Motors | Energy | Automation | Coatings

Medium Voltage Frequency Inverter

Convertidor de Frecuencia de Media Tensión

Inversor de Freqüência de Média Tensão

MVW-01

User's Guide
Manual del Usuario
Manual do Usuário

Medium Voltage Frequency Inverter Manual

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Revision	Description	Chapter
1	First Edition	-
2	Addition of functions: Vector Control with Encoder; Sensorless Vector Control; Ride-Through for vector control; Redundant Ventilation; Multivariable Read-Only Parameter; WEG Protocol with 19200bps and 38400bps; DeviceNet Drive Profile Board Communication Protocol; New alarm and fault parameters for the 4000 HP parallel drive, frame size C; General revision.	1,6 and 7

QUICK PARAMETER REFERENCE, FAULTS AND STATUS MESSAGES

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QUICK PARAMETER REFERENCE, FAULTS AND STATUS MESSAGES

Software: V1.7 X
Aplication:
Model:
Serial number:
Responsible:
Date: / / .

I. Parameters

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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P222 (1)	REMOTE Speed Reference Selection	0=HMI (Keypad) 1=AI1 2=AI2 3=AI3 4=AI4 5=Sum AI > 0 6=Sum AI 7=E.P. 8=Multispeed 9=Serial 10=Fieldbus 11=AI5 12=PLC	1=AI1	-		6-46
P223 (1)	LOCAL FWD/REV Selection	0=Always FWD 1=Always REV 2=Keypad (FWD) 3=Keypad (REV) 4=DI2 5=Serial (FWD) 6=Serial (REV) 7=Fieldbus (FWD) 8=Fieldbus (REV) 9=Polarity AI4 10=PLC (FWD) 11=PLC (REV)	2=Keypad (FWD)	-		6-46
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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
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P236	Analog Input AI1 Offset	-100.0 to +100.0	0.0	%		6-55
P237 (1)	Analog Input AI2 Function (Bipolar)	0=P221/P222 1=Not Used 2=Maximum Torque Current 3=Process Variable PID	0=P221/P222	-		6-55
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P243 (1)	Analog Input AI3 Signal	0=(0 to 10) V/(0 to 20) mA 1=(4 to 20) mA 2=(10 to 0) V/(20 to 0) mA 3=(20 to 4) mA	0=(0 to 10) V/ (0 to 20) mA	-		6-56
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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
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Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
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P264 (1)	Digital Input DI2 Function	0=FWD/REV 1=Local / Remote	0=FWD/REV	-		6-60
P265 (1)	Digital Input DI3 Function	0=Not Used 1=Local / Remote 2=General Enable 3=JOG 4=No External Fault 5=Increase E.P. 6=Ramp 2. 7=Not Used 8=Foward Run 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Start 15=Manual / Auto 16=No External Alarm 17=Not Used 18=Not Used 19=Parametrization Allowed 20=Load User 1 and 2 21=RL2 Timer 22=RL3 Timer 23=No Alarm at Redundant Fan Set A 24=No Alarm at Redundant Fan Set B 25=Initiates Synchronous Transfer 26=Ventilation OK	0=Not Used	-		6-60
P266 (1)	Digital Input DI4 Function	0=Not Used 1=Local / Remote 2=General Enable 3=JOG 4=No External Fault 5=Decrease E.P. 6=Ramp 2. 7=Multispeed 8=Reverse 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop 15=Manual / Auto 16=No External Alarm 17=Not Used 18=Not Used 19=Parametrization Allowed 20=Loads User 1 and 2 21=RL2 Timer 22=RL3 Timer 23=No Alarm at Redundant Fan Set A 24=No Alarm at Redundant Fan Set B 25=Initiates Synchronous Transfer 26=Ventilation OK	0=Not Used	-		6-60

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P267 (1)	Digital Input DI5 Function	0=Not Used 1=Local / Remote 2=General Enable 3=JOG 4=No External Fault 5= Increase E.P. 6=Ramp 2 7=Multispeed 8=Stop 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Start 15=Manual / Auto 16=No External Alarm 17=Not Used 18=Not Used 19=Parametrization Allowed 20=Load User 1 and 2 21=RL2 Timer 22=RL3 Timer 23=No Alarm at Redundant Fan Set A 24=No Alarm at Redundant Fan Set B 25=Initiates Synchronous Transfer 26=Ventilation OK	3=JOG	-		6-60
P268 (1)	Digital Input DI6 Function	0=Not Used 1=Local / Remote 2=General Enable 3=JOG 4= No External Fault 5=Decrease E.P. 6=Ramp 2 7=Multispeed 8=Stop 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop 15=Manual / Auto 16=No External Alarm 17=Not Used 18=Not Used 19=Parametrization Allowed 20=Load User 1 and 2 21=RL2 Timer 22=RL3 Timer 23=No Alarm at Redundant Fan Set A 24=No Alarm at Redundant Fan Set B 25=Initiates Synchronous Transfer 26=Ventilation OK	6= Ramp 2	-		6-60

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P269 (1)	Digital Input DI7 Function (use Expansion Board)	0=Not Used 1=Local/Remote 2=General Enable 3=JOG 4=No External Fault 5=Not Used 6=Ramp 2. 7=Not Used 8=Stop 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Start 15=Manual/Auto 16=Not Used 17=Not Used 18=Not Used 19=Parametrization Allowed 20=Load User 1 and 2 21=RL2 Timer 22=RL3 Timer 23=Initiates Synchronous Transfer 24=Ventilation OK	0=Not Used	-		6-60
P270 (1)	Digital Input DI8 Function (use Expansion Board)	0=Not Used 1=Local/Remote 2=General Enable 3=JOG 4=No External Fault 5=Not Used 6=Ramp 2 7=Not Used 8=Stop 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop 15=Man/Auto 16=Motor Thermo Resistor 17=Not Used 18=Not Used 19=Parametrization Allowed 20=Loads User 1 and 2 21=RL2 Timer 22=RL3 Timer 23=Initiates Synchronous Transfer 24=Ventilation OK	0=Not Used	-		6-60

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P271 (1)	Digital Input DI9 Function	0=Not Used 1=Local / Remote 2=General Enable 3=JOG 4=No External Fault 5=Not Used 6=Ramp 2 7=Not Used 8=Stop 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop 15=Manual/Auto 16=No External Alarm 17=Not Used 18=Not Used 19=No Motor Fault 20=No Motor Alarm 21=No Alarm at Redundant Fan Set A 22=No Alarm at Redundant Fan Set B 23=Initiates Synchronous Transfer 24=Ventilation OK	0=Not Used	-		6-61
P272 (1)	Digital Input DI10 Function	0=Not Used 1=Local/Remote 2=General Enable 3=JOG 4=No External Fault 5=Not Used 6=Ramp 2 7=Not Used 8=Stop 9=Not Used 10=JOG+ 11=JOG- 12=Reset 13=Fieldbus 14=Stop 15=Manual/Auto 16=No External Alarm 17=Not Used 18=Not Used 19=No Motor Fault 20=No Motor Alarm 21=No Alarm at Redundant Fan Set A 22=No Alarm at Redundant Fan Set B 23=Initiates Synchronous Transfer 24=Ventilation OK	0=Not Used	-		6-61

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
	Digital Outputs					
P275 $^{(1)}$	Digital Output DO1 Function (use Expansion Board)	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20)mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=With Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Not Used 30=Redundant Ventilation Selection 31=Not Used 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transfer OK 34=Synchronism OK 35=Serial	0=Not Used	-		6-67
P276 $^{(1)}$	Digital Output DO2 Function (use Expansion Board)	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20)mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=With Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Not Used 30=Redundant Ventilation 31=Not Used 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transference OK 34=Synchronism OK 35=Serial	0=Not Used	-		6-67

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P277 (1)	Relay Output RL1 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20) mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Not Used 30=Redundant Ventilation 31=PLC 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transference OK 34=Synchronism OK 35=Serial	13=Not Used	-		6-67
P279 (1)	Relay Output RL2 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20) mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=With Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Timer 30=Redundant Ventilation 31=PLC 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transference OK 34=Synchronism OK 35=Serial	2= N > Nx	-		6-67

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P280 $^{(1)}$	Relay Output RL3 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20)mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=With Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Timer 30=Redundant Ventilation 31=PLC 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transference OK 34=Synchronism OK 35=Serial	1= N*>Nx	-		6-67
P281 $^{(1)}$	Relay Output RL4 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20)mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=With Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Not Used 30=Redundant Ventilation 31=Not Used 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transference OK 34=Synchronism OK 35=Serial	0=Not Used	-		6-67

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P282 (1)	Relay Output RL5 Function	0=Not Used 1=N* > Nx 2=N > Nx 3=N < Ny 4=N = N* 5=N = 0 6=Is > Ix 7=Is < Ix 8=Not Used 9=Not Used 10=Remote 11=Run 12=Ready 13=No Fault 14=No E71+E70 15=No E22+E21+E06 16=No E62 17=No E72 18=(4 to 20)mA OK 19=Fieldbus 20=Forward 21=Process Variable > VPx 22=Process Variable < VPy 23=Not Used 24=Pre-charge OK 25=With Fault 26=N>Nx and Nt>Nx 27=No Fault, with Delay 28=No Alarm 29=Not Used 30=Redundant Ventilation Selection 31=Not Used 32=Circuit Break ON (Input Circuit Breaker ON) 33=Transfer OK 34=Synchronism OK 35=Serial	0=Not Used	-		6-67
P283	Time to RL2 ON	0.0 to 300.0	0.0	s		6-72
P284	Time to RL2 OFF	0.0 to 300.0	0.0	s		6-72
P285	Time to RL3 ON	0.0 to 300.0	0.0	s		6-72
P286	Time to RL3 OFF	0.0 to 300.0	0.0	s		6-72
Nx,Ny,Ix,N=0,N=N* and Tx						
P288 (2)	Nx Speed	0 to P134	120	rpm		6-72
P289 (2)	Ny Speed	0 to P134	1800	rpm		6-72
P290 (5)	IxCurrent	0 to 2.0xP295	1.0xP295	A		6-72
P291	Zero Speed Zone	1 to 100	1	%		6-72
P292	Band for N=N*	1 to 100	1	%		6-72
P293	*Tx Torque*	*0 to 200 (P401)*	*100 (P401)*	*%*		*6-72*

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
	Inverter Data					
P295 (1)	Inverter Rated Current	0=32 1=53 2=70 3=80 4=85 5=94 6=100 7=110 8=112 9=120 10=130 11=138 12=140 13=150 14=160 15=162 16=165 17=170 18=175 19=186 20=188 21=210 22=235 23=250 24=265 25=280 26=300 27=310 28=357 29=375 30=386 31=450 32=475 33=490 34=500 35=560 36=580 37=1064	According to the rated current of the Inverter	A		6-73
P296 (1)	Inverter Rated Voltage	0=220/230 1=380 2=2300 3=3300 4=4160	According to the voltage supply Inverter	V		6-74
P297 (1)	Switching Frequency	0=200 1=333 2=250 3=500	3=500	Hz		6-74
	Avoided Speeds					
P303	Skip Speed 1	P133 to P134	600	rpm		6-75
P304	Skip Speed 2	P133 to P134	900	rpm		6-75
P305	Skip Speed 3	P133 to P134	1200	rpm		6-75
P306	Skip Band	0 to 750	0	rpm		6-75
	Serial Communication					
P308 (1)	Inverter Address	1 to 30	1	-		6-75

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P309 (1)	Fieldbus	0=Inactive 1=Profibus DP 2 I/O 2=Profibus DP 4 I/O 3=Profibus DP 6 I/O 4=DeviceNet 2 I/O 5=DeviceNet 4 I/O 6=DeviceNet 6 I/O 7=Modbus-RTU 2 I/O 8=Modbus-RTU 4 I/O 9=Modbus-RTU 6 I/O 10=DeviceNet Drive Profile 11=Ethernet IP 2 I/O 12=Ethernet IP 4 I/O 13=Ethernet IP 6 I/O	0=Inactive	-		6-76
P312	Type of Serial Protocol	0=WEG Protocol 1=Modbus-RTU,9600 bps, without parity 2=Modbus-RTU,9600 bps, odd parity 3=Modbus-RTU,9600 bps, even parity 4=Modbus-RTU,19200 bps, without parity 5=Modbus-RTU,19200 bps, odd parity 6=Modbus-RTU,19200 bps, even parity 7=Modbus-RTU,38400 bps, without parity 8=Modbus-RTU,38400 bps, odd parity 9=Modbus-RTU,38400 bps, even parity 10=WEG Protocol,19200 bps 11=WEG Protocol,38400 bps	0=WEG Protocol	-		6-76
P313	Type of Disabling by A128/A129/ A130	0=Run/Stop 1=General Enable 2=Inactive 3=Changes to Local	0=Run/Stop	-		6-76
P314	Time for Serial Watchdog Action	0.0 to 999.0	0.0	s		6-77
P315	MVC1 1 Serial Function	0=HMI 1=TECSYSTEM	0=HMI	-		6-77
	Flying Start/Ride-Through					
P320 (1)	Flying Start/Ride-Through	0=Inactive 1=Flying Start 2=Flying Start + Ride-Through 3=Ride-Through	0=Inactive	-		6-77
P321 (4)	Ud Line Loss Level	166 to 800 (P296=0) 287 to 800 (P296=1) 2000 to 8000 (P296=2) 2000 to 8000 (P296=3) 2000 to 8000 (P296=4)	252 436 2681 3847 4850	V		6-77
P322 (4)	Ud Ride-Through	166 to 800 (P296=0) 287 to 800 (P296=1) 2000 to 8000 (P296=2) 2000 to 8000 (P296=3) 2000 to 8000 (P296=4)	245 423 2598 3728 4700	V		6-78
P323 (4)	Ud Line Recovery Level	166 to 800 (P296=0) 287 to 800 (P296=1) 2000 to 8000 (P296=2) 2000 to 8000 (P296=3) 2000 to 8000 (P296=4)	267 461 2930 4204 5300	V		6-78
P325	Ride-Through Proportional Gain	0.0 to 63.9	1.0	-		6-79
P326	Ride-Through Integral Gain	0 to 9999	201	-		6-79

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
P327	Sensorless Flying Start Delay	0.000 to 9.999	0.100	s		6-79
P328	Sensorless Flying Start Frequency	0=P134 1=P001	0	-		6-79
P329	Sensorless Flying Start Direction	0=+P328 1=-P328	0	-		6-79
P331	Voltage Ramp	0.2 to 50.0	8.0	s		6-80
P332	Dead Time	0.1 to 20.0	10.0	s		6-80
P333	Ride-Through Time	0.0 to 20.0	10.0	s		6-80
	MOTOR PARAMETERS P400 to P499					
	Motor Nameplate Data					
P400 (1)(4)	Motor Rated Voltage	0 to 9999	P296	V		6-82
P401 (1)	Motor Rated Current	0.0 to 1.30xP295	1.0xP295	A		6-82
P402 (1)	Motor Rated Speed	0 to 7200	1796	rpm		6-82
P403 (1)	Motor Rated Frequency	0 to100	60	Hz		6-82
P404 (1)	*Motor Rated Power*	*0*	*-*	*-*		*6-82*
P405	Encoder PPR	100 to 9999	1024	ppr		6-82
P406 (1)(2)	Motor Ventilation Type	0=Self Ventilated 1=Separate Ventilation	0=Self Ventilated	-		6-82
P408 (1)	Self-tuning	0=No Self-tuning 1=Self-tuning	0=No Self-tuning	-		6-82
P409 (1)	Motor Stator Resistance (Rs)	0.000 to 9.999	0.000	Ω		6-82
P410	Motor Magnetizing Current (Imr)	0 to 1.25xP295	0.0	A		6-83
P411 (1)	Motor Flux Leakage Inductance (σIs)	0.00 to 99.99	0.00	mH		6-83
	Measured Parameters					
P412 (1)	Lr/Rr Constant (Rotor Time Constant)	0.000 to 9.999	0.000	s		6-83
P413 (1)	TM Constant	0.00 to 99.99	0.00	s		6-83
P414	Magnetizing Voltage	0.0 to 20.0	0.0	%		6-83
	SPECIAL FUNCTIONS PARAMETERS P520 to P725					
	PID Regulator					
P520	PID Proportional Gain	0.000 to 7.999	1.000	-		6-86
P521	PID Integral Gain	0.000 to 9.999	1.000	-		6-86
P522	PID Differential Gain	0.000 to 9.999	0.000	-		6-86
P523	PID Ramp Time	0.0 to 999.0	3.0	s		6-86
P524 (1)	Selection of the PID Feedback	0=AI2 1=AI3	0=AI2	-		6-87
P525	PID Setpoint	0.0 to 100.0	0.0	%		6-87
P526	Process Variable Filter	0.0 to 16.0	0.1	s		6-87
P527	PID Action	0=Direct 1=Reverse	0=Direct	-		6-88
P528	Process Variable Scale Factor	0 to 9999	1000	-		6-89
P529	Process Variable Decimal Point	0 to 3	1	-		6-89
P530	Engineering Unite Process Variable 1	32 to 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	37=%	-		6-90
P531	Engineering Unite Process Variable 2	32 to 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	32=blank	-		6-90
P532	Engineering Unite Process Variable 3	32 to 127 (ASCII) A, B, ..., Y, Z 0, 1, ..., 9 #, $, %, (,), *, +, ...	32=blank	-		6-90
P533	Value of Process Variable X	0.0 to 100.0	90.0	%		6-90
P534	Value of Process Variable Y	0.0 to 100.0	10.0	%		6-90
P535	Wake up Band	0 to 100	0	%		6-90

Parameters	Description	Range	Factory Setting	Unit	User Setting	Page
	Trace Function					
P550	Trigger Parameter	0 to 999	0	-		6-96
P551	Trigger Value	-32768 to +32767	0	-		6-96
P552	Trigger Condition	0 to 20	4	-		6-97
P553	Sampling Time	1 to 9999	1	x500μs		6-97
P554	Pre - Trigger %	0 to 100	50	%		6-98
P555	CH1	0 to 727	1	-		6-98
P556	CH1 I/O Mask	0 to 16	0	-		6-99
P557	CH2	0 to 727	2	-		6-98
P558	CH2 I/O Mask	0 to 16	0	-		6-99
P559	CH3	0 to 727	3	-		6-98
P560	CH3 I/O Mask	0 to 16	0	-		6-99
P561	CH4	0 to 727	4	-		6-98
P562	CH4 I/O Mask	0 to 16	0	-		6-99
P563	CH5	0 to 727	5	-		6-98
P564	CH5 I/O Mask	0 to 16	0	-		6-99
P565	CH6	0 to 727	6	-		6-98
P566	CH6 I/O Mask	0 to 16	0	-		6-99
P567	CH7	0 to 727	7	-		6-98
P568	CH7 I/O Mask	0 to 16	0	-		6-99
P569	CH8	0 to 727	68	-		6-98
P570	CH8 I/O Mask	0 to 16	0	-		6-99
P571	Trace Start/Stop	0=Inactive 1=Active	0=Inactive	-		6-100
P572	Trace % of Memory	1 to 100	100	%		6-100
P721 (1)	Input AI5 Function	0=P221/P222	0=P221/P222	-		6-102
P722	Input AI5 Gain	0.000 to 9.999	1.000	-		6-102
P723 (1)	Input AI5 Signal	0=(0 to 10) V/(0 to 20) mA 1=(4 to 20) mA 2=(10 to 0) V/(20 to 0) mA 3=(20 to 4) mA	0=(0 to 10) V/ (0 to 20) mA	-		6-102
P724	Input AI5 Offset	0.0 to +100.0	0.0	%		6-102
P725	Minimum Time of Coast	0 to 300	0	s		6-102

NOTE!

Quick parameter reference notes:

(1) Parameter can be changed only with the inverter disabled (motor stopped).

(2) Values may change as a function of the motor parameters.

(3) Values may change as a function of P412.

(4) Values may change as a function of P296.

(5) Values may change as a function of P295.

(6) Values may change as a function of P320.

ATTENTION!

Parameters and functions described in clear grey italic are not implemented in this software version.

II.Messages of Alarms and Faults

The faults of the MVW-01 can be subdivided in Alarms (Axxx) and Faults (Fxxx). In general, the alarms serve to indicate a situation that, if it is not corrected, it can carry the inverter to stop by fault. A signalized fault indicates a situation that carried the inverter to be desabilitated (main breaker opening can or not ocurr, depending of the type of fault).

Table I *- Alarm and fault messages*

Indication (A=Alarm / F=Failure)	Meaning	Page
A 001	Mains low voltage	7-1
A 002	Mains high voltage	7-1
F 003	Mains undervoltage	7-1
F 004	Mains overvoltage	7-1
F 006	Mains unbalance / loss of phase	7-1
F 007	Mains voltage feedback fault	7-1
A 008	Line synchronism time-out	7-1
A 010	Rectifier high temperature	7-2
F 011	Rectifier overtemperature	7-2
F 012	Rectifier feedback temperature fault	7-2
F 014	Circuit breaker closing fault	7-2
F 015	Circuit breaker opening fault	7-2
F 016	External disconnection for breaker protection	7-2
F 017	Circuit breaker not ready	7-2
A 018	Input transformer alarm	7-2
F 019	Input transformer fault	7-2
F 020	Pre-load fault	7-2
F 021	DC link undervoltage	7-3
F 022	DC link overvoltage	7-3
F 023	DC link imbalance	7-3
F 024	Link DC voltage feedback fault	7-3
F 025	Door closing fault	7-3
F 026	CB not ready	7-3
F 030	S1U IGBT fault	7-3
F 031	S2U IGBT fault	7-3
F 032	S3U IGBT fault	7-3
F 033	S4U IGBT fault	7-3
F 034	S1V IGBT fault	7-3
F 035	S2V IGBT fault	7-4
F 036	S3V IGBT fault	7-4
F 037	S4V IGBT fault	7-4
F 038	S1W IGBT fault	7-4
F 039	S2W IGBT fault	7-4
F 040	S3W IGBT fault	7-4
F 041	S4W IGBT fault	7-4
F 042	IGBT 1 of braking fault	7-4
F 043	IGBT 2 of braking fault	7-4
F 044	Arc detection	7-4
F 045	PS1 power supply fault	7-4
A 046	Alarm I x t	7-4
F 047	IGBT overload fault	7-4
F 048	Forced ventilation fault	7-4
A 050	U phase heatsink high temperature	7-5
F 051	U phase heatsink overtemperature	7-5
F 052	U phase heatsink temperature feedback fault	7-5
A 053	V phase heatsink high temperature	7-5
F 054	V phase heatsink overtemperature	7-5
F 055	V phase heatsink temperature feedback fault	7-5
A 056	W phase heatsink high temperature	7-5

Table I (cont.) *- Alarm and fault messages*

Indication (A=Alarm / F=Failure)	Meaning	Page
F 057	W phase heatsink overtemperature	7-5
F 058	W phase heatsink temperature feedback fault	7-5
A 059	Braking arm high temperature	7-6
F 060	Braking arm overtemperature	7-6
F 061	Braking arm temperature feedback fault	7-6
F 062	Thermal imbalance between phases U,V and W	7-6
F 063	U output feedback fault	7-6
F 064	V output feedback fault	7-6
F 065	W output feedback fault	7-6
F 066	Null current	7-6
F 068	Failure when entering in test mode	7-6
F 069	Calibration fault	7-6
F 070	Overcurrent / short circuit	7-6
F 071	Overcurrent at output	7-6
F 072	Overload I x t	7-6
A 073	Fault to ground alarm	7-7
F 074	Fault to ground	7-7
F 075	Voltage PM-ground feedback fault	7-7
F 076	Motor connection open / Motor unbalanced current	7-7
F 077	Braking resistor overload	7-7
F 078	Motor overtemperature	7-7
F 079	Encoder fault	7-7
F 080	CPU (watchdog) fault	7-7
F 081	Checksum error	7-7
F 082	Copy function fault	7-7
F 083	Programming fault	7-7
F 085	Electronic power supply fault	7-7
F 087	Control boards communication fault	7-7
F 090	External defect (MVC2) fault	7-8
F 092	Pre-charge supply fault	7-8
A 093	Rectifier redundant ventilation failure alarm - set A	7-8
A 094	Inverter redundant ventilation failure alarm - set A	7-8
F 095	PS1 supply fault	7-8
A 096	Alarm 4 to 20 mA (current <3mA)	7-8
F 097	Fault 4 to 20 mA	7-8
A 098	Not recorded help/Incompatible graphic HMI version	7-8
F 099	Current offset not valid	7-8
F 100	MVC1 fatal fault	7-8
F 101	Software version not compatible	7-8
F 102	Failure not known in EPLD of MVC1	7-8
F 103	MVC1 RAM fault	7-8
F 104	A/D of MVC1 fault	7-8
F 105	EEPROM of MVC1 fault	7-8
F 106	MVC2 fatal fault	7-8
A 108	Inverter not initialized alarm	7-8
F 109	MVC1 external general disable fault	7-8
A 110	Motor overtemperature alarm	7-8
A 111	External defect alarm	7-8
F 112	Motor overspeed fault	7-8
A 113	Rectifier redundant ventilation failure alarm - set B	7-8
A 114	Inverter redundant ventilation failure alarm - set B	7-8
A 124	Parameter alteration with enabled inverter	7-8
A 125	Reading / writing in inexistent parameter	7-8
A 126	Value outside of the range	7-8
A 127	Function not configureted for Fieldbus	7-8
A 129	Inactive Fieldbus connection	7-8
A 130	Inactive Fieldbus board	7-8
A 131 (1)	Rectifier B high temperature	7-9

Table I (cont.) *- Alarm and fault messages*

Indication (A=Alarm / F=Failure)	Meaning	Page
F 132 (1)	Rectifier B overtemperature	7-9
F 133 (1)	Rectifier B temperature feedback fault	7-9
F 134 (1)	S1U B IGBT fault	7-9
F 135 (1)	S2U B IGBT fault	7-9
F 136 (1)	S3U B IGBT fault	7-9
F 137 (1)	S4U B IGBT fault	7-9
F 138 (1)	S1V B IGBT fault	7-9
F 139 (1)	S2V B IGBT fault	7-9
F 140 (1)	S3V B IGBT fault	7-9
F 141 (1)	S4V B IGBT fault	7-9
F 142 (1)	S1W B IGBT fault	7-10
F 143 (1)	S2W B IGBT fault	7-10
F 144 (1)	S3W B IGBT fault	7-10
F 145 (1)	S4W B IGBT fault	7-10
F 146 (1)	Braking IGBT 1 B fault	7-10
F 147 (1)	Braking IGBT 2 B fault	7-10
F 148 (1)	PS1 B electronic power supply fault	7-10
A 149 (1)	U B phase heatsink high temperature	7-10
F 150 (1)	U B phase heatsink overtemperature	7-10
F 151 (1)	U B phase heatsink temperature feedback fault	7-10
A 152 (1)	V B phase heatsink high temperature	7-10
F 153 (1)	V B phase heatsink overtemperature	7-11
F 154 (1)	V B phase heatsink temperature feedback fault	7-11
A 155 (1)	W B phase heatsink high temperature	7-11
F 156 (1)	W B phase heatsink overtemperature	7-11
F 157 (1)	W B phase heatsink temperature feedback fault	7-11
A 158 (1)	BR B heatsink high temperature	7-11
F 159 (1)	BR B heatsink overtemperature	7-11
F 160 (1)	BR B heatsink temperature feedback fault	7-11
F 161 (1)	Thermal imbalance between U B, V B and W B phases	7-11
F 162 (1)	U B output voltage feedback fault	7-11
F 163 (1)	V B output voltage feedback fault	7-11
F 164 (1)	W B output voltage feedback fault	7-11

(1) Frame size C models.

III. Other Messages

Table II *- Other messages*

Indication		Meaning
DISPLAY HMI LED	DISPLAY HMI LCD	
boot	Waiting Initialization	'Booting ' indicates that the control is waiting the finishing of its initialization.
sub	Inverter in Undervoltage	'Sub' indicates that the inverter is with insufficient mains voltage for operation (undervoltage) or the power was not energized (it misses to make pre-load and energize the input transformer). In this situation it is not accepted commands that enable the inverter (Enable General or Rotate / Stop).
rdy	Inverter Ready	'Inv.Ready' indicates that the inverter is ready to be enabled (General Enable, Start / Stop and/or Reference).

SAFETY NOTICES

This manual contains the necessary information for the correct use of the MVW-01 Frequency Inverter. It 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

Throughout this manual the following safety notes are used:

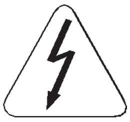
DANGER!
The procedures recommended in this warning have the purpose of protecting the user from death, severe personal injury and considerable property damage.

ATTENTION!
The procedures recommended in this warning have the purpose of preventing property damage.

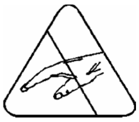
NOTE!
This warning provides important information for the proper understanding and operation of the equipment.

1.2 SAFETY NOTICES IN THE PRODUCT

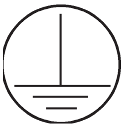
The following labels are attached to the product, serving as safety notes:



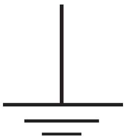
High Voltages



Electrostatic discharge sensitive components
Do not touch them



Mandatory connection to the protective ground (PE)



Connection of the shield to the ground

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!

Only qualified personnel familiar with the MVW-01 frequency inverter and associated equipment should plan or implement the installation, start-up and subsequent maintenance of this equipment

These personnel must follow all the safety instructions included in this manual and/or defined by local regulations.

Failure to comply with these instructions can lead to death, serious injuries or considerable material damage.

NOTE!

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

1. Install, ground, energize and operate the MVW-01 according to this manual and the effective legal safety procedures;
2. Use the protection equipments according to the established standards;
3. Give first aid services.

DANGER!

Always disconnect the main and auxiliary power supplies before touching any electric component associated to the inverter.

Many components may remain charged with high voltages or be in movement (fans) even after that AC power supply has been disconnected or switched off. In order to open or get access to the medium voltage panels, follow all the safe de-energization procedures (section 5.4).

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

ATTENTION!

Electronic boards have components sensitive to electrostatic discharges. Do not touch directly on components or connectors.

If necessary, touch the grounded metallic frame before or use an adequate grounded wrist strap.

DO NOT PERFORM ANY HIGH POT TEST WITH THE INVERTER!
IF IT IS NECESSARY CONSULT THE MANUFACTURER.

NOTE!

Frequency inverters may interfere with other electronic equipment. Take all the necessary precautions to minimize these effects.

NOTE!

Read the MVW-01 manual completely before installing or operating the inverter. Follow carefully the instructions and take the precautions of the safety notes contained in this manual.

GENERAL INFORMATION

This chapter defines the contents and the purpose of this manual and describes the main characteristics of the MVW-01 frequency inverter and how to identify its components. It provides also additional information on the receiving and storage of the product.

2.1 ABOUT THIS MANUAL

Eleven chapters presented in a logical sequence, in order to instruct the user on how to receive, install, program and operate the MVW-01, compose this manual:

Chapter 1 - Safety instructions;
Chapter 2 - General information;
Chapter 3 - Information on the MVW-01 mounting and on the electrical installation (power and control);
Chapter 4 - Keypad operation;
Chapter 5 - Start-up and safe de-energization, step by step;
Chapter 6 - Detailed description of the parameters;
Chapter 7 - Diagnostics, troubleshooting, preventive maintenance and cleaning instructions;
Chapter 8 - Optional devices characteristics and installation instructions;
Chapter 9 - Tables and technical information about the MVW-01 inverter series;
Chapter 10 - An attachment with the standard electric project;
Chapter 11 - Remissive index.

The purpose of this Manual is to provide the minimum necessary information for the proper use of the MVW-01. Due to this product variety of functions, it is possible to apply it in a variety of ways other than described herein. Neither is the intention of this manual to cover all application possibilities, nor can WEG assume any responsibility or liability for the MVW-01 use that is not based on this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of WEG, is prohibited.

2.2 SOFTWARE VERSION

It is important to note the software version installed in the MVW-01, since it defines the functions and the programming parameters of the inverter. This manual refers to the software version indicated on its first page. The version V1.0x, for instance, applies to versions 1.00 to 1.09, the “X” represent evolutions in the software that do not affect the contents of the manual.

The read-only parameter P023 presents the software version.

2.3 ABOUT THE MVW-01

The MVW-01 is a variable frequency inverter destined to control medium voltage induction motors with nominal voltages of 2300 V, 3300 V and 4160 V, and with a power range from 500 HP to 4000 HP. It uses non-controlled semiconductors (diodes) at the input rectifier stage and controlled semiconductors (HV-IGBTs) to generate the three output phases at the inverter stage, in order to control the medium voltage motor speed and torque.

The MVW-01 presents protections against overload, short-circuit, phase loss, undervoltage, overvoltage, overtemperature, and ground fault, it also has an independent fault monitoring for each HV-IGBT, has pressure sensors for ventilation efficiency monitoring, and presents output current limitation. The control type can be selected by the user, between scalar control (constant V/f ratio) and vector control (with sensorless or encoder feedback).

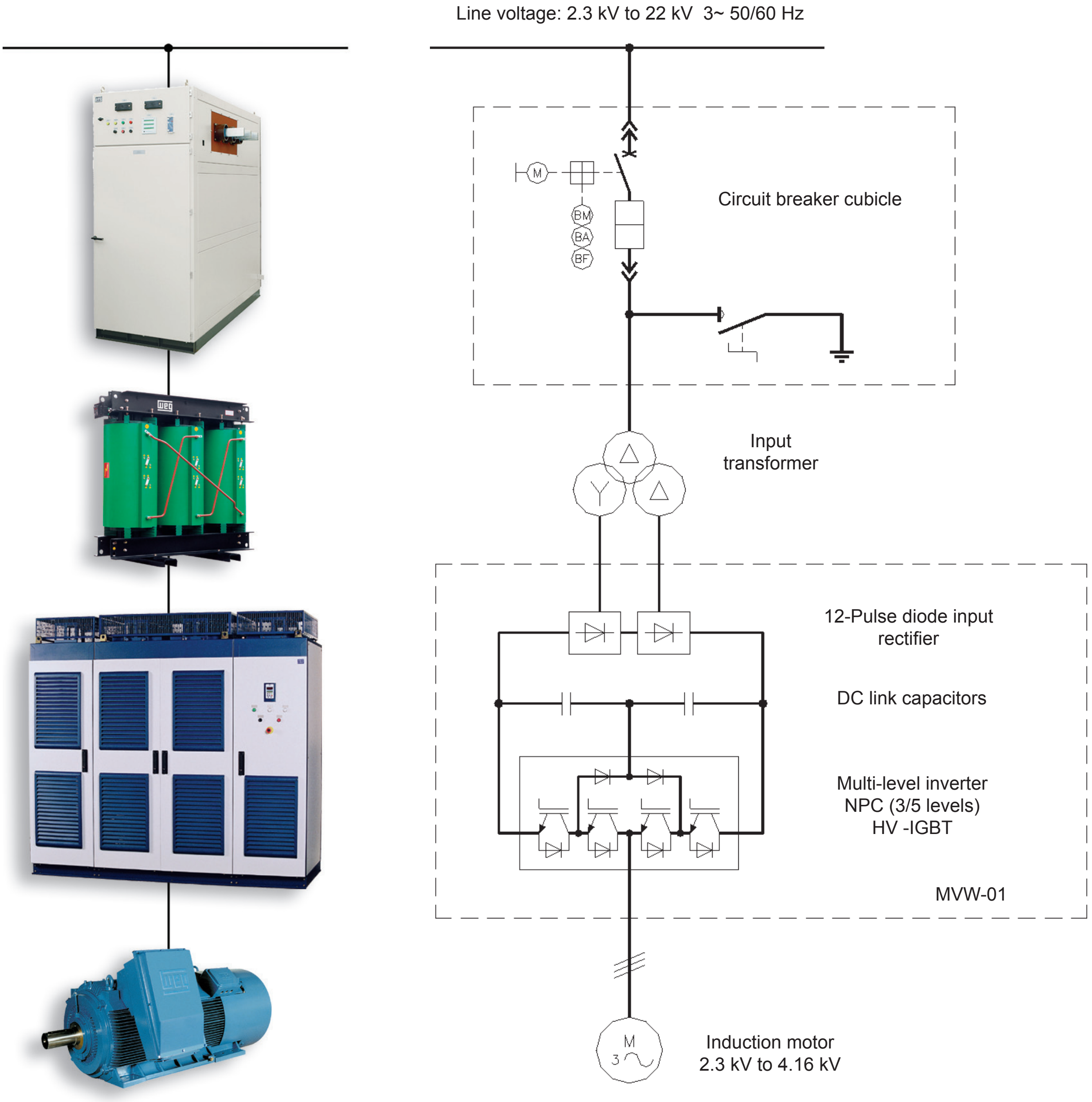


***Figure 2.1** - General block diagram*

The input stage rectifier is a 12-pulse diode bridge (it can be supplied optionally for 18 or 24 pulses). This bridge generates the inverter DC link voltage, receiving the supply voltage from an isolating transformer and a medium voltage circuit breaker. Both the transformer and the circuit breaker may be within the scope of the MVW-01 supply. The minimum specifications of the input transformer are:

- nominal power according to the inverter power rating considering the input current harmonics;
- minimum impedance of 6 %;
- shield between primary and secondary windings;
- primary voltage according to the available line voltage;
- secondary voltages according to the motor nominal voltage and 7.2 kV voltage insulation class.

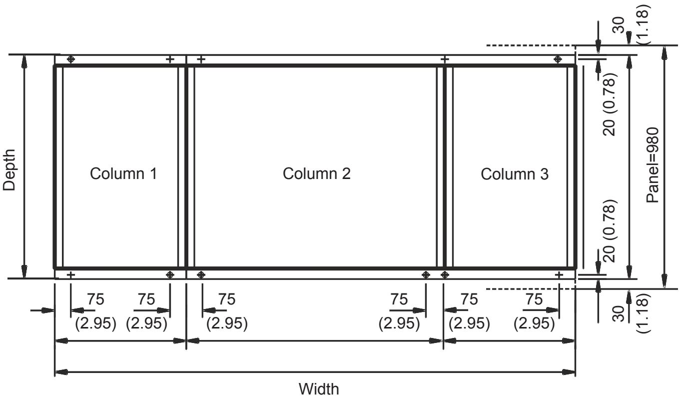
The DC link is composed by high reliable dry plastic film capacitors with long useful live used for filtering. The capacitor bank is distributed through the three arms and split into two parts by a series connection that creates a medium point dividing the DC link into two voltages, VP and VN. The medium point is necessary for the NPC - Neutral Point Clamped - inverter implementation, which is composed by 12 HV IGBTs (6.5 kV) and 6 clamping diodes, in a three-level topology.

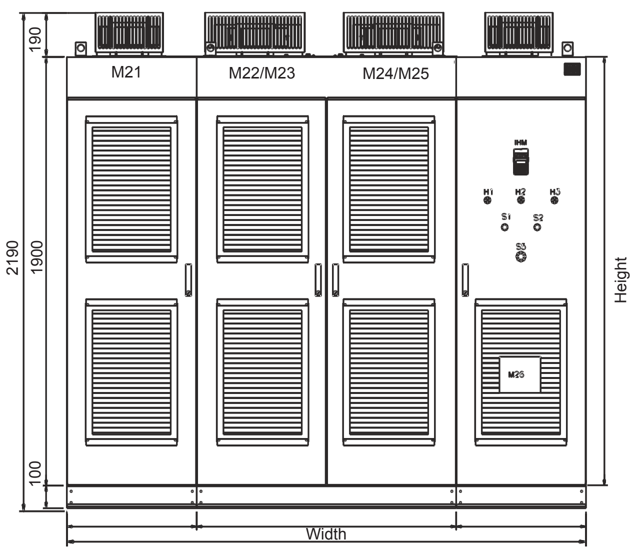
The complete inverter is assembled inside metallic cabinets with IP41 protection degree.

Figure 2.2 *- MVW-01 panel (frame size A)*

2.3.1 MVW-01 Panel Constructive Details

The MVW-01 line is assembled in panels with the following dimensions:





Frame size	Width	Height	Depth	Weight
	mm (in)	mm (in)	mm (in)	kg (lb)
A0	1000 (39.36)	2000 (78.73)	980 (38.60)	600 (1322.7)
A	2400 (94.48)	2190 (86.22)		1560 (3439.2)
B	2600 (102.36)			1700 (3747.8)
C	4000 (157.47)			2700 (5952.4)

Figure 2.3 *- MVW-01 panel dimensions in mm and inches*

The panel cooling is achieved by means of forced ventilation. The cold air enters through the grids located at the front doors, passes through the power section heatsinks, and the hot air is exhausted at the panel tops where the fans are installed.

The MVW-01 has been designed to comply with the CEI – IEC 61800 (part 4 and 5) standard.

The MVW-01 is appropriate for operation in industrial environments, with resistance to chemical agents and to corrosion.

The cabinet is built with painted steel plates that are processed (cutting, drilling, bending, chemical treatment, painting and finishing) at WEG, assuring the cabinet quality. The inverter parts that are not painted are zinc plated or have another suitable treatment in order to assure their resistance against corrosion.

The internal frame is composed by gauge #12 sheet steel (2.65 mm (0.10 in)) whereas the doors and closures are composed by gauge #14 sheet steel. The protection degree is IP41, for indoors environment.

The cooling air enters the panel through front openings protected by grids (one internal and another external) with air filters.

Filter cleaning or replacement can be done by removing the external grid with no need to open the doors and to interrupt the inverter operation. The internal grid with openings smaller than 10 mm prevents the access to the medium voltage compartment.

The hot air exhaustion occurs at the panel top where the exhausting fans are located, making service possible without opening the medium voltage compartment doors.

The medium voltage compartments (input rectifier and inverter) are mechanically and electrically interlocked in order to prevent the access to all the components that are able to present electric shock danger.

Only after closing the rectifier and the inverter stage doors it becomes possible to lock them by means of a mechanical interlocking device located at the control stage. This device has an electric switch that, once closed, enables the MVW-01 medium voltage energization. The door opening while the inverter is energized is not allowed.

In the event of door unlocking, the inverter disables the operation and switches off the input circuit breaker.

The control stage is fed by an auxiliary power supply (220-480 V) and can be locked in order to prevent access.

2.3.2 MVW-01 Electronic Boards

Table 2.1 *- MVW-01 Electronic boards*

	Name	Function	Column / Module
1	MVC1	Main control	Control / A8 Rack
2	MVC2	User interface control	Control / A8 Rack
3	FOI	It converts electrical signals into optical signals and vice-versa	Control / A8 Rack
4	PIC	Power supplies for the electronics, internal use digital inputs and relay outputs	Control / A8 Rack
5	EBA EBB EBC	Optional function expansion boards (refer to the chapter 8)	Control / A8 Rack
6	Fieldbus	Optional network communication boards (refer to the chapter 8)	Control / A8 Rack
7	ISOY	Signal feedback boards, they measure medium voltages or temperatures and send the information via optical signals (1 channel)	Rectifier / A9
8	ISOX	Signal feedback boards, they measure medium voltages or temperatures and send the information via optical signals (2 channels)	Rectifier / A9
9	PS24	Electronics power supply - Input: 220 Vac 3-phase - Output: 24 Vdc	Control / A11
10	PS1	Isolated power supply - Input: 22 Vac single-phase - Output: 15 Vdc	Rectifier / A9.5
11	HVM	It indicates that the DC link is energized (Neon lamps)	Inverter (visible in the control)
12	1SD210F2	Gate drivers	Inverter / BIR, BIS, BIT

2.3.3 MVW-01 Main Components

***Table 2.2** - MVW-01 Main Components*

	Name	Function	Location (column)
1	A1	Input rectifier	Rectifier
2	V1	Pre-charge rectifier	Rectifier
3	T2	Pre-charge transformer (210 V - 4.3 kV)	Rectifier
4	T3	PS1 Power supply transformer (220 V - 22 V)	Rectifier
5	F1	Medium voltage fuse for +UD (pre-charge)	Rectifier
6	A9.1	ISOY: Signal feedback board - Rectifier heatsink temperature	Rectifier
7	A9.2	ISOY: Signal feedback board - Medium Point to ground voltage	Rectifier
8	A9.3	ISOX.00: Signal feedback board - link P and N	Rectifier
9	A9.4	ISOX.01: Signal feedback board - Input voltage	Rectifier
10	A9.5	PS1 - Isolated power supply - Input: 22 Vac single-phase - Output: 15 Vdc	Rectifier
11	A15	Medium voltage resistors, for the Medium Point to ground voltage measurement	Rectifier
12	BIR	U phase inverter arm	Inverter
13	BIS	V phase inverter arm	Inverter
14	BIT	W phase inverter arm	Inverter
15	HCTU	U phase Hall effect CT	Inverter
16	HCTV	V phase Hall effect CT	Inverter
17	HCTW	W phase Hall effect CT	Inverter
18	Q1	General control circuit breaker - Auxiliary power supply	Control
19	T1	Auxiliary supply transformer Input: 220 V to 480 V (customer) Output: 220 V (internal)	Control
20	Q3	Circuit breaker for T3	Control
21	Q2	Circuit breaker for T2	Control
22	Q7	Electronics power supply PS24 circuit breaker	Control
23	Q4	Rectifier column exhausting fan circuit breaker	Control
24	Q5	Inverter column exhausting fans circuit breaker	Control
25	R2 to R7	Pre-charge resistors	Control
26	A8	Control rack	Control
27	A10	MVC1 - Main control board	Control
28	A11	PS24 - Electronics power supply - Input: 220 Vac 3-phase - Output: 24 Vdc	Control
29	PIC	Power supply and internal I/O board	Control
30	A12	MVC2 - Customer control board	Control
31	A13	EBX.XX - Optional function expansion board	Control
32	A14	Optional fieldbus board	Control
33	HMI	Human Machine Interface	Control

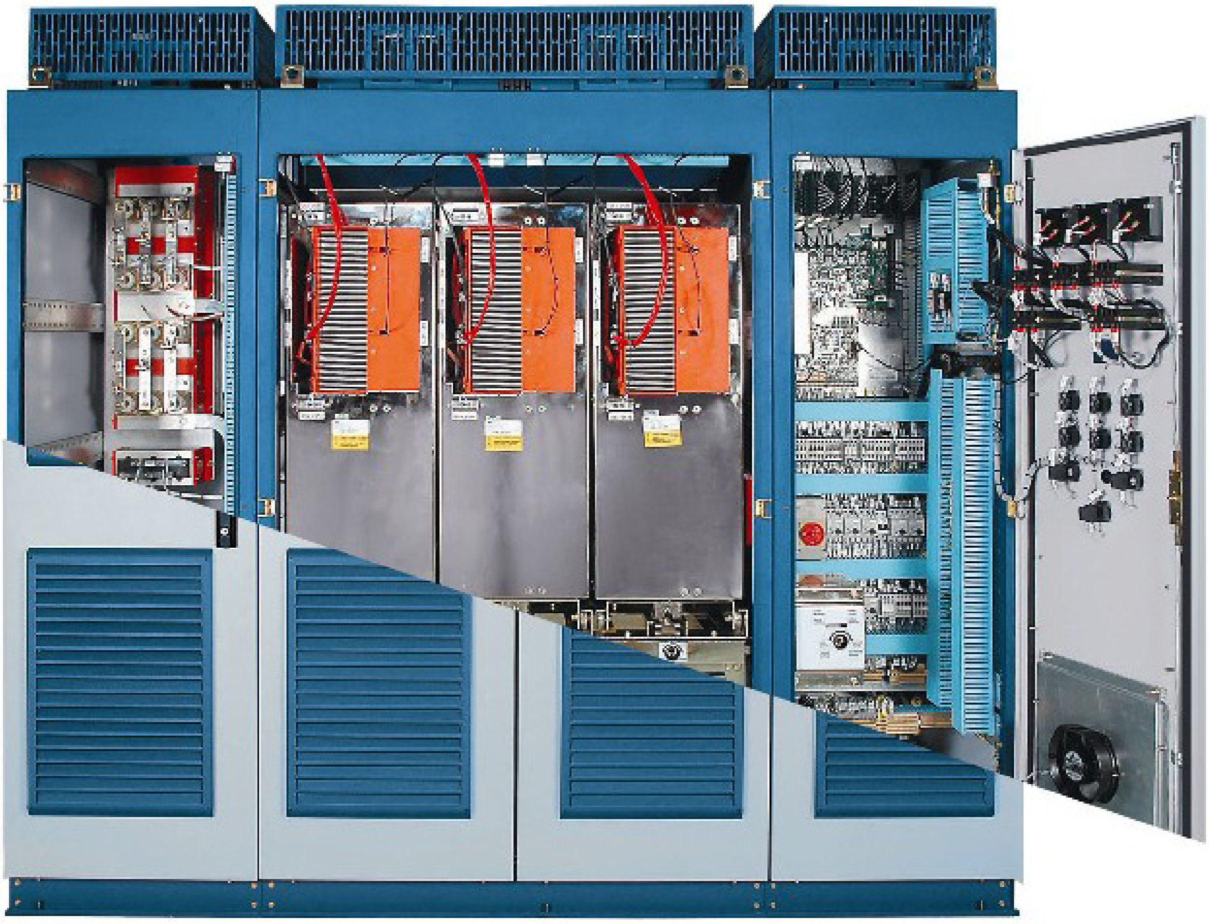


Figure 2.4 *- MVW-01 Panel general view*

The following block diagram provides a general view of the MVW-01 (for a standard project):

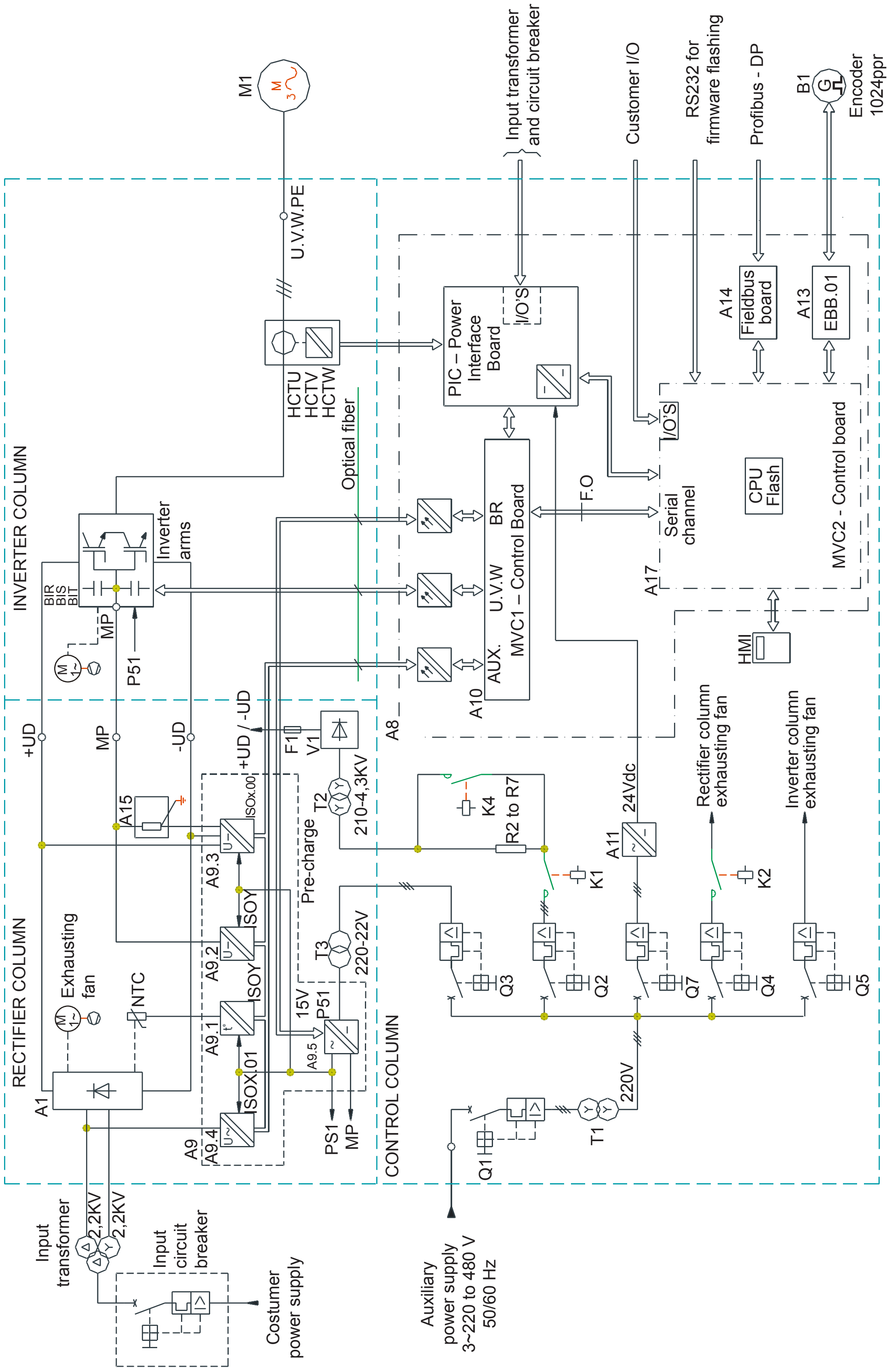
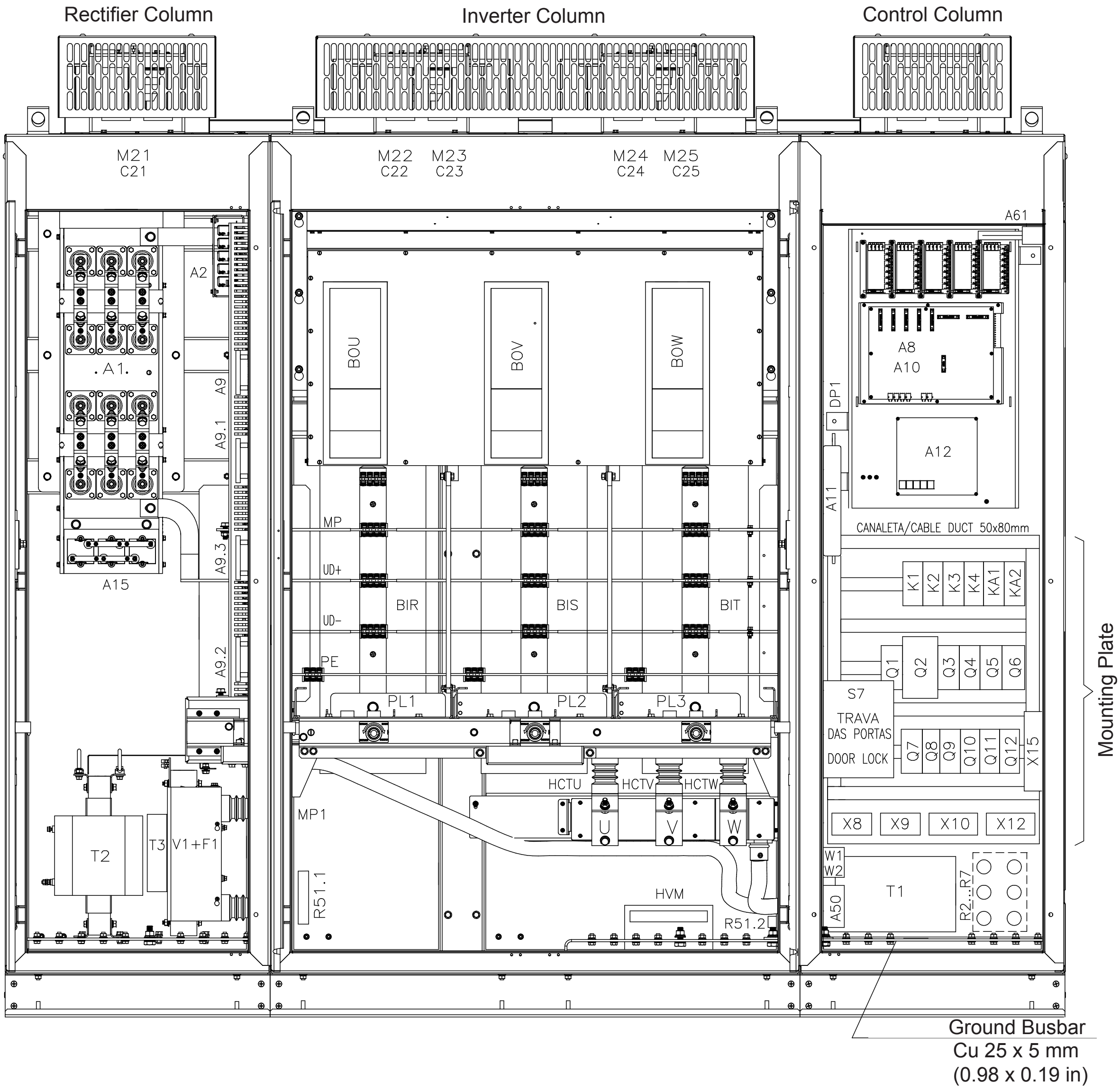


Figure 2.5 - *MVW-01 detailed block diagram*

The internal component distribution is presented in the figure 2.6 (frame size A).



Rectifier Column	Inverter Column	Control Column
The rectifier column receives the cables from the transformer through the bottom of the cabinet. Besides the power rectifier, this column also contains electronic boards destined to measurements and power supply, medium voltage pre-charge circuit, and medium voltage transformers to supply these circuits. The cabinet has a grounding bar and its door remains closed during the operation. The measured signals are sent to the control column via optical fibers.	The inverter column contains the inverter extractible arms (BIR, BIS and BIT). Connection bars for the motor medium voltage cables are available, and are accessed via the cabinet bottom. The arm semiconductors are controlled and monitored through fiber optic cables coming from the control column. This column also contains the medium voltage Hall effect current transformers, voltaic arc detection sensors and differential pressure sensor probe used to monitor exhausting fan faults. The cabinet also has a grounding bar and its door remains closed during the operation.	The control column contains the electronic rack composed by the control, fiber optics interface, power supply, I/O, optional (function expansion and communication network) boards, as well as the command and protection circuits destined to the system operation (circuit breaker + transformer + inverter + motor), command transformer, low voltage pre-charge circuit, Human Machine Interface and terminal strips (refer to the chapter 10 – electric project).

***Figure 2.6** - MVW-01 Internal components distribution (frame size A)*

2.3.4 Input Rectifier

The medium voltage cables for the input rectifier (A1) supply come from the input transformer secondary windings. The transformer configuration and the number of cables depend on the rectifier number of pulses:

- 12 pulses requires 6 cables;
- 18 pulses 9 cables;
- 24 pulses 12 cables.

Considering the standard rectifier version (12 pulses) the secondary winding voltage depends on the motor nominal voltage, being 2.2 kV for 4160 V motors, 1.75 kV for 3300 V motors and 1.2 kV for 2300 V motors. The 6 cables enter the rectifier cabinet at the top or at the bottom and are connected directly to terminals mounted on the rectifier module (A1) copper bars.

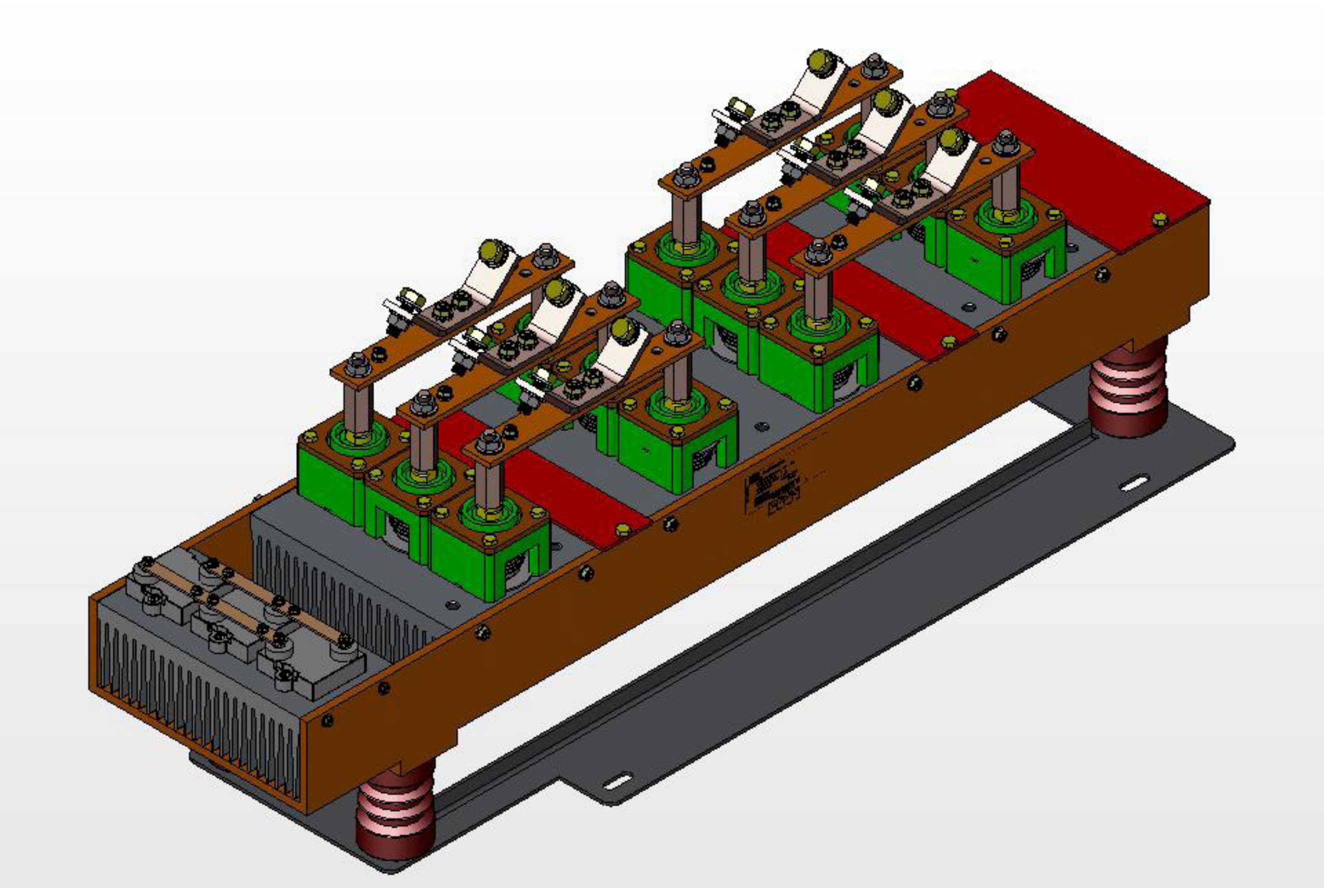


Figure 2.7 *- MVW-01 12-pulse rectifier*

The rectifier is connected to the DC link bus located at the rear part of the MVW-01 panel. The DC bus supplies the voltage for the three inverter power arms (BIR, BIS and BIT).

2.3.5 Inverter Arms

The inverter arms are identical and contain:

- 2 filtering capacitors (dry plastic film);
- 4 medium voltage IGBT modules;
- 1 medium voltage diode module;
- 1 power heatsink;
- 4 gate driver boards (one for each IGBT);
- 4 isolated DC/DC converters (gate driver boards power supply);
- 1 heatsink temperature sensor (NTC resistor);
- 1 ISOX.X2 Signal Feedback Board.

Steel plates chemically treated in order to assure corrosion resistance and BMC (polyester resin and fiberglass) plastic insulation material form the arm structure.

The singers/pinchers located at the back of the inverter cabinet make the electrical connection of the arms to the busbars. Chapter 3 describes the arm transportation and installation procedures.

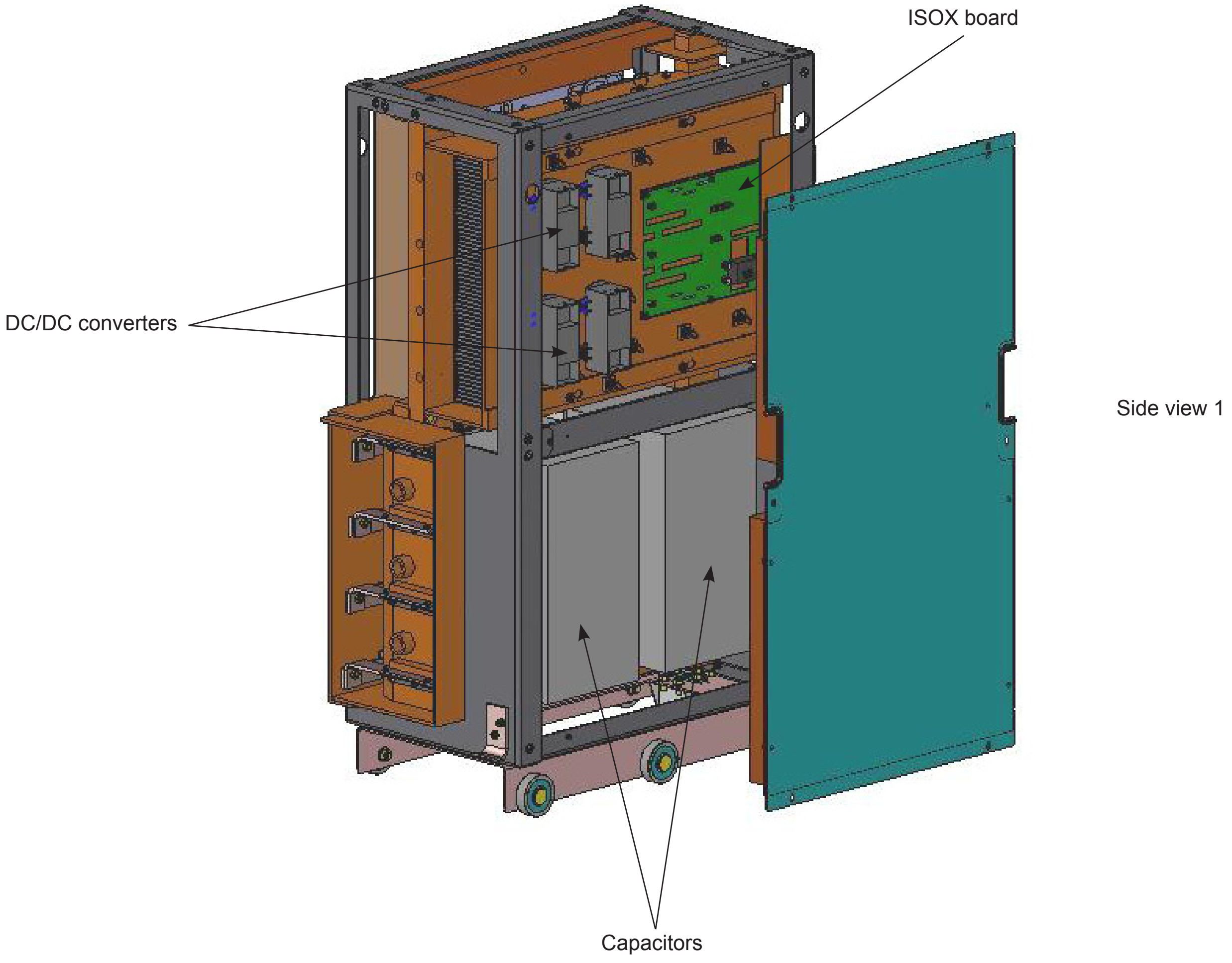


Figure 2.8 *- MVW-01 Power arm*

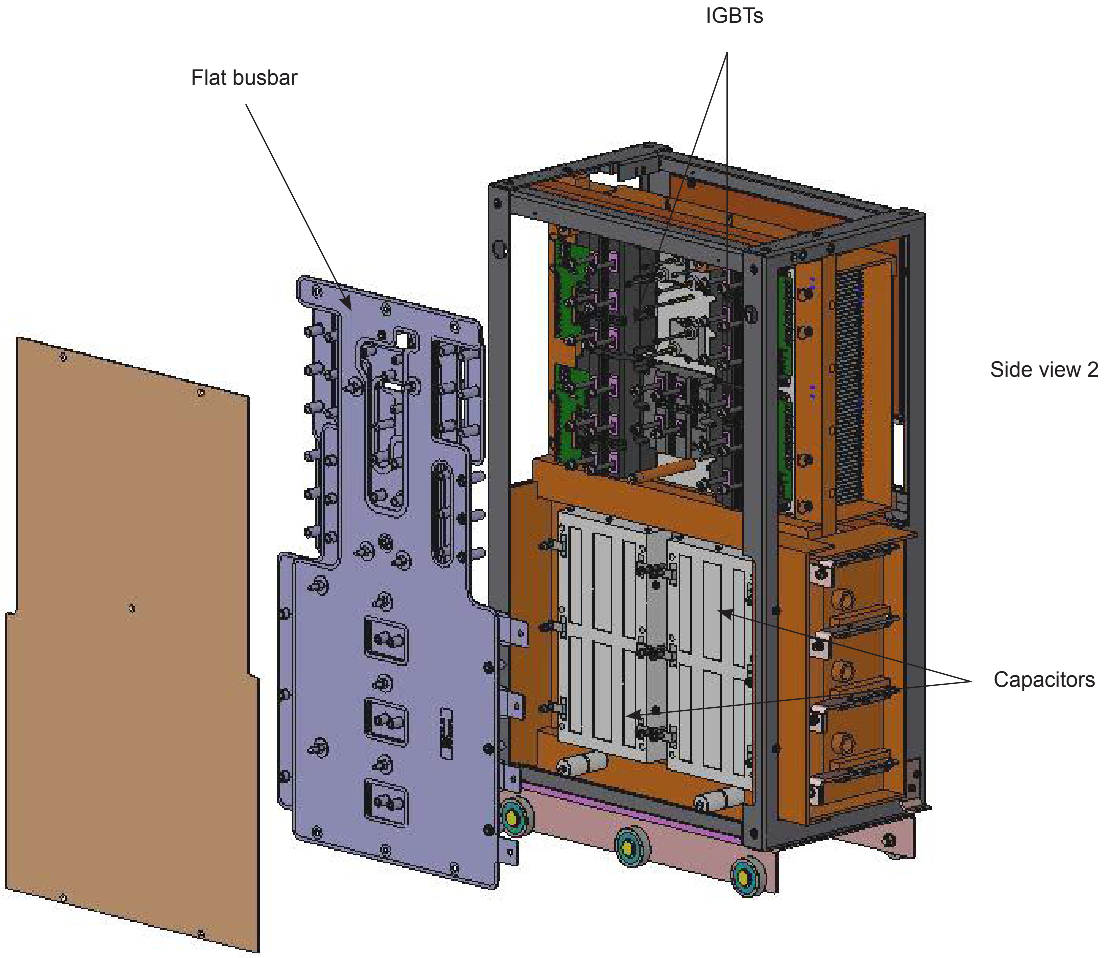


Figure 2.8 (cont.) *- MVW-01 Power arm*

2.3.6 Complementary Information

The inverter uses PWM (Pulsed Width Modulation) modulation technique, in order to produce AC voltage with variable frequency and amplitude, from the DC link voltage, and make it available to the motor at the output terminals. The motor connection terminals are copper bars and the outlet for the medium voltage motor cables is located at the front bottom of the inverter cabinet.

Medium voltage Hall effect CTs measure the output (motor) current at the three phases and send the signals to the control board. The inverter uses the measurements to indicate the current and to perform the control and protection functions of the INVERTER + MOTOR system.

There are electronic boards (A9.1 to A9.4) in the rectifier column destined to attenuate, measure, convert into frequency and send via optical fibers the following signals to the control column:

- 2 input transformer secondary line voltages;
- the rectifier heatsink temperature;
- 2 DC link voltages (+UD and -UD) referenced to the medium point (MP);
- the voltage between medium point and ground.

These boards (A9.1 to 9.4) as well as the boards and DC/DC converters present in the inverter arm are fed with 15 Vdc by the PS1 (A9.5) power supply, which is fed by the isolating transformer secondary winding.

During the power-up, due to the high inrush current that is necessary to load the DC link, a pre-charge in the DC link becomes necessary, and it is carried out by the rectifier (V1) and the high insulation transformer T2. The pre-charge circuit energizes the primary of this transformer with 220 V. The pre-charge resistors (R2 to R7) are also connected to the primary winding of this transformer, but they are installed in the control cabinet. Only after the pre-charge procedure it becomes possible to close the main circuit breaker.

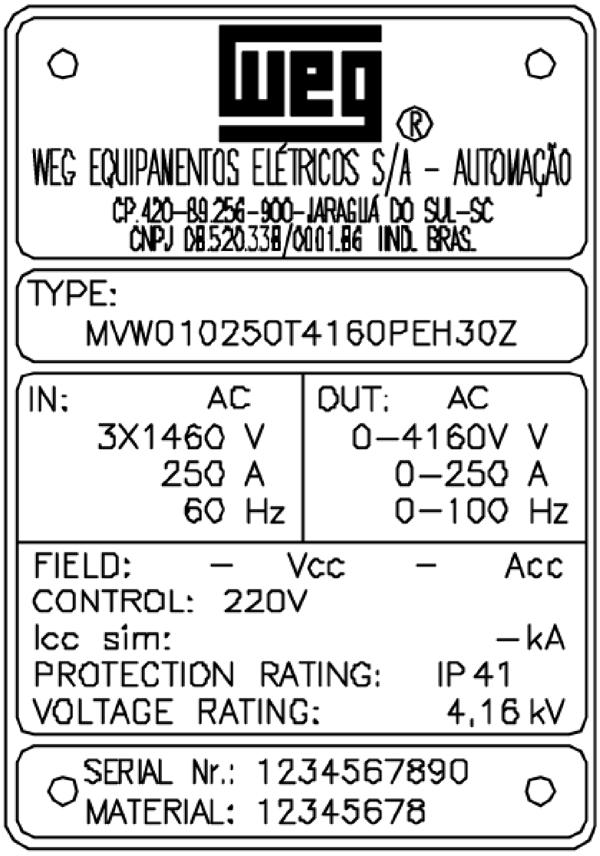
The auxiliary power supply (220-480 V) must be connected to the specific terminal strip located in the control cabinet. The T1 transformer has taps for different primary voltages and supplies 220 V at the secondary in order to feed the low voltage circuits and the exhausting fans present in the product.

The control rack A8 is fed with 24 Vdc supplied by the PS24 (A11) power supply, whose input is of 220 Vac three-phase. The control rack is composed by the Power Supply and Interface Board (PIC), and by 02 control boards (MVC1 and MVC2). The MVC1 board is responsible for the motor and inverter control, and the MVC2 board performs the user interface tasks. Both boards are fed by low voltages coming from the PIC board, which also contains opto-isolated digital inputs and relay outputs (220 Vac) for internal MVW-01 use. Optional Fieldbus communication and function expansion boards (EBA, EBB or EBC) can be connected to the MVC2 control board. The connections between the MVC1 board and the power stages are made with fiber-optic cables through the FOI interface boards.

The chapter 10 makes available the standard MVW-01 electric project. Special projects may have different panel configuration, in those cases the specific documentation must also be consulted, besides this manual.

2.4 MVW-01 IDENTIFICATION LABEL

The MVW-01 stainless steel identification label is located inside the control column. This label describes important information about the inverter.



WEG EQUIPAMENTOS ELÉTRICOS S/A - AUTOMAÇÃO
CP.420-89.256-900-JARAGUÁ DO SUL-SC
CNPJ 08.520.338/0001.86 IND. BRAS.

TYPE:
MVW010250T4160PEH30Z

IN: AC	OUT: AC
3X1460 V	0-4160V V
250 A	0-250 A
60 Hz	0-100 Hz

FIELD: - Vcc - Acc
CONTROL: 220V
Icc sim: -kA
PROTECTION RATING: IP41
VOLTAGE RATING: 4,16 kV

SERIAL Nr.: 1234567890
MATERIAL: 12345678

Figure 2.9 - *Example of an MVW-01 identification label*

2.5 HOW TO SPECIFY THE MVW-01

MVW-01	0070	T	4160	P	H	Z
WEG medium voltage frequency inverter series 01	Nominal output current for constant torque (CT) application: 2300 V: 0120=120 A 0140=140 A 0165=165 A 0175=175 A 0210=210 A 0250=250 A 0280=280 A 0386=386 A 0450=450 A 0490=490 A 0560=560 A 1064=1064A 4160 V: 0070=70 A 0080=80 A 0094=94 A 0110=110 A 0120=120 A 0130=130 A 0162=162 A 0170=170 A 0188=188 A 0250=250 A 0300=300 A 0357=357 A 0475=475 A 3300 V: 0085=85 A 0100=100 A 0112=112 A 0138=138 A 0150=150 A 0160=160 A 0186=186 A 0235=235 A 0265=265 A 0310=310 A 0375=375 A 0500=500 A 0580=580 A	Three-phase input power supply	Nominal voltage: 2300 = 23 kV 3300 = 3.3 kV 4160 = 4.16 kV	Manual language: P = Portuguese E = English S = Spanish	H20 12 Pulse Rectifier H30 18 Pulse Rectifier	Final digit of this code (refer to note)

NOTES:

- Refer to the chapter 9 for the specification of variable torque (VT) application nominal output current.
- Always put the letter Z at the code final position. For instance: MVW010250T4160PH30Z = MVW-01 inverter with 250 A nominal current, 4.16 kV nominal voltage, Portuguese manual and 18 pulse rectifier.

2.6 RECEIVING AND STORAGE

The MVW-01 is supplied with the BIR, BIS and BIT arms separated from the panel, and packed individually. The OSB frame and polystyrene wedges form the package. There is an identification label outside this package, which is identical to the one attached to the arms. Confront the content of this label with the purchase order.

In order to open the arm packages, refer to the procedure described in the chapter 3.

If the MVW-01 arms are not installed soon in the cabinet, store them in a clean and dry environment (temperature between -25 °C and 50 °C (-13 and 122 °F), covered up in order to avoid dust accumulation or water splashing.

The MVW-01 panel is supplied in a package composed of cardboard and wood. The guidance for handling, transportation, mechanical and electric installation is presented in the chapter 3.

ATTENTION!

It is very important to verify whether the inverter software is of the version indicated in the first page of this manual.

INSTALLATION AND CONNECTION

This chapter describes the electrical and mechanical installation procedures for the MVW-01. The presented guidance and suggestions must be followed in order to assure the proper inverter operation.

ATTENTION!

Qualified personnel trained for that purpose must perform the mounting and electric installation of the MVW-01.

ATTENTION!

STORAGE OF THE MVW-01 PANEL AND ARMS

After receiving the equipment, remove the plastic film in order to prevent moisture condensation.

Do not store exposed to sunshine and to temperatures above 50 °C (122 °F)

Store the equipment in a clean, protected place with relative humidity not higher than 85 %.

DANGER!

Power supply isolating switches: Equipment for isolating the inverter power and auxiliary supplies must be planed. They must cut off the inverter supplies (e.g., during installation maintenance tasks).

DANGER!

This equipment cannot be used as emergency stop mechanism.

DANGER!

Make sure that the power supply is disconnected before starting the wiring.

DANGER!

The following information is intended to be a guide for a proper installation. Comply with applicable local regulations for electrical installations .

3.1 MECHANICAL INSTALLATION

3.1.1 Environmental Conditions

The inverter installation location is an important factor to assure good performance and high product reliability. The inverter must be installed in an environment free of:

☑ Direct exposure to sunlight, rain, high humidity, or sea-air;

☑ Inflammable or corrosive gases or liquids;

☑ Excessive vibration, dust or metallic particles and oil mist.

Allowed environmental conditions:

☑ Temperature: From 0 ºC to 40 ºC (32 ºF to 140 ºF) - nominal conditions (no derating required). From 40 ºC to 50 ºC (140 ºF to 122 ºF): current reduction of 2.5 % for each Celsius degree above 40 ºC (140 ºF);

☑ Relative humidity: from 5 % to 90 % non-condensing;

☑ Altitude: up to 1000 m (3,300 ft) - nominal conditions (no derating required); From 1000 m to 4000 m (3,300 ft to 13,200 ft) - current derating of 1 % each 100 m (or 0.3 % each 100 ft) above 1000 m (3,300 ft) altitude.

☑ Pollution degree: 2 (according to IEC/UL standards) with non-conductive pollution. Condensation shall not originate conduction through the accumulated residues.

The MVW-01 is supplied as a panel with the following dimensions:
Width (variable) x Height of 2190 mm (86.22 in) x Depth of 980 mm (38.60 in).

According to the components mounted in each column and their function, the complete panel can be defined as the inseparable union of 3 columns:

Table 3.1 *- Panel dimensions*

Frame size	Frame size A0 Width	Frame size A Width	Frame size B Width	Frame size C Width
	mm (in)	**mm (in)**	**mm (in)**	**mm (in)**
Rectifier Column	500 (19.70)	600 (23.7)	800 (31.49)	800 (31.49)
Inverter Column	1000 (39.36)	1200 (47.24)	1200 (47.24)	2 x 1200 (0.07 x 47.24)
Control Column	500 (19.70)	600 (23.7)	600 (23.7)	800 (31.49)

Arm dimensions: 360 mm (14.17 in) x 1040 mm (41.0 in) x 680 mm (26.8 in) (width x height x depth).

The figure 3.1 shows the complete panel drawing. The inverter arms (BIR, BIS and BIT) are supplied separately in proper packages.

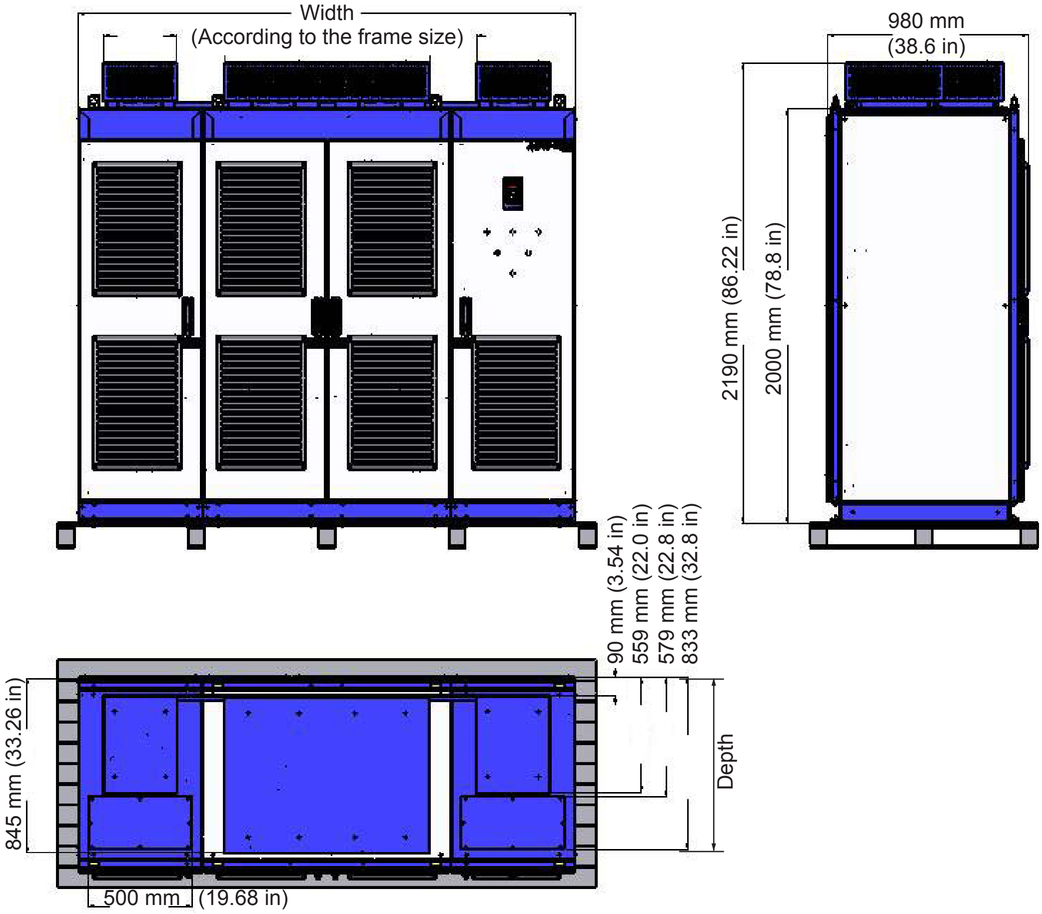


Figure 3.1 *- Complete panel drawing*

3.1.2 Handling Recommendations

The inverter package must be removed only at the installation site, where the panel will be operated.

Before hoisting or moving the panel, locate the hoisting eyes and fragile spots in the documentation that comes with the product.

