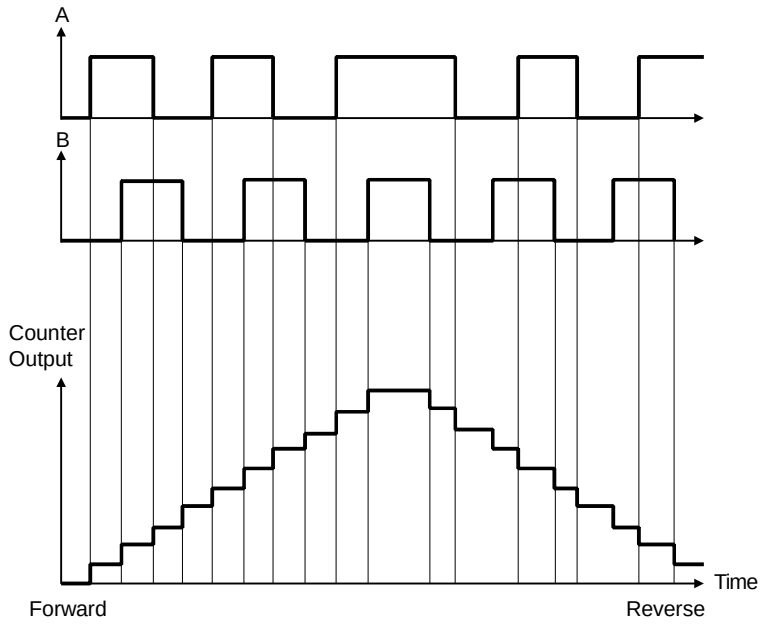


Figure 8.28 - *Counting Mode 1*

Note that the contactor is incremented or decremented at the edge of each ascent or descent of pulse trains A and B. Therefore, the frequency of the contactor will be equal to four times the frequency of each pulse train. If, for example, pulse trains that supply 4096 pulses per second are used, the contactor will be incremented or decremented 16,384 times in one second.

Mode 2 - A pulse train A must be sent through connector X8. The count direction is determined by the logic level of B as in the figure 8.29.
Note that the counter is increased or decreased only at the moment in which there is a step down function negative pulse in train pulse A. Therefore, the frequency of the counter will be the same as the frequency of pulse train A. If, for example, pulse trains that supply 4,096 pulses per second are used, the counter will also be increased or decreased 4,096 timed in one second.