Follow the instructions that come with the panel.

3.1.3 Hoisting

Make sure that the lifting device used to hoist the panel and the arms is suitable for their weight and shape, refer to the table 3.2.

Table 3.2 *- Panel weight (approximately)*

Frame Size	Weight
	kg (lb)
A0	600 (1322.7)
A	1560 (3439.2)
B	1700 (3747.8)
C	2700 (5952.4)

The inverter arms weigh approximately 140 kg (308.6 lb) each one.

Observe the gravity center and ensure that the hoisting mechanism is adequate and safe. Use the configuration showed in the figure 3.2.

The cables or chains used for hoisting must be at a minimum angle of 45° regarding the horizontal plane.

Hoisting must be done in a slow and stable manner. Before starting make sure the entire pass is clear of obstacles. If any alteration or damage in the panel structure is noticed, then abort the hoisting and rearrange the cables or chains.

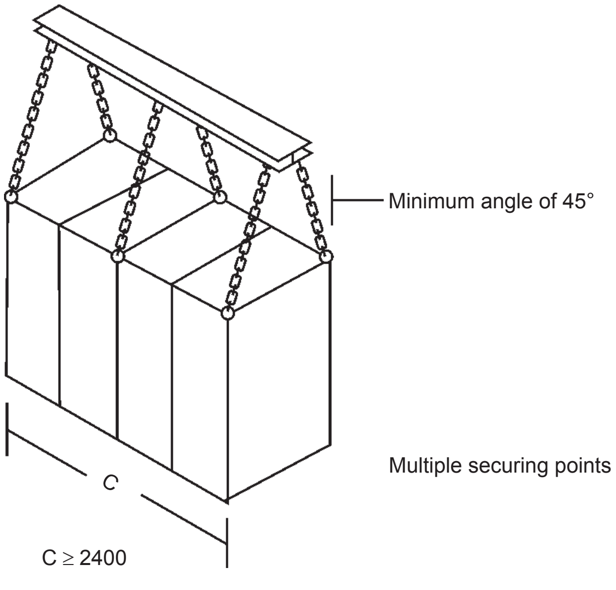


Figure 3.2 *- Recommended hoisting mechanism for the panel movement*

3.1.4 Moving

When cranes or pulleys are used, make sure that the movements are slow and smooth, so that the panel and the arms do not suffer excessive swings and vibration.

When using movable hydraulic jacks, forklifts, rollers or other means, distribute the support points from one extreme through the other, avoiding pressure on fragile areas.

Make sure that all the panel doors be closed and locked, and that the door handles be in protected position.

3.1.5 Unpacking

Use proper tools to unpack the MVW-01 panel and its arms. During this process, make sure that all the items listed in the documentation that comes with the product are present and in perfect conditions. Contact your local WEG representative in case of any irregularity.

Remove the arm packages carefully. The arms have hoisting eyes.

The inverter arms have fragile components (electronic boards, fiber optic connectors, busbars, wiring, etc.). Avoid touching these components! The arms must always be handled through their external metallic frame. While opening the package, inspect the arms for transportation damage. Do not install the arms if they are damaged or if you suspect of any damage.

Remove all packing material (plastic, wood, polystyrene foam, metal, nails, bolts, nuts, etc.) that might have remained inside the inverter panel or in the arms.

ATTENTION!

If any component presents problems (damages) it is recommended to:

- Stop the unpacking immediately;
- Contact the carrier and formally fill in a complaint with the problem found;
- Take pictures of the damaged parts;
- Contact WEG service.

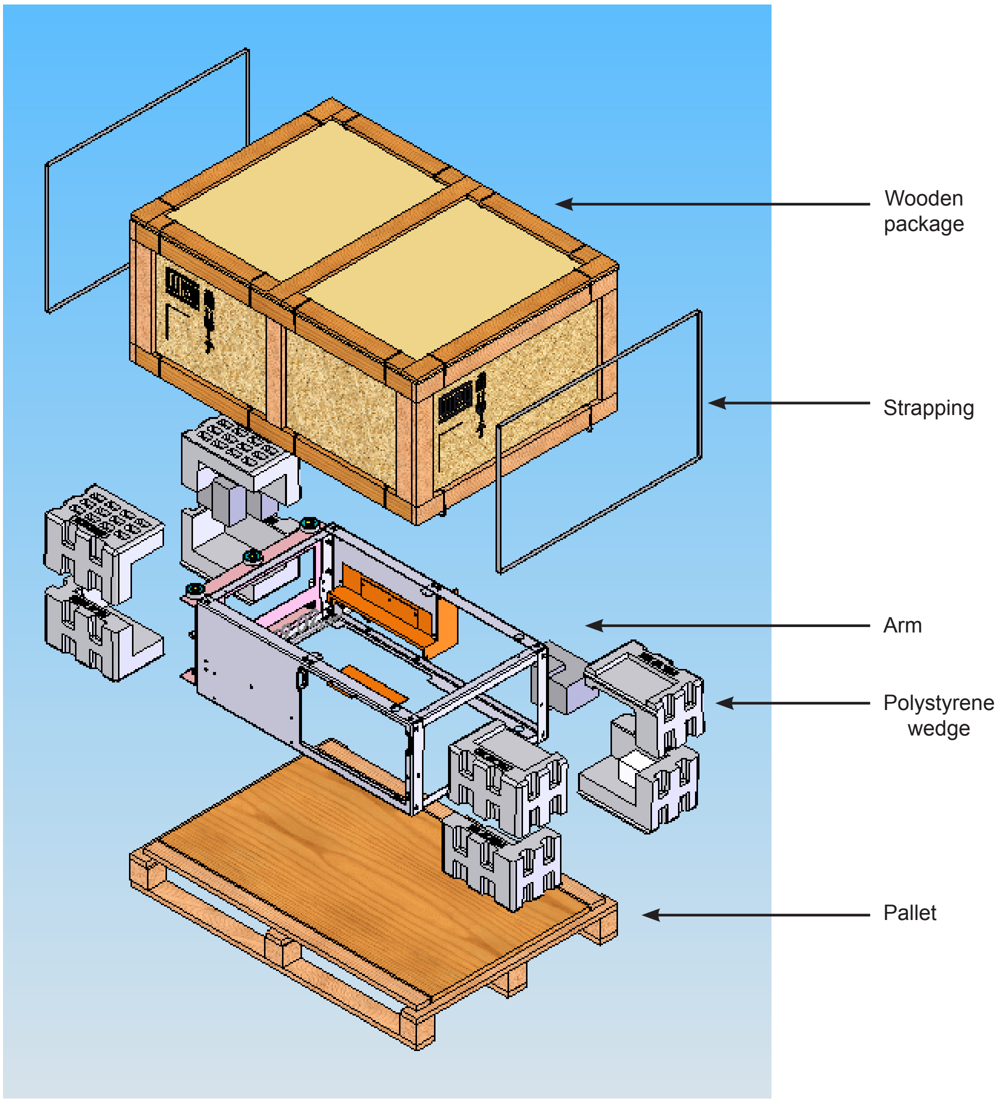


Figure 3.3 *- Power arm with package*

3.1.6 Positioning/Mounting

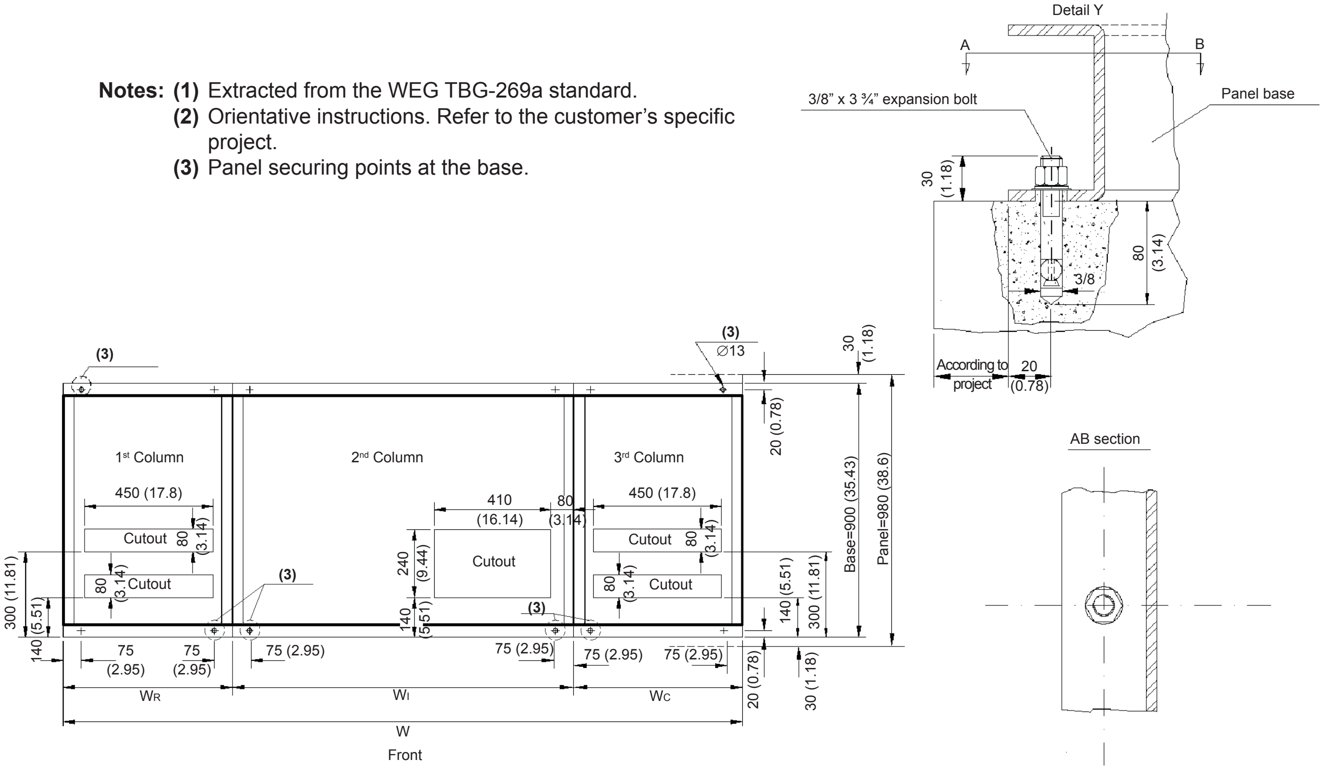
The MVW-01 panel must be placed on a flat leveled surface, thus avoiding mechanical instability, door misalignment, among other problems.

The permanent operation position must allow heat radiation from all the surfaces and the necessary ventilation for its operation. The area in front of the panel must remain unobstructed, so that a total opening of the doors be possible, as well as the insertion and extraction of the arms and/or the power and control cables.

The figure 3.4 shows the panel dimensions.

ATTENTION!

Make sure there is access for the electric connections: Input cables at the rectifier column and the output for the motor, main circuit breaker commands and status, transformer and motor protections, analog and digital inputs and outputs.



Notes: **(1)** Extracted from the WEG TBG-269a standard.
(2) Orientative instructions. Refer to the customer's specific project.
(3) Panel securing points at the base.

Frame size	W_R	W_I	W_C	W
	mm (in)	mm (in)	mm (in)	mm (in)
A	600 (23.62)	1200 (47.24)	600 (23.62)	2400 (94.48)
B	800 (31.5)	1200 (47.24)	600 (23.62)	2600 (102.36)
C	800 (31.5)	2 x 1200 (47.24)	800 (31.5)	4000 (157.47)

Note: A0 is composed by only one 1000 mm (39.36 in) column.
In order to get more details, refer to the figure 2.3.

***Figure 3.4** - Anchoring the MVW-01 panel to the floor - dimensions in mm (in)*

3.1.7 Power Arm Insertion

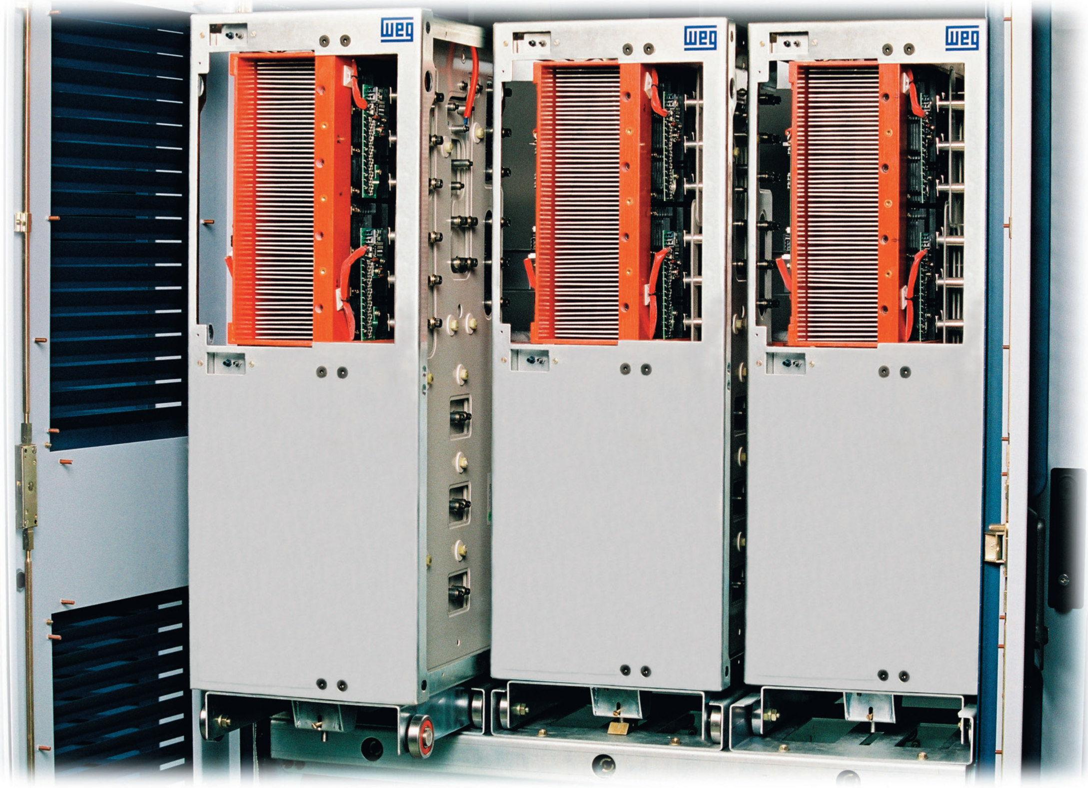


Figure 3.5 - Power Arm

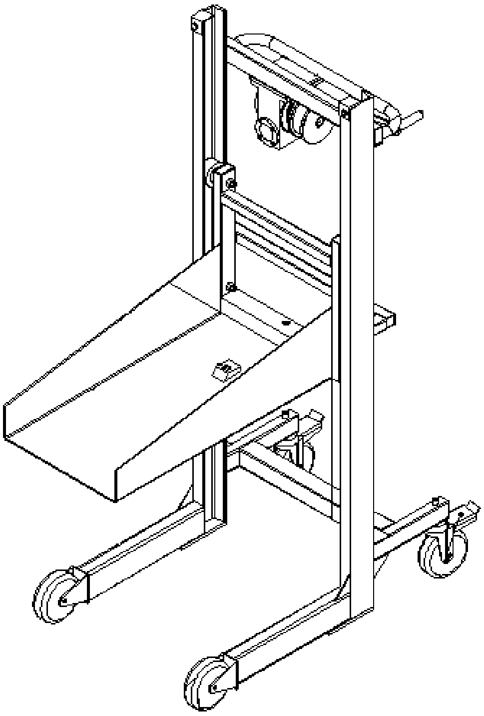


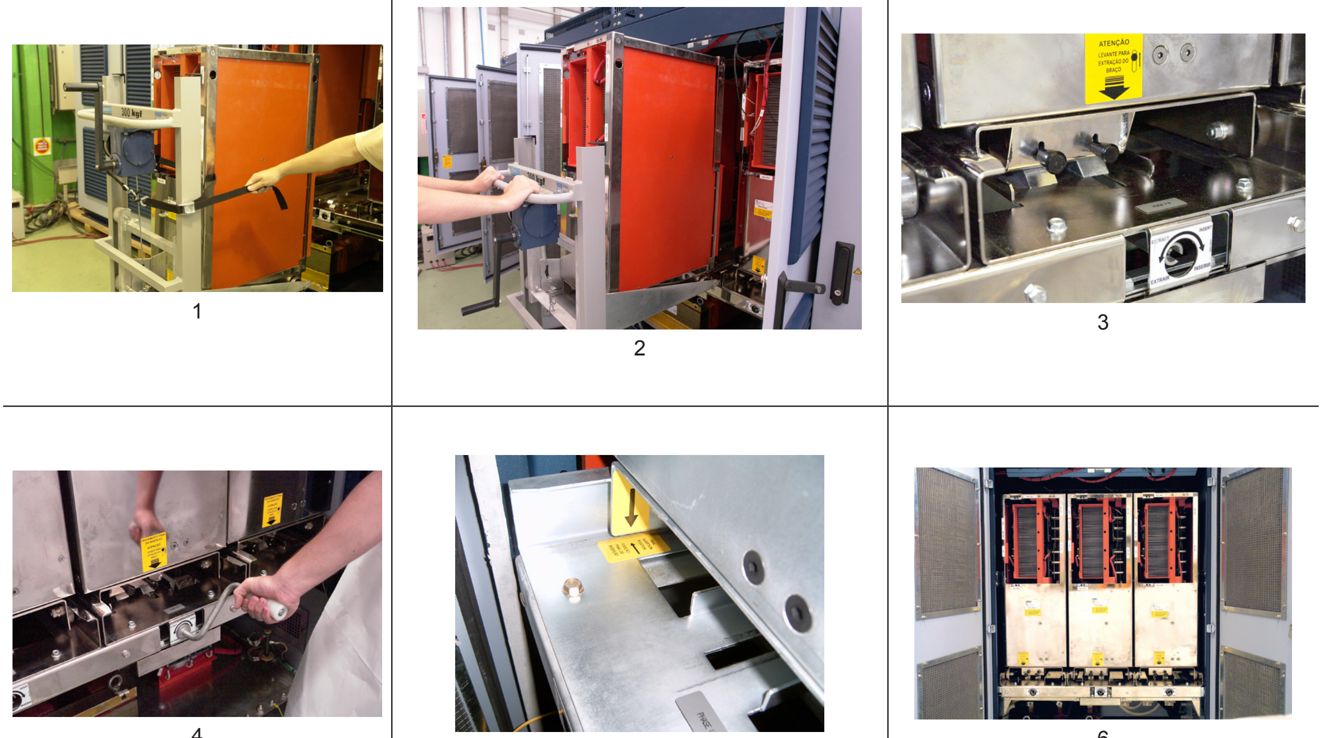
Figure 3.6 - Power arm insertion/extraction/movement trolley

The power arms (BIR, BIS and BIT) insertion must be done with the use of the WEG insertion trolley (part number 10411852) showed in the figure 3.6, and according to the following procedure:

NOTE!

While moving the power arm, keep it locked to the trolley and secured with the safety belt (figure 3.7 - picture 1).

1) Rotate the crank handle until the trolley reaches the floor level;
2) Push the arm onto the trolley rails and secure it with the locking mechanism;
3) Lift the arm to the necessary height in the position indicated in the figure 3.7 - picture 2;
4) Lock the trolley wheels;
5) Release the lock that secures the arm (figure 3.7 – picture 3) and push the arm into the panel observing the alignment of the wheels on the rail;
6) The arm must be manually inserted until the locking system (locking pin) is activated;
7) The final insertion stage is achieved using a crank handle and observing the marks on the insertion end tags (figure 3.7 – pictures 4, 5 and 6).



1

2

3

4

5

6

Figure 3.7 *- Details of the arm insertion stages*

3.1.8 Power Arm Electric and Fiber Optic Connections

After inserting the power arms (U, V and W phases) connect the fiber optic cables and the supply cables according to the labels presented on the arms and on the cables. The identifications of the cables are presented in the tables 3.3 and 3.4.

***Table 3.3** - Fiber optic cables identification*

	Identification on the fiber optic cable	Identification on the arm
1	10191022 GS1U-N1-FOI U	GS1
2	10191022 GS2U-N2-FOI U	GS2
3	10191023 GS3U-N3-FOI U	GS3
4	10191023 GS4U-N4-FOI U	GS4
5	10191022 VST1U-N5-FOI U	VST1
6	10191022 VST2U-N6-FOI U	VST2
7	10191024 VST3U-N7-FOI U	VST3
8	10191024 VST4U-N8-FOI U	VST4
9	10191022 TEMPU-N9-FOI U	TEMP
10	10191022 OSAU-N10-FOI U	OSA
11	10191022 OSBU-N11-FOI U	OSB
12	10191022 GS1V-N1-FOI V	GS1
13	10191022 GS2V-N2-FOI V	GS2
14	10191023 GS3V-N3-FOI V	GS3
15	10191023 GS4V-N4-FOI V	GS4
16	10191022 VST1V-N5-FOI V	VST1
17	10191022 VST2V-N6-FOI V	VST2
18	10191024 VST3V-N7-FOI V	VST3
19	10191024 VST4V-N8-FOI V	VST4
20	10191022 TEMPV-N9-FOI V	TEMP
21	10191022 OSAV-N10-FOI V	OSA
22	10191022 OSBV-N11-FOI V	OSB
23	10191022 GS1W-N1-FOI W	GS1
24	10191022 GS2W-N2-FOI W	GS2
25	10191023 GS3W-N3-FOI W	GS3
26	10191023 GS4W-N4-FOI W	GS4
27	10191022 VST1W-N5-FOI W	VST1
28	10191022 VST2W-N6-FOI W	VST2
29	10191024 VST3W-N7-FOI W	VST3
30	10191024 VST4W-N8-FOI W	VST4
31	10191022 TEMPW-N9-FOI W	TEMP
32	10191022 OSAW-N10-FOI W	OSA
33	10191022 OSBW-N11-FOI W	OSB

***Table 3.4** - Power arms supply cables identification*

	Identification on the arm supply cable	Identification on the arm
1	BIR	XC1
2	BIS	XC1
3	BIT	XC1

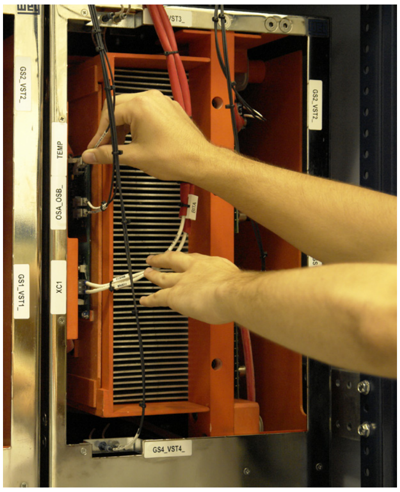
 7	 8	 9
Note: In order to connect the fiber optic cables GS1, GS2, VST1 and VST2, it is necessary to remove the protection plate according to the picture 7.	 10	**Note:** The fiber optic cables must be handled with caution, in order not to fold, bend, squeeze or cut them. Hold the cables only at their connectors when inserting or removing them, and never apply pressure or tensile force on the fiber.

***Figure 3.8** - Details of the power arm supply and fiber optic cables installation stages*

3.1.9 Power Arm Extraction

In order to extract the power arms follow the procedures described in the previous sections in reverse order.

3.2 ELECTRICAL INSTALLATION

3.2.1 Power Section

The power cables that connect the supply line to the main circuit breaker and the circuit breaker to the input transformer primary must be sized for the specified voltage and current. Refer to the cubicle (main circuit breaker) and transformer documentation, strictly following all the recommendations.

The power cables that connect the input, transformer secondary windings to the MVW-01 rectifier column and those that connect the inverter column to the medium voltage motor (figure 3.9) must be specified for medium voltage application and sized for the nominal currents.

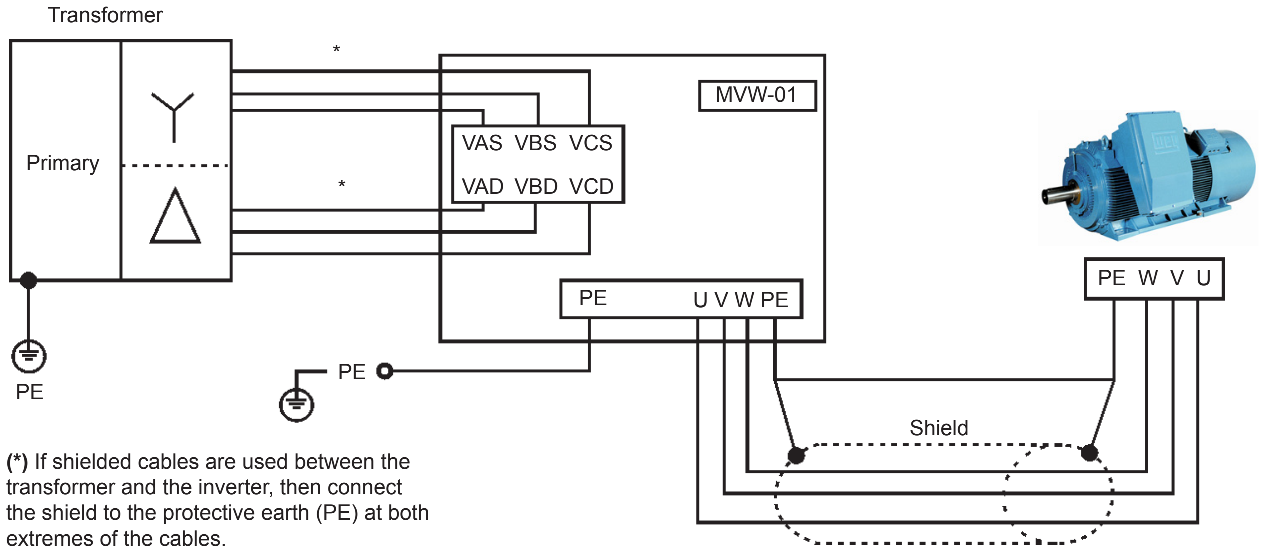
***Table 3.5** - Recommended power cables cross section (copper) [AWG]*

Nominal Voltage [V]	Inverter Nominal Current		Power Cables (S cross section) (mm^2, copper) U, V, W, VAS, VBS, VCS, VAD, VBD, VCD	
	CT	**VT**	**CT**	**VT**
2300	120	140	25	25
	140	165	25	35
	165	175	35	50
	175	210	50	70
	210	250	70	70
	250	280	70	95
	280	340	95	2x50
	386	450	2x50	2x70
	450	490	2x70	2x70
	490	560	2x70	2x95
	560	650	2x95	2x120
3300	85	100	10	16
	100	112	16	25
	112	138	25	25
	138	150	25	35
	150	160	35	35
	160	188	35	50
	186	244	50	70
	235	265	70	95
	265	310	95	120
	310	365	120	150
	375	430	2x50	2x70
	500	580	2x95	2x95
	580	650	2x95	2x120
4160	70	80	10	10
	80	94	10	16
	94	110	16	25
	110	120	25	25
	120	130	25	25
	130	160	25	35
	162	170	35	50
	170	188	50	50
	188	245	50	70
	250	286	70	95
	300	357	95	2x50
	357	450	2x50	2x70
	475	544	2x70	2x95

Gauge of the power cables (S cross section) (mm^2)	Minimun gauge of the grounding cables (S cross section) (PE) (mm^2)
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S$	S / 2

NOTE!

The cable cross sections/gauges presented in the table 3.5 are only orientative. In order to size the cables correctly the installation conditions, the applicable standards and regulations, and the maximum allowed voltage drop must be considered.



(*) If shielded cables are used between the transformer and the inverter, then connect the shield to the protective earth (PE) at both extremes of the cables.

Figure 3.9 *- Power and ground connections*

☑ Minimum cable insulation voltage: 6 kV.
Commercial examples:
Cofiban: Cofialt 7 kV (without shield);
Pirelli: Eprotenax 6/10 kV;
Ficap: Fibep or EPDry 6/10 kV.

☑ Use proper terminations for the power connections as well as for the shield connections to the ground bar;

☑ Tighten the connections with the appropriate torque.

Table 3.6 *- Power connections cable lugs and tightening torque*

Identification	**Column**	**Cable Lug**	**Torque [N.m] ± 20%**
VAD	Rectifier	M10	30
VBD	Rectifier		
VCD	Rectifier		
VAS	Rectifier		
VBS	Rectifier		
VCS	Rectifier		
U	Inverter	M12	60
V	Inverter		
W	Inverter		
PE	Inverter		
Shields	Rectifier and Inverter	M8	15

DANGER!

It is mandatory to connect the inverter to a protection ground (PE). The grounding connection must follow the local regulations. Use at least conductors with the wire gauge indicated in the table 3.5. Connect the inverter to a specific grounding rod or to the general ground system (resistance ≤ 10 Ohms), the transformer frame ground for instance.

DANGER!

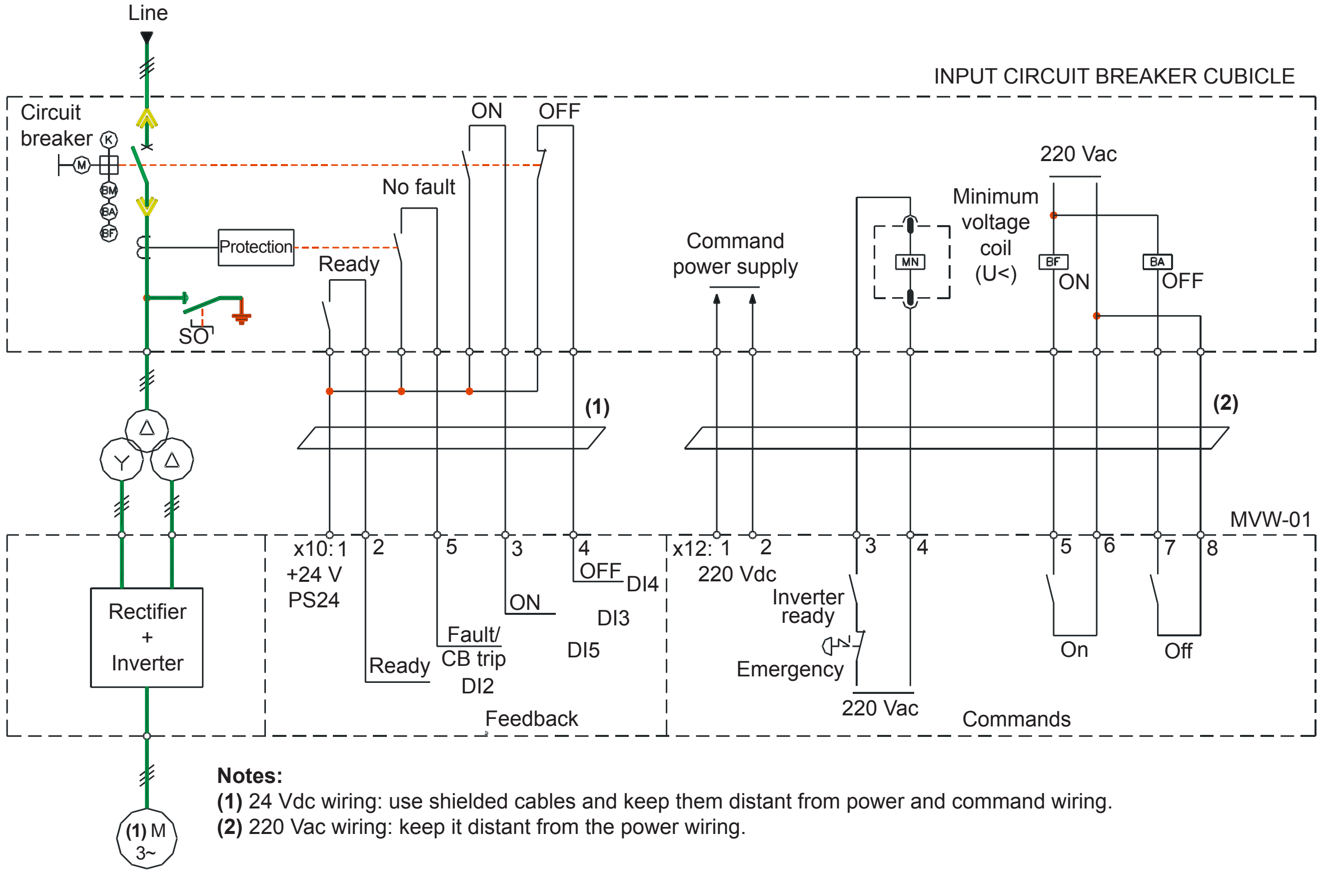
Never connect the input transformer secondary windings to the ground.

3.2.2 Input Circuit Breaker

The MVW-01 operates the input circuit breaker. This circuit breaker must have minimum voltage, closing and opening coils. The power supply for the circuit breaker circuits comes from the MVW-01. The following signals, provided by the circuit breaker, are necessary for its operation: Ready, On, Off and Trip. These signals must be dry contacts (potential free).

The MVW-01 also has inputs for the indications of input transformer alarm and fault.

Refer to the chapter 10 or the specific project that comes with the product in order to obtain details of the electric project.



Notes:
(1) 24 Vdc wiring: use shielded cables and keep them distant from power and command wiring.
(2) 220 Vac wiring: keep it distant from the power wiring.

***Figure 3.10** - Connections between the input circuit breaker and the inverter*

ATTENTION!

The input circuit breaker must only be closed by the inverter, otherwise the transformer and the inverter may be damaged.

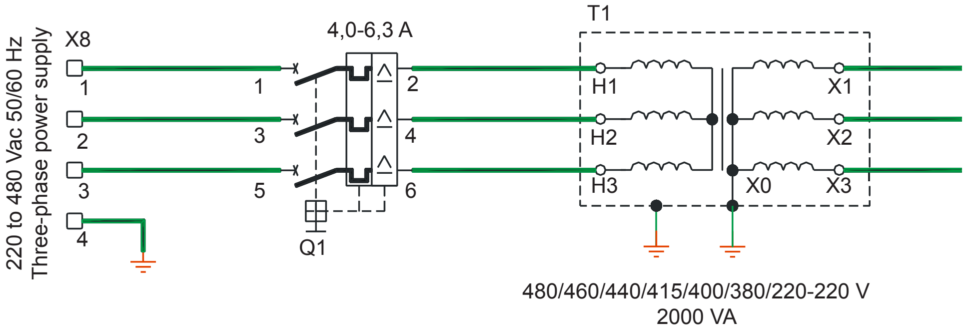
DANGER!

Although the inverter commands the opening of the circuit breaker, there is no guarantee of its opening. In order to open the medium voltage cabinets for maintenance, follow all the procedures of safe de-energization (chapter 5).

3.2.3 Low Voltage Auxiliary Supply

CONTROL COLUMN POWER SUPPLY NOMINAL VOLTAGE SELECTION

An auxiliary voltage supply (220 V - 480 V) is necessary for the MVW-01. This voltage must be wired to the terminal strip present in the control column. The command transformer (T1) taps must be selected according to the available auxiliary voltage. Refer to the chapter 10 in order to clarify questions on the electric project.



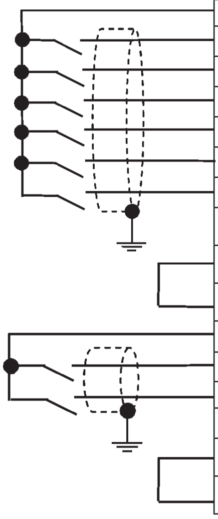
Primary taps	Voltage
H1-H2-H3	480 V
H4-H5-H6	460 V
H7-H8-H9	440 V
H10-H11-H12	415 V
H13-H14-H15	400 V
H16-H17-H18	380 V
H19-H20-H21	220 V

***Figure 3.11** - Auxiliary power supply*

3.2.4 Signal and Control Wiring

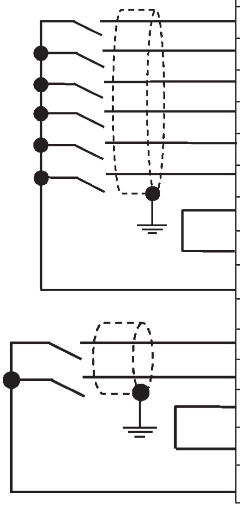
The signal (analog inputs/outputs) and control (digital inputs/outputs and relay outputs) connections are made at the following terminal strips on the MVC2 control board (refer to the figure 3.16 for the terminal strip location):

XC1A: Digital signals
XC1B: Analog signals
XC1C: Relay outputs



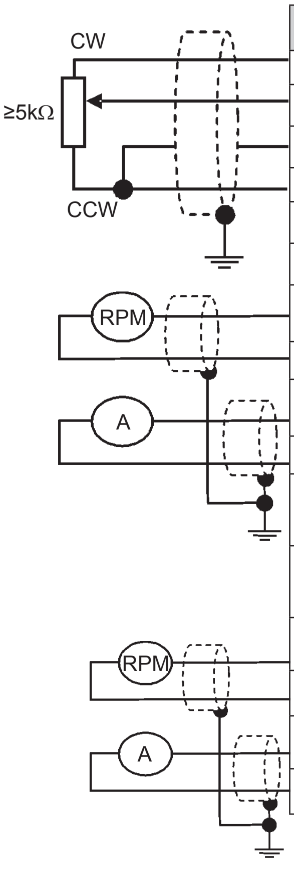
Terminal strip XC1A		Factory standard function	Specifications
1	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ±8%, capacity: 90 mA
2	DI1	Start / Stop	6 isolated digital inputs Minimum high level: 18 Vdc Maximum low level: 3 Vdc Maximum voltage: 30 Vdc Input current: 11 mA @ 24 Vdc
3	DI2	FWD / REV Section (Remote mode)	
4	DI3	No function	
5	DI4		
6	DI5	JOG(Remote mode)	
7	DI6	Ramp 2 Selection	
8	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ±8 %, capacity: 90 mA
9	COM	Digital inputs DI1 to DI6 common point	-
10	DGND*	0 V reference of the 24 Vdc supply	Grounded
11	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ± 8 %, capacity: 90 mA
12	DI9	No function	Identical to the DI1 to DI6 specification
13	DI10		
14	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ± 8 %, capacity: 90 mA
15	COM	Digital inputs DI9 and DI10 common point	-
16	DGND*	0 V reference of the 24 Vdc supply	Grounded

***Figure 3.12** - XC1A terminal strip description: Active high-level digital inputs*



Terminal strip XC1A		Factory default function	Specifications
1	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ±8%, capacity: 90 mA
2	DI1	Start / Stop	6 isolated digital inputs Minimum high level: 18 Vdc Maximum low level: 3 Vdc Maximum voltage: 30 Vdc Input current: 11 mA @ 24 Vdc
3	DI2	FWD / REV Section (Remote mode)	
4	DI3	No function	
5	DI4		
6	DI5	JOG(Remote mode)	
7	DI6	Ramp 2 Selection	
8	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ± 8 %, capacity: 90 mA
9	COM	Digital inputs DI1 to DI6 common point	-
10	DGND*	0 V reference of the 24 Vdc supply	Grounded
11	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ± 8 %, capacity: 90 mA
12	DI9	No function	Identical to the DI1 to DI6 specification
13	DI10		
14	24 Vdc	24 Vdc supply for the digital inputs	Isolated 24 Vdc ± 8 %, capacity: 90 mA
15	COM	Digital inputs DI9 and DI10 common point	-
16	DGND*	0 V reference of the 24 Vdc supply	Grounded

***Figure 3.13** - XC1A terminal strip description: Active low-level digital inputs*



Terminal strip XC1B		Factory default function	Specifications
1	+REF	Positive reference for potentiometer	+5.4 V ±5 %, capacity: 2 mA
2	AI1+	Analog input 1: speed reference (remote mode)	Differential, resolution: 10 bits, Impedance: 400 kΩ [0 to 10 V] 500 Ω [(0 to 20) mA/(4 to 20) mA]
3	AI1-		
4	-REF	Negative reference for potentiometer	-4.7 V ± 5 %, capacity: 2 mA
5	AI2+	Analog input 2: No function	Differential, resolution: 9 bits, Impedance: 400 kΩ [-10 V to +10 V] 500 Ω [(0 to 20) mA/(4 to 20) mA]
6	AI2-		
7	AO1	Analog output 1: Speed	(0 to 10) V, R_L ≥ 10 kΩ (Maximum load) Resolution: 11bits
8	DGND	0 V Reference for analog outputs	Grounded through a 5.1 Ω resistor
9	AO2	Analog output 2: motor current	(0 to 10) V, R_L ≥ 10 kΩ (Maximum load) Resolution: 11bits
10	DGND	0 V Reference for analog outputs	Grounded through a 5.1 Ω resistor
11	AI5+	Analog input 5: No function	Isolated analog input signal: (0 to 10) V or (0 to 20) mA / (4 to 20) mA Resolution: 10 bits Impedance: 400 kΩ [0 V to 10 V] 500 Ω [(0 to 20) mA/ (4 to 20) mA]
12	AI5-		
13	AO5	Analog output 5: Speed	Isolated analog output signals: (0 to 20) mA / (4 to 20) mA Scales: Refer to parameter descriptions Resolution: 11 bits (0.05 % of the full scale) R_L ≤ 600 Ω
14	GNDAO5	0 V Reference for analog output 5	
15	AO6	Analog output 6: Motor current	
16	GNDAO6	0 V Reference for analog output 6	

***Figure 3.14** - XC1B terminal strip description: Analog inputs and outputs*

Terminal strip XC1C		Factory default function	Specifications
1	RL1 NO	Relay output 1- Without Error	Contact capacity: 1 A 240 Vac
2	RL1 C		
3	RL1 NC		
4	RL2 NO	Relay output 2 - N > Nx	
5	RL2 C		
6	RL2 NC		
7	RL3 NO	Relay output 3 - N* > Nx	
8	RL3 C		
9	RL3 NC		
10	RL4 NO	Relay output 4 - No function	
11	RL4 C		
12	RL4 NC		
13	RL5 NO	Relay output 5 - No function	
14	RL5 C		
15	RL5 NC		
16	--	--	--

Note: NO = normally open contact;

C = common;

NC = normally closed contact.

Figure 3.15 *- XC1C terminal strip description: Relay outputs*

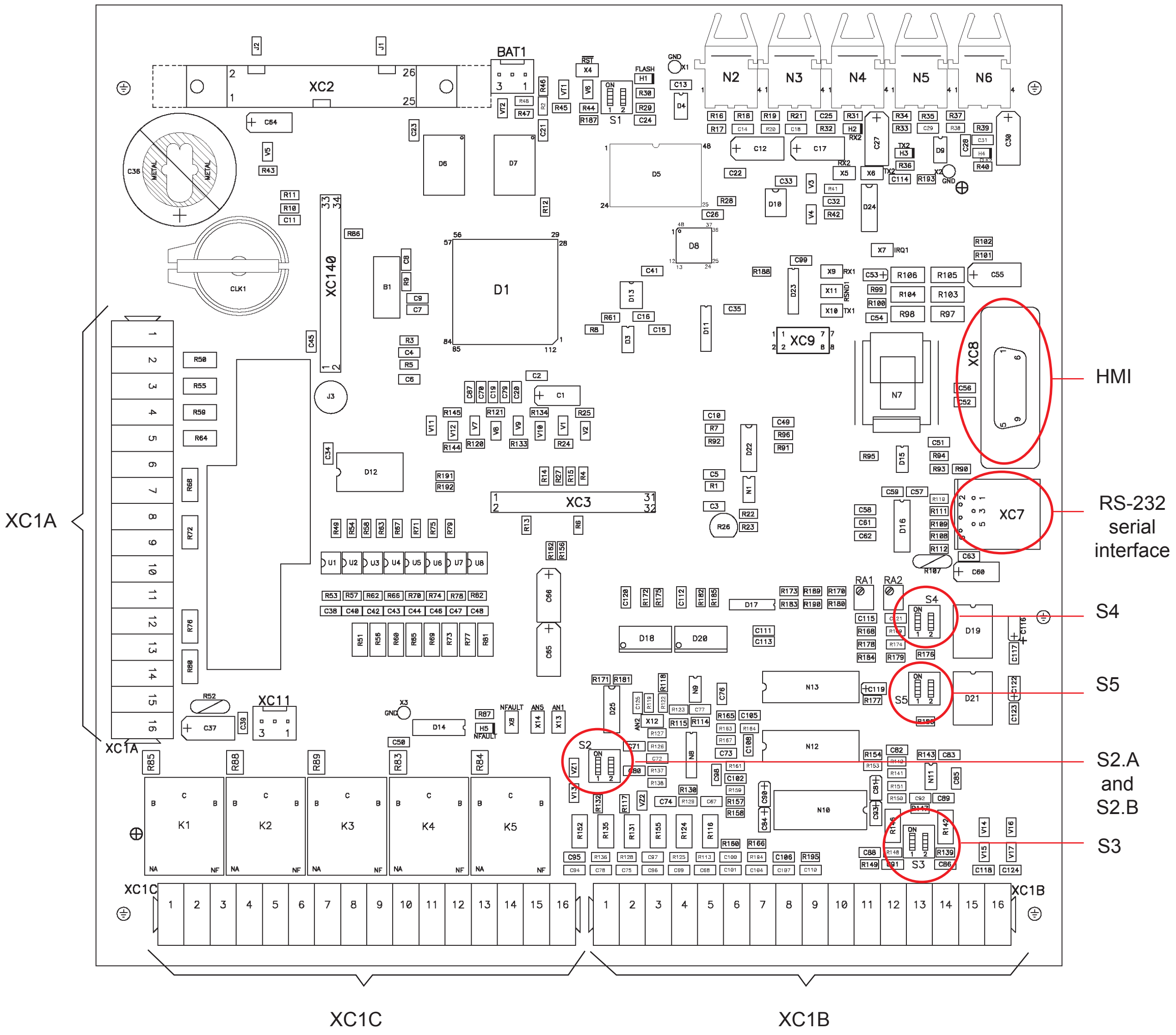


Figure 3.16 *- Connectors and configuration switches location on the MVC2 board*

Table 3.7 *- Configuration of the switches*

Signal	Factory default function	Setting element	Selection
AI1	Speed reference	S2.A	OFF - (0 to 10) V **(1)** ON - (0 to 20) mA / (4 to 20) mA
AI2	No function	S2.B	OFF - (0 to 10) V **(1)** ON - (0 to 20) mA / (4 to 20) mA
AI5	No function	S3.A	OFF - (0 to 10) V **(1)** ON - (0 to 20) mA / (4 to 20) mA
AO5	Speed	S4.A	OFF - (0 to 20) mA **(1)** ON - (4 to 20) mA
AO6	Motor current	S5.A	OFF - (0 to 20) mA **(1)** ON - (4 to 20) mA

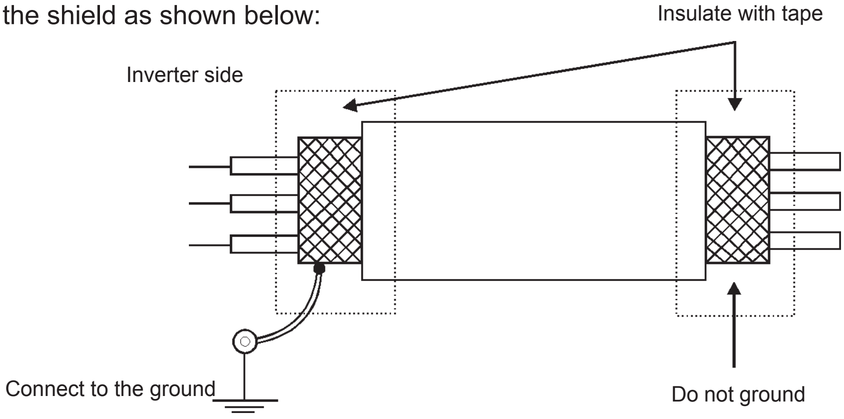
(1) Factory default.

Related parameters: P221, P222, P234 to P240.

During the signal and control wiring installation, pay attention to:

1) Cable gauge: 0.5 mm^2 to 1.5 mm^2 [20 AWG to 17 AWG];
2) Maximum torque: 0.50 N.m (4.5 lbf.in);
3) XC1A, XC1B and XC1C wiring must be made with shielded cables and be separated from other cables (power, 110/220 V command, etc.). If crossing of these cables is unavoidable, install them perpendicularly, keeping a minimum separation distance of 5 cm (2 in) at the crossing point.

Connect the shield as shown below:



The shield connection screws are located on the MVC2 board and on its mounting plate.

Figure 3.17 *- Shield connection*

4) It is necessary to use galvanic isolators at the XC1B terminal strip signals for wiring distances longer than 50 m (150 ft);
5) Relays, contactors, solenoids or electromagnetic braking coils installed near inverters can generate interference in the control circuit. In order to eliminate this interference, connect RC suppressors in parallel with the coils of AC relays. Connect a free-wheeling diode in case of DC relays/coils;
6) When an external keypad (HMI) is used (Refer to chapter 8), separate the cable that connects the keypad to the inverter from other cables of the installation, keeping a minimum distance of 10 cm (4 in) between them.

KEYPAD (HMI) OPERATION

This chapter describes the inverter standard keypad - Human-Machine Interface (HMI) and the mode to operate it, with the following information:

☑ General HMI description;
☑ HMI operation;
☑ Inverter parameter organization;
☑ Parameter programming;
☑ Description of status indications.

4.1 DESCRIPTION OF THE HMI MVW-01 LCD HUMAN-MACHINE INTERFACE

The standard MVW-01 HMI has two readout displays: a LED readout with a 4 digit, seven-segment display and a LCD display with two lines of 16 alphanumeric characters. There are also 4 indicator LEDs and 8 keys. Figure 4.1 shows the front view of the HMI and indicates the position of the readouts, keys and status LEDs.

__Figure 4.1__ - HMI MVW-01 LCD (keypad)

4.1.1 LED Display Functions

It shows error and status messages (Refer to the Quick Parameter Reference, Fault and Status Messages section), the parameter number or its contents. The rightmost digit indicates the selected variable unit:

- A → current
- U → voltage
- H → frequency
- As a digit of the number, for speed and other parameters

NOTE!

When the indication is greater than 9999 (rpm for instance) the ten thousands digit is not showed on the LED display (e.g., 12345 rpm will appear as 2345 rpm).
The correct indication is displayed on the LCD display.

4.1.2 LCD Display Functions

The LCD simultaneously shows the parameter number and its contents without the need of pressing a key to so. Besides this, there is also a brief description of the parameter functions and their units (A, Hz, V, s, %, etc.) if applicable. It also provides a brief description of inverter errors or status.

4.1.3 Local LED and Remote LED Functions

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

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

4.1.4 Forward LED and Reverse LED Functions

Figure 4.2 shows the operation of the speed direction LEDs.

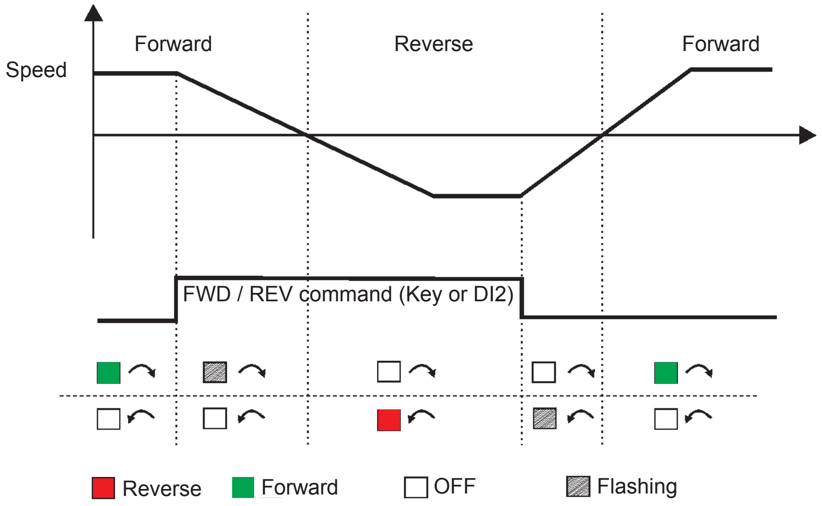


Figure 4.2 *- Speed direction (FWD / REV) LEDs*

4.1.5 Basic Functions of the Keys

NOTE!
The functions described below are valid for factory default programming and Local Mode operation.

I It starts (enables) the inverter via the acceleration ramp. After starting, the display changes the indication at each touch of the Start key in the order shown below:

→ rpm → Volts → Status → % → Hz → Amps

0 It stops (disables) the inverter via the deceleration ramp. It also resets the inverter after faults have occurred.

PROG It toggles the display between the parameter number and its value (Par. number / Contents).

▲ It increases the speed, the parameter number or the parameter value.

▼ It decreases the speed, the parameter number or the parameter value.

⟳ It reverses the motor speed direction between Forward and Reverse,

LOC/REM It selects the origin of commands/reference between Local and Remote modes.

JOG It executes the JOG function while pressed, provided that the inverter is disabled and that General Enabling is active.

4.2 USE OF THE KEYPAD (HMI)

The HMI is a simple interface that allows the inverter operation and programming. It presents the following functions:

☑ Indication of the inverter status and main variables;
☑ Fault Indication;
☑ Viewing and programming of parameters;
☑ Inverter operation (keys I, 0, ⟳, LOC/REM and JOG) and speed reference control (▲ and ▼).

4.2.1 Keypad (HMI) Inverter Operation

All functions related to the MVW-01 operation (Start, Stop, Motor Direction of Rotation, JOG, Increment/Decrement of the Speed Reference and Selection of Local mode/Remote mode) can be performed through the Keypad.

With the factory default programming, all the HMI keys are enabled when the Local command source is selected.

These functions can also be executed by means of digital and analog inputs. Therefore, it is necessary to program the parameters applicable to these functions and to the correspondent inputs.

HMI keys operation description:

LOC/REM When programmed (with P220 = 2 or 3), it selects the source of the commands between Local and Remote. When the I and 0 keys are programmed in Local mode (with P224 = 0) and/or in Remote mode (with P227 = 0), then:

I Starts the inverter (the motor accelerates according to the acceleration ramp).

0 Stops the inverter (the motor decelerates according to the deceleration ramp and stops).
It resets the inverter after a fault trip (this function is always active).

JOG This function is active only when the inverter is stopped, with General Enabling active and the key programmed, in Local mode (with P225 = 1) and/or in Remote mode (with P228 = 1). While pressed, it accelerates the motor following the ramp time up to the speed programmed in P122 (150 rpm factory setting), and when released it decelerates following the ramp and stops.

⟳ When programmed, with P223 = 2 (HMI key Forward) or 3 (HMI key Reverse) in Local mode and/ or P226 = 2 (HMI key Forward) or 3 (HMI key Reverse) in Remote mode, then it inverts the motor speed direction every time it is pressed.

▲ ▼ These Keys are only enabled to adjust the speed reference when the speed reference source is the keypad with P221 = 0 for the Local mode and/or P222 = 0 for the Remote mode.

▲ When pressed it increases the speed reference.

▼ When pressed it decreases the speed reference. The parameter P121 contains the value of the speed reference adjusted via keypad.

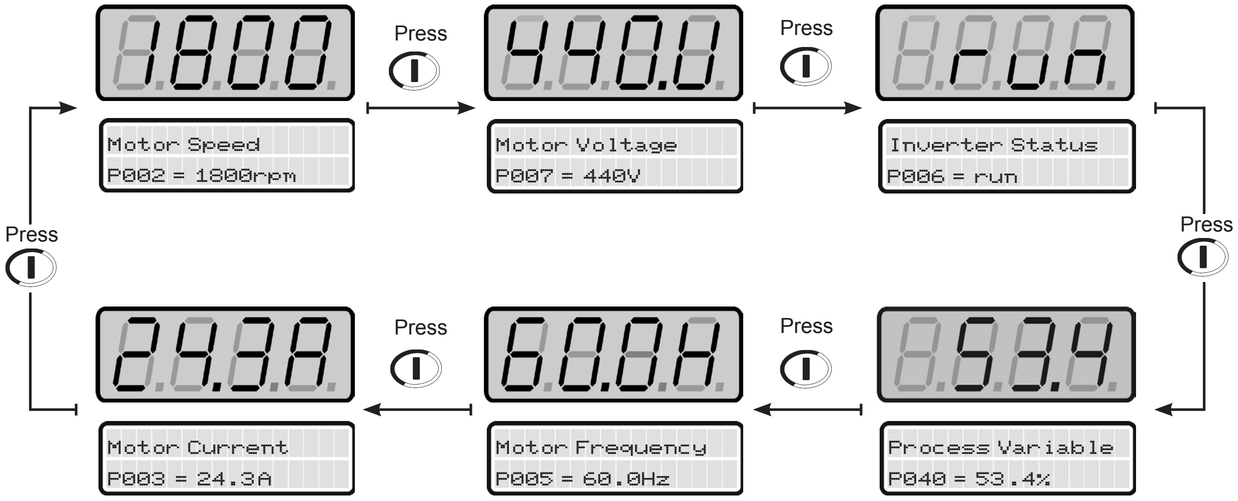
Reference Backup

The last speed reference value set by the keys ▲ and ▼ is stored when the inverter is stopped or the AC power supply is removed, if P120 = 1 (Reference Backup active). In order to change the reference value before starting the inverter, the value of the parameter P121 must be changed.

4.2.2 HMI Display Indications

The parameters from P002 up to P099 are read-only parameters (P001 and P002 may also be used for the speed reference setting). According to the factory default, the first parameter shown on the display when the inverter is energized is P002 (motor speed in rpm). After starting the inverter the user is able to monitor different read-only parameters by pressing the Ⓘ key (refer to the section 5.1).

4.2.2.1 Monitoring Variables



The monitoring variable to be initially shown after the inverter power-on is defined in the parameter P205:

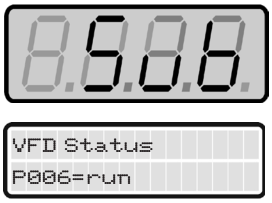
Table 4.1 - Initial monitoring parameter choice

P205	Parameter to be initially shown on the display
0	P005 – Motor Frequency
1	P003 – Motor Current
2	P002 – Motor Speed
3	P007 – Motor Voltage
4	P006 – Inverter Status
5	P009 – Motor Torque
6	P040 – PID Process Variable

4.2.2.2 Inverter Status

The inverter is ready to be started.

The control board is waiting for the initialization conclusion.



The line voltage is too low for the inverter operation (undervoltage condition) and it does not accept command to start (the inverter waits for the pre charge/ power energization command).

4.2.2.3 LED Display Flashing

The display flashes in the following conditions:

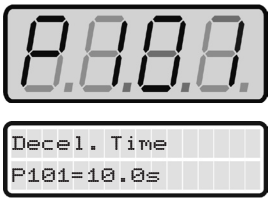
- ☑ When trying to change a not allowed parameter;
- ☑ The inverter is in current limitation (refer to the chapter 7);
- ☑ Inverter in an error condition (refer to the chapter 7);
- ☑ When trying to enable the inverter in the SUB (undervoltage) condition.

4.2.3 Parameter Viewing and Programming

All inverter settings are made through parameters.

The parameters are shown on the display with the letter “P” followed by a number:

Example (P101):

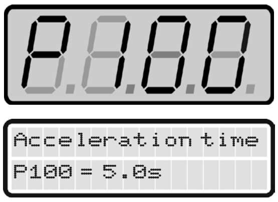
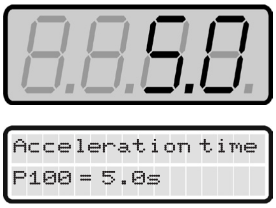
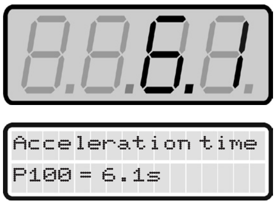
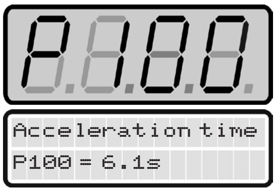


101 = Parameter Number

Each parameter is associated to a numerical value (parameter content) that corresponds to an option selected among those available for this parameter.

The parameter values define the inverter programming or the value of a variable (e.g., current, frequency, voltage).

In order to perform the inverter programming the parameter contents must be changed.

ACTION	LED HMI DISPLAY LCD HMI DISPLAY	DESCRIPTION
Use the ▲ and/or ▼ key to select the desired parameter.	P100 Acceleration time P100 = 5.0s	Locate the desired parameter.
Press the PROG key in order to enter the programming mode.	5.0 Acceleration time P100 = 5.0s	View the parameter contents (4).
Use the ▲ and/or ▼ key to program the parameter.	6.1 Acceleration time P100 = 6.1s	Adjust the desired value (1) (4).
Press the PROG key in order to save the modification and exit the programming mode.	P100 Acceleration time P100 = 6.1s	Leave the programming mode (1) (2) (3).

(1) For parameters that are allowed to be changed with the motor running, the inverter uses the new adjusted value immediately. For parameters that can only be changed with a stopped motor, the inverter will use the new adjusted value only after the PROG key is pressed.

(2) By pressing the PROG key after the modification, the new programmed value is automatically stored in the inverter nonvolatile memory, remaining stored until a new modification.

(3) If the last value set in the parameter turns it incompatible with other parameter values previously programmed, an F083 - Programming Error- indication will be displayed.

Programming error example:
Programming two digital inputs (DIx) with the same function. Refer to table 4.2 for the list of programming incompatibilities that cause F083.

(4) In order to allow the modification of any parameter, it is necessary to program the password in P000. Otherwise, you can only read the parameter values but not change them. The factory default password is 5.

In order to get more details, refer to the P000 description in the chapter 6.

Table 4.2 *- Incompatibility between parameters – F083*

1) Two or more parameters between P264, P265, P266, P267, P268, P269 and P270 equal to 1 (LOC/REM)
2) Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 6 (ramp 2)
3) P265 equal to 8 and P266 different from 8 or vice-versa (Forward Run / Reverse Run)
4) P221 or P222 equal to 8 (Multispeed) and P266 ≠ 7 and P267 ≠ 7 and P268 ≠ 7
5) [P221 = 7 and P222 = 7] and [(P265 ≠ 5 or P267 ≠ 5) or (P266 ≠ 5 or P268 ≠ 5)] (with reference = E.P. and without DIx = Accelerate E.P. or without DIx = Decelerate E.P.)
6) [P221 ≠ 7 or P222 ≠ 7] and [(P265 = 5 and P267 = 5 or P266 = 5 and P268 = 5)] (without reference = E.P. and with DIx = Accelerate E.P. or with DIx = Decelerate E.P.)
7) P265 or P267 or P269 equal to 14 and P266 and P268 and P270 different from 14 (with DIx = START, without DIx = STOP)
8) P266 or P268 or P270 equal to 14 and P265 and P267 and P269 different from 14 (without START, with STOP)
9) P220 > 1 and P224 = P227 = 1 and without DIx = Start/Stop or DIx = Fast Stop and without DIx = General Enable
10) P220 = 0 and P224 = 1 and without DIx = Start/Stop or Fast Stop and without DIx = General Enable
11) P220 = 1 and P227 = 1 and without DIx = Start/Stop or Fast Stop and without DIx = General Enable
12) DIx = START and DIx = STOP, but P224 ≠ 1 and P227 ≠ 1
13) Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 15 (MAN/AUT)
14) Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 17 (Disables Flying Start)
15) Two or more parameters between P265, P266, P267, P268, P269 and P270 equal to 18 (Regulator DC Voltage)
16) P264 = 1 (DI2 = LOC / REM) and P226 = 4 (Selection of Fwd / Rev, Remote Situation by DI2)

ENERGIZATION, START-UP AND SAFE DE-ENERGIZATION

This Chapter provides the following information:

☑ How to check and prepare the inverter before powering-up;

☑ How to power-up and verify the energization success;

☑ How to operate the inverter when installed according to the standard project (refer to the section 3.2 Electrical Installation and the attached electric project);

☑ How to de-energize the inverter safely.

5.1 PRE-POWER CHECKS

The inverter must have already been installed according to the chapter 3 - Installation and Connection. Even when the inverter electric project is different from the suggested one in the attachment, the following recommendations are applicable.

DANGER!

Always disconnect all the power supplies before making any connections.

DANGER!

Although the inverter commands the opening of the input circuit breaker, there is no guarantee of its opening and neither that no voltages are present.

In order to open the medium voltage cabinets, follow all the safe de-energization procedures.

1) Check if all the power, grounding and control connections are correct and tightened.

2) Clean the inverter internally, remove all packing material and installation residues from within the MVW-01 cabinets.

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

4) If it is possible, decouple the motor mechanically from the load. If the motor cannot be decoupled, then make sure that rotation in any speed direction (Forward or reverse) is not hazardous to people or to the machine.

5) Close and lock the panel doors.

5.2 INITIAL POWER-UP (Parameter Settings)

After the pre-power checks the inverter can be powered up:

1) Verify the supply voltages
   Verify whether the medium voltage line is available at the input cubicle.
   Measure the auxiliary low voltage power supply voltage that feeds the control column and make sure it is within the allowed limits of +10 % / -15 %.

2) Check the control column circuit breakers
   Verify if the settings of the control circuit breakers are according to the electric project. Close the control column door.

3) Verify the emergency pushbutton
   Make sure the emergency pushbutton is not actuated. In case it is actuated, use the safety key to unlock it.

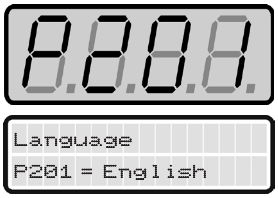
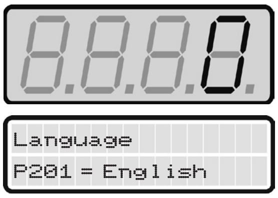
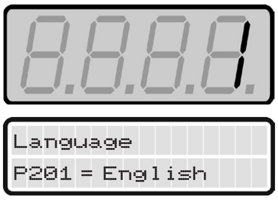
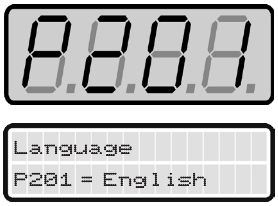
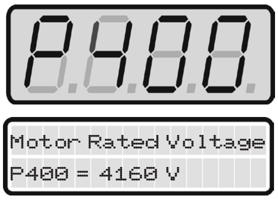
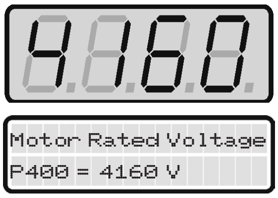
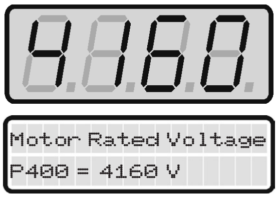
4) Apply power to the control column
   Close the control column auxiliary supply disconnector switch only after the power-up process be concluded.

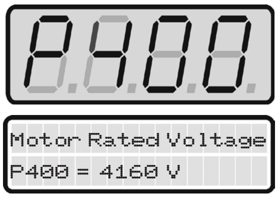
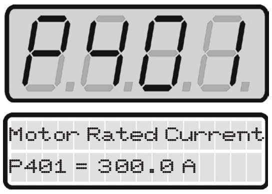
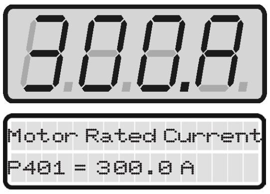
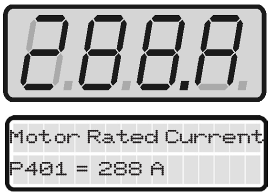
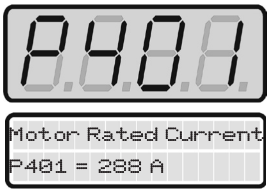
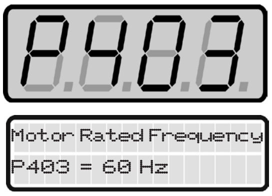
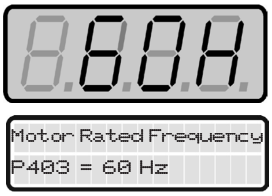
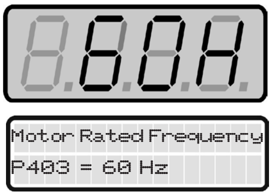
5) Verify the first energization success
   The first time the panel is energized or when the factory settings are loaded with P204 = 5, the guided start-up routine is initiated. This routine asks the user to program some parameters regarding the inverter and the motor.

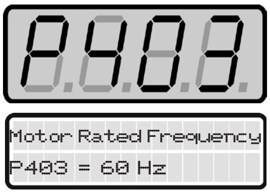
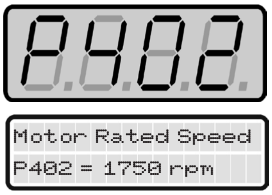
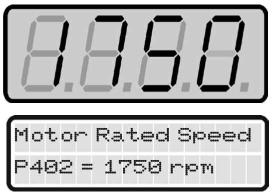
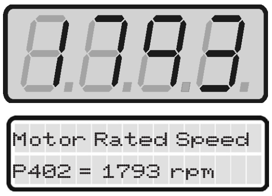
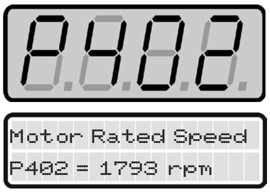
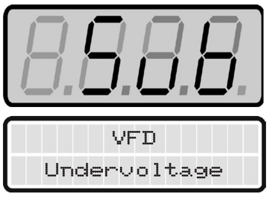
6) An example of programming following this routine is showed next.

   Example:
   Inverter
   MVW-01 4160 V
   Motor
   WEG - Model: HGF560L
   Power: 2500 HP
   Speed: 1793 rpm IV pole
   Rated current with 4160 V: 288 A
   Frequency: 60 Hz

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

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
After the initial power-up the display shows the following message	 Language P201 = English	Language selection: 0 = Portuguese 1 = English 2 = Spanish 3 = German
Press the PROG key in order to enter the programming mode	 Language P201 = English	Enter the programming mode
Use the ▲ and ▼ keys in order to select the language	 Language P201 = English	Selected language: English (the existing value was kept)
Press the PROG key in order to save the selected option and exit the programming mode	 Language P201 = English	Exit the programming mode
Press the ▲ key in order to go to the next parameter	 Motor Rated Voltage P400 = 4160 V	Motor rated voltage: 0 V to 4160 V
Press the PROG key in order to enter the programming mode	 Motor Rated Voltage P400 = 4160 V	Enter the programming mode
Use the ▲ and ▼ keys in order to program the motor rated voltage	 Motor Rated Voltage P400 = 4160 V	Programmed motor rated voltage: 4160 V (the existing value was kept)

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key in order to save the programmed value and exit the programming mode	 Motor Rated Voltage P400 = 4160 V	Exit the programming mode
Press the ▲ key in order to go to the next parameter	 Motor Rated Current P401 = 300.0 A	Motor rated current: 0 to 1.30 x P295
Press the PROG key in order to enter the programming mode	 Motor Rated Current P401 = 300.0 A	Enter the programming mode
Use the ▲ and ▼ keys in order to program the motor rated current	 Motor Rated Current P401 = 288 A	Programmed motor rated current: 288 A
Press the PROG key in order to save the programmed value and exit the programming mode	 Motor Rated Current P401 = 288 A	Exit the programming mode
Press the ▲ key in order to go to the next parameter	 Motor Rated Frequency P403 = 60 Hz	Motor rated frequency: 0 to 100 Hz
Press the PROG key in order to enter the programming mode	 Motor Rated Frequency P403 = 60 Hz	Enter the programming mode
Use the ▲ and ▼ keys in order to program the motor rated frequency	 Motor Rated Frequency P403 = 60 Hz	Programmed motor rated frequency: 60 Hz (the existing value was kept)

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key in order to save the programmed value and exit the programming mode		Exit the programming mode
Press the ▲ key in order to go to the next parameter		Motor rated speed: 0 to 7200 rpm
Press the PROG key in order to enter the programming mode		Enter the programming mode
Use the ▲ and ▼ keys in order to program the motor rated speed		Programmed motor rated speed: 1793 rpm
Press the PROG key in order to save the programmed value and exit the programming mode		Exit the programming mode
Refer to the section 5.3		The inverter is ready for the medium voltage power-up (pre-charge)

NOTE!

Guided start-up routine repetition:
In order to repeat the guided start-up routine, set the parameter P204 = 5 (Load the factory default parameters) and follow the routine as during the initial power-up;

The guided start-up routine automatically adjusts other parameters according to the programmed data. Refer to the chapter 6 for more details.

5.3 START-UP

This section describes the inverter start-up with keypad operation. The considered control mode is V/F 60 Hz.

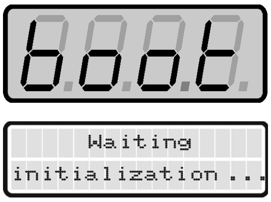
DANGER!

High voltages may be present even after the power supply disconnection.
The following sequence is valid for the standard MVW-01 inverter. The inverter should have already been installed and programmed, according to chapter 3 and section 5.2, respectively.

5.3.1 Start-up with HMI Operation and V/F 60 Hz Control Mode

1) Apply power to the panel
   Close the disconnector switch at the control column power supply input.

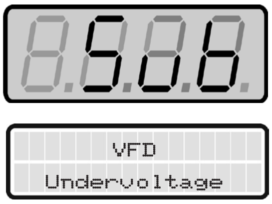
2) Once the control column has been energized, the MVC1 control board waits for its initialization, presenting the following message on the HMI:



Waiting
initialization ...

Waiting for the control initialization.

After the control has finished its initialization (approximately 10 seconds), the message “VFD Undervoltage” appears on the HMI.



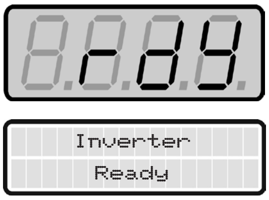
VFD
Undervoltage

The inverter is ready for the medium voltage power-up (pre-charge).

At this moment the inverter is in undervoltage state (DC link is discharged) and the "Ready to Start" pilot light (H1) at the control column door is on, indicating that it is already possible to initiate the inverter pre-charge.

3) Initiate the pre-charge / power section energization
The MVW-01 inverter pre-charge command must be given manually:

☑ With the pilot light "READY TO START" on, press the "POWER-ON" pushbutton (S1);
☑ Wait until the pre-charge is finished (approximately 10 seconds). During the pre-charge the "PRE-CHARGE" pilot light (H2) must remain on;
☑ Once the pre-charge is successfully completed, the "PRE-CHARGE" pilot light goes off and the "INPUT ON" (H3) goes on, indicating that the input transformer circuit breaker was successfully closed.
☑ The "Inverter Ready" message is displayed on the HMI.

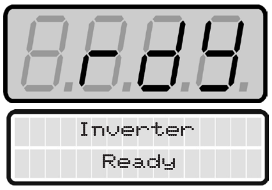
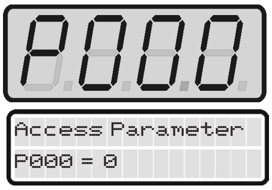

rdy
Inverter
Ready

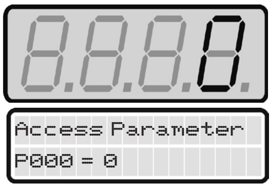
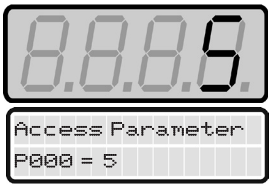
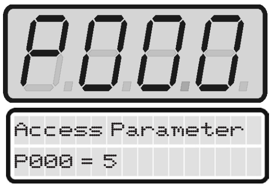
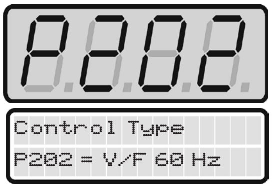
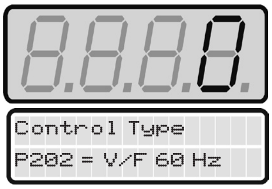
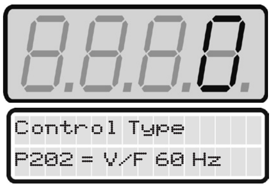
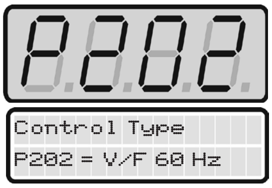
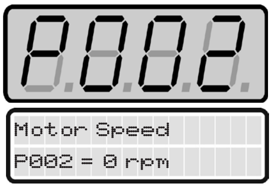
The inverter is ready for operation.

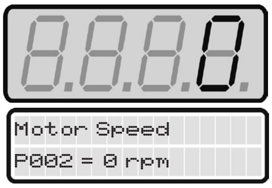
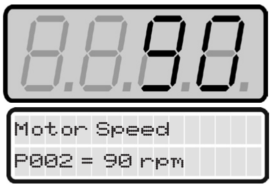
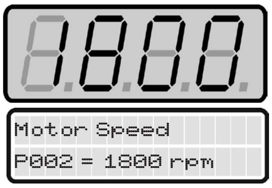
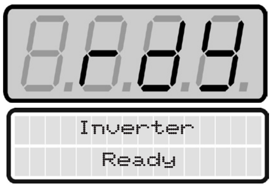
ATTENTION!

If during the pre-charge any problem occurs, the inverter indicates an error related to it.
The possible errors are:
F014 - Fault in the input transformer circuit breaker closure;
F017 - Circuit breaker not ready;
F020 - Pre-charge fault.
Refer to these error (alarm/fault) descriptions in the chapter 7.

4) The inverter is ready to operate. Follow the procedure described next:

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Power-up the panel and initiate the pre-charge as described previously	 rdy Inverter Ready	Inverter ready for operation
Press the ▲ or ▼ key in order to reach P000	 P000 Access Parameter P000 = 0	It grants access for parameter modification. With the factory default settings (P200 = 1 - Active password), adjust P000 = 5 in order to get access to modify parameters

ACTION	LED DISPLAY LCD DISPLAY	DESCRIPTION
Press the PROG key in order to enter the programming mode	 Access Parameter P000 = 0	Enter the programming mode
Use the ▲ and ▼ keys in order to program the password	 Access Parameter P000 = 5	Password value (Factory default)
Press the PROG key in order to save the programmed value and exit the programming mode	 Access Parameter P000 = 5	Exit the programming mode
Press the ▲ or ▼ key until reaching P202	 Control Type P202 = V/F 60 Hz	It defines the type of control: 0 = V/F 60 Hz 1 = V/F 50 Hz 2 = Adjustable V/F 3 = Sensorless Vector 4 = Vector with Encoder
Press the PROG key in order to enter the programming mode	 Control Type P202 = V/F 60 Hz	Enter the programming mode
Use the ▲ and ▼ keys in order to choose the correct control type	 Control Type P202 = V/F 60 Hz	If V/F 60 Hz is the right option, then keep it
Press the PROG key in order to save the chosen option and exit the programming mode	 Control Type P202 = V/F 60 Hz	Exit the programming mode
Press the ▲ or ▼ key until reaching P002	 Motor Speed P002 = 0 rpm	Motor speed (rpm)

ACTION	LED DISPLAY	DESCRIPTION
	LCD DISPLAY	
Press PROG		Read-only parameter
Press I		The motor accelerates from 0 rpm to 90 rpm (4) (Minimum speed), in the forward direction (1)
Keep the ▲ key pressed until reaching 1800 rpm		Motor accelerates up to 1800 rpm (4) (2)
Press 0		The motor decelerates down to 0 rpm (3). The inverter is ready for operation

NOTE!

The last speed reference value, set via the ▲ and ▼ keys, is saved in the memory. If you want to change this value before enabling the inverter, change it through the parameter P121 (Keypad Speed Reference), which stores the keypad speed reference.

NOTES:

(1) If the motor speed direction is inverted, switch off the inverter following the safe de-energization instructions and swap two of the motor cables.

(2) It the current is too high during the acceleration, especially at low speeds, it is necessary to reduce the acceleration ramp time (P100 or P102) or change P136 - Torque boost setting. Gradually increase and decrease the P136 content until reaching an operation with approximately constant current throughout the entire speed range. Refer to the parameter description in chapter 6.

(3) If F022 occurs during the deceleration, then increase its time via P101 or P103.

(4) Value for a 4 pole motor.

ATTENTION!

If the inverter receives a general enabling or a start command before the pre-charge has been finished (inverter still in undervoltage state), the command will be ignored and a warning message “Inverter Undervoltage” will be displayed on the HMI.

5.4 SAFE DE-ENERGIZATION INSTRUCTIONS

DANGER!

Although the inverter commands the opening of the input circuit breaker, there is no guarantee of its opening and neither that no voltages are present, because the capacitors remain charged for a long time and they can also be charged through the auxiliary supply (pre-charge).

In order to open the medium voltage cabinets, follow all the safe de-energization procedures described next.

1) Decelerate the motor to a complete stop.

2) Check the DC link voltage at the parameter P004 on the HMI. Open the control panel door and locate the neon lamps of the HVM (High Voltage Monitoring board), mounted on the cabinet left side. The four lamps must be on if the voltage showed via P004 is above 200 V.

3) Press the “POWER OFF” pushbutton. The input transformer circuit breaker is switched off at this moment, and the “INPUT ON” pilot light going off indicates it.

ATTENTION!

If the input transformer circuit breaker does not open with the “POWER OFF” command, then open it manually.

4) Follow the DC link voltage decrease through P004 on the HMI and the HVM neon lamps. When the DC link voltage crosses below 200 V the neon lamps start flashing with progressively lower frequency until going off completely.
Wait until the DC link voltage displayed at P004 on the HMI gets below 25 V.

5) At the input transformer circuit breaker cubicle, extract the circuit breaker from its operation position and close the transformer primary winding grounding switch. Lock the cubicle with the key and/or put a warning sign “System in maintenance”.

6) Press the emergency pushbutton located on the control column door and remove its key.

7) Switch off the Q2 circuit breaker in the control column and lock it in the open position with a padlock and/or put a warning sign “System in maintenance”.

8) Switch off the Q1 circuit breaker in the control column. Remove the auxiliary power supply.

It is only after the sequence of procedures described here that medium voltage compartment doors can be opened.

DANGER!

If it were not possible to follow the discharge of the DC link capacitors through the parameter P004, as well as through the HVM board neon lamps, due to a malfunction or a previous de energization, follow the instructions 5) through 8) and wait 10 minutes more.

DETAILED PARAMETER DESCRIPTION

This Chapter describes in detail all the MVW-01 parameters. In order to simplify the explanation, the parameters have been grouped by characteristics and functions:

Read-only Parameters	Variables that can be viewed on the display but cannot be changed by the user.
Regulation Parameters	Programmable values used by the inverter functions.
Configuration Parameters	They define the inverter characteristics, the functions to be executed, as well as the control board I/O functions.
Motor Parameters	Used motor data, consisting of information from the motor nameplate.
Special Function Parameters	It includes parameters related to special functions.

Symbols and definitions used in this chapter:

(1) Parameter can be changed only with the inverter disabled (motor stopped).
(2) Values may change as a function of the motor parameters.
(3) Values may change as a function of P412 (Tr Constant).
(4) Values may change as a function of P296.
(5) Values may change as a function of P295.
(6) Values may change as a function of P320.

Torque current is the total motor current component responsible for the torque development (in vector control mode).

Active current is the total motor current component proportional to the active electric power consumed by the motor (in V/F control mode).

6.1 READ-ONLY PARAMETERS - P000 to P099

Parameter	Range [Factory Setting] Unit	Description/Notes
P000 Access Parameter/ Password Setting	0 to 999 [0] -	☑ It allows the parameter contents modification. With the parameters adjusted according to the factory default (P200 = 1, Active password), it is necessary to program P000 = 5 in order to be able to change the parameter contents, i.e., the password is 5. ☑ Adjust P000 with the password + 1 in order to get access only to the parameters with contents different from the factory default values. ☑ Password modification: 1) Adjust P000 = 5 (current password) and P200 = 0 (Inactive password). 2) Press the PROG key. 3) Change P200 to 1 (Active password). 4) Press PROG again. The display shows P000. 5) Press PROG again. The display shows 5 (current password value). 6) Adjust the new password (Password 1) with the ▲ and ▼ keys. 7) Press PROG. The display shows P000. From this moment on the value adjusted above becomes the new password (Password 1). Therefore, in order to change parameters it will be necessary to program P000 = the new password (Password 1).
P001 Speed Reference	P133 to P134 [-] 1 rpm	☑ Speed reference value presented in rpm (factory default). ☑ Regardless of the reference source. ☑ The displayed unit can be changed by means of P207, P216 and P217, as well as the scale through P208 and P210. ☑ It is also possible to change the speed reference value via this parameter (P121 content) when P221 and/or P222 = 0.
P002 Motor Speed	P133 to P134 [-] 1 rpm	☑ It shows the motor speed in rpm and with a 0.5 s filter. ☑ The displayed unit can be changed by means of P207, P216 and P217, as well as the scale through P208 and P210. ☑ It is also possible to change the speed reference value via this parameter (P121 content) when P221 and/or P222 = 0.
P003 Motor Current	0 to 2600 [-] 0.1 A(<100) 1 A(>99.9)	☑ It indicates the inverter output current in Amperes (A).
P004 DC Link Voltage	0 to 8000 [-] 1 V	☑ It shows the DC link actual voltage in Volts (V). ☑ P004 is equal to the addition of P052 and P053 values.

Parameter	Range [Factory Setting] Unit	Description/Notes
P005 Motor Frequency	0.0 to 300.0 [-] 0.1 Hz	☑ Inverter output frequency value in Hertz (Hz).
P006 Inverter Status	0 to 26 [-] -	☑ It indicates the current inverter status according to the status machine diagram presented in the figure 6.1. Inverter possible states: 0 = ‘Booting’ indicates that the control board is waiting for the initialization end; 1 = ‘Sub’ indicates that the inverter has insufficient voltage for operation (undervoltage), and does not accept the enabling command (inverter waiting for the pre-charge/power energization command); 2 = ‘Inv. Ready’ indicates that the inverter is ready to be enabled; 3 = ‘Motor Mag.’ indicates that the motor is being magnetized by DC current. This state lasts for two times the motor rotoric constant time (P412); 4 = ‘Motor Rdy’ indicates that the motor is magnetized and the inverter is waiting for the run command; 5 = ‘Up Ramp’ indicates the motor is in the speed acceleration ramp; 6 = ‘Down Ramp’ indicates that the motor is in the speed deceleration ramp; 7 = ‘In Ref.’ indicates that the motor is rotating at the adjusted speed reference; 8 = ‘DC Break’ indicates that the motor is stopping with DC braking; 9 = ‘Coast’ indicates that the motor is coasting, without being driven by the inverter; 10 = ‘Ride Thro.’ indicates that the inverter is operating during momentary line faults; 11 = ‘Flying St.’ indicates that the inverter has received a command to start a spinning motor. This state persists until the inverter reaches the motor speed; 12 = ‘Test Mode’ indicates that the inverter is in a transitory state to test mode or to self-tuning; 13 = ‘Inv. Test’ indicates that the inverter is in a general test state; 14 = ‘Self-Comm.’ Indicates that the inverter is performing the self-tuning, automatically measuring motor parameters; 15 = ‘Power Test’ indicates that the inverter is testing power cabinet specific processes; 16 = Fault; 17 = Alarm; 18 = ‘Calibrat.’ indicates that the inverter is in the feedback signal calibration process; 19 = ‘Hold’ indicates that the inverter is in DC link regulation mode. Refer to the parameter P151 description;

Parameter	Range [Factory Setting] Unit	Description/Notes

20 = ‘I Limit’ indicates that the inverter is in current limitation. Refer to the parameter P169 description;

21 = ‘I Fast Limit’ indicates that the inverter is in fast current limitation;

22 = ‘Ride Thr 2’ indicates Ride-Through without interruption.

The state machine diagram can be seen in the figure 6.1, where the states indicated from 1 to 22 have their possible transitions indicated by the state changing arrows.

23 = ‘Hold 2’;

24 = ‘Sync’ indicates that the inverter is synchronized with the line;

25 = ‘Fast Disab’ indicates fast disable mode (General Enable = off) at the MVC1;

26 = ‘In Sync’ indicates that the inverter is trying to synchronize with the line.

NOTE!

The states that are not transitory, i.e., in which the inverter may remain for an undetermined time, they are identified with an arrow indicating a loop ↻.

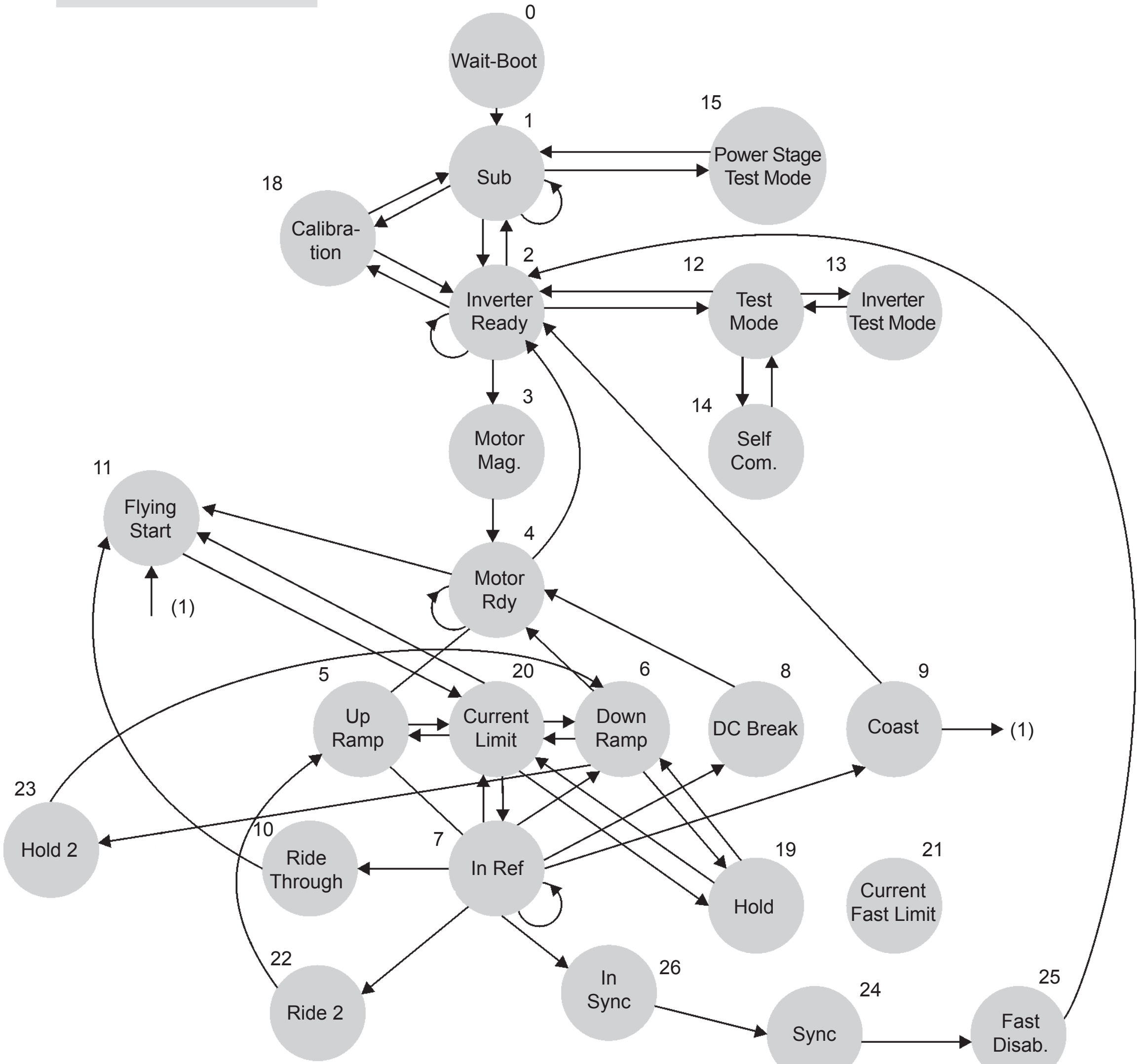
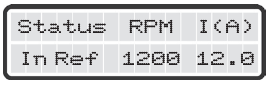
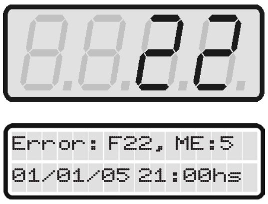


***Figure 6.1** - State machine*

Parameter	Range [Factory Setting] Unit	Description/Notes
P007 Motor Voltage	0 to 8000 [-] 1 V	☑ It indicates the inverter output voltage in Volts (V).
P008 Multivariable Parameter	- [-] -	☑ It shows three parameters simultaneously on the HMI, namely P006, P002 and P003. Therefore, the indication on the HMI will be the following:  
P009 Motor Torque	0.0 to 150.0 [-] 0.1 %	☑ It indicates the torque developed by the motor, calculated in the following way: $P009 = \frac{I_{TM} \cdot 100}{I_{TM_{NOMINAL}}}$ Where: I_{TM} = Actual motor torque current Vector Mode: $I_{TM_{NOMINAL}}$ = Motor nominal torque current. V/F mode: $I_{TM_{NOMINAL}}$ = Inverter nominal torque current.
P010 Output Power	0 to 9999 [-] 1 kW	☑ It indicates the inverter instantaneous output power in kW.

Parameter	Range [Factory Setting] Unit	Description/Notes
P012 Digital Inputs DI1 to DI10 (MVC2 and optional board) Status	LCD = A, I LED = 0 to 1023 [-] -	☑ On the keypad LCD it indicates the status of the MVC2 control board 8 digital inputs (DI1 to DI6, DI9, DI10), and the option board 2 digital inputs (DI7, DI8), by means of the letters A (Active) and I (Inactive), in the following sequence: DI1, DI2, ... ,DI7, DI8, DI9, DI10 ☑ On the keypad LED display it shows the decimal value correspondent to the 10 digital inputs status, so that each input is considered a bit in the sequence from DI10, DI9, DI1 and DI2 to DI8, where: - Active = 1 - Inactive = 0 - DI10 represents the most significant bit. Example: DI10 = Active (+24 V); DI9 = Inactive (0 V); DI1 = Inactive (0 V); DI2 = Active (+24 V); DI3 = Inactive (0 V); DI4 = Inactive (0 V); DI5 = Active (+24 V); DI6 = Inactive (0 V); DI7 = Inactive (0 V); DI8 = Active (+24 V). The inputs form the binary number 10 0100 1001, which corresponds to the decimal 585. The HMI indication will be the following: 

Parameter	Range [Factory Setting] Unit	Description/Notes
P013 Digital Outputs DO1, DO2 and Relays RL1, RL2, RL3, RL4 and RL5 (MVC2 and optional board) Status	LCD = A, I LED = 0 to 255 [-] -	☑ On the keypad LCD it indicates the status of the 2 optional board digital outputs (DO1, DO2) and of the MVC2 control board 5 relay outputs, by means of the numbers 1 (Active) and 0 (Inactive), in the following sequence: DO1, DO2, RL1, RL2, RL3, RL4, RL5. ☑ On the keypad LED display it shows the decimal value correspondent to the 7 digital outputs status, so that each output is considered a bit in the specific sequence, where: - Active = 1 - Inactive = 0 - DO1 represents the most significant bit. - The least significant bit does not correspond to an output and has always a '0' value. Example: DO1 = Inactive; DO2 = Inactive; RL1 = Active; RL2 = Inactive; RL3 = Active; RL4 = Active; RL5 = Active. The outputs form the binary number 0010 1110, which corresponds to the decimal 46. The HMI indication will be the following:  DO1...RL5 Status P013 = IIAIAAA

Parameter	Range [Factory Setting] Unit	Description/Notes
P014 Last Error	0 to 199 [-] -	☑ These parameters indicate the error code of the last, second, third and fourth errors, respectively. ☑ Recording sequence: Error → P014 → P015 → P016 → P017 → P060 → P061 → P062 → P063 → P064 → P065. ☑ Press the PROG key while at the parameters P014 to P017 in order to get more information on the occurred error. The error number will be presented on the LED display, whereas the LCD will indicate the error type, alarm (A) or fault (F), the hour and date when it occurred, and during which inverter status (ME) it happened. Example: A DC Link Overvoltage (F022) trip that occurred on January 1st, 2005 at 21:00 hours during the deceleration ramp (P006=5). The HMI indication will be the following:  **Note:** ME = Inverter status at the error moment, i.e., what P006 was showing.
P015 Second Error	0 to 199 [-] -	
P016 Third Error	0 to 199 [-] -	
P017 Fourth Error	0 to 199 [-] -	
P018 Analog Input AI1' (MVC2 Board)	0.0 to 100.0 [-] 0.1 %	☑ They present the MVC2 control board analog inputs AI1 and AI2, EBB board AI3 and EBA board AI4 values, as a full scale percentage. The indicated values are those obtained after offset action and gain multiplication. Refer to the parameters P234 to P247 description. The analog input AI2 has a filter that differentiates it from the others (Refer to P248).
P019 Analog Input AI2' (MVC2 Board)	-100.0 to +100.0 [-] 0.1 %	
P020 Analog Input AI3' (EBB Board)	-100.0 to +100.0 [-] 0.1 %	
P021 Analog Input AI4' (EBA Board)	-100.0 to +100.0 [-] 0.1 %	

Parameter	Range [Factory Setting] Unit	Description/Notes
P022 MVC1 Board Temperature	0 to 100 [-] 1 °C	☑ It indicates the MVC1 control board temperature, in Celsius degrees.
P023 MVC2 Software Version	XX.X [-] -	☑ It indicates the software version contained in the MVC2 microcontroller memory.
P024 Analog Input AI4 (optional board) A/D Conversion Value	LCD = -32768 to +32767 LED = 0 to FFFFH [-] -	☑ It indicates the analog input AI4, which is located in the optional board, A/D conversion result. ☑ The HMI LCD indicates the conversion result in decimal, and the LED display in hexadecimal with negative values in two's complement.
P025 Iv Current A/D Conversion Value	0 to 4095 [-] -	☑ P025, P026 and P027 indicate the A/D conversion result, in modulus, of the V, W and U phase currents, respectively.
P026 Iw Current A/D Conversion Value	0 to 4095 [-] -	
P027 Iu Current A/D Conversion Value	0 to 4095 [-] -	
P028 Analog Input AI5' (MVC2 Board)	0.0 to 100.0 [-] 0.1 %	☑ It presents the MVC2 control board analog input AI5 value as a full scale percentage. The indicated value is obtained after offset action and gain multiplication. Refer to the parameters P721 to P724 description.
P029 Trace Function Status	0 to 3 [0] 1	☑ Refer to the special parameters – Trace Function – in the section 6.5.2.

Parameter	Range [Factory Setting] Unit	Description/Notes
P030 Motor Temperature 1	0 to 240 [-] 1 ºC	☑ The NT538 Tecsystem module must be installed following the recommendations contained in its manual, so that these parameters indicate the motor temperature correctly. ☑ The communication between the Tecsystem and the MVW-01 control boards occurs through the Tecsystem-Busmod module and the MVC1 SCI1 serial channel. The parameter P315 must be programmed so that the SCI1 channel be used with the Tecsystem module (P315=1). ☑ The overtemperature alarm and fault levels are programmed directly in the NT538 Tecsystem, according to its manual. ☑ The Tecsystem-Busmod serial communication must be configured in the following manner: Baud rate: 19200 bps (DIP switch SW1:1 = 1, SW1:2 = 1) Parity: Even (DIP switch SW1:3 = 1, SW1:4 = 1) Slave address: 1 (DIP switch SW2:7 to SW2:1 = 0, SW2:0 = 1)
P031 Motor Temperature 2	0 to 240 [-] 1 °C	
P032 Motor Temperature 3	0 to 240 [-] 1 °C	
P033 Motor Temperature 4	0 to 240 [-] 1 °C	
P034 Motor Temperature 5	0 to 240 [-] 1 °C	
P035 Motor Temperature 6	0 to 240 [-] 1 °C	
P036 Motor Temperature 7	0 to 240 [-] 1 °C	
P037 Motor Temperature 8 ☛ These parameters are only visible on the display when P315 = 1 (Tecsystem)	0 to 240 [-] 1 °C	
P040 PID Process Variable ☛ These parameters are only visible on the display when P203 = 1 or 3	0 to P528 [-] %	☑ It indicates, in percentage (factory default), the process variable used as the PID feedback. ☑ The variable unit can be changed through the parameters P530, P531 and P532. The scale can be changed through P528 and P529. ☑ Refer to the detailed description at section 6.5 – Special Function Parameters.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P041
Active Redundant Ventilation Set</td><td>0 to 7
[0]
-</td><td>

☑ It indicates the status of the redundant ventilation.

☑ P041 is only accessible when the redundant ventilation is programmed (P140 > 0).

Table 6.1 *- Redundant ventilation set*

<table>
<tr><th>Status</th><th>Status description</th></tr>
<tr><td>0</td><td>Set A is active</td></tr>
<tr><td>1</td><td>Set B is active</td></tr>
<tr><td>2</td><td>Set A is active - Set B has failed</td></tr>
<tr><td>3</td><td>Set B is active - Set A has failed</td></tr>
<tr><td>4</td><td>Set A is active - Sets A and B have failed</td></tr>
<tr><td>5</td><td>Set B is active - Sets A and B have failed</td></tr>
<tr><td>6</td><td>Set A automatic test</td></tr>
<tr><td>7</td><td>Set B automatic test</td></tr>
</table>

☑ The states 4 and 5 occur when both the sets have failed. In this case the inverter must be powered off and the defective fans must be repaired or replaced (followed by a reset of the Redundant Ventilation function, refer to P140), otherwise successive ventilation set changes will occur, until the situation is normalized.

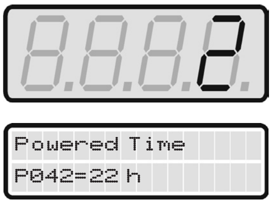
</td></tr>
<tr><td>P042
Powered Time</td><td>LCD = 0 to 65530
LED = 0 to 6553
(x10)
[-]
1 h</td><td>

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

☑ The LED display shows the total number of hours that the inverter remained powered divided by 10.

☑ This value remains stored even when the inverter is turned OFF.

Example: Indication of 22 hours powered.



</td></tr>
<tr><td>P043
Enabled Time</td><td>0 to 6553
[-]
0.1 h (<999.9)
1 h (>1000)</td><td>

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

☑ It counts up to 6553 hours, and then it rolls over to 0000.

☑ If P204 is set to 3, P043 is reset to zero.

☑ This value remains stored even when inverter is turned OFF.

</td></tr>
<tr><td>P044
MWh Counter</td><td>0 to 11930
[-]
1 MWh</td><td>

☑ It indicates the energy consumed by the motor.

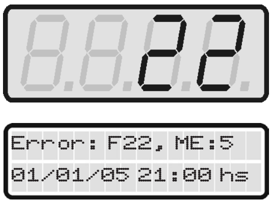
☑ It counts up to 11930 MWh, and then it rolls over to 00000.

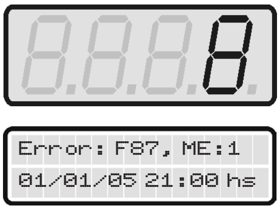
☑ If P204 is set to 4, P044 is reset to zero.

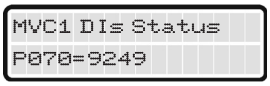
☑ This value remains stored even when the inverter is turned OFF.

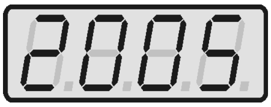
</td></tr>
</table>

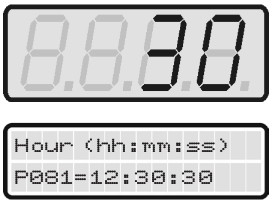
Parameter	Range [Factory Setting] Unit	Description/Notes
P045 HMI Software Version	XX.X [-] -	☑ It indicates the software version contained in the Graphic HMI microcontroller memory.
P046 Junction Temperature	-20.0 to +200.0 [-] 0.1 °C	☑ It indicates the theoretical junction temperature of the IGBTs.
P047 Inverter B (parallel) U Phase Power Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	☑ P047, P048 and P049 indicate, respectively, the temperature in Celsius degrees at the power arms of the phases U, V and W of the inverter B (only frame size C).
P048 Inverter B (parallel) V Phase Power Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	
P049 Inverter B (parallel) W Phase Power Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	
P050 Inverter B (parallel) Braking Circuit Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	☑ It indicates the temperature in Celsius degrees at the inverter B braking circuit arm.
P051 Inverter B (parallel) Rectifier Temperature	-20.0 to +200.0 [-] 0.1 °C	☑ It indicates the temperature in Celsius degrees at the inverter B input rectifier.
P052 Negative DC Link Voltage	0 to 8000 [-] 1 V	☑ It indicates the negative DC link actual voltage, in Volts.
P053 Positive DC Link Voltage	0 to 8000 [-] 1 V	☑ It indicates the positive DC link actual voltage, in Volts.

Parameter	**Range [Factory Setting] Unit**	**Description/Notes**
P055 U Phase Power Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	☑ P055, P056 and P057 indicate, respectively, the temperature in Celsius degrees at the power arms of the phases U, V and W.
P056 V Phase Power Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	
P057 W Phase Power Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	
P058 Braking Arm Temperature	-20.0 to +200.0 [-] 0.1 °C	☑ It indicates the braking arm temperature, in Celsius degrees. ☑ When the braking arm (optional) is not present, P058 shows 0.0 °C.
P059 Rectifier 1 Temperature (standard)	-20.0 to +200.0 [-] 0.1 °C	☑ It indicates the input rectifier heatsink temperature, in Celsius degrees.
P060 Fifth Error	0 to 199 [-] -	☑ These parameters indicate the error code of the fifth, sixth, seventh, eighth, ninth and tenth errors, respectively. ☑ Recording sequence: Error → P014 → P015 → P016 → P017 → P060 → P061 → P062 → P063 → P064 → P065. ☑ Press the PROG key while at the parameters P060 to P065 in order to get more information on the occurred error. The error number will be presented on the LED display, whereas the LCD will indicate the error type, alarm (A) or fault (F), the hour and date when it occurred, and during which inverter status (ME) it happened. Example: A DC Link Overvoltage (F022) trip that occurred on January 1st, 2005 at 21:00 hours during the deceleration ramp (P006 = 5). The HMI indication will be the following:  Error: F22, ME:5 01/01/05 21:00 hs **Note:** ME = Inverter status at the error moment, i.e., what P006 was showing.
P061 Sixth Error	0 to 199 [-] -	
P062 Seventh Error	0 to 199 [-] -	
P063 Eighth Error	0 to 199 [-] -	
P064 Ninth Error	0 to 199 [-] -	
P065 Tenth Error	0 to 199 [-] -	

Parameter	Range [Factory Setting] Unit	Description/Notes
P066 MVC1 Software Version	XX.X [-] -	☑ It indicates the software version contained in the MVC1 microcontroller memory.
P067 Error Log	1 to 100 [-] -	☑ It keeps the record of the last 100 errors (alarms/faults) occurred in the inverter. ☑ To access the error log, press the PROG key and then use the ▲ and ▼ keys to change the indication of the corresponding error. The last occurred error, i.e., the most recent error event, is represented by the error record 1, and the oldest event is the record 100. After pressing the PROG key the error record number is presented in the LED display. The information presented at each error record consists of the error number (e.g., F087), the inverter status at the moment of the error (e.g., ME:1), and the date/hour at the instant it occurred. For instance, in order to access the 8th last occurred error, proceed in the following manner: ☑ Access the parameter P067; ☑ Press the PROG key; ☑ Use the ▲ and ▼ keys to access the eighth record. The HMI indication could be the following, for instance:  8 Error: F87, ME:1 01/01/05 21:00 hs Thus informing that the eighth last error was the fault 87, which occurred while the inverter in the state 1 (Undervoltage), and presenting also the date and time at the moment of the fault.

Parameter	Range [Factory Setting] Unit	Description/Notes
P070 Digital Inputs DI1 to DI16 (MVC1 board) Status	0 to FFFFH [-] -	☑ It indicates on both, LED display and LCD, the hexadecimal value correspondent to the status of the 16 digital inputs of the MVC1 control board (DI1 to DI16), and each input is considered a bit, in the following order: DI1, DI2, ... , DI15, DI16. Active = 1 and Inactive = 0. The DI1 state represents the most significant bit. Example: DI1 = Active (+24 V); DI2 = Inactive (0 V); DI3 = Inactive (0 V); DI4 = Active (+24 V); DI5 = Inactive (0 V); DI6 = Inactive (0 V); DI7 = Active (+24 V); DI8 = Inactive (0 V); DI9 = Inactive (0 V); DI10 = Active (+24 V); DI11 = Inactive (0 V); DI12 = Inactive (0 V); DI13 = Active (+24 V); DI14 = Inactive (0 V); DI15 = Inactive (0 V); DI16 = Active (+24 V). The inputs form the binary number 1001 0010 0100 1001, which corresponds to the hexadecimal 9249H. The HMI indication will be the following:  MVC1 DIs Status P070=9249
P071 Relay Outputs RL1 to RL8 (MVC1 board) Status	0 to FFFFH [-] -	☑ It indicates on both, LED display and LCD, the hexadecimal value correspondent to the status of the 8 relay outputs of the MVC1 control board, and each output is considered a bit, in the following order: RL1, RL2, ... , RL7, RL8. Active = 1 and Inactive = 0. The RL1 state represents the most significant bit. Example: RL1 = Active; RL2 = Inactive; RL3 = Inactive; RL4 = Active; RL5 = Active; RL6 = Inactive; RL7 = Inactive; RL8 = Active. The outputs form the binary number 1001 1001, which corresponds to the hexadecimal 99H. The HMI indication will be the following:  MVC1 DOs Status P071=99

Parameter	Range [Factory Setting] Unit	Description/Notes
P072 Vab Input Voltage (Sinusoidal Signal)	-8000 to +8000 [-] 1 Vac	☑ It indicates the line voltage between phases *a* and *b* (Vab) at the input inverter, in Volts.
P073 Vcb Input Voltage (Sinusoidal Signal)	-8000 to +8000 [-] 1 Vac	☑ It indicates the line voltage between phases *c* and *b* (Vcb) at the input inverter, in Volts.
P074 Input Transformer Secondary Voltage Modulus	0 to 3750 [-] 1 Vac	☑ It indicates the voltage modulus of the input transformer secondary star winding, in Volts.
P075 Voltage Between the Medium Point and the Ground	0.0 to 100.0 [-] 0.1 %	☑ It indicates the voltage between the DC link medium point (PM) and the ground (GND), in %. **Note:** 100 % is equivalent to the line voltage of the an input transformer secondary winding.
P076 I x t Overload Status	0.0 to 150.0 [-] 0.1 %	☑ It indicates the overload status - adjusted through P156, P157 and P158 – in percentage. ☑ Motor Overload fault (F072) trips when P076 reaches 100 %.
P080 Date	LCD = dd/mm/yy LED = yyyy [-] 1 day	☑ On the keypad LCD it indicates the present date in the “dd/mm/yy” format. ☑ Procedure to adjust the date: 1. Press the PROG key. 2. Adjust the new date with the ▲ and ▼ keys. ☑ On the keypad LED display it shows the current year in the “yyyy” format. ☑ This parameter is adjusted at the factory to show the actual date. ☑ The maximum supported date is 2099. Only lower values must be programmed. Example: Indication of January 1st 2005   Date (dd/mm/yy) P080=01/01/05

Parameter	Range [Factory Setting] Unit	Description/Notes
P081 Hour	LCD = hh:mm:ss LED = ss [-] 10 s	☑ On the keypad LCD it indicates the current time in the "hh:mm:ss" format. ☑ On the keypad LED display it shows the seconds in the "ss" format. ☑ Procedure to adjust the hour: 1. Press the PROG key. 2. Adjust the new time with the ▲ and ▼ keys. ☑ This parameter is adjusted at the factory to show the actual time. ☑ The 24 hours system is adopted and it is not possible to select another standard. ☑ The time is adjusted in 10 s steps. Example: Indication 12 hours, 30 minutes and 30 seconds.  Hour (hh:mm:ss) P081=12:30:30

6.2 REGULATION PARAMETERS - P100 to P199

Parameter	Range [Factory Setting] Unit	Description/Notes
P100 Acceleration Time	0.0 to 999.0 [100.0] 0.1 s (<99.9) - 1 s (>99.9)	☑ 0.0 s setting means no use of ramp, i.e., the application of a voltage step (0 to 100 %) to the motor. ☑ They define the times to accelerate linearly from 0 up to the maximum speed (P134) and decelerate linearly from the maximum speed down to 0. ☑ The commutation to the 2nd Ramp can be done through one of the digital inputs from DI3 to DI10, if programmed for the 2nd Ramp function. Refer to P265 to P272.
P101 Deceleration Time	0.0 to 999.0 [180.0] 0.1 s (<99.9) - 1 s (>99.9)	
P102 Acceleration Time 2nd Ramp	0.0 to 999.0 [100.0] 0.1 s (<99.9) - 1 s (>99.9)	
P103 Deceleration Time 2nd Ramp	0.0 to 999.0 [180.0] 0.1 s (<99.9) - 1 s (>99.9)	

Parameter	Range [Factory Setting] Unit	Description/Notes
P104 S Ramp	0.0 to 100.0 [0.0] 0.1 %	☑ It defines the S Ramp percentage used during accelerations and decelerations. The figure 6.2 allows a better understanding.

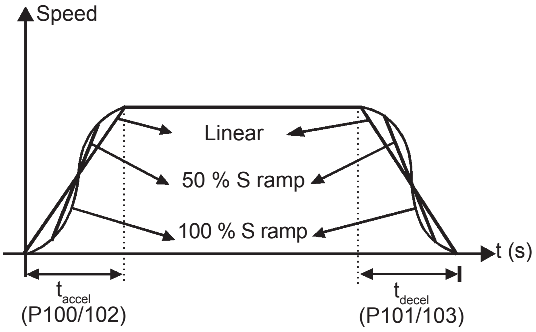


Figure 6.2 *- S or linear ramp*

$$P104=\frac{t_{ramps}}{t_{accel}}\ .\ 100\ \%=\frac{(t_{accel}-t_{linear})}{t_{accel}}\ .\ 100\ \%$$, in the accelerations, or

$$P104=\frac{t_{ramps}}{t_{decel}}\ .\ 100\ \%=\frac{(t_{decel}-t_{linear})}{t_{decel}}\ .\ 100\ \%$$, in the decelerations.

Where:

t_{accel} = acceleration time, defined by P100 or P102;

t_{decel} = deceleration time, defined by P101 or P103;

t_{ramps}= time of S ramp;

t_{linear}= time of linear ramp.

☑ A setting of 0.0 % means inactive function and only the linear ramp will be used.

☑ The S ramp reduces the mechanical shocks during accelerations and decelerations.

Parameter	Range [Factory Setting] Unit	Description/Notes
P120 Speed Reference Backup	0 or 1 [1] -	☑ It defines whether the Speed Reference Backup is active (1) or inactive (0). ☑ If P120 = inactive, then the inverter will not save the reference when it is disabled, i.e., when the inverter is enabled again the speed reference will be the minimum speed. ☑ This backup function is applied only to the reference via HMI.

Table 6.2 *- Backup function*

P120	Backup
0	Inactive
1	Active

Parameter	Range [Factory Setting] Unit	Description/Notes
P121 Keypad Speed Reference	P133 to P134 [90] 1 rpm	☑ In order to activate the ▲ and ▼ keys, set P221 = 0 and/or P222 = 0. ☑ With P120 = 1 (Active) the content of P121 is maintained (backup) even when the inverter is disabled or turned off.
P122 (2) JOG or JOG+ Speed Reference **P123** (2) JOG- Speed Reference	0 to P134 [150] 1 rpm 0 to P134 [150] 1 rpm	☑ JOG function activation.

Table 6.3 *- JOG command selected by digital input*

JOG Key	DI1 to DI3 Digital Inputs (P225 = 2 and/or P228 = 2)
P225 = 1 and/or P228 = 1	DI3 – P265 = 3 or DI4 – P266 = 3 or DI5 – P267 = 3 or DI6 – P268 = 3 or DI7 – P269 = 3 or DI8 – P270 = 3 or DI9 – P271 = 3 or DI10 – P272 = 3

☑ During the JOG command, the motor accelerates to the value defined at P122, following the acceleration ramp setting.

☑ The direction of rotation is defined by the Forward/Reverse function (P223 or P226).

☑ JOG can only be activated when the motor is disabled (stopped).

☑ JOG+ function activation:

Table 6.4 *- JOG+ command selection*

Digital Inputs	Parameters
DI3 to DI10	P265 to P272 = 10

☑ JOG- function activation:

Table 6.5 *- JOG- command selection*

Digital Inputs	Parameters
DI3 to DI10	P265 to P272 = 11

☑ During the JOG+ or JOG- commands the values of P122 or P123 are, respectively, added to or subtracted from the speed reference, to generate the total reference. Refer to the figure 6.24.

Parameter	Range [Factory Setting] Unit	Description/Notes
P124 $^{(2)}$ Multispeed Reference 1	P133 to P134 [90] 1 rpm	☑ The parameters from P124 to P131 will only be shown when P221 = 8 and/or P222 = 8 (Multispeed). ☑ Multispeed is used when up to 8 fixed pre-programmed speeds are required. ☑ When just 2 or 4 speeds are required, any combination of inputs between DI4, DI5 and DI6 can be used. Verify the speed reference parameters according to the used DIs. ☑ The inputs programmed for other functions must be considered as 0 V in the table 6.7. ☑ The stability of the fixed pre-programmed references and their immunity against electric noises (isolated digital inputs) are advantages of the Multispeed function. ☑ The Multispeed function is active only when P221 or P222 = Multispeed. ☑ It allows control of the output speed by associating the values defined in the parameters P124 to P131 to the logic combination of the digital inputs.
P125 $^{(2)}$ Multispeed Reference 2	P133 to P134 [300] 1 rpm	
P126 $^{(2)}$ Multispeed Reference 3	P133 to P134 [600] 1 rpm	
P127 $^{(2)}$ Multispeed Reference 4	P133 to P134 [900] 1 rpm	
P128 $^{(2)}$ Multispeed Reference 5	P133 to P134 [1200] 1 rpm	
P129 $^{(2)}$ Multispeed Reference 6	P133 to P134 [1500] 1 rpm	
P130 $^{(2)}$ Multispeed Reference 7	P133 to P134 [1800] 1 rpm	
P131 $^{(2)}$ Multispeed Reference 8	P133 to P134 [1650] 1 rpm	

Table 6.6 *- Multispeed function selected by digital input*

Enabled Digital Input	Parameter
DI4	P266 = 7
DI5	P267 = 7
DI6	P268 = 7

Table 6.7 *- Multispeed references*

8 speeds			Speed Reference
	4 speeds		
		2 speeds	
DI6	DI5	DI4	
0	0	0	P124
0	0	1	P125
0	1	0	P126
0	1	1	P127
1	0	0	P128
1	0	1	P129
1	1	0	P130
1	1	1	P131

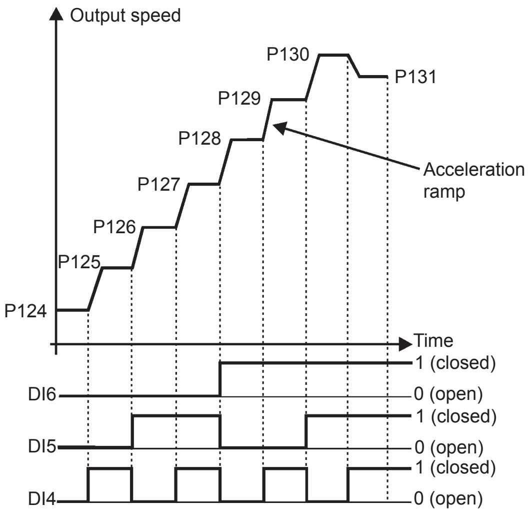
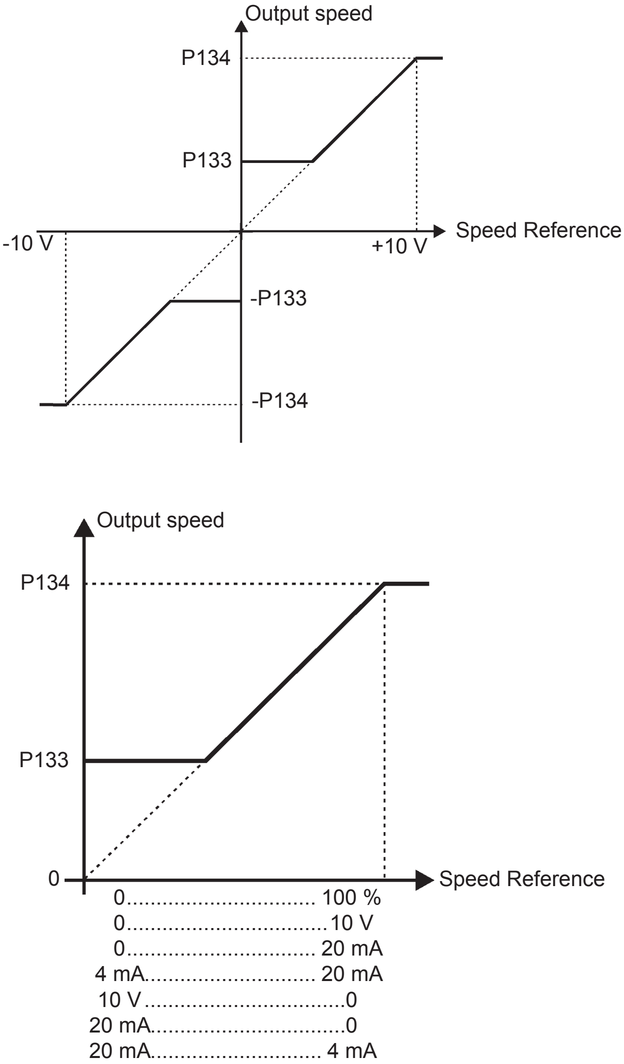


Figure 6.3 *- Multispeed*

Parameter	Range [Factory Setting] Unit	Description/Notes
P132 Overspeed Level ☞ This parameter is only visible in the display(s) when P202 = 3 or 4 (Vector Control)	0 to 100 [10] 1 %	☑ It defines the speed for the motor Overspeed fault F112. ☑ The Overspeed is expressed in percentage above the nominal speed.
P133 (2) Minimum Speed Reference **P134** (2) Maximum Speed Reference	0 to (P134-1) [90] 1 rpm (P133+1) to (3.4xP402) [1800] 1 rpm	☑ They define the minimum and the maximum motor speed reference values. They are valid for any type of reference signal. ☑ For more details about the actuation of P133 refer to P233 (Analog Inputs Dead Zone).  ***Figure 6.4*** *- Speed limits considering an active Dead Zone (P233=1)*

Parameter	Range [Factory Setting] Unit	Description/Notes
P136 Manual Torque Boost (IxR) (V/F Control [P202 = 0 or 1])	0 to 9 [0] 1	☑ It compensates the voltage drop across the motor stator resistance at low speeds, by increasing the inverter output voltage, in order to maintain a constant motor torque in V/F operation. ☑ The optimum setting is the lowest P136 value that allows a satisfactory motor starting. Values higher than the necessary increase the motor current at low speeds, being able to cause overcurrent conditions (F070, F071 or F072). ☑ The maximum voltage increase occurs at 0 Hz and is equal to 2.5 % of the nominal voltage when P136 = 9. ☑ The setting 0 means inactive function.

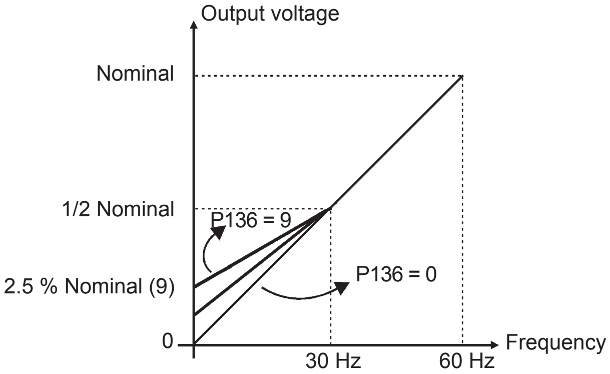


Figure 6.5 *- P202 = 0 - V/F 60 Hz curve*

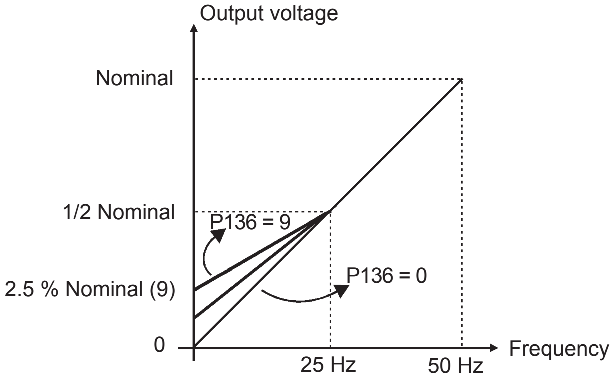
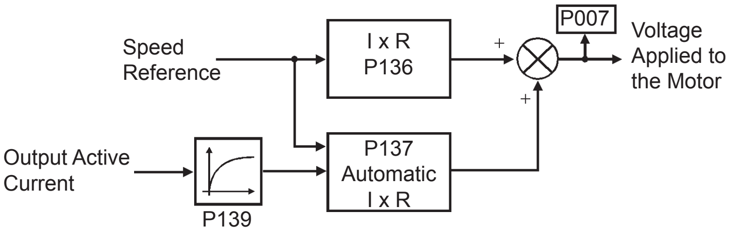
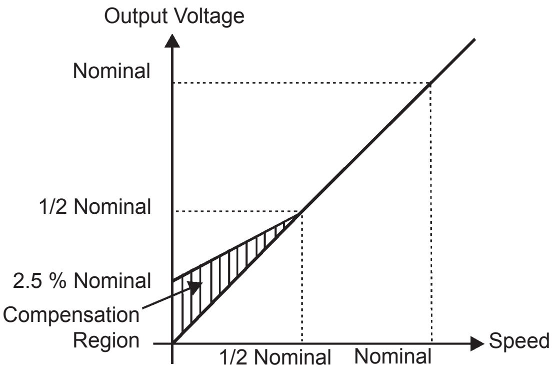
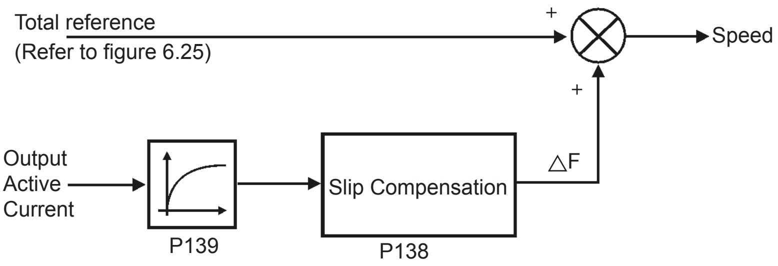
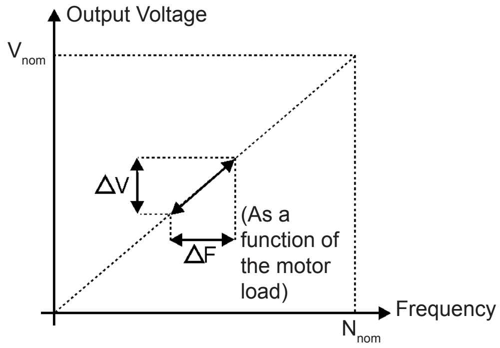
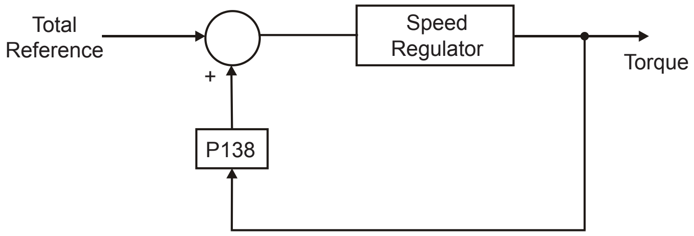


Figure 6.6 *- P202 = 1 - V/F 50 Hz curve*

Parameter	Range [Factory Setting] Unit	Description/Notes
P137 Automatic Torque Boost (Automatic IxR) This parameter is only visible on the display when P202 = 0, 1 or 2 (V/F Control)	0.000 to 1.000 [0.000] 0.001	☑ The Automatic Torque Boost compensates the voltage drop across the motor stator resistance as a function of the motor active current. ☑ The criteria for adjusting P137 are the same as for adjusting P136.  **Figure 6.7** - *P137 block diagram*  **Figure 6.8** - *V/F curve with automatic torque boost*

Parameter	Range [Factory Setting] Unit	Description/Notes
P138 $^{(2)}$ Slip Compensation	-10.00 to +10.00 [0.00] 0.01 %	**V/F Mode:** ☑ The parameter P138 (for values between -10.00 % and +10.00 %) is used to adjust the motor slip compensation function. It compensates the speed drop due to load application, by increasing the output frequency as a function of the motor active current increase. ☑ P138 allows the user to accurately adjust the MVW-01 slip compensation. Once P138 is set, the inverter keeps a constant speed even with load variations, through the automatic adjustment of output voltage and frequency.  *Figure 6.9 - P138 block diagram (V/F)*  *Figure 6.10 - V/F curve with Slip Compensation* ☑ P138 adjustment procedure: ⇒ Run the motor without load at half the maximum application speed; ⇒ Measure the actual motor or equipment speed; ⇒ Apply the equipment nominal speed; ⇒ Increase P138 until reaching the no load speed. ☑ Negative P138 values are used in special applications, in which the speed has to be reduced as a function of the output current. E.g., load distribution on motors driven in parallel.

Parameter	Range [Factory Setting] Unit	Description/Notes
		Vector Mode (Droop Control):  ***Figure 6.11*** *- P138 block diagram (vector)* ☑ In vector mode (with encoder or sensorless), the parameter P138 has the function described in the figure 6.11. ☑ A value proportional to the motor load is added to the total speed reference. ☑ This parameter is used in multimotor applications.
P139 Output Current Filter (V/F Control) ☛ This parameter is only visible on the display when P202 = 0, 1 or 2 (V/F Control)	0.0 to 16.0 [0.2] 0.1 s	☑ It adjusts the active current filter time constant. ☑ It adjusts the response time of the slip compensation and the automatic torque boost. Refer to figures 6.7 and 6.9.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P140
Redundant Ventilation Selection</td><td>0 to 4
[0]
-</td><td>☑ It selects the active ventilation set and the redundant ventilation operation mode.
<p><i>Table 6.8</i> <i>- Redundant Ventilation selection</i></p>
<table>
<tr><th>Function</th><th>Description</th></tr>
<tr><td>0</td><td>Inactive</td></tr>
<tr><td>1</td><td>Set A</td></tr>
<tr><td>2</td><td>Set B</td></tr>
<tr><td>3</td><td>Alternating A</td></tr>
<tr><td>4</td><td>Alternating B</td></tr>
</table>
<p>☑ With P140 = Inactive, the redundant ventilation function is deactivated and all the software internal records and timers are reset.</p>
<p>☑ With P140 programmed for Set A or Set B, the redundant ventilation function operates with just one set of fans, and the periodical set alternation must be done manually, by changing P140 between 1 and 2. An automatic test of the second set is done automatically after the time programmed in P141 has elapsed.</p>
<p>☑ With P140 programmed for Alternating A or Alternating B, the redundant ventilation function initiates the operation of the selected set and starts alternating automatically between the two sets, according to the time programmed in P141.</p>
<p>☑ The redundant ventilation status can be visualized in P041.</p>
<p>☑ In order that the redundant ventilation function operates properly, it is necessary to program a digital output (DO1 to DO2, or RL1 to RL5) for the selection of the active set, and two digital inputs (DI1 to DI10) for set A and set B operation failure.</p>
<p>☑ A ventilation failure alarm is activated when one of the sets fails (A093/A094 or A113/A114 alarm for set A or set B, respectively).</p>
<p>☑ The Redundant Ventilation function is only possible with the appropriated hardware installed (refer to the supplier specific project).</p></td></tr>
<tr><td>P141
Number of Hours for Alternating Ventilation Sets</td><td>1 to 9999
[720]
1 h</td><td>☑ It defines the number of hours between ventilation sets alternation.</td></tr>
</table>

Parameter	Range [Factory Setting] Unit
P142 (1) Maximum Output Voltage	0.0 to 100.0 [100.0] 0.1 %
P143 (1) Intermediate Output Voltage	0.0 to 100.0 [50.0] 0.1 %
P144 (1) Output Voltage at 3 Hz	0.0 to 100.0 [8.0] 0.1 %
P145 (1)(2) Field Weakening Speed	P133(>90) to P134 [1800] 1 rpm
P146 (1)(2) Intermediate Speed	90 to P145 [900] 1 rpm

☞ These parameters are only visible on the display(s) when P202 = 0, 1 or 2 (V/F Control)

Description/Notes

☑ These parameters allow changing the standard V/F curves defined at P202. They can be used to create approximately quadratic curves, or with motors with nominal voltages and/or frequencies different from the standard ones.

☑ This function allows changing the predefined standard curves, which represent the relationship between the output voltage and the output frequency of the drive, and consequently, the motor magnetization flux. This feature may be useful with special applications that require rated voltage or frequency values different from the standard ones.

☑ The function is activated by setting P202 = 2 (Adjustable V/F).

☑ P144 factory default value of (8.0 %) is defined for standard 60 Hz motors. If the rated motor frequency (set at P403) is different from 60 Hz, the factory default value of P144 may be inappropriate and cause difficulties during the motor start.

If it becomes necessary to increase the starting torque, increase the value of P144 gradually.

☑ Adjustable V/F parameter setting procedure:

1. Disable the inverter;
2. Verify the inverter data (P295 to P297);
3. Set the motor data (P400 to P406);
4. Adjust the parameters for P001 and P002 indication (P208, P210, P207, P216 and P217);
5. Set the speed limits (P133 and P134);
6. Set the Adjustable V/F function parameters (P142 to P146);
7. Enable the Adjustable V/F function (P202 = 2).

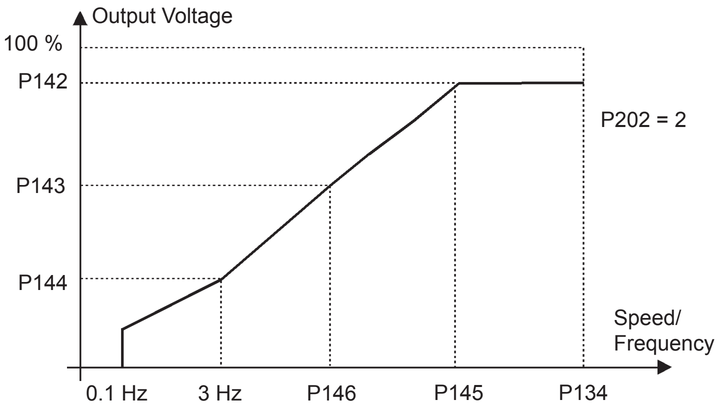


***Figure 6.12** - Adjustable V/F curve*

Parameter	Range [Factory Setting] Unit	Description/Notes

P150 (1)
DC Link Voltage
Regulation Mode

0 to 2
[2]
-

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

Table 6.9 *- DC Link voltage regulation mode*

P150	Action
0 = Without losses (Normal)	It is a deceleration ramp control identical to the V/F mode control. The setting is done via P151.
1 = Without losses (Automatic)	Automatic deceleration ramp control. Optimal braking is not active. The deceleration ramp is automatically adjusted to keep the DC link voltage below the level set in P151. This avoids F022 DC link overvoltage tripping. Can also be used with eccentric loads.
2 = With losses (Optimal Braking)	Optimal braking is active as described in P151 for vector control. This gives the shortest possible deceleration time without using dynamic braking or regeneration. The maximum rotoric flux is adjusted in P179.

P151 (4)
DC Link Voltage
Regulation Level

325 to 400
(P296 = 0)
[375]
1 V

564 to 800
(P296 = 1)
[618]
1 V

3541 to 4064
(P296 = 2)
[3571]
1 V

5080 to 5831
(P296 = 3)
[5123]
1 V

6404 to 7350
(P296 = 4)
[6428]
1 V

V/F mode (P202 = 0, 1 or 2):

☑ P151 adjust the DC link regulation level, in order to prevent F022 – DC link Overvoltage trips. This parameter, together with P152, allows two types of DC link regulation operation. See next the description and settings for both.

Ramp Holding – When P152 = 0.00 and P151 is different from the maximum value. When the DC link voltage reaches the regulation level (P151), the deceleration ramp is extended and the speed kept constant until the DC voltage becomes lower than the regulation level. Refer to the figure 6.13.

☑ This type of DC link regulation (Ramp Holding) tries to avoid overvoltage trips (F022) during decelerations with high inertia loads or with short deceleration times.

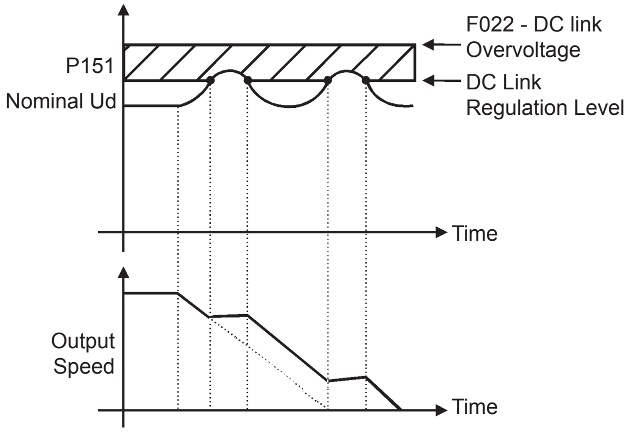


Figure 6.13 *- Deceleration with Ramp Holding*

☑ An optimized (minimum) deceleration time for the driven load is obtained with this function.

☑ This function is useful with medium inertia applications, which require short deceleration ramps.

Parameter	Range [Factory Setting] Unit	Description/Notes

☑ If overvoltage trips (F022) continue occurring during the deceleration, the value of P151 must be gradually reduced, or the deceleration time increased (P101 and/or P103).

☑ In case that the supply line is permanently with overvoltage, so that Ud > P151, then the inverter will not be able to decelerate. In such case, reduce the line voltage or increase the P151 setting.

☑ If, even after these settings, the motor is not able to decelerate in the necessary time, then use dynamic braking (refer to the dynamic braking in the specific project).

DC Link Regulation with Proportional Gain – When P152 > 0.00 and P151 is different from the maximum value. When the DC link voltage reaches the regulation level (P151), the deceleration ramp is extended and the motor is accelerated until the DC voltage becomes lower than the regulation level. Refer to figures 6.14 and 6.15.

Table 6.10 *- Recommended DC link voltage regulation levels*

Inverter voltage Parameter	220 V / 230 V	380 V	2300 V	3300 V	4160 V
P296	0	1	2	3	4
P151	375	618	3571	5123	6428

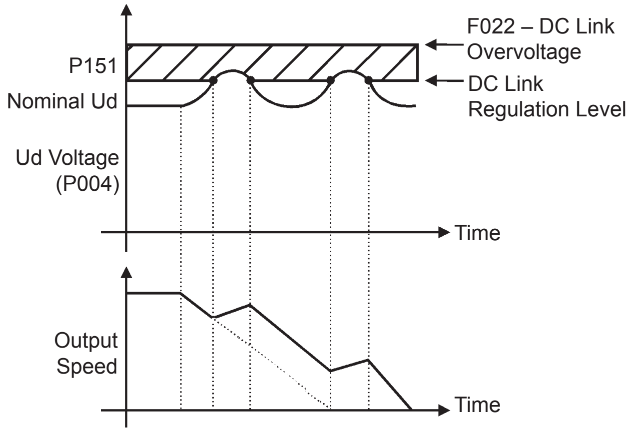
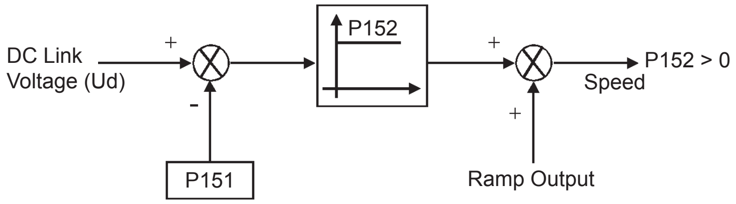


Figure 6.14 *- Deceleration with DC link voltage regulation*

NOTES!

☑ If overvoltage trips (F022) continue occurring during the deceleration, the value of P152 must be gradually increased, or the deceleration time increased (P101 and/or P103).

In case that the supply line is permanently with overvoltage, so that Ud > P151, then the inverter will not be able to decelerate. In such case, reduce the line voltage or increase the P151 setting.

Parameter	Range [Factory Setting] Unit	Description/Notes
		 ***Figure 6.15*** *- DC link voltage regulation block diagram* **Vector mode (P202 = 3 or 4):** ☑ P151 defines the DC link regulation level during braking. During the braking process, the deceleration ramp time is automatically extended, thus avoiding overvoltage fault F022. ☑ The DC link voltage regulation operation can be set in two forms: 1. With losses (Optimal Braking) - Set P150 = 2. In this mode the rotoric flux current is applied in a manner that increases the losses in the motor, thus increasing the braking torque. 2. Without losses - Set P150 = 1. It only activates the DC link voltage regulation.
P152 DC Link Regulator Proportional Gain (Only for V/F Control P202 = 0, 1 or 2)	0.00 to 9.99 [0.00] 0.01	☑ Refer to P151 and figure 6.14. ☑ If P152 = 0.00 and P151 is different from the maximum value, then the Ramp Holding function will be active. Refer to P151 in V/F mode. ☑ P152 multiplies the DC link error (error = actual DC link - P151). P152 is typically used to prevent overvoltage with eccentric load applications.

Parameter	Range [Factory Setting] Unit	Description/Notes
P153 $^{(4)}$ Dynamic Braking Voltage Level	325 to 400 (P296 = 0) [375] 1 V 564 to 800 (P296 = 1) [618] 1 V 3541 to 4064 (P296 = 2) [3571] 1 V 5080 to 5831 (P296 = 3) [5123] 1 V 6404 to 7350 (P296 = 4) [6428] 1 V	☑ Dynamic braking can be used only if a braking resistor is connected to the MVW-01. The braking transistor operation voltage level must be set according to the supply line voltage. If P153 is adjusted at a level too close to the overvoltage (F022) trip level, then the fault may occur before the braking transistor and resistor are able to dissipate the regenerated energy. See table 6.11 and figure 6.16.

***Table 6.11** - Recommended adjustment*

Inverter Voltage	P296	P153	F022
220 V / 230 V	0	375 V	> 420 V
380 V	1	618 V	> 734 V
2300 V	2	3571 V	> 4064 V
3300 V	3	5123 V	> 5830 V
4160 V	4	6428 V	> 7350 V

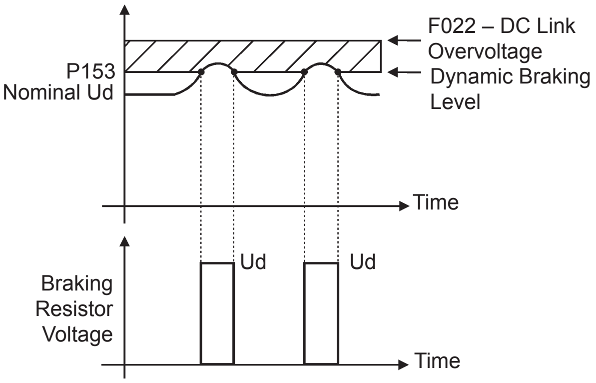


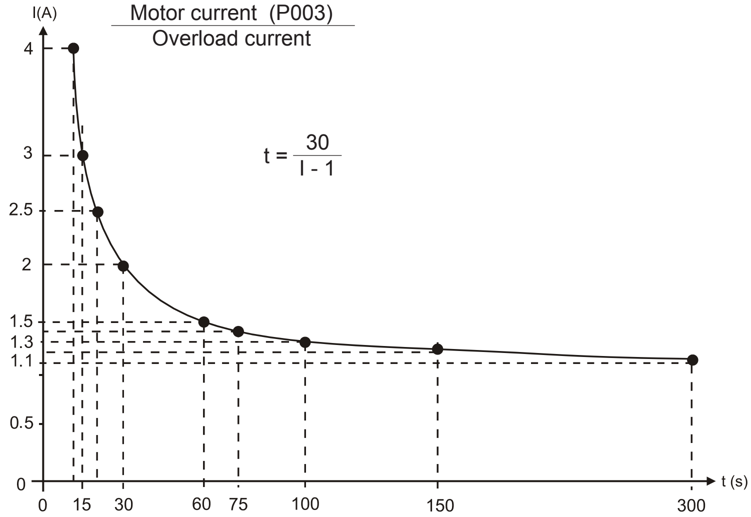
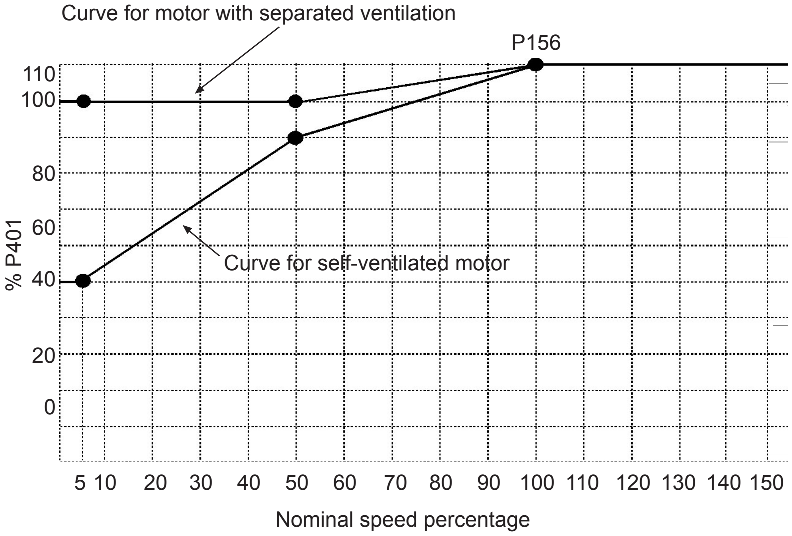
***Figure 6.16** - Dynamic Braking operation curve*

☑ Dynamic braking setup:

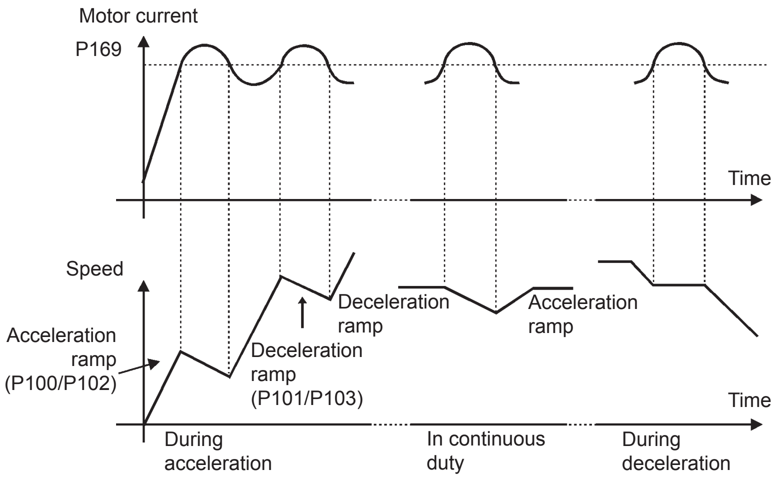
⇒ Install the dynamic braking resistor. Refer to the chapter 8.

⇒ Adjust P154 and P155 values according to the used braking resistor.

Parameter	Range [Factory Setting] Unit	Description/Notes
P154 Dynamic Braking Resistor	0.0 to 500.0 [0.0] 0.1 Ω (<100) - 1 Ω (≥100)	☑ Adjust it with the used braking resistor ohmic resistance value. ☑ P154 = 0 disables the braking resistor overload protection. It must be programmed with 0 when no braking resistor is used.

Parameter	Range [Factory Setting] Unit	Description/Notes
P155 DB Resistor Power Rating	10 to 1500 [50] 1 kW	☑ It adjusts the overload protection for the dynamic braking resistor. ☑ Set it according to the DB resistor nominal power rating. ☑ Operation: If the average power on the braking resistor is higher than the value set at P155 during 2 minutes, the inverter trips with F077 (Braking Resistor Overload) fault. ☑ Refer to the dynamic braking in the specific project.
P156 (2)(5) Motor Overload Current at 100 % of Nominal Speed	P157xP295 to 1.2xP295 [1.1xP401] 0.1 A (<100) - 1 A (>99.9)	 ***Figure 6.17*** *- I x t Function - Overload detection*  ***Figure 6.18*** *- Overload protection levels*
P157 (2)(5) Motor Overload Current at 50 % of Nominal Speed	P158 to P156 [0.9xP401] 0.1 A (<100) - 1 A (>99.9)	
P158 (2)(5) Motor Overload Current at 5 % of Nominal Speed	0.2xP295 to P157 [0.5xP401] 0.1 A (<100) - 1 A (>99.9)	

Parameter	Range [Factory Setting] Unit	Description/Notes
		☑ It is for the motor and inverter overload protection (I x t – F072 - Motor Overload). ☑ The motor overload current is the value above which the inverter considers that the motor is operating under overload. The higher the difference between the motor current and the overload level, the sooner F072 occurs. ☑ P156 (Motor Overload Current at 100 % of Nominal Speed) must be adjusted 10 % higher than the used motor nominal current (P401). ☑ The overload current is given as a function of the motor speed. Parameters P156, P157 and P158 are the three points used to form the overload curve, as shown in the figure 6.18, with the factory default settings. ☑ This curve changes when P406 (Type of Ventilation) is adjusted during the Guided Start-up Routine. Refer to the section 5.2. ☑ With the overload current curve adjustment it is possible to program an overload value that varies according to the inverter operation speed (factory default), improving the protection for self-ventilated motors, or to use a constant overload level for any speed applied to the motor (motor with separated ventilation).
P159 Overload Alarm Setting	0 to 100 [80] 1 %	☑ When the value visible in P076 reaches the value adjusted in P159, the alarm A046 is indicated on the HMI.
P161 Speed Regulator Proportional Gain	0.0 to 200.0 [20.0] -	☑ These gains are adjusted as a function of parameter P413 (Tm Constant). ☑ These gains can also be manually adjusted to optimize the speed dynamic response. Increase those gains in order to obtain a faster response. If the speed starts oscillating, reduce the gains.
P162 Speed Regulator Integral Gain	1 to 9999 [100] -	
P163 Local Reference Offset	-999 to +999 [0] 1	☑ When the speed reference comes through the analog inputs AI1 to AI4, P163 or P164 can be used to compensate undesired offsets in these signals.
P164 Remote Reference Offset	-999 to +999 [0] 1	
P165 Speed Filter	0.001 to 1.000 [0.012] 0.001 s	☑ It adjusts the time constant for the speed filter.

Parameter	Range [Factory Setting] Unit	Description/Notes
P167 Current Regulator Proportional Gain	0.000 to 9.999 [0.080] 0.001	☑ P167 and P168 are adjusted as a function of parameters P411 and P409, respectively.
P168 Current Regulator Integral Gain	0.1 to 999.9 [12.3] 0.1	
P169 Maximum Output Current (With V/F Control P202 = 0, 1 or 2)	0.2xP295 to 1.5xP295 [1.35xP295] 0.1 A (<100) - 1 A (>99.9)	☑ This parameter limits the motor output current by reducing the speed, thus avoiding motor stalling under overload conditions. ☑ As the motor load increases, the motor current also increases. When this current exceeds the value set at parameter P169, the motor speed is reduced (by using the deceleration ramp) until the current value falls below the value set at P169. The motor speed returns to the normal when the overload condition ceases existing.  **Figure 6.19** - *Curves showing the current limitation actuation*
P169 Maximum Forward Torque Current (With Vector Control P202 = 3 or 4)	0 to (P295/P401)x150 [125] 1 %	☑ It limits the value of the motor current component that produces torque. The adjustment is expressed in percentage (%) of the inverter rated current (P295 value). ☑ During the current limitation process, the motor current can be calculated by: $I_{motor} = [(P169 \text{ or } P170)^2 + (P401)^2]^{1/2}$ ☑ During the optimal braking, P169 acts as maximum output current limit to generate the forward braking torque (refer to the P151 description).
P170 Maximum Reverse Torque Current	0 to (P295/P401)x150 [125] 1 %	

Parameter	Range [Factory Setting] Unit	Description/Notes
P175 (1) Flux Regulator Proportional Gain	0.0 to 999.9 [50.0] 0.1	☑ These gains are adjusted as a function of the parameter P412.
P176 (3) Flux Regulator Integral Gain	1 to 9999 [900] -	
P177 Minimum Flux	0 to 120 [0] 1 %	☑ Motor flux conditions.
P178 Nominal Flux	0 to 120 [100] 1 %	
P179 Maximum Flux	0 to 200 [120] 1 %	
P180 Field Weakening Starting Point	0 to 120 [85] 1 %	☑ It expresses the percentage of the modulation index from which the motor field weakening starts.
P181 Magnetization Mode	0 or 1 [0] -	See Table 6.12
P182 Flux Reference Regulator Proportional Gain	0.00 to 99.99 [0.20] 0.1	☑ They are the flux reference PI regulator gains.
P183 Flux Reference Regulator Integral Gain	1 to 9999 [25] -	

***Table 6.12** - Magnetization mode*

P181	Action
0 = General Enable	It applies magnetization current after General Enable ON
1 = Start/Stop	It applies magnetization current after Start/Stop ON

6.3 CONFIGURATION PARAMETERS - P200 to P399

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

P200
Password

0 or 1
[1]
-

Table 6.13 *- Password status*

P200	Result
0 (Inactive)	Disables the password and allows changing parameters content regardless of P000 setting.
1 (Active)	Enables the password that allows changing parameter contents only when P000 is equal to that password.

☑ The factory default value for the password is P000 = 5.

☑ Refer to P000 in order to change the password.

P201
Language Selection

0 to 3
[To be defined by the user]
-

Table 6.14 *- Language selection*

P201	Language
0	Portuguese
1	English
2	Spanish
3	German

P202 (1)(2)
Control Type

0 to 4
[0]
-

Table 6.15 *- Control type selection*

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

Guided Start-up Routine:

☑ When P202 is programmed for sensorless vector (P202 = 3) or vector with encoder (P202 = 4), the inverter enters the guided start-up routine (refer to the figure 6.20).

☑ In this mode, the user must adjust a series of motor parameters, so that the vector control operates properly.

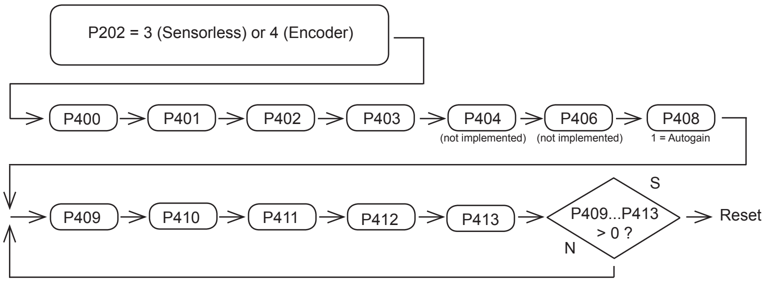


Figure 6.20 *- Guided start-up routine sequence*

Parameter	Range [Factory Setting] Unit	Description/Notes

A table with the summarized description of each parameter is shown next:

Table 6.16 *- Guided start-up routine*

Parameter	Description
P400	Motor rated voltage
P401	Motor rated current
P402	Motor rated speed
P403	Motor rated frequency
P404	Not implemented in this software version
P406	Not implemented in this software version
P408	Self-tuning 0 = Inactive 1 = Autogain (automatic calculation of the gains of the regulators)
P409	Motor stator resistance
P410	Motor magnetization current
P411	Motor flux leakage inductance
P412	Motor rotor time constant (Lr/Rr)
P413	Motor mechanical time constant (Tm)

☑ Refer to the specific description of each parameter for more details.

☑ Parameters from P409 to P413 correspond to motor internal parameters, and they must be programmed according to the motor nameplate data.

☑ The values programmed at P409 to P413 must be different from zero; otherwise, the inverter will not leave the guided start-up routine.

P203
Especial Function Selection

0 to 3
[0]
-

☑ It defines the special function selection.

Table 6.17 *- Selection of the special functions*

P203	Special Functions
0	None
1	PID Regulator
2	Trace
3	Trace + PID

☑ For the PID regulator special function, refer to the detailed description of the related parameters P520 to P535.

☑ When P203 is changed to 1 or 3, P265 changes automatically to 15 – Manual/Automatic.

Parameter	Range [Factory Setting] Unit	Description/Notes
P204 (1) Load/Save Parameters	0 to 11 [0] -	☑ The parameters P295 (Inverter Rated Current), P296 (Inverter Rated Voltage), P297 (Switching Frequency), P308 (Serial Address) and P201 (Language) are not changed when the factory default parameters are loaded through P204 = 5. ☑ In order to load the User Parameters #1 (P204 = 7) and/or the User Parameters #2 (P204 = 8) into the operation area of the MVW-01, it is necessary that the User Memory #1 and/or the User Memory #2 have been previously saved (P204 = 10 and/or P204 = 11). ☑ The options P204 = 5, 7, 8, 10 and 11 are disabled when P309 ≠ 0 (Fieldbus active).

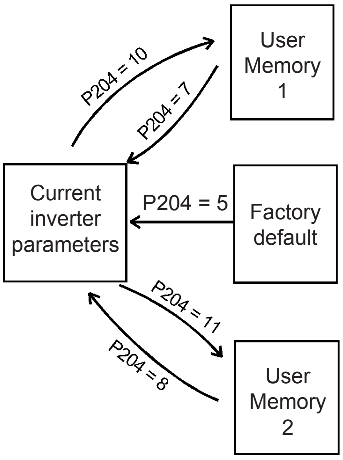


Figure 6.21 *- Parameter Transference*

Table 6.18 *- Load/save parameters*

P204	Action
0, 1, 2, 6, 9	Without function: No action.
3	Reset P043: It resets the enabled time counter.
4	Reset P044: It resets the MWh counter.
5	Load WEG – 60 Hz: It reset all the parameters to the 60 Hz factory default values.
7	Load User 1: It resets all the parameters to the values stored in the User Memory 1.
8	Load User 2: It resets all the parameters to the values stored in the User Memory 2.
10	Save User 1: It saves all the current inverter parameters in the User Memory 1.
11	Save User 2: It saves all the current inverter parameters in the User Memory 2.

NOTE!

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

Parameter	Range [Factory Setting] Unit	Description/Notes
P205 Display Default Selection	0 to 6 [2] -	☑ Selects which of the parameters listed below will be shown on the display every time after the inverter has been powered up:
P206 Auto-Reset Time	0 to 255 [0] 1 s	☑ In the event of a fault trip the inverter can initiate an automatic reset after the time given by P206 has elapsed. ☑ If P206 ≤ 2, then auto-reset does not occur. ☑ If after the auto-reset the same fault is repeated three times consecutively, then the Auto-Reset function will be disabled. A fault is considered consecutive if it happens again within 30 seconds after an auto-reset. Therefore, if an error occurs four consecutive times, it will be permanently indicated and the drive will be disabled (in such case a reset command becomes necessary, e.g., HMI, DI, serial, etc.).
P207 Reference Engineering Unit 1	32 to 127 [114 (r)] -	☑ This parameter is useful only for inverters fitted with an LCD keypad. ☑ P207 is used to apply a customized display to P001 and P002. The letters rpm can be changed to user selected characters, e.g., L/s, CFM. ☑ The reference engineering unit is formed by three characters, which will be applied to the Speed Reference (P001) and to the Motor Speed (P002). P207 defines the leftmost character, P216 the center one and P217 the rightmost. ☑ All characters correspondent to the ASCII code, from 32 to 127, can be chosen. Examples: A, B, ... , Y, Z, a, b, ... , y, z, 0, 1, ... , 9, #, $, %, (,), *, +, ...

Table 6.19 *- Selection of the first monitoring parameter*

P205	Displayed read-only parameter
0	P005 (Motor Frequency)
1	P003 (Motor Current)
2	P002 (Motor Speed)
3	P007 (Output Voltage)
4	P006 (Inverter Status)
5	P009 (Motor Torque)
6	P040 - PID Process Variable

Parameter	Range [Factory Setting] Unit	Description/Notes
P208 (2) Reference Scale Factor	1 to 18000 [1800] 1	☑ It defines how the Speed Reference (P001) and the Motor Speed (P002) will be presented when the motor is running at synchronous speed.

☑ To indicate the values in rpm:

Adjust P208 for the synchronous speed, according to the table 6.20.

Table 6.20 *- Synchronous speed reference in rpm*

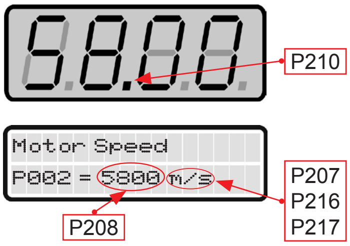
Frequency	Number of motor poles	Synchronous speed – rpm
50 Hz	2	3000
	4	1500
	6	1000
	8	750
60 Hz	2	3600
	4	1800
	6	1200
	8	900

☑ In order to indicate other units:

1. Adjust at P208 the number to be showed when the motor is at the rated (synchronous) speed, with the places for the tenths, hundredths and/or thousandths.
2. Set the place of the decimal point at P210.
3. Adjust the new unit with the three characters programmable at P207, P216 and P217.

Example:
To get an indication of
58.00 m/s program:

P208 = 5800
P210 = 2
P207 = “m”
P216 = “/”
P217 = “s”



Equations:

$$P001 = P002 = Speed \times P208 / Synchronous\ Speed \times (10)^{P210}$$

$$P001 = Reference \times P208 / Synchronous\ Speed \times (10)^{P210}$$

where:

Speed = Actual Speed in rpm;

Synchronous Speed = 120 x P403 / poles;

Poles = 120 x P403 / P402, can be equivalent to 2, 4, 6, 8 or 10;

Reference = Speed Reference in rpm;

The number of places after the decimal point is defined in P210.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P209
Motor Phase Loss Detection</td><td>0 or 1
[0]
-</td><td>
<i>Table 6.21 - Motor phase loss</i>
<table>
<tr><th>P209</th><th>Function</th></tr>
<tr><td>0</td><td>Inactive</td></tr>
<tr><td>1</td><td>Active</td></tr>
</table>
☑ The Motor Phase Loss Detection trips indicating F076 (Motor Phase Loss) when the following conditions are simultaneously satisfied:
I. P209 = Active;
II. Enabled inverter;
III. Speed reference higher than 3 %;
IV. Imax > 1.125 x Imin.
Where: Imax = the highest current among the three phases;
Imin = the lowest current among the three phases.
</td></tr>
<tr><td>P210
Speed Indication Decimal Point</td><td>0 to 3
[0]
1</td><td>☑ It defines the number of digits after the decimal point of the Speed Reference (P001) and the Motor Speed (P002) indications.</td></tr>
<tr><td>P211
Zero Speed Disable</td><td>0 or 1
[1]
-</td><td>
<i>Table 6.22 - Zero speed disable</i>
<table>
<tr><th>P211</th><th>Function</th></tr>
<tr><td>0</td><td>Inactive</td></tr>
<tr><td>1</td><td>Active</td></tr>
</table>
☑ When active it disables the inverter (general disable) when the speed reference and the actual speed become lower than the value adjusted in P291 (Zero Speed Zone) and after the time adjusted in P213 has elapsed.
☑ The inverter is enabled again when any of the conditions defined in P212 is fulfilled.
</td></tr>
<tr><td>P212
Condition to Leave Zero Speed Disable</td><td>0 or 1
[0]
-</td><td>
<i>Table 6.23 - Condition to leave zero speed disable</i>
<table>
<tr><th>P212 (P211 = 1)</th><th>Inverter leaves Zero Speed Disable when:</th></tr>
<tr><td>0</td><td>P001 (N*) > P291 or P002 (N) > P291</td></tr>
<tr><td>1</td><td>P001 (N*) > 0</td></tr>
</table>
☑ When the PID regulator is active (P203 = 1 or 3) and in automatic mode, besides the condition programmed in P212, it is also necessary that the PID error (the difference between the setpoint and the process variable) be more than the value programmed in P535, so that the inverter be able to leave the zero speed disable.
</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P213
Time Delay for Zero Speed Disable</td><td>0 to 999
[0]
1 s</td><td>☑ P213 = 0: Zero Speed Disable without timing.
☑ P213 > 0: Zero Speed Disable with timing. Timing begins after the speed reference and the actual speed become lower than the speed set in P291. When the time programmed at P213 has elapsed the inverter will be disabled. If during that timing any of the conditions for the disable no longer exists, the timer is reset and normal operation continues.</td></tr>
<tr><td>P214 (1) (6)
Line Phase Loss Detection</td><td>0 or 1
[1]
-</td><td><i>Table 6.24 - Line phase loss detection</i>
<table>
<tr><th>P214</th><th>Function</th></tr>
<tr><td>0</td><td>Inactive</td></tr>
<tr><td>1</td><td>Active</td></tr>
</table>
☑ When P214 is active it controls the following faults and alarms:
A001 = Input Transformer Secondary Low Voltage alarm;
A002 = Input Transformer Secondary High Voltage alarm;
F003 = Input Transformer Secondary Undervoltage fault;
F004 = Input Transformer Secondary Overvoltage fault;
F006 = Input Transformer Secondary Unbalance or Phase Loss fault.
☑ Conditions for the Line Phase Loss Detection activation:
I. P214 = Active
II. Enabled inverter
III. Finished pre-charge
IV. No active Ride-through function</td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description/Notes
P215 (1) Keypad Copy Function	0 to 2 [0] -	

Table 6.25 - Copy function

P215	Action
0 = Inactive	None
1 = INV → HMI	It transfers the current parameter values to the nonvolatile EEPROM memory of the HMI. The current inverter parameters are not changed.
2 = HMI → INV	It transfers the contents of the HMI memory to the current inverter parameters.

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

Note:

If parameters from an inverter with a software version different from software version of the inverter where they are supposed to be transferred have been previously copied into the keypad, then the operation will not be executed and the keypad will indicate F082 (Fault in the Copy function). A version is understood as different when the digits x and y, of a Vx.yz version, are different.

Example:

I. V1.60 → x = 1, y = 6 and z = 0 has been previously stored in the HMI.

II. If the inverter version V1.75 → x' = 1, y' = 7 and z' = 5. P215 = 2 → F082 ([y = 6] ≠ [y' = 7]).

III. If the inverter version V1.62 → x' = 1, y' = 6 and z' = 2. P215 = 2 → Normal copy ([y = 6] = [y' = 6]).

Copy function procedure:

1. Connect the HMI to the inverter (inverter A) from which the parameters have to be copied.
2. Set P215 = 1 (INV → HMI) in order to transfer the parameters from the inverter A to the HMI. Press the PROG key. P215 resets to 0 (inactive) automatically after the parameter transferring has been completed.
3. Switch off the inverter and disconnect the keypad.

NOTE!

The calibration parameters (WEG use) are also copied.

4. Connect the keypad to the inverter B, to which the parameters have to be transferred.

Parameter	Range [Factory Setting] Unit	Description/Notes
		5. Set P215 = 2 (HMI → INV) in order to transfer the parameters from the HMI to the inverter B. Press the PROG key. P215 resets to 0 (inactive) automatically after the parameter transferring has been completed. From that moment on, the inverters A and B have the same parameters. 6. If the inverters A and B drive different motors, then verify the inverter B motor parameters. 7. To copy the parameters from the inverter A to more inverters, repeat the steps from 4 to 6.

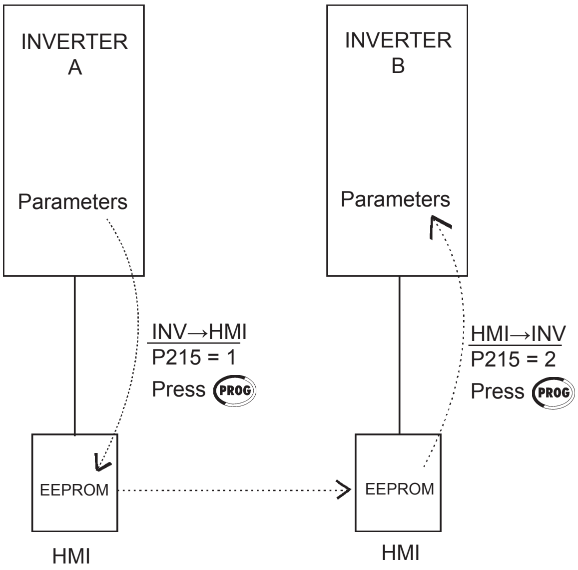


Figure 6.22 *- Copy of the parameters from inverter A to B*

☑ It is not possible to operate the HMI while it is performing the Copy function.