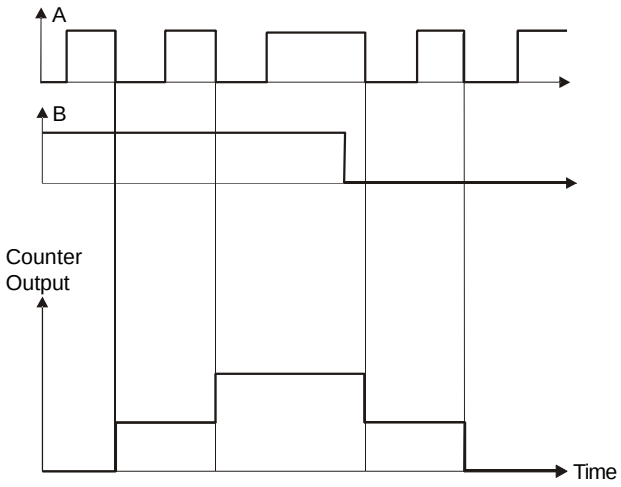


Figure 8.29 - *Counting Mode 2*

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8.9 OPTIONAL BOARD FOR PROFIBUS COMMUNICATION

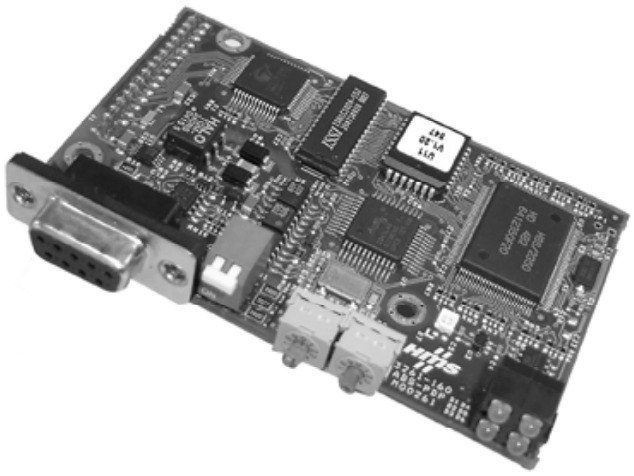


Figure 8.30 *- Profibus Communication Board*

Fieldbus is to general term used to describe to digital communication system that interconnects several field devices, like, sensors, actuators and controllers. A *fieldbus* network works as to local communication network.

The Profibus optional board is used when the SCA-05 shall be connected to a Fieldbus network operating with the Profibus DP protocol. It may be supplied already installed on the SCA-05 (it shall be requested at the purchase order by specifying the PD code at the field “Boards for network communication” – item 2.4) or it may be purchased separately (Profibus DP kit, part number 417110088). In this last case, follow the instructions on the Installation Manual that comes with the product for the proper installation of the Profibus Board on the SCA-05.
Refer to the Fieldbus Communication User’s Guide provided with the product CD for detailed electrical installation requirements and start-up instructions.

NOTE!
This board cannot be used on the SCA-05 4/8 MF model.

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TECHNICAL CHARACTERISTICS

This Chapter describes the technical specifications (electrical and mechanical) of the servodrive.

9.1 POWER DATA

Power Supply Specification:

- ☑ Voltage : -15%, +10% (with motor power loss);
- ☑ Frequency : 50/60Hz (±2Hz);
- ☑ Phase Unbalance ≤ 3%;
- ☑ Overvoltage Category III (EN 61010/UL 508C);
- ☑ Transient voltages according to Category III;
- ☑ Minimum Power Supply line impedance: 1% voltage drop;
- ☑ Maximum Overload: 2x Inominal during 3s.

Connections to line: 10 connections per hour, max.

9.1.1 220-230V POWER SUPPLY

Model: Current	4/8	8/16	24/48
Power (kVA) (1)	1.5	3.1	9.2
Rated Output Current (A) (2)	4	8	24
Maximum Output Current (A) (3)	8	16	48
Rated Input Current (A) (5)	4.8	9.6	28.8
Switching Frequency (kHz)	10	10	10
Maximum Motor (kW) (4)	0.7	1.6	4.2
Rated Dissipated Power (W)	70	90	274
Frame Size	1	2	3

NOTES!

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

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

The values presented in the tables were calculated based on the servodrive rated current for a voltage of 220V.

(2) Rated Current at the following conditions:
- ☑ Relative Air Humidity: 5% to 90%, non condensing;
- ☑ Altitude : 1000m (3300 ft), up to 4000m (13200 ft) with 1% derating /100m (330 ft);
- ☑ Ambient Temperature: 0ºC to 45ºC (32ºF to 113ºF), up to 50ºC (122ºF) with 2% / ºC derating, of the rated current.

(3) Maximum Current: 2 x I nominal (3s)

(4) The motor powers should be considered only as orientation values. A precise servodrive sizing must consider the rated currents of the used servomotors.

(5) Rated input current for three-phase operation:
This is to conservative value. In practice the value of this current depends on the line impedance. See table 9.1:

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X (%)	$I_{input\ (rms)}$ (%)
0.5	131
1.0	121
2.0	106
3.0	99
4.0	96
5.0	96

X = Voltage drop (in percent) in the line impedance for the rated SCA-05 output current.
$I_{input\ (rms)}$ = Percent of the rated output current