Parameter	Range [Factory Setting] Unit	Description/Notes
P216 Reference Engineering Unit 2	32 to 127 [112 (p)] -	☑ These parameters are useful only for inverters fitted with an LCD keypad. ☑ The reference engineering unit is formed by three characters, which will be applied to the Speed Reference (P001) and to the Motor Speed (P002). P207 defines the leftmost character, P216 the center one and P217 the rightmost. ☑ Refer to the parameter P207 description for more information.
P217 Reference Engineering Unit 3	32 to 127 [109 (m)] -	

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P218
LCD Contrast Adjustment</td><td>0 to 150
[127]
-</td><td>☑ This parameter is useful only for inverters fitted with an LCD keypad.
☑ It allows the adjustment of the LCD contrast. Increase or decrease the parameter content to obtain the best contrast.</td></tr>
<tr><td>P220 (1)
Local/Remote Selection Source</td><td>0 to 10
[2]
-</td><td>☑ It defines the origin of the command that will select between the Local situation and the Remote situation.

<i>Table 6.26</i> <i>- Local/Remote selection</i>
<table>
<tr><th>P220</th><th>Function</th></tr>
<tr><td>0</td><td>Always Local</td></tr>
<tr><td>1</td><td>Always Remote</td></tr>
<tr><td>2</td><td>HMI LOC REM key (Local default)</td></tr>
<tr><td>3</td><td>HMI LOC REM key (Remote default)</td></tr>
<tr><td>4</td><td>Digital inputs DI2 to DI10 (P264 to P272)</td></tr>
<tr><td>5</td><td>Serial (Local default)</td></tr>
<tr><td>6</td><td>Serial (Remote default)</td></tr>
<tr><td>7</td><td>Fieldbus (Local default)</td></tr>
<tr><td>8</td><td>Fieldbus (Remote default)</td></tr>
<tr><td>9</td><td>Local PLC</td></tr>
<tr><td>10</td><td>Remote PLC</td></tr>
</table>

☑ With the factory default settings the LOC REM key selects between Local and Remote. After powering up the inverter, it will initiate in Local mode (Local default).</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr>
<td>P221 (1)
Speed Reference Selection – Local Situation

P222 (1)
Speed Reference Selection – Remote Situation</td>
<td>0 to 12
[0]
-

0 to 12
[1]
-</td>
<td>
☑ The AIx’ designation refers to the analog signal obtained after the addition of the AIx input to the offset and its multiplication by the applied gain (refer to the figure 6.28).

<i>Table 6.27 - Local/Remote speed reference selection</i>
<table>
<tr><th>P221/
P222</th><th>Function</th></tr>
<tr><td>0</td><td>HMI ▲ and ▼ keys</td></tr>
<tr><td>1</td><td>Analog input AI1’ (P234 to P236)</td></tr>
<tr><td>2</td><td>Analog input AI2’ (P237 to P240 and P248)</td></tr>
<tr><td>3</td><td>Analog input AI3’ (P241 to P244)</td></tr>
<tr><td>4</td><td>Analog input AI4’ (P245 to P247)</td></tr>
<tr><td>5</td><td>Sum of Analog Inputs (AI1’ + AI2’) > 0
(Negative values are zeroed)</td></tr>
<tr><td>6</td><td>Sum of Analog Inputs (AI1’ + AI2’)</td></tr>
<tr><td>7</td><td>Electronic Potentiometer (E.P.)</td></tr>
<tr><td>8</td><td>Multispeed (P124 to P131)</td></tr>
<tr><td>9</td><td>Serial</td></tr>
<tr><td>10</td><td>Fieldbus</td></tr>
<tr><td>11</td><td>Analog input AI5’ (P721 to P724)</td></tr>
<tr><td>12</td><td>PLC</td></tr>
</table>

☑ The factory default for the Local speed reference is via HMI ▲ and ▼ keys, and for Remote speed reference is via Analog Input AI1.

☑ The reference value adjusted with the ▲ and ▼ keys is contained in the parameter P121.

☑ Refer to the Electronic Potentiometer operation in the figure 6.36 m).

☑ When the option 7 is selected, P265 or P267 must be programmed with the option 5, as well as P266 or P268 also with the option 5.

☑ When the option 8 is selected, then P266 and/or P267 and/or P268 must be programmed with the option 7.
</td>
</tr>
<tr>
<td>P223 (1)
Forward/Reverse Selection – Local Situation</td>
<td>0 to 11
[2]
-</td>
<td>
<i>Table 6.28 - Forward/Reverse selection - Local situation</i>
<table>
<tr><th>P223</th><th>Function</th></tr>
<tr><td>0</td><td>Always Forward</td></tr>
<tr><td>1</td><td>Always Reverse</td></tr>
<tr><td>2</td><td>HMI ⟳ key (Forward default)</td></tr>
<tr><td>3</td><td>HMI ⟳ key (Reverse default)</td></tr>
<tr><td>4</td><td>Digital input DI2 (P264 = 0)</td></tr>
<tr><td>5</td><td>Serial (Forward default)</td></tr>
<tr><td>6</td><td>Serial (Reverse default)</td></tr>
<tr><td>7</td><td>Fieldbus (Forward default)</td></tr>
<tr><td>8</td><td>Fieldbus (Reverse default)</td></tr>
<tr><td>9</td><td>AI4 polarity</td></tr>
<tr><td>10</td><td>Forward PLC</td></tr>
<tr><td>11</td><td>Reverse PLC</td></tr>
</table>
</td>
</tr>
</table>

Parameter	Range [Factory Setting] Unit	Description/Notes
P224 (1) Start/Stop Selection – Local Situation	0 to 4 [0] -	Table 6.29 (below)

***Table 6.29** - Start/Stop selection – Local situation*

P224	Function
0	HMI I and 0 keys
1	Digital input DIx
2	Serial
3	Fieldbus
4	PLC

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

Parameter	Range [Factory Setting] Unit	Description/Notes
P225 (1) JOG Selection Local Situation	0 to 5 [1] -	Table 6.30 (below)

***Table 6.30** - JOG selection – Local situation*

P225	Function
0	Disabled
1	HMI JOG key
2	Digital inputs DI3 to DI10 (P265 to P272)
3	Serial
4	Fieldbus
5	PLC

☑ The parameter P122 defines the JOG speed reference.

Parameter	Range [Factory Setting] Unit	Description/Notes
P226 (1) Forward/Reverse Selection – Remote Situation	0 to 11 [4] -	Table 6.31 (below)

***Table 6.31** - Forward/Reverse selection - Remote situation*

P226	Function
0	Always Forward
1	Always Reverse
2	HMI ⟲ key (Forward default)
3	HMI ⟲ key (Reverse default)
4	Digital input DI2 (P264 = 0)
5	Serial (Forward default)
6	Serial (Reverse default)
7	Fieldbus (Forward default)
8	Fieldbus (Reverse default)
9	AI4 polarity
10	Forward PLC
11	Reverse PLC

Parameter	Range [Factory Setting] Unit	Description/Notes

P227 (1)
Start/Stop Selection
– Remote Situation

0 to 4
[1]
-

Table 6.32 *- Start/Stop selection – Remote situation*

P227	Function
0	HMI I and 0 keys
1	Entradas digitais DIx
2	Serial
3	Fieldbus
4	PLC

Note: If the Digital Inputs are programmed for Forward Run / Reverse Run, the I and 0 keys will remain disabled, regardless of the value programmed at P227.

P228 (1)
JOG Selection
- Remote Situation

0 to 5
[2]
-

Table 6.33 *- JOG selection – Remote situation*

P228	Function
0	Disabled
1	HMI JOG key
2	Digital inputs DI3 to DI10 (P265 to P272)
3	Serial
4	Fieldbus
5	PLC

☑ The parameter P122 defines the JOG speed reference.

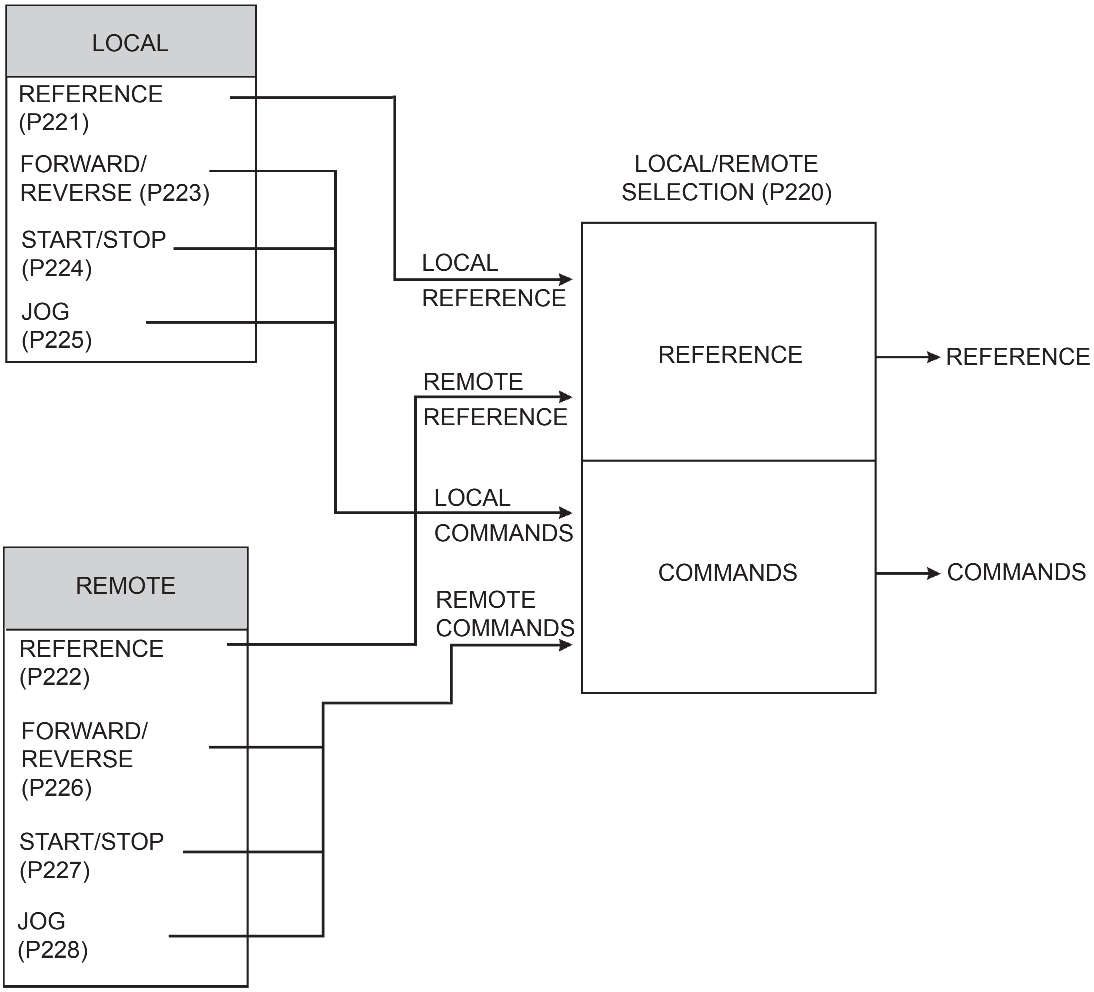


Figure 6.23 *- Local/Remote situation block diagram*

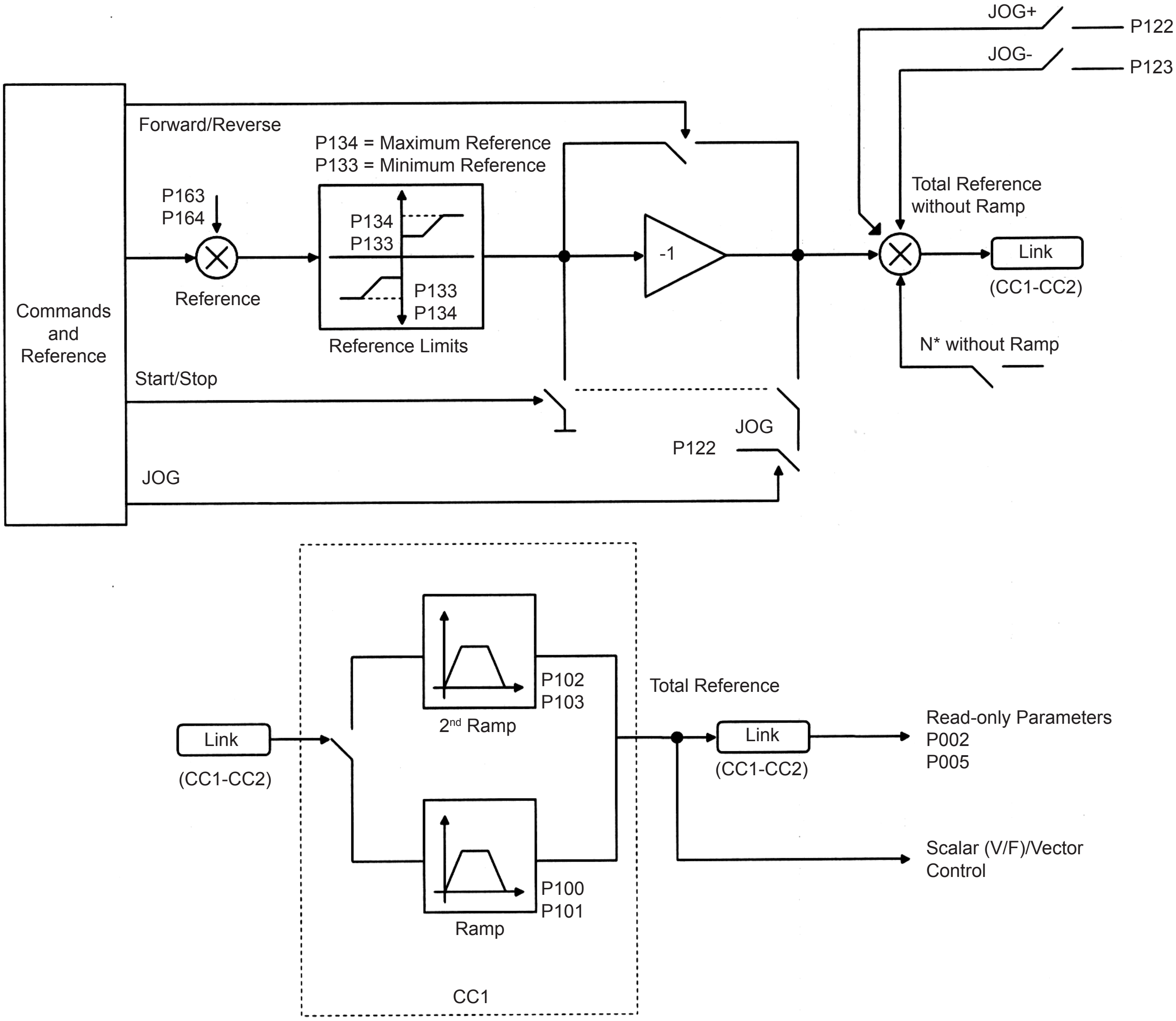


***Figure 6.24** - Speed reference block diagram*

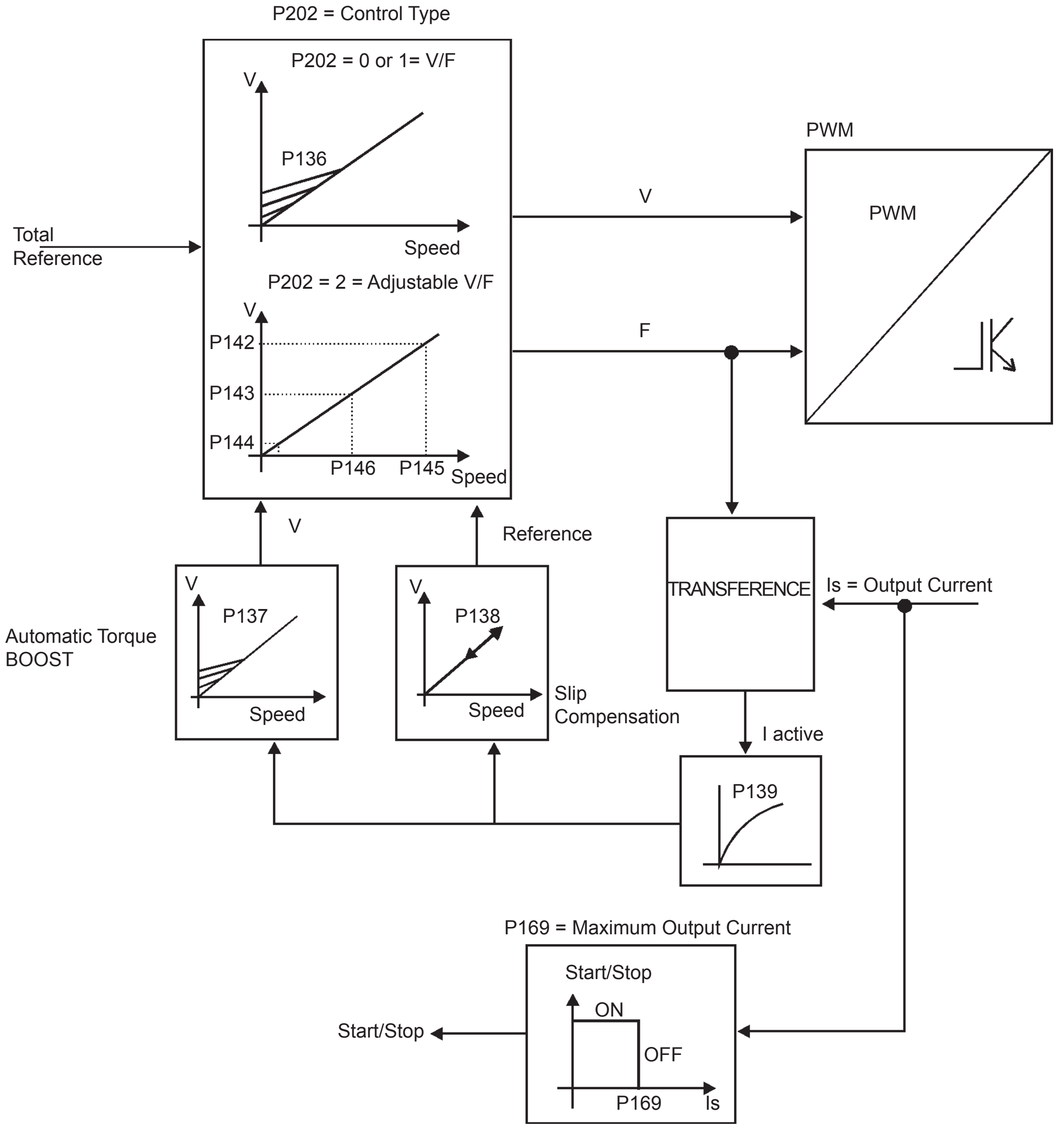


Figure 6.25 *- V/F (scalar) control block diagram*

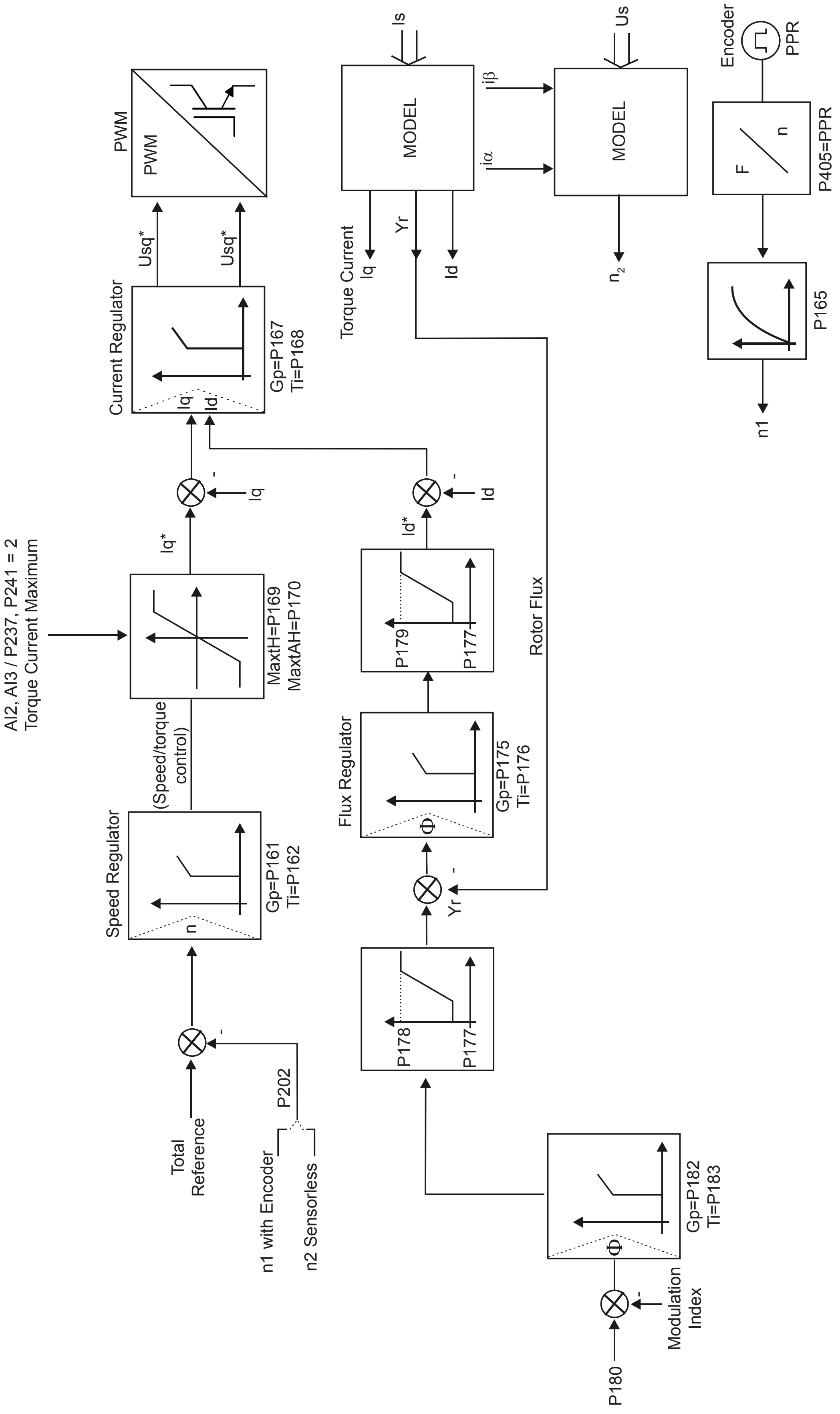


Figure 6.26 - *Vector control block diagram*

Parameter

Range
[Factory Setting]
Unit

Description/Notes

P232
Stop Mode
Selection

0 or 1
[0]
-

Table 6.34 - Stop mode selection

P232	Function
0	Run/Stop
1	General Disable

☑ With the P232 setting, it is possible to select between the stop modes Run/Stop and General Disable for the 0 key or for the stop function via DIx.

NOTE!

When the General Disable mode is programmed, then restart the motor only when it is stopped, or adjust the parameter P725 (Minimum Coasting Time) with a value long enough to ensure a complete motor stopping.

P233
Analog Input Dead
Zone

0 or 1
[1]
-

☑ It defines whether the dead zone of the analog inputs is inactive (0) or active (1).

☑ If P233 is inactive (0), the signal at the analog inputs acts on the speed reference starting from its minimum value that can be 0 V, 0 mA, 4 mA, 10 V or 20 mA.

☑ If P233 is active (1), then if the minimum speed (P133) is greater than 0 (zero) the analog inputs present a dead zone, i.e., the speed remains at the minimum (P133) until the analog signal becomes greater than the adjusted minimum speed.

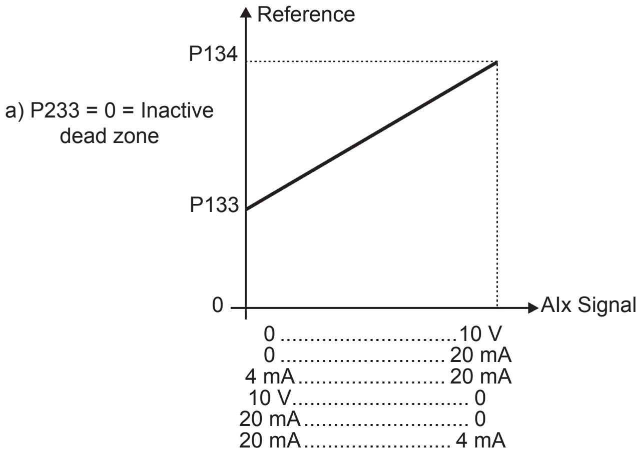


Figure 6.27 a) - Analog input dead zone inactive

Parameter	Range [Factory Setting] Unit	Description/Notes

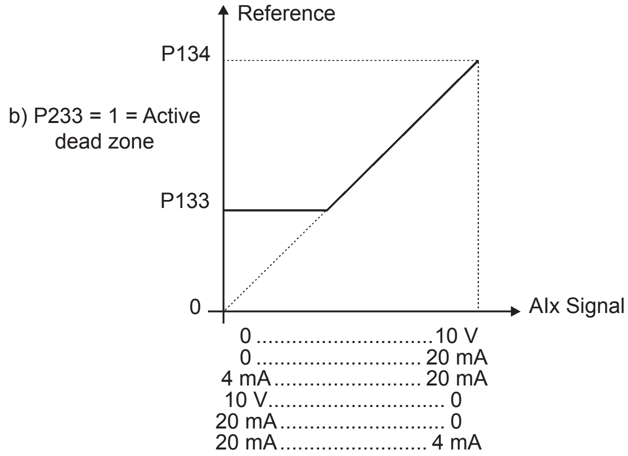


Figure 6.27 b) *- Analog input dead zone active*

☑ If the analog input AI4 is programmed for -10 V to +10 V (P246 = 4), curves identical to those of the figure 6.27 will apply, and only when AI4 is negative the speed direction will be inverted.

P234 Analog Input AI1 Gain	0.000 to 9.999 [1.000] 0.001	

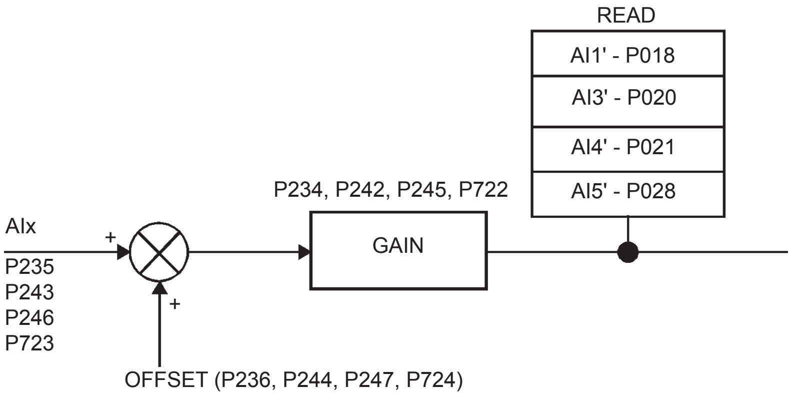


Figure 6.28 *- Analog inputs AI1, AI3, AI4 and AI5 block diagram*

☑ The internal values AI1', AI3', AI4' and AI5' are the results of the following equation:

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

Example: AI1 = 5 V, OFFSET = -70 % and Gain = 1.00:

$$\text{AI1'} = (5 + \frac{(-70)}{100} \times 10\ \text{V})\ \text{x1} = -2\ \text{V}$$

AI1' = -2 V, meaning that the motor will run in reverse direction with a speed reference absolute value equal to 2 V.

Parameter	Range [Factory Setting] Unit	Description/Notes
P235 (1) Analog Input AI1 Signal Type	0 to 3 [0] -	see Table 6.35 below
P236 Analog Input AI1 Offset	-100.0 to +100.0 [0.0] 0.1 %	☑ Refer to the P234 description.
P237 (1) Analog Input AI2 Function	0 to 3 [0] -	see Table 6.36 below
P238 Analog Input AI2 Gain	0.000 to 9.999 [1.000] 0.001	see Figure 6.29 below

P235 (1) Analog Input AI1 Signal Type

***Table 6.35** - Analog input AI1 signal type*

P235	Signal
0	(0 to 10) V/(0 to 20) mA
1	(4 to 20) mA
2	(10 to 0) V/(20 to 0) mA
3	(20 to 4) mA

☑ Set the S2.A switch on the MVC2 control board to the on position when a current signal is used at the analog input AI1.

☑ Inverse reference is obtained with the options 2 and 3, i.e., the maximum speed is obtained with the minimum reference.

P237 (1) Analog Input AI2 Function

***Table 6.36** - Analog input AI2 function*

P237	Function
0	P221/P222
1	Without function
2	Maximum Torque Current
3	PID process variable

☑ When the option 0 (P221/P222) is selected, AI2 is able to receive the speed reference, which will be subjected to the speed limits (P133 and P134) and ramp action (P100 to P103), providing that it has been programmed so in P221 and/or P222. Refer to the figure 6.24.

☑ The option 3, process variable, defines the AI2 input as the PID regulator feedback signal (e.g., pressure or temperature sensor, etc.), provided that P524 = 0.

P238 Analog Input AI2 Gain

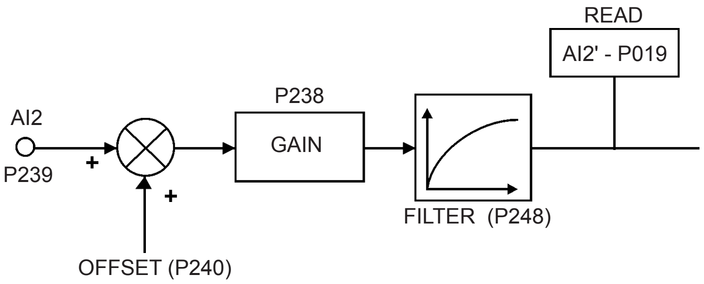


***Figure 6.29** - Analog input AI2 block diagram*

☑ The internal value AI2’ is the results of the following equation:

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

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

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

AI2’ = -2 V, meaning that the motor will run in reverse direction with a speed reference absolute value equal to 2 V.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P239 (1)
Analog Input AI2
Signal Type</td><td>0 to 4
[0]
-</td><td>

<i>Table 6.37</i> <i>- Analog input AI2 signal type</i>

<table>
<tr><th>P239</th><th>Signal</th></tr>
<tr><td>0</td><td>(0 to 10) V/(0 to 20) mA</td></tr>
<tr><td>1</td><td>(4 to 20) mA</td></tr>
<tr><td>2</td><td>(10 to 0) V/(20 to 0) mA</td></tr>
<tr><td>3</td><td>(20 to 4) mA</td></tr>
<tr><td>4</td><td>(-10 to +10) V</td></tr>
</table>

☑ Set the S2.B switch on the MVC2 control board to the on position when a current signal is used at the analog input AI2.

☑ Inverse reference is obtained with the options 2 and 3, i.e., the maximum speed is obtained with the minimum reference.
</td></tr>
<tr><td>P240
Analog Input AI2
Offset</td><td>-100.0 to +100.0
[0.0]
0.1%</td><td>☑ Refer to the P238 description.</td></tr>
<tr><td>P241 (1)
Analog Input AI3
Function

(Isolated Analog Input located on the Optional Board EBB.
Refer to the chapter 8)</td><td>0 to 3
[0]
-</td><td>

<i>Table 6.38</i> <i>- Analog input AI3 function</i>

<table>
<tr><th>P241</th><th>Function</th></tr>
<tr><td>0</td><td>P221/P222</td></tr>
<tr><td>1</td><td>Without function</td></tr>
<tr><td>2</td><td>Maximum Torque Current</td></tr>
<tr><td>3</td><td>PID process variable</td></tr>
</table>

☑ When the option 0 (P221/P222) is selected, AI3 is able to receive the speed reference, which will be subjected to the speed limits (P133 and P134) and ramp action (P100 to P103), providing that it has been programmed so in P221 and/or P222. Refer to the figure 6.24.

☑ The option 3, process variable, defines the AI3 input as the PID regulator feedback signal (e.g., pressure or temperature sensor, etc.), provided that P524 = 1.
</td></tr>
<tr><td>P242
Analog Input AI3
Gain</td><td>0.000 to 9.999
[1.000]
0.001</td><td>☑ Refer to the P234 description.</td></tr>
<tr><td>P243 (1)
Analog Input AI3
Signal Type</td><td>0 to 3
[0]
-</td><td>

<i>Table 6.39</i> <i>- Analog input AI3 signal type</i>

<table>
<tr><th>P243</th><th>Signal</th></tr>
<tr><td>0</td><td>(0 a 10) V/(0 a 20) mA</td></tr>
<tr><td>1</td><td>(4 a 20) mA</td></tr>
<tr><td>2</td><td>(10 a 0) V/(20 a 0) mA</td></tr>
<tr><td>3</td><td>(20 a 4) mA</td></tr>
</table>

☑ Set the S4.1 switch on the EBB optional board to the on position when a current signal is used at the analog input AI3.

☑ Inverse reference is obtained with the options 2 and 3, i.e., the maximum speed is obtained with the minimum reference.
</td></tr>
<tr><td>P244
Analog Input AI3
Offset</td><td>-100.0 to +100.0
[0.0]
0.1%</td><td>☑ Refer to the P234 description.</td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description/Notes
P245 Analog Input AI4 Gain (14 bit Analog Input located on the EBA Optional Board. Refer to the chapter 8)	0.000 to 9.999 [1.000] 0.001	☑ Refer to the P234 description.
P246 (1) Analog Input AI4 Signal Type	0 to 4 [0] -	*Table 6.40 - Analog input AI4 signal type* (see below) ☑ Inverse reference is obtained with the options 2 and 3, i.e., the maximum speed is obtained with the minimum reference. ☑ Set the S2.1 switch on the EBA optional board to the on position when a current signal is used at the analog input AI4.
P247 Analog Input AI4 Offset	-100.0 to +100.0 [0.0] 0.1 %	☑ Refer to the P234 description.
P248 Analog Input AI2 Filter	0.0 to 16.0 [0.0] 0.1 s	☑ It adjusts the analog input AI2 RC filter time constant. Refer to the figure 6.29.
P251 Analog Output AO1 Function	0 to 21 [2] -	☑ Verify the possible options presented in the table 6.41. ☑ With factory default values (P251 = 2 and P252 = 1.000) AO1 = 10 V when the actual motor speed is equal to the maximum speed defined at P134. ☑ The AO1 output can be located on the MVC2 control board (as 0 to 10 V) or on the option board EBB (AO1', as a 0 to 20 mA / 4 to 20 mA output). Refer to the chapter 8.
P252 Analog Output AO1 Gain	0.000 to 9.999 [1.000] 0.001	☑ It adjusts the analog output AO1 gain. For a setting of P252 = 1.000, the AO1 value is adjusted according to the description of the analog output indication scales presented at P262 description.
P253 Analog Output AO2 Function	0 to 21 [5] -	☑ Verify the possible options presented in the table 6.41. ☑ With factory default values (P253 = 5 and P254 = 1.000) AO2 = 10 V when the output current is equal to 1.5 x P295. ☑ The AO2 output can be located on the MVC2 control board (as 0 to 10 V) or on the option board EBB (AO2', as a 0 to 20 mA / 4 to 20 mA output). Refer to the chapter 8.

***Table 6.40** - Analog input AI4 signal type*

P246	Signal
0	(0 to 10) V/(0 to 20) mA
1	(4 to 20) mA
2	(10 to 0) V/(20 to 0) mA
3	(20 to 4) mA
4	(-10 to +10) V

Parameter	Range [Factory Setting] Unit	Description/Notes
P254 Analog Output AO2 Gain	0.000 to 9.999 [1.000] 0.001	☑ It adjusts the analog output AO2 gain. For a setting of P254 = 1.000, the AO2 value is adjusted according to the description of the analog output indication scales presented at P262 description.
P255 Analog Output AO3 Function (Located on the EBA optional board)	0 to 21 [2] -	☑ Verify the possible options presented in the table 6.41. ☑ With factory default values (P255 = 2 and P256 = 1.000) AO3 = 10 V when the actual motor speed is equal to the maximum speed defined at P134. ☑ Refer to the chapter 8 for more information on the AO3 output.
P256 Analog Output AO3 Gain	0.000 to 9.999 [1.000] 0.001	☑ It adjusts the analog output AO3 gain. For a setting of P256 = 1.000, the AO3 value is adjusted according to the description of the analog output indication scales presented at P262 description.
P257 Analog Output AO4 Function (Located on the EBA optional board)	0 to 21 [5] -	☑ Verify the possible options presented in the table 6.41. ☑ With factory default values (P257 = 5 and P258 = 1.000) AO4 = 10 V when the output current is equal to 1.5 x P295. ☑ Refer to the chapter 8 for more information on the AO4 output.
P258 Analog Output AO4 Gain	0.000 to 9.999 [1.000] 0.001	☑ It adjusts the analog output AO4 gain. For a setting of P258 = 1.000, the AO4 value is adjusted according to the description of the analog output indication scales presented at P262 description.
P259 Analog Output AO5 Function	0 to 21 [2] -	☑ Verify the possible options presented in the table 6.41. ☑ With factory default values (P259 = 2 and P260 = 1.000) AO5 = 20 mA when the actual motor speed is equal to the maximum speed defined at P134.
P260 Analog Output AO5 Gain	0.000 to 9.999 [1.000] 0.001	☑ It adjusts the analog output AO5 gain. For a setting of P260 = 1.000, the AO5 value is adjusted according to the description of the analog output indication scales presented at P262 description.
P261 Analog Output AO6 Function	0 to 21 [5] -	☑ Verify the possible options presented in the table 6.41. ☑ With factory default values (P261 = 5 and P262 = 1.000) AO6 = 20 mA when the output current is equal to 1.5 x P295.
P262 Analog Output AO6 Gain	0.000 to 9.999 [1.000] 0.001	☑ It adjusts the analog output AO6 gain. For a setting of P262 = 1.000, the AO6 value is adjusted according to the description of the analog output indication scales presented here at P262 description.

Parameter	Range [Factory Setting] Unit	Description/Notes

Table 6.41 *- Analog output functions*

Function	P251 (AO1)	P253 (AO2)	P255 (AO3)	P257 (AO4)	P259 (AO5)	P261 (AO6)
Speed Reference	0	0	0	0	0	0
Total Reference	1	1	1	1	1	1
Actual Speed	2	2	2	2	2	2
Not Used	3/4	3/4	3/4	3/4	3/4	3/4
Output Current (with 0.5 sec filter)	5	5	5	5	5	5
PID Process Variable	6	6	6	6	6	6
Output Active Current	7	7	7	7	7	7
Output Power	8	8	8	8	8	8
PID Setpoint	9	9	9	9	9	9
Not Used	10	10	10	10	10	10
Trace Channels (1 to 8)	11 to 18	11 to 18	11 to 18	11 to 18	11 to 18	11 to 18
Inverter Temperature	19	19	19	19	19	19
PLC	20	20	20	20	20	20
Output Voltage	21	21	21	21	21	21

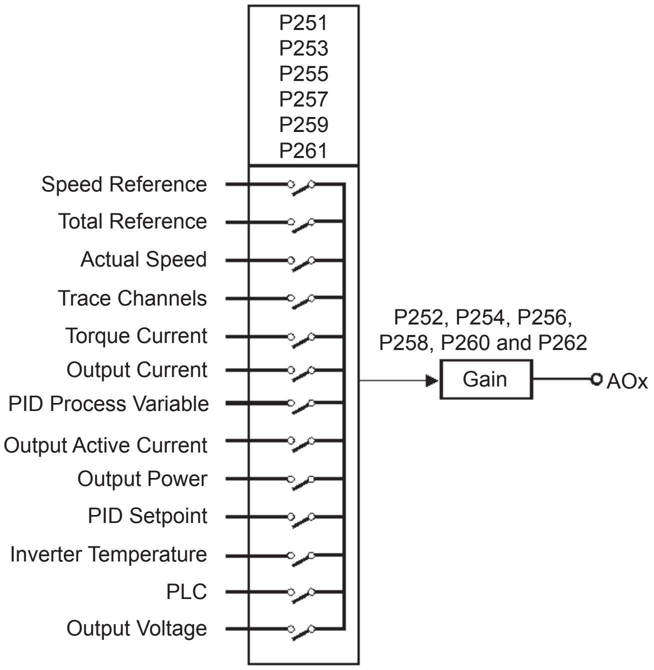
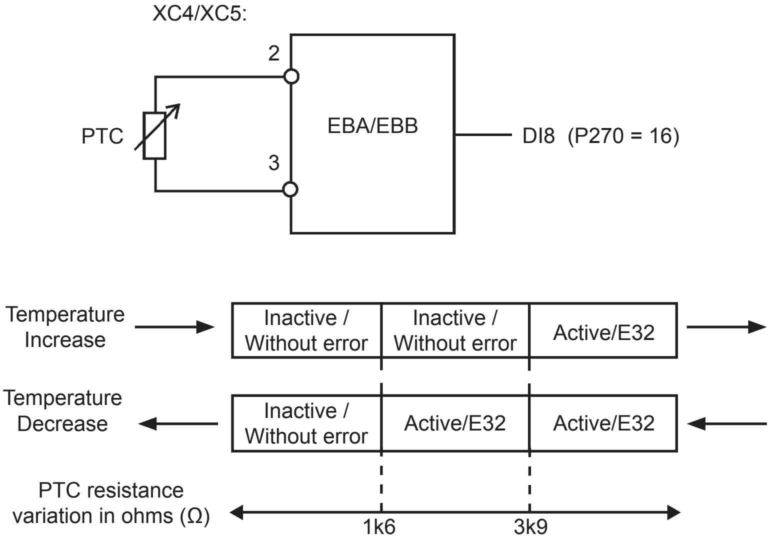
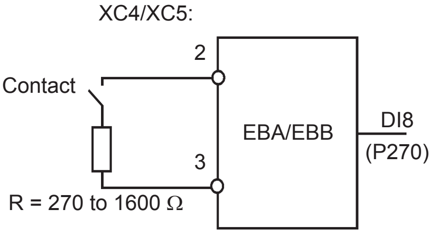


Figure 6.30 *- Analog outputs block diagram*

Parameter	Range [Factory Setting] Unit	Description/Notes
		☑ Analog output indication scales: - Full scale of 10 V for AO1 and AO2 outputs located on the MVC2 control board, and for AO3 and AO4 located on the EBA optional board; - Full scale of 20 mA for AO1’ and AO2’ outputs located on the EBB optional board, and for AO5 and AO6 located on the MVC2 control board. Speed Reference (P001): Full scale = P134 Total Reference: Full scale = P134 Actual Speed (P002): Full scale = P134 Output Current: Full scale = 1.5 x P295 PID Process Variable: Full scale = 1.0 x P528 PID Setpoint: Full scale = 1.0 x P528 Inverter Temperature = 150 ºC (302 °F)
P263 (1) Digital Input DI1 Function	0 to 3 [1 (Start/Stop)] -	☑ Verify the possible options presented in the table 6.42, and their operation details in the figures 6.31 to 6.34. ☑ The digital input status can be monitored at the parameter P012. **Notes:** - **Increase EP** (Electronic Potentiometer) is active when DI3 or DI5 are closed. - **Decrease EP** (Electronic Potentiometer) is active when DI4 or DI6 are open. - **Local/Remote** are active with open/closed digital input, respectively. - The digital input DI8, present on the EBA and EBB optional boards, is also used as the **Motor Thermistor (PTC)** input:  ***Figure 6.31** - DI8 as a PTC input*
P264 (1) Digital Input DI2 Function	0 or 1 [0 (Forward/Reverse)] -	
P265 (1) Digital Input DI3 Function	0 to 26 [0 (Not used)] -	
P266 (1) Digital Input DI4 Function	0 to 26 [0 (Not used)] -	
P267 (1) Digital Input DI5 Function	0 to 26 [3 (JOG)] -	
P268 (1) Digital Input DI6 Function	0 to 26 [6 (2nd Ramp)] -	
P269 (1) Digital Input DI7 Function (Located on the optional board)	0 to 24 [0 (Not used)] -	
P270 (1) Digital Input DI8 Function (Located on the optional board)	0 to 24 [0 (Not used)] -	

Parameter	Range [Factory Setting] Unit	Description/Notes
P271 (1) Digital Input DI9 Function	0 to 24 [0 (Not used)] -	
P272 (1) Digital Input DI10 Function	0 to 24 [0 (Not used)] -	

In order to use the DI8 as a **normal digital input**, program the designated function at P270, and connect a resistor, ranging from 270 to 1600 Ω, in series with the contact.



Contact	DI8
Open	Deactivated
Closed	Activated

Figure 6.32 *- DI8 as a normal digital input*

- The function **Load User via DIx** allows the selection between the user memories 1 and 2, performing actions similar to the setting of P204 = 7 or 8; however, the user memories are loaded by the transition of a digital input programmed for that function.

  When the DIx state changes from low to high level (open to closed), the user memory 1 is loaded, provided that the contents of the inverter actual parameters had been previously transferred to the user memory 1 (P204 = 10).

  When the DIx state changes from high to low level (closed to open), the user memory 2 is loaded, provided that the contents of the inverter actual parameters had been previously transferred to the user memory 2 (P204 = 11).

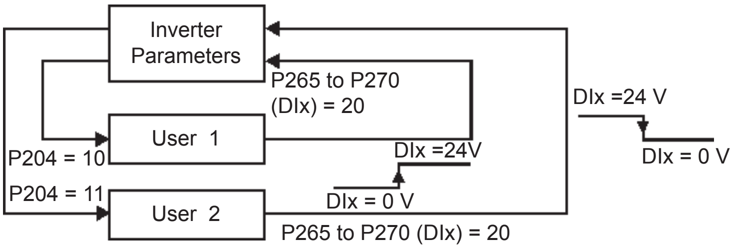


Figure 6.33 *- Details on the Load User via DIx operation*

NOTE!

Make sure that when using those functions the parameter sets (user memory 1 and 2) be entirely compatible with the application (motors, Start/Stop commands, etc.).

It will not be possible to load the user memory with the inverter enabled.

If two parameter sets from different motors were saved in the user memories 1 and 2, the correct motor current values for each user memory must be adjusted at the parameters P156, P157 and P158.

Parameter	Range [Factory Setting] Unit	Description/Notes

- If the function **Parameterization Disabling** is programmed and the correspondent DIx input is closed, then parameter changes are not allowed, regardless of P000 and P200 settings. When the DIx input is open, parameter changes are conditioned to P000 and P200 settings.

- **RL2 and RL3 Timer**: this function acts as a timer to activate and deactivate the relays 2 and 3 (RL2 and RL3). When the timer function for the relay 2 or 3 is programmed at any DIx, and a transition from open to closed occurs, the programmed relay will be activated with the delay set in P283 (RL2) or P285 (RL3).

  When a transition from closed to open occurs, the programmed relay will be deactivated with the delay adjusted in P284 (RL2) or P286 (RL3).

  After the transition of the DIx, either for activating or deactivating the programmed relay, it is necessary that the DIx remains closed or open during at least the time set in P283/P285 or P284/P286. Otherwise, the timer will be reset. Refer to the figure 6.34.

  Note: In order to enable that function it is also necessary to program P279 and/or P280 = 29 (Timer).

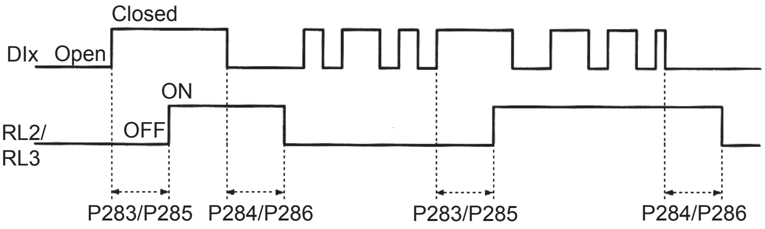


Figure 6.34 *- RL2 and RL3 timer function operation*

- The 'Ventilation OK' function generates an inverter ventilation fault (F048).

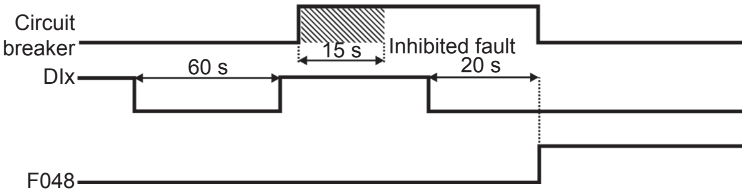


Figure 6.35 *- Ventilation OK function operation*

Table 6.42 - *Digital input functions*

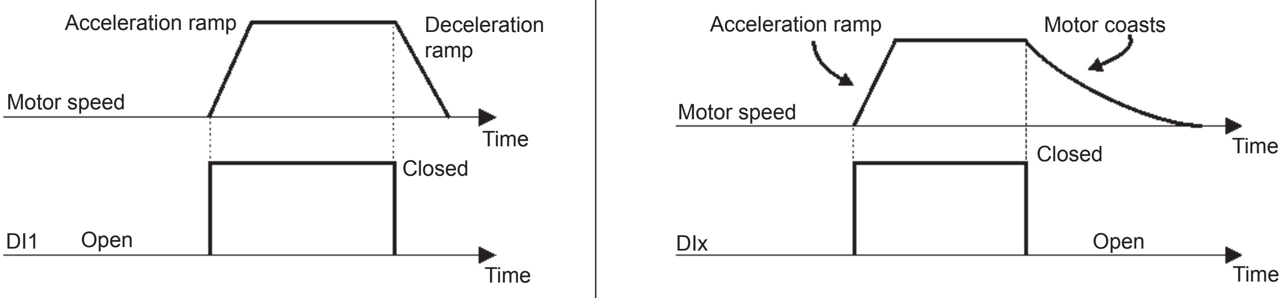
Parameter DIx Function	P263 (DI1)	P264 (DI2)	P265 (DI3)	P266 (DI4)	P267 (DI5)	P268 (DI6)	P269 (DI7)	P270 (DI8)	P271 (DI9)	P272 (DI10)
Not used	0	-	0, 7, 9, 17 and 18	0, 9, 17 and 18	0, 9, 17 and 18	0, 9, 17 and 18	0, 5, 7, 9, 16, 17 and 18	0, 5, 7, 9, 17 and 18	0, 5, 7, 9, 17 and 18	0, 5, 7, 9, 17 and 18
Start/Stop	1	-	-	-	-	-	-	-	-	-
General Enable	2	-	2	2	2	2	2	2	2	2
Fast Stop	3	-	-	-	8	8	8	8	8	8
Forward/Reverse	-	0	-	-	-	-	-	-	-	-
Local/Remote	-	1	1	1	1	1	1	1	1	1
JOG	-	-	3	3	3	3	3	3	3	3
No External Fault	-	-	4	4	4	4	4	4	4	4
Increase EP	-	-	5	-	5	-	-	-	-	-
Decrease EP	-	-	-	5	-	5	-	-	-	-
2nd Ramp	-	-	6	6	6	6	6	6	6	6
Multispeed (MSx)	-	-	-	7	7	7	-	-	-	-
Forward Run	-	-	8	-	-	-	-	-	-	-
Reverse Run	-	-	-	8	-	-	-	-	-	-
JOG+	-	-	10	10	10	10	10	10	10	10
JOG-	-	-	11	11	11	11	11	11	11	11
Reset	-	-	12	12	12	12	12	12	12	12
Fieldbus	-	-	13	13	13	13	13	13	13	13
Start (3-wire)	-	-	14	-	14	-	14	-	-	-
Stop (3-wire)	-	-	-	14	-	14	-	14	14	14
Manual/Automatic	-	-	15	15	15	15	15	15	15	15
No External Alarm	-	-	16	16	16	16	-	-	16	16
Motor Thermistor	-	-	-	-	-	-	-	16	-	-
Parameterization Disabling	-	-	19	19	19	19	19	19	-	-
Load User 1/2	-	-	20	20	20	20	20	20	-	-
RL2 Timer	-	-	21	21	21	21	21	21	-	-
RL3 Timer	-	-	22	22	22	22	22	22	-	-
No Motor Fault	-	-	-	-	-	-	-	-	19	19
No Motor Alarm	-	-	-	-	-	-	-	-	20	20
No Alarm in the Redundant Ventilation Set A	-	-	23	23	23	23	-	-	21	21
No Alarm in the Redundant Ventilation Set B	-	-	24	24	24	24	-	-	22	22
Initiates Synchronous Transfer	-	-	25	25	25	25	23	23	23	23
Ventilation OK	-	-	26	26	26	26	24	24	24	24

NOTE!

In order that Start/Stop works, program also P224 and/or P227 = 1.

The selection of P265 or P267 = 5, and P266 or P268 = 5, also requires the programming of P221 and/or P222 = 7.

The programming of P266 and/or P267 and/or P268 = 7 also requires the programming of P221 and/or P222 = 8.

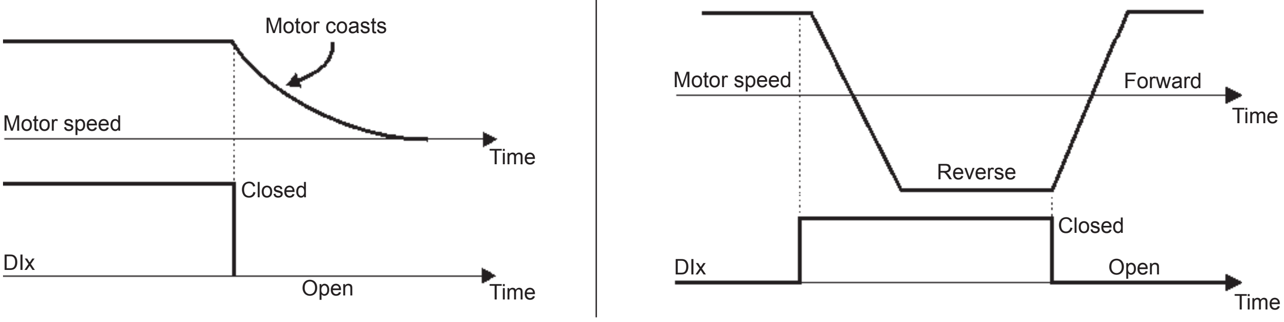


a) START/STOP

b) GENERAL ENABLE

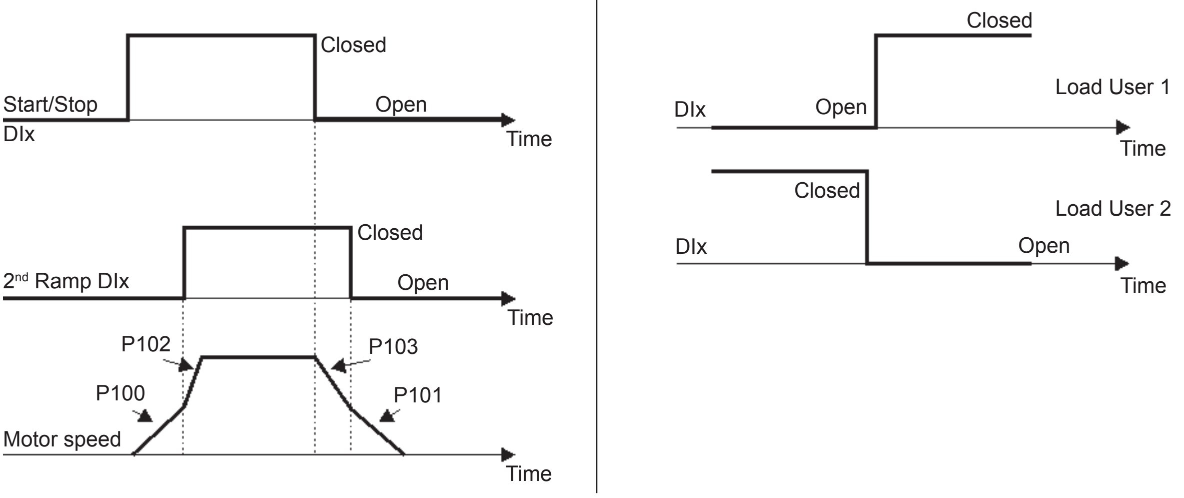
Note: All the inputs programmed for General Enable must be closed, so that the MVW-01 operates as showed above.

Note: All the inputs programmed for Start/Stop must be closed, so that the MVW-01 operates as showed above.



c) NO EXTERNAL FAULT

d) FORWARD/REVERSE

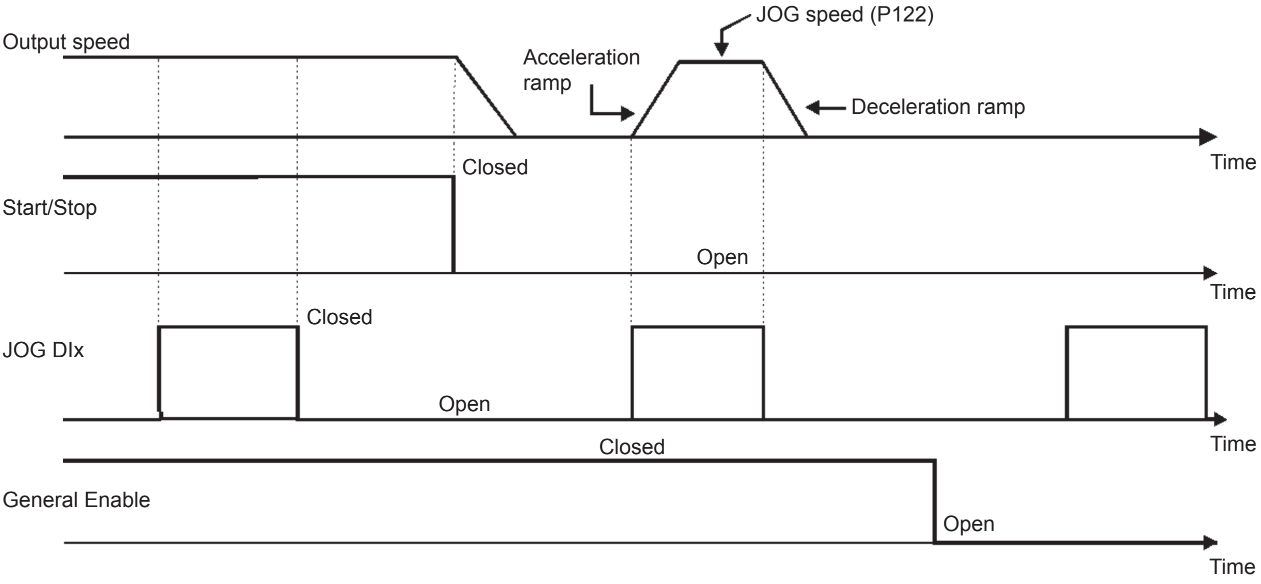


e) 2nd RAMP

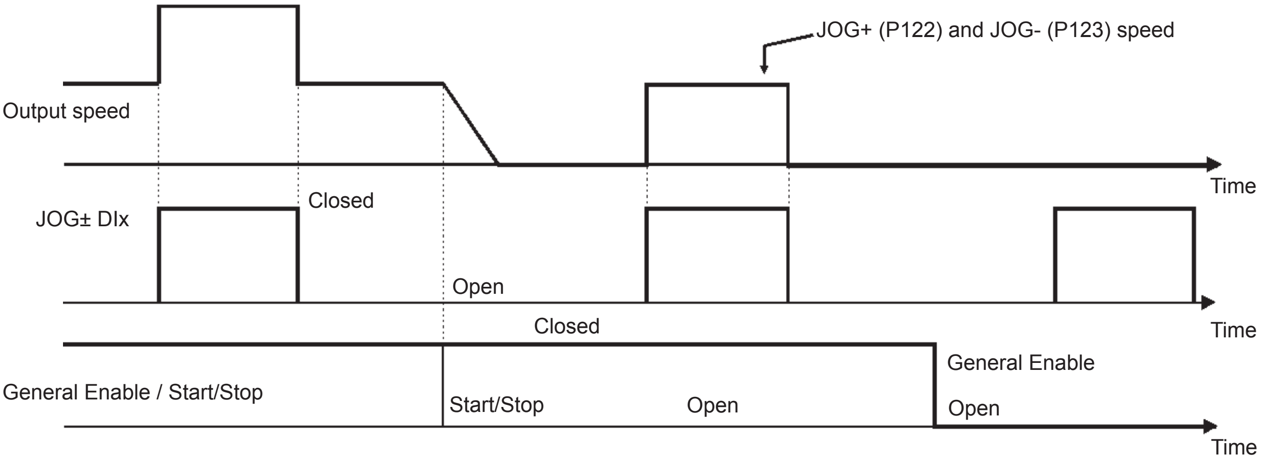
f) LOAD USER VIA DIX

***Figure 6.36 a) to f)** - Details on the operation of the digital input functions*

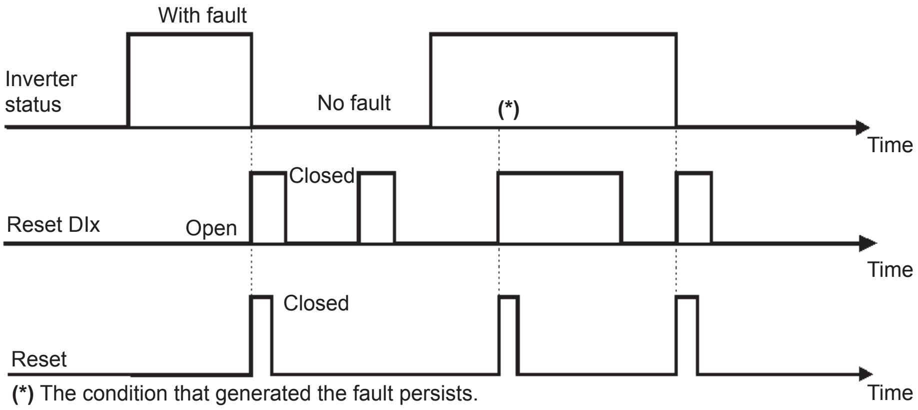
g) JOG



h) JOG+ AND JOG-



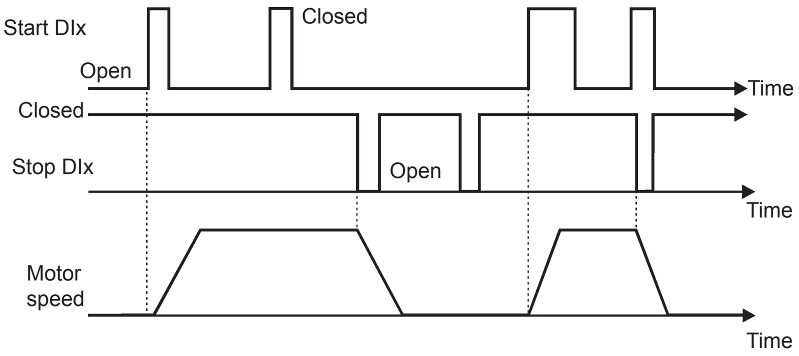
i) RESET



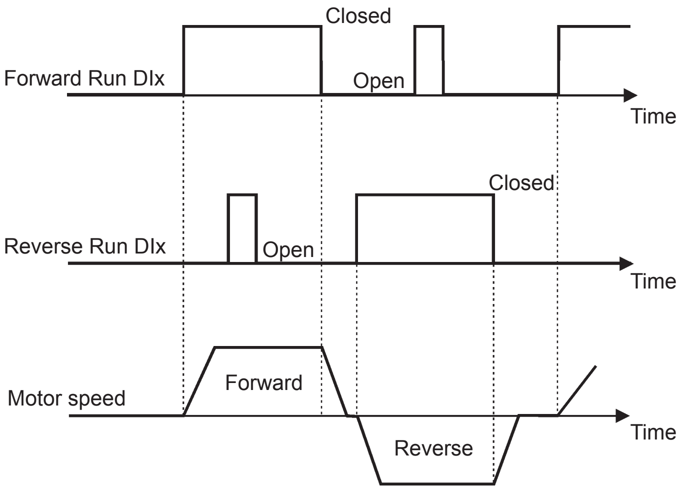
(*) The condition that generated the fault persists.

***Figure 6.36 g) to i) (cont.)** - Details on the operation of the digital input functions*

j) 3-WIRE START/STOP



k) FORWARD RUN/REVERSE RUN



l) ELECTRONIC POTENTIOMETER (EP)

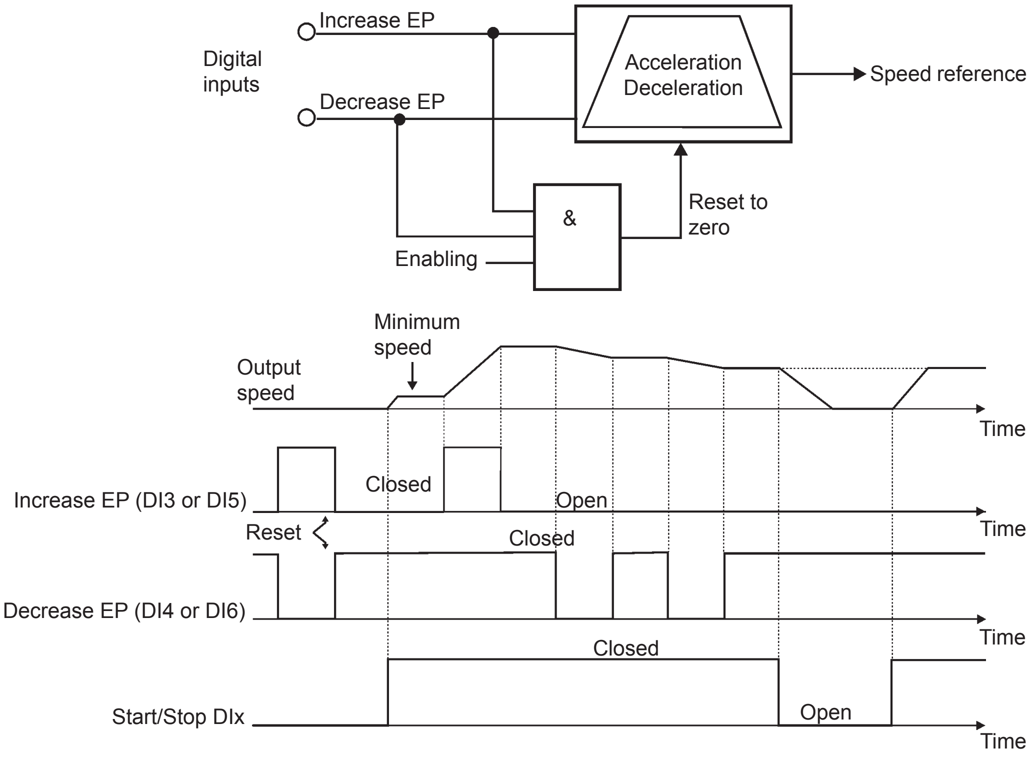


Figure 6.36 j) to l) (cont.) *- Details on the operation of the digital input functions*

Parameter	Range [Factory Setting] Unit	Description/Notes
P275 $^{(1)}$ Digital Output DO1 Function (Located on the Optional Board)	0 to 35 [0 (Not used)] -	☑ For more details about the digital and relay output, refer to table 6.43 and figure 6.37. ☑ The digital and relay output status can be monitored at the parameter P013. ☑ When the condition declared by the function is true, the digital output will be activated, i.e., a saturated transistor at a DOx output and/or a relay with energized coil for a RLx output. Example: **Is > Ix** function – when Is > Ix, then DOx = saturated transistor and/or RLx = relay with the coil energized. When Is ≤ Ix then DOx = open transistor and/or RLx = relay with the coil not energized. **Notes:** - **Not used**: it means that the digital outputs will remain always in a resting state, i.e., DOx = open transistor and/or RLx = relay with the coil not energized. - **N = 0**: it means that the motor speed is below the value adjusted in P291 (Zero Speed Zone). - **Remote**: it means that the inverter is operating in Remote situation. - **Run**: it corresponds to enabled inverter. In this state, the IGBTs are commutating, and the motor may be at any speed, even zero speed. - **Ready**: it corresponds to the inverter without error and without undervoltage. - **No Fault**: it means that the inverter is not disabled by any type of fault. - **No F070 + F071**: it means that the inverter is not disabled by faults F070 or F071. - **No F003 + F006 + F021 + F022**: it means that the inverter is not disabled by faults F003, F006, F021 or F022. - **No F011 + F020 + F051 + F054 + F057 + F060 + F062**: it means that the inverter is not disabled by faults F011, F020, F051, F054, F057, F060 or F062. - **No F072**: it means that the inverter is not disabled by fault F072. - **4 to 20 mA Reference OK**: it means that the reference in current is within the 4 to 20 mA range. - **Forward**: it means that when the motor is rotating in the forward direction, the DOx = saturated transistor and/or RLx = relay with the coil energized. When the motor is rotating in the reverse direction, the DOx = open transistor and/or RLx = relay with the coil not energized. - **Pre-charge OK**: it means that the DC Link voltage is above the pre-charge voltage level. - **Fault**: it means that the inverter is disabled by a fault.
P276 $^{(1)}$ Digital Output DO2 Function (Located on the Optional Board)	0 to 35 [0 (Not used)] -	
P277 $^{(1)}$ Relay Output RL1 Function	0 to 35 [13 (No fault)] -	
P279 $^{(1)}$ Relay Output RL2 Function	0 to 35 [2 (N > Nx)] -	
P280 $^{(1)}$ Relay Output RL3 Function	0 to 35 [1 (N* > Nx)] -	
P281 $^{(1)}$ Relay Output RL4 Function	0 to 35 [0 (Not used)] -	
P282 $^{(1)}$ Relay Output RL5 Function	0 to 35 [0 (Not used)] -	

Parameter	Range [Factory Setting] Unit	Description/Notes
		- **N > Nx and Nt > Nx**: it means that both the conditions must be satisfied, so that DOx = saturated transistor and/or RLx = relay with the coil energized. In order that the digital outputs go back to the resting state, i.e., DOx = open transistor and/or RLx = relay with the coil not energized, it is necessary that only the condition N > Nx not be satisfied anymore (regardless of the Nt > Nx condition). Definition of the symbols used with the functions: - N = P002 (Motor Speed); - N* = P001 (Speed Reference); - Nx = P288 (Nx Speed) – It is a reference point of the speed selected by the user; - Ny = P289 (Ny Speed) – It is a reference point of the speed selected by the user; - Ix = P290 (Ix Current) – It is a reference point of the current selected by the user; - Is = P003 (Motor Current); - Torque = P009 (Motor Torque); - Tx = P293 (Tx Torque) – It is a reference point of the torque selected by the user; - PVx = P533 (PVx Process Variable) – It is a reference point of the process variable selected by the user; - PVy = P534 (PVy Process Variable) – It is a reference point of the process variable selected by the user; - Nt = Total Reference (refer to the figure 6.24).

Table 6.43 *- Digital and relay output functions*

Parameter Function	P275 (DO1)	P276 (DO2)	P277 (RL1)	P279 (RL2)	P280 (RL3)	P281 (RL4)	P282 (RL5)
Not used	0, 8, 9, 23 and 29	0, 8, 9, 23 and 29	0, 8, 9, 23 and 29	0, 8, 9 and 23	0, 8, 9 and 23	0, 8, 9, 23 and 29	0, 8, 9, 23 and 29
N* > Nx	1	1	1	1	1	1	1
N > Nx	2	2	2	2	2	2	2
N < Ny	3	3	3	3	3	3	3
N = N*	4	4	4	4	4	4	4
N = 0	5	5	5	5	5	5	5
Is > Ix	6	6	6	6	6	6	6
Is < Ix	7	7	7	7	7	7	7
Remote	10	10	10	10	10	10	10
Run	11	11	11	11	11	11	11
Ready	12	12	12	12	12	12	12
No Fault	13	13	13	13	13	13	13
No F070 + F071	14	14	14	14	14	14	14
No F003 + F006 + F021 + F022	15	15	15	15	15	15	15
No F011 + F020 + F051 + F054 + F057 + F060 + F062	16	16	16	16	16	16	16
No F072	17	17	17	17	17	17	17
4 to 20 mA Reference OK	18	18	18	18	18	18	18
Fieldbus	19	19	19	19	19	19	19
Forward	20	20	20	20	20	20	20
Process Variable > VPx	21	21	21	21	21	21	21
Process Variable < VPy	22	22	22	22	22	22	22
Pre-charge OK	24	24	24	24	24	24	24
Fault	25	25	25	25	25	25	25
N > Nx and Nt > Nx	26	26	26	26	26	26	26
Without error with delay	27	27	27	27	27	27	27
No Alarm	28	28	28	28	28	28	28
Timer	-	-	-	29	29	-	-
Redundant ventilation	30	30	30	30	30	30	30
PLC	-	-	31	31	31	-	-
Circuit Break ON (Input Circuit Breaker ON)	32	32	32	32	32	32	32
Transference OK	33	33	33	33	33	33	33
Synchronism OK	34	34	34	34	34	34	34
Serial	35	35	35	35	35	35	35

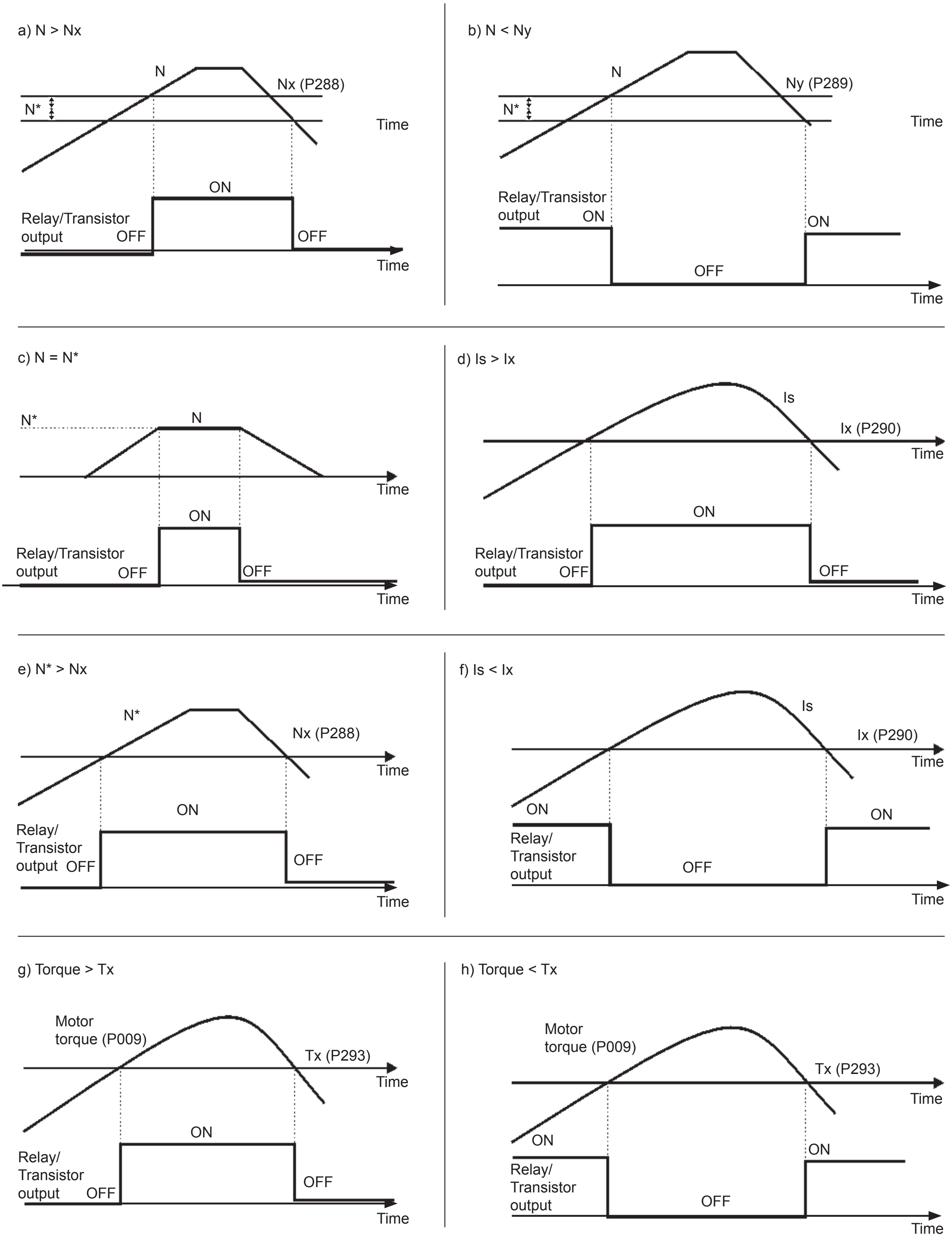
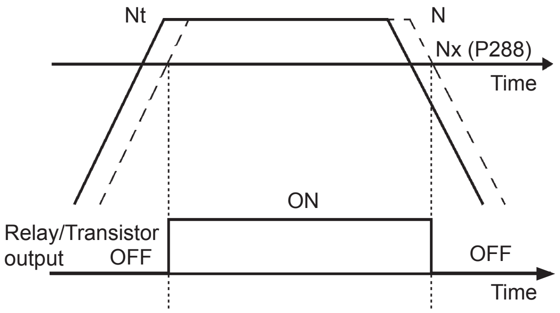
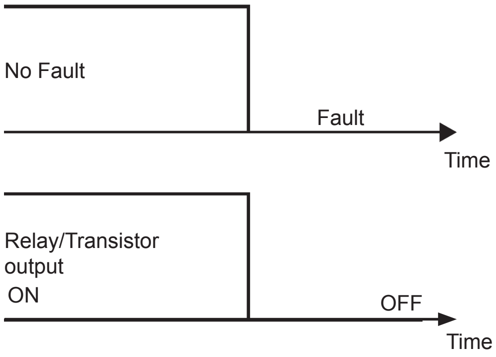


Figure 6.37 a) to h) *- Details on the operation of the digital output functions*

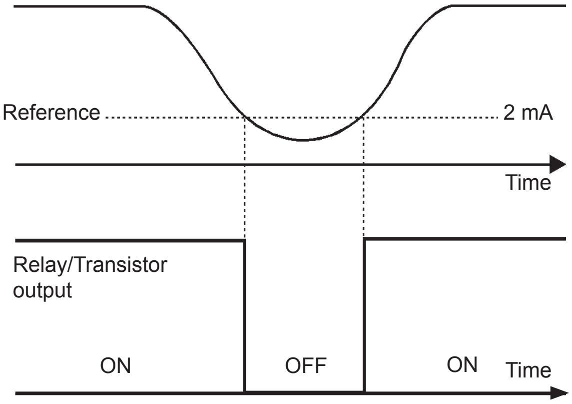
i) N > Nx and Nt > Nx



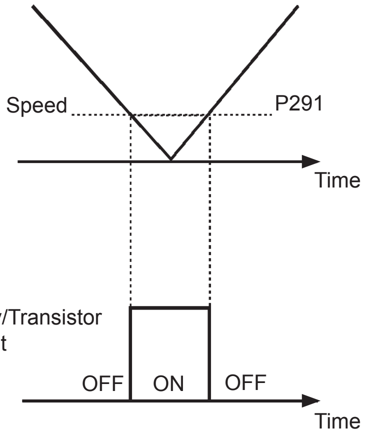
j) No external error



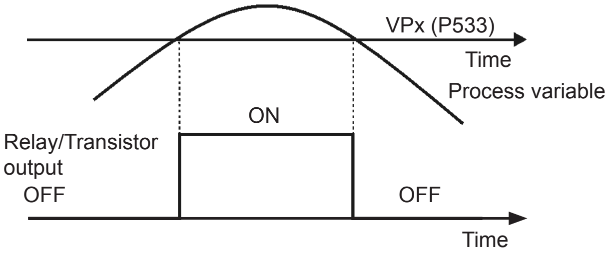
k) 4 to 20 mA reference OK



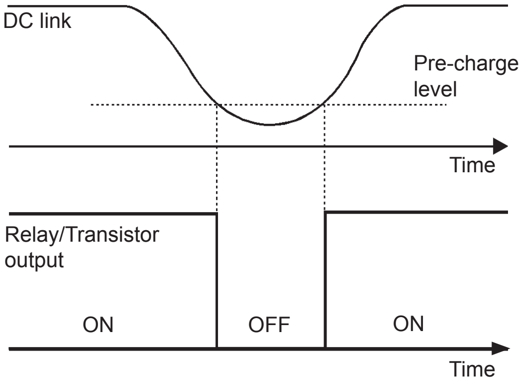
l) N = 0



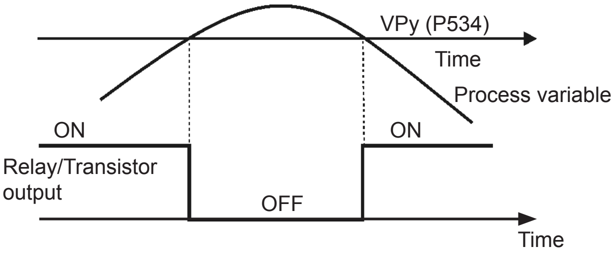
m) Process variable > VPx



n) Pre-charge OK



o) Process variable < VPy



Figures 6.37 i) to o) (cont.) *- Details on the operation of the digital output functions*

Parameter	Range [Factory Setting] Unit	Description/Notes
P283 RL2 On Time	0.0 to 300.0 [0.0] 0.1 s	☑ It is used with the output relay function: Relay 2 timer.
P284 RL2 Off Time	0.0 to 300.0 [0.0] 0.1 s	☑ It is used with the output relay function: Relay 2 timer.
P285 RL3 On Time	0.0 to 300.0 [0.0] 0.1 s	☑ It is used with the output relay function: Relay 3 timer.
P286 RL3 Off Time	0.0 to 300.0 [0.0] 0.1 s	☑ It is used with the output relay function: Relay 3 timer.
P288 (2) Nx Speed **P289** (2) Ny Speed	0 to P134 [120] 1 rpm 0 to P134 [1800] 1 rpm	☑ They are used with the digital and relay output functions: N* > Nx, N > Nx and N < NY.
P290 (5) Ix Current	0 to 2.0 x P295 [1.0 x P295] 0.1 A (<100) 1 A (>99.9)	☑ It is used with the digital and relay output functions: Is > Ix and Is < Ix
P291 Zero Speed Zone	1 to 100 [1] 1 %	☑ It is used with the digital and relay output functions: N = 0 and Zero Speed Disable (Refer to P211 and P212 descriptions).
P292 N = N* Band (Reached Speed)	1 to 100 [1] 1 %	☑ It is used with the digital and relay output function: N = N*
P293 Tx Torque	-	☑ Function not implemented in this software version.

Parameter	Range [Factory Setting] Unit	Description/Notes
P295 (1) Inverter Rated Current	0 to 37 [According to the inverter rated current] A	See Table 6.44

Table 6.44 *- Current available models*

P295	Inverter Rated Current
0	32 A
1	53 A
2	70 A
3	80 A
4	85 A
5	94 A
6	100 A
7	110 A
8	112 A
9	120 A
10	130 A
11	138 A
12	140 A
13	150 A
14	160 A
15	162 A
16	165 A
17	170 A
18	175 A
19	186 A
20	188 A
21	210 A
22	235 A
23	250 A
24	265 A
25	280 A
26	300 A
27	310 A
28	357 A
29	375 A
30	386 A
31	450 A
32	475 A
33	490 A
34	500 A
35	560 A
36	580 A
37	1064 A

Parameter	Range [Factory Setting] Unit	Description/Notes
P296 (1) Rated Voltage	0 to 4 [According to the inverter rated voltage] V	

Table 6.45 - *Voltage available models*

P296	Inverter Rated Voltage
0	220 V
1	380 V
2	2300 V
3	3300 V
4	4160 V

ATTENTION!

Adjust P296 according to the input AC voltage to be used!

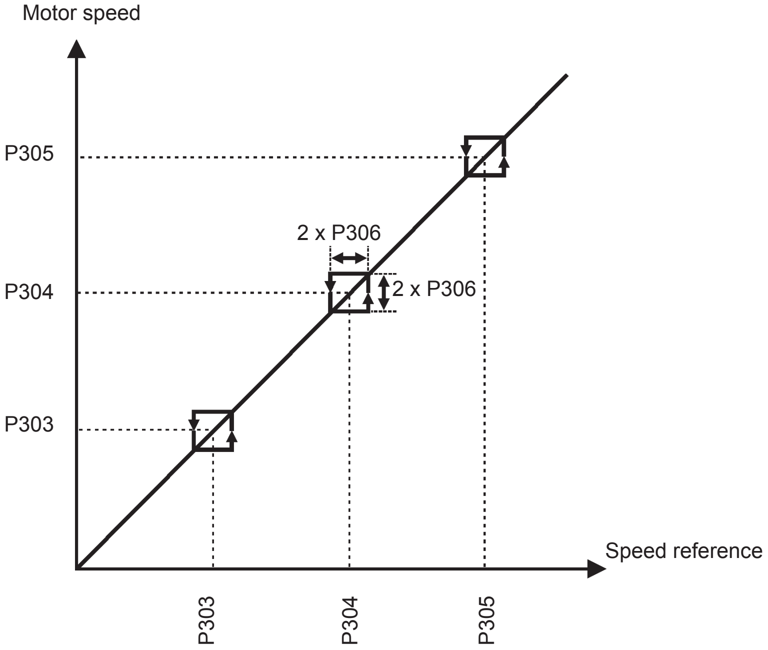
Parameter	Range [Factory Setting] Unit	Description/Notes
P297 (1) Switching Frequency	0 to 3 [3] Hz	

Table 6.46 - *Available switching frequency*

P297	Switching Frequency
0	200 Hz
1	333 Hz
2	250 Hz
3	500 Hz

☑ The switching frequency choice results in a compromise between the motor acoustic noise and the inverter IGBT losses. Higher switching frequencies imply in less motor acoustic noise, however, the IGBT losses rise increasing the temperature in those components. The predominant frequency in the motor is the double of the switching frequency programmed in P297. Thus, P297 = 500 Hz results in an audible 1 kHz frequency at the motor, due to the used PWM method.

☑ The switching frequency reduction contributes in the reduction of instabilities and resonances that might occur in certain application conditions. The reduction of the switching frequency also reduces the ground leakage currents, being able to avoid improper F074 (Ground fault) trips.

Parameter	Range [Factory Setting] Unit	Description/Notes
P303 Skipped Speed 1	P133 to P134 [600] 1 rpm	 ***Figure 6.38*** *- Skipped speed curve* ☑ It avoids permanent motor operation at speeds in which, for instance, the mechanical system enters into resonance causing high vibration or noise levels. ☑ The passage through the skipped range (2 x P306) occurs through the acceleration and deceleration ramps. ☑ The function does not operate properly if two bands of skipped speed overlap.
P304 Skipped Speed 2	P133 to P134 [900] 1 rpm	
P305 Skipped Speed 3	P133 to P134 [1200] 1 rpm	
P306 Skipped Range	0 to 750 [0] 1 rpm	
P308 (1) Inverter Address	1 to 30 [1] -	☑ It sets the inverter address for serial communication. Refer to the section 8.5.

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P309 (1)
Fieldbus</td><td>0 to 13
[0]
-</td><td>
☑ 0 = Inactive Fieldbus.
☑ The options 1 to 6 define the fieldbus standard to be used (Profibus DP or DeviceNet) and the number of variables to be exchanged with the master. Refer to the section 8.4.4.
☑ It is only applicable for the Profibus DP or DeviceNet optional kits.
☑ For P309 = 10, refer to the DeviceNet Drive Profile guide.
<i>Table 6.47 - Type of fieldbus protocol</i>
<table>
<tr><th>P309</th><th>Type</th></tr>
<tr><td>0</td><td>Inactive</td></tr>
<tr><td>1</td><td>Profibus-DP 2 I/O</td></tr>
<tr><td>2</td><td>Profibus-DP 4 I/O</td></tr>
<tr><td>3</td><td>Profibus-DP 6 I/O</td></tr>
<tr><td>4</td><td>DeviceNet 2 I/O</td></tr>
<tr><td>5</td><td>DeviceNet 4 I/O</td></tr>
<tr><td>6</td><td>DeviceNet 6 I/O</td></tr>
<tr><td>7</td><td>Modbus-RTU 2 I/O</td></tr>
<tr><td>8</td><td>Modbus-RTU 4 I/O</td></tr>
<tr><td>9</td><td>Modbus-RTU 6 I/O</td></tr>
<tr><td>10</td><td>DeviceNet Drive Profile</td></tr>
<tr><td>11</td><td>Ethernet/IP 2 I/O</td></tr>
<tr><td>12</td><td>Ethernet/IP 4 I/O</td></tr>
<tr><td>13</td><td>Ethernet/IP 6 I/O</td></tr>
</table>
</td></tr>
<tr><td>P312
Type of Serial Protocol</td><td>0 to 11
[0]
-</td><td>
<i>Table 6.48 - Type of serial protocol</i>
<table>
<tr><th>P312</th><th>Type</th></tr>
<tr><td>0</td><td>WEG Protocol</td></tr>
<tr><td>1</td><td>Modbus-RTU, 9600 bps, no parity</td></tr>
<tr><td>2</td><td>Modbus-RTU, 9600 bps, odd parity</td></tr>
<tr><td>3</td><td>Modbus-RTU, 9600 bps, even parity</td></tr>
<tr><td>4</td><td>Modbus-RTU, 19200 bps, no parity</td></tr>
<tr><td>5</td><td>Modbus-RTU, 19200 bps, odd parity</td></tr>
<tr><td>6</td><td>Modbus-RTU, 19200 bps, even parity</td></tr>
<tr><td>7</td><td>Modbus-RTU, 38400 bps, no parity</td></tr>
<tr><td>8</td><td>Modbus-RTU, 38400 bps, odd parity</td></tr>
<tr><td>9</td><td>Modbus-RTU, 38400 bps, even parity</td></tr>
<tr><td>10</td><td>WEG Protocol, 19200 bps</td></tr>
<tr><td>11</td><td>WEG Protocol, 38400 bps</td></tr>
</table>
☑ It defines the type of protocol used for the serial communication.
</td></tr>
<tr><td>P313
Disabling with A128, A129 or A130</td><td>0 to 3
[0]
-</td><td>
<i>Table 6.49 - Disabling with A128, A129 or A130</i>
<table>
<tr><th>P313</th><th>Function</th></tr>
<tr><td>0</td><td>Disable via Run/Stop</td></tr>
<tr><td>1</td><td>Disable via General Enable</td></tr>
<tr><td>2</td><td>No action</td></tr>
<tr><td>3</td><td>Changes to Local</td></tr>
</table>
☑ Defines the inverter behavior when the serial communication is inactive (causing A128), when the physical connection with the Fieldbus network master is interrupted (causing A129), when the Fieldbus board is inactive (causing A130) or when the communication between MVC1 and MVC2 boards is interrupted.
</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P314
Time for Serial Watchdog Action</td><td>0.0 to 999.0
[0.0]
0.1 s</td><td>

<i>Table 6.50 - Time for serial watchdog action</i>

<table>
<tr><th>P314</th><th>Function</th></tr>
<tr><td>0.0</td><td>Disabled</td></tr>
<tr><td>0.1 to 999.0</td><td>Enabled</td></tr>
</table>

☑ If the inverter does not receive any valid serial telegram after the time programmed at P314 has elapsed, A128 will be indicated on the HMI and the inverter will execute the action programmed in P313 – Disabling with A128, A129 or A130.

☑ In order that the inverter be able to execute that action, it is necessary that the commands be programmed for the “Serial” option at the parameters P220 to P228.
</td></tr>
<tr><td>P315
Function of the MVC1 Control Board SCI1 Serial Channel</td><td>0 or 1
[0]
-</td><td>

☑ It selects the function of the MVC1 control board SCI1 serial channel.

<i>Table 6.51 - Serial channel SCI1 function</i>

<table>
<tr><th>P315</th><th>Function</th></tr>
<tr><td>0</td><td>Service HMI</td></tr>
<tr><td>1</td><td>Modbus serial for Tecsystem module</td></tr>
</table>
</td></tr>
<tr><td>P320 (1)
Flying Start/ Ride-Through

This parameter works together with P331, P332, P333</td><td>0 to 3
[0]
-</td><td>

<i>Table 6.52 - Flying Start / Ride-Through</i>

<table>
<tr><th>P320</th><th>Function</th></tr>
<tr><td>0</td><td>Inactive</td></tr>
<tr><td>1</td><td>Only Flying Start is active [Valid only for P202 = 0,1 or 2 (V/F Control)]</td></tr>
<tr><td>2</td><td>Flying Start and Ride-Through are active [Valid only for P202 = 0,1 or 2 (V/F Control)]</td></tr>
<tr><td>3</td><td>Only Ride-Through is active</td></tr>
</table>
</td></tr>
<tr><td>P321 (4)
Ud Line Loss Level

This parameter is only visible on the display when P202 = 3 or 4 (Vector Control)</td><td>166 V to 800 V
(P296 = 0)
252 V
1 V

287 V to 800 V
(P296 = 1)
436 V
1 V

2000 V to 8000 V
(P296 = 2)
2681 V
1 V

2000 V to 8000 V
(P296 = 3)
3847 V
1 V

2000 V to 8000 V
(P296 = 4)
4850 V
1 V</td><td>

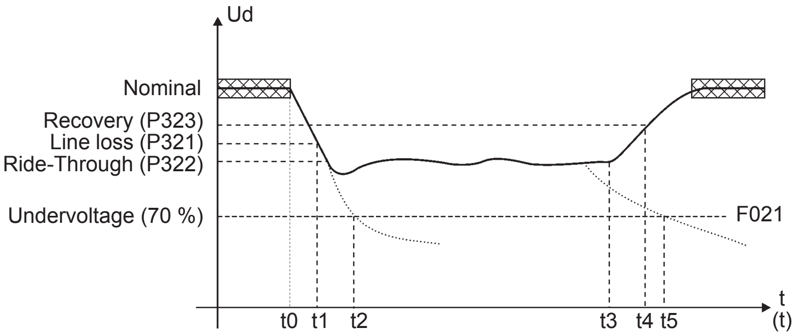
☑ The occurrence of the Ride-Through function can be visualized at the outputs DO1, DO2, RL1, RL2 and/or RL3 (P275, P276, P277, P279 and/or P280) if they have been programmed as “23 = Ride-Through”;

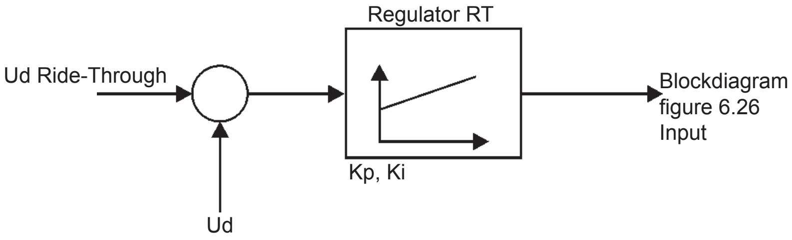
NOTE!
When either Ride-Through or Flying Start is activated, the parameter P214 (Line Phase Loss Detection) is automatically set to 0 = Inactive.

NOTE!
Ud = Vca 1.35.

<u>Ride-Through Vector Control (P202 = 3 or 4)</u>

☑ The purpose of the Ride-Through function in vector mode (P202 = 3 or 4) is to assure that the inverter keeps the motor running without interruption or fault storage during a power failure. The energy necessary to maintain the inverter operation is obtained from the motor/load kinetic energy (inertia) through its controlled deceleration. After the recovery of the line, the motor accelerates again to the speed reference value.
</td></tr>
</table>

Parameter	Range [Factory Setting] Unit	Description/Notes
P322 $^{(4)}$ Ud Ride-Through This parameter is only visible on the display when P202 = 3 or 4 (Vector Control)	166 V to 800 V (P296 = 0) 245 V 1 V 287 V to 800 V (P296 = 1) 423 V 1 V 2000 V to 8000 V (P296 = 2) 2598 V 1 V 2000 V to 8000 V (P296 = 3) 3728 V 1 V 2000 V to 8000 V (P296 = 4) 4700 V 1 V	☑ After the line loss (t0), the DC Link voltage (Ud) starts decreasing according to a rate dependent on the motor load, it could reach the undervoltage level (t2) if the Ride-Through function were not active; ☑ With Ride-Through function active, the line loss is detected when the Ud voltage becomes lower than the "Ud line loss" value (t1). The inverter immediately starts a controlled motor deceleration, regenerating the energy into the DC link and thus maintaining the motor running, with the Ud voltage regulated at the "Ud Ride-Through" value; ☑ If the line does not return, the inverter remains in this condition as long as possible (depending on the inertia load) until undervoltage fault (F021) occurs at (t5). If the line returns (t3) before the undervoltage fault, the inverter detects it when the Ud voltage reaches the "Ud Recovery Level" (t4). Then the motor is accelerated, according to the adjusted ramp time, from the actual speed up to the active speed reference value (figure 6.39); ☑ If the line voltage falls in a region between P322 and P323 the values of P321, P322 and P323 must be readjusted. **NOTE!** The Ride-Through function activation occurs when the power supply voltage is lower than the value (P321 ÷ 1.35).
P323 $^{(4)}$ Ud Line Recovery Level This parameter is only visible on the display when P202 = 3 or 4 (Vector Control)	166 V to 800 V (P296 = 0) 267 V 1 V 287 V to 800 V (P296 = 1) 461 V 1 V 2000 V to 8000 V (P296 = 2) 2930 V 1 V 2000 V to 8000 V (P296 = 3) 4204 V 1 V 2000 V to 8000 V (P296 = 4) 5300 V 1 V	 ***Figure 6.39 -*** *Actuation of the Ride-Through function in Vector Control mode* ☑ t0 - Line loss; ☑ t1 - Line loss detection; ☑ t2 - Undervoltage fault trip (F021 without Ride-Through); ☑ t3 - Line recovery; ☑ t4 - Line recovery detection; ☑ t5 - Undervoltage fault trip (F021 with Ride-Through).

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P325
Ride-Through Proportional Gain
☞ This parameter is only visible on the display when P202 = 3 or 4 (Vector Control)</td><td>0.0 to 63.9
[1.0]
0.1</td><td rowspan="2">

<i>Figure 6.40 - Ride-Through PI controller</i>
☑ The factory settings for P325 and P326 are adequate for the majority of the applications. Do not change these parameter settings.</td></tr>
<tr><td>P326
Ride-Through Integral Gain
☞ This parameter is only visible on the display when P202 = 3 or 4 (Vector Control)</td><td>0 to 9999
[201]
1</td></tr>
<tr><td>P327
Sensorless Flying Start Delay</td><td>0.000 to 9.999
0.100
0.001 s</td><td>☑ It is the delay to change the Sensorless Flying Start searching direction.</td></tr>
<tr><td>P328
Sensorless Flying Start Frequency</td><td>0 = P134
1 = P001</td><td><i>Table 6.53 - Sensorless Flying Start Frequency</i>
<table>
<tr><th>P328</th><th>Function</th></tr>
<tr><td>0</td><td>P134 starting search speed</td></tr>
<tr><td>1</td><td>P001 starting search speed</td></tr>
</table></td></tr>
<tr><td>P329
Sensorless Flying Start Direction</td><td>0 = +P328
1 = -P328</td><td>☑ It is the Flying Start searching direction.</td></tr>
</table>

Parameter	**Range [Factory Setting] Unit**	**Description/Notes**
P331 Voltage Ramp	0.2 to 50.0 [8.0] 0.1 s	Parameters are active with P202 = 0, 1 or 2 (V/F Control): ☑ Parameter P331 sets the time required for the output voltage, starting from 0 V, to reach the nominal voltage. ☑ The Flying Start function allows starting a spinning motor. This function only acts when the inverter is enabled, then it imposes the speed of the reference and applies a voltage ramp with the time defined in P331. ☑ The parameter P333 sets the minimum time the inverter waits before restarting the motor after the line recovery in Ride-Through. This time is counted after the dead time (P332) has elapsed, and it is necessary for the motor demagnetization. P332 is also used when activating the Flying Start, before the Flying Start itself. Adjust the Dead Time (P332) with two times the motor Rotor Time Constant. ☑ The Ride-Through function allows the inverter recovery without F021 (DC link undervoltage), when a voltage dip occurs in the supply line. ☑ The inverter will indicate F003 (Input transformer secondary undervoltage fault) if the voltage dip lasts longer than P332 + P333 seconds. ☑ If Ride-Through is enabled and a voltage dip occurs, causing the DC link to drop below the undervoltage level, the output pulses are disabled and the motor coasts. If the line supply returns to its normal value, the inverter enables the pulses again, imposing the speed of the reference instantaneously and applying a voltage ramp with the time defined in P331. Refer to the figures 6.41 a) and 6.41 b). The Flying Start function does not work when P202 = 3 or 4. ☑ During Ride-Through the pre-charge relay is activated.
P332 Dead Time	0.1 to 20.0 [10.0] 0.1 s	
P333 Ride-Through Time The parameter P331 is only visible on the display if P202 = 0, 1 or 2 (V/F control)	0.0 to 20.0 [10.0] 0.1 s	

Parameter	Range [Factory Setting] Unit	Description/Notes

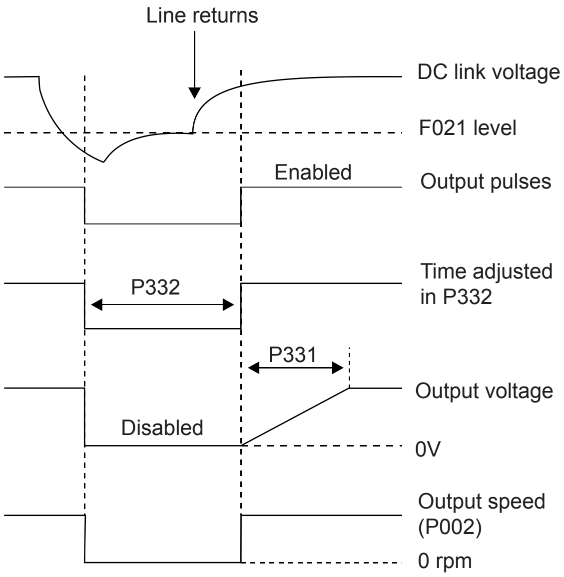


Figure 6.41 a) *- Ride-Through operation when the line returns before the time P332 has elapsed, in V/F mode*

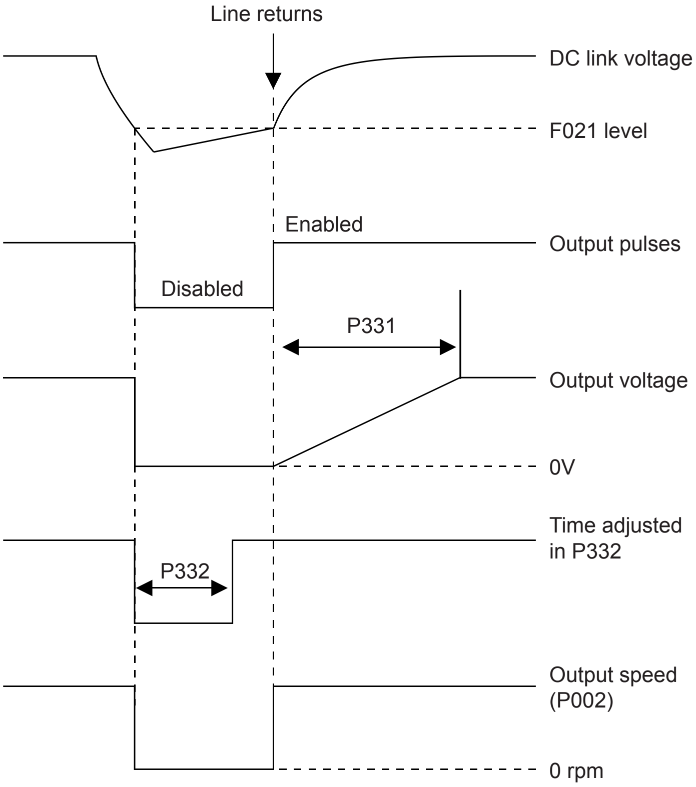


Figure 6.41 b) *- Ride-Through operation when the line returns after the time P332 has elapsed, but before the time adjusted in P332 + P333, in V/F mode*

6.4 MOTOR PARAMETERS - P400 to P499

Parameter	Range [Factory Setting] Unit	Description/Notes
P400 (1) (4) Motor Rated Voltage	0 to 9999 [P296] 1 V	☑ Set this parameter according to the motor nameplate data and the connection diagram used in the terminal box.
P401 (1) Motor Rated Current	0.0 to 1.30 x P295 [1.0 x P295] 0.1 A (<100) 1 A (>99.9)	☑ Adjust it according to the motor nameplate data, considering the motor operating voltage.
P402 (1) Motor Rated Speed	0 to 7200 [1796] 1 rpm	☑ Set this parameter according to the motor nameplate data. ☑ The range for V/F is from 0 to 7200 rpm.
P403 (1) Motor Rated Frequency	0 to 100 [60] 1 Hz	☑ Set this parameter according to the motor nameplate data. ☑ The range for V/F is from 0 to 100 Hz.
P404 (1) Motor Rated Power	0 [0] -	☑ Function not implemented in this software version.
P405 Encoder PPR	100 to 9999 [1024] ppr	☑ Program the number of pulses per revolution (PPR) of the used incremental encoder when P202 = 4 (Vector with Encoder).
P406 (1) (2) Motor Ventilation	0 to 1 [0] -	☑ The value set in P406 during the Guided Start-up Routine automatically adjusts the motor overload protection in the following manner:

Table 6.54 *- Type of motor ventilation*

P406	Motor Ventilation
0	Self-ventilated
1	Separated ventilation

Parameter	Range [Factory Setting] Unit	Description/Notes
P408(1) Self-Tuning	0 or 1 [0] -	☑ With P40 8 = 1 (Autogain) the gains of the vector control regulators are automatically recalculated when the motor configuration parameters are changed.

Table 6.55 *- Self-Tuning*

P408	Function
0	No Autogain
1	Autogain

Parameter	Range [Factory Setting] Unit	Description/Notes
P409(1) Motor Stator Resistance (Rs)	0.000 to 9.999 [0.000] 0.001 Ω	☑ It is the value of the motor stator resistance.

Parameter	Range [Factory Setting] Unit	Description/Notes
P410 Motor Magnetization Current (Imr)	0 to 1.25xP295 [0.0] 0.1 A	☑ It is the value of the motor magnetization current.
P411 (1) Motor Flux Leakage Inductance (ls)	0.00 to 99.99 [0.00] 0.01 mH	☑ It is the value of the motor flux leakage inductance.
P412 (1) Lr/Rr Constant (Rotor Time Constant - Tr)	0.000 to 9.999 [0.000] 0.001 s	☑ Typical Tr values for standard WEG motors.
P413 (1) TM Constant (Mechanical Time Constant)	0.00 to 99.99 [0.00] 0.01 s	☑ It is the mechanical time constant of the driven load.
P414 Magnetizing Voltage	0.0 to 20.0 [0.0] 0.1 %	☑ It is a percentage of the nominal voltage applied during 2 x P412 to magnetize the motor when starting it.

6.5 PARAMETERS OF THE SPECIAL FUNCTIONS

6.5.1 PID Regulator

☑ The MVW-01 has a PID regulator function, which can be used to control a closed loop process. That function consists of a controller with proportional, integral and derivative gain, superposed to the normal MVW-01 speed control.

☑ In order to keep the process variable (the one to be controlled - water level in a reservoir for instance) at the value adjusted with the setpoint, the speed will be varied automatically by the PID controller.

☑ That regulator is able, for instance, to control the flow in a pipeline by means of flow feedback applied to the analog input AI2 or AI3 (selected through P524) and setpoint according to P221 or P222 definition (e.g., AI1), with the inverter driving the pump that is responsible for the pipeline flow.

☑ Other application examples are: Level or temperature control, dosage, etc.

6.5.1.1 Description

☑ The PID regulator function is activated by setting P203 = 1 or 3.

☑ The figure 6.42 presents the Academic PID Regulator block diagram.

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

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

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

$$y(kTa) = y(k-1)Ta + Kp[(e(kTa) - e(k-1)Ta) + Kie(k-1)Ta + Kd(e(kTa) -2e(k-1)Ta + e(k-2)Ta)]$$

Where:
Kp (Proportional Gain): Kp = P520 x 4096.
Ki (Integral Gain): Ki = P521 x 4096 = [Ta/Ti x 4096].
Kd (Differential Gain): Kd = P522 x 4096 = [Td/Ta x 4096].
Ta = 0.02 sec (PID regulator sampling time).
SP*: reference, maximum 13 bits (0 to 8191).
X: process variable (or controlled), read through AI2 or AI3, maximum 13 bits.
y(kTa): current PID output, maximum 13 bits.
y(k-1)Ta: previous PID output.
e(kTa): current error [SP*(k) – X(k)].
e(k-1)Ta: previous error [SP*(k-1) – X(k-1)].
e(k-2)Ta: error at two previous samplings [SP*(k-2) – X(k-2)].

☑ The feedback signal must be connected to the analog input AI2’ or AI3’ (refer to the figures 6.28 and 6.29).

☑ The setpoint can be defined via:
- Keypad: parameter P525.
- Analog input: AI1’, AI2’, AI3’, AI4’, AI5’, (AI1’+ AI2’) > 0, (AI1’+ AI2’), Multispeed, Serial, Fieldbus.

Note: when P203 = 1 or 3 (PID), do not use the reference via EP (P221/P222 = 7).

☑ When the PID function is enabled (P203 = 1 or 3):
- One of the digital inputs from DI3 to DI10 can select between manual and automatic PID operation (P265 to P272).
- When the PID regulator function is activated (P203 = 1 or 3), the digital input DI3 is automatically programmed for the Manual/Automatic function (P265 = 15).

***Table 6.56** - DIx operation mode*

DIx	PID status
0 (Open)	Manual
1 (Closed)	Automatic

- P040 indicates the process variable value (feedback) in the selected scale and unit. In order to avoid the feedback analog input saturation during a regulation overshoot, the signal must vary between 0 and 9.0 V (0(4) to 18 mA). The adaptation between the setpoint and the feedback can be done changing the gain of the analog input selected as feedback (P238 for AI2 or P242 for AI3). The Process variable can also be visualized at the outputs AO1 to AO6, if it has been programmed at P251, P253, P255, P257, P259 or P261. This is also valid for the PID setpoint.

  The outputs DO1, DO2 and RL1 to RL5, can be programmed (P275 to P277, P279 to P282) for the functions Process Variable > VPx (P533) and Process Variable < VPy (P534).

  The functions JOG and Forward/Reverse remain disabled. Enable and Start/Stop commands are defined at P220, P224 and P227.
- If the setpoint is defined by P525 (P221 or P222 = 0), and the system is changed from manual to automatic, then P525 is automatically adjusted with the P040 value.

  In this case the transition from manual to automatic is smooth (there is no abrupt speed variation).

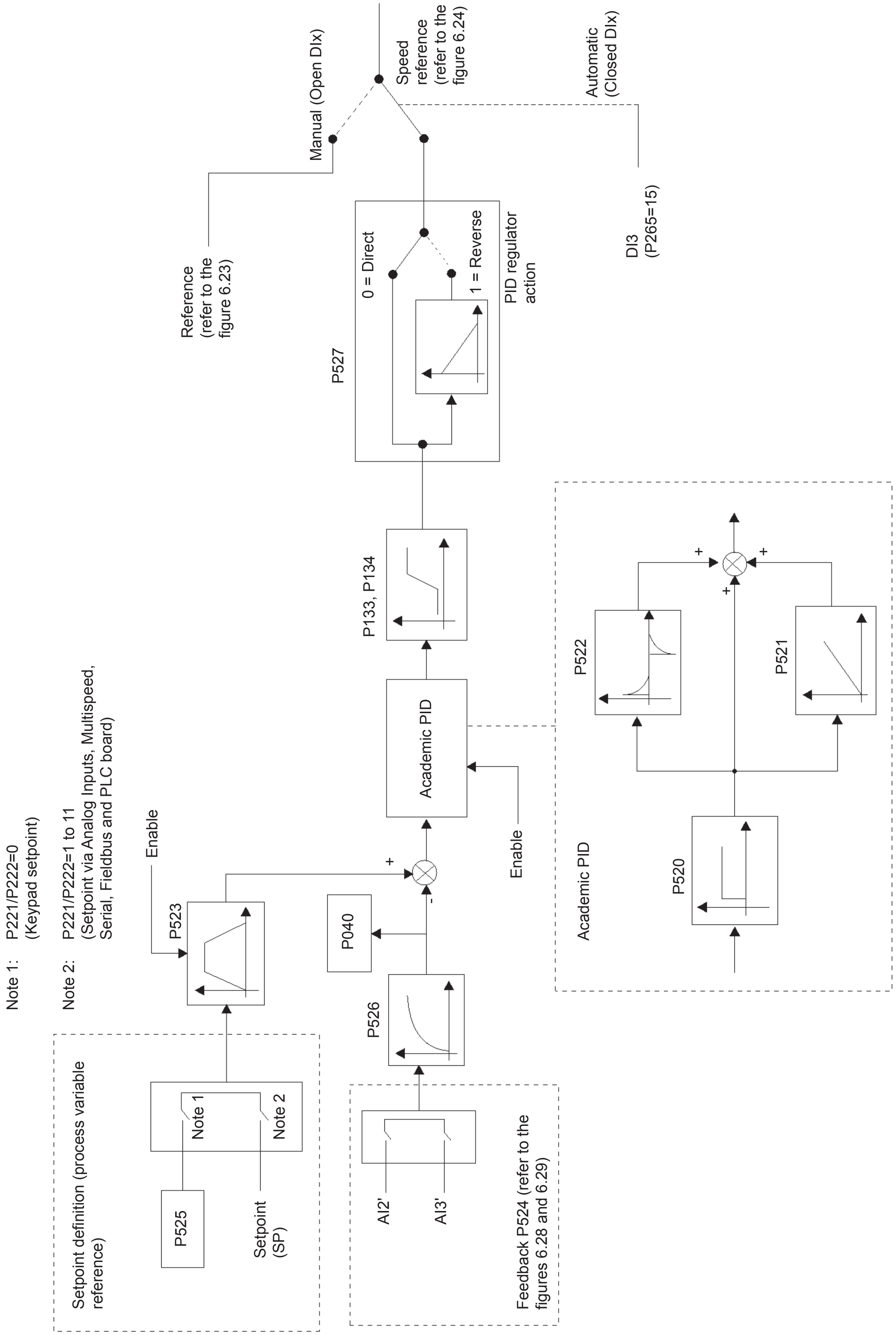


Figure 6.42 - *Academic PID Regulator block diagram*

Parameter	Range [Factory Setting] Unit
P520 PID Proportional Gain	0.000 to 7.999 [1.000] 0.001
P521 PID Integral Gain	0.000 to 9.999 [1.000] 0.001 (<9.999) 0.01 (>9.999)
P522 PID Differential Gain	0.000 to 9.999 [0.000] 0.001
P523 PID Ramp Time	0.0 to 999.0 [3.0] 0.1 s (<99.9 s) 1 s (>99.9 s)

☞ These parameters are only visible on the display if P203 = 1 or 3

Description/Notes

☑ The initial gain and PID ramp settings recommendation for some applications mentioned in the section 6.5.1, are given in the table 6.57.

Table 6.57 *- PID initial gain setting suggestions*

Process variable	Gains			P523 PID Ramp	P527 Action type
	P520 P	P521 I	P522 D		
Pneumatic system pressure	1	0.043	0.000	3	0 = Direct
Pneumatic system flow	1	0.037	0.000	3	0 = Direct
Hydraulic system pressure	1	0.043	0.000	3	0 = Direct
Hydraulic system flow	1	0.037	0.000	3	0 = Direct
Temperature	2	0.004	0.000	3	Notes
Level	1	Notes	0.000	3	Notes

Notes:

- For temperature and level, the action type setting will depend on the process. For level control, for instance, if the inverter drives the motor that pumps fluid out of the reservoir, the action will be reverse because when the level increases the inverter must increase the motor speed in order to lower the level, otherwise, when the inverter drives a motor that pumps fluid into the reservoir, the action will be direct.
- In case of level control, the integral gain adjustment will depend on the time required for the reservoir to pass from the minimum acceptable to the desired level, in the following conditions:

I. For direct action, the time must be measured with maximum input flow and minimum output flow.

II. For reverse action, the time must be measured with minimum input flow and maximum output flow.

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

$$P521 = 0.02/t$$

t = time (seconds)

Parameter	Range [Factory Setting] Unit	Description/Notes

P524 (1)
PID Feedback
Selection

☞ This parameter is only visible on the display if P203 = 1 or 3

0 or 1
[0]
-

☑ It defines the PID regulator feedback (Process variable) input.

***Table 6.57** - Feedback input selection*

P524	AIx
0	AI2 (P237 to P240 and P248)
1	AI3 (P241 to P244)

☑ After the feedback input has been chosen, the function of the selected input must be programmed at P237 (for AI2) or at P241 (for AI3).

☑ Feedback type:

- The PID action type described above considers that the process variable feedback signal increases when the process variable also increases (direct feedback). This is the most used feedback type.
- If the process variable feedback decreases as the process variable increases (inverse feedback), then it is necessary to program the selected PID feedback analog input as inverse reference: For AI2 feedback, P239 = 2 (10 to 0 V/20 to 0 mA) or P239 = 3 (20 to 4 mA). For AI3 feedback, P243 = 2 (10 to 0 V/20 to 0 mA) or P243 = 3 (20 to 4 mA). Without this setting, the PID does not operate correctly.

P525
Keypad PID
Setpoint

☞ This parameter is only visible on the display if P203 = 1 or 3

0.0 to 100.0
[0.0]
0.1 %

☑ It provides the PID regulator setpoint that is adjusted via the ▲ and ▼ keys provided that P221 = 0 (Local) or P222 = 0 (Remote), and in automatic mode. If the PID is in manual mode, then the speed reference is given by P121.

☑ When the PID regulator is operating in automatic mode, the setpoint is the one defined as speed reference via P221 (Local) or P222 (Remote). The majority of PID applications either use setpoint via analog input AI1 (P221 = 1 in Local, or P222 = 1 in Remote), or via ▲ and ▼ keys (P221 = 0 in Local, or P222 = 0 in Remote), refer to the figure 6.42.

P526
Process Variable
Filter

☞ This parameter is only visible on the display if P203 = 1 or 3

0.0 to 16.0
[0.1]
0.1 s

☑ It adjusts the process variable filter time constant.

☑ The 0.1 s value is usually adequate, unless the process variable presents much noise. In such case, increase the value gradually, observing the result.

Parameter	Range [Factory Setting] Unit	Description/Notes
P527 PID Action Type	0 or 1 [0] -	☑ It defines the type of PID control action:

This parameter is only visible on the display if P203 = 1 or 3

Table 6.58 - PID action type

P527	Action type
0	Direct
1	Reverse

☑ Selection criteria:

Table 6.59 - Selection of operation

Motor speed	Process variable	Action type
Increases	Increases	Direct
	Decreases	Reverse

☑ Selection according to the process requirements:
- PID action type: The action must be selected as Direct when it is necessary to increase the motor speed to increase the process variable. Otherwise, select Reverse.

Example 1 – Direct: The inverter drives a pump responsible for filling a water reservoir using the PID to control the level. In order that the level (process variable) increases, it is necessary that the flow, and consequently the motor speed, also increases.

Example 2 – Reverse: The inverter drives a fan responsible for refrigerating a cooling tower using the PID to control the temperature. In order to increase the temperature (process variable), it is necessary to decrease the ventilation by decreasing the motor speed.

Parameter	Range [Factory Setting] Unit	Description/Notes
P528 Process Variable Scale Factor	0 to 9999 [1000] -	☑ P528 and P529 define how the process variable (P040) will be displayed. ☑ P529 defines the number of digits after the decimal point. ☑ P528 must be adjusted according to the equation below: $P528 = \frac{\text{Process F.S.V. indication x } 10^{P529}}{\text{Gain (AI2 or AI3)}}$ Where: Process F.S.V. indication = Process variable full-scale value, corresponding to 10 V or 20 mA at the feedback analog input (AI2 or AI3). Example 1: 0 to 25 bar pressure transducer with 4 to 20 mA output signal. - Desired indication: 0 to 25 bar (F.S.V.) - Feedback input: AI3 - AI3 gain, P242 = 1.000 - AI3 signal, P243 = 1 (4 to 20 mA) - P529 = 0 (no positions after the decimal point) $P528 = \frac{25 \text{ x } (10)^0}{1.000} = 25$ Example 2: Factory default values - Desired indication: 0.0 % to 100 % (F.S.V.) - Feedback input: AI2 - AI2 gain = P238 = 1.000 - P529 = 1 (one position after the decimal point) $P528 = \frac{100.0 \text{ x } (10)^1}{1.000} = 1000$
P529 Process Variable Decimal Point ☛ These parameters are only visible on the display if P203 = 1 or 3	0 to 3 [1] -	

Parameter	Range [Factory Setting] Unit	Description/Notes
P530 Process Variable Engineering Unit 1 **P531** Process Variable Engineering Unit 2 **P532** Process Variable Engineering Unit 3 ☛ These parameters are only visible on the display if P203 = 1 or 3	32 to 127 [37 (%)] - 32 to 127 [32 ( )] - 32 to 127 [32 ( )] -	☑ These parameters are useful only for inverters fitted with an LCD keypad. ☑ The process variable engineering unit is formed by three characters, which will be applied to the parameter P040 indication. P530 defines the leftmost character, P531 the center one and P532 the rightmost. ☑ Characters correspondent to the ASCII code, from 32 to 127, can be chosen. Examples: A, B, ... , Y, Z, a, b, ... , y, z, 0, 1, ... , 9, #, $, %, (,), *, +,... Engineering unit examples: - To indicate “bar”: P530 = “b” (98) P531 = “a” (97) P532 = “r” (114) - To indicate “%”: P530 = “%” (37) P531 = ” ” (32) P532 = ” ” (32)
P533 VPx Value **P534** VPy Value **P535** Wake up Band ☛ These parameters are only visible on the display if P203 = 1 or 3	0.0 to 100.0 [90.0] 0.1 % 0.0 to 100.0 [10.0] 0.1 % 0 to 100 [0] 1 %	☑ They are used with the digital and relay output functions: Process Variable > VPx and Process Variable < VPy with the function of signal/alarm. ☑ The process variable full scale value in percentage is: $(P040 = \frac{(10)^{P529}}{P528} \times 100\ \%)$ ☑ P535 works together with P212 (Condition to Leave Zero Speed Disable), giving an additional condition to leave the disabled condition, i.e., PID error > P535. Refer to P211 and P213 descriptions.

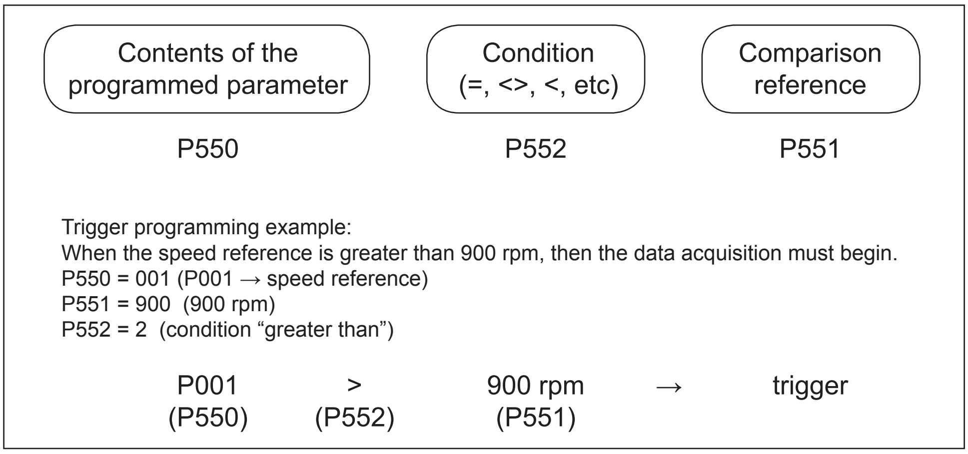
6.5.2 Trace Function

☑ The trace function is used to record MVW-01 parameters (e.g., current, voltage, speed) when a certain event occurs in the system (e.g., alarm/fault, high current, etc.). This system event, for unleashing the data storage process, is called trigger, and is of fundamental importance in the trace function.

6.5.2.1 Trigger

☑ Trigger can be understood as the element that defines the beginning of a process that, in this case, is recording and storing data of the programmed trace channels in the memory of the control boards.

☑ The trigger can be programmed in several manners. Any MVW-01 available parameter can be used as trigger, and this parameter is programmed in P550. The value of the parameter programmed in P550 is compared to a reference set by the user in the parameter P551. The type of comparison between the parameter and the reference is established programming P552 and can be =, <>, >, <, inverter fault or binary selection(1) (or bit mask). When the comparison condition is fulfilled, the storage of the trace channels is triggered (refer to the figure 6.43 example).



Trigger programming example:
When the speed reference is greater than 900 rpm, then the data acquisition must begin.
P550 = 001 (P001 → speed reference)
P551 = 900 (900 rpm)
P552 = 2 (condition “greater than”)

Figure 6.43 *- Trigger programming example*

(1) The binary selection has the purpose of allowing the use of a specific digital input or output as trigger. This procedure is necessary because there is no single inverter parameter related to each digital input or output, so that the status of all the digital inputs is presented at parameter P012, and in a similar manner, P013 presents the digital output status. Therefore, it is necessary to determine which parameter bit contains the desired input or output information (for more details, refer to the P552 description).

ATTENTION!

If a trigger condition that is fulfilled immediately after the data capture is enabled (P571 = 1) is programmed, then the trace function data will not be valid.

E.g.: I. Acceleration ramp programmed with 10.0 seconds (P100 = 10.0)
II. Trigger programmed for P100 = 10.0 seconds (P550 = 100 and P551 = 100)
III. Data capture enabled (P571 = 1)
IV. Trigger occurs immediately because P100 was already programmed with 10.0 seconds. In this condition, data are not valid.

6.5.2.2 Data Access

☑ Data stored by the Trace function can be visualized at the inverter analog outputs or on a PC by using the SuperDrive software. There are eight channels available for the Trace function, and they are all synchronized with the trigger (the trigger simultaneously unleashes the storage of all the active channels). Any MVW-01 parameter (except P000) can be stored in one of the eight trace channels.

6.5.2.3 Memory

☑ The memory used by the Trace function is able to automatically assume several size configurations, depending on the parameters selected in each trace channel (from 31.08 kword up to 248.64 kword of total memory).

*1kword = 1000 words

☑ Each trace channel is able to store any inverter parameter, with the exception of P000. Some of the parameters are handled by the MVC1 control board and the others by the MVC2 control board. The list of the parameters handled by the MVC1 board is presented next:

P002, P003, P004, P005, P007, P009, P022, P025, P026, P027, P030, P031, P032, P033, P034, P035, P036, P037, P052, P053, P055, P056, P057, P058, P059, P070, P071, P072, P073, P074, P075 and P076.

☑ In order to allow the analysis of data captured by the Trace function, it is important that all the channels have the same size, not mattering whether the MVC1 or the MVC2 control board controls them. As can be observed in the figure 6.44, each board makes available a different total Trace function memory and, therefore, there are some important implications to be observed when it comes to knowing the total allocated memory for each channel.

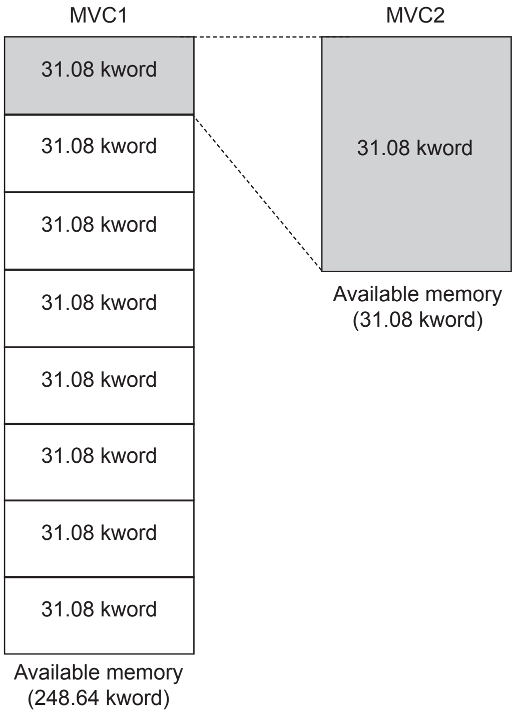


Figure 6.44 *- Example of Trace function memory distribution by the control boards*

In general, the size of each channel is limited by the smaller memory available on the MVC2 board, in case that there are MVC2 channels programmed. Then maximum size of each channel will be the MVC2 memory size (31.08 kword) divided by the number of used MVC2 channels.

NOTE!

☛ P572 defines the percentage of the memory used in each board. The factory default setting is 100 % and the examples given here use this total memory capacity (100 %). For more information, refer to the P572 description.

Thus, the maximum total memory (248.64 kword) use situation will be possible when the user selects only parameters handled by the MVC1 control board, or when the user selects only one parameter from the MVC2 and seven from the MVC1 board. The minimum total memory (31.08 kword) will be used when only parameters handled by the MVC2 board were selected.

In any other case an intermediate size configuration will be used, limited by the memory available in the MVC2 board and depending, therefore, on the number of channels with MVC2 parameters. In this way, the memory is distributed according to the number of active channels on each board.

Example 1: Trace function programmed for 3 MVC2 channels.

MVC2 RAM = 31.08 kword
RAM area per MVC2 channel = 31.08/3 = 10.36 kword
RAM area per MVC1 channel = 0 kword
RAM area per channel = 10.36 kword ⇒ 10360 points per channel
Total RAM use = 3 x 10.36 kword = 31.08 kword

Therefore, the MVC2 board handles 3 channels, witch use 10.36 kword of memory each one.

The MVC1 control board has a memory capacity 8 times greater than the MVC2; therefore, the memory reserved for each channel handled by the MVC1 is equal to the size of each channel handled by the MVC2, regardless of the allocated RAM memory area size. If there are no channels handled by the MVC2 board, then the size of each MVC1 handled channel is equal to the total RAM area (248.64 kword) divided by the number of programmed channels.

Example 2: Trace function programmed with 4 MVC2 handled channels and 2 MVC1 channels.

MVC2 RAM = 31.08 kword
RAM area per MVC2 channel = 31.08/4 = 7.77 kword
RAM area per MVC1 channel = 7.77 kword
RAM area per channel = 7.77 kword ⇒ 7770 points per channel
Total RAM use = 6 x 7.77 kword = 46.62 kword

6.5.2.4 Sampling

☑ Sampling time is the time interval between the points stored by the Trace function (refer to the figure 6.45). If, for instance, a 1 ms (1 millisecond or 1/1000 second), it means that 1000 points will be stored per second (if there is enough memory available).

☑ The sampling time is the same for all the channels programmed in the Trace function, and it can be programmed as a whole number multiplying 500 µs. If a 2 ms sampling time (4 x 500 µs) is programmed for the example 2, then 15.54 seconds of information will be stored in each channel (7770 x 2 ms).

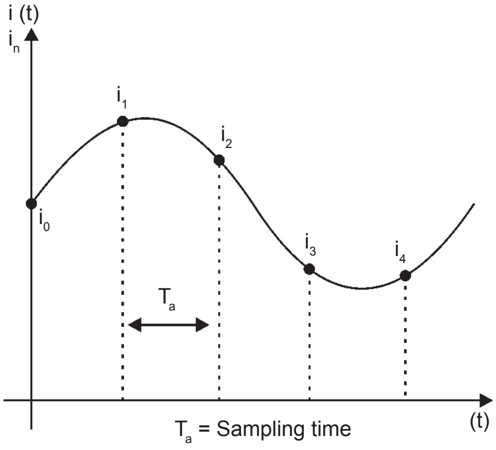


Figure 6.45 - Example of Trace function signal sampling

6.5.2.5 Pre-Trigger

☑ It is possible to program a pre-trigger time as a percentage of the total record (see the figure 6.46), meaning that part of the Trace function data before the trigger event will be stored. If a 50 % pre-trigger is programmed for the example 2, then 7.77 sec data before the trigger and 7.77 sec after, will be stored.

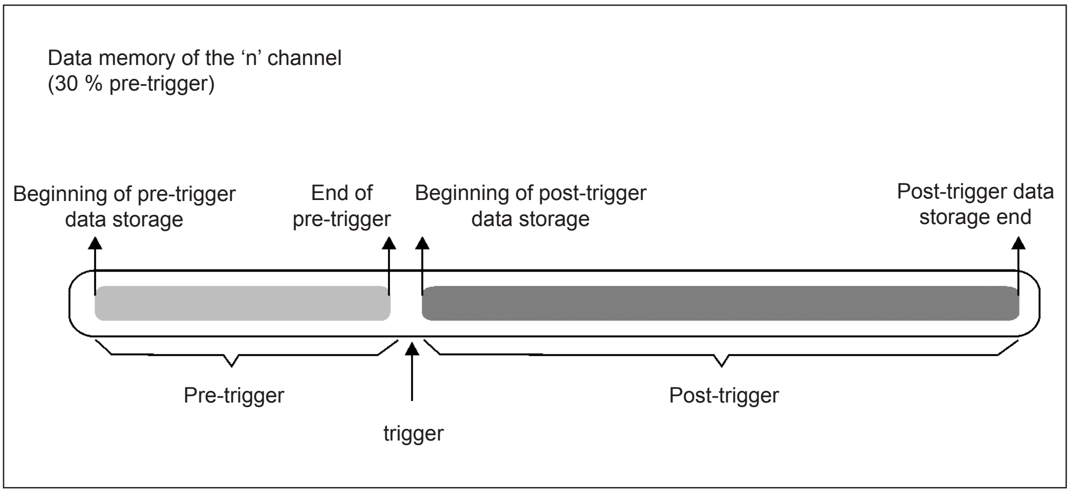


Figure 6.46 *- Example of Trace function data distribution for one channel with 30 % programmed pre-trigger*

6.5.2.6 Trace Function Parameters

Read-Only Parameters

Parameter	Range [Factory Setting] Unit	Description/Notes
P029 Trace Function Status	0 to 3 [0] -	☑ It indicates the Trace function status. ☑ When the trace acquisition has been finished, then by pressing the PROG key the date/time of the trigger moment is presented.

***Table 6.60** - Trace Function Status*

P029	Function
0	Inactive
1	Waiting for trigger
2	Triggered
3	Trace finished

Configuration for the Trigger Event

Parameter	Range [Factory Setting] Unit	Description/Notes
P550 Trigger Parameter	0 to 727 [0] -	☑ Program the number of the parameter to be used as trigger for the Trace function. Example: By programming P550 = 4 the trigger parameter will be P004 (DC Link Voltage). **Note:** When the trigger is defined by alarm or fault, then P550 can have any value. Refer to the P552 description.
P551 Trigger Value	-32768 to +32767 [0] -	☑ The value programmed in P551 is compared to the contents of the parameter defined at P550. If the trigger condition is fulfilled, (refer to P552), the Trace function will be triggered. ☑ The user must apply the processor internal representation, so that the Trace function works properly. Example: I. If P550 = 3, program P551 = 0x1FFF if the user wants to compare P003 with 100 % of the nominal output current. The parameter P003 uses Q13 numerical format. II. If P550 = 100, program P551 = 100 if the user wants to compare P100 (acceleration ramp) with a 10.0 s value programmed for triggering the trace function.

Parameter	Range [Factory Setting] Unit	Description/Notes
P552 Trigger Condition	0 to 20 [4] -	☑ Refer to P550. ☑ With the factory default programming (refer to the Trace function programming example, figure 6.43) the trigger is defined as a fault trip. ☑ Trace function trigger condition:

Table 6.61 *- Trace function trigger condition*

P552	Trigger condition		
0	P550* = P551		
1	P550* ≠ P551		
2	P550* > P551		
3	P550* < P551		
4	Fault trip		
-	**Binary selection (bit mask)**	**Respective DI (P550 = 12)**	**Respective DO (P550 = 13)**
5	P550* bit 0 = P551	DI8	-
6	P550* bit 1 = P551	DI7	RL5
7	P550* bit 2 = P551	DI6	RL4
8	P550* bit 3 = P551	DI5	RL3
9	P550* bit 4 = P551	DI4	RL2
10	P550* bit 5 = P551	DI3	RL1
11	P550* bit 6 = P551	DI2	DO2
12	P550* bit 7 = P551	DI1	DO1
13	P550* bit 8 = P551	DI9	-
14	P550* bit 9 = P551	DI10	-
15	P550* bit 10 = P551	-	-
16	P550* bit 11 = P551	-	-
17	P550* bit 12 = P551	-	-
18	P550* bit 13 = P551	-	-
19	P550* bit 14 = P551	-	-
20	P550* bit 15 = P551	-	-

* Contents of the parameter programmed at P550.

Note: The binary selection conditions (5 to 20) are only effective if the parameter programmed in P550 is 12 or 13 (P012 or P013).

Recording Configuration

Parameter	Range [Factory Setting] Unit	Description/Notes
P553 Sampling Time	1 to 9999 [1] x500 µs	☑ It is the trace channels sampling time (as a multiplier of the 500 µs time base). Example: If P553 = 10, a sampling time of 5 ms is obtained.

Parameter	Range [Factory Setting] Unit	Description/Notes
P554 Pre-Trigger Percentage	1 to 100 [50] 1 %	☑ It is the percentage of trace data before the trigger event that has to be recorded.
P555 CH1 - Trace channel 1 **P557** CH2 - Trace channel 2 **P559** CH3 - Trace channel 3 **P561** CH4 - Trace channel 4 **P563** CH5 - Trace channel 5 **P565** CH6 - Trace channel 6 **P567** CH7 - Trace channel 7 **P569** CH8 - Trace channel 8	0 to 727 [001] [002] [003] [004] [005] [006] [007] [074] -	☑ Number of the parameter that will be recorded by the Trace function at the respective channel. ☑ The setting 0 means inactive channel. ☑ With the factory default settings (refer to the Trace function programming example, figure 6.43) the following parameters are programmed with the Trace function.

Table 6.62 *- Trace channel*

Channel	Parameter	Description
1	P001	Speed Reference
2	P002	Motor Speed
3	P003	Motor Current
4	P004	DC Link Voltage
5	P005	Motor Frequency
6	P006	Inverter Status
7	P007	Output Voltage
8	P074	Input Transformer Secondary Voltage

Parameter	Range [Factory Setting] Unit	Description/Notes
P556 CH1 Trace Mask **P558** CH2 Trace Mask **P560** CH3 Trace Mask **P562** CH4 Trace Mask **P564** CH5 Trace Mask **P566** CH6 Trace Mask **P568** CH7 Trace Mask **P570** CH8 Trace Mask These parameters are only visible on the display when the respective trace channel has been programmed for 12 or 13.	0 to 16 [0] -	☑ They are only visible when the channel is programmed for 12 (P012) or 13 (P013). P012 and P013 are parameters that contain multiplexed information on digital inputs and outputs and need a binary selection (bit mask). ☑ They define the record manner of the respective channel during trace acquisition. ☑ If the respective channel is programmed for P012 or P013, the channel data will be recorded according to P556 to P570.

Table 6.63 *- Trace record type*

Value	Record Type	DI	DO
0	Normal		
1	Only the bit 0	DI8	-
2	Only the bit 1	DI7	RL5
3	Only the bit 2	DI6	RL4
4	Only the bit 3	DI5	RL3
5	Only the bit 4	DI4	RL2
6	Only the bit 5	DI3	RL1
7	Only the bit 6	DI2	DO2
8	Only the bit 7	DI1	DO1
9	Only the bit 8	DI9	-
10	Only the bit 9	DI10	-
11	Only the bit 10	-	-
12	Only the bit 11	-	-
13	Only the bit 12	-	-
14	Only the bit 13	-	-
15	Only the bit 14	-	-
16	Only the bit 15	-	-

Starting Configuration

Parameter	Range [Factory Setting] Unit	Description/Notes
P571 Trace Activation	0 or 1 [0] -	☑ It programs the trace function, initiating its operation.

NOTE!

The trace programming becomes active when this parameter changes from inactive to active. Therefore, if the Trace function is active and trace parameters are reprogrammed, those changes will only become effective when P571 is disabled (Inactive) and enabled (Active) again.

***Table 6.64** - Trace activation*

P571	Trace
0	Inactive
1	Active

Memory Configuration

Parameter	Range [Factory Setting] Unit	Description/Notes
P572 Trace Memory Percentage	1 to 100 [100] 1 %	☑ It defines the percentage of the available memory that will be used for the Trace function recording.

☑ When the user wants short time intervals, then values smaller than 100 % could be useful for the visualization at the analog outputs, and in the data transfer to the SuperDrive software.

☑ In order to calculate the memory available for each channel when P572 is different from 100 %, one must simply consider the total memory of each board as:

P572/100 x total board memory

Example:

Memory available for each channel = 7.77 kword.

Sampling time = 500 µs (P553 = 1).

If P572 = 100 %, then: 7770 x 500 µs = 3.885 s record.

If P572 = 10 %, then: 777 x 500 µs = 0.3885 s record and 90 % of the memory is not used.

If P572 = 1 %, then: 77 x 500 µs = 0.0385 s record and 99 % of the memory is not used.

6.5.3 Trace Function Use and Programming Example

☑ The first step to use the Trace function is to enable the parameters for the trace by programming P203 = 2 (Trace) or P203 = 3 (Trace + PID), so that the configuration parameters (P550 to P572) become accessible.

☑ The factory default settings for the Trace function may be applied by the user as a reference, and if convenient, as the programming base for other trace configurations.

☑ This standard configuration presents trigger caused by inverter fault and the default parameters programmed at the trace channels. Data for this programming can be observed in the table 6.65.

Table 6.65 *- Standard Trace programming data*

Parameter	Description	Programming
P550	Trigger Parameter	(0)
P551	Trigger Value	(0)
P552	Trigger Condition	(4) Fault trip
P553	Sampling Time	(1) 500 μs
P554	Pre-Trigger Percentage	50 %
P555	CH1 - Channel 1	(1) P001 - Speed Reference
P557	CH2 - Channel 2	(2) P002 - Motor Speed
P559	CH3 - Channel 3	(3) P003 - Motor Current
P561	CH4 - Channel 4	(4) P004 - DC Link Voltage
P563	CH5 - Channel 5	(5) P005 - Motor Frequency
P565	CH6 - Channel 6	(6) P006 - Inverter Status
P567	CH7 - Channel 7	(7) P007 - Output Voltage
P569	CH8 - Channel 8	(74) P074 - Input Transformer Secondary Voltage
P572	Trace Memory Percentage	(100) 100 %

☑ For this configuration, P550 and P551 can assume any value, because the trigger condition is an inverter fault trip, which is independent from the other trigger parameter configurations.

☑ The memory size for each channel can be calculated in the following manner:

Number of MVC2 channels = 1 (P001)
Trace Memory Percentage (P572) = 100 %
MVC2 board total RAM = 31.08 kword x 100 % = 31080 words
RAM area per channel on the MVC2 board = 31080/1 = 31080 words

Number of MVC1 channels = 7 (P002, P003, P004, P005, P006, P007 and P074)
RAM area per MVC1 channel = 31080 words (same size as the MVC2 channel)
RAM area per channel = 31.08 kword = 31080 points per channel

Total RAM = 8 x 31.08 kword = 248.64 kword

☑ The function can be enabled for the programmed data acquisition by setting P571 = 1 (Active). In this condition the Trace function is storing the pre-trigger (50 %) data and the parameter P029 (Trace Function Status) shows (1) Waiting for trigger.

☑ When the inverter trips with a fault, then the trace memory will be filled with the post-trigger (50 %) data and P029 will indicate (2) Triggered.

☑ When the post-trigger data acquisition is complete, then P029 will indicate Trace finished. At this point the data can be visualized at the analog outputs, by programming them (P251, P253, P255, P257, P259 and P261) with the respective trace channel. If the function is not in the Trace finished state (P029 = 3), the analog outputs programmed for those channels will output a zero value.

6.6 OTHER MVW-01 PARAMETERS

<table>
<tr><th>Parameter</th><th>Range
[Factory Setting]
Unit</th><th>Description/Notes</th></tr>
<tr><td>P721 (1)
Analog Input AI5 Function

(Isolated unipolar analog input)</td><td>0
[0]
-</td><td><i>Table 6.66 - Analog input AI5 function</i>
<table>
<tr><th>P721</th><th>Function</th></tr>
<tr><td>0</td><td>P221/P222</td></tr>
</table>
☑ When the option 0 (P221/P222) is selected, AI5 is able to receive the speed reference, which will be subjected to the speed limits (P133 and P134) and ramp action (P100 to P103), providing that it has been programmed so in P221 and/or P222. Refer to the figure 6.24.</td></tr>
<tr><td>P722
Analog Input AI5 Gain</td><td>0.000 to 9.999
[1.000]
0.001</td><td>☑ Refer to the P234 description.</td></tr>
<tr><td>P723 (1)
Analog Input AI5 Signal Type</td><td>0 to 3
[0]
-</td><td><i>Table 6.67 - Analog input AI5 signal type</i>
<table>
<tr><th>P723</th><th>AI5</th></tr>
<tr><td>0</td><td>(0 to 10) V / (0 to 20) mA</td></tr>
<tr><td>1</td><td>(4 to 20) mA</td></tr>
<tr><td>2</td><td>(10 to 0) V / (20 to 0) mA</td></tr>
<tr><td>3</td><td>(20 to 4) mA</td></tr>
</table>
☑ Inverse reference is obtained with the options 2 and 3, i.e., the maximum speed is obtained with the minimum reference.
☑ Set the S3.1 switch on the MVC2 control board to the on position when a current signal is used at the analog input AI5.</td></tr>
<tr><td>P724
Analog Input AI5 Offset</td><td>0.0 to +100.0
[0.0]
0.1 %</td><td>☑ Refer to the P234 description.</td></tr>
<tr><td>P725
Minimum Coasting Time</td><td>0 to 300
[0]
1 s</td><td>☑ The minimum coasting time determines for how long the inverter will not be accepting General Enable or Start/Stop commands after a coasting stop (P232 = 1 - General Disable).
☑ By programming 0 at this parameter the function is deactivated.</td></tr>
</table>

CHAPTER 7

DIAGNOSTICS AND TROUBLESHOOTING

This Chapter assists the user in the identification and correction of possible faults that may occur during the inverter operation. Guidance on the necessary periodical inspections and cleaning of the inverter is also provided.

7.1 ALARMS/FAULTS AND POSSIBLE CAUSES

When faults or alarms are detected, the inverter indicates them on the HMI. Alarms and faults are displayed as AXXX (for alarms) and FXXX (for faults), and "XXX" is the code of the alarm or fault.

If a fault occurs the inverter is disabled, whereas in an alarm event it continues operating normally. In order to restart the inverter after a fault has occurred, it must be reset. The reset can normally be performed in the following manners:

☑ By pressing the 0 key on the HMI (Manual reset);

☑ Automatically through P206 setting (Auto-reset);

☑ Via a digital input: DI3 (P265 = 12) or DI4 (P266 = 12) or DI5 (P267 = 12) or DI6 (P268 = 12) or DI7 (P269 = 12) or DI8 (P270 = 12) or DI9 (P271 = 12) or DI10 (P272 = 12): DI Reset.

☑ Via network.

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

Table 7.1 *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Power supply	A001	Input transformer secondary low voltage.	☑ It resets automatically when the input transformer secondary voltage becomes greater than 80.5 %.	☑ The input transformer secondary voltage is less than 80 % of the rated value; ☑ Power supply undervoltage; ☑ Incorrect settings of the input transformer primary taps.
	A002	Input transformer secondary high voltage.	☑ It resets automatically when the input transformer secondary voltage becomes less than 113.5 %.	☑ The input transformer secondary voltage is greater than 114 % of the rated value; ☑ Power supply overvoltage; ☑ Incorrect settings of the input transformer primary taps.
	F003	Input transformer secondary undervoltage.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ The input transformer secondary voltage is less than 70 % of the rated value; ☑ Power supply undervoltage; ☑ Incorrect settings of the input transformer primary taps.
	F004	Input transformer secondary overvoltage.		☑ The input transformer secondary voltage is greater than 117 % of the rated value; ☑ Power supply overvoltage; ☑ Incorrect settings of the input transformer primary taps.
	F006	Input transformer secondary imbalance or phase loss.		☑ Phase loss at the power supply; ☑ Voltage imbalance greater than 10 % of the rated value.
	F007	Input transformer secondary voltage feedback fault.	☑ Contact WEG.	☑ Input transformer secondary voltage feedback circuit failure (A9.4 - ISOX.01 board); ☑ Fiber optic cables VAB or VBC not connected, inverted or defective.
	A008	Line synchronism time-out.	☑ Manual.	☑ The line synchronism function did not succeed.

Table 7.1 (cont.) - *Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Rectifier	A010	Input rectifier high temperature.	☑ It resets automatically when the rectifier temperature becomes lower than 70 °C (158 °F).	☑ The input rectifier temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked M21 fan; ☑ Obstructed air inlet filter.
	F011	Input rectifier overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ The input rectifier temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked M21 fan; ☑ Obstructed air inlet filter.
	F012	Input rectifier temperature feedback fault.	☑ Contact WEG.	☑ Input rectifier temperature feedback circuit failure (A9.1 - ISOY board); ☑ Fiber optic cable TEMPR not connected, inverted or defective.
Input circuit breaker	F014	Input circuit breaker closing failure.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ The not closing of the input circuit breaker when commanded; ☑ Defective circuit breaker; ☑ Open wiring at the PIC board DI3 (XC7:3) input (+24 V closing checkback signal is not present).
	F015	Input circuit breaker opening failure.		☑ The not opening of the input circuit breaker when commanded; ☑ Defective circuit breaker; ☑ Open wiring at the PIC board DI4 (XC7:4) input (+24 V opening checkback signal is not present).
	F016	External trip by circuit breaker protection.		☑ Open wiring at the PIC board DI5 (XC7:5) input (+24 V signal is not present); ☑ Trip of the external protection related to the inverter input transformer.
	F017	Input circuit breaker not ready.		☑ The circuit breaker was not ready when it was commanded to close; ☑ Defective circuit breaker; ☑ An attempt to switch on the circuit breaker through DI1, while DO1 is indicating that the inverter is not capable of closing it.
Input transformer	A018	Input transformer alarm.	☑ It resets automatically when the input transformer alarm ceases existing.	☑ The PIC board DI11 (XC7:16) input is active with +24 V applied; ☑ Verify the cause at the transformer.
	F019	Input transformer fault.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ The PIC board DI12 (XC8:1) input is active with +24 V applied; ☑ Verify the cause at the transformer.
DC Link	F020	Pre-charge fault.		☑ The DC link voltage has not increased in the specified time; ☑ Incorrect primary tap setting of the command transformer T1; ☑ Auxiliary power supply phase loss; ☑ Open pre-charge circuit fuse F1; ☑ Failure of the pre-charge contactors K1 or K4.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
DC Link	F021	DC link undervoltage (Positive or Negative).	☑ Power-on; ☑ Manual (⓪/reset key); ☑ Autoreset; ☑ Digital input.	☑ The power supply voltage is too low producing a DC link voltage lower than the minimum 80 % of the nominal value; ☑ Transformer input phase loss; ☑ Parameter P296 adjusted at a voltage higher than the rated line voltage.
	F022	DC link overvoltage (Positive or Negative).		☑ The power supply voltage is too high producing a DC link voltage higher than the maximum 130 % of the nominal value; ☑ The load inertia is too high or the deceleration ramp is too fast; ☑ P151 or P153 setting is too high.
	F023	DC link imbalance.		☑ The difference between the positive and the negative DC link voltages > 15 % of the rated value.
	F024	Positive or negative DC link voltage feedback fault.	☑ Contact WEG.	☑ DC link voltage feedback circuit failure (A9.3 - ISOX.00 board); ☑ Fiber optic cables VP or VN not connected, inverted or defective.
	F025	Door closing fault.	☑ Power-on; ☑ Manual (⓪/reset key); ☑ Autoreset; ☑ Digital input.	☑ An attempt to power-up the inverter with open cabinet doors; ☑ Open wiring at the PIC board DI16 (XC8:10) input (+24 V indicating closed doors is not present).
	F026	Input circuit breaker not ready.		☑ An attempt to power-up the inverter while the input circuit breaker was not ready; ☑ Defective circuit breaker; ☑ The circuit breaker is indicating, through DI2, that the attempt to close it has failed.
Inverter	F030	S1U IGBT fault.	☑ Contact WEG.	☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F031	S2U IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F032	S3U IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F033	S4U IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F034	S1V IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Inverter	F035	S2V IGBT fault.	☑ Contact WEG.	☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F036	S3V IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F037	S4V IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F038	S1W IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F039	S2W IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F040	S3W IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F041	S4W IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F042	Braking IGBT 1 fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F043	Braking IGBT 2 fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F044	Arc detection.		☑ Electrical arcing detection by cabinet sensors; ☑ The opening of cabinet doors.
	F045	PS1 power supply fault.		☑ Problem with the PS1 power supply, located in the rectifier column; ☑ Fiber optic cable not connected, inverted or defective.
	A046	Motor I x t overload alarm.	☑ It resets automatically when the overload status value (P076) becomes lower than P159.	☑ The P159 setting is too low for the used motor; ☑ Too heavy load at the motor shaft; ☑ P136 and P137 settings are too high (valid for low speed operation).
	F047	IGBT overload fault.	☑ Manual.	☑ A high current transitory occurred while the heatsink was with high temperature.
	F048	Forced ventilation fault.		☑ Obstructed fans; ☑ Obstructed air inlet filters.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Inverter	A050	U phase heatsink high temperature.	☑ It resets automatically when the U phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ U phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F051	U phase heatsink overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ U phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F052	U phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ U phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPU not connected, inverted or defective.
	A053	V phase heatsink high temperature.	☑ It resets automatically when the V phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ V phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F054	V phase heatsink overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ V phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F055	V phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ V phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPV not connected, inverted or defective.
	A056	W phase heatsink high temperature.	☑ It resets automatically when the W phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ W phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F057	W phase heatsink overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ W phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F058	W phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ W phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPW not connected, inverted or defective.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Inverter	A059	Braking arm high temperature.	☑ It resets automatically when the braking arm temperature becomes lower than 70 °C (158 °F).	☑ Braking arm temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F060	Braking arm overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ Braking arm temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F061	Braking arm temperature feedback fault.	☑ Contact WEG.	☑ Braking arm temperature feedback circuit failure; ☑ Fiber optic cable TEMPBR not connected, inverted or defective.
	F062	Thermal imbalance among the U, V and W phase heatsinks.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ Temperature difference among the U, V and W phase heatsinks greater than 10 °C (50 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
Power section test	F063	U output feedback fault.	☑ For WEG use.	☑ For WEG use.
	F064	V output feedback fault.		
	F065	W output feedback fault.		
Self-tuning/ Test mode	F066	Null current.		
	F068	Test mode.		
	F069	Calibration fault.		
Output/ Motor	F070	Overcurrent/Short-circuit at the output.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ High instantaneous current at the motor output (hardware detection); ☑ Short-circuit between two motor phases or power cables; ☑ Short-circuit between motor cables and the ground; ☑ Load inertia is too high or acceleration ramp is too fast; ☑ Shorted IGBT modules; ☑ Incorrect regulation and/or configuration parameters; ☑ P169 setting is too high.
	F071	Overcurrent at the output.		☑ High current at the three phases (software detection); ☑ Load inertia is too high or acceleration ramp is too fast; ☑ Incorrect regulation and/or configuration parameters; ☑ P169 setting is too high.
	F072	Motor I x t overload.		☑ P156, P157 and P158 settings are too low for the used motor; ☑ P136 and P137 settings are too high (valid for low speed operation); ☑ Too heavy load at the motor shaft; ☑ The output overload fault does not cause the input circuit breaker opening.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Output/ Motor	A073	Ground fault alarm.	☑ It resets automatically when the cause ceases existing.	☑ Short circuit to ground at the motor, its cables or the inverter. It is detected via voltage measurement from PM to ground. It also occurs when the sum of the three output currents is higher than 10 % of the nominal current.
	F074	Ground fault.	☑ Manual; ☑ Autoreset.	☑ Time limit, for operation with ground fault has elapsed.
	F075	DC link medium point (PM) feedback fault.	☑ Contact WEG.	☑ DC link PM voltage feedback circuit failure; ☑ Fiber optic cable not connected, inverted or defective.
	F076	Motor phase loss.	☑ Power-on; ☑ Manual (⓪/reset key); ☑ Autoreset; ☑ Digital input.	☑ Bad contact at the motor cables; ☑ Current feedback circuit failure.
	F077	Braking resistor overload.		☑ The load inertia is too high or the deceleration ramp is too fast; ☑ Too heavy load at the motor shaft; ☑ P154 and/or P155 programmed incorrectly.
	F078	Motor overtemperature.		☑ Deactivation of the digital input programmed for Motor Fault; ☑ External thermal relay trip (Tecsystem).
	F079	Encoder fault.	☑ Power-on; ☑ Manual/Automatic; ☑ Autoreset.	☑ Interrupted wiring between the encoder and the encoder interface accessory; ☑ Defective encoder.
Control	F080	CPU watchdog fault.	☑ Power-on; ☑ Manual (⓪/reset key); ☑ Autoreset; ☑ Digital input.	☑ Electric noise.
	F081	Program memory fault.	☑ Not implemented.	☑ Not implemented.
	F082	Copy function fault.	☑ Power-on; ☑ Manual (⓪/reset key); ☑ Autoreset; ☑ Digital input.	☑ An attempt to copy incompatible parameters from the HMI to the inverter.
	F083	Programming error.	☑ It resets automatically when the incompatibility between parameters is eliminated.	☑ An attempt to adjust a parameter that is incompatible with the others. Refer to the table 4.2.
Electronics	F085	Electronics power supply fault.	☑ Manual; ☑ Autoreset.	☑ Power supply monitoring signal indicating that the electronics power supplies are not OK.
Commu-nication	F087	Control boards communication fault.	☑ It resets automatically when the MVC1 and MVC2 boards start communicating again.	☑ MVC1 board serial communication circuit failure; ☑ MVC2 board serial communication circuit failure; ☑ Fiber optic cables not connected, inverted or defective.

***Table 7.1 (cont.)** - Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Auxiliary circuits	F090	External fault.	☑ Manual; ☑ Autoreset.	☑ Deactivation of a digital input programmed for No External Fault.
	F092	Pre-charge supply fault.	☑ Power-on; ☑ Manual/Automatic; ☑ Autoreset.	☑ DC link short-circuit; ☑ Open pre-charge circuit breaker.
	A093	Rectifier ventilation failure alarm - set A.	☑ It resets automatically when the cause ceases existing.	☑ Obstructed fans; ☑ Obstructed air inlet filters; ☑ Redundant ventilation set A failure alarm (MVC2).
	A094	Inverter ventilation failure alarm - set A.		☑ Obstructed fans; ☑ Obstructed air inlet filters; ☑ Redundant ventilation set A failure alarm (MVC2).
	F095	PS1 supply fault.		☑ Obstructed fans; ☑ Obstructed air inlet filters.
Others	A096	4 to 20 mA analog input out of range alarm (less than 3 mA).		☑ Analog input signal cable disconnection or rupture.
	F099	Invalid current offset.	☑ Contact WEG.	☑ Current offset out of the allowed range.
	F100	MVC1 fatal fault.		☑ Invalid CPU addressing.
	F101	Incompatible software version between boards.		☑ MVC1 software version incompatible with MVC2 version.
	F102	MVC1 EPLD unknown fault.		☑ EPLD invalid fault.
	F103	MVC1 RAM fault.		☑ SRAM with battery auto-diagnosis fault.
	F104	MVC1 A/D failure.		☑ A/D auto-diagnosis fault.
	F105	MVC1 EEPROM fault.		☑ EEPROM auto-diagnosis fault.
	F106	MVC2 fatal fault.		☑ Invalid CPU addressing.
	A108	Not initialized inverter alarm.	☑ Automatic.	☑ Waiting for the boot conclusion.
	F109	MVC1 general disable fault.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ PIC board DI13 input not active (XC8:7).
	A110	Motor overtemperature alarm.	☑ It resets automatically when the cause ceases existing.	☑ Deactivation of a digital input programmed for Motor Alarm; ☑ External thermal relay actuation (Tecsystem).
	A111	External alarm.		☑ Deactivation of a digital input programmed for No External Alarm.
	F112	Motor overspeed fault.	☑ Manual.	☑ The motor speed is higher than the programmed maximum speed.
Auxiliary circuits	A113	Rectifier redundant ventilation failure alarm - set B.	☑ It resets automatically when the cause ceases existing.	☑ Obstructed fans; ☑ Obstructed air inlet filters; ☑ Redundant ventilation set B failure alarm (MVC2).
	A114	Inverter redundant ventilation failure alarm - set B.		☑ Obstructed fans; ☑ Obstructed air inlet filters; ☑ Redundant ventilation set B failure alarm (MVC2).
Communication	A124	Parameter change with enabled inverter.	☑ Automatic.	☑ Specific Fieldbus/Serial fault.
	A125	Reading/Writing in inexistent parameter.		
	A126	Value out of range.		
	A127	Function not configured for Fieldbus.		
	A129	Inactive Fieldbus connection.	☑ It resets automatically when the cause ceases existing.	
	A130	Inactive Fieldbus board.		
	F097	4…20 mA fault	☑ Power-on; ☑ Manual/Automatic; ☑ Autoreset.	☑ Analog input signal cable disconnection or rupture.
	A098	Not recorded help/ Incompatible graphic HMI version.		☑ Graphic HMI software version is incompatible with the inverter software version.

***Table 7.1 (cont.)** - Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Rectifier	A131 (1)	Rectifier B high temperature.	☑ It resets automatically when the rectifier temperature becomes lower than 70 °C (158 °F).	☑ The B rectifier temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fan; ☑ Obstructed air inlet filter.
	F132 (1)	Rectifier B overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ The input rectifier temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked M20 fan; ☑ Obstructed air inlet filter.
	F133 (1)	Rectifier B temperature feedback fault.	☑ Contact WEG.	☑ Input rectifier temperature feedback circuit failure (A9.1 - ISOY board); ☑ Fiber optic cable TEMPRB not connected, inverted or defective.
Inverter	F134 (1)	S1U B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F135 (1)	S2U B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F136 (1)	S3U B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F137 (1)	S4U B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F138 (1)	S1V B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F139 (1)	S2V B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F140 (1)	S3V B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F141 (1)	S4V B IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.

(1) Frame size C models.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Inverter	F142 (1)	S1WB IGBT fault.	☑ Contact WEG.	☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F143 (1)	S2WB IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F144 (1)	S3WB IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F145 (1)	S4WB IGBT fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F146 (1)	Braking IGBT 1 B fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F147 (1)	Braking IGBT 2 B fault.		☑ Related to the gate driver fault feedback, its power supply or the IGBT desaturation; ☑ Fiber optic cable not connected, inverted or defective.
	F148 (1)	PS1 B electronic power supply fault.		☑ A problem with the PS1 B power supply, located in the rectifier column; ☑ Fiber optic cable not connected, inverted or defective.
	A149 (1)	U B phase heatsink high temperature.	☑ It resets automatically when the U B phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ U B phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F150 (1)	U B phase heatsink overtemperature.	☑ Power-on; ☑ Manual (⓪/reset key); ☑ Autoreset; ☑ Digital input.	☑ U B phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F151 (1)	U B phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ U phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPUB not connected, inverted or defective.
	A152 (1)	V B phase heatsink high temperature.	☑ It resets automatically when the V B phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ V B phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.

(1) Frame size C models.

Table 7.1 (cont.) *- Alarms/faults and possible causes*

Group	Indication	Name	Reset	Possible Causes
Inverter	F153 (1)	V B phase heatsink overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ V B phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F154 (1)	V B phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ U phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPVB not connected, inverted or defective.
	A155 (1)	W B phase heatsink high temperature.	☑ It resets automatically when the W B phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ W B phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F156 (1)	W B phase heatsink overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ W B phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F157 (1)	W B phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ U phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPWB not connected, inverted or defective.
	A158 (1)	BR B phase heatsink high temperature.	☑ It resets automatically when the BR B phase heatsink temperature becomes lower than 70 °C (158 °F).	☑ BR B phase heatsink temperature is higher than 75 °C (167 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F159 (1)	BR B phase heatsink overtemperature.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ BR B phase heatsink temperature is higher than 95 °C (203 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
	F160 (1)	BR B phase heatsink temperature feedback fault.	☑ Contact WEG.	☑ U phase heatsink temperature feedback circuit failure; ☑ Fiber optic cable TEMPBRB not connected, inverted or defective.
	F161 (1)	Thermal imbalance between U B, V B and W B phases.	☑ Power-on; ☑ Manual (0/reset key); ☑ Autoreset; ☑ Digital input.	☑ Temperature difference among the U B, V B and W B phase heatsinks greater than 10 °C (50 °F); ☑ High ambient temperature (> 40 °C or 104 °F) and high output current; ☑ Defective or blocked fans; ☑ Obstructed air inlet filters.
Power section test	F162 (1)	U B output voltage feedback fault.	☑ For WEG use.	☑ For WEG use.
	F163 (1)	V B output voltage feedback fault.		
	F164 (1)	W B output voltage feedback fault.		

(1) Frame size C models.

7.2 INFORMATION FOR CONTACTING TECHNICAL SUPPORT

NOTE!

For technical support or service request, it is important to have the following data available:

☑ Inverter model;

☑ Serial number, manufacturing date and hardware revision, which are available on the product identification label (refer to the section 2.4);

☑ Software version (refer to the section 2.2);

☑ Application and Programming data.

7.3 PREVENTIVE MAINTENANCE

7.3.1 Introduction

DANGER!

Only trained personnel, with proper qualifications, and familiar with the MVW-01 and associated equipment shall plan and implement the installation, starting, operation, and maintenance of this equipment. These personnel shall follow all the safety instructions described in this manual and/or defined by local regulations.

Failure to comply with the safety instructions may result in death, serious injury, and/or equipment damage.

The MVW-01 inverter has been designed and tested to have a long, failure-free, operation life. The preventive maintenance helps early identification of possible future failures, extending the useful life of the equipment, increasing the mean time between failures and reducing the stopped equipment time. It also helps identifying whether the equipment is being used within its mechanical, electrical and environmental limits. The periodical cleaning during preventive maintenance assures an adequate operation when the inverter is used within its rated conditions.

In order to produce the best benefits, the preventive maintenance must be performed periodically by a qualified technician. The interval depends on factors like the duty cycle and the environmental conditions (ambient temperature, ventilation, the existence of dust, etc.). It is recommended to begin with the preventive maintenance frequently and increase the interval as the obtained results indicate the possibility of reducing that frequency. A detailed record of the preventive maintenance is also recommended. These records serve as proof of the maintenance fulfillment and facilitate the identification of possible faults and alarms.

Two types of preventive maintenance are described next, during the operation of the equipment and with the complete stop/de-energization of the inverter.

7.3.2 Preventive Maintenance During the Operation

This type of maintenance is performed with the inverter energized and in operation. There is necessary access only to the control cabinet where low voltage supply voltages (< 480 V) are present, but which are potentially dangerous.

> **DANGER!**
>
> This equipment has high voltages that may cause electric shocks.
>
> Only qualified personnel familiar with the MVW-01 Frequency Inverter and associated equipment should plan or implement the maintenance of this equipment. In order to avoid risk of electric shock, follow all the safety procedures required for service on energized equipment.
>
> Do not touch any electric circuit before making sure it is de-energized.

Procedures:

1) Operation of the fans and exhausting fans:
   - ☑ Verify the proper operation of the exhausting fans at the top of the rectifier cabinet (M21) and the inverter cabinet (M22 to M25). The fans must be running in the same direction and their exhausting action must be perceptible.
   - ☑ Verify the proper operation of the fan at the control cabinet (M26). It must be running and blowing air into the cabinet.

2) Cleaning of the air inlet filters:
   - ☑ Remove the protection grids from the air inlets at the doors of all the cabinets by unbolting them. Remove the filters and clean, wash or replace them. The amount of accumulated dirt on the filters helps defining the correct interval between preventing maintenances. Reinstall the filters and bolt the protection grids again.