***Table 9.1** - Input current for different line impedances*

9.2 ELECTRONICS/GENERAL DATA

CONTROL	METHOD	☑ Vector Control with Encoder Feedback; ☑ PWM SVM (Space Vector Modulation); ☑ Current, Flux, Speed and Position Regulators (full digital software); ☑ Execution rate: 100μs (10kHz); ☑ Current Regulators: 100μs (10kHz); ☑ Flux Regulator:100μs (10kHz); ☑ Speed Regulator / Speed Measurement: 100μs (10kHz).
	OUTPUT FREQUENCY	☑ 0 to 400Hz;
INPUTS	ANALOG	☑ 2 Non Isolated Differential Inputs; ☑ Resolution: 14 bits (AI1) or 10bits (AI2). Signal: (-10 to +10)V or (0 to 20)mA or (4 to 20)mA; ☑ Impedance: 400kΩ (-10 to +10)V, 500Ω (0 to 20)mA or (4 to 20)mA; ☑ Programmable Functions.
	DIGITAL	☑ 6 Isolated Inputs: 24Vdc; Programmable Functions
OUTPUTS	ANALOG	☑ 2 Non Isolated Outputs; ☑ Resolution: 12 bits; ☑ Signal: (-10 to +10)V, RL 10kΩ (max. load); ☑ Programmable Functions.
	DIGITAL	☑ 1 isolated open collector transistor output, 24Vdc, 50mA; ☑ 2 relays with NO/NC-contacts, 240Vac, 1A; ☑ Programmable Functions.
SAFETY	PROTECTION	☑ Overcurrent/short-circuit at output; ☑ Power undervoltage/Overvoltage; ☑ Power overtemperature or servomotor overtemperature; ☑ Braking resistor overload; ☑ Output overload (IxT); ☑ External fault; ☑ CPU/EPROM error; ☑ Output phase-ground short-circuit; ☑ Resolver fault; ☑ Serial communication fault.
HUMAN - MACHINE INTERFACE (HMI)	HMI STANDARD	☑ 4 keys: Increment, Decrement, Reset and Programming; ☑ LED Display (7 segments) with 5 digits; ☑ LED's for indication of "Power on" and "Fault"; ☑ Permits access/change of all parameters; ☑ Display accuracy: - Current: 5% of the Rated Current; - Speed resolution: 1rpm.

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HUMAN MACHINE INTERFACE (HMI)	REMOTE HMI (HMI-SCA-05-LCD)	☑ 8 keys: Run/Stop; Increment, Decrement, Direction of Rotation, Jog, Local/Remote and Programming; ☑ LCD display with 2 lines of 16 alphanumeric characters and LED display (7-segment) with 4 digits; ☑ LED´s for indication of Direction of Rotation; ☑ Permits access/change of all parameters; ☑ Display accuracy: - Current: 5% of the Rated Current; - Speed resolution: 1rpm. ☑ May be assembled externally, cables up to 10m are available.
DEGREE OF PROTECTION	IP20	

9.2.1 Standards

GENERAL	☑ **UL508C** - *Power conversion equipment.* ☑ **UL840** - *Insulation coordination including clearances and creepage distances for electrical equipment.* ☑ **EN50178** - *Electronic equipment for use in power installations.* ☑ **EN60204-1** - *Safety of machinery. Electrical equipment of machines. Part 1: General requirements. Provisions for compliance: the final assembler of the machine is responsible for installing:* *- an emergency-stop device;* *- a supply disconnecting device.* ☑ **EN60146 (IEC 146)** - *Semiconductor convertors.* ☑ **EN61800-2** - *Adjustable speed electrical power drive systems - Part 2: General requirements - Rating specifications for low voltage adjustable frequency AC power drive systems.*
EMC	☑ **EN 61800-3** - *Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods.* ☑ **EN55011** - *Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.* ☑ **CISPR11** - *Industrial, scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement.* ☑ **EN61000-4-2** - *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test.* ☑ **EN61000-4-3** - *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test.* ☑ **EN61000-4-4** - *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test.* ☑ **EN61000-4-5** - *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test.* ☑ **EN61000-4-6** - *Electromagnetic compatibility (EMC)- Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields.*
ENCLOSURE	☑ **EN60529** - *Degrees of protection provided by enclosures (IP code).* ☑ **UL50** - *Enclosures for electrical equipment.*

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