3) Open the control cabinet and visually inspect the components inside it, verifying them to identify faults or the need of preventive maintenance with complete stop/de-energization for cleaning or replacement:

***Table 7.2** - Visually inspect*

Components	Anomalies
Electronic boards	Excessive dust, oil, moisture, etc. accumulation. Discolored or darker points, due to excessive heat.
Capacitors on electronic boards	Discoloration, smell, electrolyte leakage, case deformation.
Resistors in general	Discoloration or smell.
Control rack (A8), electronics power supply PS24 (A11).	Excessive heating of the aluminum base (more than 40 °C, 104 °F, above the ambient temperature).

4) Read and write down the following from the HMI, P003 - Motor Current, P004 - DC Link Voltage, P005 - Motor Frequency, P006 - Inverter Status, P014 to P017 Last to Fourth Error (get access to the details of each error by pressing the PROG key on the HMI while the parameter is selected), P022 - MVC1 Board Temperature, P042 - Powered Time, P043 - Enabled Time, P055 - U Phase Power Arm Temperature, P056 - V Phase Power Arm Temperature, P057 - W Phase Power Arm Temperature, P058 - Braking Arm Temperature, P059 - Rectifier Temperature, P080 - Date and P081 - Time.

7.3.3 Preventive Maintenance with Complete Stop/De-energization

DANGER!

This equipment has high voltages that may cause electric shocks.

Only qualified personnel familiar with the MVW-01 Frequency Inverter and associated equipment should plan or implement the maintenance of this equipment. In order to avoid risk of electric shock, follow all the safety procedures required for service on energized equipment.

Do not touch any electric circuit before making sure it is de-energized.

This type of maintenance is also destined for the cleaning and visual inspection of the high voltage cabinets; therefore, it requires the complete de-energization of the inverter. It can be less frequent than the maintenance during operation.

Procedures:

1) Execute the procedures from 1 and 4, of the Preventive Maintenance During Operation.

DANGER!

Although the inverter commands the opening of the input circuit breaker, there is no guarantee of its opening and neither that no voltages are present, because the capacitors remain charged for a long time and they can also be charged through the auxiliary low voltage supply. Before opening and accessing the medium voltage cabinets, follow all the safe de-energization procedures described next.

7.4 SAFE DE-ENERGIZATION INSTRUCTIONS

1) Decelerate the motor to a complete stop.
2) Check the DC link voltage at the parameter P004 on the HMI. Open the control panel door and locate the neon lamps of the HVM (High Voltage Monitoring board), mounted on the cabinet left side. The four lamps must be on if the voltage showed via P004 is above 200 V.
3) Press the “POWER OFF” pushbutton. The input transformer circuit breaker is switched off at this moment, and the “INPUT ON” pilot light going off indicates it.

ATTENTION!

If the input transformer circuit breaker does not open with the “POWER OFF” command, then open it manually.

4) Follow the DC link voltage decrease through P004 on the HMI and the HVM neon lamps. When the DC link voltage crosses below 200 V the neon lamps start flashing with progressively lower frequency until going off completely.
   Wait until the DC link voltage displayed at P004 on the HMI gets below 25 V.
5) At the input transformer circuit breaker cubicle, extract the circuit breaker from its operation position and close the transformer primary winding grounding switch. Lock the cubicle with the key and/or put a warning sign “System in maintenance”.

6) Press the emergency pushbutton located on the control column door and remove its key.
7) Switch off the Q2 circuit breaker in the control column and lock it in the open position with a padlock and/or put a warning sign “System in maintenance”.
8) Switch off the Q1 circuit breaker in the control column. Remove the auxiliary power supply.

It is only after the sequence of procedures described here that medium voltage compartment doors can be opened.

DANGER!

If it were not possible to follow the discharge of the DC link capacitors through the parameter P004, as well as through the HVM board neon lamps, due to a malfunction or a previous, de-energization, follow the instructions 5 through 8 and wait 10 minutes more.

9) Execute the procedures 2 and 3 of the Preventive Maintenance During Operation.
10) Clean the dust accumulated in the interior of the control and medium voltage cabinets as described next:
    - ☑ Heatsink ventilation system (fans, rectifier and inverter arm heatsinks): Remove the dust accumulated on the heatsink fins using compressed air.
    - ☑ Electronic boards: Remove the dust accumulated on the boards using a anti-static brush and/or low pressure ionized compressed air. If necessary, remove the boards from the inverter.

ATTENTION!

Electronic boards have components sensitive to electrostatic discharges. Do not touch directly on components or connectors. If necessary, touch the grounded metallic frame first or use an adequate grounded wrist strap.

    - ☑ Cabinet inner part and other components: Remove the accumulated dust using an vacuum cleaner with a nonmetallic nozzle. Perform this cleaning especially on the insulating materials that support energized parts, to avoid leakage currents during the operation.

11) Connection retightening: Inspect all the electrical and mechanical connections and retighten them if necessary.
12) Reinstall all the removed components and connections in their respective places and follow the start-up procedures described in the chapter 5 of this manual.

OPTIONAL DEVICES

This Chapter describes the optional devices that can be used with the inverter. The optional devices are the function expansion boards, encoder, load reactance and Fieldbus communication boards.

8.1 FUNCTION EXPANSION BOARDS

The function expansion boards increase the MVC2 control board functions. There are 3 expansion boards available and their selection depends on the application and the desired functions. The three boards cannot be used simultaneously. The difference between the EBA and EBB boards is in the analog inputs/outputs. The EBC1 board serves for the encoder connection; however, it does not have its own power supply as do the EBA/EBB boards. Next, the detailed description of those boards is presented.

8.1.1 EBA (I/O Expansion Board A)

The EBA board can be supplied in different configurations, created from the combination of specific functions.

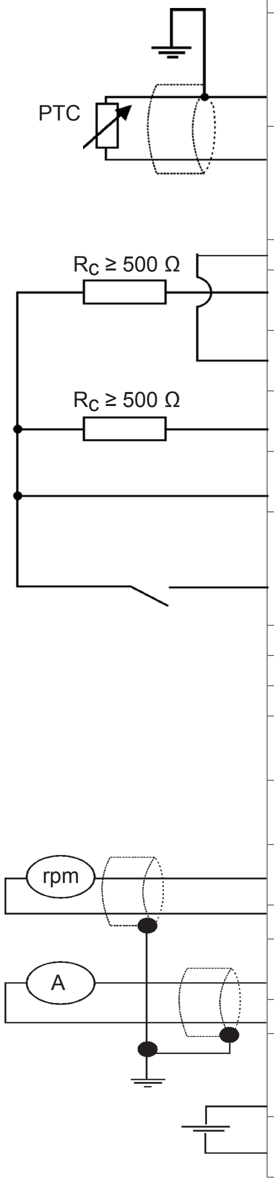
The available functions are presented in the table 8.1.

***Table 8.1** - EBA board versions and available features*

Included features	**EBA Board models - Code**		
	EBA.01 - A1	**EBA.02 - A2**	**EBA.03 - A3**
Power supply for incremental encoder: isolated internal 12 V source, differential input;	Available	Not available	Not available
Buffered encoder output signals: isolated input signal repeater, differential output, available to external 5 V to 15 V power supply;	Available	Not available	Not available
Analog differential input (AI4): 14 bits (0.006 % of the full scale range), bipolar: -10 V to +10 V, (0 to 20) mA / (4 to 20) mA programmable;	Available	Not available	Available
2 Analog outputs (AO3/AO4): 14 bits (0.006 % of the range [±10 V]), bipolar: -10 V to + 10 V, programmable;	Available	Not available	Available
Isolated RS-485 serial port;	Available	Available	Not available
Digital Input (DI7): isolated, programmable, 24 V;	Available	Available	Available
Digital Input (DI8) with special function for motor thermistor (PTC): actuation 3.9 kΩ, release 1.6 kΩ;	Available	Available	Available
2 isolated Open Collector transistor outputs (DO1/DO2): 24 V, 50 mA, programmable.	Available	Available	Available

NOTE!

The use of the RS-485 serial interface does not allow the use of the standard RS-232 input - they cannot be used simultaneously.



Terminal strip XC4		Factory default function	Specifications
1	NC	Not connected	-
2	DI8	Motor Thermistor Input 1 - PTC 1 (P270=16, refer to the figure 6.31). For operation as a normal DI, refer to P270 and figure 6.32.	Actuation 3.9 kΩ, Release:1.6 kΩ Minimum resistance: 100 Ω
3	DGND (DI8)	Motor Thermistor Input 2 - PTC 2 (P270=16, refer to the figure 6.31). For operation as a normal DI, refer to P270 and figure 6.32.	Reference to DGND (DI8) through a 249 Ω resistor
4	DGND	0 V reference of the 24 Vdc	Grounded via a 249 Ω resistor
5	DO1	Transistor output 1: Not used	Isolated, open collector, 24 Vdc, 50 mA maximum, Required load (RL) ≥ 500 Ω
6	COMMON	Common point for Digital Input DI7 and Digital Outputs DO1 and DO2	-
7	DO2	Transistor output 2: Not used	Isolated, open collector, 24 Vdc, 50 mA maximum, Required load (RL) ≥ 500 Ω
8	24 Vdc	Power Supply for the digital inputs/ outputs	24 Vdc ±8 %, isolated, Capacity: 90 mA
9	DI7	Isolated Digital Input: Not used	Minimum high level: 18 Vdc Maximum low level: 3 Vdc Maximum voltage: 30 Vdc Input current: 11 mA @ 24 Vdc
10	SREF	Reference for RS-485	Isolated RS-485 serial port
11	A-LINE	RS-485 A-LINE (-)	
12	B-LINE	RS-485 B-LINE (+)	
13	AI4 +	Analog input 4: Speed reference Program P221 = 4 or P222 = 4	Differential analog input programmable at P246: -10 V to +10 V or (0 to 20) mA / (4 to 20) mA Resolution: 14 bits (0.006 % of full scale range) Impedance: 40 kΩ (-10 V to +10 V) 500 Ω [(0 to 20) mA / (4 to 20) mA]
14	AI4 -		
15	AGND	0 V reference for analog output (internally grounded)	Analog outputs signals: -10 V to +10 V Scales: see P255 and P257. Resolution: 14 bits (0.006 % of ±10 V range) Required load (RL) ≥ 2 kΩ
16	AO3	Analog output 3: Speed	
17	AGND	0 V reference for analog output (internally grounded)	
18	AO4	Analog output 4: Motor current	
19	+ V	Available to be connected to an external power supply to feed the encoder repeater output (XC8).	External power supply: 5 V to 15 V Consumption: 100 mA @ 5 V not including the outputs
20	COM 1	0 V reference of the external power supply	

Figure 8.1 *- XC4 Terminal Block description (complete EBA board)*

ENCODER CONNECTION: Refer to section 8.2.

INSTALLATION

The EBA board is installed directly on the MVC2 control board, secured with spacers and connected via terminal blocks XC11 (24 V) and XC3.

Mounting instructions:

1. Configure the board via S2 and S3 DIP switches (refer to the table 8.2 a));
2. Carefully insert XC3 connector (EBA) into the female connector XC3 on the MVC2 control board. Make sure that all pins fit in the XC3 connector;
3. Press on the EBA board (near to XC3) and on the left top edge until the complete insertion of the connector and the plastic spacer;
4. Secure the board to the 2 metallic spacers with the 2 provided bolts;
5. Plug the XC11 connector of the EBA board to the XC11 connector on the MVC2 control board.

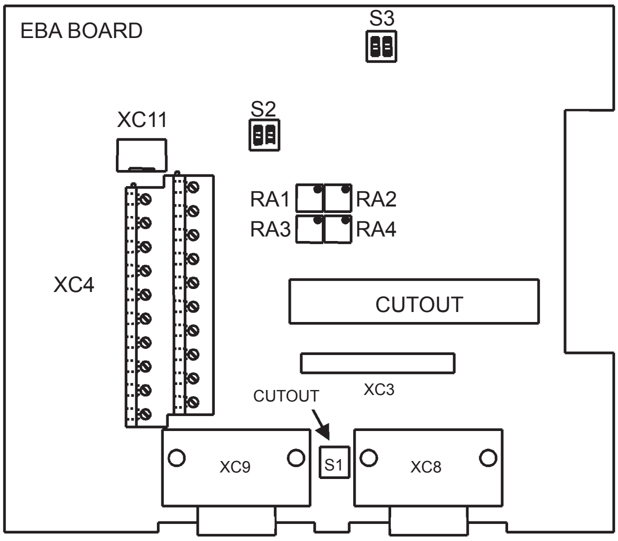


Figure 8.2 *- EBA board layout*

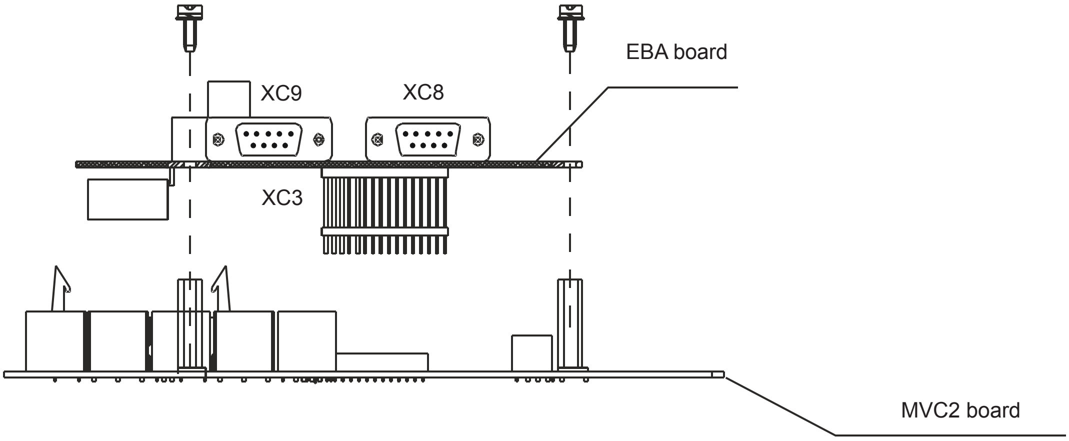


Figure 8.3 *- EBA board installation procedure*

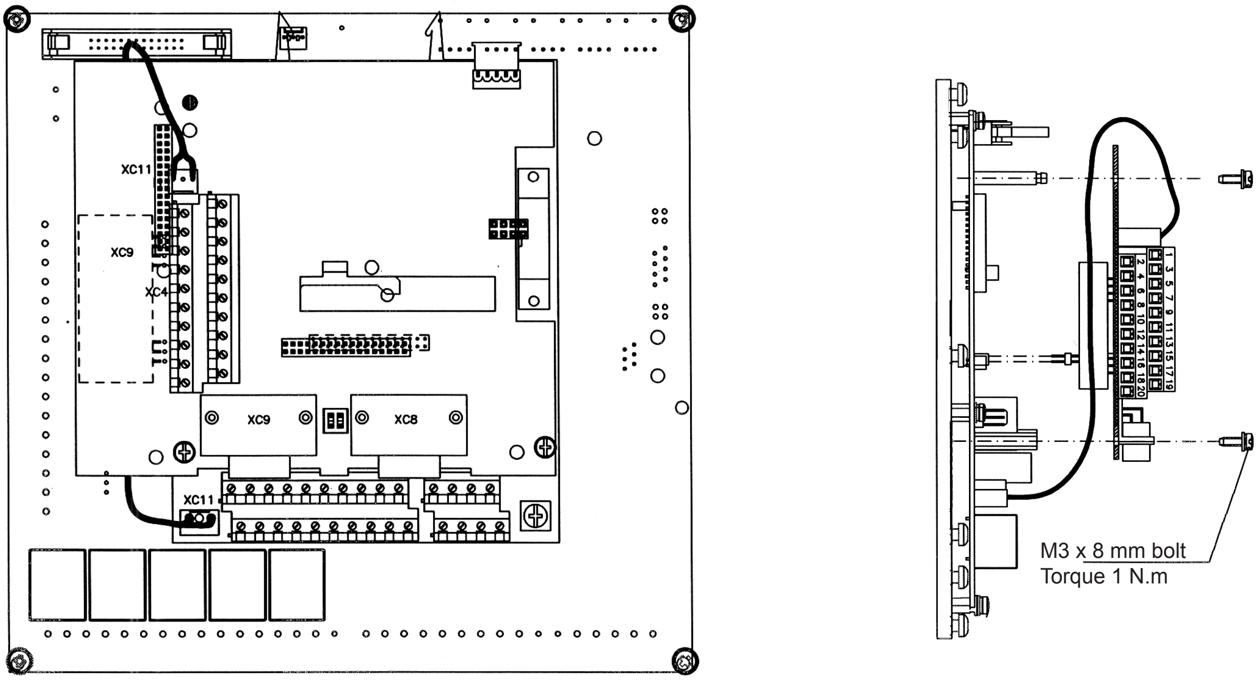


Figure 8.3 (cont.) *- EBA board installation procedure*

Table 8.2 a) *- EBA board DIP switch configurations*

Switch	Function - Factory setting	OFF (Standard)	ON
S2.1	AI4 - Speed Reference	(0 to 10) V	(0 to 20) mA or (4 to 20) mA
S3.1	RS-485 B-LINE (+)	Without termination	With 120 Ω termination
S3.2	RS-485 A-LINE (-)		

Note: Both switches, S3.1 and S3.2, must be adjusted for the same option.

Table 8.2 b) *- EBA board trimpot configurations*

Trimpot	Function	Factory default function
RA1	AO3 offset	Motor speed
RA2	AO3 gain	
RA3	AO4 offset	Motor current
RA4	AO4 gain	

NOTE!

The external signal and control wiring must be connected to XC4 (EBA), following the same recommendations as for the wiring of the MVC2 control board (refer to the section 3.2.4).

8.1.2 EBB (I/O Expansion Board B)

The EBB board can be supplied in different configurations, created from the combination of specific functions.

The available functions are presented in the table 8.3.

Table 8.3 *- EBB board versions and available features*

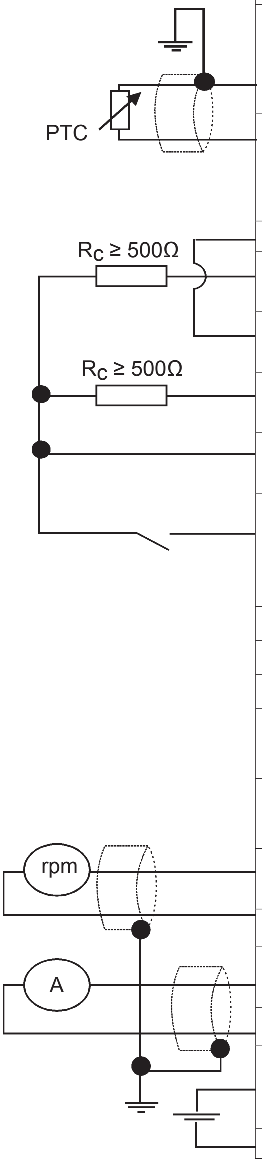
Included features	EBB Board models - Code				
	EBB.01 B1	**EBB.02 B2**	**EBB.03 B3**	**EBB.04 B4***	**EBB.05 B5**
Power supply for incremental encoder: isolated internal 12 V source, differential input;	Available	Available	Not available	Available	Not available
Buffered encoder output signals: isolated input signal repeater, differential output, available to external 5 V to 15 V power supply;	Available	Not available	Not available	Available	Not available
Analog differential input (AI3): 10 bits (0 to 10) V, (0 to 20) mA / (4 to 20) mA, programmable;	Available	Not available	Available	Available	Not available
2 Analog outputs (AO1'/AO2'): 11 bits (0.05 % of the full scale range), (0 to 20) mA / (4 to 20) mA, programmable;	Available	Not available	Available	Available	Available
Isolated RS-485 serial port;	Available	Not available	Not available	Available	Not available
Digital input (DI7): isolated, programmable, 24 V;	Available	Available	Available	Available	Not available
Digital input (DI8) with special function for motor thermistor (PTC): actuation 3.9 kΩ, release 1.6 kΩ;	Available	Available	Available	Available	Not available
2 isolated Open Collector transistor outputs (DO1/DO2): 24 V, 50 mA, programmable.	Available	Available	Available	Available	Not available

***** Board with 5 V encoder power supply.

NOTE!

The use of the RS-485 serial interface does not allow the use of the standard RS-232 input - they cannot be used simultaneously.

The analog outputs AO1' and AO2' have the same functions and parameters as AO1 and AO2 on the MVC2 control board.



Terminal strip XC5		Factory default function	Specifications
1	NC	Not connected	-
2	DI8	Motor thermistor input 1 - PTC 1 (P270=16, refer to the figure 6.31). For operation as a normal DI, refer to P270 and figure 6.32.	Actuation 3.9 kΩ, Release:1.6 kΩ Minimum resistance: 100 Ω
3	DGND (DI8)	Motor thermistor input 2 - PTC 2 (P270=16, refer to the figure 6.31). For operation as a normal DI, refer to P270 and figure 6.32.	Reference to DGND (DI8) through a 249 Ω resistor.
4	DGND	0 V reference of the 24 Vdc	Grounded via a 249 Ω resistor
5	DO1	Transistor output 1: Not used	Isolated, open collector, 24 Vdc, 50 mA maximum, Required load (RL) ≥ 500 Ω
6	COMMON	Common point for Digital Input DI7 and Digital Outputs DO1 and DO2	-
7	DO2	Transistor output 2: Not used	Isolated, open collector, 24 Vdc, 50 mA maximum, Required load (RL) ≥ 500 Ω
8	24 Vdc	Power Supply for the digital inputs/outputs	24 Vdc ±8 %, Isolated, Capacity: 90 mA
9	DI7	Isolated Digital Input: Not used	Minimum high level: 18 Vdc Maximum low level: 3 Vdc Maximum voltage: 30 Vdc Input current: 11 mA @ 24 Vdc
10	SREF	Reference for RS-485	Isolated RS-485 serial port
11	A-LINE	RS-485 A-LINE	
12	B-LINE	RS-485 B-LINE	
13	AI3 +	Analog input 3: Speed reference Program P221 = 3 or P222 = 3	Isolated analog input programmable at P243: (0 to 10) V or (0 to 20) mA / (4 to 20) mA Resolution: 10 bits (0.1 % of full scale range) Impedance: 400 kΩ (0 to 10 V) 500 Ω [(0 to 20) mA / (4 to 20) mA]
14	AI3 -		
15	AGND’	0 V reference for analog output (internally grounded)	Isolated analog outputs signals: (0 to 20) mA / (4 to 20) mA Scales: see P251 and P253. Resolution: 11 bits (0.5 % of full scale range) Required load ≥ 600 Ω
16	AO1’	Analog output 1: Speed	
17	AGND’	0 V reference for analog output (internally grounded)	
18	AO2’	Analog output 2: Motor current	
19	+ V	Available to be connected to an external power supply to feed the encoder repeater output (XC8).	External power supply: 5 V to 15 V Consumption: 100 mA @ 5 V, not including the outputs.
20	COM 1	0 V reference of the external power supply	

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

ATTENTION!

The analog input AI3 and the analog outputs AO1’ and AO2’ isolation has the purpose of interrupting ground loops. Do not connect them to high potentials.

ENCODER CONNECTION: Refer to section 8.2.

INSTALLATION

The EBB board is installed directly on the MVC2 control board, secured with spacers and connected via terminal blocks XC11 (24 V) and XC3.

Mounting instructions:

1. Configure the board via S4, S5, S6 and S7 DIP switches (refer to the table 8.4 a));
2. Carefully insert XC3 connector (EBB) into the female connector XC3 on the MVC2 control board. Make sure that all pins fit in the XC3 connector;
3. Press on the EBB board (near to XC3) and on the left top edge until the complete insertion of the connector and the plastic spacer;
4. Secure the board to the 2 metallic spacers with the 2 provided bolts;
5. Plug the XC11 connector of the EBB board to the XC11 connector on the MVC2 control board.

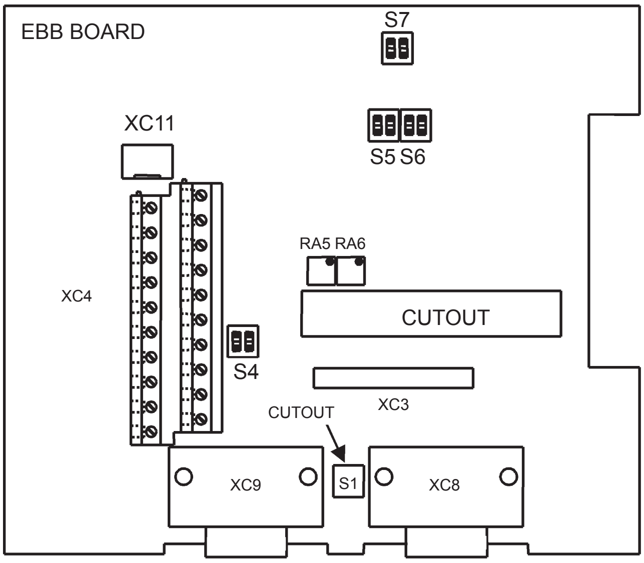


Figure 8.5 *- EBB board layout*

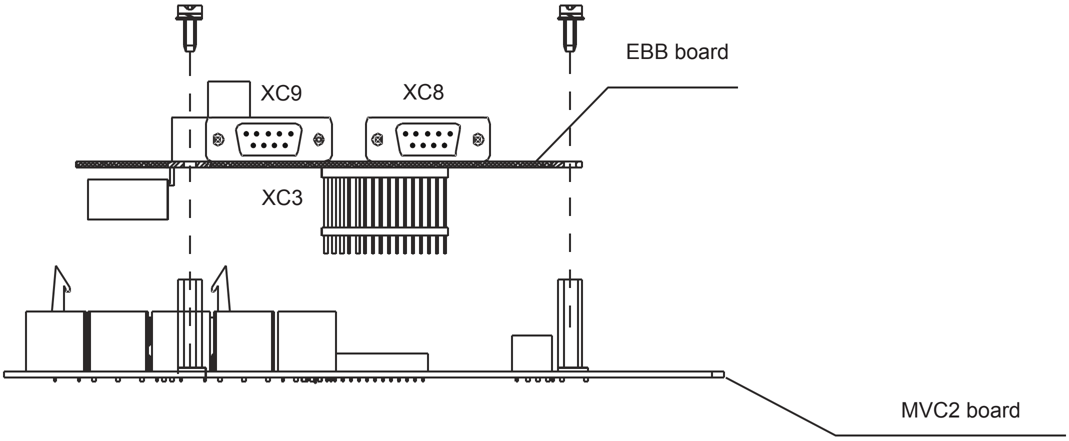


Figure 8.6 *- EBB board installation procedure*

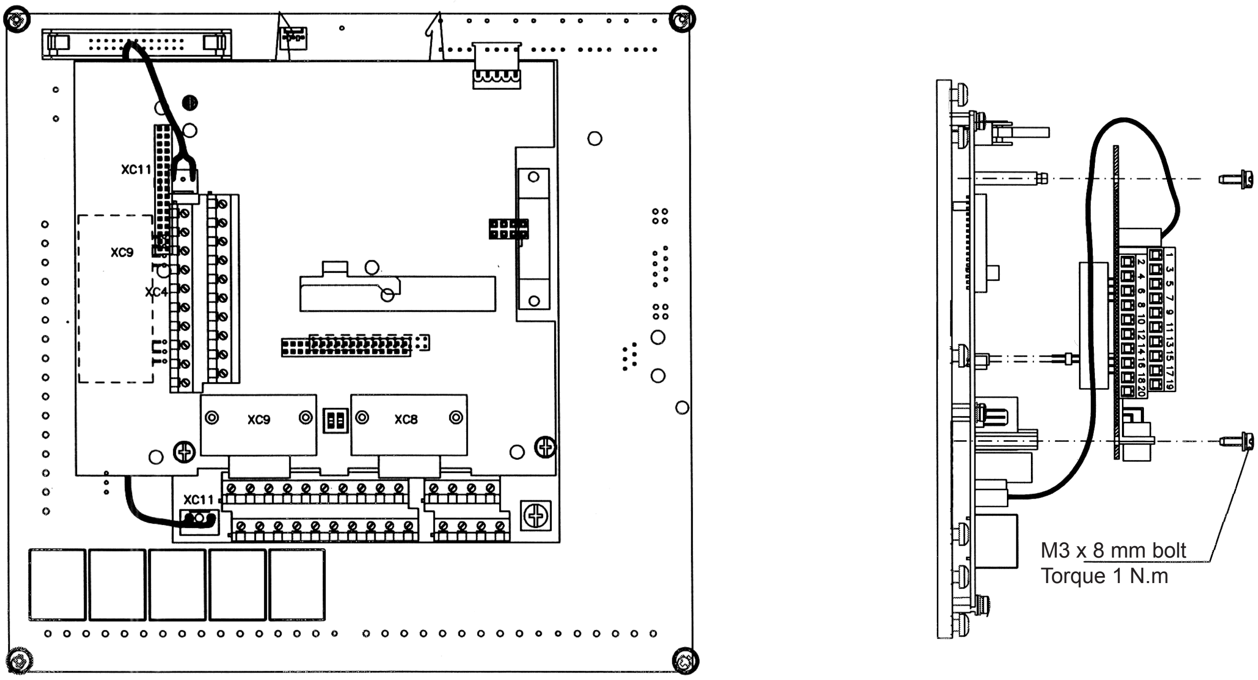


Figure 8.6 (cont.) - *EBB board installation procedure*

Table 8.4 a) - *EBB board DIP switch configurations*

Switch	Function - Factory setting	OFF	ON
S4.1	AI3 - Speed Reference	(0 to 10) V (1)	(0 to 20) mA or (4 to 20) mA
S5.1 and S5.2	AO1 - Motor Speed	(0 to 20) mA (2)	(4 to 20) mA (1)
S6.1 and S6.2	RS-485 B-LINE (+)		
S7.1 and S7.2	RS-485 A-LINE (-)	Without termination (1)	With 120 Ω termination

(1) Factory default setting.
Note: Each group of switches must be set for the same option (ON or OFF for both).
E.g., S6.1 and S6.2 = ON.
(2) When the outputs are set to (0 to 20) mA, it may be necessary to readjust the full scale.

Table 8.4 b) - *EBB board trimpot configurations*

Trimpot	Function	Factory default function
RA5	AO1 Full scale adjustment	Motor speed
RA6	AO2 Full scale adjustment	Motor current

NOTE!

☞ The external signal and control wiring must be connected to XC5 (EBB), following the same recommendations as for the wiring of the MVC2 control board (refer to the section 3.2.4).

8.2 INCREMENTAL ENCODER

For applications that require higher speed accuracy, it is necessary the feedback of the motor shaft speed via an incremental encoder. The encoder is electrically connected to the inverter through the XC9 (DB9) connector of the function expansion board - EBA or EBB, and XC9 or XC10 of the EBC board.

8.2.1 EBA/EBB Boards

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

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

Follow the recommendations bellow when mounting the encoder on the motor:

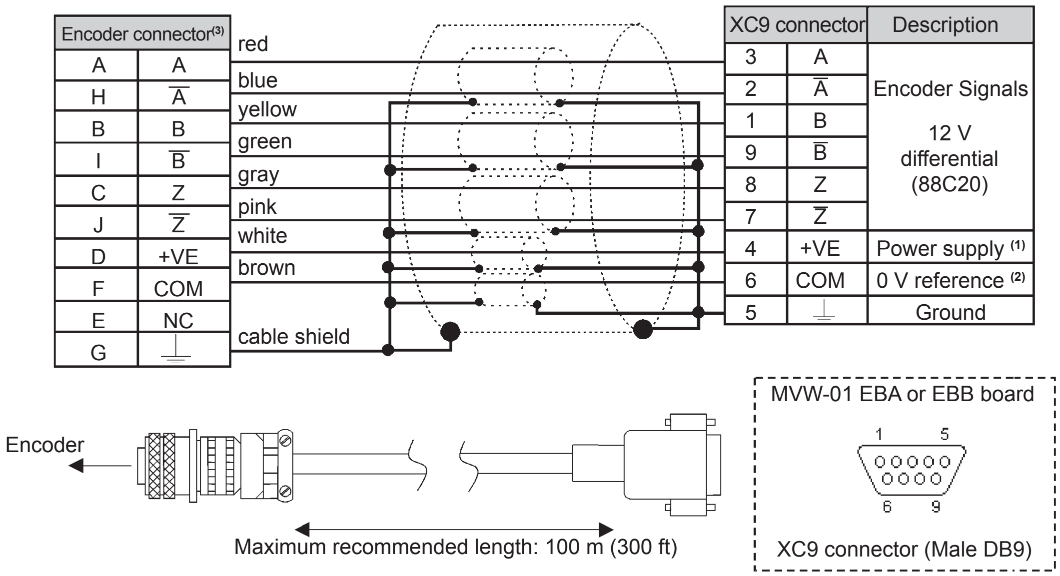
☑ Couple the encoder directly to the motor shaft (use a flexible coupling without torsional flexibility);
☑ Both the shaft and the metallic frame of the encoder must be electrically isolated from the motor (3 mm (0.119 in) minimum distance);
☑ Use high quality flexible couplings to prevent mechanical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

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

During the commissioning, it is necessary to program the control type, P202 = 4 (Vector with encoder), in order to operate with speed feedback via incremental encoder.

Refer to the chapter 6 for more details on vector control.

The function expansion boards EBA and EBB have an encoder signal repeater, isolated and externally powered.



Encoder connector[3]	
A	A
H	$\overline{A}$
B	B
I	$\overline{B}$
C	Z
J	$\overline{Z}$
D	+VE
F	COM
E	NC
G	⏚

XC9 connector		Description
3	A	Encoder Signals 12 V differential (88C20)
2	$\overline{A}$	
1	B	
9	$\overline{B}$	
8	Z	
7	$\overline{Z}$	
4	+VE	Power supply (1)
6	COM	0 V reference (2)
5	⏚	Ground

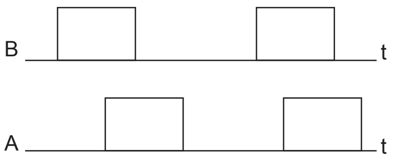
(1) Power supply voltage 12 Vdc / 220 mA for encoder.
(2) Referenced to ground via 1 μF in parallel with 1 kΩ.
(3) Connector pinout valid for HS35B Dynapar encoder. For other encoder models, verify the correct connection in order to meet the required sequence.

Figure 8.7 *- Encoder input*

NOTE!

The maximum allowed encoder signal frequency is 100 kHz.

Sequence of the encoder signals:

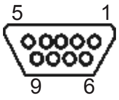


Motor running in forward direction.

Figure 8.8 *- Encoder signals*

MVW-01 EBA or EBB board

XC8 connector		Description
3	A	Encoder signals Line driver differential (88C30) Average high level current: 50 mA
2	$\overline{A}$	
1	B	
9	$\overline{B}$	
8	Z	
7	$\overline{Z}$	
4	+V*	Power supply*
6	COM 1*	0 V reference
5	⏚	Ground



XC8 connector (female DB9)

* Connection of the external power supply: 5 V to 15 V.
Consumption: 100 mA @ 5 V not including the outputs.

Note: The external power supply can also be connected at:
XC4:19 and XC4:20 (EBA) or
XC5:19 and XC5:20 (EBB)

NOTE!
There is no internal power supply for XC8 on the expansion boards EBA and EBB.

Figure 8.9 *- Encoder repeater*

8.2.2 EBC1 Board

When the board EBC1 is used, the selected encoder should have the following characteristics:

☑ Power supply voltage: 5 V to 15 V;

☑ 2 quadrature channels (90º) with complementary outputs (differential): Signals A, $\overline{A}$, B and $\overline{B}$;

☑ ”Linedriver” or “Push-Pull” output circuit type (with identical level as the power supply voltage);

☑ Electronic circuit isolated from the encoder frame;

☑ Recommended number of pulses per revolution: 1024 ppr.

INSTALLATION OF THE EBC1 BOARD

The EBC board is installed directly on the MVC2 control board, secured by means of spacers and connected through the XC3 connector.

Mounting instructions:

1. Carefully insert the pins of the connector XC3 (EBC1) into the female connector XC3 of the MVC2 control board. Make sure that all pins fit in the XC3 connector;
2. Press on the board center (near to XC3) until the connector is completely inserted;
3. Secure the board to the 2 metallic spacers with the 2 provided bolts.

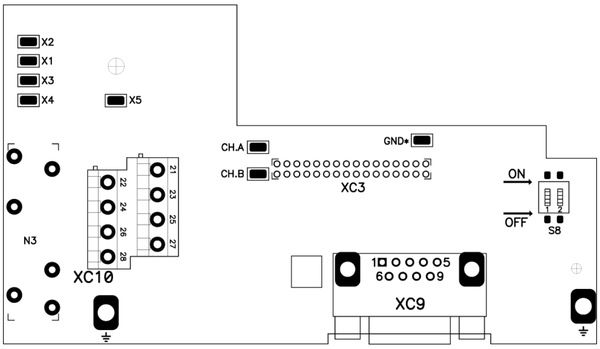


Figure 8.10 - EBC1 board layout

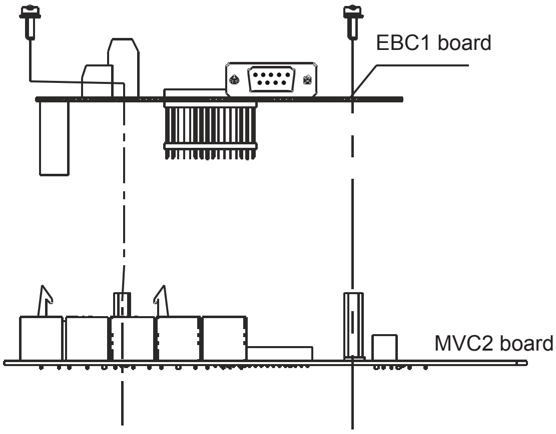


Figure 8.11 - EBC1 board installation procedure

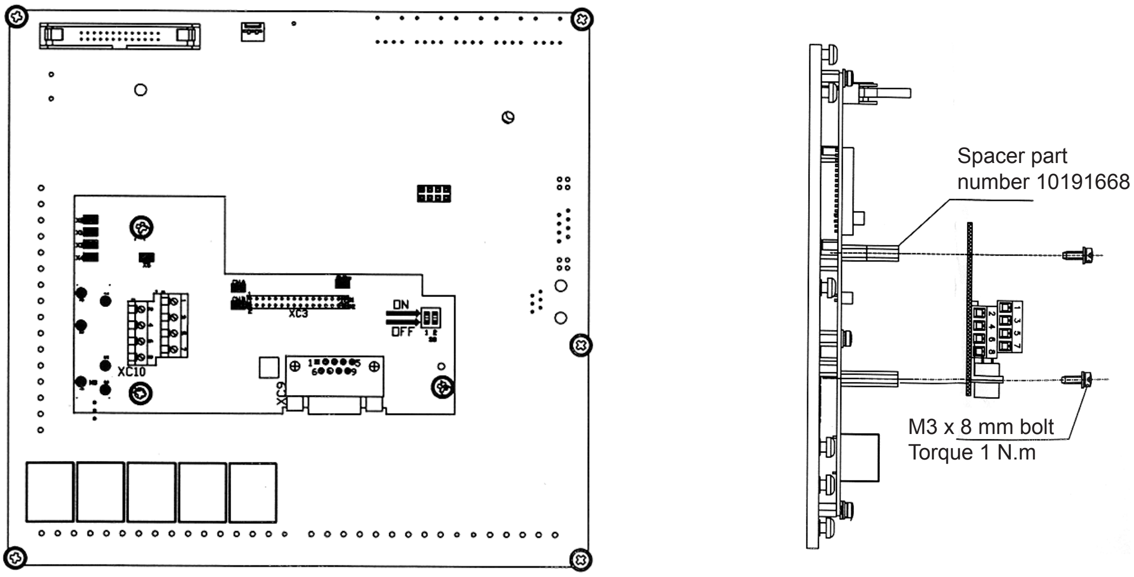


Figure 8.11 (cont.) *- EBC1 board installation procedure*

CONFIGURATIONS:

Table 8.5 *- EBC1 board configurations*

Expansion board	Power supply	Encoder voltage	Necessary setting
EBC1.01	External 5 V	5 V	Commutate switch S8 to ON, see figure 8.10.
	External 8 V to 15 V	8 V to 15 V	None
EBC1.02	Internal 5 V	5 V	None
EBC1.03	Internal 12 V	12 V	None

NOTE!

The terminals XC10:22 and XC10:23 (see figure 8.10), should only be used for encoder supply, when the encoder power supply is not coming from the DB9 connector.

ENCODER MOUNTING:

Follow the recommendations bellow when mounting the encoder on the motor:

☑ Couple the encoder directly to the motor shaft (use a flexible coupling without torsional flexibility);

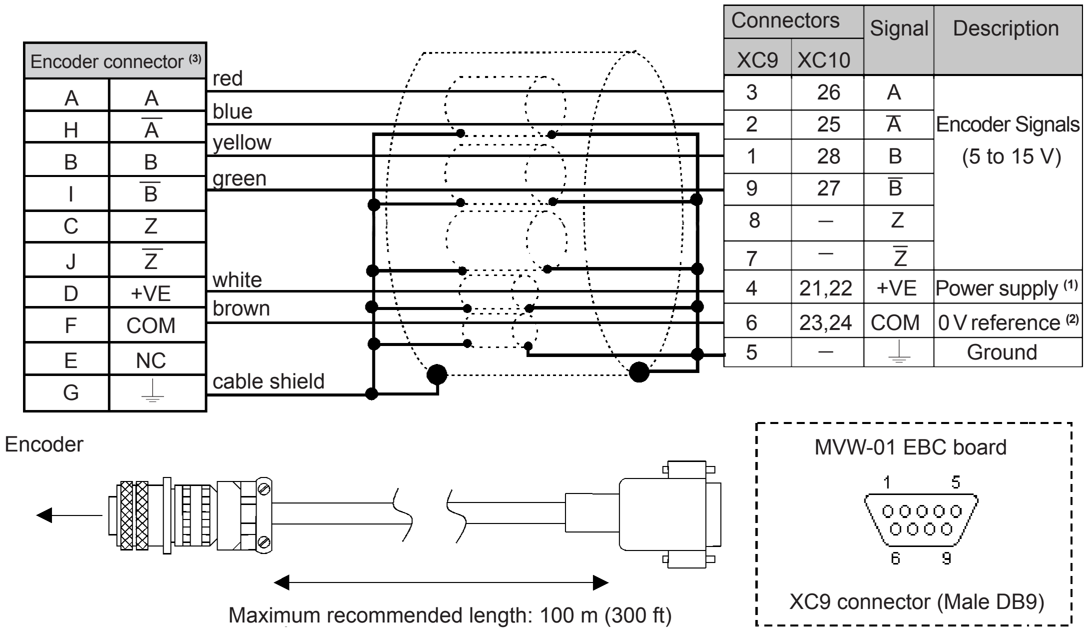
☑ Both the shaft and the metallic frame of the encoder must be electrically isolated from the motor (3 mm (0.119 in) minimum distance);

☑ Use high quality flexible couplings to prevent mechanical oscillation or backlash.

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

During the commissioning, it is necessary to program the control type, P202 = 4 (Vector with encoder), in order to operate with speed feedback via incremental encoder.

Refer to the chapter 6 for more details on vector control.



Encoder connector (3)	
A	A
H	$\overline{A}$
B	B
I	$\overline{B}$
C	Z
J	$\overline{Z}$
D	+VE
F	COM
E	NC
G	⏚

Connectors		Signal	Description
XC9	XC10		
3	26	A	Encoder Signals (5 to 15 V)
2	25	$\overline{A}$	
1	28	B	
9	27	$\overline{B}$	
8	–	Z	
7	–	$\overline{Z}$	
4	21,22	+VE	Power supply (1)
6	23,24	COM	0 V reference (2)
5	–	⏚	Ground

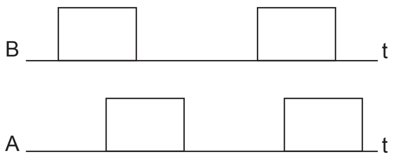
(1) External encoder power supply: 5 to 15 Vdc. Consumption of 40 mA plus the encoder consumption.
(2) 0 V reference of the power supply voltage.
(3) Connector pinout valid for HS35B Dynapar encoder. For other encoder models, verify the correct connection in order to meet the required sequence.

Figure 8.12 *- EBC1 encoder input*

NOTE!

The maximum allowed encoder signal frequency is 100 kHz.

Sequence of the encoder signals:



Motor running in forward direction.

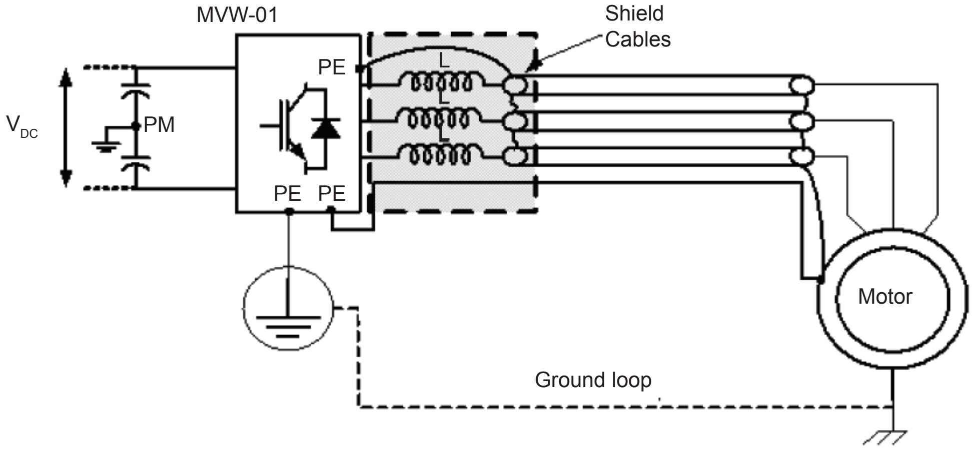
Figure 8.13 *- Encoder signals*

8.3 OUTPUT FILTERS FOR LONG CABLES

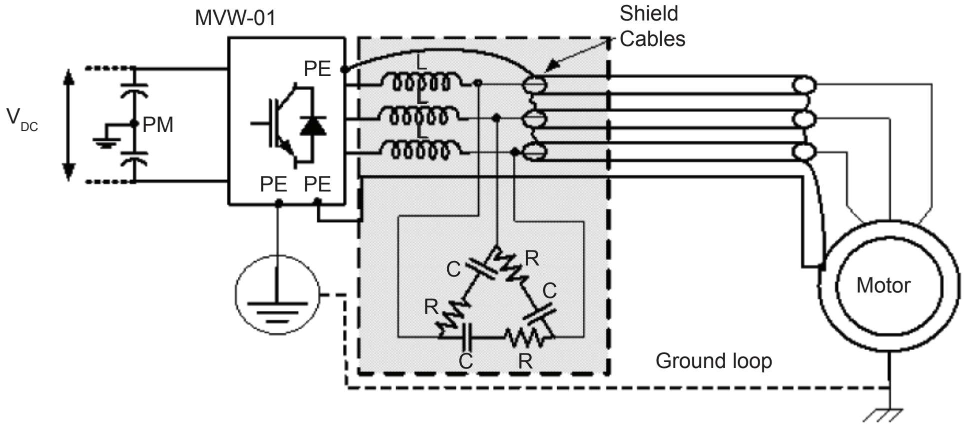
Pulses with variable width, characterized by a high voltage variation rate (dv/dt), compose the frequency inverter voltage waveform. Since there is no match between the line impedance (cables) and the motor input impedance, wave reflection phenomena occur. As a result, the voltage reaching the motor terminals presents a transitory overvoltage, so that the voltage peak may reach up to twice the amplitude of the inverter output, being able to compromise the motor insulation and reduce its life span.

The overvoltages can be minimized with the installation of output dv/dt filters, recommended for drive systems with cable length between 100 m (328.08 ft) and 500 m (1640.41 ft), which are designed for application with new WEG motors. For drive systems with cable length greater than 500 m (1640.41 ft), or for driving already existent motors (retrofit applications) the use of sinusoidal filters (by consulting WEG) is recommended.

The MVW-01 dv/dt filter line, according to the criteria described above, is presented in the figure 8.14 table.

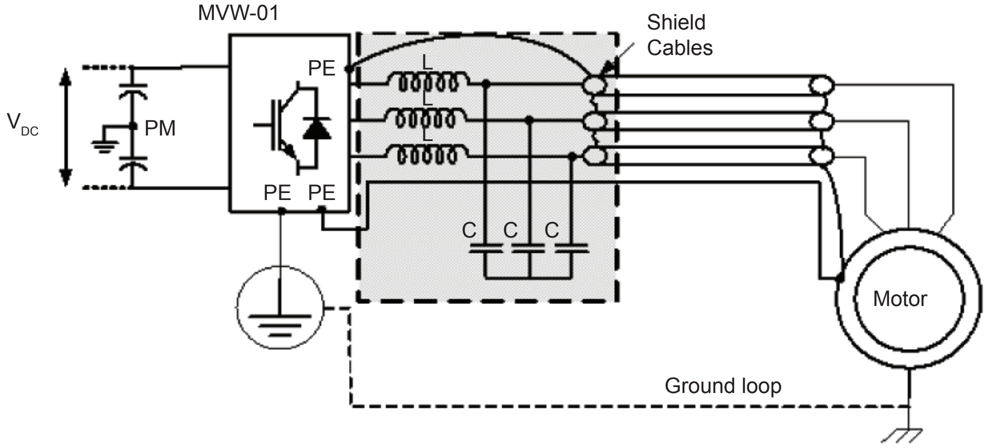


a) output reactor - solution for cable length between 100 and 200 m (328.08 and 656.17 ft). (1)



b) RLC dv/dt filter - solution for cable length between 200 and 500 m (656.17 and 1640.41 ft). (2)

Figure 8.14 *- Output filters for MVW-01 inverters*



c) sinusoidal filter - solution for cable length greater than 500 m (1640.41 ft), or for retrofit applications. (3)

Motor cables length	Inverter model: nominal current (CT) / size	dV/dt filter	Components
Up to 100 m (328.08 ft)	All models	It is not necessary	-
> 100 m to 200 m (328.08 and 656.17 ft) (1)	70 A ... 120 A – 4160 V / Size A0 70 A ... 250 A – 4160 V / Size A 85 A ... 112 A – 3300 V / Size A0 85 A ... 310 A – 3300 V / Size A 120 A ... 280 A – 2300 V / Size A 386 A ... 560 A – 2300 V / Size B	Output reactor with 2 % voltage drop	Reactor according to WEG specification
	300 A ... 475 A – 4160V / Size C 375 A ... 580 A – 3300V / Size C	It is not necessary	-
> 200 m to 500 m (656.17 and 1640.41 ft) (2)	70 A ... 250 A – 4160 V / Size A 85 A ... 310 A – 3300 V / Size A 120 A ... 280 A – 2300 V / Size A 386 A ... 560 A – 2300 V / Size B	RLC 01 dV/dt filter	Reactor according to WEG specification RC01 set
	300 A ... 475 A – 4160 V / Size C 375 A ... 580 A – 3300 V / Size C	RLC 02 dV/dt filter	RC02 set
> 500 m (1640.41 ft) (3)	All models	Sinusoidal filter	Under consultation to WEG

Figure 8.14 (cont.) *- Output filters for MVW-01 inverters*

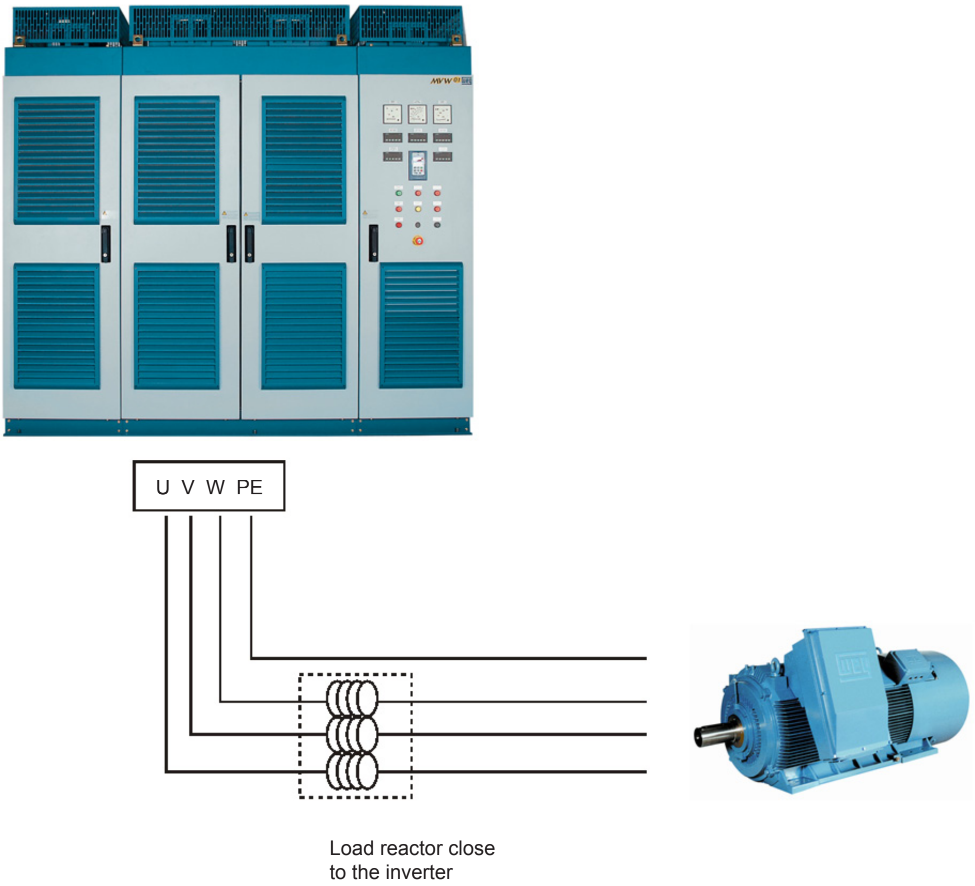


***Figure 8.15** - Load reactor connection*

8.4 FIELDBUS

The MVW-01 can be connected to communication networks allowing its control and parameterization. Therefore, it is necessary to install an optional electronic board according to the desired Fieldbus standard: Profibus DP or DeviceNet.

NOTE!

The chosen Fieldbus option can be specified in the suitable field of the MVW-01 model coding. In such case, the MVW-01 will be supplied with all the necessary components already installed in the product. In case of a later purchase of the Fieldbus optional kit, the user must install it.

8.4.1 Installation of the Fieldbus Kit

The Fieldbus kit communication board is installed directly on the MVC2 control board, connected to the XC140 connector and fixed by spacers.

NOTE!

Follow the safety notes presented in the chapter 1.

If a function expansion board (EBA/EBB) is already installed, it must be temporarily removed.

1. Remove the bolt from the metallic spacer next to the XC140 connector (MVC2 board).
2. Carefully fit the male XC140 connector into the correspondent MVC2 connector. Verify the exact coincidence of all the XC140 connector pins (figure 8.16).

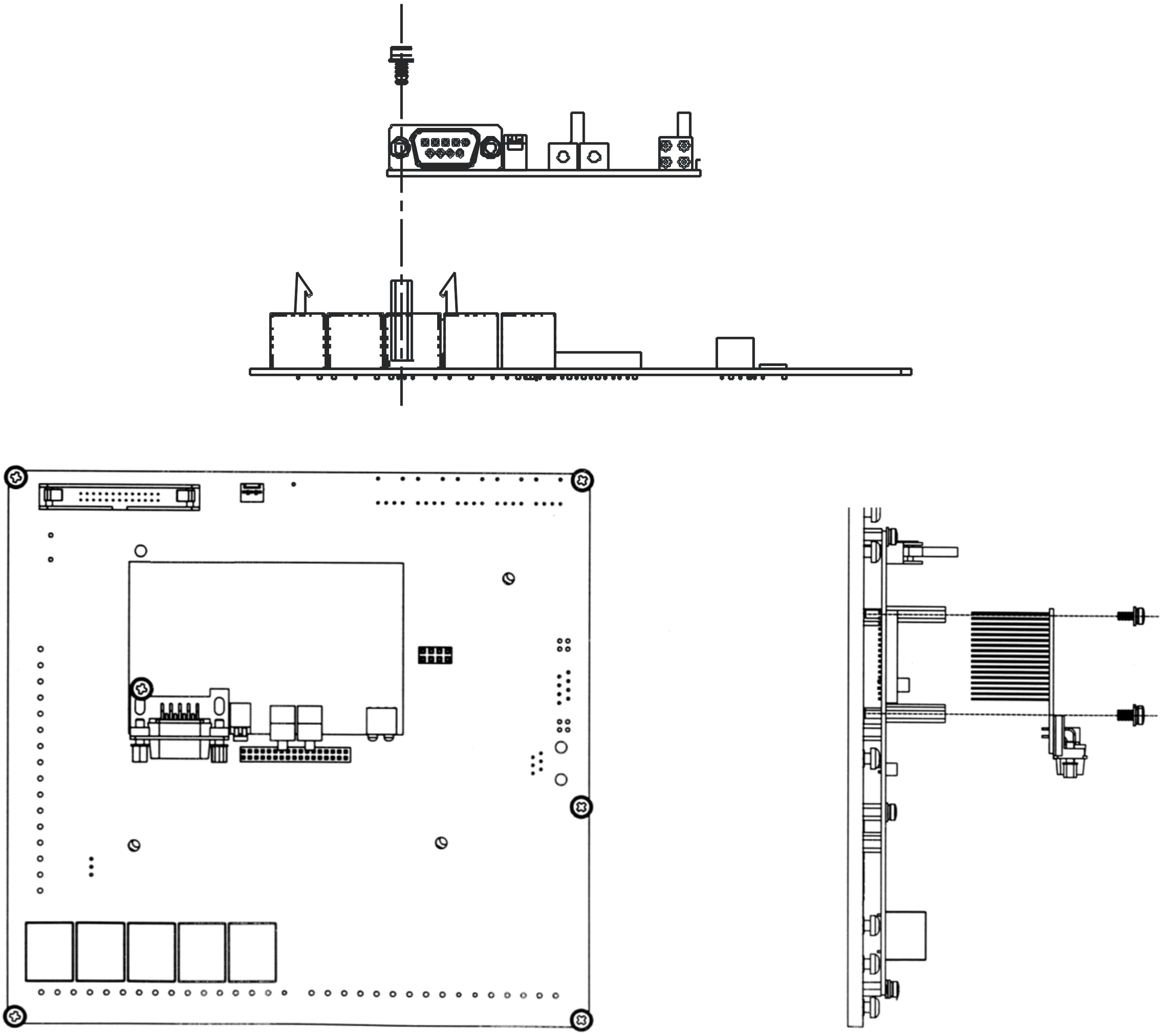
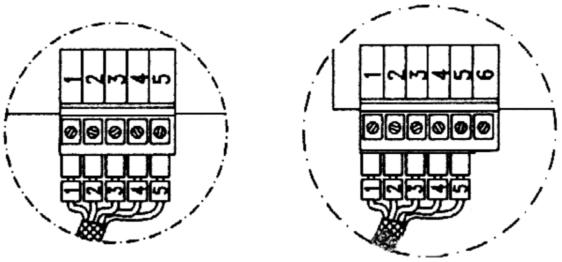


Figure 8.16 - Fieldbus electronic board installation

3. Press the board close to XC140 and on the bottom right corner until the complete insertion of the connector and the plastic spacer;
4. Secure the board to the metallic spacers with the provided bolt;
5. Connect one end of the Fieldbus cable to the MVW-01 control rack, according to the figure 8.18;
6. Connect the other end of the Fieldbus cable to the Fieldbus board, according to the figure 8.18.



DEVICENET PROFIBUS DP

Figure 8.17 - *Connection to the Fieldbus board*

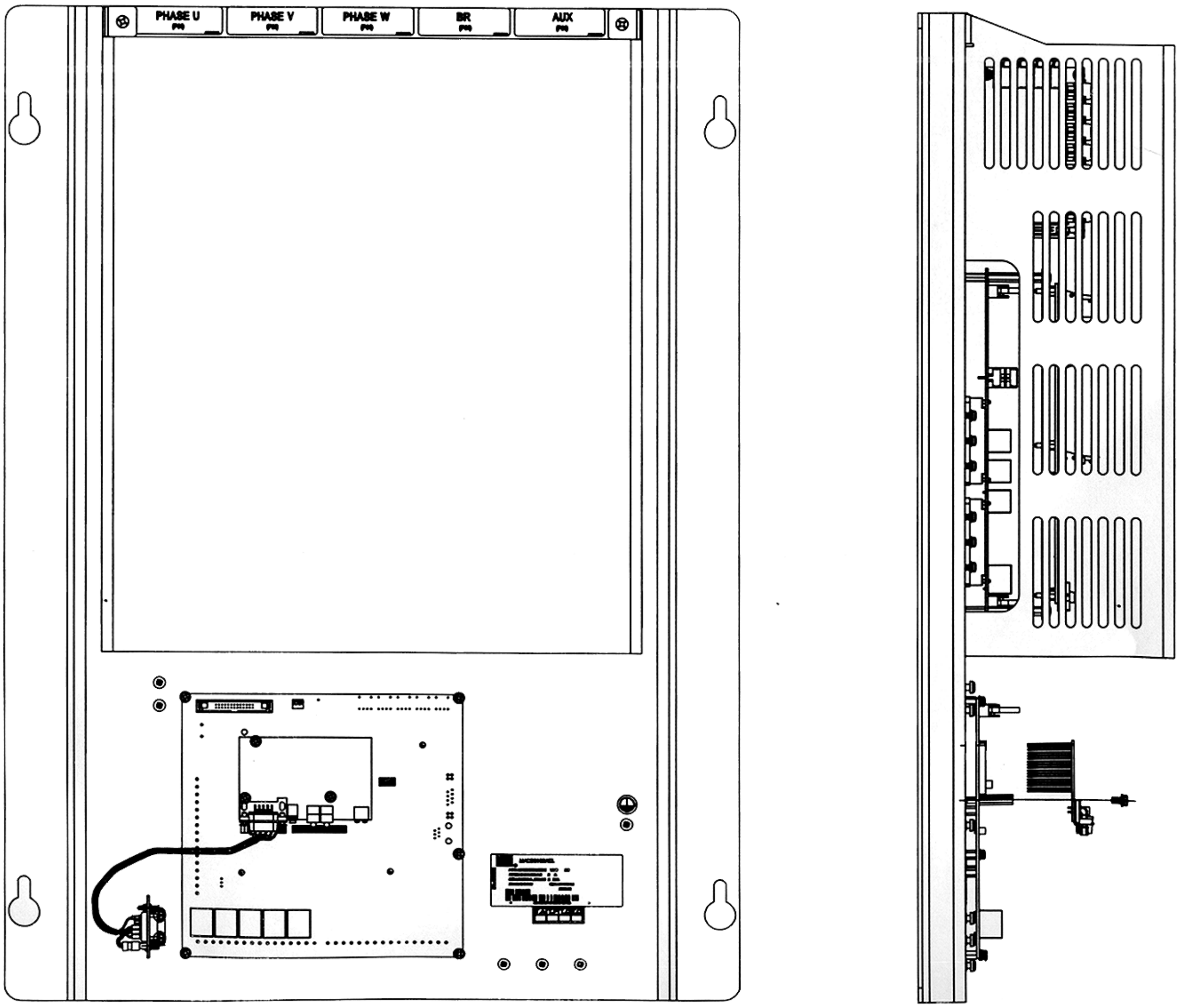


Figure 8.18 *- Fieldbus cable connection to the control rack*

8.4.2 Profibus DP

Introduction

The inverter that is fitted with the Profibus DP Kit operates in slave mode, allowing the reading/writing of its parameters through a master. The inverter does not start the communication with other nodes, it only answers to the master controls. The physical medium uses a two-conductor twisted-pair cable (RS-485) allowing data transmission at baud rates between 9.6 kbits/s and 12 Mbits/s. Figure 8.19 shows a general view of a Profibus DP network.

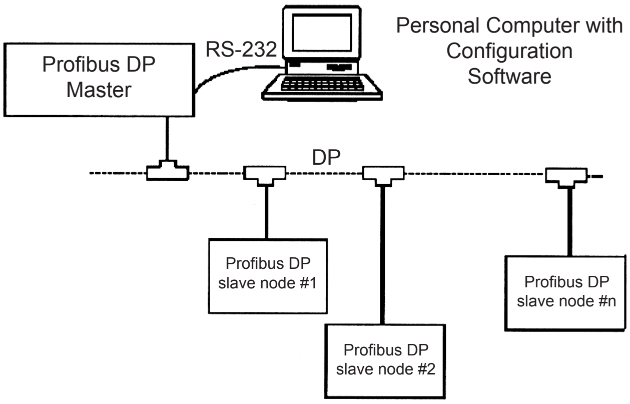


Figure 8.19 *- Profibus DP network*

- Fieldbus Type: PROFIBUS DP EN 50170 (DIN 19245).

Physical Interface

- Transmission medium: Profibus busbar line, type A or B as specified in EN50170.
- Topology: Master-Slave communication.
- Insulation: the bus is fed by a DC/DC converter, which is galvanically isolated from the remaining electronics, and the signals A and B are isolated by means of optocouplers.
- It allows the connection/disconnection of a node without affecting the network.

Inverter user Fieldbus connector

Connector: D-sub 9 pins - female, pinout according to the next table.

Table 8.6 *- Profibus DP DB9 pinout*

Pin	Name	Function
1	Not connected	-
2	Not connected	-
3	B-line	RxD/TxD positive, according to the RS-485 specification
4	Not connected	-
5	GND	0 V isolated from the RS-485 circuit
6	+5 V	+5 V isolated from the RS-485 circuit
7	Not connected	-
8	A-line	RxD/TxD negative, according to the RS-485 specification
9	Not connected	-
Frame	Shield	Connected to the protective ground (PE)

Line Termination

The initial and the end points of the network must present the characteristic impedance, in order to prevent reflections. The DB9 cable male connector has the suitable termination resistor. When the inverter is the first or the last of the network, the termination resistor switch must be set to on. Otherwise, leave the switch in the off position. The terminating switch of the Profibus DP board must be set to 1 (Off).

Baud rate

The baud rate of a Profibus DP network is defined during the master configuration and only one rate is allowed in the same network. The Profibus DP board has automatic baud rate detection and the user does not need to configure it on the board. The supported baud rates are 9.6 kbits/s, 19.2 kbits/s, 45.45 kbits/s, 93.75 kbits/s, 187.5 kbits/s, 500 kbits/s, 1.5 Mbits/s, 3 Mbits/s, 6 Mbits/s and 12 Mbits/s.

Node Address

The node address is established by means of two rotating switches on the electronic Profibus DP board, allowing the addressing from 1 to 99. Looking at the board with the inverter in normal position, the leftmost switch sets the ten of the address, while the rightmost switch sets the units of the address:

Address = (leftmost rotary switch x 10) + (rightmost rotary switch x 1)

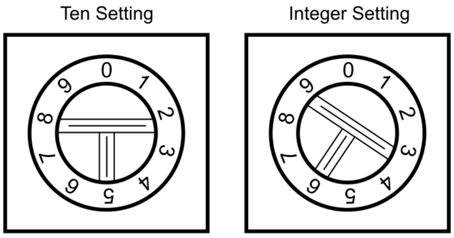


Figure 8.20 *- Node address*

NOTE!

The node address must not be changed with the network in operation.

Configuration File (GSD File)

Each element of a Profibus DP network is associated to a GSD file that has all information about the element operation. This file is supplied together with the product and is used by the network configuration program.

Signaling

The electronic board has a bicolor LED indicating the status of the Fieldbus according to the table 8.7.

Table 8.7 *- Fieldbus status LED signaling*

LED color	Frequency	Status
Red	2 Hz	Fault during the test of the ASIC and Flash ROM
Green	2 Hz	Board has not been initialized
Green	1 Hz	Board has been initialized and is operating
Red	1 Hz	Fault during the RAM test
Red	4 Hz	Fault during the DPRAM test

NOTE!

The red signalizations may indicate hardware problems on the electronic board. Its reset is performed by cycling the power of the inverter. If the problem persists, replace the electronic board.

The board also has other four LEDs grouped at the right bottom corner, indicating the Fieldbus network status according to the next figure and table.

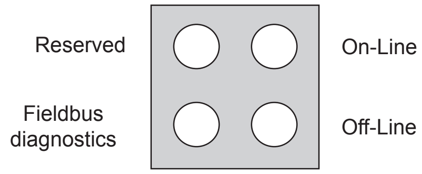


Figure 8.21 *- LEDs indicating the status of the Profibus DP network*

Table 8.8 *- Profibus DP network status LEDs*

LED	Color	Function
Fieldbus diagnostics	Red	It indicates certain Fieldbus faults: **Flashing 1 Hz** - Configuration error: the IN/OUT area size set at board initialization is different from the size set during the network configuration. **Flashing 2 Hz** - Error in the user parameter data: the size/content of the user parameter data set at board initialization is different from the size/content set during the network configuration. **Flashing 4 Hz** - Profibus Communication ASIC initialization error. OFF - No present problems.
On-line	Green	Indicates that the board is on-line in Fieldbus network: **ON** - The board is on-line and the data exchange is possible. **OFF** - The board is not on-line.
Off-line	Red	Indicates that the board is off-line in Fieldbus network: **ON** - The board is off-line and the data exchange is not possible. **OFF** - The board is not off-line.

NOTE!

When power is applied to the drive and both on-line and off-line LEDs on the Profibus DP board flash alternately, then a network address configuration or an installation problem may be present.

Check the installation and the network node address.

NOTE!

Refer to the section 8.4.4 for Profibus DP application/MVW-01 related parameters.

8.4.3 DeviceNet

Introduction

The DeviceNet communication is used for industrial automation, mainly for the control of valves, sensors, input/output units and automation equipment. The DeviceNet communication link is based on a communication protocol "broadcast oriented", the Controller Area Network (CAN). The physical medium of the DeviceNet network consists of a shielded cable comprising a twisted pair and two wires for the external power supply. The baud rate can be set to 125 kbits/s, 250 kbits/s or 500 kbits/s. The figure 8.22 gives a general view of a DeviceNet network.

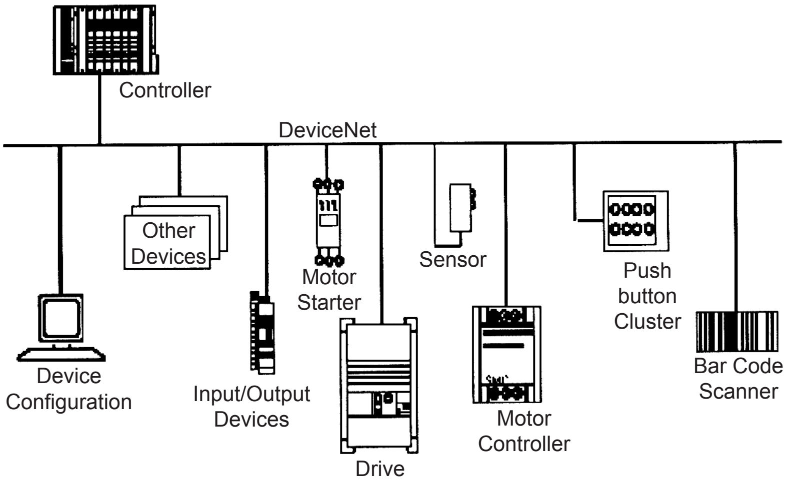


Figure 8.22 *- DeviceNet network*

Inverter user Fieldbus connector

5 pin plug-in terminal block (screw terminal), pinout according to the next table.

Table 8.9 *- DeviceNet terminal block pinout*

Terminal	Description	Color
1	V-	Black
2	CAN_L	Blue
3	Cable shield	-
4	CAN_H	White
5	V+	Red

Line Termination

The initial and the end points of the network must present the characteristic impedance, in order to prevent reflections. Thus a 121 Ω / 0.5 W resistor must be connected between the terminals 2 and 4 of the Fieldbus terminal block.

Baudrate/Node Address

There are three different baudrates for DeviceNet: 125 kbits/s, 250 kbits/s and 500 kbits/s. Choose the baudrate by setting the DIP switches on the electronic board, before the network configuration. The node address is selected through the six DIP switches on the electronic board, permitting addressing from 0 to 63.

Baudrate [bits/s]	DIP switches 1 and 2
125k	00
250k	01
500k	10
Reserved	11

Address	DIP switches 3 to 8
0	000000
1	000001
2	000010
⋮	⋮
61	111101
62	111110
63	111111

***Figure 8.23** - DeviceNet baudrate and node address configuration*

Configuration File (EDS File)

Each element of a DeviceNet network is associated to an EDS file, which has all information about the element. This file is supplied together with the product and is used by the network configuration program.

By means of the parameter P309 it is possible to select 2, 4 or 6 input/output words, when P309 is programmed 4, 5 or 6, respectively (refer to the section 8.4.4).

Define in the network configuration program the number of exchanged words, according to the number selected at the parameter P309. The type of connection used for data exchange must be “Polled I/O”.

NOTE!

The PLC (master) must be programmed for Polled I/O connection.

Signaling

The electronic board has a bicolor LED indicating the status of the Fieldbus according to the table 8.7.

NOTE!

The red signalizations may indicate hardware problems on the electronic board. Its reset is performed by cycling the power of the inverter. If the problem persists, replace the electronic board.

The board also has other four LEDs grouped at the right bottom corner, indicating the Fieldbus network status according to the next figure and table.

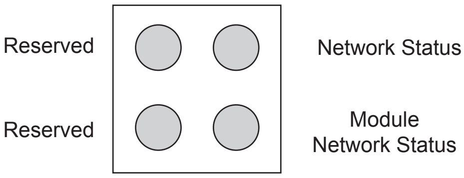


***Figure 8.24** - LEDs indicating the status of the DeviceNet network*

***Table 8.10** - DeviceNet network status LEDs*

LED	Color	Description
Module Network Status	Off	Without supply
Module Network Status	Red	Nonrecoverable fault
Module Network Status	Green	Operational board
Module Network Status	Flashing red	Minor fault
Network Status	Off	Without supply/off-line
Network Status	Green	Operative link, connected
Network Status	Red	Link critical fault
Network Status	Flashing green	On-line, not connected
Network Status	Flashing red	Connection timeout

NOTE!

Refer to the section 8.4.4 for DeviceNet application/MVW-01 related parameters.

NOTE!

The company HMS Industrial Networks AB has developed the communication board that comes with the product. Therefore, the network configuration software will not recognize the product as the MVW-01 frequency inverter, but as the “Anybus-S DeviceNet” at the “Communications Adapter” category. The differentiation will be done using the device network address, adjusted according to the figure 8.24 and the table 8.10.

8.4.4 Fieldbus Application/MVW-01 Related Parameters

There are two main parameters: **P309 and P313.**

P309 - defines the used Fieldbus protocol (Profibus DP, DeviceNet) and the number of variables (I/O) exchanged with the master (2, 4 or 6).

The parameter P309 has the following options:

0 = Inactive,
1 = Profibus DP 2 I/O,
2 = Profibus DP 4 I/O,
3 = Profibus DP 6 I/O,
(for Profibus DP),
4 = DeviceNet 2 I/O,
5 = DeviceNet 4 I/O,
6 = DeviceNet 6 I/O, (for DeviceNet),
7 = Modbus-RTU 2 I/O,
8 = Modbus-RTU 4 I/O,
9 = Modbus-RTU 6 I/O,
10 = Devicenet Drive Profile,
11 = Ethernet IP 2 I/O,
12 = Ethernet IP 4 I/O,
13 = Ethernet IP 6 I/O.

NOTE!

The alarms A129/A130 are presented on the conventional HMI as E29/E30.

P313 - defines the inverter behavior when the physical connection with the master is interrupted and/or the Fieldbus board is inactive (A128, A129 or A130 indicated on the display).

The parameter P313 has the following options:

0 = Disables the inverter by using the Start/Stop controls via deceleration ramp.
1 = Disables the inverter by using the General En abling, motor coasting.
2 = The inverter status is not changed.
3 = The inverter goes to Local mode.

8.4.4.1 Variables Read From the Inverter

1 - Status word,
2 - Motor speed, for the option P309 = 1or 4 (2I/O) - read 1 and 2,
3 - Digital input status (P012),
4 - Parameter contents, for the option P309 = 2 or 5 (4I/O) - it reads 1, 2, 3 and 4,
5 - Torque current (P009),
6 - Motor current (P003), for the option P309 = 3 or 6 (6I/O) - it reads 1, 2, 3, 4, 5 and 6.

1. Status word (EL):

The status word is composed by a total of 16 bits, 8 high order bits and 8 low order bits. It has the following construction:

High-order bits – they indicate the status of the associated function
EL.15 – Active error: 0 = No, 1 = Yes;
EL.14 – PID Regulator: 0 = Manual, 1 = Automatic;
EL.13 – Undervoltage of the electronics power supplies: 0 = Without, 1 = With;
EL.12 – Local/Remote command: 0 = Local, 1 = Remote;
EL.11 – JOG command: 0 = Inactive, 1 = Active;
EL.10 – Forward/Reverse: 0 = Reverse, 1 = Forward;
EL.09 – General enabling: 0 = Disabled, 1 = Enabled;
EL.08 – Start/Stop: 0 = Stop, 1 = Start.

Low-order bits – they indicate the error code number, i.e., 03, 07 or 87 (57h). Refer to the section 7.1.

2. Motor speed:

This variable is shown by using 13-bit resolution plus signal. Thus, the rated value will be equal to 8191 (1FFFh) (Forward) or -8191 (E001h) (Reverse) when the motor is running at synchronous speed (or base speed, for instance 1800 rpm for a IV-pole motor, 60 Hz).

3. Digital input status:

It presents the parameter P012 contents, where 1 indicates an active input and 0 indicates an inactive input.

Refer to the section 6.1. The digital inputs are distributed in the manner in this WORD:

Bit 7 - DI1 status
Bit 6 - DI2 status
Bit 5 - DI3 status
Bit 4 - DI4 status
Bit 3 - DI5 status
Bit 2 - DI6 status
Bit 1 - DI7 status
Bit 0 - DI8 status
Bit 8 - DI9 status
Bit 9 - DI10 status

4. Parameter contents:

This position allows reading the contents of inverter parameters, which are selected at the position 4 - Number of the parameters to be read - of the variables written in the inverter. The read values have the same order of magnitude of those described in the product manual or showed on the HMI.

The values are read without the decimal point, if that is the case.

Examples:
a) HMI displays 12.3, the Fieldbus reading will be 123,
b) HMI displays 0.246, the Fieldbus reading will be 246.

There are some parameters whose representation on the LED display can suppress the decimal position when the values are higher than 99.9. These parameters are P100, P101, P102, P103, P155, P156, P157, P158, P169 (for P202 < 3), P290 and P401.

Example:
Indication on the LED display: 130,
Indication on the LCD: 130.0,
Fieldbus reading is: 1300.

The reading of the parameter P006 via Fieldbus has the meaning presented in the detailed parameter description - Chapter 6.

5. Torque current:

This position indicates P009 parameter contents, without the decimal point. A low pass filter with a time constant of 0.5 s filters this variable.

6. Motor current:

This position indicates P003 parameter contents, without the decimal point. A low pass filter with a time constant of 0.3 s filters this variable.

8.4.4.2 Variables Written in Inverter

The variables are written in the following order:

1 - Control Word,
2 - Motor speed reference, for the option P309 = 1 or 4 (2I/O) - it writes in 1 and 2;
3 - Status of the digital outputs;
4 - Number of the parameters to be read, for the option P309 = 2 or 5 (4I/O) - it writes in 1, 2, 3 and 4;
5 - Number of the parameter to be changed;
6 - Content of the parameter to be changed, selected in the previous position, for the option P309 = 3 or 6 (6I/O) - it writes in 1, 2, 3, 4, 5 and 6.

1. Control word (CL):

The control word is composed by a total of 16 bits, 8 high order bits and 8 low order bits. It has the following construction:

High-order bits – they select the functions to be controlled, when the correspondent bits are set to 1.
CL.15 - Inverter fault reset;
CL.14 - Without function;
CL.13 - To save the changes of parameters P169/P170 in the EEPROM;
CL.12 - Local/Remote command;
CL.11 - Jog command;
CL.10 - Forward/Reverse;
CL.09 - General enabling;
CL.08 - Start/Stop.

Low-order bits – they determine the activation of the functions selected in the high-order bits.
CL.7 - Inverter fault reset: Every time it changes from 0 to 1 it causes an inverter reset, except for the errors (except A124, A125, A126 and A127);
CL.6 - No function;
CL.5 - To save P169/P170 in the EEPROM: 0 = to save, 1 = not to save;
CL.4 - Local/Remote command: 0 = Local, 1 = Remote;
CL.3 - Jog command: 0 = Inactive, 1 = Active;
CL.2 - Forward/Reverse: 0 = Reverse, 1 = Forward;
CL.1 - General enabling: 0 = Disabled, 1 = Enabled;
CL.0 - Start/Stop: 0 = Stop, 1 = Start.

NOTE!

The inverter will only execute the command defined in the low-order bit if the correspondent high-order bit is set to 1 (one). If the high-order bit is set to 0 (zero), the inverter will disregard the value of the correspondent low-order bit.

NOTE!

CL.13:

The function of saving parameter content changes in the EEPROM occurs normally when the HMI is used. The EEPROM allows a limited number of writings (100,000). In applications in which the speed regulator remains saturated and torque control is required, this control can be achieved by adjusting the torque limits P169/P170 (valid for P202 > 2). Therefore, if the network master keeps writing continuously in P169/P170, then the correspondent bits must be programmed in order to avoid that every change be saved in the EEPROM by setting:

CL.13 = 1 and CL.5 = 1

In order to enable the functions of the Control Word, it is necessary to set the inverter respective parameters with the option "Fieldbus".

a) Local/Remote Selection Source - P220;
b) Speed Reference - P221 and/or P222;
c) Forward/Reverse Selection - P223 and/or P226;
d) General Enabling, Start/Stop Selection - P224 and/or P227;
e) JOG Selection - P225 and/or P228.

2. Motor speed reference:

This variable is presented using a 13 bit resolution. Therefore, the speed reference value for the motor synchronous speed will be equal to 8191 (1FFFh).

This value must be used only as the base speed for the calculation of the desired speed (speed reference).

Examples:

1) 4-pole, 60 Hz motor, synchronous speed = 1800 rpm and speed reference = 650 rpm

1800 rpm - 8191
650 rpm - X → X = 2958 = 0B8Eh

This value (0B8Eh) must be written in the second word, which represents the motor speed reference (according to the beginning of this section).

2) 6-pole, 60 Hz motor, synchronous speed = 1200 rpm and speed reference = 1000 rpm

1200 rpm - 8191
1000 rpm - X → X = 4096 = 1AAAh

This value (1AAAh) must be written in the second word, which represents the motor speed reference (according to the beginning of this section).

NOTE!

Values above 8191 (1FFFh) are allowed when speed references above the motor synchronous speed are required, as long as the maximum programmed speed reference is respected.

3. Status of the digital outputs:

It allows controlling the status of the digital outputs that have been programmed for Fieldbus at the parameters P275 to P282. 16 bits, with the following construction, form the word that defines the status of the digital outputs:

High-order bits: they define the outputs to be controlled, when set in 1.
Bit 08: 1 - DO1 output control;
Bit 09: 1 - DO2 output control;
Bit 10: 1 - RL1 output control;
Bit 11: 1 - RL2 output control;
Bit 12: 1 - RL3 output control.

Low-order bits: they define the status of the controlled outputs
Bit 0 - DO1 status: 0 = inactive output, 1 = active output;
Bit 1 - DO2 status: idem;
Bit 2 - RL1 status: idem;
Bit 3 - RL2 status: idem;
Bit 4 - RL3 status: idem.

4. Number of the parameters to be read:

Through this position, the reading of any inverter parameter can be defined. The number of the parameter to be read must be programmed here, and its contents will be presented at the position 4 of the variables read from the inverter.

5. Number of the parameter to be changed:

This position operates together with the position 6 (parameter contents modification), described next. When no parameter has to be changed, then fill this position with the code 999.

Changing process sequence:

1) Keep 999 in the position 5;
2) Replace 999 by the number of the parameter to be changed;
3) If no error code (124 to 127) is signalized in the Status Word, then replace the parameter number by 999, in order to conclude the modification.

The modification can be verified via the HMI or by reading the parameter contents.

NOTES!

1) The command to pass from V/F to vector control will not be accepted if any of the parameters from P409 to P413 remains set to zero. In such case, this command must be done via HMI.
2) Do not program P204 = 5, because in the factory default settings P309 = Inactive.
3) P204 and P408 do not accept modification via network command.
4) The parameter contents must be kept by the master during 15 ms. Send a new value or write in another parameter only after this time has elapsed.

6. Content of the parameter to be changed, selected at the position 5: (Number of the parameter to be changed)

The format of the values adjusted in this position must be the ones described in the manual. The values, however, must be written without the decimal point, if this is the case. When the parameters P409 to P413 are modified, small differences in the contents may occur when comparing the value sent via Fieldbus and the value read at the position 4 (Parameter contents) or at the HMI, because of the truncating during the reading process.

8.4.4.3 Error Indications

During the Fieldbus reading/writing process the following error indications may occur and be informed at the Status Word variable:

Status Word variable indications:

A124- An attempt to change a parameter that can be modified only with disabled inverter.
- Parameterization error.

A125- Caused by:
- An attempt to read an inexistent parameter,
- An attempt to write in an inexistent parameter,
- Attempts to write in P408 and P204.

A126- An attempt to write a value out of the permitted range.

A127- Caused by:
a) A function selected by the Control Word has not been programmed for Fieldbus,
b) Command of a digital output that has not been programmed for Fieldbus,
c) An attempt to write in a read-only parameter.

The indication of the listed errors will be removed from the Status Word when the indented action is sent correctly, except for A127 (“b” case), whose reset is performed writing in the Control Word.

Example: Assuming that no digital output has been programmed for Fieldbus, then if the word 11h is written in the position 3, the inverter will respond indicating A127 in the Status Word. To remove this indication from the Status Word it is necessary:

1) To write zero in the position 3 (because no DO has been programmed for Fieldbus);

2) To change the Control Word variable so that the A127 indication be removed from the Status Word.

The removal of the listed errors from the Status Word can also be achieved by writing the 999 code in the position 5 of the variables written in the inverter. Except for A127 (“b” and “a” cases), whose reset occurs only through the writing in the Control Word, as exemplified above.

NOTE!

The errors A124, A125, A126 and A127 do not cause any change in the inverter operation status.

HMI Indications:

E29 - Inactive Fieldbus Connection

- This indication occurs when the physical connection from the inverter to the master is interrupted. The action that the inverter will take when E29 is detected is programmed at P313. The E29 indication is removed from the display when the HMI PROG key is pressed.

E30 - Inactive Fieldbus Board

- This indication will appear when:

1) P309 is programmed different from Inactive, without the existence of the respective board mounted on the MVC2 board XC140 connector;
2) The Fieldbus board exists but it is defective;
3) The board exists; however, the model programmed in P309 does not match the used board model.

The action that the inverter will take when E30 is detected is programmed at P313. The E30 indication is removed from the display when the HMI PROG key is pressed.

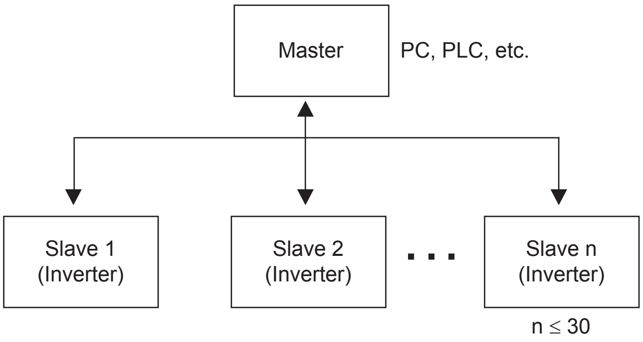
8.4.4.4 MVW-01 Variable Addressing at the Fieldbus Devices

The variables are arranged in the Fieldbus device memory from 00h on, for both writing and reading. What deals with the address differences is the protocol itself, and the communication board. The manner the variables are arranged in each address of the Fieldbus device memory depends on the equipment that is being used as master. In an A PLC, for instance, the variables are arranged High and Low, whereas in a B PLC the variables are arranged Low and High.

8.5 SERIAL COMMUNICATION

8.5.1 Introduction

The basic purpose of the serial communication is the physical connection of the inverters in an equipment network configured in the following form:



The inverters have a software for the interface data transmission/reception control, to make it possible the receiving of data sent by the master as well as the transmission of data requested by it.

The baudrate is 9600 bits/s, following an exchange protocol of the request/response type, using ASCII characters.

The master will have the means to do the following operations regarding each inverter:

- IDENTIFICATION

☑ network address;
☑ inverter type (model);
☑ software version.

- COMMAND

☑ general enabling/disabling;
☑ start/stop;
☑ speed direction;
☑ speed reference;
☑ local/remote;
☑ JOG;
☑ fault reset.

- STATUS ACKNOWLEDGMENT

☑ ready;
☑ Sub;
☑ run;
☑ local/remote;
☑ fault;
☑ JOG;
☑ speed direction;
☑ setting mode after the reset to the factory default;
☑ setting mode after changing from V/F mode to Vector mode.

- PARAMETER READING

- PARAMETER MODIFICATION

Typical examples of network use:

☑ PC (master) for parameterization of one or several inverters at the same time;
☑ SDCD monitoring inverter variables;
☑ PLC controlling the operation of an inverter in an industrial process.

8.5.2 Description of the Interfaces

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

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

8.5.2.1 RS-485

This interface allows the connection of up to 30 inverters to a master (PC, PLC, etc.), attributing to each inverter an address (1 to 30) that must be set at each one. In addition to these 30 addresses, there are two other addresses available to perform special tasks:

Address 0: Any inverter in the network is inquired, regardless of its address. Only one inverter must be connected to the network (point-to-point) in order to prevent short-circuits in the interface lines.

Address 31: A command can be transmitted simultaneously to all the inverters in the network, without acceptance acknowledgment.

List of the addresses and the correspondent ASCII characters:

Table 8.11 *- ASCII characters*

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

Other ASCII characters used by the protocol:

Table 8.12 *- ASCII characters used in protocol*

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

The connection between the network nodes is performed through a pair of wires. The signal levels are according to RS-485 EIA STANDARD, with differential receivers and transmitters. Expansion boards EBA.01, EBA.02 or EBB.01 (refer to the sections 8.1.1 and 8.1.2), which have the RS-485 interface, must be used.

When the master does only have a RS-232 interface, then a RS232/RS485 converter must be used.

8.5.2.2 RS-232

With the RS-232 interface the connection of one master to one slave is possible (point-to-point). Data can be exchanged in a bidirectional way, but not simultaneously (HALF DUPLEX).

The logic levels follow the RS-232 EIA STANDARD, which determines the use of unbalanced signaling. In the present case, one wire is used for transmission (TX), other for reception (RX) and another for ground (0 V). This configuration is the minimal “3-wire” RS-232 connection (3-wire economy model).

Note: Refer to the section 8.5.8, which describes the physical connection.

8.5.3 Protocol Definitions

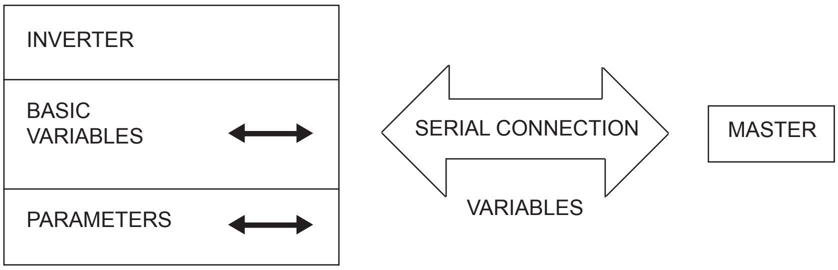
8.5.3.1 Used Terms

☑ **Parameters:** Are those existent in the inverter, whose visualization or modification is possible through the HMI;

☑ **Variables:** Are values with specific functions in the inverter and can be read and, in some cases, modified by the master;

☑ **Basic Variables:** Are those that can only be accessed through the serial communication.

DIAGRAM:



8.5.3.2 Parameter/Variable Resolutions

During parameter reading/writing their decimal points are disregarded in the values received/sent via telegrams, whereas the basic variables V04 (Serial Reference) and V08 (Motor Speed) that are standardized as 13 bit (0 to 8191).

Examples:

☑ **Writing:** If the purpose is to change the P100 content to 10.0 s, 100 must be sent (disregarding the decimal point);

☑ **Reading:** If 1387 (disregarding the decimal point) is read from P409, them its value is 1.387;

☑ **Writing:** In order to change V04 content to 900 rpm one must send:

$$\boxed{V04 = 900 \text{ x } \frac{8191}{P208} = 4096}$$

Assuming that P208 = 1800 rpm

☑ **Reading:** If 1242 is read from V08, the corresponding value is given by

$$\boxed{V08 = 1242 \text{ x } \frac{P208}{8191} = 273 \text{ rpm}}$$

Assuming that P208 = 1800 rpm

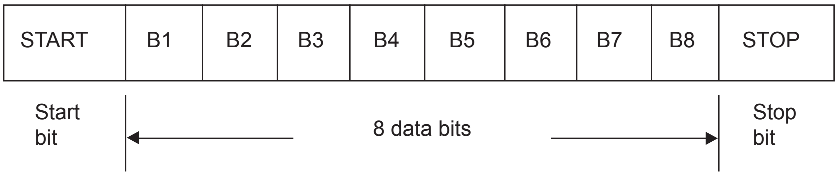
8.5.3.3 Character Format

☑ 1 start bit;

☑ 8 data bits (they codify text and transmission characters, taken from the 7-bit code, according to ISO 646 and complemented for even parity [eighth bit]);

☑ 1 stop bit.

After the start bit goes the least significant bit:



8.5.3.4 Protocol

The transmission protocol follows the ISO 1745 standard for coded data transmission. Only sequences of text characters without header are used. Error monitoring is performed through the parity monitoring of the 7-bit characters, according to ISO 646. The parity monitoring is made according to DIN 66219 (even parity).

The master uses two types of messages:

READING TELEGRAM: Used to request the contents of the inverter variables;

WRITING TELEGRAM: Used to change the contents of the variables or to send commands to the inverters.

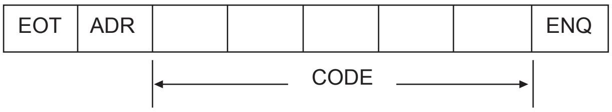
NOTE!

A transmission between two inverters is not possible. The master has the buss access control.

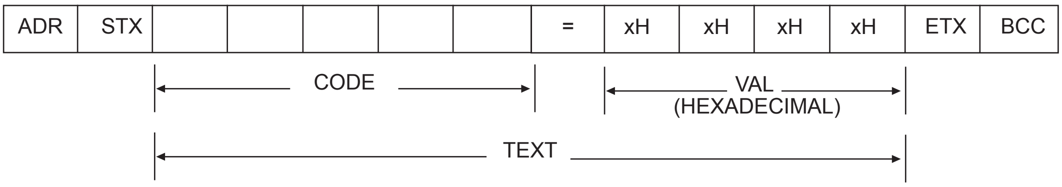
Reading Telegram

This telegram allows the master to receive from the inverter the contents correspondent to the request code. The inverter sends in the response telegram the data requested by the master.

1) Master:



2) Inverter:



Format of the reading telegram:

EOT: control character of End of Transmission;

ADR: inverter address (ASCII@, A, B, C, to) (ADdRess);

CODE: address of the 5-digit variable coded in ASCII;

ENQ: control character ENQuiry (enquiry).

Format of the inverter response telegram:

ADR: 1 character - inverter address;

STX: control character - Start of TeXt;

TEXT: consists in:

☑ CODE: address of the variable;

☑ " =": separation character;

☑ VAL: 4 digits value (HEXADECIMAL);

ETX: control character - End of TeXt;

BCC: CheCksum Byte - EXCLUSIVE OR of all the bytes between STX (excluded) and ETX (included).

In some cases, there may be an inverter response with:

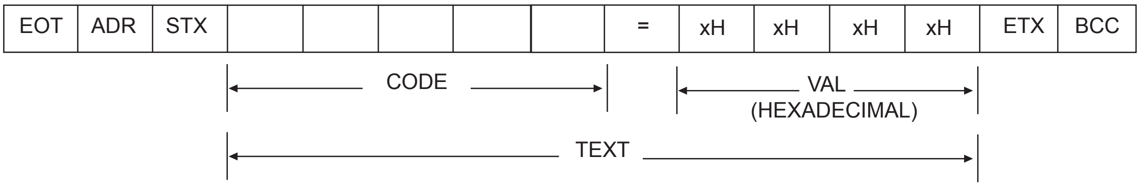
ADR	NAK

Refer to the section 8.5.3.5

Writing Telegram

This telegram sends data to the inverter variables. The inverter will respond indicating whether or not the data has been accepted.

1) Master:



2) Inverter:

ADR	NAK

or

ADR	ACK

Format of the writing telegram:

EOT: control character of End Of Transmission;

ADR: inverter address;

STX: control character of Start of TeXt;

TEXT: consists in:

☑ CODE: variable address;

☑ “ =”: separation character;

☑ VAL: 4 hexadecimal digit value;

ETX: control character of End of TeXt;

BCC: Byte of CheCksum - EXCLUSIVE OR of all the bytes between STX (excluded) and ETX (included).

Format of the inverter response telegram:

Acceptance:

☑ **ADR:** inverter address;

☑ **ACK:** ACKnowledge control character.

No acceptance:

☑ **ADR**: inverter address;

☑ **NAK:** Not AcKnowledge control character, meaning that the data were not accepted and the addressed variable continues with its old value.

8.5.3.5 Telegram Execution and Test

The inverters and the master test the telegram syntax.

The answers for the respective verified conditions are defined as follows:

Reading Telegram:

☑ No answer: with wrong telegram structure, control characters received incorrectly or wrong inverter address;

☑ NAK: code corresponding to inexistent or write-only variable;

☑ TEXT: with valid telegrams.

Writing Telegram:

☑ No answer: with wrong telegram structure, control characters received incorrectly or wrong inverter address;

☑ NAK: code corresponding to inexistent variable, wrong BCC (Checksum), read-only variable, VAL out of range for the variable in question, operation parameter out of the alteration mode;

☑ ACK: with valid telegrams.

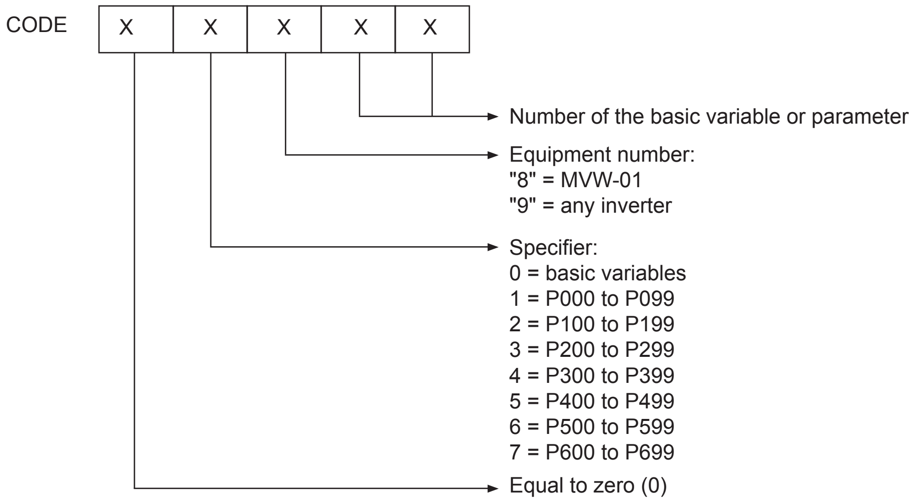
The master should maintain a waiting time that is compatible with the used inverter between two variable transmissions to that same inverter.

8.5.3.6 Telegram Sequence

In the inverters, the telegrams are processed in determined time intervals. Therefore, a pause larger than the sum of the times $T_{proc} + T_{di} + T_{txi}$ should be guaranteed between two telegrams addressed to the same inverter (refer to the section 8.5.7).

8.5.3.7 Variable Code

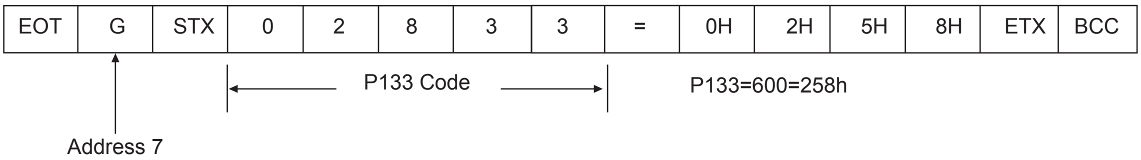
The field denominated Code contains the addresses from parameters and basic variables. It is composed by 5 digits (ASCII characters), as presented next:



8.5.4 Telegram Examples

Modification of the inverter 7 minimum speed (P133) to 600 rpm.

1) Master:



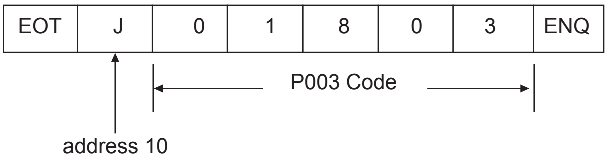
EOT	G	STX	0	2	8	3	3	=	0H	2H	5H	8H	ETX	BCC

2) Inverter:

G	ACK

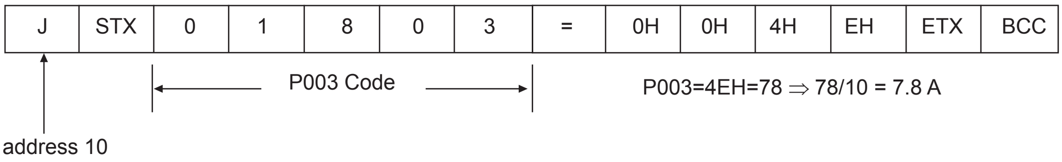
Reading of the output current from the inverter at the address 10 (assuming that it was 7.8 A at the moment of the request).

1) Master:



EOT	J	0	1	8	0	3	ENQ

2) Inverter:



J	STX	0	1	8	0	3	=	0H	0H	4H	EH	ETX	BCC

NOTE!

The values sent and received via serial interface are always integer values. It is necessary to know the parameter resolution in order to read the correct value (e.g., the actual current value = 7.8 A ⇔ read value = 78).

8.5.5 Variables and Serial Communication Errors

8.5.5.1 Basic Variables

V00 (code 00800):

Inverter model indication (reading variable).

Reading this variable allows identifying the inverter type. For the MVW-01 this value is 8, as described in the section 8.5.3.7.

V02 (code 00802):
Inverter status indication (reading variable).
☑ status word (high-order bits)
☑ error code (low-order bits)

where:
Status Word:

EL15	EL14	EL13	EL12	EL11	EL10	EL9	EL8

- EL8: 0 = Stop
  1 = Start
- EL9: 0 = General enable inactive
  1 = General enable active

Enabled inverter
if EL8=EL9=1

- EL10: 0 = Reverse
  1 = Forward
- EL11: 0 = JOG inactive
  1 = JOG active
- EL12: 0 = Local
  1 = Remote
- EL13: 0 = No undervoltage
  1 = Undervoltage
- EL14: 0 = Manual PID
  1 = Automatic PID
- EL15: 0 = No error
  1 = Error

Error code: error number in hexadecimal format.
Examples:
F001 → 01h
F087 → 57h

V03 (code 00803):
Control Word
Writing variable, whose bits have the following meaning:

High-order bits: Desired action mask. In order that the action be possible, the correspondent bit must be set in 1.

CL15	CL14	CL13	CL12	CL11	CL10	CL9	CL8
MSB							LSB

- CL8: Start/Stop
- CL9: General enable
- CL10: Forward/Reverse
- CL11: JOG
- CL12: Local/Remote
- CL13: Not used
- CL14: Not used
- CL15: Inverter reset

Low-order bit: Logic level of the desired action.

CL7	CL6	CL5	CL4	CL3	CL2	CL1	CL0
MSB							LSB

- CL0: 1 = Start
  0 = Stop
- CL1: 1 = Activates the general enable
  0 = Deactivates the general enable (motor coasts)
- CL2: 1 = Forward
  0 = Reverse
- CL3: 1 = Activates JOG
  0 = Deactivates JOG
- CL4: 1 = Remote
  0 = Local
- CL5: Not used
- CL6: Not used
- CL7: The transition of this bit from 0 to 1 causes the inverter reset, if it is in an error condition.

NOTE!

A disable command via digital input has higher priority than the Control Word enabling;
In order to enable the inverter it is necessary that CL0 = CL1 = 1, and that there is no external disabling command;
If CL0 and CL1 are set to 0 simultaneously, than general disable occurs.

V04 (code 00804):
Serial speed reference (reading/writing variable)
It allows sending the speed reference to the inverter, as long as P221 = 9 for Local situation, or P222 = 9 for Remote situation. This variable has a 13 bit resolution (refer to the section 8.5.3.2).

V06 (code 00806):

Status of the operation modes (reading variable)

EL2 7	EL2 6	EL2 5	EL2 4	EL2 3	EL2 2	EL2 1	EL2 0

MSB LSB

- EL2.0: 1= During the Guided Start-up Routine after a reset to the factory default/first power-up.

The inverter will enter this operation mode when it is powered-up for the first time or when the factory default parameters are loaded (P204 = 5 or 6). In this mode only the parameters P023, P201, P295, P296, P400, P401, P402, P403, P404 and P406 will be accessible. If an attempt to access another parameter is done, the inverter will respond with A125. In order to get more details, refer to the section 5.2 - Initial Power-Up.

- EL2.1: 1= During the adjusting mode after changing from V/F to Vector Mode.

The inverter will enter this operation mode when the control mode is changed from V/F (P202 = 0, 1 or 2) to Vector (P202 = 3 or 4). In this mode only the parameters P023, P201, P295, P296, P400, P401, P402, P403, P404 and P406 will be accessible. If an attempt to access another parameter is done, the inverter will respond with A125.

- EL2.2: 1 = performing the self-tuning.
- EL2.3: not used.
- EL2.4: not used.
- EL2.5: not used.
- EL2.6: not used.
- EL2.7: not used.

V07 (code 00807):

Status of the operation modes (reading/writing variable)

CL2 7	CL2 6	CL2 5	CL2 4	CL2 3	CL2 2	CL2 1	CL2 0

MSB LSB

- CL2.0: 1 - it leaves the Guided Start-up Routine after a reset to the factory default.
- CL2.1: 1 - it leaves the adjusting mode after changing from V/F to Vector Mode.
- CL2.2: 1 - it aborts the self-tuning.
- CL2.3: 1 - not used.
- CL2.4: 1 - not used.
- CL2.5: 1 - not used.
- CL2.6: 1 - not used.
- CL2.7: 1 - not used.

V08 (code 00808):

Motor Speed in 13 bit resolution (reading variable)

It allows reading the motor speed with a 13 bit resolution (refer to the section 8.5.3.2).

V09 (code 00809). Reading:

b0: 1 - reversing SG (Forward/Reverse).

b1: 1 - active alarm.

VB 12 (code 005012). Status of the Digital Outputs:

It allows controlling the status of the digital outputs that have been programmed for Serial at the parameters P275 to P280. 16 bits, with the following construction, form the word that defines the status of the digital outputs:

High-order bits: They define the outputs to be controlled, when set in 1.

Bit.08: 1 - DO1 output control;

Bit.09: 1 - DO2 output control;

Bit.10: 1 - RL1 output control;

Bit.11: 1 - RL2 output control;

Bit.12: 1 - RL3 output control;

Bit.13: 1 - RL4 output control;

Bit.14: 1 - RL5 output control.

Low-order bits: they define the status of the controlled outputs.

Bit.0: - DO1 status: 0=inactive output, 1=active output;

Bit.1: - DO2 status: 0=inactive output, 1=active output;

Bit.2: - RL1 status: 0=inactive output, 1=active output;

Bit.3: - RL2 status: 0=inactive output, 1=active output;

Bit.4: - RL3 status: 0=inactive output, 1=active output;

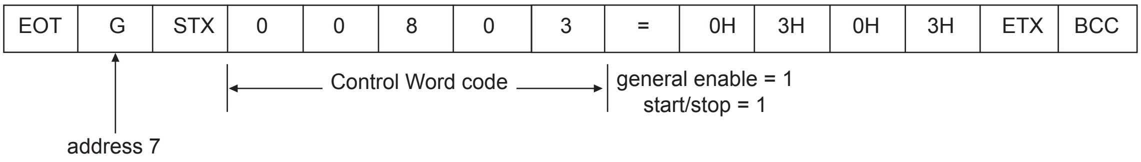
Bit.5: - RL4 status: 0=inactive output, 1=active output;

Bit.6: - RL5 status: 0=inactive output, 1=active output.

8.5.5.2 Examples of Telegrams with Basic Variables

Inverter enabling (if P224 = 2 for Local situation or P227 = 2 for Remote situation).

1) Master:



EOT	G	STX	0	0	8	0	3	=	0H	3H	0H	3H	ETX	BCC

2) Inverter:

G	ACK

Change of the motor speed direction to Reverse (if P223 = 5 or 6 for Local situation or P226 = 5 or 6 for Remote situation).

1) Master:

EOT	G	STX	0	0	8	0	3	=	0H	4H	0H	0H	ETX	BCC

Control Word code

Forward/Reverse = 0

address 7

2) Inverter:

G	ACK

JOG activation (if P225 = 3 for Local situation or P228 = 3 for Remote situation).

1) Master:

EOT	G	STX	0	0	8	0	3	=	0H	8H	0H	8H	ETX	BCC

Control Word code

JOG = 1

address 7

2) Inverter:

G	ACK

Error reset

1) Master:

EOT	G	STX	0	0	8	0	3	=	8H	0H	8H	0H	ETX	BCC

Control Word code

Reset = 1

address 7

2) Inverter:

G	ACK

8.5.5.3 Parameters Related to the Serial Communication

Table 8.13 *- Parameters Related to the Serial Communication*

Parameter Nr.	Parameter Description
P220	Local/Remote Selection Source
P221	Speed Reference Selection - Local Situation
P222	Speed Reference Selection - Remote Situation
P223	Forward/Reverse Selection - Local Situation
P224	Start/Stop Selection - Local Situation
P225	JOG Selection - Local Situation
P226	Forward/Reverse Selection - Remote Situation
P227	Start/Stop Selection - Remote Situation
P228	JOG Selection - Remote Situation
P308	Inverter address in the serial communication network (range from 1 to 30)

In order to get more details on the parameters above, refer to the chapter 6 - Detailed Parameter Description.

8.5.5.4 Errors Related to the Serial Communication

They operate in the following way:

☑ the do not disable the inverter;
☑ they do not commutate fault relays;
☑ they are reported in the Status Word (V02).

Type of errors:

☑ A122: longitudinal parity error (BCC);
☑ A124: parameterization error (occurrence of some of the situations indicated in the table 4.2 of the chapter 4 or when there is an attempt to change a parameter that cannot be changed with a rotating motor);
☑ A125: nonexistent variable or parameter;
☑ A126: value out of the range;
☑ A127: an attempt to write in a read-only variable or a disabled control word command.

NOTE!

If in the inverter data reception a parity error is detected, then the telegram is ignored. The same will happen in cases of syntax errors.
Examples:
Code values different from the numbers 0 to 9;
Separation character different from “=”, etc.

8.5.6 MVW-01 Special Parameters

In general, the parameters of an inverter store their information in 16-bit words. To know the contents of one of these parameters through a communication network (serial, fieldbus, etc.), the number of the parameter must be informed (according to the used protocol) and a 16-bit information will be received as the answer, because there is only one information word associated for each parameter.

Some of the MVW-01 parameters have more than one word of associated information, so that the access to these parameters is done in a special manner. These parameters are:

☑ last errors: P014 to P017, P060 to P065 - 3 words per parameter;
☑ date and Time: P080 and P081 - 2 words per parameter;
☑ error log: P067 - 300 words;
☑ trace function data: P555, P557, P559, P561, P563, P565, P567, P569 – up to 31080 words per parameter.

To gain access to the contents of these special parameters, successive readings must be performed until all the words associated to that parameter have been obtained (the readings must be done normally, according to the specified protocol), remembering that in each reading the access to only one word (16 bits) is obtained.

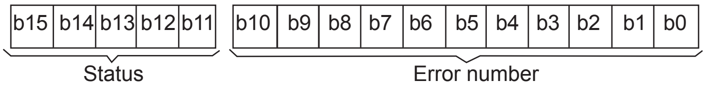
NOTE!

While reading special parameters, this reading should be done in an uninterrupted form, reading the same parameter repeated times without reading any other parameter in between until all the readings of the special parameter associated words have been accomplished. If another parameter is read before the conclusion of the reading of all the words, then when it is read again it sends the first associated word again.

8.5.6.1 Parameters of the Last Errors

The parameters that bring the information of the 10 last errors (P014 to P017, P060 to P065) have three words associated to each one of them.

The first read word brings the information of the occurred error number and of the inverter status at the moment it occurred. The information is distributed among the word bits in the following way:



The second and the third words bring the information of the date/time when the error happened. The date/time information has 32 bits and two words are necessary to represent it.

In order to decode the date/time information, refer to the section 8.5.3.2.

For instance, in order to obtain the information of the last error (P014), read P014 three consecutive times.

8.5.6.2 Date and Time Parameters

The MVW-01 inverter has a real time clock with the purpose of recording date and time of events as, for instance, the occurred errors. Date and time can be adjusted through the parameters P080 and P081, respectively.

NOTE!

Date and time can only be modified through the local HMI.

Despite having two parameters related with the date and hour, the information is stored in a single 32-bit variable. Thus, to obtain the inverter date and time information, two readings of P080 are necessary, since the information is stored in 32 bits, i.e., in two words.

In the first reading the inverter sends the most significant word (bits 16 to 31) and in the second reading the less significant word (bits 0 to 15).

Those 32 bits of information contain the counting of the seconds elapsed since 00:00 a.m. of January 1st, 1970. A Julianne codifying routine must be used to determine the date and the hour correspondent the this counting.

8.5.6.3 Error Log Parameter

The parameter P067 has the information of the 100 last inverter errors. Since each error has 3 words (48 bits) of associated information, this parameter has 300 words.

Therefore, the first three readings of P067 supply the information of the last error, the three following readings of the next one, and so on until 300 readings are done. For information on the words related to an error, refer to the section 8.5.3.1.

8.5.6.4 Trace Function Data Parameters

The trace function stores an enormous amount of information in each of its channels. To get access to this data, it is necessary to read the parameter related to the wanted channel (P555, P557, P559, P561, P563, P565, P567, P569).

When the first reading of a certain channel parameter is done, it responds with the number of the corresponding parameter programmed for trace.

Starting from the second reading on (in sequence), the information recorded by the trace function is sent.

In order to know how many words are associated to each channel, refer to the section 6.5.2.

8.5.7 Times for Telegram Reading/Writing

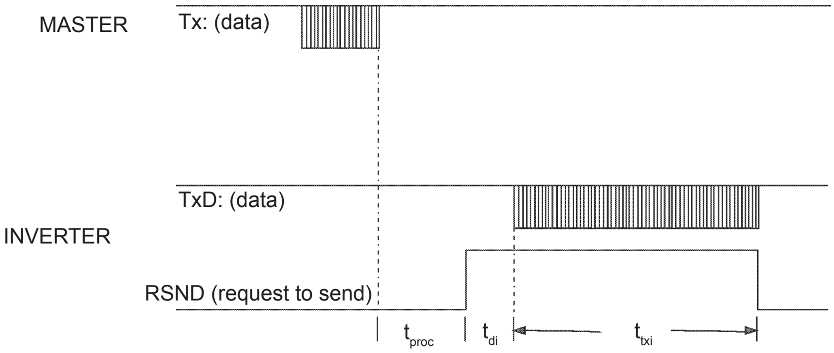


Figure 8.25 *- Time of the telegrams exchanged between Master and Inverter*

Table 8.14 *- Reading and writing time*

Time (ms)		Typical
Tproc		10
Tdi		5
T_{txi}	reading	15
	writing	3

8.5.8 RS-232 and RS-485 Physical Connection

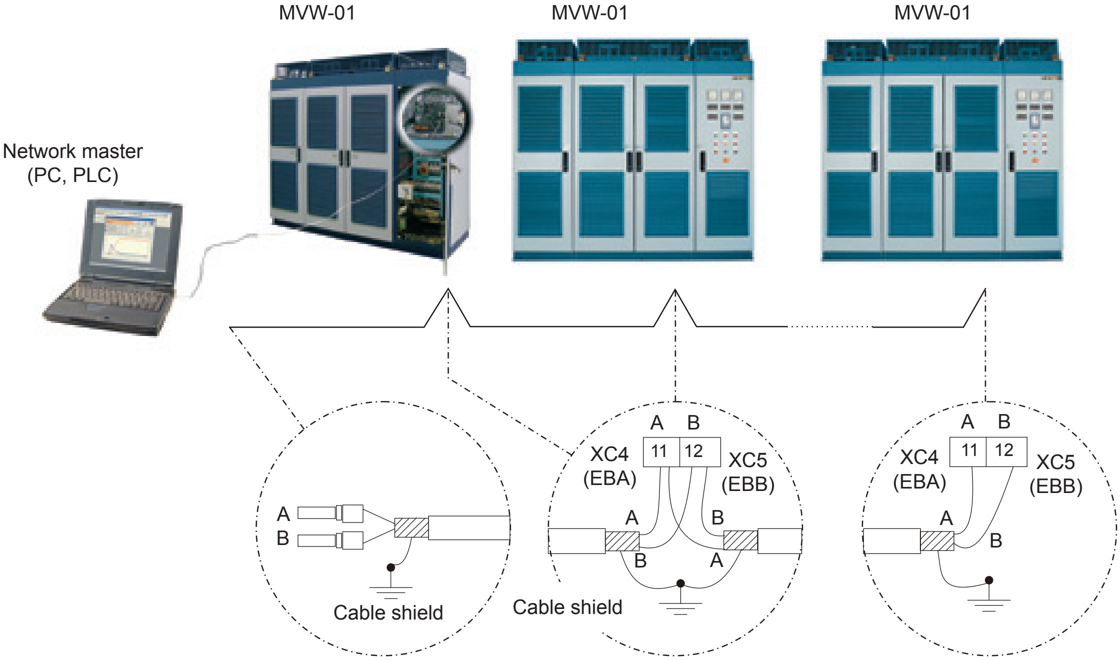


Figure 8.26 *- MVW-01 network connection through the RS-485 serial interface*

Notes:

☑ LINE TERMINATION: add a line termination (120 Ω) at the ends, and only at the ends, of the line. Therefore, set S3.1/S3.2 (EBA) and S7.1/S7.2 (EBB) in the on position (refer to the sections 8.1.1 and 8.1.2);

☑ CABLE SHIELD GROUNDING: connect them to the equipment frames (properly grounded);

☑ RECOMMENDED CABLE: balanced pair, shielded.
E.g., AFS Line, manufacturer KMP;

☑ The RS-485 network wiring must be separated from power cables and 110/220 V command;

☑ The reference signal for the RS-485 interface (SREF) should be used if the master of the network is not referenced to the ground used in the installation. For instance, in case the master is fed by an isolated power supply, it is necessary to ground that power supply reference, or take this reference signal to the rest of the system. Normally, it is only necessary to connect the A (-) and B (+) signals, without the connection of the SREF signal.

RS-232 Serial Interface Module

The MVW-01 serial interface connection is available at the MVC2 board XC7 connector (refer to the figure 3.16 to find its location).

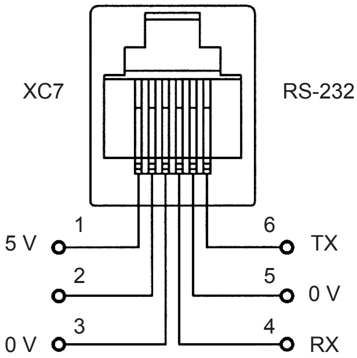


Figure 8.27 *- XC7 (RJ12) connector signal description*

NOTE!
The RS-232 wiring must be separated from power cables and 110/220 V command.

NOTE!
It is not possible to use RS-232 and RS-485 simultaneously.

8.6 MODBUS-RTU

8.6.1 Introduction to the Modbus-RTU Protocol

The Modbus protocol was initially developed in 1979. Nowadays it is an open protocol, widely spread and used by many manufacturers in several equipments. The MVW-01 Modbus-RTU communication was developed based in two documents:

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

These documents define the format of the messages used by the elements that compose the Modbus network, the services (or functions) that can be made available through the network, and how these elements exchange date in the network.

8.6.1.1 Transmission Modes

Two transmission modes are defined in the protocol specification: ASCII and RTU. The modes define how the bytes of the message are transmitted. It is not possible to use both transmission modes in the same network.

In the RTU mode each transmitted package has 1 start bit, eight data bits, 1 parity bit (optional) and 1 stop bit (2 stop bits if the parity bit is not used). Therefore, the bit sequence for the transmission of one byte is the following:

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

In the RTU mode each data byte is transmitted as being a single word directly with its value in hexadecimal. The MVW-01 uses only this transmission mode for communication, not having therefore, the ASCII communication mode.

8.6.1.2 RTU Mode Message Structure

The Modbus-RTU network operates in the master-slave system, where up to 247 slaves may exist, but with just one master. Every communication begins with the master doing a request to a slave, and then the slave responds to the master what had been requested. In both telegrams (request and response), the used structure is the same: address, function code, data and CRC. Only the data field may have a changeable size, depending on what is being requested.

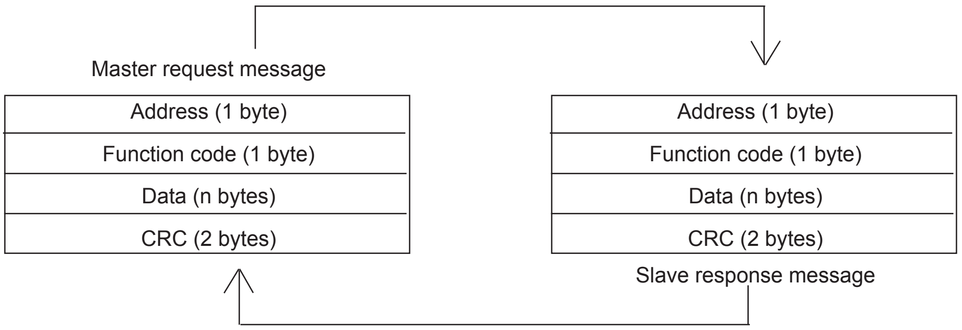


Figure 8.28 *- Telegram structure*

Address:

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

Function Code:

This field contains a single byte, where the master specifies the type of service or function requested to the slave (reading, writing, etc.). According to the protocol, each function is used to access a specific data type.

In the MVW-01 all data are available as holding type registers (referenced from the address 40000 or '4x'). Besides these registers, the inverter status (enabled/disabled, with or without error, etc.) and the command for the inverter (Start/Stop, Forward/Reverse, etc.) can be also accessed through the coil read/write functions, or the internal bits (referenced from the address 00000 or '0x' on).

Data Field:

This field has a variable length. The format and the content of this field depend on the used function and the transmitted values. This field is described together with the functions (refer to the section 8.6.3).

CRC:

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

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

1. The first message byte (Only the data bits. Start bit, parity bit and stop bit are not used) is submitted to an XOR logic (exclusive OR) with the 8 least significant bits of the CRC variable, returning the result to the CRC variable.
2. Then the CRC variable is shifted one position to the right, in the direction of the least significant bit and the position of the most significant bit is filled with 0 (zero).
3. After this shift, the flag bit (bit that has been shifted out the CRC variable) is analyzed, resulting in the following:
   - ☑ If the bit value is 0 (zero), no change is made.
   - ☑ If the bit value is 1, the CRC variable content is submitted to XOR logic with a constant value A001h, and the result is returned to the CRC variable.
4. Repeat steps 2 and 3 until eight shifts have been done.
5. Repeat the steps 1 to 4, by using the next message byte until the whole message have been processed.

The final content of the CRC variable is the CRC field value that is transmitted at the end of the message.

The least significant part is transmitted first (CRC-), and then the most significant part (CRC+) is transmitted.

Time between Messages:

In the RTU mode, there is no specific character indicating the beginning or the end of a telegram. Therefore, what indicates when a new message starts or when it finishes is the absence of data transmission in the network, during a minimum period of 3.5 times the transmission time of a data word (11 bits). Therefore, if a telegram has initiated after the minimum time without transmission has elapsed, the network elements will assume that the received character represent the beginning of a new telegram. And in the same way, the network elements will assume that the telegram has reached the end after lapsing this time elapses again.

If during the transmission of a telegram, the time between bytes is greater than this minimum time, the telegram will be considered invalid, because the inverter is going to discard the already received bytes and it will assemble a new telegram with the bytes that are being transmitted.

The following table shows the times for three different baudrates.

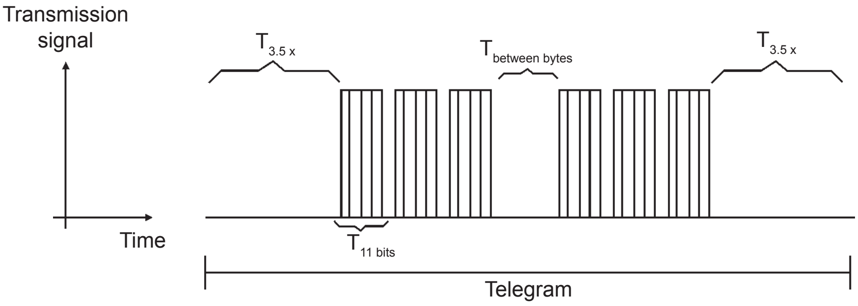


__Figure 8.29__ - Time between bytes in a telegram transmission

__Table 8.15__ - Telegram transmission time

Baudrate	$T_{11\ bits}$	$T_{3,5x}$
9600 kbits/sec	1.146 ms	4.010 ms
19200 kbits/sec	573 μs	2.005 ms
38400 kbits/sec	285 μs	1.003 ms

$T_{11\ bits}$ = Time to transmit one word of the message.

$T_{between\ bytes}$ = Time between bytes (cannot be longer than $T_{3.5x}$).

$T_{3.5x}$ = Minimum interval indicating the begin and the end of the message (3.5 x T_{11bits}).

8.6.2 Operation of the MVW-01 in the Modbus-RTU Network

The MVW-01 frequency inverters operate as Modbus-RTU network slaves, and all the communication initiates with the Modbus-RTU network master requesting some service to a network address. If the inverter is configured for the corresponding address, then it processes the request and responds what was asked to the master.

8.6.2.1 RS-232 and RS-485 Interface Description

The MVW-01 frequency inverters use a serial interface to communicate with the Modbus-RTU network. There are two possibilities for the physical connection between the network master and an MVW-01:

RS-232:

☑ The interface is used for a point-to-point connection (between a single slave and the master).

☑ Maximum distance: 10 meters.

☑ Signal levels according to EIA STANDARD RS-232C.

☑ Three wires: transmission (TX), reception (RX) and return (0V).

RS-485:

☑ This interface is used for multipoint connection (several slaves and the master).

☑ Maximum distance: 1000 meters (using shielded cables).

☑ Signal levels according to EIA STANDARD RS-485.

☑ The EBA or the EBB expansion board, which have interface for the RS-485 communication, must be used.

Note: Refer to the section 8.5.8, which describes how to make the physical connection.

8.6.2.2 Inverter Configurations in the Modbus-RTU Network

In order that the inverter be able to communicate properly in the network, besides the physical connection, it is necessary to configure the inverter address, as well as the baudrate and the type of existent parity.

Inverter address in the Network:

It is defined through the parameter 308.

☑ If the type of serial communication (P312) is configured for Modbus-RTU, it is possible to select addresses from 1 to 247.

☑ Each slave in the network must have an address different from the others.

☑ The network master does not have an address.

☑ It is necessary to know the address of the slave even when the connection is point-to-point.

Baudrate and Parity:

☑ Both configurations are defined through the parameter P312.

☑ Baudrates: 9600, 19200 or 38400 kbits/sec.

☑ Parity: None, Odd Parity or Even Parity.

☑ All slaves, and also the network master, must use the same baudrate and parity.

8.6.2.3 Access to the Inverter Data

Through the network, it is possible to access all the parameters and basic variables available for the MVW-01:

☑ Parameters: they are those existing in the inverters, whose visualization and modification is possible through the Human-Machine Interface (HMI) (refer to the section 1 - Parameters).

☑ Basic Variables: they are internal inverter variables, and they can only be accessed via serial communication. It is possible through the basic variables, for instance, to change the speed reference, read the status, enable or disable the inverter, etc. (refer to the section 8.5.5.1- Basic Variables).

☑ Register: name used to represent either parameters or the basic variables during the data transmission.

☑ Internal Bits: they are bits accessed only by the serial, used for the inverter command and status monitoring.

The section 8.5.3.2 defines the parameter and variable resolutions when transmitted via serial.

Available functions and response times:

In the Modbus-RTU protocol specification it is defined the functions used to access the type of registers described in the specification. In the MVW-01, parameters and basic variables were defined as being holding type registers (referenced as 4x). Besides these registers, it is also possible to access directly internal command and monitoring bits (referenced as 0x).To access these bits and registers, the next services (or functions) for the MVW-01 frequency inverters were made available:

☑ **Read Coils**
Description: reading of internal bit blocks or coils.
Function code: 01.
Broadcast: not supported.
Response time: 5 to 10 ms.

☑ **Read Holding Registers**
Description: reading of register blocks of the holding type.
Function code: 03.
Broadcast: not supported.
Response time: 5 to 10 ms.

☑ **Write Single Coil**
Description: writing in a single internal bit or coil.
Function code: 05.
Broadcast: supported.
Response time: 5 to 10 ms.

☑ **Write Single Register**
Description: writing in a single register of the holding type.
Function code: 06.
Broadcast: supported.
Response time: 5 to 10 ms.

☑ **Write Multiple Coils**
Description: writing in internal bit blocks or coils.
Function code: 15.
Broadcast: supported.
Response time: 5 to 10 ms.

☑ **Write Multiple Registers**

Description: writing in register blocks of holding type.

Function code: 16.

Broadcast: supported.

Response time: 10 to 20 ms for each written register.

☑ **Read Device Identification**

Description: Identification of the inverter model.

Function code: 43.

Broadcast: not supported.

Response time: 5 to 10 ms.

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

Data Addressing and Offset:

The data addressing in the MVW-01 is done with offset equal to zero, meaning that the number of the address is equal to the given number. The parameters are made available starting from the address 0 (zero), while the basic variables are made available starting from the address 5000. In the same way, the status bits are made available starting from the address 0 (zero) and the command bytes are made available beginning from the address 100. The following table illustrates the addressing of bits, parameters and basic variables:

Parameters		
Parameter Number	Modbus Address	
	Decimal	Hexadecimal
P000	0	00h
P001	1	01h
⋮	⋮	⋮
P100	100	64h
⋮	⋮	⋮

Basic Variables		
Variable Number	Modbus Address	
	Decimal	Hexadecimal
V00	5000	1388h
V01	5001	1389h
⋮	⋮	⋮
V08	5008	1390h

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

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

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

The status bits have the same functions of the bits 8 to 15 of the Status (basic variable 2). These bits are available just for reading, and any writing command returns an error to the master.

Status Bit	
Bit Number	Function
Bit 0	0 = Stop 1 = Start
Bit 1	0 = General Enable inactive 1 = General Enable active
Bit 2	0 = Reverse 1 = Forward
Bit 3	0 = JOG inactive 1 = JOG active
Bit 4	0 = Local 1 = Remote
Bit 5	0 = No undervoltage 1 = Undervoltage
Bit 6	No function
Bit 7	0 = No error 1 = Error

The command bits are available for reading and writing, and have the same function of the bits 0 to 7 of the Control Word (basic variable 3), without the necessity, however, of the mask use. Writing in the basic variable 3 has influence in the state of these bits.

Command Bit	
Bit Number	**Function**
Bit 100	0 = Stop 1 = Start
Bit 101	0 = Deactivates the General Enable (motor coasts) 1 = Activates the General Enable
Bit 102	0 = Reverse 1 = Forward
Bit 103	0 = Deactivates JOG 1 = Activates JOG
Bit 104	0 = Local 1 = Remote
Bit 105	No function
Bit 106	No function
Bit 107	0 = Does not reset the inverter 1 = Resets the inverter

8.6.3 Detailed Description of the Functions

This section presents a detailed description of functions available at the MVW-01 for Modbus-RTU communication. In order to elaborate the telegrams, it is important to observe the following:

☑ The values are always transmitted in hexadecimal format.

☑ The address of one piece of data, the number of data and the value of the registers, are always represented in 16 bits. Therefore, it is necessary to transmit those fields using two bytes (high and low). To access bits, the form to represent a bit depends on the used function.

☑ Both the request and response telegrams, cannot be longer than 128 bytes.

☑ The resolution of each parameter or basic variable is as described in the section 8.5.3.2.

8.6.3.1 Function 01 - Read Coils

It reads the contents of a group of internal bits that must necessarily be in a numerical sequence. This function has the following structure for the request and response telegrams (the values are always hexadecimal, and each field represents one byte):

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

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

Example: reading the status bits for general enable (bit 1) and Forward/Reverse (bit 2) of then MVW-01 at the address 1:

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

As the number of read bits in the example is smaller than 8, the slave required only 1 byte for the response. The value of the byte was 02h, which as binary value will have the form 0000 0010. As the number of read bits is equal to 2, only the two less significant bits, that have the value 0 (General Enable inactive) and 1 (Forward) are of interest. The other bits, as they had not been requested, are filled out with 0 (zero).

8.6.3.2 Function 03 - Read Holding Register

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

Request (Master)	Response (Slave)
Slave address	Slave address
Function	Function
Address of the initial register (byte high)	Field Byte Count
Address of the initial register (byte low)	Data 1 (high)
Number of registers (byte high)	Data 1 (low)
Number of registers (byte low)	Data 2 (high)
CRC-	Data 2 (low)
CRC+	etc. to
-	CRC-
-	CRC+

Example: Reading of the motor speed (P002) and motor current (P003) from the MVW-01 at the address 1:

Request (Master)		Response (Slave)	
Field	**Value**	**Field**	**Value**
Slave address	01h	Slave address	01h
Function	03h	Function	03h
Initial register (byte high)	00h	Byte Count	04h
Initial register (byte low)	02h	P002 (high)	03h
Number of registers (byte high)	00h	P002 (low)	84h
Number of registers (byte low)	02h	P003 (high)	00h
CRC-	65h	P003 (low)	35h
CRC+	CBh	CRC-	7Ah
-	-	CRC+	49h

Each register is always formed by two bytes (high and low). For the example, we have P002 = 0384h, that in decimal number is equal to 900. As this parameter does not have a decimal place, the actual read value is 900 rpm. In the same way we will have a motor current value at P003 = 0035h, which corresponds to 53 decimal. As the current has one decimal digit resolution, the read value is 5.3 A.

8.6.3.3 Function 05 - Write Single Coil

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

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

Example: To activate the start command (bit 100 = 1) of an MVW-01 at the address 1:

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

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

8.6.3.4 Function 06 - Write Single Register

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

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

Example: Writing a speed reference (basic variable 4) of 900 rpm, to an MVW-01 at the address 1. It is useful to remember that the value for the basic variable 4 depends on the used motor type and that the value 8191 is equal to the rated motor speed. In this case, we suppose that the used motor has a rated speed of 1800 rpm, thus the value to be written into the basic variable 4 for a speed of 900 rpm is half of 8191, i.e., 4096 (1000h).

Request (Master)		Response (Slave)	
Field	**Value**	**Field**	**Value**
Slave address	01h	Slave address	01h
Function	06h	Function	06h
Register (byte high)	13h	Register (byte high)	13h
Register (byte low)	8Ch	Register (byte low)	8Ch
Value (byte high)	10h	Value (byte high)	10h
Value (byte low)	00h	Value (byte low)	00h
CRC-	41h	CRC-	41h
CRC+	65h	CRC+	65h

For this function, the slave response will be again a copy identical to the request made by the master. As already informed above, the basic variables are addressed from 5000, thus the basic variable 4 will be addressed at 5004 (138Ch).

8.6.3.5 Function 15 - Write Multiple Coils

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

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

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

Example: Writing of the commands for start (bit 100 = 1), general enable (bit 101 = 1) and Reverse speed direction (bit 102 = 0), to an MVW-01 at the address 1:

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

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

8.6.3.6 Function 16 - Write Multiple Registers

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

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

Example: Writing an acceleration time (P100) of 1.0 s and a deceleration time (P101) of 2.0 s, to an MVW-01 at the address 20:

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

Considering that the two parameters have a resolution of one decimal place, in order to write 1.0 and 2.0 seconds, the values 10 (000Ah) and 20 (0014h) must be transmitted, respectively.

8.6.3.7 Function 43 - Read Device Identification

It is an auxiliary function, which allows reading the manufacturer name, model and firmware version of the product. It has the following structure.

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

The fields are repeated according to the number of objects.

This function allows reading three information categories: Basic, Regular and Extended, and each category is formed by a group of objects. Each object is formed by a sequence of ASCII characters. For the MVW-01 only basic information is available, composed by three objects:

Object 00 - VendorName: Always ‘WEG’.

Object 01 - Product Code: Formed by the product code (MVW-01), plus the inverter rated current.

Object 02 - MajorMinorRevision: It indicates the inverter firmware version in the “VX.XX” format.

The Read Code indicates the information categories being read, and whether the objects are being accessed in a sequence or individually. In the case, the inverter supports the codes 01 (basic information in sequence), and 04 (individual access to the objects).

The remaining fields for MVW-01 have fixed values.

Example: Sequential reading of basic information, starting from the object 00 of an MVW-01 at the address 1:

Request (Master)		Response (Slave)	
Field	**Value**	**Field**	**Value**
Slave address	01h	Slave address	01h
Function	2Bh	Function	2Bh
MEI Type	0Eh	MEI Type	0Eh
Read Code	01h	Read Code	01h
Object Number	00h	Conformity Level	51h
CRC-	70h	More Follows	00h
CRC+	77h	Next Object	00h
-	-	Number of Objects	03h
-	-	Object Code	00h
-	-	Object Length	03h
-	-	Object Value	'WEG'
-	-	Object Code	01h
-	-	Object Length	0Eh
-	-	Object Value	'MVW-01 7.0A'
-	-	Object Code	02h
-	-	Object Length	05h
-	-	Object Value	'V2.09'
-	-	CRC-	B8h
-	-	CRC+	39h

In this example, the object values were not represented in hexadecimal, but using the corresponding ASCII characters. For the object 00, for instance, the value 'WEG' was transmitted as being three ASCII characters that in hexadecimal have the values 57h (W), 45h (E) and 47h (G).

8.6.4 Communication Errors

Errors may occur in telegram transmission through the network, or in the contents of the received telegrams. According to the type of error, the inverter may or may not send a response to the master:

When the master sends a message to an inverter configured at a specific network address, the inverter will not respond to the master if the following occurs:

☑ Parity bit error.
☑ CRC error.
☑ Timeout between transmitted bytes (3.5 times the transmission time of a 11 bit word).

In the case of a successful reception, during the telegram processing the inverter may detect problems, and send an error message, indicating the type of problem found:

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

8.6.4.1 Error Messages

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

The messages sent by the slave have following structure:

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

Example: The master requests the slave at address 1 to write in the parameter 89 (inexistent parameter):

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

TECHNICAL CHARACTERISTICS

This chapter describes the TECHNICAL CHARACTERISTICS (electrical and mechanical) of the MVW-01 inverter line.

9.1 MAIN CHARACTERISTICS

POWER SUPPLY	Voltages	2300, 3300 or 4160 V (± 10 %, -20 % with output power reduction)	
	Frequency	50 or 60 Hz (specify) ± 3 %	
	Imbalance between phases	< 3 %	
	Cos φ	> 0.97	
	Overvoltage category	Category III	
AUXILIARY SUPPLY	Voltages	220, 380, 400, 415, 440, 460 or 480 V	
	Frequency	50 or 60 Hz (± 3 %)	
	Imbalance between phases	< 3 %	
PROTECTION DEGREE	Standard	IP41	
DIMENSIONS	Width /Height / Depth (mm)	3 distinct frame sizes (refer to the section 9.4)	
ENVIRONMENTAL CONDITIONS	Temperature	0 to 40 °C (up to 50 °C with reduction of 2.5 % / °C at the output current)	
	Humidity	5 to 90 % without condensation	
	Altitude	0 to 1000 m (up to 4000 m with reduction of 10 % / 1000 m)	
	Pollution degree	2	
FINISHING	Color	Gray ultra dull (Doors)	
		Blue ultra dull (Base, Roof, Shutter)	
CONTROL	Microprocessor	32 bits	
	Control method	Sinusoidal SVM (Space Vector Modulation) PWM and optimum pulses (OPP) Digital	
	Type of control	Scalar (Imposed voltage - V/F), Vector (encoder and sensorless)	
	Switching	High voltage IGBT Transistor (HV – IGBT)	
	Frequency variation	0 to 100 Hz	
	Admissible overload	150 % during 60 sec once every 10 min. (1.5 x Inom. – CT) 115 % during 60 sec once every 10 min. (1.15 x Inom. – VT)	
	Efficiency	Higher than 98.5 %	
PERFORMANCE	Speed control	V/F	Regulation: 1 % of nominal speed with slip compensation
			Resolution: 1 rpm (reference via keyboard)
		Sensorless	Regulation: 0.5 % of nominal speed
			Speed variation range: 1:100
		With Encoder (use EBA or EBB board)	Regulation: ±0.01 % of nominal speed with 14-bits analog input (EBA); ±0.01 % of nominal speed with digital reference (Keypad, Serial, Fieldbus, Electronic Potentiometer, Multispeed); ±0.1 % of nominal speed with 10-bits analog input (CC9).
INPUTS	Analog	2 programmable differential inputs (10 bits): 0 to 10 V, 0 to 20 mA or 4 to 20 mA	
		1 programmable bipolar input (14 bits): -10 to +10 V, 0 to 20 mA or 4 to 20 mA(1)	
		1 programmable isolated input (10 bits): 0 to 10 V, 0 to 20 mA or 4 to 20 mA(1)	
		1 programmable isolated input (10 bits): 0 to 10 V, 0 to 20 mA or 4 to 20 mA	
	Digital	8 programmable isolated inputs: 24 Vdc	
		1 programmable isolated input: 24 Vdc(1)	
		1 programmable isolated input: 24 Vdc (for thermistor - motor PTC)(1)	
OUTPUTS	Analog	2 programmable outputs (11 bits): 0 to 10 V	
		2 bipolar programmable outputs (14 bits): (-10 to +10)V(1)	
		2 isolated programmable outputs (11 bits): 0 to 20 mA or 4 to 20 mA (1)	
		2 isolated programmable outputs (11 bits): 0 to 20 mA or 4 to 20 mA	
	Relay	5 programmable outputs, contacts NO/NC: 240 Vac, 1 A	
	Transistor	2 programmable isolated open collector outputs: 24 Vdc, 50 mA(1)	

(1) Optional

COMMUNICATION	Serial Interface	RS-232 (point to point)	
		RS-485, isolated, via EBA or EBB boards (multipoint up to 30 inverters)(1)	
	Fieldbus Network	Modbus-RTU (incorporated software) via RS-485 serial interface	
		Profibus DP or DeviceNet via additional KFB kits(1)	
PROTECTIONS	Protections (memory of the last 100 faults/ alarms with date and time)	DC link overvoltage	Short-circuit at the output
		DC link undervoltage	Phase-ground short-circuit at the output
		Overtemperature at the inverter and at the motor	External fault
		Overcurrent at the output	Self-diagnoses fault and programming error
		Motor overload (I x t)	Serial communication fault
		Braking resistor overload	Phase loss at the input
		CPU (watchdog)/EEPROM fault	HMI-MVW-01 connection fault
		Incremental encoder fault	
APPLICABLE STANDARDS	EMC	EMC directive 89 / 336 / EEC – industrial ambient	
		EN 61800-3 (EMC – Emission and Immunity)	
	CEI – IEC 61800	Adjustable Speed Electrical Power Drive System	
		Part 4 – General Requirements	
		Part 5 – Safety Requirements	
HUMAN-MACHINE INTERFACE	Command	Start/Stop, Parameterization (Programming of general functions)	
		Increase/decrease the speed	
		JOG, Forward/Reverse selection, Local/Remote selection	
	Supervision (Reading)	Speed reference (rpm)	
		Motor speed (rpm)	
		Value proportional to the speed (E.g.: m/min)	
		Motor frequency (Hz)	
		DC link voltage (V)	
		Motor torque %	
		Output power (kW)	
		Energized time (h)	
		Operation time (h)	
		Motor current (A)	
		Motor voltage (V)	
		Inverter status	
		Digital input status	
		Digital output status	
		Relay output status	
		Analog input values	
		100 last errors, with date and time record	
		Fault/alarm messages	
RESOURCES / AVAILABLE FUNCTIONS	Options	Remote NEMA 4 Human-Machine Interface (LCD)	
		Cable for remote HMI connection (1, 2, 3, 5, 7.5 and 10 m)	
		Blank cover for local HMI	
		Blank cover for remote HMI	
		Remote HMI frame kit	
		Function expansion boards	
		Fieldbus network communication kits (internal inverter installation)	Profibus DP
			DeviceNet
		SuperDrive kit with RS-232 serial communication interface (Inverter - PC)	

(1) Optional

9.2 AVAILABLE MODELS

Nominal Voltage (V)	Constant Torque Loads - CT[1]					Variable Torque Loads - VT [2]					Frame Size
	Rated Output Current (A)	Maximum Output Current (A)	Applicable Motor Power[2]		Nominal Power Losses (kW)	Rated Output Current (A)	Maximum Output Current (A)	Applicable Motor Power		Nominal Power Losses (kW)	
			(HP)	(kW)				(HP)	(kW)		
2300	120	180	500	400	4.35	137	161	600	450	4.69	A
	140	210	600	450	4.69	160	190	700	500	5.14	
	165	247.5	700	500	5.14	175	201	750	560	5.32	
	175	262.5	750	560	5.32	200	242	900	710	6.00	
	210	315	900	710	6.00	240	288	1000	750	6.82	
	250	375	1000	800	6.82	280	322	1250	900	7.47	
	280	420	1250	900	7.47	320	391	1500	1120	8.85	
	386	579	1750	1250	10.80	440	518	2000	1400	12.65	B
	450	675	2000	1400	12.65	490	564	2250	1600	13.89	
	490	735	2250	1600	13.89	560	644	2500	1800	16.19	
	560	840	2500	1800	16.19	640	748	3000	2200	19.45	
3300	85	127.5	500	400	4.71	97	15	600	450	5.14	A0
	100	150	600	450	5.14	112	128	700	500	5.51	
	112	168	700	500	5.51	128	158	800	630	6.36	
	85	127.5	500	400	4.71	97	115	600	450	5.14	A
	100	150	600	450	5.14	112	128	700	500	5.51	
	112	168	700	500	5.51	128	158	800	630	6.36	
	138	207	800	630	6.36	150	172	900	710	6.78	
	150	225	900	710	6.78	160	184	1000	800	7.15	
	160	240	1000	800	7.15	182	214	1250	900	8.15	
	186	279	1250	900	8.15	212	270	1500	1120	10.26	
	235	352.5	1500	1120	10.26	265	305	1750	1250	11.68	
	265	397.5	1750	1250	11.68	302	356	2000	1400	14.01	
	310	465	2000	1400	14.01	354	420	2250	1600	17.16	
	375	562.5	2500	1800	16.68	428	494.5	2750	2000	19.17	C
	500	750	3000	2200	22.37	571	667	3750	2800	26.05	
	580	870	3750	2800	26.05	650	747.5	4000	3000	29.29	
4160	70	105	500	400	5.14	80	92	600	450	5.43	A0
	80	120	600	450	5.43	91	108	700	500	5.85	
	94	141	700	500	585	110	126	800	630	6.38	
	110	165	800	630	6.38	120	138	900	710	6.72	
	70	105	500	400	5.14	80	92	600	450	5.43	A
	80	120	600	450	5.43	91	108	700	500	5.85	
	94	141	700	500	585	107	126	800	630	6.38	
	110	165	800	630	6.38	120	138	900	710	6.72	
	120	180	900	710	6.72	130	150	1000	800	7.07	
	130	195	1000	800	7.07	148	184	1250	900	8.21	
	162	243	1250	900	8.29	170	195	1350	1000	8.62	
	170	255	1350	1000	862	188	216	1500	1120	9.38	
	188	282	1500	1120	9.38	214	282	1750	1300	12.07	
	250	375	2000	1400	12.31	286	328	2250	1600	14.23	
	300	450	2250	1600	14.31	342	410.6	2750	2000	17.07	C
	357	535.5	3000	2200	17.07	408	517.5	3500	2600	21.60	
	475	712.5	4000	2900	22.83	542	625.6	4500	3300	26.22	

NOTES:

(1)

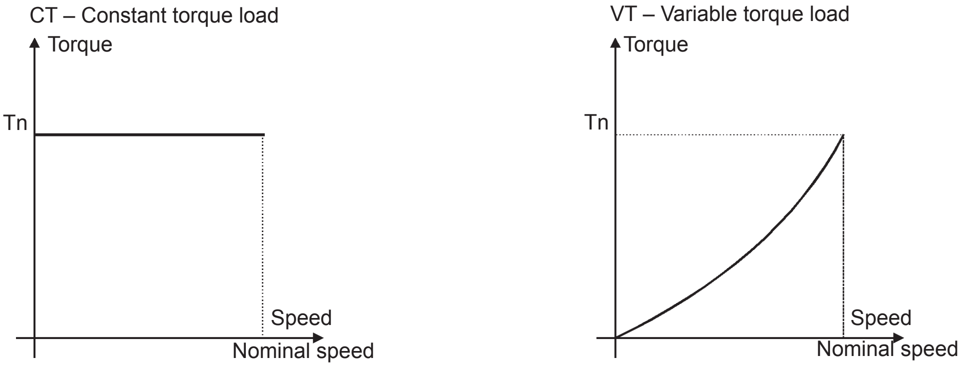


Figure 9.1 *- Load characteristics*

(2)

The showed motor power value is only orientative, and the correct inverter selection must be done considering the nominal current of the motor to be used, as well as the overload conditions related to the application.

☑ The nominal input currents are equal or less than the nominal output currents.

☑ The maximum allowed currents are allowed during 60 seconds every 10 minutes.

9.3 OPTIONAL DEVICES

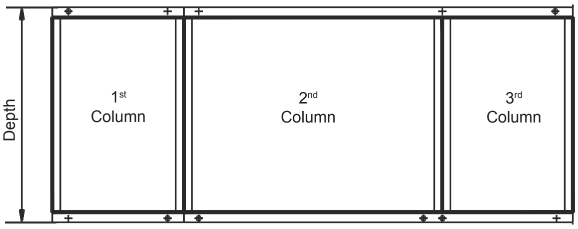
9.3.1 Expansion Function Board EBA

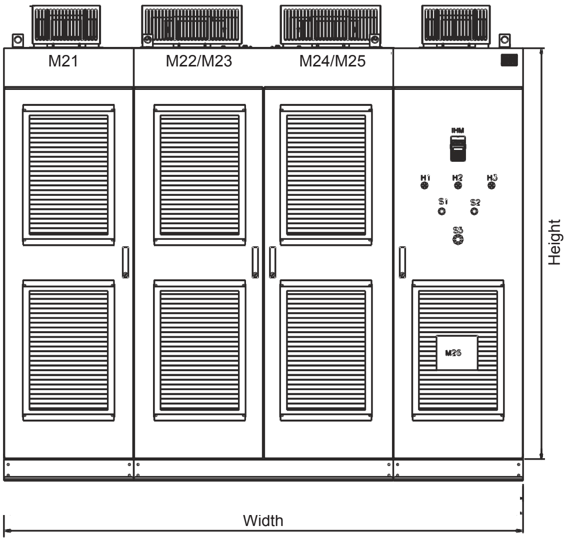
COMMUNICATION	Serial interface	☑ Isolated RS-485 serial interface (the RS-485 and RS-232 serial interfaces cannot be used simultaneously)
INPUTS	Analog	☑ 1 bipolar analog input (AI4): -10 V to +10 V; 0 to 20 mA or 4 to 20 mA; Linearity: 14 bits (0.006 % of 10 V range). Programmable functions
	Incremental encoder	☑ Incremental encoder feedback input: Internal 12 Vdc, 200 mA max isolated power supply. Differential inputs A, $\overline{A}$, B, $\overline{B}$, Z and $\overline{Z}$ signals (100 kHz max) 14 bits resolution. Used as speed feedback for the speed regulator and digital speed measurement
	Digital	☑ 1 programmable isolated 24 Vdc digital input (DI7) ☑ Programmable digital input (DI8). For motor PTC- thermistor Actuation: 3.9 kΩ, Release: 1.6 kΩ
OUTPUTS	Analog	☑ 2 bipolar analog outputs (AO3/AO4): -10 V to +10 V. Linearity: 14 bits (0.006 % of ±10 V range). Programmable functions
	Encoder	☑ Buffered encoder output: Input signal repeater; Isolated differential outputs, external power supply 5 V to 15 V
	Digital	☑ 2 isolated transistor outputs (DO1/DO2): Open collector, 24 Vdc, 50 mA. Programmable functions

9.3.2 Expansion Function Board EBB

COMMUNICATION	Serial interface	☑ Isolated RS-485 serial interface (the RS-485 and RS-232 serial interfaces cannot be used simultaneously)
INPUTS	Analog	☑ 1 isolated analog input (AI3): 0 V to 10 V or 0 to 20 mA or 4 to 20 mA Resolution: 10 bits; Programmable functions
	Incremental encoder	☑ Incremental encoder feedback input: Internal 12 Vdc, 200 mA max isolated power supply. Differential inputs A, $\overline{A}$, B, $\overline{B}$, Z and $\overline{Z}$ signals (100 kHz max) 14 bits resolution. Used as speed feedback for the speed regulator and digital speed measurement
	Digital	☑ 1 programmable isolated 24 Vdc digital input (DI7) ☑ Programmable digital input (DI8). For motor PTC- thermistor Actuation: 3.9 kΩ, Release: 1.6 kΩ
OUTPUTS	Analog	☑ 2 bipolar analog outputs (AO1'/AO2'): 0 to 20 mA or 4 to 20 mA Linearity: 11 bits (0.05 % of full scale). Programmable functions that are the ones of AO1 and AO2 of the CC9 control board
	Encoder	☑ Buffered encoder output: Input signal repeater; Isolated differential outputs, external power supply 5 V to 15 V
	Digital	☑ 2 isolated transistor outputs (DO1/DO2): Open collector, 24 Vdc, 50 mA. Programmable functions

9.4 MECHANICAL DATA





Frame size	Width	Height	Depth	Weight
	mm (in)	mm (in)	mm (in)	kg (lb)
A0	1000 (39.36)	2000 (78.73)	980 (38.60)	600 (1322.7)
A	2400 (94.48)	2190 (86.22)		1560 (3439.2)
B	2600 (102.36)			1700 (3747.8)
C	4000 (157.47)			2700 (5952.4)

Figure 9.2 *- MVW-01 complete panel dimensions*

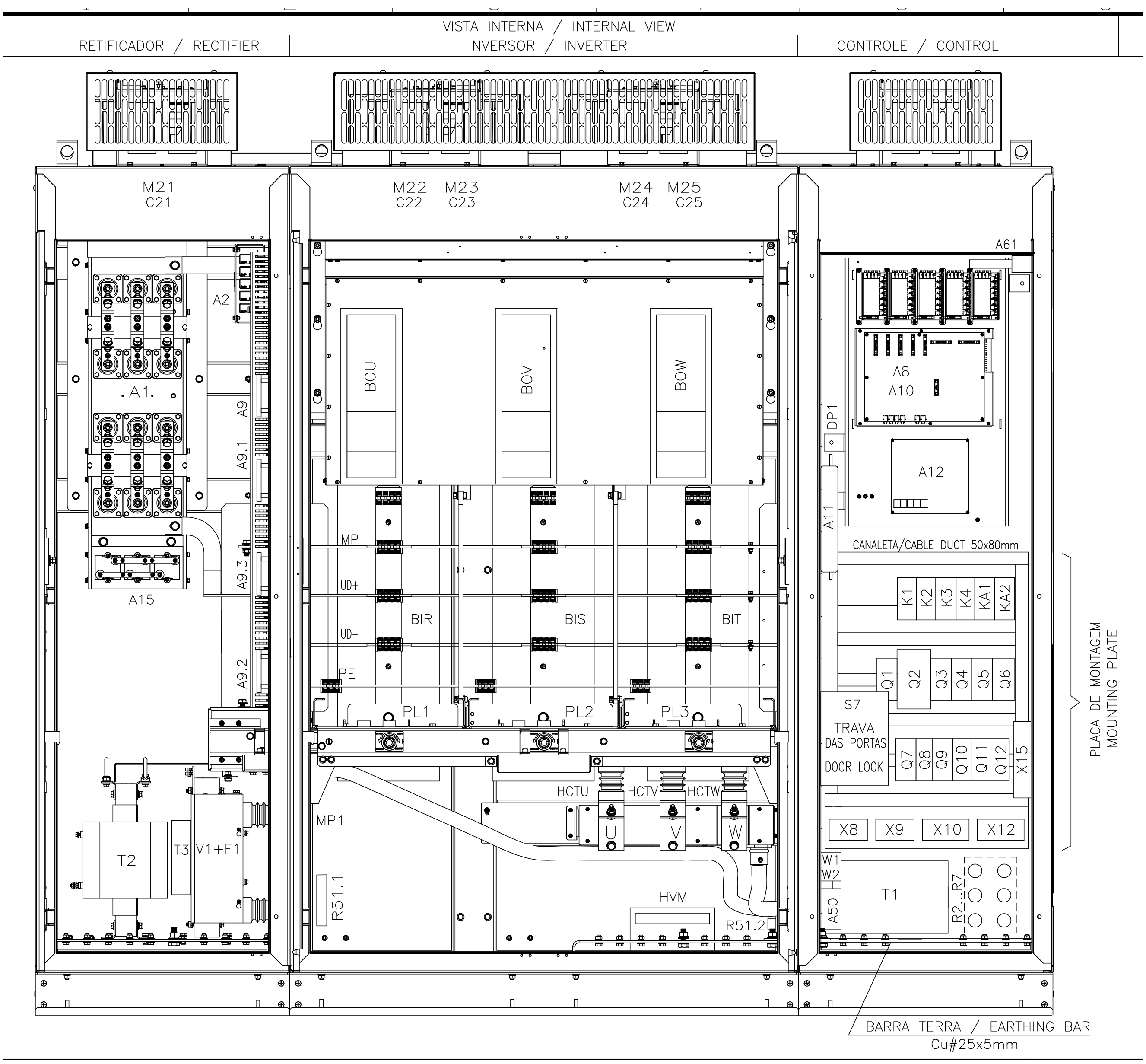
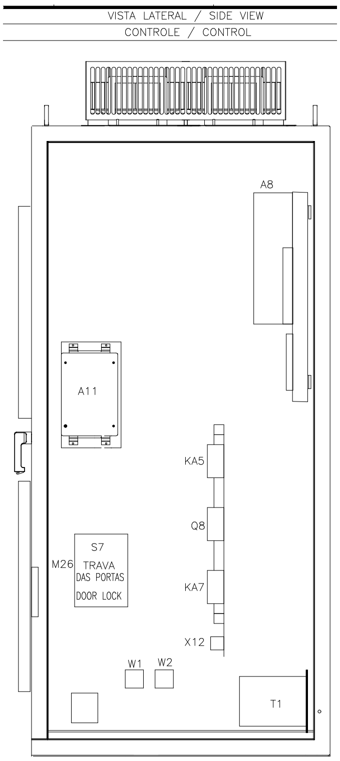
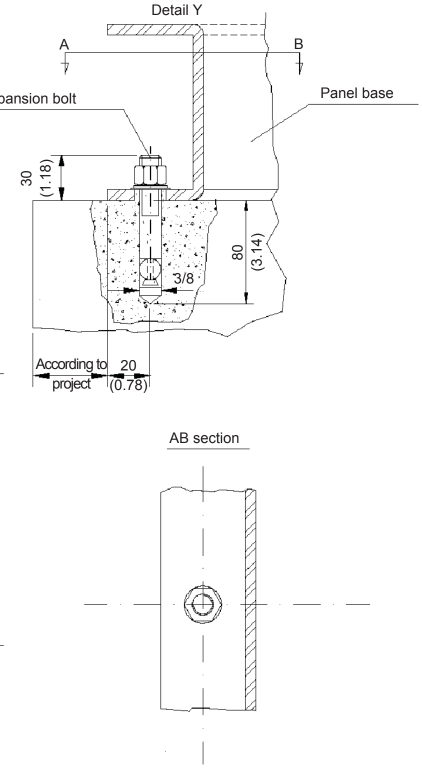
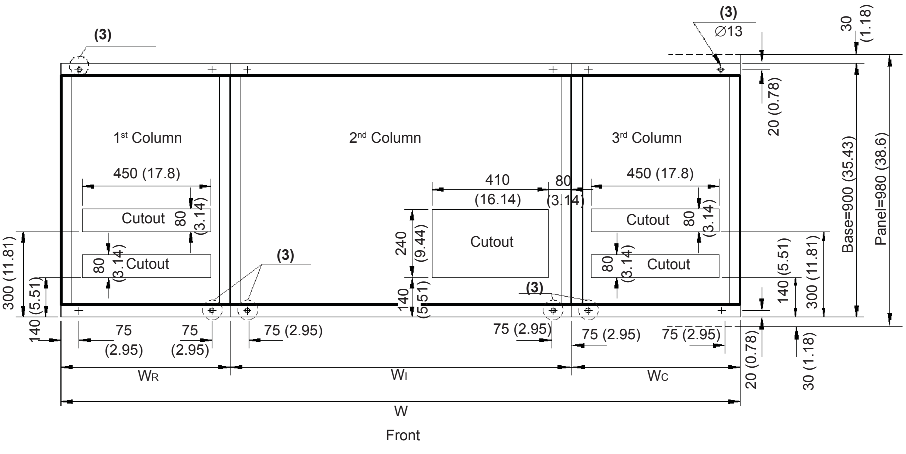


Figure 9.3 - *MVW-01 internal components distribution (frame size A)*



Notes: **(1)** Extracted from the WEG TBG-269a standard.
(2) Orientative instructions. Refer to the customer's specific project.
(3) Panel securing points at the base.





Frame size	W_R	W_I	W_C	W
	mm (in)	mm (in)	mm (in)	mm (in)
A	600 (23.62)	1200 (47.24)	600 (23.62)	2400 (94.48)
B	800 (31.5)	1200 (47.24)	600 (23.62)	2600 (102.36)
C	800 (31.5)	2 x 1200 (47.24)	800 (31.5)	4000 (157.47)

Note: A0 is composed by only one 1000 mm (39.36 in) column.
In order to get more details, refer to the figure 2.3.

Figure 9.4 *- Mechanical data - dimensions in mm (in)*

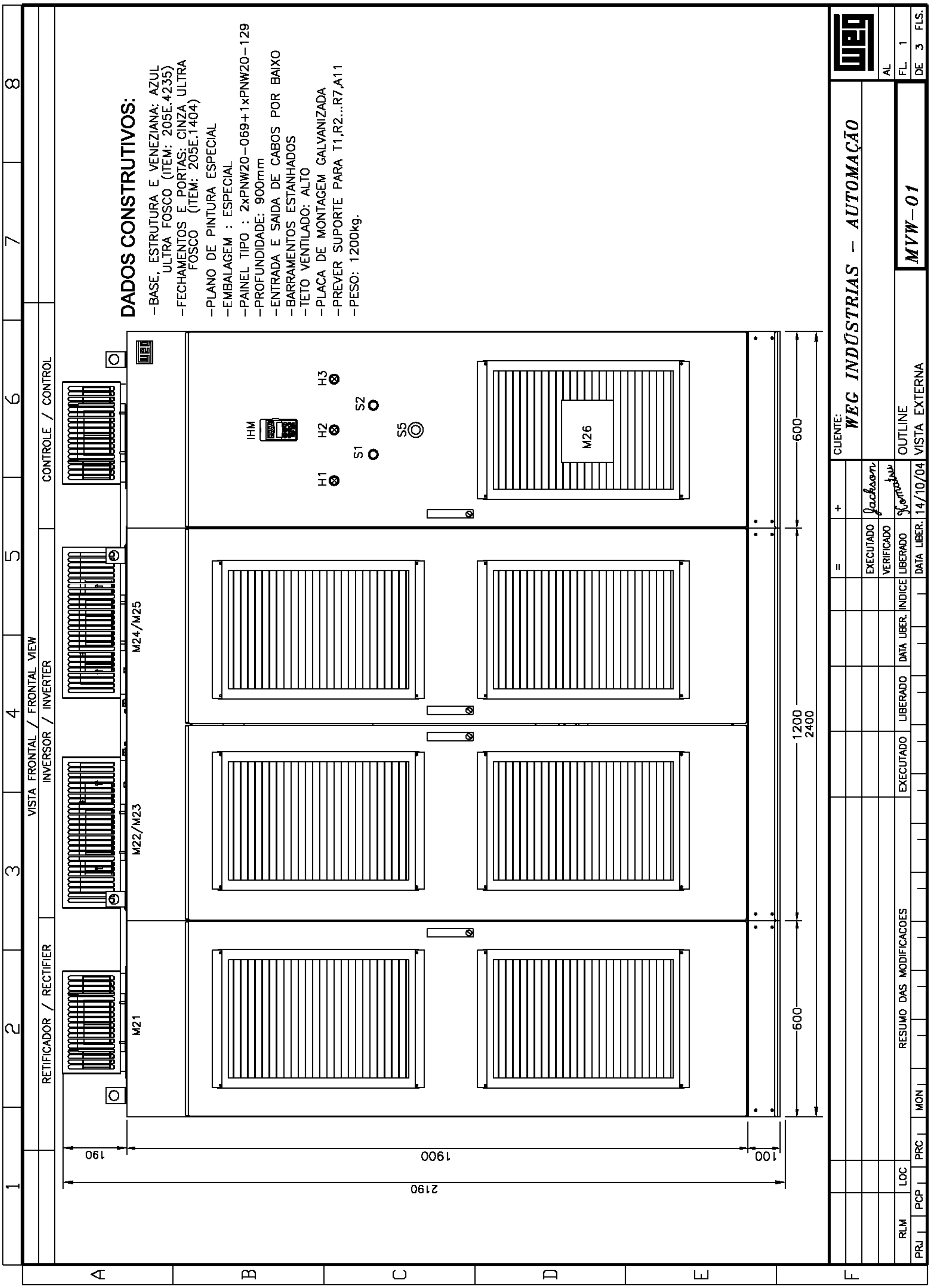
ATTACHMENT

MVW-01

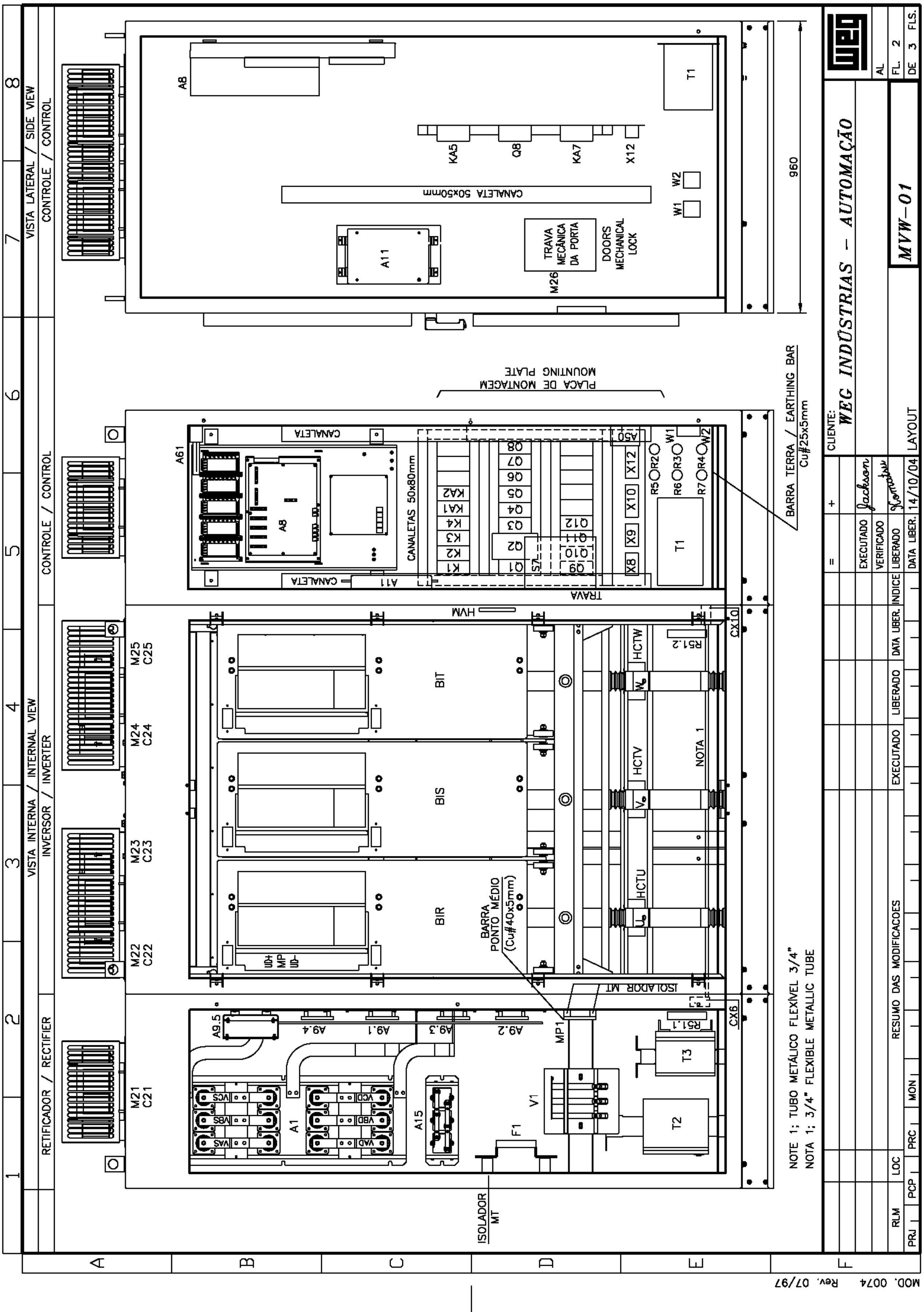
Standard Electric Design

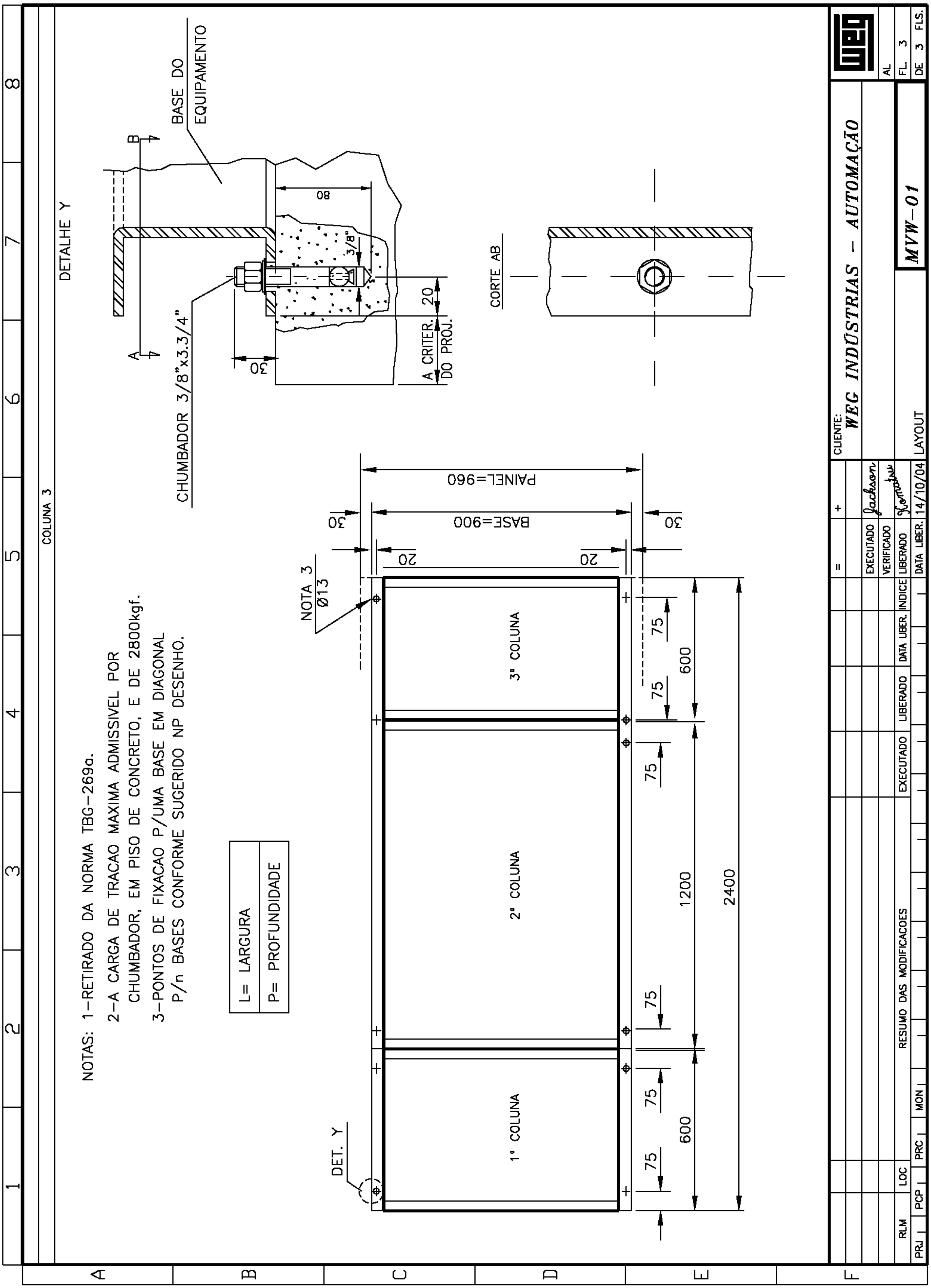
Note: In this annex, it is presented the MVW-01's standard electric project.

Also consult the documentation of the specific design that accompanies the product.

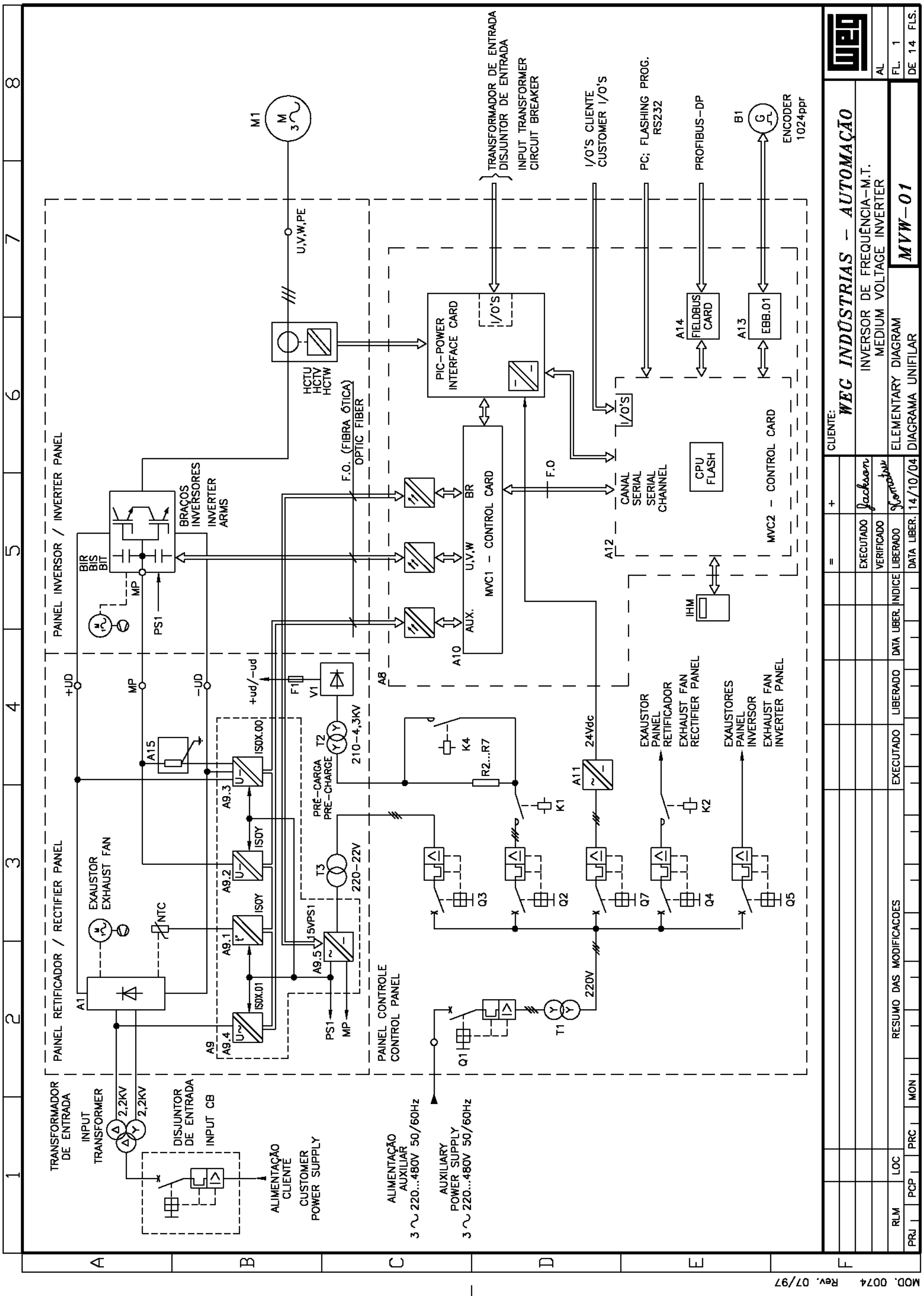

DADOS CONSTRUTIVOS:
-BASE, ESTRUTURA E VENEZIANA: AZUL ULTRA FOSCO (ITEM: 205E.4235)
-FECHAMENTOS E PORTAS: CINZA ULTRA FOSCO (ITEM: 205E.1404)
-PLANO DE PINTURA ESPECIAL
-EMBALAGEM : ESPECIAL
-PAINEL TIPO : 2xPNW20-069+1xPNW20-129
-PROFUNDIDADE: 900mm
-ENTRADA E SAIDA DE CABOS POR BAIXO
-BARRAMENTOS ESTANHADOS
-TETO VENTILADO: ALTO
-PLACA DE MONTAGEM GALVANIZADA
-PREVER SUPORTE PARA T1,R2...R7,A11
-PESO: 1200kg.
VISTA FRONTAL / FRONTAL VIEW
RETIFICADOR / RECTIFIER
INVERSOR / INVERTER
CONTROLE / CONTROL
M21
M22/M23
M24/M25
M26
IHM
H1
H2
H3
S1
S2
S5
190
1900
100
2190
600
1200
2400
600
1
2
3
4
5
6
7
8
A
B
C
D
E
F
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
MVW-01
OUTLINE
VISTA EXTERNA
=
+
EXECUTADO
Jackson
VERIFICADO
LIBERADO
DATA LIBER.
14/10/04
AL
FL. 1
DE 3 FLS.
RESUMO DAS MODIFICACOES
EXECUTADO
LIBERADO
DATA LIBER.
INDICE
RLM
PRJ
LOC
PCP
PRC
MON
MOD. 0074 Rev. 07/97

]


VISTA LATERAL / SIDE VIEW
CONTROLE / CONTROL
CONTROLE / CONTROL
VISTA INTERNA / INTERNAL VIEW
INVERSOR / INVERTER
RETIFICADOR / RECTIFIER
1
2
3
4
5
6
7
8
A
B
C
D
E
F
M21
C21
M22
C22
M23
C23
M24
C24
M25
C25
A8
KA5
Q8
KA7
X12
CANALETA 50x50mm
W1
W2
A11
M26
TRAVA MECÂNICA DA PORTA
DOORS MECHANICAL LOCK
T1
960
PLACA DE MONTAGEM
MOUNTING PLATE
BARRA TERRA / EARTHING BAR
Cu#25x5mm
A61
CANALETA
CANALETAS 50x80mm
K1
K2
K3
K4
KA1
KA2
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
S7
X8
X9
X10
X12
A50
R2
R3
R4
R5
R6
R7
TRAVA
HVM
CX10
R51.2
HCTW
HCTV
HCTU
W
V
U
BIT
BIS
BIR
NOTA 1
BARRA PONTO MÉDIO
(Cu#40x5mm)
UD+
MP
UD-
ISOLADOR MT
CX6
A9.5
A9.4
A9.1
A9.3
A9.2
MP1
R51.1
T3
VCS
VBS
VAS
VCD
VBD
VAD
A1
A15
V1
F1
T2
ISOLADOR MT
NOTE 1: TUBO METÁLICO FLEXÍVEL 3/4"
NOTA 1: 3/4" FLEXIBLE METALLIC TUBE
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
MVW-01
LAYOUT
AL
FL. 2
DE 3 FLS.
EXECUTADO Jackson
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
INDICE
DATA UBER.
LIBERADO
EXECUTADO
RESUMO DAS MODIFICACOES
MON
PRC
LOC
PCP
RLM
PRJ
MOD. 0074 Rev. 07/97


NOTAS: 1-RETIRADO DA NORMA TBG-269a.
2-A CARGA DE TRACAO MAXIMA ADMISSIVEL POR CHUMBADOR, EM PISO DE CONCRETO, E DE 2800kgf.
3-PONTOS DE FIXACAO P/UMA BASE EM DIAGONAL P/n BASES CONFORME SUGERIDO NP DESENHO.

L=	LARGURA
P=	PROFUNDIDADE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INPUT TRANSFORMER
2,2KV
2,2KV
DISJUNTOR DE ENTRADA
INPUT CB
ALIMENTAÇÃO CLIENTE
CUSTOMER POWER SUPPLY
ALIMENTAÇÃO AUXILIAR
3 ~ 220...480V 50/60Hz
AUXILIARY POWER SUPPLY
3 ~ 220...480V 50/60Hz
PAINEL RETIFICADOR / RECTIFIER PANEL
PAINEL INVERSOR / INVERTER PANEL
PAINEL CONTROLE
CONTROL PANEL
EXAUSTOR
EXHAUST FAN
NTC
A1
A9
A9.1
A9.2
A9.3
A9.4
A9.5
A15
ISOX.00
ISOX.01
ISOY
ISOY
15VPS1
PS1
MP
+UD
-UD
MP
+ud/-ud
F1
V1
T2
PRÉ-CARGA
PRE-CHARGE
210-4,3KV
T3
220-22V
BIR
BIS
BIT
PS1
MP
BRAÇOS INVERSORES
INVERTER ARMS
HCTU
HCTV
HCTW
F.O. (FIBRA ÓTICA)
OPTIC FIBER
U,V,W,PE
M1
M
3~
A8
A10
AUX.
U,V,W
BR
MVC1 - CONTROL CARD
PIC-POWER INTERFACE CARD
I/O'S
F.O
CANAL SERIAL
SERIAL CHANNEL
CPU FLASH
I/O'S
A12
MVC2 - CONTROL CARD
IHM
A14
FIELDBUS CARD
A13
EBB.01
TRANSFORMADOR DE ENTRADA
DISJUNTOR DE ENTRADA
INPUT TRANSFORMER
CIRCUIT BREAKER
I/O'S CLIENTE
CUSTOMER I/O'S
PC; FLASHING PROG.
RS232
PROFIBUS-DP
B1
G
ENCODER
1024ppr
Q1
T1
220V
Q3
Q2
Q7
Q4
Q5
K1
K2
K4
R2...R7
A11
24Vdc
EXAUSTOR PAINEL RETIFICADOR
EXHAUST FAN RECTIFIER PANEL
EXAUSTORES PAINEL INVERSOR
EXHAUST FAN INVERTER PANEL
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELEMENTARY DIAGRAM
DIAGRAMA UNIFILAR
MVW-01
AL
FL. 1
DE 14 FLS.
EXECUTADO
VERIFICADO
LIBERADO
DATA LIBER.
14/10/04
INDICE
DATA LIBER.
LIBERADO
EXECUTADO
RESUMO DAS MODIFICACOES
RLM
PRJ
PCP
LOC
PRC
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A
B
C
D
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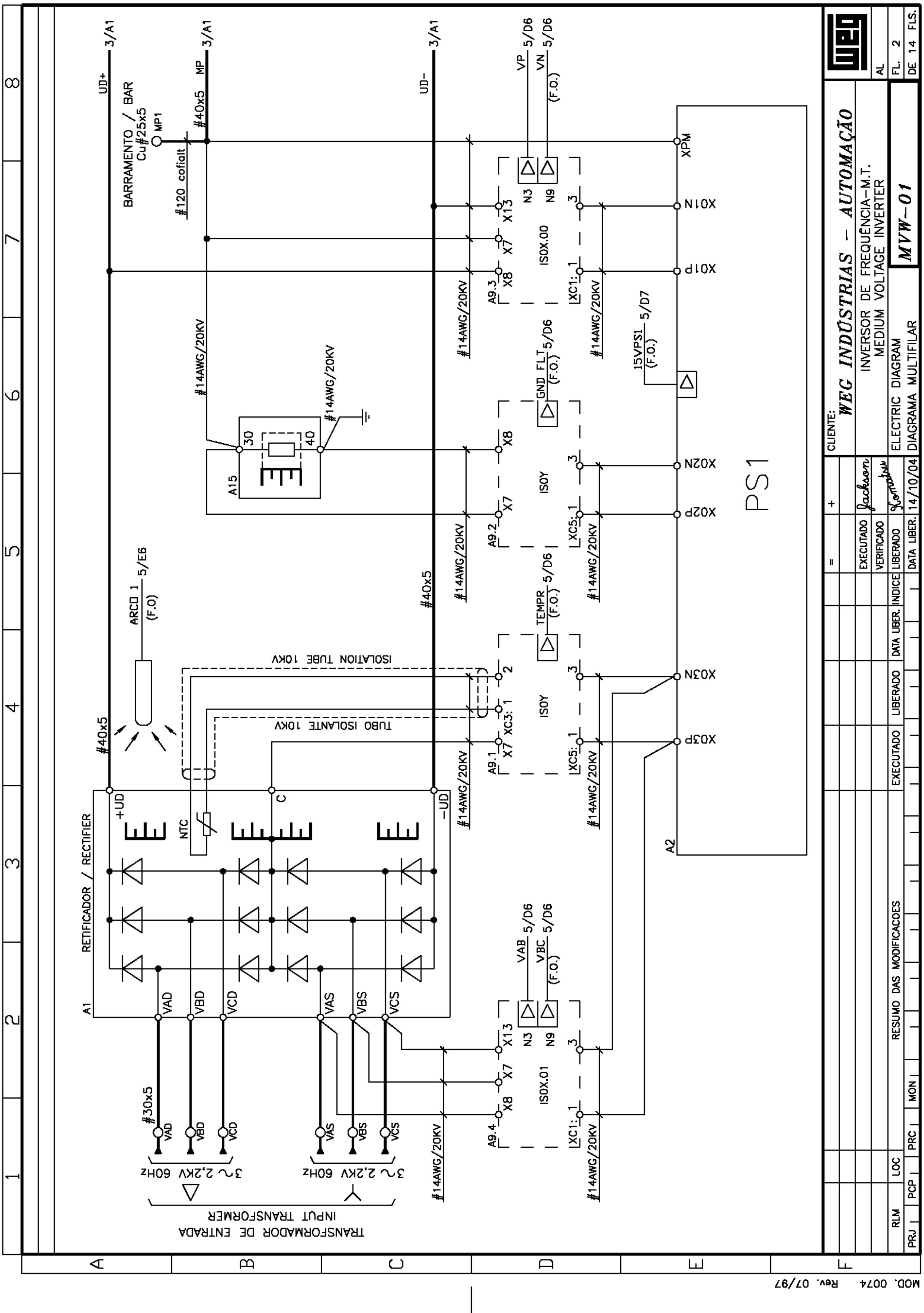
F
MOD. 0074 Rev. 07/97


TRANSFORMADOR DE ENTRADA
INPUT TRANSFORMER
3~ 2,2KV 60Hz
3~ 2,2KV 60Hz
VAD VBD VCD VAS VBS VCS
#30x5
RETIFICADOR / RECTIFIER
A1
NTC
+UD
-UD
C
#40x5
UD+ 3/A1
UD- 3/A1
MP 3/A1
BARRAMENTO / BAR Cu#25x5
MP1
#120 cofialt
A15
30
40
ARC 1 5/E6 (F.O)
ISOLATION TUBE 10KV
TUBO ISOLANTE 10KV
#14AWG/20KV
A9.1 X7 XC3: 1 2
A9.2 X7 X8
A9.3 X8 X7 X13
A9.4 X8 X7 X13
ISOY
ISOY
ISOX.00
ISOX.01
XC5: 1 3
XC1: 1 3
N3 N9
TEMPR 5/D6 (F.O.)
GND FLT 5/D6 (F.O.)
VP 5/D6
VN 5/D6 (F.O.)
VAB 5/D6
VBC 5/D6 (F.O.)
15VPS1 5/D7 (F.O.)
XPM
X01N X01P
X02N X02P
X03N X03P
A2
PS1
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW-01
AL
FL. 2
DE 14 FLS.
EXECUTADO Jackson
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
RESUMO DAS MODIFICACOES
INDICE DATA LIBER. LIBERADO EXECUTADO
PRJ RLM PCP LOC PRC MON
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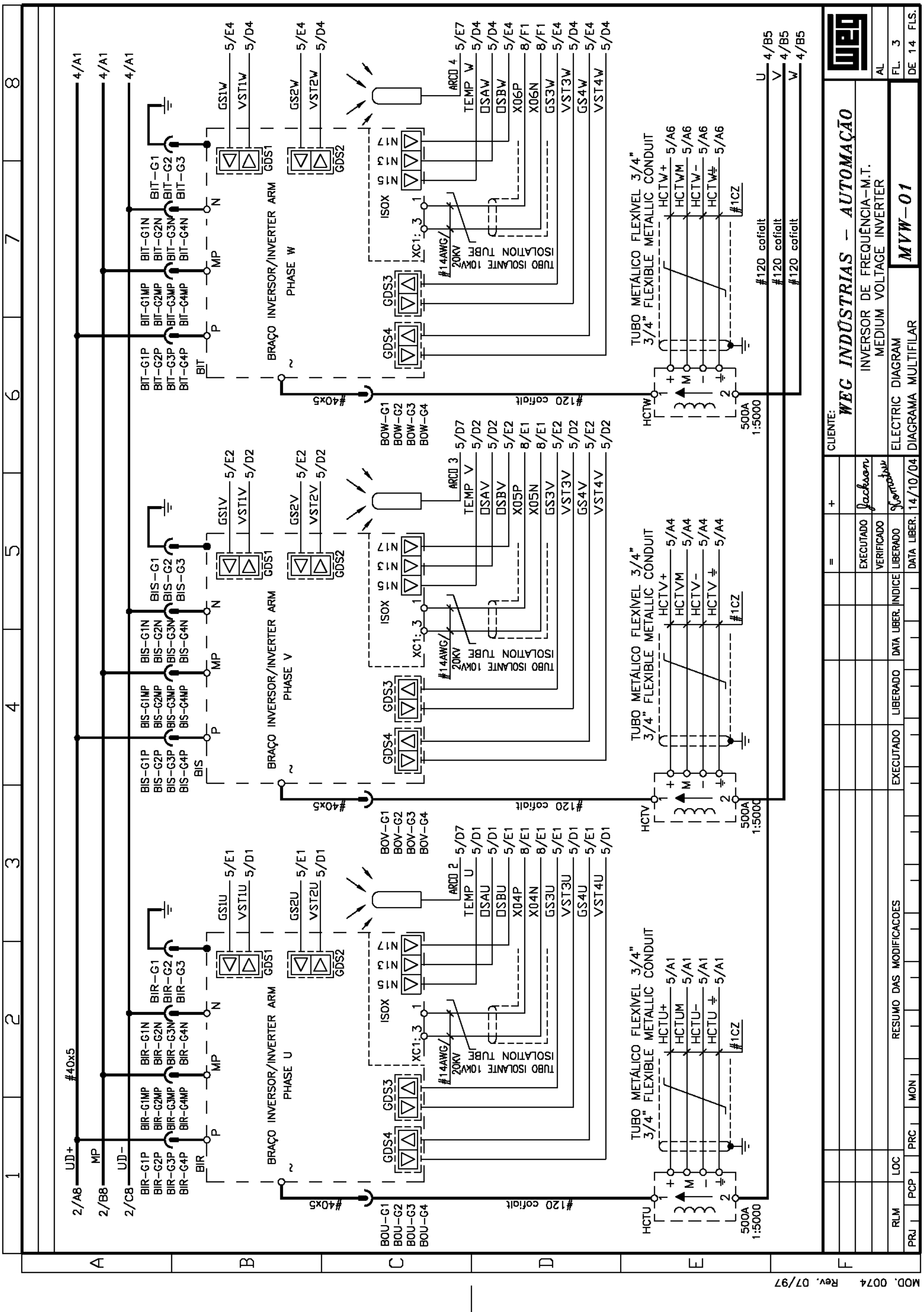
A B C D E F
MOD. 0074 Rev. 07/97


WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW-01
FL. 3
DE 14 FLS.
AL
CLIENTE:
EXECUTADO
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
RESUMO DAS MODIFICACOES
MOD. 0074 Rev. 07/97
BRAÇO INVERSOR/INVERTER ARM PHASE U
BRAÇO INVERSOR/INVERTER ARM PHASE V
BRAÇO INVERSOR/INVERTER ARM PHASE W
UD+
MP
UD-
2/A8
2/B8
2/C8
4/A1
#40x5
BIR
BIS
BIT
GDS1
GDS2
GDS3
GDS4
ISOX
XC1: 3
#14AWG/20KV
TUBO ISOLANTE 10KV/ISOLATION TUBE
TEMP U
TEMP V
TEMP W
ARCO 2
ARCO 3
ARCO 4
#120 cofialt
HCTU
HCTV
HCTW
500A 1:5000
TUBO METÁLICO FLEXÍVEL 3/4" 3/4" FLEXIBLE METALLIC CONDUIT
#1CZ
U 4/B5
V 4/B5
W 4/B5
A
B
C
D
E
F
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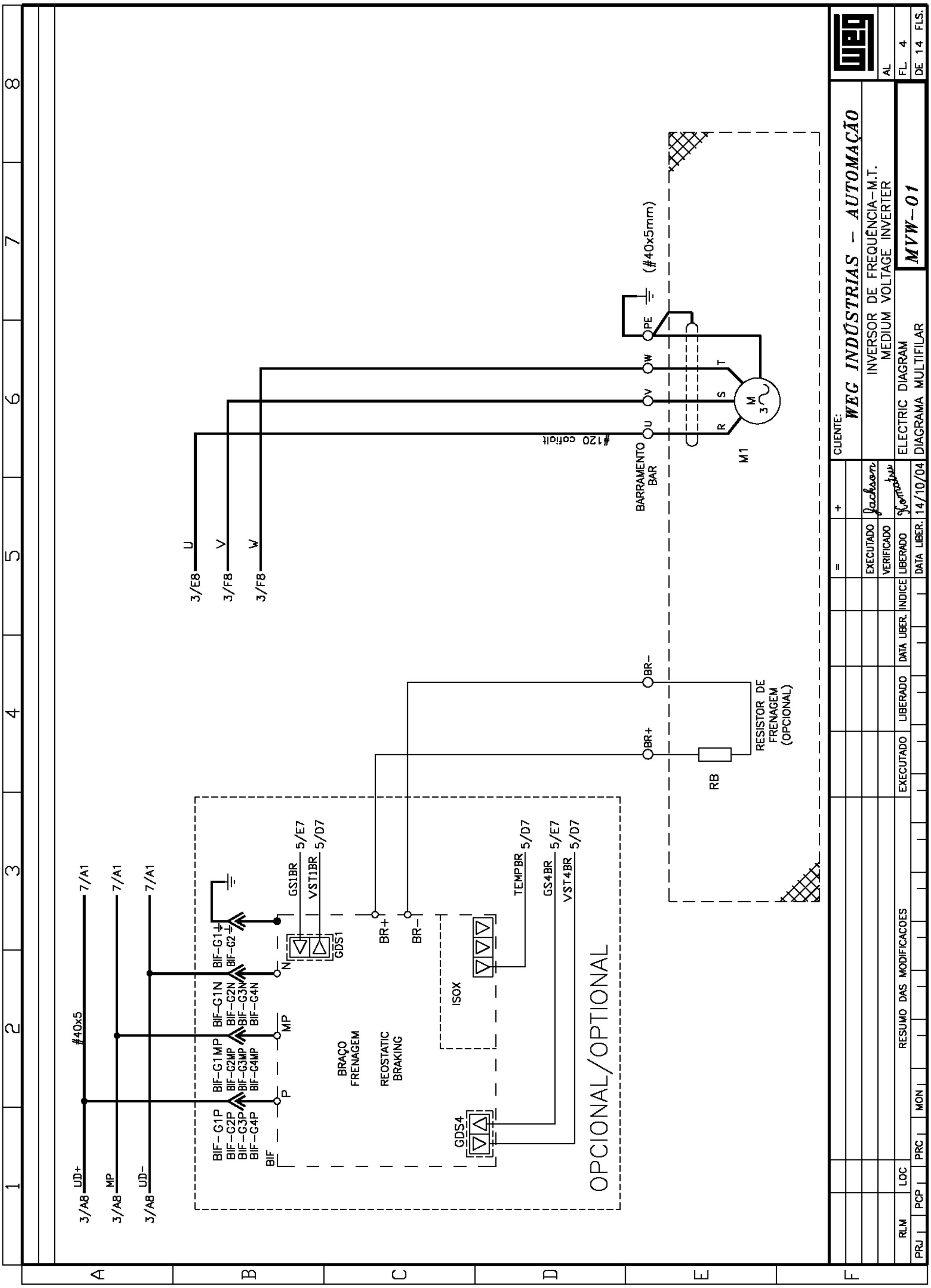
2
3
4
5
6
7
8


3/A8
UD+
3/A8
MP
3/A8
UD-
#40x5
7/A1
7/A1
7/A1
BIF-G1P
BIF-G2P
BIF-G3P
BIF-G4P
BIF-G1MP
BIF-G2MP
BIF-G3MP
BIF-G4MP
BIF-G1N
BIF-G2N
BIF-G3N
BIF-G4N
BIF-G1⏚
BIF-G2⏚
BIF
P
MP
N
GDS1
GS1BR 5/E7
VST1BR 5/D7
BR+
BR-
BRAÇO
FRENAGEM
REOSTATIC
BRAKING
ISOX
TEMPBR 5/D7
GS4BR 5/E7
VST4BR 5/D7
GDS4
OPCIONAL/OPTIONAL
3/E8 U
3/F8 V
3/F8 W
#120 cofiolit
BARRAMENTO
BAR
U
V
W
PE
(#40x5mm)
R
S
T
M
3~
M1
BR+
BR-
RB
RESISTOR DE
FRENAGEM
(OPCIONAL)
1
2
3
4
5
6
7
8
A
B
C
D
E
F
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW-01
AL
FL. 4
DE 14 FLS.
EXECUTADO
Jackson
VERIFICADO
LIBERADO
Tomaselli
DATA LIBER. 14/10/04
RESUMO DAS MODIFICACOES
EXECUTADO
LIBERADO
DATA LIBER.
INDICE
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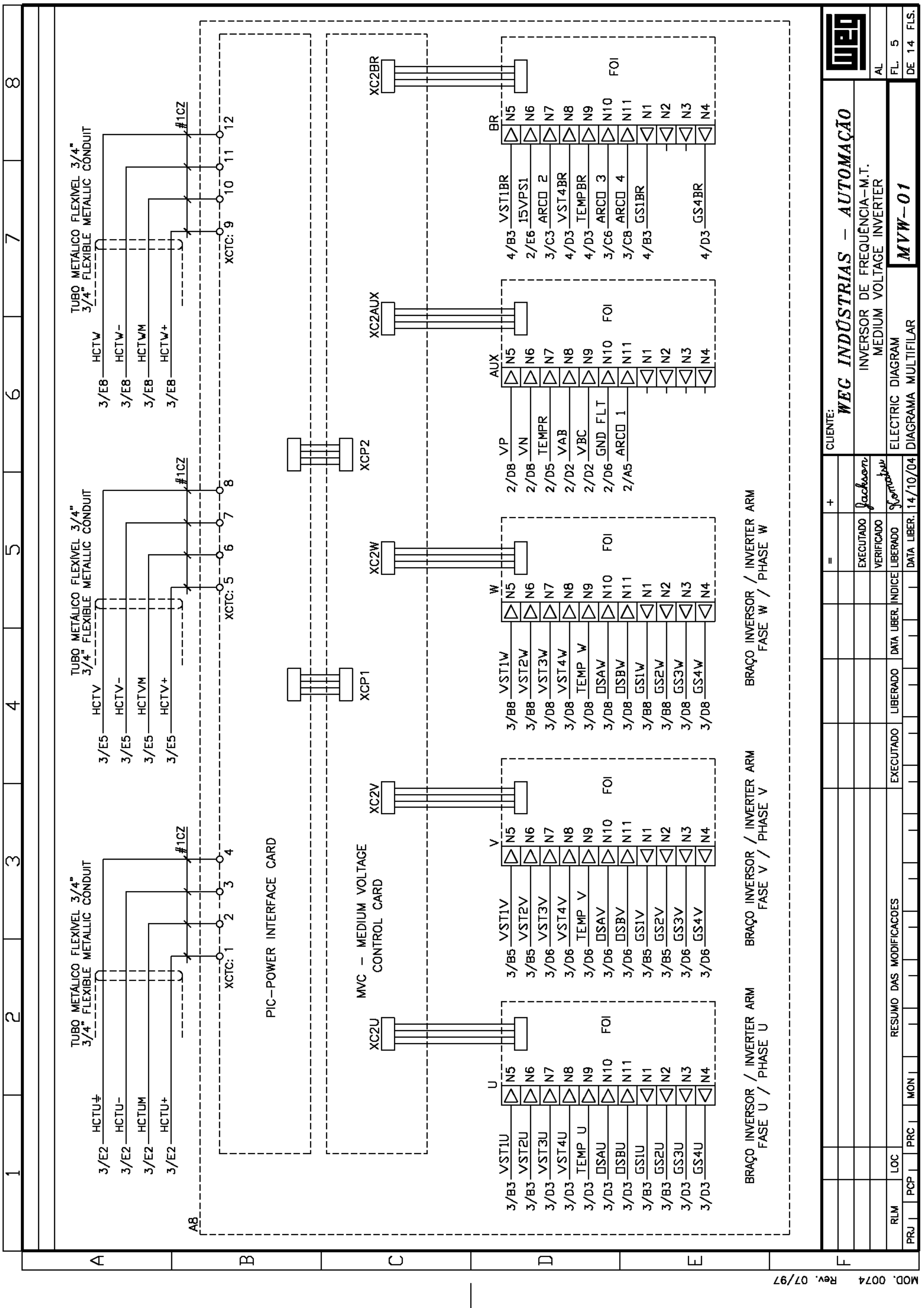
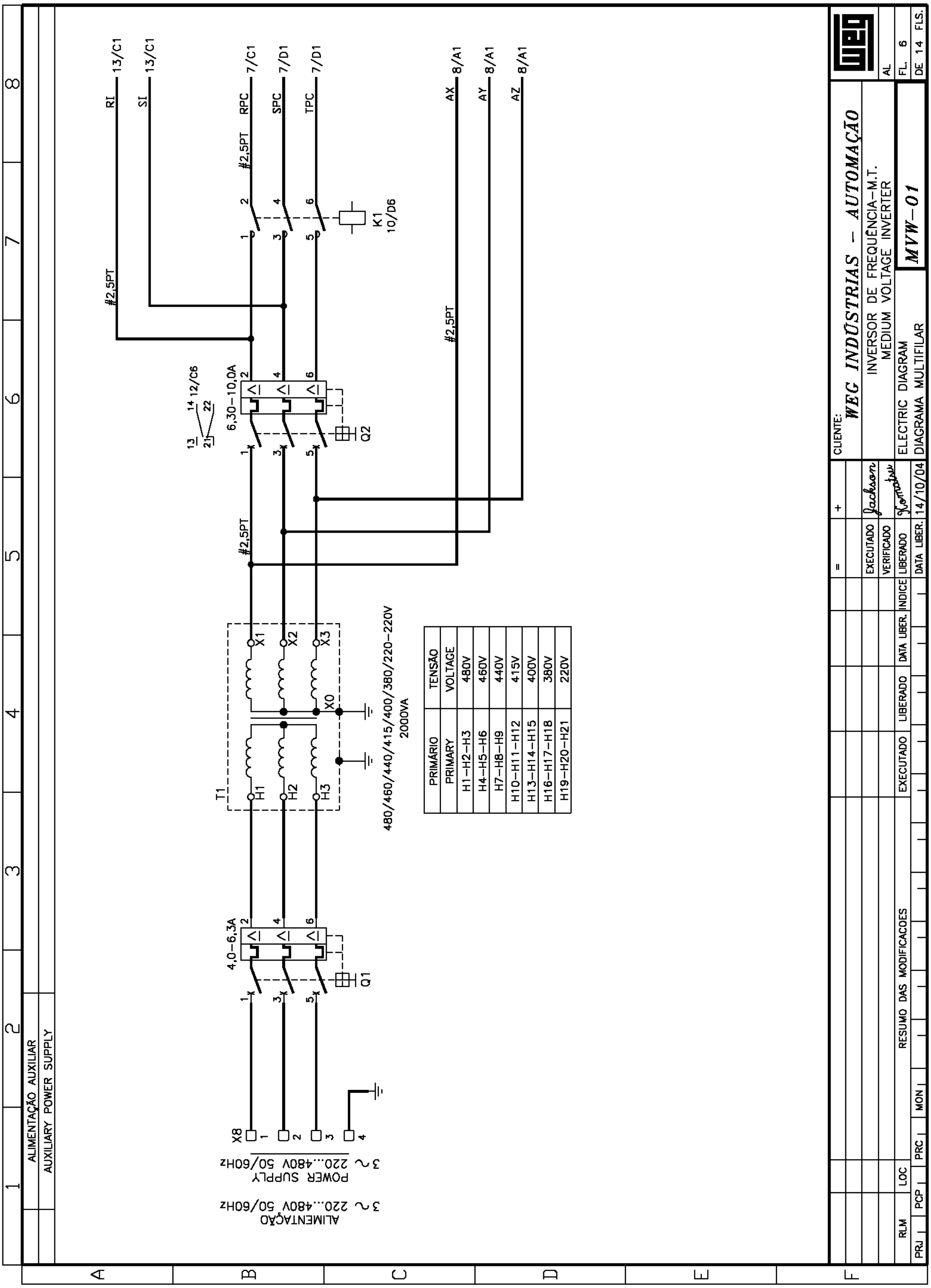
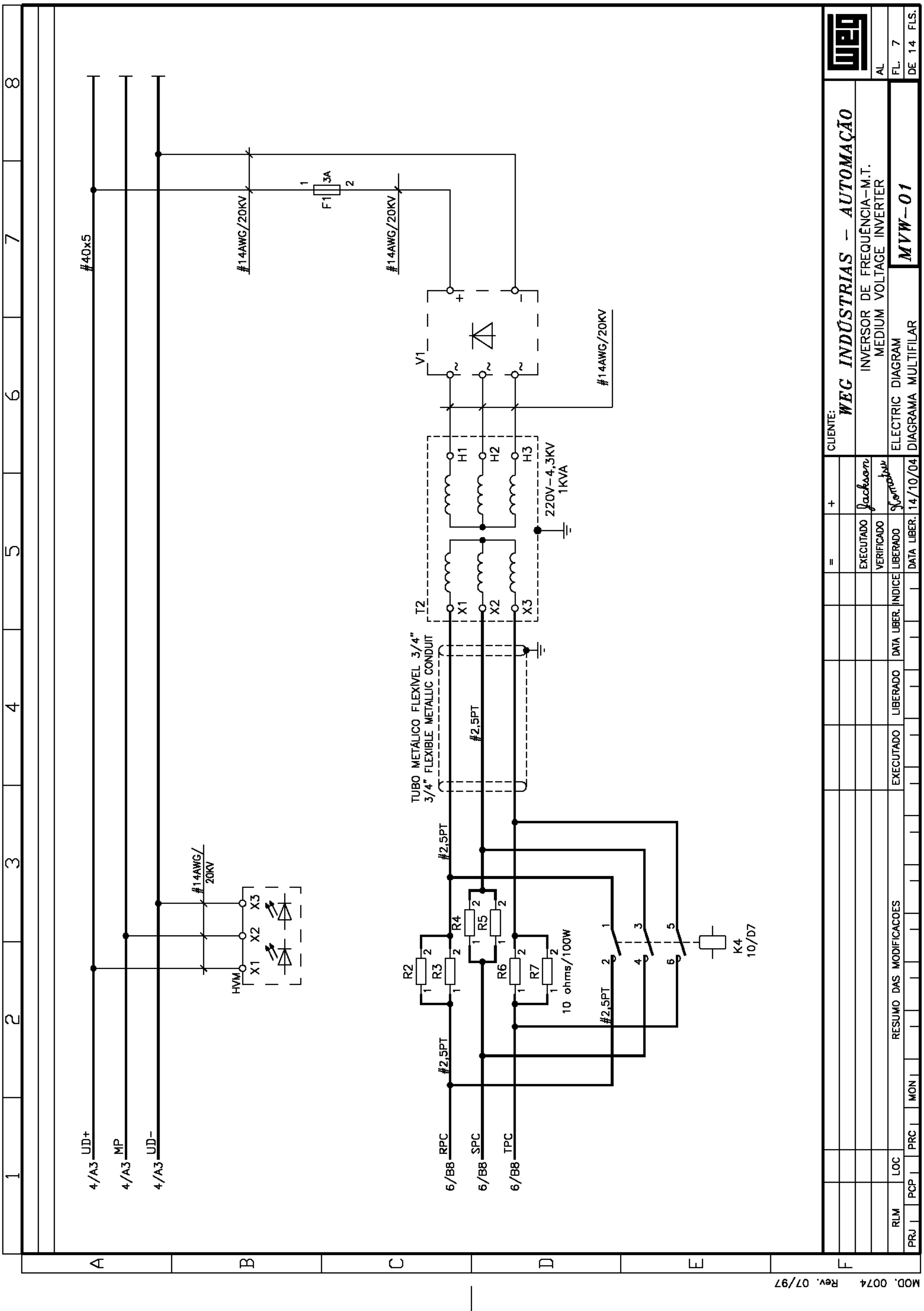
RLM
PCP
LOC
PRC
MON
MOD. 0074 Rev. 07/97



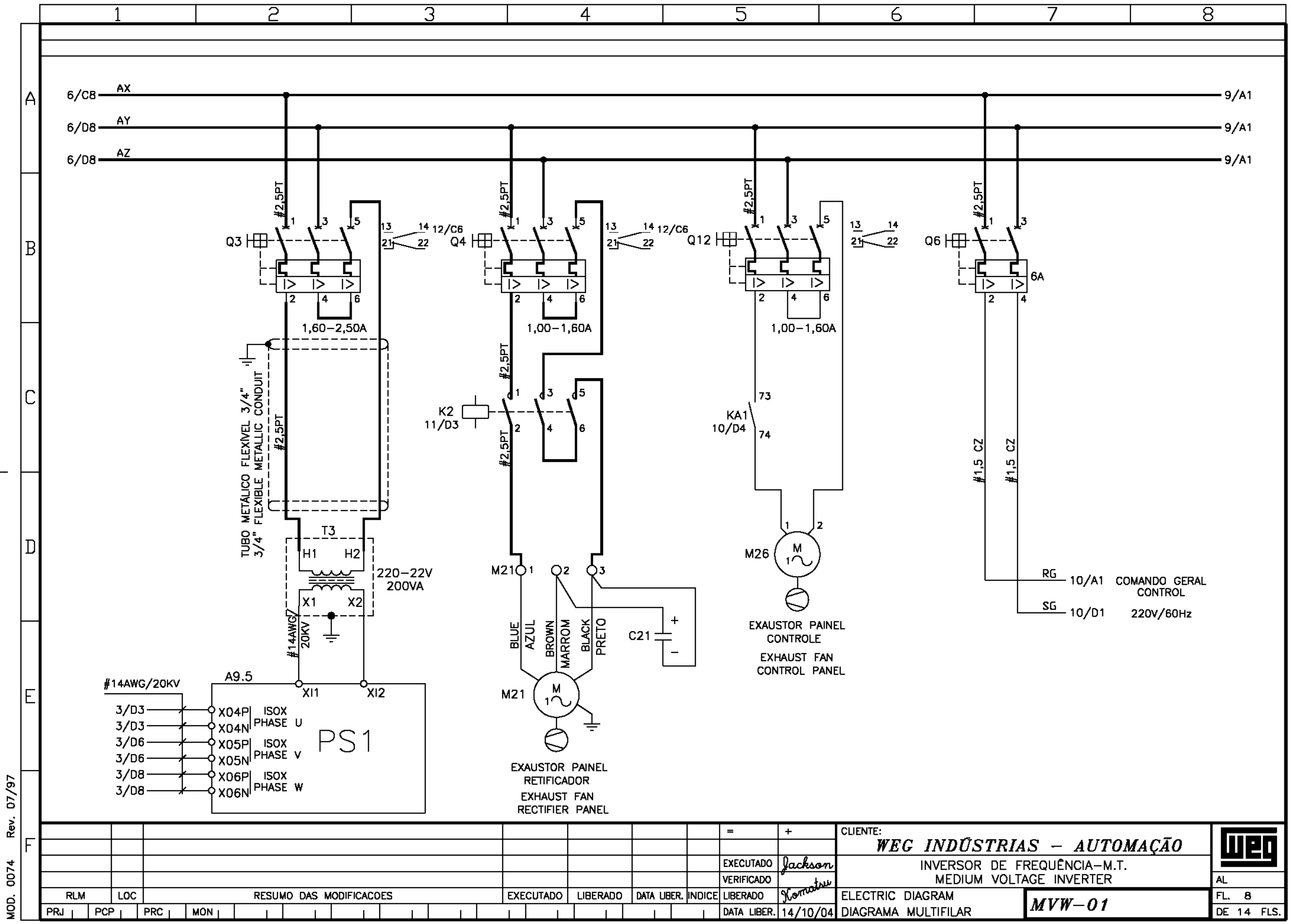
TUBO METÁLICO FLEXÍVEL 3/4"
3/4" FLEXIBLE METALLIC CONDUIT
3/E2 HCTU±
3/E2 HCTU-
3/E2 HCTUM
3/E2 HCTU+
3/E5 HCTV
3/E5 HCTV-
3/E5 HCTVM
3/E5 HCTV+
3/E8 HCTW
3/E8 HCTW-
3/E8 HCTWM
3/E8 HCTW+
#1CZ
XCTC: 1 2 3 4
XCTC: 5 6 7 8
XCTC: 9 10 11 12
PIC-POWER INTERFACE CARD
MVC - MEDIUM VOLTAGE CONTROL CARD
XCP1
XCP2
XC2U
XC2V
XC2W
XC2AUX
XC2BR
FOI
U
V
W
AUX
BR
N5 N6 N7 N8 N9 N10 N11 N1 N2 N3 N4
3/B3 VST1U
3/B3 VST2U
3/D3 VST3U
3/D3 VST4U
3/D3 TEMP U
3/D3 DSAU
3/D3 DSBU
3/D3 GS1U
3/B3 GS2U
3/B3 GS3U
3/D3 GS4U
3/B5 VST1V
3/B5 VST2V
3/D6 VST3V
3/D6 VST4V
3/D6 TEMP V
3/D6 DSAV
3/D6 DSBV
3/D6 GS1V
3/B5 GS2V
3/B5 GS3V
3/D6 GS4V
3/B8 VST1W
3/B8 VST2W
3/D8 VST3W
3/D8 VST4W
3/D8 TEMP W
3/D8 DSAW
3/D8 DSBW
3/D8 GS1W
3/B8 GS2W
3/B8 GS3W
3/D8 GS4W
2/D8 VP
2/D8 VN
2/D5 TEMPR
2/D2 VAB
2/D2 VBC
2/D6 GND FLT
2/A5 ARCD 1
4/B3 VST1BR
2/E6 15VPS1
3/C3 ARCD 2
4/D3 VST4BR
4/D3 TEMPBR
3/C6 ARCD 3
3/C8 ARCD 4
4/B3 GS1BR
4/D3 GS4BR
BRAÇO INVERSOR / INVERTER ARM
FASE U / PHASE U
BRAÇO INVERSOR / INVERTER ARM
FASE V / PHASE V
BRAÇO INVERSOR / INVERTER ARM
FASE W / PHASE W
A8
1 2 3 4 5 6 7 8
A B C D E F
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW-01
AL
FL. 5
DE 14 FLS.
EXECUTADO Jackson
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
RESUMO DAS MODIFICACOES
EXECUTADO
LIBERADO
DATA LIBER.
INDICE
PRJ PCP PRC MON
RLM LOC
MOD. 0074 Rev. 07/97



PRIMÁRIO PRIMARY	TENSÃO VOLTAGE
H1-H2-H3	480V
H4-H5-H6	460V
H7-H8-H9	440V
H10-H11-H12	415V
H13-H14-H15	400V
H16-H17-H18	380V
H19-H20-H21	220V



WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW-01
CLIENTE:
EXECUTADO
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
AL
FL. 7
DE 14 FLS.
RESUMO DAS MODIFICACOES
PRJ
RLM
PCP
LOC
PRC
MON
INDICE
DATA UBER.
MOD. 0074 Rev. 07/97
UD+
MP
UD-
4/A3
#40x5
#14AWG/20KV
F1
3A
V1
220V-4,3KV
1KVA
T2
H1
H2
H3
X1
X2
X3
TUBO METÁLICO FLEXÍVEL 3/4"
3/4" FLEXIBLE METALLIC CONDUIT
#2,5PT
R2
R3
R4
R5
R6
R7
10 ohms/100W
K4
10/D7
HVM
RPC
SPC
TPC
6/B8
1
2
3
4
5
6
7
8
A
B
C
D
E
F


1
2
3
4
5
6
7
8
A
B
C
D
E
F
6/C8
AX
6/D8
AY
6/D8
AZ
9/A1
9/A1
9/A1
#2,5PT
Q3
1
3
5
2
4
6
13
14
12/C6
21
22
1,60–2,50A
TUBO METÁLICO FLEXÍVEL 3/4"
3/4" FLEXIBLE METALLIC CONDUIT
#2,5PT
T3
H1
H2
X1
X2
220–22V
200VA
#14AWG
20KV
A9.5
XI1
XI2
#14AWG/20KV
3/D3
3/D3
3/D6
3/D6
3/D8
3/D8
X04P
X04N
X05P
X05N
X06P
X06N
ISOX PHASE U
ISOX PHASE V
ISOX PHASE W
PS1
Q4
#2,5PT
12/C6
1,00–1,60A
K2
11/D3
#2,5PT
#2,5PT
M21
BLUE
AZUL
BROWN
MARROM
BLACK
PRETO
C21
+
–
M21
M
1~
EXAUSTOR PAINEL
RETIFICADOR
EXHAUST FAN
RECTIFIER PANEL
Q12
#2,5PT
1,00–1,60A
KA1
10/D4
73
74
M26
M
1~
EXAUSTOR PAINEL
CONTROLE
EXHAUST FAN
CONTROL PANEL
Q6
#2,5PT
6A
#1,5 CZ
#1,5 CZ
RG
10/A1
COMANDO GERAL
CONTROL
SG
10/D1
220V/60Hz
RLM
LOC
RESUMO DAS MODIFICACOES
EXECUTADO
LIBERADO
DATA LIBER.
INDICE
PRJ
PCP
PRC
MON
=
+
EXECUTADO
Jackson
VERIFICADO
LIBERADO
Komatsu
DATA LIBER.
14/10/04
CLIENTE:
WEG INDÚSTRIAS – AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW–01
AL
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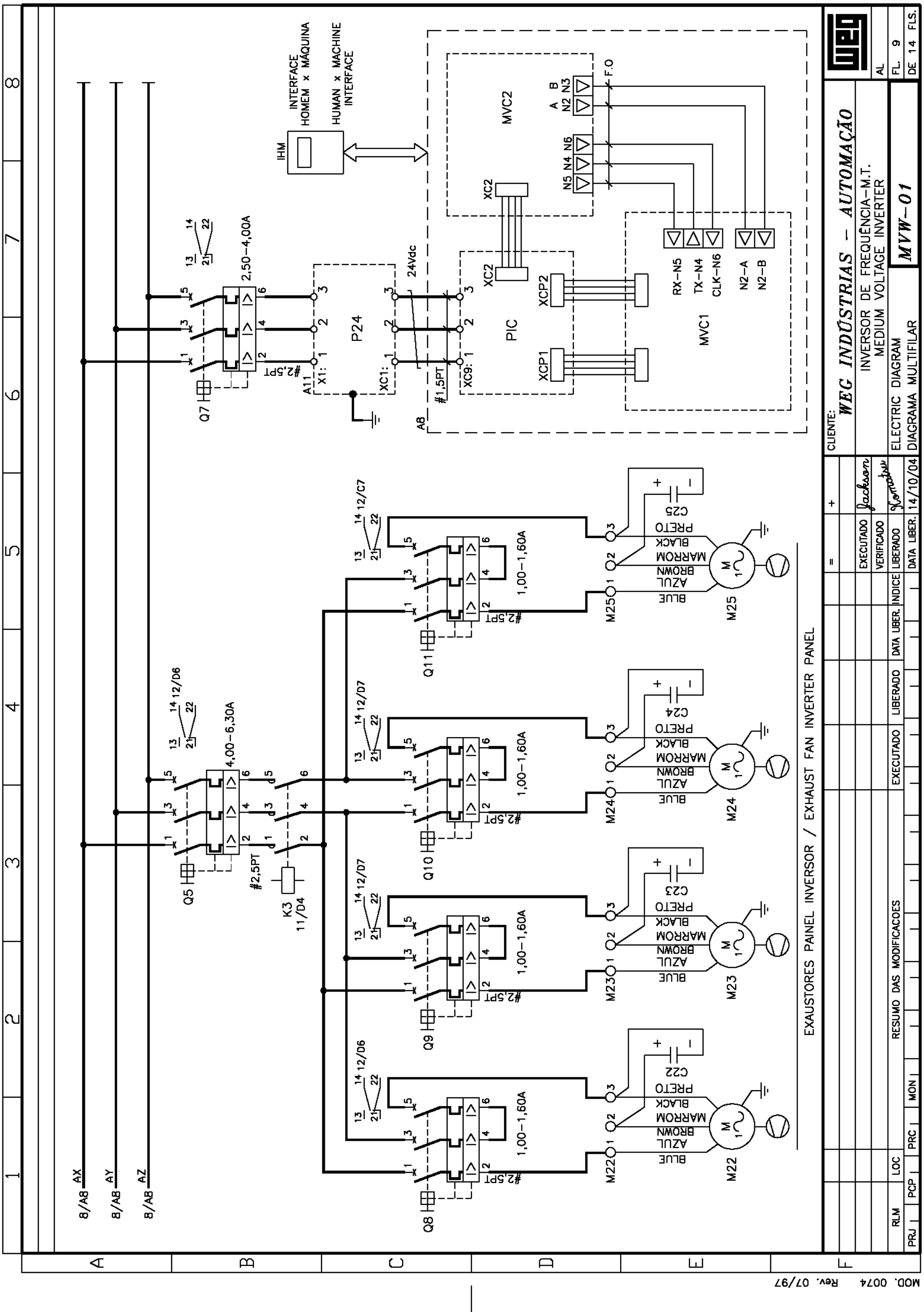
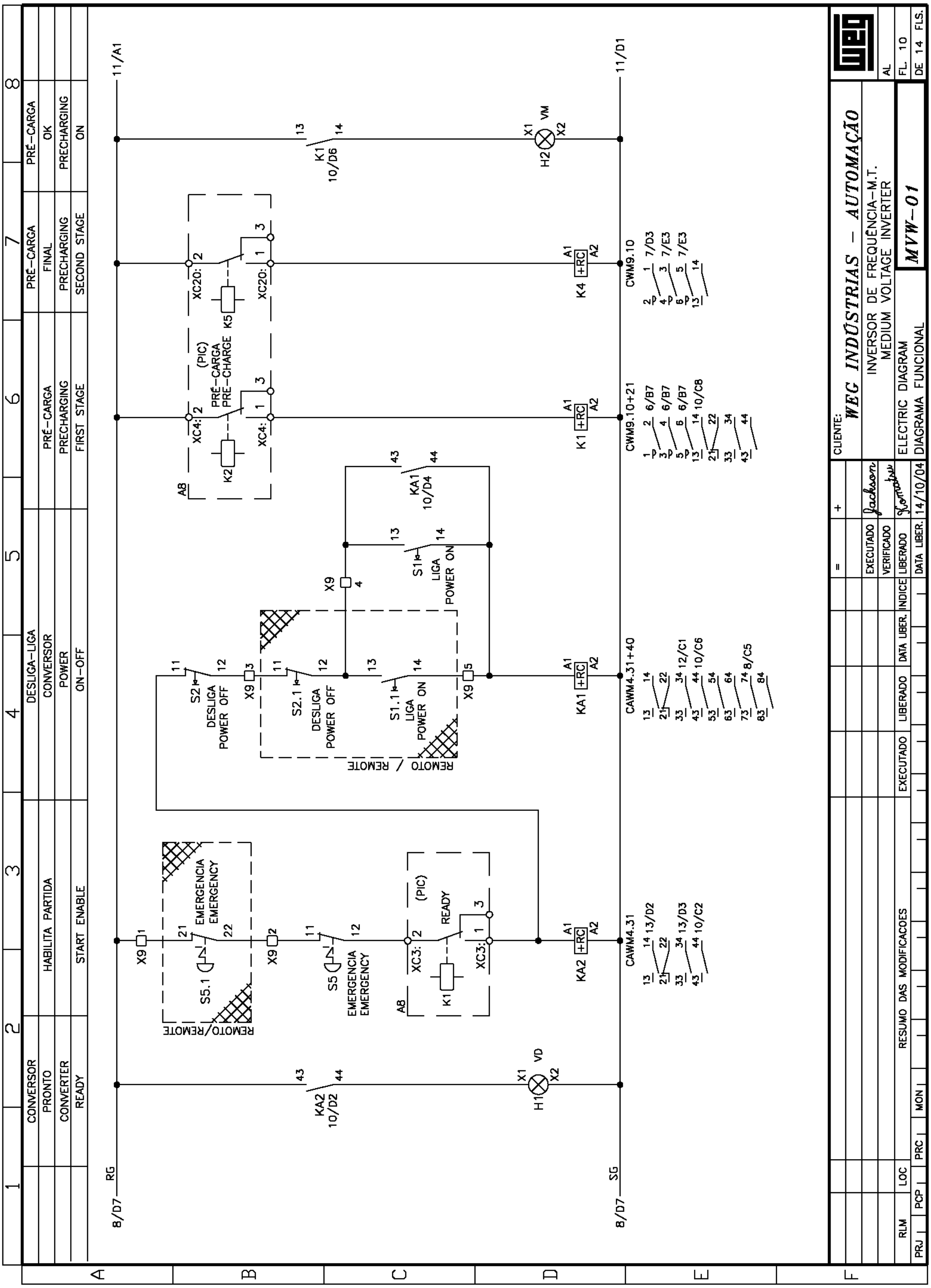

EXAUSTORES PAINEL INVERSOR / EXHAUST FAN INVERTER PANEL
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA–M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA MULTIFILAR
MVW-01
CLIENTE:
EXECUTADO
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
AL
FL. 9
DE 14 FLS.
RESUMO DAS MODIFICACOES
INDICE
DATA LIBER.
LIBERADO
EXECUTADO
PRJ
RLM
PCP
LOC
PRC
MON
MOD. 0074 Rev. 07/97
8/A8 AX
8/A8 AY
8/A8 AZ
Q5
4,00-6,30A
#2,5PT
12/D6
K3
11/D4
Q7
2,50-4,00A
P24
X1:
XC1:
24Vdc
#1,5PT
A11
A8
XC9:
PIC
XC2
XCP1
XCP2
MVC1
MVC2
RX-N5
TX-N4
CLK-N6
N2-A
N2-B
N5 N4 N6
A B
N2 N3
F.O
IHM
INTERFACE HOMEM x MÁQUINA
HUMAN x MACHINE INTERFACE
Q8
Q9
Q10
Q11
1,00-1,60A
12/D6
12/D7
12/D7
12/C7
M22
M23
M24
M25
C22
C23
C24
C25
AZUL
BLUE
MARROM
BROWN
PRETO
BLACK


CONVERSOR PRONTO
CONVERTER READY
HABILITA PARTIDA
START ENABLE
DESLIGA-LIGA CONVERSOR
POWER ON-OFF
PRÉ-CARGA PRECHARGING FIRST STAGE
PRÉ-CARGA FINAL PRECHARGING SECOND STAGE
PRÉ-CARGA OK PRECHARGING ON
8/D7 RG
8/D7 SG
11/A1
11/D1
KA2 10/D2
H1 VD
X1 X2
S5.1
EMERGENCIA EMERGENCY
REMOTO/REMOTE
X9
S5 EMERGENCIA EMERGENCY
XC3: 2
XC3: 1
K1
(PIC) READY
A8
KA2 +RC A1 A2
CAWM4.31
13 14 13/D2
21 22
33 34 13/D3
43 44 10/C2
S2 DESLIGA POWER OFF
S2.1 DESLIGA POWER OFF
S1.1 LIGA POWER ON
REMOTO / REMOTE
S1 LIGA POWER ON
KA1 10/D4
KA1 +RC
CAWM4.31+40
12/C1
10/C6
8/C5
XC4: 2
XC4: 1
K2
(PIC) PRÉ-CARGA PRE-CHARGE
K5
XC20: 2
XC20: 1
K1 +RC
CWM9.10+21
6/B7
10/C8
K4 +RC
CWM9.10
7/D3
7/E3
K1 10/D6
H2 VM
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA FUNCIONAL
MVW-01
AL
FL. 10
DE 14 FLS.
EXECUTADO Jackson
VERIFICADO
LIBERADO
DATA LIBER. 14/10/04
INDICE
DATA LIBER.
LIBERADO
EXECUTADO
RESUMO DAS MODIFICACOES
MON
PRC
LOC
PCP
RLM
PRJ
A B C D E F
1 2 3 4 5 6 7 8
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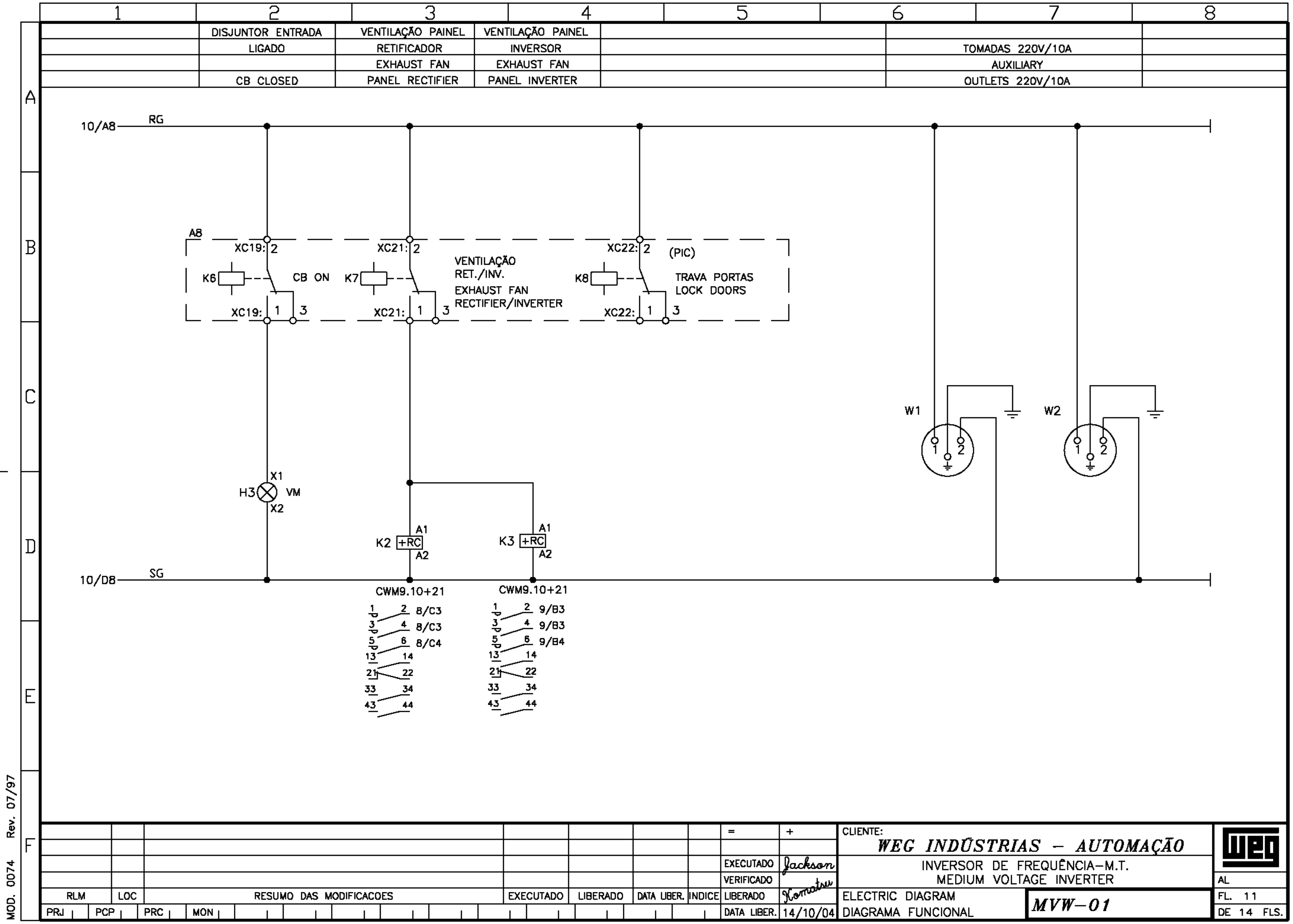
1 2 3 4 5 6 7 8
A B C D E F
DISJUNTOR ENTRADA
LIGADO
CB CLOSED
VENTILAÇÃO PAINEL
RETIFICADOR
EXHAUST FAN
PANEL RECTIFIER
VENTILAÇÃO PAINEL
INVERSOR
EXHAUST FAN
PANEL INVERTER
TOMADAS 220V/10A
AUXILIARY
OUTLETS 220V/10A
10/A8
RG
10/D8
SG
A8
XC19: 2
K6
CB ON
XC19: 1 3
XC21: 2
K7
VENTILAÇÃO
RET./INV.
EXHAUST FAN
RECTIFIER/INVERTER
XC21: 1 3
XC22: 2
(PIC)
K8
TRAVA PORTAS
LOCK DOORS
XC22: 1 3
H3
X1
VM
X2
K2 +RC A1 A2
K3 +RC A1 A2
CWM9.10+21
1 2 8/C3
3 4 8/C3
5 6 8/C4
13 14
21 22
33 34
43 44
CWM9.10+21
1 2 9/B3
3 4 9/B3
5 6 9/B4
13 14
21 22
33 34
43 44
W1
W2
1 2
RLM
LOC
PRJ
PCP
PRC
MON
RESUMO DAS MODIFICACOES
EXECUTADO
LIBERADO
DATA LIBER.
INDICE
=
+
EXECUTADO
Jackson
VERIFICADO
LIBERADO
Komatsu
DATA LIBER.
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CLIENTE:
WEG INDÚSTRIAS – AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA–M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA FUNCIONAL
MVW–01
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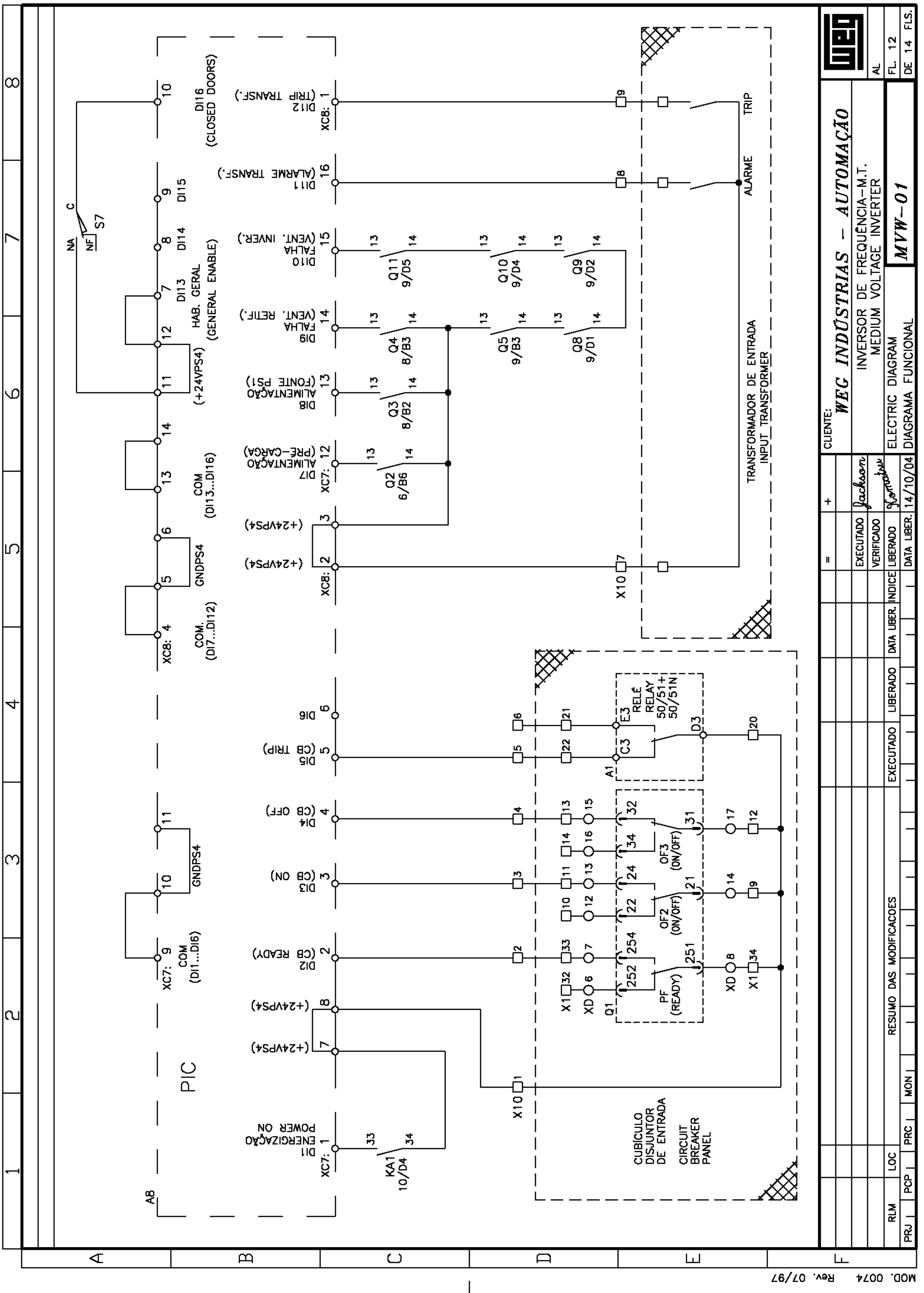
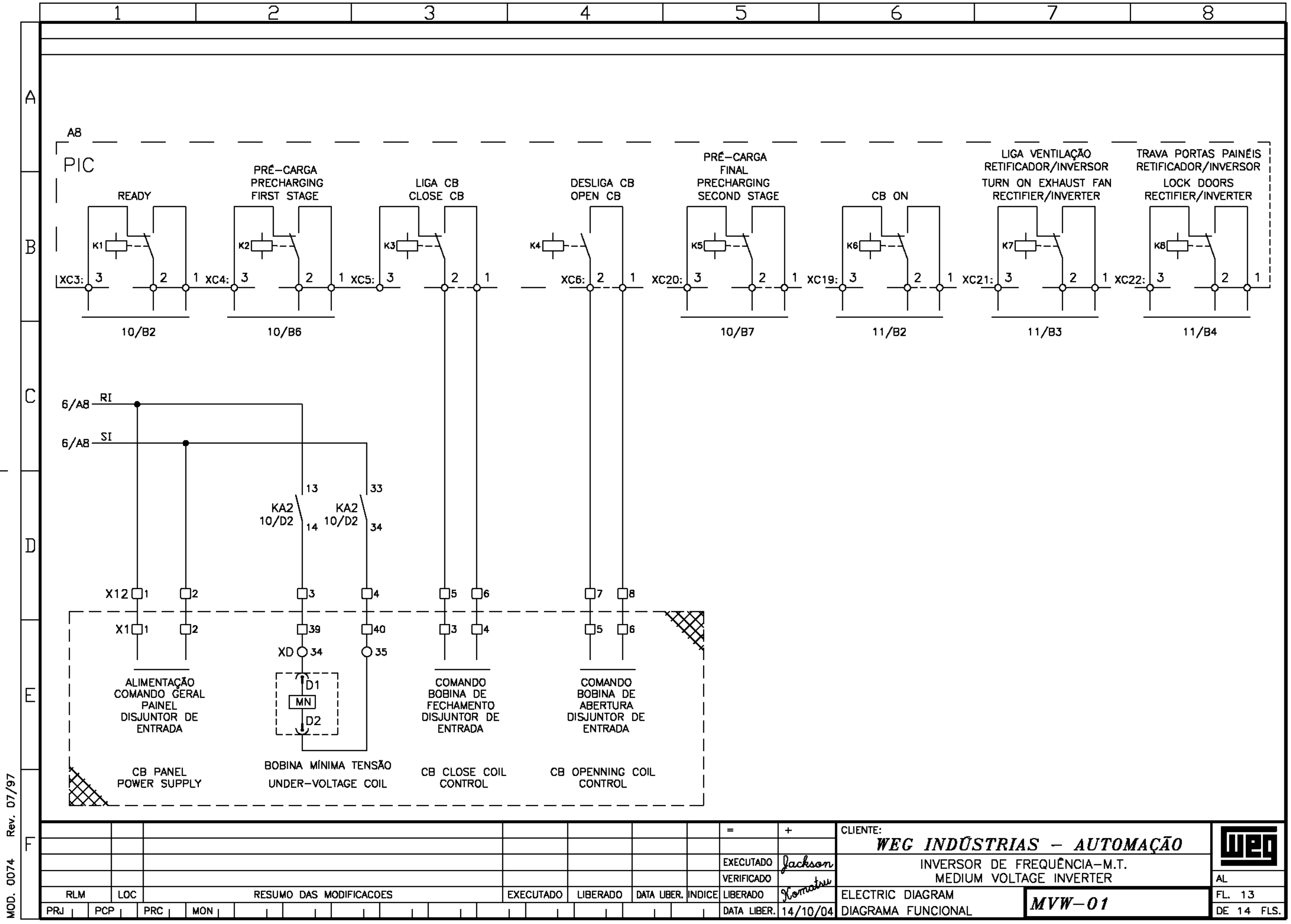
DE 14 FLS.
MOD. 0074 Rev. 07/97


WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA FUNCIONAL
MVW-01
CLIENTE:
EXECUTADO
VERIFICADO
LIBERADO
DATA LIBER.
14/10/04
Jackson
FL. 12
DE 14 FLS.
AL
RESUMO DAS MODIFICACOES
INDICE
DATA LIBER.
LIBERADO
EXECUTADO
RLM
LOC
PRC
MON
PRJ
PCP
MOD. 0074 Rev. 07/97
PIC
A8
XC7: 1 DI1 ENERGIZAÇÃO POWER ON
KA1 10/D4
33
34
7 (+24VPS4)
8 (+24VPS4)
2 DI2 (CB READY)
3 DI3 (CB ON)
4 DI4 (CB OFF)
5 DI5 (CB TRIP)
6 DI6
XC7: 9 COM (DI1...DI6)
10
11
GNDPS4
XC8: 4 COM. (DI7...DI12)
5
6
GNDPS4
13
14
COM (DI13...DI16)
11
12
(+24VPS4)
7 DI13 HAB. GERAL (GENERAL ENABLE)
8 DI14
9 DI15
10 DI16 (CLOSED DOORS)
NA
NF
C
S7
XC8: 2 (+24VPS4)
3 (+24VPS4)
XC7: 12 DI7 ALIMENTAÇÃO (PRE-CARGA)
13 DI8 ALIMENTAÇÃO (FONTE PS1)
14 DI9 FALHA (VENT. RETIF.)
15 DI10 FALHA (VENT. INVER.)
16 DI11 (ALARME TRANSF.)
XC8: 1 DI12 (TRIP TRANSF.)
Q2 6/B6
Q3 8/B2
Q4 8/B3
Q5 9/B3
Q8 9/D1
Q11 9/D5
Q10 9/D4
Q9 9/D2
X10
7
8
9
ALARME
TRIP
TRANSFORMADOR DE ENTRADA
INPUT TRANSFORMER
X10 1
2
3
4
5
6
X1 32
33
10
11
13
14
21
22
XD 6
7
12
13
15
16
Q1
252
254
22
24
32
34
251
21
31
PF (READY)
OF2 (ON/OFF)
OF3 (ON/OFF)
XD 8
14
17
X1 34
9
12
20
A1
C3
E3
D3
RELÉ RELAY 50/51+ 50/51N
CUBÍCULO DISJUNTOR DE ENTRADA
CIRCUIT BREAKER PANEL
1
2
3
4
5
6
7
8
A
B
C
D
E
F


A8
PIC
READY
PRÉ-CARGA
PRECHARGING
FIRST STAGE
LIGA CB
CLOSE CB
DESLIGA CB
OPEN CB
PRÉ-CARGA
FINAL
PRECHARGING
SECOND STAGE
CB ON
LIGA VENTILAÇÃO
RETIFICADOR/INVERSOR
TURN ON EXHAUST FAN
RECTIFIER/INVERTER
TRAVA PORTAS PAINÉIS
RETIFICADOR/INVERSOR
LOCK DOORS
RECTIFIER/INVERTER
K1
K2
K3
K4
K5
K6
K7
K8
XC3:
XC4:
XC5:
XC6:
XC20:
XC19:
XC21:
XC22:
10/B2
10/B6
10/B7
11/B2
11/B3
11/B4
6/A8 RI
6/A8 SI
KA2
10/D2
13
14
33
34
X12
X1
XD
MN
D1
D2
ALIMENTAÇÃO
COMANDO GERAL
PAINEL
DISJUNTOR DE
ENTRADA
CB PANEL
POWER SUPPLY
BOBINA MÍNIMA TENSÃO
UNDER-VOLTAGE COIL
COMANDO
BOBINA DE
FECHAMENTO
DISJUNTOR DE
ENTRADA
CB CLOSE COIL
CONTROL
COMANDO
BOBINA DE
ABERTURA
DISJUNTOR DE
ENTRADA
CB OPENNING COIL
CONTROL
RLM
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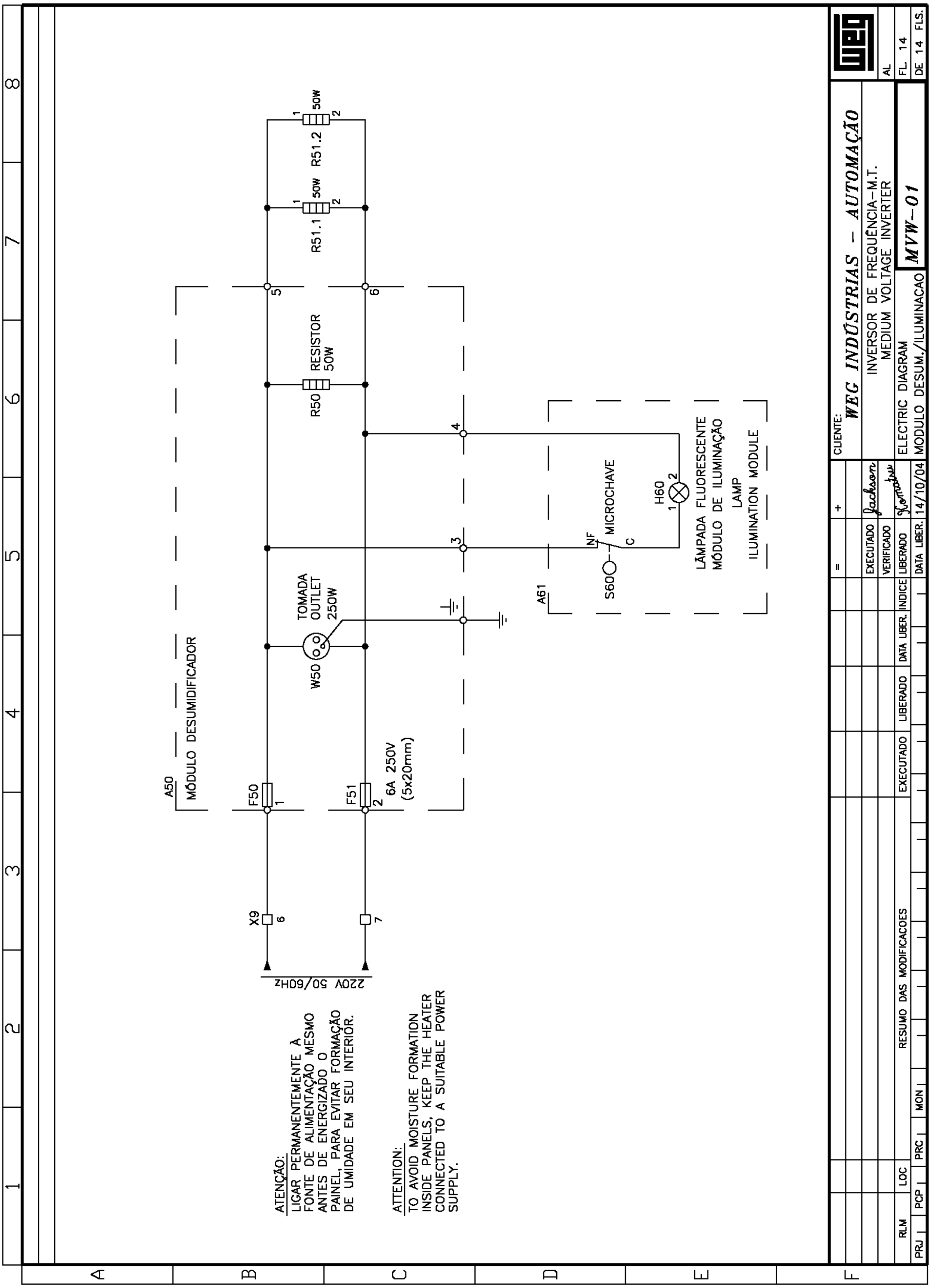
PRC
MON
=
+
EXECUTADO
VERIFICADO
LIBERADO
DATA LIBER.
Jackson
Komatsu
14/10/04
CLIENTE:
WEG INDÚSTRIAS - AUTOMAÇÃO
INVERSOR DE FREQUÊNCIA-M.T.
MEDIUM VOLTAGE INVERTER
ELECTRIC DIAGRAM
DIAGRAMA FUNCIONAL
MVW-01
AL
FL. 13
DE 14 FLS.
MOD. 0074 Rev. 07/97



ATENÇÃO:
LIGAR PERMANENTEMENTE À FONTE DE ALIMENTAÇÃO MESMO ANTES DE ENERGIZADO O PAINEL, PARA EVITAR FORMAÇÃO DE UMIDADE EM SEU INTERIOR.

ATTENTION:
TO AVOID MOISTURE FORMATION INSIDE PANELS, KEEP THE HEATER CONNECTED TO A SUITABLE POWER SUPPLY.

Remissive Index – MVW-01